The Genera of the Aphids of Canada

Homoptera: Aphidoidea and Phylloxeroidea
THE INSECTS
AND ARACHNIDS
OF CANADA

PART 22

The Genera of the Aphids of Canada

Homoptera: Aphidoidea and Phylloxeroidea

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# Contents

Acknowledgments .................................................. 7
Introduction ....................................................... 8
General characteristics of aphids ................................ 8
Morphology and terminology ..................................... 10
Collecting, preserving, and mounting .......................... 17
Aphid life cycles ................................................... 18
Relationships with other organisms ............................. 23
Higher classification of aphids ................................... 25
Use of identification keys .......................................... 44
Key to superfamilies of infraorder Aphidoidea .............. 44
Clé des superfamilles de l’infraordre des Aphidoidea ........ 44
Key to genera of superfamily Aphidoidea ..................... 45
Clé des genres de la superfamille des Aphidoidea ........... 79
Key to genera of superfamily Phylloxeroidea ................ 117
Clé des genres de la superfamille des Phylloxeroidea ...... 118
Generic descriptions of superfamily Aphidoidea ............ 118
Generic descriptions of superfamily Phylloxeroidea ....... 710
Glossary of anatomical terms .................................... 724
Glossary of biological terms ..................................... 731
References .......................................................... 734
Host list ............................................................. 751
Index of generic and subgeneric names ....................... 763
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Introduction

The aphids are among the best known of all plant pests. Anyone who has grown plants either in the home or garden is familiar with these insects. What is not generally known, however, is that many plant species have a particular aphid species, or group of species, exclusively associated with it. The relationships between aphids and their plant food source is probably so specialized that they should be considered plant parasites. Their life cycles exhibit all the physiological adaptations to their hosts that characterize true parasites.

Because of their capacity to transmit plant virus diseases, aphids are one of the most economically important groups of insects. Many viruses that harm plants and cause serious crop losses are transmitted by these pests.

The aims of this handbook are to provide some generalized introductory information on morphology and terminology, and on the general biology. It also provides keys (in English and French) to the genera that occur, or potentially occur, in Canada, or could be expected as horticultural interceptions.

Among aphid specialists, there is sometimes little agreement as to the correct definition of some genera of aphids. We hope that the arrangement used here will prove to be the most stable. However, stability is difficult to achieve in a relatively small group of organisms worked on by many researchers. The areas of controversy are debated elsewhere. We have included the Phylloxeridae and Adelgidae and have used current North American generic concepts for these families. Workers in Europe have recognized many genera for these two families with some justification. However, applying the same concepts in North America would require extensive revision of the Nearctic representatives.

Descriptions of genera are arranged alphabetically under each of the superfamilies Aphidoidea and Phylloxeroidea. The generic descriptions are detailed because no comprehensive comparative descriptions apply to the Canadian aphid fauna.

Because of the complexity of aphid life cycles, a great number of descriptive terms are available and there is little conformity of usage among aphid workers. We have included a glossary of terms so that the terms used here for morphological and biological aspects can be equated to some degree with terms used by other workers.

General characteristics of aphids

Like other members of the insect order Homoptera, aphids have slender, piercing and sucking mouthparts that form a hollow tube with which they suck juices from plants. They are also similar to
other Homoptera in having four membranous, usually veined wings. They are distinguished by the combination of the following:

- strongly costalized wing veins (i.e., the veins tend to be crowded toward, and more strongly developed near, the anterior or costal margin)
- two-segmented tarsi (rarely one or both vestigial, or the segments fused)
- a cluster of three eye facets (trionmatidium) usually appended to the posterior margin of the compound eye
- commonly a pair of siphunculi on the dorsal part of the fifth abdominal segment.

Aphids are also peculiar in that they reproduce without mating during most of the growing season of their plant hosts. The Aphidoidea give rise to living young, whereas the Phylloxeroidea produce only eggs. Complex life cycles, involving both winged and wingless generations and at least two different host plants, characterize many species of aphids. Characteristic galls and pseudogalls, consisting of deformed leaves or stems, are produced on many plants by the feeding activities of certain aphid species.

**Superfamily Aphidoidea.** The Aphidoidea constitute the largest group of Aphidodea; more than 5000 names have been used to describe about 4000 known species. The species in this family are chiefly distinguished from those of Phylloxeridae and Adelgidae by

- usually having more than three antennal segments
- possessing a radial sector in the fore wing
- lacking a sclerotic ovipositor
- bearing live young (parthenogenesis)
- nearly always having a pair of pore-bearing structures called siphunculi situated on each side of the abdomen near the posterior end. The siphunculi are commonly long, tubular appendages.

Species of Aphidoidea are known from all continents except Antarctica. However, the overwhelming majority of the species occur naturally in regions north of the equator, where plant diversity is lower, and the aphid host plants are consequently easier to locate (Dixon et al. 1987).

**Family Phylloxeridae.** The family Phylloxeridae contains fewer than 50 species. Although the best known pest species, *Daktulosphaira vitifoliae* (Fitch), feeds on grape, all other species occur only on poplars, willows, chestnuts, oaks, and hickories.

Species of Phylloxeridae are distinguished from Aphidoidea and Adelgidae by

- having three-segmented antennae
- usually having vestiges of an ovipositor
- having long capitate setae near the apex of the apical or distal tarsal segment
never having siphunculi.

One genus of Aphidoidea, Hormaphis Osten Sacken has a three-segmented antenna, but, unlike species of Phylloxeridae, the tarsi of one or all pairs of legs are reduced and clawless, and the antennae in the winged forms have closely set, ringlike sensoria.

**Family Adelgidae.** Adelgidae are chiefly distinguished by having

- a well-developed ovipositor
- five-segmented antennae
- two-segmented tarsi that lack preapical capitate setae
- the lack of siphunculi.

About 50 species of Adelgidae are known; all are confined to conifers. The general distribution of the Adelgidae closely reflects that of the spruces on which some species of adelgids cause characteristic galls to form.

**Morphology and terminology**

Morphology and terminology of aphids are complicated by the different forms or morphs that occur in each clone. The present discussion is a generalization of the most common and economically important apterous and alatae viviparous morphs.

**Head** (Figs. 4, 34–47). The aphid head is strongly opisthognathous, with the beak or rostrum usually retracted between the front legs. As a result the head is somewhat dorsoventrally flattened with the antennae arising from the anterior margin, which is sometimes called the vertex or front. The front margin is variable in shape, ranging from convex to U- or W-shaped when viewed dorsally (Figs. 34–38). The latter condition is produced by anterolateral protuberances, called antennal tubercles, bearing the antennal socket (Fig. 46, FT). The mesal margin of the antennal tubercle projects anteromedially in some species. Where large frontal tubercles occur, the ventral margin of the antennal socket is also commonly protuberant (Fig. 46, Pr). The dorsal surface of the head is called the disc. The disc has papillae, tubercles, and wax-gland facets in some species. A median, longitudinal, suture is present in some species (Fig. 1, DSu).

The chaetotaxy of the disc of the head is variable throughout the Aphidodea. The number and arrangement of setae on the disc ranges from a pattern in which there are four anterior discal setae and four posterior discal setae (Fig. 39) to discs that are completely clothed with setae (Fig. 41). Intergrades between these patterns do occur although they are relatively uncommon. In Eucallipterus Schouteden, for example there are four anterior discal setae, but the posterior discal setae consist of a transverse cluster of more than the usual four setae (Fig. 40).
Ocular structures consist of ocelli, compound eyes, and the triommatidium (Figs. 1, 4). Ocelli normally occur only in the alate morph, one ocellus laterally on each side of the disc and one on or below the anterior margin. Ocelli do not occur in true apterae. Apterous morphs with ocelli are aptera–alata intermediates, and a close examination will show some other characters that are intermediate between those of apterae and alatae.

Compound eyes are always present in alatae and in most apterae of species known to occur in Canada. The compound eye in some genera such as Phyllaphis Koch (Fig. 1583) is partially or completely divided into dorsal and ventral clusters of facets. Compound eyes are always absent in the apterae of gall and some pseudogall-producing forms. Generally in Canada, aphids that lack compound eyes can produce galls or pseudogalls at some point during their life cycles, if the proper host plant is available.

The triommatidium consists of a cluster of three facets on each side of the head. These facets are always present. If a compound eye occurs the triommatidium is appended to its posterior margin (Figs. 1, 4, E3) or may occasionally be incorporated into the compound eye. The triommatidium is apparently not a "larval" eye in the usual sense as it is not replaced by the compound eye during development. It is a structure that characterizes the Aphidodea and is only known to occur elsewhere in the first-instar stage of some species of Psylloidea. In a few species the triommatidium appears to be absent in some apterae and alatae, but only because its facets have been engulfed by the facets of the compound eye.

The antenna is normally six-segmented in the apterous and alate morphs. Fewer segments are characteristically present in a few genera. For example, there are only four segments in Paducia Hottes & Frison and five segments in the apterae of Rhopalosiphum rufiabdominale (Sasaki). Antennae with fewer than six segments commonly occur in some morphs, such as the fundatrix and sexualis. The portion distad of the primary sensoria on the sixth antennal segment is called the processus terminalis (Figs. 1, 75, 76, PT).

Only one type of prominent sensory structure is associated with the antenna, namely a type of placoid sensilla that can occur on the third to sixth segments. On the basis of development, these are placed in two categories: primary and secondary. Primary sensoria (Figs. 1, 75, 76, Ss1) occur subapically on the last segment and also, with few exceptions, subapically on the penultimate segment. They occur in all stages of development including the embryo and are nearly always surrounded by a row of fine, ciliationike structures. Characteristically only one such sensorium occurs on the penultimate segment, but of a cluster of sensoria on the last segment the smaller are referred to as accessory sensoria (Fig. 75, SsAc). The secondary sensoria (Figs. 70–74) occur only in the adult apterae and alatae. With the exception of Phloeomyzus Horvath, they are always present in the alatae, but are commonly absent in apterae. Secondary sensoria are characteristically restricted to the third antennal segment, but also
occur fairly commonly on the fourth segment, and less so on the fifth and sixth segments. Marginal cilia are associated with the secondary sensoria in some.

The rostrum arises from the posterior margin of the head and extends backwards between the legs. The maxillae and mandibles are long, hairlike structures called stylets, which together form a tube for piercing plant tissues, extracting the juices, and injecting the saliva. In embryos the stylets are commonly visible as coiled structures suggestive of watch springs. Taxonomic characters of the rostrum are largely confined to the length and shape and to the chaetotaxy of the apical segment. The length of the rostrum is measured by the distance between the base and apex of the stylets. The chaetotaxy of the apical segments consists of two categories, primary and secondary setae. The primary setae are present and constant in all stages of development and consist of a minute pair situated basally on the anterior surface, and a preapical whorl of 4–6 setae (Figs. 77–81). The secondary setae are all those setae that occur in the area between the basal and apical primary setae. The number and arrangement of the latter commonly varies between species, genera, and sometimes between different developmental stages. The small portion of the apical rostral segment that occurs distad of the apical primary setae varies greatly in shape; in some genera, such as *Cinara* Curtis it is separated from the rest of the apical segment by a membranous, articular area immediately distad of the apical primary setae (Fig. 77). The apical rostral segment of most aphids is subcylindrical, or somewhat conical, gradually tapering from the base to the apical primary setae. The portion beyond the apical primary setae is usually somewhat rounded or pointed (Figs. 78, 79). However, in all aphid genera where species feed on *Artemisia* and allied plants, the sides of the rostrum are commonly concave and the portion beyond the primary setae is narrow, prolonged, and somewhat needlelike (Fig. 80). The rostrum arises from a circular or oval structure (Figs. 46, 47) composed of the clypeus and surrounding genal and frontal elements (Hamilton 1981). Traditionally, the upper mesal plate has been designated the postclypeus (PCl), and the lower portion the anteclypeus (Cl). This structure is usually separated from the rest of the head capsule by a membrane that permits the rostrum to extend forwards, but fusion of the frontal area of the head capsule and the anterior margin of the clypeal structure does occur (as in *Drepanaphis* Del Guercio, Fig. 654). The presence or absence of sutures bounding the postclypeus is distinctive for various groups of aphids.

**Thorax.** The chaetotaxy of the prothorax is commonly distinctive and characteristic of large groups of genera. The pronotum may be completely clothed with setae (Figs. 112, 113) or may have only three setae on each side (Fig. 109): the posterior submedian, and anterior and posterior lateral setae (Fig. 1, SMP, SLA, SLP). One large group, exemplified by *Liosomaphis* Walker (Fig. 108) and allied
genera, also has anterior submedian setae (Fig. 1, SMA). Intermediates between these extremes are common, and the anterior and posterior lateral and submedian setae can be represented by clusters of two to many setae.

The aphid fore wing is typically as in Fig. 1. Variation between species and genera is confined to the stigma (St), media (M_1-M_3), and cubitus (Cu_1-Cu_9). The stigma normally terminates well before the apex of the wing, but in Longistigma Wilson (Fig. 1131) and Mindarus Koch (Fig. 1247) it is prolonged to the apex of the wing. The radial sector (RS) is commonly evanescent basally or apically. The radial sector and the anterior branch of the media are fused in Idiopterus Davis (Fig. 1030). The media may consist of a single vein or it may branch once or twice. The cubital veins may be widely separated or fused basally. In the Adelgidae and Phylloxeridae the venation is much reduced and consists of remnants of the media and cubitus. The hind wing in all alate aphids has one longitudinal vein and at least vestiges of one (rarely) or two transverse veins.

The legs of aphids each consist of a coxa, a trochanter that is fused with the femur, a tibia, usually two tarsal segments, and a pretarsus bearing two curved claws. The fore femora are enlarged in genera such as Drepanaphis Del Guercio and Drepanosiphum Koch (Figs. 636, 647). In Iziphyia Nevsky both the fore and mid femora are enlarged, whereas in Grylloprociphilus Smith the hind femora are enlarged.

The tibiae exhibit few characters that are of value taxonomically. In Glyphina Koch the fore tibiae each commonly bear one to several protruding, somewhat bilobate sensoria (Fig. 892). The hind tibiae of Nearctaphis sensoriata (Gillette & Bragg) each bears a basal cluster of circular, placoid sensoria that are similar in shape to the secondary antennal sensoria. A longitudinal row of blunt or pointed, short, peglike setae occur on the hind tibiae of Toxoptera Koch and the fundatrices of some species of Muscaphis Börner (Fig. 93). These setae apparently constitute a stridulatory organ. Many alate aphids have a rastral organ at the apex of one or more pairs of tibiae. This organ consists of a series of stout, movable, spinelike setae (Fig. 92, SR). In Drepanaphis, each hind tibia has one to five stout, thornlike immovable spines apically, called rastral spines (Fig. 91, SpR). The hind tibiae of the oviparae of many aphids are swollen and bear numerous flat, circular, or oval sensoriumlike structures, usually termed pseudosensoria. These structures apparently secrete sex pheromones (Pettersson 1970).

The basal tarsal segment is triangular or trapezoidal in lateral view. The presence and number of dorsal and ventral setae are the main taxonomic characteristics of this segment. Aside from its length in relation to other structures and the type of sculpturing, the apical tarsal segment offers little of taxonomic value. In some this segment has conspicuous preapical capitate setae, which are useful in segregating some genera or groups of genera. Reduction of the tarsi occurs in Mastopoda Oestlund, Atarsos Gillette, Hormaphis Osten
are analogous in many respects. In many species the lateral lobes are present and

Among them is only as small, irregular spots on the anterior region of the abdomen, and

in the larval stage, the larval sclerites are also present, but these plates are formed by the fusion of the segments. The larval sclerites are also present, but these plates are formed by the fusion of the segments.
some related genera the cauda is narrowed at the base with a relatively long, blunt, tassel-like mesal prolongation (Fig. 64). In a few genera, such as Myzodium Börner the cauda is essentially arc-shaped with a relatively slender, mesal projection (Fig. 69). The cauda in many genera is short, or elongate triangular, tapering from base to apex (Figs. 62, 63). A knobbled cauda is common in one group of the Aphidoidea. In such genera the cauda is constricted at the base and the portion distad of this is spherical, ovoid, or oblong (Figs. 60, 65).

On the ventral surface of the abdomen, the genital (GP) and anal (AP) sclerotic plates lie anteriad of the genital orifice and of the anus, respectively, (Figs. 2, 5). The genital plate is uniformly quadrate or rectangular. The anal plate is usually similar, but its posterior margin may be strongly bilobate (Fig. 2, AP). The gonapophyses are one to four setiferous bosses or papillae situated along the posterior margin of the genital plate (Figs. 2, 5, Go). They occur in all viviparous forms. Structures suggestive of the ovipositor found in other Homoptera occur as internal sclerites in the Adelgidae (Fig. 24) and in some of the Phylloxeridae (Fig. 25). The male genitalia consist only of a penis (Fig. 3, P), which is membranous apically, and a pair of setose claspers (Fig. 3, Cs).

The siphunculi are a pair of pore-bearing structures usually associated with the lateral sclerite of the sixth abdominal segment (Figs. 1, 9, Si, 48–55). The pore is most commonly situated at the apex of a more or less columnar tube of varying length, which may be basally or apically swollen. The orifice is usually at the apex of the tube, surrounded by a flangelike structure (Figs. 51–53). A few species are known in which the orifice is situated obliquely on the inner side (Fig. 54) of the tube. The apical half of the tube is characteristically reticulate in some genera, such as Macrosiphum Passerini, Uroleucon Mordvilko, and related genera (Figs. 56, 57). Where the pore is situated directly on a mammiform base, this base is commonly clothed with a few to many setae (Fig. 50), but where the siphunculus is tubular, it rarely bears setae.

**Types of setae.** The setae of aphids are mostly pointed, hairlike (Fig. 96). Capitate setae (Figs. 97, 98) are common, but the size of the apical bulb varies enormously in various genera and species. Blunt, or rod-shaped setae occur, but are not common. Flabellate setae (Fig. 100) are not uncommon and in some species of Pleotrichophorus Börner these intergrade with setae that are apparently funnel-shaped. In Chaitophorus Koch some dorsal setae are commonly chisel- or fishtail-shaped apically (Fig. 95). Furcate or branched setae (Fig. 99) are rare and occur as an abnormality. Shield-shaped setae (Figs. 102, 103) are found on species of Subsaltusaphis Quednau. Secretory setae are known to occur in Thelaxes Westwood. In this genus the spinelike setae situated dorsally and laterally on the body secrete threads of wax (Fig. 101, XC). Part of the bulb in some capitate setae is usually membranous.
and is perhaps secretory, or sensory. In most slides of *Uroleucon* Mordvilko, for example, dorsal setae appear pointed, but these apparently have a membranous bulb apically that collapses when the specimens are mounted (Figs. 97, 98).

**Tubercles and papillae.** The terms dorsal and lateral tubercles in aphid taxonomy have been used both for structures that are evidently derived from sensory organs, and for conical or fingerlike protuberances. In the strict sense, dorsal and lateral tubercles are sensoriumlike and may occur submedially on the head, prothorax, and all abdominal terga and laterally on the prothorax and abdominal segments I–VII (Fig. 9, DT, LT). These tubercles are circular, protuberant, bulbous in some, and membranous, or at least lacking the typical integumentary sculpturing of the surrounding region.

Dorsal papillae are commonly encountered in the Aphidoidea. These protrusions of the integument occur in conjunction with the anterior and posterior discal head setae and the submedian and lateral setae of the prothorax and abdomen (Figs. 1, 9, Pap).

The eighth abdominal tergum in some has a median dorsal papilla, as in *Aspidaphis* Gillette and *Cavariella* Del Guercio (Figs. 226, 426). It is also bilobate in some genera, as in *Saltusaphis* Theobald (Fig. 1753).

**Wax glands.** Many aphids produce a waxy secretion. In some genera, the wax glands are unicellular structures scattered over the integument, producing a waxy bloom on the surface. However, many genera have the glands producing this secretion aggregated into clusters, called cribriform discs or gland facets, which produce filaments of wax that can completely cover the insect. The arrangement of these clusters is distinctive and characteristic of genera or groups of genera (Figs. 104–107). Commonly the facets are clustered around the bases of some dorsal setae. The setae with which the association is most common are the anterior and posterior discal setae, the anterior and posterior submedian and lateral prothoracic setae, and the submedian, dorsolateral, and lateral setae on abdominal segments II–VII. The best examples of this kind of arrangement occur in *Trichocallis* Börner, *Phyllaphis* Koch, and *Stegophylla* Oestlund. In *Pemphigus* Hartig and many related genera the cribriform discs have distinct septae separating them, and the whole cluster is surrounded by an obscure carina in some species (Fig. 107). In *Eriosoma* Leach and related genera the clusters of facets occur as irregular rings surrounding an apparently nonglandular central space (Figs. 104–106). The individual gland facets in this category commonly appear nonporiferous in normal slide preparations. In *Cerataphis* Lichtenstein the whole body has a marginal row of gland facets in which the pores are arranged in a more or less distinct reticulate pattern. The arrangement of gland facets in the apterae of *Hormaphis* Osten Sacken (Fig. 959) is
somewhat similar to that of *Cerataphis* (Figs. 451, 452), but submedian dorsal facets also occur on the body.

**Spiracles.** Seven or fewer pairs of spiracles occur in the Aphidoidea. In a few genera they have a fixed operculumlike structure as in *Nasonovia* Mordvilko (Fig. 7), or, an articulated, sclerotic operculum as in *Cinara* (Fig. 8).

### Collecting, preserving, and mounting

Aphids are best collected by searching and handpicking them from the infested host plants. Collecting by other methods does not produce the host data that are often needed for identifying the species, although sweeping or beating is sometimes useful to reveal the presence of insects on a host plant. Notes on the natural colors of the living insects are helpful for making identifications and they are also useful for future recognition in the field.

Colonies, or clones of aphids may occur anywhere on the host plant. It is often convenient to remove the infested part of the plant and to preserve it in ethanol with the aphids. By doing this one is more likely to collect all the stages present in the colony or clone. Another method of collecting these insects is to place the infested part of the plant in a plastic bag and to store it in a cool place in the laboratory for a few days before preserving it. This method often yields additional winged morphs, or late in the season it may produce sexuales; sometimes parasites and hyperparasites emerge.

Before specimens of Aphidoidea can be identified, they must be cleared and mounted on microscope slides. Pretreat fresh specimens by boiling them in alcohol. Specimens that have been preserved in alcohol for several months may be used directly. Heat in 5% potassium hydroxide for a few minutes, then rinse with alcohol. After decanting the alcohol, replace it with chloralphenol, and heat the specimens until they clear. If Hoyer’s mounting medium (or a similar medium containing chloral hydrate and gum arabic) is used, transfer the specimens directly from the chloralphenol clearing agent to a drop of medium on a slide. Place the specimen dorsal side up on the slide and carefully spread the appendages with the beak extended between the coxae. Add a cover slip and dry the slide in an oven (about 40°C) until the medium is firm. Use a rapidly drying sealant to ring slides made with any medium containing chloral hydrate and gum arabic. Several satisfactory sealants are available from most biological supply houses. Unless the mounts are carefully ringed, air creeps inward from the edge of the cover slip and destroys the specimen for microscopical study as the mounting medium dries up.

Canada balsam is the best mountant for preparing permanent slides. When Canada balsam is used, decant off most of the chloralphenol, and add a dehydrating and hardening solution that is
miscible with the balsam. A solution consisting of 40% glacial acetic acid, 40% oil of cedar, 10% oil of wintergreen, and 10% oil of lilac is satisfactory. The duration of treatment in this solution varies with the size of the specimens, but the best results are obtained usually by leaving the specimens in this solution for about 12 h. Transfer the specimens directly from the solution of acetic acid and essential oils to a drop of balsam, carefully spreading the appendages before adding the cover slip. The amount of mountant to use depends on the size of the specimens but should be no thicker than the head of the specimen. If Canada balsam is used as the mountant, thin it to a manageable viscosity with oil of lilac. If the specimens become milky or opaque when they are in the balsam, dehydration is incomplete. Dry the slides in an oven until they are firm. Staining is unnecessary, especially if your microscope is equipped with attachments for phase and interference microscopy. Do not remove embryos before mounting aphids, because embryonic structures are often useful for identification and taxonomic research.

**Aphid life cycles**

Aphids are parthenogenetic during most of their life cycles and at least some of them exhibit alternation of hosts. Although the following generalization is accurate, it oversimplifies the varied and complex intraclonal polymorphism for which no comparable situation exists elsewhere in the Insecta.

**The generalized life cycle** (Fig. 10). A generalized aphid life cycle, in addition to the egg, consists of five morphologically discernible morphs, or intraclonal forms: the stem mother or *fundatrix*, wingless *apterae viviparae*, winged *alatae viviparae*, winged *males*, and wingless *oviparae*. The males of some species are wingless, whereas the fundatrix and oviparae of a few others may be winged. All these morphs, except the fundatrix, are produced parthenogenetically. The seasonal occurrence of these morphs coincides to a great extent with the seasonal developmental patterns of the host plant. The overwintering eggs, which the sexual morph deposits on the bark of a tree or woody shrub, hatch in early spring about the time that the leaf buds begin to open on the winter, or primary host. The aperous form that hatches is the fundatrix, which immediately feeds on the developing leaves. The leaves may react to the feeding by producing a gall that completely encloses the fundatrix, leaving no openings or apertures. Within the gall, the fundatrix produces large numbers of offspring, which develop into alate viviparous females. When these become winged some portion of the wall of the gall deteriorates, and the alatae escape and migrate to the roots or aerial portions of the summer, or secondary host, which is usually some herbaceous plant. On the herbaceous plant, generations
apterous forms (apterous viviparae) are produced, within which alate viviparae are periodically produced that fly to other summer host plants. Here they produce other colonies, in which dispersing forms are again periodically produced. This situation persists throughout the growing season of the summer host. In autumn, however, when the secondary host has set seed and is beginning senescence, clones on the secondary host will produce alate males and viviparous fall migrants, both of which return to the primary host. The fall migrants deposit small nymphs that develop into apterous, oviparous females. Mating occurs, fertilized eggs are produced, and the seasonal cycle is completed.

Usually, alatae are the morph that migrates or disperses. However, sometimes sedentary alatae are produced in a clone. These remain in the clone and are functionally equivalent to apterous viviparae.

Although the cycle described above indicates basic morphs and their temporal sequence, additional terms are widely used to denote portions of a clone, or identify morphs that are only behaviorally or physiologically distinct. The term fundatrigeniae may be used for all the progeny of the fundatrix but is often restricted to the apterous generations between the fundatrix and the first alate generation, or migrants. Alienicolae and exules are collective terms applied to all generations on the secondary host. The term radicolae is sometimes used for root-feeding alienicolae. Androparae is a term for viviparae that directly give rise to males. Gynoparae are viviparae that directly give rise to oviparae. Fall migrants are nearly always gynoparae and are mostly physiological entities, usually scarcely discernible from other alatae in a clone. Viviparae that directly give rise to both males and oviparae are called sexuparae. Single sexuparae are known to sometimes alternately function as an andropara and a gynopara. Sexuparae are usually physiological entities, but in gall-producing forms they are also morphologically distinct, the number of antennal sensoria being commonly reduced and the arrangement of abdominal wax gland facets different. The males and oviparae are collectively known as sexuales.

In gall-forming aphids and oviparous Aphidodea the sexuales do not grow after birth. They remain about the size of first-instar nymphs and are called microsexuales. In oviparous species the microsexuales each have a rostrum or beak, but in viviparous species the microsexuales lack mouthparts. In such species alatae can be easily recognized as sexuparae, because the abdomen contains beakless embryos.

The number of eggs deposited by ovipara is somewhat variable, but no detailed comparative studies have been made. In species that produce microsexuales, each ovipara never produces more than one egg. In some species with microsexuales the ovipara dies before depositing the egg and in this sense becomes an ovisac.
The reasons or mechanisms whereby a clone changes through many discernible morphs is probably the most intriguing aspect of aphid life cycles. Most of the experimental work has been concerned with the factors that cause the production of alatae in clones that consist of apterae. Crowding is known to be a factor in at least some species such as *Megoura vicieae* Buckton. It is probable that crowding is a factor in all aphids to some degree, whether by direct stimulus, or by competition for food supply, or a combination of these. Deterioration of the host plant resulting from feeding by a large colony of aphids has been correlated with alate production in several aphid species.

**Classification of life cycles.** Aphid life cycles can be divided into two main categories: viviparous (characteristic of Aphidoidea) and oviparous (characteristic of Phylloxeroidea) cycles, depending on the mode of production of young by parthenogenetic females. Each main category can be conveniently divided into four subgroups to which all aphid life cycles can be assigned although there is much variation of details dependent on the species. Terms given to these four types of life cycle are anholocycly, holocycly, monoecious heterocycly, and dioecious heterocycly.

**Anholocycly.** This term is used for life cycles in which sexuales are unknown. The best examples are *Aulacorthum circumflexum* (Buckton), *Tuberolachnus salignus* (Gmelin), and *Rhopalosiphum maidis* (Fitch). In Canada species of *Forda* Heyden reproduce anholocyclicly on grass roots, but this is only because the normal primary hosts (*Pistacia* species) do not occur here. In the Arctic, *Pemphigus groenlandicus* (Rubsamen) is anholocyclic in the absence of the primary host, *Populus* species.

Species of Phylloxeroidea are also known to be anholocyclic. Some species of *Pineus* Shimer are believed to be anholocyclic because the primary host, usually a particular species of *Picea* A. Dietr. (spruce) is absent. *Phylloxerina* Börner, which is associated with *Salix* and *Populus*, also belongs in this category but differs in that production of alatae is not known to occur. Dispersal therefore, is presumably accomplished by the windborne first-instar stage in much the same manner as many scale insects.

**Holocycly.** This term is often used for any life cycle in which sexuales are produced. However, it applies here only to species that produce sexuales and complete their entire life cycle on the same part of a single host. Most aphids in Canada belong in this category.

In viviparous species of this category, the eggs hatch in the spring and large clones of apterous forms are produced. Alate viviparae periodically occur, which migrate to different individuals of the same kind of host plant and start new colonies. In the autumn sexuales are produced. The oviparae are apterous and morphologically similar to apterous viviparae. The males are usually alate, but apterous forms
do occur, sometimes in the same clone. In the Arctic, the males of holocyclic species are, as far as is known, always apterous. In *Myzocallis* Passerini, *Drepanaphis*, and related genera the only apterous form is the ovipara. All other morphs, including the fundatrix are alate. *Tamalia* Baker produces a leaf gall on *Arctostaphylos* Adans., in which only apterae are produced, but the sexuales are alate. *Phloeomyzus* Horvath is similar but produces no gall; the apterae feed on the trunks of *Populus*. In viviparous gall-producing species such as *Pemphigus monophagus* Maxson, the fundatrix produces a gall in which only alatae are produced. These alatae are all sexuparae in that the abdomen contains only beakless embryos that become microsexuales. In these species, the sexuparae constitute the dispersal morph; they fly to other individuals of the host plant to deposit the microsexuales. In the genus *Periphyllus* van der Hoeven, most species aestivate during the summer on the under surfaces of the leaves as highly modified first-instar nymphs called *dimorphs*.

These variations are only a few that are covered by the term holocycle. Various other minor variations occur depending on the species and genus.

**Monoecious heterocycle.** In this type of life cycle the aphid is restricted to one species of host plant (monoecious) but alternates between different parts of its host. In general, the colony starts the season on the aerial parts of the host but migrates to the roots. Monoecious heterocycle is known in both Phylloxeroidea and Aphidoidea.

Among Phylloxeroidea, the grape phylloxera has one of the most complex of aphid life cycles. Simply described, the fundatrix hatching from a fertilized egg produces a small leaf gall in which eggs are deposited parthenogenetically. Some of the progeny infest other leaves, some migrate to the roots. On the roots endless generations of apterous parthenogenetic morphs are possible. Gall-like structures occur on the roots in response to the feeding aphids. Alatae, which are rarely produced, are sexuparae and fly to other plants where microsexuales are deposited.

In Aphidoidea monoecious heterocycle is uncommon and not nearly as well defined as in the grape phylloxera. The woolly apple aphid, *Eriosophla lanigerum* (Hausmann), produces generations and galls on both the aerial and subterranean parts of its host plant. Whether this change of feeding site is necessary requires proof. The large balsam aphid, *Cinara abieticola* (Cholodkovsky), starts as small clones on the apical twigs. The aphids in these clones usually move to the larger branches or trunks early in the season. Later in the season they migrate to the roots.

**Dioecious heterocycle.** This type of life cycle encompasses some of the most complex examples of polymorphism in the Aphidoidea, which can only be referred to in a relatively simplified
way here. Such species require two different species of host plants. There are three main categories of dioecious heterocycle: viviparous gall-producing species, other viviparous species, and oviparous gall-producing species.

In the viviparous gall-producing species, the fertilized eggs overwinter on some tree or woody shrub. In the spring the fundatrices produce leaf or petiole galls in which large numbers of alatae are produced. These alatae eventually migrate to an alternate host where the clone reproduces parthenogenetically. In autumn some alate sexuparae are produced that return to the tree or woody shrub that is the appropriate primary or winter host, and on which numerous microsexuales are produced. The secondary host is nearly always a herbaceous plant and almost without exception only the roots are infested. Grass is the most commonly used group of herbaceous plants. In a few species, such as in the genus Prociphilus Koch and relatives, the roots of other woody plants and shrubs sometimes serve as summer, or secondary hosts.

In viviparous species that do not produce true galls, the overwintering fertilized egg hatches in the spring on a woody host plant. The feeding of the fundatrix usually causes curling or folding, or blisterlike swellings on the leaves. Usually the affected leaves are also discolored. The first generation is usually a Willard and helps to increase the extent of the pseudogall. Alate migrants are eventually produced that fly to the secondary host where the clone reproduces parthenogenetically for the remainder of the season. The secondary host is always one or more kinds of herbaceous plants. Some species, such as Myzus persicae (Sulzer), are very restrictive in the choice of primary or winter host, but as alienicolae accept a wide variety of herbaceous hosts. Eventually, in the autumn, the alienicolous clones produce fall migrants, which are gynoparae and alate males. These males fly back to the winter host where the gynoparae produce apterous oviparae. This type of life cycle is fairly widespread in the Aphidoidea and is exemplified by some of the more economically important species such as Myzus persicae (Sulzer), Myzus cerasi (Fabricius), Rhopalosiphum padi (Linnaeus), Dysaphis plantaginea (Passerini), and Cryptomyzus ribis (Linnaeus).

Oviparous dioecious heterocycle is confined to the Adelgidae, which feed exclusively on conifers. The polymorphism in this kind of life cycle is complex, with variants depending on species and host plants. Much of the generic classification used by European workers is largely based on biological characters. The fertilized eggs hatch on the primary host in the spring. The larvae or “crawlers” then move to the bases of the developing needles of the primary host, which is usually a species of spruce. Each crawler develops into a fundatrix, which causes a small gall to develop at the base of the needle in which the fundatrix deposits a large number of eggs. Clusters of these individual galls produce a composite gall at the apices of the twigs, and these composite galls are characteristic for various species of adelgids. The progeny of the fundatrices are alatae that fly to the
summer or secondary host, which are conifers other than spruces. On the secondary host the alatae deposit their eggs and die in place, the wings providing a protective covering for the eggs. Three kinds of larvae or crawlers hatch from these eggs. Some larvae immediately mature into apterae that give rise to parthenogenetic generations on the summer host. The adelgids comprising these generations are called *progredientes* (sing. *progrediens*) and may be alate or apterous. The remaining larvae undergo a resting period before developing into what are collectively called *sistentes* (sing. *sistens*). *Aestivosistentes* develop from aestivating larvae; *hiemosistentes* develop from diapausing larvae. In some instances the first-instar larva of a sistens is denoted by the prefix *neo-*, because this nymphal stage sometimes behaves differently than other instars of the maturing sistens. A progrediens potentially can produce progredientes, aestivosistentes, hiemosistentes, or sexuparae. The progeny of an aestivosistens can become progredientes, hiemosistentes, or sexuparae. A hiemosistens may produce progredientes, aestivosistentes, or hiemosistentes.

The sexuparae are alatae and return to the primary or winter host. Microsexuales hatch from the deposited eggs. They differ, like those of the Phylloxeridae, from microsexuales of the Aphidoidea in that a rostrum is present.

### Relationships with other organisms

**Diseases.** Although aphids can damage plants by feeding alone, the main reason for their economic importance is that they transmit or carry many destructive viruses. Viruses transmitted by aphids are generally classified as nonpersistent or styletborne and persistent or circulative.

Styletborne virus particles are transmitted by adhering to the ends of the stylets of the feeding channel. They are not ingested. Other plants become inoculated merely by an aphid probing a potential food source. Aphids can acquire styletborne viruses in a short time, ranging from about 5–60 s. Inoculation also requires little time and studies suggest that the maximum probability of infection occurs within about 15 s. Aphids transmitting styletborne viruses usually remain viruliferous for only a few minutes and do not remain viruliferous after molting. Many viruses are transmitted in this manner and usually do not require a specific aphid for transmission. However, some viruses that can be transmitted in the laboratory using a needle for inoculation are not transmitted by aphids, except by the addition of other compounds. This finding suggests some possible degree of specificity.

Because circulative viruses spend some time developing in the aphid, there is a lag between when the aphid acquires and transmits a virus. Such viruses are found in the haemocoel of the aphid and are inoculated into plants by means of the saliva. Many of these viruses
are specific to particular aphids. Some such viruses are apparently associated with infraspecific entities within well-known aphid species, which have not been characterized by usual taxonomic techniques, for example, in clones of the greenbug, *Schizaphis graminum* (Rondani).

**Honeydew.** Although honeydew contains many other substances, sugars are the main component. Most species of ants are attracted to aphids for the honeydew. Ants are able to stimulate the production of honeydew by stroking the aphids with their antennae. In this instance honeydew is excreted without the usual flicking motions of legs, abdomen, or cauda. Ants will protect and defend aphids and transport them from danger. They are also known to build extensive protective “sheds” of soil and detritus around colonies of aphids.

Many other insects that require sugars in their diets are attracted to aphid honeydew. As aphids and scale insects evolved before flowering plants, this sugar source may have been the only one readily available to groups of insects that appeared before flowering plants, such as Diptera, Mecoptera, and Lepidoptera.

**Pathogens.** Fungal pathogens are well known and at least 13 species have been recorded from aphids. Several of the imperfect fungi have been successfully field tested as control agents for aphids.

**Parasitoids.** One group of Hymenoptera, the Aphidiidae, depends exclusively on aphids as hosts. The females of these small wasps lay their eggs in the body cavity of the aphid. The wasp larva feeds on the tissues of the aphid eventually killing it. Parasitized aphids are easily recognized because they become brown or black hardened “mummies.” The adult parasitoid escapes from the mummy by cutting a circular hole in the dorsal surface.

Species of one group of chalcid wasps, the Aphelinidae, attack some aphids in a similar manner. Species of Aphidiidae and Aphelinidae have been used for biological control of aphids.

**Predators.** Because of parthenogenesis aphids can build up large populations in a relatively short time. This provides an important and frequently exclusive source of food for a variety of insect predators. Animals that are known to be predacious on aphids include birds; lady beetles (Coccinellidae); green, brown, and powdery lacewing flies (neuropteroid families Chrysopidae, Hemerobiidae, and Coniopterygidae); hoverflies (Syrphidae); some gall midges (Cecidomyiidae, Aphidoletes spp.); some plant bugs (Miridae); flower bugs (Anthrideridae); and silverflies (Chamaemyiidae, Diptera). Lady beetles, plant bugs, and anthocorids feed on aphids as adults and as immatures. Only the larval stages of the other groups of insects listed above feed on aphids.
**Symbionts.** Within the body cavity of aphids are found *mycetomes*, or longitudinal clusters of cells (*mycetocytes*), which contain bacterialike structures. Mycetocytes are passed from the mother to the embryo early in its development. These structures are believed to be in some way associated with aphid metabolism.

**Higher classification of aphids**

There is no general agreement among aphid workers on a classification scheme for the aphids. The question of the number of families that should be recognized is still being debated. We have adopted the scheme of Heie (1980) in which 12 families are recognized. They represent biologically distinct groups. This scheme allows for three additional suprageneric categories, namely subfamily, tribe, and subtribe.

To identify the main taxonomic and biological groups of the genera found in Canada, brief descriptions of the suprageneric categories are provided. The genera used in this handbook are listed under the appropriate heading. Additional generic and subgeneric names that have appeared in the literature are listed in the index, where they are referred to the name used in this work.

**Order Homoptera; suborder Sternorrhyncha; infraorder Aphidodea**

**Superfamily Aphidoidea.** Fore wing with at least traces of more than 3 transverse veins besides common longitudinal vein. Female without sclerotic ovipositor, with rudimentary gonapophyses. Parthenogenetic female viviparous. Siphunculus usually present.


**Genus: Mindurus**

Family Hormaphididae: Apterae with head and pronotum fused. Antenna with 3–5 segments; processus terminalis shorter than base of ultimate segment; secondary sensoria of alatae annular. Eye of apterae absent (triommatidium present). Tibiae without rastral spines or setae; tarsi with preapical capitate setae; plantar setae capitate. Siphunculi poriform or absent. Cauda knobbed.
Anal plate bilobate. Dorsal and lateral tubercles absent. Wax glands aggregated into marginal facets. Apterae commonly flattened, aleurodiform, with reduced antenna and legs. Indigenous Canadian species forming galls on foliage of *Hamamelistes* and *Betula*. This group most diverse in tropics.

**Genera:** *Cerataphis*  
*Hormaphis*  
*Hamamelistes*

**Family Phloeomyzidae:** Head and pronotum not fused. Antenna with 6 segments; processus terminalis shorter than base of segment VI; secondary sensoria absent from all morphs. Tibia with rastral setae; plantar setae acuminate. Siphunculi poriform. Cauda semicircular. Anal plate entire. Wax glands forming large faceted plates restricted to abdominal segment VII. Ovipara alate, laying 2 eggs. Holocyclic on *Populus*.

**Genus:** *Phloeomyzus*

**Family Thelaxidae:** Apterae with head and pronotum fused. Antenna with 5 segments; processus terminalis shorter than base of ultimate segment; secondary sensoria oval or rounded. Eye of aptera absent (triommatidium present). Dorsal and lateral tubercles absent. Tibia without rastral spines or setae; plantar setae acuminate or capitate. Wax gland facets absent. Cauda knobbed or not. Anal plate rounded. Apical part of rostrum thin, elongate. Species in Canada monoecious on *Betula* or *Quercus*.

**Genera:** *Glyphina*  
*Thelaxes*

**Family Anoeciidae:** Head and pronotum of apterae fused medially, separate laterally. Antenna with 6 segments; processus terminalis shorter than base of segment VI; secondary sensoria rounded. Eye present or absent in apterae (absent in immature apterae). Tibiae without rastral spines or setae; plantar setae acuminate. Cauda semicircular. Anal plate entire. Lateral tubercles present. Males and oviparae apterous. Primary host *Cornus*; secondary hosts roots of various herbaceous plants, especially grasses; often restricted to secondary host.

**Genus:** *Anoecia*

**Family Pemphigidae:** Head and pronotum not fused. Eye of aptera absent, or rarely with a few facets (triommatidium always present). Processus terminalis of antenna shorter than base of ultimate segment (one exception). Tibiae commonly with rastral setae. Plantar setae acuminate. Media of fore wing usually unbranched, with two branches in certain morphs of some genera, exceptionally branched more than once in aberrant individuals. Dorsal and lateral tubercles absent. Siphunculus poriform or absent. Wax glands, when present, aggregated into faceted plates.
Cauda semicircular. Anal plate entire. Sexuales small, apterous, with reduced nonfunctioning mouthparts; ovipara producing 1 egg. Usually dioecious; primary hosts: deciduous trees and shrubs, where gall or pseudogall produced on foliage; secondary hosts: various plants, often feeding on the roots.

Subfamily Eriosomatinae: Antenna of alatae with secondary sensoria transverse-linear. Sensorium on basal segment of mid tarsus dorsolateral or lateral and less than its diameter from base of segment. Siphunculus poriform or absent. Wax gland facets forming ring around central facets. Hind wing with origin of oblique veins distant from each other, or with only one such vein. Primary host usually *Ulmus*, secondary hosts various, usually shrubby Rosaceae or Saxifragaceae, or herbaceous Compositae, grasses, or sedges.

Tribe Eriosomatini: Forming pseudogalls on primary host.

Genera: *Eriosoma* *Georgiaphis*

Tribe Tetraneurini: Forming closed galls on primary host (when known).

Genera: *Colopha* *Kaltenbachiella*
* Tetranura *Gharesia*

Subfamily Pemphiginae: Antenna of alatae with secondary sensoria transverse-linear to oval. Sensorium on side of basal segment of mid tarsus dorsal and more than its diameter from base of segment. Siphunculus poriform or absent. Wax gland facets arranged in uniform plates, not forming ring; some wax gland plates with setae. Hind wing with 2 oblique veins arising at or near common point on longitudinal vein. Primary hosts *Populus, Crataegus, Fraxinus, Lonicera, Tilia*; secondary hosts roots of Coniferae, or roots and aerial parts of various Dicotyledonae.

Tribe Pemphigini: Secondary antennal sensoria not ciliate.

Plantar setae of first instar shorter than claw. Primary host *Populus*.

Genera: *Cornaphis* *Mordwilkoja*
* Pemphigus *Thecabius*

Tribe Prociphilini: Secondary antennal sensoria usually ciliate.

Plantar setae of first instar usually longer than claw.

Genera: *Grylloprociphilus* *Meliarthiphagus*
* Neoprociphilus *Pachypappa*
* Prociphilus *Stagona*
* Tiliphagus*
Subfamily Fordinae: Wax gland facets, when present, not forming ring; setae never present within wax plates. Siphunculus absent. Abdominal segments setose. Primary hosts Anacardiaceae.


Genera: *Forda*  *Geoica*  *Smynthurodes*


Genus: *Melaphis*

Family Drepanosiphidae: Head and pronotum not fused (except in apterae of one genus). Compound eye present in all morphs. Antenna with 6 segments, some species with 4 or 5 segments; secondary sensoria round to transversely oval, usually present only on segment III of viviparae alatae, usually absent from apterae. Rastral setae or spines usually present on tibiae; basal tarsal segment trapezoidal in some genera, with or without dorsal setae; plantar setae usually clavate. Siphunculus directed laterally, usually truncate. Lateral tubercles present or absent. Wax glands, when present, aggregated into faceted plates; dorsal plates associated with setal bases; oviparae usually with pair of large ventral wax plates (below siphunculi). Anal plate bilobed or entire. Cauda usually knobbed. Monoecious, almost always holocyclic.

Subfamily Drepanosiphinae: Antenna with 6 segments. Rastral spines present. All individuals, including fundatrices and oviparae alate. Usually with submedian setigerous dorsal papillae on anterior abdominal segments. Posterior abdominal segments of ovipara commonly prolonged forming ovipositor. Anal plate of viviparae slightly emarginate to bilobed; anal plate of oviparae entire. Three gonapophyses. Species in Canada on *Acer*.

Genera: *Drepanaphis*  *Drepanosiphum*

Subfamily Phyllaphidinae: Antenna with 6 or rarely 5 segments. Base of rostral segment II with sclerotized arch. Rastral structures, where present, of setae. Oviparae apterous. Two gonapophyses.

Tribe Phyllaphidini: Triommatidium distinct. Some species with submedian setigerous dorsal papillae on abdominal segments. Dorsal setae of apterae and nymphs large, capitate in some genera. Anal plate of viviparae bilobed or entire; anal plate of oviparae entire. Many species with all viviparae, including fundatrices, alate; others with both apterous and
alate viviparae; a few alate vivipara unknown and males either alate or apterous. Mostly on deciduous trees and shrubs (especially Betulaceae, Fagaceae, Juglandaceae) or legumes.

Genera: Appendiseta, Betulaphis
Boernerina, Callaphis
Callipterinella, Cepegillettea
Chromaphis, Cienocallis
Diphyllaphis, Eucallipterus
Euceraphis, Hoplochaitophorus
Lachnochaitophorus, Monellia
Monelliopsis, Myzocallis
Neosymydobius, Oestlundiiella
Panaphis, Phyllaphis
Protopterocallis, Pterocallis
Stegophylla, Symydobius
Takecallis, Tamalia
Teroaphis, Tinocallis
Tuberculatus


Genera: Iziphyya, Saltusaphis
Subsaltusaphis, Thripsaphis

Subfamily Chaitophorinae: Fundatrices and oviparae apterous. Anal plate at most slightly emarginate. Four gonapophyses. Dorsal setae numerous, acuminate.


Genera: Chaitophorus, Periphyllus

Tribe Siphini: Antenna with 4 or 5 segments. Siphunculus poriform or truncate, never reticulate. Setae usually long, commonly thick and spinelike. Males apterous. On herbaceous Monocotyledonae, especially grasses and sedges.

Genera: Atheroides, Sipha

Family Greenideidae: Mainly oriental. Not found in Canada.

Family Aphididae: Head and pronotum not fused. Antenna with 6 or rarely 5 segments (4-segmented fundatrices of some species); processus terminalis usually longer than base of ultimate antennal segment; secondary sensoria round. Eye present in all morphs;
triommatidium distinct. Fore wing with media branched (usually with 3 branches); branches of cubitus leave longitudinal vein separately. Tibiae usually without rastral spines or setae; plantar setae acuminate. Dorsal and lateral tubercles present or absent. Siphunculus usually tubular, occasionally short, poriform, or absent. Anal plate always entire. Cauda not knobbed except in a few species (knob differs in form from that of other subfamilies with knobbed cauda). Wax glands unicellular, opening separately into integument, not aggregated into facets. Oviparae apterous.


Genera: Fullawaya Pterocomma Pseudopterocomma

Subfamily Aphidinae: Body setae usually few. Plantar setae acuminate. Cauda variously shaped; if semicircular then with few setae, or body setae few. Males usually alate. Anholocyclic, holocyclic, and heterocyclic life cycles represented. Most plant groups among the hosts.

Tribe Aphidini: Antenna shorter than body. Antennal tubercles not, or only slightly developed. Spiracles of abdominal segments I and II not exceptionally close together. Lateral tubercles of abdominal segments I and VII commonly more developed than those of segments II–VI; if absent from segments I or VII then also absent from segments II–VI. First tarsal segments with 2 ventral setae.

Genera: Aphis Hyalopterus Rhopalosiphum Toxoptera Asiphonaphis Misturaphis Schizaphis Zyxaphis

Tribe Macrosiphini: Antenna and legs commonly elongate, antenna longer than body in some genera. Antennal tubercles commonly strongly developed. Spiracles of abdominal segments I and II approximate. Lateral tubercles of segments II–VI more strongly developed than those of segments I or VII; if absent from segments II–VI then also absent from segments I and VII. First tarsal segments with 2–5 ventral setae.

Genera: Acyrthosiphon Amphicercidus Aphthargelia Aspidaphium Aulacorthum Brachycaudus Alphitoaphis Amphorophora Aspidaphis Atarsos Bipersona Brachycolus
Brevicoryne  
Capitophorus  
Catamergus  
Ceruraphis  
Coloradoa  
Cryptomyzus  
Diuraphis  
Elatobium  
Epameibaphis  
Flabellomicrosiphum  
Glendenningia  
Hayhurstia  
Hyalomyzus  
Hysteroneura  
Illinoia  
Liosomaphis  
Longicaudus  
Macrosiphum  
Microlophium  
Microstiphoniella  
Myzaphis  
Myzus  
Nearctaphis  
Neotoxoptera  
Ovatus  
Papulaphis  
Placoaphis  
Pseudacaudella  
Pseudoepameibaphis  
Rhopalosiphoninus  
Siphonatrophia  
Utamphorophora  
Wahlgreniella  
Cachryphora  
Carolinaia  
Cavariella  
Chaetosiphon  
Cryptaphis  
Decorosiphon  
Dysaphis  
Eomacrosiphon  
Fimbriaphis  
Glabromyzus  
Gypsoaphis  
Hyadaphis  
Hyalopteroides  
Idiopterus  
Jacksonia  
Lipaphis  
Macrosiphoniella  
Mastopoda  
Microparsus  
Musaphis  
Myzodium  
Nasonovia  
Neoamphorophora  
Obtusicauda  
Paducia  
Phorodon  
Pleotrichophorus  
Pseudocercidis  
Rhopalomyzus  
Sanbornia  
Uroleucon  
Vesiculaphis  

Family Lachnidae:  Head and pronotum not fused. Apex of rostrum beyond subapical setae separated as segment V or partly fused to base of segment IV. Antenna with 5 or usually 6 segments; processus terminalis shorter than base of ultimate segment. Eye present, usually well-developed, in all morphs. Tibia without rastral spines or setae; basal tarsal segment trapezoidal, with dorsal setae in some genera; plantar setae acuminate. Fore wing with media usually branched. Dorsal and lateral tubercles absent. Siphunculus usually present, poriform or mammiform and with many setae. Cauda short, semicircular. Anal plate entire.

Subfamily Lachninae:  Rostrum with numerous setae; apex rounded. Radial sector of fore wing long and curved; media distinct, with 3 branches. Holocyclic on dicotyledonous shrubs and trees.
Subfamily Cinarinae: Rostrum less setose; apex usually elongate, slender. Radial sector of fore wing short, straight; media indistinct, usually with 1 or 2 branches. Usually holocyclic, a few species monoeciously heterocyclic. On conifers.

Genera: *Cinara*  *Essigella*  *Eulachnus*  *Schizolachnus*

Subfamily Traminae: Antenna with processus terminalis as broad as base of ultimate segment. Hind tarsus more than half length of hind tibia. On roots of various plants.

Genus: *Trama*

**Superfamily Phylloxeroidea:** Fore wing with 3 transverse veins besides longitudinal vein. Siphunculus absent. Female with at least traces of sclerotic ovipositor; gonapophyses absent. Parthenogenetic females oviparous.

Family Phylloxeridae: Antenna with 3 segments. Tarsi with preapical setae capitate. Fore wing with 2 basal transverse veins diverging from common stem. Ovipositor rudimentary. On deciduous trees and grape.

Genera: *Phylloxera*  *Phylloxerina*  *Longistigma*  *Maculolachnus*  *Tuberochaenus*

Family Adelgidae: Antenna of alata with 5 segments; of aptera with 3 or 4 segments. Tarsi with preapical setae acuminate. Fore wing with all transverse veins arising separately from common longitudinal vein, almost parallel. Ovipositor well-developed. On conifers.

Genera: *Adelges*  *Pineus*
Fig. 1. General aphid morphology. AP, anal plate; Cd, cauda; Cu1, first branch of first cubital vein; Cu2, second branch of first cubital vein; DSu, dorsal suture; E3, triommatidium; Fe, femur; I–VI, antennal segments; I–VIII, abdominal segments; M1, first branch of media; M2, second branch of media; M3+4, fused third and fourth branches of media; Oc, ocellus; Pap, conical papilla; PT, processus terminalis; RS, radial sector; SDA, anterior discal setae; SDP, posterior discal setae; SDL, dorsolateral seta of abdominal tergum; Si, siphunculus; SLA, anterior lateral setae of pronotum; SLP, posterior lateral seta of pronotum; SM, submedian setae of abdominal tergum; SMA, anterior submedian setae of pronotum; SMP, posterior submedian seta of pronotum; SSL, lateral setae; St, stigma; Ts, tarsus; Tb, tibia.
Fig. 2. Ventral view of terminalia of apterous viviparous female. AP, bilobate anal plate; Cd, cauda; Go, gonapophyses; GP, genital plate.
Fig. 3. Terminalia of male. Cs, clasper; P, penis.
Fig. 4. Lateral view of head. A, antennal socket; Cl, clypeus; E3, trionmatidium; Lb, labrum; PCl, postclypeus; R1, R2, R3, R4, segments of rostrum.
Fig. 10. Basic features of a generalized aphid life cycle. Stages shown above the horizontal line are on the primary host, those below on the secondary host.
Figs. 11–23. Examples of galls and pseudogalls. 11, gall of *Kaltenbachiella* on elm; 12, gall of *Mordwilkoja* on poplar; 13, gall of *Pemphigus bursarius* (Linnaeus) on lombardy poplar; 14, leaf and petiole galls of *Phylloxera* on hickory; 15, petiole gall of *Pemphigus spirothecae* Passerini on lombardy poplar; 16, gall of *Pemphigus populicaulis* Fitch on large-toothed aspen; 17, leaf gall of *Pemphigus populivenae* Fitch on balsam poplar; 18, pseudogall of *Pachypappa* on trembling aspen; 19, pseudogall of the rosy apple aphid, *Dysaphis plantaginea* (Passerini), on apple; 20, gall of *Adelges* sp. on spruce; 21, pseudogall of the (continued)

Figs. 27–30. Typical fore wing venation of aphids. 27, Adelgidae; 28, Phylloxeridae; 29, Aphidoidea, media with 3 branches; 30, Aphidoidea, media unbranched.

Figs. 31–33. Hind wing venation of aphids. 31, two transverse veins arising separately from longitudinal vein; 32 two transverse veins arising near same point on longitudinal vein; 33, one transverse vein.

currant aphid, Cryptomyzus ribis (Linnaeus), on currant; 22, pseudogall of Eriosoma on elm; 23, pseudogall of Georgiaphis on elm.
Figs. 34–38. Shape of anterior margin of head. 34, antennal and median tubercles undeveloped; 35, antennal tubercles well-developed, smooth, diverging; 36, antennal tubercles well-developed, scabrous, converging, anteromedian process rounded; 37, antennal tubercles well-developed, scabrous, converging, anteromedian process digitiform; 38, antennal and median tubercles similarly developed.

Figs. 39–41. Chaetotaxy of disc of head. 39, two pairs of anterior and two pairs of posterior discal setae; 40, numerous posterior setae forming a single transverse group; 41, numerous setae not forming discrete groups (note median dorsal suture).

Figs. 42–45. Union of head and pronotum, and eye development. 42, head and pronotum fused; 43, head and pronotum distinct laterally, fused medially; 42, 43, eye (continued)
Figs. 48–55. Form of siphunculus. 48, poriform; 49, truncate; 50, mammiform; 51, cylindrical, with a flange; 52, swollen, with a flange; 53, truncate-reticulate, with a flange; 54, swollen, with a subapical flangeless orifice; 55, capitate.

Figs. 56–59. Subapical sculpture of siphunculus. 56, with coarse isodiametric reticulation; 57, with fine isometric reticulation; 58, with two rows of weak transverse reticulae; 59, with encircling rows of spicules.

Figs. 60–69. Caudae. 60, knobbed; 61, semicircular; 62, short triangular; 63, elongate triangular; 64, tassel-shaped; 65, with elongate knob; 66, arclike; 67, tongue-like; 68, irregularly constricted cauda of Bipersona sp.; 69, with median fingerlike process.

consisting of triommatidium only; 44, head and pronotum separated by a distinct suture; 45, head and pronotum fused, pronotum with a secondary transverse suture; 44, 45, eye well-developed.

Figs. 46, 47. Ventral views of head of alate viviparous female showing the two basic types: 46, with postclypeus; 47, without postclypeus. Cl, clypeus; DSu, dorsal suture; FOc, frontal (anterior) ocellus; FT, antennal tubercles; Lb, labrum; PCl, postclypeus; Pr, protuberance on ventral margin of antennal socket; VSu, ventral suture.
Figs. 70–74. Form of secondary sensoria of third antennal segment. 70, round, with margins; 71, transverse-oval, with ciliate margins; 72, irregular, platelike, lacking margins; 73, transverse-linear, or annular; 74, large plates.

Figs. 75, 76. Terminal antennal segments. 75, with elongate processus terminalis; 76, with processus terminalis shorter than basal part of segment. PT, processus terminalis; Ss1, primary sensorium; SsAc, accessory primary sensorium.
Figs. 77–81. Apical segments of rostrum. 77, part beyond primary subapical setae articulated to segment IV, forming a fifth segment; 78, subcylindrical, with rounded apex; 79, segment short and blunt (typical of a grass-feeding species); 80, base triangular, sides concave, apex elongate, secondary setae long (typical of species feeding on Anthemidae); 81, basal part elongate, apex short and rounded. S1, subapical primary setae; S2, secondary setae.

Figs. 82–86. Sculpture on apex of cauda. 82, apical spicules similar to those of more basal parts of cauda; 83–86, apical spicules reduced or absent.
Figs. 87–92. Tarsus and apex of tibia. 87, 88, with preapical capitate setae (Cap); 88, tarsus reduced to a single segment and lacking claws; 87, 89, 92, basal segment triangular; 90, 91, basal segment trapezoidal; 91, basal segment with dorsal setae; 89, apical segment imbricate (some imbricae spiculose); 90, apical segment smooth; 91, apical segment with encircling rows of spicules; 92, apical segment spiculose ventrally; 87, 89, 90, 92, plantar setae (Ar) acuminate; 91, plantar setae spatulate; 91, with rastral spines (SpR); 92, with rastral setae (SR).

Fig. 93. Peglike stridulatory setae on hind tibia of Toxoptera.

Fig. 94. Atrium of thoracic spiracle of Nasonovia and related genera.
Figs. 95–103. Various types of setae. 95, capito-flabellate; 96, acuminat; 97, glandular-capit; 98, capit; 99, multifid or branched; 100, flabellate; 101, wax-secreting; XC, waxy filament produced by secretory seta in *Thelaxes*; 102, 103, peltate.

Figs. 104–107. Arrangement of wax gland facets. 104, ring of smaller facets around a large central area; 105, incomplete ring; 106, rosette; 107, uniform.

Figs. 108–113. Chaetotaxy of pronotum. 108, one seta in each of the four principle setal positions; 109, 110, anterior submedian setae absent; 111, numerous setae in each of the principle positions; 112, 113 numerous setae without distinct arrangement.

Use of identification keys

The keys presented here for identifying the genera of aphids found in Canada are based on morphological characters, with biological and field characteristics as supplemental characters. They are designed for use with slide-mounted, adult female specimens. Although oviparae and fundatrices were considered during construction of the keys, these morphs in some genera may be difficult to key out. Because the head becomes distorted during slide preparation, its features may be more reliably interpreted by examining cleared specimens before final mounting.

Key to superfamilies of infraorder Aphidodea

1. Female with well-developed sclerotic ovipositor (Fig. 24) or with traces of sclerotic ovipositor (Fig. 25); gonapophyses absent; parthenogenetic females oviparous. Fore wing with 3 transverse veins besides main longitudinal vein (Figs. 27, 28). Siphunculus absent ........................................ Phylloxeroidea (p. 117)

Sclerotized ovipositor absent; rudimentary gonapophyses almost always present (Fig. 26); parthenogenetic females viviparous (developing embryos usually visible through body wall). Fore wing with at least traces of more than 3 veins besides main longitudinal vein (Figs. 29, 30) (viz. a radial sector, 1–3 branches of media, and 2 cubital veins). Siphunculus usually present ........................................ Aphidoidea (p. 45)

Clé des superfamilles de l’infraordre des Aphidodea

1. Femelles pourvue d’un ovipositeur scléréfié bien développé (fig. 24) ou de traces d’ovipositeur scléréfié (fig. 25); gonapophyses absentes; femelles parthenogénétiques ovipares. Aile antérieure munie de 3 nervures transverses à côté de la principale nervation longitudinale (fig. 27 et 28). Siphon absent .............

................................. Phylloxeroidea (p. 118)

Femelles sans ovipositeur scléréfié; gonapophyses rudimentaires presque toujours présentes (fig. 26); femelles parthenogénétiques vivipares (embryons habituellement visibles à travers les parois abdominales). Aile antérieure munie de plus de trois nervures à l’état de simples traces situées à côté de la
Key to genera of superfamily Aphidoidea

1. Cauda distinctly constricted before apex, part beyond constriction forming abrupt transverse, circular or elongate knob (Figs. 60, 65); anal plate commonly bilobate (Figs. 115, 116) ................................................................. 2
   Cauda arc-shaped, semicircular, triangular or elongate (Figs. 61–64, 66–69) (if elongate with subbasal constriction, then not abruptly expanded (Fig. 64) and anal plate not bilobate) ................................................................. 3

2(1). Eye of aptera consisting only of triommatidium; head and prothorax fused, so that triommatidium remote from apparent posterior margin of head (Fig. 42); alata with 3–5-segmented antenna; plantar setae usually capitate; tarsi with dorsal or ventral preapical capitate setae (Fig. 87) ................................................................. 12
   Eye of aptera well-developed; head and prothorax distinctly separate (Fig. 44); alata with 5- or 6-segmented antenna; plantar setae spatulate or acuminate; tarsi without capitate setae ............. 29

3(1). Plantar setae broadly (Fig. 91) to narrowly spatulate, or anal plate strongly to weakly bilobate (Figs. 115, 116), or both ................................................................. 15
   Plantar setae acuminate (Fig. 90), blunt or minutely capitate (absent in 1 genus); anal plate entire (Fig. 114) ................................................................. 4

4(3). Processus terminalis shorter than basal part of ultimate antennal segment (Fig. 76), or if about equal then cauda short, rounded or arclike (Figs. 61, 66) ........... 6
   Processus terminalis longer (usually much longer) (Fig. 75) than basal part of ultimate antennal segment, or if about equal then cauda elongate (Figs. 63, 64) ..... 5

5(4). Antenna with narrow annular secondary sensoria (Fig. 73); alata only .................................................................
   ... Mordvilkoja Del Guercio (spring migrant) (p. 470)
   Antenna with round to oval secondary sensoria (Figs. 70, 71), or without secondary sensoria .......... 133
6(4). Apical segment of hind tarsus at least half as long as hind tibia; on roots of Taraxacum ........................................
......................................................... Trama von Heyden (p. 682) Apical segment of hind tarsus much shorter than half length of tibia .......................................................... 7

7(6). Basal tarsal segments triangular (Fig. 92) ...................... 8
Basal segment of each tarsus trapezoidal (Fig. 90), with dorsal surface commonly longer than basal width (in doubtful cases, siphuncular pore set on hairy mammiform base) ........................................ 67

8(7). Abdomen with lateral tubercles; antennal sensoria, especially primary sensoria, rounded and strongly protuberant (Fig. 168); siphunculus short, almost poriform, on low setose cone (Fig. 50); faceted wax glands absent; on Cornus or roots of grasses .......... ................................................................. Anoeicia Koch (p. 133) Abdomen lacking lateral tubercles; antennal sensoria various, if round then flat or convex, but not strongly protuberant; siphunculus present or absent; wax gland facets present or absent ........................................ 9

9(8). Aptera with wax glands facets present only on segment VII, forming 2 large patches of gland facets; antenna of alata lacking secondary sensoria ................................................................. Phloeomyzus Horvath (p. 549) Aptera with wax glands facets present on other parts of body, or entirely absent; alata with secondary sensoria ................................................................. 10

10(9). Enclosed in gall or pseudogall on leaves or twigs ........ 74
Not enclosed in gall or pseudogall (feeding site may be distorted, but aphids not enclosed) (key alatae not associated with host here) .................................................. 11

11(10). Apterae ..................................................................... 112
Alatae .............................................................................. 88

12(2). Anal plate entire (Fig. 114); alata with secondary sensoria of antenna round to oval (Fig. 70); dorsal setae of aptera spinelike; apical rostral segment conical, sides slightly concave, apical part long and slender (Fig. 80); on Quercus .......... Thelaxes Westwood (p. 660) Anal plate bilobed (Fig. 116); alata with narrow transverse secondary sensoria (Fig. 73); apical rostral segment subcylindrical, short, blunt ..................................... 13
13(12). Aptera with two hornlike projections on anterior margin of head; antenna of aptera 4-segmented, of alata 5-segmented; media branched; on palms and other exotic ornamentals ......................................................... *Cerataphis Lichtenstein* (p. 222)

Aptera without anterior horns; antenna of aptera 3-segmented; media unbranched; on *Betula* and *Hamamelis* ................................................................. 14

14(13). Antenna of alata 3-segmented; fore and mid tarsi of aptera each reduced to single clawless segment (Fig. 88); aptera aleurodiform or normal ........................................... 15

................................. *Hormaphis Osten Sacken* (p. 368)

Antenna of alata 5-segmented; all tarsi of aptera with 2 segments and claws ................................................................. *Hamamelistes Shimer* (p. 357)

15(3). Antenna 5-segmented; on grasses ........................................... 16

Antenna 6-segmented; on trees ........................................... 17

16(15). Siphunculus short, truncate; abdominal tergum VIII not expanded to cover cauda ................................................................. 15

................................. *Sipha Passerini* (in part) (p. 622)

Siphunculus poriform, obscure; abdominal tergum VIII expanded, covering cauda ................................................................. *Atheroides Haliday* (p. 164)

17(15). Processus terminalis covered with numerous setae (Fig. 1683) ......................................................... 15

................................. *Pseudopterocomma MacGillivray* (in part) (p. 586)

Processus terminalis with apical setae only ................................ 18

18(17). Siphunculus truncate, reticulate (Fig. 53) ................................ 18

Siphunculus variously shaped, not reticulate ................................ 20

19(18). Tibia of alata spiculose; integument of aptera smooth or with only a few dispersed spicules; summer resting stages of some species with foliate peripheral setae; on *Acer* .................. *Periphyllus van der Hoeven* (p. 546)

Tibia of alata without spicules; integument of aptera with distinct nodules, spicules, or reticulation (Figs. 489, 490), at least laterally; on *Salix* or *Populus* ....................... 19

................................. *Chaitophorus Koch* (in part) (p. 232)

20(18). Basal tarsal segment with dorsal setae .................................. 21

Basal tarsal segments lacking dorsal setae .................................. 25
21(20). Rastral setae absent; 0–5 lateral tubercles on each of abdominal segments II–VII; dorsal setae of aptera acuminate; on Quercus .................................................. Neosymydobius Baker (p. 509)

Rastral setae present (not clearly differentiated from other tibial setae in aptera); aptera with capitate dorsal setae and without lateral tubercles; on Betula or Alnus .................................................. 22

22(21). Apterae; on Betula ...... Calaphis Walsh (in part) (p. 196)

All adults alate; on Betula or Alnus .................................. 23

23(22). Secondary antennal sensoria ciliate; on Betula .......... 24

Secondary sensoria not ciliate; wax glands present around bases of abdominal setae; on Alnus ..................................................

........................................ Oestlundiella Granovsky (p. 519)

24(23). Secondary sensoria restricted to basal half of antennal segment III .... Euceraphis Walker (in part) (p. 309)

Secondary sensoria not restricted to basal half of antennal segment III ...... Betulaphis Glendenning (p. 171)

25(20). Wax glands present around bases of dorsal setae; on Quercus ................. Diphyllaphis Takahashi (p. 268)

Wax glands absent; on Betula or Quercus .......................... 26

26(25). Rastral setae lacking; head of aptera fused to prothorax, with secondary transverse suture on pronotum, so that eyes remote from apparent hind margin of head; on Quercus ..................................................

.......................... Lachnochaitophorus Granovsky (p. 405)

Rastral setae present; poorly differentiated from other tibial setae in some genera; on Betula ......................... 27

27(26). Dorsal setae capitate (Fig. 290); siphunculus not spiculose .................................. Betulaphis Glendenning (p. 171)

Dorsal setae acuminate; siphunculus with encircling rows of spicules or nodules ........................................... 28

28(27). Antennal segment III with smooth imbrications; lateral abdominal sclerites present, some with tubercles; rastral setae on fore tibia not well-differentiated from other tibial setae .................................................................

........... Callipterinella van der Goot (in part) (p. 200)

Antennal segment III with minutely spiculose or nodulose imbrications; lateral abdominal sclerites absent or fragmented, without tubercles; rastral setae well-developed on fore tibia .................................

........................................ Symydobius Mordvilko (p. 642)
29(2). Antenna with 5 segments; on grasses .......................... 30
Antenna with 6 segments; segments III and IV partly fused in some specimens ........................................ 31

30(29). Siphunculus short, truncate; processus terminalis less than twice length of base of ultimate antennal segment; on grasses .................................................................

Siphunculus short, but distinctly cylindrical; processus terminalis more than 3 times length of basal part of ultimate antennal segment; on *Artemisia* ...............................

*Sipha Passerini* (in part) (p. 622)

31(29). Integument of entire body densely covered with spicules and nodules; siphunculus elongate, cylindrical, with dense spicules or nodulose imbrications; plantar setae acuminate; apical tarsal segment short, no longer than apical width of tibia; tibia with row of peglike setae (Fig. 93) .........................................................

Musaphis Börner (fundatrix, in part) (p. 473)

Not exactly as above .................................................. 32

32(31). Triommatidium embedded in compound eye, apparently absent; abdominal tergite VIII commonly bilobed; on *Carex, Juncus,* or grasses .................................................... 33
Triommatidium distinguishable; abdominal tergum VIII entire; on deciduous trees and shrubs or Leguminosae or bamboo ................................................................. 36

33(32). Fore and mid femora enlarged, distinctly broader than hind femur ...................................................... 34
All femora similarly shaped .......................................... 35

34(33). Antennal segment III densely and evenly spiculose over entire length; secondary sensoria of alata distributed over most of length of segment III, sparser towards apex in some species .............. *Iziphya Nevsky* (p. 396)
Antennal segment III with spicules less dense near base; secondary sensoria of alata restricted to basal two-thirds of segment III ..............................................

Saltusaphis Theobald (p. 608)

35(33). All dorsal setae acuminate ........................................

Thripsaphis Gillette (p. 668)

Most dorsal setae peltate (Figs. 102, 103) ..................

Subsaltusaphis Quednau (p. 639)

36(32). Siphunculus truncate, reticulate (Fig. 53); on *Populus* or *Salix* ............ *Chaitophorus Koch* (in part) (p. 232)
Siphunculus variously shaped, never reticulate .......... 37

37(36). Head with pair of anterior quadrate tubercles, each with pair of short capitate setae; aptera only ............................................................. Boernerina Bramstedt (p. 178)

Head without quadrate processes ........................................ 38

38(37). Caudal knob elongate (Fig. 65) ............................................. 39

Caudal knob circular (Fig. 60) .................................................. 40

39(38). Fore coxa enlarged, more than twice as broad as mid coxa; on Leguminosae .......... Therioaphis Walker (p. 664)

Fore coxa not enlarged; on Betula or Comptonia .................. Cepegillettea Granovsky (p. 218)

40(38). Basal tarsal segments with dorsal setae ....................... 44

Basal tarsal segments lacking dorsal setae .......................... 41

41(40). Wax glands present around bases of dorsal setae; on Fagus ........................................ Phyllaphis Koch (p. 556)

Wax glands lacking; not on Fagus ........................................... 42

42(41). Alata with median setigerous papilla on at least one of abdominal terga I—III; dorsal setae of aptera capitate and serrulate (Fig. 1690); on Alnus .................................................. Pterocallis Passerini (p. 589)

Alata without median papillae on abdominal terga; aptera with acuminate dorsal setae ......................... 43

43(42). Siphunculus with dense encircling rows of spicules or nodules; dorsal setae of aptera long, hairlike; on Betula .................................................. Callipterinella van der Goot (in part) (p. 200)

Siphunculus smooth; dorsal setae of aptera long, thick, and spinelike; on Quercus .................................................. Hoplochaitophorus Granovsky (p. 364)

44(40). Rastral setae (Fig. 92) or rastral spines (Fig. 91) present on at least one pair of tibiae ........................................... 49

Rastral setae and spines absent from all tibiae ................. 45

45(44). Alata .................................................................................. 46

Aptera ..................................................................................... 47

46(45). Fore wing veins conspicuously bordered with dark pigment; processus terminalis less than half length of basal part of antennal segment VI; on Juglans ...................... Panaphis Kirkaldy (p. 535)
Fore wing veins not or only obscurely bordered with dark pigment; processus terminalis more than half length (usually as long as) basal part of antennal segment VI; on Quercus .......................................................... Neosymydobius Baker (in part) (p. 509)

47(45). Abdominal and some thoracic segments with digitate posteriorly directed lateral and submedian dorsal papillae (Fig. 592); on Cytisus ................................................. Ctenocallis Klodnitzki (p. 261)

Abdominal papillae, if present, conical, not digitate ...... 48

48(47). Dorsal setae short (not much longer than siphunculus), pointed (Fig. 1422); on Quercus .......................................................... Neosymydobius Baker (in part) (p. 509)

Dorsal setae long, capitate, serrulate (Fig. 1690); on Alnus .................................................. Pterocallis Passerini (p. 559)

49(44). Rastral spines present (Fig. 91, SpR); gonapophyses 3; on Acer .......................................................... 50

Rastral setae present (Fig. 92, SR); gonapophyses 2 .... 51

50(49). Siphunculus elongate; dorsum of abdomen without papillae ...................... Drepanosiphum Koch (p. 279)

Siphunculus short, vasiform; dorsum of abdomen with one or more pairs of submedian papillae ................... Drepanaphis Del Guercio (p. 275)

51(49). Rastral setae on fore tibia only; on Juglans ...................... Chromaphis Walker (p. 236)

Rastral setae present on hind tibia ..................... 52

52(51). Fore coxa enlarged, more than twice as broad as mid coxa; on Leguminosae .................. Therioaphis Walker (p. 664)

Fore coxa no more than 1.5 times as broad as mid coxa .................................................. 53

53(52). Aptaera ....................................................... Calaphis Walsh (in part) (p. 196)

Alata ........................................................................ 54

54(53). Secondary sensoria of antenna strongly transverse-oval, with distinctly ciliate margins (Fig. 760) .................. Euceraphis Walker (in part) (p. 309)

Secondary sensoria circular to oval, with margins spiculose or smooth, not ciliate ...................... 55

55(54). Wax glands present at bases of dorsal setae .................. Boernnerina Bramstedt (p. 178)

Wax glands absent .................................................. 56

51
56(55). With more than 1 seta laterally on each of abdominal segments I–IV ...................................................... 63
Lateral abdominal setae single ........................................... 57

57(56). Siphunculus poriform; lateral setae of abdominal segment VI appended to its base; on Carya or Juglans ........ 61
Siphunculus short but not poriform; lateral setae of abdominal segment VI not appended to its base .... 58

58(57). Dorsum of abdomen with distinct submedian dark spots, or antennal segment III dark in area bearing secondary sensoria and pale at base and in apical half ................................................................. 60
Dorsum of abdomen without submedian spots; antennal segment III without a dark band in basal half .... 59

59(58). Dorsal submedian setae on at least some abdominal segments anterior of siphunculus on distinct papillae; on Ulmus .................. Tinocallis Matsumura (p. 675)
Dorsum of abdomen without papillae; on Betula .............. ...................................................................... Calaphis Walsh (p. 196)

60(58). Posterior portion of head with transverse cluster of more than 4 setae (Fig. 40); apices of veins with conspicuous pigmented spots; hind femur dark; on Tilia .................. Eucallipterus Schouteden (p. 305)
Head with only 4 posterior discal setae (Fig. 39); spots at apices of veins of fore wings absent, obscure, or distinct; hind femur not conspicuously darker than fore and mid femur; on Arundinaria ..................... ..................................................... Takecallis Matsumura (p. 646)

61(57). Abdomen with transverse row of pigmented papillae of various sizes on terga I–III or IV ......................... Protopterocallis Richards (p. 572)
Abdomen with paired submedian papillae, or dorsal papillae absent ....................................................... 62

62(61). Vein Cu₂ in fore wing heavily bordered with brown pigment; wings of living specimens held vertically when at rest .......... Monelliopsis Richards (p. 466)
Vein Cu₂ not heavily bordered with brown pigment; wings of living specimens held horizontally against body when at rest .......... Monellia Oestlund (p. 463)

63(56). With paired conical or fingerlike papillae on at least terga I–III (Fig. 1 Pap) .............................................. 64
Without paired dorsal papillae; some genera with single, median, papilla or rounded boss on abdominal terga I–III ....................................................... 65
64(63). Siphunculus spiculose .......................................................... 
Myzocallis Passerini (in part) (p. 481)
Siphunculus smooth or wrinkled, never with spicules 
............................................. Tuberculatus Mordvilko (p. 685)

65(63). At least one of abdominal terga I–III with submedian 
setae set on median papilla; on Alnus ............................ 
............................................. Pterocallis Passerini (p. 589)
Abdominal terga without median papillae .......... 66

66(65). Hind femur without dorsal preapical dark spot; some 
species with femur completely brownish or streaked 
with brown; on various trees, especially Quercus, but 
not Robinia ..........................................................
Myzocallis Passerini (in part) (p. 481)
Hind femur with dorsal preapical brown or black spot; 
remainder of femur yellowish or colorless; on Robinia 
................................................ Appendiseta Richards (p. 145)

67(7). Basal tarsal segments with dorsal setae ................. 68
Basal tarsal segments lacking dorsal setae .......... 70

68(67). Claw with dorsal tunica (Fig. 741); eye on short stalk (Fig. 
742); antenna 5-segmented; media with 2 branches; 
on Pinus or Pseudotsuga ............................. 
............................................. Essigella Del Guercio (p. 301)
Claw simple; eye not stalked; antenna 6-segmented; 
media with 1 or 3 branches .............................. 69

69(68). Siphunculus poriform, situated on narrow asetose sclerite; 
longest body setae longer than first antennal segment; 
media unbranched, evanescent; on Pinus ....................
............................................. Eulachnus Del Guercio (p. 312)
Siphunculus hairy, mammiform; body setae shorter than 
first antennal segment; media with 3 branches; on 
Rosa ............................................. Maculolachnus Gaumont (p. 432)

70(67). Abdomen with large median conical papilla on segment V; 
body large; on Salix ............................................. 
............................................. Tuberolachnus Mordvilko (p. 689)
Abdomen without large dorsal papilla ............... 71

71(70). Apical segment of rostrum broad and short, with length 
less than twice basal width; media unbranched, 
evanescent; flocculent colonies on Pinus ............ 
............................................. Schizolachnus Mordvilko (p. 619)
Apical segment of rostrum slender, with length greater 
than twice basal width; siphunculus usually on hairy 
mammiform base; media with 2 or 3 branches ....... 72
72(71). Rostral segments IV and V separate; V elongate with length more than twice its basal width; on conifers .......... Cinara Curtis (p. 239)
Rostral segments IV and V partly fused; length of V less than 1.2 times its basal width .......... 73

73(72). Aptera lacking secondary sensoria; pterostigma elongate, reaching apex of wing; body longer than 6 mm; on various deciduous trees ................................................................. Longistigma Wilson (p. 421)
Aptera with secondary sensoria on antennal segment III; pterostigma not reaching wing apex; body less than 5 mm long; on Quercus ................................................................. Lachmus Burmeister (p. 408)

74(10). On leaves of Arctostaphylos .......... Tamalia Baker (p. 649)
On leaves or various deciduous trees and shrubs .......... 75

75(74). On Rhus ........................................ Melaphis Walsh (p. 439)
Not on Rhus .................................................................. 76

76(75). On leaves or twigs of Populus .................................. 77
Not on Populus ................................................................. 81

77(76). In closed gall on leaves or twigs .................................. 78
In pseudogall formed by folding, cupping, or curling of leaf blade, or in rosette formed from terminal leaves .... 79

78(77). Gall large, irregular, tuberculate, involving entire leaf blade (Fig. 12) .... Mordwilkoja Del Guercio (p. 470)
Gall swelling on twig, petiole, or leaf blade, but not involving entire leaf (Figs. 13, 15–17) .................. Pemphigus Hartig (p. 542)

79(77). Front margin of head of aptera with central triangular projection (Fig. 553); alata with antennal secondary sensoria restricted to distal half of segment III; pseudogall formed by folding of leaf edge .......... Cornaphis Gillette (p. 250)
Head without such a structure; alata with secondary sensoria of antenna on apical two-thirds or more of segment III ................................................................. 80

80(79). Pseudogall in rosette formed from terminal leaves or saclike deformation of single leaf (Fig. 18); alata with secondary sensoria of antenna oval .................................................. Pachypappa Koch (p. 526)
Pseudogall formed by rolling of edges or folding of leaf; alata with secondary sensoria transverse-linear .......... Thecatus Koch (p. 657)
81(76). In gall or pseudogall on Ulmus .............................. 82
In pseudogall on Tilia or Fraxinus .............................. 86

82(81). In closed gall on upper surface of leaf ......................... 83
In pseudogall on leaves or closed gall on twigs .............. 85

83(82). Gall elongate spindle-shaped or globular (Fig. 11) ...... 84
Gall cockscomblike, arranged parallel to lateral veins ...... ............................. Colopha Monell (p. 243)

84(83). Tarsi of all legs of aptera (fundatrix) with segments completely fused; antennal segment V of alata longer than segment IV or VI; segment VI of alata without secondary sensoria .......... Tetraneura Hartig (p. 653)
Tarsal segments of hind leg (and usually also middle leg) of aptera (fundatrix) broadly joined but with distinct line dividing them; antennal segment V no longer than VI; alata with secondary sensoria on segment VI ............................ Kaltenbachiella Schouteden (p. 402)

85(82). Secondary sensoria of antenna of alata relatively remote from each other; average distance between them at least as great as diameter of segment; length of many sensoria less than half circumference of segment .......... ......................... Georgiaphis Maxson & Hottes (p. 334)
Secondary sensoria of antenna of alata relatively densely distributed; distance between them less than antennal diameter; length of most sensoria more than half circumference of segment .................................................. Eriosoma Leach (p. 297)

86(81). In rosette of deformed terminal leaves on Tilia .................. Tiliphagus Smith (p. 671)
In pseudogalls on foliage of Fraxinus ......................... 87

87(86). Apical rostral segment of aptera with 2 secondary setae; aptera with rastral setae; antenna of alata with secondary sensoria on segment V ............................................................... Meliarhizophagus Smith (p. 442)
Apical rostral segment of aptera with 4 secondary setae; aptera lacking rastral setae; antenna of alata without secondary sensoria on segment V ............................................................. Prociphilus Koch (in part) (p. 568)

88(11). Stigma prolonged to apex of wing .................................................. Mindarus Koch (p. 456)
Stigma not prolonged ............................................. 89
89(88). Hind wing with 2 transverse veins having common stem or arising at or near common point on the longitudinal vein (Fig. 32); gonapophyses 3 ............................................. 90
Hind wing with 2 transverse veins widely separated at base (Fig. 31), or with only 1 transverse vein (Fig. 33); gonapophyses 2 ........................................................................ 100

90(89). Secondary sensoria strongly protruding, shelflike (Fig. 1970) ........................................... *Tiliphagus Smith* (p. 671)
If secondary sensoria protruding, then base gradually rising (Fig. 1536) ........................................... 91

91(90). Media branched .................................................................................................
.............. *Pachypappa Koch* (spring migrant) (p. 526)
Media unbranched ......................................................................................... 92

92(91). Secondary sensoria of antenna (at least those on distal part of segment IV and on segment V, if present) with spiculose or ciliate margins ........................................ 93
Margin of all secondary sensoria lacking cilia and spicules ................................................................. 98

93(92). Stigma somewhat elongate (its apex reaching more than half the distance from the base to the apex of the radial sector), attenuate, with its posterior margin slightly concave ...................... *Stagona Koch* (p. 632)
Stigma generally shorter, its posterior margin at least slightly, commonly strongly convex ...................... 94

94(93). Antennal segment VI about as long as segment III ................ 95
Antennal segment VI less than 0.85 length of segment III ................................................................. 96

95(94). Antennal segment VI with secondary sensoria; but sensoria lacking basal one-third of segment III .............
...................... *Meliarhizophagus Smith* (p. 442)
Antennal segment VI lacking sensoria; segment III with sensoria present on basal one-third .....................
...................... *Neoprociphilus Patch* (p. 505)

96(94). Antennal segment III without secondary sensoria on basal one-third .......... *Pachypappa Koch* (sexupara) (p. 526)
Antennal segment III with sensoria over entire length ........................................................................... 97
97(96). Secondary antennal sensoria round to transversely oval, with length less than half diameter of antennal segment III; sexupara and embryo with hind femur enlarged; rastral setae present (less distinctly developed in spring migrant) ......................................................... **Grylloprociphilus Smith & Pepper** (p. 351)

At least some secondary sensoria transverse, either linear or length more than half diameter of antennal segment III; rastral setae present; hind femur of sexupara and embryo not especially enlarged ................................. **Prociphilus Koch** (p. 568)

98(92). Secondary antennal sensoria round to oval, restricted to distal half of segment III ................................................................. **Cornaphis Gillette** (p. 250)

Secondary sensoria oval to transverse-linear, present over entire length of segment III and on some of segments IV–VI ........................................................................................................ 99

99(98). Gonapophyses not sclerotized; wax gland plates not present on mesonotum, or if present, small .............................. **Pemphigus Hartig** (p. 542)

Gonapophyses sclerotized, raised; mesonotum with large wax gland plates .................. **Thecabius Koch** (p. 657)

100(89). Secondary sensoria of antenna round (Fig. 70) to transverse-oval (Fig. 71) ................................................................. 101

Secondary sensoria transverse-linear (Fig. 73) ............ 106

101(100). Femora, tibiae, and antenna with transverse rows of spicules ................................................................. 102

Tibiae and antenna without spicules, or with a few spicules on antenna ..................................................... 103

102(101). Mid (in some species also fore) tibia with protruding sensoria (Fig. 892); secondary sensoria of antenna round, with distinct ciliate margins .............................................. **Glyphina Koch** (p. 348)

Tibiae without protruding sensoria; secondary sensoria of antenna transversely oval, with indistinct nonciliate margins .............................. **Tamalia Baker** (p. 649)

103(101). Antennae long, with segments IV and V each as long as or longer than segment III; secondary sensoria round, with diameter less than half width of segment; media with 3 branches ....... **Stegophylla Oestlund** (p. 635)
Antenna short, with segment IV less than three-quarters as long as segment III; secondary sensoria large, platelike, more than half diameter of segment (Fig. 74), or if smaller, then crowded, irregular in shape (Fig. 72); media unbranched .......................... 104

104(103). Margins of primary sensoria ciliate; cubital veins arising from short common stalk or from single point on main longitudinal vein ......................... Geoica Hart (p. 330)

Margins of primary sensoria not ciliate; cubital veins arising separately from longitudinal vein ............ 105

105(104). Secondary sensoria of antenna numerous, 10–60 on segment III; antennal segment II at most 1.5 times as long as segment I; antenna 5-segmented ..................

Forda von Heyden (p. 323)

Secondary sensoria few, less than 10 on segment III; segment II about twice as long as segment I; antenna 6- rarely 5-segmented ........................................ Smynthurodes Westwood (p. 629)

106(100). Antennal segment V more than twice length of segment IV; media unbranched ........................................ Tetrameura Hartig (p. 653)

Antennal segment V less than twice length of segment IV; media branched or unbranched .................. 107

107(106). Siphuncular pore surrounded by setigerous sclerotic ring .................................................................... 108

Siphuncular pore not surrounded by setigerous sclerite, or absent .......................................................... 109

108(107). Secondary sensoria of antenna relatively remote from each other, with average distance between them at least as great as diameter of segment; length of many sensoria less than half circumference of segment ................. Georigraphis Maxson & Hottes (p. 334)

Secondary sensoria of antenna relatively densely distributed, with distance between them less than antennal diameter; length of most sensoria more than half circumference of segment ............................................ Eriosoma Leach (p. 297)

109(107). Ultimate antennal segment distinctly longer than segment IV, with more than 5 secondary sensoria similar in form and distribution to those on segment III; media unbranched, or some individuals with media branched near wing margin .................. 110
Ultimate antennal segment with 0–5 secondary sensoria less densely distributed than those on III; media branched near middle of wing, or unbranched ...... 111

110(109). Siphunculi absent; tibiae without spicules .............................................. Melaphis Walsh (p. 439)

Siphuncular pore present; tibiae with spicules on distal one-third ...... Kaltenbachiella Schouteden (p. 402)

111(109). Ultimate antennal segment longer than IV; siphunculi absent; hind wing with 2 oblique veins; media branched ........................................ Gharesia Stroyan (p. 337)

Ultimate antennal segment at most as long as segment IV; siphuncular pore present; hind wing with 1 oblique vein; media branched or unbranched ................................................. Colopha Gillette (p. 243)

112(11). Antennal segment II more than three-quarters length of segment III; segment III shorter than segment VI ...... .......................................................... 113

Antennal segment II less than half length of segment III; segment III longer than ultimate segment .............. 114

113(112). Apical antennal segments not spiculose; anal plate large, quadrate; cauda minute; posterior part of abdomen emarginate above anal plate; anus located dorsally above base of anal plate (Fig. 1825); on roots of grasses .................. Smynthurodes Westwood (p. 629)

Apical antennal segments spiculose; anal plate and abdominal tergites not as above; anus terminal; on foliage of Quercus ..... Stegophylla Oestlund (p. 635)

114(112). Head and prothorax fused; triommatidium remote from apparent hind margin of head (Fig. 42) ................. 115

Head and prothorax separate at least laterally; triommatidium near hind margin of head (Fig. 43) .............................................................. 116

115(114). Cauda subtriangular, extending beyond anal plate; integument with numerous wax glands; on twigs of Picea or Abies .................. Mindarus Koch (p. 456)

Cauda short, semicircular, with anal plate extending beyond cauda; integument rugulose, without wax glands; on roots of Alnus or Betula, some colonies above ground in shelters provided by ants ......................

.................................................. Glyphina Koch (p. 348)
Facets of at least some wax glands arranged as rosette or ring (incomplete or multiple in some specimens) around central facet of different size or form (Figs. 104–106) ........................................ 117

Facets of wax glands uniform, not arranged in rings (Fig. 107) .................................................. 120

All tarsi 2-segmented; on Pomoidea or Ribes ..............................

........................................... Eriosoma Leach (p. 297)

At least fore tarsi 1-segmented ........................................... 118

Setae at apex of abdomen longer than hind tarsus; all tarsi 1-segmented ........................................

................................. Tetraneura Hartig (alienicola) (p. 653)

Setae at apex of abdomen not especially long .................. 119

Tarsi with capitate preapical setae; on Gramineae or Cyperaceae ...... Colopha Monell (alienicola) (p. 243)

Tarsi without capitate preapical setae; on roots of Labiatae ...........................................................

... Kaltenbachiella Schouteden (alienicola) (p. 402)

Tarsi with 1 segment; on mosses ...........................................

........................................... Melaphis Walsh (p. 439)

Tarsi with 2 segments; not on mosses .......................... 121

Wax glands absent ........................................................... 122

Wax glands present .......................................................... 124

Most dorsal setae flabellate ............. Geoica Hart (p. 330)

All dorsal setae acuminate ................................. 123

Antennal sensoria with ciliate margins; on aerial parts of Juncus .............. Prociphilus Koch (in part) (p. 568)

Antennal sensoria with margins not ciliate; on roots of grasses .......................... Forda von Heyden (p. 323)

Base of ultimate antennal segment longer than apical segment of hind tarsus; on Smilax ........................................

........................................... Neoprociphilus Patch (p. 505)

Base of ultimate antennal segment not longer than apical segment of hind tarsus; not on Smilax .................. 125

Ventral setae of basal tarsal segments short, spindelike ................................................................. 126

Ventral setae of basal tarsal segments hairlike ........... 129

Apical tarsal segments spiculose ventrally (Fig. 92); not on conifer roots .................................. 127
Apical tarsal segments not spiculose ventrally; on roots of conifers ........................................ 128

127(126). Antennal segment II nearly twice as long as segment I; on roots of Lysimachia ........................................... Mordwilkoja Del Guercio (p. 470)
Antennal segment II less than 1.5 times length of segment I; on roots of various plants ........................................... Pemphigus Hartig (p. 542)

128(126). Ventral setae of basal tarsal segments similar in size and shape to rastral setae .......... Stagona Koch (p. 632)
Ventral setae of basal tarsal segments inconspicuous, much smaller than rastral setae ........................................... Pachypappa Koch (p. 526)

129(125). Rastral setae distinct; on roots of Ranunculus ........................................... Thecabius Koch (p. 657)
Rastral setae absent or not differentiated from other tibial setae ........................................... 130

130(129). Plantar setae minutely capitate; on Carex ........................................... Gharesia Stroyan (p. 337)
Plantar setae acuminate ........................................... 131

131(130). Apical tarsal segments spiculose; on roots of Fraxinus ........................................... Meliarhizophagus Smith (p. 442)
Apical tarsal segments not spiculose; on various plants, but not Fraxinus ........................................... 132

132(131). Ultimate rostral segment with 2–4 secondary setae; cauda with more than 10 setae; on Lycopus roots ........................................... Tiliphagus Smith (p. 671)
Ultimate rostral segment with 6 or more secondary setae or cauda with fewer than 10 setae ........................................... Prociphilus Koch (in part) (p. 568)

133(5). Siphunculus well-developed, longer than wide .......... 134
Siphunculus absent, poriform, or shorter than its basal width ........................................... 260

134(133). Siphunculus with more than 2 rows of subapical isodiametric sculpture (Fig. 56, 57) ........................................... 247
Siphunculus without isodiametric reticulations; some species with 2 or 3 subapical rows of poorly developed transverse reticulation (Fig. 58) ........................................... 135

135(134). Tarsi virtually absent or reduced to single segment; claws absent ........................................... 136
Tarsi normal, with 2 segments and claws ........................................... 137

61
136(135). Tarsi reduced to single clawless segment (Fig. 1183); on ferns .................. Mastopoda Oestlund (p. 435)
Tarsi reduced to an obscure sclerite, apparently absent (Fig. 263); on Grindelia ...... Atarsos Gillette (p. 161)

137(135). Processus terminalis clothed with setae (Fig. 1683) ......... Pseudopterocoma MacGillivray (p. 586)
Processus terminalis usually with apical setae only, rarely with a few setae in addition to apical setae .......... 138

138(137). Antenna of aptera with 4 segments, of alata with 4 or 5 segments; longest antennal setae longer than twice diameter of segment; siphunculus inflated (Fig. 52) ................................ Paducia Hottes & Frison (p. 531)
Antenna with 6 segments, or if with 5 segments then antennal setae shorter or siphunculus cylindrical ....
........................................................................................................................................................................ 139

139(138). Cauda short, semicircular, with 20 or more setae; pronotum with numerous scattered setae (Fig. 112) 
........................................................................................................................................................................ 140
Cauda of various shapes: if semicircular, then with fewer than 15 setae, or pronotum with setae arranged in definite anterior and posterior submedian and lateral groups (usually single seta in each position), or both (Figs. 108–110) ................................. 141

140(139). Siphunculus well-developed, with definite flange; on aerial parts of Populus or Salix .................. Pterocoma Buckton (p. 594)
Siphunculus usually reduced or absent, if well-developed then without flange; on Populus or Salix, usually on roots ......................... Fullawaya Essig (p. 327)

141(139). Ultimate rostral segment with part beyond subapical setae slender, elongate, with at least one-third length of part before subapical setae or 1 pair of secondary setae (or both) longer than primary subapical setae; on Artemisia ................................................................. 154
Ultimate rostral segment with part beyond subapical setae shorter than one-quarter length of part before subapical setae, usually rounded; subapical primary setae equal to or longer than all secondary setae; on various hosts, rarely Artemisia ......................... 142

142(141). Siphunculus capitate (Fig. 55); ultimate rostral segment long and subcylindrical, part beyond subapical setae conical, blunt (Fig. 81); on Solidago ................................................................. Cachryphora Oestlund (p. 192)
Siphunculus cylindrical or swollen before apex, but not capitate .............................................. 143

143(142). Siphunculus with well-developed flange .................. 144
Siphunculus without flange ................................. 149

144(143). Antennal tubercles well-developed, diverging (Figs. 35, 38) or converging (Fig. 36) .................. 145
Antennal tubercles undeveloped (Fig. 34) ................ 158

145(144). Median frontal tubercle moderately to well-developed (Fig. 38), about equal to development of antennal tubercles; prothorax with anterior submedian setae (Fig. 108) .................. 152
Median tubercle undeveloped, or if developed antennal tubercles extending beyond median tubercle; prothorax usually without anterior submedian setae (but when present front of head distinctly concave) ................................................................. 146

146(145). Antennal tubercles smooth, diverging, rarely with a few obscure spicules ventrally (Fig. 35) .............. 147
Antennal tubercles converging, or diverging, but always scabrous at least near anterior margin or with spicules and nodules ventrally (or both) .................. 148

147(146). Apterae ........................................................ 192
Alatae ................................................................ 209

148(146). Apterae ........................................................ 223
Alatae ................................................................ 236

149(143). Siphunculus swollen; on Prunus, Phragmites, or Typha ........................................ Hyalopterus Koch (p. 382)
Siphunculus not swollen ..................................... 150

150(149). Abdominal tergum VIII with median setigerous papilla (Fig. 226), or entire tergum forming triangular shield covering cauda (Fig. 224) .................. Aspidaphis Gillette (p. 152)
Abdominal tergum VIII without median process ...... 151

151(150). Siphunculus tapering, orifice oblique (Fig. 238) ............
......................................................... Aspidaphium Börner (p. 157)
Siphunculus narrowest in middle; diameter at base and apex greater; orifice not oblique .................................................. Jacksonia Theobald (p. 400)

152(145). Siphunculus cylindrical, distinctly imbricate especially towards apex; on conifers ........................................ Elatobium Mordvilko (p. 286)

63
Siphunculus strongly swollen, almost without sculpture; not on conifers ........................................... 153

153(152). Abdominal tergites I–VI of aptera fused into pigmented carapace (paler in middle) with impressed reticulations; apical part of hind tibia strongly spiculose; on Kalmia .........................................................
... Neoamphorophora Mason (p. 502)

Abdominal tergites of aptera unpigmented; apex of hind tibia not spiculose; on Berberis .........................................................
... Liosomaphis Walker (p. 411)

154(141). Siphunculus capitate (Fig. 55) .........................................................
... Epameibaphis Oestlund (p. 293)
Siphunculus cylindrical or swollen before apex, but not capitate ......................................................... 155

155(154). Antennal tubercles well-developed .........................................................
... Pleotrichophorus Börner (p. 564)
Antennal tubercles not developed ............................................ 156

156(155). Many dorsal setae, especially those on prothorax, flabellate (Fig. 100) or flabello-capitate (Fig. 95); siphunculus with orifice oblique (Fig. 1667); pronotum with anterior submedian setae .........................................................
... Pseudoepameibaphis Gillette & Palmer (p. 582)

Dorsal setae of head and thorax acuminate to slightly clavate, never flabellate; siphunculus with orifice transverse; pronotum without anterior submedian setae .............................................. 157

157(156). Siphunculus slightly but distinctly swollen before apex; dorsal abdominal setae of aptera blunt to clavate ........
... Coloradoa Wilson (p. 247)
Siphunculus cylindrical or tapering; all dorsal setae of aptera acuminate ....... Zyxaphis Knowlton (p. 706)

158(144). Abdominal tergum VIII with median setigerous papilla (Fig. 426); on Salix or Umbelliferae .........................
... Cavariella Del Guercio (p. 214)
Abdominal tergum VIII not produced or papillate ...... 159

159(158). Cauda short, flaplike with apex rounded to bluntly triangular (Fig. 67), or cauda arc-shaped (Figs. 61, 66) ................................................................. 160
Cauda elongate triangular, with sides nearly parallel (Fig. 63), or fingerlike beyond base (Fig. 69), or tassel-shaped beyond basal constriction (Fig. 64) ........... 167
160(159). Cauda small, arc-shaped, inconspicuous (Fig. 66) ............ Brachycaudus van der Goot (in part) (p. 183)
Cauda not arc-shaped ................................................. 161

161(160). Lateral tubercles on abdominal segment VII large, diameters more than half basal diameter of siphunculus .......... Aphis Linnaeus (in part) (p. 137)
Lateral tubercles on abdominal segment VII, if present, small, diameters not more than half basal diameters of siphunculus .............................................. 162

162(161). Siphunculus nearly smooth, some specimens with obscure dispersed spicules especially basally ......................... Brachycaudus van der Goot (in part) (p. 183)
Siphunculus conspicuously wrinkled, or with smooth or spiculose imbrications, or with spicules and nodules ................................................................. 163

163(162). Siphunculus with encircling rows of fines spicules or nodules (Fig. 59) ......................................................... 164
Siphunculus variously sculptured, but not with closely set encircling rows of spicules or nodules ................................. 165

164(163). Spiracle on abdominal segment VII without expanded anterior margin forming operculum (Fig. 6); hind tibia usually with numerous pseudosensoria; on Viburnum or sedges .......... Ceruraphis Börner (p. 225)
Spiracle on abdominal segment VII with anterior margin expanded forming operculum (Fig. 7); hind tibia rarely with a few pseudosensoria (one species); on Prunae, Pomoidea, or mainly Leguminosae, also infrequently on Labiatae or Scrophulariaceae ......................... Nearctaphis Shaposhnikov (p. 498)

165(163). Siphunculus wrinkled or imbricate; imbrications without conspicuous nodules or spicules; on Pomoidea and various herbaceous plants, e.g., Plantago ..................... Dysaphis Börner (p. 283)
Siphunculus strongly imbricate; imbrications with conspicuous nodules or spicules; on Sorbus, Crataegus, Viburnum, or sedges ......................... 166

166(165). Siphunculus more or less swollen in middle, noticeably narrowed before orifice (Fig. 464); on Viburnum or sedges ..................... Ceruraphis Börner (p. 225)
Siphunculus not as above (Fig. 1303); on Crataegus or Sorbus ......................... Muscaphis Börner (p. 473)
Siphunculus short, usually distinctly shorter than cauda, at most subequal to cauda, in which case cauda broadly triangular

Siphunculus longer than cauda, if subequal in length then cauda fingerlike or tassel-shaped, not broadly triangular

Antenna with 5 segments

Antenna with 6 segments

Secondary sensoria restricted to third antennal segment in alatae; alatae with narrow irregular transverse dashes on abdominal terga; apterae with dorsal spots on abdomen generally coalescing into distinct transverse dashes; on Cruciferae

Secondary sensoria occurring on antennal segments III–V of alatae; dorsum of abdomen in alatae extensively pigmented; on Symphoricarpos

Secondary sensoria occurring on antennal segments III–V of alatae; dorsum of abdomen in alatae extensively pigmented; on Symphoricarpos

Siphunculus subequal to half length of apical segment of hind tarsus

Siphunculus longer than half length of apical segment of hind tarsus

Siphunculus not swollen on apical half, base much broader than apex

Siphunculus swollen on apical half; on Chenopodium

Apterae

Alatae

Hind tibia with stridulatory organ of longitudinal row of peglike setae (Fig. 93)

Hind tibia without stridulatory organ of longitudinal row of peglike setae

Abdominal tergites forming fused pigmented carapace; on mosses

Abdominal tergites not forming fused carapace

Lateral abdominal tubercles present on segment VII

Lateral abdominal tubercles, if present, not present on segment VII

Dorsum of body pitted, wrinkled, or folded
Abdomen unsculptured ........................................ 179

177(176). Antenna with 5 segments ....... Carolinaia Wilson (p. 207)
Antenna with 6 segments ........................................ 178

178(177). Setae on head blunt to minutely capitate; on Rosaceae
......................... Myzaphis van der Goot (p. 477)
Setae on head acuminate; on Carex ..........................
........................ Vesiculaphis Del Guercio (p. 701)

179(176). Dorsal surface of abdomen smooth, without pigmented
sclerites anteriad of siphunculus; on Lonicera or
Umbelliferae ............... Hyadaphis Kirkaldy (p. 372)
Dorsal surface of abdomen with distinct reticulate
sculpture; segments anteriad of siphunculus with
small sclerites at bases of submedian setae; on
Cruciferae ......................... Lipaphis Mordvilko (p. 414)

180(175). Cauda with 2 setae on each side; on Pruneae, Pomoidea,
or Gramineae ................................. 181
Cauda with more than 2 setae on each side; if with 2 setae
not associated with above groups of plants .......... 182

181(180). Dorsum of abdomen with finely reticulate sculpturing;
siphunculus usually distinctly swollen on apical half
or in middle; if cylindrical then on Prunus, Typha, or
rarely Scirpus ................................. Rhopalosiphum Koch (in part) (p. 605)
Dorsum of abdomen without finely reticulate sculpturing;
siphunculus not swollen; mostly on grasses, rarely on
Scirpus, not associated with Prunus or Typha ............
........................................ Schizaphis Börner (p. 615)

182(180). On Pruneae and Gramineae .......................... Hysteroneura Davis (p. 386)
Not on Pruneae and Gramineae ..........................
........................................ Aphis Linnaeus (in part) (p. 137)

183(172). Media with 2 branches ............................... 184
Media with 3 branches ........................................ 186

184(183). Siphunculus swollen, abruptly narrowed before apex ......
........................................ Vesiculaphis Del Guercio (p. 701)
Siphunculus cylindrical or tapering .......................... 185

185(184). Hind tibia with stridulatory organ of longitudinal row of
short peglike setae (Fig. 93) ..........................
........................................ Toxoptera Koch (p. 678)
Hind tibia without peglike setae ..........................
........................................ Schizaphis Börner (p. 615)
186(183). Siphunculus more or less swollen near middle or on apical half ................................................................. 187
Siphunculus subcylindrical, tapering, not swollen near middle or on apical half; not strongly narrowed in middle ................................................................. 191

187(186). Lateral abdominal tubercles present .................................. 188
Lateral abdominal tubercles absent ........................................ 189

188(187). Lateral abdominal tubercles present on segment VII ..........
.............................. Rhopalosiphum Koch (in part) (p. 605)
Lateral abdominal tubercles not present on segment VII .............. Lipaphis Mordvilko (p. 414)

189(187). Hind wing with 1 transverse vein (Fig. 33) ......................
.................................................. Carolina Wilson (p. 207)
Hind wing with 2 transverse veins (Fig. 31) ......................... 190

190(189). Dorsum of abdomen usually with central pigmented patch, if absent secondary sensoria on antennal segment III in straight line; tarsi commonly with more than 3 setae ventrally on each of basal segments ...................... Myzaphis van der Goot (p. 477)
Dorsum of abdomen membranous; secondary sensoria scattered over whole surface of third antennal segment; never more than 3 setae on each of basal tarsal segments .......... Hyadaphis Kirkaldy (p. 372)

191(186). Hind wing with 1 transverse vein (Fig. 33) ......................
.............................. Hysteroneura Davis (p. 386)
Hind wing with 2 transverse veins (Fig. 31) .........................
.............................. Aphis Linnaeus (in part) (p. 137)

192(147). Anterior margins of at least the spiracles on abdominal segment VII produced, overlapping the spiracles (Fig. 7) .... Nasonovia Mordvilko (in part) (p. 493)
Anterior margins of abdominal spiracles not produced (Fig. 6) ................................................................. 193

193(192). Dorsum of abdomen with longitudinal rows of pigmented sclerites situated around bases of setae; atrium of prothoracic spiracle reticulate (Fig. 94); on Delphinium .......... Nasonovia Mordvilko (in part) (p. 493)
Dorsum of abdomen without spots as above; atrium of prothoracic spiracle not reticulate .............................. 194

194(193). Siphunculus distinctly swollen on apical half ............ 195
Siphunculus cylindrical or tapered towards apex ....... 198
195(194). Spicules at apex of cauda smaller than those on rest of cauda; on Rhus, grasses, or sedges .............................. Glabromyzus Richards (p. 341)

196(195). Swollen area of siphunculus with sculpturing same as on basal part; antennal segment III in aptera without sensoria; on Rosa or Ericaceae .............................. Wahlgreniella Hille Ris Lambers (p. 703)

197(196). Basal hind tarsal segments each with more than 2 setae ventrally; not associated with Lonicera or Gramineae; many species on Rubus .............................. Amphorophora Buckton (p. 130)

198(194). Dorsum of head and body with long capitate or short clavate setae .......................................................... 199

199(198). Dorsum of abdomen pigmented, sclerotic, forming carapace; on grasses ....................................................... Cryptaphis Hille Ris Lambers (p. 254)

200(199). Antennal segment III with sensoria .......................... 201

201(200). Dorsal setae numerous, not distributed in distinct pattern, usually short, clavate or flabellate (Fig. 1608); on Compositae (rarely Boraginaceae) ..................... Pleotrichophorus Börner (p. 564)

202(200). Dorsal setae on anterior abdominal segments and thorax short, clavate or flabellate; anterior submedian prothoracic setae present; on Elaeagnaceae, Compositae, or Polygonaceae ............................. Capitophorus van der Goot (p. 203)
Dorsal setae all long, capitate; anterior submedian prothoracic setae absent; on Rosaceae

Chaetosiphon Mordvilko (p. 229)

203(198). Dorsum of abdomen with large pigmented areas, commonly forming dorsal pigmented carapace

Aphthargelia Hotteis (in part) (p. 141)

204(203). Base of siphunculus situated in fully or nearly fully pigmented sclerotic ring; on Desmodium

Microparsus Patch (p. 449)

205(204). Siphunculus not longer than cauda; dorso-anterior margin of antennal tubercle with small accessory tubercle; on grasses

Hyalopteroides Theobald (p. 379)

Siphunculus much longer than cauda; antennal tubercle without small obscure accessory dorsal tubercle; uncommon on grasses

206(205). At least ventral imbrications on hind tarsus with nodules or spicules; apical portion of hind tibia usually with a few imbrications; on Urtica

Microlophium Mordvilko (p. 446)

Hind tibia without apical imbrications; imbrications on apical hind tarsal segment not spiculose or nodulose; not associated with Urtica

207(206). Cauda short to long, triangular (Figs. 62, 63)

Acyrthosiphon Mordvilko (p. 118)

Cauda shorter than above, almost arc-shaped or semilunar (Figs. 61, 66)

208(207). Basal tarsal segments each with 3 or fewer ventral setae; on Eriogonum, Lonicera, or Symphoricarpos

Amphicercidus Oestlund (p. 126)

Basal tarsal segments each with 5 or 6 setae ventrally; on Rosa

Pseudocercidis Richards (p. 579)

209(147). Dorsum of abdomen membranous

210(209). Cauda much longer than siphunculus

Hyalopteroides Theobald (p. 379)
Cauda never longer than siphunculus ...................... 211

211(210). Basal tarsal segments each with 6 or 5 ventral setae; on Rosa .................. Pseudocercidis Richards (p. 579)
Basal tarsal segment each normally with 3 or fewer ventral setae ........................................... 212

212(211). Base of siphunculus surrounded by complete or nearly complete ring of pigment; on Desmodium ..................
......................................................... Microparsus Patch (p. 449)
Base of siphunculus not surrounded by complete or nearly complete ring of pigment ..................... 213

213(212). Siphunculus cylindrical, or tapering toward apex ...... 214
Siphunculus swollen on apical half ...................... 215

214(213). Cauda short, tongue-shaped, bluntly rounded, not triangular, (Fig. 67) ........................................ Amphicercidus Oestlund (p. 126)
Cauda short to elongate, triangular (Figs. 62, 63) ....
......................................................... Acrysthasiphe Mordvilko (p. 118)

215(213). Spicules at apex of cauda shorter than those on rest of cauda .................. Glabromyzus Richards (p. 341)
Spicules at apex of cauda as long as or longer than those on rest of cauda ................................... 216

216(215). Swollen part of siphunculus smooth or nearly so .............. Amphorophora Buckton (p. 130)
Swollen part of siphunculus fairly evenly sculptured with spicules, nodules, and imbrications .................. Wahlgreniella Hille Ris Lambers (p. 703)

217(209). Atrium of mesothoracic spiracle cylindrical, with reticulate walls (Fig. 94); anterior margin of at least spiracles on abdominal segment VII commonly produced forming operculum (Fig. 7) ...........
......................................................... Nasonovia Mordvilko (p. 493)
Atrium of mesothoracic spiracle without reticulate walls, more less conical; anterior margins of abdominal spiracles not produced (Fig. 6) ....................... 218

218(217). Basal segment of hind tarsus with only 2 ventral setae .......... Rhopalomyzus Mordvilko (in part) (p. 598)
Basal segment of hind tarsus with 3–5 ventral setae .... 219

219(218). Siphunculus much longer than cauda ...................... 220
Siphunculus subequal to or shorter than cauda; on Symphoricarpos ............................................. Aphthargelia Hottes (in part) (p. 141)
220(219). Secondary sensoria on antennal segment III restricted to posterior surface ..................................................

.................... **Cryptaphis Hille Ris Lambers** (p. 254)
Secondary sensoria on antennal segment III numerous and scattered on all surfaces .......................... 221

221(220). Secondary sensoria restricted to antennal segment III

.................... **Chaetosiphoz Mordvilko** (in part) (p. 229)
Secondary sensoria occurring on segments III and IV, and commonly also on segment V .......................... 222

222(221). Pronotum with anterior submedian setae ..........................

.................... **Capitophorus van der Goot** (p. 203)
Pronotum without anterior submedian setae ..........................

.................... **Cryptomyzus Oestlund** (p. 258)

223(148). Dorsum of head and body with long capitate setae at least laterally and on abdominal tergum VII or VIII (or both) ................................................................. 224
Dorsum of head and body without long capitate setae (if setae capitate then shorter than greatest diameter of antennal segment II) ............................................................. 225

224(223). Lateral setae on head and body much longer than dorsal setae; setae of aptera conspicuously capitate; siphunculus strongly swollen, coarsely sculptured with nodules and imbrications; on mosses ...........................................

........................ **Decorosiphon Börner** (p. 265)
Lateral setae usually not distinctly longer than dorsal setae; siphunculus at most weakly swollen, lightly to moderately imbricate; on Rosaceae ...........................................

.................... **Chaetosiphoz Mordvilko** (in part) (p. 229)

225(223). Antennal tubercles with inner margins parallel or diverging (Fig. 35) .............................................. 226
Antennal tubercles converging (Figs. 36, 37) ............... 232

226(225). Siphunculus swollen, diameter of swollen part at least 1.25 times that of cylindrical part (Fig. 52) .......... 227
Siphunculus cylindrical, if faintly swollen then diameter less than above .................................................. 229

227(226). Diameter of swollen part of siphunculus several times that of cylindrical basal portion .............................

.................... **Rhopalosiphoninus Baker** (in part) (p. 601)
Diameter of swollen part of siphunculus not more than twice that of cylindrical basal portion .................... 228

228(227). Basal hind tarsal segment with 2 setae; on grasses ........

.................... **Rhopalomyzus Mordvilko** (in part) (p. 598)
Basal hind tarsal segments each with 3 setae; on Physocarpus or grasses

229(226). Siphunculus pigmented basally, colorless apically; on ferns

Siphunculus colorless, or evenly pigmented, or apical half darkest; rarely on ferns

230(229). Apex of cauda abruptly narrowed forming a terminal digitate process

Apex of cauda not abruptly narrowed

231(230). Dorsum of abdomen with reticulate sculpture (more obvious on pigmented areas) (Fig. 130); on Lonicera

Dorsum of abdomen without reticulate sculpture

232(225). Siphunculus cylindrical

Siphunculus swollen

233(232). Antennal segments I and II dark, contrasting with paler antennal segment III

Antennal segments I and II not much darker than antennal segment III

234(233). Antennal tubercle with fingerlike anteromedial projection (Fig. 37); on Prunus or Humulus

Antennal tubercle with rounded anteromedial projection (Fig. 36)

235(234). Dorsum of abdomen distinctly rugose; median frontal tubercle developed; spicules at apex of cauda reduced in size, smaller than those on rest of cauda

Dorsum of abdomen not conspicuously rugose; median frontal tubercle not developed; spicules at apex of cauda at least as large as those on rest of cauda

236(148). Antennal tubercles with inner margins parallel or converging, conspicuously scabrous, always with some spicules or nodules ventrally

Antennal tubercles diverging, without spicules or nodules ventrally; some species obscurely scabrous near anterior margins
237(236). Basal segments of hind tarsus with 5 setae ventrally .......... Chaetosiphon Mordvilko (in part) (p. 229)
Basal segments of hind tarsus never with more than 3 setae ventrally ........................................ 238

238(237). Siphunculus subcylindrical ........................................ 239
Siphunculus swollen on apical half .......................... 240

239(238). Margins of secondary sensoria commonly ciliate (Fig. 71) ........ Fimbriaphis Richards (in part) (p. 316)
Margins of secondary sensoria not ciliate .......................... Alphitoaphis Hottes (p. 122)

240(238). Apex of cauda abruptly narrowed forming terminal digitate process (Fig. 69) .......................... Glendenningia MacGillivray (p. 344)
Apex of cauda not abruptly narrowed; cauda evenly tapering ........................................ 241

241(240). Basal segment of hind tarsus with 3 setae ventrally ........ Utamphorophora Knowlton (p. 697)
Basal segment of hind tarsus with 2 setae ventrally .......... Rhopalomyzus Mordvilko (in part) (p. 598)

242(236). Veins of fore wings, especially basal veins, conspicuously bordered with brownish pigment .......................... 243
Veins of fore wing not conspicuously bordered with brownish pigment ........................................ 244

243(242). Siphunculus swollen on apical half, evenly pigmented; dorsum of abdomen with more or less well defined pigmented sclerotic patch ........................................ Neotoxoptera Theobald (p. 512)
Siphunculus cylindrical; basal portion brown; apical portion colorless; dorsum of abdomen without pigment; radial sector dipping down to intersect media .......................... Idiopterus Davis (p. 389)

244(242). Dorsum of abdomen with irregular, more or less quadrate, central patch of pigment ........................................ Myzus Passerini (in part) (p. 489)
Dorsum of abdomen without irregular, more or less quadrate, central patch of pigment, either membranous or with transverse dashes of pigment ........................................ 245

245(244). Dorsum of abdomen membranous; siphunculus swollen on apical half; secondary sensoria numerous, distributed on all surfaces of antennal segments III and IV and usually on segment V ........................................ Hyalomyzus Richards (p. 376)
Dorsum of abdomen membranous with conspicuous transverse dashes of pigment; siphunculus usually not swollen; secondary sensoria restricted to antennal segment III, usually distributed only on posterior surface ......................................................... 246

246(245). Prothorax with spicules laterally or ventrolaterally ........

........................................ Aulacorthum Mordvilko (in part) (p. 168)
Prothorax without spicules laterally or ventrolaterally

........................................ Fimbiaphis Richards (in part) (p. 316)

247(134). Siphunculus abruptly inflated below reticulate region
(Fig. 1729) ........... Rhopalosiphoninus Baker (p. 601)
Siphunculus cylindrical or with subapical swelling less abrupt than above (Fig. 52) ........................................ 248

248(247). Siphunculus with setae; ultimate rostral segment with part beyond subapical setae slender, parallel-sided; primary subapical setae of rostrum shorter than subbasal secondary setae (Fig. 80) ...........................................................

.............................................. Obtusicauda Soliman (p. 516)
Siphunculus without setae, or if with a few setae then subapical setae of rostrum longer than more basal setae and apical portion not slender ............... 249

249(248). Reticulate part extending at least two-fifths length of siphunculus; ultimate rostral segment with sides more or less concave, with apical part slender or triangular, and with subbasal secondary setae longer than preapical primary setae; sclerite in front of siphunculus larger than sclerite behind siphunculus (latter absent in some species); on Compositae, especially Artemisia or Achillea ..........................................................

........................................ Macrocephoniella Del Guercio (p. 425)
Reticulate region usually covers less than one-third of siphunculus; ultimate rostral segment never with concave sides; sclerite behind siphunculus larger than that in front of siphunculus (latter commonly absent)

................................................................. 250

250(249). Entire ultimate rostral segment subcylindrical, elongate, with part beyond subapical setae short and rounded (Fig. 81); cauda with several constrictions, appearing twisted (Fig. 68); on Cirsium and Hypericum ............

................................................................................ Bipepersona Hottes (p. 175)
Ultimate rostral segment subconical; cauda elongate-triangular, not appearing twisted ........................................ 251
251(250). Reticulations on siphunculus fine, with average diameter of cell less than one-fifth width of siphunculus, arrayed in more than 6 transverse rows (Fig. 57) .......................................................... 252

Reticulations on siphunculus coarse, with average diameter of cell one-third to one-fifth width of siphunculus, usually in 6 or fewer transverse rows (Fig. 56) .......................................................... 254

252(251). Fore wing with apical macula; lateral and dorsal tubercles large, with larger tubercles multilobate; antennal segment III of aptera without sensoria; basal tarsal segments with 5 ventral setae; on Rosa ......................

............... Eomacrosiphon Hille Ris Lambers (p. 290)

Fore wing without apical macula; lateral and dorsal tubercles small and simple, or absent; antennal segment III of aptera usually with sensoria; basal tarsal segments with 3 or 5 ventral setae .......... 253

253(252). Antennal tubercles well-developed, projecting beyond front margin of head for at least half the length of first antennal segment; median tubercle absent; dorsal abdominal setae commonly set on minute sclerites; dorsum otherwise membranous; cauda long, tapering to point; basal tarsal segments with 3 or 5 ventral setae; on Compositae or Campanulaceae ........

......................... Uroleucon Mordvilko (p. 692)

Antennal tubercles less well developed, little exceeding moderately developed median tubercle; aptera with dorsum sclerotic, with segmentation obscure, unpigmented or diffusely pigmented; dorsum of abdomen of alata with pigmented areas, but with dorsal setae never set on small distinct sclerites; cauda more or less parallel-sided, with rounded apex; basal tarsal segments with 3 ventral setae; on Rosaceae or grasses ........................................

......................... Macrosiphum Passerini (in part) (p. 428)

254(251). Thoracic spiracles much larger than abdominal spiracles (diameter greater than that of antennal segment III), located at bottom of cylindrical atrium with rugulose to reticulate walls (Fig. 94); abdominal spiracles operculate (Fig. 7) .......................................................... 255

Thoracic spiracles only a little larger than abdominal spiracles (diameter less than that of antennal segment III); atrium not reticulate; abdominal spiracles not operculate ..................
255(254). Siphunculus distinctly swollen before reticulate area, or basal tarsal segments with 5 ventral setae, or both; imbrications on apical tarsal segments strongly spiculose in some species. *Illinoa Wilson* (p. 393)

Diameter of siphunculus before reticulate area no greater, or rarely slightly greater than diameter of more basal parts, reticulate area commonly somewhat constricted (giving illusion that siphunculus swollen); basal tarsal segments always with 3 ventral setae; imbrications on apical tarsal segments usually smooth, rarely with a few obscure spicules or nodules

256(255). Secondary antennal sensoria small, protruding, vesiclelike (Fig. 1524); on ferns. *Papulaphis Robinson* (p. 539)

Secondary antennal sensoria not protruding, or if protruding then flat-topped (Fig. 418)

257(256). Antennal tubercle of aptera scabrous; dorsum of alata with extensive pigmented area, or patches of pigment anteriad of siphunculus

Antennal tubercle of aptera smooth; dorsum of alata anteriad of siphunculus membranous (lateral sclerites developed and terga VII and VIII pigmented in some genera)

258(257). Siphunculus with distinct apical flange

Siphunculus with apical flange indistinct, barely wider than siphunculus (Fig. 414)

259(231). Prothorax with spicules laterally and ventrolaterally

Prothorax without spicules laterally or ventrolaterally

260(133). Basal segment of tarsus minute, commonly hidden by apex of tibia, without setae (Fig. 1774); anterior margin of head of aptera with large median quadrate process; antennal tubercle and antennal segment I each with conical process on mesal margin (Fig. 1765); abdominal terga of aptera fused into sclerotized pigmented carapace; antenna of aptera 4-segmented, of alata 5-segmented; media of fore wing with 2 branches; hind wing with 1 oblique vein; on *Juniperus*

*Sanbornia Baker* (p. 612)
Basal segment of tarsus normally developed, triangular with ventral setae; anterior margin of head, antennal tubercle and antennal segment I without processes; hind wing with 2 oblique veins; if abdominal tergites of aptera forming carapace then not on Juniperus; media of fore wing usually with 3 branches; antenna usually 6-segmented .......................... 261

261(260). Main part of ultimate rostral segment conical with slightly concave sides, with longest setae near its base, with part beyond subapical setae elongate (at least half as long as main part), triangular or stiletto-shaped (Fig. 80); on Artemisia .................. 262

Ultimate rostral segment with straight to convex sides, with longest setae near apex, with apical part short, broadly rounded (Fig. 78); not on Artemisia ........ 263

262(261). Dorsal setae short, flabellate (Fig. 792); abdominal terga of aptera not forming pigmented carapace; cauda much longer than basal width ...................... Flabellomicrosiphum Gillette & Palmer (p. 320)

Dorsal setae long, pointed, or with apex flabellate or multifid (Fig. 1235); abdominal terga of aptera fused into pigmented sclerotic carapace; cauda broadly triangular, shorter than basal width ...................... Microsiphoniella Hille Ris Lambers (p. 452)

263(261). Siphunculus poriform or absent; lateral tubercles present ........................................................................................................... 264

Siphunculus short, but not poriform; lateral tubercles absent ..................................................................................................... 266

264(263). Cauda semicircular, shorter than basal width; lateral tubercles large, with diameter of largest more than that of antennal segment III, commonly multilobate; on Lonicera ............... Gypsoaphis Oestlund (p. 354)

Cauda narrowly triangular, longer than basal width; lateral tubercles smaller, diameter usually less than that of antennal segment III .................................................. 265

265(264). Antenna 5-segmented, or if 6-segmented in alata then media with 2 branches; lateral tubercles dome-shaped; on Juniperus ................................................................. Siphonatrophia Swain (p. 625)

Antenna 6-segmented and media with 3 branches; lateral tubercles digitiform, as long or longer than basal width ........ Asiphonaphis Wilson & Davis (p. 148)
266(263). Body slender, more than twice as long as greatest width; abdominal tergum VIII of some species with median process; on Gramineae ..............................................  
...................................................................................... Diuraphis Aizenberg (p. 271)  
Body broader; tergum VIII never with median process; on Asparagus or Stellaria ..............................................  
...................................................................................... Brachycolus Buckton (p. 186)  

Clé des genres de la superfamille des Aphidoidea

1. Queue distinctement rétrécie avant l’apex, la partie située au-delà du point de constriction brusquement renflée, formant un bouton transverse, circulaire ou allongé (fig. 60 et 65); plaque anale souvent bilobée (fig. 115 et 116) .......................................................... 2  

Queue en forme d’arc, semi-circulaire, triangulaire ou allongée (fig. 61–64, 66–69) (si allongée avec une constriction sous-basale, alors non élargie brusquement (fig. 64) et plaque anale non bilobée) .......................................................... 2

2(1). Yeux des aptères réduits à la triommatidie; tête et prothorax fusionnés, la triommatidie éloignée du bord postérieur apparent de la tête (fig. 42); ailés pourvus d’une antenne composée de 3 à 5 articles; soies plantaires habituellement capitées; tarses pourvus dorsalement ou ventralement de soies capitées préapicales (fig. 87) .......................................................... 12  

Yeux des aptères bien développés; tête et prothorax distinctement séparés (fig. 44); ailés pourvus d’une antenne composée de 5 ou 6 articles; soies plantaires spatulées ou acuminées; tarses sans soies capitées ........................................................................ 29

3(1). Soies plantaires largement (fig. 91) à étroitement spatulées ou plaque anale faiblement à fortement bilobée (fig. 115 et 116), ou ces deux caractères à la fois .......................................................... 15  

Soies plantaires acuminées (fig. 90), obtuses ou finement capitées (absentes chez un genre); plaque anale entière (fig. 114) .......................................................... 4

4(3). Processus terminal plus court que la partie basale du dernier article antennaire (fig. 76) ou, si environ de la même longueur, alors queue courte, arrondie ou en forme d’arc (fig. 61 et 66) .......................................................... 6

79
Processus terminal plus long (habituellement beaucoup plus long) que la partie basale du dernier article antennaire (fig. 75) ou, si environ de la même longueur, alors queue allongée (fig. 63 et 64) .......... 5

5(4). Antennes pourvues de sensoria secondaires étroits et annulaires (fig. 73); ailés seulement .... **Mordwilkoja Del Guercio** (émigrantes printanières) (p. 470)

Antennes pourvues de sensoria secondaires arrondis à ovales (fig. 70 et 71) ou absents .................................. 133

6(4). Article apical du tarse postérieur égal à au moins la moitié de la longueur du tibia postérieur; sur les racines de *Taraxacum* .................................................................

........................................... **Trama von Heyden** (p. 682)

Article apical du tarse postérieur nettement inférieur à la moitié de la longueur du tibia postérieur .......... 7

7(6). Article basal des tarses triangulaire (fig. 92) ............... 8

Article basal de chaque tarse trapézoïdal (fig. 90), généralement plus long dorsalement que large à la base (en cas de doute, pore du siphon monté sur une base mammiforme pubescente) ........................................ 67

8(7). Abdomen pourvu de tubercules latéraux; sensoria antennaires, en particulier les sensoria primaires, arrondis et très saillants (fig. 168); siphon court, presque poriforme, monté sur une petite base conique couverte de soies (fig. 50); glandes cirières à facettes absentes; sur *Cornus* ou sur les racines des Graminées ........................................... **Anoecia Koch** (p. 133)

Abdomen dépourvu de tubercules latéraux; sensoria antennaires de forme variable ou, si arrondis, alors aplatis ou convexes mais peu saillants; siphon présent ou absent; glandes cirières à facettes présentes ou absentes ................................................................. 9

9(8). Aptères pourvus de glandes cirières à facettes uniquement sur le segment VII et distribuées en 2 grandes aires glandulaires; antennes des ailes dépourvues de sensoria secondaires antennaires

...................................................... **Phloeomyzus Horvath** (p. 549)

Aptères pourvus de glandes cirières à facettes sur d'autres parties du corps ou entièrement absentes; ailés pourvus de sensoria secondaires des antennes .......... 10

10(9). Vivant dans une galée ou dans une pseudogalle, sur les feuilles ou sur les rameaux ........................................ 74

80
Ne vivant pas dans une galle ou dans une pseudogalle (le site d’alimentation peut être déformé, mais ne renferme pas de pucerons), ou ailés qu’on ne trouve pas sur une plante-hôte ........................................ 11

11(10). Aptères ......................................................................................... 112
Ailés ............................................................................................................. 88

12(2). Plaque anale entière (fig. 114); ailés ayant des antennes pourvues de sensoria secondaires arrondis à ovales (fig. 70); aptères pourvus de soies dorsales spiniformes; article apical du rostre conique et à bords légèrement concaves, la partie apicale longue et mince (fig. 80); sur Quercus .... *Thelaxes Westwood* (p. 660)

Plaque anale bilobée (fig. 116); ailés ayant des antennes pourvues de sensoria secondaires transverses et étroits (fig. 73); article apical du rostre subcylindrique, court, obtus ........................................ 13

13(12). Aptères pourvus de deux projections ressemblant à des cornes sur le bord antérieur de la tête; antenne de 4 articles chez les aptères, de 5 articles chez les ailés; nervure médiane ramifiée; sur les palmiers et sur d’autres espèces ornementales exotiques ............................................. *Cerataphis Lichtenstein* (p. 222)

Aptères sans projections ressemblant à des cornes; antenne composée de 3 articles chez les aptères; nervure médiane non ramifiée; sur Betula et sur *Hamamelis* ............................................................ 14

14(13). Antenne des ailés composée de 3 articles; aptères ayant les tarses antérieur et médian réduits à un seul article dépourvu de griffes (fig. 88); aptères aleurodiformes ou normaux ............................................. *Hormaphis Osten Sacken* (p. 368)

Antenne des ailés composée de 5 articles; aptères ayant tous les tarses composés de 2 articles pourvus de griffes ...................... *Hamamelistes Shimer* (p. 357)

15(3). Antenne composée de 5 articles; sur les Graminées ...... 16

Antenne composée de 6 articles; sur les arbres ................. 17

16(15). Siphon court, tronqué; tergite abdominal VIII non élargi et ne recouvrant pas la queue ......................................................... *Sipha Passerini* (en partie) (p. 622)

Siphon poriforme, peu visible; tergite abdominal VIII élargi, recouvrant la queue ......................................................... *Atheroides Haliday* (p. 164)
17(15). Processus terminal orné de nombreuses soies (fig. 1670)...

*Pseudopterocomma MacGillivray* (en partie) (p. 586)

Processus terminal orné de soies sur la partie apicale seulement ........................................ 18

18(17). Siphon tronqué et réticulé (fig. 53) ......................... 19

Siphon de forme variable, non réticulé ................................ 20

19(18). Ailés ayant les tibias spiculés; aptères pourvus d’une cuticule lisse ou ne portant que quelques spicules dispersés; formes estivantes de certaines espèces avec des soies foliacées périphériques; sur Acer .........................

......................... *Periphyllus van der Hoeven* (p. 546)

Ailés ayant les tibias non spiculés; aptères pourvus d’une cuticule ornée de nodules ou de spicules bien visibles ou distinctement réticulée (fig. 489 et 490), au moins latéralement; sur Salix ou sur Populus .........................

......................... *Chaitophorus Koch* (en partie) (p. 232)

20(18). Article basal des tarses pourvu de soies dorsales ........... 21

Article basal des tarses dépouvu de soies dorsales ...... 25

21(20). Soies rastrales absentes; de 0–5 tubercules latéraux sur chacun des segments abdominaux II à VII; aptères pourvus de soies dorsales acuminées; sur Quercus ........................................

......................... *Neosymydobius Baker* (p. 509)

Soies rastrales présentes (non clairement différenciées des autres soies tibiales chez les aptères); aptères pourvus de soies dorsales capitées et sans tubercules latéraux; sur Betula ou sur Alnus ......................... 22

22(21). Aptères; sur Betula ........................................

......................... *Calaphis Walsh* (en partie) (p. 196)

Adultes toujours ailés; sur Betula ou sur Alnus ........... 23

23(22). Sensoria secondaires des antennes ciliés; sur Betula .... 24

Sensoria secondaires des antennes non ciliés; glandes cirières entourant la base des soies abdominales; sur Alnus ......................... *Oestlundiella Granovsky* (p. 519)

24(23). Sensoria secondaires présents seulement sur la moitié basale de l’article anténnaire III .................................

......................... *Euceraphis Walker* (en partie) (p. 309)

Sensoria secondaires non confinés à la moitié basale de l’article anténnaire III .................................

......................... *Betulaphis Glendenning* (p. 171)
Glandes cirrières entourant la base des soies dorsales; sur *Quercus* ............... *Diphyllaphis Takahashi* (p. 268)
Glandes cirrières absentes; sur *Betula* ou sur *Quercus* ... 26

Soies rastrales absentes; aptères ayant la tête fusionnée au prothorax, une suture transverse secondaire sur le pronotum et les yeux éloignés du bord postérieur apparent de la tête; sur *Quercus* ........................................

............... *Lachnochaitophorus Granovsky* (p. 405)
Soies rastrales présentes, peu différenciées des autres soies tibiales chez certains genres; sur *Betula* ............ 27

Soies dorsales capitées (fig. 290); siphon non spiculé ........

........................... *Betulaphis Glendenning* (p. 171)
Soies dorsales acuminées; siphon annelé de spicules ou de nodules .............................................................. 28

Article antennaire III orné d'imbrications lisses; sclérites abdominaux latéraux présents, certains portant des tubercules; soies rastrales du tibia antérieur peu différenciées des autres soies tibiales ......................

.... *Callipterinella van der Goot* (en partie) (p. 200)
Article antennaire III orné d'imbrications finement spiculées ou nodulées; sclérites abdominaux latéraux absents ou fragmentés, sans tubercules; soies rastrales du tibia antérieur bien développées ........

........................................ *Symdobius Mordvilko* (p. 642)

Antenne composée de 5 articles; sur les Graminées ...... 30

Antenne composée de 6 articles, avec les articles III et IV partiellement fusionnés chez certains spécimens ........... 31

Siphon court et tronqué; processus terminal égal à moins de deux fois la longueur de la partie basale du dernier article antennaire; sur les Graminées ......................

.......................... *Sipha Passerini* (en partie) (p. 622)

Siphon court, mais distinctement cylindrique; processus terminal égal à plus de trois fois la longueur de la partie basale du dernier article antennaire; sur *Artemisia* .................................................................

........................... *Misturaphis Robinson* (en partie) (p. 459)
31(29). Cuticule de l’ensemble du corps densément couvert de spicules et de nodules; siphon allongé, cylindrique, densément couvert de spicules ou de nodules imbriqués; soies plantaires acuminées; article apical des tarses court, sa longueur ne dépassant pas la largeur de la partie apicale du tibia; tibia portant une rangée de soies en forme de petites dents (fig. 93) .......

..... *Muscaphis Börner* (fondateur, en partie) (p. 473)

Ne possédant pas tous ces caractères .................................. 32

32(31). Triommatidie enchassée dans l’oeil composé et apparemment absente; tergite abdominal VIII souvent bilobé; sur *Carex, Juncus* ou sur les Graminées ................................................................. 33

Triommatidie visible; tergite abdominal VIII entier; sur les essences à feuilles caduques, les arbuscules, les bambous ou sur les Légumineuses ............................................. 36

33(32). Fémurs antérieur et médian élargis, distinctement plus larges que le fémur postérieur ........................................ 34

Tous les fémurs de forme semblable .................................. 35

34(33). Article antennaire III densément et uniformément spiculé sur toute sa longueur; ailés ayant les sensoria secondaires distribués sur la majeure partie de l’article III ou, chez certaines espèces, moins nombreux sur la partie apicale ......................................................................................

................................................................. *Iziphyo Nevsky* (p. 396)

Article antennaire III moins densément spiculé à la base; ailés n’ayant des sensoria secondaires que sur les deux premiers tiers de l’article III ..................................................

................................................................. *Saltusaphis Theobald* (p. 608)

35(33). Toutes les soies dorsales acuminées ..............................

........................................................................ *Thripsaphis Gillette* (p. 668)

La plupart des soies dorsales peltées (fig. 102 et 103) ........

........................................................................ *Subsaltusaphis Quednau* (p. 639)

36(32). Siphon tronqué et réticulé (fig. 53); sur *Populus* ou sur *Salix* ............ *Chaitophorus Koch* (en partie) (p. 232)

Siphon de forme variable, mais jamais réticulé ............ 37

37(36). Tête pourvue d’une paire de tubercules frontaux quadrangulaires, chacun portant deux soies courtes et capitées; aptères seulement ........................................

........................................................................ *Boernerina Bramstedt* (p. 178)

Tête sans tubercules quadrangulaires ................................. 38

38(37). Bouton caudal allongé (fig. 65) ........................................ 39
Bouton caudal circulaire (fig. 60) ........................................... 40

39(38). Coxa antérieure élargie, plus de deux fois plus large que la coxa médiane; sur les Légumineuses .......................................................... Therioaphis Walker (p. 664)

Coxa antérieure non élargie; sur Betula ou sur Comptonia .............................................. Cepegillettea Granovsky (p. 218)

40(38). Article basal des tarses pourvu de soies dorsales .......... 44
Article basal des tarses sans soies dorsales ................................. 41

41(40). Glandes cirières présentes autour de la base des soies dorsales; sur Fagus .......... Phyllaphis Koch (p. 556)
Glandes cirières absentes; pas sur Fagus ................................. 42

42(41). Ailés ayant une papille sétigère médiane sur au moins un des tergites abdominaux I à III; aptères ayant les soies dorsales capitées ou serrulées (fig. 1677); sur Alnus ...................... Pterocallis Passerini (p. 589)

Ailés sans papille médiane sur les tergites abdominaux; aptères pourvus de soies dorsales acuminées .......... 43

43(42). Siphon densément annelé de spicules ou de nodules;
aptères pourvu de soies dorsales longues et fines; sur Betula ...........................................................

.... Callipterinella van der Goot (en partie) (p. 200)

Siphon lisse; aptères pourvu de soies dorsales longues,
épaisses et spiniformes; sur Quercus ..............................................
Hoplochaitophorus Granovsky (p. 364)

44(40). Au moins une paire de tibias pourvu de soies rastrales
(fig. 92) ou d'épines rastrales (fig. 91) ......................... 49
Tous les tibias dépourvu de soies ou d'épines rastrales
.................................................................................. 45

45(44). Ailés .............................................................................. 46
Aptères .................................................................................. 47

46(45). Nervures de l’aile antérieure distinctement bordées d’une pigmentation foncée; processus terminal égal à moins de la moitié de la longueur de la partie basale de l’article antennaire VI; sur Juglans .........................

............................................................ Panaphis Kirkaldy (p. 535)

Nervures de l’aile antérieure non bordées d’une pigmentation foncée ou faiblement pigmentées;
processus terminal égal à plus de la moitié de la longueur de la partie basale de l’article antennaire VI (habituellement aussi long); sur Quercus .................

........................................... Neosymydobius Baker (en partie) (p. 509)
47(45). Segments abdominaux et certains segments thoraciques pourvus de papilles digitées latérales et submédianes dorsales dirigées vers l'arrière du corps (fig. 592); sur *Cytisus* .......... *Ctenocallis Klodnitzki* (p. 261)

Papilles abdominales, lorsque présentes, coniques, non digitées ................................................................. 48

48(47). Soies dorsales courtes (à peine plus longues que le siphon), pointues (fig. 1422); sur *Quercus* .................

............... *Neosymydobius Baker* (en partie) (p. 509)

Soies dorsales longues, capitées, serrulées (fig. 1677); sur *Alnus* ...................... *Pterocallis Passerini* (p. 589)

49(44). Épines rastrales présentes (fig. 91, SpR); gonapophyses 3; sur *Acer* .......................................................... 50

Soies rastrales présentes (fig. 92, SR); gonapophyses 2...

.............................................................................. 51

50(49). Siphon allongé; dorsum de l'abdomen sans papilles ........

............................................................................. *Drepanosphum Koch* (p. 279)

Siphon court, vasiforme; dorsum de l'abdomen ayant une ou plusieurs paires de papilles submédianes........

............................................................................. *Drepanaphis Del Guercio* (p. 275)

51(49). Soies rastrales présentes seulement sur le tibia antérieur; sur *Juglans* .......... *Chromaphis Walker* (p. 236)

Soies rastrales présentes sur le tibia postérieur .......... 52

52(51). Coxa antérieure élargie, plus de deux fois plus large que la coxa médiane; sur les Légumineuses ..............

............................................................................. *Theriaphis Walker* (p. 664)

Coxa antérieure pas plus de 1,5 fois plus large que la coxa médiane .................................................................. 53

53(52). Aptères .................. *Calaphis Walsh* (en partie) (p. 196)

Ailés ................................................................................. 54

54(53). Sensoria secondaires des antennes fortement transverses-ovales, ayant les bords distinctement ciliés (fig. 760)

............................................................................. *Euceraphis Walker* (en partie) (p. 309)

Sensoria secondaires des antennes circulaires à ovales, ayant les bords spiculés ou lisses, mais non ciliés ...

55(54). Glandes cirières présentes à la base des soies dorsales ........................................................................... *Boernerina Bramstedt* (p. 178)

Glandes cirières absentes .................................................. 56

56(55). Plus d'une soie latérale sur chacun des segments abdominaux I à IV......................................................... 63
Une seule soie latérale sur chaque segment abdominal ..... 57

Siphon poriforme; soie latérale du segment abdominal VI rattachée à la base du siphon; sur Carya ou sur Juglans ................................................................. 61

Siphon court, mais non poriforme; soie latérale du segment abdominal VI non rattachée à la base du siphon ................................................................. 58

Dorsum de l'abdomen ayant des taches submédianes foncées distinctes ou le segment III de l'antenne foncé dans la région qui porte les sensoria secondaires et pâle à la base et à la moitié de l'extrémité ....................... 60

Dorsum de l'abdomen sans taches submédianes le segment III de l'antenne dépourvu de la bande foncée à la moitié de l'extrémité ............................................... 59

Soies dorsales submédianes présentes sur au moins certains des segments abdominaux antérieurs au siphon et montées sur des papilles bien visibles; sur Ulmus ...................... Tinocallis Matsumura (p. 675)

Dorsum de l'abdomen sans papilles; sur Betula ............ ........................................... Calaphis Walsh (p. 196)

Partie postérieure de la tête munie d'une touffe transverse comprenant plus de 4 soies (fig. 40); nervures ornées apicalement de taches pigmentées bien visibles; fémur postérieur foncé; sur Tilia ............... Eucallipterus Schouteden (p. 305)

Partie postérieure de la tête n'ayant que 4 soies discales (fig. 39); pas de taches pigmentées à l'extrémité des nervures de l'aile antérieure, faiblement indiquées ou distinctes; fémur postérieur non distinctement plus foncé que les fémurs antérieur et médian; sur Arundinaria ............. Takecallis Matsumura (p. 646)

Abdomen pourvu d'une rangée transverse de papilles pigmentées de taille variable sur les tergites I à III ou IV ......................... Protopierocallis Richards (p. 572)

Abdomen pourvu de paires de papilles submédianes ou papilles dorsales absentes ............................................. 62

Nervure Cu₂ de l'aile antérieure fortement bordée par un pigment brun; ailes des spécimens vivants au repos maintenues verticalement ........................................... Monelliopsis Richards (p. 466)

Nervure Cu₂ de l'aile antérieure non fortement bordée par un pigment brun; ailes des spécimens vivants au repos maintenues horizontalement ........................................... Monellia Oestlund (p. 463)
Au moins les tergites abdominaux I à III pourvus d'une paire de papilles coniques ou digitiformes (fig. 1 Pap)
.................................................................................................................................. 64
Tergites abdominaux sans paires de papilles dorsales; chez certains genres, tergites abdominaux I à III pourvus d'une seule papille ou d'une seule protubérance médiane arrondie ............................. 65

Siphon spiculé ........................................................................................................... 64
.................................................. Myzocallis Passerini (en partie) (p. 481)
Siphon lisse ou plissé, mais jamais spiculé ......................................................
.................................................. Tuberculatus Mordvilko (p. 685)

Au moins un des tergites abdominaux I à III pourvu de soies submédianes montées sur une papille médiane; sur Alnus ...................... Pterocallis Passerini (p. 589)
Tergites abdominaux sans papilles médianes ............................. 66

Fémur postérieur non orné dorsalement d'une tache foncée préapicale, parfois complètement brunâtre ou marbré de brun chez certaines espèces; sur diverses essences, en particulier sur Quercus, mais pas sur Robinia ..... Myzocallis Passerini (en partie) (p. 481)
Fémur postérieur orné dorsalement d'une tache préapicale brune ou noire; reste du fémur jaunâtre ou incolore; sur Robinia .......................................................... Appendiseta Richards (p. 145)

Article basal des tarses pourvu de soies dorsales ........ 68
Article basal des tarses sans soies dorsales ................. 70

Griffe pourvue d'une tunica dorsale (fig. 741); oeil monté sur un court pédoncule (fig. 742); antenne composée de 5 articles; nervure médiane comportant 2 branches; sur Pinus ou sur Pseudotsuga .................................................. Essigella Del Guercio (p. 301)
Griffe simple; oeil non pédonculé; antenne composée de 6 articles; nervure médiane comportant 1 ou 3 branches .................................................................................................................................. 69

Siphon poriforme, situé sur un étroit sclérite sans soies; les plus longues soies du corps plus longues que le premier article antennaire; nervure médiane non ramifiée, évanescente; sur Pinus .......................................................... Eulachnus Del Guercio (p. 312)
Siphon pubescent, mammiforme; soies du corps plus courtes que le premier article antennaire; nervure médiane comportant trois branches; sur Rosa ............... 
.................................................................................. Maculolachnus Gaumont (p. 432)
70(67). Segment abdominal V orné d'une grosse papille médiane conique; corps de grande taille; sur *Salix* ........................................... *Tuberolachnus Mordvilko* (p. 689) 
Abdomen sans grosse papille dorsale ............................ 71
71(70). Segment apical du rostre de grande et de petite taille, la longueur inférieure à deux fois la largeur de la base; nervure médiane non ramifiée, évanescente; colonies floconneuses sur *Pinus* ................................................................. 
........................................................................ *Schizolachnus Mordvilko* (p. 619) 
Segment apical du rostre plus mince, la longueur supérieure à deux fois la largeur de la base; nervure médiane comportant 2 ou 3 branches .................. 72
72(71). Articles IV et V du rostre séparés; article V plus de deux fois plus long que son diamètre basal; sur les conifères ....................................................... *Cinara Curtis* (p. 239) 
Articles IV et V du rostre partiellement fusionnés; article V moins de 1,2 fois plus long que son diamètre basal .... 73
73(72). Aptères sans sensoria secondaires; ptérostigma allongé, atteignant l'apex de l'aile; longueur du corps supérieure à 6 mm; sur diverses essences à feuilles caduques ............... *Longistigma Wilson* (p. 421) 
Aptères pourvus de sensoria secondaires sur l'article antennaire III; ptérostigma n'atteignant pas l'apex de l'aile; longueur du corps inférieure à 5 mm; sur *Quercus* .................... *Lachnus Burmeister* (p. 408)
74(10). Sur les feuilles de *Arctostaphylos* .......................... *Tamalia Baker* (p. 649) 
Sur les feuilles de divers arbres et arbustes à feuilles caduques ................................................................. 75
75(74). Sur *Rhus* ........................................... *Melaphis Walsh* (p. 439) 
Pas sur *Rhus* ............................................. 76
76(75). Sur les feuilles ou sur les rameaux de *Populus* .......... 77
Pas sur *Populus* ........................................... 81
77(76). Dans une galle fermée, sur les feuilles ou sur les rameaux ................................................................. 78 
Dans une pseudogalle formée par le plissement, le renflement ou l'enroulement du limbe d'une feuille ou dans une rosette englobant des feuilles terminales ................................................................. 79
78(77). Dans une grosse galle tuberculée de forme irrégulière englobant l'ensemble du limbe de la feuille (fig. 12) ........................................... *Mordwilkoja Del Guercio* (p. 470)
Dans une galle créée par le renflement d'un rameau ou du pétiole ou du limbe d'une feuille, la galle n'englobant pas toute la feuille (fig. 13, 15–17) ........................................... Pemphigus Hartig (p. 542)

79(77). Aptères ayant le bord antérieur de la tête pourvu d'une projection centrale triangulaire (fig. 553); ailés ayant des sensoria secondaires d'antenne seulement sur la moitié distale de l'article antennaire III; dans une pseudogalle formée par l'enroulement du bord d'une feuille ...................................... Cornaphis Gillette (p. 250)

Tête non ornée d'une telle structure; ailés pourvus de sensoria secondaires d'antenne répartis sur au moins les deux tiers apicaux de l'article antennaire III ..... 80

80(79). Dans une pseudogalle formée dans la rosette des feuilles terminales ou dans une déformation sacciforme d'une feuille isolée (fig. 18); ailés avec les sensoria secondaires d'antenne ovales .............................................. Pachypappa Koch (p. 526)

Dans une pseudogalle formée par l'enroulement des bords d'une feuille ou par le plissement d'une feuille; ailés pourvus de sensoria secondaires d'antenne transverses à linéaires ..... Thecabius Koch (p. 657)

81(76). Dans une galle ou dans une pseudogalle, sur Ulmus ..... 82
Dans une pseudogalle, sur Tilia ou sur Fraxinus .......... 86

82(81). Dans une galle fermée sur la face dorsale d'une feuille ........................................................................... 83
Dans une pseudogalle sur une feuille ou dans une galle fermée sur un rameau ............................................. 85

83(82). Dans une galle allongée fusiforme ou globulaire (fig. 11) ........................................................................ 84
Dans une galle en crête de coq disposée parallèlement aux nervures latérales de la feuille ............................................. Colopha Monell (p. 243)

84(83). Aptères (fondatrices) pourvus des articles de tous les tarses complètement fusionnés; ailés ayant l'article antennaire V plus long que l'article IV ou VI et ayant l'article VI dépourvu de sensoria secondaires ............... Tetraneura Hartig (p. 653)

Aptères (fondatrices) pourvus des articles du tarse postérieur (et habituellement du tarse médian) largement réunis, mais divisés par une ligne bien visible; article antennaire V pas plus long que l'article VI; ailés avec l'article VI pourvu de sensoria secondaires .... Kaltenbachiella Schouteden (p. 402)
Ailés pourvus de sensoria secondaires d’antenne relativement éloignés les uns des autres, la distance moyenne entre eux étant au moins égale au diamètre de l’article antennaire; longueur de nombreux sensoria égale à moins de la moitié de la circonférence de l’article. [Georgiaphis Maxson & Hottes](p. 334)

Ailés pourvus de sensoria secondaires d’antenne relativement rapprochés les uns des autres, la distance entre eux étant inférieure au diamètre de l’article antennaire; longueur de la plupart des sensoria supérieure à la moitié de la circonférence de l’article. [Eriosoma Leach](p. 297)

Dans une rosette de feuilles terminales déformées, sur *Tilia* [Tiliphagus Smith](p. 671)

Dans une pseudogalle, sur le feuillage de *Fraxinus* ...... 87

Aptères ayant l’article apical du rostre pourvu de 2 soies secondaires; aptères avec des soies rastrales; ailés ayant l’article antennaire V pourvu de sensoria secondaires. [Meiarhizophagus Smith](p. 442)

Aptères ayant l’article apical du rostre pourvu de 4 soies secondaires; aptères sans soies rastrales; ailés ayant l’article antennaire V dépouvé de sensoria secondaires. [Prociphilus Koch](en partie) (p. 568)

Ptérostigma atteignant l’apex de l’aile. [Mindarus Koch](p. 456)

Ptérostigma n’atteignant pas l’apex de l’aile. 89

Aile postérieure avec 2 nervures transverses ayant une origine commune ou originant d’un même point sur la nervure longitudinale ou près de ce point (fig. 32); gonapophyses 3. 90

Aile postérieure ayant 2 nervures transverses largement séparées à la base (fig. 31) ou avec une seule nervure transverse (fig. 33); gonapophyses 2. 100

Sensoria secondaires très saillants, en forme de tablette (fig. 1970) [Tiliphagus Smith](p. 671)

Si sensoria secondaires saillants, alors base s’élevant graduellement (fig. 1536). 91

Nervure médiane ramifiée. [Pachypappa Koch](émiгранtes printanières) (p. 526)

Nervure médiane non ramifiée. 92
Bords des sensoria secondaires antennaires (au moins ceux situés sur la partie distale de l'article IV et sur l'article V, si présent) spiculés ou ciliés .......................... 93
Bords de tous les sensoria secondaires non spiculés ou non ciliés ................................................................. 98

Ptérostigma assez allongé (son apex atteignant plus de la moitié de la distance entre la base et l'apex du secteur radial) et rétréci, son bord postérieur étant légèrement concave .............. Stagona Koch (p. 632)
Ptérostigma généralement plus court, son bord postérieur étant au moins légèrement convexe ou, souvent, fortement convexe ............................................ 94

Article antennaire VI approximativement aussi long que l'article III ............................................................... 95
Article antennaire VI égal à moins de 0,85 la longueur de l'article III ................................................................. 96

Sensoria secondaires présents sur l'article antennaire VI, mais absents sur le tiers basal de l'article III ...................
.......................... Melia rhizophagus Smith (p. 442)
Sensoria secondaires absents sur l'article antennaire VI, mais présents sur le tiers basal de l'article III ............
.......................... Neoprociphilus Patch (p. 505)

Tiers basal de l'article antennaire III sans sensoria secondaires ........................................................................ 97

Sensoria secondaires d'antenne arrondis à transversalement ovales, leur longueur étant inférieure à la moitié du diamètre de l'article antennaire III; sexupares et embryons avec le fémur postérieur élargi; soies rastrales présentes (moins développées chez les émigrantes printanières) ............... Gryllopro ciphilus Smith & Pepper (p. 351)
Au moins quelques sensoria secondaires transverses, soit linéaires, soit plus longs que la moitié du diamètre de l'article antennaire III; soies rastrales présentes; sexupares et embryons ayant le fémur postérieur non distinctement élargi ........ Pro ciphilus Koch (p. 568)

Sensoria secondaires arrondis à ovales et confinés à la moitié distale de l'article III ...........................................
.......................... Cornaphis Gillette (p. 250)
Sensoria secondaires ovaies à transverses-linéaires, présents sur toute la longueur de l'article III et sur certains des articles IV à VI ........................................ 99

99(98). Gonapophyses non sclérifiées; mésonotum sans plaques de glandes cirières ou avec de petites plaques seulement ...................... *Pemphigus Hartig* (p. 542)

Gonapophyses sclérifiées et soulevées; mésonotum portant de larges plaques de glandes cirières ................
............................................................................................................ *Thecabius Koch* (p. 657)

100(89). Sensoria secondaires antennaires arrondis (fig. 71) ........................................ 101
Sensoria secondaires antennaires transverses-linéaires (fig. 73) ......................................................... 106

101(100). Fémurs, tibias et antenne ayant des rangées transverses de spicules ........................................ 102
Tibias et antenne sans spicules, ou antenne avec seulement quelques spicules ................................. 103

102(101). Tibia médian (et tibia antérieur chez certaines espèces) ayant des sensoria saillants (fig. 892); sensoria secondaires antennaires arrondis, avec les bords distinctement ciliés .................. *Glyphina Koch* (p. 348)

Tibias sans sensoria saillants; sensoria secondaires d'antenne transversalement ovaies, ayant les bords indistinctement non ciliés ... *Tamalia Baker* (p. 649)

103(101). Antenne longue, chacun des articles IV et V étant au moins aussi longs que l'article III; sensoria secondaires arrondis, leur diamètre inférieur à la moitié du diamètre de l'article; nervure médiane comportant 3 branches ....................................................... .......................... *Stegophylla Oestlund* (p. 635)

Antenne courte, l'article IV étant moins de 0,75 fois aussi long que l'article III; sensoria secondaires de grande taille, en forme d'assiette, leur diamètre supérieur à la moitié du diamètre de l'article (fig. 74) ou, si plus petits, nombreux et de forme irréguli ère (fig. 72); nervure médiane non ramifiée ........................................ 104

104(103). Bords des sensoria primaires ciliés; nervures cubitales issues d'un court pédoncule commun ou d'un point unique sur la principale nervure longitudinale .............. ......................................................... *Geoica Hart* (p. 330)

Bords des sensoria primaires non ciliés; nervures cubitales issues de deux points distincts sur la nervure longitudinale .......................... 105
105(104). Sensoria secondaires d'antenne nombreux, entre 10 et 60 sur l'article III; article antennaire II au plus 1,5 fois aussi long que l'article I; antenne composée de 5 articles ........................................ Forda von Heyden (p. 323)

Sensoria secondaires d'antenne peu nombreux, moins de 10 sur l'article III; article antennaire II environ 2 fois plus long que l'article I; antenne composée de 6 articles, rarement de 5 articles ........................................ Smynthurodes Westwood (p. 629)

106(100). Article antennaire V plus de 2 fois plus long que l'article IV; nervure médiane non ramifiée ............................................................... Tetraneura Hartig (p. 653)

Article antennaire V égal à moins de 2 fois la longueur de l'article IV; nervure médiane ramifiée ou non ramifiée ................................................................. 107

107(106). Pore du siphon entouré d'un anneau sclérisé sétigère ...... ............................................................................................................................ 108

Pore du siphon non entouré d'un anneau sclérisé sétigère, ou absent .................................................................................................................. 109

108(107). Sensoria secondaires d'antenne relativement éloignés les uns des autres, la distance moyenne entre eux étant au moins égale au diamètre de l'article antennaire; longueur de nombreux sensoria inférieure à la moitié de la circonférence de l'article ......................................................... 107

Sensoria secondaires d'antenne relativement rapprochés les uns des autres, la distance entre eux étant inférieure au diamètre de l'article antennaire; longueur de la plupart des sensoria supérieure à la moitié de la circonférence de l'article ......................................................... 107

....................... Georgiaphis Maxson & Hotte (p. 334)

....................... Eriosoma Leach (p. 297)

109(107). Dernier article antennaire distinctement plus long que l'article IV et portant plus de 5 sensoria secondaires semblables à ceux de l'article III pour ce qui est de leur forme et de leur distribution; nervure médiane non ramifiée ou se ramifiant près du bord de l'aile chez certains spécimens ............................................. 110

Dernier article antennaire portant de 0 à 5 sensoria secondaires moins densément distribués que ceux situés sur l'article III; nervure médiane non ramifiée ou se ramifiant près du milieu de l'aile ............... 111

110(109). Siphon absent; tibias sans spicules ................................................................. Melaphis Walsh (p. 439)
Pore du siphon présent; tibias pourvus de spicules sur le tiers distal .... *Kaltenbachiella Schouteden* (p. 402)

111(109). Dernier article antennaire plus long que l'article IV; siphon absent; aile postérieure pourvue de deux nervures obliques; nervure médiane ramifiée .................. *Gharesia Stroyan* (p. 337)

Dernier article antennaire au plus aussi long que l'article IV; pore du siphon présent; aile postérieure pourvue d'une nervure oblique; nervure médiane ramifiée ou non ramifiée .................. *Colopha Gillette* (p. 243)

112(11). Article antennaire II égal à plus des trois quarts de la longueur de l'article III; article III plus court que l'article VI ............................................................... 113

Article antennaire II égal à moins de la moitié de la longueur de l'article III; article III plus long que le dernier article ............................................................... 114

113(112). Article antennaire apical non spiculé; plaque anale de grande taille, quadrangulaire; queue très petite; partie postérieure de l'abdomen émarginée au-dessus de la plaque anale; anus dorsal, situé au-dessus de la base de la plaque anale (fig. 1825); sur les racines des Graminées .......... *Smynthurodes Westwood* (p. 629)

Article antennaire apical spiculé; plaque anale et tergites abdominaux ne présentant pas les caractères susmentionnés; anus terminal; sur le feuillage de *Quercus* ................. *Stegophyllia Oestlund* (p. 635)

114(112). Tête et prothorax fusionnés; triommatidie éloignée du bord postérieur apparent de la tête (fig. 42) ......... 115

Tête et prothorax séparés, au moins latéralement; triommatidie située près du bord postérieur de la tête (fig. 43) ..................................................................................... 116

115(114). Queue subtriangulaire, dépassant la plaque anale; cuticule pourvue de nombreuses glandes cirières; sur les rameaux de *Picea* ou de *Abies* .........................

............................................................... *Mindarus Koch* (p. 456)

Queue courte, semi-circulaire; plaque anale dépassant la queue; cuticule rugueuse, sans glandes cirières; sur les racines de *Alnus* ou de *Betula*, certaines colonies vivant au-dessus du sol dans des abris fournis par les fourmis ......................... *Glyphina Koch* (p. 348)

116(114). Facettes d'au moins quelques glandes cirières distribuées en rosettes ou en anneaux (incomplets ou multiples chez certains spécimens) autour d'une facette centrale de taille et de forme différentes (fig. 104–106) ...... 117
Facettes des glandes cirières d’aspect uniforme et non distribuées en anneaux (fig. 107) .......................... 120

117(116). Tous les tarses composés de 2 articles; sur les Pomoidées ou sur Ribes ................... Eriosoma Leach (p. 297)
Au moins le tarse antérieur composé d’un seul article ...... ........................................................................ 118

118(117). Soies situées à l’apex de l’abdomen plus longues que le tarse postérieur; tous les tarses composés d’un seul article ....... Tetraneura Hartig (aliénicoles) (p. 653)
Soies situées à l’apex de l’abdomen pas particulièrement longues ................................................................. 119

119(118). Tarses pourvus de soies préapicales capitées; sur les Graminées ou sur les Cypéracées ................. Colopha Monell (aliénicoles) (p. 243)
Tarses sans soies préapicales capitées; sur les racines des Labiées ................................................................. ... Kaltenbachiella Schouteden (aliénicoles) (p. 402)

120(116). Tarses composés d’un seul article; sur les mousses ................. Melaphis Walsh (p. 439)
Tarses composés de 2 articles; pas sur les mousses ..... 121

121(120). Glandes cirières absentes ...................................................... 122
Glandes cirières présentes ................................................. 124

122(121). La plupart des soies dorsales flabellées .................... Geoica Hart (p. 330)
Toutes les soies dorsales acuminées .............................. 123

123(122). Bords des sensoria antennaires ciliés; sur les parties aériennes de Juncus .................. Prociphilus Koch (en partie) (p. 568)
Bords des sensoria antennaires non ciliés; sur les racines des Graminées ............. Forda von Heyden (p. 323)

124(121). Base du dernier article antennaire plus long que l’article apical du tarse postérieur; sur Smilax ................................................................. Neoprociphilus Patch (p. 505)
Base du dernier article antennaire pas plus long que l’article apical du tarse postérieur; pas sur Smilax ........................................................................ 125

125(124). Soies ventrales de l’article basal des tarses courtes, spiniformes .................................................. 126
Soies ventrales de l’article basal des tarses longues et fines ........................................................................ 129
126(125). Articles apicaux des tarses spiculés ventralement (fig. 92); pas sur les racines des conifères .......................... 127
Articles apicaux des tarses non spiculés ventralement; sur les racines des conifères .......................... 128

127(126). Article antennaire II près de 2 fois aussi long que l’article I; sur les racines de Lysimachia ..........................
.............................................................. Mordwilkoja Del Guercio (p. 470)
Article antennaire II moins de 1,5 fois aussi long que l’article I; sur les racines de diverses plantes ..............
.............................................................. Pemphigus Hartig (p. 542)

128(126). Soies ventrales de l’article basal des tarses semblables aux soies rastrales pour ce qui est de la taille et de la forme ............................................. Stagona Koch (p. 632)
Soies ventrales de l’article basal des tarses peu visibles, beaucoup plus petites que les soies rastrales ........
.............................................................. Pachypappa Koch (p. 526)

129(125). Soies rastrales distinctes; sur les racines de Ranunculus .............................................................. Thecabius Koch (p. 657)
Soies rastrales absentes ou non différenciées des autres soies tibiales .................................................. 130

130(129). Soies plantaires finement capitées; sur Carex ..............................
.......................................................................... Gharesia Stroyan (p. 337)
Soies plantaires acuminées ........................................ 131

131(130). Article apical des tarses spiculé; sur les racines de Fraxinus ............ Meliarhizophagus Smith (p. 442)
Article apical des tarses non spiculé; sur diverses plantes, mais pas sur Fraxinus ............................... 132

132(131). Dernier article du rostre portant de 2 à 4 soies secondaires et queue ayant plus de 10 soies; sur les racines de Lycopus ............. Tiliphagus Smith (p. 671)
Dernier article du rostre ayant au moins 6 soies secondaires ou queue ayant moins de 10 soies ........
.............................................................. Prociphilus Koch (en partie) (p. 568)

133(5). Siphon bien développé, plus long que large ..................... 134
Siphon absent, poriforme ou plus court que son diamètre basal ................................................................. 260

134(133). Siphon ayant plus de 2 rangées subapicales de sculpture isodiamétrale (fig. 56 et 57) ...................... 247
Siphon sans rangées de sculpture réticulée isodiamétrale ou, chez certaines espèces, 2 ou 3 rangées subapicales de sculpture réticulée transverse peu développée (fig. 58) ......................... 135
135(134). Tarses pratiquement absents ou réduits à un seul article; griffes absentes ........................................ 136
Tarses normaux composés de 2 articles pourvus de griffes ............................................................... 137

136(135). Tarses réduits à un seul article sans griffes (fig. 1183); sur les fougères .............. *Mastopoda Oestlund* (p. 435)
Tarses réduits à un sclérite peu visible, en apparence absent (fig. 263); sur *Grindelia* ................................................................. *Atarsos Gillette* (p. 161)

137(135). Processus terminal couvert de soies (fig. 1670) ....................... *Pseudopterocomma MacGillivray* (p. 586)
Processus terminal ayant habituellement des soies sur la partie apicale seulement ou, rarement, ayant quelques soies en plus des soies apicales .......... 138

138(137). Antenne composée de 4 articles chez les aptères, de 4 à 5 articles chez les ailés; les plus longues soies antennaires égales à plus de 2 fois le diamètre de l'article; siphon renflé (fig. 52) ........................................................... *Paducia Hottes & Frison* (p. 531)
Antenne composée de 6 articles, ou si composée de 5 articles, alors soies antennaires plus courtes ou siphon cylindrique ............................................. 139

139(138). Queue courte, semi-circulaire, pourvue d'au moins 20 soies; pronotum pourvu de nombreuses soies dispersées (fig. 112) ................................................................. 140
Queue de forme variable, ayant moins de 15 soies si semi-circulaire; ou pronotum ayant les soies distinctement disposées en groupes submédiains et latéraux antérieurs et postérieurs (habituellement une seule soie à chaque position), ou ces deux caractères à la fois (fig. 108–110) ................................................................................. 141

140(139). Siphon bien développé pourvu d'une collerette distincte; sur les parties aériennes de *Populus* ou de *Salix* .......... ........................................... *Pterocomma Buckton* (p. 594)
Siphon habituellement réduit ou absent ou, si bien développé, alors sans collerette; sur *Populus* ou sur *Salix*, habituellement sur les racines ................................................................. *Fullawayya Essig* (p. 327)

141(139). Partie du dernier article du rostre s'étendant au-delà des soies subapicales étroite et allongée et au moins égale au tiers de la longueur de la partie précédant les soies subapicales, ou 1 paire de soies secondaires (ou les deux) plus longues que les soies subapicales primaires; sur *Artemisia* ......................................................... 154
Partie du dernier article du rostre s'étendant au-delà des soies subapicales habituellement arrondie et inférieure au quart de la longueur de la partie précédant les soies subapicales; soies subapicales primaires de la même longueur ou plus longues que toutes les soies secondaires; sur diverses plantes-hôtès, rarement sur Artemisia ....................... 142

142(141). Siphon capité (fig. 55); dernier article du rostre long et subcylindrique, la partie s'étendant au-delà des soies subapicales conique et émoussée (fig. 81); sur Solidago ......................... Cachryphora Oestlund (p. 192)
Siphon cylindrique ou renflé avant l'apex, mais non capité ................................................................. 143

143(142). Siphon ayant une collerette bien définie .................. 144
Siphon sans collerette ................................................................. 149

144(143). Tubercules antennaires bien développés, divergents (fig. 35 et 38) ou convergents (fig. 36) ....................... 145
Tubercules antennaires non développés (fig. 34) ........... 158

145(144). Tubercule frontal médian modérément à fortement développé (fig. 38), presque autant que les tubercules antennaires; prothorax pourvu d'une soie submédiane antérieure (fig. 108) ................................................. 152
Tubercule médian non développé ou, dans le cas contraire, tubercules antennaires dépassant le tubercule médian; prothorax habituellement sans soie submédiane antérieure (mais si présente, alors front distinctement concave) ........................................... 146

146(145). Tubercules antennaires lisses, divergents, rarement ornés ventralement de quelques spicules peu visibles (fig. 35) .............................................................................. 147
Tubercules antennaires convergents ou divergents, mais toujours scabres au moins près du bord antérieur ou orné ventralement de spicules ou de nodules (ou ces deux caractères à la fois) ..................... 148

147(146). Aptères ........................................................................ 192
Ailés .................................................................................. 209

148(146). Aptères .................................................................... 223
Ailés .................................................................................. 236

149(143). Siphon renflé; sur Prunus, Phragmites ou sur Typha .......
.................................................................................. Hyalopterus Koch (p. 382)
Siphon non renflé ........................................................................ 150
150(149). Tergite abdominal VIII pourvu d'une papille sétigère médiane (fig. 226) ou ensemble du tergum formant une plaque triangulaire couvrant la queue (fig. 224) .................................................. *Aspidaphis* Gillette (p. 152)

Tergite abdominal VIII sans processus médian .......... 151

151(150). Siphon rétréci graduellement vers l'apex, ayant le pore oblique (fig. 238) .......... *Aspidaphium* Börner (p. 157)

Siphon plus étroit au milieu, plus large à la base et à l'apex, ayant le pore non oblique .................................................. *Jacksonia* Theobald (p. 400)

152(145). Siphon cylindrique et distinctement orné d'imbrications, particulièrement vers l'apex; sur les conifères .................. *Elatobium* Mordvilko (p. 286)

Siphon très renflé, presque sans sculpture; pas sur les conifères .......................................................... 153

153(152). Aptères ayant les tergites abdominaux I à VI fusionnés en une carapace pigmentée (plus pâle au milieu) ornée d'impressions réticulées; partie apicale du tibia postérieur fortement spiculée; sur *Kalmia* ..................... .................................................. *Neoamphorophora* Mason (p. 502)

Aptères ayant les tergites abdominaux non pigmentés; apex du tibia postérieur non spiculé; sur *Berberis* .......... .......................................................... *Liosomaphis* Walker (p. 411)

154(141). Siphon capité (fig. 55) ........................................... *Epameibaphis* Oestlund (p. 293)

Siphon cylindrique ou renflé avant l'apex, mais non capité .......................................................... 155

155(154). Tubercules antennaires bien développés .................. *Pleotrichophorus* Börner (p. 564)

Tubercules antennaires non développés .................. 156

156(155). Soies dorsales nombreuses, particulièrement sur le prothorax, flabellées (fig. 100) ou flabello-capitées (fig. 95); pore du siphon oblique (fig. 1654); pronotum pourvu de soies submédianes antérieures .................................. *Pseudoepameibaphis* Gillette & Palmer (p. 582)

Soies dorsales de la tête et du thorax acuminées à légèrement claviformes, jamais flabellées; pore du siphon transverse; pronotum sans soies submédianes antérieures .......................................................... 157

157(156). Siphon légèrement, mais distinctement renflé avant l'apex; aptères pourvus de soies dorsales abdominales émoussées à claviformes .......................................................... *Coloradoa* Wilson (p. 247)
Siphon cylindrique ou rétréci graduellement vers l’apex; aptères ayant toutes les soies dorsales acuminées ...... 
...................................................... Zyxaphis Knowlton (p. 706)

158(144). Tergite abdominal VIII pourvu d’une papille sétigère médiane (fig. 426); sur Salix ou sur les Ombellifères 
............................................... Cavariella Del Guercio (p. 214)

159(158). Queue courte et élargie, ayant l’apex arrondi à obtusément triangulaire (fig. 67) ou en forme d’arc (fig. 61 et 66) ........................................... 160

159(158). Queue lancéiforme ayant les bords presque parallèles (fig. 63), ou digitiforme au-delà de la base (fig. 69), ou allongée au-delà du point de constriction basal (fig. 64) ........................................... 162

160(159). Queue petite, en forme d’arc, peu visible (fig. 66) ............. 
.......... Brachycaudus van der Goot (en partie) (p. 183)

161(160). Tubercules latéraux sur le segment abdominal VII de grande taille, leur diamètre étant supérieur à la moitié du diamètre basal du siphon ................. 
...................................................... Aphis Linnaeus (en partie) (p. 137)

161(160). Tubercules latéraux sur le segment abdominal VII, si présents, petits, leur diamètre ne dépassant pas la moitié du diamètre basal du siphon ................. 161

162(161). Siphon presque lisse, certains spécimens pourvus de quelques spicules peu visibles et dispersés, en particulier à la base ............................................. 
.......... Brachycaudus van der Goot (en partie) (p. 183)

162(161). Siphon distinctement plissé ou ayant des imbrications lisses ou spiculées ou ayant des spicules ou des nodules ............................................. 164

163(162). Siphon finement annelé de petits spicules ou de petits nodules (fig. 59) .................................................. 164

163(162). Siphon pourvu d’une sculpture de forme variable, mais non finement annelé de petits spicules ou de petits nodules ............................................. 165

164(163). Stigmate sur le segment abdominal VII pourvu d’un bord antérieur saillant en forme d’opercule (fig. 6); tibia postérieur habituellement pourvu de nombreux pseudosensoria; sur Viburnum ou sur les laîches ............................................. Ceruraphis Börner (p. 225)
Stigmate sur le segment abdominal VII prolongé antérieurement en forme d'opercule (fig. 7); tibia postérieur rarement pourvu de quelques pseudosensoria (une espèce); sur les Prunées, les Pomoidées, principalement sur les Légumineuses ou, rarement, sur les Labiées ou sur les Scrophulariaceae .................

...................... *Nearctaphis Shaposhnikov* (p. 498)

165(163). Siphon plissé ou imbriqué; imbrications sans nodules ou spicules bien visibles; sur les Pomoidées et sur diverses plantes herbacées, p. ex., *Plantago* ................

.............................. *Dysaphis Börner* (p. 283)

Siphon fortement imbriqué; imbrications avec des nodules ou des spicules bien visibles; sur *Sorbus, Crataegus, Viburnum* ou sur les laîches .................. 166

166(165). Siphon plus ou moins renflé au milieu, distinctement rétréci avant le pore (fig. 464); sur *Viburnum* ou sur les laîches ...................... *Ceruraphis Börner* (p. 225)

Siphon ne présentant pas ces caractères (fig. 1303); sur *Crataegus* ou sur *Sorbus* ..................

.............................. *Muscaphis Börner* (p. 473)

167(159). Siphon court, d'habitude distinctement plus court que la queue ou au plus presque de la même longueur, cette dernière étant alors largement triangulaire ....... 168

Siphon plus long que la queue ou, si presque de la même longueur, alors queue digitiforme ou allongée, non pas largement triangulaire ........................................... 170

168(167). Antenne composée de 5 articles .................................................................

.............................. *Misturaphis Robinson* (p. 459)

Antenne composée de 6 articles ........................................ 169

169(168). Ailés pourvus de sensoria secondaires seulement sur l'article antennaire III et ayant de petites taches étroites, irrégulières et transverses sur les tergites abdominaux; aptères pourvus de taches dorsales coalescentes formant des taches transverses distinctes sur les tergites abdominaux; sur les Crucifères ........

.............................. *Breucoryne van der Goot* (p. 188)

Ailés pourvus de sensoria secondaires sur les articles antennaires III à V et ayant une pigmentation s'étendant à une grande partie du dorsum de l'abdomen; sur *Symphoricarpos* ........................................

.............................. *Aphthargelia Hottes* (en partie) (p. 141)

170(167). Siphon égal à environ la moitié de la longueur de l'article apical du tarse postérieur ...................................... 171
Siphon supérieur à la moitié de la longueur de l'article apical du tarse postérieur ........................................ 172

171(170). Siphon non renflé sur sa moitié apicale, beaucoup plus large à la base qu'à l'apex .......................................... Longicaudus van der Goot (p. 418)
Siphon renflé sur sa moitié apicale; sur Chenopodium ........................................ Hayhurstia Mordvilko (p. 361)

172(170). Aptères .......................................................... 173

Ailés .......................................................... 183

173(172). Tibia postérieure pourvu d'un organe stridulant formé d'une rangée longitudinale de soies en forme de petites dents (fig. 93) .......... Toxoptera Koch (p. 678)
Tibia postérieur sans organe stridulant formé d'une rangée longitudinale de soies en forme de petites dents .......................................................... 174

174(173). Tergites abdominaux fusionnés en une carapace pigmentée; sur les mousses ........................................ Pseudacaudella Börner (p. 575)
Tergites abdominaux non fusionnés en une carapace pigmentée .......................................................... 175

175(174). Tubercules abdominaux latéraux présents sur le segment VII .......................................................... 180
Tubercules abdominaux latéraux, si présents, non situés sur le segment VII .......................................................... 176

176(175). Dorsum du corps criblé de petites dépressions, plissé ou plié .......................................................... 177
Abdomen sans spicules, nodules ou imbrications .......... 179

177(176). Antenne composée de 5 articles ........................................ Carolinaia Wilson (p. 207)
Antenne composée de 6 articles ........................................ 178

178(177). Soies céphaliques émoussées à finement capitées; sur les Rosacées .......... Myzaphis van der Goot (p. 477)
Soies céphaliques acuminées; sur Carex ........................................ Vesiculaphis Del Guercio (p. 701)

179(176). Surface dorsale de l'abdomen lisse, sans sclérites pigmentés sur les segments situés avant le siphon; sur Lonicera ou sur les Ombellifères ........................................ Hyadaphis Kirkaldy (p. 372)
Surface dorsale de l'abdomen ornée d'une réticulation bien visible; segments situés avant le siphon pourvus de petits sclérites à la base des soies submédianes; sur les Crucifères .......... Lipaphis Mordvilko (p. 414)
180(175). Queue pourvue de 2 soies de chaque côté; sur les Prunées, les Pomoidées ou sur les Graminées .......................... 181
Queue pourvue de plus de 2 soies de chaque côté ou, si avec 2 soies, alors non associés aux groupes de végétaux susmentionnés ..................................... 182

181(180). Dorsum de l’abdomen orné d’une sculpture finement réticulée; siphon d’habitude distinctement renflé sur sa moitié apicale ou au milieu ou, si cylindrique, alors vivant sur Prunus ou Typha ou, rarement, sur Scirpus ....................... Rhopalosiphum Koch (en partie) (p. 605)
Dorsum de l’abdomen sans spicules, ou nodules finement réticulée; siphon non renflé; surtout sur les Graminées, rarement sur Scirpus, non associé à Prunus ou à Typha .......... Schizaphis Börner (p. 615)

182(180). Sur les Prunées et sur les Graminées ................................................. Hysteroneura Davis (p. 386)
Pas sur les Prunées ou sur les Graminées ................................................. Aphis Linnaeus (en partie) (p. 137)

183(172). Nervure médiane comportant 2 branches ...................... 184
Nervure médiane comportant 3 branches ......................... 186

184(183). Siphon renflé, brusquement rétréci avant l’apex ............... Vesiculaphis Del Guercio (p. 701)
Siphon cylindrique ou rétréci graduellement vers l’apex .............................................. 185

185(184). Tibia postérieur pourvu d’un organe stridulant formé d’une rangée longitudinale de soies courtes en forme de petites dents (fig. 93) ...... Toxoptera Koch (p. 678)
Tibia postérieur sans soies en forme de petites dents ........ Schizaphis Börner (p. 615)

186(183). Siphon plus ou moins renflé près du milieu ou sur sa moitié apicale ......................................................... 187
Siphon subcylindrique, rétréci graduellement vers l’apex, non renflé près du milieu ou sur sa moitié apicale ou non fortement rétréci au milieu ......................... 191

187(186). Tubercules abdominaux latéraux présents .................. 188
Tubercules abdominaux latéraux absents .................... 189

188(187). Tubercules abdominaux latéraux présents sur le segment VII .......... Rhopalosiphum Koch (en partie) (p. 605)
Tubercules abdominaux latéraux non situés sur le segment VII .......... Lipaphis Mordvilko (p. 414)

189(187). Aile postérieure ayant une nervure transverse (fig. 33) .............................................. Carolinaia Wilson (p. 207)
Aile postérieure ayant deux nervures transverses (fig. 31) .................................................. 190

190(189). Dorsum de l'abdomen habituellement orné d'une tache pigmentée centrale ou, en l'absence d'une telle tache, sensoria secondaires distribués en ligne droite sur l'article antenneaire III; article basal de chaque tarse souvent pourvu de plus de 3 soies ventrales ..................... *Myzaphis van der Goot* (p. 477)

Dorsum de l'abdomen membraneux; sensoria secondaires répartis sur toute la surface de l'article antenneaire III; jamais plus de 3 soies ventrales sur l'article basal de chaque tarse ............... *Hyadaphis Kirkaldy* (p. 372)

191(186). Aile postérieure ayant une nervure transverse (fig. 33) .............................................. *Hysteroneura Davis* (p. 386)
Aile postérieure ayant 2 nervures transverses (fig. 31) ..................................................... *Aphis Linnaeus* (en partie) (p. 137)

192(147). Bord antérieur du stigmate du segment abdominal VII prolongé vers l'arrière et couvrant le stigmate (fig. 7) .................................................. *Nasonovia Mordvilko* (en partie) (p. 493)

Bord antérieur des stigmates abdominaux non prolongé vers l'arrière (fig. 6) ............................................. 193

193(192). Dorsum de l'abdomen pourvu de rangées longitudinales de sclérites pigmentés entourant la base des soies; atrium du stigmate prothoracique réticulé (fig. 94); sur *Delphinium* .............................................................. *Nasonovia Mordvilko* (en partie) (p. 493)

Dorsum de l'abdomen sans rangées longitudinales de sclérites pigmentés entourant la base des soies; atrium du stigmate prothoracique non réticulé ...... 194

194(193). Siphon distinctement renflé sur sa moitié apicale ...... 195
Siphon cylindrique ou rétréci graduellement vers l'apex ........................................................................... 198

195(194). Spicules sur l'apex de la queue plus petits que ceux situés sur le reste de la queue; sur *Rhus*, sur les Graminées ou sur les laïches .... *Glabromyzus Richards* (p. 341)
Spicules sur l'apex de la queue au moins aussi longs que ceux situés sur le reste de la queue; non associé à *Rhus* .................................................................................................................. 196

196(195). Partie renflée du siphon couverte de nodules et d'imbrications semblables à celles se trouvant sur la partie basale; aptères pourvus d'un article antenneaire III sans sensoria; sur *Rosa* ou sur les Éricacées .......... *Wahlgreniella Hille Ris Lambers* (p. 703)
Partie renflée du siphon souvent lisse ou presque lisse ou, si scabre chez les aptères, alors article anténnaire III pourvu de sensoria; pas sur *Rosa* ou sur les *Éricacées*

197(196). Article basal du tarse postérieur ayant plus de 2 soies ventrales; non associé à *Lonicera* ou aux *Graminées*; nombreuses espèces sur *Rubus* .................................

............... *Amphorophora Buckton* (p. 130)

Article basal du tarse postérieur ayant 2 soies ventrales; sur *Lonicera* ou sur les *Graminées* .................................

............. *Rhopalomyzus Mordvilko* (en partie) (p. 598)

198(194). Dorsum de la tête et du corps ayant de longues soies capitées ou de courtes soies claviformes .......... 199

Dorsum de la tête et du corps sans soies capitées bien visibles ................................................................. 203

199(198). Dorsum de l'abdomen pigmenté et sclérifié en une carapace; sur les *Graminées* ........................................

............... *Cryptaphis Hille Ris Lambers* (p. 254)

Dorsum de l'abdomen ne formant pas une carapace sclérifiée; pas sur les *Graminées* ........................................ 200

200(199). Article anténnaire III pourvu de sensoria .............. 201

Article anténnaire III sans sensoria ............................... 202

201(200). Soies dorsales nombreuses, non distribuées en groupes distincts, habituellement courtes, claviformes ou flabellées (fig. 1608); sur les *Composées* (rarement sur les *Boraginacées*) .................................................................

............... *Pleotrichophorus Börner* (p. 564)

Soies dorsales moins nombreuses; 1 soie submédiane, 1 soie dorsolatérale et 1 soie latérale de chaque côté, toutes longues et capitées (fig. 580); sur *Ribes* ou sur les *Labiées* .............. *Cryptomyzus Oestlund* (p. 258)

202(200). Soies dorsales sur les premiers segments abdominaux et sur le thorax courtes, claviformes ou flabellées; soies prothoraciques submédianes antérieures présentes; sur les *Éléagnacées*, les *Composées* ou les *Polygonacées* .................................................................

............... *Capitophorus van der Goot* (p. 203)

Soies dorsales toutes longues et capitées; soies prothoraciques submédianes antérieures absentes; sur les *Rosacées* .............................................

............... *Chaetosiphon Mordvilko* (p. 229)

203(198). Dorsum de l'abdomen ayant de grandes aires pigmentées formant souvent une carapace dorsale .....................

............... *Aphthargelia Hottes* (en partie) (p. 141)
Dorsum de l'abdomen en apparence membraneux, sans aires pigmentées .............................................. 204

204(203). Base du siphon entièrement ou presque entièrement entouré d'un anneau sclérisé pigmenté; sur *Desmodium* ........................................... *Microparsus Patch* (p. 449)

Base du siphon non entouré d'une aire ou d'un anneau sclérisé pigmenté .............................................. 205

205(204). Siphon pas plus long que la queue; bord antérieur du tubercule antennaire orné dorsalement d'un petit tubercule accessoire; sur les Graminées ..............................................

....................................................... *Hyalopteroides Theobald* (p. 379)

Siphon beaucoup plus long que la queue; tubercule antennaire non pourvu dorsalement d'un petit tubercule accessoire peu visible; rarement sur les Graminées .............................................. 206

206(205). Au moins les imbrications ventrales sur le tarse postérieur pourvu de nodules ou de spicules; partie apicale du tibia postérieur habituellement ornée de quelques imbrications; sur *Urtica* ..............................................

....................................................... *Microlophium Mordvilko* (p. 446)

Tarse postérieur sans imbrications apicales; imbrications sur la partie apicale du tibia postérieur sans spicules ou nodules; non associés à *Urtica* .............................................. 207

207(206). Queue courte ou longue, triangulaire (fig. 62 et 63) ............

....................................................... *Acyrthosiphon Mordvilko* (p. 118)

Queue plus courte, presque en forme d'arc ou semi-lunaire (fig. 61 et 66) .............................................. 208

208(207). Article basal des tarses ayant au plus 3 soies ventrales; sur *Eriogonum, Lonicera* ou *Symphoricarpos* ......................

....................................................... *Amphicercidus Oestlund* (p. 126)

Article basal des tarses ayant 5 ou 6 soies ventrales; sur *Rosa* ......................... *Pseudocercidis Richards* (p. 579)

209(147). Dorsum de l'abdomen membraneux .............................................. 210

Dorsum de l'abdomen ayant des aires sclérisées pigmentées bien visibles .................. 217

210(209). Queue beaucoup plus longue que le siphon ..................

....................................................... *Hyalopteroides Theobald* (p. 379)

Queue jamais plus longue que le siphon .............................................. 211

211(210). Article basal des tarses ayant 5 ou 6 soies ventrales; sur *Rosa* ......................... *Pseudocercidis Richards* (p. 579)

Article basal des tarses ayant normalement au plus 3 soies ventrales .................. 212
212(211). Base du siphon entièrement ou presque entièrement entourée d’un anneau pigmenté; sur *Desmodium* ........

...............*Microparsus Patch* (p. 449)

Base du siphon non entièrement ou presque non entièrement entourée d’un anneau pigmenté ...... 213

213(212). Siphon cylindrique ou rétréci progressivement vers l’apex ....................................................... 214

Siphon renflé sur sa moitié apicale ......................... 215

214(213). Queue courte, linguiforme, grossièrement arrondie, non triangulaire (fig. 67) ........................................ Amphilicercidus Oestlund (p. 126)

Queue courte à allongée, triangulaire (fig. 62 et 63) ........ Acyrthosiphon Mordvilko (p. 118)

215(213). Spicules sur l’apex de la queue plus courts que ceux situés sur le reste de la queue ........................................ Glabromyzus Richards (p. 341)

Spicules sur l’apex de la queue au moins aussi longs que ceux situés sur le reste de la queue ..................... 216

216(215). Partie renflée du siphon lisse ou presque lisse ................ Amorphophora Buckton (p. 130)

Partie renflée du siphon couverte assez uniformément de spicules, de nodules et d’imbrications .................. Wahlgreniella Hille Ris Lambers (p. 703)

217(209). Atrium du stigmate mésothoracique cylindrique réticulé (fig. 94); bord antérieur du stigmate du segment abdominal VII souvent prolongé vers l’arrière en forme d’opercule (fig. 7) ........................................ Nasonovia Mordvilko (p. 493)

Atrium du stigmate mésothoracique plus ou moins conique et non réticulé; bord antérieur des stigmates abdominaux non prolongé vers l’arrière en forme d’opercule (fig. 6) ........................................ 218

218(217). Article basal du tarse postérieur n’ayant seulement que 2 soies ventrales .................................*Rhopalomyzus Mordvilko* (en partie) (p. 598)

Article basal du tarse postérieur ayant de 3 à 5 soies ventrales ................................................................. 219

219(218). Siphon beaucoup plus long que la queue .................. 220

Siphon à peu près de la même longueur que la queue ou plus court; sur *Symphoricarpos* .................... Aphthargelia Hottes (en partie) (p. 141)
Sensoria secondaires sur l'article antennaire III présents seulement sur la surface postérieure ..................... Cryptaphis Hille Ris Lambers (p. 254)
Sensoria secondaires sur l'article antennaire III nombreux et répartis sur toutes les surfaces .......... 221

Sensoria secondaires présents seulement sur l'article antennaire III .................................................... Chaetosiphon Mordvilko (en partie) (p. 229)
Sensoria secondaires présents sur les articles antennaires III et IV, et souvent également sur l'article V ...... 222

Pronotum pourvu de soies submédianes antérieures ........
............................................ Capitophorus van der Goot (p. 203)
Pronotum sans soies submédianes antérieures ............
.................................................. Cryptomyzus Oestlund (p. 258)

Dorsum de la tête et du corps (au moins latéralement) et
tergite abdominal VII ou VIII (ou les deux) avec de
longues soies capitées .................................................. 224
Dorsum de la tête et du corps sans longues soies capitées
(longueur des soies, si capitées, inférieure au diamètre
de l'article antennaire II en son point le plus large)
.......................................................................................................................... 225

Soies latérales sur la tête et le corps beaucoup plus
longues que les soies dorsales; aptères pourvus de
soies distinctement capitées; siphon fortement renflé
ever couvert de nodules et d'imbrications grossières; sur
les mousses ...................... Decoroaphon Börner (p. 265)
Soies latérales d'habitude non distinctement plus longues
que les soies dorsales; siphon au plus faiblement
renflé et légèrement à modérément imbriqué; sur les
Rosacées ................................................................. Chaetosiphon Mordvilko (en partie) (p. 229)

Bords internes des tubercules antennaires parallèles ou
divergents (fig. 35) ..................................................... 226
Bords internes des tubercules antennaires convergents
(fig. 36 et 37) ............................................................. 232

Siphon renflé, le diamètre de la partie renflée étant au
moins égal à 1,25 fois celui de la partie cylindrique
(fig. 52) ........................................................................ 227
Siphon cylindrique ou, si faiblement renflé, le diamètre de
la partie renflée étant inférieur à 1,25 fois celui de la
partie cylindrique ......................................................... 229
227(226). Diamètre de la partie renflée du siphon plusieurs fois supérieur à celui de la partie basale cylindrique ..........

......... **Rhopalosiphoninus Baker** (en partie) (p. 601)

Diamètre de la partie renflée du siphon égal au plus au double de celui de la partie basale cylindrique ...... 228

228(227). Article basal du tarse postérieur ayant 2 soies; sur les Graminées .................................................................

......... **Rhopalomyzus Mordvilko** (en partie) (p. 598)

Article basal du tarse postérieur avec 3 soies; sur *Physocarpus* ou sur les Graminées ........................................

.................... **Utamorphophora Knowlton** (p. 697)

229(226). Siphon pigmenté à la base, incolore à l'apex; sur les fougères ...................................... **Idiopterus Davis** (p. 389)

Siphon incolore ou pigmenté uniformément, ou avec la moitié apicale plus foncée; rarement sur les fougères ............................................................. 230

230(229). Apex de la queue brusquement rétréci, formant un processus digitiforme ...... **Myzodium Börner** (p. 486)

Apex de la queue non rétréci brusquement .............. 231

231(230). Dorsum de l'abdomen réticulé (nODULES et imbrications plus visibles sur les aires pigmentées) (fig. 130); sur *Lonicerara* ................................... **Alphitoaphis Hottes** (p. 122)

Dorsum de l'abdomen non réticulé .................................. 259

232(225). Siphon cylindrique ................................................................. **Myzus Passerini** (en partie) (p. 489)

Siphon renflé ........................................................................ 233

233(232). Articles antennaires I et II distinctement plus foncés que l'article III ............... **Neotoxoptera Theobald** (p. 512)

Articles antennaires I et II non distinctement plus foncés que l'article III ..................................................... 234

234(233). Tubercule antennaire pourvu d'une projection antéromédiane digitiforme (fig. 37); sur *Prunus* ou sur *Humulus* ......................... **Phrodon Passerini** (p. 553)

Tubercule antennaire pourvu d'une projection antéromédiane arrondie (fig. 36) ........................................... 235

235(234). Dorsum de l'abdomen visiblement rugueux; tubercule frontal médian développé; spicules sur l'apex de la queue plus petits que ceux situés sur le reste de la queue ................. **Ovatus van der Goot** (p. 523)
Dorsum de l'abdomen non visiblement rugueux; tubercule frontal médian non développé; spicules sur l'apex de la queue au moins aussi gros que ceux situés sur le reste de la queue .................................................. *Myzus Passerini* (en partie) (p. 489)

236(148). Tubercules antennaires ayant les bords internes parallèles ou convergents, visiblement rugueux, toujours ornés ventralement de quelques spicules ou de quelques nodules ........................................ 242

Tubercules antennaires ayant les bords internes divergents, parfois non visiblement rugueux près des bords antérieurs chez certaines espèces, mais non pourvus ventralement de spicules ou de nodules .... 237

237(236). Article basal du tarse postérieur pourvu de 5 soies ventrales .......................................................... *Chaetosiphon Mordvilko* (en partie) (p. 229)

Article basal du tarse postérieur ayant au plus 3 soies ventrales .................................................. 238

238(237). Siphon subcylindrique .............................. 239

Siphon renflé sur sa moitié apicale ......................... 240

239(238). Bords des sensoria secondaires souvent ciliés (fig. 71) .................................................. *Fimbriaphis Richards* (en partie) (p. 316)

Bords des sensoria secondaires non ciliés .................

.................................................. *Alphitoaphis Hottes* (p. 122)

240(238). Apex de la queue brusquement rétrécì, formant un processus digitiforme (fig. 69) .................................................. *Glendenningia MacGallivray* (p. 344)

Apex de la queue non rétrécì brusquement; queue rétréciegraduellement vers l'apex .......... 241

241(240). Article basal du tarse postérieur pourvu de 3 soies ventrales ...... *Utamphorophora Knowlton* (p. 697)

Article basal du tarse postérieur pourvu de 2 soies ventrales .................................................. *

*Rhopalomyzus Mordvilko* (en partie) (p. 598)

242(236). Nervures de l'aile antérieure, en particulier les nervures basales, distinctement bordées d'un pigment brun .................................................. 243

Nervures de l'aile antérieure non distinctement bordées d'un pigment brun .................. 244

243(242). Siphon renflé sur sa moitié apicale, uniformément pigmenté; dorsum de l'abdomen ayant une aire sclérifiée pigmentée plus ou moins distincte ..............

.................................................. *Neotoxoptera Theobald* (p. 512)
Siphon cylindrique, ayant la partie basale brune et la partie apicale incolore; dorsum de l'abdomen non pigmenté; secteur radial prolongé vers le bas, interceptant la nervure médiane .............................................................. *Idiopterus Davis* (p. 389)

244(242). Dorsum de l'abdomen ayant une aire centrale pigmentée de forme irrégulière, plus ou moins quadrangulaire ........................................ Myzus Passerini (en partie) (p. 489)

Dorsum de l'abdomen soit membraneux, soit orné de taches pigmentées transverses, mais sans aire centrale pigmentée de forme irrégulière et plus ou moins quadrangulaire ........................................ 245

245(244). Dorsum de l'abdomen membraneux; siphon renflé sur sa moitié apicale; sensoria secondaires nombreux, répartis sur toutes les surfaces des articles antennaires III et IV et, habituellement, de l'article V ........................................ Hyalomyzus Richards (p. 376)

Dorsum de l'abdomen membraneux ayant des taches pigmentées transverses bien visibles; siphon habituellement non renflé; sensoria secondaires distribués seulement sur l'article antennaire III, en général uniquement sur la surface postérieure .... 246

246(245). Prothorax orné de spicules latéraux ou ventrolatéraux ........ Aulacorthum Mordvilko (en partie) (p. 168)

Prothorax sans spicules latéraux ou ventrolatéraux .......... Fimbriaphis Richards (en partie) (p. 316)

247(134). Siphon brusquement renflé avant l'aire réticulée (fig. 1729) ................. Rhopalosiphinsonus Baker (p. 601)

Siphon cylindrique ou plus faiblement renflé sur sa partie apicale (fig. 52) ................................................................. 248

248(247). Siphon orné de soies; dernier article du rostre ayant la partie située au-delà des soies subapicales étroite, à bords parallèles; soies subapicales primaires du rostre plus courtes que les soies secondaires sous-basales (fig. 80) ...................... Obtusicauda Soliman (p. 516)

Siphon sans soies ou, si pourvu de quelques soies, alors les soies subapicales du rostre plus longues que les soies secondaires sous-basales et la partie apicale du dernier article du rostre non étroite ....................... 249
249(248). Réticulation couvrant au moins les deux cinquièmes du siphon; dernier article du rostre ayant les bords plus ou moins concaves, sa partie apicale étant étroite ou triangulaire et les soies secondaires sous-basales étant plus longues que les soies primaires préapicales; sclérite situé avant le siphon plus gros que le sclérite situé après le siphon (ce dernier étant absent chez certaines espèces); sur les Composées, en particulier *Artemisia* ou *Achillea* .......................................................... *Macrosiphoniella Del Guercio* (p. 425)

Réticulation couvrant habituellement moins du tiers du siphon; dernier article du rostre n'ayant jamais les bords concaves; sclérite situé après le siphon plus gros que le sclérite situé avant le siphon (ce dernier étant souvent absent) .......................................................... 250

250(249). Dernier article du rostre entièrement subcylindrique, allongé, ayant la partie située au-delà des soies subapicales courte et arrondie (fig. 81); queue ayant plusieurs constrictions, paraissant tordue (fig. 68); sur *Cirsium* et sur *Hypericum* .................................

.......................................................... *Bipersona Hottes* (p. 175)

Dernier article du rostre subconique; queue allongée à triangulaire, mais ne semblant pas tordue ........... 251

251(250). Réticulations du siphon fines, le diamètre moyen des cellules inférieur au cinquième de celui du siphon; plus de six rangées transverses de cellules (fig. 57) .......................................................... 252

Réticulations du siphon grossières, le diamètre moyen des cellules oscillant entre un tiers et un cinquième de celui du siphon; habituellement 6 rangées transverses de cellules ou moins (fig. 56) ................................................. 254

252(251). Aile antérieure pourvue d’une macula apicale; tubercules latéraux et dorsaux de grande taille, les plus grands étant multilobés; aptères pourvus de l’article antennaire III sans sensoria; article basal des tarses ayant 5 soies ventrales; sur *Rosa* .......................................................... *Eomacrosiphon Hille Ris Lambers* (p. 290)

Aile antérieure sans macula apicale; tubercules latéraux et dorsaux de petite taille et simples, ou absents; aptères ayant l’article antennaire III habituellement pourvu de sensoria; article basal des tarses muni de 3 ou 5 soies ventrales .......................................................... 253
Tubercules antennaires bien développés, prolongés vers l'avant au-delà du bord antérieur de la tête sur une distance égale à au moins la moitié de la longueur du premier article antennaire; tubercule médian absent; soies abdominales dorsales souvent insérées sur de très petits sclérites; le reste du dorsum membraneux; queue longue, rétrécie graduellement vers l'apex; article basal des tarses muni de 3 à 5 soies ventrales; sur les Composées ou sur les Campanulacées ...

Uroleucon Mordvilko (p. 692)

Tubercules antennaires moins développés, dépassant à peine le tubercule médian modérément développé; aptères ayant le dorsum scléréifié et non visiblement segmenté, non pigmenté ou ayant une pigmentation diffuse; ailes ayant le dorsum orné d'aires pigmentées, mais pourvus de soies dorsales jamais insérées sur de petits sclérites visibles; queue ayant les bords plus ou moins parallèles et arrondie à l'apex; article basal des tarses pourvu de 3 soies ventrales; sur les Rosacées ou sur les Graminées ...

Macrocephum Passerini (en partie) (p. 428)

Stigmates thoraciques beaucoup plus grands que les stigmates abdominaux (leur diamètre étant supérieur à celui de l'article antennaire III), situés au fond d'un atrium cylindrique rugueux ou réticulé (fig. 94); stigmates abdominaux operculés (fig. 7) ...

Delphinobium Mordvilko (p. 498)

Stigmates thoraciques à peine plus grands que les stigmates abdominaux (leur diamètre étant inférieur à celui de l'article antennaire III); atrium non réticulé; stigmates abdominaux non operculés ...

Siphon visiblement renflé avant la partie réticulée, ou article basal des tarses pourvu de 5 soies ventrales, ou ces deux caractères à la fois; imbrications sur les articles apicaux des tarses fortement spiculés chez certaines espèces ...

Illinoia Wilson (p. 393)

Siphon non visiblement renflé avant la partie réticulée, son diamètre n’excédant pas celui des parties plus basales ou, rarement, le dépassant légèrement; partie réticulée souvent plus ou moins rétrécie (donnant l’illusion que le siphon est renflé); article basal des tarses toujours pourvu de 3 soies ventrales; imbrications sur les articles apicaux des tarses habituellement lisses ou, rarement, avec quelques spicules ou nodules peu visibles ...

114
Sensoria secondaires antennaires petits, saillants, en forme de vésicule (fig. 1524); sur les fougères .......... Papulaphis Robinson (p. 539)

Sensoria secondaires antennaires non saillants ou, si saillants, à sommet aplati (fig. 418) ............... 257

Aptères pourvus de tubercules antennaires scabres; ailés ayant la partie du dorsum précédant le siphon ornée d’une aire pigmentée étendue ou de taches pigmentées .......... Placoaphis Richards (p. 561)

Aptères pourvus de tubercules antennaires lisses; ailés ayant la partie du dorsum précédant le siphon membraneux (sclérites latéraux bien développés et tergites VII et VIII pigmentés chez certains genres) ...................................................... 258

Siphon pourvu d’une collerette apicale visible ............... Macrosiphum Passerini (en partie) (p. 428)

Siphon pourvu d’une collerette apicale non visible à peine plus large que le siphon (fig. 414) ......................... Catamergus Oestlund (p. 211)

Prothorax avec des spicules latéraux ou ventrolatéraux ............ Aulacorthum Mordvilko (en partie) (p. 168)

Prothorax sans spicules latéraux ou ventrolatéraux .......... Fimbriaphis Richards (en partie) (p. 316)

Article basal des tarses très petit, souvent caché par l’apex du tibia, sans soies (fig. 1774); aptères ayant le bord antérieur de la tête ornée d’un processus médian quadrangulaire de grande taille; bord médian du tubercule antennaire et de l’article antennaire I orné d’un processus conique (fig. 1765); aptères pourvus de tergites abdominaux fusionnés en une carapace sclérifiée pigmentée; antenne composée de 4 articles chez les aptères, de 5 articles chez les ailés; aile antérieure ayant la nervure médiane comportant 2 branches; aile postérieure ayant une nervure oblique; sur Juniperus ........ Sanbornia Baker (p. 612)

Article basal des tarses normalement développé, triangulaire, pourvu de soies ventrales; bord antérieur de la tête, tubercule antennaire et article antennaire I sans processus; si les tergites abdominaux des aptères forment une carapace, alors pas sur Juniperus; aile antérieure munie d’une nervure médiane composée habituellement de 3 branches; aile postérieure pourvue de 2 nervures obliques; antenne habituellement composée de 6 articles .......... 261
Principale partie du dernier article du rostre conique, ayant les bords légèrement concaves, les plus longues soies étant situées près de la base et la partie située au-delà des soies subapicales étant allongée (au moins égale à la moitié de la longueur de la partie principale), triangulaire ou en forme de stylet (fig. 80); sur *Artemisia* ........................................ 262

Dernier article du rostre ayant les bords droits ou convexes, les plus longues soies étant situées près de l’apex et la partie apicale étant courte, largement arrondie (fig. 78); pas sur *Artemisia* ...................... 263

Soies dorsales courtes, flabellées (fig. 792); aptères pourvus de tergites abdominaux ne formant pas une carapace pigmentée; queue beaucoup plus longue que large à la base ................................................................. 264

.... *Flabellomicrosiphum* Gillette & Palmer (p. 320)

Soies dorsales longues et pointues ou ayant un apex flabellé ou multifide (fig. 1235); aptères pourvus de tergites abdominaux fusionnés en une carapace sclérisée pigmentée; queue largement triangulaire, plus courte que large à la base ................................................................. 266

.... *Microsiphoniella* Hille Ris Lambers (p. 452)

Siphon poriforme ou absent; tubercules latéraux présents ................................................................. 267

Siphon court mais non poriforme; tubercules latéraux absents ................................................................ 268

Queue semi-circulaire, plus courte que large à la base; tubercules latéraux souvent multilobés et de grande taille, le diamètre des plus gros tubercules étant supérieur à celui de l’article antennaire III; sur *Lonicera* ........................................... *Gypsoaphis* Oestlund (p. 354)

Queue étroitement triangulaire, plus longue que large à la base; tubercules latéraux plus petits, leur diamètre étant habituellement inférieur à celui de l’article antennaire III ................................................................. 269

Antenne composée de 5 articles, ou si composée de 6 articles chez les ailés, alors la nervure médiane composée de 2 branches; tubercules latéraux campaniformes; sur *Juniperus* ........................................... 270

........................................... *Siphonatrophia* Swain (p. 625)

Antenne composée de 6 articles et nervure médiane composée de 3 branches; tubercules latéraux digitiformes, au moins aussi longs que larges à la base ............................. *Asiphonaphis* Wilson & Davis (p. 148)
Key to genera of superfamily Phylloxeroidea

1. Female with well-developed sclerotic ovipositor (Fig. 25).
   Antenna 5-segmented in alata, 3- or 4-segmented in aptera. Tarsi with preapical setae acuminate. Transverse veins of fore wing more or less parallel, arising separately from longitudinal vein (Fig. 27) .......................... 2

2. Female with only traces of sclerotic ovipositor (Fig. 26).
   Antenna with 3 segments. Tarsi with dorsal preapical setae capitate (Fig. 87). Basal 2 of 3 transverse veins of fore wing (or their projections, if partly indistinct) diverging from common stem (Fig. 28) .......................... 3

3. Abdomen with 5 pairs of spiracles ..................................................
   .................................................. Adelges Vallot (p. 710)

4. Abdomen with 4 pairs of spiracles ..................................................
   .................................................. Pineus Shimer (p. 713)

5. With dorsal clusters of wax gland facets; apterae only; on Populus or Salix ........ Phylloxerina Börner (p. 721)

6. Without dorsal gland facets; apterae and alatae; on Castanea, Carya, Quercus, or Vitis ............................. Phylloxera Boyer de Fonscolombe (p. 717)
Clé des genres de la superfamille des Phylloxeroidea

1. Femelles ayant un ovipositeur sclérisé bien développé (fig. 25). Antenne composée de 5 articles chez les ailes et de 3 ou 4 articles chez les aptères. Tarses pourvus de soies préapicales acuminées. Nervures transverses de l'aile antérieure plus ou moins parallèles, issues de points différents sur la nervure longitudinale (fig. 27) .................................................. 2

Femelles ayant seulement une trace d'ovipositeur sclérisé (fig. 26). Antenne composée de 3 articles. Tarses avec des soies dorsales préapicales capitées (fig. 87). Les 2 nervures les plus basales des 3 nervures transverses de l'aile antérieure (ou leur prolongement, si en partie non différenciées) divergeant à partir d'une origine commune (fig. 28) .................................................. 3

2(1). Abdomen pourvu de 5 paires de stigmates ....................... ............................................ Adelges Vallot (p. 710)

Abdomen pourvu de 4 paires de stigmates .......................... .................................................. Pineus Shimer (p. 713)

3(1). Aires dorsales des facettes des glandes cirières présentes; aptères seulement; sur Populus ou sur Salix ............. .................................................. Phylloxerina Börner (p. 721)

Aires dorsales des facettes des glandes cirières absentes; aptères et ailés; sur Castanea, Carya, Quercus ou sur Vitis .... Phylloxera Boyer de Fonscolombe (p. 717)

Generic descriptions of superfamily Aphidoidea

Genus Acyrthosiphon Mordvilko

Figs. 117–128

Acyrthosiphon Mordvilko, 1914:75.

Type species: Aphis pisi Kaltenbach, 1843:23 = Aphis pisum Harris, 1776: 66.

Adult (Figs. 117, 118). Length 2.0–4.0 mm.

Integument: Antennal segments I and II usually somewhat scabrous, segments III–VI with smooth imbrications; venter of head with a few spicules in some species; disc of head and thorax without evident sculpturing; abdominal terga I–IV or V usually without evident sculpturing, usually with spiculose imbrications laterally and on terga VI–VIII; tibiae without spicules; tarsi with smooth imbrications; cauda and anal and genital plates spiculose.
Head (Fig. 128): Antennal tubercle well-developed, smooth; front of head usually U-shaped except in species having median tubercle also moderately well developed. Ventral margin of antennal socket not protuberant. Discal setae usually blunt, weakly capitate, or pointed, arranged in anterior group of 4 and posterior transverse group of 4. Eye present in aptera and alata; triommatidium apparent in all individuals. Disc of head with 1 or 2 tubercles posteriorly in some species; never with gland facets. Cephalic suture absent. Antenna with 6 segments; processus terminalis elongate, slender, longer than base of segment VI; setae present or absent before apex; primary sensoria (Fig. 123) with ciliate margins; secondary sensoria (Fig. 122) present in alata, present or absent in aptera, where present usually restricted to basal half of antennal segment III, rarely extending whole length of segment except in alata, having margins without cilia or spicules. Rostrum 4-segmented; apical segment (Fig. 124) subcylindrical, pointed distad of primary subapical setae.

Thorax: Prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side, with or without posterior dorsal tubercles; small lateral tubercles commonly present. Femora (Fig. 121) with setae pointed; tibiae usually with mixture of blunt or weakly capitate setae and pointed setae, with the former concentrated basally and dorsally. Tibiae without rastral setae, rastral spines, or peglike setae. Basitarsi (Fig. 127) small, triangular, each normally with 3 ventral setae, without dorsal setae. Gland facets absent on tibiae of all morphs. Plantar setae acuminate or blunt. Claws simple. Fore wing (Fig. 119) with normal venation; media usually with 3 branches; branches of cubitus widely separated at base, diverging.

Abdomen: Terga not fused forming carapace; abdomen without pigmentation other than intersegmental sclerites; lateral sclerites in alata and in some species pigment on terga VII and VIII. Setae on abdominal terga I–VII usually blunt, appearing funnel-shaped in some specimens, arranged in 1 or 2 irregular transverse rows on each tergum; setae on tergum VIII pointed or blunt. Dorsal abdominal tubercles normally absent, rarely with 1 or 2 on tergum VIII. Lateral abdominal tubercles commonly present on segments II–IV or V, commonly minute, inconspicuous. Spiracles (Fig. 125) subcircular, without opercula. Siphunculus slender, elongate, at least as long as cauda, imbricate, with apical flange, without reticulation; one species with a few setae. Cauda spiculose, elongate triangular, with apex rounded. Abdominal tergum VIII entire, not bilobate. Anal plate (Fig. 120) entire. Abdomen without gland facets in aptera or alata. Gonapophyses 3.

**Embryo** (Fig. 126). Antenna 4-segmented; primary sensoria without ciliate margins; compound eyes and triommatidium present; abdominal setae in single lateral and single submedian row; dorsolateral setae present or absent; basitarsi triangular in outline with 2 or 3 ventral setae; distitarsi with imbrications, without preapical capitate setae; plantar setae acuminate.
Figs. 117, 118. Aptera of *Acyrthosiphon*. 117, head and prothorax; 118, apical abdominal segments.
Figs. 119–128. Embryonic chaetotaxy and alata vivipara of *Acyrthosiphon*. 119, left fore wing; 120, anal plate and gonapophyses; 121, right fore femur; 122, second and base of third antennal segments; 123, primary sensoria on antennal segment VI; 124, apical rostral segment; 125, abdominal spiracle; 126, dorsal chaetotaxy of embryo; 127, right hind tarsus; 128, ventral view of head.
Economically important species. The pea aphid, *A. pisum* (Harris), and the caragana aphid, *A. caraganae* (Cholodkovsky), are the two most important pests that belong to the genus *Acyrthosiphon* in Canada. The former infests all commercial crops of herbaceous legumes, and the latter is commonly abundant on caragana hedges. *A. dirhodus* (Walker), which migrates from *Rosa* species to various grasses including cereals, is also of some importance in Canada. *A. porosus* (Sanderson) is a pest of roses and strawberries.

Range of plants infested in Canada. Herbaceous legumes generally, species of *Amelanchier, Caragana, Dryas, Epilobium, Erodium, Geranium, Malva, Pedicularis, Purshia, Rosa, Sonchus, Spiraea, Thalictrum*.

Biology. Most species in this genus are anholocyclicly associated with the host plant. *A. dirhodus* is heterocyclicly associated with *Rosa* species and various grasses.

Comments. This genus is characterized by the presence of well-developed, nonscabrous antennal tubercles; the presence of relatively long, slender, unreticulate siphunculi; and the presence of 2 or 3 setae on the ventral surface of each tarsal segment. The elongate, triangular, apically spiculose cauda and the absence of pigmented, dorsal abdominal sclerites in the alatae are also distinctive.

*Acyrthosiphon*-like aphids, occurring either on grasses or alternating between *Rosa* and grasses (including *A. dirhodus*) and having a distinct median frontal tubercle, are assigned to subgenus *Metopolophium* Mordvilko, which is sometimes treated as a separate genus.

*A. porosus*, which has aptera with secondary sensoria over the whole length of antennal segment III, has often been placed in the genus *Rhodobium* Hille Ris Lambers (1947) (type species *Macrosiphum rosaefolium* Theobald = *Myzus porosus* Sanderson). Eastop (1971) treated *Rhodobium* as a subgenus of *Acyrthosiphon*. Richards (1972e) provided a key to the Canadian species. Eastop (1971) gave a key to, and taxonomic notes on, the world fauna then known.

Genus *Alphitoaphis* Hottes

Figs. 129–140

*Alphitoaphis* Hottes, 1926:116.
Type species: *Aphis lonicericola* Williams, 1911:129.

Adult (Figs. 129, 130). Length 1.5–2.5 mm.
Integument: Antennae with smooth and faintly spiculose imbrications; disc of head spiculose at least anteriorly in aptera,
Figs. 129, 130. Aptera of Alphitoaphis. 129, head and prothorax; 130, apical abdominal segments.
without spicules in alata; thorax with some transverse striae in aptera; dorsal abdominal pigmented patches in both aptera and alata faintly reticulate on terga I–VII; tergum VIII with weakly spiculose imbrications; tibiae without spicules; basitarsi smooth; distitarsi with smooth and sparsely, weakly spiculose imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 140): Antennal tubercle moderately well developed, weakly scabrous in alata, strongly scabrous in aptera. One small median tubercle present in aptera. Ventral margin of antennal socket not protuberant and swollen. Discal setae in anterior group of 5–6 and posterior group of 4 arranged transversely near posterior margin. Cephalic sutures absent. Disc of head with 0–2 tubercles, without gland facets. Eye present in aptera and alata; triommatidium distinct. Antenna 6-segmented; processus terminalis long, slender, with setae, or without setae except at apex; primary sensoria (Fig. 135) with ciliate margins; secondary sensoria (Fig. 134) situated on segments III–IV or V in aptera, on segments III–V in alata, with finely ciliate margins in alata. Rostrum 4-segmented; sides of apical segment (Fig. 136) nearly converging, with apex broadly rounded.

Thorax: Prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side, with one or more posterior lateral tubercles and usually 1 anterior lateral tubercle on each side, and with dorsal tubercles posteriorly in some specimens. Femora (Fig. 133) with setae pointed; tibial setae shorter than apical diameter of respective tibia, mostly pointed, but with a few blunt ones on ventral surfaces. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 139) triangular, each with 2 or 3 ventral setae, without dorsal setae. Hind tibiae without sensoria in viviparae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 131) with normal venation; media with 3 branches; branches of cubitus widely separated at base, parallel to slightly diverging.

Abdomen: Dorsum with a mixture of pointed, blunt, or weakly capitate setae, arranged in single transverse row on each tergum, rather short, no longer than apical diameter of siphunculus. Abdominal terga not fused, each with irregular transverse dash of pigment. Each tergum normally with 1 pair of submedian tubercles. Lateral abdominal tubercles present on segments II–VI. Lateral sclerites present, large in alata, restricted to small ring of pigment encircling lateral tubercles in aptera. Spiracles (Fig. 137) subcircular, without opercula. Siphunculus long, with apical flange, slender, slightly, but abruptly narrowed at apex, without setae or reticulate sculpture, with spiculose imbrications. Abdominal tergum VIII entire. Cauda (Fig. 132) about half as long as siphunculus, triangular; apex

Figs. 131–140. Embryonic chaetotaxy and alatae of *Alphitoaphis*. 131, left fore wing; 132, cauda, anal plate, and gonapophyses; 133, right fore femur; 134, second and base of third antennal segments; 135, primary sensorium on apical antennal segment; 136, apical rostral segment; 137, abdominal spiracle; 138, dorsal chaetotaxy of embryo; 139, right hind tarsus; 140, venter of head.
not rounded. Anal plate (Fig. 132) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 138). Antenna 4-segmented; compound eyes and triommatidium present; prothorax with posterior lateral and posterior submedian setae; 1 lateral tubercle on each segment anterior to poriform siphunculus; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitulate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Lonicera* species.

**Biology.** Nothing is known of the biology of this genus other than its association with *Lonicera* species, where it curls the developing terminal leaves.

**Comments.** This relatively rare, monotypic genus is characterized by its association with *Lonicera*, by the presence of scabrous antennal tubercles, and by the presence of submedian tubercles on the thoracic and abdominal terga.

**Genus Amphicercidus** Oestlund

Figs. 141–149

*Amphicercidus* Oestlund, 1922:126.

Type species: *Aphis puluerulens* Gillette, 1911b:324.

**Adult** (Figs. 141, 142). Length 1.0–3.0 mm.

Integument: Antenna with smooth imbrications; head smooth or somewhat scabrous at least anteriorly; thorax smooth or faintly reticulate; abdominal terga I–VI mostly smooth or faintly reticulate; terga VII and VIII with weakly spiculose imbrications; tibiae without spicules; tarsi with smooth imbrications on apical segments; cauda and anal and genital plates spiculose.

Head (Fig. 149): Antennal tubercle moderately developed, not projecting much beyond convex front of head; smooth or scabrous in both aptera and alata. Ventral margin of antennal socket not swollen. Discal setae in anterior and transverse posterior group of 2 on each side. Eye present in aptera and alata; triommatidium distinct. Disc without dorsal tubercles or gland facets. Cephalic sutures absent. Antenna 6-segmented; processus terminalis elongate, with or without setae except at apex; primary sensoria (Fig. 146) with ciliate margins; secondary sensoria (Fig. 145) with smooth margins, situated on segments III and IV in aptera, on segments III–V in alata. Rostrum 4-segmented; apical segment (Fig. 147) subconical, with apex rounded.
Figs. 141, 142. Aptera of *Amphicercidus*. 141, head and prothorax; 142, apical abdominal segments.
Thorax: Prothorax usually with lateral tubercles, with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side. Setae on femora (Fig. 144) and tibia pointed, with longest tibial seta not longer than diameter of respective tibia. Tibiae with a few pseudosensoria basally in some viviparous specimens, without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 148) triangular with 2 or 3 ventral setae, without dorsal setae. Distitarsi without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 143) with normal venation; media with 3 branches; branches of cubitus separate at base, divergent.


Embryo. Antenna 5-segmented; compound eyes and triommatidium present; prothorax with 1 anterior and 1 posterior lateral seta, with 1 posterior submedian seta, also with lateral tubercles; abdomen with 1 lateral, 1 submedian, and usually also 1 dorsolateral seta on each tergum; lateral tubercles present on abdominal segments II–V; siphunculus short, truncate; basitarsi with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

Economically important species. None.

Range of plants infested in Canada. The main host, Symphoricarpos, is common in western Canada. Other hosts include species of Lonicera.

Biology. Evidently holocyclicly is associated with the host plant. Colonies occur on the terminal twigs and leaves, or on the stems near the surface of the ground.

Comments. Members of this genus are probably most easily recognized by the host association in combination with the moderately developed antennal tubercles and the short, almost semicircular cauda. Of two described species, only A. pulverulens (Gillette) has been recorded in Canada.

Figs. 143–149. Alata of Amphicercidus. 143, left fore wing, 144, left fore femur; 145, second and base of third antennal segments; 146, primary sensoria on apical antennal segment; 147, apical rostral segment; 148, left hind tarsus; 149, venter of head.
Genus *Amphorophora* Buckton

*Amphorophora* Buckton, 1876:187.
Type species: *Amphorophora ampullata* Buckton, 1876:187.

**Adult** (Figs. 150, 151). Length 2.0–4.0 mm.

Integument: Antennae with smooth imbrications; head smooth except for occasional spicules ventrally; thorax without evident sculpturing; abdomen without evident sculpturing other than weakly spiculose imbrications on terga VI or VII and VIII; tibiae without spicules; tarsi with smooth and spiculose on nodulose imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 161): Antennal tubercle well-developed, smooth except a few spicules ventrally in some species. Ventral margin of antennal socket not protuberant. Eye present in aptera and alata; triommatidium distinct. Each side of disc with 2 anterior and 2 posterior setae. Disc rarely with 1 or 2 small tubercles posteriorly. Gland facets absent from disc of head. Cephalic suture absent. Antenna 6-segmented; processus terminalis long, slender, with or without setae except before apex; primary sensoria (Fig. 156) with ciliate margins; secondary sensoria (Fig. 155) with smooth margins, restricted to segment III in aptera, on III and also in some species on IV in alata. Rostrum 4-segmented; apical segment (Fig. 157) rather elongate, with sides nearly parallel or somewhat convergent, and with apex rounded.

Thorax: Each side of prothorax with 1 submedian seta and 1 anterior and 1 posterior lateral seta. Prothoracic lateral tubercles present or absent. Setae on femora (Fig. 154) and tibiae pointed; tibial setae in some species blunt or weakly capitate especially near base of each. Tibiae without gland facets, peglike setae, rastral spines, or rastral setae. Basitarsi (Fig. 160) triangular, each with 3 ventral setae, without dorsal setae; distitarsi elongate without capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 152) with normal venation; media with 3 branches; cubital veins separate at base, parallel.

Abdomen: Dorsal abdominal setae arranged in transverse row on each tergum; setae pointed, or blunt, or weakly capitate on terga II–VII. Abdominal terga not fused, without pigment except on terga VII and VIII in some species. Lateral abdominal sclerites absent in aptera, usually present in alata. Lateral abdominal tubercles usually present on one or more of segments II–V, with diameters inconspicuous, not much larger than diameter of adjacent setal sockets. Spiracles (Fig. 158) subcircular, without opercula. Siphunculus swollen on apical half, smooth or with imbrications, with apical flange, with minute setae in some species. Abdominal tergum VIII entire. Cauda in Canadian species narrowly triangular, with apex broadly rounded, up to about half as long as siphunculus. Anal plate (Fig. 153) entire. Abdomen without gland facets. Gonapophyses 3.
Figs. 150–151. Aptera of *Amphorophora*. 150, head and prothorax; 151, apical abdominal segments.
Embryo (Fig. 159). Antenna 4- or 5-segmented; eyes and triommatidium present; prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side; prothoracic lateral tubercles absent; abdomen with lateral and submedian setae, and usually also dorsolateral setae on segments I–V; lateral abdominal tubercles absent; siphunculus short, truncate, smooth; basitarsi with 2 or 3 (hind tarsus always with 2) ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

Economically important species. Although their economic importance is unassessed, most species of this genus are potentially important, because the main host plants are species of Rubus.

Range of plants infested in Canada. Rubus and Geranium species.

Biology. All species are associated monoeciously and holocyclicly with the host plant.

Comments. The distinctive features of this genus are the well-developed antennal tubercles and the long, swollen, nonreticulate siphunculi, combined with the host association.

Genus Anoecia Koch
Figs. 162–173


Adult (Figs. 162, 163). Length 1.0–3.0 mm.
Integument: Antennal segments III–VI with or without imbrications; head, thorax, and abdomen without evident sculpturing, except some weakly spiculose imbrications on terga VII and VIII in some species; tibiae and tarsi without spicules or imbrications; cauda and anal and genital plates without spicules or imbrications.

Head (Fig. 173): Antennal tubercle undeveloped; front of head somewhat convex. Ventral margin of antennal socket not swollen. Discal setae pointed, fairly numerous, scattered over surface without special arrangement. Eye present or absent in aptera; triommatidium distinct. Dorsal tubercles absent. Cephalic suture absent or indicated by median longitudinal pigmented line. Cephalic gland facets absent.

Figs. 152–161. Embryonic chaetotaxy and alata of Amphorophora. 152, right fore wing; 153, anal plate and gonapophyses; 154, left fore femur; 155, second and base of third antennal segments; 156, primary sensoria on apical antennal segment; 157, apical rostral segment; 158, abdominal spiracle; 159, dorsal chaetotaxy of embryo; 160, left hind tarsus; 161, venter of head.
Antenna 6-segmented; processus terminalis shorter than base of segment VI (Fig. 168); primary sensoria large, protruding, surrounded by circle of spicules in some species, but margins not ciliate; secondary sensoria (Fig. 167) usually absent in aptera, present or absent in alata, where present oval or semianular, with margins not ciliate. Rostrum 4-segmented, but apical segment (Fig. 169) usually divided by subapical membranous region; apical segment subconical, with apex rounded.

Thorax: Prothoracic setae pointed, rather numerous, evenly distributed over surface or occurring in submedian or median cluster and in lateral clusters; prothoracic lateral tubercles present, large, faintly protruding. Femora (Fig. 166) with setae pointed; tibial setae numerous, fine, hairlike, longer than apical diameter of respective tibia in some species. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 172) triangular, with 2–7 ventral setae, without dorsal setae; distitarsi elongate, without preapical capititate setae. Plantar setae acuminate or weakly capititate. Claws simple. Fore wing (Fig. 164) with stigma short, triangular, generally more deeply pigmented than anterior veins; media with 2 branches, having common stem evanescent at base; branches of cubitus narrowly separated at base, divergent.

Abdomen: Dorsal abdominal setae fine, pointed, spatulate on apical terga in some species, arranged in one to several irregular transverse rows on each tergum. Some abdominal terga with pigmented transverse dashes, in some species these fused into quadrate patch on terga III–VI; lateral sclerites present or absent in aptera, present in alata. Lateral tubercles present on segments II–VII in alata, commonly only visible on segments II and VII in aptera. Dorsal abdominal tubercles absent. Spiracle (Fig. 170) circular. Siphunculus a sclerotic ring on setiferous mammiform base. Abdominal tergum VIII entire. Cauda short, inconspicuous, semicircular. Anal plate (Fig. 165) entire. Abdominal gland facets absent. Gonapophyses fused forming transverse cluster of setae.

Embryo (Fig. 171). Antenna 3-segmented, obscurely 4-segmented in some specimens; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1–3 posterior submedian setae; prothoracic lateral tubercles absent; each abdominal segment with 1 or 2 lateral setae and 1–4 submedian setae on each side; siphunculus minute, poriform, or absent; abdominal lateral tubercles absent or represented by obscure circular areas with thicker integument; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capititate setae; plantar setae acuminate or faintly capititate.

Economically important species. None.

Figs. 162, 163. Aptera of *Anoezia*. 162, head and prothorax; 163, terminal abdominal segments.
Biology. The biologies of the members of this genus are incompletely known. Apparently some species are heterocyclic between *Cornus* and grass roots; others are perhaps holocyclic on grass roots and the roots of *Oenothera*.

Comments. Characters for recognizing this genus include the association with the hosts mentioned above combined with the undeveloped antennal tubercles; the general hairiness; the presence of poriform siphunculi on a setiferous, mammiform base; and the absence of tarsal sculpturing. The most common species, *A. corni* (Fabricius), is readily recognized by the presence of a large, pigmented, quadrate sclerite on the abdomen of alatae. The fusion of the gonapophyses to form a transverse cluster of setae is also distinctive.

Genus *Aphis* Linnaeus

Figs. 174–184


Type species: *Aphis sambuci* Linnaeus, 1758:451.

Adult (Figs. 174, 175). Length 1.0–3.5 mm.

Integument: Antenna with smooth imbrications; disc of head and thorax without evident sculpturing or with reticulation in some species; abdominal terga II–V or VI smooth or commonly faintly reticulate; terga VI–VIII with faintly spiculose imbrications; tibiae without spicules or imbrications; tarsi with smooth or faintly nodulose imbrications on apical segment; cauda and anal and genital plates spiculose.

Head (Fig. 184): Antennal tubercle undeveloped, or slightly developed, not projecting beyond convex front. Ventral margin of antennal socket not protuberant. Discal setae arranged in anterior group of 1–3 and transverse posterior group of 2 on each side. Eye present in aptera and alata; triommatidium distinct. Disc without dorsal tubercles. Cephalic sutures and gland facets absent. Antenna mostly 6-segmented, a few 5-segmented; processus terminalis elongate, narrow, longer than base of segment VI, usually without setae except at apex; primary sensoria with ciliate margins; secondary sensoria (Fig. 179) without ciliate margins, occurring on segments III–V depending on species. Rostrum 4-segmented; apical segment (Fig. 180) relatively elongate, with almost parallel sides, and with apex rounded.

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Figs. 164–173. Embryonic chaetotaxy and alata of *Anoecia*. 164, right fore wing; 165, anal plate and gonapophyses; 166, left fore femur; 167, second and base of third antennal segments; 168, apical antennal segment; 169, apical rostral segment; 170, abdominal spiracle; 171, dorsal chaetotaxy of embryo; 172, left hind tarsus; 173, venter of head.
Thorax: Prothorax normally with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side. Lateral tubercles commonly present; gland facets absent. Femora (Fig. 178) with pointed setae; tibial setae variable, short, blunt or weakly capitate to long, slender, hairlike. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 183) triangular, each with 2–4 ventral setae; distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 176) with normal venation; media normally with 3 branches; branches of cubitus widely separated at base.

Abdomen: Dorsal abdominal setae variable, short, blunt or weakly capitate to long, slender, hairlike, arranged mostly in single irregular transverse row on each tergum, less commonly in 2 such transverse rows, or in some species only with submedian and lateral setae. Abdominal terga usually not fused, commonly with pigmented dashes on terga VI–VIII in aptera, in some species fused forming dorsal carapace; alata commonly with dashes of pigment partially fused on some terga. Dorsal abdominal tubercles absent. Lateral abdominal tubercles present on terga II and VII, commonly also present on other segments. Lateral abdominal sclerites normally present in alata, present or absent in aptera. Spiracles (Fig. 181) subcircular, without opercula. Siphunculus elongate, cylindrical, with apical flange, usually at least as long as apical segment of hind tarsus, with smooth or infrequently nodulose imbrications, rarely with a few setae. Abdominal tergum VIII entire. Cauda usually elongate, with slight constriction near base, with apex rounded, rarely short, almost semicircular. Anal plate (Fig. 177) entire. Abdominal gland facets absent. Gonapophyses 3.

Embryo (Fig. 182). Antenna 4-segmented; each side of prothorax with 1 anterior seta, 1 posterior lateral seta, and 1 submedian seta; prothoracic lateral tubercles usually evident; each side of abdomen with 1 submedian and 1 or 2 lateral setae on each segment except VIII; dorsolateral setae present or absent on terga I–VII; lateral abdominal tubercles usually evident at least on segments II and VII; siphunculus short, roughly cylindrical; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

Economically important species. The species listed below are considered to be of economic importance in North America. Except for A. fabae Scopoli, A. nasturtii Kaltenbach, and A. pomi De Geer, the effect of the following species on Canadian agriculture has never been properly assessed:

A. craccivora Koch          A. hederae Kaltenbach          A. pomi De Geer
A. fabae Scopoli            A. illinoisensis Shimer              A. citricola van der Goot
A. forbesi Weed             A. maidiradicis Forbes              A. viburniphila Patch
A. gossypii Glover          A. nasturtii Kaltenbach
Figs. 174, 175. Aptera of *Aphis*. 174, head and prothorax; 175, terminal abdominal segments.
Range of plants infested in Canada. A wide range of plants is infested and the genus is not restricted to one particular group of plants.

Biology. Most members of this genus in Canada are anholocyclically associated with a given host plant. A. fabae and A. nasturtii are heterocyclic examples, the former producing eggs on Euonymus species and the latter on Rhamnus species.

Comments. This genus is characterized by the absence of antennal tubercles, the presence of elongate cylindrical siphunculi that usually have smooth imbrications but no reticulations, and the usual presence of an elongate cauda that is generally constricted near its base.

Keys and taxonomic notes are available for Aphis species on Cornus, (Robinson and Chen 1969), on Umbelliferae (Rojanavongse and Robinson 1976), and on Ribes (Robinson and Rojanavongse 1976). Cook (1984a) provided a key and taxonomic notes on the species found on Compositae in North America. Rojanavongse and Robinson (1977) gave a key and taxonomic notes on the species found in Manitoba.

Genus Aphthargelia Hottes

Figs. 185–196

Type species: Aphis albipes Oestlund, 1887:52 = Aphis symphoricarpi Thomas, 1878:12.

Adult (Figs. 185, 186). Length 1.0–3.0 mm.
Integument: Antenna with smooth imbrications; disc of head smooth or with a few wrinkles, and with a few reticulations in some specimens in aptera; prothorax with a few median reticulations; except for abdominal tergum VIII (and VII in some specimens) pigmented areas on abdomen, meso- and meta-thorax with reticulations; tibiae without sculpturing; distitarsi with smooth imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 196): Antennal tubercle fairly well developed, projecting well beyond front of head. Ventral margin of antennal socket not protuberant. Discal setae in anterior group of 2 and

Figs. 176–184. Embryonic chaetotaxy and alata of Aphis. 176, right fore wing; 177, anal plate and gonapophyses; 178, left fore femur; 179, second and base of third antennal segments; 180, apical rostral segment; 181, abdominal spiracle; 182, dorsal chaetotaxy of embryo; 183, left hind tarsus; 184, venter of head.
Figs. 185, 186. Aptera of *Aphthargelia*. 185, head and prothorax; 186, terminal abdominal segments.

Figs. 187–196. Embryonic chaetotaxy and alata of *Aphthargelia*. 187, right fore wing; 188, anal plate and gonapophyses; 189, left fore femur; 190, second and base of third antennal segments; 191, base of apical antennal segment; 192, apical rostral segment; 193, abdominal spiracle; 194, dorsal chaetotaxy of embryo; 195, left hind tarsus; 196, venter of head.
posterior transverse group of 2 on each side. Eye present in aptera and alata; triommatidium distinct. Dorsal tubercles absent. Cephalic sutures and gland facets absent. Antenna 6-segmented; processus terminalis long slender, with or without setae except before apex; primary sensoria (Fig. 191) with ciliate margins; secondary sensoria (Fig. 190), present on segments III–V in alata, without ciliate margins; secondary sensoria absent in aptera. Rostrum 4-segmented; apical segment (Fig. 192) subconical, bluntly triangular distad of subapical primary setae.

Thorax: Prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side; lateral prothoracic tubercles present; dorsal tubercles usually absent. Femora (Fig. 189) and tibia with pointed setae; tibial setae not longer than apical diameter of respective tibia. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 195) triangular, with 2 or 3 ventral setae; distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 187) with normal venation; media with 3 branches; branches of cubitus widely separated at base.

Abdomen: Abdominal setae short, inconspicuous. Abdominal terga not fused; terga I and II each with transverse dash of pigment, fused together in some specimens; terga III–V each with large paramedian patch on each side, fused in some specimens especially in aptera; terga VI–VIII with transverse dashes of pigment. Dorsal tubercles absent. Lateral tubercles present on abdominal segments I–V. Lateral abdominal sclerites present, fused in some specimens with the tergal dashes of pigment, especially on terga I, VI, VII. Spiracles (Fig. 193) on abdominal segments I–VI without opercula; spiracle on segment VII with anterior margin produced as operculum. Siphunculus short, lengths subequal to length of hind tarsus, with apical flange, with spiculose imbrications; diameter at base usually less than diameter at middle; apex slightly but distinctly narrowed, just proximad of flange. Cauda triangular, with apex narrow, not broadly rounded, longer than siphunculus. Abdominal tergum VIII not bilobate. Anal plate (Fig. 188) not bilobate. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 194). Each side of prothorax with 1 anterior lateral seta and 1 posterior submedian seta; prothoracic lateral tubercles present; each abdominal segment with 1 lateral, 1 submedian, 1 dorsolateral, and one submedian seta on each side; all setae pointed; siphunculus present.

Economically important species. None.

Range of plants infested in Canada. Symphoricarpos species.

Biology. Holocyclicly associated with Symphoricarpos, perhaps facultatively heterocyclic.
Comments. When alive, specimens of the only species in this genus are probably most easily recognized by their color and host association. Living specimens are black, blue-black, or dark green with conspicuous, transverse white, pulverulent dashes. Mounted specimens can be recognized by the presence of lateral abdominal tubercles and siphunculi that are shorter than the cauda.

Genus *Appendiseta* Richards

*Appendiseta* Richards, 1965:75.
Type species: *Callipterus robiniae* Gillette, 1907:395.

Adult (Figs. 197, 198). Length 1.5–2.5 mm.
Integument: Antennae spiculose; head and prothorax without evident sculpturing; pterothorax somewhat scabrous; abdomen without dorsal sculpturing other than spicules on tergum VIII; tibiae strongly spiculose; apical segment of each tarsus spiculose; cauda and anal and genital plates spiculose.

Head (Fig. 209): Antennal tubercle undeveloped. Ventral margin of antennal socket not protuberant. Discal setae in anterior group of 2 and posterior group of 2 on each side; anterior pair of discal setae on weak papillae. Eye present in aptera and alata; triommatidium present. Frontal ocellus on anterior margin, not venter of head. Dorsal tubercles absent. Cephalic sutures tubercles and discal gland facets absent. Antenna 6-segmented; processus terminalis short, without setae except at apex, shorter than base of VI; primary sensoria (Fig. 203) with ciliate margins; secondary sensoria (Fig. 202) without ciliate margins, restricted to antennal segment III. Rostrum 4-segmented; apical segment (Fig. 204) blunt, short, barely twice as long as basal width.

Thorax: Each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 posterior and 2 anterior lateral setae; dorsal and lateral tubercles absent. Femora (Fig. 200) with pointed setae; hind femur with dorsal apical spot. Tibiae with pointed setae, longest about as long as apical diameter of respective tibia. Tibiae without rastral setae, peglike setae, and wax facets. Basitarsi (Fig. 208) triangular, with 5–8 ventral and 2 dorsal setae. Distitarsi without capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 199) with normal venation; media with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Dorsal abdominal setae (Fig. 198) short, blunt, or weakly capitate at least on anterior segments, arranged in irregular transverse row on each tergum; 2–4 submedian setae on terga I and II on slight tubercles. Abdominal terga never fused, without pigment except for faint intersegmental sclerites in some specimens. Dorsal and lateral tubercles absent. Lateral sclerites absent. Lateral
Figs. 197, 198. Alata of *Appendiseta*. 197, head and prothorax; 198, abdomen.

Figs. 199–209. Embryonic chaetotaxy, alatoid nymph, and alata of *Appendiseta*. 199, right fore wing; 200, left fore femur; 201, anal plate and gonapophyses; 202, second and base of third antennal segments; 203, apical antennal segment; 204, apical rostral segment; 205, dorsal abdominal chaetotaxy of alatoid nymph; 206, abdominal spiracle; 207, dorsal chaetotaxy of embryo; 208, left hind tarsus; 209, venter of head.
abdominal papillae on segments II–IV each with apical seta. Spiracles (Fig. 206) subcircular, without opercula. Siphunculus short, without apical flange, not longer than apical segment of hind tarsus; lateral seta of abdominal segment VI appended to its base. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 201) of vivipara bilobate; anal plate of ovipara entire. Abdomen without gland facets. Gonapophyses 2–4.

**Embryo** (Fig. 207). Antenna 4-segmented; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta; prothoracic lateral tubercles present; each side of abdomen with 1 submedian and 1 lateral seta on each of segments I–VII; dorsolateral setae absent; submedian setae on segments I–IV shorter than others; submedian setae on segment VII placed farther apart than other submedian setae; all dorsal setae capitae; siphunculus poriform; abdomen without lateral tubercles; basitarsi with 2 ventral setae, without dorsal setae; distitarsi without preapical capitae setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Robinia pseudoacacica* L.

**Biology.** The single known species is holocyclicly associated with its host. Only alatae are produced and these occur on the lower surfaces of the leaves.

**Comments.** The genus is most easily recognized by the dorsal apical spot on the hind femur and the fact that it is the only small, yellow or cream-colored aphid associated with *R. pseudoacacica*. The arrangement of the dorsal setae on the embryo is also distinctive: the pair of setae on the seventh abdominal segment are much farther apart than the pairs of setae on other abdominal terga. *Monellia* Oestlund is the only other genus in which this kind of embryonic chaetotaxy occurs; but in *Monellia* the siphunculi are poriform, the apical femoral spot is ventral, and it is associated with *Carya* species. Richards (1965) provided a discussion of the single species.

**Genus Asiphonaphis** Wilson & Davis

*Figs. 210–222*

*Asiphonaphis* Wilson and Davis, 1919:39
Type species: *Asiphonaphis pruni* Wilson and Davis, 1919:39.

**Adult** (Figs. 210, 211). Length 1.5–2.5 mm.
Integument: Antennal segments with smooth imbrications; head, thorax, and abdomen without sculpturing other than a few spiculose imbrications on abdominal terga VII and VIII; cauda and
anal and genital plates spiculose; distitarsi with smooth imbrications.

Head (Fig. 222): Front tubercles weakly developed, never projecting much beyond median tubercle or frontal ocellus in alata. Ventral margin of antennal socket not protuberant. Eye present in aptera and alata; triommatidium distinct. Discal setae pointed, on each side in anterior group 1–3 and transverse posterior group of 2–4. Cephalic sutures absent. Disc of head without gland facets. Antenna 6-segmented; processus terminalis elongate, slender, usually with a few setae in addition to apical ones; primary sensoria (Fig. 216) with ciliate margins; secondary sensoria (Fig. 215) normally absent in aptera, occurring on segments III and IV in alata. Rostrum 4-segmented; apical segment (Fig. 217) elongate, nearly parallel-sided, with apex more or less rounded.

Thorax: Prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side. Prothoracic lateral tubercles present, large, bulbous or elongate conical. Femora (Fig. 214) and tibia with pointed setae; tibial setae about as long as apical diameter of respective tibia. Tibiae without peglike setae, gland facets, rastral setae, and rastral spines. Basitarsi (Fig. 221) triangular, with 3 or 4 ventral setae on fore and middle basitarsus, 2 or 3 on hind basitarsus, without dorsal setae; distitarsi elongate, without capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 212) with normal venation; media with 3 branches; branches of cubitus widely separated at base.

Abdomen: Abdominal terga not fused; terga I–VI with traces of pigment in some species; terga VII and VIII with transverse pigmented dashes. Lateral abdominal sclerites present in alata, absent or reduced to traces of pigment surrounding lateral tubercles in aptera. Lateral abdominal tubercles large, conspicuous, bulbous or elongate conical, present on segments I–IV, VI, and VII. Spiracles (Fig. 219) broadly reniform, nearly circular, with anterior margin produced as operculum on segment VII (Fig. 218). Siphunculus absent. Abdominal segment VIII entire. Cauda roughly triangular. Anal plate (Fig. 213) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 220). Antenna 4-segmented; each side of prothorax with 1 posterior and 1 anterior lateral seta and 1 posterior submedian seta; prothoracic lateral tubercles present; each side of abdomen with 1 lateral and 1 submedian seta on each segment; dorsolateral setae present or absent; all setae pointed; siphunculus absent; abdomen with lateral tubercles on segments I–VI; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

**Range of plants infested in Canada.** *Prunus virginiana* L.

**Economically important species.** None.

149
Figs. 210, 211. Aptera of *Asiphonaphis*. 210, head and prothorax; 211, terminal abdominal segments.

Figs. 212–222. Embryonic chaetotaxy and alata of *Asiphonaphis*. 212, right fore wing; 213, anal plate and gonapophyses; 214, left fore femur; 215, second and base of third antennal segments; 216, base of apical antennal segment; 217, apical rostral segment; 218, spiracle on abdominal segment I; 219, spiracle on abdominal segment VII; 220, dorsal chaetotaxy of embryo; 221, left hind tarsus; 222, venter of head.
Biology. The details of the biologies of species of Asiphonaphis are unknown. A. pruni Wilson & Davis produces pseudogalls on P. virginiana.

Comments. Members of this genus are likely to be confused only with those of Aphis, from which they can be separated by the absence of siphunculi, or by the presence of obscure poriform siphunculi.

The genus Pseudasiphonaphis was proposed by Robinson (1965; type Asiphonaphis anogis Hottes & Frison = Pergandeita corni Tissot) for the single species with poriform siphunculi present. It forms heavily flocculent colonies on Pilea and Cornus but has not yet been collected in Canada. Robinson (1964) provided a synopsis and a key to the species (including Pseudasiphonaphis corni as A. anogis).

Genus Aspidaphis Gillette

Figs. 223–236

Aspidaphis Gillette, 1917:196.

Adult (Figs. 223–226). Length 1.0–2.5 mm.

Integument: Smooth imbrications on head; thorax and abdomen rippled at least laterally, or with rather conspicuous hemispherical protuberances; tibiae without sculpturing; tarsi with imbrications on each apical segment; cauda and anal and genital plates spiculose.

Head (Fig. 236): Frontal and median tubercles fairly well developed, with front of head appearing W-shaped. Ventral margin of antennal socket not protuberant. Discal setae short, inconspicuous, on each side in anterior group of 2 or 3 and transverse posterior group of 2–4. Eye present in aptera and alata; triommatidium distinct. Dorsal tubercles absent. Cephalic suture absent. Disc without gland facets. Antenna 5- or 6-segmented; processus terminalis elongate, as long or longer than base of segment VI, with or without preapical setae; primary sensoria (Fig. 231) with ciliate margins; margins of secondary sensoria (Fig. 230) not ciliate, but with a few spicules in some species, absent in aptera, present on segments III–V in alate depending on species. Rostrum 4-segmented, apical segment (Fig. 232) subconical, short, not much more than twice as long as broad.

Thorax: Prothoracic setae inconspicuous, with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side; anterior submedian setae present or absent. Prothoracic lateral tubercles absent. Femora (Fig. 229) with seta pointed; tibial setae pointed, blunt or weakly capitate, short, not longer than apical diameter of respective tibia. Tibiae without peglike setae, rastral spines, or gland facets. Basitarsi (Fig. 235) triangular, with 2 or 3 ventral setae, without dorsal setae; distitarsi elongate,
Figs. 223, 224. Aptera of *Aspidaphis* species with expanded eighth abdominal tergite. 223, head and prothorax; 224, terminal abdominal segments.
Figs. 225, 226. Aptera of *Aspidaphis* species with papilla on eighth abdominal tergite. 225, head and prothorax; 226, terminal abdominal segments.

Figs. 227–236. Embryonic chaetotaxy and alata of *Aspidaphis*. 227, right fore wing; 228, anal plate and gonapophyses; 229, left fore femur; 230, second and base of third antennal segments; 231, base of apical antennal segment; 232, apical rostral segment; 233, abdominal spiracle; 234, dorsal chaetotaxy of embryo; 235, left hind tarsus; 236, venter of head.
without capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 227) with normal venation; media usually with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Abdominal terga not fused, without pigmented segmental patches in aptera, with or without such patches in alata; intersegmental pigment in some species present in both aptera and alata. Lateral abdominal sclerites absent in aptera, present or absent in alata. Lateral abdominal tubercles absent. Spiracles (Fig. 233) without opercula, weakly reniform, nearly circular. Siphunculus (Figs. 224, 226) flangeless, without setae or evident sculpturing, slightly to strongly clavate, with orifice apical or subapical. Abdominal tergum VII in some species with small median, protuberance (Fig. 226); tegum VIII with median fingerlike protuberance, or papilla or whole tegum elongate triangular, extending posteriorly completely covering cauda (Fig. 224). Cauda elongate, nearly parallel-sided, with apex more or less rounded. Anal plate (Fig. 228) and genital plate entire. Abdomen without gland facets. Gonapophyses 3 or 4.

**Embryo** (Fig. 234). Antenna 4-segmented; each side of prothorax with 1 anterior and 1 posterior lateral seta and usually 1 anterior and 1 posterior submedian seta; eyes present; triommatidium present, appended to each eye; prothorax without lateral tubercles or gland facets; abdominal segments I–VII each with 1 lateral seta and 1 submedian seta on each side; dorsolateral seta present or absent on each segment; all abdominal setae short; abdomen without gland facets or lateral tubercles; siphunculus short, nearly cylindrical; basitarsi with 2 (3 on fore leg of some specimens) ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Polygonum aviculare* group, *Spiraea* species, and *Salix* species.

**Biology.** All species are holocyclicly associated with their host plants.

**Comments.** This genus is easily recognized by the highly modified eighth abdominal tergum and the flangeless, usually clavate siphunculi. In North America, this genus, as interpreted here, comprises three species, which some workers (Eastop and Hille Ris Lambers 1976, Smith and Parron 1978) have placed in three separate genera: *Aspidaphis adjuvars* (Walker) (Figs. 223, 224), *Eoessigia longicauda* (Richards) (Figs. 225, 226), and *Cavariella* (*Cavariella*) *aquatica* (Gillette & Bragg). Richards (1963b) provided a key to these species.
Genus *Aspidaphium* Börner

Figs. 237–250

*Aspidaphium* Börner, 1939:81.
Type species: *Aspidaphium escherichi* Börner, 1939:81.

**Adult** (Figs. 237, 238). Length 1.0–1.5 mm.

Integument: Antenna imbricate, less well developed in alata; disc of head and dorsum of thorax and abdomen with conspicuously rounded nodules in aptera, not evident in alata; tibiae with at least a few imbrications on apical half of each, and with blunt spicules and nodules in some species; distitarsi usually with a few weak imbrications in aptera, stronger in alata, ventral imbrications usually nodulose; anal and genital plates spiculose.

Head (Fig. 250): Antennal tubercle undeveloped, or only slightly developed. Ventral margin of antennal socket not protuberant. Eye present in aptera and alata; triommatidium distinct. Disc of head without dorsal tubercles. Discal setae short, inconspicuous, on each side in anterior group of 2 or 3 and posterior transverse group of 2. Cephalic sutures absent. Disc without gland facets. Antenna 5-segmented in aptera, 6-segmented in alata; processus terminalis elongate, tapered apically in aptera, usually with 1 seta near base in addition to usual apical cluster; primary sensoria (Fig. 243) without ciliate margins; secondary sensoria (Fig. 242) absent in aptera, oval, without ciliate margins and occurring on segments III–V in alata. Rostrum 4-segmented, short, not attaining middle coxae; apical segment (Fig. 244) subcylindrical, with portion distad of primary subapical setae triangular.

Thorax: Prothoracic setae short, pointed or blunt, inconspicuous, with arrangement variable; each side usually with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothoracic lateral tubercles absent. Meso- and meta-thorax sclerotized, fused together. Femora (Fig. 241) with pointed setae; tibial setae pointed, fairly stout, not longer than apical diameter of respective tibia. Tibiae without rastral setae, rastral spines, peglike setae, and gland facets. Basitarsi (Figs. 248, 249) triangular without dorsal setae; fore and mid basitarsus each with 3, hind basitarsus with 2 or 3 ventral setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 239) with normal venation; media in known alatae with 2 branches; branches of cubitus separated at base.

Abdomen: Abdominal setae short, pointed or nearly blunt, inconspicuous; each tergum normally with 1 submedian and 1 lateral seta; dorsolateral setae usually absent. Abdominal terga I–VII heavily pigmented, fused together and to thorax forming carapace; dorsum of abdomen in alata without pigment except for segmental and intersegmental spots on some segments. Lateral abdominal
Figs. 237, 238. Aptera of *Aspidaphium*. 237, head and prothorax; 238, terminal abdominal segments.
sclerites absent in alata, present in aptera, but fused together and to dorsal abdominal carapace. Spiracles on abdominal segments I–VI (Fig. 245) minute, nearly circular, with those on segment VII (Fig. 246) having well-developed operculum. Siphunculus thick, tapered, without setae or apical flange, imbricate or imbricate-spiculose, especially in apterae. Abdominal tergum VIII entire. Cauda elongate, composed of basal heavily spiculose portion and apical portion nearly smooth, but with a few spicules. Anal plate (Fig. 240) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 247). Antenna 4-segmented; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; eyes present; triommatidium present, appended to each eye; prothorax without lateral tubercles or gland facets; abdominal segments I–VII each with 1 lateral and 1 submedian seta; dorsolateral setae mostly absent; abdomen without gland facets or lateral tubercles; siphunculus short truncate; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** Mosses.

**Biology.** Little is known about the biologies of the species of this genus, except that they occur on mosses that grow commonly partly submerged in water. The minute spiracles on abdominal segments I–VI are perhaps an adaptation to this environment.

**Comments.** The chief distinguishing characters for this genus are the association with mosses, the stout, heavily sculptured siphunculi, and the presence of a 5-segmented antenna in the apterae. Smith and Knowlton (1966) provided a key to the species.
Genus *Atarsos* Gillette

*Atarsos* Gillette, 1911a:440.
Type species: *Atarsos grindeliae* Gillette, 1911a:440.

**Adult** (Figs. 251, 252). Length 1.5–2.25 mm.

Integument: Antenna with smooth imbrications; head and body without sculpturing other than a few spiculose imbrications on abdominal terga VI–VIII; legs without sculpturing; cauda and anal and genital plates spiculose.

Head (Fig. 264): Antennal tubercle undeveloped; front of head almost convex. Ventral margin of antennal socket not protuberant. Discal setae long, capitate, on each side in anterior and posterior group of 2 or 3 each. Eye present in aptera and alata; triommatidium distinct. Disc of head without tubercles or gland facets. Cephalic sutures absent. Antenna 5- or 6-segmented; primary sensoria (Fig. 257) without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 256) circular, without ciliate margins, present on segments I–IV or V (also VI in some specimens) in both aptera and alata. Rostrum 4-segmented; apical segment (Fig. 258) elongate, with subconical apex rounded.

Thorax: Prothorax without lateral tubercles; each side of prothorax with 1 posterior and 1 anterior lateral seta and 1 posterior submedian seta. Atrium of thoracic spiracle large; walls reticulate (Fig. 260). Femora (Fig. 255) with pointed setae; tibial setae capitate basally, pointed on apical half of each, longest scarcely longer than apical diameter of respective tibia. Tibiae without peglike setae, rastral setae, rastral spines, or gland facets. Each basitarsus (Fig. 263) reduced to small setose sclerite; distitarsi absent. Claws absent. Fore wing (Fig. 253) with normal venation; media with 3 branches; branches of cubitus widely separated at base.

Abdomen: Abdominal setae capitate, arranged in single transverse row on each tergum. Abdominal terga not fused, without pigment in aptera, with broken dashes on each tergum in alata. Dorsal abdominal tubercles absent. Lateral abdominal tubercles absent. Spiracles (Fig. 259) circular on abdominal segment VI, operculate on VII (Fig. 261). Siphunculus cylindrical, without setae, smooth, with apical flange and conspicuous angular constriction proximad of flange. Abdominal tergum VIII entire. Cauda short, spatulate, with apex broadly rounded. Anal plate (Fig. 254) entire. Abdomen without gland facets. Gonapophyses 3.

Figs. 239–250. Embryonic chaetotaxy, alata, and tarsus of aptera of *Aspidaphium*. 239, right fore wing; 240, anal plate and gonapophyses; 241, left fore femur; 242, second and base of third antennal segments; 243, base of apical antennal segment; 244, apical rostral segment; 245, spiracle on abdominal segment III; 246, spiracle on abdominal segment VII; 247, dorsal chaetotaxy of embryo; 248, left hind tarsus; 249, apical tarsal segment of aptera; 250, venter of head.
Figs. 251, 252. Aptera of *Atarsos*. 251, head and prothorax; 252, terminal abdominal segments.

Figs. 253–264. Embryonic chaetotaxy and alata of *Atarsos*. 253, right fore wing; 254, anal plate and gonapophyses; 255, left fore femur; 256, second and base of third antennal segments; 257, base of apical antennal segment; 258, apical rostral segment; 259, spiracle on abdominal segment III; 260, atrium of thoracic spiracle; 261, operculate spiracle on abdominal segment VII; 262, dorsal chaetotaxy of embryo; 263, left hind tarsus; 264, venter of head.
Embryo (Fig. 262). Antenna 4-segmented; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; eyes present; triommatidium appended to each eye; prothorax without lateral tubercles or gland facets; abdominal segments I–VIII with 1 submedian seta on each side; segments I–V or VI each usually with 1 dorsolateral seta on each side, with 1 lateral seta on each segment; abdomen without gland facets or lateral tubercles; siphunculus short; nearly cylindrical; tarsal segments absent; each tarsus represented by small sclerite bearing 2 or 3 setae.

Economically important species. None.

Range of plants infested in Canada. *Grindelia* species.

Biology. Nothing is known of the details, but the only known species is holocyclic.

Comments. The absence of tarsi and the association with *Grindelia* provide the best means of recognition.

Genus *Atheroides* Haliday

Figs. 265–276

*Atheroides* Haliday, 1839:189.
Type species: *Atheroides serrulatus* Haliday, 1839:189.

Adult (Figs. 265, 266). Length 1.5–3.0 mm.
Integument: Antenna with smooth imbrications; head and body usually somewhat wrinkled or folded; tibiae without spicules, tarsi with smooth imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 276): Antennal tubercle undeveloped; median tubercle undeveloped; front of head strongly convex. Ventral margin of antennal socket not protuberant. Discal setae scattered, with no special arrangement, short, truncate, or weakly flabellate, or spinelike, or mixture of these kinds of setae. Eye present in aptera and alata; triommatidium difficult to discern, nearly completely incorporated with compound eye. Dorsal tubercles, cephalic suture, and gland facets absent. Antenna 5-segmented, processus terminalis short, at most not much longer than base of segment VI; primary sensoria (Fig. 271) without ciliate margins; secondary sensoria (Fig. 270) absent in aptera, circular, present on segment III in alata. Rostrum 4-segmented; apical segment (Fig. 272) more or less parallel-sided, or somewhat convergent distally, with apex more or less triangular.

Thorax: Prothorax more or less evenly covered with setae showing variation as cephalic setae; Prothoracic lateral tubercles
Figs. 265, 266. Aptera of *Atheroides*. 265, head and prothorax; 266, terminal abdominal segments.
absent. Femur (Fig. 269) and tibia with pointed setae; longest tibial setae about as long as apical diameter of respective tibia. Tibiae without rastral setae, rastral spines, peglike setae, or gland facets. Basitarsi (Fig. 275) triangular, with 3 (2 on mid tarsus of some specimens) ventral setae, without dorsal setae; distitarsi elongate without preapical capitate setae. Plantar setae rod-shaped to flabellate. Claws simple. Fore wing (Fig. 267) with normal venation; radial sector somewhat sigmoid; media with 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Dorsal abdominal setae similar in shape and size as those on head and prothorax, arranged in two or more irregular rows on each tergum. Dorsal and lateral tubercles absent. Segmental sclerites present in alata. Lateral abdominal sclerites absent in aptera, present in alata. Spiracles (Fig. 273) small, nearly circular, without opercula. Siphunculus poriform, situated between abdominal terga IV and V. Abdominal tergum VIII enlarged, extended capelike over the cauda. Cauda small, arc-shaped. Anal plate (Fig. 268) entire. Abdomen without gland facets. Gonapophyses 3, nearly fused into a single transverse cluster, or absent in some specimens.

**Embryo** (Fig. 274). Antenna 3-segmented; each side of head with 3–5 anterior and 2 posterior setae; prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta, with or without 1 posterior dorsolateral seta; prothoracic lateral tubercles not evident; eyes and triommatidium present; abdominal segments I–VII each with 1 lateral seta on each side; segments I–VIII each with 1 submedian seta; segments I–VI usually with 1 dorsolateral seta on each side; abdominal lateral tubercles and gland facets absent; siphunculus short, poriform, or nearly so; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae rod-shaped.

**Economically important species.** None.

**Range of plants infested in Canada.** Carex species.

**Biology.** The species in this genus are holocyclicly associated with various species of Cyperaceae and Gramineae. Nothing more is known of their life cycles.

**Comments.** The members of this genus are easily recognized by their elongate, thripslike shape; the presence of 5 antennal segments; poriform siphunculi; and the association with Cyperaceae or Gramineae. Only A. serrulatus Haliday has been recorded in Canada.

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Figs. 267–276. Embryonic chaetotaxy and alata of *Atheroides*. 267, right fore wing; 268, anal plate and gonapophyses; 269, left fore femur; 270, second and base of third antennal segments; 271, base of apical antennal segment; 272, apical rostral segment; 273, abdominal spiracle; 274, dorsal chaetotaxy of embryo; 275, left hind tarsus; 276, venter of head.
Genus *Aulacorthum* Mordvilko

Figs. 277–288

*Aulacorthum* Mordvilko, 1914:52.
Type species: *Aphis solani* Kaltenbach, 1843:15.

**Adult** (Figs. 277–279). Length 2.0–4.0 mm.

Integument: Antenna with imbrications, weakly spiculose in some species; disc of head in some species covered with spicules at least near antennal tubercles and antennal sockets; thorax and abdomen mostly without obvious sculpturing except for spicules and spiculose imbrications laterally on prothorax and on abdominal terga VI–VII; cauda and anal and genital plates with spicules; tibiae without spicules, but with apical imbrications in some species, tarsi with smooth, or in a few specimens faintly spiculose imbrications.

Head (Fig. 288): Antennal tubercles well-developed, scabrous, angular, roughly forming right angle with front of head. Ventral margin of antennal socket (Fig. 278) swollen, protuberant, scabrous or spiculose. Eye present in aptera and alata; triommatidium distinct. Each side of disc with 2 anterior and 2 posterior setae. One or 2 median tubercles present in some specimens near posterior margin. Cephalic sutures absent. Discal gland facets absent. Antenna 6-segmented; processus terminalis elongate, slender, with or without setae in addition to apical ones; primary sensoria with ciliate margins; secondary sensoria (Fig. 283) without ciliate margins, present or absent in aptera, present on segment III and also IV in some species in alata. Rostrum 4-segmented; apical segment (Fig. 284) elongate, subconical, with apex rounded.

Thorax: Prothorax usually with lateral tubercles, and with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side. Femora (Fig. 282) with pointed setae; tibial setae blunt or pointed, longest in some species longer than apical diameter of respective tibia. Tibiae without rastral setae, rastral spines, peglike setae, and gland facets. Plantar setae acuminate. Claws simple (Fig. 287). Fore wing (Fig. 280) with normal venation; media usually with 3 branches; branches of cubitus separated at base.

Abdomen: Dorsal abdominal setae pointed, blunt or weakly capitate, arranged in 1, in some species 2 irregular, transverse rows on each tergum. Dorsal abdominal tubercles present in some species on terga VII and VIII. Terga in aptera and alata usually with some pigment, commonly fused with whole abdomen in aptera appearing black or brown in mounted specimens; alata in some species with segmental and intersegmental pigment. Lateral abdominal sclerites present or absent in aptera, when present, usually fused with pigment of terga, usually present in alata. Lateral abdominal tubercles usually present on one or more of segments I–IV. Spiracles (Fig. 285) oval or almost circular, without opercula. Siphunculus long, clavate or cylindrical, with apical flange, without setae,
Figs. 277–279. Aptera of Aulacorthum. 277, head and prothorax; 278, ventral margin of antennal socket; 279, terminal abdominal segments.
Figs. 280–288. Embryonic chaetotaxy and alata of *Aulacorthum*. 280, right fore wing; 281, anal plate and gonapophyses; 282, left fore femur; 283, second and base of third antennal segments; 284, apical rostral segment; 285, abdominal spiracle; 286, dorsal chaetotaxy of embryo; 287, left hind tarsus; 288, venter of head.
spiculose or imbricate, often with a few weak reticulations proximad of flange. Abdominal tergum VIII entire. Cauda elongate, triangular. Anal plate (Fig. 281) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 286). Antenna 4-segmented; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; eyes present; triommatidium present, appended to eye; prothorax without lateral tubercles or gland facets; abdominal segments I–VII each with 1 lateral and 1 submedian seta on each side; 1 dorsolateral seta usually present on each segment; all abdominal setae short, with those on apical segments somewhat longer; abdomen without lateral tubercles; siphunculus short, nearly cylindrical; basitarsi with 2 ventral setae (some specimens with 3 on fore tarsus), without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Aulacorthum circumflexum* (Buckton), and *A. solani* (Kaltenbach).

**Range of plants infested in Canada.** Some species are widely polyphagous, feeding on plants from many families.

**Biology.** *A. solani* is rather polyphagous. *A. circumflexum* is usually found only in greenhouses. As far as is known none of the species is heterocyclic in Canada.

**Comments.** Members of this genus are most easily recognized by the angular, scabrous antennal tubercles and the protuberance along the ventral margins of the antennal socket. *Myzus* species are similar in both respects, except that the antennal tubercles converge strongly. Richards (1972d) gave a key to the Canadian species. *A. circumflexum* is in subgenus *Neomyzus* van der Goot, which has sometimes been treated as a full genus.

**Genus Betulaphis Glendenning**

*Betulaphis* Glendenning, 1926:96.
Type species: *Betulaphis occidentalis* Glendenning, 1926:96 = *Aphis quadrituberculata* Kaltenbach, 1843:134.

**Adult** (Figs. 289, 290). Length 1.5–3.0 mm.
Integument: Antenna with smooth or faintly spiculose imbrications; head and body without obvious sculpturing except for spicules and spiculose imbrications on terga VI–VIII; tibiae with at least a few spicules on apical half of each; tarsi with spiculose imbrications; cauda and anal and genital plates spiculose.
Head (Fig. 300): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Eye present in aptera and alata; triommatidium distinct. Each side of disc of head with 2 posterior and 2 anterior setae situated on more or less bilobate quadrate projection. Disc of head without dorsal tubercles or gland facets. Dorsal cephalic suture usually evident near frontal ocellus; ventral sutures faintly evident near antennal sockets. Antenna 6-segmented; primary sensoria (Fig. 295) with ciliate margins; processus terminalis shorter to longer than base of segment VI, without setae other than usual apical cluster; secondary sensoria (Fig. 294) with spiculose margins, absent in aptera, present on segment III, rarely 1 or 2 on IV in alata. Rostrum 4-segmented, apical segment (Fig. 296) less than twice as long as basal width, subconical, with apex rounded.

Thorax: Prothoracic lateral tubercles present or absent, small and inconspicuous where present; each side of prothorax with 1 anterior and 1 posterior lateral seta, and 1 anterior and 1 posterior submedian seta. Femora (Fig. 293) with setae pointed; tibial setae pointed apically, usually capitate basally. Tibiae without peglike setae, rastral spines, or gland facets. Basitarsi triangular, having 5 or 6 ventral setae, with dorsal setae in alata, without such setae in aptera; distitarsi elongate, without preapical capitate setae. Rastral setae present in alata, obscure undeveloped in aptera. Plantar setae (Fig. 299) spatulate. Claws simple. Fore wing (Fig. 291) with normal venation; media with 3 branches; branches of cubitus narrowly separated, strongly divergent.

Abdomen: Dorsal abdominal setae blunt or capitate, short or long, arranged in single irregular transverse row of 4–8 on each tergum. Abdominal terga not fused, without pigment in aptera; alata usually with irregular quadrate patch of pigment on terga III–V or VI. Dorsal abdominal tubercles absent. Lateral abdominal tubercles usually present on one or more of segments II–V, small and inconspicuous where present. Spiracles (Fig. 297) oval, without opercula. Abdominal tergum VIII entire. Cauda (Fig. 292) short, broadly triangular or somewhat rounded apically. Siphunculus short, truncate, flared apically, but without flange, without setae. Anal plate of vivipara bilobate, entire in ovipara. Abdomen without gland facets. Gonapophyses 2–4.

Embryo (Fig. 298). Antenna 4-segmented; each side of prothorax with 1 anterior and 1 posterior submedian seta; prothoracic lateral tubercles not evident; eyes and triommatidium present; abdominal segments I–VII each with 1 lateral seta on either side; segments I–VIII each with 1 submedian seta on either side; segments II–VI or VII each with 1 dorsolateral seta on either side; abdominal setae usually capitate, or mixture of conspicuous capitate and short blunt; abdomen without lateral tubercles or gland facets; siphunculus short, poriform or nearly so; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae spatulate.

172
Figs. 289, 290. Aptera of Betulaphis. 289, head and prothorax; 290, terminal abdominal segments.
Figs. 291–300. Embryonic chaetotaxy and alata of Betulaphis. 291, right fore wing; 292, anal plate and gonapophyses; 293, left fore femur; 294, second and base of third antennal segments; 295, base of apical antennal segment; 296, apical rostral segment; 297, abdominal spiracle; 298, dorsal chaetotaxy of embryo; 299, left hind tarsus; 300, venter of head.
Economically important species. The economic importance has not been assessed, but some species sometimes occur in large numbers on wild and domestic birches.

Range of plants infested in Canada. Betula species, including arctic and alpine species.

Biology. Their biology has not been studied in much detail, but all species of this genus are holocyclicly associated with various species of birch.

Comments. The short, triangular, almost semicircular cauda and the association with birches offer the best means of recognition. Calaphis is somewhat similar and, like Betulaphis, the dorsal setae are capitate. However, in Calaphis the cauda is knobbed. Richards (1961a) provided a key to, and description of, the North American species.

Genus Bipersona Hottes

Figs. 301–312

Bipersona Hottes, 1926:115.
Type species: Aphis torticauda Gillette, 1907:389 = Aphis ochrocentri Cockerell, 1903:248.

Adult (Figs. 301, 302). Length 1.5–3.5 mm.

Integument: Antenna with smooth imbrications; head and body without obvious sculpturing other than spicules and spiculose imbrications on abdominal terga VII and VIII; tibiae unsculptured; tarsi with smooth imbrications.

Head (Fig. 312): Antennal tubercle well-developed, smooth. Ventral margin of antennal socket not protuberant. Eye present in aptera and alata; triommatidium distinct. Each side of disc with 4–6 anterior and 4–8 posterior setae. Dorsal tubercles not present on disc of head. Cephalic suture and gland facets absent. Antenna 6-segmented; primary sensoria (Fig. 307) with ciliate margins; processus terminalis elongate, with about 25 small setae in addition to usual apical cluster; secondary sensoria (Fig. 306) without ciliate or spiculose margins, present on segments III–IV in aptera, on segments III–V in alata. Rostrum 4-segmented; apical segment (Fig. 308) long, slender, nearly cylindrical, with apex bluntly pointed.

Thorax: Prothorax with 1 lateral tubercle on each side, with 25 posterior submedian and cluster of 5–10 lateral setae. Femora (Fig. 305) and tibiae with setae pointed; tibial setae shorter than apical diameter of respective tibia. Tibiae without rastral setae, rastral spines, peglike setae, and gland facets. Plantar setae acuminate. Claws simple. Basitarsi (Fig. 311) triangular, without dorsal setae;
Figs. 301, 302. Aptera of Bipersona. 301, head and prothorax; 302, terminal abdominal segments.

Figs. 303–312. Embryonic chaetotaxy and alata of Bipersona. 303, right fore wing; 304, anal plate and gonapophyses; 305, left fore femur; 306, second and base of third antennal segments; 307, base of apical antennal segment; 308, apical rostral segment; 309, abdominal spiracle; 310, dorsal chaetotaxy of embryo; 311, left hind tarsus; 312, venter of head.
distitarsi elongate, without capitate setae. Fore wing (Fig. 303) with normal venation; media with 3 branches; branches of cubitus widely separated at base.

Abdomen: Abdominal terga not fused, without pigment except on tergum VII. Abdominal setae pointed, arranged in single irregular transverse row on each tergum. Dorsal abdominal tubercles absent. Lateral abdominal sclerites absent, except for small pigmented areas around lateral tubercles. Lateral abdominal tubercles present on segments I–IV. Spiracle (Fig. 309) nearly circular, partially covered by operculum. Siphunculus elongate, cylindrical, with flange, without setae, reticulate on apical one-third. Abdominal tergum VIII entire. Cauda short, triangular, appearing twisted. Anal plate (Fig. 304) entire, triangular, strongly produced posteriad. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 310). Antenna 4-segmented; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothoracic lateral tubercles usually evident; eyes and triommatidium present; abdominal segments I–VII each with 1 lateral seta; segments I–VIII each with 1 submedian seta on each side; segments I–V usually with 1 dorsolateral seta on each side; lateral tubercles evident on segments I–V in some specimens; abdominal setae pointed, not exceptionally long; abdomen without gland facets; siphunculus short, cylindrical; basitarsi with 2 (anterior legs rarely with 3) ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Cirsium* and *Hypericum* species.

**Biology.** This genus is holocyclicly associated with its host plant. The main host is *Cirsium*, but specimens have been collected on *Hypericum*.

**Comments.** The short, “twisted” cauda, the blunt projection on the anal plate, the reticulate siphunculi, and the association with *Cirsium* (thistles) comprise the chief recognition characters for this genus. One species, *B. ochrocentri* (Cockerell), has been collected in Canada.

**Genus Boernerina Bramstedt**

Figs. 313–325

*Boernerina* Bramstedt, 1940:13.

Type species: *Boernerina depressa* Bramstedt, 1940:13.
**Adult** (Figs. 313, 314). Length 1.5–3.5 mm.

Integument: Antennal segments I, II, and basal half of III without distinct sculpturing; apical half of III with obscure, weak imbrications; segment IV and V with smooth imbrications in alata, smooth or spiculose imbrications in aptera; base of segment VI with smooth or distinctly spiculose imbrications; imbrications on processus terminalis mostly spiculose; head and thorax without organised sculpturing in alata, wrinkled or rippled at least laterally in aptera; apical half of each tibia with strongly spiculose, but weak imbrications in alata, usually with a few dispersed spicules in aptera; distitarsi with weakly nodulose or weakly spiculose imbrications in aptera, with strongly spiculose imbrications in alata; cauda and anal and genital plates spiculose.

Head (Fig. 325): Antennal tubercle undeveloped; front of head convex, or almost flat, or with 2 median tubercles situated slightly dorsad or ventrad of margin. Anterior discal setae 2 on each side; in aptera, setae prominently capitate, situated on pair of quadrato papillae; in alata, setae minute, pointed, quadrato papillae prominent or inconspicuous. Posterior discal setae 2 on each side, minute, pointed in both aptera and alata. Ventral surface of each quadrato papilla usually with 1–3 transparent hemispherical tubercles. Eye present in aptera and alata; triommatidium distinct. Head of alata with gland facets consisting of small clusters of cibriiform discs (Fig. 322) surrounding dorsal and frontal setae. Disc of head usually without tubercles, rarely with 1–3 minute, transparent hemispherical tubercles associated with posterior discal setae. Dorsal cephalic suture evident in some specimens as faint pigmented longitudinal line in deeply pigmented alata. Antenna 4–6 segmented; primary sensoria (Fig. 319) with ciliate margins, not fused; secondary sensoria (Fig. 318) circular to broadly oval, present on segment III of alata, without ciliate margins; processus terminalis short, less than twice base of VI. Rostrum 4-segmented; apical segment (Fig. 320) short, not much longer than basal width, with apex rounded.

Thorax: Prothorax without evident lateral tubercles; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1–5 posterior submedian setae. Prothorax without evident gland facets in aptera; clusters of small cibriiform discs around setae usually evident in alata. Femora (Fig. 317) and tibia with pointed setae; tibial setae generally rather spinelike apically in alata. Tibiae with minute dispersed irregularly arranged gland pores evident in some specimens on tibiae in pigmented alata; rastral setae present; peglike setae absent. Plantar setae spatulate. Claws simple. Tarsi (Fig. 324) each 2-segmented; distitarsi without preapical capitate setae; basitarsi with 6 or 7 ventral and 2 dorsal setae in alata. Fore wing (Fig. 315) with normal venation; media with 3 branches; branches of cubitus approximate basally, strongly diverging.

Abdomen: Terga not fused, usually unpigmented, but with transverse pigment on each tergum in some specimens of both aptera and alata. Lateral abdominal sclerites evident only in pigmented
Figs. 313, 314. Aptera of *Boernerina*. 313, head and prothorax; 314, terminal abdominal segments.
Figs. 315–325. Embryonic chaetotaxy and alata of Boernerina. 315, right fore wing; 316, anal plate and gonapophyses; 317, left fore femur; 318, second and base of third antennal segments; 319, apical antennal segment; 320, apical rostral segment; 321, abdominal spiracle; 322, cluster of cribiform plates on disc of head; 323, dorsal chaetotaxy of embryo; 324, left hind tarsus; 325, venter of head.
alata. Dorsal abdominal setae pointed, short in alata and aptera; lateral setae pointed in alata, distinctly capitate in aptera in some specimens; setae usually arranged in single transverse row on each tergum. Tergum VIII of aptera enlarged, extending capelike over cauda and anal plate, with setae prominent and capitate. Dorsal abdominal tubercles absent. Segments II–VI each with 1 lateral conical papilla; in alata, each papilla with 1 apical seta, and commonly minute transparent basal tubercles. Spiracles (Fig. 321) without opercula, nearly circular. Siphunculus short, without setae or apical flange, usually distinctly flared in aptera, but not in alata. Abdominal tergum VIII entire, expanded in aptera to cover cauda. Cauda (Fig. 316) knobbed. Abdomen in alata with clusters of small cribiform discs around bases of most dorsal setae and usually also around base of each seta at apex of each conical lateral abdominal papilla. Anal plate bilobate in vivipara, entire in ovipara. Gonapophyses 3.

**Embryo** (Fig. 323). Antenna 3-segmented, rarely faint indication of 4 segments; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; prothoracic lateral tubercles absent; eyes and triommatidium present; abdominal segments I–VII each with 1 lateral seta; setae becoming gradually longer and more prominent posteriorly; segments I–VIII each with 1 submedian seta on each side; segment I–V or VI each with 1 minute pointed dorsolateral seta; abdomen without gland facets or lateral tubercles; siphunculus short, poriform or nearly so; basitarsi with 2 ventral setae, without dorsal setae; distitarsi each with 2 dorsal preapical capitate setae; plantar setae strongly flabellate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Alnus* species.

**Biology.** Little is known about the biology of the species other than that they are holocyclicly associated with their host plants. Alatae are rare in one common, widespread species, *B. variabilis* Richards, but are common in *B. occidentalis* Hille Ris Lambers, which is restricted to British Columbia, Yukon, and Alaska.

**Comments.** Recognition characters include the following: the restricted association with species of alder; the presence of a pair of tubercles on the anterior portion of the disc of the head; the presence of a bilobate anal plate; the presence of a knobbed cauda; the presence of circular or broadly oval secondary sensoria on the third antennal segment in the alatae; the rugose integument of the apterae; and the capelike extension of the eighth abdominal tergum in the apterae.
Genus *Brachycaudus* van der Goot

*Brachycaudus* van der Goot, 1913:97.
Type species: *Aphis myositidis* Koch, 1854:57 = *Aphis helichrysi* Kaltenbach, 1843:102.

**Adult** (Figs. 326, 327). Length 1.0–3.0 mm.

Integument: Antenna with smooth imbrications; head and body without obvious sculpturing other than some faintly spiculose imbrications on terga VII and VIII; tibiae without spicules; tarsi with smooth imbrications; siphunculus mostly smooth, with dispersed spicules in some specimens; cauda and anal and genital plates spiculose.

Head (Fig. 337): Antennal tubercle weakly developed, not projecting much beyond median tubercle. Ventral margin of antennal socket not protuberant. Discal setae mostly pointed, arranged in anterior group of 2 and posterior transverse group of 2 or 3. Eye present in aptera and alata; triommatidium distinct. Disc of head without dorsal tubercles or gland facets. Cephalic sutures absent. Antenna 6-segmented; primary sensoria (Fig. 332) with or without ciliate margins; processus terminalis elongate, slender, usually with 2–5 setae in addition to usual apical cluster; secondary sensoria absent in aptera, present on segment III or segments III and IV in alata (Fig. 331), without ciliate margins. Rostrum 4-segmented; apical segment (Fig. 333) elongate, conical, with apex rounded.

Thorax: Prothorax with, or without lateral tubercles, with 1 anterior and 1 posterior lateral seta, usually with 1 dorsolateral seta, and always 1 posterior submedian seta on each side. Femora (Fig. 330) and tibia with setae pointed; longest tibial seta not much longer than apical diameter of respective tibia. Tibiae without rastral setae, peglike setae, rastral spines, and gland facets. Plantar setae (Fig. 336) acuminate. Claws simple. Fore wing (Fig. 328) with normal venation; media with 3 branches; branches of cubitus widely separated at base.

Abdomen: Abdominal setae mostly pointed, arranged in single irregular transverse row on each tergum. Each tergum usually with some pigment; in some species the terga and lateral sclerites are fused forming pigmented dorsal carapace. Lateral sclerites present or absent in aptera, present in alata. Spiracles (Fig. 334) nearly circular, without opercula. Siphunculus short or long, with flange, without setae, smooth or nearly so. Abdominal tergum VIII entire. Cauda short, bluntly triangular, nearly semicircular. Anal plate (Fig. 329) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 335). Antenna 4-segmented; each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; prothoracic lateral tubercles usually not evident, small and
Figs. 326, 327. Aptera of *Brachycaudus*. 326, head and prothorax; 327, terminal abdominal segments.

Figs. 328–337. Embryonic chaetotaxy and alata of *Brachycaudus*. 328, right fore wing; 329, anal plate and gonapophyses; 330, left fore femur; 331, second and base of third antennal segments; 332, base of apical antennal segment; 333, apical rostral segment; 334, abdominal spiracle; 335, dorsal chaetotaxy of embryo; 336, left hind tarsus; 337, venter of head.
weakly formed where present; eyes and triommatidium present; abdominal segments I–VII each with 1 lateral seta having lengths varying between species; segments I–VIII each with small, weakly formed lateral abdominal tubercles present on segments II–V in some species; abdomen without gland facets; siphunculus short, nearly poriform; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae pointed or weakly, but distinctly, capitate.

**Economically important species.** *Brachycaudus cardui* (L.) and *B. persicae* (Passerini).

**Range of plants infested in Canada.** Species of *Achillea, Ambrosia, Carduus, Chrysanthemum, Cirsium, Delphinium, Echium, Polygonum, Prunus, and Spiraea.*

**Biology.** Some species in this genus, such as *B. cardui*, are heterocyclic between *Prunus* and various Compositae. Other species, such as *B. spiraeae* (Oestlund) and *B. rumexicolens* (Patch), are holocyclicly associated with a single host.

**Comments.** Recognition characters for this genus include the following: the short, nearly semicircular cauda; the nearly smooth, flanged, commonly short siphunculi; and the tendency for the abdominal terga in some species to be fused, and in the apterae, for them to form a pigmented dorsal carapace.

**Genus Brachycolus** Buckton

*Brachycolus* Buckton, 1879:146.
Type species: *Aphis stellariae* Hardy, 1850:788.

**Adult** (Figs. 338, 339). Length 1.5–3.0 mm.

Integument: Antenna with smooth imbrications; head and body without obvious sculpturing other than some obscure or well-developed reticulations on pronotum, with spiculose imbrications on abdominal terga VII and VIII; tibiae without sculpturing; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head: Antennal tubercle undeveloped; front of head almost straight. Ventral margin of antennal socket not protuberant. Discal setae pointed, blunt or faintly capitate, arranged on each side in anterior and posterior group of 2 each. Eye present in aptera and

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alata; triommatidium distinct. Dorsal tubercles absent. Cephalic suture absent. Discal gland facets absent. Antenna 5- or 6-segmented; primary sensoria with ciliate margins; secondary sensoria normally absent in aptera, present on segments III and in some specimens on IV in alata, without ciliate margins. Rostrum 4-segmented; apical segment short, conical, almost cylindrical; apex rounded.

Thorax: Prothorax without lateral tubercles; prothorax usually with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side. Tibial setae pointed, with longest barely as long as apical diameter of respective tibia. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi triangular, with 2 or 3 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple.


Embryo. Not observed.

Economically important species. Brachycolus asparagi Mordvilko has been a pest on asparagus in British Columbia.

Range of plants infested in Canada. Species of Asparagus and Stellaria.

Biology. This genus is holocyclicly associated with the hosts.

Comments. Recognition characters for this genus include the following: the elongate cauda; the short, nearly flangeless, smooth siphunculi; and the host association. Many workers place B. asparagi in a separate, monotypic genus, Brachycorynella Aizenberg (1956:154, type Brachycolus asparagi Mordvilko 1928:200), which differs in various minor details from Brachycolus. The only other North American species now placed in Brachycolus, B. brachysiphon Richards, is known only from Chesterfield Inlet, Northwest Territories.

Genus Brevicoryne van der Goot

Figs. 340–351

Brevicoryne van der Goot, 1915:245. Type species: Aphis brassicace Linnaeus, 1758:452.
Adult (Figs. 340, 341). Length 1.0–2.0 mm.

Integument: Antenna with smooth imbrications; head and body without obvious sculpturing, except for spicules and spiculose imbrications on apical few abdominal segments; cauda and anal and genital plates spiculose; tibiae without sculpturing; tarsi with smooth imbrications.

Head (Fig. 351): Antennal tubercle developed; front of head almost convex. Ventral margin of antennal socket not protuberant. Discal setae arranged on each side in anterior and posterior group of 2 each. Eye present in aptera and alata; triommatidium distinct. Dorsal tubercles and gland facets absent. Cephalic suture absent. Antenna 5- or 6-segmented; primary sensoria (Fig. 346) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 345) normally absent in aptera, present on segments III, 1–3 on segment V in some specimens. Rostrum 4-segmented; apical segment (Fig. 347) nearly cylindrical, with apex rounded.

Thorax: Prothorax with or without lateral tubercles. Prothoracic setae short, pointed or blunt, usually 1 seta in each of posterior lateral, dorsolateral, and posterior submedian positions. Femora (Fig. 344) and tibia with setae pointed; longest tibial seta not much longer than apical diameter of respective tibia. Basitarsi without dorsal setae, with 2 or 3 ventral setae; distitarsi elongate. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Plantar setae acuminate. Claws (Fig. 350) simple. Fore wing (Fig. 342) with normal venation; media with 3 branches; branches of cubitus widely separated at base.

Abdomen: Abdominal terga not fused, without pigment or each tergum with transverse dashes or paramedian clusters of irregular patches on terga I–V or VI; terga VII and VIII usually with some pigment. Dorsal and lateral abdominal tubercles absent. Lateral abdominal sclerites absent in aptera, usually present in alata. Dorsal abdominal setae short, pointed or blunt, arranged in single irregular transverse row on each tergum. Spiracles (Fig. 348) weakly reniform, almost circular, with anterior margins not produced as opercula. Siphunculus short, without setae, with flange, slightly swollen in some specimens; apical diameter much narrower than basal diameter, with smooth imbrications, especially on apical half. Abdominal tergum VIII entire. Cauda (Fig. 343) short, at most not much longer than siphunculus, strongly triangular. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 349). Antenna 4-segmented, 5-segmented in some species. Each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; prothoracic lateral tubercles absent; abdominal segments each with 1 submedian and 1 lateral seta on each side; lateral abdominal tubercles not evident; abdomen without gland facets; siphunculus short, poriform or nearly so; basitarsus obscurely separated from distitarsus in some specimens; each basitarsus with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.
Figs. 340, 341. Aptera of *Brevicoryne*. 340, head and prothorax; 341, terminal abdominal segments.
Figs. 342–351. Embryonic chaetotaxy and alata of *Brevicoryne*. 342, right fore wing; 343, anal plate and gonapophyses; 344, left fore femur; 345, second and base of third antennal segments; 346, base of apical antennal segment; 347, apical rostral segment; 348, abdominal spiracle; 349, dorsal chaetotaxy of embryo; 350, left hind tarsus; 351, venter of head.
Economically important species. *Brevicoryne brassicae* (L.).

**Range of plants infested in Canada.** Species of *Brassica*, *Lesquerella*, and *Raphanus*.

**Biology.** All species are holocyclicly associated with the food plant.

**Comments.** Recognition characters for the genus include the following: the association with the Cruciferae; the short, triangular cauda; and the short, slightly swollen, rather abruptly narrowed siphunculi.

**Genus Cachryphora** Oestlund

Figs. 352–363

*Cachryphora* Oestlund, 1922:132.
Type species: *Rhopalosiphum serotinae* Oestlund, 1887:76.

**Adult** (Figs. 352, 353). Length 1.5–3.0 mm.

**Integument:** Antenna with smooth imbrications; head with or without spiculose imbrications; metathorax and abdomen mostly smooth except for some weakly spiculose imbrications on abdominal tergum VIII; tibiae without spicules; tarsi with smooth imbrications; cauda and anal and genital plates spiculose.

**Head** (Fig. 363): Antennal tubercle weakly developed, scarcely evident; front of head slightly concave. Ventral margin of antennal socket not protuberant. Discal setae arranged on each side in anterior group and transverse posterior group of 2 setae each. Eye present in alata and aptera; triommatidium distinct. Disc of head without gland facets, cephalic suture, or tubercles. Antenna 6-segmented, processus terminalis elongate, with or without 1–3 setae; primary sensoria (Fig. 358) with or without distinctly ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 357) usually without ciliate margins, present on segment III in aptera, on segments III–IV or V in alata. Rostrum 4-segmented; apical segment (Fig. 359) slender, subcylindrically; apex bluntly pointed.

**Thorax:** Prothorax without lateral tubercles. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 or 2 anterior submedian setae. Femora (Fig. 356) and tibiae with setae pointed; tibial setae usually shorter than apical diameter of respective tibia. Tibiae without peglike setae, gland facets, rastral setae, and rastral spines. Basitarsi (Fig. 362) reduced to small sclerite; second segment triangular, with 2 or 3 ventral setae, without dorsal setae. Distitarsi without capitate setae. Plantar setae acuminate; claws simple. Fore wing (Fig. 354) with normal venation; media with 3 branches; cubital veins widely separated, somewhat divergent.
Figs. 352, 353. Aptera of *Cachryphora*. 352, head and prothorax; 353, terminal abdominal segments.
Abdomen: Dorsal abdominal setae short, mostly blunt or weakly capitate, arranged in single irregular, transverse row on each segment. Abdominal terga I–VII in aptera fused forming sclerotic, weakly to strongly pigmented carapace, extending laterally to include spiracles and lateral sclerites; alata without dorsal or lateral pigmentation and without carapace. Dorsal and lateral abdominal tubercles absent. Spiracles (Fig. 360) circular, margined, with prominent sclerotic margins, without opercula. Siphunculus smooth, without setae, somewhat knobbled, without an apical flange. Abdominal tergum VIII entire. Cauda elongate triangular, broadly rounded apically. Anal plate (Fig. 355) entire. Abdomen without gland facets. Gonapophyses 3, usually with vestiges of ovipositor on each side of median gonapophysis.

**Embryo** (Fig. 361). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior submedian seta and 1 anterior and 1 posterior lateral seta; prothoracic lateral tubercles and gland facets absent; abdominal segments each with 1 submedian and 1 lateral seta; segments I–IV usually with 1 dorsolateral seta; lateral abdominal tubercles absent; abdominal gland facets absent; siphunculus elongate, cylindrical, smooth, without flange; tarsi 3-segmented; second basitarsus on each leg with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae weakly but distinctly clavate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Solidago* species.

**Biology.** Details are unknown, but species are holocyclic on various species of *Solidago*.

**Comments.** The swollen, knobbed siphunculi, the fusion of the abdominal terga especially in the aptera, and the association with *Solidago* provide the chief recognition characters for this genus. Richards (1972b, c) provided a key to, and descriptions of, the species.

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Figs. 354–363. Embryonic chaetotaxy and alata of Cachryphora. 354, right fore wing; 355, anal plate and gonapophyses; 356, left fore femur; 357, second and base of third antennal segments; 358, base of apical antennal segment; 359, apical rostral segment; 360, abdominal spiracle; 361, dorsal chaetotaxy of embryo; 362, left hind tarsus; 363, venter of head.
Genus *Calaphis* Walsh

*Calaphis* Walsh, 1863:301.  
Type species: *Calaphis betulella* Walsh, 1863:301.

**Adult** (Figs. 364, 365).  
Length 2.0–4.0 mm.

Integument: Antennae with smooth and in some specimens faintly spiculose imbrications on at least segments IV–VI; head and thorax without obvious sculpturing; abdomen without obvious sculpturing other than a few weak spicules on tergum VIII in some species; tibiae spiculose apically; tarsi with spiculose imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 375): Antennal tubercle fairly well developed; front of head in both aptera and alata moderately concave. Ventral margin of antennal socket not protuberant. Discal setae capitate or blunt, usually long in aptera, always short, blunt, capitate or pointed in alata; both alata and aptera with 2 anterior and 2 posterior setae on each side of disc. Eye present in alata and aptera; triommatidium distinct. Disc of head without dorsal tubercles. Cephalic suture and gland facets absent. Antenna normally 6-, rarely 5-segmented; primary sensoria with ciliate margins; accessory primary sensoria (Fig. 370) not fused; secondary sensoria (Fig. 369) circular, without ciliate, or spiculose margins, present or absent on segment III in aptera, always present on antennal segment III in alata. Rostrum 4-segmented; apical segment (Fig. 371) subconical with rounded apex.

Thorax: Prothoracic setae capitate, usually long in aptera, always short, blunt, capitate or pointed in alata; each side usually with 1 anterior and 1 posterior lateral seta and 1 anterior and 2 or more posterior submedian setae. Prothoracic lateral tubercles usually absent, minute and inconspicuous where present. Femora (Fig. 368) with setae pointed; tibial setae usually blunt basally, pointed apically, with longest not longer than apical diameter of respective tibia. Tibiae without peglike setae, rastral spines, and gland facets; rastral setae present in alata, usually poorly developed in aptera. Basitarsi triangular with 5–7 ventral setae, with dorsal setae in alata. Claws (Fig. 374) simple. Fore wing (Fig. 366) with normal venation; radial sector weak or incomplete near base; media with 3 branches; cubital veins widely separated at base.

Abdomen: Abdominal setae capitate, blunt or pointed, usually long and conspicuous in aptera, short in alata, usually arranged in single transverse row on each tergum; lateral setae on segments II–IV on conical papillae. Abdominal terga not fused in aptera, fused in some alata specimens, with or without dashes of pigment on each; pigmented areas fusing on some terga of some specimens when present. Dorsal and lateral abdominal tubercles absent. Lateral abdominal sclerites present or absent, minute and inconspicuous when present. Spiracles (Fig. 372) reniform, without opercula.
Figs. 364, 365. Aptera of Calaphis. 364, head and prothorax; 365, terminal abdominal segments.
Siphunculus short, without setae, without apical flange, usually smooth, sometimes weakly spiculose. Abdominal tergum VIII entire. Cauda (Fig. 367) knobbed, but weakly so in aptera. Anal plate bilobate in vivipara; entire in ovipara. Abdomen without gland facets. Gonapophyses consisting of 2 or 3 clusters of setae on common weakly formed tubercle.

**Embryo** (Fig. 373). Antenna 4-segmented. Each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; prothoracic lateral tubercles not evident; prothorax without gland facets; abdomen without gland facets or lateral tubercles, with 1 submedian and 1 lateral seta on each of segments I–VII or VIII; segments I–V or VI each usually with 1 dorsolateral seta; siphunculus short, nearly poriform, without flange; tarsi 2-segmented; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Alnus* and *Betula* species.

**Biology.** All species are holocyclicly associated with one kind of host plant.

**Comments.** The chief recognition characters for this genus are the following: the association with various species of *Betula* and *Alnus*; the moderately well developed antennal tubercles; the circular secondary sensoria; the knobbed cauda; and the tendency for the dorsal and lateral setae to be long and capitate in the apterae and alatoid nymphs. Apterae are not produced in all species.

This genus appears to be predominately Nearctic. Some species are recorded from Europe, but most of these appear to belong to the genus *Callipterinella* van der Goot, which is similar to *Calaphis* but has a semicircular cauda and siphunculi that are beset with conspicuous spicules.

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Figs. 366–375. Embryonic chaetotaxy and alata of *Calaphis*. 366, right fore wing; 367, anal plate and gonapophyses; 368, left fore femur; 369, second and base of third antennal segments; 370, primary sensoria on apical antennal segment; 371, apical rostral segment; 372, abdominal spiracle; 373, dorsal chaetotaxy of embryo; 374, left hind tarsus; 375, venter of head.
Genus *Callipterinella* van der Goot

Figs. 376–387

*Callipterinella* van der Goot, 1913:118.
Type species: *Aphis betularia* Kaltenbach, 1843:119 = *Aphis tuberculata* von Heyden, 1837:296.

**Adult** (Figs. 376, 377). Length 1.5–3.0 mm.

Integument: Antennal segment with smooth imbrications; head with a few spicules in aptera, obscure or absent in alata; thorax and abdomen in aptera with spicules especially evident on pigmented areas, in some species with reticulations on lateral margins of thorax, in alata with sculpturing less well developed; tibiae with spicules apically; tarsi with weak to strongly spiculose imbrications; siphunculus with encircling rows of spicules; cauda and anal and genital plates spiculose.

Head (Fig. 387): Antennal tubercle weakly developed; front of head weakly convex. Ventral margin of antennal socket not protuberant. Discal setae long, pointed, thick and spinelike or fine and hairlike in aptera, shorter in alata; each side of disc with 2 or more setae anteriorly and 2 or more posteriorly. Eye present in alata and aptera; triommatidium distinct. Disc without dorsal tubercles, gland facets, or cephalic suture. Front of head usually with pair of inconspicuous tubercles. Antenna 6-segmented; processus terminalis more than twice length of base of segment VI; primary sensoria (Fig. 382) with ciliate margins, accessory ones not fused; secondary sensoria (Fig. 381) absent in aptera, present on segment III in alata, without ciliate margins. Rostrum 4-segmented; apical segment (Fig. 383) short, subconical, with rounded apex.

Thorax: Prothorax with or without lateral tubercles. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1–3 anterior and 1–6 posterior submedian setae. Femora (Fig. 380) and tibiae with setae pointed; longest tibial seta equal to, or longer than, apical diameter of respective tibia. Tibiae with rastral setae present, without rastral spines, peglike setae, and gland facets. Basitarsi (Fig. 386) triangular, with 5–7 ventral setae, without dorsal setae. Distitarsi elongate, without capitate setae. Claws simple. Plantar setae spatulate. Fore wing (Fig. 378) with normal venation; radial sector incomplete basally; media with 3 branches; cubital veins widely separated at base, divergent.

Abdomen: Dorsal abdominal setae usually pointed, arranged in single or double irregular transverse rows on each tergum. Dorsum of abdomen with or without pigment in alata; in aptera most terga with pigment in segmental patches usually fused to some degree on some segments. One to 3 lateral sclerites usually present. Lateral abdominal tubercles present on some or all of segments II–VII, large or small and inconspicuous. Spiracles (Fig. 384) rather small, reniform, without opercula. Siphunculus short, without apical flange.
Figs. 376, 377. Aptera of Callipterinella. 376, head and prothorax; 377, terminal abdominal segments.
or seta, not joined to lateral sclerite. Abdominal tergum VIII entire. Anal plate (Fig. 379) weakly bilobate. Cauda usually tongue-shaped or flaplike, knobbled in some species. Abdomen without gland facets. Anal plate bilobate in vivipara, entire in ovipara. Gonapophyses usually 2, represented by 2 clusters of setae on common weakly formed tubercle, with limits between clusters of setae commonly obscure.

**Embryo** (Fig. 385). Antenna 4-segmented; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 or 2 posterior submedian setae; 0–4 prothoracic lateral tubercles present. Abdomen without gland facets; segments I–VII with 0–3 lateral tubercles, without dorsal tubercles; siphunculus short, nearly poriform, without flange or setae; tarsi 2-segmented; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae spatulate.

**Economic importance.** None.

**Range of plants infested in Canada.** *Betula* species.

**Biology.** This genus is associated holocyclicly with *Betula* species.

**Comments.** The chief recognition characters for this genus are the association with *Betula*, the spiculose siphunculi, and the absence of dorsal setae on the first tarsal segments. The relative abundance of dorsal pigment in the apterae is also distinctive. *C. callipterus* (Hartig) is the only species recorded in Canada.

**Genus Capitophorus van der Goot**

Figs. 388–399

*Capitophorus* van der Goot, 1913:84.
Type species: *Aphis carduina* Walker, 1850:44.

**Adult** (Figs. 388, 389). Length 1.0–2.5 mm.
Integument: Antenna with smooth imbrications at least on apical segments; head and thorax without obvious sculpturing; abdomen with spiculose imbrications at least on posterior few terga in aptera, in alata with spicules laterally and dorsally at least on pigmented regions; siphunculus with imbrications at least basally; tibiae without

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Figs. 378–387. Embryonic chaetotaxy and alata of *Callipterinella*. 378, right fore wing; 379, anal plate and gonapophyses; 380, left fore femur; 381, second and base of third antennal segments; 382, base of apical antennal segment; 383, apical rostral segment; 384, abdominal spiracle; 385, dorsal chaetotaxy of embryo; 386, left hind tarsus; 387, venter of head.
spicules; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

**Head (Fig. 399):** Antennal tubercle well-developed; front of head concave, especially in aptera. Ventral margin of antennal socket not protuberant. Discal setae capitate, usually long in aptera, short in alata, arranged on each side in anterior and posterior group of 2 each. Eye present in alata and aptera; triommatidium distinct. Disc without dorsal tubercles, cephalic suture, or gland facets. Antenna 6-segmented; processus terminalis long, slender, usually with 1–3 minute setae; primary sensoria (Fig. 394) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 393) circular, without ciliate margins, absent in aptera, present on segments III, IV, and in alata. Rostrum 4-segmented; apical segment (Fig. 395) conical, pointed distad of preapical primary setae.

**Thorax:** Prothoracic setae capitate, short in alata, usually long in aptera; each side with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 or 2 posterior submedian setae. Prothoracic lateral tubercles present or absent, minute and inconspicuous where present. Femora (Fig. 392) with setae pointed; tibia with setae usually capitate or blunt basally, pointed apically, with longest not much longer than apical diameter of respective tibia. Tibiae without peglike setae, rastral setae, rastral spines, or gland facets. Basitarsi (Fig. 398) triangular, each with 2 or 3 ventral setae, without dorsal setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 390) with normal venation; media with 3 branches; cubital veins widely separated at base, divergent.

**Abdomen:** Dorsal and lateral abdominal setae capitate, short or long and conspicuous in aptera, short, inconspicuous, pointed or blunt posteriorly, arranged in single transverse row on each tergum. Abdominal terga without pigment in aptera, in alata commonly with at least faintly pigmented lateral sclerites and with quadrate pigmented patch covering segments on terga III or IV to V or VI. Lateral abdominal tubercles rarely present, minute and inconspicuous when present. Spiracles (Fig. 396) weakly reniform, anterior margins not produced as opercula. Siphunculus elongate, slender, cylindrical or clavate, with apical flange, without seta. Abdominal tergum VIII entire. Cauda elongate triangular. Anal plate (Fig. 391) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo (Fig. 397).** Antenna 4-segmented. Eye present. Each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; some species with small lateral tubercle on one or both sides; abdomen without gland facets, with minute lateral tubercles on one or more of segments II–V in some species, without dorsal tubercles; siphunculi short, cylindrical,

Figs. 388, 389. Aptera of *Capitophorus*. 388, head and prothorax; 389, terminal abdominal segments.
Figs. 390–399. Embryonic chaetotaxy and alata of *Capitophorus*. 390, right fore wing; 391, anal plate and gonapophyses; 392, left fore femur; 393, second and base of third antennal segments; 394, base of apical antennal segment; 395, apical rostral segment; 396, abdominal spiracle; 397, dorsal chaetotaxy of embryo; 398, left hind tarsus; 399, venter of head.
without flange or setae; tarsi 2-segmented; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae weakly but distinctly capitate.

**Economically important species.** None.

**Range of plants infested in Canada.** Species of *Carduus, Cirsium, Elaeagnus, Inula, Persicaria*, and *Shepherdia*.

**Biology.** The members of this genus are either heterocyclic between the Elaeagnaceae and the herbaceous plants listed, or holocyclicly associated with various Elaeagnaceae or the herbaceous hosts.

**Comments.** The presence of capitate setae and the association with the listed hosts provide the best means of recognition for the members of this genus. Also distinctive are the quadrate pigmented patch on the abdomen in the alata and the tendency for the rostrum to be attenuate and pointed distad of the preapical primary setae. Corpuz-Raros and Cook (1974) provided a key to, and descriptions of, the Nearctic species.

*Genus Carolinaia Wilson*

Figs. 400–412

*Carolinaia* Wilson, 1911:61.
Type species: *Carolinaia caricis* Wilson, 1911:61.

**Adult** (Figs. 400–402). Length 1.0–2.0 mm.
Integument: Antennal segments with smooth imbrications; head and body without evident sculpturing other than spicules on lateral sclerites; venter of abdomen with spiculose imbrications on apical 2 abdominal terga; tibiae without sculpturing except for a few obscure preapical imbrications in alata in some species; tarsi with imbrications smooth, in some species dispersed and weakly formed. Genital and anal plates spiculose. Cauda with spiculose base; apex (Fig. 402) with coarse imbricae.

Head (Fig. 412): Antennal tubercle weakly developed; front of head convex. Ventral margin of antennal sockets not protuberant. Each side of disc of head with 2 anterior and 2 posterior setae. Disc of head without tubercles, gland facets, or cephalic sutures. Eye present in alata and aptera; triommatidium distinct. Antenna 5- (mostly aptera) or 6-segmented (alata); processus terminalis elongate, without numerous setae; primary sensoria (Fig. 407) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 406) absent in aptera, present on segments III in alata, usually with a few marginal spicules or cilia. Rostrum 4-segmented; apical segment (Fig. 408)
subcylindrical, less than twice as long as basal width, rounded distad of preapical primary setae.

Thorax: Prothorax without dorsal tubercles, with or without small lateral tubercles. Each side of prothorax with 2 lateral setae and 1 posterior submedian seta. Femora (Fig. 405) with setae pointed; tibial setae blunt basally, pointed apically, not longer than diameter of respective tibia. Tibiae without rastral setae, rastral spines, gland facets, or peglike setae. Basitarsi (Fig. 411) triangular, with 3 ventral setae, without dorsal setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 403) with normal venation; media with 3 branches; cubital veins widely separated basally. Hind wing with only 1 transverse vein.

Abdomen: Abdominal setae short, blunt, inconspicuous, arranged in single transverse row on each tergum. Terga of aptera sclerotic, pigmented, fused, forming carapace extending laterally and including lateral sclerites and spiracles; terga in alata membranous except for intersegmental sclerites, occasional sclerites around bases of setae, and transverse pigment bars on segments VII, VIII, and in some species VI. Lateral sclerites present in alata. Lateral abdominal tubercles usually absent in aptera, usually present on some or all of segments II–V in alata. Spiracles (Fig. 409) reniform, without opercula. Siphunculus elongate, clavate, without setae or reticulations, with apical flange, in some species nearly smooth dorsally, with smooth and weakly spiculose or nodulose imbrications ventrally and apically. Abdominal tergum VIII entire, without tubercles or protuberances. Cauda short triangular. Abdomen without gland facets. Anal plate (Fig. 404) entire. Gonapophyses 3.

**Embryo** (Fig. 410). Antenna 4-segmented; each side of disc with 4 setae; eyes present; each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; evidently without prothoracic lateral tubercles; abdomen with 1 lateral and 1 submedian segment; most segments also usually with 1 dorsolateral seta on each side; abdomen without dorsal tubercles, also without lateral tubercles; siphunculus short, tubular; tarsi 2-segmented; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** Specimens available from Canada have no recorded host associations. In the United States, sedges and *Rhus* species are the only known hosts.

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Figs. 400–402. Aptera of *Carolinaia*. 400, head and prothorax; 401, terminal abdominal segments; 402, apex of cauda.
Figs. 403–412. Embryonic chaetotaxy and alata of *Carolinaia*. 403, right fore wing; 404, anal plate and gonapophyses; 405, left fore femur; 406, second and base of third antennal segments; 407, base of apical antennal segment; 408, apical rostral segment; 409, abdominal spiracle; 410, dorsal chaetotaxy of embryo; 411, left hind tarsus; 412, venter of head.
**Biology.** The details are not well known. Smith (1980b) successfully transferred *Carolinaia caricis* Wilson from *Carex* to *Rhus*.

**Comments.** Chief recognition characters are the association with sedges, the clavate siphunculi, the absence of apical spicules on the cauda, the 5-segmented antennae in the apterae, and the presence of only one transverse vein in the hind wing. Smith (1980b) provided a key to, and notes on, the species.

**Genus Catamergus Oestlund**

*Catamergus* Oestlund, 1922:141.

Type species: *Nectarophora fulvae* Oestlund, 1887:80.

**Adult** (Figs. 413, 414). Length 3.0–4.5 mm.

**Integument:** Antenna with smooth imbrications; head and body without sculpturing other than some spiculose imbrications on apical abdominal terga; tibiae without spicules; tarsi with smooth imbrications; siphunculus with smooth imbrications; cauda and anal and genital plates spiculose.

**Head** (Fig. 424): Antennal tubercle well-developed; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, arranged on each side in anterior and posterior group of 2 each. Eye present in alata and aptera; triommatidium present. Dorsal tubercles present in some species. Cephalic suture and gland facets absent. Antenna 6-segmented; processus terminalis long without numerous setae; primary sensoria (Fig. 419) with ciliate margins; accessory sensoria not fused. Secondary sensoria (Fig. 418) without ciliate margins present on segment III in both aptera and alata. Rostrum 4-segmented; apical segment (Fig. 420) short, with sides somewhat convex; apex rounded distad of preapical primary setae.

**Thorax:** Prothorax with lateral tubercles, without dorsal tubercles. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Femora (Fig. 417) and tibia with setae pointed; longest tibial setae slightly longer than apical diameter of respective tibia. Tibia without peglike setae, rastral setae, rastral spines, or gland facets. Plantar setae acuminate. Basitarsi (Fig. 423) triangular, each with 3 ventral setae, without dorsal setae. Fore wing (Fig. 415) with normal venation; media with 3 branches; cubital veins widely separated at base, not strongly divergent.

**Abdomen:** Abdominal setae short, arranged in single transverse row on each tergum. Abdominal terga not fused without pigment in aptera and alata. Lateral abdominal sclerites absent. Lateral
Figs. 415–424. Embryonic chaetotaxy and alata of *Catamergus*. 415, right fore wing; 416, anal plate and gonapophyses; 417, left fore femur; 418, second and base of third antennal segments; 419, base of apical antennal segment; 420, apical rostral segment; 421, abdominal spiracle; 422, dorsal chaetotaxy of embryo; 423, left hind tarsus; 424, venter of head.

Figs. 413, 414. Aptera of *Catamergus*. 413, head and prothorax; 414, terminal abdominal segments.
abdominal tubercles present on segments II–VII. Dorsal abdominal tubercles usually present on abdominal tergum VIII. Spiracles (Fig. 421) subcircular, without opercula. Siphunculi slender, cylindrical equal to or slightly longer than cauda, without setae, with spiculose and smooth imbrications, with 1 or 2 subapical rows of reticulations, with flange narrow. Abdominal tergum VIII entire, without median tubercle. Cauda elongate, broadly rounded apically. Anal plate (Fig. 416) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 422). Antenna 5-segmented, but with division between segments III and IV commonly incomplete. Eye present. Each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta. Usually with 1 small prothoracic lateral tubercle on each side of prothorax; abdominal segments each with 1 lateral, 1 submedian, and usually 1 dorsolateral seta; abdominal lateral tubercles usually present on one or more of segments II–V; abdominal tergum VIII commonly with 1 or 2 small tubercles; tarsi 2-segmented; basitarsi each with 3 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Impatiens* species.

**Biology.** This genus is holocyclicly associated with its host plant.

**Comments.** *Catamergus* is similar to *Macrosiphum* from which it can be distinguished by the shorter, nearly flangeless siphunculi, its restricted association with *Impatiens*, and the reduced number of reticulations on the siphunculi. In *Macrosiphum*, the siphunculus is much longer than the cauda and has four or more rows of subapical reticulations. In life, specimens are heavily flocculent, which is distinctive, although some species of *Macrosiphum*, such as *M. parvifolii* Richards, exhibit the same characteristic.

**Genus Cavariella Del Guercio**

Figs. 425–436

* Cavariella Del Guercio, 1911a:323.

**Adult** (Figs. 425, 426). Length 1.5–3.0 mm.
  Integument: Antennal segments with smooth imbrications; head and body in alata without evident sculpturing other than spiculose imbrications on posterior few abdominal segments; thorax and abdomen in aptera usually with subcircular pits or integument
appearing rippled at least laterally; tibiae in alata with apical imbrications and spicules (absent in one species), in aptera these absent or very weakly developed; tarsi with imbrications smooth, or faintly nodulose, or ventral faintly spiculose; cauda and anal and genital plates with spicules.

Head (Fig. 436): Antennal tubercle weakly developed; front of head convex. Ventral margins of antennal socket not protuberant. Each side of disc of head with 2 anterior and 2 posterior setae. Eye present in alata and aptera; triommatidium distinct. Disc of head without tubercles, gland facets, or cephalic suture. Antenna 5- or 6-segmented; processus terminalis short or elongate, without numerous setae; primary sensoria (Fig. 431) with ciliate margins, but in some species cilia reduced to coarse spicules; accessory sensoria not fused; secondary sensoria (Fig. 430) absent in aptera, present on segments III–V in alata, without ciliate margins. Rostrum 4-segmented; apical segment (Fig. 432) slender, conical, bluntly pointed distad of preapical primary setae.

Thorax: Prothorax with or without lateral tubercles, small and inconspicuous where present. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta. Femora (Fig. 429) with setae pointed; tibial setae blunt or pointed basally, pointed apically, not longer than apical diameter of respective tibia. Tibiae without rastral spines, rastral setae, peglike setae, or gland facets. Basitarsi (Fig. 435) triangular, with 3 ventral setae on fore and middle legs, with 2 or 3 on hind leg. Planter setae acuminate. Claws simple. Fore wing (Fig. 427) with normal venation; media with 3 branches; cubital veins separated basally.

Abdomen: Abdominal setae short, commonly blunt or weakly capitate, arranged in single transverse row on each tergum. Abdominal terga not fused, without pigment in aptera, with dorsal pigment in alata on at least segments III–VIII fused forming central patch on terga III–V or VI. Lateral sclerites absent in aptera, present in alata. Lateral tubercles present or absent, minute where present and only occurring on segments II–V. Spiracles (Fig. 433) reniform, without anterior opercula. Siphunculus shorter or longer than cauda, clavate or cylindrical, nearly smooth apically or with smooth and spiculose imbrications or with dispersed spicules, without setae, with apical flange. Abdominal tergum VIII entire (Fig. 426) with median tubercle either poorly developed, or long, conspicuous, about as long as cauda. Anal plate (Fig. 428) entire. Cauda short, broadly triangular or elongate, broadly rounded apically, tassel-shaped. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 434). Antenna 4-segmented; each side of disc with 4 setae; eyes present. Each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; without evident lateral tubercles; abdomen with 1 lateral and 1 submedian seta on each tergum; 1 dorsolateral seta usually present on each of segments I–V or VI; abdomen without dorsal or lateral
Figs. 427-436. Embryonic chaetotaxy and alata of Cauariella. 427, right fore wing; 428, anal plate and gonapophyses; 429, left fore femur; 430, second and base of third antennal segments; 431, base of apical antennal segment; 432, apical rostral segment; 433, abdominal spiracle; 434, dorsal chaetotaxy of embryo; 435, left hind tarsus; 436, venter of head.

Figs. 425, 426. Aptera of Cauariella. 425, head and prothorax; 426, terminal abdominal segments.
tubercles; siphunculus short, tubular; tarsi 2-segmented; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

**Economically important species.** Cavariella aegopodii (Scopoli.), C. pastanacae (L.), C. theobaldi (Gillette & Bragg).

**Range of plants infested in Canada.** Salix species and almost any species of Umbelliferae.

**Biology.** Where the biology is known in Canada, the species are nearly all heterocyclic between Salix species and various Umbelliferae. The only known exception is C. borealis Hille Ris Lambers, which lives holocyclicly on willows in Greenland and the Canadian Arctic.

**Comments.** The chief recognition characters for this genus are the association with Salix and the Umbelliferae in combination with the median tubercle on the eighth abdominal tergum. Members of subgenus Cavariellia Heinze have no siphuncular flange. The single Canadian species currently assigned to this subgenus, C. aquatica (Gillette & Bragg) will key here as an Aspidaphis: see the comments under that genus.

*Genus Cepegillettea* Granovsky

Figs. 437–448

*Cepegillettea* Granovsky, 1928:114.
Type species: *Cepegillettea betulaefoliae* Granovsky, 1928:115.

**Adult** (Figs. 437, 438). Length 2.0–4.0 mm.

Integument: Antennal segments with smooth imbrications; head and body without obvious sculpturing other than weakly formed spiculose imbrications on apical abdominal segments; tibiae with spicules apically; tarsi with spiculose imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 448): Antennal tubercle well-developed; front of head concave. Ventral margin of antennal socket not protuberant. Discal setae capitate, long and conspicuous in aptera, arranged in anterior group of 2–6 and posterior group of 2–4 setae on each side of disc. Eye present in alata and aptera; triommatidium distinct. Disc of head without cephalic suture, gland facets, or tubercles. Antenna 6-segmented; primary sensoria (Fig. 443) with or without ciliate or spiculose margins; accessory sensoria fused; secondary sensoria

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Figs. 437, 438. Aptera of *Cepegillettea*. 437, head and prothorax; 438, terminal abdominal segments.
Figs. 439-448. Embryonic chaetotaxy and alata of *Cepegillettea*. 439, right fore wing; 440, anal plate and gonapophyses; 441, left fore femur; 442, second and base of third antennal segments; 443, primary sensoria on apical antennal segment; 444, apical rostral segment; 445, abdominal spiracle; 446, dorsal chaetotaxy of embryo; 447, left hind tarsus; 448, venter of head.
(Fig. 442) present on segment III in both aptera and alata. Rostrum 4-segmented; apical segment (Fig. 444) subconical, rounded distad of preapical primary setae.

Thorax: Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1–3 posterior submedian setae. Prothorax without dorsal tubercles, with or without small inconspicuous lateral tubercles. Femora (Fig. 441) with setae pointed; tibial setae capitate basally and dorsally, pointed apically and ventrally; longest about as long as apical diameter of respective tibia. Rastral setae present in alata, absent in aptera. Tibiae without peglike setae, gland facets, or rastral spines. Basitarsi (Fig. 447) triangular, each with 5–7 ventral setae, without dorsal setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 439) with normal venation; media usually with 3, in some species 2 branches; cubital veins widely separated at base, divergent.

Abdomen: Abdomen without pigment in aptera and alata. Dorsal abdominal setae pointed, or blunt, or capitate, arranged in single transverse row on each tergum. Lateral abdominal sclerites absent. Dorsal abdominal tubercles absent; lateral abdominal tubercles absent or present on some segments, minute, inconspicuous. Spiracles (Fig. 445) subcircular, without anterior opercula. Siphunculus short, spiculose, without setae or apical flange. Abdominal tergum VIII entire. Cauda constricted near base, area distad of constriction triangular, longer than broad. Anal plate (Fig. 440) bilobate in vivipara; entire in ovipara. Abdomen without gland facets. Gonapophyses 2, with division between composite clusters of setae indefinite in some species.

**Embryo** (Fig. 446). Antenna 4-segmented; each side of disc with 4 setae; eyes present. Each side of prothorax with 1 anterior and 1 posterior submedian seta, 1 anterior and 1 posterior lateral seta, and commonly 1 posterior dorsolateral seta; prothorax without lateral tubercles; abdominal segments each with 1 submedian and 1 lateral seta and usually also with 1 dorsolateral seta; tarsi each 2-segmented; basitarsi with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** Betula species and Comptonia asplenifolia (L.)

**Biology.** The species are holocyclicly associated with the host plant.

**Comments.** Recognition characters for this genus are the fusion of the accessory primary sensoria on the sixth antennal segment, the large triangular knob on the cauda, and the host association. Richards (1969b) provided a key to, and descriptions of, the species.
Genus *Cerataphis* Lichtenstein  
Figs. 449–462

*Cerataphis* Lichtenstein, 1882: 16.  
Type species: *Coccus lataniae* Boisduval, 1867: 355.

**Adult** (Figs. 449, 451). Length 1.0–3.0 mm.

Integument: Largely unsculptured except for sparse spicules on cauda, and in some specimens on apical tarsal segments, and straight or weakly spiculose imbrications on antennal segments. Head and body of aptera margined with circular gland facets (Fig. 452).

Head (Fig. 462): Head, thorax, and first 7 abdominal segments of aptera fused into continuous pigmented sclerotic carapace. Antennal tubercle undeveloped. Median tubercle undeveloped, but anterior margin of head of aptera with 2 fingerlike papillae (Fig. 450) ventrad of anterior gland facets. Eye absent in aptera, triommatidium distinct. Each side of disc of head with 2 or more anterior and 2 or more posterior setae. Antenna 4-segmented in aptera, 5-segmented in alata; secondary sensoria (Fig. 456) present as narrow annuli on segments III–V in alata, absent in aptera; primary sensoria with ciliate margins; processus terminalis short (Fig. 457). Rostrum 4-segmented; apical segment (Fig. 458) short, blunt, with 1 or 2 basal and 2 or 3 apical setae, usually without secondary setae.

Thorax: Prothorax with 1 anterior and 1 posterior submedian seta, with 1 anterior and 1 posterior lateral seta. Prothorax without lateral or dorsal tubercles. Femora (Fig. 455) and tibiae with setae pointed. Tibiae without gland facets, peglike setae, rastral spines, or rastral setae. Basitarsi triangular, with 2 or 3 ventral setae, without dorsal setae. Distitarsi elongate, each with 1–3 preapical capitate setae. Plantar setae weakly but distinctly capitate. Claws simple. Fore wing (Fig. 453) with normal venation; media usually with 2 branches; branches of cubitus fused basally, with short common segment.

Abdomen: Dorsal abdominal setae pointed, short, inconspicuous; each segment with 1 lateral, 1 mesal, and 1 dorsolateral seta. Dorsal and lateral abdominal tubercles absent. Lateral abdominal sclerites absent in alata, fused with dorsal carapace in aptera. Spiracle (Fig. 459) as minute pore situated in ventral extension of carapace in aptera, on small unpigmented or weakly pigmented plate in alata. Siphunculus short, nearly poriform, with flared orifice, on fairly well developed mammiform base. Abdominal segment VIII unmodified. Cauda (Figs. 451, 454) knobbed; knobbed portion transversely elongate. Anal plate (Fig. 454) distinctly bilobate. Gonapophyses 2.

**Embryo** (Fig. 460). Antenna 3-segmented; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta, without evident gland facets; eyes absent; triommatidium present; abdomen without evident gland facets, each
Figs. 449–452. Aptera of *Cerataphis*. 449, head and prothorax; 450, process on anterior margin of head; 451, apical abdominal segments; 452, marginal wax gland facets.
Figs. 453–462. Embryonic chaetotaxy and alata of *Cerataphis*. 453, right fore wing; 454, anal plate and gonapophyses; 455, left fore femur; 456, second and base of third antennal segments; 457, apical antennal segment; 458, apical rostral segment; 459, abdominal spiracle; 460, dorsal chaetotaxy of embryo; 461, left hind tarsus; 462, venter of head.
segment with 1 lateral, 1 dorsolateral, and 1 submedian seta; siphunculus present or absent, poriform where present; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi elongate, each with 1 or 2 preapical capitate setae; plantar setae acuminate, usually distinctly capitate.

**Economically important species.** None in Canada.

**Range of plants infested in Canada.** Found on palms (Arecaceae) indoors.

**Biology.** In Asia, some species alternate from galls on *Styrax* to various monocots including bamboo, palms, and orchids. Several species are transported on ornamental plants to other countries.

**Comments.** Chief recognition characters for this genus are the aleurodiform apterae, the five-segmented antennae in the alatae, and the hornlike processes on the vertex in the apterae.

**Genus Ceruraphis Börner**

Figs. 463–475

*Ceruraphis* Börner, 1926:226.

**Adult** (Figs. 463, 464). Length 2.0–3.0 mm.

Integument: Antenna with smooth imbrications; head and prothorax without sculpturing; mesothorax, metathorax, and dorsum of abdominal segments I–V or VI with small spicules forming reticulate network; segment VII and VIII with weakly developed and weakly spiculose imbrications; tibiae with sculpturing; tarsi with smooth imbrications; cauda and anal and genital plates with spicules; apex of cauda (Fig. 465) with spicules reduced in size.

Head (Fig. 475): Antennal tubercle poorly developed; front of head slightly convex. Ventral margin of antennal socket not protuberant. Eye present in aptera and alata; triommatidium distinct. Discal setae arranged on each side in anterior and posterior group of 2 or 4 setae each. Disc of head without dorsal tubercles or gland facets. Cephalic suture absent, but faintly visible in some species as pigmented line in aptera. Antenna 6-segmented; processus terminalis elongate narrow, without setae other than usual apical cluster; primary sensoria (Fig. 470) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 469) without ciliate margins, absent in aptera, present on segments III–V in alata. Rostrum 4-segmented; apical segment (Fig. 471) conical, rounded distad of preapical primary setae.
Figs. 466–475. Embryonic chaetotaxy and alata of *Cerophis*. 466, right fore wing; 467, anal plate and gonapophyses; 468, left fore femur; 469, second and base of third antennal segments; 470, base of apical antennal segment; 471, apical rostral segment; 472, abdominal spiracle; 473, dorsal chaetotaxy of embryo; 474, left hind tarsus; 475, venter of head.
Thorax: Prothorax with lateral tubercles in alata, without dorsal tubercles. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 0–4 anterior and 0–4 posterior submedian setae. Femora (Fig. 468) and tibiae with setae pointed; longest tibial setae not longer than apical diameter of respective tibia. Tibiae without peglike setae, rastral setae, rastral spines, or gland facets. Basitarsi (Fig. 474) triangular, with 3 ventral setae on fore and middle tarsus and 2 or 3 on hind tarsus, without dorsal seta. Plantar setae acuminate. Claws simple. Fore wing (Fig. 466) with normal venation; media with 3 branches; cubital veins widely separated at base, slightly diverging.

Abdomen: Dorsal abdominal setae pointed, arranged in single transverse row on each tergum. Abdominal terga pigmented, fused forming carapace covering segments II–VII; carapace fused to lateral sclerites in aptera, but not in alata. Venter of alata usually pigmented. Dorsal abdominal tubercles absent. Lateral tubercles present in alata. Spiracles (Fig. 472) weakly reniform, without anterior opercula. Siphunculus elongate, usually slightly swollen near middle, narrowed apically with diameter at orifice being narrowest part of siphunculus, without setae, with apical flange, with well-developed, strongly spiculose imbrications. Cauda short triangular, slightly constricted at base; apex broadly rounded; apical spicules reduced in size. Abdominal tergum VIII entire. Anal plate (Fig. 467) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 473). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; small prothoracic lateral tubercle on each side of prothorax in some species; eyes present, triommatidium present; side of each abdominal segment with 1 lateral, 1 dorsolateral, and 1 submedian seta; siphunculus present, short, cylindrical; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

Economically important species. None.

Range of plants infested in Canada. Species of Carex, Eriophorum, Scirpus, and Viburnum.

Biology. Ceruraphis eriophori (Walker) is heterocyclic between Viburnum species, where it forms a pseudogall of deformed leaves, and Cyperaceae. *C. viburnicola* (Gillette) has been collected only on Viburnum.

Comments. The recognition characters for this genus include the host associations in combination with the abundance of pigment on the dorsum of the abdomen in both the apterae and alatae, and with the heavily sculptured siphunculi. Chakrabarti and Medda (1985) provided a key to the species and reviewed the taxonomy.
Genus *Chaetosiphon* Mordvilko

*Chaetosiphon* Mordvilko, 1914:71.
Type species: *Capitophorus chaetosiphon* Nevsky, 1928:195.

**Adult** (Figs. 476, 478). Length 1.0–3.0 mm.

Integument: Antennae with smooth imbrications; disc of head smooth in alata and aptera; thorax and abdomen not strongly sculptured other than some weakly formed spiculose imbrications on posterior abdominal segments; tibiae without spicules; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 488): Antennal tubercle and also usually median tubercle well-developed making front of head W-shaped. Ventral margin of antennal socket (Fig. 477) protuberant; protuberance commonly scabrous. Discal setae usually long, capitate, conspicuous, arranged on each side in anterior and posterior group of 2 each. Eye present in alata and aptera; triommatidium distinct. Disc of head normally without tubercles, without gland facets or cephalic suture. Antenna 6-segmented; processus terminalis elongate without numerous setae; primary sensoria (Fig. 483) with ciliate margins; secondary sensoria (Fig. 482) with or without ciliolate margins, absent in aptera, present on segments III, IV, and rarely also V in alata. Rostrum 4-segmented; apical segment (Fig. 484) conical, pointed distad of preapical primary setae.

Thorax: Prothorax usually with lateral tubercles having relatively small diameters not much greater than diameters of lateral setae. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior submedian seta. Femora (Fig. 481) with setae pointed; tibial setae capitate basally and dorsally, pointed ventrally and apically; longest seta slightly longer than apical diameter of respective tibia in some species. Rastral setae, rastral spines, peglike setae, and gland facets absent. Basitarsi (Fig. 487) triangular, each with 3–5 ventral setae, without dorsal setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 479) with normal venation; media with 3 branches; cubital veins widely separated at base.

Abdomen: Dorsal abdominal setae capitate, usually long, conspicuous, in some species short, set on small papillae, arranged in 3–8 longitudinal rows, with median rows in some species represented by clusters of 2–5 setae. Aptera without dorsal and lateral abdominal pigment; alata with lateral sclerites. Lateral abdominal tubercles usually absent, abnormally present on one or more of segments I–V, minute and inconspicuous. Spiracles (Fig. 485) reniform. Siphunculus elongate, cylindrical or clavate, with or without setae (Palaearctic species), with apical flange, nearly smooth or with smooth and weakly spiculose imbrications. Abdominal tergum VIII entire, without median tubercle. Cauda elongate, usually with nearly parallel sides, broadly rounded apically. Anal plate (Fig. 480) triangular. Abdomen without gland facets. Gonapophyses 3.
Figs. 479–488. Embryonic chaetotaxy and alata of Chaetosiphon. 479, right fore wing; 480, anal plate and gonapophyses; 481, left fore femur; 482, second and base of third antennal segments; 483, base of apical antennal segment; 484, apical rostral segment; 485, abdominal spiracle; 486, dorsal chaetotaxy of embryo; 487, left hind tarsus; 488, venter of head.

Figs. 476–478. Aptera of Chaetosiphon. 476, head and prothorax; 477, ventral margin of antennal socket; 478, terminal abdominal segments.
**Embryo** (Fig. 486). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothoracic lateral tubercles not evident; eyes present; triommatidium present; each side of abdomen with 1 submedian and 1 lateral seta on each segment; dorsolateral setae present or absent; siphunculus short, cylindrical where present, commonly apparently absent; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Chaetosiphon fragaefolii* (Cockerell).

**Range of plants infested in Canada.** *Fragaria* and *Potentilla* species.

**Biology.** As far as is known species are holocyclicly associated with the host plant.

**Comments.** The chief recognition characters for this genus are the capitate setae on small papillae and the host association. Richards (1963a) provided a key to, and descriptions of, the Canadian species. Most species in Canada are referable to subgenus *Pentatrichopus* Börner.

**Genus Chaitophorus Koch**

Figs. 489–500

*Chaitophorus* Koch, 1854:1.

Type species: *Chaitophorus leucomelas* Koch, 1854:4.

**Adult** (Figs. 489, 490). Length 1.0–4.0 mm.

Integument: Antenna with smooth imbrications; disc of head with spicules and nodules at least laterally in aptera, with sculpturing absent or much reduced in alata; prothorax commonly smooth in alata, smooth or with spicules, nodules and in some species a few reticulations in aptera; meso- and meta-thorax and abdomen without conspicuous sculpturing in alata, varying from almost smooth to heavily nodulose or reticulate in aptera; tibiae with or without spicules; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 500): Antennal tubercle undeveloped; front of head weakly convex, nearly flat. Ventral margin of antennal socket not protuberant. Discal setae without special arrangement, fairly evenly distributed. Eye present in alata and aptera; triommatidium present. Dorsal tubercles, gland facets, and cephalic suture absent. Antenna exceptionally 5-segmented, usually 6-segmented; processus
Figs. 489, 490. Aptera of *Chaitophorus*. 489, head and prothorax; 490, terminal abdominal segments.
Figs. 491–500. Embryonic chaetotaxy and alata of Chaitophorus. 491, right fore wing; 492, anal plate and gonapophyses; 493, left fore femur; 494, second and base of third antennal segments; 495, base of apical antennal segment; 496, apical rostral segment; 497, abdominal spiracle; 498, dorsal chaetotaxy of embryo; 499, left hind tarsus; 500, venter of head.
terminalis short or fairly long; primary sensoria (Fig. 495) without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 494) without ciliate margins, usually absent in aptera, in some species a few present on segment III, present on segments III, IV, or V in alata. Rostrum 4-segmented; apical segment (Fig. 496) conical, pointed distad of preapical primary setae.

Thorax: Prothoracic dorsal and lateral tubercles absent. Prothoracic setae scattered, fairly numerous, without special arrangement. Femora (Fig. 493) and tibiae with pointed setae; tibial setae variable in length. Rastral setae, peglike setae, and gland facets absent. Rastral spines usually present, minute, represented as 2–4 coarse spicules on apical margin of at least hind tibiae. Basitarsi (Fig. 499) triangular, with 5–7 ventral setae, without dorsal setae. Plantar setae acuminate to clavate. Claws simple. Fore wing (Fig. 491) with normal venation; media with 3 branches; cubital veins widely separated at base, divergent.

Abdomen: Abdominal setae long, pointed or apically flattened, furcate, arranged in 1–4 transverse rows on each tergum. Abdominal terga fused or separate, colorless, with spots around bases of setae on terga II–VI or VII, in some species fused together and to lateral sclerites forming pigmented carapace. Dorsal and lateral tubercles absent. Spiracles (Fig. 497) small, subcircular, without anterior opercula. Siphunculus short, without setae, without apical flange, always with reticulations on apical half. Abdominal tergum VIII entire. Cauda rounded, arc-shaped, spatulate, tongue-shaped, or distinctly knobbed. Anal plate (Fig. 492) entire to slightly emarginate. Abdomen without gland facets. Gonapophyses 4.

Embryo (Fig. 498). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; prothoracic lateral tubercles absent; eyes present; triommatidium present; each side of abdomen with 1 lateral and 1 submedian seta per segment; 1 dorsolateral seta present or absent on each side of abdominal segments I–V; siphunculus present or apparently absent, poriform or nearly so where present; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi with 1, usually 2 preapical capitate setae; plantar setae acuminate.

Economically important species. None.

Range of plants infested in Canada. Salix and Populus species.

Biology. As far as is known all species are holocyclicly associated with the host plants.

Comments. The presence of short, reticulate siphunculi and the associations with Salix and Populus are the best recognition characters for the species of this genus. Richards (1972a) provided a key to, and descriptions of, the Canadian species.
Genus *Chromaphis* Walker

Figs. 501–512

Type species: *Lachnus juglandicola* Kaltenbach, 1843:151.

**Adult** (Figs. 501, 502). Length 1.5–2.5 mm.  
Integument: Apical 3 antennal segments with distinct imbrications; head, thorax, and abdomen without obvious sculpturing; tibiae without spicules; tarsi spiculose; cauda and anal and genital plates with some spicules.  

Head (Fig. 512): Antennal tubercle undeveloped; front of head convex. Frontal ocellus on median tubercle. Ventral margin of antennal socket not protuberant. Discal setae short, arranged in anterior and posterior group of 2 each; anterior setae situated on small conical papillae. Eye present in alata and aptera; triommatidium present. Dorsal tubercles, gland facets, and cephalic suture absent. Antenna 6-segmented; processus terminalis shorter than base of VI; primary sensoria (Fig. 507) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 506) oval, without ciliate margins, present only on segment III. Rostrum 4-segmented; apical segment (Fig. 508) short, conical, part distad of preapical primary setae almost half the length of basal part, rounded.  

Thorax: Prothoracic lateral tubercles absent. Each side of prothorax with 1 anterior and 1–3 posterior lateral setae and 1 anterior and 1 posterior submedian seta. Femora (Fig. 505) and tibiae with setae pointed; longest tibial setae not much longer than apical diameter of respective tibia. Tibiae without rastral spines, peglike setae, or gland facets. Rastral setae present on anterior legs, undeveloped on last two pairs of legs. Basitarsi (Fig. 511) triangular, with 5 ventral and 1 or 2 dorsal setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 503) with normal venation; radial sector lacking or weakly developed; media with 3 branches; cubital veins separate at base, somewhat divergent.  

Abdomen: Abdominal chaetotaxy much reduced, represented by paired submedian setae on terga I, V, and VII, usually with 1 submedian seta on each side on tergum VI and single transverse row of setae on tergum VIII; segments with lateral cluster of 2–5 setae on each. Abdominal segments not fused, each tergum without pigment. Lateral tubercles and lateral abdominal sclerites absent. Spiracles (Fig. 509) subcircular. Siphunculi short, without apical flange, without spicules, lateral setae of abdominal segment VI appended to its base. Abdominal tergum VIII entire. Cauda (Fig. 504) knobbed. Anal plate weakly bilobate. Abdomen without gland facets. Gonapophyses 2.

**Embryo** (Fig. 510). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior
Figs. 503–512. Embryonic chaetotaxy and alata of *Chromaphis*. 503, right fore wing; 504, anal plate and gonapophyses; 505, left fore femur; 506, second and base of third antennal segments; 507, apical antennal segment; 508, apical rostral segment; 509, abdominal spiracle; 510, dorsal chaetotaxy of embryo; 511, left hind tarsus; 512, venter of head.
submedian seta and 1 anterior and 1 posterior lateral seta; prothoracic lateral tubercles absent; eyes present; triommatidium present; each side of abdomen with 1 submedian and 1 lateral seta on each segment; lateral setae long, capitate; submedian setae minute, capitate; siphunculus usually poriform; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Juglans* species.

**Biology.** The single species known in Canada is holocyclicly associated with its host and does not produce apterae.

**Comments.** The host association, the pale color, the absence of apterae and the truncate siphunculi are the chief distinguishing characters for this genus. *Monelliopsis* Richards is similar in many features and also occurs on *Juglans*. However, the siphunculus is poriform in *Monelliopsis*. Richards (1965) provided descriptions of the species.

**Genus Cinara Curtis**

Figs. 513–524

*Cinara* Curtis, 1835:576.
Type species: *Aphis pini* Linnaeus, 1758:453.

**Adult** (Figs. 513, 514). Length 2.5–8.0 mm.

Integument: Head and abdomen without obvious sculpturing; antennal segments V and VI with smooth and spiculose imbrications; femora, tibia, and tarsus with sculpturing; cauda and anal and genital plates with spicules.

Head (Fig. 524): Antennal tubercle undeveloped; front of head convex. Frontal ocellus generally situated slightly ventrad. Ventral margin of antennal socket not protuberant. Eye present in aptera and alata; triommatidium distinct or incorporated into eye in a few species. Discal setae mostly fine, hairlike, rarely short and inconspicuous, rather evenly covering disc. Antenna 6-segmented; processus terminalis short, conical, shorter than base of segment VI; primary sensoria (Fig. 519) without ciliate margins; secondary sensoria (Fig. 518) without ciliate margins, usually absent in aptera, present on segment III in alata and occasionally also on IV. Rostrum 5-segmented, with part of apical segment (Fig. 520) distad of subapical primary setae forming distinct articulated segment; segment IV elongate, subcylindrical; segment V narrow, pointed.
Thorax: Prothorax without lateral tubercles. Prothoracic setae without special arrangement, mostly fine, hairlike, occasionally minute, inconspicuous. Femora (Fig. 517) and tibiae with setae variable; tibial setae short, spinelike to long, fine, hairlike. Rastral setae, rastral spines, gland facets, and peglike setae, absent. Plantar setae minute, inconspicuous, pointed, or in some species absent. Basitarsi (Fig. 523) trapezoidal, with 7 or more ventral setae and rarely 1 dorsolateral seta. Claws simple. Fore wing (Fig. 515) with normal venation; radial sector short, straight, ending near apex of wing margin; media with 2 or 3 branches, evanescent basally; cubital veins narrowly separated, divergent.

Abdomen: Abdominal setae variable, fine, minute setulae or spinelike setae, or fine, hairlike setae, arranged in single, double, or several irregular transverse rows on each tergum. Abdominal terga usually not fused; spots or transverse dashes of pigment commonly on each tergum in the aptera fused in some species forming dorsal patches; segmental pigment absent in alata. Lateral tubercle absent. Lateral abdominal sclerites present or absent in aptera and alata. Dorsal abdominal tubercles absent. Spiracles (Fig. 521) subcircular, each with articulated operculum. Siphunculus short, nearly poriform, usually on pigmented setiferous, mammiform base, with apical flange. Abdominal tergum VIII entire. Cauda arc-shaped or semicircular. Anal plate (Fig. 516) entire. Abdominal gland facets absent. Gonapophyses 3.

Embryo (Fig. 522). Antenna 4-segmented; number of setae on each side of disc variable; each side of prothorax generally with lateral and submedian clusters of setae in variable numbers; prothoracic lateral and dorsal setae absent; eyes present; triommatidium present; each abdominal segment with 2 or more irregular transverse rows of setae; siphunculus usually evident, poriform; basitarsi ranging from triangular with 2 or 4 ventral setae to trapezoidal with more than 4 ventral setae, and without dorsal setae; distitarsi without preapical capitate setae; plantar setae short, setiform.

Economically important species. Cinara fornacula Hottes, Cinara laricis (Hartig), Cinara strobi (Fitch).

Range of plants infested in Canada. Species of Abies, Juniperus, Larix, Picea, Pinus, Pseudotsuga, Thuja, and Tsuga.

Biology. Most species are holocyclicly associated with their host plants, where they form colonies on the roots, trunks, branches, and cones and needle fascicles. Some species such as Cinara abieticola (Cholodkovsky) are monoeciously heterocyclic, forming the first colonies on the branches; but these soon migrate to the roots where substantial cloning sometimes takes place.
Figs. 513, 514. Aptera of Cinara. 513, head and prothorax; 514, terminal abdominal segments.
Figs. 515–524. Embryonic chaetotaxy and alata of Cinara. 515, right fore wing; 516, anal plate and gonapophyses; 517, left fore femur; 518, second and base of third antennal segments; 519, apical antennal segment; 520, apical rostral segment; 521, abdominal spiracle; 522, dorsal chaetotaxy of embryo; 523, left hind tarsus; 524, venter of head.
**Comments.** In addition to the restricted association with the conifers, recognition characters for this genus include the following: the 5-segmented rostrum; the short, flanged siphunculi and their large mammiform bases; the relatively large size; and the absence of marginal cilia on the primary sensoria. A catalog of the North American species is available (Voegtlin and Bridges 1988).

**Genus Colopha Monell**

Figs. 525–540

*Colopha* Monell, 1877:102.

Type species: *Byrsocrypta ulmicola* Fitch, 1859:843.

**Adult** (Figs. 525–528). Length 1.5–3.0 mm.

Integument: Apical 2 antennal segments with annuli of small spicules; head and thorax without evident sculpturing; weakly spiculose imbrications on abdomen in some species; tibiae with spicules; tarsi smooth in aptera, strongly spiculose in alata; cauda and anal and genital plates with some spicules.

Head (Fig. 540): Antennal tubercle undeveloped; front of head convex. Frontal ocellus on anteroventral surface of head. Ventral margin of antennal socket not protuberant. Eye absent in aptera; triommatidium distinct in both aptera and alata. Disc of head without dorsal tubercles. Discal suture absent or represented by faint line from frontal ocellus, but evanescent on anterior part of disc. Discal setae pointed, minute, inconspicuous; each side of disc with 2 anterior and 2 posterior setae. Circles of contiguous gland facets present in some species on disc in apterous-alate intermediates in galls, absent in alata, usually also in apterous alienicolae and fundatrix (Fig. 526). Antenna 5-segmented in aptera, 6-segmented in alata; processus terminalis short, conical, with apical cluster of setae; primary sensoria (Fig. 535) with ciliate margins, irregular in shape in alata, more or less circular in aptera; accessory sensoria generally fused especially in alata; secondary sensoria (Fig. 534) narrow annular in alata, without ciliate margins, present on segments III–IV, absent in aptera. Rostrum 4-segmented; apical segment (Fig. 536) subcylindrical, somewhat convergent distally; apex bluntly pointed distad of preapical primary setae. Rostrum vestigial in male and ovipara.

Thorax: Prothoracic lateral tubercles absent. Prothoracic setae pointed, minute; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1–4 anterior and 1–4 posterior submedian setae. Mesothorax in alata without median gland facets. Femora (Fig. 533) and tibiae with setae pointed; longest tibial setae shorter than apical diameter of respective tibia. Tibiae without rastral spines, rastral setae, peglike setae, or gland facets. Basitarsi triangular in alata (Fig. 539) with 2–3 ventral setae, without dorsal setae; in
aptera, tarsal segments (Fig. 530) partly or completely fused; distitarsi with capitate setae. Plantar setae acuminated. Claws simple. Fore wing (Fig. 531) with normal venation; media with 2 branches, with common stem evanescent toward base; cubital veins approximate at base, strongly divergent. Hind wing with one crossvein.

Abdomen: Abdominal segments not fused, without pigment in aptera and alata. Dorsal abdominal setae pointed, short, inconspicuous, arranged in single transverse row on each tergum. Lateral sclerites absent. Lateral and dorsal abdominal tubercles absent. Gland facets absent in abdomen of alata and usually in fundatrix; in apterous alienicolae (Fig. 527) most terga usually with circles of contiguous gland facets. Spiracles (Fig. 537) subcircular, or weakly reniform, and with anterior margins not produced as opercula. Siphunculus absent, or reduced to sclerotized ring when present. Abdominal tergum VIII entire. Cauda arc-shaped, minute, inconspicuous. Anal plate (Fig. 532) entire. Gonapophyses absent.

Embryo (Fig. 538). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; prothorax usually with a submedian and a lateral cluster of gland facets in circular arrangement; each cluster usually with a central boss; eyes absent, triommatidium present; each abdominal segment with 1 submedian, 1 dorsolateral, and 1 lateral seta; abdominal segments I–VII each with a submedian, dorsolateral, and lateral cluster of gland facets; each cluster commonly with a central boss; gland facets on abdominal segment VIII modified in some species into transparent tubercles; siphunculus poriform when present; basitarsi (Fig. 529) almost completely fused to apical segment each with 2 ventral setae, without dorsal setae; distitarsi elongate, with 4 preapical capitate setae; plantar setae capitate, long. Embryo of male and of ovipara lacking mouthparts.

Economically important species. None.

Range of plants infested in Canada. Ulmus spp.; grass roots.

Biology. The species in this genus are heterocyclic between Ulmus species and the roots of various grasses. On Ulmus, cockscomb galls are produced on the upper surfaces of the leaves, where the fundatrix gives rise to a winged generation that migrates to the roots of grasses. Apterae can overwinter on grass roots. Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

Figs. 525–530. Aptera, fundatrix, and embryonic characters of Colopha. 525, head and prothorax of apterous-alate intermediate; 526, head and prothorax of fundatrix; 527, apical abdominal segments of apterous alienicola; 528, apical abdominal segments of fundatrix; 529, left hind tarsus of embryo; 530, right hind tarsus of fundatrix.
Figs. 531–540. Embryonic chaetotaxy and alata of *Colopha*. 531, right fore wing; 532, anal plate and gonapophyses; 533, left fore femur; 534, second and base of third antennal segments; 535, apical antennal segment; 536, apical rostral segment; 537, abdominal spiracle; 538, dorsal chaetotaxy of embryo; 539, left hind tarsus; 540, venter of head.
Comments. Recognition characters for this genus include the characteristic galls on *Ulmus*, the annular secondary sensoria, and the spiculose tibiae in the alatae. In the apterous forms on grasses, the distinctive features are the partial fusion of the tarsal segments, absence of siphunculi, and presence of preapical capitate setae on the apical tarsal segment. *C. ulmicola* (Fitch) has been recorded from Canada.

**Genus *Coloradoa* Wilson**

Figs. 541–552

*Coloradoa* Wilson, 1910:323.
Type species: *Aphis rufomaculata* Wilson, 1908:261.

**Adult** (Figs. 541, 542). Length 1.0–2.5 mm.

Integument: Antennal segments with some smooth imbrications; head, thorax, and abdomen without obvious sculpturing other than some spiculose imbrications on terga VII and VIII; tibiae without spicules or imbrications; tarsi with smooth imbrications; siphunculus with smooth and weakly spiculose imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 552): Antennal tubercle undeveloped; front of head convex. Frontal ocellus situated on front of head. Discal setae pointed, blunt, capitate or flabellate; each side of disc with anterior and posterior group of 2 setae each. Eye present in alata and aptera; triommatidium distinct. Disc without dorsal tubercles, cephalic suture, or gland facets. Antenna 6-segmented; processus terminalis elongate without numerous setae; primary sensoria (Fig. 547) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 546) without ciliate margins, absent in aptera, present on segments III–V in alata. Rostrum 4-segmented; apical segment (Fig. 548) slender, conical, or with sides slightly concave; apex pointed distad of preapical primary setae.

Thorax: Prothoracic lateral tubercles absent or where present small, with diameters not much larger than diameter of setal socket. Each side of prothorax with or without 1 anterior dorsolateral and 1 anterior lateral seta, and with 1 posterior lateral seta and 1–3 posterior submedian setae. Femora (Fig. 545) with setae pointed; tibial setae mostly capitate or slightly flabellate dorsally, mostly pointed ventrally on apical half, with longest barely as long as apical diameter of respective tibia. Tibiae without rastral setae, rastral spines, gland facets, or peglike setae. Basitarsi (Fig. 551) triangular, with 3 ventral setae on fore and middle legs and 2 or 3 on hind leg, without dorsal setae; distitarsi elongate, without capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 543) with normal venation; media with 3 branches; cubital veins widely separated at base, weakly divergent.

247
Figs. 541, 542. Aptera of *Coloradoa*. 541, head and prothorax; 542, terminal abdominal segments.
Figs. 543–552. Embryonic chaetotaxy and alata of *Coloradoa*. 543, right fore wing; 544, anal plate and gonapophyses; 545, left fore femur; 546, second and base of third antennal segments; 547, base of apical antennal segment; 548, apical rostral segment; 549, abdominal spiracle; 550, dorsal chaetotaxy of embryo; 551, left hind tarsus; 552, venter of head.
Abdomen: Abdominal setae in some species pointed on anterior segments, but capitate, blunt or clavate on posterior segments, arranged in 1–2 irregular rows on each tergum. Abdominal segments not fused, without pigment anteriad of siphunculi in both aptera and alata. Lateral abdominal sclerites absent in aptera, usually evident in alata. Lateral abdominal tubercles present or absent. Spiracles (Fig. 549) subcircular, with anterior margins not produced as opercula. Siphunculus elongate, without setae, nearly cylindrical, usually slightly swollen on apical half, constricted proximad of well-developed flange. Abdominal tergum VIII entire. Cauda elongate, bluntly triangular. Anal plate (Fig. 544) entire. Abdomen without gland facets. Gonapophyses consisting of 4 setiferous papillae, with median pair somewhat difficult to separate.

Embryo (Fig. 550). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta, 1 anterior and 1 posterior submedian seta; prothorax without gland facets, lateral tubercles usually not evident; eyes present; triommatidium present; each abdominal segment with 1 submedian and 1 lateral seta, and with or without dorsolateral setae; abdomen without gland facets; siphunculus short, cylindrical; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminata.

Economically important species. Coloradoa rufomaculata (Wilson).

Range of plants infested in Canada. Artemisia and Chrysanthemum species.

Biology. All species are holocyclicly associated with their host plants.

Comments. Recognition characters for this genus include the following: the association with the Compositae; the elongate, slightly swollen siphunculi; and the presence of flabellate setae on at least the posterior abdominal segments of the apterae.

Genus Cornaphis Gillette

Figs. 553–564

Cornaphis Gillette, 1913:491.
Type species: Cornaphis populi Gillette, 1913:491.

Adult (Figs. 553, 554). Length 2.0–3.0 mm.
Integument: Head and body in both aptera and alata without obvious sculpturing; antenna with smooth and nodulose imbrications in alata, mostly smooth in aptera except for some anastomosing
spiculose and nodulose imbrications on segment VI; tibiae without spicules; tarsi with a few spicules ventrally in aptera, smooth or faintly scabrous in alata; cauda and anal and genital plates with ripplelike striae and with small inconspicuous spicules.

Head (Fig. 564): Antennal tubercle undeveloped; front of head convex in alata, with conical projection in aptera. Ventral margin of antennal socket not protuberant. Discal setae fine, pointed, hairlike, arranged in anterior and transverse posterior cluster with central part of disc nude. Eye present in alata, absent in aptera; triommatidium distinct in alata and aptera. Ventral and dorsal cephalic sutures absent; dorsal suture present in some specimens as pigmented line in alata. Disc without tubercles or gland facets. Antenna 6-segmented; primary sensoria (Fig. 559) with ciliate margins; accessory sensoria not fused; processus terminalis short, without setae except apical cluster; secondary sensoria (Fig. 558) absent in aptera, oval and restricted to apical part of segment III in alata, without ciliated margins. Rostrum 4-segmented; apical segment (Fig. 560) short, subconical, or with sides convexly rounded, bluntly pointed distad of preapical primary setae. Rostrum vestigial in male and ovipara.

Thorax: Prothoracic setae pointed, hairlike, scattered with no special arrangement. Head and prothorax fused in aptera. Prothorax without dorsal or lateral tubercles; each side with emarginated angular contiguous cluster of submedian and lateral gland facets in aptera, absent in alata. Femora (Fig. 557) and tibiae with setae pointed; tibial setae short, about half as long as apical diameter of respective tibia. Tibiae without peglike setae, rastral setae, rastral spines, or gland facets. Basitarsi (Fig. 563) triangular, each with 2 ventral setae, without dorsal setae. Plantar setae acuminated. Claws simple, not bifid. Fore wing (Fig. 555) with reduced venation; media with 1 branch, evanescent near base; cubital veins narrowly separated basally, strongly diverging.

Abdomen: Abdominal segments without dorsal and lateral pigment in both aptera and alata. Abdominal terga not fused. Lateral and dorsal abdominal tubercles absent. Spiracles (Fig. 561) subcircular, with sclerotic orifices, without opercula. Siphunculi absent. Abdominal tergum VIII entire. Cauda small, arc-shaped. Anal plate (Fig. 556) entire. Large circular emarginate clusters of contiguous gland facets present laterally on each abdominal segment in alata; aptera with single submedian row of similar gland facets, these present or absent in alata. Gonapophyses usually 4, with the 2 central clusters of setae situated on a common papilla, but with clusters of setae usually distinctly separated.

Embryo (Fig. 562). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta, without gland facets; lateral tubercles absent; eyes absent; triommatidium present; each abdominal segment with 1 submedian, 1 dorsolateral, and 1
Figs. 553, 554. Aptera of *Cornaphis*. 553, head and prothorax; 554, terminal abdominal segments.
Figs. 555–564. Embryonic chaetotaxy and alata of *Cornaphis*. 555, right fore wing; 556, anal plate and gonapophyses; 557, left fore femur; 558, second and base of third antennal segments; 559, apical antennal segment; 560, apical rostral segment; 561, abdominal spiracle; 562, dorsal chaetotaxy of embryo; 563, left hind tarsus; 564, venter of head.
lateral seta; clusters of gland facets always evident on at least posterior 3–4 segments; siphunculus not evident; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate without preapical capitate setae; plantar setae acuminated. Embryo of male and of ovipara lacking mouthparts.

**Economically important species.** None.

**Range of plants infested in Canada.** Not recorded in Canada, but probably occurs on *Populus angustifolia* James in Alberta and Saskatchewan.

**Biology.** The single known species is monoeciously associated with its host plant where it produces a podlike pseudogall formed from the folded margin of the leaf. The life cycle is short, and sexuales are produced by mid summer. Sexuales are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

**Comments.** Recognition characters for this genus include the association with *Populus*, and the process on the front of the head, which is especially evident in the apterae.

**Genus Cryptaphis** Hille Ris Lambers

Figs. 565–577

*Cryptaphis* Hille Ris Lambers, 1947:296.

Type species: *Cryptaphis setiger* Hille Ris Lambers, 1947:298 = *Aphis poae* Hardy, 1850:788.

**Adult** (Figs. 565, 567). Length 1.0–2.5 mm.

Integument: Antenna with smooth imbrications; head without sculpturing other than a few spicules ventrally especially in aptera; thorax without sculpturing dorsally, with some spicules ventrally in aptera; abdomen without sculpturing other than spiculose imbrications on terga VII and VIII; tibiae without spicules or imbrications; tarsi with smooth imbrications; cauda and anal and genital plates with some spicules.

Head (Fig. 577): Antennal tubercle well-developed; front of head U-shaped. Frontal ocellus on anteroventral margin of head. Ventral margin of antennal socket (Fig. 566) strongly protuberant, with swelling not scabrous but weakly spiculose in some species. Eye present in alata and aptera; triommatidium distinct. Disc without dorsal tubercles, gland facets, or cephalid suture. Discal setae conspicuous, long, capitate, arranged on each side in anterior group of 2 and posterior group of 2 or 3. Antenna 6-segmented; processus terminalis elongate, slender, without numerous setae; primary sensoria (Fig. 572) with ciliate margins; accessory sensoria absent or
Figs. 565–567. Aptera of *Cryptaphis*. 565, head and prothorax; 566, ventral margin of antennal socket; 567, terminal abdominal segments.
Figs. 568–577. Embryonic chaetotaxy and alata of Cryptaphis. 568, right fore wing; 569, anal plate and gonapophyses; 570, left fore femur; 571, second and base of third antennal segments; 572, base of apical antennal segment; 573, apical rostral segment; 574, abdominal spiracle; 575, dorsal chaetotaxy of embryo; 576, left hind tarsus; 577, venter of head.
not fused when present; secondary sensoria (Fig. 571) with or without ciliate margins, usually present on segment III in aptera, always present on this segment in alata. Rostrum 4-segmented; apical segment (Fig. 573) conical, rounded beyond apical setae.

Thorax: Head and prothorax with 1 anterior and 1 posterior lateral seta and 1–3 posterior submedian setae. Femora (Fig. 570) and tibiae with setae mostly capitate dorsally, mostly pointed ventrally, longest about as long as apical diameter of respective tibia. Basitarsi (Fig. 576) triangular with 3 ventral setae, without dorsal setae; distitarsi without capitate setae. Rastral setae, rastral spines, peglike setae, and gland facets absent from tibia. Plantar setae acuminat. Claws simple. Fore wing (Fig. 568) with normal venation; media with 3 branches; cubital veins separated basally, slightly divergent.

Abdomen: Abdominal terga fused together and to lateral sclerites forming carapace in aptera; carapace pale brown; abdominal segments not fused in alata; each tergum with irregular patches of pigment, some partially or completely fused. Dorsal and lateral abdominal setae long, capitate, conspicuous, arranged in 1 or 2 irregular transverse rows on each tergum. Lateral abdominal sclerites present, free in alata, fused with abdominal carapace in aptera. Spiracles (Fig. 574) subcircular, with anterior margin of each produced as operculum. Siphunculus elongate, without setae, nearly cylindrical, wider at base than apex, with apical flange, sparsely spiculose at least at base. Abdominal tergum VIII entire. Cauda elongate triangular; apex bluntly rounded. Anal plate (Fig. 569) bluntly triangular. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 575). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; without gland facets or lateral tubercles; eyes present; trionmatidium present; each side of each abdominal segment with 1 submedian and 1 lateral seta, usually also with 1 dorsolateral seta; gland facets and lateral tubercles absent; siphunculus when evident, short, cylindrical; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminat.

Economically important species. None.

Range of plants infested in Canada. Bromus species. Probably occurs on other grasses.

Biology. Holocyclicly associated with the host plant, forming colonies at or below the surface of the soil.

Comments. Recognition characters for this genus include the following: the association with grasses; the long, conspicuous, capitate setae in the apterae; and the presence of a swelling on the ventral margin of the antennal socket.
Genus Cryptomyzus Oestlund

Figs. 21, 578–590

Cryptomyzus Oestlund, 1922:139
Type species: Aphis ribis Linnaeus, 1758:451.

Adult (Figs. 578, 580). Length 1.0–2.5 mm.
Integument: Antennal segments with some smooth imbrications; head, thorax, and abdomen without obvious sculpturing other than some imbrications on abdominal terga VI–VIII; tibiae without spicules or imbrications; tarsi with smooth imbrications; cauda and anal and genital plates with some spicules.

Head (Fig. 590): Antennal tubercle well-developed; front of head U-shaped, with median tubercle fairly prominent. Ventral margin of antennal socket (Fig. 579) protuberant in aptera, less evident in alata. Discal setae long, conspicuous, capitate in aptera, short, blunt or capitate in alata; each side of disc with 2 anterior and 2 posterior setae. Eye present in alata and aptera; triommatidium distinct. Disc without dorsal tubercles, gland facets, or cephalic suture. Antenna 6-segmented; inner margin of segment I usually protuberant; processus terminalis elongate, slender, practically without setae other than usual apical cluster; primary sensoria (Fig. 585) usually with ciliate margins; in some species ciliate margins weakly developed, appearing absent; accessory sensoria without ciliate margins; secondary sensoria (Fig. 584) without ciliate margins, present or absent on antennal III in aptera, present on segments III–V in alata. Rostrum 4-segmented; apical segment (Fig. 586) conical, rounded distad of preapical primary setae.

Thorax: Femora (Fig. 583) with setae pointed; tibial setae mostly capitate or blunt dorsally, mostly pointed ventrally, with longest about as long as apical diameter of respective tibia. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 589) triangular, with 3 ventral setae on fore and middle tarsi and 2 or 3 on hind tarsus, without dorsal setae; distitarsi elongate, without capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 581) with normal venation; media with 3 branches; cubital veins widely separated basally, divergent.

Abdomen: Abdominal setae long, capitate, conspicuous in aptera, short, inconspicuous in alata, and in some species blunt as well as capitate. Abdomen without dorsal pigment in aptera, with central quadrate dorsal patch in alata. Abdomen without dorsal tubercles. Lateral sclerites absent in aptera, present in alata, but commonly weakly pigmented. Spiracles (Fig. 587) subcircular, without opercula. Lateral abdominal tubercles mostly absent, but in some species small ones present on segments II and VII. Siphunculus elongate, cylindrical, without setae, with or without apical flange, mostly smooth, but with some wrinkles or smooth imbrications basally. Abdominal tergum VIII entire. Cauda broadly triangular; apex
Figs. 578–580. Aptera of *Cryptomyzus*. 578, head and prothorax; 579, ventral margin of antennal socket; 580, terminal abdominal segments.
Figs. 581–590. Embryonic chaetotaxy and alata of Cryptomyzus. 581, right fore wing; 582, anal plate and gonapophyses; 583, left fore femur; 584, second and base of third antennal segments; 585, base of apical antennal segment; 586, apical rostral segment; 587, abdominal spiracle; 588, dorsal chaetotaxy of embryo; 589, left hind tarsus; 590, venter of head.
broadly rounded. Anal plate (Fig. 582) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 588). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta, without gland facets or lateral tubercles; eyes present; triommatidium present; each abdominal segment with 1 lateral, 1 submedian, and usually 1 dorsolateral seta; gland facets and lateral abdominal tubercles absent; siphunculus when evident short, cylindrical; basitarsi each triangular, with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** Ribes and Leonurus species. Probably feeds on other species of Labiatae.

**Biology.** The species in this genus are heterocyclic between Ribes species and various Labiatae, such as species of *Ballota, Galeopsis, Glechoma, Lamium*, and *Leonurus*. On Ribes the insects feed on the undersurfaces of leaves, and the leaves react by producing small, reddish or yellowish, blisterlike swellings dorsally (Fig. 21).

**Comments.** Recognition characters for this genus include the association with *Ribes* and the Labiatae, the presence of capitate setae, and the presence of a quadruple patch in the middle of the abdomen of the alatae.

**Genus Ctenocallis Klodnitzki**

Figs. 591–602

*Ctenocallis* Klodnitzki, 1924:61.  
Type species: *Ctenocallis dobrovljanskyi* Klodnitzki, 1924:61.

**Adult** (Figs. 591, 592). Length 1.0–2.0 mm.

Integument: Antenna with spiculose imbrications; head and body rugose; tibiae, tarsi, cauda, and anal and genital plates with spicules.

Head (Fig. 602): Antennal tubercle undeveloped; front of head convex when viewed from above. Ventral margin of antennal socket not protuberant. Eye present in alata and aptera; triommatidium distinct. Disc of head without tubercles; setae arranged on each side in anterior and posterior group of 2 setae each, with anterior ones on distinct processes, and with posterior ones also on processes in some specimens. Disc without cephalic suture or gland facets. Antenna 6-segmented; processus terminalis short, without setae other than apical cluster; primary sensoria (Fig. 597) with ciliate margins; secondary sensoria (Fig. 596) present only on segment III of alata,
Figs. 591, 592. Aptera of Ctenocallis. 591, head and prothorax; 592, terminal abdominal segments.
Figs. 593–602. Embryonic chaetotaxy and alata of *Ctenocallis*. 593, right fore wing; 594, anal plate and gonapophyses; 595, left fore femur; 596, second and base of third antennal segments; 597, primary sensoria on apical antennal segment; 598, apical rostral segment; 599, abdominal spiracle; 600, dorsal chaetotaxy of embryo; 601, left hind tarsus; 602, venter of head.
without ciliate margins, but surrounded by more or less complete circle of spicules. Rostrum 4-segmented; apical segment (Fig. 598), short, subconical, rounded distad of preapical primary setae.

Thorax: Prothorax without lateral tubercles. Prothorax with 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta on each side; posterior lateral seta on fingerlike process in aptera; posterior submedian seta on a rounded protuberance in both aptera and alata. Femora (Fig. 595) and tibiae with setae pointed; tibial setae shorter than apical diameter of respective tibia. Rastral setae present in alata, absent in aptera; rastral spines, gland facets, and peglike setae absent. Plantar setae (Fig. 601) spatulate. Claws simple. Fore wing (Fig. 593) with normal venation; media with 3 branches; cubital veins widely separated at base, somewhat divergent to nearly parallel.

Abdomen: Abdominal setae short, inconspicuous, in single lateral and single submedian row on each side; each seta situated on short or long slender conical process in both aptera and alata. Abdominal segments not fused; each tergum pale centrally with broad transverse lateral bands of pigment fused with lateral sclerites in aptera, but not in alata. Lateral abdominal tubercles absent. Dorsal abdominal tubercles absent. Spiracles (Fig. 599) small, subcircular, without opercula. Siphunculus poriform, inconspicuous. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 594) bilobate in vivipara; entire in ovipara. Abdomen without gland facets. Gonapophyses 2 or 4.

**Embryo** (Fig. 600). Antenna 4-segmented; each side of head with 4 setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta; prothoracic lateral tubercles absent; eyes present; triommatidium present; each side of each abdominal segment with 1 submedian and 1 lateral seta; abdomen without gland facets or lateral tubercles; siphunculus usually not evident, poriform when evident; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.

**Economically important species.** None.

**Range of host plants infested in Canada.** *Cytisus* species.

**Biology.** The single species in Canada is holocyclicly associated with its host plant.

**Comments.** This genus is characterized by its association with *Cytisus*, and the presence of fingerlike protuberances, especially in the apterae. The single species occurs in British Columbia where it was introduced from Europe with its host plant. The species was redescribed by Richards (1965).
Genus *Decorosiphon* Börner

*Figs. 603–616*

*Decorosiphon* Börner, 1939:78.
Type species: *Decorosiphon corynothrix* Börner, 1939:78.

**Adult** (Figs. 603, 605). Length 1.5–3.0 mm.

**Integument:** Antenna with distinct imbrications on segments IV–VI in aptera, on segments V and VI in alata; head and body with conspicuous nodules and imbrications in aptera, without obvious sculpturing in alata other than some spiculose imbrications; cauda and anal and genital plates with spicules; apex of cauda with spicules reduced (Fig. 606).

**Head** (Fig. 616): Antennal tubercle fairly well developed; front of head distinctly concave. Ventral margin of antennal socket (Fig. 604) swollen, scabrous, protuberant in aptera, with swelling smooth and less evident in alata. Discal setae arranged on each side in anterior group of 2 and transverse posterior group of 2 or 3 setae, shorter than those on antennal tubercle, blunt or capitate in aptera, pointed in alata. Eye present in alata and aptera; triommatidium distinct. Disc of head without gland facets, cephalic suture, or tubercles. Antenna 6-segmented; setae long, pointed in alata, many capitate in aptera; primary sensoria (Fig. 611) with ciliate margins; accessory sensoria not fused; processus terminalis long, slender, with 1 or 2 minute setae in addition to apical cluster; secondary sensoria (Fig. 610) on segments III–V in alata, without ciliate margins, absent in aptera. Rostrum 4-segmented; apical segment (Fig. 612) nearly cylindrical, bluntly pointed distad of preapical primary setae.

**Thorax:** Prothorax with minute inconspicuous lateral tubercles. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Femora (Fig. 609) and tibiae with setae pointed; tibial setae much longer than apical diameter of respective tibia, pointed in alata, many of them faintly capitate in aptera. Tibiae without peglike setae, rastral spines, rastral setae, or gland facets. Basitarsi (Fig. 615) triangular, each with 3 ventral setae; distitarsi elongate, without capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 607) with normal venation; media with 3 branches; cubital veins separate at base, divergent.

**Abdomen:** Dorsal abdominal setae pointed in alata, pointed and weakly capitate in aptera, arranged in single transverse row on each tergum. Abdomen in aptera without pigmentation, in alata with pigmented lateral sclerites and a large central pigmented patch. Lateral tubercles absent. Spiracles (Fig. 613) reniform, without opercula. Siphunculus elongate, clavate, with conspicuous imbrications at least apically, without setae, with apical flange. Abdominal tergum VIII entire. Cauda (Figs. 605, 606) triangular, with apical half narrower, bluntly rounded. Anal plate (Fig. 608) entire. Abdomen without gland facets. Gonapophyses 3.
Figs. 603–606. Aptera of *Decorosiphon*. 603, head and prothorax; 604, ventral margin of antennal socket; 605, terminal abdominal segments; 606, apex of cauda.
Figs. 607-616. Embryonic chaetotaxy and alata of *Decorosiphon*. 607, right fore wing; 608, anal plate and gonapophyses; 609, left fore femur; 610, second and base of third antennal segments; 611, base of apical antennal segment; 612, apical rostral segment; 613, abdominal spiracle; 614, dorsal chaetotaxy of embryo; 615, left hind tarsus; 616, venter of head.
**Embryo** (Fig. 614). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 submedian, 1 anterior lateral, and 1 posterior seta; prothoracic lateral tubercles not evident; eyes present; triommatidium present; each side of abdominal segments with 1 submedian and 1 lateral seta; segments I–VI each usually with 1 dorsolateral seta; siphunculus short, roughly cylindrical where visible; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Polytrichum* species.

**Biology.** Nothing is known of the habits of the only known species in this genus, other than it is holocyclicly associated with its host.

**Comments.** In addition to the association with *Polytrichum*, recognition of this genus is aided by the clavate, heavily sculptured siphunculi; the long antennal setae in both the apterae and the alatae; and the strong dorsal sculpturing in the apterae.

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**Genus *Diphyllaphis* Takahashi**

Figs. 617–631


Type species: *Phloeomyzus honarae* Shinji, 1924:370.

**Adult** (Figs. 617, 620). Length 1.5–3.0 mm.

Integument: Antenna with spiculose imbrications; head and body without obvious sculpturing; tibiae without spiracles; tarsi with spiculose imbrications; cauda almost unsculptured except for cribiform discs and a few spicules; genital plate with some spicules.

Head (Fig. 631): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae arranged in anterior and posterior group of 2 setae each. Eye present in alata and aptera; modified triommatidium present, usually consisting of 4 or 5 facets (Fig. 618). Disc of head without tubercles. Cephalic suture visible in some species in aptera, absent in alata. Disc of head with anterior and posterior cluster of cribiform discs (Fig. 619) on each side. Antenna 5- or 6-segmented in aptera, 6-segmented in alata; processus terminalis short; primary sensoria (Fig. 627) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 626) circular, with ciliate margins, present in alata on segments III–IV; segment II with an apical ventroposterior sensory structure. Rostrum 4-segmented; apical segment (Fig. 628) conical, bluntly rounded distad of preapical primary setae.
Figs. 617-622. Aptera of *Diphyllaphis*. 617, head and prothorax; 618, divided left eye; 619, wax gland facets of disc; 620, terminal abdominal segments; 621, wax gland facets of apex of abdomen; 622, right hind tarsus and apex of tibia.
Thorax: Prothorax without lateral tubercles. Prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta on each side. Femora (Fig. 625) and tibiae with setae pointed; longest tibial setae shorter than apical diameter of respective tibia. Tibiae with small rastral setae, without peglike setae, gland facets, and rastral spines. Basitarsi (Figs. 622, 630) triangular, with 2 or 3 ventral setae, without dorsal setae; distitarsi elongate, without capitate setae. Plantar setae spinate. Claws simple. Fore wing (Fig. 623) with normal venation; media with 2 or 3 branches; cubital veins separated at base, divergent.

Abdomen: Abdominal setae short, inconspicuous, pointed, not numerous, arranged in single transverse row on each tergum. Dorsal and lateral abdominal tubercles absent. Dorsum of abdomen without pigment except around gland facets. Abdominal segments not fused. Lateral sclerites absent in aptera, pigmented to some degree in alata. Spiracles (Fig. 629) minute, subcircular, without opercula. Siphunculus reduced to small pore with diameter nearly that of a spiracle, without setae. Abdominal tergum VIII entire. Cauda much reduced, arc-shaped. Anal plate (Fig. 624) entire. Abdomen with clusters of cribiform plates (Fig. 621) around lateral and dorsal setae. Gonapophyses 2.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. None known as yet, but *Diphyllaphis microtrema* Quednau is known to inhabit *Quercus rubra* L. in the northeastern United States.

Biology. Unknown apart from its holocyclical association with *Quercus* species. Colonies are heavily flocculent.

Comments. The main recognition characters for this genus are the association with *Quercus*, the rounded cauda, the dorsal and lateral cribiform discs, the flocculent colonies, and the poriform siphunculus.

Genus *Diuraphis* Aizenberg

Figs. 632–642


Type species: *Brachycolus noxius* Kurdjumov, 1913.
**Adult** (Figs. 632, 633). Length 1.0–2.25 mm.

Integument: Antenna with smooth imbrications; head and body without obvious sculpturing other than a few spiculose imbrications on apical abdominal segments; tibiae especially in alata commonly with a few preapical rounded nodules; tarsi smooth or with smooth imbrications; imbrications in some species with a few rounded nodules; cauda and anal and genital plates with spicules.

Head (Fig. 642): Antennal tubercle undeveloped or weakly developed. Ventral margin of antennal socket not protuberant. Eye present in alata and aptera; triommatidium distinct. Ventral and dorsal cephalic sutures absent. Disc of head without tubercles or gland facets. Discal setae blunt or weakly capitate in aptera, usually pointed in alata, arranged on each side in anterior and posterior group of 2 or 3 each. Antenna 6-segmented; processus terminalis elongate, as long or longer than base of VI; primary sensoria (Fig. 641) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 637) circular, without ciliate margins, present on segment III and in some species on IV of alata, usually absent in aptera. Rostrum 4-segmented; apical segment (Fig. 638) short, cylindrical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae blunt or weakly capitate in aptera, usually pointed in alata; each side of prothorax with 1–3 posterior submedian setae, 1 or 2 anterior lateral setae, and 1 posterior lateral seta. Prothorax with or without lateral tubercle on each side. Femora (Fig. 636) with setae pointed; tibial setae usually blunt or weakly capitate basally, pointed apically, fairly short, longest not much longer than apical diameter of respective tibia. Tibiae without gland facets, peglike setae, rastral spines, or rastral setae. Basitarsi (Fig. 640) triangular, with 3 ventral setae on fore and middle legs and 2 or 3 on hind leg, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Claws simple. Fore wing (Fig. 634) with normal venation; media with 3 branches; cubital veins widely separated basally, somewhat divergent.

Abdomen: Abdominal setae short, blunt or weakly capitate in aptera, usually pointed in alata arranged in single transverse row on each tergum. Abdominal terga not fused, without pigment. Lateral sclerites absent. Lateral abdominal tubercles usually absent, occasionally present on 1 or 2 segments. Spiracles (Fig. 639) subcircular, with sclerotized rims. Siphunculus short, inconspicuous, without setae, without apical flange, usually with a few spicules. Abdominal tergum VIII entire, in some species with median fingerlike tubercle. Cauda triangular. Anal plate (Fig. 635) entire. Abdomen without gland facets. Gonapophyses 3.

Figs. 632, 633. Aptera of *Diuraphis*. 632, head and prothorax; 633, terminal abdominal segments.
Figs. 634–642. Alata of *Diuraphis*. 634, right fore wing; 635, anal plate and gonapophyses; 636, left fore femur; 637, second and base of third antennal segments; 638, apical rostral segment; 639, abdominal spiracle; 640, left hind tarsus; 641, base of apical antennal segment; 642, venter of head.
Embryo. Not observed.

Economically important species. The Russian wheat aphid, Diuraphis noxia (Kurdjumov), has become a pest of cereals in the Prairie Provinces (Jones et al. 1989).

Range of plants infested in Canada. Gramineae.

Biology. This genus is holocyclicly or anholocycly associated with the host plant. Colonies are usually found in the rolled, developing leaves of the grasses.

Comments. The main recognition characters for this genus include the short siphunculi, the association with grasses, the 6-segmented antennae, the absence of gland facets, the unknobbed cauda, and the unlobed anal plate. Holcaphis Hille Ris Lambers is included as a subgenus.

Genus Drepanaphis Del Guercio

Figs. 643–654

Drepanaphis Del Guercio, 1909c:49.
Type species: Siphonophora acerifolii Thomas, 1878:12.

Adult (Figs. 643, 644). Length 1.5–3.0 mm.

Integument: Antenna with some smooth imbrications at least apically; head and body without obvious sculpturing other than some spiculose imbrications on apical abdominal segments; tibiae with spicules at least apically; tarsi with spicules; cauda and anal and genital plates spiculose.

Head (Fig. 654): Antennal tubercle developed; front of head concave. Ventral margin of antennal socket not protuberant. Discal setae arranged in anterior and posterior group of 2 on each side. Eye present in alata and aptera; triommatidium distinct. Anteroventral sutures and cephalic suture absent. Disc of head without dorsal tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 649) with ciliate margins; accessory sensoria of segment VI only loosely aggregated, forming an irregular row; secondary sensoria (Fig. 648) with ciliate margins, present on antennal segment III only. Rostrum 4-segmented; apical segment (Fig. 650) subcylindrical, rounded distad of preapical primary setae.

Thorax: Prothorax without lateral tubercles. Each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Femora (Fig. 647) with setae pointed; tibial setae commonly blunt or capitate dorsally and basally, pointed elsewhere, longest not, or barely longer than apical diameter of respective tibia. Fore femur flared apically. Tibiae without peglike
setae, gland facets, or rastral setae. Rastral spines present. Basitarsi (Fig. 653) with 5 or 6 ventral and 2 dorsal setae; distitarsi elongate, without capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 645) with normal venation; cubital veins widely separated, divergent.

Abdomen: Abdominal setae arranged in single irregular transverse row on each tergum, commonly present as submedian and dorsolateral and lateral setae; submedian setae on segments I–IV or VI commonly on conspicuous fingerlike or conical commonly pigmented papillae. Lateral abdominal sclerites commonly present, pigmented. Lateral abdominal tubercles absent. Spiracles (Fig. 651) subcircular, without opercula. Siphunculus more or less vasiform, wider at base than at apex, without setae, with apical flange, not fused with lateral sclerite of abdominal segment VI. Abdominal tergum VIII entire. Cauda (Fig. 646) knobbed. Anal plate somewhat bilobate. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 652). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; eyes present; triommatidium present; each side of each abdominal segment with 1 submedian and 1 lateral seta; segments I–V or VI usually also with 1 dorsolateral seta; lateral abdominal tubercles not evident; siphunculus short, almost poriform when evident; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae spatulate.

Economically important species. None.

Range of plants infested in Canada. Acer species.

Biology. All species are holocyclicly associated with the host plant, where they feed on the under surfaces of the leaves. Apterae viviparae are not produced. Although gland facets are not visible, one species, Drepanaphis kansensis Smith, is heavily coated with a white, flocculent wax when alive. Individuals of all species are saltatorial.

Comments. The association with Acer, the apically flared fore tibiae, the absence of apterae, the presence of large papillae on the dorsum of the abdomen, and the presence of rastral spines provide the best means of recognition for this genus. Smith and Dillery (1968) provided a key to, and descriptions of, the species.

Figs. 643, 644. Alata of Drepanaphis. 643, head and prothorax; 644, terminal abdominal segments.
Genus *Drepanosiphum* Koch

*Drepanosiphum* Koch, 1855:201.
Type species: *Aphis platanoides* Schrank, 1801:112.

**Adult** (Figs. 655, 656). Length 2.5–4.0 mm.
Integument: Antennal segments with smooth imbrications at least apically; head and body without sculpturing other than a few weakly formed spicular imbrications posteriorly on abdomen; tibiae spiculo; tarsi with spicules; cauda and anal and genital plates with some spicules.

Head (Fig. 666): Antennal tubercle well-developed; front of head concave. Ventral margin of antennal socket not protuberant. Discal setae arranged in anterior and posterior group of 2 on each side. Eye present in alata and aptera; trichomatidium distinct. Head without cephalic and ventral sutures or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 661) with ciliate margins; segment VI with 3 primary sensoria; accessory sensoria not fused; secondary sensoria (Fig. 660) oval, with ciliate margins, restricted to segment III. Rostrum 4-segmented; apical segment (Fig. 662) subconical, rounded distad of preapical primary setae.

Thorax: Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta on each side. Prothorax without lateral or dorsal tubercles. Femora (Fig. 659) and tibia with setae pointed; longest tibial setae about as long as apical diameter of antennal segment III. Tibiae with rastral spines, without peglike setae or gland facets. Fore tibia flared apically. Basitarsi (Fig. 665) with 5 or 6 ventral and 2 dorsal setae; distitarsi elongate, without capitate setae. Claws simple. Plantar setae spatulate. Fore wing (Fig. 657) with normal venation; media with 3 branches; cubital veins widely separated, divergent.

Abdomen: Abdominal setae arranged in single transverse row on each tergum. Abdominal terga not fused, with or without pigment on some segments, in some species with quadrate patch just anteriad of siphunculi. Lateral abdominal sclerites present or absent, in some species only pigmented on segments anteriad of siphunculus. Abdomen without dorsal or lateral tubercles. Spiracles (Fig. 663) subcircular, without opercula. Siphunculus long, conspicuous, nearly cylindrical but with diameter in middle usually greater than diameter at base and at apex, with apical flange, without setae, nearly smooth

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Figs. 645–654. Embryonic chaetotaxy and alata of *Drepanaphis*. 645, right fore wing; 646, anal plate and gonapophyses; 647, left fore femur; 648, second and base of third antennal segments; 649, primary sensoria on apical antennal segment; 650, apical rostral segment; 651, abdominal spiracle; 652, dorsal chaetotaxy of embryo; 653, left hind tarsus; 654, venter of head.

279
Figs. 655, 656. Alata of *Drepanosiphum*. 655, head and prothorax; 656, terminal abdominal segments.
or with transverse striae and dispersed spicules. Abdominal tergum VIII entire. Cauda (Fig. 658) knobbed. Anal plate somewhat bilobate. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 664). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; eyes present; triommatidium present; each side of each abdominal segment with 1 lateral and 1 submedian seta and usually 1 shorter dorsolateral seta on segments I–V or VI; lateral abdominal tubercles not evident; siphunculus short, poriform or nearly so; basitarsi with 2 ventral setae, without dorsal setae; distitarsi elongate, with 2 or 3 preapical capitate setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** Imported species of *Acer*.

**Biology.** All species are holocyclicly associated with maples where they feed on the undersurfaces of the leaves. Apterae viviparae are not produced. Individuals are saltatorial.

**Comments.** Recognition characters for this genus include the association with *Acer*, the apically flared fore tibiae, the long tubular siphunculi, the presence of rastral spines, the absence of dorsal papillae, and the absence of apterae.
Genus *Dysaphis* Börner

Figs. 19, 667–679

*Dysaphis* Börner, 1931:9.
Type species: *Aphis angelicae* Koch, 1854:52.

**Adult** (Figs. 667, 669). Length 1.5–3.0 mm.
Integument: Antenna with some smooth imbrications; head and body without obvious sculpturing other than some weakly spiculose imbrications; tibiae without sculpturing; tarsi with smooth imbrications. Cauda and anal and genital plates spiculose.

Head (Fig. 679): Antennal tubercle weakly developed; front of head convex. Ventral margins of antennal socket (Fig. 668) protuberant. Each side of disc with 2–4 anterior and 2–4 posterior setae. Eye present in alata and aptera; trionmatidium distinct. Cephalic and ventral sutures absent. Disc of head with or without dorsal tubercles. Head without discal gland facets. Antenna normally 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 674) with ciliate or fimbriate margins; accessory sensoria not fused; secondary sensoria (Fig. 673) without ciliate margins normally absent in aptera, present on segments III–V in alata. Rostrum 4-segmented; apical segment (Fig. 675) elongate, conical, rounded distad of preapical primary setae.

Thorax: Prothorax with lateral tubercles and commonly with dorsal tubercles. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1–5 posterior submedian setae. Femora (Fig. 672) and tibiae with setae pointed; tibial setae variable in length, with longest about as long as apical diameter of respective tibia. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Plantar setae acuminate. Claws simple. Basitarsi (Fig. 678) each with 2 or 3 ventral setae, without dorsal setae; distitarsi without capitate setae. Fore wing (Fig. 670) with normal venation; media with 3 branches; cubital veins separated basally, divergent.

Abdomen: Abdominal setae pointed or blunt, arranged in 1 or 2 irregular rows on each tergum. Abdominal terga not fused in aptera; aptera usually with some pigment on posterior 3 or 4 terga; alata with large patch of pigment covering terga 2–7 depending on species. Lateral abdominal tubercles present; dorsal abdominal tubercles usually present on at least abdominal tergum VIII. Abdomen without gland facets. Spiracles (Fig. 676) subcircular, without opercula. Laterai sclerites absent in aptera, present in alata. Siphunculus

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Figs. 657–666. Embryonic chaetotaxy and alata of *Drepanosiphum*. 657, right fore wing; 658, anal plate and gonapophyses; 659, left fore femur; 660, second and base of third antennal segments; 661, base of apical antennal segment; 662, apical rostral segment; 663, abdominal spiracle; 664, dorsal chaetotaxy of embryo; 665, left hind tarsus; 666, venter of head.
Figs. 667–669. Aptera of *Dysaphis*. 667, head and prothorax; 668, ventral margin of antennal socket; 669, terminal abdominal segments.
Figs. 670–679. Embryonic chaetotaxy and alata of *Dysaphis*. 670, right fore wing; 671, anal plate and gonapophyses; 672, left fore femur; 673, second and base of third antennal segments; 674, base of apical antennal segment; 675, apical rostral segment; 676, abdominal spiracle; 677, dorsal chaetotaxy of embryo; 678, left hind tarsus; 679, venter of head.
elongate, slightly swollen in some species, without setae, with apical flange, covered with weakly to strongly spiculose imbrications. Abdominal tergum VIII entire. Cauda triangular, shorter than siphunculus; apex rounded or distinctly bluntly pointed. Anal plate (Fig. 671) entire. Gonapophyses 3.

**Embryo** (Fig. 677). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; eyes present; triommatidium present; prothorax with or without lateral tubercles; each abdominal segment with 1 lateral and 1 submedian seta and usually 1 dorsolateral seta on each side; lateral tubercles commonly present on abdominal segments II–V; siphunculus short, cylindrical; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Dysaphis plantaginea* (Passerini).

**Range of plants infested in Canada.** Species of *Crataegus, Daucus, Malus, Plantago, Pyrus, and Tulipa.*

**Biology.** Most of the members of this genus are heterocyclic between various Pomoidea (*Crataegus, Pyrus, and Sorbus*), where they form pseudogalls of leaves (Fig. 19), and various herbaceous plants, particularly the Umbelliferae. Some species are holocyclic on the Pomoidea; *D. tulipae* (Boyer de Fonscolombe) is perhaps anholocyclic on liliaceous plants.

**Comments.** The short cauda, the spiculose and imbricately sculptured siphunculi, and the pigmented abdomen of the alatae with dorsal tubercles on tergum VIII are the best means of recognizing this genus. In Canada the association with the Pomoidea, *Plantago,* and *Daucus* is also distinctive.

This genus has many species in Europe; the few species known in Canada are all introduced. Our most common species are placed in subgenus *Pomaphis* Börner.

**Genus Elatobium** Mordvilko

Figs. 680–692

*Elatobium* Mordvilko, 1914:72.
Type species: *Aphis abietina* Walker, 1849a:301.

**Adult** (Figs. 680, 682). Length 1.0–2.5 mm.

Integument: Antenna with smooth imbrications; head and body without obvious sculpturing other than some spiculose imbrications on abdominal terga VII and VIII; tibiae without sculpturing; tarsi
with smooth imbrications. Cauda and genital and anal plates spiculose.

Head (Fig. 692): Antennal tubercle moderately well developed. Median tubercle developed or not. Ventral margin of antennal socket (Fig. 681) protuberant. Each side of disc with 2 anterior and 2 posterior setae. Eye present in aptera and alata; triommatidium distinct. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis only slightly longer than base of segment VI, without numerous setae; primary sensoria (Fig. 687) with ciliate margins; secondary sensoria (Fig. 686) present on segments III and IV of alata, without ciliate margins; accessory sensoria not fused. Rostrum 4-segmented; apical segment (Fig. 688) subconical to subcylindrical, blunt distad of preapical primary setae.

Thorax: Prothorax without lateral tubercles or gland facets. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta. Femora (Fig. 685) with setae pointed; tibial setae mostly pointed, with some short blunt ones basally. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 691) with 3 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae. Plantar setae acuminated. Claws simple. Fore wing (Fig. 683) with normal venation; media with 3 branches; cubital veins widely separated at base, divergent.

Abdomen: Abdominal setae short, mostly blunt, in some specimens pointed on abdominal segment VIII, arranged in single transverse row on each segment. Abdomen in alata and aptera without pigment except for weak transverse bar on tergum VIII and indistinct lateral sclerites in alata. Dorsal and lateral abdominal tubercles absent. Spiracles (Fig. 689) reniform, subcircular. Siphunculus elongate, slightly tapering, with apical flange, with smooth imbrications. Abdominal tergum VIII entire. Cauda elongate triangular, acuminated, shorter than siphunculus. Anal plate (Fig. 684) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 690). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; eyes present; triommatidium distinct; lateral prothoracic tubercles absent; each abdominal segment with 1 lateral and 1 submedian seta; segments I–V or VI also usually with 1 dorsolateral seta; lateral abdominal tubercles absent; siphunculus short, cylindrical where evident; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminated.

Economically important species. *Elatobium abietinum* (Walker).

Range of plants infested in Canada. *Picea* and *Abies* species.
Figs. 683–692. Embryonic chaetotaxy and alata of *Elatobium*. 683, right fore wing; 684, anal plate and gonapophyses; 685, left fore femur; 686, second and base of third antennal segments; 687, base of apical antennal segment; 688, apical rostral segment; 689, abdominal spiracle; 690, dorsal chaetotaxy of embryo; 691, left hind tarsus; 692, venter of head.

Figs. 680–682. Aptera of *Elatobium*. 680, head and prothorax; 681, ventral margin of antennal socket; 682, terminal abdominal segments.
**Biology.** Feeds on the needles and is holocyclic or can evidently be anholocyclic where winters are mild, such as coastal British Columbia.

**Comments.** Recognition characters include the association with *Picea* and *Abies* in combination with the developed antennal tubercles, elongate cauda and siphunculus, and the presence of anterior prothoracic submedian setae. One species is known in North America.

**Genus Eomacrosiphon** Hille Ris Lambers

*Eomacrosiphon* Hille Ris Lambers, in MacGillivray 1958:24.

Type species: *Macrosiphum nigromaculosum* MacDougall, 1926:169.

**Adult** (Figs. 693, 694). Length 3.0–4.0 mm.

Integument: Apical antennal segments with smooth imbrications; segment II with a few spicules; base of segment III with minutely spiculose imbrications; head, thorax, and abdomen smooth except for minute spicules and spiculose imbrications on lateral sclerites and on posterior abdominal segments; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 704): Antennal tubercle moderately developed; median tubercle developed. Ventral margin of antennal socket not protuberant. Each side of disc with 2 anterior and 2 posterior setae distinctly capitate in aptera, minutely glandular capitate or blunt in alata. Eye present in aptera and alata; triommatidium distinct. Cephalic suture absent. Ventral sutures absent except for remnants extending posteriorly from each side of median ocellus. Disc of head without gland facets; with 1 pair of dorsal tubercles, well-developed and commonly multilobate in aptera, obscure in alata. Antenna 6-segmented; processus terminalis elongate, slender, without numerous setae; primary sensoria (Fig. 699) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 698) without ciliate margins, numerous, restricted to antennal segment III in the alata, absent in aptera. Rostrum 4-segmented; apical segment (Fig. 700) subconical, rounded distad of preapical primary setae.

Thorax: Prothorax of aptera with well-developed multilobate lateral and dorsal tubercles, absent or obscure in alata. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Femora (Fig. 697) with setae capitate in aptera, acuminate to minutely glandular-capitate in alata. Tibiae with basal

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Figs. 693, 694. Aptera of *Eomacrosiphon*. 693, head and prothorax; 694, terminal abdominal segments.
Figs. 695–704. Embryonic chaetotaxy and alata of *Eomacrosiphon*. 695, right fore wing; 696, anal plate and gonapophyses; 697, left fore femur; 698, second and base of third antennal segments; 699, base of apical antennal segment; 700, apical rostral segment; 701, abdominal spiracle; 702, dorsal chaetotaxy of embryo; 703, left hind tarsus; 704, venter of head.
setae capitate in aptera, acuminate to minutely glandular-capitate in alata; distal setae acuminate, with longest about half the apical diameter of respective tibiae. Tibiae without peglike setae, gland facets, rastral spines, or rastral setae. Basitarsi (Fig. 703) triangular, each with 5 ventral setae, without dorsal setae; distitarsi short, without capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 695) with dark apical macula; media with 3 branches; branches of cubitus widely separated at base, slightly divergent.

Abdomen: Tergites not fused. Setae short, distinctly capitate in aptera, minutely capitate in alata, arranged in a transverse row on each tergum. With pigmented lateral sclerites, and small sclerites at the base of each seta. Dorsal tubercles present on segment VII and, in many specimens, on VIII. Lateral tubercles well-developed on segments II–VI; larger tubercles multilobate. Spiracles (Fig. 701) subcircular, without opercula. Siphunculus elongate nearly cylindrical, without setae, with apical flange, coarsely nodulose-imbricate coalescing in apical one-fifth to one-quarter to form dense reticulations. Abdominal tergum VIII entire. Cauda elongate. Anal plate (Fig. 696) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 702). Antenna 4-segmented; each side of disc with 6 setae; eyes present; triommatidium distinct; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothoracic tubercles visible in some specimens; each abdominal tergum with 1 submedian and 1 lateral seta and 1 dorsolateral seta on at least abdominal segments I–VI; siphunculus short, cylindrical; basitarsi triangular, with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** Species of *Rosa*.

**Biology.** This genus is holocyclicly associated with the host.

**Comments.** Recognition characters for this genus include the host association, the multilobate tubercles, the apical macula on the fore wing, the finely reticulate siphunculi, and the small sclerites at the bases of the dorsal setae. In life, the bright red color and black siphunculi and abdominal markings are distinctive. The genus has one species, *Eomacrosiphon nigromaculosus* (MacDougall), known from British Columbia.

Genus *Epameibaphis* Oestlund

Figs. 705–716

*Epameibaphis* Oestlund, 1922:132.
Type species: *Aphis frigidae* Oestlund, 1886:47.
Adult (Figs. 705, 706). Length 1.0–2.0 mm.

Integument: Antenna with smooth imbrications; head and body without evident sculpturing other than some weakly spiculose imbrications; tibiae without sculpturing; tarsi with imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 716): Antennal tubercle undeveloped; front of head transverse to convex. Ventral margin of antennal socket not protuberant. Discal setae elongate, capitate, or apically flabellate. Eye present in aptera and alata; triommatidium distinct. Cephalic and ventral sutures, gland facets, and tubercles absent. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 711) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 710) without ciliate margins, situated on segments II or IV and V of alata. Rostrum 4-segmented; apical segment (Fig. 712) elongate, conical, with sides somewhat concave, with part distad of primary subapical setae slender and elongate.

Thorax: Prothorax without lateral or dorsal tubercles. Pronotal setae as on disc of head, scattered, with no discernible arrangement. Femora (Fig. 709) with setae pointed; tibial setae capitate or blunt dorsally and basally, pointed ventrally and apically. Tibiae without peglike setae, rastral spines, or gland facets; rastral setae in some species weakly differentiated in aptera and alata, but not much thicker or more spinelike than other tibial setae. Basitarsi (Fig. 715) triangular, with 3 ventral setae on fore and middle tarsi and 2 on hind tarsus, without dorsal setae; distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 707) with normal venation; media with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Abdominal setae similar to discal setae; arranged in 2–4 irregular transverse rows on each tergum. Abdominal terga and lateral sclerites fused, but not pigmented. Dorsal and lateral tubercles absent. Lateral sclerites evident in alata. Spiracles (Fig. 713) reniform. Siphunculus elongate, slender, cylindrical to somewhat swollen subapically, without setae, without apical flange, with membranous apical part swollen and bulbous where not collapsed giving siphunculus appearance of having an apical knob. Abdominal segment VIII entire. Cauda elongate; apex rounded, somewhat triangular or nearly parallel sided. Anal plate (Fig. 708) entire. Gonapophyses 3.

Embryo (Fig. 714). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; triommatidium not apparent; eyes present; lateral prothoracic tubercles not evident; each of first 5 or 6 abdominal segments with 1

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Figs. 705, 706. Aptera of Epameibaphis. 705, head and prothorax; 706, terminal abdominal segments.

294
Figs. 707–716. Embryonic chaetotaxy, aptera, and alate male of *Epameibaphis*. 707, right fore wing of male; 708, anal plate and gonapophyses of aptera; 709, left fore femur of male; 710, second and base of third antennal segments of male; 711, base of apical
lateral and 1 submedian seta and usually also 1 dorsolateral seta; lateral abdominal tubercles not evident; siphunculus elongate where evident, more or less swollen on apical half; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Artemisia* species.

**Biology.** All known species are holocyclic on their host plants.

**Comments.** Recognition characters for this genus include the association with *Artemisia*, the slender needlelike rostrum, and the knobbed siphunculus.

**Genus Eriosoma Leach**

*Figs. 22, 717–730*

_Eriosoma_ Leach, 1818:60.

Type species: *Eriosoma mali* Leach, 1818:60 = *Aphis lanigera* Hausmann, 1802:440.

**Adult** (Figs. 717, 718). Length 1.5–3.5 mm.

Integument: Antenna with spicules at least on apical segments; head and body without obvious sculpturing; tibiae each usually with a few spicules apically; tarsi with spicules at least on ventral surface of each; cauda and genital plate with spicules; anal plate with or without spicules.

Head (Fig. 730): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Eye absent in aptera; triommatidium present in both aptera and alata. Cephalic and ventral sutures absent in both aptera and alata. Disc without dorsal tubercles. Discal setae short, pointed, inconspicuous, arranged on each side in anterior group of 2–5 and posterior group of 2–4. Disc in aptera with contiguous gland facets arranged in circle. Antenna 6-segmented; processus terminalis (Fig. 725) short; primary sensoria with ciliate margins in aptera, large, irregular in shape, with or without ciliate margins in alata; accessory sensoria present or absent in alata, with ciliate margins in alata; secondary sensoria (Fig. 724) present only in alata as narrow annuli on segments III–VI depending on species. Rostrum 4-segmented; apical segment (Fig.

- antennal segment of male; 712, apical rostral segment of aptera; 713, abdominal spiracle of male; 714, dorsal chaetotaxy of embryo; 715, left hind tarsus; 716, venter of head of male.
726) elongate, cylindrical to subconical, bluntly pointed distad of preapical primary setae. Rostrum vestigial in male and ovipara.

Thorax: Head and prothorax partially fused in aptera. Prothorax with 0–3 anterior and 0–2 posterior lateral setae and 1 or 2 anterior and posterior submedian setae. Femora (Fig. 723) and tibiae with setae pointed, with longest tibial setae not longer than apical diameter of respective tibia. Tibiae without peglike setae, gland facets, rastral setae; with short rastral spines in aptera in some species. Basitarsi (Figs. 720, 729) triangular, each with 2 or 3 ventral setae, without dorsal setae; distitarsi elongate. Plantar setae acuminate. Claws simple. Fore wing (Fig. 721) with normal venation; media with 2 branches; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal terga not fused, without pigment other than intersegmental sclerites. Each tergum with 1 or 2 irregular, transverse rows of short, pointed setae. Dorsal and lateral abdominal tubercles absent. Lateral sclerites absent. Spiracles (Fig. 727) subcircular, without opercula. Siphunculus present, poriform, usually on pigmented, setose, sclerotic ring in alata. Abdominal tergum VIII entire. Cauda arc-shaped. Anal plate (Fig. 722) entire. Abdomen with gland facets at least in aptera contiguous and forming ring. Gonapophyses absent.

**Embryo** (Fig. 728). Antenna 5-segmented; each side of disc usually with 4 setae; each side of prothorax with 1 submedian and 1 lateral cluster of wax pores, with 1 anterior and 1 posterior submedian seta and 1 anterior and posterior lateral seta, without lateral tubercles; eyes absent; triommatidium present; each side of first 5–7 abdominal segments usually with 1 submedian and 1 lateral cluster of wax pores having or not having central area without gland facets; lateral abdominal tubercles not evident; basitarsi (Fig. 719) triangular, usually distinctly separated from apical segment, each with 2 ventral setae, without dorsal setae; distitarsi elongate, with preapical weakly capitate setae; plantar setae acuminate, weakly, but distinctly capitate. Embryo of male and of ovipara lacking mouthparts.

**Economically important species.** *Eriosoma americanum* (Riley), *Eriosoma lanigerum* (Hausmann), and *Eriosoma pyricola* Baker & Davidson.

**Range of plants infested in Canada.** Species of *Amelanchier, Crataegus, Pyrus, Sorbus,* and *Ulmus.*

**Biology.** Species in this genus are heterocyclic between elms and various Pomoidea. Some species are monoeciously heterocyclic on Pomoidea. On the elms, pseudogalls are formed from an apical rosette

Figs. 717–720. Aptera of *Eriosoma.* 717, head and prothorax; 718, terminal abdominal segments; 719, left hind tarsus of embryo; 720, right hind tarsus of aptera.
Figs. 721–730. Embryonic chaetotaxy and alata of *Eriosoma*. 721, right fore wing; 722, anal plate and gonapophyses; 723, left fore femur; 724, second and base of third antennal segments; 725, apical antennal segment; 726, apical rostral segment; 727, abdominal spiracle; 728, dorsal chaetotaxy of embryo; 729, left hind tarsus; 730, venter of head.
of leaves or tightly curled leaf margins (Fig. 22). The apterae produce copious amounts of woolly wax. Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

Comments. Recognition characters for this genus include the association with *Ulmus* and the typical formation of pseudogalls, the association with the Pomoidea, the circular arrangement of the dorsal wax glands and the production of large amounts of wool-like wax by the apterae. *Schizoneura* Hartig is treated as a subgenus of *Eriosoma*.

Genus *Essigella* Del Guercio

Type species: *Lachnus californicus* Essig, 1909:1.

**Adult** (Figs. 731, 732). Length 1.5–3.0 mm.
Integument: Antenna with smooth, or in some species with faintly spiculose imbrications; head and body without obvious sculpturing; tibiae usually with some smooth imbrications ventrally on apical half of each; tarsi with smooth imbrications; cauda at least with ventral spicules; anal and genital plates with spicules.

Head (Fig. 742): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Each side of disc of head with 2–4 setae anteriorly and 2 or 3 setae posteriorly. Eyes weakly but distinctly stalked, less evident in aptera; triommatidium incorporated into eye, apparently absent. Cephalic suture present in alata, usually visible in aptera. Ventral sutures absent. Disc without gland facets. Antenna 5-segmented; processus terminalis short; primary sensoria (Fig. 737) usually without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 736) without ciliate margins, occurring on segment III in alata, absent in aptera. Rostrum 4-segmented; apical segment (Fig. 738) short, cylindrical; apex distal of preapical primary setae rounded, separated from basal portion by a more or less distinct membranous area.

Thorax: Head and prothorax fused in aptera, not fused in alata. Prothorax without lateral tubercles. Each side of prothorax with 1 or 2 anterior and 1–4 posterior submedian setae and 1 anterior and 1–4 posterior lateral setae. Femora (Fig. 735) with setae pointed; tibial setae short or long, thick or hairlike, commonly capitate at least dorsally. Tibia without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 741) trapezoidal, each with more than 5 ventral setae, with 2 dorsal setae in aptera and 2 or 3 in alata; distitarsi elongate, without capitate setae. Plantar setae acuminate, short, inconspicuous. Claws commonly with dorsal tunicalike process,
appearing bifid. Fore wing (Fig. 733) with normal venation; radial sector straight; media with 2 branches, stem evanescent; branches of cubitus widely separated at base, divergent.

Abdomen: Abdominal terga fused in aptera forming pigmented or unpigmented carapace, not fused in alata, without pigment except around bases of setae. Abdominal setae arranged in 1 or 2 transverse rows on each tergum. Dorsal and lateral abdominal tubercles absent. Lateral sclerites absent in alata, where present in aptera incorporated into dorsal carapace. Spiracles (Fig. 739) subcircular, without opercula. Siphunculus short, nearly poriform, usually not on pigmented base, not surrounded by setae, without setae or apical flange. Abdominal tergum VIII entire. Cauda (Fig. 734) rounded, commonly with small median triangular projection. Anal plate entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 740). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1–3 anterior and posterior submedian setae and also 1–3 anterior and posterior lateral setae, without lateral tubercles or gland facets; eyes present; triommatidium present, but obscurely developed; each side of first 7 abdominal segments with 1 or 2 submedian, 1–3 lateral, and 1–4 dorsolateral setae; lateral abdominal tubercles and gland facets absent; siphunculus usually evident, poriform; basitarsi short, trapezoidal, with 2 ventral setae, without dorsal setae; distitarsi elongate, usually with one preapical seta that is capitate, or explanate apically; plantar setae acuminate; claws usually bifid apically, and usually with a conspicuous membranous dorsal tunica.

Economically important species. None.

Range of plants infested in Canada. Pinus and Pseudotsuga species. One species occurring in Canada on Pinus is found on Picea in Alaska (Sorensen 1988).

Biology. Members of this genus feed on the needles of the host plant. Individuals are active and move rapidly to the bases of the needles when disturbed. As far as is known all species are holocyclicly associated with the host plant and none produces cottony wax.

Comments. Recognition characters for this genus include the 5-segmented antenna, the nearly poriform siphunculi, the dorsal tunica on the claw, the habit of feeding on the needles of species of Pinus and Pseudotsuga, and the absence of cottony wax.
Figs. 731, 732. Aptera of *Essigella*. 731, head and prothorax; 732, terminal abdominal segments.
Genus *Eucallipterus* Schouteden

Type species: *Aphis tiliae* Linnaeus, 1758:452.

**Adult** (Figs. 743, 744). Length 1.5–3.0 mm.
Integument: Antenna with smooth and weakly spiculose imbrications; head and body without sculpturing except for spicules on lateral abdominal sclerites and on some dorsal pigmented spots; tibiae with spicules on apical half of each; tarsi spiculose; cauda and anal and genital plates with some spicules.

Head (Fig. 754): Antennal tubercle slightly developed; front of head convex. Frontal ocellus generally hidden from dorsal view by slight projection. Ventral margin of antennal socket not protuberant. Eye present in aptera and alata; triommatidium distinct. Each side of disc with 2 anterior setae and with single irregular transverse row of setae near posterior margin. Cephalic and ventral sutures absent. Disc without dorsal tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, but not as long as base of segment VI; primary sensoria (Fig. 749) with ciliate margins; accessory sensoria indistinct; secondary sensoria (Fig. 748) situated on antennal segment III, small, transversely oval, with margins not ciliate. Rostrum 4-segmented; apical segment short (Fig. 750), broadly conical, part distad of preapical primary setae rounded.

Thorax: Prothorax without lateral tubercles. Each side of prothorax with 1 posterior lateral and 1 anterior submedian seta and 2–6 posterior submedian setae. Femora (Fig. 747) with setae pointed. Tibial setae short, not longer than apical diameter of respective tibia. Tibiae without peglike setae, gland facets, or rastral spines. Rastral setae present. Basitarsi (Fig. 753) triangular, each with 5–7 ventral and 2 dorsal setae; distitarsi elongate, without capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 745) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent to almost parallel.

Abdomen: Abdominal terga not fused, with pair of pigmented spots on each; each spot with 1–3 short setae. Pigmented lateral sclerites present or absent, on segment III each with 1 small papilla; segment IV with 1 large conspicuous conical papilla. Dorsal and lateral abdominal tubercles absent. Spiracles subcircular. Siphunculus short, without setae or apical flange, unsculptured.

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Figs. 733–742. Embryonic chaetotaxy and alata of *Essigella*. 733, right fore wing; 734, anal plate and gonapophyses; 735, left fore femur; 736, second and base of third antennal segments; 737, apical antennal segment; 738, apical rostral segment; 739, abdominal spiracle; 740, dorsal chaetotaxy of embryo; 741, left hind tarsus; 742, venter of head.
Figs. 743, 744. Alata of *Eucallipterus*. 743, head and prothorax; 744, terminal abdominal segments.

306
Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 746) bilobate in vivipara; entire in ovipara. Abdomen without gland facets. Gonapophyses 2.

Embryo (Fig. 752). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; prothorax without gland facets or lateral tubercles; eyes present; triommatidium distinct; each side of abdominal segments with short blunt submedian and lateral setae, without dorsolateral setae; submedian setae on abdominal segment VIII elongate, pointed; siphunculus usually evident, poriform, or nearly so; basitarsi triangular with 2 ventral setae, without dorsal setae; distitarsi elongate, pointed, without preapical capitate setae; siphunculus usually evident, poriform, or nearly so; plantar setae spatulate.

Economically important species. None.

Range of plants infested in Canada. Tilia species.

Biology. Members of this genus are holocyclicly associated with the host plant where they feed on the under surfaces of the leaves. Apterae viviparae are not produced in the known species.

Comments. Recognition characters for this genus include the association with Tilia, the absence of apterae, the habit of feeding on the surfaces of the leaves, and the short siphunculi. The color pattern is also quite distinctive: dark lateral margins on the head and thorax, dark hind femora, paired dark spots on the abdomen, and dark areas on the wing at the apices of the veins and along the leading edge. The only species in North America was probably introduced from Europe.
Genus *Euceraphis* Walker


**Adult** (Figs. 755, 756). Length 3.0–6.0 mm.
Integument: At least apical 3 antennal segments with imbrications; head, thorax, and abdomen without obvious sculpturing; tibiae with spicules; tarsi spiculose; cauda and usually also anal and genital plates with some spicules.

Head (Fig. 766): Antennal tubercle fairly well developed; front of head concave. Frontal ocellus on anteroventral margin of the head. Discal setae fine, hairlike; each side of disc with group of 2–5 setae anteriorly and posteriorly. Eye present in aptera and alata; triommatidium distinct. Disc of head without gland facets, tubercles, or cephalic suture. Anteroventral sutures present. Antenna 6-segmented; processus terminalis short, without setae other than apical cluster; primary sensoria (Fig. 761) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 760) with ciliate margins, narrowly oval, slitlike, present only on the basal part of segment III. Rostrum 4-segmented; apical segment (Fig. 762) subconical, rounded distad of preapical primary setae.

Thorax: Prothorax with 0–5 small weakly protuberant lateral tubercles. Prothoracic setae fine, hairlike, with 1 or 2 posterior lateral setae, and covering mesal region of pronotum rather evenly with no special arrangement. Femora (Fig. 759) with setae short, pointed; tibial setae fine, hairlike, with longest longer than apical diameter of respective tibia. Tibia without peglike setae, or rastral spines. Hind tibiae in some species with scattered cribriform discs. Rastral setae present. Basitarsi (Fig. 765) triangular, with 5–7 ventral and 1 or 2 dorsal setae; distitarsi elongate, without capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 757) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Dorsal abdominal setae pointed, fine, hairlike, arranged in 1–3 irregular transverse rows on each tergum. Abdominal terga not fused, with irregular transverse dashes or spots of pigment on each. Dorsal abdominal tubercles absent. Each of abdominal segments I–V with 1–5 lateral tubercles circular to irregularly shaped, weakly protuberant, almost flat inconspicuous.
Figs. 755, 756. Alata of *Eucerasphis*. 755, head and prothorax; 756, terminal abdominal segments.
Figs. 757–766. Embryonic chaetotaxy and alata of *Euceraphis*. 757, right fore wing; 758, anal plate and gonapophyses; 759, left fore femur; 760, second and base of third antennal segments; 761, primary sensoria on apical antennal segment; 762, apical rostral segment; 763, abdominal spiracle; 764, dorsal chaetotaxy of embryo; 765, left hind tarsus; 766, venter of head.
Lateral abdominal sclerites present; mesal margin of each of those on segments III–V with broadly rounded elevation. Spiracles (Fig. 763) subcircular, with anterior margins not forming opercula. Siphunculus short, smooth, without apical flange, without setae, not fused with lateral sclerite of segment VI. Abdominal tergum VIII entire. Cauda usually knobbed, in some species tongue-shaped. Anal plate (Fig. 758) entire or faintly bilobed. Abdomen dorsally and laterally commonly with clusters of cibriiform pores around bases of setae; setae usually not visible except on pigmented regions. Gonapophyses usually fused forming single cluster of setae, in some species 2 distinct clusters visible on common tubercle.

**Embryo** (Fig. 764). Antenna 4-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta, 1 anterior submedian seta, and 1 or 2 posterior submedian setae; prothorax without lateral tubercles or gland facets; abdominal terga each with 1 lateral and 1 submedian seta and usually also 1 dorsolateral seta; all abdominal setae long; siphunculus short, nearly poriform; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Alnus* and *Betula* species.

**Biology.** All species live holocyclicly on their host plants, where they feed mainly on the leaves or terminal new growth. Apterae viviparae are not produced.

**Comments.** Recognition characters for this genus include the association with *Alnus* and *Betula*, the presence of cilia on the margins of the narrow secondary sensoria, and the entire or faintly bilobed anal plate.

**Genus Eulachnus Del Guercio**

Figs. 767–777

*Eulachnus* Del Guercio, 1909a:315.
Type species: *Lachnus agilis* Kaltenbach, 1843:161.

**Adult** (Figs. 767, 768). Length 1.5–3.0 mm.
Integument: Antenna with smooth and in some species faintly spiculose imbrications; head and body without obvious sculpturing;
tibiae apically and especially ventrally with a few smooth or faintly
but distinctly spiculose imbrications; tarsi with smooth imbrications;
cauda and anal and genital plates with spicules.

Head (Fig. 777): Antennal tubercle undeveloped; front of head
nearly flat, slightly convex. Ventral margin of antennal socket not
protuberant. Discal setae pointed, long, conspicuous, somewhat
spinelike in aptera, arranged in anterior group of 4–8 and 2 posterior
lateral groups of 3–5 on each side. Eye present in aptera and alata;
triummatidium distinct. Ventral cephalic suture absent; dorsal suture
present. Disc without tubercles or gland facets. Antenna 6-
segmented; processus terminalis (Fig. 773) short, tuberclelike,
without setae other than apical ones; primary sensoria without ciliate
margins on segments IV–VI, absent from segment III (Fig. 772);
accessory sensoria not fused, displaced basad of primary sensorium
with striated and spiculose margins; secondary sensoria normally
absent, in some species with an apical one present on segment III of
alata. Rostrum (Fig. 774) with part distad of preapical setae obscurely
separated as segment V; segment IV short, not much longer than
basal width; segment V broad, transverse.

Thorax: Prothoracic setae about the same size and shape as
discal setae; each side with 1 anterior and 1 posterior lateral seta and
1 or more anterior and posterior submedian setae. Prothorax without
dorsal or lateral tubercles. Prothorax without wax glands. Femora
(Fig. 771) and tibiae with setae pointed; tibial setae somewhat
spinelike in aptera. Tibiae without peglike setae, gland facets, rastral
setae, or rastral spines. Basitarsi (Fig. 776) trapezoidal, each with 6
or more ventral and 2 dorsal setae. Distitarsi elongate, without
preapical capitode setae. Plantar setae acuminate. Fore wing (Fig.
769) with radial sector straight; media with 1 branch, evanescent,
incomplete basally; branches of cubitus narrowly separated basally,
strongly divergent.

Abdomen: Abdominal terga not swollen, without pigment other
than spots around bases of some or many setae. Abdominal setae
pointed, long, conspicuous, commonly somewhat spinelike in aptera,
arranged in 2 or more, irregular transverse rows on each tergum,
posterior row on each tergum consisting of only submedian setae.
Dorsal and lateral abdominal tubercles absent. Lateral abdominal
sclerites absent. Spiracles (Fig. 775) without sclerotic rims.
Siphunculus reduced to sclerotic rim on narrow nonsetigerous base.
Abdominal tergum VIII entire. Cauda short, nearly semicircular, or
arc-shaped. Anal plate (Fig. 770) entire. Abdomen without gland
facets. Gonapophyses 3.

Embryo. Not observed.

Figs. 769–777. Embryonic chaetotaxy and alata of Eulachnus. 769, right fore wing;
770, anal plate and gonapophyses; 771, left fore femur; 772, second and base of third
antennal segments; 773, apical antennal segment; 774, apical rostral segment; 775,
abdominal spiracle; 776, left hind tarsus; 777, venter of head.
Economically important species. None.

Range of plants infested in Canada. *Pinus* species.

Biology. The species in this genus are holocyclicly associated with the host plant, forming nonflocculent colonies on the needles. Individuals are active and move to the base of the needles when disturbed.

Comments. Recognition characters for this genus include the habit of feeding on pine needles, the absence of flocculence, the 6-segmented antenna, the presence of dorsal setae on each of the tarsi, and the reduced and almost poriform siphunculi that are not surrounded by setae.

Genus *Fimbriaphis* Richards

Figs. 778–790

Type species: *Fimbriaphis fimbriata* Richards, 1959:250.

Adult (Figs. 778, 780). Length 1.5–3.0 mm.

Integument: Antenna with smooth imbrications; head in aptera usually with some spicules and nodules anterodorsally and ventrally on antennal tubercles, without sculpturing in alata other than slightly scabrous antennal tubercles; thorax and abdomen appearing slightly rippled laterally in aptera, with some spiculose imbrications on posterior abdominal segments, without sculpturing in alata other than some spicules and spiculose imbrications on lateral sclerites and on posterior abdominal segments; tibiae usually with a few smooth and in some species faintly spiculose imbrications apically; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 790): Antennal tubercle well-developed, somewhat scabrous in aptera; front of head concave. Ventral margin of antennal socket (Fig. 779) protuberant, more evident in aptera than in alata. Each side of disc with 2 anterior and 2 posterior short blunt or capitate setae. Eye present in aptera and alata; triommatidium distinct. Cephalic suture absent. Ventral sutures absent except for remnants extending posteriorly from each side of median ocellus. Disc of head without gland facets. Antenna 6-segmented; processus terminalis elongate, slender, without numerous setae; primary sensoria (Fig. 785) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 784) with finely ciliate margins in some species, normally restricted to antennal segment III in the alata; aptera without secondary sensoria. Rostrum 4-segmented; apical segment (Fig. 786) subconical, rounded distad of preapical primary setae.
Thorax: Prothorax normally without lateral tubercles, rarely evident as small transparent discs in alata. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 or 2 posterior submedian setae. Femora (Fig. 783) with setae pointed, short; tibial setae mostly pointed, in some species blunt dorsally on basal half, with longest about as long as apical diameter of respective tibiae. Tibiae without peglike setae, gland facets, rastral spines, or rastral setae. Basitarsi (Fig. 789) triangular, each with 2 or 3 ventral setae, without dorsal setae; distitarsi elongate, without capitate setae. Plantar setae acuminated. Claws simple. Fore wing (Fig. 781) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent.

Abdomen: Abdominal segments not fused; abdominal setae short, pointed or blunt, arranged in single transverse row on each tergum. Abdomen in aptera without pigment, in alata with pigmented lateral sclerites and with or without large irregular central pigmented mass. Dorsal abdominal tubercles absent. Lateral abdominal tubercles commonly present on segments II–IV, where present small, inconspicuous, diameters usually not much larger than diameter of setal socket. Spiracles (Fig. 787) subcircular, without opercula. Siphunculus elongate nearly cylindrical, without setae, with apical flange, with smooth and faintly spiculose imbrications generally coalescing apically and forming a few reticulations. Abdominal tergum VIII entire. Cauda elongate, constricted near base; apex rounded. Anal plate (Fig. 782) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 788). Antenna 4-segmented; each side of disc with 4 setae; eyes present; triommatidium distinct; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothoracic lateral tubercles not evident; each abdominal tergum with 1 submedian and 1 lateral seta, and usually also with 1 dorsolateral seta on at least abdominal segments I–V or VI; siphunculus short, cylindrical where visible; basitarsi triangular, with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminated.

Economically important species. None.

Range of plants infested in Canada. Species of Crataegus, Fragaria, Mespilus, and Vaccinium. Also known to occur on pear in the United States.

Biology. Members of this genus are holocyclicly associated with the host plants.

Comments. Recognition characters for this genus include the host associations in combination with the distinctly scabrous antennal tubercles, the swollen ventral margin of the antennal
Figs. 781-790. Embryonic chaetotaxy and alata of *Fimbriaphis*. 781, right fore wing; 782, anal plate and gonapophyses; 783, left fore femur; 784, second and base of third antennal segments; 785, base of apical antennal segment; 786, apical rostral segment; 787, abdominal spiracle; 788, dorsal chaetotaxy of embryo; 789, left hind tarsus; 790, venter of head.

Figs. 778-780. Aptera of *Fimbriaphis*. 778, head and prothorax; 779, ventral margin of antennal socket; 780, terminal abdominal segments.
socket, the irregular patch of abdominal pigment in the alatae, and, in those species in which it occurs, the finely ciliate margins of the secondary sensoria in the alatae.

Genus *Flabellomicrosiphum* Gillette & Palmer

Figs. 791–799

*Flabellomicrosiphum* Gillette and Palmer, 1932b:472.
Type species: *Chaitophorus tridentatae* Wilson, 1915:89.

**Adult** (Figs. 791, 792). Length 1.0–2.0 mm.

Integument: Antennae with smooth imbrications; head and body without obvious sculpturing other than some weakly spiculose imbrications on posterior abdominal terga; tibiae unsculptured; tarsi with smooth imbrications; cauda and anal and genital plates with some spicules.

Head (Fig. 799): Antennal tubercle weakly developed; front of head transverse. Ventral margin of antennal socket not protuberant. Discal setae abundant, long, conspicuously flabellate in both aptera and alata. Eye present in aptera and alata; triommatidium distinct. Ventral and dorsal cephalic sutures not evident. Disc of head without gland facets or tubercles. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 798) with ciliate margins; accessory sensoria not fused; secondary sensoria, situated on antennal segment III of alata. Rostrum 4-segmented; apical segment (Fig. 797) elongate, narrow, with slightly concave sides, part distad of preapical primary setae elongate, pointed.

Thorax: Prothoracic setae abundant, long, conspicuously flabellate, with no specific arrangement. Femora (Fig. 793) and tibiae with setae capitate; tibial setae long, conspicuous basally, pointed apically. Tibiae without peglike setae, gland facets, rastral spines, or rastral setae. Basitarsi (Fig. 796) triangular, with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing with normal venation; media with 3 branches; cubital veins widely separated basally, slightly divergent.

Abdomen: Abdominal setae blunt or distinctly flabellate or funnel-shaped, arranged in 2 or more transverse rows on each tergum. Abdominal terga not fused, without pigment except for faint trace on tergum VIII. Lateral abdominal sclerites absent in aptera, present or absent in alata. Lateral and dorsal abdominal tubercles absent. Spiracles subcircular, with sclerotized rims. Siphunculus short, nearly poriform, without setae, unsculptured. Abdominal tergum VIII entire. Cauda elongate, bluntly rounded apically. Anal plate (Fig. 794) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Not observed.
Figs. 791, 792. Aptera of *Flabellomicrosiphum*. 791, head and prothorax; 792, terminal abdominal segments.
Economically important species. None.

Range of plants infested in Canada. None known, but the shrubby *Artemisia* species in the dry interior of British Columbia are probably host plants as they are in western United States.

Biology. This genus is holocyclicly associated with the host plant.

Comments. Recognition characters for this genus include the association with the western shrubby *Artemisia*, the nearly poriform siphunculi, the stiletto-like apical rostral segment, and the numerous flabellate or funnel-like dorsal setae.

Genus *Forda* Heyden

Figs. 800–813

*Forda* von Heyden, 1837:291.
Type species: *Forda formicaria* von Heyden, 1837:292.

Adult (Figs. 800, 801). Length 2.0–4.0 mm.

Integument: Head and dorsal surface of body finely spiculose in aptera, without evident sculpturing in alata other than some transverse striae on abdominal terga, striae weakly spiculose on posterior 2 or 3 terga; legs without sculpturing; cauda without conspicuous spicules; anal and genital plates with fine spicules.

Head (Fig. 813): Antennal tubercle undeveloped; front of head weakly convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, fine, hairlike, with no recognizable arrangement, fairly numerous in alata, in some species reduced to longitudinally arranged group of 6 on each side in aptera. Eye present in alata, absent in aptera; triommatidium distinct in both aptera and alata. Dorsal cephalic suture well-developed in alata, barely evident in aptera; ventral cephalic sutures absent in both aptera and alata. Dorsal tubercles present or absent, when present represented by flat circular membranous areas near posterior margin of disc. Gland facets absent. Antenna 5-segmented in both aptera and alata; processus terminalis short, shorter than base of antennal segment V; primary sensoria (Fig. 808) without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 807) absent in aptera, numerous, oval, situated on segments III and IV, in some specimens also on V, without ciliate margins; base of segment III with cluster of minute circular sensilla in alata. Rostrum 4-segmented; apical

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Figs. 793–799. Aptera of *Flabellomicrosiphum*. 793, left fore femur; 794, anal plate and gonapophyses; 795, second and base of third antennal segments; 796, left hind tarsus; 797, apical rostral segment; 798, base of apical antennal segment; 799, venter of head.
Figs. 804–813. Embryonic chaetotaxy and alata of *Forda*. 804, right fore wing; 805, anal plate and gonapophyses; 806, left fore femur; 807, second and base of third antennal segments; 808, base of apical antennal segment; 809, apical rostral segment; 810, abdominal spiracle; 811, dorsal chaetotaxy of embryo; 812, left hind tarsus; 813, venter of head.

Figs. 800–803. Aptera and embryo of *Forda*. 800, head and prothorax of aptera; 801, terminal abdominal segments of aptera; 802, left hind tarsus of embryo; 803, right hind tarsus of aptera.
segment (Fig. 809) elongate, subconical, more or less rounded distad of preapical primary setae.

Thorax: Prothoracic setae pointed, hairlike, longest shorter than apical diameter of respective tibia. Femora (Fig. 806) with setae short, pointed. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Figs. 803, 812) triangular, each with 5–7 ventral setae, without dorsal setae. Distitarsi elongate, without capitate setae. Plantar setae acuminate. Fore wing (Fig. 80a) with venation reduced; radial sector almost straight; median with 1 branch, weak or incomplete basally; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal setae pointed, hairlike, relatively short, arranged in 2 or more, irregular, transverse rows on each tergum. Abdominal terga not fused, unpigmented in alata; each tergum in alata with pigmented transverse band. Dorsal and lateral tubercles absent. Lateral sclerites present in alata, small, commonly fused with pigmented, sclerotic terga, absent in alata. Spiracles (Fig. 810) subcircular, with articulated opercula. Siphunculus absent. Abdominal segment VIII entire. Cauda, small, arc-shaped, inconspicuous. Anal plate (Fig. 805) large, elongate. Abdomen without gland facets. Gonapophyses obscure, represented by transverse cluster of setae.

Embryo (Fig. 811). Antenna 5-segmented; each side of disc with 4 setae; eyes absent; triommatidium present; each side of prothorax with 1 or more anterior and posterior lateral setae and 1 or more anterior and posterior submedian setae; prothoracic gland facets and lateral tubercles absent; each abdominal tergum with 1 submedian, 1 lateral, and 1 or more dorsolateral setae; siphunculus absent; basitarsi triangular, at least partially separated from apical segment, each with 2–5 ventral setae; distitarsi (Fig. 802) elongate, with or without 1 or 2 preapical capitate setae; plantar setae distinctly but weakly capitate.

Economically important species. None.

Range of plants infested in Canada. Grass roots.

Biology. Species live anholocyclicly on the roots of grasses in North America. In the Palaeartic region, from which the genus was introduced into North America, species are heterocyclic between galls on Pistacia species and grass roots. Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

Comments. In Canada, members of this genus are easily recognized by the following: the association with grass roots; the 5-segmented antennae; the abundant, oval secondary sensoria in the alatae; the absence of cilia on the margins of the primary sensoria; and the pigmented, transverse bars on the abdominal terga.
Genus *Fullawaya* Essig

*Fullawaya* Essig, 1912:735.
Type species: *Fullawaya saliciradicis* Essig, 1912:737.

**Adult** (Figs. 814, 815). Length 3.0–5.0 mm.

Integument: Antenna mostly smooth, or with a few imbrications on apical 1 or 2 segments; head and body without sculpturing, other than a few spiculose imbrications on abdominal tergum VIII; tibiae without sculpturing; tarsi smooth, or with a few weak dorsal imbrications; cauda and anal and genital plates with some spicules.

Head (Fig. 825): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Eye present in aptera and alata; triommatidium distinct. Discal setae pointed, fine, hairlike with no particular arrangement, or with anterior and posterior group of several setae. Cephalic and ventral sutures absent. Disc without gland facets or tubercles. Antenna 6-segmented; processus terminalis elongate with few to several fine setae in addition to apical cluster; primary sensoria (Fig. 820) with or without ciliate margins; secondary sensoria (Fig. 819) absent in aptera, present on segments III and IV in alata. Rostrum 4-segmented; apical segment (Fig. 821) elongate, cylindrical, portion distal of preapical primary setae more or less triangular.

Thorax: Prothorax with lateral tubercles. Setae on prothorax fine, hairlike, without special arrangement. Femora (Fig. 818) and tibiae with setae fine, hairlike, variable in length. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 824) triangular, each with 3 or 4 ventral setae, without dorsal setae; distitarsi elongate, without capitulate setae. Plantar setae acuminate. Claws simple, without a tunica. Fore wing (Fig. 816) with normal venation; radial sector only weakly curved; media with 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Abdominal segments not fused, usually without pigment laterally and dorsally, in some species with large lateral sclerites and each tergum with pair of large median spots. Each abdominal tergum with 2–5 irregular transverse rows of setae. Spiracles (Fig. 822) subcircular, without opercula. Siphunculus present or absent, when present, without apical flange, setae or sculpturing. Abdominal tergum VIII entire. Cauda broadly rounded. Anal plate (Fig. 817) entire. Abdomen without gland facets. Gonapophyses 4.

**Embryo** (Fig. 823). Antenna 4-segmented; each side of disc usually with 4 setae; eyes and triommatidium present; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta, a few specimens with small clusters of submedian and lateral setae; lateral prothoracic tubercles visible in some species;
Figs. 814, 815. Aptera of *Fullawaya*. 814, head and prothorax; 815, terminal abdominal segments.
Figs. 816–825. Embryonic chaetotaxy and alata of *Fullawaya*. 816, right fore wing; 817, anal plate and gonapophyses; 818, left fore femur; 819, second and base of third antennal segments; 820, base of apical antennal segment; 821, apical rostral segment; 822, abdominal spiracle; 823, dorsal chaetotaxy of embryo; 824, left hind tarsus; 825, venter of head.
each abdominal tergum usually with 1 submedian, 1 dorsolateral, and 1 lateral seta; siphunculus usually absent; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Populus* and *Salix* species.

**Biology.** Little is known of the biologies of the species in this genus. They are probably holocyclicly associated with the host plant. All species feed on the trunks and branches or underground portions of the stem.

**Comments.** Recognition characters for this genus include the host associations, the subterranean tendency, the absence of siphunculi, or the absence of apical flanges where siphunculi are present. Richards (1966b) provided a key to, and descriptions of, the species (as *Plocamaphis* Oestlund).

**Genus Geoica Hart**

Figs. 826–839


**Adult** (Figs. 826, 827). Length 1.5–2.0 mm.


Head (Fig. 839): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, hairlike, not numerous, scattered, without special arrangement. Eye present in alata, absent in aptera; triommatidium distinct. Ventral cephalic sutures absent; dorsal suture well-developed in alata, in some species represented by a longitudinal impression in aptera. Dorsal tubercles present or absent, large, circular, flat when present. Disc of head without gland facets. Antenna 5- (aptera) or 6-segmented (alata); processus terminalis short; primary sensoria (Fig. 834) with ciliate margins; accessory sensoria not fused, small, inconspicuous; secondary sensoria (Fig. 833) absent in aptera, present on segments III and IV in alata, large, fused in some species, circular, restricted to posterior surfaces of

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*Figs. 826–829. Aptera and embryo of *Geoica*. 826, head and prothorax of aptera; 827, terminal abdominal segments of aptera; 828, left hind tarsus of embryo; 829, right hind tarsus of aptera.*

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330
segments. Rostrum 4-segmented; apical segment (Fig. 835) elongate, cylindrical, bluntly pointed distad of preapical primary setae. Rostrum vestigial in male and ovipara.

Thorax: Head and prothorax not fused in alata, fused in aptera. Prothoracic lateral tubercles present in some species, large, flat. Femora (Fig. 832) with setae pointed, short; tibial setae usually pointed, a few squamose setae basally in some species. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 829, 838) triangular, each with 3–5 ventral setae, without dorsal setae; distitarsi elongate, without capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 830) with venation reduced; radial sector evanescent apically; media unbranched, evanescent throughout, incomplete basally; branches of cubitus fused basally, strongly divergent, evanescent towards wing margin.

Abdomen: Abdominal segments not fused. Setae acuminate or spatulate to flabellate. Spiracles (Fig. 836) with articulated opercula. Siphunculus absent. Cauda inconspicuous, arc-shaped. Anal plate (Fig. 831) prolonged, with pointed setae. Gonapophyses 2.

Embryo (Fig. 837). Antenna 4-segmented; each side of disc usually with 4 setae; eyes absent; triommatidium present; each side of prothorax with 1 or more anterior and 1 or more posterior lateral setae and 1 or more anterior and 1 or more posterior submedian setae; prothoracic setae pointed or flabellate; prothorax without gland facets; prothoracic lateral tubercles absent; each abdominal tergum with 1 pointed or flabellate lateral and 1 submedian seta and 1 or several short pointed or flabellate dorsolateral setae; abdominal gland facets or lateral tubercles absent; siphunculus absent; basitarsi (Fig. 828) triangular, commonly indistinctly separated from apical segment, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate, weakly capitate. Embryo of male and of ovipara lacking mouthparts.

Economically important species. None.

Range of plants infested in Canada. Not recorded in Canada, but widespread in United States on grass roots.

Biology. Species in this genus live holocyclicly on grass roots and are commonly tended by ants. In the Palaearctic region, from which the North American species were introduced, they alternate between galls on Pistacia species and grass roots. Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

Figs. 830–839. Embryonic chaetotaxy and alata of Geoica. 830, right fore wing; 831, anal plate and gonapophyses; 832, left fore femur; 833, second and base of third antennal segments; 834, apical antennal segment; 835, apical rostral segment; 836, abdominal spiracle; 837, dorsal chaetotaxy of embryo; 838, left hind tarsus; 839, venter of head.
Comments. Recognition characters for this genus include its association with the roots of grasses, the absence of siphunculi, the presence of cilia on the margins of the primary sensoria, and the usual presence of squamose seta.

Genus *Georgiaphis* Maxson & Hottes

Figs. 23, 840–852

*Georgiaphis* Maxson and Hottes, 1926:266.
Type species: *Georgia ulmi* Wilson, 1911:64.

Adult (Figs. 840, 841). Length 1.0–3.0 mm.

Integument: Obvious sculpturing absent except for blunt spicules on some basal antennal segments, faint spicules and reticulations on cauda and anal plates, and dispersed spicules on tarsi of alata.

Head (Fig. 852): Antennal tubercle undeveloped; front of head flat or slightly convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, arranged in anterior and posterior cluster of 4 or more setae each. Disc of aptera covered with circular papillalike glandular structures. Eye absent in aptera, present in alata; triommatidium distinct. Dorsal and ventral cephalic sutures mostly absent, but in some species dorsal suture indicated by faint line of pigment near frontal ocellus. Antenna 6-segmented, primary sensoria (Fig. 847) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 846) dispersed, narrow slits on segments III–V of alata, absent in aptera. Rostrum 4-segmented; apical segment (Fig. 848) weakly conical, bluntly pointed. Rostrum vestigial in male and ovipara.

Thorax: Prothorax and head fused in aptera, not in alata. Prothorax with 1 to several anterior and posterior lateral setae, 0–3 anterior submedian setae, and 2 or more posterior submedian setae. Prothorax without lateral tubercles. Femora (Fig. 845) and tibiae with setae pointed; longest tibial setae not longer than apical diameter of respective tibia. Tibia without gland facets, peglike setae, rastral spines, or rastral setae. Basitarsi triangular, with 2 or 3 ventral setae in aptera (Fig. 842), with 3 ventral setae in fore and middle tarsi and 2 on hind tarsus in alata (Fig. 851), and without dorsal setae in aptera or alata; distitarsi elongate, with preapical capitate setae in aptera, without such setae in alata. Plantar setae pointed. Claws simple. Fore wing (Fig. 843) with normal venation; radial sector curved only in basal part; media with 2 branches or in some species unbranched, with common stem incomplete or absent; branches of cubitus arising from common point, strongly divergent.

Figs. 840–842. Fundatrix of *Georgiaphis*. 840, head and prothorax; 841, terminal abdominal segments; 842, right hind tarsus.
Figs. 843–852. Embryonic chaetotaxy and alata of *Georgiaphis*. 843, right fore wing; 844, anal plate and gonapophyses; 845, left fore femur; 846, second and base of third antennal segments; 847, apical antennal segment; 848, apical rostral segment; 849, abdominal spiracle; 850, dorsal chaetotaxy of embryo; 851, left hind tarsus; 852, venter of head.
Abdomen: Abdominal segments not fused, without pigment. Abdominal setae pointed, arranged in single irregular transverse row on each segment. Spiracles (Fig. 849) subcircular, without operculum. Siphunculus usually present, poriform in alata, usually absent in aptera. Abdominal segment VIII entire. Cauda short, arc-shaped. Anal plate (Fig. 844) entire. Genital orifice with 3, in some species obscurely 4, gonapophyses. Abdominal tergum VII covered with circular, papillate, transparent, glandularlike structures in both aptera and alata.

Embryo (Fig. 850). Antenna 4-segmented; each side of disc with 4 setae; eyes absent; triommatidium present; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; prothorax without gland facets; prothoracic lateral tubercles absent; each abdominal tergum with 1 lateral and 1 submedian seta, and usually with at least 1 dorsolateral seta on each side; abdominal gland facets not evident; basitarsi triangular, with 2 ventral setae, without dorsal setae; distitarsi elongate with preapical capititate setae; plantar setae acuminate, short. Embryo of male and of ovipara lacking mouthparts.

Economically important species. None.

Range of plants infested in Canada. Ulmus species.

Biology. Members of this genus are holocyclic on elms where they produce leaf curl (Fig. 23). Heavy infestations occur locally. Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

Comments. Recognition characters for this genus include the following: the formation of pseudogalls on Ulmus; the preapical, capititate tarsal setae in the apterae; the circular, transparent, glandular structures on the seventh abdominal tergum in both apterae and alatae and on the head of apterae; the sparsity of the slitlike annular secondary sensoria on the antennae of the alatae. Smith (1984) considered Georgiaphis to be a subgenus of Eriosoma.

Genus Gharesia Stroyan

Figs. 853–862

Type species: Gharesia polunini Stroyan, 1963:81.

Adult (Figs. 853, 854). Length 1.5–2.5 mm.
Integument: Antennae with spicules; head with faint reticulations; anal plate with faint reticulate pattern of spicules;
basitarsi in aptera in some specimens with a few spicules, in alata both segments of tarsi and apical part of tibiae with long spicules.

Head (Fig. 862): Antennal tubercle undeveloped; front of head flat or nearly so. Ventral margin of antennal socket not protuberant. Discal setae pointed, arranged on each side in anterior and posterior group of 2 setae each. Eyes absent from aptera; triommatidium distinct. Dorsal and ventral cephalic sutures absent. Disc of head without tubercles; aptera with clusters of cribiform discs anteriorly, posteriorly, and ventrally. Antenna 6-segmented in alata, in aptera usually 5-segmented, with segment III partially divided by small or large membranous area (Fig. 857), in some specimens 6-segmented; primary sensoria (Fig. 860) with ciliated margins; accessory sensoria not fused; secondary sensoria transverse on segments III–V of alata, lacking in aptera. Rostrum 4-segmented; apical segment (Fig. 859) short, with sides weakly convex, broadly rounded distad of apical setae.

Thorax: Prothorax and head of aptera fused. Each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax without lateral tubercles, in aptera with clusters of cribiform discs laterally and mesally. Fore coxa not enlarged. Femora (Fig. 855) and tibia with setae pointed; longest tibial setae not longer than apical diameter of respective tibia. Tibia without gland facets, peglike setae, rastral spines, or rastral setae. Basitarsi (Fig. 861) triangular, with 2 or 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae weakly capitate in aptera, acuminate in alata. Claws simple. Fore wing with media branched once; branches of cubitus approximate at base, strongly diverging.

Abdomen: Abdominal segments not fused, sclerotic, without pigment. Dorsal and lateral abdominal tubercles absent; cribiform discs in clusters laterally and dorsolaterally on segments I–VII, submedially on terga I–VI. Spiracles (Fig. 858) subcircular, without opercula. Siphunculus absent. Abdominal tergum VIII entire. Cauda short, arc-shaped. Anal plate (Fig. 856) entire. Gonapophyses 4, with 2 middle clusters of setae close together, apparently fused.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Carex* species.

**Biology.** Little is known about the life history of the single species in this genus, *Gharesia polunini* Stroyan. The apterous form produces flocculent colonies on the stems of the host plant (Foottit and Mackauer 1980).

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Figs. 853, 854. Aptera of *Gharesia*. 853, head and prothorax; 854, terminal abdominal segments.

338
Figs. 855–862. Aptera of Gharesia. 855, left fore femur; 856, anal plate and gonapophyses; 857, second to fifth antennal segments; 858, abdominal spiracle; 859, apical rostral segment; 860, apical antennal segment; 861, left hind tarsus; 862, venter of head.
Comments. Recognition characters for this genus include the flocculent colonies on Carex, the dorsal gland facets composed of clusters of cribiform discs on the body and head, the normally 5-segmented antenna in which the third segment has a large or small membranous area, and the capitate plantar setae. Some workers consider Gharesia a synonym of Byrsocryptoides Dzhibladze.

Genus Glabromyzus Richards

Figs. 863–875

Type species: Rhopalosiphum rhois Monell, 1879:27.

Adult (Figs. 863, 864). Length 1.0–3.0 mm.

Integument: Head and body without sculpturing other than some weakly spiculose imbrications on apical abdominal segments; tibia without sculpturing; tarsi with smooth imbrications; cauda and anal and genital plates with spicules; apex of cauda (Fig. 865) with spicules reduced.

Head (Fig. 875): Antennal tubercle slightly developed, in some species weakly scabrous; in aptera median tubercle slightly developed making front of head somewhat W-shaped. Ventral margins of antennal socket not protuberant. Discal setae arranged in anterior and posterior group of 2 setae each on each side. Eye present in aptera and alata; triommatidium distinct. Cephalic and ventral sutures absent. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate without numerous fine setae; primary sensoria (Fig. 870) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 869) without ciliate margins, normally absent in aptera, present on segment III in alata. Rostrum 4-segmented; apical segment (Fig. 871) narrow, subconical, bluntly triangular distad of preapical primary setae.

Thorax: Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1–3 posterior submedian setae. Prothorax without lateral tubercles. Femora (Fig. 868) and tibiae with setae pointed; longest tibial setae not longer than apical diameter of respective tibia. Tibiae without peglike setae, rastral setae, rastral spines, or gland facets. Basitarsi (Fig. 874) triangular, each with 2 or 3 ventral setae, without dorsal setae; distitarsi elongate, without capitate setae. Plantar setae acuminate. Claws simple, without tunica. Fore wing (Fig. 866) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent.

Abdomen: Abdominal terga separated or fused, with or without pigment. Dorsal and lateral abdominal tubercles absent. Abdomen without gland facets. Spiracles (Fig. 872) subcircular, without opercula. Siphunculus inflated, without setae, with apical flange, smooth or with spicules and imbrications. Abdominal tergum VIII entire. Cauda short, triangular; apex rounded. Anal plate (Fig. 867) entire. Gonapophyses 3.
Figs. 863-865. Aptera of *Glabromyzus*. 863, head and prothorax; 864, terminal abdominal segments; 865, apex of cauda.
Figs. 866–875. Embryonic chaetotaxy and alata of Glabromyzus. 866, right fore wing; 867, anal plate and gonapophyses; 868, left fore femur; 869, second and base of third antennal segments; 870, base of apical antennal segment; 871, apical rostral segment; 872, abdominal spiracle; 873, dorsal chaetotaxy of embryo; 874, left hind tarsus; 875, venter of head.
**Embryo** (Fig. 873). Antenna 4-segmented; each side of disc with 4 setae; eyes and triommatidium present; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothorax without gland facets or lateral tubercles; each abdominal tergum with 1 submedian and 1 lateral seta, also with 1 dorsolateral seta on each side of at least some segments; abdominal gland facets absent; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** Carex species, Juncus species, Lazula species, and Rhus species.

**Biology.** This genus is heterocyclic between Rhus species and various rushes, sedges and grasses.

**Comments.** Recognition characters for this genus include the following: the association with Rhus, sedges, and grasses; the smooth or slightly scabrous, weakly developed antennal tubercles; and the swollen siphunculi. Cook (1984b) provided a key to, and taxonomic notes on, the species. He included Utamphorophora crataegi (Monell), which occurs on Crataegus in British Columbia, while transferring Glabromyzus schlengeri Hille Ris Lambers to Utamphorophora.

**Genus Glendenningia MacGillivray**

Figs. 876–888


**Adult** (Figs. 876, 877). Length 2.0–3.0 mm.

Integument: Antenna with smooth imbrications; head and body without sculpturing other than scabrous antennal tubercles and weakly spiculose imbrications on posterior few abdominal terga; tibiae without spicules; tarsi with smooth imbrications; cauda and anal and genital plates with spicules, with those at apex of cauda smaller (Fig. 878).

Head (Fig. 888): Antennal tubercle weakly developed, scabrous ventrally; front of head convex. Ventral margin of antennal socket weakly protuberant in alata; aptera unknown. Each side of disc with 2 setae anteriorly and 2 posteriorly. Eye present; triommatidium distinct. Ventral and dorsal cephalic sutures absent. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 883) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 882)
Figs. 876–878. Alata of *Glendenningia*. 876, head and prothorax; 877, terminal abdominal segments; 878, apex of cauda.
Figs. 879–888. Embryonic chaetotaxy and alata of *Glendenningia*. 879, right fore wing; 880, anal plate and gonapophyses; 881, left fore femur; 882, second and base of third antennal segments; 883, base of apical antennal segment; 884, apical rostral segment; 885, abdominal spiracle; 886, dorsal chaetotaxy of embryo; 887, left hind tarsus; 888, venter of head.
with partially or completely ciliate margins, present on segments III–V in alata; aptera unknown. Rostrum 4-segmented; apical segment (Fig. 884) subcylindrical, rounded distad of preapical primary setae.

Thorax:  Prothorax without lateral tubercles. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Femora (Fig. 881) with setae pointed; tibial setae blunt or weakly capititate basally, pointed apically, with longest not longer than apical diameter of respective tibia. Tibiae without peglike setae, rastral spines, rastral setae, or gland facets. Basitarsi (Fig. 887) triangular, with 2 or 3 ventral setae, without dorsal setae; distitarsi elongate, without capititate setae. Plantar setae acuminate. Claws simple, without a tunica. Fore wing (Fig. 879) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent.

Abdomen:  Abdominal terga fused, forming large pigmented patch covering most of abdomen. Dorsal and lateral abdominal tubercles absent. Spiracles (Fig. 885) subcircular, without opercula. Lateral sclerites present, partially or completely fused to dorsal pigmented patch. Abdominal tergum VIII entire. Siphunculus elongate, swollen, mostly smooth, usually with a few short blunt setae on basal half; with apical flange. Cauda short, triangular, with median fingerlike projection; apical spicules shorter than others. Anal plate (Fig. 880) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 886). Antenna 4-segmented; eye and triommatidium present; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothorax without gland facets or lateral tubercles; each abdominal tergum with 1 submedian and 1 lateral seta, usually also with 1 dorsolateral seta on each side but absent on 1 or 2 but not all segments in some specimens; abdominal gland facets absent; basitarsi triangular, with 2 ventral setae, without dorsal setae; distitarsi elongate without preapical capititate setae; plantar setae acuminate.

Economically important species. None.

Range of plants infested in Canada. The single known species forms colonies on *Philadelphus* sp. The morphology suggests that it may alternate to mosses.

Biology. Unknown.

Comments. Recognition characters for this genus include the following: the swollen siphunculi; the cilia on the margins of the secondary sensoria; and the median projection on the short, broad cauda. Only the alate morph has been described.
Genus *Glyphina* Koch

*Glyphina* Koch, 1856:259.

Type species: *Vacuna betulae* Kaltenbach, 1843:177 = *Aphis betulae* Linnaeus, 1758:452.

**Adult** (Figs. 889, 890). Length 1.5–2.5 mm.

Integument: Antenna with fine sharp spicules in both aptera and alata; head, thorax, and abdominal terga I–V in aptera with scattered blunt nodules or anastomosing fine striae; abdominal terga VI–VII with some spiculose imbrications; abdomen in alata without sculpturing other than a few spicules on lateral sclerites in some species and some spiculose imbrications on apical abdominal segments; tibiae and tarsi with fine sharp spicules; cauda and anal and genital plates spiculose.

Head (Fig. 903): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, fine, hairlike, arranged in anterior group of 6–10 and transverse posterior group of 4–8. Eye present in alata, absent in aptera; triommatidium distinct in both aptera and alata. Ventral and dorsal cephalic sutures absent. Disc of head without tubercles or gland facets. Antenna 5-segmented; processus terminalis short, shorter than base of segment V; primary sensoria (Fig. 898) with ciliate margins; accessory sensoria not fused, minute, inconspicuous; secondary sensoria absent in aptera, present on segment III (Fig. 897) in alata, circular, with ciliate margins. Rostrum 4-segmented; apical segment (Fig. 899) slender, bluntly pointed distad of preapical primary setae.

Thorax: Head and prothorax fused in aptera, not fused in alata. Prothoracic setae arranged in anterior and posterior submedian clusters and 1 lateral cluster on each side. Prothorax without lateral tubercles. Femora (Fig. 896) and tibiae with setae pointed, hairlike; longest tibial setae as long or longer than apical diameter of respective tibia. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines; meso- and in some species pro-tibiae with protruding commonly bilocular sensoria (Fig. 892). Basitarsi (Fig. 902) triangular, each with 5–7 ventral setae, without dorsal setae; distitarsi (Fig. 891, 902) elongate, with 2 long finely capitata or acuminate preapical setae commonly evident in both aptera and alata. Plantar setae acuminate to slightly capitate. Fore wing (Fig. 894) with normal venation; radial sector almost straight; media with 2 branches, base incomplete; branches of cubitus widely separated at base, slightly divergent, almost parallel.

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Figs. 889–893. Aptera and embryo of *Glyphina*. 889, head and prothorax of aptera; 890, terminal abdominal segments of aptera; 891, left hind tarsus of aptera; 892, sensoria on mesotibia of aptera; 893, apex of right hind tarsus of embryo.
Figs. 894–903. Embryonic chaetotaxy and alata of *Glyphina*. 894, right fore wing; 895, anal plate and gonapophyses; 896, left fore femur; 897, second and base of third antennal segments; 898, apical antennal segment; 899, apical rostral segment; 900, abdominal spiracle; 901, dorsal chaetotaxy of embryo; 902, left hind tarsus; 903, venter of head.
Abdomen: Dorsal abdominal setae pointed, arranged in single transverse row on each tergum. Abdomen without dorsal or lateral tubercles. Abdomen either without pigment or each tergum in aptera heavily pigmented and terga fused on segments I–VI; in alata terga without pigment except for single or paired median spots. Pigmented lateral sclerites present in both aptera and alata, commonly fused with pigmented terga in aptera. Spiracles (Fig. 900) small, oval, having orifice without sclerotized rim, and with each situated on a rather large tubercle. Siphunculus short, nearly poriform, on setiferous weakly mammiform base, with weakly developed apical flange. Abdominal tergum VIII entire. Cauda nearly arc-shaped. Anal plate (Fig. 895) entire. Abdomen without gland facets. Gonapophyses 2.

**Embryo** (Fig. 901). Antenna 4-segmented; eye absent; triommatidium present; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; prothorax without gland facets or lateral tubercles; each abdominal tergum with 1 submedian and 1 lateral seta, and with dorsolateral setae usually absent; abdominal gland facets absent; basitarsi triangular, with 2 ventral setae, without dorsal setae; distitarsi elongate with preapical capitate setae (Fig. 893); plantar setae capitate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Alnus* and *Betula* species.

**Biology.** The species live holocyclicly on the roots of saplings of the host plants. The aphids are tended by ants, which sometimes build covers over the aphid colonies. In such instances the aphids can be found above the surface of the ground.

**Comments.** Recognition characters for this genus include the following: the habit of feeding on the roots of *Alnus* and *Betula*; the five-segmented antenna; the absence of eyes in the apterae; the fusion of the head and prothorax in the apterae; the short, almost poriform siphunculi; the usual presence of capitate setae on the apical tarsal segments; the presence of sensoria on at least the mesotibiae in both apterae and alatae; and the spiculose tibiae and tarsi.

**Genus Grylloprociphilus** Smith & Pepper

Figs. 904–913

*Grylloprociphilus* Smith and Pepper, 1968:57.
Type species: *Grylloprociphilus frosti* Smith and Pepper, 1968:57 = *Eriosoma imbricator* Fitch, 1851:68.

**Adult.** Length 1.5–3.0 mm.
Integument: Antenna with spiculose imbrications at least on apical segments; head and body without obvious sculpturing; tibiae without spicules; tarsi with dispersed but well-developed spicules ventrally; cauda and anal and genital plates with finely spiculose imbricate reticulations.

Head (Fig. 913): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, 4 or 5 anteriorly, in cluster of 3–5 on each side posteriorly. Eye absent or in some specimens reduced to a few facets in aptera; trionmatidium distinct. Dorsal cephalic suture evident at least anteriorly; ventral cephalic sutures absent. Disc without gland facets or tubercles, except fundatrix with pair of large wax gland plates. Antenna 6-segmented in alata, 5- or 6-segmented in aptera of alienicola, 4-segmented in fundatrix; processus terminalis short, papillalike; primary sensoria (Fig. 908) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 907) present on segments III–V of alata, oval to strongly transverse, nearly slitlike, with finely ciliate to spiculose margins. Rostrum 4-segmented; apical segment (Fig. 909) elongate, narrow, tapering, rounded distad of preapical primary setae. Rostrum vestigial in male and ovipara.

Thorax: Prothoracic setae pointed; each side with 1 posterior submedian and 1 anterior lateral seta. Prothorax in some specimens with partial median longitudinal carina. Prothoracic dorsal and lateral tubercles absent. Clusters of gland facets present on either side of pronotum. Mesonotum of alata with pair of large submedian wax-gland plates. Femora (Fig. 906) with setae short, pointed; hind femur of aptera alienicola and sexupara enlarged. Tibial setae fine, hairlike. Tibiae with rastral setae, strongly developed in aptera and sexupara (Fig. 912), poorly differentiated from other tibial setae in spring migrant (Fig. 911); without peglike setae, gland facets, or rastral spines. Basitarsi (Figs. 911, 912) triangular, with 2–7 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Fore wing (Fig. 904) with venation reduced; media unbranched, evanescent; branches of cubitus approximate at base, strongly divergent.

Abdomen: Without pigment, segments not fused. Setae pointed, obscure, arranged in single transverse row on each tergum. Without dorsal or lateral tubercles. Wax gland plates present laterally and submedially on each segment in aptera, laterally in alate spring migrant, laterally on each segment, and dorsally on segments I and VIII in sexupara. Spiracles (Fig. 910) without sclerotic rims. Siphunculus poriform or absent. Abdominal tergum VIII entire. Cauda arc-shaped. Anal plate (Fig. 905) entire. Gonapophyses 3.

Figs. 904–913. Alata of Grylloprociphilus. 904, right fore wing; 905, anal plate and gonapophyses; 906, left fore femur; 907, second and base of third antennal segments of spring migrant; 908, apical antennal segment of spring migrant; 909, apical rostral segment; 910, abdominal spiracle; 911, left hind tarsus of spring migrant; 912, apex of left hind tibia of sexupara; 913, venter of head.
**Embryo.** Antenna 4-segmented; eye absent; triommatidium present; tibiae with large rastral setae; hind femur markedly enlarged; abdominal segments with large lateral and dorsal wax-gland plates; basitarsi with 2 ventral setae each; plantar setae acuminate. Embryo of male and of ovipara lacking mouthparts.

**Economically important species.** None.

**Range of plants infested in Canada.** *Fagus grandifolia.*

**Biology.** Fundatrigeniae produce flocculent colonies on the trunk and limbs of beech. The alternate host in Canada is unknown, but alienicolae have been collected on *Taxodium* in Florida (Smith and Denmark 1984).

**Comments.** The best recognition character for the single species in this genus, *Grylloprociphilus imbricator* (Fitch), is the association with *Fagus* and the type of colony produced. Alatae viviparae may be most easily recognized by the enlarged hind femora and large rastral setae of the embryos they contain. The large mesothoracic wax-gland plates, long tarsi, large lateral clusters of abdominal gland facets, and the finely ciliate margins of the secondary sensoria are also distinctive. *Fagiphagus* Smith is a junior synonym of *Grylloprociphilus* (Smith and Denmark 1984).

**Genus Gypsoaphis Oestlund**

Figs. 914–924

*Gypsoaphis* Oestlund, 1922:126.

Type species: *Aphis lonicerae* Monell, 1879:26, not Siebold, 1839 = *Gypsoaphis oestlundi* Hottes, 1930:181.

**Adult (Figs. 914, 915).** Length 1.5–2.0 mm.

Integument: Head and body without pronounced sculpturing other than some reticulations and/or with weakly formed spiculose or nodulose imbrications on anal plate and on abdominal terga VI or VII and VIII; antennae and tarsi with smooth imbrications; tibiae with some preapical nodules and imbrications; cauda spiculose.

Head (Fig. 924): Antennal tubercle weakly developed; front of head slightly convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, hairlike, arranged on each side of head in anterior and posterior group of 2 each. Eye present in aptera and alata; triommatidium distinct. Disc of head without gland facets, usually without tubercles. Dorsal and ventral cephalic sutures absent. Processus terminalis elongate, without numerous setae; primary sensoria (Fig. 920) not fused, with ciliate margins; secondary sensoria (Fig. 919) circular, present on antennal segments III and IV.
Figs. 914, 915. Aptera of *Gypsoaphis*. 914, head and prothorax; 915, terminal abdominal segments.
Figs. 916–924. Alata of *Gypsoaphis*. 916, right fore wing; 917, anal plate and gonapophyses; 918, left fore femur; 919, second and base of third antennal segments; 920, base of apical antennal segment; 921, apical rostral segment; 922, abdominal spiracle; 923, left hind tarsus; 924, venter of head.
of alata, 0–3 present on segment III of aptera; without ciliate margins, but with spiculose margins in some specimens. Rostrum 4-segmented; apical segment (Fig. 921) conical, bluntly pointed.

Thorax: Prothoracic setae pointed, each side with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax normally without dorsal tubercles, with conspicuous lateral tubercles; without gland facets. Femora (Fig. 918) and tibiae with setae pointed. Tibiae without sensoria, gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 923) triangular, with 3 (rarely 2 on hind tarsus) ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae, Plantar setae acuminate. Claws simple. Fore wing (Fig. 916) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Abdomen without pigmented areas dorsally, in some specimens alata with faint lateral sclerites. Dorsal abdominal tubercles normally absent; large lateral abdominal tubercles present on segments II–VII. Spiracles (Fig. 922) slightly reniform, usually not surrounded by pigment. Abdominal setae pointed, arranged in single transverse row on each tergum. Siphunculus poriform, or nearly so. Abdominal tergum VIII entire. Cauda semicircular to tongue-shaped. Anal plate (Fig. 917) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Lonicera species.

Biology. Details are unknown for the single species placed in this genus. Presumably the species is holocyclicly associated with its host.

Comments. Recognition characters for this genus include the restricted association with Lonicera, the poriform siphunculi, and the weakly developed antennal tubercles.

Genus Hamamelistes Shimer

Figs. 925–935

Hamamelistes Shimer, 1867:284.
Type species: Hamamelistes spinosus Shimer, 1867:284.

Adult (Figs. 925, 926). Length 1.2–2.0 mm.
Integument: Antennal segments III–V in alata with fine network of smooth nodulose and faintly spiculose imbrications; antenna similar in aptera but spicules more evident; head with some wrinkles and faintly nodulose striae in both aptera and alata; thorax unsculptured in alata, with faint nodulose and spiculose imbrications
in aptera and alata; tibiae, especially foretibia, usually with a few faint nodulose and weakly spiculose imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 935): Antennal tubercle undeveloped; front of head weakly convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, fairly long in aptera, minute in alata, arranged in transverse cluster on posterior half of disc and narrow transverse cluster extending along posterior margin of disc. Eye present in alata, absent in aptera; triommatidium present in aptera and alata. Disc of head without tubercles or gland facets. Ventral sutures absent in alata.

Discal setae pointed, fairly long in aptera, minute in alata, arranged in transverse cluster on posterior half of disc and narrow transverse cluster extending along posterior margin of disc. Eye present in alata, absent in aptera; triommatidium present in aptera and alata.

Discal setae of head without tubercles or gland facets. Ventral sutures absent in alata.

Antenna 3-segmented in aptera, 5-segmented in alata. Processus terminalis usually absent, represented only by usual apical cluster of setae; primary sensoria absent in alata (Fig. 931), minute in aptera, without ciliate margins; accessory sensoria present or absent, minute where present; secondary sensoria (Fig. 930) consisting of numerous, narrow annuli on segments III–V in alata; absent in aptera. Rostrum 4-segmented; apical segment (Fig. 932) short, nearly cylindrical, blunt distad of preapical primary setae.

Thorax: Prothoracic setae pointed, about same length as discal setae, arranged in lateral cluster on each side and distinct anterior and posterior submedian cluster. Prothorax without dorsal or lateral tubercles. Femora (Fig. 929) and tibiae with setae pointed; tibial setae not longer than apical diameter of respective tibia. Tibiae without sensoria, gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 934) triangular, with 3 or 4 preapical setae on a ledge; distitarsi elongate, with dorsal preapical capitulate setae. Plantar setae weakly but distinctly capitulate. Claws simple. Fore wing (Fig. 927) with venation reduced; media unbranched, incomplete basally; branches of cubitus fused at base, arising from common stem, strongly divergent.

Abdomen: Abdomen without pigmented sclerotic areas dorsally or laterally. Lateral and dorsal abdominal tubercles absent. Spiracles (Fig. 933) small, circular, with sclerotic rims. Siphunculus absent. Abdominal setae pointed, longer in aptera than in alata, arranged in single transverse row on each tergum. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 928) bilobate. Gland facets absent. Gonapophyses 2, represented by clusters of small setae on weakly pigmented spots.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Betula and Hamamelis species.

Figs. 925, 926. Aptera of Hamamelistes. 925, head and prothorax; 926, terminal abdominal segments.
Figs. 927–935. Alata of *Hamamelistes*. 927, right fore wing; 928, anal plate and gonapophyses; 929, left fore femur; 930, second and base of third antennal segments; 931, base of apical antennal segment; 932, apical rostral segment; 933, abdominal spiracle; 934, left hind tarsus; 935, venter of head.
Biology. The single known North American species is usually heterocyclic between a twig gall on *Hamamelis* species and *Betula* species, where it forms a pseudogall on the leaves. However, the form on birch occurs across Canada and is probably anholocyclic in areas where *Hamamelis* does not occur.

Comments. Recognition characters for this genus include the association with birch, the aleurodiform aestivating stage, and the 3-segmented antennae in the apterae.

Genus *Hayhurstia* Del Guercio

Type species: *Hayhurstia deformans* Del Guercio, 1917:206 = *Aphis atriplicis* Linnaeus, 1761:262.

**Adult** (Figs. 936, 937). Length 1.5–2.5 mm.

Integument: Antenna with smooth imbrications; head and body without sculpturing other than some spiculose imbrications on apical abdominal segments; tibiae without sculpturing; tarsi with nodulose and sharply spiculose imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 946): Antennal tubercle weakly or not developed; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae blunt or weakly capitate, arranged on each side in an anterior and posterior group of 2 each. Eye and triommatidium present in aptera and alata. Ventral and dorsal cephalic sutures absent. Disc without gland facets or tubercles. Antenna 6-segmented; primary sensoria (Fig. 942) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 940) circular, without ciliate margins, absent in aptera, present on segment III and in a few specimens on segment IV in alata. Rostrum 4-segmented; apical segment (Fig. 943) elongate, slender, strongly tapered, rounded distad of preapical primary setae.

Thorax: Prothoracic setae of similar size and shape as discal setae, arranged with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta on each side. Prothorax with or without a lateral tubercle on each side. Without dorsal tubercles. Femora (Fig. 941) with setae pointed; tibial setae mostly blunt or weakly capitate, except some pointed on apical half of each tibia, longest barely as long as apical diameter of respective tibia. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 945) triangular, with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 938) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent, nearly parallel.

361
Figs. 936, 937. Aptera of Hayhurstia. 936, head and prothorax; 937, terminal abdominal segments.
Figs. 938–946. Alata of *Hayhurstia*. 938, right fore wing; 939, cauda, anal plate and gonapophyses; 940, second and base of third antennal segments; 941, left fore femur; 942, base of apical antennal segment; 943, apical rostral segment; 944, abdominal spiracle; 945, left hind tarsus; 946, venter of head.
Abdomen: Abdominal terga not fused, without pigment except on tergum VIII in some specimens. Lateral abdominal sclerites absent in aptera, present but weakly pigmented in alata. Dorsal abdominal tubercles absent; lateral abdominal tubercles usually present on one or all of segments III–VI. Spiracles (Fig. 944) subcircular, with sclerotized rims. Siphunculus short, slightly swollen, without setae, with weakly developed apical flange, nearly smooth, but usually with some weakly spiculose imbrications basally. Abdominal tergum VIII entire. Cauda (Fig. 939) elongate, finger-shaped, with slight constriction, broadly rounded apically. Anal plate entire. Abdomen without gland facets. Gonapophyses 4, having 2 central clusters of setae commonly situated close together in alata, apparently partially fused.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Chenopodium album L.

Biology. The single species in North America is holocyclicly associated with its host plant, causing the leaves to fold or roll longitudinally to form a pseudogall.

Comments. Recognition characters for this genus include the association with Chenopodium and the pseudogall of deformed leaves produced, the short swollen siphunculi, the long cauda, and the spicules and nodules on the tarsal imbrications.

Genus *Hoplochaitophorus* Granovsky

Figs. 947–958

*Hoplochaitophorus* Granovsky, 1933:32.
Type species: *Chaitophorus quercicola* Monell, 1879:32.

Adult (Figs. 947, 948). Length 1.5–2.5 mm.

Integument: Apical portion of antennal segment III and segments IV–V with spicules and spiculose imbrications; head and body without sculpturing; tibiae with spicules on apical half of each; tarsi spiculose; cauda and anal and genital plates spiculose.

Head (Fig. 958): Antennal tubercle undeveloped; front of head slightly concave. Ventral margin of antennal socket not protuberant. Discal setae mixture of spinelike and hairlike setae in aptera, hairlike in alata, arranged in anterior and posterior transverse cluster, with centre of disc nude or nearly so. Eye and triommatidium present in aptera and alata. Antenna 6-segmented; processus terminalis (Fig. 953) short, not as long as base of VI; primary sensoria with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 952) present on antennal segment III, circular, with ciliate
Figs. 947, 948. Aptera of *Hoplochaitophorus*. 947, head and prothorax; 948, terminal abdominal segments.
Figs. 949–958. Embryonic chaetotaxy and alata of *Hoplochaetophorus*. 949, right fore wing; 950, anal plate and gonapophyses; 951, left fore femur; 952, second and base of third antennal segments; 953, apex of ultimate antennal segment; 954, apical rostral segment; 955, abdominal spiracle; 956, dorsal chaetotaxy of embryo; 957, left hind tarsus; 958, venter of head.
margins. Rostrum 4-segmented; apical segment (Fig. 954) short, triangular, bluntly rounded distad of preapical primary setae.

Thorax: Prothoracic setae arranged in clusters of anterior and posterior lateral setae and anterior and posterior submedian setae, with all except anterior lateral clusters containing spinelike setae in aptera. Prothorax with several lateral tubercles, none dorsally. Femora (Fig. 951) and tibiae with setae pointed, fine, hairlike. Tibiae without peglike setae, gland facets, or rastral spines. Rastral setae present in aptera and alata, but not much thicker than normal tibial setae. Basitarsi (Fig. 957) triangular with 5 or 6 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitiate setae. Plantar setae narrowly clavate, almost setiform in alata. Fore wing (Fig. 949) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Abdominal terga not fused. Each tergum with small median dorsal pigmented patch on each side in alata, with small indistinct or large paired rectangular patches on each tergum in aptera. Lateral sclerites present in aptera and alata, in some species these small, inconspicuous in aptera. Abdomen without dorsal tubercles, with 1–6 lateral tubercles on segments II–VII. Spiracles (Fig. 955) subcircular, with sclerotic rim. Siphunculus short, smooth, without setae, somewhat flared apically, but without apical flange. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 950) weakly bilobate. Abdomen without gland facets. Gonapophyses 2.

Embryo (Fig. 956). Antenna 4-segmented; each side of disc with 2 setae anteriorly and posterior lateral seta; disc and prothorax without gland facets, or tubercles; each side of abdomen with 1 lateral seta and 1 or 2 submedian setae; abdomen without gland facets or tubercles; siphunculus poriform where visible; basitarsi with 2 ventral setae, without dorsal setae; distitarsi elongate without preapical capitate setae; plantar setae spatulate.

Economically important species. None.

Range of plants infested in Canada. Quercus macrocarpa Michx.

Biology. This genus lives holocyclicly on its host plant.

Comments. Recognition characters for this genus include the spiculose tarsi, the presence of spinelike dorsal setae, and the association with Quercus. The embryos and first-instar larvae are also distinctive because they have paired submedian setae on most of the abdominal terga.
Genus *Hormaphis* Osten Sacken

Figs. 959–970

*Hormaphis* Osten Sacken, 1861:422.
Type species: *Hormaphis hamamelidis* Osten Sacken, 1861:422 = *Hamamelistes cornu* Shimer, 1867:284.

**Adult** (Figs. 959–961). Length 1.0–2.0 mm.

Integument: Antenna in alata with annuli of sharp spicules, in aptera (fundatrix) with nodulose or weakly spiculose anastomosing imbrications; head and body without obvious sculpturing in aptera or alata; tibiae and tarsi with spiculose imbrications in alata, without sculpturing in aptera except a few weak imbrications in some specimens; cauda and anal and genital plates spiculose.

Head (Fig. 970): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, arranged on each side in anterior and posterior cluster leaving centre of disc nude. Eye present in alata, absent in aptera; triommatidium present in both aptera and alata. Ventral and dorsal cephalic sutures not evident. Disc without dorsal tubercles. Disc without gland facets in alata and fundatrix, circular, with lateral and dorsal pores present in aleurodiform aptera. Antenna 3-segmented in alata and fundatrix, reduced to small inconspicuous 1 or 2-segmented papillae in aleurodiform stage; processus terminalis short in fundatrix, absent in alata and aleurodiform stage; primary sensoria absent in fundatrix and aleurodiform stage; numerous annular secondary sensoria (Figs. 965, 966) present on segment III of alata. Rostrum 4-segmented; apical segment (Fig. 967) short, bluntly rounded distad of preapical primary setae.

Thorax: Head and prothorax fused in aptera. Prothorax without dorsal or lateral tubercles, with marginal, circular gland facets in aleurodiform stage. Prothoracic setae pointed, arranged in distinct lateral, anterior and posterior submedian clusters. Femora (Fig. 964) and tibiae with setae pointed. Tibiae without gland facets, peglike setae, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 969) of alata triangular, with 3 ventral setae, with long lateral setae, without dorsal setae; distitarsi elongate with capitae preapical setae; aleurodiform stage with fore tarsus 1-segmented, with apical capitae setae, without middle and hind tarsi; nonaleurodiform aptera with fore and middle tarsi 1-segmented, with preapical capitae setae, and with hind tarsus 2-segmented, with preapical capitae setae. Plantar setae capitae. Claws simple. Fore wing (Fig. 962) with venation reduced; media unbranched, incomplete basally; branches of cubitus arising from short common stem, strongly divergent.

Abdomen: Abdominal terga not fused in alata or fundatrix, fused in aleurodiform stage. Abdomen without dorsal pigment in alata or fundatrix, with pigment in aleurodiform stage. Dorsal and lateral abdominal tubercles absent. Lateral sclerites absent.
Fig. 959. Aleurodiform aptera of *Hormaphis*.
Figs. 960, 961. Aptera of *Hormaphis*. 960, head and prothorax; 961, terminal abdominal segments.
Figs. 962–970. Alata of *Hormaphis*. 962, right fore wing; 963, anal plate and gonapophyses; 964, left fore femur; 965, second and base of third antennal segments; 966, apical antennal segment; 967, apical rostral segment; 968, abdominal spiracle; 969, left hind tarsus; 970, venter of head.
Spiracles (Fig. 968) subcircular, with sclerotized rims. Siphunculus absent. Abdominal tergum VIII entire. Cauda knobbled. Anal plate (Fig. 963) bilobate. Alata and fundatrix without obvious abdominal gland facets; each segment laterally with fine glandular network; aleurodiform stages with clusters of median dorsal and marginal circular gland facets on each thoracic and abdominal segment. Gonapophyses 2.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Hamamelis* species.

**Biology.** The single Canadian species, *Hormaphis hamamelidis* (Fitch) is monoeciously holocyclic on *Hamamelis virginiana* L., on which it forms conical galls on the upper surface of the leaves. A second species from the eastern United States is heterocyclic between *Hamamelis* and *Betula*.

**Comments.** Recognition characters for this genus include the conical galls on witch hazel and the presence of three antennal segments in the fundatrices and alatae. The abundant, narrow, annular sensoria on the antenna of the alatae are also distinctive.

**Genus Hyadaphis Kirkaldy**

Figs. 971–981

*Hyadaphis* Kirkaldy, 1904:279.

Type species: *Aphis xylostei* Schrank, 1801:107, nec DeGeer, 1773 = *Siphocoryne foeniculi* Passerini, 1860:37.

**Adult** (Figs. 971, 972). Length 1.5–3.0 mm.

Integument: Antennae with smooth imbrications; head and body in alata without obvious sculpturing, except in some species a few reticulations on abdomen and some weakly spiculose imbrications on apical abdominal segments, in aptera with similar distinct reticulations commonly on thorax and abdomen; tibiae without spicules or imbrications; tarsi with smooth imbrications; cauda and anal and genital plates with some spicules.

Head (Fig. 981): Antennal tubercle undeveloped in aptera, slightly developed in alata of some species; front of head convex in aptera, slightly W-shaped in some alata. Ventral margin of antennal socket not protuberant. Discal setae short, usually blunt or weakly capitate, arranged in anterior and posterior group of 4 each. Eye and triommatidium present in aptera and alata. Ventral and dorsal cephalic sutures absent. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 977) with ciliate margins;
Figs. 971, 972. Aptera of *Hyadaphis*. 971, head and prothorax; 972, terminal abdominal segments.
Figs. 973–981. Alata of *Hyadaphis*. 973, right fore wing; 974, anal plate and gonapophyses; 975, second and base of third antennal segments; 976, left fore femur; 977, base of apical antennal segment; 978, apical rostral segment; 979, abdominal spiracle; 980, left hind tarsus; 981, venter of head.
accessory sensoria not fused; secondary sensoria (Fig. 975) absent in aptera; circular sensoria lacking ciliate margins present on segments III, IV, and in some species V in alata. Rostrum 4-segmented; apical segment (Fig. 978) slender, conical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae same size and shape as discal setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Prothorax without dorsal or lateral tubercles. Femora (Fig. 976) with setae short, blunt; tibial setae blunt or weakly capitate basally, pointed apically. Tibiae without peglike setae, sensoria, gland facets, rastral setae, or rastral spines. Basitarsus of fore and middle legs (Fig. 980) triangular, each with 3 ventral setae; hind basitarsus with 2 or rarely 3 ventral setae; all basitarsi without dorsal setae. Distitarsi elongate, without preapical capitae setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 973) with normal venation; media with 3 branches; branches of cubitus widely separated at base, divergent to nearly parallel.

Abdomen: Abdominal setae short, blunt, arranged in single transverse row on each tergum. Abdominal terga not fused, not pigmented. Small lateral abdominal sclerites usually present in alata. Abdomen without dorsal tubercles, with or without lateral tubercles. Spiracles (Fig. 979) subcircular, with sclerotized rims, without opercula. Siphunculus swollen or constricted proximad of flange, nearly smooth or with smooth imbrications, with well-developed apical flange. Abdominal tergum VIII entire. Cauda (Fig. 974) elongate, with sides nearly parallel or slightly tapering, broadly rounded or short, broadly triangular apically. Anal plate entire. Abdomen without gland facets. Gonapophyses 3.

Embryo. Not observed.

Economically important species. *Hyadaphis tataricae* (Aizenberg).

Range of plants infested in Canada. *Lonicera* species and various Umbelliferae.

Biology. Some species are heterocyclic between *Lonicera* species and Umbelliferae. Many species in the Old World are holocyclicly associated with various Umbelliferae and Cruciferae.

Comments. Recognition characters for this genus include the association with *Lonicera*, the well-developed siphuncular flange, and the elongate cauda. *Hyadaphis* is difficult to separate from *Brevicoryne* and *Lipaphis*.
Genus *Hyalomyzus* Richards

Type species: *Myzus eriobotryae* Tissot, 1935:49.

**Adult** (Figs. 982, 983). Length 1.0–2.0 mm.

Integument: Antennae with smooth imbrications, these best-developed in aptera, inconspicuous or absent in alata; head and body in alata without pronounced sculpturing other than some more or less distinct spiculose imbrications laterally and posteriorly; in aptera head and prothorax with spicules and nodules dorsally, elsewhere integument smooth, appearing rippled and folded or wrinkled; tibiae with smooth imbrications at least apically, in some species also basally, and more conspicuous in aptera; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 992): Antennal tubercle with weakly developed base; but mesal margin with large scabrous mesally projecting protuberance at least in aptera. Ventral margin of antennal socket protuberant. Discal setae short, inconspicuous, blunt, or faintly capitate, arranged on each side in anterior and posterior pair. Eye and triommatidium present in aptera and alata. Disc without gland facets or tubercles. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 988) with coarsely ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 986) without ciliate margins, absent in aptera, numerous on segments III–V in alata. Rostrum 4-segmented; apical segment (Fig. 989) relatively short, conical, with apex rounded.

Thorax: Each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; setae short, inconspicuous, blunt. Dorsal and lateral prothoracic tubercles absent. Femora (Fig. 987) with setae blunt; tibial setae blunt, or weakly capitate basally in aptera, pointed in alata and apically in aptera. Tibiae without peglike setae, rastral setae, rastral spines, or gland facets. Basitarsi (Fig. 991) triangular, each with 3 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae. Plantar setae acuminate or capitate. Claws simple. Fore wing (Fig. 984) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent.

Abdomen: Abdominal setae short, mostly blunt at least in aptera, arranged in single transverse row on each tergum, with only submedian and lateral setae on some posterior terga. Abdominal terga more or less fused, with or without pigment, sclerotic. Lateral abdominal sclerites absent in aptera, present but commonly minute in alata. Spiracles (Fig. 990) subcircular to reniform, not operculate. Siphunculus elongate, swollen on apical half, with apical flange, without setae, with strongly spiculose imbrications at least ventrally in aptera, in alata similar but much less strongly sculptured. Cauda
Figs. 982, 983. Aptera of *Hyalomyzus*. 982, head and prothorax; 983, terminal abdominal segments.
Figs. 984–992. Alata of *Hyalomyzus*. 984, right fore wing; 985, anal plate and gonapophyses; 986, second and base of third antennal segments; 987, left fore femur; 988, base of apical antennal segment; 989, apical rostral segment; 990, abdominal spiracle; 991, left hind tarsus; 992, venter of head.
bluntly triangular. Abdominal tergum VIII entire. Anal plate (Fig. 985) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Crataegus* species. Fall migrants are sometimes common on apple in Ontario and the Maritimes.

**Biology.** This genus is heterocylic, alternating between *Crataegus* and other Pomoidea, and Labiatae, Hypericaceae, and Onagraceae.

**Comments.** Recognition characters for this genus include the scabrous and well-developed antennal tubercles, the absence of a dorsal patch in the alatae, the reduction in size of the apical spicules on the cauda, the swollen siphunculi, and, in Canada, the association with apple late in the season.

**Genus Hyalopteroides** Theobald


**Adult** (Figs. 993, 994). Length 2.0–3.0 mm.

Integument: Antenna with smooth imbrications; head and body without conspicuous sculpturing other than a few spiculose imbrications on apical abdominal terga; tibiae without sculpturing, or with a few imbrications in alata; tarsi with smooth spiculose and nodulose imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1003): Antennal and median tubercles well-developed so that front of head is W-shaped; antennal tubercle with mesal process. Ventral margin of antennal socket not protuberant. Discal setae short, blunt or weakly capitate, arranged in anterior and posterior group of 4 each. Eye and triommatidium present in aptera and alata. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 999) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 998) present on segment III or absent in aptera, always present on segment III in alata, circular, without ciliate margins. Rostrum 4-segmented; apical segment (Fig. 1000) short, cylindrical, bluntly rounded distad of preapical primary setae.

Thorax: Prothoracic setae about same size and shape as discal setae; each side of prothorax with 1 posterior submedian seta and 1
Figs. 995–1003. Alata of *Hyalopteroides*. 995, right fore wing; 996, anal plate and gonapophyses; 997, left fore femur; 998, second and base of third antennal segments; 999, base of apical antennal segment; 1000, apical rostral segment; 1001, abdominal spiracle; 1002, left hind tarsus; 1003, venter of head.

Figs. 993, 994. Aptera of *Hyalopteroides*. 993, head and prothorax; 994, terminal abdominal segments.
anterior and 1 posterior lateral seta. Prothorax without lateral or dorsal tubercles. Femora (Fig. 997) with setae short, pointed; tibial setae blunt or weakly capitate basally, pointed apically, with longest about as long as apical diameter of respective tibia. Tibiae without peglike setae, sensoria, gland facets, rastral spines, or rastral setae. Basitarsi (Fig. 1002) triangular, with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 995) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Abdominal terga not fused, without pigment. Lateral sclerites absent. Lateral abdominal tubercles small, inconspicuous, weakly protuberant when present, on one or all of segments III–V. Spiracles (Fig. 1001) subcircular, weakly reniform, without opercula, with sclerotized rims. Siphunculus shorter than cauda, without setae, with weakly developed apical flange, with smooth imbrications. Abdominal tergum VIII entire. Cauda elongate almost parallel sided, with apex broadly rounded. Anal plate (Fig. 996) entire. Abdomen without gland facets. Gonapophyses 3; centre one divided in some specimens.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Gramineae.

Biology. This genus is monoeciously and holocyclically associated with the host plant where colonies form on the upper surfaces of the leaves.

Comments. Recognition characters for this genus include the short and almost flangeless siphunculi, the long bluntly rounded cauda, the association with grasses, and the distinct process on the antennal tubercles. Hyalopteroides humilis (Walker) is the only species in this genus.

Genus Hyalopterus Koch

Figs. 1004–1014

Hyalopterus Koch, 1854:16.

Type species: Aphis pruni Fabricius, 1775:725 = Aphis pruni Geoffroy, 1762:497.

Adult (Figs. 1004, 1005). Length 1.0–3.0 mm.

Integument: Antenna with smooth and weakly nodulose imbrications; head and body without sculpturing except for some spiculose imbrications on apical 2 or 3 abdominal terga; tibiae with a
few smooth or weakly nodulose preapical imbrications; tarsi mostly with smooth imbrications, but usually a few nodulose or distinctly spiculose imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 1014): Antennal tubercle weakly to moderately developed; front of head slightly concave. Ventral margin of antennal socket not protuberant. Eye and triommatidium present in aptera and alata. Discal setae pointed, arranged on each side in anterior and posterior group of 2 each. Disc without gland facets or tubercles. Antenna 6-segmented; processus terminalis elongate without numerous setae; primary sensoria (Fig. 1010) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1009) circular, only present on segment III of alata, with short spicules or cilia on margins of most. Rostrum 4-segmented; apical segment (Fig. 1011) short, triangular, bluntly rounded distad of preapical primary setae.

Thorax: Prothoracic setae pointed; each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax with lateral tubercle on each side. Femora (Fig. 1008) and tibiae with setae pointed. Tibia without peglike setae, gland facets, sensoria, basal spines, or basal spines. Basitarsi (Fig. 1013) triangular, with 3 ventral setae on fore and middle basitarsi and 2 on hind basitarsus, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae short, setiform. Claws simple. Fore wing (Fig. 1006) with normal venation; media with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Abdominal terga not fused, without pigment. Dorsal abdominal setae pointed, arranged in single transverse row on each tergum. Dorsal abdominal tubercles absent. Lateral sclerites absent. Lateral tubercles usually present on each of segments II–VII. Spiracles (Fig. 1012) subcircular, with sclerotic rims. Siphunculus shorter than cauda, swollen on apical half, without setae, smooth on apical half, with some spiculose imbrications on basal half, without apical flange. Abdominal tergum VIII entire. Cauda elongate, broadly rounded apically. Anal plate (Fig. 1007) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Antenna 4- or 5-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; disc and prothorax without gland facets or tubercles; each side of abdomen with 1 submedian and 1 lateral seta, with dorsolateral setae usually present on terga I–V or VI; abdomen without gland facets or tubercles; siphunculus short, nearly poriform; basitarsi triangular, with 2 ventral setae; distitarsi elongate, without preapical setae; plantar setae acuminate.

**Economically important species.** *Hyalopterus pruni* (Geoffroy)

**Range of plants infested in Canada.** *Prunus* species (plums) and *Phragmites* species.
Figs. 1006–1014. Alata of *Hyalopterus*. 1006, right fore wing; 1007, anal plate and gonapophyses; 1008, left fore femur; 1009, second and base of third antennal segments; 1010, base of apical antennal segment; 1011, apical rostral segment; 1012, abdominal spiracle; 1013, left hind tarsus; 1014, venter of head.

Figs. 1004, 1005. Aptera of *Hyalopterus*. 1004, head and prothorax; 1005, terminal abdominal segments.
**Biology.** The single representative of this genus in Canada is heterocyclic between plums and *Phragmites*. Large colonies, in which the apterae are covered with conspicuous mealy wax, are produced on the leaves of both host plants.

**Comments.** Recognition characters for this genus include the short siphunculi, long cauda, the associations with plums and *Phragmites*, and the conspicuous mealy secretions on bodies of the apterae.

**Genus Hysteroneura** Davis

Figs. 1015–1025

*Hysteroneura* Davis, 1919:263.

Type species: *Siphonophora setariae* Thomas, 1878:5.

**Adult** (Figs. 1015, 1016). Length 1.5–2.25 mm.

Integument: Antenna with smooth and in some specimens faintly nodulose imbrications; head and body without obvious sculpturing, but with some spiculose imbrications on apical abdominal segments and in some specimens with irregular reticulations on abdominal terga of aptera; tibiae usually without sculpturing; tarsi usually with smooth imbrications, rarely a few imbrications with a few spicules; cauda and anal and genital plates spiculose.

Head (Fig. 1025): Antennal tubercle slightly developed. Ventral margin of antennal socket not protuberant. Eye and triommatidium present in aptera and alata. Discal setae pointed, arranged in anterior and posterior group of 4 each. Ventral and dorsal cephalic sutures absent. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1021) with ciliate margins; accessory sensoria (Fig. 1020) circular, without ciliate margins, present on segment III of alata. Rostrum 4-segmented; apical segment (Fig. 1022) short, slightly tapered, with apex rounded distad of preapical primary setae.

Thorax: Prothoracic setae pointed, each side with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax with 1 lateral tubercle on each side. Femora (Fig. 1019) with setae pointed; tibial setae shorter than apical diameter of respective tibia, pointed, or in some specimens blunt basally. Tibiae without sensoria, gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1024) triangular, with 3 ventral setae on fore and middle basitarsi and 2 on hind basitarsus, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae relatively long, bluntly setiform. Claws simple. Fore wing (Fig. 1017) with normal venation; media with 3 branches; branches of cubitus widely separated at base, somewhat divergent. Hind wing with single transverse vein.

386
Figs. 1015, 1016. Aptera of *Hysteroneura*. 1015, head and prothorax; 1016, terminal abdominal segments.
Figs. 1017–1025. Alata of *Hysteroneura*. 1017, right fore wing; 1018, anal plate and gonapophyses; 1019, left fore femur; 1020, second and base of third antennal segments; 1021, base of apical antennal segment; 1022, apical rostral segment; 1023, abdominal spiracle; 1024, left hind tarsus; 1025, venter of head.
Abdomen: Abdominal terga not fused, without pigment except transverse dash on tergum VIII. Lateral sclerites present in alata, absent in aptera. Dorsal abdominal tubercles absent. Lateral abdominal tubercles normally present on segments II–VII. Abdominal setae pointed or blunt, arranged in single transverse row on each tergum. Spiracles (Fig. 1023) oval to reniform. Siphunculus elongate, tapering, nearly cylindrical, without setae, apical flange poorly developed, vestigial, commonly not visible in aptera, with well-developed spiculose imbrications. Cauda fairly short, broadly rounded apically, with a slight constriction. Abdominal tergum VIII entire. Anal plate (Fig. 1018) entire. Abdomen without gland facets. Gonapophyses 3 of which centre one subdivided in some specimens.

Embryo. Not observed.

Economically important species. Hysteroneura setariae (Thomas).

Range of plants infested in Canada. The single known species feeds on Prunus species and various Gramineae.

Biology. The single known species is known to be heterocyclic between Prunus, where pseudogalls of deformed leaves are produced, and various Gramineae. Injury to both groups of plants can occur.

Comments. Recognition characters for this genus include the association with Prunus and various Gramineae, the cylindrical and heavily imbricated flangeless siphunculi, and the single cross vein in the hind wing.

Genus Idiopterus Davis

Idiopterus Davis, 1909:198.
Type species: Idiopterus nephrelepidis Davis, 1909:199.

Adult (Figs. 1026, 1028). Length 1.5–2.5 mm.
Integument: Antennal segments I and II with spicules and nodules; segments III–VI with smooth imbrications; disc of head with spicules, in alata with spicules dispersed, less evident; thorax and abdomen without obvious sculpturing other than ripples laterad on thorax and weakly nodulose and spiculose imbrications on apical abdominal terga; tibiae unsculptured; tarsi mostly with smooth imbrications, in some specimens imbrications with a few spicules; cauda except apex (Fig. 1029) and anal and genital plates spiculose.

Head (Fig. 1037): Antennal tubercle well-developed, scabrous, dorsomedial margin with small setigerous projection. Ventral margin of antennal socket protuberant (Fig. 1027). Discal setae short, blunt, or slightly capitate, arranged on each side in anterior and posterior
Figs. 1030–1037. Alata of Idiopterus. 1030, right fore wing; 1031, anal plate and gonapophyses; 1032, second and base of third antennal segments; 1033, base of apical antennal segment; 1034, apical rostral segment; 1035, abdominal spiracle; 1036, left hind tarsus; 1037, venter of head.

Figs. 1026–1029. Aptera of Idiopterus. 1026, head and prothorax; 1027, ventral margin of antennal socket; 1028, terminal abdominal segments; 1029, apex of cauda.
group of 4 each. Dorsal cephalic sutures absent; ventral sutures evident on each side and ventrad of median ocellus. Eye and triommatidium present in aptera and alata. Disc without dorsal tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 103) with faintly nodulose margins in some specimens, without cilia; accessory sensoria not fused; secondary sensoria (Fig. 1032) circular, without ciliate margins, present on segment III in alata and aptera. Rostrum 4-segmented; apical segment (Fig. 1034) subcylindrical, long, slender, rounded distad of preapical primary setae.

Thorax: Prothoracic setae similar to discal setae, arranged with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta on each side. Tibial setae capitate basally, pointed apically. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 1036) triangular, with 3 ventral setae on fore and middle legs and 2 on hind leg, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1030) with unusual venation; stigma broad, triangular; radial sector fused or nearly fused with anterior branch of media; media with 1 or 2 branches; branches of cubitus widely separated at base, divergent to nearly parallel.

Abdomen: Abdomen without dorsal pigment, with lateral sclerites evident in alata. Abdominal setae capitate or blunt, arranged in single transverse row on each tergum. Lateral abdominal tubercles absent. Spiracles (Fig. 1035) with sclerotized rims, weakly, but distinctly operculate on segment VII. Siphunculus elongate, cylindrical, without setae, with apical flange, with smooth and weakly spiculose or nodulose imbrications. Abdominal tergum VIII entire. Cauda elongate, bluntly pointed. Anal plate (Fig. 1031) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** None, but has been intercepted on ferns being imported at Vancouver.

**Biology.** The single known species is anholocyclicly associated with ferns.

**Comments.** This genus is easily recognized by the association with imported tropical ferns, the cylindrical siphunculi, the well-developed antennal tubercles, and the highly modified venation of the fore wing.
Genus *Illinoia* Wilson

*Illinoia* Wilson, 1910:318.
Type species: *Siphonophora liriodendri* Monell, 1879:20.

**Adult** (Figs. 1038, 1040). Length 1.5–3.0 mm.

Integument: Antennae with imbrications and spicules, especially in aptera; head and body without obvious sculpturing other than some spiculose imbrications on apical abdominal terga; tibiae mostly smooth, rarely with a few subapical imbrications; tarsi mostly with imbrications smooth, in some species ventral, faintly nodulose or spiculose; cauda and anal and genital plates with spicules.

Head (Fig. 1050): Antennal tubercle well-developed; front of head strongly concave. Ventral margin of antennal socket (Fig. 1039) protuberant, with or without spicules. Each side of disc with 2 anterior and 2 posterior setae. Disc without gland facets, in some species with 1 or 2 tubercles posteriorly. Antenna 6-segmented; processus terminalis elongate, filiform, without numerous setae; primary sensoria (Fig. 1045) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1044) circular, without ciliate margins, present on segments III–V of alata, in some species a few on segment III of aptera. Eye and triommatidium present in aptera and alata. Rostrum 4-segmented; apical segment (Fig. 1046) subcylindrical to conical.

Thorax: Prothorax without gland facets, commonly with lateral tubercles, rarely with dorsal tubercles; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Femora (Fig. 1043) with setae short, pointed; tibial setae variable throughout genus. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 1049) triangular, with 3 or 4 (rare specimens with 5) ventral setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws not bifid. Fore wing (Fig. 1041) with normal venation; media with 3 branches; branches of cubitus separated at base, slightly divergent.

Abdomen: Abdominal setae pointed, or weakly capitate, arranged in single transverse row on each tergum. Abdomen without gland facets, commonly with lateral tubercles on some segments, and with dorsal tubercles present on tergum VIII in some species. Abdomen not sclerotic, unpigmented, other than occasional traces on terga VII and VIII. Lateral sclerites evident in alata in some species. Spiracles (Fig. 1047) subcircular, with sclerotic rims, without opercula. Siphunculus elongate, swollen on apical half, without setae, with a few subapical rows of reticulations, with flange, ranging from nearly smooth to spiculose with weak spiculose or nodulose imbrications. Abdominal tergum VIII entire. Cauda short to elongate, bluntly triangular. Anal plate (Fig. 1042) entire. Gonapophyses 3.
Figs. 1038–1040. Aptera of *Illinoia*. 1038, head and prothorax; 1039, ventral margin of antennal socket; 1040, terminal abdominal segments.
Figs. 1041–1050. Embryonic chaetotaxy and alata of *Illinoia*. 1041, right fore wing; 1042, anal plate and gonapophyses; 1043, left fore femur; 1044, second and base of third antennal segments; 1045, base of apical antennal segment; 1046, apical rostral segment; 1047, abdominal spiracle; 1048, dorsal chaetotaxy of embryo; 1049, left hind tarsus; 1050, venter of head.
**Embryo** (Fig. 1048). Antenna 4- or 5-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; disc and prothorax without gland facets, without visible tubercles; each side of abdomen with 1 lateral and 1 submedian seta on each segment, usually also with 1 dorsolateral seta on each of terga I–V or VI; basitarsi triangular with 2 ventral setae; distitarsi elongate, without preapical capitlate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** Species of *Alnus, Anaphalis, Comptonia, Convallaria, Juniperus, Linnaea, Liriodendron, Menziesia, Pieris, Pseudotsuga, Rhododendron, Sequoia, Spiraea, Thalictrum, Tsuga, and Vaccinium.*

**Comments.** Recognition characters for this genus include the swelling along the ventral margin of the antennal socket, the swollen and reticulate siphunculi, and the absence of spicules on the tarsal imbrications. *Illinoia* includes subgenera *Masonaphis* Hille Ris Lambers, *Oestlundia* Hille Ris Lambers, and *Amphorinophora* MacGillivray. *Ericobium* MacGillivray, originally described as a subgenus of *Masonaphis*, is a synonym of *Illinoia* in the strict sense. The genus was revised by MacGillivray (1958) (as *Masonaphis*).

**Genus Iziphya Nevsky**

Figs. 1051–1061

*Type species:* *Iziphya maculata* Nevsky, 1929:314.

**Adult** (Fig. 1051). Length 1.5–2.5 mm.

Integument: Antennae with annuli of closely placed spicules or nodules; head and body in aptera with numerous or scattered spicules or scalelike nodules; in alata head commonly with a few spicules mesally; prothorax usually spiculose laterally; pterothorax without spicules; abdomen usually with some spicules evident on pigmented regions; tibiae and tarsi with closely set annuli of spicules; cauda and anal and genital plates spiculose.

Head (Fig. 1061): Antennal tubercle undeveloped or barely evident. Ventral margin of antennal socket not protuberant. Discal setae blunt, rod-shaped, or flabellate, scattered, without special arrangement. Eye present, slightly stalked in aptera, less evident in alata. Ventral and dorsal cephalic sutures absent. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, usually subequal to base of VI; primary sensoria (Fig. 1056) with ciliate margins; accessory sensoria in 2 groups situated
proximad and distad of primary sensorium; secondary sensoria (Fig. 1055) absent in aptera, present in alata, circular, with ciliate margins. Rostrum 4-segmented; apical segment (Fig. 1057) short, triangular, rounded distad of preapical primary setae.

Thorax: Prothoracic setae without special arrangement, of same size and shape as discal setae. Head and prothorax not fused in alata, indistinctly separated in aptera, apparently fused mesally. Prothorax without gland facets or lateral tubercles. Fore coxa not enlarged. Fore femur (Fig. 1054) and mesofemur enlarged. Femoral and tibial setae variable throughout genus, with apical setae pointed, with basal setae pointed, blunt, weakly capitate, rod-shaped or flabellate. Tibiae without peglike setae, sensoria, gland facets, rastral setae, or rastral spines. Basal part of fore and middle tibia with thickened integument. Basitarsi (Fig. 1060) triangular, with 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1052) normal; media with 3 branches; branches of cubitus widely separated at base, slightly divergent.

Abdomen: Abdominal terga I–VI or VII fused, with limits of terga indicated by pigmented sutures, not fused in alata. Abdominal terga in both aptera and alata with spots around many setae and usually with large patch of pigment mesad of and including siphunculus and in some species fused dorsally with patch on opposite side of tergum. Without dorsal or lateral abdominal tubercles. Lateral sclerites present in alata, absent in aptera. Spiracles (Fig. 1058) subcircular, with sclerotic rims, without opercula. Siphunculus short, without setae except on expanded base, without apical flange, but in some species weakly flared apically, covered with closely placed annuli of sharp nodules or spicules. Abdominal tergum VIII entire or bilobate. Cauda knobbed. Anal plate (Fig. 1053) of both vivipara and ovipara bilobate. Abdomen without gland facets. Gonapophyses 2.

Embryo (Fig. 1059). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; all setae flabellate, rod-shaped or clavate; disc and prothorax without gland facets or tubercles; each side of abdomen with 1 flabellate rod-shaped or clavate lateral and submedian seta on each segment; siphunculus poriform when evident; abdomen without gland facets or tubercles; basitarsi triangular, with 2 ventral setae; distitarsi triangular, with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.

Economically important species. None.

Range of plants infested in Canada. Carex species.

Biology. This genus is holocyclicly associated with Carex species.
Fig. 1051. Aptera of *Iziphya*.
Figs. 1052–1061. Embryonic chaetotaxy and alata of Iziphy. 1052, right fore wing; 1053, anal plate and gonapophyses; 1054, left fore femur; 1055, second and base of third antennal segments; 1056, primary sensoria on apical antennal segment; 1057, apical rostral segment; 1058, abdominal spiracle; 1059, dorsal chaetotaxy of embryo; 1060, left hind tarsus; 1061, venter of head.
Comments. Recognition characters for this genus include the association with Carex, the knobbed cauda, the bilobate anal plate, the enlarged femora, the short siphunculi, and the presence of flabellate or rod-shaped dorsal setae in most species. The dark pigment bordering the veins of the wings is also distinctive. Richards (1968c, 1971) provided keys to, and descriptions of, the species.

Genus *Jacksonia* Theobald

Figs. 1062–1064

*Jacksonia* Theobald, 1923:19.
Type species: *Jacksonia papillata* Theobald, 1923:19.

Adult (Figs. 1062, 1063). Length 1.5–2.0 mm.

Integument: Antenna with coarse smooth imbrications; dorsum of head and prothorax with nodules and spicules; remainder of body with irregular angular wrinkles; tibiae unsculptured; tarsi with a few weakly formed dorsal imbrications; cauda, except apex (Fig. 1064), and anal and genital plates spiculose.

Head: Antennal tubercle well-developed, with mesal margin swollen, scabrous. Ventral margin of antennal socket protuberant. Discal setae short, inconspicuous, blunt or faintly capitate, arranged in anterior and posterior group of 2 on each side. Ventral and dorsal cephalic sutures absent in aptera (alata not seen). Disc without gland facets. Antenna 6-segmented in aptera (alata not seen); primary sensoria with ciliate or spiculose margins; secondary sensoria absent in aptera. Rostrum 4-segmented, apical segment short, subcylindrical, blunt distad of preapical primary setae.

Thorax: Prothoracic setae short, blunt, or faintly capitate; each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax without gland facets or lateral tubercles. Tibial setae short, mostly pointed, some blunt basally. Tibiae without peglike setae, gland facets, sensoria, rastral spines, or setae. Basitarsi triangular, with 3 ventral setae on fore and middle legs and 2 on hind leg, without dorsal setae. Distitarsi elongate, without preapical capitade setae. Plantar setae acuminate. Claws not bifid.

Abdomen: Abdominal terga not fused, pigmented sclerotic. Dorsal abdominal setae short, blunt, or faintly capitate, inconspicuous, arranged either in single transverse row on each tergum or with only 1 submedian and 1 lateral seta on each side, especially on more posterior segments. Lateral sclerites absent. Dorsal and lateral tubercles absent. Spiracles nearly circular, without opercula. Siphunculus elongate, with middle portion thinner than basal and apical portions, without apical setae.

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Figs. 1062–1064. Aptera of *Jacksonia*. 1062, head and prothorax; 1063, terminal abdominal segments; 1064, apex of cauda.

**Embryo.** Not observed.

**Range of plants infested in Canada.** *Ranunculus* species, in British Columbia only.

**Biology.** Nothing is known of the biology of the single known species.

**Comments.** Recognition characters for this genus include the scabrous and slightly converging antennal tubercles, the conspicuously nodulose and spiculose dorsal surfaces of the head and prothorax, and the flangeless siphunculi with the narrowest portion in the middle.

**Genus Kaltenbachiella Schouteden**

Figs. 11, 1065–1073

*Kaltenbachiella* Schouteden, 1906:194. 

**Adult.** Length 1.5–3.0 mm.

Integument: Antenna without sculpturing other than a few spicules on segment VI; head and body without sculpturing; tibiae with spicules on apical half in alata, smooth in aptera; tarsi with annuli of spicules in alata, almost smooth in aptera; anal and genital plates with some spicules.

Head (Fig. 1073): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, short; each side of disc with 2–4 setae anteriorly and 2 or 3 posteriorly. Eye present in alata, absent in aptera; triommatidium present in aptera and alata. Ventral and dorsal cephalic sutures absent. Disc without tubercles and gland facets. Antenna 4- to 5-segmented in aptera, with apical segments partly fused; 6-segmented in alata, with segment VI longer than VI or V; processus terminalis short; primary sensoria (Fig. 1069) small, with ciliate margins; secondary sensoria (Figs. 1068, 1069) present only in alata, consisting of closely set annuli on segments III–VI. Rostrum 4-segmented; apical segment (Fig. 1070) elongate, subcylindrical, blunt distad of subapical primary setae.

Thorax: Prothorax of aptera with submedian and lateral clusters of wax gland facets; facets in each cluster forming a ring around an elongate irregular central area. Prothorax with pointed setae,
Figs. 1065–1073. Alata of Kaltenbachiella. 1065, right fore wing; 1066, anal plate and gonapophyses; 1067, left fore femur; 1068, second and base of third antennal segments; 1069, apical antennal segment; 1070, apical rostral segment; 1071, abdominal spiracle; 1072, left hind tarsus; 1073, venter of head.
arranged with 1–3 submedian setae and 1–3 lateral setae on each side. Femora (Fig. 1067) and tibiae with setae pointed; tibial setae shorter than apical diameter of respective tibia. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines. Tarsal segments fused in aptera but separated by a pale suture, without preapical capitulate setae; basitarsi (Fig. 1072) triangular in alata, with 3 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitulate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1065) with venation reduced; media unbranched, or rarely branched near the wing margin; branches of cubitus slightly separated at base, strongly divergent.

Abdomen: Terga without dorsal and lateral pigment, not fused. Setae pointed, short, arranged in single transverse row on anterior terga. Dorsal and lateral tubercles absent. Gland facets usually absent on abdomen of alata, present in aptera, in 1 lateral and 2 dorsal rows on each side, with the largest clusters of facets in form of a ring of angular contiguous facets around elongate irregular central area. Spiracles (Fig. 1071) without opercula, not on tuberculate papillae, without complete sclerotic rims. Siphunculus present but commonly obscure, poriform, consisting of narrow sclerotic ring. Abdominal tergum VIII entire. Cauda arc-shaped. Anal plate (Fig. 1066) entire. Gonapophyses 2, indistinctly separate in alata.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Ulmus species.

Biology. The members of this genus are heterocyclic between elms and the roots of Labiatae. A baglike gall is produced on the upper surfaces of elm leaves (Fig. 11). This genus belongs to the group of aphids in which sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts, with each ovipara laying a single egg.

Comments. Recognition characters for this genus include the baglike galls on the leaves of Ulmus, the association with the roots of Labiatae, the annular secondary sensoria on the antenna of the alatae, a sixth antennal segment in the alatae that is as long or longer than either or both of segments IV or VI, the presence of siphunculi, the presence of spicules on the tibiae and tarsi in alatae, the fused tarsi of the apterae, and the elongate central area of the wax gland clusters.

Ghosh (1981) provided a key to, and review of, the species of the world. Only Kaltenbachiella ulmifusa (Walsh & Riley) occurs in Canada. Gobaisha Matsumura is a synonym.
Genus *Lachnochaitophorus* Granovsky

Figs. 1074–1084

*Lachnochaitophorus* Granovsky, 1933:33.

Type species: *Lachnochaitophorus querceus* Granovsky, 1933:35.

**Adult** (Figs. 1074, 1075). Length 1.5–2.25 mm.

Integument: Antenna with spiculose imbrications; head and body without obvious sculpturing; tibiae and tarsi spiculose; cauda and anal and genital plates spiculose.

Head (Fig. 1084): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, with variable number of setae along lateral and anterior margins of disc, and with a transverse cluster on posterior half of disc. Eye present in both aptera and alata; triommatidium present. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis relatively short, without numerous setae; primary sensoria (Fig. 1080) with margins nonciliate, but in some species with a few spicules; accessory sensoria not fused; secondary sensoria (Fig. 1079) circular, without ciliate margins, present on segment III of alata only. Rostrum 4-segmented; apical segment (Fig. 1081) subconical, rounded distad of preapical primary setae.

Thorax: Head and prothorax fused or not fused in aptera, when fused pronotum split into an anterior sclerite fused to head and a free posterior sclerite; head and prothorax not fused in alata. Prothoracic setae pointed, hairlike, arranged on each side in anterior submedian cluster, with transverse submedian cluster on posterior half and distinct anterior and posterior lateral clusters. Prothorax without dorsal tubercles and normally without lateral tubercles. Femora (Fig. 1078) and tibiae with setae pointed; tibial setae hairlike, with longest usually longer than apical diameter of respective tibia. Tibiae without peglike setae, sensoria, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1083) triangular, with 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae narrowly flabellate. Claws simple. Fore wing (Fig. 1076) with normal venation; media with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Terga of alata each usually with rectangular sclerite, at least on posterior terga; lateral sclerites present, pigmented. Terga of aptera fused forming sclerotic carapace extending laterally and including lateral sclerites. Abdominal setae pointed, arranged in 2–4 irregular transverse rows on each tergum. Abdomen normally without lateral tubercles, never with dorsal tubercles. Spiracles (Fig. 1082) with sclerotic rims, without opercula. Siphunculus short, nearly poriform, without seta, sculpturing, or apical flange. Abdominal tergum VIII entire. Cauda rounded. Anal plate (Fig. 1077) bilobate in vivipara; entire in ovipara. Gonapophyses 2.
Figs. 1074, 1075. Aptera of Lachnochittochorus. 1074, head and prothorax; 1075, terminal abdominal segments.
Figs. 1076–1084. Alata of *Lachnochaitophorus*. 1076, right fore wing; 1077, anal plate and gonapophyses; 1078, left fore femur; 1079, second and base of third antennal segments; 1080, apical antennal segment; 1081, apical rostral segment; 1082, abdominal spiracle; 1083, left hind tarsus; 1084, venter of head.
Embryo.  Not observed.

Economically important species.  None.

Range of plants infested in Canada.  Quercus species (red oak group).

Biology.  This genus is holocyclicly associated with the host plant, where it feeds on the terminal twigs of oak saplings.

Comments.  Recognition characters for this genus include its association with Quercus, the sclerotic abdominal carapace in the apterai, the absence of lateral tubercles on the prothorax and the abdomen, the short and almost poriform siphunculi, and the rounded cauda.  Richards (1965) provided a redescription of the single species found in Canada.

Genus Lachnus Burmeister

Lachnus Burmeister, 1835:91.
Type species: Lachnus fasciatus Burmeister, 1835:93 = Aphis roboris Linnaeus, 1758:452.

Adult (Figs. 1085, 1086).  Length 5.0–8.0 mm.
Integument:  Antenna with smooth and spiculose imbrications; head and body without obvious sculpturing; tibiae and tarsi without spicules or imbrications; cauda and anal and genital plates with some spicules.
Head (Fig. 1095):  Antennal tubercle undeveloped; front of head convex.  Ventral margin of antennal socket not protuberant.  Discal setae fine, hairlike, scattered, without special arrangements.  Eye and triommatidium present in aptera and alata.  Ventral cephalic sutures absent or evident postero-laterad of median ocellus.  Disc without dorsal tubercles or gland facets.  Antenna 6-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 1091) without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1090) circular, with margins not ciliate, situated on segment III, sometimes on segment IV of alata, normally absent in aptera.  Rostrum 5-segmented; segment IV (Fig. 1092) elongate, subcylindrical, with portion distad of preapical primary setae (segment V) more or less pointed, always separated from basal portion by distinct membranous area.
Thorax:  Prothoracic setae fine, hairlike, scattered, without special arrangement.  Prothorax without dorsal or lateral tubercles.  Femora (Fig. 1089) and tibiae with setae pointed, numerous.  Tibiae without peglike setae, sensoria, gland facets, rastral setae, or rastral spines.  Basitarsi (Fig. 1094) trapezoidal, with numerous ventral
Figs. 1085, 1086. Aptera of *Lachnus*. 1085, head and prothorax; 1086, terminal abdominal segments.
Figs. 1087–1095. Alata of *Lachnus*. 1087, right fore wing; 1088, anal plate and gonapophyses; 1089, left fore femur; 1090, second and base of third antennal segments; 1091, apical antennal segment; 1092, apical rostral segment; 1093, abdominal spiracle; 1094, left hind tarsus; 1095, venter of head.
setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae short, inconspicuous, pointed. Fore wing (Fig. 1087) with normal venation; radial sector sigmoid; media with 3 branches; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal setae pointed, fine, hairlike, arranged in several irregular rows on each tergum. Abdominal terga not fused, without pigmented dorsal carapace. Dorsal and lateral abdominal tubercles absent. Spiracles (Fig. 1093) without sclerotic rims. Siphunculus little more than a pore on a large mammiform base with fine hairlike setae. Abdominal tergum VIII entire. Cauda arc-shaped. Anal plate (Fig. 1088) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Quercus species.

Biology. This genus is holocyclicly associated with the host plant.

Comments. This genus is most easily recognized by its association with Quercus, the 5-segmented rostrum, the mammiform siphunculi, and the spicules and imbrications on the antenna.

Genus Liosomaphis Walker

Figs. 1096–1106

Liosomaphis Walker, 1868:1119.
Type species: Aphis berberidis Kaltenbach, 1843:95.

Adult (Figs. 1096, 1097). Length 1.5–3.0 mm.

Integument: Antennae with smooth imbrications; head and body mostly without conspicuous sculpturing, except for weak nodules and ripples on anterior part of abdominal tergum VI and weakly spiculose imbrications on apical terga; legs without spicules; tarsi with spiculose imbrications at least ventrally; cauda and anal and genital plates spiculose.

Head (Fig. 1106): Frontal and median tubercles fairly well developed; front of head W-shaped. Ventral margin of antennal socket not protuberant. Eye and triommatidium present in both aptera and alata. Dorsal cephalic suture absent; ventral sutures evident on each side of ocellus and in some specimens extending to junction near anterior margin of clypeus. Discal setae pointed, blunt or weakly capitate, arranged on each side in anterior and posterior group of 2 each. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae;
Figs. 1096, 1097. Aptera of *Liosomaphis*. 1096, head and prothorax; 1097, terminal abdominal segments.
Figs. 1098–1106. Alata of Liosomaphis. 1098, right fore wing; 1099, anal plate and gonapophyses; 1100, left fore femur; 1101, second and base of third antennal segments; 1102, base of apical antennal segment; 1103, apical rostral segment; 1104, abdominal spiracle; 1105, left hind tarsus; 1106, venter of head.
primary sensoria (Fig. 1102) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1101) circular, present on segments III and IV of alate, having margins usually with a few fine cilia or fine sharp spicules. Rostrum 4-segmented, with apical segment (Fig. 1103) subcylindrical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae about same size and shape as discal setae of head; each side of pronotum with 1 posterior submedian seta, nearly always with 1 anterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax always without visible lateral tubercles. Femora (Fig. 1100) with pointed setae. Tibial setae mostly blunt or weakly capitate, some pointed on apical half of each tibia. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 1105) triangular, with 2 or 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminete. Claws simple. Fore wing (Fig. 1098) with media with 2 or 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Setae pointed, blunt or weakly capitate, arranged in single transverse row on each tergum. Terga without pigment except on terga III and IV in alate, more or less fused, unpigmented, sclerotic in aptera. Pale lateral sclerites evident in alata in some specimens. Lateral and dorsal tubercles and gland facets absent. Spiracles (Fig. 1104) subcircular, with sclerotic rims, without opercula. Siphunculus swollen, nearly smooth, without setae. Abdominal tergum VIII entire. Cauda elongate, bluntly pointed apically. Anal plate (Fig. 1099) entire. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Berberis* species.

**Biology.** The only species found in Canada, *L. berberidis* (Kaltenbach), is apparently holocyclically associated with the host plant.

**Comments.** Recognition characters for this genus include the association with *Berberis*, the presence of spicules on the tarsal imbrications, the presence of anterior submedian prothoracic setae, and the spicules or cilia on the margins of the secondary antennal sensoria.

**Genus Lipaphis Mordvilko**

Figs. 1107–1117

Type species: *Aphis erisymi* Kaltenbach, 1843:99.

414
Adult (Figs. 1107, 1108). Length 1.5–3.0 mm.

Integument: Antennal segments III–VI with smooth imbrications; segments I and II with nodules and coarse imbrications; head rugulose; unpigmented areas of dorsum of abdomen in alata and aptera and also of thorax in alata reticulately sculptured, obscure in alata; lateral and dorsal sclerites, siphunculus, and genital plate with spiculose imbrications; venter of abdomen with transverse spiculose striae; cauda and anal plate spiculose; femora with spiculose imbrications; tibiae with a few distal imbrications; tarsi with smooth imbrications.

Head (Fig. 1117): Frontal and median tubercles fairly well developed; front of head W-shaped. Ventral margin of antennal socket not protuberant. Eye and triommatidium present in aptera and alata. Dorsal and ventral cephalic sutures absent. Discal setae blunt or weakly capitate, arranged on each side in anterior and posterior group of 2 each. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1113) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1112) circular, present on segments III and IV or V of alata, without cilia or spicules on margins. Rostrum 4-segmented, with apical segment (Fig. 1114) subconical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae about same size and shape as discal setae; each side of pronotum with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax with lateral tubercles, without dorsal tubercles. Femora (Fig. 1111) with setae blunt or capitate; tibial setae mostly blunt or weakly capitate proximally, pointed on apical one-third of each tibia. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 1116) triangular, with 2 or 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1109) with normal venation; media with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Setae short, blunt or weakly capitate, arranged in single transverse row on each tergum. Terga of alata without pigment except on segments VI–VIII; terga of aptera more or less fused, sclerotic, but not or only faintly pigmented except on segments VII and VIII, with submedian patches on segment VI in some specimens; muscle attachment points pigmented. Lateral sclerites present in alata, evident in aptera in some specimens. Lateral tubercles on segments II–VI of alata; dorsal tubercles absent. Gland facets absent. Spiracles (Fig. 1115) subcircular, with sclerotic rims, without opercula. Siphunculus swollen, with spiculose imbrications, with well-developed flange, without setae. Abdominal tergum VIII entire. Cauda elongate, with blunt apex. Anal plate (Fig. 1110) entire. Gonapophyses 3.

Embryo. Not observed.
Figs. 1109–1117. Alata of Lipaphis. 1109, right fore wing; 1110, anal plate and gonapophyses; 1111, left fore femur; 1112, second and base of third antennal segments; 1113, base of apical antennal segment; 1114, apical rostral segment; 1115, abdominal spiracle; 1116, left hind tarsus; 1117, venter of head.

Figs. 1107, 1108. Aptera of Lipaphis. 1107, head and prothorax; 1108, terminal abdominal segments.
Economically important species. None.

Range of plants infested in Canada. Species of Cruciferae.

Biology. This genus is holocyclicly associated with Cruciferae.

Comments. Recognition characters for this genus include the association with Cruciferae, the spiculose imbrications on the femora and on the slightly swollen and short siphunculi, and the reticulate pattern on the abdominal tergites. Lipaphis is a Palearctic genus, with one introduced species, L. erysimi (Kaltenbach), in North America.

Genus Longicaudus van der Goot

Figs. 1118–1128

Longicaudus van der Goot, 1913:107.
Type species: Aphis trirhoda Walker, 1849a:45.

Adult (Figs. 1118, 1119). Length 2.5–4.0 mm.

Integument: Antennae with smooth imbrications; head and body without sculpturing other than some weakly spiculose imbrications on apical abdominal terga; tibiae unsulptured or with apical imbrications in alata; tarsi with smooth and in some specimens finely spiculose imbrications at least ventrally; cauda and anal and genital plates with spicules.

Head (Fig. 1128): Antennal tubercle evident, but not well-developed. Ventral margin of antennal socket not protuberant. Discal setae blunt, or in some specimens pointed, arranged in anterior and posterior group of 4 each. Eye and triommatidium present in aptera and alata. Disc of head without gland facets or tubercles. Antenna 6-segmented; processus terminalis elongate; primary sensoria (Fig. 1124) with or without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1123) circular, few to numerous, protruding in some specimens, without ciliate margins, present on segment III of alata. Rostrum 4-segmented; apical segment (Fig. 1125) short, subconical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae short, inconspicuous, pointed or blunt, each side with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax with or without lateral tubercles. Femora (Fig. 1122) with setae pointed; tibial setae blunt basally, pointed apically. Tibiae without sensoria, peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1127) triangular in outline, with 3–5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1120) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent.
Figs. 1118, 1119. Aptera of *Longicaudus*. 1118, head and prothorax; 1119, terminal abdominal segments.
Figs. 1120–1128. Alata of *Longicaudus*. 1120, right fore wing; 1121, anal plate and gonapophyses; 1122, left fore femur; 1123, second and base of third antennal segments; 1124, base of apical antennal segment; 1125, apical rostral segment; 1126, abdominal spiracle; 1127, left hind tarsus; 1128, venter of head.
Abdomen: Abdominal terga not fused, large quadrate pigmented patch present in alata in some specimens. Abdominal setae arranged in 1 or in some specimens 2 irregular transverse rows on each tergum. Dorsal and lateral abdominal tubercles absent. Lateral sclerites present in alata, absent in aptera. Spiracles (Fig. 1126) subcircular, with sclerotized rims. Siphunculus shorter than cauda, subcylindrical, tapered toward apex, without seta, with apical flange, with spiculose imbrications or concentric striae. Abdominal tergum VIII entire. Cauda elongate, triangular, bluntly rounded apically. Anal plate (Fig. 1121) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo. Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; disc and prothorax without gland facets or tubercles; each side of abdomen with 1 lateral and 1 submedian seta on each segment; terga I–VI usually also with 1 dorsolateral seta; siphunculus poriform when evident; abdomen without gland facets or tubercles; basitarsi triangular, with 2 ventral setae, without dorsal setae; distitarsi elongate without preapical capitate setae; plantar setae acuminate.

Economically important species. None.

Range of plants infested in Canada. Rosa species.

Biology. Details of the life cycle have not been recorded in Canada, but in Europe, the species found in Canada, Longicaudus trirhodus (Walker), is heterocyclic between Rosa and secondary hosts Aquilegia and Thalictrum.

Comments. Recognition characters for this genus include the association with Rosa, the long narrow cauda, the short flanged and basally broadened siphunculus with spiculose imbrications, the dorsal abdominal patch in the alatae of the species, the numerous protruding secondary antennal sensoria in the alatae, and the presence of setae ventrally on each basal tarsal segment.

Genus Longistigma Wilson

Figs. 1129–1139

Longistigma Wilson, 1909:385.
Type species: Aphis caryae Harris, 1841:190.

Adult (Figs. 1129, 1130). Length 6.0–9.0 mm.
Integument: Antennae without sculpturing; head, body, and legs unsculptured other than a few weakly formed nodulose imbrications; cauda and anal and genital plates with spicules.
Figs. 1129, 1130. Aptera of *Longistigma*. 1129, head and prothorax; 1130, terminal abdominal segments.
Figs. 1131–1139. Alata of *Longistigma*. 1131, right fore wing; 1132, anal plate and gonapophyses; 1133, left fore femur; 1134, second and base of third antennal segments; 1135, apical antennal segment; 1136, apical rostral segment; 1137, abdominal spiracle; 1138, left hind tarsus; 1139, venter of head.
Head (Fig. 1139): Antennal tubercle undeveloped; front of head transverse. Ventral margin of antennal socket not protuberant. Discal setae pointed, fine, hairlike, scattered, without special arrangement. Eye and triommatidium present in aptera and alata. Dorsal suture well-developed in aptera and alata; ventral suture present only in alate, diverging from anterior margin of median ocellus to near posterior margin of eye. Disc without dorsal tubercles or gland facets. Antenna 6-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 1135) with minutely ciliate margins; accessory sensoria not fused, large, subcircular, without ciliate margins; secondary sensoria (Fig. 1134) present on segment III and in some specimens segment IV of alata, absent in aptera, but commonly present on segment III in apterous-alate intermediates, which are common. Rostrum 5-segmented, but segment V fused caplike to the apex of segment IV (Fig. 1136); segment IV subcylindrical; segment V triangular, pointed.

Thorax: Prothoracic setae pointed, fine, hairlike, without special arrangement. Prothorax without gland facets and dorsal or lateral tubercles. Prothoracic spiracles with apposable plates. Femora (Fig. 1133) with setae short, pointed; tibial setae long, fine, hairlike in alata, shorter and somewhat more spinelike in aptera. Tibiae without peglike setae, sensoria, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1138) trapezoidal, each with many ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae absent, or when present extremely minute, setiform. Claws simple. Fore wing (Fig. 1131) with stigma long, extending along costal margin to wing apex; radial sector straight, reaching margin at wing apex; media with 3 branches; branches of cubitus narrowly separated basally, divergent.

Abdomen: Abdominal segments not fused, without pigment except in some species as paramedian spots on each tergum and commonly with a transverse dash on terga VII and VIII. Lateral abdominal sclerites present or absent. Lateral abdominal tubercles absent. Spiracles (Fig. 1137) without sclerotized rims. Siphunculus short, almost poriform, on large subcircular mammiform base. Abdominal tergum VIII entire. Cauda short, almost arc-shaped. Anal plate (Fig. 1132) entire. Abdomen without gland facets. Gonapophyses 3 or 4.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Acer, Fagus, and Tilia species. Also collected on Carya, Quercus, and other trees elsewhere.

Biology. Species are holocyclicly associated with their host plants, but little else is known.

Comments. Recognition characters for this genus include the large size and the shape of the pterostigma. There is one species, Longistigma caryae (Harris), in Canada.
Genus *Macrosiphoniella* Del Guercio

Figs. 1140–1150

*Macrosiphoniella* Del Guercio, 1911:331.

Type species: *Siphonophora atra* Ferrari, 1872:58.

**Adult** (Figs. 1140, 1141). Length 2.0–4.0 mm.

Integument: Antenna with smooth imbrications; head and body without sculpturing other than some spiculose imbrications on apical abdominal terga and in some species pigmented regions with some spicules or imbrications; tibiae unsculptured; tarsi with smooth imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 1150): Antennal tubercle well-developed; front of head concave. Ventral margin of antennal socket not protuberant. Discal setae pointed, blunt or clavate, arranged in anterior group of 2–4 and posterior group of 2–8, in some species forming a cluster of up to 15 setae. Eye and triommatidium present in aptera and alata. Dorsal cephalic suture absent, in some species evident as longitudinal streak of pigment; ventral sutures usually evident as pigmented streaks on each side and posteriad of median ocellus. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1146) without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1145) protruding, tuberclelike, present on segments III in both aptera and alata. Rostrum 4-segmented; apical segment (Fig. 1147) elongate, conical or stiletto-shaped with concave sides.

Thorax: Prothoracic setae pointed, blunt or clavate, with arrangement varying on each side from one to several posterior submedian setae and one or more anterior and posterior lateral setae. Prothoracic lateral tubercles present or absent. Femora (Fig. 1144) with setae pointed; tibial setae mostly blunt or clavate on basal half, pointed on apical half. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 1149) triangular in outline, with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1142) with normal venation; media with 3 branches; branches of cubitus widely separated at base.

Abdomen: Abdominal terga not fused, without pigment, or with spots of various sizes, or with transverse segmental dashes on some or most terga. Abdominal setae usually clavate, in some specimens pointed, arranged in 1–4 irregular transverse rows on each tergum. Lateral abdominal tubercles present or absent on terga II–V. Dorsal abdominal tubercles absent. Lateral sclerites present or absent. Spiracles (Fig. 1148) subcircular, with sclerotic rims. Siphunculus elongate, subcylindrical, usually without setae, imbricate or spiculose basally, in some species nearly smooth, with apical half or more reticulate, with apical flange. Abdominal tergum VIII entire. Cauda
Figs. 1142–1150. Alata of *Macrosiphoniella*. 1142, right fore wing; 1143, anal plate and gonapophyses; 1144, left fore femur; 1145, second and base of third antennal segments; 1146, base of apical antennal segment; 1147, apical rostral segment; 1148, abdominal spiracle; 1149, left hind tarsus; 1150, venter of head.

Figs. 1140, 1141. Aptera of *Macrosiphoniella*. 1140, head and prothorax; 1141, terminal abdominal segments.
elongate, in some species with slight neck, broadly rounded apically. Anal plate (Fig. 1143) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; disc and prothorax without gland facets, with tubercles not evident; each side of abdomen with 1 lateral and 1 submedian seta on each segment; each of terga I–V or VI usually with 1 pleural seta; abdomen without gland facets, with tubercles not evident; siphunculus short, nearly poriform when evident; basitarsi triangular, with 2 ventral setae without dorsal setae; distitarsi elongate without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Macrosiphoniella sanborni* (Gillette).

**Range of plants infested in Canada.** Species of *Achillea, Artemisia, Chrysanthemum,* and *Tanacetum.*

**Biology.** Species known to occur in Canada have not been well studied. Collecting records suggest that they are holocyclicly associated with their host plants.

**Comments.** Recognition characters for this genus include the association with Compositae, the elongate and blunt cauda, the relatively short but extensively reticulate siphunculi, and the sharply triangular and commonly stiletto-shaped apical rostral segment. Robinson (1987) provided a key to, and an annotated list of, the species found in North America north of Mexico.

**Genus Macrosiphum Passerini**

Figs. 1151–1162

*Macrosiphum* Passerini, 1860:27. 
Type species: *Aphis rosae* Linnaeus, 1758:452.

**Adult** (Figs. 1151, 1152). Length 2.0–5.0 mm.

Integument: Antennae with smooth imbrications; head and body without sculpturing other than some weakly spiculose or nodulose imbrications on apical abdominal segments; tibiae unsculptured or imbricate apically; tarsi with smooth, or rarely faintly nodulose or weakly spiculose imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 1162): Antennal tubercle well-developed; median tubercle undeveloped to slightly developed. Ventral margin of antennal socket not protuberant. Discal setae pointed, blunt or
weakly capitate; each side of disc with anterior and posterior group of 2 setae each; posterior group in some species with more than 2 setae. Eye and triommatidium present in aptera and alata. Dorsal cephalic suture absent, in some species evident as a longitudinal streak of pigment; ventral cephalic sutures usually evident extending posteriorly for short distance on each side of median ocellus. Disc of head in some species with tubercles, never with gland facets. Antenna 6-segmented; processus terminalis elongate without numerous setae; primary sensoria (Fig. 1157) with ciliated margins; accessory sensoria not fused; secondary sensoria (Fig. 1156) circular, without ciliate margins, present or absent on segment III of aptera, present on segment III, in some species also on segment IV in alata. Rostrum 4-segmented; apical segment (Fig. 1158) subconical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae pointed, blunt or weakly capitate; each side of pronotum with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothoracic dorsal tubercles absent; lateral tubercles present or absent. Femora (Fig. 1155) with setae pointed; tibial setae pointed, blunt or weakly capitate basally, pointed apically. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 1161) triangular, with 3–5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1153) with normal venation; media with 3 branches; branches of cubitus widely separated at base, nearly parallel to divergent.

Abdomen: Terga not distinctly fused, usually without pigment; aptera of some species with whole dorsum of abdomen lightly sclerotized and diffusely pigmented; alata of some species with segmental dashes of pigment. Dorsal setae pointed, blunt or weakly capitate, usually arranged in single transverse row on each tergum, in some species with 2 irregular transverse rows on each tergum. Dorsal tubercles present on tergum VIII in some species. Lateral tubercles absent or present on segments II–V. Lateral sclerites present in aptera of some species, usually present in alata. Spiracles (Fig. 1159) subcircular, with sclerotic rims. Siphunculus long, subcylindrical, tapered toward apex, constricted basad of apex in some species; rarely with a few setae, with preapical polygonal reticulation; diameter of a cell usually more than 1/6 diameter of siphunculus; basal portion with smooth or weakly nodulose imbrications; with apical flange. Abdominal tergum VIII entire. Cauda elongate, narrow, broadly rounded apically. Anal plate (Fig. 1154) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 1160). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; disc and prothorax without gland facets, in some species lateral tubercles evident; each side of abdomen with 1 lateral and 1
Figs. 1151, 1152. Aptera of *Macrosiphum*. 1151, head and prothorax; 1152, terminal abdominal segments.
Figs. 1153–1162. Embryonic chaetotaxy and alata of *Macrosiphum*. 1153, right fore wing; 1154, anal plate and gonapophyses; 1155, left fore femur; 1156, second and base of third antennal segments; 1157, base of apical antennal segment; 1158, apical rostral segment; 1159, abdominal spiracle; 1160, dorsal chaetotaxy of embryo; 1161, left hind tarsus; 1162, venter of head.
submedian seta on each segment; terga I–V usually with 1 pleural seta on each; abdomen without gland facets, in some species lateral tubercles evident; basitarsi triangular, with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Macrosiphum avenae* (Fabricius), *M. euphorbiae* (Thomas), *M. roae* (Linnaeus).

**Range of plants infested in Canada.** A wide range of plants.

**Biology.** Most species are holocyclicly associated with their host plants. *M. fragariae* (Walker), which occurs in British Columbia, is partially heterocyclic between *Rubus* species and various Gramineae. *M. roae* is heterocyclic to some degree between *Rosa* species and species of *Dypsis, Valariana,* and perhaps some other plants.

**Comments.** There is no thorough treatment of this group for North America. Accounts of the North American fauna have been given by Patch (1919), Soliman (1927), Hottes and Frison (1931), Palmer (1952), MacGillivray (1968), and Robinson (1980).

Many workers consider the *Macrosiphum*-like aphids, with less well developed antennal tubercles and a more sclerotic dorsal surface with shorter setae, to comprise the genus *Sitobion* Mordvilko. However, Smith and Parron (1978) considered it to be a subgenus of *Macrosiphum*.

**Genus Maculolachnus Gaumont**

Figs. 1163–1173


Type species: *Lachnus roae* Cholodkovsky, 1899:471 = *Aphis submaculao* Walker, 1848a:104.

**Adult** (Figs. 1163, 1164). Length 3.0–5.0 mm.

Integument: Antennae without sculpturing other than a few vague imbrications on apical 2 or 3 segments; head and body without obvious sculpturing, other than some spiculose imbrications on apical abdominal segments; tibiae unsculptured; tarsi without spicules or imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1173): Antennal tubercle not developed; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, fine, hairlike, scattered, without definite arrangement. Eye and triommatidium present in aptera and alata. Dorsal cephalic suture well-developed in aptera and alata; ventral cephalic suture present only as pigmented ring around median ocellus. Disc without gland facets or tubercles. Antenna 6-segmented; processus terminalis short, with only apical setae; primary sensoria (Fig. 1169) without
Figs. 1163, 1164. Aptera of *Maculolachnus*. 1163, head and prothorax; 1164, terminal abdominal segments.
Figs. 1165–1173. Alata of *Maculolachnus*. 1165, right fore wing; 1166, anal plate and gonapophyses; 1167, left fore femur; 1168, second and base of third antennal segments; 1169, apical antennal segment; 1170, apical rostral segment; 1171, abdominal spiracle; 1172, left hind tarsus; 1173, venter of head.
ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1168) without ciliate margins, subcircular, present on segments III and IV in alata, on segment III and commonly also IV in aptera. Rostrum 5-segmented, with segments IV and V partly fused and (Fig. 1170) having separation indicated by broad conspicuous membranous region.

Thorax: Prothoracic setae fine, pointed, hairlike, scattered, without special arrangement. Prothorax without dorsal or lateral tubercles. Prothoracic spiracle with opposable sclerites. Femora (Fig. 1167) with setae pointed; tibial setae pointed, hairlike, variable in length depending on species. Tibia without peglike setae, sensoria, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1172) trapezoidal, with 1–5 ventral setae and 2–4 dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1165) with normal venation; media with 3 branches; branches of cubitus separated at base, strongly divergent.

Abdomen: Abdominal terga not fused, with conspicuous spots of pigment around bases of all setae in aptera and alata. Lateral and dorsal abdominal tubercles absent. Lateral sclerites present in alata, present but small in aptera. Spiracles (Fig. 1171) without sclerotic rims, but somewhat sclerotized anteriorly. Siphunculus short, finely striate and reticulate, nearly poriform, situated on large subcircular setose mammiform base. Abdominal tergum VIII entire. Cauda short, arc-shaped. Anal plate (Fig. 1166) entire. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Rosa* species.

**Biology.** This genus is holocyclicly associated with the host plant, where it may be found at ground level.

**Comments.** Recognition characters for this genus include the association with *Rosa*, the mammiform siphunculi, the 5-segmented rostrum, the well-developed dorsal cephalic suture, the dorsal setae on trapezoidal basitarsi, the large size, and the arc-shaped cauda.

Genus *Mastopoda* Oestlund

Figs 1174–1184

*Mastopoda* Oestlund, 1886:52.
Type species: *Mastopoda pteridis* Oestlund, 1886:53.

**Adult** (Figs. 1174, 1175). Length 1.5–3.0 mm. Integument: Antennae with well-developed imbrications; disc of head scabrous especially in aptera; abdomen with wrinkles especially
in aptera, both aptera and alata with spiculose imbrications on apical abdominal terga; tibiae in aptera without sculpturing, with well-developed imbrications in alata, of these some with distinct nodules or spicules; tarsi unsculptured; cauda and anal and genital plates with spicules.

Head (Fig. 1184): Antennal tubercle well-developed, scabrous; front of head in alata W-shaped because of median ocellus situated on tubercle; front of head concave in aptera. Discal setae minute, blunt or weakly capitate, arranged on each side of disc in anterior and posterior group of 2 each. Eye with number of facets much reduced in aptera; triommatidium present, indistinct, nearly completely incorporated into compound eye. Dorsal suture absent in aptera and alata; ventral sutures present in alata, fused between margin of median ocellus and margin of clypeus. Disc of head without gland facets or dorsal tubercles. Antenna 5-segmented; processus terminalis elongate; without numerous setae; primary sensoria (Fig. 1180) without ciliate margins in aptera, with marginal ciliate lamellae in alata; accessory sensoria not fused; secondary sensoria (Fig. 1179) circular, numerous, distributed over whole of surfaces of segments III and IV, with margins mostly smooth, but usually a few sensoria with sharp spicules on margins. Rostrum 4-segmented; apical segment (Fig. 1181) conical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae short, blunt; each side of pronotum with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax with or without a lateral tubercle on each side; without dorsal tubercles. Femora (Fig. 1178) and tibiae with setae pointed, short, shorter dorsally. Tibiae without sensoria, gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi each represented only by a small obscure sclerite. Distitarsi (Fig. 1183) narrow, atrophied, shorter than apical diameter of respective tibia. Claws short, atrophied, reduced to a small setiform structure. Plantar setae absent. Fore wing (Fig. 1176) with normal venation; media with 2 or 3 branches; branches of cubitus separated at base, slightly divergent.

Abdomen: Abdominal terga not fused; aptera without pigment; alata with large quadrate patch situated immediately anterior to siphunculus. Lateral and dorsal abdominal tubercles absent. Small lateral sclerites present in alata. Spiracles (Fig. 1182) with sclerotized rims. Siphunculus elongate, tapering, subcylindrical, without setae or apical flange, with well-developed spiculose imbrications. Abdominal tergum VIII entire. Cauda short, broadly triangular. Anal plate (Fig. 1177) entire. Gland facets absent. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Pteris* species.
Figs. 1174, 1175. Aptera of *Mastopoda*. 1174, head and prothorax; 1175, terminal abdominal segments.
Figs. 1176–1184. Alata of *Mastopoda*. 1176, right fore wing; 1177, anal plate and gonapophyses; 1178, left fore femur; 1179, second and base of third antennal segments; 1180, base of apical antennal segment; 1181, apical rostral segment; 1182, abdominal spiracle; 1183, left hind tarsus; 1184, venter of head.
Biology. The single known species is presumably heterocycly associated with the ferns and species of *Viburnum*. A pseudogall is produced at the apices of infested fern fronds.

Comments. Recognition characters for this genus include the association with bracken (*Pteris*) and the atrophied tarsi.

Genus *Melaphis* Walsh

*Melaphis* Walsh, 1867:281.
Type species: *Byrsocrypta rhois* Fitch, 1866:73.

Adult (Figs. 1185, 1186). Length 1.5–2.5 mm.

Integument: Antennae with some spicules at least on apical segments; head and body without obvious sculpturing other than some spiculose imbrications on apical abdominal segments; tibiae unsculptured; tarsi with spicules in alata, unsculptured in aptera; cauda and anal and genital plates with spicules.

Head (Fig. 1195): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae short, pointed, inconspicuous, arranged in anterior and posterior group of 4 each. Eye absent in aptera; triommatidium present in aptera and alata. Dorsal and ventral cephalic sutures absent. Disc without tubercles. Disc with one to several gland facets associated with the discal setae in aptera; gland facets usually absent in alata. Antenna of alata 6-segmented; processus terminalis short; primary sensoria (Fig. 1191) with ciliate margins; accessory sensoria not fused; secondary sensoria (Figs. 1190, 1191) present in alata, consisting of narrow annuli on segments III–VI. Rostrum 4-segmented; apical segment (Fig. 1192) conical, with apex rounded.

Thorax: Head and prothorax fused in aptera, not fused in alata. Prothoracic setae minute, pointed; each side of pronotum with 1 anterior and 2 posterior lateral setae and 1 posterior submedian seta. Prothorax without lateral tubercles. Prothorax with a cluster of gland facets associated with submedian and anterior and posterior lateral setae. Pterothorax with paramedian pair of gland facets. Femora (Fig. 1189) with setae pointed, short; tibiae with short rather stout setae. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines (Fig. 1194). Basitarsi (Fig. 1194) triangular, with 2 ventral setae, without dorsal setae. Distitarsi without preapical capitate setae. Plantar setae acuminate. Fore wing (Fig. 1187) with venation reduced; media unbranched; branches of cubitus approximate at base, divergent.

Abdomen: Abdominal segments not distinctly fused, but with margins of segments indistinct. Abdominal setae minute, inconspicuous, arranged in single transverse row on each tergum.
Figs. 1185, 1186. Aptera of *Melaphis*. 1185, head and prothorax; 1186, terminal abdominal segments.
Figs. 1187–1195. Alata of *Melaphis*. 1187, right fore wing; 1188, anal plate and gonapophyses; 1189, left fore femur; 1190, second and base of third antennal segments; 1191, apical antennal segment; 1192, apical rostral segment; 1193, abdominal spiracle; 1194, left hind tarsus; 1195, venter of head.
Abdomen without pigment except on apical 1 or 2 abdominal terga. Spiracle (Fig. 1193) without sclerotized rims, apparently with opposable sclerites. Siphunculus absent. Abdominal tergum VIII entire. Cauda (Fig. 1188) arc-shaped. Anal plate entire. Abdomen with a cluster of gland facets laterally on each segment and with a submedian cluster on each segment in alata; aptera usually with four dorsal rows of clusters in addition to lateral clusters. Gonapophyses 4, of which middle pair commonly fused.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Rhus typhina* L.

**Biology.** The single known species produces a saclike gall on the leaves of sumac; alatae emerge from the galls in late summer. The secondary host is probably moss (Moran 1989). Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts.

**Comments.** Recognition characters for this genus include the saclike gall on sumac, the slitlike secondary sensoria, and the clustered arrangement of gland facets.

**Genus Meliarhizophagus Smith**

Figs. 1196–1208


Type species: *Pemphigus fraxinifolii* Riley, 1879:17.

**Adult** (Figs. 1196, 1197). Length 2.0–3.5 mm.

Integument: Antenna with some spicules or nodules at least evident on apical 1–3 segments; thorax and abdomen without evident sculpturing; tibiae unsculptured; tarsi with a few spicules ventrally on apical segment; cauda and anal and genital plates with a few dispersed spicules.

Head (Fig. 1208): Antennal tubercle undeveloped; front of head slightly convex. Ventral margin of antennal socket not protuberant. Discal setae pointed; each side of disc with 2–5 anterior and posterior setae; clusters of gland facets commonly present on either side of frontal ocellus and mesally on disc. Eye present in alata, absent in aptera; triommatidium present. Dorsal cephalic suture absent or faintly evident anteriorly in alata; ventral sutures absent. Primary sensoria (Fig. 1203) with ciliate margins; accessory sensoria absent; secondary sensoria (Fig. 1202) present only in alata on segments III–V and usually also VI, slitlike, with lengths not more than half circumference of respective segments, with ciliate or nodulose margins. Rostrum 4-segmented; apical segment (Fig. 1204) subconical, triangular distad of preapical primary setae.
Figs. 1196–1198. Aptera of Meliarhizophagus. 1196, head and prothorax; 1197, terminal abdominal segments; 1198, facets of wax plate.
Figs. 1199-1208. Embryonic chaetotaxy and alata of _Meliarhizophagus_. 1199, right fore wing; 1200, anal plate and gonapophyses; 1201, left fore femur; 1202, second and base of third antennal segments; 1203, apical antennal segment; 1204, apical rostral segment; 1205, abdominal spiracle; 1206, dorsal chaetotaxy of embryo; 1207, left hind tarsus; 1208, venter of head.
Thorax: Head and prothorax not fused in alata, apparently partially fused in aptera in some specimens. Prothoracic setae pointed; each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax without lateral or dorsal tubercles, usually with median cluster of gland facets on each side in alata, present or absent in aptera. Mesothorax with pair of median dorsal gland facets. Femora (Fig. 1201) with setae pointed, short; tibial setae pointed, hairlike. Tibiae without gland facets, sensoria, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1207) triangular, with 2 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capititate setae. Plantar setae acuminated. Claws simple.

Femora (Fig. 1201) with setae pointed, short; tibial setae pointed, hairlike. Tibiae without gland facets, sensoria, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1207) triangular, with 2 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capititate setae. Plantar setae acuminated. Claws simple.

Fore wing (Fig. 1199) with venation reduced; media unbranched; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal setae pointed, arranged in single transverse row on each tergum. Abdominal segments not fused, without pigment dorsally and laterally except for a trace on abdominal tergum VIII in some specimens. Abdomen with distinct submedian and lateral clusters and usually also with pleural clusters of gland facets on each tergum. Lateral and dorsal abdominal tubercles absent. Spiracles (Fig. 1205) circular, with hinged operculum. Siphunculus absent. Abdominal tergum VIII entire. Cauda short, arc-shaped. Anal plate (Fig. 1200) large, entire. Gonapophyses 3.

**Embryo** (Fig. 1206). Antenna 4-segmented; eyes absent; triommatidium present; disc without evident gland facets, with 2 or 3 anterior and 2 or 3 posterior setae; prothorax without evident gland facets or tubercles; each side of prothorax with 1 posterior submedian setae and 1 anterior and 1 posterior lateral seta; abdomen with 1 submedian and 1 lateral seta on each side of each tergum; submedian and lateral gland facets usually evident at least on apical 2–5 segments; basitarsi with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capititate setae; plantar setae acuminated.

**Economically important species.** None.

**Range of plants infested in Canada.** Occurs on *Fraxinus* species in southern Ontario.

**Biology.** The single species known in this genus is monoeciously heterocyclic on *Fraxinus* species. It begins its life cycle by curling the leaves of ash and then migrates to the roots where it is associated with fungal growths (Brundrett and Kendrick 1987).

**Comments.** Recognition characters for this genus include the restricted association with *Fraxinus*, the presence of only two setae on the ventral surface of each tarsal segment, the spicules on the apical tarsal segments, the slitlike but relatively short secondary sensoria surrounded by cilia or minute blunt nodules, and the frequent presence of secondary sensoria on antennal segment VI.
Genus *Microlophium* Mordvilko


Type species: *Aphis urticae* Schrank, 1801:106, nec Linnaeus, 1758 = *Siphonophora carnosa* Buckton, 1876:144.

**Adult** (Figs. 1209, 1211). Length 3.5–5.0 mm.

Integument: Antennae with smooth imbrications; head and body without obvious sculpturing other than some spiculose imbrications on apical abdominal terga; tibiae with smooth and in some species a few weakly to strongly spiculose imbrications; tarsi with smooth imbrications dorsally, and with ventral imbrications always having at least a few nodules and spicules; cauda and anal and genital plates spiculose.

Head (Fig. 1221): Antennal tubercle well-developed, angular or weakly diverging, smooth; front of head convex. Ventral margin of antennal socket (Fig. 1210) protuberant. Discal setae capitate in aptera, capitate or pointed in alata, arranged in anterior and posterior group of 4 each. Eye and triommatidium present in aptera and alata. Disc of head in some species with a tubercle near posterior margin, never with gland facets. Antenna 6-segmented; processus terminalis long, without numerous setae; primary sensoria (Fig. 1217) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1216) circular, without ciliate margins, present on segment III in aptera and alata. Rostrum 4-segmented; apical segment (Fig. 1218) elongate, conical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae weakly capitate; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 submedian seta. Prothoracic lateral tubercles normally absent. Femora (Fig. 1215) with setae pointed; tibial setae usually capitata basally, pointed apically. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 1220) triangular in outline, with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminates. Claws simple. Fore wing (Fig. 1213) with normal venation; media with 3 branches; branches of cubitus widely separated at base.

Abdomen: Abdominal terga not distinctly fused in aptera and alata, with some indication of margins of segments. Abdominal terga without pigment except on apical 1 or 2 segments. Setae capitata or pointed, arranged in single transverse row on each tergum. Lateral tubercles normally absent. Lateral abdominal sclerites absent in aptera, present or absent in alata. Spiracles (Fig. 1219) with sclerotized rims. Siphunculus (Figs. 1211, 1212) elongate, swollen or subcylindrical, tapered, without setae, with apical flange, in some species with a few weak preapical reticulations, in some species mostly smooth at least on apical half, or completely covered with...
Figs. 1209–1212. Aptera of *Microlophium*. 1209, head and prothorax; 1210, ventral margin of antennal socket; 1211, terminal abdominal segments; 1212, variant form of siphunculus.
Figs. 1213–1221. Alata of *Microlophium*. 1213, right fore wing; 1214, anal plate and gonapophyses; 1215, left fore femur; 1216, second and base of third antennal segments; 1217, base of apical antennal segment; 1218, apical rostral segment; 1219, abdominal spiracle; 1220, left hind tarsus; 1221, venter of head.
imbrications and spicules. Abdominal tergum VIII entire. Cauda elongate, narrowly triangular, or broadly rounded apically. Anal plate (Fig. 1214) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Urtica species.

Biology. The biologies of the species have not been well studied in Canada, but all species are holocyclicly associated with the host plants.

Comments. Recognition characters for this genus include the association with nettles, the elongate and subcylindrical or swollen siphunculi, the preapical imbrications on the tibiae, the well-developed smooth antennal tubercles, and the spicules on the ventral tarsal imbrications.

Genus Microparsus Patch

Figs. 1222–1233

Microparsus Patch, 1909:337.
Type species: Microparsus variabilis Patch, 1909:338.

Adult (Figs. 1222, 1224). Length 2.0–3.0 mm.
Integument: Antenna with smooth and in some species faintly nodulose imbrications; head and body without sculpturing other than some weakly spiculose imbrications on apical abdominal terga; tibiae unsculptured; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1233): Antennal tubercle well-developed, with an anterodorsal weakly scabrous process; front of head strongly convex. Ventral margin of antennal socket (Fig. 1223) protuberant. Discal setae blunt or weakly capitate; each side of disc with anterior and posterior group of 4 setae each. Dorsal cephalic sutures absent; ventral sutures evident on each side of ocellus. Disc without gland facets or tubercles. Antenna 6-segmented; processus terminalis elongate; primary sensoria (Fig. 1229) with weakly ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1228) circular, without ciliate margins, present on segment III, in some specimens also on segment IV in alata, present or absent on segment III in aptera. Rostrum 4-segmented; apical segment (Fig. 1230) elongate, conical, rounded distad of preapical primary setae.

Thorax: Prothoracic dorsal and lateral tubercles present or absent. Each side of prothorax with 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta. Femora (Fig. 1227) with
Figs. 1222–1224. Aptera of *Microparsus*. 1222, head and prothorax; 1223, ventral margin of antennal socket; 1224, terminal abdominal segments.
Figs. 1225–1233. Alata of *Microparsus*. 1225, right fore wing; 1226, anal plate and gonapophyses; 1227, left fore femur; 1228, second and base of third antennal segments; 1229, base of apical antennal segment; 1230, apical rostral segment; 1231, abdominal spiracle; 1232, left hind tarsus; 1233, venter of head.
setae pointed; tibial setae blunt or capitate basally, pointed apically. Tibiae without peglike setae, sensoria, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1232) triangular in outline, with 3 or 4 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Fore wing (Fig. 1225) with normal venation; media with 2 or 3 branches; branches of cubitus widely divergent.

Abdomen: Dorsal abdominal setae blunt or weakly clavate, arranged in single transverse row on each tergum. Abdominal terga partially fused, with limits evident. Abdomen without pigment except for circular patch of pigment around each siphunculus. Lateral abdominal sclerites absent in aptera, absent or obscure in alata. Dorsal abdominal tubercles absent. Lateral abdominal tubercles present on some or all of segments II–V. Spiracles (Fig. 1231) circular, with sclerotized rims. Siphunculus elongate, subcylindrical or swollen on apical half, without setae or apical flange; with spicules and spiculose imbrications, without reticulations. Abdominal tergum VIII entire. Cauda elongate, narrowly triangular, narrowly rounded apically. Anal plate (Fig. 1226) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Desmodium species.

Biology. The species are holocyclicly associated with their host plants, but nothing else is known about their biological details.

Comments. Recognition characters for this genus include the host association, the circle of pigment around the base of the siphunculus that is especially evident in the apterae, and the tendency for the media to have only one branch. Smith and Tuatay (1960) provided a key to the species.

Genus Microsiphoniella Hille Ris Lambers

Figs. 1234–1244

Microsiphoniella Hille Ris Lambers, 1947:186.
Type species: Chaitophorus artemisiae Gillette, 1911a:443.

Adult (Figs. 1234, 1235). Length 1.5–3.0 mm.

Integument: Antennae with smooth imbrications; head and body without sculpturing other than a few weakly spiculose imbrications on posterior abdominal terga; tibiae unsculptured; tarsi with smooth imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 1244): Antennal tubercle poorly developed, smooth; front of head concave. Ventral margin of antennal socket not swollen,
Figs. 1234, 1235. Aptera of *Microsiphoniella*. 1234, head and prothorax; 1235, terminal abdominal segments.
Figs. 1236–1244. Alata of Microsiphoniella. 1236, right fore wing; 1237, anal plate and gonapophyses; 1238, left fore femur; 1239, second and base of third antennal segments; 1240, base of apical antennal segment; 1241, apical rostral segment; 1242, abdominal spiracle; 1243, left hind tarsus; 1244, venter of head.
or weakly swollen protuberant. Discal setae pointed, or capitate, long, arranged in anterior and posterior group of 4 each. Eye and triommatidium present in aptera and alata. Dorsal cephalic sutures not evident, ventral cephalic sutures evident on each side of median ocellus. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1240) with serrate or ciliate marginal lamellae; accessory sensoria not fused; secondary sensoria (Fig. 1239) circular, present on segment III of alata, rarely also present on segment III of aptera. Rostrum 4-segmented; apical segment (Fig. 1241) narrow, stiletto-shaped, usually with concave sides, pointed distal of preapical primary setae.

Thorax: Prothoracic setae pointed, or capitate, long; each side of prothorax with 1 anterior and 1 posterior lateral seta, 2–4 posterior submedian setae, and usually 1 anterior submedian seta. Prothorax without dorsal tubercles, with a large circular lateral tubercle. Femora (Fig. 1238) with setae pointed; tibial setae all pointed or capitate basally. Tibiae without gland facets, sensoria, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1243) triangular in outline, with 3 ventral setae, without dorsal setae. Distitarsi elongate. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1236) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent to nearly parallel.

Abdomen: Dorsal abdominal setae long, pointed, explanate or capitate, arranged in 2 irregular rows on each tergum. Abdominal terga not fused in alata, without pigment except in some species for dashes on posterior terga; terga in aptera pigmented and fused into sclerotic carapace extending laterally and including the lateral sclerites. Lateral sclerites present in alata. Lateral abdominal tubercles present on segments II–V in alata, usually large, circular, usually absent in aptera. Spiracles (Fig. 1242) circular, with sclerotic rims. Siphunculus short, about same length as basal tarsal segments, without setae, somewhat flared apically, but without flange, with a few spiculose imbrications. Abdominal tergum VIII entire. Cauda broadly triangular. Anal plate (Fig. 1237) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Artemisia* species.

**Biology.** All the species are holocyclicly associated with the host plant.

**Comments.** Recognition characters for this genus include the association with the *Artemisia*, the poorly developed antennal tubercles, the short siphunculi, and the presence of a pigmented abdominal carapace in the apterae.
Genus *Mindarus* Koch

Figs. 1245–1255

Type species: *Mindarus abietinus* Koch, 1857:278.

**Adult** (Figs. 1245, 1246). Length 1.5–3.0 mm.

Integument: Antenna with weakly spiculose imbrications on part of segment III, with annuli of spicules on apical 3 segments; head and body without sculpturing other than some spiculose imbrications on apical abdominal terga; tibiae spiculose apically; tarsi spiculose; some spicules or nodules evident on cauda and anal and genital plates.

Head (Fig. 1255): Antennal tubercle undeveloped. Ventral margin of antennal socket not protuberant. Each side of head near antennal socket with an apparently vestigial gland everted in some species, or more commonly represented as a wrinkled spot. Discal setae short, pointed, arranged in anterior group of 6 and posterior group of 4–6. Dorsal cephalic suture absent except for a faint pigmented streak in some species; ventral cephalic sutures absent except for a short spur extending mesad from the antennal socket in some species. Disc without dorsal tubercles. Disc in alata with scattered clusters of small gland pores generally concentrated around bases of setae; disc in aptera similar, but concentration of pores around bases of setae not usually evident; frontal margin of head mesad of antennal socket with clusters of weakly margined cribiform discs. Eye present in alata, present or absent in aptera; triommatidium present. Antenna 6-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 1251) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1250) without ciliate margins, present only on segment III of alata. Rostrum 4-segmented; apical segment (Fig. 1252) cylindrical, blunt distad of preapical primary setae.

Thorax: Prothorax and head more or less fused in aptera, not fused in alata. Prothoracic setae short inconspicuous; each side of pronotum with 1 posterior and 1 anterior lateral seta and 1 anterior and one to several posterior submedian setae. Prothorax without dorsal or lateral tubercles. Prothoracic gland facets in aptera consisting of a cluster of emarginate cribiform discs on each side and clusters of pores concentrated around bases of setae; in alata gland facets consisting of clusters of pores concentrated around bases of setae. Femora (Fig. 1249) and tibiae with setae short, pointed. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 1254) triangular, with 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Fore wing (Fig. 1247) with stigma prolonged along costal margin to wing apex; radial sector straight, meeting margin behind wing apex; media with 2 branches; branches of cubitus narrowly separated at base, divergent.
Figs. 1245, 1246. Aptera of *Mindarus*. 1245, head and prothorax; 1246, terminal abdominal segments.
Figs. 1247–1255. Alata of Mindarus. 1247, right fore wing; 1248, anal plate and gonapophyses; 1249, left fore femur; 1250, second and base of third antennal segments; 1251, base of apical antennal segment; 1252, apical rostral segment; 1253, abdominal spiracle; 1254, left hind tarsus; 1255, venter of head.
Abdomen: Abdominal setae short, pointed, arranged in 2 or 3 irregular transverse rows on each tergum. Abdominal terga usually with large transverse dashes of pigment in alata, in aptera with cribiform discs usually on pigmented spots. Dorsal and lateral abdominal tubercles absent. Lateral abdominal sclerites absent in alata, commonly evident in aptera as pigmented spots with lateral cluster of cribiform discs. Spiracles (Fig. 1253) without sclerotized rims. Siphunculus short, nearly poriform, orifice sclerotized, but without apical flange, unsculptured, without setae, in some species absent on one side of body. Abdominal tergum VIII entire. Cauda in alata usually flaplike, short, in some species distinctly knobbed, somewhat rugulose, but without spicules or imbrications; cauda in aptera reduced to small sclerite. Anal plate (Fig. 1248) entire, usually with vestigial gland facets in alata, with two large clusters of margined cribiform discs in aptera. Abdominal gland facets in aptera consisting of clusters of cribiform discs laterally and associated with posterior transverse row of setae on each tergum; anterior setae on each tergum with clusters of pores around bases; in alata gland facets consisting of clusters of pores around some setae and usually in broad band along posterior margin of each tergum. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** *Mindarus abietinus* Koch.

**Range of plants infested in Canada.** *Picea* and *Abies* species.

**Biology.** The species are holocyclicly associated with the host plant, where they cause distortion of the needles. Sexuales occur relatively early in the summer.

**Comments.** Recognition characters for this genus include the elongate stigma in the alatae and the production of a pseudogall on the terminal twigs of its hosts. The abundant production of white waxy secretion by the apterae in the pseudogall is also distinctive.

**Genus Misturaphis** Robinson

Figs. 1256–1266


**Adult** (Figs. 1256, 1257). Length 1.0–2.0 mm.
Integument: Antennae with smooth imbrications; head and body without sculpturing other than some spiculose imbrications on posterior abdominal terga; tibiae unsculptured; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.
Figs. 1258–1266. Alata of Misturaphis. 1258, right fore wing; 1259, anal plate and gonapophyses; 1260, left fore femur; 1261, second and base of third antennal segments; 1262, base of apical antennal segment; 1263, apical rostral segment; 1264, abdominal spiracle; 1265, left hind tarsus; 1266, venter of head.

Figs. 1256, 1257. Aptera of Misturaphis. 1256, head and prothorax; 1257, terminal abdominal segments.
Head (Fig. 1266): Antennal tubercle undeveloped; front of head flat. Ventral margin of antennal socket not protuberant. Discal setae pointed, hairlike; each side of disc with anterior and posterior group of 2 setae each. Eye and triommatidium present in aptera and alata. Dorsal cephalic suture absent; ventral sutures evident posteriad and on each side of median ocellus. Disc without dorsal tubercles or gland facets. Antenna 5-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1262) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1261) circular, with margins not ciliate, present on segment III of alata. Rostrum 4-segmented; apical segment (Fig. 1263) subconical, rounded distad of preapical primary setae.

Thorax: Prothorax without lateral tubercles or gland facets. Prothoracic setae pointed; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Femora (Fig. 1260) and tibiae with setae pointed. Tibiae without gland facets, peglike setae, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 1265) triangular in outline, with 2 ventral setae. Distitarsi elongate, without preapical capititate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1258) with normal venation; media with 3 branches; branches of cubitus separated or fused at base, divergent.

Abdomen: Abdominal setae pointed, arranged in single transverse row on each tergum, usually restricted to 1 submedian and 1 pleural seta on each tergum. Abdominal terga not fused, sclerotic, without pigment except on tergum VIII. Lateral abdominal sclerites absent in aptera, evident in alata. Lateral and dorsal abdominal tubercles absent. Spiracles (Fig. 1264) with sclerotized rims. Siphunculus short, with weakly developed flange, without setae, with spiculose imbrications. Abdominal tergum VIII entire. Cauda with subbasal constriction, broadly rounded and expanded distally, in aptera commonly forming a knob. Anal plate (Fig. 1259) entire. Abdominal gland facets absent. Gonapophyses 3, of which the middle one faintly subdivided in some species.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Artemisia species

Biology. Nothing is known about the biological details, but presumably the single species is holocyclicly associated with the host plant.

Comments. Recognition characters for this genus include the association with Artemisia, the 5-segmented antennae, the absence of lateral tubercles, the reduced number of dorsal abdominal setae, and the absence of antennal tubercles.
Genus *Monellia* Oestlund
Figs. 1267–1278

*Monellia* Oestlund, 1887:44.
Type species: *Aphis caryella* Fitch, 1855:867.

**Adult** (Figs. 1267, 1268). Length 1.5–3.0 mm.

Integument: Antennae with annuli of spicules; head without spicules; prothorax usually with spicules evident mesally and laterally; abdomen with spicules usually evident laterally and mesally on segments I–V; segment VI, or VII and VIII with spiculose imbrications; tibia and tarsi with spicules; cauda and anal and genital plates with spicules.

Head (Fig. 1278): Antennal tubercle undeveloped; front of head weakly convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, usually short, arranged on each side of disc in posterior and anterior group of 2 each; anterior pair of discal setae on distinct papillae. Eye slightly stalked; triommatidium present. Dorsal cephalic suture absent; ventral cephalic suture evident between margin of clypeus and median ocellus. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis short, about same length as basal portion of segment VI; primary sensoria (Fig. 1273) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1272) with spiculose margins, without cilia, present on segment III of alata. Rostrum 4-segmented; apical segment (Fig. 1274) subconical, rounded distad of preapical primary setae.

Thorax: Each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta, in some specimens with several smaller setae situated between posterior submedian setae. Prothorax without lateral tubercles. Fore coxa enlarged, more than half as long as width of head through eyes. Femora (Fig. 1271) and tibiae with pointed setae. Tibiae with rastral setae; without sensoria, peglike setae, gland facets, or rastral spines. Basitarsi (Fig. 1277) trapezoidal, with 5–7 ventral and 2 dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Fore wing (Fig. 1269) broad; radial sector short; media with 3 branches, with stem arising in apical one-third to one-half of wing; cubital veins widely separated, slightly divergent to nearly parallel; wings held flat over abdomen when at rest.

Abdomen: Abdominal terga not fused, without pigment except in some specimens laterally on segments I–III. Lateral and dorsal abdominal tubercles absent. Dorsal setae arranged in single transverse row on each tergum; each row consisting of only submedian setae, or of submedian and pleural setae, or submedian setae with smaller setae situated between them; submedian setae on tergum VII placed much farther apart than other submedian setae. Spiracle (Fig. 1275) without sclerotic rims. Siphunculus short, nearly poriform, without apical flange, lateral seta of abdominal segment VI

463
Figs. 1267, 1268. Alata of *Monellia*. 1267, head and prothorax; 1268, terminal abdominal segments.
Figs. 1269–1278. Embryonic chaetotaxy and alata of *Monellia*. 1269, right fore wing; 1270, anal plate and gonapophyses; 1271, left fore femur; 1272, second and base of third antennal segments; 1273, primary sensoria on apical antennal segment; 1274, apical rostral segment; 1275, abdominal spiracle; 1276, dorsal chaetotaxy of embryo; 1277, left hind tarsus; 1278, venter of head.
appended to its base. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 1270) bilobate in vivipara; entire in ovipara. Abdomen without gland facets. Gonapophyses usually represented by 2 clusters of setae.

**Embryo** (Fig. 1276). Antenna 4-segmented; each side of disc with 2 setae long, capitate anteriorly and 2 setae short, capitate posteriorly; each side of prothorax with short capitate anterior and posterior submedian setae, and with 1 longer capitate posterior lateral seta; disc and prothorax without gland facets or tubercles; each side of abdomen with 1 long capitate lateral seta and 1 short capitate submedian seta on tergum VII, situated much farther apart than submedian setae on other terga; siphunculus poriform when evident; abdomen without gland facets or tubercles; basitarsi triangular, with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.

**Economically important species.** Monellia caryella (Fitch).

**Range of plants infested in Canada.** Carya species.

**Biology.** The species feed on the under surfaces of the leaves of their host. It is holocyclic and does not produce apterous viviparae.

**Comments.** Recognition characters for this genus include the association with Carya, the nearly poriform siphunculi with appended setae, and the habit of folding the wings flat against the abdomen when at rest. The chaetotaxy of the embryo is also distinctive in that the submedian setae on abdominal tergum VII are placed farther apart than the submedian setae on other abdominal terga. A key to, and descriptions of, the species were provided by Bissell (1978).

**Genus Monelliopsis Richards**

Figs. 1279–1290

Monelliopsis Richards, 1965:89.
Type species: Callipterus caryae Monell, 1879:31.

**Adult** (Figs. 1279, 1280). Length 1.5–3.0 mm.

Integument: Antennae with annuli of spicules; head unsculptured; prothorax usually with spicules mesally and laterally; abdomen with some spicules laterally and mesally on anterior segments; posterior segments with some weakly spiculose imbrications; tibiae and tarsi spiculose; cauda and anal and genital plates spiculose.

Head (Fig. 1290): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, short, arranged on each side in anterior and posterior
group of 2 each; anterior pair of discal setae on papillae, in some species other discal setae also on papillae. Eye and triommatidium distinct in aptera and alata. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis short, about as long as base of VI; primary sensoria (Fig. 1285) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1284) oval, present on segment III of alata, without ciliate margins. Rostrum 4-segmented, subcylindrical, with apical segment (Fig. 1286) pointed distal of preapical primary setae.

Thorax: Prothoracic setae pointed; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta; submedian setae situated on papillae in some species. Prothorax without lateral or dorsal tubercles or gland facets. Fore coxa enlarged, length more than half width of head through eyes. Femora (Fig. 1283) and tibiae with setae pointed. Tibiae with rastral setae, without gland facets, peglike setae, or rastral spines. Basitarsi (Fig. 1289) weakly trapezoidal, with 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1281) broad; radial sector weakly developed or absent; media with 3 branches, with stem arising in apical one-third to one-half of wing; branches of cubitus widely separated at base, nearly parallel, usually darkly pigmented.

Abdomen: Abdomen without pigment, except in some species spots present at bases of lateral and submedian setae. Segments not fused. Abdominal setae pointed, short, arranged in single transverse row on each tergum; each row consisting of only submedian setae or of submedian and 1 dorsolateral seta on each side; submedian setae on some anterior terga on well-developed papillae in some species. Abdomen without dorsal and lateral tubercles, and without lateral sclerites. Spiracles (Fig. 1287) without completely sclerotic rims. Siphunculus short, nearly poriform, without apical flange or sculpturing, with lateral seta of abdominal segment VI appended to the broadened base. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 1282) bilobate in vivipara; entire in ovipara. Abdomen without gland facets. Gonapophyses 2.

Embryo (Fig. 1288). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta; all discal and pronotal setae long, capitate; disc and prothorax without gland facets or tubercles; each side of abdomen with capitate lateral and submedian setae on each tergum; submedian setae on terga IV and VI situated much closer together than other submedian setae; siphunculus poriform when evident; abdomen without gland facets or tubercles; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.

Economically important species. None.
Figs. 1281–1290. Embryonic chaetotaxy and alata of *Monelliopsis*. 1281, right fore wing; 1282, anal plate and gonapophyses; 1283, left fore femur; 1284, second and base of third antennal segments; 1285, primary sensoria on apical antennal segment; 1286, apical rostral segment; 1287, abdominal spiracle; 1288, dorsal chaetotaxy of embryo; 1289, left hind tarsus; 1290, venter of head.

Figs. 1279, 1280. Alata of *Monelliopsis*. 1279, head and prothorax; 1280, abdominal segments.
Range of plants infested in Canada. *Juglans* species.

Biology. Apterous viviparae are not produced. All species are holocyclicly associated with the host plant.

Comments. Recognition characters for this genus include the yellow color, the very dark pigment on the cubital veins, the poriform siphunculi, the distinctive embryonic chaetotaxy with the submedian setae on abdominal terga placed closer together than other pairs of submedian setae, the absence of apterous viviparae, and the restricted association with species of walnut. Richards (1966a) provided a key to, and descriptions of, the species.

Genus *Mordwilkoja* Del Guercio

Figs. 12, 1291-1301

*Mordwilkoja* Del Guercio, 1909b:11.
Type species: *Byrsocrypta vagabunda* Walsh, 1863:306.

Adult (Figs. 1291, 1292). Length 3.0–4.0 mm.

Integument: Antenna with smooth nodulose and spiculose imbrications; head and body usually without obvious sculpturing, in some species with some weakly spiculose imbrications; tibiae unsculptured other than a few imbrications in some species; tarsi with some spicules on venter of apical segment; cauda and anal and genital plates with spicules forming reticulate pattern on anal plate in fundatrix.

Head (Fig. 1301): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae short, pointed, arranged in anterior group of 4–6 and posterior group of 6–10. Eye absent in apterous morphs; triommatidium distinct in aptera and alata. Dorsal cephalic suture well-developed; ventral sutures represented by groove between median ocellus and clypeus. Disc without tubercles or gland facets except in aptera (fundatrices) in some species. Antenna 6-segmented in alata and aptera, 4-segmented in fundatrices; processus terminalis (Fig. 1297) as long or longer than base of terminal segment (much longer in alate spring migrants), with 3–5 sensory pegs on margins of circular membranous areas; primary sensoria with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1296) narrow, annular, but not encircling the segments, present on segment III, usually also on segment IV and in some species on segment V. Rostrum 4-segmented; apical segment (Fig. 1298) subconical, rounded distad of preapical primary setae.

Thorax: Head and prothorax fused in aptera. Prothorax without lateral or dorsal tubercles. Each side of prothorax with 1 anterior and 1–3 posterior lateral setae and 1 anterior and 1 posterior submedian
Figs. 1291, 1292. Alata of *Mordwilkoja*. 1291, head and prothorax; 1292, terminal abdominal segments.
Figs. 1293–1301. Alata of *Mordwilkoja*. 1293, right fore wing; 1294, anal plate and gonapophyses; 1295, left fore femur; 1296, second and base of third antennal segments; 1297, apical antennal segment; 1298, apical rostral segment; 1299, abdominal spiracle; 1300, left hind tarsus; 1301, venter of head.
seta. Gland facets present on prothorax of aptera; each side of pronotum with 1 submedian and 1 lateral cluster of emarginate contiguous facets. Femora (Fig. 1295) and tibiae with setae pointed. Tibiae without gland facets, peglike setae, or rastral spines; rastral setae undeveloped in alata, present in aptera. Basitarsi (Fig. 1300) triangular, each with 2 ventral setae in aptera (some apterae alienicolae with 3 ventral setae on fore basitarsus) and 5–7 in alata. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1293) with venation reduced; media unbranched, usually vestigial basally; branches of cubitus approximate at base, strongly divergent.

**Abdomen:** Abdominal segments not fused, without pigment. Abdominal setae pointed, arranged in single transverse row on each tergum. Abdomen without dorsal and lateral tubercles. Abdomen with emarginate clusters of gland facets present in 1–4 submedian clusters and 1 lateral cluster on each of segments II–VII. Spiracles (Fig. 1299) without sclerotic rims. Siphunculus present or absent, small, poriform, inconspicuous when present. Abdominal tergum VIII entire. Cauda arc-shaped. Anal plate (Fig. 1294) entire. Gonapophyses 3; middle gonapophysis absent in some specimens, and always with fewer setae than the lateral ones.

**Embryo.** Not observed.

**Economically important species.** *Mordwilkoja vagabunda* (Walsh).

**Range of plants infested in Canada.** *Populus* species other than *P. tremuloides*.

**Biology.** Produces a large irregular gall (Fig. 12) at the ends of the twigs of poplars and is heterocyclic between these hosts and *Lysimachia* species. This genus belongs to the group of aphids in which sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

**Comments.** Recognition characters for this genus include large irregular galls on *Populus* and the sensory cones on the processus terminalis of the alatae. Smith (1971) redescribed the single species and gave information on the life cycle.

**Genus Muscaphis Börner**

Figs. 1302–1314

*Muscaphis* Börner, 1933:4.
Type species: *Muscaphis musci* Börner, 1933:4.

**Adult** (Figs. 1302, 1303). Length 1.5–5.0 (fundatrix) mm.
Integument: Antenna with smooth and in some species nodulose imbrications; head and body with nodules and spicules in fundatrix, without obvious sculpturing other than some weakly spiculose imbrications on apical abdominal terga; tibiae in fundatrix with nodules and spicules on basal halves and in some species subapically, without sculpturing in alata; tarsi with smooth and faintly nodulose imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1314): Antennal tubercle slightly developed. Ventral margin of antennal socket not protuberant. Discal setae pointed or blunt; each side of disc with 2 anterior and 2–4 posterior setae. Dorsal cephalic sutures absent; ventral sutures usually evident between median ocellus and anterior margin of clypeus. Disc without tubercles or gland facets. Antenna 6-segmented, with segments III and IV wholly or partly fused in some fundatrices; processus terminalis elongate, without numerous setae, tapering toward apex; primary sensoria (Fig. 1309) usually without ciliate margins, with some cilia present in some fundatrices; accessory sensoria not fused; secondary sensoria (Fig. 1308) numerous, oval or subcircular, without ciliate margins, present on segments III–V of alata. Rostrum 4-segmented; apical segment (Fig. 1310) somewhat concave laterally, rounded distad of preapical primary setae.

Thorax: Prothoracic setae pointed or blunt, weakly capitate in some specimens. Each side of prothorax with 1 or more anterior and posterior submedian setae and 1–4 anterior lateral setae, mostly without posterior lateral setae. Femora (Fig. 1307) with pointed setae; tibial setae mostly pointed, blunt basally in some specimens. Tibiae without gland facets, rastral setae, or rastral spines; peglike setae present on hind tibiae of fundatrix (Fig. 1304), absent in other known morphs. Basitarsi (Fig. 1313) triangular, without dorsal setae, each with 3 ventral setae; hind basitarsus of some specimens with only 2 ventral setae. Distitarsi elongate (short in fundatrix), without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1305) with normal venation; media with 2 branches; branches of cubitus separated at base, divergent.

Abdomen: Abdominal segments not fused, without abundant pigment; pigment restricted to last few terga where present. Abdominal setae short, pointed, blunt or weakly capitate, arranged in single transverse row on each tergum in alate; several transverse rows of pointed setae in fundatrix. Abdomen without dorsal and lateral tubercles. Lateral sclerites absent in aptera, present or absent in alata. Spiracles (Fig. 1311) without well-developed sclerotic rims, distinctly operculate on apical 1–3 abdominal segments in some specimens. Siphunculus elongate, with nodules, spicules, and smooth and spiculose imbrications, without setae, without distinct apical flange. Abdominal tergum VIII entire. Cauda short, broadly and bluntly triangular or spatulate, almost knoblike in some specimens. Anal plate (Fig. 1306) entire. Abdomen without gland facets. Gonapophyses 3 or 4.
Figs. 1302–1304. Aptera of *Muscaphis*. 1302, head and prothorax; 1303, terminal abdominal segments; 1304, middle portion of right hind tibia.
Figs. 1305–1314. Embryonic chaetotaxy and alata of *Muscaphis*. 1305, right fore wing; 1306, anal plate and gonapophyses; 1307, left fore femur; 1308, second and base of third antennal segments; 1309, base of apical antennal segment; 1310, apical rostral segment; 1311, abdominal spiracle; 1312, dorsal chaetotaxy of embryo; 1313, left hind tarsus; 1314, venter of head.
**Embryo** (Fig. 1312). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; abdominal terga each with 1 submedian and 1 lateral seta; most of terga I–V or VI also with 1 pleural seta; siphunculus short, truncate where evident; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitae setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Crataegus* and *Sorbus* species.

**Biology.** The species in this genus are heterocyclic and leave the winter hosts early in the summer. The alternate hosts are mosses, but none of this genus has yet been collected on these plants in Canada. Pseudogalls of deformed leaves are produced on the winter host.

**Comments.** Recognition characters for this genus include the pseudogalls on *Crataegus* and *Sorbus*, the presence in these galls of a large bluish fundatrix that is several times larger than the associated alatoid nymphs, the abundance of the secondary sensoria in the alatae, the short and bluntly triangular cauda, the heavily spiculose and nodulose integument of the fundatrix, and the presence of short and peglike setae on the hind tibiae of the fundatrix. Remaudière and Muñoz Viveros (1985) provided a key to the species. Species of *Muscaphis* have, until recently, been assigned to *Toxopterella*.

**Genus Myzaphis** van der Goot

Figs. 1315–1327

*Myzaphis* van der Goot, 1913:96.

**Adult** (Figs. 1315, 1316). Length 1.5–2.5 mm.

Integument: Antenna with smooth imbrications; head and body in alata without obvious sculpturing other than some spiculose imbrications on apical abdominal segments; head and body of aptera with conspicuous circular pits or with complex series of ripplelike folds; tibiae unsulptured; tarsi with spiculose or nodulose imbrications; anal and genital plates and cauda with spicules, these reduced at apex of cauda (Fig. 1317).

Head (Fig. 1327): Antennal tubercle weakly developed; median tubercle slightly to well developed. Ventral margin of antennal socket not protuberant. Discal setae pointed, blunt, or weakly capitata.
arranged on each side of disc in anterior and posterior group of 2 each. Disc of head without gland facets or tubercles. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1322) circular, with ciliate margins; secondary sensoria (Fig. 1321) on segments III–IV or V of alata only; margins without cilia, but usually some sensoria with a few blunt spicules on margins. Rostrum 4-segmented; apical segment (Fig. 1323) subconical, pointed distal of preapical primary setae.

Thorax: Dorsal and lateral prothoracic tubercles and gland facets absent. Each side of prothorax with 1 anterior and 1 posterior lateral seta, 1 or 2 posterior submedian setae, and in some specimens 1 aberrant anterior submedian seta. Femora (Fig. 1320) with setae pointed; tibial setae all pointed, or mostly blunt, or weakly capitate with pointed ones situated apically. Tibia without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1326) triangular, with 2–5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1318) with normal venation; media with 3 branches; branches of cubitus widely separated at base, somewhat divergent.

Abdomen: Abdominal segments II–VI or VII, more or less fused, with limits indistinct, mostly pigmented in some apterous specimens; alata with large central pigmented patch, or with small dashes and spots on each tergum; lateral sclerites present or absent. Abdominal setae blunt, pointed or capitate, arranged in single transverse row on each tergum. Abdomen without dorsal or lateral tubercles. Spiracles (Fig. 1324) not operculate, with sclerotized rims. Siphunculus subcylindrical or distinctly swollen on apical half, without setae, with apical flange, wrinkles, smooth spiculose imbrications. Abdominal segment VIII entire. Cauda elongate, rather narrow, apex acute. Anal plate (Fig. 1319) entire. Abdomen without gland facets. Gonapophyses 3 or 4.

Embryo (Fig. 1325). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; disc and prothorax without gland facets or tubercles; each side of abdomen with 1 lateral and 1 submedian seta; most terga also with 1 pleural seta; siphunculus short, nearly poriform when evident; basitarsi with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.

Economically important species. None.

Range of plants infested in Canada. *Potentilla* and *Rosa* species.

Biology. The species are holocyclicly associated with their hosts where they feed on the undersurfaces of the terminal leaves.
Figs. 1315–1317. Aptera of *Myzaphis*. 1315, head and prothorax; 1316, terminal abdominal segments; 1317, apex of cauda.
Figs. 1318-1327. Embryonic chaetotaxy and alata of *Myzaphis*. 1318, right fore wing; 1319, anal plate and gonapophyses; 1320, left fore femur; 1321, second and base of third antennal segments; 1322, base of apical antennal segment; 1323, apical rostral segment; 1324, abdominal spiracle; 1325, dorsal chaetotaxy of embryo; 1326, left hind tarsus; 1327, venter of head.
Comments. Recognition characters for this genus include the association with *Potentilla* and *Rosa*, the rippled or pitted integument, and the fusion of the abdominal terga in apterae. The pigmented dorsal patch in the alatae of some species is also distinctive. Richards (1963a) provided a key to, and descriptions of, the Canadian species.

Genus *Myzocallis* Passerini


Type species: *Aphis coryli* Goeze, 1778:311.

**Adult** (Figs. 1328–1331). Length 1.5–3.0 mm.

**Integument:** Antennae with annuli of spicules; head and body without obvious sculpturing other than some spicules laterally and dorsally on prothorax and abdomen; apical abdominal terga also with some weakly spiculose imbrications; tibiae and tarsi spiculose; cauda and anal and genital plates spiculose.

**Head** (Fig. 1341): Antennal tubercle weakly developed; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed or capitate, usually arranged in anterior and posterior group of 4 each, in some species each group with 1 or 2 additional setae. Eye and triommatidium present in aptera and alata. Dorsal suture absent; ventral sutures evident between median ocellus and clypeus. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae, usually as long, or longer than base of segment VI; primary sensoria (Fig. 1336) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1335) circular, with ciliate or spiculose margins, present on segment III of alata (aptera not produced in most species). Rostrum 4-segmented; apical segment (Fig. 1337) short, subcylindrical, blunt distad of preapical primary setae.

**Thorax:** Prothoracic setae pointed, blunt or distinctly capitate, inconspicuous in alata, prominent in aptera; each side of prothorax with 0–2 anterior and 1–8 posterior lateral setae and 1–4 anterior and 1–8 posterior submedian setae. Prothorax usually without lateral tubercles, but some species with as many as 3 small and inconspicuous tubercles on each side. Prothorax without gland facets. Femora (Fig. 1334) with setae pointed; tibial setae mostly pointed, or with some blunt or weakly capitate ones on basal half of each tibia. Tibiae usually with rastral setae, without peglike setae and wax glands. Basitarsi (Fig. 1340) trapezoidal, each with 5 or 6 ventral setae, with 2 dorsal setae in alata and usually also in aptera when aptera occur. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1332) with normal venation; media with 3 branches; branches of cubitus widely.
Figs. 1328, 1329. Alata of Myzocallis species without submedian abdominal papillae. 1328, head and prothorax; 1329, abdominal segments.
Figs. 1330, 1331. Alata of *Myzocallis* species with submedian abdominal papillae. 1330, head and prothorax; 1331, abdominal segments.
Figs. 1332–1341. Embryonic chaetotaxy and alata of *Myzocallis*. 1332, right fore wing; 1333, anal plate and gonapophyses; 1334, left fore femur; 1335, second and base of third antennal segments; 1336, primary sensoria on apical antennal segment; 1337, apical rostral segment; 1338, abdominal spiracle; 1339, dorsal chaetotaxy of embryo; 1340, left hind tarsus; 1341, venter of head.
separated at base, slightly divergent, with Cu1 arising near middle of common longitudinal vein.

Abdomen: Abdominal terga not fused, with or without pigment, with extent of pigmentation variable where it occurs. Lateral sclerites present or absent. Lateral abdominal tubercles present or minute, inconspicuous, commonly not strongly protruding when present. Dorsal and lateral abdominal setae pointed, blunt or capitate, inconspicuous in alata, conspicuous in aptera where aptera occur, basically arranged in single transverse row on each tergum; submedian setae represented by single seta or a cluster of 2 to many setae in some species; pleural setae present in some species; submedian seta usually on bosses, in some species on fingerlike papillae. Segments II–V with lateral conical papillae having no apical seta. Spiracles (Fig. 1338) not operculate, without sclerotized rims. Siphunculus short, without apical flange, without setae, with lateral setae of abdominal segment VI not appended to its base, mostly smooth, with spicules in some species. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 1333) bilobate in vivipara; entire in ovipara. Abdomen without gland facets. Gonapophyses 2.

Embryo (Fig. 1339). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta; disc and pronotum without gland facets, without tubercles evident; each side of abdomen with 1 submedian and 1 lateral seta on each tergum; siphunculus poriform where evident; basitarsi triangular, with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.

Economically important species. None.

Range of plants infested in Canada. Species of Asclepias, Carpinus, Castanea, Corylus, and Quercus.

Biology. All species are holocyclicly associated with the host plant and feed on the undersurfaces of the leaves. Apterae are not produced in species that occur in Canada and are only known in one North American species, Myzocallis meridionalis Granovsky.

Comments. Recognition characters for this genus include the host associations, the short siphunculi, the spiculose tibiae and tarsi, the knobbed cauda, the bilobate anal plate, and the presence of clusters of submedian setae on each abdominal tergum in most species. The absence of apical seta on the lateral abdominal conical papillae is also distinctive. Richards (1968d) provided a key to, and descriptions of, the species.
Genus *Myzodium* Börner


**Adult** (Figs. 1342, 1344). Length 1.50–2.25 mm.

**Integument**: Antenna with smooth imbrications; disc unsculptured; centre of head with spicules at least in aptera; prothorax unsculptured other than some wrinkles and in some species coarse nodules laterally in aptera; tibiae unsculptured; tarsi with smooth imbrications; cauda and anal and genital plates spiculose, with spicules reduced at apex of cauda (Fig. 1345).

**Head** (Fig. 1354): Antennal tubercle fairly well developed; mesal margin swollen, scabrous, especially in aptera; median tubercles also developed in aptera making front of head W-shaped. Ventral margin of antennal socket (Fig. 1343) weakly protuberant, scabrous. Eye and triommatidium present in aptera and alata. Discal setae short, blunt or weakly capitate, arranged on each side in anterior and posterior group of 2 each. Dorsal cephalic suture evident in some species as a pigmented line; ventral sutures evident between median ocellus and clypeus. Antenna usually 5- or 6-segmented; processus terminalis rather elongate, without numerous setae; primary sensoria (Fig. 1350) usually with ciliate margins, in some species reduced to nodules or absent; accessory sensoria not fused; secondary sensoria (Fig. 1349) circular without ciliate margins, present on segments III, IV, and commonly V of alata. Rostrum 4-segmented; apical segment (Fig. 1351) conical, rounded distad of preapical primary setae.

**Thorax**: Prothoracic setae short, inconspicuous, blunt or weakly capitate; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Prothorax without lateral tubercles or gland facets. Fore coxa not enlarged. Femora (Fig. 1348) with pointed setae; tibial setae mostly blunt or weakly capitate basally and dorsally, pointed ventrally and apically. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1353) triangular, each with 3 or hind basitarsus with 2 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1346) with normal venation; media with 2 or 3 branches; branches of cubitus widely separated at base.

**Abdomen**: Abdominal setae mostly short, blunt or weakly capitate, inconspicuous, arranged in single transverse row on each tergum. Abdomen in aptera with pigmented sclerotic carapace fused to lateral sclerites, in alata with large dorsal patch commonly fused to...
Figs. 1346–1354. Alata of *Myzodium*. 1346, right fore wing; 1347, anal plate and gonapophyses; 1348, left fore femur; 1349, second and base of third antennal segments; 1350, base of apical antennal segment; 1351, apical rostral segment; 1352, abdominal spiracle; 1353, left hind tarsus; 1354, venter of head.
lateral abdominal sclerites. Lateral abdominal tubercles and gland facets absent. Spiracles (Fig. 1352) not operculate, with sclerotized rims. Siphunculus elongate, subcylindrical to slightly swollen on apical half, rather abruptly attenuate just proximal of flange, without setae, with course imbrications except immediately proximal of flange. Abdominal tergum VIII entire. Cauda short, abruptly narrowed medially to a fingerlike extension. Anal plate (Fig. 1347) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Polytrichum* species.

**Biology.** The details are unknown, but collection data indicate that species are holocyclically associated with various mosses.

**Comments.** Recognition characters for this genus include its association with mosses, the deeply pigmented sclerotic dorsum of the abdomen in both apterae and alatae, the median projection on the cauda, coarse and smooth imbrications on the siphunculi, and scabrous antennal tubercles that are especially evident in the apterae. Smith and Robinson (1975) provided a key to, and descriptions of, the species.

**Genus Myzus Passerini**

Figs. 1355–1368

*Myzus* Passerini, 1860:27.

Type species: *Aphis cerasi* Fabricius, 1775:734.

**Adult** (Figs. 1355, 1357). Length 1.5–3.0 mm.

Integument: Antenna with smooth imbrications; disc of head with spicules in aptera, unsculptured in alata; thorax usually unsculptured other than wrinkles and in some species some nodules laterally on prothorax in aptera; abdomen in aptera with wrinkles dorsally and with spiculose imbrications on apical 2 or 3 terga, in alata usually with some spicules on lateral sclerites and spiculose imbrications on apical 2 or 3 terga; tibiae unsculptured, or in some species with apical imbrications in alata; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1368): Antennal tubercle well-developed, scabrous, with mesal margin projecting. Ventral margin of antennal socket (Fig. 1356) protuberant. Discal setae short, inconspicuous, blunt or obscurely capitate, arranged on each side of disc in anterior and posterior group of 2 each. Eye and triommatidium present in aptera and alata. Disc of head exceptionally with 1 or 2 tubercles near
posterior margin, without gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1363) with ciliate margins in alata, commonly obscure or absent in aptera; secondary sensoria (Fig. 1362) circular, without ciliate margins, on segment III of alata, exceptionally present in aptera. Rostrum 4-segmented; apical segment (Fig. 1364) slender, conical, rounded distal of preapical primary setae.

Thorax: Prothoracic setae short, blunt or obscurely capitate, inconspicuous; each side of prothorax with 1 anterior lateral seta and 1 posterior submedian seta. Prothoracic lateral tubercles present or absent. Prothorax without gland facets, with dorsal tubercles in some species. Femora (Fig. 1361) with pointed setae; tibial setae consisting of mixture of pointed and blunt or obscurely capitate ones, with the former situated mostly apically and ventrally, and with the latter situated mostly dorsally and basally. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1367) triangular, each with 3 or hind basitarsus with 2 ventral setae, without dorsal setae. Apical tarsal segment elongate, without preapical capitate setae. Plantar setae acuminated. Claws simple. Fore wing (Fig. 1359) with normal venation; media with 3 branches; branches of cubitus widely separated at base.

Abdomen: Abdominal setae mostly short, inconspicuous especially on anterior terga, blunt or obscurely capitate, arranged in single transverse row on each tergum. Abdominal terga with variable amounts of pigment; in aptera of some species dorsum of abdomen completely sclerotic forming pigmented dorsal carapace, of others without pigment except in some species for dashes on apical 1 or 2 terga; alata always with central quadrate dorsal patch. Lateral sclerites usually evident in alata. Abdomen with or without lateral tubercles, in some species with 1 or 2 dorsal tubercles on tergum VIII. Spiracles (Fig. 1365) subcircular, with sclerotic rims, those on abdominal segments VI and VII usually operculate. Siphunculus (Figs. 1357, 1358) elongate, subcylindrical, tapered toward apex, or swollen on apical half, with smooth or distinctly nodulose or spiculose imbrications at least on basal half, without setae, with apical flange. Abdominal tergum VIII entire. Cauda short triangular, usually broadly rounded apically. Anal plate (Fig. 1360) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 1366). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; disc and prothorax without gland facets; tubercles not evident; each side of abdomen with 1 lateral and 1 submedian seta on each tergum; most terga also with 1 pleural seta; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminated.
Figs. 1355–1358. Aptera of *Myzus*. 1355, head and prothorax; 1356, ventral margin of antennal socket; 1357, terminal abdominal segments; 1358, variant form of siphunculus.
Figs. 1359–1368. Embryonic chaetotaxy and alata of *Myzus*. 1359, right fore wing; 1360, anal plate and gonapophyses; 1361, left fore femur; 1362, second and base of third antennal segments; 1363, base of apical antennal segment; 1364, apical rostral segment; 1365, abdominal spiracle; 1366, dorsal chaetotaxy of embryo; 1367, left hind tarsus; 1368, venter of head.
Economically important species. *Myzus ascalonicus* Doncaster, *M. cerasi* (Fabricius), *M. ligustri* (Mosley), and *M. persicae* (Sulzer).

Range of plants infested in Canada. *Prunus* species and a wide variety of herbaceous plants. The alienicolae of *M. persicae* are especially polyphagous.

Biology. Some species, such as *M. cerasi*, are heterocyclic between *Prunus* species and a relatively narrow range of herbaceous plants. Others, such as *M. ascalonicus*, are associated only with herbaceous plants. Pseudogalls of twisted terminal leaves are produced by *M. cerasi* and *M. persicae* on *Prunus*, and by *M. ligustri* on *Ligustrum*.

Comments. Recognition characters for this genus include the scabrous convergent antennal tubercles in the apterae, and in the alatae the presence of scabrous antennal tubercles and a quadrate, pigmented patch on the dorsum of the abdomen. Most species in Canada belong to subgenus *Nectarosiphon* Schouteden.

Genus *Nasonovia* Mordvilko

Figs. 1369–1384

*Nasonovia* Mordvilko, 1914:72.
Type species: *Aphis ribicola* Kaltenbach, 1843:33 = *Aphis ribisnigri* Mosley, 1841:628.

Adult (Figs. 1369, 1371, 1373, 1374). Length 2.0–4.0 mm.
Integument: Antenna with smooth imbrications at least apically; head and body without sculpturing other than spiculose imbrications on apical abdominal segments; tibiae unsculptured; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.
Head (Fig. 1384): Antennal tubercle well-developed, smooth; front of head U-shaped. Ventral margin of antennal socket (Fig. 1370) smooth, protuberant. Discal setae blunt or weakly capitate, arranged on each side in anterior and posterior group of 2 each. Eye and triommatidium present in aptera and alata. Dorsal cephalic suture absent; ventral suture evident between median ocellus and clypeus. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1379) with or without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1378) circular, commonly protuberant, having margins nonciliate but commonly with a few blunt spicules, present on segments III and IV, rarely 1 or 2 on V of alata, usually present on segment III, in some species on segment IV of aptera. Rostrum 4-segmented; apical segment (Fig. 1380) elongate, subcylindrical, with sides somewhat concave, rounded distad of preapical primary setae.
Thorax: Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Prothoracic dorsal tubercles and gland facets absent; 0–3 lateral tubercles present. Spiracles large; atrium barrel-shaped with reticulate walls. Femora (Fig. 1377) with setae pointed. Tibial setae mostly blunt or weakly capitate or clavate dorsally and basally, pointed apically and ventrally, in alata swollen apices of setae membranous and commonly collapsed. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1383) triangular or slightly trapezoidal, with 3 or 4 ventral setae on fore and mid basitarsi and 2 or 3 on hind basitarsus, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1375) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent to almost parallel.

Abdomen: Setae blunt or weakly capitate, arranged in single transverse row on each tergum. Dorsum in alata usually with abundant irregularly shaped pigment, in some species forming central patch; aptera usually without pigment, in some species diffusely pigmented. Abdominal segments not fused. Lateral abdominal sclerites absent, or present on segments II–V. Spiracles (Fig. 1381) with sclerotic rims, subcircular, usually with opercula. Siphunculus (Figs. 1371, 1372, 1374) elongate, subcylindrical, tapered toward apex, or distinctly swollen on apical half, covered with dispersed spicules or weakly formed spiculose imbrications, or mostly smooth with a few spicules basally, usually without setae, with apical flange, usually with a few small transverse preapical reticulations. Abdominal tergum VIII entire. Cauda elongate, nearly parallel sided, broadly rounded apically. Anal plate (Fig. 1376) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 1382). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; disc and pronotum without gland facets; lateral tubercles not evident; each side of abdomen with 1 lateral and 1 submedian seta, and usually with 1 pleural seta on some terga; basitarsi triangular, with 2 ventral seta; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

Economically important species. Nasonovia ribisnigri (Mosley), N. lactucae (Linnaeus).

Range of plants infested in Canada. Mainly Hieracium, Saxifraga, and Sonchus species, and various species of Saxifragaceae including species of Ribes grown commercially.

Biology. Heterocyclic species alternate between Ribes and Hieracium, Sonchus and other closely related Compositae,
Figs. 1369–1372. Aptera of *Nasonovia* (subgenus *Nasonovia*). 1369, head and prothorax; 1370, ventral margin of antennal socket; 1371, terminal abdominal segments; 1372, variant form of siphunculus.
Figs. 1375–1384. Embryonic chaetotaxy and alata of *Nasonovia*. 1375, right fore wing; 1376, anal plate and gonapophyses; 1377, left fore femur; 1378, second and base of third antennal segments; 1379, base of apical antennal segment; 1380, apical rostral segment; 1381, abdominal spiracle; 1382, dorsal chaetotaxy of embryo; 1383, left hind tarsus; 1384, venter of head.

Figs. 1373, 1374. Aptera of *Nasonovia* (subgenus *Kakimia*). 1373, head and prothorax; 1374, terminal abdominal segments.
Scrophulariaceae, or sometimes Solanaceae. Nonalternating species are found on Compositae, Saxifragaceae (including Ribes), Scrophulariaceae, Geraniaceae, or Ranunculaceae. Colonies on Ribes may cause severe distortion and discoloration of the leaves.

Comments. Recognition characters for this genus include the following: the association with Ribes, other Saxifragaceae, Scrophulariaceae, and Compositae; the well-developed, smooth antennal tubercles; the operculate spiracles of some species; the large thoracic spiracles; the absence of extensive reticulations on the siphunculi; and the abundance of secondary sensoria in both the apterae and alatae.

Nasonovia, as used here, includes Capitosiphon Heie, Kakimia Hottes & Frison, Eokakimia Heie, Neokakimia Doncaster & Stroyan, Ranakimia Heie, Hyperomyzus Börner, and Neonasonovia Hille Ris Lambers. Kakimia species are characterized by operculate spiracles, whereas members of Hyperomyzus and Neonasonovia have swollen siphunculi. Most Canadian species belong in Kakimia. Heie (1979) provided keys to the subgenera and species and descriptions of the world fauna, excluding Hyperomyzus and Neonasonovia.

Delphiniobium Mordvilko has somewhat swollen siphunculi with a distinctly reticulate subapical area, but it is otherwise quite similar to Nasonovia. A single species from western North America, originally described as Kakimia canadensis Robinson, is currently placed in this genus.

Genus Nearctaphis Shaposhnikov

Figs. 1385–1396

Type species: Aphis bakeri Cowen, 1895:118.

Adult (Figs. 1385, 1386). Length 1.5–3.0 mm.
Integument: Antenna with imbrications; head usually with spicules or nodules at least anteriorly, in some species covering whole disc at least in aptera; thorax and abdomen unsculptured or with spicules and nodules at least on some of the pigmented areas; tibiae unsculptured; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.
Head (Fig. 1396): Antennal tubercle weakly developed, not projecting beyond median tubercle. Ventral margin of antennal socket not protuberant. Discal setae mostly pointed, blunt in some species; each side of disc with fairly well defined anterior and posterior groups of 2–8 setae each. Eye and triommatidium present in aptera and alata. Dorsal cephalic sutures absent; ventral cephalic sutures evident on each side and ventrad of median ocellus in some species. Disc of head without gland facets or tubercles. Antenna 6-segmented;
processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1391) with or without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1390) circular, without ciliate margins, present on segments III, IV, and commonly V of alata, normally absent in aptera. Rostrum 4-segmented; apical segment (Fig. 1392) conical, pointed distad of preapical primary setae.

Thorax: Prothoracic setae pointed, blunt in some species; each side with one to several anterior and posterior submedian setae and one to several anterior and posterior lateral setae. Prothoracic lateral tubercles present. Femora (Fig. 1389) with setae pointed; tibial setae pointed, blunt basally in some species. Tibia without peglike setae, gland facets, rastral setae, or rastral spines; in some species with pseudosensoria on hind tibia. Basitarsi (Fig. 1395) triangular, each with 3 or 4 or hind basitarsus with 2 ventral setae, without dorsal setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1387) with normal venation; media usually with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Dorsal and lateral abdominal setae mostly pointed, blunt dorsally in some species, arranged in 1–4 irregular transverse rows on each tergum. Abdominal terga not fused; terga in aptera unpigmented in some species, or each with pigmented spots or large pigmented plates commonly fused producing central pigmented patch; terga in alata mostly unpigmented, or with transverse bars on each tergum, or with large central pigmented sclerotic patch. Dorsal abdominal tubercles absent; lateral abdominal tubercles usually present on segments II–V. Spiracles (Fig. 1393) subcircular, with sclerotic rims. Siphunculus elongate, without setae, with apical flange, with closely placed strongly spiculose imbrications. Abdominal tergum VIII entire. Cauda short, bluntly triangular (Fig. 1388) to somewhat pentagonal (Fig. 1386). Anal plate entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 1394). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothoracic gland facets absent; lateral tubercles not evident; each side of abdomen with 1 submedian, 1 pleural, and 1 lateral seta; abdominal tubercles not evident; basitarsi triangular, with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Nearctaphis bakeri* (Cowen).

**Range of plants infested in Canada.** Various Pomoideae, various herbaceous legumes, and some Scrophulariaceae.

**Biology.** Some species are heterocyclic between various Pomoideae and the flowers and roots of herbaceous legumes such as
Figs. 1385, 1386. Aptera of *Nearctaphis*. 1385, head and prothorax; 1386, terminal abdominal segments.
Figs. 1387–1396. Embryonic chaetotaxy and alata of *Nearctaphis*. 1387, right fore wing; 1388, anal plate and gonapophyses; 1389, left fore femur; 1390, second and base of third antennal segments; 1391, base of apical antennal segment; 1392, apical rostral segment; 1393, abdominal spiracle; 1394, dorsal chaetotaxy of embryo; 1395, left hind tarsus; 1396, venter of head.
Trifolium and Medicago. Some are holocyclic on Castilleja and perhaps also on some herbaceous legumes.

Comments. Recognition characters for this genus include the following: the association with various Pomoideae; the tendency for most of the species to occur in the flowers or in the roots of various herbaceous legumes as secondary hosts; the short, bluntly triangular cauda; the restriction of lateral tubercles to abdominal segments II-V; the short, spiculose siphunculi; the spicules on at least the anterior portion of the disc; and the tendency in many species to have four setae on the ventral surfaces of the basal tarsal segments.

Robinson (1984) provided a key to the North American species. Richards (1969c) reviewed the species (as part of Roepkea Hille Ris Lambers).

Genus Neoamphorophora Mason
Figs. 1397–1408

Neoamphorophora Mason, 1924:49.
Type species: Neoamphorophora halmiae Mason, 1924:49.

Adult (Figs. 1397, 1399). Length 1.5–2.5 mm.
Integument: Antenna with smooth imbrications; head and body without obvious sculpturing other than some spiculose imbrications on apical abdominal terga; tibia and tarsi with spicules; cauda and anal and genital plates spiculose.

Head (Fig. 1408): Frontal and median tubercles well-developed making front of head W-shaped. Ventral margin of antennal socket (Fig. 1398) protuberant. Discal setae blunt or weakly capitate, arranged on each side in anterior and posterior group of 2 each. Eye and triommatidium present in aptera and alata. Dorsal cephalic suture absent; ventral sutures evident between median ocellus and clypeus. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1404) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1403) circular, without ciliate margins, but commonly with a few marginal nodules or spicules, present on segments III, IV, and rarely V of alata. Rostrum 4-segmented; apical segment (Fig. 1405) short, conical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae blunt or weakly capitate; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta. Prothorax without lateral tubercles or gland facets; small tubercles evident in a few specimens. Femora (Fig. 1402) with setae pointed. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Figs. 1407) triangular, with 3 ventral setae, without dorsal setae. Distitarsi
Figs. 1397–1399. Aptera of *Neoamphorophora*. 1397, head and prothorax; 1398, ventral margin of antennal socket; 1399, terminal abdominal segments.
Figs. 1400–1408. Alata of *Neoamphorophora*. 1400, right fore wing; 1401, anal plate and gonapophyses; 1402, left fore femur; 1403, second and base of third antennal segments; 1404, base of apical antennal segment; 1405, apical rostral segment; 1406, abdominal spiracle; 1407, left hind tarsus; 1408, venter of head.
elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1400) with normal venation; media with 2 or 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Abdominal setae blunt or weakly capitate, arranged in single transverse row on each tergum. Abdominal terga fused in aptera, pigmented, forming dorsal carapace; in alata each tergum with irregularly shaped transverse dash. Dorsal and lateral abdominal tubercles absent. Lateral sclerites absent in aptera, evident but poorly developed in alata. Spiracles (Fig. 1406) with sclerotic rims. Siphunculus strongly swollen, smooth except for a few spicules and weakly formed preapical reticulations. Abdominal tergum VIII entire, with median protuberance in males. Cauda elongate, nearly parallel sided, broadly rounded apically. Anal plate (Fig. 1401) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo. Not observed.

Economically important species. None

Range of plants infested in Canada. Kalmia species.

Biology. The single North American species is holocyclic on Kalmia species.

Comments. Recognition characters for this genus include the host association, the presence of anterior submedian setae, the deeply pigmented abdomen in the apterae, the absence of lateral abdominal tubercles, and the swollen smooth siphunculi. The median protuberance on the eighth abdominal tergum in the males is also distinctive.

Genus Neoprociphilus Patch

Figs. 1409–1420

Type species: Pemphigus attenuatus Osborn and Sirrine, 1893:237
= Pemphigus aceris Monell, 1882:16.

Adult (Figs. 1409, 1410). Length 3.5–4.5 mm.
Integument: Antenna with spicules on apical segments in aptera and alata; head and body without obvious sculpturing; tibiae without sculpturing; tarsi nearly smooth except for some dispersed spicules on ventral surfaces of apical segments; cauda and anal and genital plates with a few dispersed spicules.
Head (Fig. 1420): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed; each side of disc with 2 anterior and 2 posterior discal
setae, and with cluster of gland facets posteriorly. Eye absent in aptera; triommatidium distinct. Dorsal cephalic suture absent; ventral sutures present in alata. Primary sensoria (Fig. 1415) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1414) present on segments III–V of alata, oval, with ciliate margins. Rostrum 4-segmented; apical segment (Fig. 1416) elongate, subcylindrical, not prolonged distad of preapical primary setae. Rostrum vestigial in male and ovipara.

Thorax: Head and prothorax not fused in alata, partially fused in aptera. Each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta, and with large median cluster of gland facets. Prothorax without dorsal and lateral tubercles. Mesothorax with median cluster of gland facets on each side. Femora (Fig. 1413) and tibiae with setae pointed. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1419) triangular, with 4 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1411) with venation reduced; radial sector almost straight beyond base; media unbranched; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal setae pointed, arranged in single transverse row on each tergum; each row consisting of 1 submedian, 1 pleural, and 1–3 lateral setae. Abdominal terga I–VI with 3 clusters of gland facets on each side; tergum VII with 2 clusters; tergum VIII with an unpaired median cluster of facets. Abdominal segments not fused, without pigment. Lateral and dorsal abdominal tubercles absent. Spiracles (Fig. 1417) circular with hinged operculum. Siphunculus present, poriform, situated near centre of lateral cluster of gland facets on segment VI. Abdominal tergum VIII entire. Cauda short, arc-shaped. Anal plate (Fig. 1412) entire. Gonapophyses 3.

Embryo (Fig. 1418). Antenna 4-segmented; eyes absent; triommatidium present; disc with gland facets, with 2 anterior and 2 posterior setae; prothorax with gland facets, with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; abdomen with 1 submedian, 1 pleural, and 1 lateral seta on terga I–V or VI, with fewer setae on terga VII and VIII; clusters of gland facets evident on most terga; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminiate, but commonly weakly capitate. Embryo of male and of ovipara lacking mouthparts.

Economically important species. None.

Range of plants infested in Canada. Acer and Smilax species.

Biology. The single known species is heterocyclic between Acer and Smilax. Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.
Figs. 1409, 1410. Aptera of Neoprociphilus. 1409, head and prothorax; 1410, terminal abdominal segments.
Figs. 1411–1420. Embryonic chaetotaxy and alata of Neoprociphilus. 1411, right fore wing; 1412, anal plate and gonapophyses; 1413, left fore femur; 1414, second and base of third antennal segments; 1415, base of apical antennal segment; 1416, apical rostral segment; 1417, abdominal spiracle; 1418, dorsal chaetotaxy of embryo; 1419, left hind tarsus; 1420, venter of head.
Comments. Recognition characters for this genus include the associations with *Acer* and *Smilax*, the oval secondary sensoria, the presence of 4 setae on the ventral surface of each basal tarsal segment, and the poriform siphunculus situated near the centre of the lateral cluster of gland facets on the sixth abdominal segment.

**Genus Neosymydobius** Baker

*Figs. 1421–1432*

*Type species:* *Symydobius albasiphus* Davis, 1914:226.

**Adult** (Figs. 1421, 1422). Length 1.5–2.5 mm.  
*Integument:* Antenna with spiculose imbrications and annuli of spicules; head and body without obvious sculpturing other than some spiculose imbrications on apical abdominal terga; tibiae with spicules; tarsi with spicules; cauda and anal and genital plates with spicules.  
*Head* (Fig. 1432): Antennal tubercle undeveloped, or weakly developed; front of head convex to slightly concave. Ventral margin of antennal socket not protuberant. Discal setae pointed, arranged on each side in anterior and posterior group of 2 each. Eye and triommatidium present in aptera and alata. Dorsal cephalic suture absent; ventral sutures absent or in some species evident between median ocellus and margin of postclypeus. Head without tubercles or gland facets. Antenna 6-segmented; processus terminalis rather short, without numerous setae; primary sensoria (Fig. 1427) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1426) circular, restricted to segment III of alata, with ciliate margins. Rostrum 4-segmented; apical segment (Fig. 1428) tapered, subcylindrical, bluntly pointed distad of preapical primary setae.  
*Thorax:* Prothoracic setae pointed; each side of prothorax with 1 or 2 posterior lateral setae, 1–5 anterior submedian setae, and several posterior submedian setae more or less fused forming transverse cluster or 2 distinct clusters of setae. Prothorax with 0–6 lateral tubercles on each side. Femora (Fig. 1425) with setae pointed; tibial setae pointed, fine, hairlike. Tibiae without gland facets, peglike setae, sensoria, rastral spines, or rastral setae. Basitarsi (Fig. 1431) weakly trapezoidal, nearly triangular, each with 5 or 6 ventral setae, with 1 or 2 dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae flabellate to nearly rod-shaped. Claws simple. Fore wing (Fig. 1423) with normal venation; media with 3 branches; branches of cubitus widely separated at base, nearly parallel to divergent.  
*Abdomen:* Abdominal setae pointed, arranged in single or in some species double irregular transverse rows on each tergum. Abdominal terga in some species without pigment, usually with transverse pigmented bar on each tergum in both aptera and alata;
Figs. 1421, 1422. Aptera of Neosymydobius. 1421, head and prothorax; 1422, terminal abdominal segments.
Figs. 1423–1432. Embryonic chaetotaxy and alata of *Neosymydobius*. 1423, right fore wing; 1424, anal plate and gonapophyses; 1425, left fore femur; 1426, second and base of third antennal segments; 1427, base of apical antennal segment; 1428, apical rostral segment; 1429, abdominal spiracle; 1430, dorsal chaetotaxy of embryo; 1431, left hind tarsus; 1432, venter of head.
bar broken in aptera in some species. Abdominal terga never fused. Dorsal abdominal tubercles absent. Abdominal segments II–VII with 0–5 lateral tubercles. Spiracles (Fig. 1429) with sclerotic rims. Siphunculus short, smooth, without setae or apical flange, in some species somewhat flared apically. Abdominal tergum VIII entire. Cauda short, arc-shaped, or weakly knobbed. Anal plate (Fig. 1424) bilobate in vivipara, entire in ovipara. Gonapophyses 2.

**Embryo** (Fig. 1430). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta; disc and prothorax without gland facets; tubercles not evident; each side of abdomen with 1 submedian and 1 lateral seta on each tergum; siphunculus poriform when present; basitarsi triangular, with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae narrowly rod-shaped, or clavate.

**Economically important species.** None

**Range of plants infested in Canada.** *Quercus* species.

**Biology.** All species are holocyclicly associated with the host plant and feed on the terminal twigs, petioles, and basally on the undersurfaces of the leaves.

**Comments.** This genus is most readily recognized by the association with *Quercus*, the arc-shaped or weakly knobbed cauda, the presence of lateral tubercles on the prothorax and the abdominal segments, the short and smooth siphunculi, and the long and slightly sigmoid hind tibiae. Richards (1968b) revised the genus.

**Genus Neotoxoptera Theobald**

Figs. 1433–1444


**Adult** (Figs. 1433, 1435). Length 1.0–2.5 mm.
Integument: Dorsum and venter of head with nodules and spicules in aptera, less conspicuous in alata; thorax and abdomen without obvious sculpturing other than some dispersed spicules laterally and posteriorly; tibiae without sculpturing; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.
Head (Fig. 1444): Antennal tubercle well-developed, with mesal margin slightly to strongly protuberant. Ventral margins of antennal sockets (Fig. 1434) protuberant. Discal setae short, blunt, inconspicuous; each side of disc with 2 anterior and 2 posterior setae.
Figs. 1433-1435. Aptera of *Neotoxoptera*. 1433, head and prothorax; 1434, ventral margin of antennal socket; 1435, terminal abdominal segments.
Figs. 1436–1444. Alata of *Neotoxoptera*. 1436, right fore wing; 1437, anal plate and gonapophyses; 1438, left fore femur; 1439, second and base of third antennal segments; 1440, base of apical antennal segment; 1441, apical rostral segment; 1442, abdominal spiracle; 1443, left hind tarsus; 1444, venter of head.
Dorsal cephalic sutures absent; ventral sutures usually slightly developed just anterior of clypeus. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1440) with ciliate margins; secondary sensoria (Fig. 1439) circular, without ciliate margins, present on segments III and IV, rarely also V of alata, absent in aptera. Rostrum 4-segmented; apical segment (Fig. 1441) slender, conical, bluntly pointed distad of preapical primary setae.

Thorax: Prothoracic setae about same size and shape as discal setae; each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax without gland facets; dorsal tubercles usually absent; lateral tubercles present or absent. Femora (Fig. 1438) with setae pointed; tibial setae mostly pointed; usually some blunt setae basally. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1443) triangular, with 2 or 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acminate. Claws simple. Fore wing (Fig. 1436) with normal venation; media with 2 branches, having branches of cubitus widely separated at base, almost parallel.

Abdomen: Dorsal and lateral abdominal setae short, mostly blunt, arranged in single transverse row on each tergum; abdominal segments not fused, pigmented and sclerotic in aptera (in known species in Canada), in alata with more or less quadrate pigmented patch on anterior terga, and with posterior terga with transverse pigmented dashes; lateral sclerites present in alata. Dorsal tubercles absent; lateral tubercles usually present on some segments, small and inconspicuous where present. Spiracles (Fig. 1442) subcircular, without opercula. Siphunculus swollen on apical half. Abdominal tergum VIII entire. Cauda short, triangular. Anal plate (Fig. 1437) entire. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None in Canada.

**Range of plants infested in Canada.** None. One species recorded in Canada on onions imported from California.

**Biology.** Species of this genus are mainly associated with violets and onions, but they occur on a wide variety of herbaceous plants in greenhouses.

**Comments.** Recognitions characters for this genus are the unbranched media and the prominent scabrous antennal tubercles.
Genus *Obtusicauda* Soliman

Figs. 1445–1455

*Obtusicauda* Soliman, 1927:98.
Type species: *Obtusicauda essigi* Soliman, 1927:99.

**Adult** (Figs. 1445, 1446). Length 1.5–3.0 mm.

**Integument:** Antenna with smooth imbrications on at least apical 2 segments; head and body without obvious sculpturing, other than some spiculose imbrications on apical 2 or 3 abdominal terga; tibiae without spicules; tarsi with imbrications; cauda and anal and genital plates with spicules.

**Head** (Fig. 1455): Antennal tubercle well-developed; front of head U-shaped. Ventral margins of antennal socket not protuberant. Each side of disc with 4 anterior and 2 posterior setae. Discal setae usually distinctly clavate, but with apices membranous, commonly collapsed. Eye and triommatidium present in aptera and alata. Ventral and dorsal cephalic sutures absent. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1451) without ciliate margins; secondary sensoria (Fig. 1450) circular, without ciliate margins, situated on segment III of aptera and alata. Rostrum 4-segmented; apical segment (Fig. 1452) narrow, needlelike, with concave or nearly concave sides.

**Thorax:** Prothoracic lateral tubercles absent. Prothoracic setae usually distinctly clavate; each side of prothorax with 1–3 posterior submedian setae and 1 or 2 anterior and usually 2 posterior lateral setae. Femora (Fig. 1449) with setae clavate; apical tibial setae acuminatae; basal tibial setae clavate or capitate with swollen part membranous, commonly collapsed in mounted specimens. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1454) each with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitata setae. Plantar setae acuminatae. Claws simple. Fore wing (Fig. 1447) with normal venation; media with 3 branches; branches of cubitus widely separated at base, nearly parallel.

**Abdomen:** Abdominal terga not fused, usually with brown spots around bases of most dorsal setae, with large postsiphuncular sclerites. Dorsal and lateral abdominal setae mostly clavate or blunt, with apices membranous, commonly collapsed, arranged in single or double irregular rows on each tergum. Abdomen without dorsal tubercles. Lateral abdominal tubercles mostly absent, small, inconspicuous where present. Spiracles (Fig. 1453) subcircular, with incomplete sclerotic rim. Siphunculus elongate, tapered toward apex, subcylindrical with apical rim, usually with setae, with reticulations on apical one-third or

Figs. 1445, 1446. Aptera of *Obtusicauda*. 1445, head and prothorax; 1446, terminal abdominal segments.

516
Figs. 1447–1455. Alata of *Obtusicauda*. 1447, right fore wing; 1448, anal plate and gonapophyses; 1449, left fore femur; 1450, second and base of third antennal segments; 1451, base of apical antennal segment; 1452, apical rostral segment; 1453, abdominal spiracle; 1454, left hind tarsus; 1455, venter of head.
less. Abdominal tergum VIII entire. Cauda elongate, bluntly rounded apically, with slight basal constriction. Anal plate (Fig. 1448) entire. Abdomen without gland facets. Gonapophyses 3.

Embryos. Not observed.

Economically important species. None.


Biology. Biological details are not well known, but all species are probably holocyclicly associated with *Artemisia*.

Comments. Recognition characters for this genus include the following: the association with *Artemisia*; the reticulate, seta-bearing siphunculus; the elongate, bluntly rounded cauda with a slight basal constriction; and the needlelike apical rostral segment.

A key to, and a review of, the North American species was provided by Robinson and Halbert (1989). Subgenus *Artemisaphis* Knowlton & Roberts [with the single species *artemisicola* (Williams)], which has a median conical protuberance on the anal plate and a differently shaped cauda, is often given full generic status.

Genus *Oestlundiella* Granovsky

Figs. 1456–1466

*Oestlundiella* Granovsky, 1930:63. Type species: *Euceraphis flavus* Davidson, 1912:406.

Adult (Figs. 1456, 1457). Length 1.5–3.0 mm.

Integument: Antenna with spiculose imbrications; head and abdomen without obvious sculpturing other than some spiculose imbrications on lateral sclerites and apical abdominal segments; tibiae and tarsi with spicules; cauda and anal and genital plates with spicules.

Head (Fig. 1466): Antennal tubercle well-developed; front of head strongly concave. Ventral margin of antennal socket not protuberant. Discal setae pointed; each side of disc with 4 anterior and 2 posterior setae. Eye and triommatidium distinct in aptera and alata. Ventral and dorsal cephalic sutures absent. Disc of head without tubercles, with cribiform discs around bases of setae. Antenna 6-segmented; processus terminalis shorter than base of segment VI, without numerous setae; primary sensoria (Fig. 1462) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1461) circular to somewhat oval, usually with a few fine cilia or minute spicules at margins. Rostrum 4-segmented; apical segment (Fig. 1463) subcylindrical, rounded distad of preapical primary setae.
Figs. 1456, 1457. Alata of Oestlundiella. 1456, head and prothorax; 1457, abdominal segments.
Figs. 1458–1466. Alata of *Oestlundiella*. 1458, right fore wing; 1459, anal plate and gonapophyses; 1460, left fore femur; 1461, second and base of third antennal segments; 1462, base of apical antennal segment; 1463, apical rostral segment; 1464, abdominal spiracle; 1465, left hind tarsus; 1466, venter of head.
Thorax: Prothoracic setae pointed; each side of prothorax with 1 posterior and 1 anterior submedian seta and 1 anterior and 1 posterior lateral seta. Each side of prothorax with 0–4 small lateral tubercles. Femora (Fig. 1460) with setae short, pointed; tibial setae pointed, shorter than apical diameter of respective tibiae. Tibiae without peglike setae, or rastral spines; rastral setae present; each tibia covered with many small cribiform discs. Basitarsi (Fig. 1465) weakly trapezoidal, each with 6 or 7 ventral and 2 dorsal setae. Distitarsi elongate, without preapical capitae setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1458) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Abdominal setae pointed, short, inconspicuous, relatively sparse, arranged in transverse submedian and lateral rows, in some specimens in single row of 6, on each tergum. Abdominal segments not fused, with or without dorsal pigment, where present pigment confined to blotches around dorsal setae. Dorsal abdominal tubercles absent. Lateral abdominal tubercles present, with 0–3 on each of segments II–VI or absent. Lateral sclerites usually present, with those on segment II produced as prominent papilla. Spiracles (Fig. 1464) subcircular, without sclerotic rims. Siphunculus short, without apical flange, weakly spiculose, with base strongly flared. Lateral seta of abdominal segment VI appended to its base. Abdominal tergum VIII entire. Cauda tongue-shaped, with slight basal constriction. Anal plate (Fig. 1459) bilobate in vivipara; entire in ovipara. Abdomen with clusters of cribiform discs around bases of lateral setae and of some dorsal setae. Gonapophyses situated on prominent tubercle.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. *Alnus* species.

Biology. Little is known about the biology. The single known species is holocyclicly associated with the host plant. Apterae are not produced and alate specimens are covered with conspicuous filamentous wax.

Comments. Recognition characters for this genus include the association with *Alnus*, the conspicuous wax production in the adults, the tongue-shaped cauda, and the broadly expanded basal portion of the siphunculus.
Genus *Ovatus* van der Goot

Figs. 1467–1480

*Ovatus* van der Goot, 1913:84.

Type species: *Ovatus mespili* van der Goot, 1913:84 = *Aphis insita* Walker, 1849b:xxxix.

**Adult** (Figs. 1467, 1469). Length 1.0–2.5 mm.

**Integument:** Antennal segments III–VI with imbrications, these more conspicuous in aptera; disc of head unsculptured in alata, heavily nodulose in aptera; thorax without dorsal sculpturing; abdomen in alata in some species with some nodules on lateral sclerites, with spiculose imbrications on apical 2 or 3 segments in both aptera and alata; dorsum of abdomen wrinkled in aptera; tibiae with or without imbrications on apical half; tarsi with smooth and spiculose imbrications; cauda with numerous spicules well-developed basally, becoming less well developed apically (Fig. 1470), in alata modified forming apical reticulate network; anal and genital plates spiculose.

**Head** (Fig. 1480): Antennal tubercle well-developed, with mesal margin strongly protuberant, scabrous. Ventral margin of antennal segment (Fig. 1468) protuberant. Discal setae short, blunt or weakly capitate especially in aptera, similar or pointed setae in alata, arranged in anterior and posterior group of 4 each. Eye and triommatidium present in aptera and alata. Ventral and dorsal cephalic sutures absent. Disc without dorsal tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1475) with ciliated margins; accessory sensoria not fused; secondary sensoria (Fig. 1474) absent in aptera, present on segments III–IV of alata and in some species also on V, without ciliate margins. Rostrum 4-segmented; apical segment (Fig. 1476) narrow, subconical, bluntly pointed distad of preapical primary setae.

**Thorax:** Prothoracic setae about same size and shape as discal setae, with 1 posterior submedian seta and 1 posterior and 1 anterior lateral seta. Prothoracic lateral tubercles present or absent in alata, usually absent in aptera; dorsal tubercles absent. Femora (Fig. 1473) with setae short, pointed; tibial setae blunt, or weakly capitate basally, pointed apically. Tibiae without sensoria, gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1479) triangular, with 3 ventral setae on fore and hind basitarsi and 2 on middle basitarsus, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1471) with normal venation; media with 3 branches; branches of cubitus widely separated at base, diverging to almost parallel.

**Abdomen:** Abdominal terga I–VI or VII fused in aptera, not fused in alata. Abdominal terga not pigmented except tergum VIII in alata, in some species whole dorsum of abdomen pigmented in aptera forming sclerotic pigmented carapace. Abdominal setae similar to
Figs. 1467–1470. Aptera of *Ovatus*. 1467, head and prothorax; 1468, ventral margin of antennal socket; 1469, terminal abdominal segments; 1470, apex of cauda.
Figs. 1471–1480. Embryonic chaetotaxy and alata of *Ovatus*. 1471, right fore wing; 1472, anal plate and gonapophyses; 1473, left fore femur; 1474, second and base of third antennal segments; 1475, base of apical antennal segment; 1476, apical rostral segment; 1477, abdominal spiracle; 1478, dorsal chaetotaxy of embryo; 1479, left hind tarsus; 1480, venter of head.
discal setae, but in some species pointed on apical abdominal segments, arranged in single transverse row on each tergum. Lateral sclerites usually present in alata but small and inconspicuous in some species; present in aptera in some species but fused to dorsal pigmented carapace where present. Lateral abdominal tubercles present on segments III–V in some species especially in alata. Spiracles (Fig. 1477) weakly reniform to subcircular, without opercula, with sclerotic rims. Siphunculus cylindrical or swollen, with conspicuous and in some species weakly spiculose imbrications in aptera, usually nearly smooth, with a few dispersed spicules and imbrications in alata. Abdominal tergum VIII entire. Cauda elongate triangular, usually rounded apically or with apical protuberance in some species; apical spicules reduced, shorter than others. Anal plate (Fig. 1472) entire. Gonapophyses 3.

**Embryo** (Fig. 1478). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; disc and pronotum without gland facets, without tubercles evident; each side of abdomen with 1 lateral, 1 pleural, and 1 submedian seta on each tergum; abdomen without gland facets, without tubercles evident; siphunculus short, nearly poriform where evident; basitarsi triangular, with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Ovatus ornatus* (Laing).

**Range of plants infested in Canada.** *Crataegus* and *Pyrus* species, and various Labiatae.

**Biology.** This genus is heterocyclic between various Pomoideae and various Labiatae, or apparently holocyclic on some Labiatae in Canada. Elsewhere it is also associated with the Onagraceae.

**Comments.** Recognition characters for this genus include the association with the Pomoideae and Labiatae, the presence of converging antennal tubercles, the presence of three setae on the venter of each first tarsal segment, and the absence of a pigmented dorsal abdominal patch in the alatae. The heavily imbricated siphunculi in the apterae are distinctive as is the reticulate area at the apex of the cauda, especially in the alatae.

**Genus Pachypappa Koch**

Figs. 18, 1481–1495

*Pachypappa* Koch, 1856:269.
Type species: *Pachypappa marsupialis* Koch, 1856:270.
**Adult** (Figs. 1481–1484). Length 3.5–5.5 mm.

Integument: Antenna with some spicules on apical 1–3 segments; head and body without evident sculpturing; tibiae unsculptured; apical tarsal segment with a few spicules at least ventrally; cauda and anal and genital plates with a few well-dispersed obscure spicules.

Head (Fig. 1495): Antennal tubercle undeveloped; front of head flat or slightly convex. Ventral margin of antennal socket not protuberant. Discal setae pointed; each side of disc with 3–5 anterior and 3–8 posterior discal setae. Eye present in alata, absent in aptera; triommatidium distinct. Ventral cephalic sutures absent; dorsal cephalic suture faintly evident in some specimens. Disc without tubercles or gland facets in alata and fundatrix. Antenna 5-(fundatrix) or 6-segmented; processus terminalis short, inconspicuous; primary sensoria (Fig. 1490) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1489) absent in aptera (fundatrix), present on segment III and IV of alata, transversely oval, lengths less than half circumference of respective segment, with ciliate margins. Rostrum 4-segmented; apical segment (Fig. 1491) subcylindrical to subconical. Rostrum vestigial in male and ovipara.

Thorax: Prothoracic setae pointed, fine, hairlike; anterior and posterior submedian clusters not distinct, joined forming median cluster of numerous setae; anterior and posterior lateral prothoracic clusters not distinct, joined forming single cluster of setae. Dorsal and lateral prothoracic tubercles absent. Prothorax without gland facets. Metathorax of alata with or without a pair of wax plates. Femora (Fig. 1488) with setae pointed. Tibial setae fine, hairlike. Tibiae without gland facets, or peglike setae; aptera alienicola with rastral setae. Basitarsi (Figs. 1485, 1494) triangular with 2 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1486) of spring migrant with media with 2 branches, of sexupara with media unbranched; branches of cubitus approximate at base, divergent.

Abdomen: Abdominal terga not fused, without pigment, except for traces medially in some specimens; abdominal setae pointed, on most terga arranged in 2 or more irregular transverse rows. Abdomen with or without gland facets; without dorsal or lateral tubercles. Spiracles (Fig. 1492) circular with hinged operculum. Siphunculus absent. Abdominal tegum VIII entire. Cauda short, arc-shaped. Anal plate (Fig. 1487) entire. Gonapophyses 3.

**Embryo** (Fig. 1493). Antenna 4-segmented; eyes absent; triommatidium present; disc without gland facets, with 2 anterior and 2 posterior setae on each side; prothorax with or without gland facets, without tubercles; each side of pronotum with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; abdomen with 1 submedian, 1 pleural, and 1 lateral seta on most terga, and with 4 rows of wax gland plates associated with bases of
Figs. 1481, 1482. Fundatrix of *Pachypappa*. 1481, head and prothorax; 1482, terminal abdominal segments.
Figs. 1483–1485. Aiptera alienicola of *Pachypappa*. 1483, head and prothorax; 1484, terminal abdominal segments; 1485, apex of hind tibia and basal tarsal segment.
setae; basitarsi triangular, with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate. Embryo of male and of ovipara lacking mouthparts.

**Economically important species.** *Pachypappa tremulae* (Linnaeus) damages spruce seedlings (Lavallée 1987).

**Range of plants infested in Canada.** *Populus tremuloides* Michx. and *Picea* species.

**Biology.** The three known species are heterocyclic between the foliage of *Populus* and (where known) the roots of *Picea*. *P. sacculi* (Gillette) forms a distinctive psuedogall on trembling aspen, in which the leaves are bent ventrally and backwards towards the petioles (Fig. 18). Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

**Comments.** Recognition characters for this genus include the association with *P. tremuloides*, the presence of only two ventral setae on each basal tarsal segment, and the presence of oval secondary sensoria on antennal segments III and IV.

*Asiphum* Koch and *Rhizomaria* Hartig are synonyms of *Pachypappa* (Stroyan 1975). Smith (1974b) provided a key and descriptions of North American species (as *Asiphum* and *Pachypappa*). Recently Danielsson (1990) described a new genus, *Clydesmithia*, which is apparently closely related to *Pachypappa*, from material collected in Alberta and British Columbia. An elongate gall is formed on the upper side of the leaf on *P. trichocarpa* Torr. & Gray.

**Genus Paducia** Hottes & Frison

Figs. 1496–1506

*Paducia* Hottes and Frison, 1931:167.
Type species: *Melanoxantherium antennatum* Patch, 1913:87.

**Adult** (Figs. 1496, 1497). Length 2.0–3.5 mm.

Integument: Antenna with smooth and distinctly spiculose imbrications; head and body without obvious sculpturing other than some spiculose imbrications on apical abdominal terga; tibiae with a few subapical spicules on inner surface in some specimens; tarsi mostly with smooth imbrications, but ventrally some with a few spicules; cauda and anal and genital plates spiculose.

Figs. 1486–1495. Embryonic chaetotaxy and alata of *Pachypappa*. 1486, right forewing; 1487, anal plate and gonapophyses; 1488, left fore femur; 1489, second and base of third antennal segments; 1490, apical antennal segment; 1491, apical rostral segment; 1492, abdominal spiracle; 1493, dorsal chaetotaxy of embryo; 1494, left hind tarsus; 1495, venter of head.
Head (Fig. 1506): Antennal tubercle slightly developed. Ventral margin of antennal socket not protuberant. Discal setae pointed, fine, hairlike, arranged in fairly distinct anterior and posterior clusters; mesal margins of posterior clusters indistinct in some specimens because intermediate setae present. Eye and triommatidium distinct in aptera and alata. Front margin of head with 0–2 anterodorsal tubercles; disc of head with 1 or 2 tubercles near posterior margin in some specimens. Antenna 4-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1502) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1501) circular, present on segment III, also IV of alata in some specimens, absent from aptera. Rostrum 4-segmented; apical segment (Fig. 1503) subcylindrical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae fine, pointed, hairlike, arranged on each side of prothorax in fairly distinct submedian and lateral clusters. Each side of pronotum with 1 lateral tubercle and commonly with dorsal pair near posterior margin. Femora (Fig. 1500) with setae pointed; tibial setae pointed, fine, hairlike. Tibia without peglike setae, sensoria, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1505) triangular, with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1498) with normal venation; media with 2 branches; branches of cubitus separated at base, strongly divergent.

Abdomen: Abdominal terga I–VII usually fused forming fairly well defined pigmented dorsal carapace extending laterally and including spiracles in aptera; alata with broad partially fused segmental bars. Abdominal segments II–VII with large lateral tubercles; each segment with 0–3 submedian tubercles. Abdominal setae pointed, fine, hairlike, relatively numerous on each tergum. Spiracles (Fig. 1504) subcircular to weakly reniform, with sclerotic rims. Siphunculus strongly swollen on apical half, or diameter of middle portion much greater than apical and basal diameter, without setae, smooth, or with smooth and faintly spiculose imbrications, with apical flange. Abdominal tergum VIII entire. Cauda short, bluntly rounded apically, tassel-shaped with slight basal constriction or neck. Anal plate (Fig. 1499) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** One colony collected from roots of *Solidago* sp. in an ants' nest, but the association needs confirmation. Elsewhere roots of *Salix* species known to be infested.

**Biology.** Nothing is known about the biologies of the species in this genus, except that they are root-inhabiting. *Paducia antennatum* (Patch) is the only species recognized in North America.
Figs. 1496, 1497. Aptera of Paducia. 1496, head and prothorax; 1497, terminal abdominal segments.
Figs. 1498–1506. Alata of Paducia. 1498, right fore wing; 1499, anal plate and gonapophyses; 1500, left fore femur; 1501, second and base of third antennal segments; 1502, base of apical antennal segment; 1503, apical rostral segment; 1504, abdominal spiracle; 1505, left hind tarsus; 1506, venter of head.
Comments. Recognition characters for this genus include the 4-segmented antennae, the strongly swollen siphunculi, and the constricted cauda.

Genus *Panaphis* Kirkaldy

Figs. 1507–1518

*Panaphis* Kirkaldy, 1904:279.
Type species: *Aphis juglandis* Frisch, 1734:12 = *Aphis juglandis* Goeze, 1778:311.

Adult (Figs. 1507, 1508). Length 2.5–4.0 mm.

Integument: Apical antennal segments with smooth and faintly spiculose imbrications; head and body without obvious sculpturing; tibiae with a few fine spicules apically; tarsi with encircling rows of spicules; cauda and anal and genital plates without sculpturing other than a few fine dispersed spicules.

Head (Fig. 1518): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Disc of head with 4–6 anterior discal setae, and with 10–20 posterior discal setae arranged in single transverse band. Eye present in alata and aptera; trichomatidium distinct. Disc of head without tubercles, gland facets, or cephalic suture. Antenna 6-segmented; primary sensoria (Fig. 1513) without ciliated margins; accessory sensoria not fused; secondary sensoria (Fig. 1512) without ciliate margins, restricted to antennal segment III. Rostrum 4-segmented; apical segment (Fig. 1514) short, conical, with rounded apex.

Thorax: Prothorax without lateral tubercles. Prothoracic setae fine, hairlike, arranged in clusters at anterior angles; anterior submedian region with large posterior lateral and posterior submedian cluster on each side. Femora (Fig. 1511) and tibia with pointed setae; longest tibial seta longer than apical diameter of respective tibia. Tibiae with rastral setae; without peglike setae, or gland facets. Basitarsi (Fig. 1517) triangular, with 5–7 ventral and 2 dorsal setae; distitarsi without capitulate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1509) with normal venation; radial sector incomplete near base; media with 3 branches; cubital veins widely separated at base, divergent.

Abdomen: Dorsal abdominal setae fine, hairlike, arranged in 2 or 3 irregular rows on each tergum. Lateral abdominal sclerites absent. Abdominal terga pigmented, in some specimens with pigment broken into spots on terga I and II. Lateral and dorsal abdominal tubercles absent. Spiracles (Fig. 1515) subcircular, without opercula. Siphunculus short, with apex slightly flared, but without apical flange, fused with lateral sclerite; setae of lateral sclerites appearing situated on expanded base of siphunculus. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 1510) bilobate in vivipara; entire in ovipara. Abdomen without gland facets. Gonapophyses 2.
**Embryo** (Fig. 1516). Antenna 3-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; prothoracic lateral tubercles absent; prothorax more or less divided into anterior and posterior portion, with anterior portion more or less fused to head; abdomen without gland facets or lateral tubercles, with 1 submedian and 1 lateral seta on each side of each of segments I–VII; abdominal segment VIII only with 1 submedian seta on each side; siphunculus short, virtually poriform, without flange or setae; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Juglans* species, in southern British Columbia.

**Biology.** This genus is holocyclicly associated with *Juglans* species.

**Comments.** The chief recognition characters for this genus are the abundance of fine setae, the large amount of pigment on the abdomen, and the association with *Juglans*. Other aphids associated with *Juglans* are yellowish and the setae are small and inconspicuous.

*Panaphis juglandis* (Goeze) is the single species in this genus, which is better known as *Callaphis* Walker. However, the International Commission on Zoological Nomenclature (1985: Opinion 1358) decided in favor of a submission by Quednau (1983) to suppress *Callaphis* to avoid confusion with *Callaphis* Walsh.

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Figs. 1507, 1508. Alata of *Panaphis*. 1507, head and prothorax; 1508, abdominal segments.
Genus *Papulaphis* Robinson

Figs. 1519–1529


**Adult** (Figs. 1519, 1520). Length 2.0–3.0 mm.

Integument: Antenna with smooth imbrications; dorsum of head unsculptured; venter of head with some spicules anteriorly, especially in aptera; body without sculpturing other than some weakly spiculose imbrications on apical abdominal terga; tibiae unsculptured, usually with a few dispersed subapical imbrications; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1529): Antennal tubercle well-developed. Ventral margin of antennal socket not protuberant. Discal setae short, inconspicuous, blunt, 4 anterior and 4–6 posterior. Dorsal cephalic suture absent; ventral sutures evident posteriad of medium ocellus. Disc of head without dorsal tubercles or gland facets. Eye and triommatidium distinct. Antennal 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1525) without or with weakly ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1524) protruding, tuberclelike, without ciliate margins clustered on apical half of segment III of aptera and alata, also present on segment IV of alata. Rostrum 4-segmented; apical segment (Fig. 1526) subconical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae about same size and shape as discal setae; each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothoracic lateral tubercles absent. Femora (Fig. 1523) with setae pointed. Tibial setae mostly blunt dorsally, pointed ventrally. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1528) triangular, each with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Claws simple. Fore wing (Fig. 1521) with normal venation; media with 2 branches; branches of cubitus widely separated at base, slightly divergent.

Abdomen: Abdominal terga not fused, without pigment. Abdominal setae short, blunt, inconspicuous, arranged in single transverse row on each tergum. Dorsal and lateral abdominal tubercles absent. Lateral sclerites absent. Spiracles (Fig. 1527) with sclerotized rims. Siphunculus elongate, without setae, with spiculose imbrications, with a few transverse rows of reticulations apically, with weakly developed apical flange. Abdominal tergum VIII entire.

Figs. 1509–1518. Embryonic chaetotaxy and alata of *Panaphis*. 1509, right fore wing; 1510, anal plate and gonapophyses; 1511, left fore femur; 1512, second and base of third antennal segments; 1513, base of apical antennal segment; 1514, apical rostral segment; 1515, abdominal spiracle; 1516, dorsal chaetotaxy of embryo; 1517, left hind tarsus; 1518, venter of head.
Figs. 1519, 1520. Aptera of *Papulaphis*. 1519, head and prothorax; 1520, terminal abdominal segments.
Figs. 1521–1529. Alata of *Papulaphis*. 1521, right fore wing; 1522, anal plate and gonapophyses; 1523, left fore femur; 1524, second and base of third antennal segment; 1525, base of apical antennal segment; 1526, apical rostral segment; 1527, abdominal spiracle; 1528, left hind tarsus; 1529, venter of head.
Cauda short, triangular. Anal plate (Fig. 1522) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** None known, but probably occurs on ferns (*Adiantum* species), as the only known species occurs on this plant in Pennsylvania and New York.

**Biology.** Details are unknown, but presumably the species is holocyclic.

**Comments.** Recognition characters for this genus include the association with ferns, the reticulate siphunculi, the short triangular cauda, and the cluster of tuberclelike secondary sensoria on the apical half of the third antennal segment in both the apterae and the alatae.

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**Genus Pemphigus** Hartig

Figs. 13, 15–17, 1530–1542

*Pemphigus* Hartig, 1839:645.
Type species: *Aphis bursarius* Linnaeus, 1758:453.

**Adult (Figs. 1530, 1531).** Length 1.75–2.0 mm.
Integument: Antennae usually with a few spicules on apical antennal segment in alata, on last 2 or 3 segments in aptera; head and body without obvious sculpturing; tibiae without spicules; tarsi with spicules, without imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 1542): Antennal tubercle undeveloped; front of head weakly convex. Ventral margin of antennal socket not protuberant. Discal setae short, pointed, arranged in anterior and posterior clusters of four or more. Eye present in alata, present or absent in aptera, where present size and number of facets reduced; triommatidium distinct. Ventral and dorsal cephalic sutures absent in alata, evident in aptera in some species. Disc of head without tubercles and normally without gland facets. Antenna 6-segmented in alata and alienicolous aptera. Primary sensoria (Fig. 1537) with ciliate margins; accessory sensoria in some specimens fused; secondary sensoria (Fig. 1536) consisting of transverse annular slits, without ciliate margins, present on segments III–VI of alata. Rostrum 4-segmented; apical segment (Fig. 1538) subcylindrical or with convex sides, pointed or rounded distal of preapical primary setae. Rostrum vestigial in male and ovipara.

Thorax: Head and prothorax fused in aptera. Prothoracic setae pointed; in alata each side of prothorax with one to several anterior
and posterior submedian setae, usually with more than one anterior and posterior lateral setae; usually 1 submedian and 1 lateral seta in aptera. Prothorax without lateral tubercles. Femora (Fig. 1535) with setae short, pointed; tibial setae pointed, not longer than apical diameter of respective tibia. Tibiae with (Fig. 1532) or without (Fig. 1541) rastral setae; without peglike setae, gland facets, or rastral spines. Basitarsi (Fig. 1541) triangular, with 2 or 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Fore wing (Fig. 1533) with venation reduced; media unbranched, evanescent basally; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal setae pointed, short, arranged in single transverse row on each tergum. Abdomen without lateral or dorsal sclerites, except for trace of pigment on tergum VIII. Dorsal or lateral tubercles absent. Spiracles (Fig. 1539) subcircular, without sclerotic rims. Siphunculus absent in aptera, present as sclerotic ring in alata. Cauda short, arc-shaped, inconspicuous. Anal plate (Fig. 1534) entire. Abdomen in aptera in some species with clusters of margined gland facets laterally, and usually also dorsolaterally and submedially; gland facets reduced in size and commonly absent on some segments in alata. Gonapophyses 2.

**Embryo** (Fig. 1540). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; disc and pronotum without tubercles or gland facets; abdominal terga with 1 lateral, 1 pleural, and 1 submedian seta, usually with lateral, submedian, and pleural clusters of gland facets; siphunculus absent; basitarsi triangular, each with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae capitate. Embryo of male and of ovipara lacking mouthparts.

**Economically important species.** *Pemphigus bursarius* (L.), *Pemphigus populitransversus* Riley, *Pemphigus populivenae* Fitch.

**Range of plants infested in Canada.** *Populus* species and the roots of various herbaceous plants, including some crops such as sugar beet.

**Biology.** Most species in this genus are heterocyclic between poplars, where they produce galls (Figs. 13, 15–17), and the roots of various herbaceous plants. Few species are holocyclic on poplars. In the Arctic, they are anholocyclic on the roots of plants, especially grasses. Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

**Comments.** Recognition characters for this genus include the induction of galls on poplar, the spicules on the tarsi, the presence of transverse and usually annular antennal sensoria in the alatae, and
Figs. 1530–1532. Aptera of *Pemphigus*. 1530, head and prothorax; 1531, terminal abdominal segments; 1532, apex of hind tibia and basal tarsal segment.
Figs. 1533–1542. Embryonic chaetotaxy and alata of *Pemphigus*. 1533, right fore wing; 1534, anal plate and gonapophyses; 1535, left fore femur; 1536, second and base of third antennal segments; 1537, apical antennal segment; 1538, apical rostral segment; 1539, abdominal spiracle; 1540, dorsal chaetotaxy of embryo; 1541, left hind tarsus; 1542, venter of head.
the simple unbranched media. The apterous alienicolous forms of most species have not been associated with the gall-inhabiting morphs by experimental transfers; for this reason they are still unidentifiable.

Genus *Periphyllus* van der Hoeven

Figs. 1543–1554

*Periphyllus* van der Hoeven, 1863:6.

Type species: *Periphyllus testudo* van der Hoeven, 1863:7 = *Phyllophora testudinacea* Fernie, 1852:265.

**Adult** (Figs. 1543, 1544). Length 2.0–4.0 mm.

Integument: Head and body without spicules, except in some species for a few dispersed small spicules on disc of head and on dorsal and lateral pigmented areas of abdomen; tibiae with spicules; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1554): Antennal tubercle undeveloped; front of head nearly flat or slightly convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, long, conspicuous, nearly spikelike in aptera of some species, arranged in anterior and posterior group of 4 each. Eye and triommatidium distinct; facets in eye reduced in number in the dimorph. Ventral and dorsal cephalic sutures usually not evident; dorsal suture evident in some species as pigmented line, ventral sutures evident in some species on each side of median ocellus. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1549) without ciliate margins, or with a few spicules. Accessory sensoria not fused; secondary sensoria (Fig. 1548) circular, situated on antennal segment III of alata only. Rostrum 4-segmented; apical segment (Fig. 1550) subconical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae about same size and shape as discal setae, each side of pronotum with 1 anterior and one to several posterior submedian setae and one to several anterior and posterior lateral setae; lateral groups of setae fused in some species forming composite lateral cluster. Prothorax without dorsal or lateral tubercles. Femora (Fig. 1547) with setae pointed, long; tibial setae long, pointed, usually longer than apical diameter of respective tibia. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1553) triangular, or weakly trapezoidal, each with 5–7 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitade setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1545) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent.
Figs. 1543, 1544. Aptera of *Periphyllus*. 1543, head and prothorax; 1544, terminal abdominal segments.

Abdomen: Abdominal setae about same size and shape as discal and prothoracic setae, arranged in single irregular transverse row on each tergum. Abdominal terga not pigmented in aptera, in alata with pigment on each tergum forming median spots or complete transverse bars. Lateral sclerites present in alata. Abdomen without dorsal or lateral tubercles. Spiracles (Fig. 1551) without complete sclerotic rims. Siphunculus short, with basal striae and reticulations on apical
Figs. 1545–1554. Embryonic chaetotaxy and alata of *Periphyllus*. 1545, right fore wing; 1546, anal plate and gonapophyses; 1547, left fore femur; 1548, second and base of third antennal segments; 1549, base of apical antennal segment; 1550, apical rostral segment; 1551, abdominal spiracle; 1552, dorsal chaetotaxy of embryo (dimorph); 1553, left hind tarsus; 1554, venter of head.
half or more, without setae, without apical flange. Abdominal tergum VIII entire. Cauda semicircular. Anal plate (Fig. 1546) entire. Abdomen without gland facets. Gonapophyses 4.

**Embryo** (Fig. 1552). Antenna 4-segmented; each side of disc with 2 anterior setae usually ribbed, foliate, and with 2 posterior setae usually minute, inconspicuous; each side of pronotum with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; all prothoracic setae about same size and shape as posterior discal setae; each side of abdomen with 1 submedian and 1 lateral seta on each tergum; lateral setae commonly conspicuously ribbed, foliate; abdomen without gland facets; basitarsi with 2 ventral setae, without dorsal setae; distitarsi elongate, with 1 or 2 preapical capitate setae; plantar setae spatulate.

**Economically important species.** *Periphyllus lyropictus* (Kessler), *Periphyllus negundinis* (Thomas).

**Range of plants infested in Canada.** *Acer* species.

**Biology.** All species are holocyclicly associated with their host plants. They are peculiar in that most species generally aestivate during the summer as highly specialized first-instar nymphs, called dimorphs. These dimorphs somewhat resemble psyllid nymphs but have foliate marginal setae in some species.

**Comments.** Recognition characters for this genus include its association with *Acer*, the reticulate siphunculi, the prominent setae especially in the apterae, the rounded cauda and anal plate, and the occurrence of dimorphs.

Essig and Abernathy (1952) gave a systematic account of this genus. Richards (1972a) provided a key to, and descriptions of, the Canadian species.

**Genus Phloeomyzus Horvath**

Figs. 1555–1565

*Phloeomyzus* Horvath, 1896:5.
Type species: *Schizoneura passerinii* Signoret, 1875:202.

**Adult** (Figs. 1555, 1556). Length 1.5–3.0 mm.

Integument: Antennae with a few spicules at least apically; head and body without sculpturing; tibiae unsculptured except for some wrinkles and folds; tarsi nearly unsculptured, but some with a few spicules ventrally.

Head (Fig. 1565): Antennal tubercle undeveloped; front of head weakly convex to nearly flat. Ventral margin of antennal socket not protuberant. Discal setae pointed, short, arranged transversely in
variable number near posterior margin and in anterior cluster. Eye absent in aptera; triommatidium distinct. Ventral and dorsal cephalic sutures absent. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis short, papillalike; primary sensoria (Fig. 1561) with ciliate margins; accessory sensoria not fused; secondary sensoria absent. Rostrum 4-segmented; apical segment (Fig. 1562) slender, elongate, with sides subparallel, pointed distal of preapical primary setae.

Thorax: Head and prothorax not fused in alata, fused in aptera. Prothoracic setae short, pointed, inconspicuous, about same size and shape as discal setae; each side of prothorax usually with 1 anterior and one to several posterior submedian setae and 1–3 anterior and 1–3 posterior submedian setae. Prothorax normally without lateral tubercles or gland facets, but a few specimens with a small atrophied lateral tubercle. Femora (Fig. 1559) and tibiae with setae pointed, short. Tibiae with rastral setae, without peglike setae, gland facets, or rastral spines. Basitarsi (Fig. 1564) triangular, with 2 or 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminete. Claws simple. Fore wing (Fig. 1557) with normal venation; media with 2 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Abdominal setae short, pointed, inconspicuous, arranged in single transverse row on each tergum. Abdominal segments not fused, without pigment except around spiracles. Dorsal tubercles absent; lateral tubercles normally absent, rarely a small atrophied lateral tubercle present on segments VII and VIII. Spiracles (Fig. 1563) without sclerotic rims. Siphunculus reduced to a small pore, absent in aptera in some specimens. Abdominal tergum VIII entire. Cauda arc-shaped. Anal plate (Fig. 1558) entire. Abdomen with large glandular disc on either side of abdominal tergum VIII in aptera, with similar disc much reduced in alata. Gonapophyses 2.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Populus* species.

**Biology.** In Canada, the genus is represented by one species, *Phloeomyzus dearborni* Smith, in the Maritime Provinces. This species produces flocculent colonies in crevices in the bark of the host. Both sexuales are winged, but little else is known of the biological details.

**Comments.** Recognition characters for this genus include the flocculent colonies on the trunks of the host plants, the extreme reduction or absence of secondary sensoria in the alatae, the presence of winged sexuales, the reported habit of holding the wings flat...
Figs. 1555, 1556. Aptera of *Phloeomyzus*. 1555, head and prothorax; 1556, terminal abdominal segments.
Figs. 1557–1565. Alata of *Phloeomyzus*. 1557, right fore wing; 1558, anal plate and gonapophyses; 1559, left fore femur; 1560, second and base of third antennal segments; 1561, base of apical antennal segment; 1562, apical rostral segment; 1563, abdominal spiracle; 1564, left hind tarsus; 1565, venter of head.
against the abdomen when at rest, the presence of rastral setae, the short processus terminalis, the poriform siphunculi, and the presence of only two large clusters of wax pores on the seventh abdominal tergum in at least the apterae. Smith (1974b) provided a key to the species.

Genus Phorodon Passerini

Figs. 1566–1579

Phorodon Passerini, 1860:27.
Type species: Aphis humuli Schrank, 1801:110.

Adult (Figs. 1566, 1568). Length 1.5–2.5 mm.
Integument: Antenna with smooth imbrications; head with spicules and nodules especially in aptera and much reduced in size and number in alata; thorax and abdomen without obvious sculpturing other than some spiculose imbrications posteriorly; tibiae without spicules; tarsi with smooth imbrications; cauda and anal and genital plates spiculose, with spicules reduced at apex of cauda (Fig. 1569).

Head (Fig. 1579): Antennal tubercle well-developed; mesal margin with a long anteriorly directed fingerlike process, in aptera this process more conspicuous than in alata. Ventral margin of antennal socket (Fig. 1567) protuberant. Discal setae blunt, capitate or slightly flabellate. Eye and triommatidium present in aptera and alata. Ventral sutures present, well-developed; dorsal sutures absent. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1574) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1573) circular, without ciliate margins, distributed over segments III–V of alata. Rostrum 4-segmented; apical segment (Fig. 1575) subconical, more or less rounded distad of preapical primary setae.

Thorax: Prothoracic setae about same shape and length as discal setae; each side of prothorax with 1 posterior submedian seta and 1 or 2 anterior and 1 posterior lateral setae. Prothorax usually with small atrophied lateral tubercles. Femora (Fig. 1572) with setae pointed; tibial setae blunt or weakly capitate basally and dorsally, mostly pointed apically and ventrally. Tibiae without gland facets, peglike setae, rastral spines, or rastral setae. Basitarsi (Fig. 1578) triangular, each with 3 or hind basitarsus with 2 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1570) with normal venation; media with 3 branches; branches of cubitus separated at base, slightly divergent.

Abdomen: Abdomen in aptera without pigment, in alata each tergum with transverse bars or spots, in some specimens those on terga III–V more or less fused together. Abdominal setae about same
Figs. 1566–1569. Aptera of Phorodon. 1566, head and prothorax; 1567, ventral margin of antennal socket; 1568, terminal abdominal segments; 1569, apex of cauda.
Figs. 1570–1579. Embryonic chaetotaxy and alata of *Phorodon*. 1570, right fore wing; 1571, anal plate and gonapophyses; 1572, left fore femur; 1573, second and base of third antennal segments; 1574, base of apical antennal segment; 1575, apical rostral segment; 1576, abdominal spiracle; 1577, dorsal chaetotaxy of embryo; 1578, left hind tarsus; 1579, venter of head.
shape as discal setae, usually arranged in single transverse row on each tergum, in some specimens with partial second transverse row in some stages. Lateral sclerites absent in aptera, present in alata. Lateral tubercles normally absent, where present small, atrophied, scarcely distinguishable except as pale spots on lateral sclerites. Spiracles (Fig. 1576) with sclerotic rims, without opercula. Siphunculus elongate, subcylindrical, or slightly swollen on apical half, with conspicuous smooth or faintly nodulose imbrications, without setae, with apical flange, with 1 or 2 transverse rows of subapical reticulations. Abdominal tergum VIII entire. Cauda short, triangular, rounded, smooth apically, or with apical spicules reduced in size. Anal plate (Fig. 1571) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 1577). Antenna 5-segmented; each side of disc with anterior and posterior group of 2 setae each; most discal setae short, blunt, inconspicuous; each side of pronotum with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; all prothoracic setae about same size and shape as discal setae; disc and prothorax without gland facets or tubercles; each side of abdomen with 1 submedian and 1 lateral seta on each tergum; pleural setae not evident; siphunculus short, nearly poriform where evident; basitarsi triangular, with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Phorodon humuli* (Schrank)

**Range of plants infested in Canada.** *Prunus* and *Humulus* species.

**Biology.** The only known species in Canada is heterocyclic between *Prunus* and *Humulus*.

**Comments.** Recognition characters for this genus include its associations with *Prunus* and *Humulus* and the presence of the fingerlike prolongations of the antennal tubercles.

**Genus Phyllaphis** Koch

Figs. 1580–1593

*Phyllaphis* Koch, 1856:248.
Type species: *Aphis fagi* Linnaeus, 1767:735.

**Adult** (Figs. 1580–1582, 1584). Length 2.5–4.0 mm.
Integument: Antenna with nodulose and spiculose imbrications especially evident on apical 2 or 3 segments; head and body without obvious sculpturing other than opening of gland facets; tibiae with a
few apical spicules; tarsi spiculose; cauda and anal and genital plates spiculose.

Head (Fig. 1593): Antennal tubercle undeveloped; front of head flat or weakly convex. Ventral margin of antennal socket not protuberant. Distal setae short, pointed, arranged in anterior group of 4–6 and posterior group of 4 or 5. Eye in aptera (Fig. 1583) partially divided into dorsal and ventral clusters of facets; triommatidium present, obscure in aptera except in lateral view. Ventral and dorsal cephalic sutures absent. Disc without tubercles. Disc with well-developed ring-shaped glands generally forming 2 large clusters on each side of disc, also with some scattered clusters of minute glandular pores. Antennae 6-segmented; processus terminalis short, without setae other than usual few apical ones; primary sensoria (Fig. 1589) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1588) circular to oval, with ciliate margins, situated on segment III of alata; antennal segment II with 2 or 3 pitlike organs; segments I and II with clusters of minute glandular pores at least apically; segments III–VI with minute glandular pores clustered along poorly developed imbrications. Rostrum 4-segmented; apical segment (Fig. 1590) subconical, obtusely pointed distal of preapical primary setae.

Thorax:  Prothoracic setae short, pointed; each side with 1 anterior and 1 or 2 posterior submedian setae and 1 or 2 anterior lateral and 1 posterior lateral setae. Femora (Fig. 1587) and tibiae with setae pointed. Tibiae without peglike setae, or rastral spines, with rastral setae weakly developed, and with numerous clusters of wax glands; glands more evident in alata. Basitarsi (Fig. 1592) triangular, each with 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1585) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent.

Abdomen:  Abdominal setae pointed, short, inconspicuous, arranged in single transverse row on each tergum. Abdominal terga not fused; each tergum with or without transverse bar of pigment. Lateral sclerites present or absent. Dorsal and lateral abdominal tubercles absent. Both aptera and alata with gland facets composed of minute pores in circles of various sizes and conspicuous on pigmented tergites and lateral sclerites. Spiracles (Fig. 1591) without sclerotic rims, with transparent setae on opercula. Siphunculus poriform, not surrounded with setae. Abdominal tergum VIII entire. Cauda knobbed in alata, arc-shaped in aptera. Anal plate (Fig. 1586) bilobate in vivipara; entire in ovipara. Gonapophyses 2.

Embryo.  Not observed.

Economically important species.  None.

Range of plants infested in Canada.  Fagus species.
Figs. 1580, 1581. Spring and early summer aptera of *Phyllaphis*. 1580, head and prothorax; 1581, terminal abdominal segments.
Figs. 1582–1584. Summer and early autumn aptera of *Phyllaphis*. 1582, head and prothorax; 1583, ventral view of eye; 1584, terminal abdominal segments.
Figs. 1585–1593. Alata of Phyllaphis. 1585, right fore wing; 1586, anal plate and gonapophyses; 1587, left fore femur; 1588, second and base of third antennal segments; 1589, apical antennal segment; 1590, apical rostral segment; 1591, abdominal spiracle; 1592, left hind tarsus; 1593, venter of head.
Biology. Species of this genus are holocyclicly associated with the host plant, where they produce flocculent colonies on the undersurfaces of the leaves and cause the margins of the leaves to fold.

Comments. Recognition characters for this genus include its association with *Fagus*, the production of waxy white filaments by apterae in the colony, the knobbed cauda in alatae and the arc-shaped cauda in the apterae, the abundance of dorsal and lateral gland facets, and the spiculose tarsi. Richards (1973) provided a key to, and descriptions of, the species.

Genus *Placoaphis* Richards

Figs. 1594–1606

Type species: *Placoaphis siphunculata* Richards, 1961b:624.

Adult (Figs. 1594, 1596). Length 2.0–4.0 mm.

Integument: Antennal segments III–VI with smooth imbrications; segments I and II scabrous; disc of head mostly smooth, somewhat scabrous near antennal tubercles; antennal tubercles nearly smooth in alata, scabrous in aptera; centre of head nearly smooth in alata, slightly scabrous near antennal tubercles in aptera; tibiae unsculptured; tarsi with smooth imbrications; abdomen without evident sculpturing other than some imbrications on apical abdominal segments; cauda and anal and genital plates with some spicules.

Head (Fig. 1606): Antennal tubercle well-developed, with mesal margin swollen, faintly scabrous in alata, more so in aptera. Ventral margin of antennal socket (Fig. 1595) protuberant, especially evident in aptera. Eye and triommatidium distinct in aptera and alata. Ventral and dorsal sutures absent. Each side of disc with anterior and posterior group of 2 setae each. Disc with or without tubercles, without gland facets. Antenna 6-segmented; processus terminalis elongate, without abundant setae; primary sensoria (Fig. 1602) ciliate; accessory sensoria not fused; secondary sensoria (Fig. 1601) present on antennal segment III in alata, apparently absent in aptera. Rostrum 4-segmented; apical segment (Fig. 1603) nearly cylindrical, slightly tapered, rounded distad of preapical primary setae.

Thorax: Prothorax with lateral tubercles; pronotal setae blunt, short, 1 posterior and 1 anterior lateral seta and 1 posterior submedian seta present on each side. Femora (Fig. 1600) with setae pointed, short; tibial setae short, blunt dorsally on basal half of each, pointed elsewhere, longest about as long as apical diameter of respective tibia. Tibia without sensoria, peg-like setae, rastral spines,
Figs. 1594–1597. Aptera of Placoaphis. 1594, head and prothorax; 1595, ventral margin of antennal socket; 1596, terminal abdominal segments; 1597, apex of cauda.
Figs. 1598–1606. Alata of *Placoaphis*. 1598, right fore wing; 1599, anal plate and gonapophyses; 1600, left fore femur; 1601, second and base of third antennal segments; 1602, base of apical antennal segment; 1603, apical rostral segment; 1604, abdominal spiracle; 1605, left hind tarsus; 1606, venter of head.
rastral setae or gland facets. Basitarsi (Fig. 1605) triangular, with 3 or hind basitarsus with 2 ventral setae, without dorsal setae; distitarsi elongate, without capitate setae. Claws simple. Fore wing (Fig. 1598) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Dorsal and lateral abdominal setae short and blunt on terga I–VII, longer and pointed on tergum VIII in some specimens. Abdominal terga pigmented in both aptera and alata; terga fused in aptera forming carapace including lateral sclerites; terga III–VI or VII fused in alata forming central patch; terga I and II each with transverse pigmented bar. Abdominal tergum VIII with or without tubercles. Lateral sclerites well-developed in alata. With large lateral tubercles on segments II–V. Spiracles (Fig. 1604) subcircular, without opercula. Siphunculus elongate, without setae, with apical flange, nearly cylindrical, not swollen, imbricate, reticulate on apical one-fifth to one-quarter. Cauda elongate, with slight constriction about the middle, tapered to blunt point. Abdominal tergum VIII entire. Anal plate (Fig. 1599) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of host plants infested in Canada.** Specimens of the single known species have been collected on *Rosa* species in Canada, and *Rubus* species in the eastern United States.

**Biology.** Details are unknown, but the single species is probably holocyclicly associated with either *Rosa* or *Rubus*.

**Comments.** The reticulate siphunculi, the swelling on the ventral margin of the antennal socket, the dorsal patch on the abdomen in the alatae, and the association with *Rosa* or *Rubus* provide the best recognition characters for this genus. Except for the rather extensive reticulate area on the siphunculi, *Placoaphis* in all other details resembles *Aulacorthum*.

**Genus Pleotrichophorus Börner**

Figs. 1607–1618

Type species: *Aphis glandulosus* Kaltenbach, 1846:170.

**Adult** (Figs. 1607, 1608). Length 1.0–3.0 mm.
Integument: Antennal segments with smooth imbrications; head and body without obvious sculpturing, other than some spiculose imbrications on apical abdominal terga; tibiae unsculptured; tarsi
with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1618): Antennal tubercle fairly well developed. Median tubercle present in some species. Discal setae capitate, flabellate or appearing funnel-shaped, scattered, without definite arrangement, or arranged in anterior cluster of 4 or more and posterior cluster of several on each side. Ventral margin of antennal socket not protuberant. Eye and triommatidium distinct in aptera and alata. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1613) with ciliate margins, and with cilia reduced in number in some species; secondary sensoria (Fig. 1612) circular, without ciliate margins, present or absent on segment III of aptera, always present on segment III of alata, also present in alata on segments IV and V in some species. Rostrum 4-segmented; apical segment (Fig. 1614) conical, with sides generally somewhat concave, or long and slender, pointed distad of preapical primary setae.

Thorax: Prothoracic setae about same size and shape as discal setae, scattered evenly over surface of notum, or forming lateral and anterior and posterior submedian clusters on each side. Prothoracic lateral tubercles present or absent, tiny when present. Prothorax without gland facets. Femora (Fig. 1611) with setae pointed, short; tibial setae pointed apically and ventrally, blunt, capitate, flabellate or somewhat funnel-shaped basally and dorsally. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1617) triangular, each with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1609) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent.

Abdomen: Dorsal and lateral abdominal setae capitate, flabellate or funnel-shaped, arranged in 2 or more irregular transverse rows on each tergum. Abdominal terga not fused, without pigment other than intersegmental dashes in aptera; alata usually with segmental dashes and spots and lateral sclerites usually present. Abdomen without dorsal tubercles, with small atrophied lateral tubercles present on segments II–V in some species. Spiracles (Fig. 1615) subcircular, with sclerotic rims. Siphunculus short (a few species) to elongate, subcylindrical, tapering, not swollen, rarely with a few setae, with apical flange, without reticulations. Abdominal tergum VIII entire. Cauda short, triangular, bluntly rounded apically. Anal plate (Fig. 1610) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 1616). Antenna 4-segmented; each side of disc of head with 2 anterior and 2 posterior setae; all discal setae capitate or funnel-shaped; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 anterior and one to several posterior submedian setae; disc and prothorax without gland facets or lateral tubercles; each side of abdomen with 1 capitate or funnel-shaped lateral and 1
Figs. 1607, 1608. Aptera of *Pleotrichophorus*. 1607, head and prothorax; 1608, terminal abdominal segments.
Figs. 1609–1618. Embryonic chaetotaxy and alata of *Pleotrichophorus*. 1609, right fore wing; 1610, anal plate and gonapophyses; 1611, left fore femur; 1612, second and base of third antennal segments; 1613, base of apical antennal segment; 1614, apical rostral segment; 1615, abdominal spiracle; 1616, dorsal chaetotaxy of embryo; 1617, left hind tarsus; 1618, venter of head.
submedian seta on each tergum, usually also with 1 pleural seta on
most terga; siphunculus short where evident; basitarsi triangular,
with 2 ventral setae; distitarsi elongate, without preapical capitate
setae; plantar setae acuminated.

**Economically important species.** None.

**Range of plants infested in Canada.** Various species of
*Achillea, Ambrosia*, and *Artemisia*.

**Biology.** All species are holocyclicly associated with their host
plants.

**Comments.** Recognition characters for this genus include the
usual association with aromatic compositae, the well-developed
antennal tubercles, the capitate or flabellate or funnel-shaped dorsal
setae, and the sharply triangular or stiletto-shaped apical rostral
segment. Corpuz-Raros and Cook (1974) provided a key to, and
descriptions of, the Nearctic species.

**Genus *Prociphilus* Koch**

*Prociphilus* Koch, 1857:279.
Type species: *Aphis bumeliae* Schrank, 1801:102.

**Adult** (Figs. 1619, 1620). Length 2.0–4.0 mm.

Integument: Mostly unsculptured except for a few spicules or
nODULES on apical antennal segment, cauda, and anal and genital
plates; tarsi without spicules.

Head (Fig. 1630): Antennal tubercle undeveloped; front of head
somewhat convex. Ventral margin of antennal socket not
protuberant, swollen. Discal setae pointed, hairlike; each side of disc
with 2–8 anterior and posterior discal setae; wax gland facets usually
associated with setae in aptera, also in alata in some species. Eye
present in alata, absent in aptera; triommatidium distinct. Dorsal
cephalic suture usually present at least as pigmented line; ventral
cephalic sutures absent. Antenna 6-segmented; primary sensoria
(Fig. 1625) with ciliate margins; accessory sensoria not fused;
secondary sensoria (Fig. 1624) slitlike, lengths not more than half
circumference of respective segment, with ciliate margins, present on
segment III–V or VI of alata, absent in aptera. Rostrum 4-segmented;
apical segment (Fig. 1626) usually subcylindrical, rarely conical.
Rostrum vestigial in male and ovipara.

Thorax: Head and prothorax not fused in alata, evidently
partially fused in aptera. Each side of prothorax with 1 or 2 posterior
submedian setae and 1 anterior and 1 posterior lateral seta; clusters
of wax gland facets associated with bases of these setae at least in aptera, commonly absent in alata. Prothoracic dorsal and lateral tubercles absent. Mesonotum with a median and posterior pair of wax gland facets in alata. Femora (Fig. 1623) with setae short, pointed; tibial setae pointed, hairlike. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1629) triangular, with 2–4 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitata setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1621) with venation reduced; media unbranched, incomplete basally; branches of cubitus approximate at base, divergent.

Abdomen: Abdominal segments not fused, without pigment, except a trace on tergum VII in some species; abdominal setae pointed, arranged in single transverse row on each tergum. Abdomen usually with lateral, submedian, and pleural clusters of gland facets on some or all segments. Lateral sclerites absent. Spiracles (Fig. 1627) circular, with hinged operculum. Siphunculus absent. Abdominal tergum VIII entire. Cauda bluntly triangular to arc-shaped. Anal plate (Fig. 1622) relatively large, commonly produced laterally and posteriorly, forming cuplike structure embracing the cauda. Gonapophyses 3.

**Embryo** (Fig. 1628). Antenna 4 segmented; disc with 2 anterior and 2 posterior setae on each side, with or without evident clusters of wax gland facets; prothorax with 1 submedian seta and 1 anterior and 1 posterior lateral seta on each side; clusters of wax gland facets usually associated with base of prothoracic setae; abdominal terga with 1 submedian and 1 lateral seta, and with 1 pleural seta usually also present on terga I–VI or VII; clusters of wax gland facets associated with most abdominal setae; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitata setae; plantar setae acuminate. Embryo of male and of ovipara lacking mouthparts.

**Economically important species.** None.

**Range of plants infested in Canada.** Species of *Amelanchier, Crataegus, Fraxinus, Pinus*, and various herbaceous plants.

**Biology.** The details of the biologies of some species are unknown, but available evidence suggests that all species are heterocyclic between *Amelanchier, Crataegus, Fraxinus*, and the roots of a wide assortment of plants including the roots of pines. Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

**Comments.** Recognition characters for this genus include the usual presence of a dorsal cephalic suture, the absence of spicules on the tarsi, the presence of gland facets on the abdominal terga in both
Figs. 1619, 1620. Fundatrix of *Prociphilus*. 1619, head and prothorax; 1620, terminal abdominal segments.
Figs. 1621–1630. Embryonic chaetotaxy and alata of Prociphilus. 1621, right fore wing; 1622, anal plate and gonapophyses; 1623, left fore femur; 1624, second and base of third antennal segments; 1625, apical antennal segment; 1626, apical rostral segment; 1627, abdominal spiracle; 1628, dorsal chaetotaxy of embryo; 1629, left hind tarsus; 1630, venter of head.
apterae and alatae, the absence of siphunculi, and the enlarged anal plate that generally envelops the cauda especially in the apterae.

This genus includes subgenera Neoparacletus Strom, Paraprociophilus Mordvilko, and Pulvius Sanborn. Smith (1974a) provided a key to, and descriptions of, the North American species.

Genus Protopterocallis Richards

Figs. 1631–1642


Adult (Figs. 1631, 1632). Length 1.5–2.5 mm.

Integument: Antenna with whorls of imbricately arranged spicules; disc of head with a few fine spicules; prothorax with spicules at least laterally; abdomen with distinct spicules on lateral sclerites; cauda and anal and genital plates spiculose; fore coxae with reticulations on lateral margins; tibiae and tarsi with spicules.

Head (Fig. 1642): Antennal tubercle undeveloped; front of head convex, or nearly so. Ventral margin of antennal socket not protuberant. Eye and triommatidium distinct in aptera and alata. Discal setae pointed in some species, mostly weakly, but distinctly clavate or capitate. Ventral and dorsal cephalic sutures absent. Discal setae arranged in anterior and posterior group of 4 each, mostly situated on conical papillae. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis short; primary sensoria (Fig. 1637) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1636) oval, without ciliate margins, present only on segment III. Rostrum 4-segmented; apical segment (Fig. 1638) subconical, bluntly rounded distad of preapical primary setae.

Thorax: Prothoracic setae about same length and shape as discal setae; each side of prothorax with 1 posterior lateral seta and 1 anterior and 1–3 posterior submedian setae; submedian setae situated on small conical papillae. Prothoracic lateral tubercles absent. Fore coxa greatly enlarged. Femora (Fig. 1635) with setae pointed; tibial setae pointed ventrally and apically, some distinctly capitate ones dorsally and basally. Tibiae without peglike setae, gland facets, or rastral spines; rastral setae present. Basitarsi (Fig. 1641) trapezoidal, each with 5 ventral and 2 dorsal setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1633) with normal venation; media with 3 branches; branches of cubitus widely separated at base, nearly parallel, slightly divergent.

Figs. 1631, 1632. Alata of Protopterocallis. 1631, head and prothorax; 1632, abdominal segments.

572
Figs. 1633–1642. Embryonic chaetotaxy and alata of *Protopteryctocallis*. 1633, right fore wing; 1634, anal plate and gonapophyses; 1635, left fore femur; 1636, second and base of third antennal segments; 1637, primary sensoria on apical antennal segment; 1638, apical rostral segment; 1639, abdominal spiracle; 1640, dorsal chaetotaxy of embryo; 1641, left hind tarsus; 1642, venter of head.

Abdomen: Abdominal terga not fused, without pigment except for spots around bases of setae. Dorsal setae about same shape as discal setae, somewhat longer than discal setae on posterior segments, arranged in single irregular transverse row on most segments; most setae on
conical integumentary papillae. Abdomen without dorsal or lateral tubercles. Lateral sclerites at least faintly pigmented, evident, with those on segments II–V having a distinct conical projection. Spiracles (Fig. 1639) without sclerotic rims. Siphunculus poriform. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 1634) bilobed in vivipara; entire in ovipara. Abdomen without gland facets. Gonapophyses 4; lateral clusters of setae reduced to 1 seta or absent in some species.

**Embryo** (Fig. 1640). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; all discal setae long, capitate; pronotal setae long, capitate; each side of pronotum with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta; prothoracic gland facets and tubercles absent; abdominal setae long, capitate; each side of each abdominal segment with 1 submedian seta and single lateral row of setae; submedian setae on segments V and VI much closer together than other submedian pairs; basitarsi triangular, with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Carya* species.

**Biology.** Details are not known, but the genus is both monoeciously and holocyclicly associated with the host plant where each species feeds on the undersurfaces of leaves. Apterae are not produced and the alatae viviparae are generally solitary and do not form colonies.

**Comments.** Recognition characters for this genus include the association with *Carya*, the absence of aptera, the presence of poriform siphunculi, the knobbed cauda, the bilobate anal plate, and the conical papillae on which many of the dorsal setae are situated. The arrangement of the submedian setae in the embryo is also distinctive—the pair of submedian setae on abdominal tergum VI are much closer together than are other pairs of submedian setae. There is a single species, *P. fumipennella* (Fitch), in Canada.

**Genus Pseudacaudella** Börner

Figs. 1643–1653

Type species: *Acaudella rubida* Börner, 1939:77.

**Adult** (Figs. 1643, 1644). Length 0.50–1.25 mm.
Integument: Antenna with smooth imbrications; head and prothorax smooth, except for some obscure wrinkles and ripples; abdomen mostly without sculpturing other than some rippling, especially laterally; tibiae unsculptured; tarsi nearly smooth, other
Figs. 1643–1645. Aptera of *Pseudacaudella*. 1643, head and prothorax; 1644, terminal abdominal segments; 1645, apex of cauda.
Figs. 1646–1653. Aptera of *Pseudacaudella*. 1646, left fore femur; 1647, anal plate and gonapophyses; 1648, base of third antennal segment; 1649, base of apical antennal segment; 1650, abdominal spiracle; 1651, apical rostral segment; 1652, left hind tarsus; 1653, venter of head.
than 1 or 2 obscure imbrications on each distitarsus; cauda and anal and genital plates spiculose; apical spicules of cauda (Fig. 1645) distinctly shorter, less dense that more basal ones.

Head (Fig. 1653): Antennal tubercle undeveloped; front of head flat or weakly convex. Ventral margin of antennal socket not protuberant. Discal setae short, obscure, blunt or pointed, arranged in anterior and posterior group of 2 on either side of disc. Eye and triommatidium distinct in aptera. Dorsal and ventral cephalic sutures absent. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1649) without ciliate margins; secondary sensoria absent. Rostrum 4-segmented; apical segment (Fig. 1651) elongate, subconical, blunt apically.

Thorax: Prothoracic setae about same size and shape as discal setae; each side of prothorax with 1 posterior submedian seta and 1 posterior and 1 anterior lateral seta; lateral setae situated close together near anterior angle of pronotum. Prothorax without dorsal and lateral tubercles. Femora (Fig. 1646) with setae short, pointed; tibial setae mostly pointed, with some short blunt ones usually evident dorsally and basally. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1652) triangular, each with 3 or hind basitarsus with 2 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws normal.

Abdomen: Abdominal terga fused forming pigmented sclerotic carapace. Abdominal setae about same size and shape as discal and prothoracic setae; arranged in single transverse row on each tergum, or each segment with only submedian and lateral setae. Dorsal and lateral abdominal tubercles absent. Spiracles (Fig. 1650) subcircular, with sclerotic rims, without opercula. Siphunculus elongate, tapering toward apex, with distinct preapical constriction, without setae, with spicules and spiculose imbrications. Abdominal tergum VIII entire. Cauda elongate, apex narrow (Fig. 1645). Abdomen without gland facets. Anal plate (Fig. 1647) entire. Gonapophyses 3.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Mosses.

Biology. The biological details of the single known species are unknown, but it is probably holocyclic on mosses.

Comments. Recognition characters include the association with mosses, the flat anterior margin of the head, the small and narrow cauda, the preapical constriction on the siphunculus, the pigmented abdominal carapace, and the rippling (at least laterally) on the abdomen. The description is based only on the apterous viviparous female, because alatae have not yet been collected in Canada and none were available for study.

578
Genus *Pseudocercidis* Richards

Type species: *Pseudocercidis rosae* Richards, 1961b:623.

**Adult** (Figs. 1654, 1655). Length 2.0–3.5 mm.

Integument: Antenna with smooth imbrications; head and body without obvious sculpturing; tibiae without spicules; tarsi with some smooth but mostly distinctly spiculose imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 1665): Antennal tubercle well-developed; front of head U-shaped. Ventral margin of antennal socket not protuberant. Discal setae pointed, arranged in anterior and posterior group of 4 each. Eye and triangularium distinct in aptera and alata. Ventral cephalic sutures evident between median ocellus and margin of clypeus. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, filiform, without numerous setae. Primary sensoria (Fig. 1660) with ciliate margins; accessory sensoria not fused. Secondary sensoria (Fig. 1659) circular, present on segment III of some aptera, margins not ciliate, present in alata on segment III and in some specimens on IV and V with margins ciliate. Rostrum 4-segmented; apical segment (Fig. 1661) tapering, short, rounded distad of preapical primary setae.

Thorax: Prothoracic setae pointed, about same size as discal setae. Each side of prothorax with 1 anterior and 1 posterior lateral seta and 1–3 posterior submedian setae. Prothorax with or without lateral tubercles; tubercles small, inconspicuous where present; dorsal tubercles absent. Femora (Fig. 1658) and tibiae with setae pointed. Tibiae without peglike setae, gland facets, sensoria, rastral setae, or rastral spines. Basitarsi (Fig. 1664) triangular, each with 5 or 6 ventral setae, without dorsal setae. Distitarsi elongate, without preapical dorsal setae. Plantar setae acuminated. Claws normal. Forewing (Fig. 1656) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent.

Abdomen: Abdominal terga not fused, without pigment except faint lateral sclerites evident in some specimens. Abdominal setae pointed, short, in single transverse row on each tergum. Dorsal abdominal tubercles absent; lateral abdominal tubercles usually present on segments III–V, small where present. Spiracles (Fig. 1662) with sclerotic rims, not operculate. Siphunculus elongate, cylindrical, without setae, with poorly developed apical flange, with smooth and weakly spiculose imbrications. Abdominal tergum VIII entire. Cauda short, bluntly triangular. Anal plate (Fig. 1657) entire. Abdominal gland facets absent. Gonapophyses 3.

**Embryo** (Fig. 1663). Antenna 4-segmented; each side of disc with anterior and posterior group of 2 setae each; each side of pronotum
Figs. 1654, 1655. Aptera of *Pseudocercidis*. 1654, head and prothorax; 1655, terminal abdominal segments.
Figs. 1656–1665. Embryonic chaetotaxy and alata of *Pseudocercidis*. 1656, right fore wing; 1657, anal plate and gonapophyses; 1658, left fore femur; 1659, second and base of third antennal segments; 1660, base of apical antennal segment; 1661, apical rostral segment; 1662, abdominal spiracle; 1663, dorsal chaetotaxy of embryo; 1664, left hind tarsus; 1665, venter of head.
with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothorax without gland facets or tubercles; each side of abdomen with 1 lateral and 1 submedian seta and usually 1 pleural seta on each tergum; abdominal gland facets absent; tubercles not evident; basitarsi triangular, with 2 ventral setae; distitarsi elongate without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Rosa* species.

**Biology.** Details are unknown, but the single described species produces pulverulent, green colonies in deformed leaves on roses.

**Comments.** Recognition characters for this genus include its associations with *Rosa*, the well-developed antennal tubercles, the absence of a swelling along the ventral margin of the antennal socket, the absence of reticulations on the siphunculi, the short and bluntly triangular cauda, the presence of 5 or 6 setae on the venter of each basal tarsal segment, the ciliate secondary sensoria in the alatae, and the spicules on the apical tarsal segments.

### Genus *Pseudoepameibaphis* Gillette & Palmer

Figs. 1666–1676

*Pseudoepameibaphis* Gillette and Palmer, 1932a:145.

Type species: *Pseudoepameibaphis glauca* Gillette and Palmer, 1932a:145.

**Adult** (Figs. 1666, 1667). Length 1.0–2.0 mm.

Integument: Antenna with smooth imbrications; head and body without obvious sculpturing other than some spiculose imbrications on apical 2 or 3 abdominal terga; tibiae unsculptured; tarsi with smooth imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 1676): Antennal tubercle undeveloped; front of head flat or distinctly convex. Ventral margin of antennal socket not protuberant. Discal setae flabellate, more or less scattered over surface of disc or generally arranged in 2 distinct lateral clusters. Eye present; triommatidium incorporated into eye, apparently absent. Dorsal cephalic sutures absent; ventral sutures evident between median ocellus and clypeus. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, filiform, without numerous setae; primary sensoria (Fig. 1672) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1671) circular, restricted to segment III of alata, without ciliate margins. Rostrum 4-segmented; apical segment (Fig. 1673) slender, pointed, with sides convex basally, needlelike distad of preapical primary setae.

582
Figs. 1666, 1667. Aptera of *Pseudoepameibaphis*. 1666, head and prothorax; 1667, terminal abdominal segments.
Figs. 1668–1676. Alata of *Pseudoepameibaphis*. 1668, right fore wing; 1669, anal plate and gonapophyses; 1670, left fore femur; 1671, second and base of third antennal segments; 1672, base of apical antennal segment; 1673, apical rostral segment; 1674, abdominal spiracle; 1675, left hind tarsus; 1676, venter of head.
Thorax: Prothoracic setae flabellate, about same size as discal setae, more or less scattered over surface of notum, but generally forming distinct submedian and lateral clusters. Prothorax without dorsal tubercles, usually with at least small lateral tubercles. Femora (Fig. 1670) with setae pointed basally and ventrally, some flabellate dorsally and apically; tibial setae pointed apically and basally, generally blunt or weakly flabellate dorsally and basally. Tibiae without peglike setae, gland facets, sensoria, or rastral spines; well-developed rastral setae present. Basitarsi (Fig. 1675) triangular, with 3 ventral setae on fore and mid basitarsi and 2 on hind basitarsus, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws normal. Fore wing (Fig. 1668) with normal venation; media with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Abdominal terga not fused in alata, fused and without pigment in aptera, usually with some segmental and intersegmental dashes in alata. Dorsal and lateral abdominal setae flabellate, or somewhat funnel-shaped, arranged in 2 or more irregular transverse rows on each tergum except sometimes for single transverse row on tergum VIII in some specimens. Dorsal abdominal tubercles mostly absent, rarely 1 or 2 on tergum VII; lateral abdominal tubercles absent in most species, but present on one or all of abdominal segments II–V in some species. Spiracles (Fig. 1674) with sclerotic rims. Siphunculus elongate, subcylindrical, with apical diameter somewhat oblique, without setae, with apical flange, strongly imbricate, situated near posterior margin of abdominal segment V. Abdominal tergum VIII entire. Cauda short, triangular. Anal plate (Fig. 1669) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Western, shrubby Artemisia species.

Biology. Species are holocyclicly associated with the host plants.

Comments. Recognition characters for this genus include the lack of antennal tubercles and the convex front margin of head, the association with Artemisia, the flabellate dorsal setae, the triangular cauda, and the slightly but distinct apical flaring of the siphunculus and its somewhat oblique orifice.
Genus *Pseudopterocomma* MacGillivray

Figs. 1677–1688

Type species: Fullawaya (*Pseudopterocomma*) hughi MacGillivray, 1963:941.

**Adult** (Figs. 1677, 1678). Length 2.0–4.0 mm.

Integument: Antenna nearly smooth, in some species with a few dispersed spicules on segment III and also on segments I and II in alata; head and thorax with some spicules dorsally, at least in aptera; tibiae without spicules except for usual 1–4 on apical margin as in other Chaitophorinae; tarsi with smooth imbrications on segment II, but in some species these much reduced; abdomen without sculpturing other than a few faint spiculose imbrications on tergum VIII in some species; cauda and anal and genital plates with spicules.

Head (Fig. 1688): Antennal tubercle undeveloped; front of head flat or weakly convex. Ventral margin of antennal socket not protuberant. Discal setae fine, pointed, hairlike, arranged in anterior group of 2–4 and transverse group of 4–8 on each side. Eye and triommatidium distinct in aptera and alata. Ventral and dorsal cephalic sutures absent. Disc without gland facets or tubercles. Antenna 6-segmented (5-segmented in aptera in some species), elongate, with all segments including processus terminalis (Fig. 1683) covered in fine hairlike setae; primary sensoria with fine dispersed marginal spicules; accessory sensoria free; secondary sensoria (Fig. 1682) circular, situated on segments III and IV of alata and in some species also of aptera, in some species with margins smooth but mostly having dispersed sharp spicules. Rostrum 4-segmented; apical segment (Fig. 1684) elongate, subcylindrical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae pointed; each side of pronotum with 1–3 anterior and 1–4 posterior submedian setae and a cluster of lateral setae generally separated into anterior and posterior groups. Prothorax without lateral tubercles. Femora (Fig. 1681) and tibiae with setae pointed, hairlike. Tibiae without peglike setae, gland facets, rastral spines, or rastral setae. Basitarci (Fig. 1687) triangular, each with 7 or 8 ventral setae, without dorsal setae. Distitarci elongate, without preapical capitate setae. Plantar setae obscurely to strongly clavate. Claws simple. Fore wing (Fig. 1679) with normal venation; media with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Dorsal abdominal setae pointed, sparse, in some species absent on some terga, where present arranged in single irregular transverse row in submedian region of each tergum. Lateral abdominal seta arranged in clusters on each segment; setae spinelike, or fine, hairlike. Abdominal terga in aptera I–VII fused forming colorless or strongly pigmented carapace also including lateral
Figs. 1677, 1678. Aptera of *Pseudopterocomma*. 1677, head and prothorax; 1678, terminal abdominal segments.
Figs. 1679–1688. Alata of *Pseudopterocomma*. 1679, right fore wing; 1680, anal plate and gonapophyses; 1681, left fore femur; 1682, second and base of third antennal segments; 1683, primary sensoria on apical antennal segment; 1684, apical rostral segment; 1685, abdominal spiracle; 1686, variant of apex of tibia; 1687, left hind tarsus; 1688, venter of head.
sclerites; in alata each tergum with more or less distinct pigmented transverse bar and pigmented lateral sclerites. Lateral and dorsal abdominal tubercles absent. Spiracles (Fig. 1685) subcircular, without completely sclerotic rims. Siphunculus poriform. Abdominal tergum VII entire. Cauda arc-shaped. Anal plate (Fig. 1680) entire. Abdomen without gland facets. Gonapophyses 4.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Populus tremuloides* Michx.

**Biology.** The details are unknown, but all species are monoeciously and holocyclicly associated with the host plant and feed on the trunk and roots.

**Comments.** This genus is most readily recognized by the host association and by the presence of numerous, fine, hairlike setae on the processus terminalis of the antenna. The poriform siphunculi and the tendency to feed on the roots of the host plant are also distinctive. Richards (1972a) provided a key to, and descriptions of, the Canadian species.

**Genus Pterocallis Passerini**

Figs. 1689–1702

Type species: *Aphis alni* Fabricius, 1781:386 = *Aphis alni* DeGeer, 1773:47.

**Adult** (Figs. 1689–1692). Length 1.0–2.25 mm.
Integument: At least apical 3 antennal segments with spiculose imbrications; head and body mostly without sculpturing other than some spicules on lateral sclerites and some weakly spiculose imbrications on apical abdominal terga; tibiae and tarsi with spicules; cauda and anal and genital plates with spicules.
Head (Fig. 1702): Antennal tubercle undeveloped or weakly developed; front of head mostly convex. Ventral margin of antennal socket not protuberant. Discal setae short, inconspicuous, pointed or blunt in alata, long, conspicuously capitate in aptera and alatoid nymphs; each side of disc with anterior and posterior group of 2 setae each. Eye and triommatidium distinct in aptera and alata. Ventral and dorsal cephalic sutures absent. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis relatively short, without numerous setae; primary sensoria (Fig. 1697) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1696)
circular, situated on segment III of alata, with spiculose margins. Rostrum 4-segmented; apical segment (Fig. 1698) subconical, more or less rounded distal of preapical primary setae.

Thorax: Prothoracic setae long, capitate in aptera, short, inconspicuous, pointed or blunt in alata; each side with 1 anterior and 1 posterior submedian seta and 1 posterior and commonly also 1 anterior lateral seta. Prothorax with 0–3 lateral tubercles small, nearly flat, inconspicuous where present. Femora (Fig. 1695) with setae short, pointed; tibial setae mostly pointed, in some species blunt or weakly capitate basally in aptera. Tibiae without peglike setae, gland facets, sensoria, or rastral spines; rastral setae present in alata, undeveloped in aptera. Basitarsi (Fig. 1701) weakly trapezoidal, almost triangular, each with 4–6 ventral and 2 dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1693) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent, nearly parallel.

Abdomen: Abdominal setae arranged in single transverse row on each tergum; setae long, capitate, conspicuous in aptera, short and mostly pointed in alata. Abdominal terga not fused, usually without pigment, except in some species for weak spots around some setae and median papillae and for lateral sclerites weakly pigmented. Abdominal terga I–III with distinct median papillae represented by low bosses or distinctly fingerlike. Abdomen without dorsal tubercles, with 0–3 small lateral tubercles on segments II–V. Lateral abdominal sclerites usually unpigmented, but indicated by spiculose patch on each of segments I–VII. Spiracles (Fig. 1699) with sclerotic rims. Siphunculus short, truncate, smooth except for obscure wrinkles, without setae; lateral seta of abdominal segment VI not appended to base of siphunculus. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 1694) distinctly bilobate. Abdomen without gland facets. Gonapophyses 2, situated on a common papilla.

**Embryo** (Fig. 1700). Antenna 4-segmented; each side of disc with long capitate setae, arranged in anterior and posterior group of 2 each; pronotal setae long, capitate; each side of pronotum with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta; prothorax without gland facets or tubercles; each side of abdomen with 1 submedian and 1 lateral seta on each tergum; pairs of submedian setae on terga 1, IV, and VI situated much closer together than pairs of submedian setae on other terga; siphunculus poriform where evident; abdomen without gland facets; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.

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Figs. 1689, 1690. Aptera of *Pterocallis*. 1689, head and prothorax; 1690, terminal abdominal segments.
Figs. 1693–1702. Embryonic chaetotaxy and alata of *Pterocallis*. 1693, right fore wing; 1694, anal plate and gonapophyses; 1695, left fore femur; 1696, second and base of third antennal segments; 1697, primary sensoria on apical antennal segment; 1698, apical rostral segment; 1699, abdominal spiracle; 1700, dorsal chaetotaxy of embryo; 1701, left hind tarsus; 1702, venter of head.

Figs. 1691, 1692. Alata of *Pterocallis*. 1691, head and prothorax; 1692, abdominal segments.
Economically important species. None.

Range of plants infested in Canada. Alnus species.

Biology. The species are holocyclicly associated with the host plant.

Comments. Recognition characters for this genus include its association with Alnus, the presence of long capitate setae in the apterae and alatoid nymphs, the presence of single median papillae on the anterior abdominal terga of the alatae. The chaetotaxy of the embryo and first-instar larvae is also distinctive in that the pairs of submedian setae on each of the first, fourth, and sixth abdominal segments are situated much closer together than are the pairs of submedian setae on other abdominal terga. Richards (1965) provided descriptions of, and a key to, the species.

Genus Pterocomma Buckton

Figs. 1703–1714

Pterocomma Buckton, 1879:142.
Type species: Pterocomma pilosa Buckton, 1879:143.

Adult (Figs. 1703, 1704). Length 3.5–4.5 mm.
Integument: Antenna with smooth imbrications; head and body without obvious sculpturing, except for weakly formed spiculose imbrications on apical 1 or 2 abdominal terga; tibiae unsculptured; tarsi with smooth, or in some species sparsely spiculose imbrications; cauda and anal and genital plates with spicules.
Head (Fig. 1714): Antennal tubercle weakly developed, or undeveloped; front of head convex, or weakly W-shaped. Ventral margin of antennal socket not protuberant. Each side of head with fine hairlike setae scattered and without special arrangement. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic suture absent; ventral sutures evident laterally and posteriad of median ocellus in some species. Disc of head without tubercles or gland facets. Antenna 6-segmented; primary sensoria (Fig. 1709) with ciliate margins; accessory sensoria not fused; processus terminalis elongate, without numerous setae; secondary sensoria (Fig. 1708) circular, present on segment III of alata, rarely also on a segment IV of alata and on segment III of aptera. Rostrum 4-segmented; apical segment (Fig. 1710) subconical, bluntly pointed distad of preapical primary setae.
Thorax: Each side of prothorax with fine scattered hairlike setae in no special arrangement, in some species separated into distinct submedian and lateral clusters. Prothorax without gland facets, with lateral tubercles usually large, conspicuous, and in some species
Figs. 1703, 1704. Aptera of *Pterocomma*. 1703, head and prothorax; 1704, terminal abdominal segments.
Figs. 1705–1714. Embryonic chaetotaxy and alata of *Pterocomma*. 1705, right fore wing; 1706, anal plate and gonapophyses; 1707, left fore femur; 1708, second and base of third antennal segments; 1709, base of apical antennal segment; 1710, apical rostral segment; 1711, abdominal spiracle; 1712, dorsal chaetotaxy of embryo; 1713, left hind tarsus; 1714, venter of head.
bulbous. Femora (Fig. 1707) and tibiae with setae pointed, fine hairlike. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1713) triangular, with 4 or 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1705) with normal venation; media with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Abdominal terga mostly unpigmented in aptera, except for transverse dashes and spots on apical 1–4 segments; most terga with transverse dashes in alata. Abdominal setae pointed, hairlike, numerous on each tergum, without discernible arrangement. Lateral sclerites present in alata, commonly represented by irregular blotches in aptera. Lateral abdominal tubercles usually present on segments II–VII, absent on some segments in some species. Dorsal abdominal tubercles absent. Spiracles (Fig. 1711) subcircular to weakly reniform, without opercula. Siphunculus usually swollen either basally, or on apical half, rarely nearly subcylindrical, without setae, with apical flange, mostly unsculptured, with a few imbrications or nodules in some species. Cauda short, rounded, almost semicircular. Abdominal tergum VIII entire. Anal plate (Fig. 1706) entire. Gonapophyses 3 or 4.

Embryo (Fig. 1712). Antenna 4-segmented; each side of disc with 3–5 anterior and 3–5 posterior setae; disc without gland facets; each side of prothorax with 1–3 anterior and 2–6 posterior submedian setae and 1 anterior and 1 posterior lateral seta; prothorax without gland facets, with lateral tubercles commonly evident; each side of abdomen with 1 lateral, 1 pleural, and 1–5 submedian setae; abdomen without gland facets or dorsal tubercles, with lateral tubercles usually evident on at least some segments; siphunculus short, truncate, where evident; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

Economically important species. None.

Range of plants infested in Canada. Populus and Salix species.

Biology. Species in this genus are holocyclicly associated with their host plants, where they feed on the branches and trunks.

Comments. Recognition characters for this genus include the relatively large size, the feeding site on poplars and willows, the presence of abundant fine and hairlike setae, the siphunculi that are usually swollen apically or basally, and the usual presence of four setae on the ventral surface of each basal tarsal segment. Richards (1967c) provided a key to, and descriptions of, the Canadian fauna.
Genus Rhopalomyzus Mordvilko

Figs. 1715–1726

Rhopalomyzus Mordvilko, 1921:45.
Type species: Rhopalosiphum poae Gillette, 1908:61.

Adult (Figs. 1715, 1716). Length 1.5–3.0 mm.
Integument: Antenna with smooth imbrications; head and body without obvious sculpturing, except antennal tubercles rugulose in some species; abdominal terga VII–VIII with spiculose imbrications. Tibiae without spicules or imbrications; tarsi with smooth imbrications. Cauda and anal plate with spiculose imbrications.

Head (Fig. 1726): Antennal tubercle weakly to strongly developed, smooth or scabrous; front of head U-shaped, or W-shaped where median tubercle is also well-developed. Ventral margin of antennal socket not protuberant. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic sutures absent; ventral sutures faintly evident on each side of median ocellus. Discal setae pointed, blunt in some species, arranged on each side in anterior and posterior group of 2 each. Disc of head without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without primary sensoria (Fig. 1721), with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1720) with circular to oval margins not ciliate, situated on segments III–IV or V of alata. Rostrum 4-segmented; apical segment (Fig. 1722) short, triangular, rounded distad of preapical primary setae.

Thorax: Prothoracic setae pointed, blunt in some species; each side of prothorax with 1–3 posterior submedian setae and 1 anterior and 1 posterior lateral seta. Prothorax with or without small inconspicuous lateral tubercles. Femora (Fig. 1719) with setae short, pointed; tibial setae mostly pointed, blunt basally in some species. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1725) triangular, without dorsal setae; fore and mid basitarsus each with 3 and hind basitarsus with 2 ventral setae. Distitarsi elongate, without preapical setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1717) with normal venation; media with 2 or 3 branches; branches of cubitus separated at base, divergent to nearly parallel.

Abdomen: Abdominal setae short, pointed or blunt, arranged in single transverse row on each tergum. Abdominal terga not fused or pigmented in aptera; alata with central pigmented patch, or rectangular patches on various terga. Lateral sclerites present in alata. Lateral and dorsal abdominal tubercles absent. Spiracles (Fig. 1723) with sclerotic rims. Siphunculus elongate, swollen, clavate, without setae, smooth, or nearly smooth on swollen portion, with weak apical flange. Abdominal tergum VIII entire. Cauda short, triangular. Anal plate (Fig. 1718) entire. Abdomen without gland facets. Gonapophyses 3.
Figs. 1715, 1716. Aptera of *Rhopalomyzus*. 1715, head and prothorax; 1716, terminal abdominal segments.
Figs. 1717–1726. Embryonic chaetotaxy and alata of *Rhopalomyzus*. 1717, right fore wing; 1718, anal plate and gonapophyses; 1719, left fore femur; 1720, second and base of third antennal segments; 1721, base of apical antennal segment; 1722, apical rostral segment; 1723, abdominal spiracle; 1724, dorsal chaetotaxy of embryo; 1725, left hind tarsus; 1726, venter of head.
Embryo (Fig. 1724). Antenna 4-segmented; each side of disc with 2 anterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothoracic gland facets and tubercles absent; each side of abdomen with 1 lateral and 1 submedian seta; most terga also with 1 pleural seta; siphunculus short, truncate when visible; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without capitate setae; plantar setae acuminate.

Economically important species. None.

Range of plants infested in Canada. Lonicera species and various grasses especially Poa species.

Biology. All species are heterocyclic between Lonicera and grasses.

Comments. Recognition characters for this genus include the associations with Lonicera and grasses, the scabrous and fairly well developed antennal tubercles, the swollen siphunculi, and the presence of only two setae on the basal segment of the hind tarsi.

Genus Rhopalosiphoninus Baker

Figs. 1727–1738

Type species: Amphorophora latysiphon Davidson, 1912:408.

Adult (Figs. 1727, 1729). Length 1.5–3.0 mm.
Integument: Antenna with smooth imbrications at least apically; head and body unsculptured except for spicules dorsally and ventrally on antennal tubercles and on lateral abdominal sclerites, and spiculose imbrications on apical abdominal terga; tibiae without spicules, but with a few imbrications in some species; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1738): Antennal tubercle well-developed, with distinct spicules at least ventrally; front of head U-shaped, or W-shaped in aptera. Ventral margin of antennal socket (Fig. 1728) protuberant. Discal setae pointed or blunt; each side of disc with 2–4 anterior and 2–4 posterior setae. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic sutures absent; ventral sutures evident on each side and posteriad of median ocellus. Disc of head without gland facets, usually without tubercles. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1734) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1733) circular, without ciliate margins, situated on segment III and rarely IV of alata, present or absent on segment III of aptera. Rostrum 4-segmented; apical segment (Fig. 1735) elongate, subconical, rounded distad of preapical primary setae.
Figs. 1727–1729. Aptera of *Rhopalosiphoninus*. 1727, head and prothorax; 1728, ventral margin of antennal socket; 1729, terminal abdominal segments.
Figs. 1730–1738. Alata of *Rhopalosiphoninus*. 1730, right fore wing; 1731, anal plate and gonapophyses; 1732, left fore femur; 1733, second and base of third antennal segments; 1734, base of apical antennal segment; 1735, apical rostral segment; 1736, abdominal spiracle; 1737, left hind tarsus; 1738, venter of head.
Thorax: Prothoracic setae pointed or blunt, short; each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothoracic lateral tubercles normally absent. Femora (Fig. 1732) with setae pointed; tibial setae mostly pointed, blunt basally in some species. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1737) triangular, without dorsal setae; fore and mid basitarsus each with 3 and hind basitarsus with 2 or 3 ventral setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1730) with normal venation; media with 3 branches; branches of cubitus separated at base, slightly divergent.

Abdomen: Dorsal abdominal setae pointed or blunt, usually short, arranged in single transverse row on each tergum. Abdominal terga fused in aptera to some degree, usually pigmented; sclerites commonly fused forming more or less complete carapace, or without pigment except posteriad of siphunculus and on tergum VIII; alata with relatively well defined quadrate central pigmented patch. Abdomen without dorsal and lateral tubercles. Lateral sclerites present in alata, small in some species, obscure ones present in aptera. Spiracles (Fig. 1736) circular, with sclerotic rims. Siphunculus elongate, swollen, clavate, without setae, with swollen part smooth, narrow, and with basal part wrinkled or with vague imbrications, with distinct subapical reticulations or with anastomosing spiculose striae in some species, with apical flange. Abdominal tergum VIII entire. Cauda short, narrowly triangular. Anal plate (Fig. 1731) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** Stored tulip bulbs and potatoes.

**Biology.** Little is known about the biologies of the species in this genus. All tend to be subterranean or at least to feed near the surface of the ground. *Rhopalosiphoninus latysiphon* (Davidson) is possibly anholocyclic.

**Comments.** Recognition characters for this genus include the swollen and commonly reticulate siphunculus, the quadrate abdominal patch in the alatae, the spiculose angular antennal tubercles, and, in Canada, the habit of feeding on stored bulbs and potatoes. A key to, and taxonomic accounts of, the species were given by Smith and Knowlton (1977).
Genus *Rhopalosiphum* Koch

Figs. 1739–1751

*Rhopalosiphum* Koch, 1854:23.
Type species: *Aphis nymphaeae* Linnaeus, 1761:260.

**Adult** (Figs. 1739, 1740). Length 1.5–3.0 mm.

**Integument:** Antenna with smooth imbrications; head and body without obvious sculpturing other than some spicules on lateral sclerites and some spiculose imbrications on apical abdominal terga; tibia unsculptured, or with distinct smooth imbrications apically; tarsi with smooth imbrications; cauda and anal and genital plates with spicules, with those at apex of cauda usually shorter (Fig. 1741).

**Head** (Fig. 1751): Antennal tubercle slightly developed, especially in aptera; each antennal tubercle at least in aptera with distinct small scabrous dorsal papilla. Ventral margin of antennal socket not protuberant. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic suture absent, but indicated by longitudinal streak of more intense pigment in some species; ventral sutures absent or vaguely evident on each side and posteriad of median ocellus. Disc without tubercles or gland facets. Antenna 5- or 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1746) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1745) with smooth or distinctly ciliate margins. Rostrum 4-segmented; apical segment (Fig. 1747) conical, more or less rounded distad of preapical primary setae.

**Thorax:** Prothoracic setae pointed or blunt; each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax usually with a tubercle on each side. Femora (Fig. 1744) with setae pointed; tibial setae mostly pointed, blunt basally in some species. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1750) triangular, without dorsal setae; fore and mid basitarsus each with 3 and hind basitarsus with 2 or 3 ventral setae. Distitarsi elongate, without preapical capititate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1742) with normal venation; media with 3 branches, with second and third separating near wing margin, or with only 2 branches in some specimens; branches of cubitus separated at base, nearly parallel to slightly divergent.

**Abdomen:** Abdominal setae pointed or blunt, arranged in single transverse row on each tergum. Abdominal terga not fused, usually without pigment except for spots around bases of setae in some specimens, and small irregular sclerites on some terga in some species. Abdomen without dorsal tubercles, with lateral tubercles on segments II and VII, rarely present on other segments; tubercle on segment II dorsad of spiracle. Lateral sclerites present in alata. Spiracles (Fig. 1748) with sclerotic rims. Siphunculus elongate, subcylindrical, or distinctly swollen before apex, without setae, with smooth and spiculose imbrications, but with subapical swollen portion in some
Figs. 1739–1741. Aptera of *Rhopalosiphum*. 1739, head and prothorax; 1740, terminal abdominal segments; 1741, apex of cauda.
Figs. 1742–1751. Embryonic chaetotaxy and alata of *Rhopalosiphum*. 1742, right fore wing; 1743, anal plate and gonapophyses; 1744, left fore femur; 1745, second and base of third antennal segments; 1746, base of apical antennal segment; 1747, apical rostral segment; 1748, abdominal spiracle; 1749, dorsal chaetotaxy of embryo; 1750, left hind tarsus; 1751, venter of head.

**Embryo** (Fig. 1749). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 submedian seta; prothorax without gland facets; lateral tubercles occasionally evident; each side of abdomen with 1 lateral and 1 submedian seta; terga I–V or VI with 1 pleural seta on some segments; siphunculus truncate where visible; basitarsi each with 2 setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Rhopalosiphum insertum* (Walker), *R. maidis* (Fitch), *R. nymphaeae* (Linnaeus), and *R. padi* (Linnaeus).

**Range of plants infested in Canada.** Various Pomoideae, Prunoideae, Gramineae, and Cyperaceae are the main groups of hosts, but *R. nymphaeae* occurs on many emergent and floating plants.

**Biology.** Typically the species in this genus are heterocyclic between various Pomoideae or Prunoideae and the Gramineae or other herbaceous plants. Some species, such as *R. enigmae* Hottes & Frison, are holocyclic on the herbaceous plants. On the herbaceous plants, the colonies usually form on the aerial portions of the plants, but *R. insertum* and *R. rufiabdominale* (Sasaki) and at times *R. padi* are found on the roots of the secondary herbaceous host.

**Comments.** Recognition characters for this genus include the host associations, the presence of a small papilla on the dorsal surface of the antennal tubercles (at least in the apterae), the shorter spicules apically on the cauda, the short and rounded cauda, and the usually weakly swollen siphunculus. The position of the first abdominal tubercle dorsad of the spiracles is distinctive. About 12 species occur in North America; 10 are known in Canada. Richards (1960a, 1962) gave a synopsis of the species found in Canada and provided keys for most life history stages.

**Genus Saltusaphis** Theobald

Figs. 1752–1763

Type species: *Saltusaphis scirpus* Theobald, 1915:138.

**Adult** (Figs. 1752, 1753). Length 1.5–3.0 mm.
Integument: Antenna spiculose; head and body with spicules and nodules of various sizes; tibiae, tarsi, and anal plate spiculose; cauda with spiculose imbrications.

Head (Fig. 1763): Antennal tubercle undeveloped; front of head strongly convex. Ventral margin of antennal socket not protuberant. Discal setae flabellate, scattered, without special arrangement. Ventral and dorsal cephalic sutures absent. Triommatidium incorporated into eye, apparently absent in both aptera and alata. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate; primary sensoria (Fig. 1758) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1757) circular, present on segment III of alata, with spiculose margins. Rostrum 4-segmented; apical segment (Fig. 1759) short, with sides convex.

Thorax: Head and prothorax fused in aptera, although limits of each evident. Prothoracic setae minute, flabellate, scattered, without special arrangement. Prothoracic lateral tubercles and gland facets absent. Femora (Fig. 1756) and tibiae with setae pointed. Integument of dorsal basal portion of fore and middle tibiae thickened forming pigmented or unpigmented "knee-cap." Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1762) triangular, each with 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1754) with normal venation; media with 2 or 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Dorsal and lateral setae on basal abdominal segments, mostly minute, flabellate, scattered over each tergum, without special arrangement, long, capitate, rod-shaped, or pointed on apical segments. Abdominal segments mostly fused in aptera, although margins evident in aptera. Abdominal pigment mostly absent in aptera, except apically in some specimens; alata with pigmented lateral sclerites and transverse dashes on most terga. Abdomen without dorsal and lateral abdominal tubercles. Spiracles (Fig. 1760) without sclerotic rims. Siphunculus short, nearly poriform, without setae or apical flange, with concentric rows of spicules or wrinkles. Abdominal tergum VIII strongly bilobate. Cauda knobbed. Anal plate (Fig. 1755) of both vivipara and ovipara bilobate. Abdomen without gland facets. Gonapophyses 2.

Embryo (Fig. 1761). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior flabellate or mushroom-shaped setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta; disc and prothorax without gland facets or tubercles; each side of abdomen with 1 lateral and 1 submedian seta on each tergum; most setae short, mushroom-shaped, except elongate, rod-shaped, or capitate on last 2 or 3 terga; siphunculus poriform where evident; basitarsi each with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.
Figs. 1752, 1753. Aptera of *Saltusaphis*. 1752, head and prothorax; 1753, terminal abdominal segments.
Figs. 1754–1763. Embryonic chaetotaxy and alata of *Saltusaphis*. 1754, right fore wing; 1755, anal plate and gonapophyses; 1756, left fore femur; 1757, second and base of third antennal segments; 1758, base of apical antennal segment; 1759, apical rostral segment; 1760, abdominal spiracle; 1761, dorsal chaetotaxy of embryo; 1762, left hind tarsus; 1763, venter of head.
Economically important species. None.

Range of plants infested in Canada. Carex species.

Biology. Details are unknown, but the genus is evidently monoeciously and holocyclicly associated with the host plants.

Comments. Recognition characters for this genus include the association with Carex, the flabellate setae, and the strongly bilobate eighth abdominal tergum. One species, Saltusaphis elongata Baker, has been collected in Canada; an Old World species has been reported from Ohio and may occur in southern Ontario.

Genus Sanbornia Baker

Figs. 1764–1775

Type species: Sanbornia juniperi Pergande, in Baker 1920:50.

Adult (Figs. 1764, 1766). Length 1.0–1.5 mm.

Integument: Head, thorax, and abdomen rippled laterally, to a lesser extent dorsally in some specimens; tibiae unsculptured; apical tarsal segment with spiculose and nodulose imbrications; cauda and anal and genital plates (except apex, Fig. 1767) spiculose.

Head (Fig. 1775): Antennal tubercle well-developed; front of head with large quadrate median tubercle. Discal setae pointed, minute and inconspicuous, apparently absent in some specimens; each side of disc with 2 posterior setae and 1 anterior seta situated at anterior angles of median tubercle. Disc without tubercles, gland facets, or sutures. Ventral cephalic sutures absent. Eye with few facets; triommatidium present. Antenna with 4 segments; basal segment (Fig. 1765) with anterior process; primary sensoria (Fig. 1771) without ciliate margins; accessory sensoria not fused; secondary sensoria absent in aptera; alata not seen. Rostrum 4-segmented; apical segment (Fig. 1772) not much longer than wide, cylindrical, blunt distad of preapical primary setae.

Thorax: Each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta all tiny, obscure, absent in some specimens. Prothorax without gland facets, tubercles, or papillae. Femora (Fig. 1768) with setae pointed, short; tibial setae small, pointed, fairly thick in some specimens. Tibiae without gland facets, rastral setae, or rastral spines, with single row of peglike setae on inner surfaces of hind tibiae. Basitarsi (Fig. 1774) small, narrowly triangular, without ventral or dorsal setae. Distitarsi without capitate setae. Plantar setae absent. Claws simple, small.

Abdomen: Abdominal terga fused, not deeply pigmented, forming carapace. Abdominal setae pointed, minute, in some species absent on
Figs. 1764–1767. Aptera of Sanbornia. 1764, head and prothorax; 1765, first and second antennal segments; 1766, terminal abdominal segments; 1767, apex of cauda.
Figs. 1768–1775. Aptera of *Sanbornia*. 1768, left fore femur; 1769, anal plate and gonapophyses; 1770, basal antennal segments; 1771, base of apical antennal segment; 1772, apical rostral segment; 1773, abdominal spiracle; 1774, left hind tarsus; 1775, venter of head.
some terga; each segment with 1 submedian and 1 lateral seta; pleural setae usually not evident on most terga. Abdomen without tubercles, papillae, or gland facets. Spiracles (Fig. 1773) with partially sclerotic rims. Siphunculus minute, poriform, obscure. Cauda elongate, bluntly triangular. Abdominal tergum VIII and anal plate (Fig. 1769) entire. Gonapophyses 3.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** None; the single species known is associated with *Juniperus* species in the western United States.

**Biology.** Nothing is known about the single known species, *Sanbornia juniperi* Pergande, but it is probably holocyclicly associated with its host plants.

**Comments.** Recognition characters for this genus include the host association, the poriform siphunculus, the minute basitarsus without setae, the absence of plantar setae, and the pronounced antennal and median tubercles. Alatae were not seen and the description is based on the apterous morph.

**Genus Schizaphis Börner**

Figs. 1776–1787

*Schizaphis* Börner, 1931:10.
Type species: *Aphis graminum* Rondani, 1852:9.

**Adult** (Figs. 1776, 1777). Length 1.0–2.5 mm.

Integument: Antenna with smooth imbrications; head and body without sculpturing except for spicules on lateral sclerites and apical abdominal terga; tibiae unsculptured; tarsi with smooth rarely faintly spiculose imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1787): Antennal tubercle weakly but distinctly developed; front of head weakly W-shaped; each frontal tubercle, especially in aptera, usually with small dorsal slightly scabrous papilla. Discal setae pointed or blunt; each side of disc with anterior and posterior group of 2 setae each. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic sutures absent; ventral cephalic sutures vaguely evident posteriad of median ocellus in some species. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1782) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1781) circular, with or without ciliate margins, situated on segments III–V of alata, also on segment III of
Figs. 1776, 1777. Aporia of Schizaphis. 1776, head and prothorax; 1777, terminal abdominal segments.
Figs. 1778–1787. Embryonic chaetotaxy and alata of *Schizaphis*. 1778, right fore wing; 1779, anal plate and gonapophyses; 1780, left fore femur; 1781, second and base of third antennal segments; 1782, base of apical antennal segment; 1783, apical rostral segment; 1784, abdominal spiracle; 1785, dorsal chaetotaxy of embryo; 1786, left hind tarsus; 1787, venter of head.
aptera in some species. Rostrum 4-segmented; apical segment (Fig. 1783) short, conical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae pointed or blunt; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Prothorax usually with a lateral tubercle on each side. Femora (Fig. 1780) with setae pointed; tibial setae mostly pointed, commonly blunt basally and dorsally. Tibiae without gland facets, peglike setae, or rastral spines. Basitarsi (Fig. 1786) triangular, with 2 or 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1778) with normal venation; media usually with 2 in some species 3 branches; branches of cubitus widely separated at base, nearly parallel.

Abdomen: Abdominal setae pointed or blunt, arranged in single in some species 2 irregular transverse rows on each tergum. Abdominal terga not pigmented or fused. Lateral sclerites present in alata. Dorsal abdominal tubercles absent. Lateral abdominal tubercles present on segments II and VII, on segment II lying dorsad of imaginary line drawn between first 2 spiracles. Spiracles (Fig. 1784) with partially sclerotic rims. Siphunculus elongate, subcylindrical, without setae, with smooth or spiculoose imbrications, usually without apical flange, poorly developed where present. Abdominal tergum VIII entire. Cauda blunt, elongate triangular, or tassel-shaped with constriction near base. Anal plate (Fig. 1779) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 1785). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothorax without gland facets; tubercles not evident; each side of abdomen with 1 submedian and 1 lateral seta; pleural setae usually present on some segments; siphunculus short, when visible; basitarsi with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

Economically important species. Schizaphis graminum (Rondani).

Range of plants infested in Canada. Gramineae, Cyperaceae, and Juncus species.

Biology. Species of this genus are monoeciously and holocyclicly associated with the host plants.

Comments. Recognition characters for this genus include the association with the Gramineae and the Cyperaceae, the presence in most species of a single-branched media, the usual presence of a papilla on the dorsal surface of each frontal tubercle, the position of the lateral tubercle on the second abdominal segment relative to the first two spiracles, and the usual absence of an apical flange on the siphunculus. Eastop (1961) provided a key to the species then known.
Genus *Schizolachnus* Mordvilko

*Schizolachnus* Mordvilko, 1909:375.


**Adult** (Figs. 1788, 1789). Length 1.5–4.0 mm.

Integument: Antenna with a few transverse, smooth and commonly weakly spiculose striae; head and body without obvious sculpturing other than in some species spicules on spots where these occur; tibiae without spicules; tarsi smooth or with a few isolated spicules; cauda and anal and genital plates with some spicules.

Head (Fig. 1799): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, scattered over surface of disc, without special arrangement. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic suture present; ventral sutures evident in some species on either side of median ocellus. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis short, with 3–5 apical setae; primary sensoria (Fig. 1794) without ciliate margins; accessory sensoria not fused; secondary sensoria circular, without ciliate margins, present on segment III of alata. Rostrum 4-segmented, with portion distal of preapical primary setae (Fig. 1795) separated from basal part by a colorless membranous area, or commonly also by a suture, forming a fifth segment; segment IV elongate, subconical; part distal of preapical primary setae triangular.

Thorax: Prothoracic setae pointed, long, scattered, with no definite arrangement. Prothoracic lateral tubercles absent. Femora (Fig. 1792) and tibiae with setae short, spikelike to long, slender, hairlike. Tibiae without peglike setae, gland facets, rastral spines, or rastral setae. Basitarsi (Fig. 1798) trapezoidal, with more than 7 ventral setae on each, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae short, setiform. Claws simple. Fore wing (Fig. 1790) with venation reduced; media simple, or branched once, weakly developed in some species; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal setae varying from spikelike to long, fine, hairlike, arranged in 1–4 irregular transverse rows on each tergum. Abdomen without dorsal sclerites or pigmentation other than spots around bases of setae in some species. Abdominal terga not fused. Abdomen without dorsal and lateral tubercles. Spiracles (Fig. 1796) without sclerotic rims. Siphunculus poriform, usually situated on a small setose pigmented mammiform base. Abdominal tergum VIII entire. Abdomen without gland facets. Cauda arc-shaped. Anal plate (Fig. 1791) entire. Gonapophyses 3.
Figs. 1788, 1789. Aptera of *Schizolachnus*. 1788, head and prothorax; 1789, terminal abdominal segments.
Figs. 1790–1799. Embryonic chaetotaxy and alata of *Schizolachnus*. 1790, right fore wing; 1791, anal plate and gonapophyses; 1792, left fore femur; 1793, second and base of third antennal segments; 1794, apical antennal segment; 1795, apical rostral segment; 1796, abdominal spiracle; 1797, dorsal chaetotaxy of embryo; 1798, left hind tarsus; 1799, venter of head.
Embryo (Fig. 1797). Antenna 4-segmented; each side of disc with 2 or 3 anterior and 3–6 posterior setae; each side of pronotum with 1–3 anterior and 3–6 posterior submedian setae and 1 anterior and 1 posterior lateral seta; each abdominal tergum with single transverse row of setae; siphunculus poriform where visible; basitarsi triangular with 2–4 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae tiny, obscure, setiform.

Economically important species. None.

Range of plants infested in Canada. Pinus species.

Biology. Details of the biologies of species of this genus in Canada are not well known. They feed in small, flocculent colonies on the needles of pines and are holocyclicly associated with their host.

Comments. Recognition characters for this genus include the restrictive habit of feeding in flocculent or mealy colonies on pine needles, the absence of dorsal setae on the tarsi, the 6-segmented antennae, the weakly developed mammiform base of the poriform siphunculus, and the rounded cauda.

Genus Sipha Passerini

Figs. 1800–1812

Sipha Passerini, 1860:29.
Type species: Aphis glyceriae Kaltenbach, 1843:113.

Adult (Figs. 1800, 1801). Length 1.0–3.0 mm.

Integument: Antenna with smooth imbrications; head and body without obvious sculpturing or covered with fine or coarse spicules and nodules; tibiae with or without spicules; tarsi usually with at least a few imbrications.

Head (Fig. 1812): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, usually spinelike especially in aptera, arranged in anterior and posterior groups of 2 or more on each side. Eye present; triommatidium distinct in aptera and alata. Ventral sutures evident on either side of median ocellus in some species; dorsal cephalic sutures absent. Disc of head without tubercles or gland facets. Antenna 5-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1807) without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1806) circular, present on segment III, also on IV of alata in some specimens, absent in aptera. Rostrum 4-segmented; apical segment (Fig. 1808) short, conical, more or less triangular or rounded distad of preapical primary setae.

Thorax: Prothoracic setae about same size and shape as discal setae, arranged in more or less well defined anterior and posterior
Figs. 1800–1802. Aptera of *Sipha*. 1800, head and prothorax; 1801, terminal abdominal segments; 1802, cauda.
Figs. 1803–1812. Embryonic chaetotaxy and alata of *Sipha*. 1803, right fore wing; 1804, anal plate and gonapophyses; 1805, left fore femur; 1806, second and base of third antennal segments; 1807, base of apical antennal segment; 1808, apical rostral segment; 1809, abdominal spiracle; 1810, dorsal chaetotaxy of embryo; 1811, left hind tarsus; 1812, venter of head.
submedian and lateral clusters. Prothorax without lateral tubercles. Femora (Fig. 1805) and tibiae with setae pointed. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1811) triangular, each with 4 or 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1803) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent to nearly parallel.

Abdomen: Dorsal abdominal setae pointed, rather thick and spinelike especially in aptera, arranged in 1–3 irregular transverse rows on each tergum. Abdominal terga not fused, with or without pigment. Lateral sclerites present or absent. Dorsal and lateral abdominal tubercles absent. Spiracles (Fig. 1809) with sclerotic rims. Siphunculus short, truncate, without setae, without apical flange, with subapical striae in some species, but without distinct reticulations. Abdominal tergum VIII entire. Cauda knobbed (Fig. 1802) or arc-shaped. Anal plate (Fig. 1804) entire. Abdomen without gland facets. Gonapophyses 4.

**Embryo** (Fig. 1810). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; prothorax without gland facets or tubercles; each side of abdomen with 1 submedian, 1 pleural, and 1 lateral seta on each tergum; siphunculus poriform when evident; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Sipha flava* (Forbes).

**Range of plants infested in Canada.** Gramineae.

**Biology.** Species of this genus are holocyclicly associated with the host plant.

**Comments.** Recognition characters for this genus include its association with the Gramineae, the 5-segmented antennae, the tendency for the dorsal setae to be spinelike especially in the apterae, and the short nonreticulate siphunculi. Richards (1972a) provided a key to, and descriptions of, the Canadian species. Species with an arc-shaped cauda are placed in subgenus *Rungsia* Mimeur.

**Genus Siphonatrophina Swain**

Figs. 1813–1823

*Siphonatrophina* Swain, 1918b:363.
Type species: *Cerosipha cupressi* Swain, 1918a:19.
Figs. 1813, 1814. Aptera of *Siphonatrophia*. 1813, head and prothorax; 1814, terminal abdominal segments.
Figs. 1815–1823. Alata of *Siphonatrophia*. 1815, right fore wing; 1816, anal plate and gonapophyses; 1817, left fore femur; 1818, second and base of third antennal segments; 1819, base of apical antennal segment; 1820, apical rostral segment; 1821, abdominal spiracle; 1822, left hind tarsus; 1823, venter of head.
**Adult** (Figs. 1813, 1814). Length 1.5–3.0 mm.

Integument: Antenna with smooth imbrications; head, body, and tibiae without sculpturing; tarsi with smooth imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1823): Antennal tubercle weakly developed, slightly scabrous in alata in some species. Ventral margin of antennal socket not protuberant. Discal setae pointed, short; each side of disc with anterior and posterior group of 1 or 2 setae each. Ventral cephalic sutures evident ventrad of median ocellus. Dorsal cephalic suture absent. Eye present; triommatidium distinct in aptera and alata. Disc without tubercles or gland facets. Antenna 5- or 6-segmented; processus terminalis elongate without numerous setae; primary sensoria (Fig. 1819) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1818) circular, present on segments III and in some species on IV and V of alata. Rostrum 4-segmented; apical segment (Fig. 1820) subcylindrical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae short, pointed, about same length as discal setae; each side of prothorax with 1 posterior submedian seta and 1 posterior and 1 or 2 anterior lateral setae. Prothorax with or without lateral tubercles. Femora (Fig. 1817) and tibiae with setae pointed, short. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1822) triangular, without dorsal setae; fore and mid basitarsi with 2 or 3 and hind basitarsus with 2 ventral setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1815) with normal venation; media with 2 or 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Abdominal setae pointed, short, arranged in single transverse row on each tergum. Abdomen without dorsal pigment. Lateral sclerites present on some abdominal segments. Dorsal abdominal tubercles absent. Spiracles (Fig. 1821) circular, with sclerotic rims. Siphunculus short, nearly poriform, without setae, without apical flange, with conspicuous ridges or striae. Abdominal tergum VIII entire. Cauda elongate, triangular, blunt. Anal plate (Fig. 1816) entire. Abdomen without gland facets. Gonapophyses 4.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** *Cupressus* and *Juniperus* species.

**Biology.** The single species of this genus, *Siphonatrophia cupressi* (Swain), is holocyclicly associated with the host plant.

**Comments.** Recognition characters for this genus include the associations with *Cupressus* and *Juniperus* and the poriform siphunculi. In life the apterae are strikingly hemispherical in outline.
Genus *Smynthurodes* Westwood

*Smynthurodes* Westwood, 1849:420.
Type species: *Smynthurodes betaee* Westwood, 1849:420.

**Adult** (Figs. 1824, 1825). Length 1.5–3.0 mm.

Integument: Antenna, head, body, tibiae, tarsi, cauda, and anal and genital plates without sculpturing.

Head (Fig. 1834): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae present or absent in aptera, pointed, scattered, without special arrangement. Eye present; triommatidium distinct in aptera and alata. Ventral cephalic sutures absent; dorsal suture present in alata. Disc without tubercles or gland facets. Antenna 6-segmented, in some specimens 5-segmented in aptera; segment II twice as long as segment I; processus terminalis short; without numerous setae; primary sensoria (Fig. 1830) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1829) of alata circular to oval, without ciliates margins, but surrounded by minutely rugulate border on segments III and IV, absent from aptera. Rostrum 4-segmented; apical segment (Fig. 1831) subconical, bluntly pointed distad of preapical primary setae.

Thorax: Prothoracic seta pointed, scattered over dorsal surface, without special arrangement. Prothoracic lateral and dorsal tubercles absent. Femora (Fig. 1828) and tibiae with pointed setae. Tibiae without peglike setae, gland facets, rastal setae, or rastal spines. Basitarsi (Fig. 1833) triangular, each with 4 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitale setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1826) with venation reduced; media unbranched, incomplete or weak basally; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal setae pointed, fine, hairlike, arranged in several irregular rows on each tergum. Abdomen without pigmentation in aptera, with spots around bases of setae or with large pigmented transverse bars in alata. Lateral sclerites absent in aptera, present in alata. Dorsal and lateral abdominal tubercles absent. Spiracles (Fig. 1832) without sclerotic rims, with hinged opercula. Siphunculus absent. Abdominal tergum VIII entire. Cauda short, inconspicuous, arc-shaped. Anal plate (Fig. 1827) strongly sclerotic. Abdomen without gland facets. Gonapophyses 2.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** Not yet assessed in Canada. In Europe, the species that occurs in Canada, *Smynthurodes*
Figs. 1824, 1825. Aptera of Smynthurodes. 1824, head and prothorax; 1825, terminal abdominal segments.
Figs. 1826–1834. Alata of *Smynthurodes*. 1826, right fore wing; 1827, anal plate and gonapophyses; 1828, left fore femur; 1829, second and base of third antennal segments; 1830, apical antennal segment; 1831, apical rostral segment; 1832, abdominal spiracle; 1833, left hind tarsus; 1834, venter of head.
betae Westwood, is known from the roots of many plants. Material studied was from the roots of Vicia faba.

Comments. Recognition characters for this genus include the habit of occurring on the roots of plants, the well-developed eyes in the apterae, the long second antennal segment, the reticulate margins on the antennal sensoria, and the lack of gland facets and integumentary sculpturing.

Genus Stagona Koch

Figs. 1835–1846

Stagona Koch, 1857:284.
Type species: Aphis xylostei DeGeer, 1773:96.

Adult (Figs. 1835, 1836). Length 2.0–3.5 mm.
Integument: Without obvious sculpturing other than some spicules on apical antennal segments and on ventral surfaces of apical tarsal segments.

Head (Fig. 1846): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, hairlike; each side of disc with group of 2–4 anterior and 2–5 posterior setae. Eye absent in aptera; triommatidium present, obscure in some root-feeding apterae. Dorsal cephalic suture present; ventral sutures absent. Disc without tubercles, commonly with small cluster of gland facets near posterior margin in alata at least. Antenna 6-segmented in alata, 5- or 6-segmented in aptera; primary sensoria (Fig. 1841) with ciliate margins; secondary sensoria (Fig. 1840) present only in alata, narrow, transverse, present on segments I–V, with finely nodulose or ciliate margins. Rostrum 4-segmented; apical segment (Fig. 1842) conical. Rostrum vestigial in male and ovipara.

Thorax: Head and prothorax not fused in alata, partially fused in aptera. Prothoracic setae pointed, hairlike; each side of pronotum with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; without gland facets or tubercles. Mesothorax in alata with median pair of gland facets near posterior margin. Femora (Fig. 1839) and tibiae with setae pointed. Tibiae without gland facets, peglike setae, rastral spines; rastral setae present in apterous alienicolae, usually also present in alata. Basitarsi (Fig. 1845) triangular, without dorsal setae in alata, each with 3 setae ventrally in alata, in some species with 2 setae in apterous alienicolae. Distitarsi elongate, without preapical capititate setae. Claws simple. Plantar setae acuminate. Fore wing (Fig. 1837) with venation reduced; stigma narrow, linear; media unbranched, usually evanescent throughout; branches of cubitus approximate at base, strongly divergent.
Figs. 1835, 1836. Aptera of *Stagona*. 1835, head and prothorax; 1836, terminal abdominal segments.
Figs. 1837–1846. Embryonic chaetotaxy and alata of Stagona. 1837, right fore wing; 1838, anal plate and gonapophyses; 1839, left fore femur; 1840, second and base of third antennal segments; 1841, base of apical antennal segment; 1842, apical rostral segment; 1843, abdominal spiracle; 1844, dorsal chaetotaxy of embryo; 1845, left hind tarsus; 1846, venter of head.
Abdomen: Abdominal setae pointed, arranged in 1–3 irregular transverse rows on each tergum. Abdomen without pigment, except a transverse bar present on terga VII and VIII in some species. Lateral abdominal sclerites absent. Lateral and dorsal abdominal tubercles absent. Spiracles (Fig. 1843) circular, with articulated operculum. Siphunculus absent. Abdominal tergum VIII entire, not bifid. Cauda, short, arc-shaped to semicircular. Anal plate (Fig. 1838) entire. Abdomen usually with lateral clusters of gland facets in alata, fundatrix, and alienicolae; dorsal clusters of gland facets present or absent. Gonapophyses 3.

Embryo (Fig. 1844). Antenna 4-segmented; disc with 4 setae on each side, without gland facets; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 or 2 posterior submedian setae, with gland facets around their bases; abdomen with 1 pleural, 1 lateral, and 1 submedian seta on each segment; clusters of gland facets around bases of lateral setae and some submedian setae; basitarsi each with 2 setae; distitarsi without preapical capitate setae; plantar setae acuminate. Embryo of male and of ovipara lacking mouthparts.

Range of plants infested in Canada. Lonicera species. This genus has not been well collected or studied in Canada. Elsewhere in North America the species are known to be associated with Crataegus, Lonicera, Picea, and Pinus.

Biology. All the species are heterocyclic between the aerial parts of Crataegus, Lonicera, Picea, and Pinus and the roots of Picea or Pinus. Sexuales (males and oviparae) are small and have vestigial, nonfunctional mouthparts. Each ovipara lays a single egg.

Comments. Recognition characters for this genus include the host associations, the transverse secondary sensoria, the spicules on the ventral surfaces of the apical tarsal segments, the semicircular or arc-shaped cauda, the presence of rastral setae inapterous alienicolae and alatae, and the small and articulated spiracular opercula. Smith (1974a) provided a key to, and descriptions of, the North American species. This genus is sometimes treated as a subgenus of Prociphilus.

Genus Stegophylla Oestlund

Figs. 1847–1856


Adult (Figs. 1847, 1848). Length 0.5–2.0 mm.
Integument: Without obvious sculpturing other than some spicules on antenna, tarsi, and in some species on cauda and anal plate.

Head (Fig. 1856): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, arranged on each side in anterior and posterior group of 2 each. Eye in aptera divided into a dorsal and ventral group of facets; triommatidium incorporated into eye, not apparent. Dorsal cephalic suture absent; ventral sutures evident on each side and posteriad of median ocellus. Disc without tubercles, with clusters of cribriform pores surrounding base of each setae, at least in aptera. Antenna 6-segmented; processus terminalis short; primary sensoria (Fig. 1852) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1851) circular, without ciliate margins, present on segments III–VI in male; segment II with cribriform disc at least in aptera. Rostrum 4-segmented; apical segment (Fig. 1853) subconical, pointed distad of preapical primary setae.

Thorax: Head and prothorax partially fused in aptera. Prothoracic setae pointed, with each surrounded by cluster of cribriform discs; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 posterior and 2 anterior lateral setae. Prothoracic lateral tubercles absent. Femora (Fig. 1850) and tibiae with pointed setae. Tibiae with rastral setae in alata (male), without peglike setae or rastral spines. Basitarsi (Fig. 1855) triangular, with 3–5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate to narrowly clavate. Claws simple. Fore wing (Fig. 1849) with normal venation; media with 2 branches; branches of cubitus widely separated at base, nearly parallel (based on alate male).

Abdomen: Abdomen without pigmentation or with large lateral and submedian spots in aptera. Dorsal abdominal setae pointed, arranged in single transverse row on each tergum. Lateral sclerites present or absent in aptera and alata. Lateral and dorsal abdominal tubercles absent. Clusters of cribriform discs around bases of dorsal and lateral setae, on segments III or IV–VIII each dorsal and lateral cluster usually consisting of discs of two distinct sizes. Spiracles oval (Fig. 1854). Siphunculus poriform, on a slight mammiform base with pointed setae. Abdominal tergum VIII entire. Cauda arc-shaped. Anal plate entire. Gonapophyses 2, fused in some specimens into a single cluster of setae.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Quercus species.

Biology. Details of this genus are not well known. The species are holocyclicly associated with the host plants. Flocculent colonies develop on the undersurfaces of the leaves. Alatae viviparae are rare; alatae found in colonies are usually males.
Figs. 1847, 1848. Aptera of *Stegophylla*. 1847, head and prothorax; 1848, terminal abdominal segments.
Figs. 1849–1856. Alate male of *Stegophylla*. 1849, right fore wing; 1850, left fore femur; 1851, second and base of third antennal segments; 1852, apical antennal segment; 1853, apical rostral segment; 1854, abdominal spiracle; 1855, left hind tarsus; 1856, venter of head.
Comments. Recognition characters for this genus include the flocculent colonies on the undersurfaces of the leaves of Quercus species. The usual presence of two kinds of cribriform discs on the apical abdominal segments, the rounded cauda, the absence of a bilobate anal plate, and the clusters of cribriform discs on the first two antennal segments and on the bases of the tibiae in the apterae. The characters for alatae given in the description are based on males because no alatae viviparae were studied.

Genus Subsaltusaphis Quednau

Figs. 1857–1868

Subsaltusaphis Quednau, 1953:224.
Type species: Saltusaphis intermedia Hille Ris Lambers, 1939:103.

Adult (Figs. 1857, 1858). Length 1.0–3.0 mm.

Integument: Antenna with spicules; head and body with spicules and nodules; tibiae and tarsi spiculose; cauda and anal plate with spicules.

Head (Fig. 1868): Antennal tubercle undeveloped; front of head strongly convex. Ventral margin of antennal socket not protuberant. Discal setae mostly mushroom-shaped, or mixed with pointed setae in some species. Eye present; triommatidium incorporated into eye, not apparent. Dorsal and ventral cephalic sutures absent. Disc without dorsal tubercles or gland facets. Antenna 6-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 1863) with ciliate or spiculose margins; accessory sensoria not fused; secondary sensoria (Fig. 1862) circular to oval, present on segment III, in some species on IV of alata, with finely spiculose or ciliate margins. Rostrum short, 4-segmented; apical segment (Fig. 1864) short, hemispherical in outline.

Thorax: Head and prothorax not fused in alata, more or less fused in aptera, but limits of both structures still evident. Prothoracic setae mostly mushroom-shaped, with pointed setae intermixed in some species, scattered, without special arrangement. Prothorax without gland facets or dorsal or lateral tubercles. Femora (Fig. 1861) and tibiae with setae pointed, blunt in some species, or rod-shaped basally. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1867) triangular, normally with 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1859) with normal venation; radial sector weakly developed; media with 2 or 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Abdominal setae mostly mushroom-shaped, with many pointed ones intermixed in some species, scattered over surface of each tergum, without special arrangement. First 5 or 6 abdominal
Figs. 1859–1868. Embryonic chaetotaxy and alata of *Subsaltusaphis*. 1859, right fore wing; 1860, anal plate and gonapophyses; 1861, left fore femur; 1862, second and base of third antennal segments; 1863, base of apical antennal segment; 1864, apical rostral segment; 1865, abdominal spiracle; 1866, dorsal chaetotaxy of embryo; 1867, left hind tarsus; 1868, venter of head.

Figs. 1857, 1858. Aptera of *Subsaltusaphis*. 1857, head and prothorax; 1858, terminal abdominal segments.
segments more or less fused in aptera, but margins of segments discernible, not fused in alata. Abdomen without pigment in aptera, with pigmented lateral sclerites present in alata, and with transverse dashes on each tergum usually fused on terga I or II–IV or V forming an irregularly shaped median patch. Dorsal and lateral abdominal tubercles absent. Spiracles (Fig. 1865) without completely sclerotic rims. Siphunculus short, nearly poriform. Abdominal tergum VIII with major setae situated on tubercles, appearing weakly bilobate. Cauda (Fig. 1860) knobbled. Anal plate of both vivipara and ovipara bilobate. Gonapophyses 2.

**Embryo** (Fig. 1866). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of pronotum with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; disc and prothorax without gland facets or tubercles; abdomen with 1 submedian, 1 lateral, and usually 1 pleural seta on each tergum; siphunculus poriform where evident; basitarsi triangular, with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Carex* species.

**Biology.** Little is known of the biology of this genus. All species are monoeciously and holocyclicly associated with the host plant.

**Comments.** Recognition characters for this genus include the association with *Carex*, the knobbled cauda, the mushroom-shaped dorsal and lateral setae, the flabellate plantar setae, the poriform siphunculi, and the weakly bilobate eighth abdominal tergum. Richards (1971) provided a key to, and descriptions of, the species.

**Genus Symydobius Mordvilko**

Figs. 1869–1880

Type species: *Aphis oblonga* von Heyden, 1837:298.

**Adult** (Figs. 1869, 1870). Length 2.5–4.0 mm.

Integument: Antenna mostly with smooth imbrications, in some species a few imbrications with small teeth; head smooth, or with distinct spicules mesally; thorax and abdomen with some spicules or spiculose imbrications evident at least on pigmented regions; tibiae with or without spicules; tarsi with mixture of smooth and spiculose imbrications; cauda and anal and genital plates with spicules.

Head (Fig. 1880): Antennal tubercle poorly developed; front of head weakly concave. Ventral margin of antennal socket not
protuberant. Discal setae pointed, hairlike, or in some species somewhat spinelike in aptera; each side of disc with anterior cluster of 2 or more setae, and usually with distinct transverse cluster of setae near posterior margin. Dorsal cephalic sutures present or absent; ventral sutures usually evident between median ocellus and clypeus. Eye present; triommatidium distinct in aptera and alata; ocelli or vestiges of ocelli commonly present in aptera. Disc of head without gland facets or tubercles. Antenna 6-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 1875) with ciliate or smooth margins; accessory sensoria not fused; secondary sensoria (Fig. 1874) without ciliate margins, circular or oval, present on segment III of aptera and alata. Rostrum 4-segmented; apical segment (Fig. 1876) subconical, bluntly triangular distad of preapical primary setae.

Thorax: Prothoracic setae fine, hairlike, or in some species somewhat spinelike in aptera, arranged in a more or less distinct submedian cluster and a lateral cluster on each side. Prothoracic lateral tubercles absent. Femora (Fig. 1873) and tibiae with setae pointed. Tibiae with rastral setae; without peglike setae, gland facets, or sensoria. Basitarsi (Fig. 1879) triangular, with 5–7 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1871) with normal venation; media with 3 branches; branches of cubitus separated at base, divergent.

Abdomen: Abdominal setae pointed, hairlike or somewhat spinelike in aptera. Abdomen with transverse bars of pigment on each tergum, with bars broken or incomplete in aptera in some species. Lateral abdominal sclerites present or absent in aptera, present in alata, with those on segment II, III, or IV having conical papillae. Dorsal and lateral abdominal tubercles absent. Spiracles (Fig. 1877) circular, without sclerotic rims. Siphunculus short, truncate, without apical flange or setae, with concentric rows of blunt nodules. Abdominal tergum VIII entire. Cauda arc-shaped. Anal plate (Fig. 1872) entire or faintly bilobate. Abdomen without gland facets. Gonapophyses 2, but commonly fused forming single cluster of setae.

Embryo (Fig. 1878). Antenna 4-segmented; each side of disc with 2 anterior and 3–6 posterior setae; each side of pronotum with 2–6 anterior and posterior submedian setae and 1 anterior and 1 posterior lateral seta; disc and pronotum without gland facets or tubercles; each side of abdomen with clusters of 2–4 submedian and lateral setae and 1–4 pleural setae on each segment; basitarsis triangular, each with 2 ventral setae, without dorsal setae; distitarsis elongate, without preapical capitate setae; plantar setae rod-shaped to flabellate.

Economically important species. None.

Range of plants infested in Canada. Betula species.
Figs. 1869, 1870. Aptera of *Symdobia*. 1869, head and prothorax; 1870, terminal abdominal segments.
Figs. 1871–1880. Embryonic chaetotaxy and alata of Symydo
ius. 1871, right fore wing; 1872, anal plate and gonapophyses; 1873, left fore femur; 1874, second and base of third antennal segments; 1875, base of apical antennal segment; 1876, apical rostral segment; 1877, abdominal spiracle; 1878, dorsal chaetotaxy of embryo; 1879, left hind tarsus; 1880, venter of head.
Biology. The species are holocyclicly associated with the host plants. Colonies form on the small branches.

Comments. Recognition characters for this genus include the association with *Betula*, the arc-shaped cauda, the usually weakly bilobate anal plate, the short truncate and nodulose siphunculus, the large transverse and pigmented sclerites on each abdominal tergum, and the presence of secondary sensoria in the apterae. Also distinctive is the tendency for ocelli, or rudiments of lateral ocelli, to be present in the apterae.

Genus *Takecallis* Matsumura

Figs. 1881–1892

Type species: *Takecallis bambusae* Matsumura, 1917:373 = *Callipterus arundicolens* Clarke, 1903:249.

Adult (Figs. 1881, 1882). Length 1.5–3.0 mm.

Integument: Antenna with spicules, and with spiculose and smooth imbrications; head and body mostly without sculpturing except in some species for a few spicules laterally on some terga and in some specimens dorsally on apical terga; tibiae and tarsi spiculose; cauda and anal and genital plates spiculose.

Head (Fig. 1892): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed; each side of disc with 2 anterior and 2 posterior setae. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic suture absent; ventral sutures evident on each side of median ocellus. Disc without dorsal tubercles; some small clusters of wax pores evident on pigmented regions of disc in some specimens. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1887) without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1886) circular to oval, with spiculose or ciliate margins. Rostrum 4-segmented; apical segment (Fig. 1888) short, triangular in outline. Clypeus with prominent saclike protuberance.

Thorax: Prothoracic setae pointed; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta. Clusters of gland facets evident around base of prothoracic setae in some specimens. Fore coxa enlarged. Femora (Fig. 1885) and tibiae with setae pointed. Tibiae with rastral setae, without peglike setae, or gland facets. Basitarsi (Fig. 1891) trapezoidal, with 5–7 ventral and 2 dorsal setae. Distitarsi without preapical capitate setae. Claws

Figs. 1881, 1882. Alata of *Takecallis*. 1881, head and prothorax; 1882, abdominal segments.

646
Figs. 1883–1892. Embryonic chaetotaxy and alata of *Takecallis*. 1883, right fore wing; 1884, anal plate and gonapophyses; 1885, left fore femur; 1886, second and base of third antennal segments; 1887, primary sensoria on apical antennal segment; 1888, apical rostral segment; 1889, abdominal spiracle; 1890, dorsal chaetotaxy of embryo; 1891, left hind tarsus; 1892, venter of head.
simple. Plantar setae spatulate. Fore wing (Fig. 1883) with normal venation; media with 3 branches; branches of cubitus widely separated at base.

Abdomen: Abdominal terga not fused, in some specimens with pair of submedian or median spots on each tergum. Abdominal setae pointed; each side of each tergum with 1 submedian seta, on tergum VII seta farther from midline than setae on other terga. Lateral abdominal sclerites absent; segments II–IV or V with lateral conical papillae. Abdomen without dorsal and lateral sclerites. Spiracles (Fig. 1889) without sclerotic rims. Siphunculus short, truncate, without apical flange, smooth, with 1 seta appended to its base on posterior surface. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 1884) bilobate in vivipara; entire in ovipara. Abdomen mostly without gland facets, in some specimens with clusters of pores evident on pigmented regions. Gonapophyses 2.

**Embryo** (Fig. 1890). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior capitate setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 posterior lateral seta; all prothoracic setae capitate; each side of abdomen with 1 submedian and 1 lateral seta on each tergum, with submedian setae on terga V and VII situated much closer together than other submedian setae, and with all dorsal and lateral abdominal setae capitate, large; basitarsi triangular, each with 2 ventral setae, without dorsal setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** Bamboolike grasses (Gramineae) in B.C.

**Biology.** Details are unknown.

**Comments.** Recognition characters for this genus include the associations with bamboo and related grasses, the saclike protuberance on the clypeus, the knobbed cauda, the bilobate anal plate, and the laterally displaced submedian setae. Although of Asiatic origin, three species occur in North America; two of these, *Takecallis arundinariae* (Essig) and *T. arundicolens* (Clarke), have been collected in British Columbia.

**Genus Tamalia Baker**

Figs. 1893–1904

Type species: *Pemphigus coweni* Cockerell, 1905:392.
Adult (Figs. 1893, 1894). Length 1.5–3.0 mm.

Integument: Head, body, and appendages in aptera spiculose; alata similar, but with spicules reduced or absent from much of head and body; cauda and anal and genital plates with spicules.

Head (Fig. 1904): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, or blunt, scattered, without special arrangement. Eye absent in aptera; triommatidium present. Ventral cephalic sutures absent; dorsal suture evident in some specimens. Disc without tubercles or gland facets. Antenna 4-segmented in aptera, 6-segmented in alata; processus terminalis short, without numerous setae; primary sensoria (Fig. 1899) with or without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1898) circular or oval, present on segments III–IV of alata. Rostrum 4-segmented; apical segment (Fig. 1900) subconical, spiculose on posterior surface.

Thorax: Head and prothorax not fused in alata, at least partially fused in aptera. Prothoracic setae pointed, scattered, without special arrangement. Prothoracic lateral tubercles absent. Femora (Fig. 1897) and tibiae with setae pointed. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1903) triangular; aptera with 2 ventral setae, without dorsal setae; alata with 7 ventral and 2 dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate or weakly capitate. Claws simple. Fore wing (Fig. 1895) with normal venation; media with 3 branches; branches of cubitus approximate at base, strongly divergent.

Abdomen: Abdominal terga not fused, without pigment, or with pigment forming spots or dashes or completely pigmented terga. Abdominal setae pointed, arranged in one to several irregular transverse rows on each tergum. Dorsal and lateral abdominal tubercles absent. Spiracles (Fig. 1901) without sclerotic margins, with small hinged operculum usually evident. Siphunculus absent in fundatrix in a few specimens, virtually poriform, usually surrounded by setae, but these absent in fundatrix in some specimens. Abdominal tergum VIII entire. Cauda arc-shaped, commonly with single row of reticulations along ventral anterior margin. Anal plate (Fig. 1896) entire, with 1 or 2 rows of reticulations along posterior margin. Abdomen without gland facets, except for large glandular area partly surrounding and ventrad of siphunculus in alata ovipara. Gonapophyses 2 or 4.

Embryo (Fig. 1902). Antenna 4-segmented; each side of disc of head with 2–5 anterior and 2 posterior setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; disc and pronotum without gland facets or tubercles; each side of abdomen with 1 submedian and 1 lateral seta on each tergum, also with 1 pleural seta on some apical terga; basitarsi triangular, each with 2 setae faintly capitate ventrally in some specimens; distitarsi elongate without preapical capitate setae; plantar setae spatulate.
Figs. 1893, 1894. Aptera of *Tamalia*. 1893, head and prothorax; 1894, terminal abdominal segments.
Figs. 1895–1904. Embryonic chaetotaxy and alata of *Tamalia*. 1895, right fore wing; 1896, anal plate and gonapophyses; 1897, left fore femur; 1898, second and base of third antennal segments; 1899, apical antennal segment; 1900, apical rostral segment; 1901, abdominal spiracle; 1902, dorsal chaetotaxy of embryo; 1903, left hind tarsus; 1904, venter of head.
Economically important species. None.

Range of plants infested in Canada. *Arctostaphylos* species.

Biology. Species are monoeciously and holocyclicly associated with the host plant. Colonies live in a podlike pseudogall formed from a folded leaf, which usually turns reddish when the gall is mature and the alatae are leaving. Oviparae and males are both winged.

Comments. Recognition characters for this genus include the associations with *Arctostaphylos*, and the podlike leaf galls, the reticulations on the cauda and anal plate, the poriform siphunculi, the 4-segmented antennae in the fundatrices, the abundance of spicules in the apterae, and the presence of winged oviparae. Four species of this Nearctic genus are known. One of these, *Tamalia coueni* (Cockerell), occurs in Canada. The other two occur on manzanita in southwestern United States and northern Mexico. Richards (1967a) provided a key to, and descriptions of, the three species known to him.

Genus *Tetraneura* Hartig

*Figs. 1905–1916*

*Tetraneura* Hartig, 1841:366.
Type species: *Aphis ulmi* Linnaeus, 1758:451.

Adult (Figs. 1905, 1906). Length 1.5–3.0 mm.

Integument: Antenna with spicules on distal segments and forming dense annuli on ultimate segment of alata; head and body without obvious sculpturing; tarsi of alata with annuli of dense long spicules, of aptera smooth or spiculose; tibia of alata spiculose apically.

Head (Fig. 1916): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae short. Eye present in alata, absent in aptera; triommatidium present. Dorsal and ventral cephalic sutures absent. Disc of aptera with gland facets arranged as small facets around a larger central facet; ventral surface with a pair of larger clusters with small facets forming a ring around central facet; alata with 1 or 2 isolated discal facets in some species, and with a ventral pair of large wax plates between the antennal socket and clypeus, commonly fused with base of antennal socket. Antenna 6-segmented in alata, with segment V longer than IV or VI, commonly longer than both together, in aptera 3- to 6-segmented, with various degrees of fusion; processus terminalis short, without numerous setae; primary sensoria subcircular in aptera, variously shaped in alata (Fig. 1911), without ciliate margins; secondary sensoria of alata (Fig. 1910) annular, on
segments III to IV, absent in aptera. Rostrum 4-segmented; apical segment (Fig. 1912) conical, rounded distad of preapical primary setae.

Thorax: Pronotum of alata concealing mesonotum. Prothorax of aptera with 1–3 pairs of short submedian setae and 1–2 pairs of short lateral setae. Tubercles absent. Mesonotum and metanotum of alata usually with pair of submedian clusters of uniform wax gland facets; aptera with dorsal and ventrolateral clusters of small facets around large central facet on each thoracic segment (ventrolateral clusters better-developed, in the form of rings). Femora (Fig. 1909) and tibiae with pointed setae. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1915) triangular in alata, each with 2 ventral setae, without dorsal setae. Distitarsi of alata elongate, of aptera with tarsal segments fused, appearing one-segmented. Plantar setae acuminated setiform. Claws simple. Fore wing (Fig. 1907) with reduced venation; media unbranched; branches of cubitus narrowly separated at base, diverging.

Abdomen: Setae mostly short, long on segment VIII and cauda. Tubercles absent. Segments I–VII of aptera each with a submedian, a dorsolateral, and a ventrolateral pair of wax gland clusters, with each cluster consisting of a complete or incomplete ring of small facets around a central larger facet; ventrolateral clusters larger, with those on segments VII and VIII more developed than those on I–VI; wax gland clusters of alata ringlike or composed of uniform facets, usually obscure, commonly present laterally only, or entirely absent. Spiracles (Fig. 1913) without sclerotic rims. Siphunculus short, nearly poriform, with a narrow flange, in aptera surrounded by narrow sclerite with a few minute setae, usually absent in spring migrants of some species. Abdominal tergum VIII entire. Cauda arc-shaped. Anal plate (Fig. 1908) entire, exceeding cauda. Gonapophyses 2, commonly not distinctly separate in alata.

Embryo (Fig. 1914). Antenna 4-segmented; each side of disc with 2 or 3 anterior and 2 or 3 posterior setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; head, thoracic segments, and abdomen with ring-shaped clusters of wax gland facets; each side of each abdominal tergum with 1 submedian, 1 dorsolateral, and 1 lateral seta; tarsal segments fused, with preapical capitular setae; plantar setae acuminated or capitate. Several species in other regions with a few to many supernumerary setae.

Economically important species. None.


Biology. Species in this genus are heterocyclic between elms and grass roots. An elongate baglike gall is produced on the leaves of elm.
Figs. 1907–1916. Embryonic chaetotaxy and alata of *Tetraneura*. 1907, right fore wing; 1908, anal plate and gonapophyses; 1909, left fore femur; 1910, second and base of third antennal segments; 1911, apical antennal segment; 1912, apical rostral segment; 1913, abdominal spiracle; 1914, dorsal chaetotaxy of embryo; 1915, left hind tarsus; 1916, venter of head.
Comments. Members of this genus may be recognized by the formation of elongate galls on elm, the association with the roots of grasses, the long fifth antennal segment and annular secondary sensoria of the alatae, the one-segmented tarsi of the apterae, and the rounded central area of the ring-shaped wax gland clusters. Hille Ris Lambers (1970) provided keys to, and descriptions of, the world fauna.

Genus *Thecabius* Koch

Figs. 1917–1928


Adult (Figs. 1917, 1918). Length 2.5–4.0 mm.
Integument: Antenna in aptera with spicules, in alata with some smooth imbrications on segments V and VI, usually without spicules; head, body, and tibiae without sculpturing; tarsi with spicules; cauda and anal plate with or without a few dispersed spicules; genital plate usually with a few spicules or spiculose imbrications.

Head (Fig. 1928): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, arranged in lateral clusters of variable number. Ventral cephalic sutures absent; dorsal cephalic suture usually present at least as pigmented line. Disc in some species with a cluster of contiguous gland facets on each side, without tubercles. Eye present in alata, absent in aptera; triommatidium present. Antenna 6-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 1923) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1922) oval to strongly annular, without ciliate margins, present on segments III–VI of alata. Rostrum 4-segmented; apical segment (Fig. 1924) subconical, triangular distad of preapical primary setae.

Thorax: Head and prothorax fused in aptera, not fused in alata. Prothorax with pointed setae; each side of prothorax with 0 or 1 anterior and 1–3 posterior submedian setae and 1–4 anterior and 1 posterior lateral seta. Gland facets usually present around at least posterior submedian and posterior lateral setae. Prothoracic lateral tubercles absent. Mesothorax in alata with a pair of median clusters of gland facets. Femora (Fig. 1921) and tibiae with setae pointed. Tibiae without gland facets, sensoria, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1927) triangular, each with 5–7 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1919) with venation reduced; media unbranched, weakly developed; branches of cubitus narrowly separated at base, strongly divergent.
Figs. 1917, 1918. Aptera of *Thecabius*. 1917, head and prothorax; 1918, terminal abdominal segments.
Figs. 1919–1928. Embryonic chaetotaxy and alata of *Thecabius*. 1919, right fore wing; 1920, anal plate and gonapophyses; 1921, left fore femur; 1922, second and base of third antennal segments; 1923, apical antennal segment; 1924, apical rostral segment; 1925, abdominal spiracle; 1926, dorsal chaetotaxy of embryo; 1927, left hind tarsus; 1928, venter of head.
Abdomen: Abdominal setae pointed, arranged in single transverse row on each tergum, small, inconspicuous, sparse. Abdominal terga not fused, without pigment. Lateral sclerites and lateral and dorsal tubercles absent. Spiracles (Fig. 1925) without sclerotic rims, with hinged opercula. Siphunculus absent. Abdominal tergum VIII entire. Terga usually with submedian and lateral clusters of gland facets, but commonly with these absent on some segments, especially in alata. Cauda arc-shaped. Anal plate (Fig. 1920) entire. Gonapophyses 2 or 3.

Embryo (Fig. 1926). Antenna 5-segmented; each side of disc of head with 2 or 3 anterior and 2 or 3 posterior setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; clusters of gland facets associated with at least some discal and prothoracic setae; each side of abdomen with 1 submedian, 1 pleural, and 1 lateral seta on each tergum; basitarsi triangular, each with 2 ventral setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

Economically important species. None.

Range of plants infested in Canada. Populus species and roots of Ranunculus species.

Biology. Details of the biology of the species in Canada are poorly understood. Presumably all are heterocyclic between Populus and the roots of herbaceous plants such as Ranunculus. On Populus, the fundatrices produce small, individual pseudogalls. Their progeny live either in pseudogalls produced by the downward-folding of the leaf along the midrib, or in a series of reddish moniliform galls along the margins of the leaves.

Comments. Recognition characters for this genus include the association with Populus, the characteristic galls and pseudogalls produced, the absence of siphunculi, the narrow annular sensoria in the alatae, the spicules on the tarsi, the unbranched media, and the association of the alienicoleae with the roots of Ranunculus. Two of the three North American species are in subgenus Parathecabius Börner. Smith (1974a) provided a key to, and descriptions of, the North American species (with Parathecabius considered as a separate genus).

Genus Thelaxes Westwood

Figs. 1929–1940

Thelaxes Westwood, 1840:118.
Type species: Thelaxes quercicola Westwood, 1840:118 = Aphis dryophila Schrank, 1801:113.
**Adult** (Figs. 1929, 1930). Length 1.5–3.0 mm.

Integument: Antenna with spicules; head and body without obvious sculpturing, except in some specimens for a few dispersed nodules and spiculose imbrications on apical abdominal terga; tibiae and tarsi with spicules.

Head (Fig. 1940): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae in aptera short, spinelike, with most occurring laterally and anteriorly, usually with a median pair, similar in alata, but at least posterior setae commonly fine, hairlike. Eye present in alata, absent in aptera; triommatidium present. Dorsal cephalic suture absent, or represented by streak of pigment in alata; ventral cephalic sutures absent. Disc without gland facets or tubercles. Antenna 5-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 1935) mostly with ciliate margins; secondary sensoria circular, usually present on segment III of alata, without ciliate margins, absent in aptera. Rostrum 4-segmented; apical segment (Fig. 1936) narrow, conical, long and tapered distad of preapical primary setae.

Thorax: Head and prothorax fused in aptera, not fused in alata. Prothoracic setae short, spinelike in aptera, similar in alata, but with some fine hairlike setae laterally; each side with 1 anterior and 1 posterior submedian seta and 1 posterior and 1–3 anterior lateral setae. Prothoracic lateral tubercles present. Femora (Fig. 1933) and tibiae with setae pointed. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 1939) triangular, each with 5–7 ventral setae, without dorsal setae. Distitarsi elongate, each with 1 or 2 weakly capitate preapical setae. Plantar setae nearly setiform, weakly capitate. Claws simple. Fore wing (Fig. 1931) with normal venation; media with 2 branches; branches of cubitus separated at base, nearly parallel, somewhat divergent near wing margin.

Abdomen: Abdominal setae mostly short, spinelike in aptera, mostly fine, hairlike in alata, arranged in single transverse row on each tergum. Abdominal terga I–VI more or less fused in aptera, pigmentation variable, ranging from completely pigmented to without pigment; pigmentation variable in alata, ranging from no pigment to large median areas of pigment. Dorsal tubercles absent. Lateral abdominal tubercles present on segments II–VII. Lateral sclerites present or absent in aptera, fused with dorsal pigmented areas where present. Spiracles (Fig. 1937) without sclerotic rims. Siphunculus short, nearly poriform, without apical flange, surrounded by setae. Abdominal tergum VIII not bilobate. Cauda knobbed. Anal plate (Fig. 1932) entire. Abdomen without gland facets, but spinelike setae glandular, secreting filaments of wax apically when alive. Gonapophyses 2.

**Embryo** (Fig. 1938). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of prothorax with 1
Figs. 1929, 1930. Aptera of *Thelaxes*. 1929, head and prothorax; 1930, terminal abdominal segments.
Figs. 1931–1940. Embryonic chaetotaxy and alata of *Thelaxes*. 1931, right fore wing; 1932, anal plate and gonapophyses; 1933, left fore femur; 1934, second and base of third antennal segments; 1935, apical antennal segment; 1936, apical rostral segment; 1937, abdominal spiracle; 1938, dorsal chaetotaxy of embryo; 1939, left hind tarsus; 1940, venter of head.
anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; head, prothorax, and abdomen without gland facets; each side of abdomen with 1 submedian and 1 lateral seta on each tergum, and usually also with 1 pleural seta; all setae short, spinelike; basitarsi triangular, each with 2 ventral setae, without dorsal setae; distitarsi elongate, with 1 or 2 weakly capitate preapical setae; plantar setae weakly capitate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Quercus* species.

**Biology.** Details are not well known, but species of this genus are holocyclicly associated with the host plant. They feed on the undersurfaces of leaves and, to some extent, on the apical twigs of the host.

**Comments.** Recognition characters for this genus include the association with *Quercus*, the long and almost needlelike apical rostral segment, the virtually poriform siphunculi, the knobbed cauda, the entire anal plate, the weakly capitate setiform plantar setae, the weakly capitate preapical setae on the distitarsi, the 5-segmented antenna, absence of eyes in the apterae, and the presence of wax-secreting short and spinelike dorsal setae especially in the apterae. Only one [*Thelaxes californica* (Davidson)] of the three known species has been collected in Canada.

Genus *Therioaphis* Walker

Figs. 1941–1952

Type species: *Aphis ononidis* Kaltenbach, 1846:773.

**Adult** (Figs. 1941, 1942). Length 1.5–3.0 mm.

Integument: Antenna with spicules; head and body without obvious sculpturing other than some dispersed spicules usually only evident on lateral sclerites and dorsal pigmented spots on some abdominal terga; lateral sclerite of abdominal segment II with scalelike sculpturing; tibiae and tarsi with spicules.

Head (Fig. 1952): Antennal tubercle undeveloped, or weakly developed; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae weakly to strongly capitate; each side of disc with 2 anterior and 2 posterior setae. Eye present; triommatidium distinct in aptera and alata. Ventral and dorsal cephalic sutures absent. Disc without tubercles or gland facets. Antenna 6-segmented, aberrantly 5-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 1947) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig.
1946) circular to oval, without ciliate margins, but partially or completely surrounded by single row of spicules, present on segment III, aberrantly also on IV of alata. Rostrum 4-segmented; apical segment (Fig. 1948) short, subcylindrical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae mostly weakly to strongly capitate, in some species pointed in alata. Fore coxa enlarged. Femora (Fig. 1945) with setae pointed; tibiae with mixture of capitate and pointed hairlike setae; capitate setae mostly confined to basal half of each tibia. Tibiae without peglike setae, gland facets, or rastral spines; rastral setae present in alata, also present in aptera, but commonly much less prominent. Basitarsi (Fig. 1951) triangular, each with 5–7 ventral and usually 2 dorsal setae; dorsal setae absent in aptera in some species. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1943) with normal venation; media with 3 branches; branches of cubitus separated at base.

Abdomen: Abdominal setae capitate, short in alata, mostly long, conspicuous in aptera. Abdominal terga not fused, with pigmented sclerotic plates or spots around bases of most dorsal setae. Setae arranged in single irregular transverse row on each tergum, or consisting of only a submedian pair of setae on each tergum. Lateral sclerites usually present, with a conical papilla on segments II–V, at least in alata. Dorsal abdominal tubercles absent. Lateral abdominal tubercles present or absent, where present consisting of only flat transparent area in lateral sclerites. Spiracles (Fig. 1949) without sclerotic rims, with a pigmented or membranous hinged operculum in some species. Siphunculus short, truncate, without apical flange or setae, usually with at least a few spicules or weakly spiculose imbrications. Abdominal tergum VIII entire. Cauda with an oval to elongate knob. Anal plate (Fig. 1944) strongly bilobate in vivipara; entire in ovipara. Abdomen without gland facets. Gonapophyses 2.

**Embryo** (Fig. 1950). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of prothorax with 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; each side of abdomen with 1 submedian seta on terga V and VII much farther apart than other pairs of submedian setae; siphunculus poriform where evident; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical capitate setae; plantar setae spatulate.

**Economically important species.** Not assessed in Canada.

**Range of plants infested in Canada.** Species of *Medicago*, *Melilotus*, and *Trifolium*.

**Biology.** All species are holocyclicly associated with the host plant.
Figs. 1943–1952. Embryonic chaetotaxy and alata of *Therioaphis*. 1943, right fore wing; 1944, anal plate and gonapophyses; 1945, left fore femur; 1946, second and base of third antennal segments; 1947, base of apical antennal segment; 1948, apical rostral segment; 1949, abdominal spiracle; 1950, dorsal chaetotaxy of embryo; 1951, left hind tarsus; 1952, venter of head.

Figs. 1941, 1942. Aptera of *Therioaphis*. 1941, head and prothorax; 1942, terminal abdominal segments.
Comments. Recognition characters for this genus include the host associations, the yellowish body color when alive, the knobbed cauda, the bilobate anal plate, the presence of rastral setae, the large pigmented spots surrounding the dorsal and lateral setae, and the arrangement of the dorsal abdominal setae in the embryo. In the embryo the pairs of submedian setae on abdominal terga V and VII are placed much further apart than are other pairs of submedian setae. Richards (1965) provided a key to, and descriptions of, the species.

Genus *Thripsaphis* Gillette

*Figs. 1953–1964*

Type species: *Brachycolus ballii* Gillette, 1908:67.

Adult (Figs. 1953, 1954). Length 1.0–3.0 mm.

Integument: Antenna with spicules and smooth weakly developed imbrications; head and body with dispersed spicules and nodules; tibiae and tarsi with spicules; cauda and anal and genital plates with spicules.

Head (Fig. 1964): Antennal tubercle undeveloped; front of head convex, or with large quadrature median tubercle. Ventral margin of antennal socket not protuberant. Discal setae pointed, hairlike or slightly spinelike, scattered, without special arrangement. Eye not or weakly stalked, partially divided into dorsal and ventral clusters of facets; triommatidium incorporated into eye, not evident. Ventral and dorsal cephalic sutures absent. Disc without tubercles or gland facets. Antenna 5- or 6-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 1959) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 1958) circular, at least some with ciliate or spiculose margins, present only on segment III and IV in alata vivipara. Rostrum 4-segmented; apical segment (Fig. 1960) short, triangular to hemispherical in outline.

Thorax: Head and prothorax partially fused in aptera in some species, but with margins of both evident. Prothoracic setae short, pointed, hairlike, scattered, without special arrangement. Prothoracic lateral tubercles absent. Femora (Fig. 1957) and tibiae with setae pointed, fine, hairlike or short, almost spinelike. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1963) triangular, each with 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate or acuminate. Claws simple. Fore wing (Fig. 1955) with normal venation; media with 3 branches; branches of cubitus separated at base, strongly divergent.

Abdomen: Abdominal segments usually not fused; each tergum with a transverse pigmented sclerotic bar, or with spots of various
sizes; one species with terga II–VI fused into a carapace. Abdominal setae pointed, long, hairlike or short, spinelike, scattered over each tergum, without special arrangement. Abdomen with lateral sclerites in both aptera and alata, tiny in some species; tergites of one species fused into a carapace. Abdomen without dorsal and lateral tubercles. Spiracles (Fig. 1961) with nearly complete sclerotic rims. Siphunculus short, virtually poriform (short tubular in one species), surrounded by setae. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 1956) of both vivipara and ovipara bilobate. Abdomen without definite gland facets, but minute scattered glandular pores evident in some species. Gonapophyses 2.

**Embryo** (Fig. 1962). Antenna 4-segmented; each side of disc with 2–4 anterior and 2–5 posterior setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1–3 anterior and 1–3 posterior lateral setae; abdominal segments each with 1 submedian and 1 lateral seta, and with 1 small pleural seta present on at least some terga; siphunculus poriform where evident; basitarsi each with 2 ventral setae; distitarsi without preapical capitate setae; plantar setae spatulate or acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** Carex species.

**Biology.** Details are not well known, but all species are monoeciously and holocyclicly associated with the host plants.

**Comments.** Recognition characters for the genus include the association with Carex, the knobbed cauda, the spatulate plantar setae, the absence of modifications on the eighth abdominal tergum, the bilobate anal plate, and the elongate narrow thripslike shape. All species are generally bluish pruinose when alive.

This genus includes subgenera (sometimes treated as genera) Trichocallis Börner, which has acuminate plantar setae, Peltaphis Frison & Ross, which has abdominal tergites II to VI fused into a carapace, and Allaphis Mordvilko, which has a large number of secondary antennal sensoria and distinct wax-gland facets (lacking in Thripsaphis in the strict sense). Richards (1971) provided a key to, and descriptions of, the species (as Allaphis, Peltaphis, Thripsaphis, and Trichocallis).

**Genus Tiliphagus Smith**

Figs. 1965–1975

*Tiliphagus* Smith, 1965:783.

Type species: *Tiliphagus lycoposugus* Smith, 1965:783.

**Adult** (Figs. 1965, 1966). Length 2.0–3.0 mm.
Integument: Apical antennal segment with spiculose imbrications; head and body without obvious sculpturing; tibiae and tarsi without sculpturing; cauda and anal and genital plates smooth, or with a few dispersed fine spicules.

Head (Fig. 1975): Antennal tubercle undeveloped; front of head weakly convex. Ventral margin of antennal socket not protuberant. Discal setae short, pointed, inconspicuous; each side of disc with 4–6 anterior and 2–4 posterior setae. Dorsal cephalic suture present; ventral sutures not evident except around median ocellus. Eye present or absent in aptera; triommatidium present. Disc without dorsal tubercles or gland facets. Antenna 6-segmented; processus terminalis short, tuberclelike; primary sensoria (Fig. 1971) with ciliate margins, relatively large, irregular in outline; accessory sensoria not fused, or incorporated with the primary sensorium in some specimens; secondary sensoria (Fig. 1970) with ciliate margins, consisting of scattered short transverse slightly arched slitlike openings, present on segments III–V. Rostrum 4-segmented; apex of apical segment demarcated by a pale area in some specimens; apical segment (Fig. 1972) elongate, subconical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae fine, pointed, hairlike, arranged in submedian and lateral clusters on each side. Femora (Fig. 1969) with setae short, pointed; tibial setae pointed, with longest not longer than apical diameter of respective tibia. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 1974) triangular, each with 4 or 5 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae accumulate. Claws simple. Fore wing (Fig. 1967) with venation reduced; stigma quadrate; media unbranched, incomplete basally; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal setae pointed, mostly short, inconspicuous, arranged in single transverse row on each tergum. Abdominal terga not fused, without pigment except for faint dash on tergum VIII in some specimens. Dorsal and lateral abdominal tubercles absent. Abdomen without lateral sclerites. Spiracles (Fig. 1973) circular, without sclerotic rims. Siphunculus absent. Abdominal tergum VIII entire. Cauda short, nearly arc-shaped. Anal plate (Fig. 1968) entire. Abdomen with or without clusters of emarginate gland facets dorsolaterally on segments II–VII, and commonly also submedially on each tergum; some lateral glandular clusters with a large circular modified glandular area attached to mesal margin. Gonapophyses 3, partly fused forming transverse cluster of setae.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. None. It is known from *Tilia* in eastern United States, so probably occurs on species of *Tilia* in eastern Canada.
**Biology.** The only known species, *Tiliphagus lycopsosugus* Smith, is heterocyclic between *Tilia* species and the roots of Labiatae. On *Tilia* it produces a pseudogall consisting of rosette of modified leaves.

**Comments.** Recognition characters for this genus include the characteristic pseudogall formed on *Tilia*, the presence of clusters of contiguous emarginate wax pores not arranged around a central nonglandular area, and the numerous narrow and arched secondary antennal sensoria.

**Genus *Tinocallis* Matsumura**

Figs. 1976–1987

*Tinocallis* Matsumura, 1919:100.


**Adult** (Figs. 1976, 1977). Length 1.0–3.0 mm.

Integument: Antenna with spicules; head and body commonly with spicules laterally and on lateral pigmented regions of abdomen; tibiae, tarsi, cauda, and anal and genital plates spiculose.

Head (Fig. 1987): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae short, pointed, or blunt in some species; each side of disc with 2 anterior and 2 posterior setae; anterior setae commonly and posterior setae less commonly on conical papillae. Eye present; triommatidium distinct in aptera and alata. Ventral and dorsal cephalic sutures present. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 1982) with ciliate margins; secondary sensoria (Fig. 1981) oval, without ciliate margins, but encircled by sharp spicules in some species. Rostrum 4-segmented; apical segment (Fig. 1983) subconical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae similar in size and shape to discal setae; each side of prothorax with 1 anterior and 1 posterior submedian seta commonly on conical or fingerlike papillae. Prothoracic lateral tubercles absent. Mesothorax commonly with a pair of median conical papillae. Femora (Fig. 1980) with pointed setae; tibial setae pointed, blunt basally and dorsally in some species. Tibiae with rastral setae, without peglike setae, or gland facets. Basitarsi (Fig. 1986) triangular, each with 5–7 ventral and 2 dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae spatulate. Claws simple. Fore wing (Fig. 1978) with normal venation; radial sector weakly developed or lacking; media with 3 branches; branches of cubitus widely separated at base, slightly divergent, almost parallel.

Abdomen: Abdominal setae short, blunt or pointed, usually arranged on each side in single submedian and lateral row; submedian...

setae duplicated in some species, on segments I–III located on short or conspicuous papillae, on segments III, V, and VII placed further apart than other pairs of submedian setae. Abdominal segments not fused, colorless or in some species with large pigmented spots associated with submedian and lateral setae, with some spots coalescing. Dorsal and lateral abdominal tubercles absent. Lateral sclerites on segments II–V with large or small conical papillae. Spiracles (Fig. 1984) with sclerotic rims. Siphunculus short, truncate, without apical flange, smooth or nearly so. Lateral seta of abdominal segment VI appended to flared base in some species. Abdominal tergum VIII entire. Cauda knobbed. Anal plate (Fig. 1979) bilobate in vivipara, entire in ovipara. Abdominal gland facets evident in some species on pigmented spots and consisting of clusters of minute pores. Gonapophyses 2.

**Embryo** (Fig. 1985). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of prothorax with 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; each side of abdomen with 1 submedian and 1 lateral seta on each tergum; pairs of submedian setae on terga III, V, and VII situated much farther apart than other pairs; siphunculus poriform where evident; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without apical capitate setae; plantar setae spatulate.

**Economically important species.** None.

**Range of plants infested in Canada.** *Ulmus* species.

**Biology.** All species are holocyclically associated with the host, where they feed on the undersurfaces of the leaves. Apterous viviparae are not produced.

**Comments.** Recognition characters for this genus include the following: the association with *Ulmus*; the relatively greater distance between the submedian setae on abdominal terga III, V, and VII in all stages including the embryo; the flabellate plantar setae; the tendency for dorsal setae on the prothorax, mesothorax, and the anterior few abdominal terga to be situated on small or conspicuous papillae; the single pair of lateral seta on each abdominal segment; and the tendency for the secondary sensoria to be somewhat oval. Richards (1965, 1967b) provided a key to, and descriptions of, the species.

**Genus Toxoptera Koch**

Figs. 1988–2000

*Toxoptera* Koch, 1856:253.
**Adult** (Figs. 1988, 1989). Length 1.0–3.0 mm.

Integument: Antenna with smooth imbrications; head mostly smooth; thorax of alata unsulptured, aptera with distinct reticulations and transverse rugulose imbrications; abdomen of some specimens with weakly nodulose imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 2000): Antennal tubercle slightly developed; median tubercle usually slightly developed. Ventral margin on antennal socket not protuberant. Discal setae pointed, fine, hairlike; each side of disc with 2 anterior and 2 posterior setae. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic sutures absent; ventral sutures evident on each side of median ocellus and between median ocellus and anterior margin of clypeus. Disc without tubercles or gland facets. Antenna 6-segmented; primary sensoria (Fig. 1995) obscurly ciliate; secondary sensoria round, on segment III of alata (Fig. 1994), absent from aptera. Rostrum 4-segmented; apical segment (Fig. 1996) conical, pointed distad of preapical primary setae.

Thorax: Each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax without gland facets or tubercles. Femora (Fig. 1993) and tibiae with pointed setae. Tibiae without gland facets, rastral setae, or rastral spines; hind tibia (Figs. 1990) with single longitudinal row of peglike setae. Basitarsi (Fig. 1999) triangular, without dorsal setae; fore and mid basitarsi with 3 ventral setae; hind basitarsus with 2 (rarely 3) ventral setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 1991) with normal venation; posterior margin of stigma almost straight; media usually with 2 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Abdominal segments not fused, without pigment except on terga VII and VIII. Setae pointed, arranged in single transverse row on each tergum. Abdomen without dorsal tubercles; lateral tubercles present on segments II and VII. Lateral sclerites absent except in area posterior of base of siphunculus. Sternites V and VI of aptera with ventrolateral patches of sclerotic ridges. Spiracles (Fig. 1997) without completely sclerotic rims. Siphunculus elongate, subcylindrical, without setae, with apical flange, with spiculose imbrications. Abdominal tergum VIII entire. Cauda elongate, apically rounded, somewhat tassel-shaped. Anal plate (Fig. 1992) entire. Abdomen without gland facets. Gonapophyses 3.

**Embryo** (Fig. 1998). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; each side of abdomen with 1 submedian and 1 lateral seta and usually also with 1 pleural seta on most terga; siphunculus short, truncate, where evident; basitarsi each with 2 ventral setae, without dorsal setae.
**Economically important species.** None in Canada.

**Range of plants infested in Canada.** Some plants imported from tropical or subtropical areas.

**Biology.** Species in this genus are anholocyclicly associated with the host plant. Apterae of this genus stridulate by rubbing the peglike setae on the hind tibiae across the sclerotic ridges on sternites V and VI.

**Comments.** Recognition characters for this genus include the tropical and subtropical or warm temperate distribution, the once-branched media, the conspicuous patch of strongly nodulose imbrications ventrad of the siphunculi, and the row of peglike setae on the hind tibiae. Three circumtropical species are known.

**Genus Trama von Heyden**

Figs. 2001–2011

*Trama* von Heyden, 1837:293.
Type species: *Trama troglodytes* von Heyden, 1837:293.

**Adult** (Figs. 2001, 2002). Length 3.0–5.0 mm.

Integument: Appendages, head, and body without sculpturing except some evident on apical 1–3 terga in some specimens.

Head (Fig. 2011): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, fine, hairlike, scattered, without definite arrangement. Eye present in alata, present or absent in aptera; triommatidia present. Dorsal cephalic suture evident at least in alata; ventral sutures absent. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 2007) without ciliate margins; accessory sensoria not fused in single Canadian species, occurring in clusters distad and proximad of primary sensorium of segment VI; secondary sensoria circular, without ciliate margins, present on segments III—V in alata and commonly also in aptera. Rostrum long, 5-segmented; segment IV (Fig. 2008) long, conical; segment V short, triangular.

Thorax: Prothoracic setae fine, pointed, scattered, without definite arrangement. Prothoracic lateral tubercles and gland facets absent. Femora (Fig. 2005) with pointed setae; tibial setae pointed, hairlike, fine. Tibiae without peglike setae, gland facets, sensoria, rastral spines, or rastral setae. Basitarsi (Fig. 2010) triangular, without dorsal setae; fore and mid basitarsi of single known species in Canada with 10–15 ventral setae; hind basitarsus with 4–6 ventral setae. Distitarsi elongate, with those on hind leg much prolonged, measuring more than half length of hind tibia. Plantar setae minute, apparently absent in some specimens of single species known in

682
Canada. Claws simple. Fore wing (Fig. 2003) with normal venation; media with 2 or 3 branches; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal terga not fused, without pigment in aptera, with transverse dashes on each tergum in alata. Abdominal setae pointed, fine, hairlike, scattered over surface of terga without special arrangement. Dorsal and lateral abdominal tubercles absent. Lateral sclerites present, pigmented in alata. Spiracles (Fig. 2009) with sclerotic rims, usually with hinged operculum. Siphunculus absent in species known in Canada. Abdominal tergum VIII entire. Cauda short, arc-shaped. Anal plate (Fig. 2004) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. Taraxacum species.

Biology. The single species known in Canada is anholocycly associated with the roots of its hosts and is tended by ants.

Comments. Recognition characters for this genus include the conspicuously prolonged apical segment of the hind tarsus and in Canada the association with the roots of Taraxacum. The Palearctic species Trama rara Mordvilko has been introduced into North America.

Genus Tuberculatus Mordvilko

Figs. 2012–2023

Tuberculatus Mordvilko, 1894:51.
Type species: Aphis querceae Kaltenbach, 1843:136.

Adult (Figs. 2012, 2013). Length 1.5–3.0 mm.
Integument: Antenna with spicules; head and body without obvious sculpturing, except with spicules commonly evident laterally on abdomen and on dorsal abdominal pigmented areas, also with some weakly spiculose imbrications evident on apical abdominal terga in some species; tibiae and tarsi spiculose; cauda and anal and genital plates spiculose.
Head (Fig. 2023): Antennal tubercle usually slightly developed; front of head usually weakly concave. Ventral margin of antennal socket not protuberant. Discal setae mostly short, pointed, blunt or weakly capitate; each side of disc with 2 anterior and 2 posterior setae, in some species with one or both of anterior pair long, pointed or capitate where frontal setae also long, conspicuous, pointed or capitate. Eye present and triommatidium distinct in aptera and alata.
Dorsal cephalic suture absent; ventral suture evident between median ocellus and clypeus in some species. Disc without tubercles or gland facets. Antenna 6-segmented; processus terminalis short or long, without numerous setae; primary sensoria (Fig. 2017) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 2017) circular, present on segment III of alata (no aptera known), with or without ciliate margins. Rostrum 4-segmented; apical segment (Fig. 2019) subconical, more or less rounded distad of preapical primary setae.

Thorax: Prothoracic setae short, pointed, blunt or weakly capitate; each side of prothorax with 1–6 anterior and 1–6 posterior submedian setae and 1 posterior and 0–4 anterior lateral setae. Prothorax with 0–6 lateral tubercles. Submedian setae on short to long papillae. Mesothorax of aptera with median pair of fingerlike papillae. Femora (Fig. 2016) with setae short, pointed; tibial setae mostly pointed, at least apically and ventrally, blunt, or weakly capitate basally and dorsally. Tibiae with rastral setae, without peglike setae, gland facets, or rastral spines. Basitarsi (Fig. 2022) triangular, each with 5–7 ventral and 2 dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae bluntly setiform, or rod-shaped to narrowly spatulate. Claws simple. Fore wing (Fig. 2014) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent.

Abdomen: Abdominal terga not fused. Abdomen mostly without pigment, but with median papillae pigmented in some species. Dorsal abdominal tubercles absent. Lateral abdominal tubercles present on some or all segments in some species. Abdominal setae pointed, fine, hairlike, blunt, or distinctly capitate, commonly short, inconspicuous. Abdomen always with one or more pairs of median or submedian, short or long, conical or fingerlike papillae, fused basally in some species, always with 1 apical seta and commonly with one or more lateral setae. Lateral abdominal sclerites pigmented in some species, on segments II–V always produced as small to large conical papillae, with each having 1 apical seta and usually one or more lateral setae. Spiracles (Fig. 2020) with partially sclerotic rims. Abdominal tergum VIII entire. Siphunculus short, smooth or spiculose, without apical flange or setae. Cauda knobbed. Anal plate (Fig. 2015) bilobate in vivipara, entire in ovipara. Abdomen without gland facets. Gonapophyses 2.

**Embryo** (Fig. 2021). Antenna 4-segmented; all dorsal and lateral setae long and capitate; each side of disc with 2 anterior and 2 posterior setae; each side of prothorax with 1 anterior and 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta; abdominal setae consisting of 1 submedian and 1 lateral seta on each segment;

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submedian setae forming 2 longitudinal rows converging slightly posteriorly, rarely with the pair on tergum VII farther apart than other submedian pairs; siphunculus not usually evident, or small, poriform; basitarsi each with 2 ventral setae, without dorsal setae; distitarsi without preapical setae; plantar setae spatulate in North American species.

**Economically important species.** None.

**Range of plants infested in Canada.** *Quercus garryana* Doug.

**Biology.** Species are holocyclicly associated with the host plants, which include *Lithocarpus* and *Quercus* species.

**Comments.** Recognition characters for this genus include the association with *Quercus*, the presence of one or more conspicuous papillae on the dorsum of the abdomen, the knobbed cauda, the bilobate anal plate, and the presence of an apical seta on the lateral conical papilla on abdominal segments II–V.

This genus includes the subgenera *Tuberculoides* van der Goot and *Pacificallis* Richards. Richards (1965, 1968a, 1969a) provided a key to, and descriptions of, the species.

**Genus *Tuberolachnus* Mordvilko**

Figs. 2024–2034


Type species: *Aphis viminalis* Boyer de Fonscolombe, 1841:184 = *Aphis saligna* Gmelin, 1790:2209.

**Adult** (Figs. 2024, 2025). Length 4.0–7.0 mm.

Integument: Antenna mostly smooth, with imbrications evident on apical 1 or 2 segments in some specimens; head and body without obvious sculpturing, but with integument of dorsum of abdomen having minute striae and wrinkles in some specimens; tibiae and tarsi unsculptured; cauda and anal and genital plates with some spicules.

Head (Fig. 2034): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae pointed, fine, hairlike, scattered, without special arrangement. Ventral and dorsal cephalic sutures well-developed. Disc without tubercles and gland facets. Eye present; triommatidium distinct in aptera and alata. Antenna 6-segmented; processus terminalis short, without numerous setae; primary sensoria (Fig. 2030) without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 2029) circular, without ciliate margins, present on segments III and IV of alata, usually also in aptera. Rostrum 4-segmented with apical part of
Figs. 2024, 2025. Aptera of *Tuberolachnus*. 2024, head and prothorax; 2025, terminal abdominal segments.
Figs. 2026–2034. Alata of *Tuberolachnus*. 2026, right fore wing; 2027, anal plate and gonapophyses; 2028, left fore femur; 2029, second and base of third antennal segments; 2030, apical antennal segment; 2031, apical rostral segment; 2032, abdominal spiracle; 2033, left hind tarsus; 2034, venter of head.
segment IV partially separated by a membranous region; with apical segment (Fig. 2031) conical, and with apical part broadly rounded.

Thorax: Prothoracic setae pointed, fine, hairlike, scattered, without special arrangement. Prothorax without lateral tubercles or gland facets. Femora (Fig. 2028) and tibiae with pointed setae. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 2033) trapezoidal, with abundant ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae short, inconspicuous, setiform. Claws simple. Fore wing (Fig. 2026) with normal venation; radial sector almost straight; media with 3 branches; branches of cubitus narrowly separated at base, strongly divergent.

Abdomen: Abdominal terga not fused, without abundant pigment. Abdominal setae short, fine, scattered. Lateral abdominal sclerites absent; spiracular sclerites large. Dorsal and lateral abdominal tubercles absent. Conspicuous conical median papilla present slightly anteriad of siphunculus, much better developed in aptera than in alata. Spiracles (Fig. 2032) without sclerotic rims, with articulated opercula. Siphunculus poriform, situated on large setigerous mammiform base. Abdominal tergum VIII entire. Cauda short, arc-shaped. Anal plate (Fig. 2027) entire. Abdomen without gland facets. Gonapophyses 4.

**Embryo.** Not observed.

**Economically important species.** None.

**Range of plants infested in Canada.** Salix species.

**Biology.** Colonies are associated with the trunks and branches of the host plant. The single known species is anholocyclic.

**Comments.** Recognition characters for this genus include the association with *Salix*, the large body size, the conical dorsal abdominal tubercle, the apparently 5-segmented rostrum, the large pigmented mammiform base on which the poriform siphunculi are situated, the trapezoidal basal tarsal segments each with abundant ventral setae, the well-developed ventral and dorsal cephalic sutures, and the arc-shaped cauda.

**Genus Uroleucon Mordvilko**

Figs. 2035–2050

*Uroleucon* Mordvilko, 1914:64.
Type species: *Aphis sonchi* Linnaeus, 1767:735

**Adult** (Figs. 2035, 2037, 2038, 2040). Length 2.0–3.0 mm.
Integument: Antenna with smooth imbrications; head and body without obvious sculpturing other than weakly spiculose imbrications on posterior abdominal segments; tibiae without spicules or imbrications; tarsi with smooth imbrications; cauda and genital plate with some spicules.

Head (Fig. 2050): Antennal tubercle well-developed; front of head concave. Ventral margin of antennal socket not protuberant. Eye present; triommatidium distinct in aptera and alata. Each side of disc with 2 anterior and 2 posterior setae. Disc of head with or without tubercles, without gland facets or cephalic suture. Anteroventral cephalic sutures absent. Antenna 6-segmented; processus terminalis long, slender; primary sensoria (Fig. 2045) without ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 2044) without ciliate margins, present on segment III in aptera and alata, rarely also present on segment IV or V in alata. Rostrum 4-segmented; apical segment (Fig. 2046) elongate, subconical.

Thorax: Prothorax with or without lateral and dorsal tubercles. Prothoracic setae mostly capitate, but apices usually membranous and collapsed when cleared and mounted; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Femora (Fig. 2043) with setae pointed. Tibia without rastral spines, rastral setae, peglike setae, or gland facets. Basitarsi (Fig. 2049) triangular, each with 3 or 5 ventral setae, without dorsal setae; distitarsi elongate, without capitate setae. Plantar setae acuminate. Fore wing (Fig. 2041) with normal venation; media usually with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Abdominal segments not fused, without pigment except in some species for spots around bases of setae, around intersegmental sclerites, and commonly around a large pigmented sclerite posteriad of siphunculus. Dorsal tubercles present on some or all terga in some species. Lateral tubercles present or absent. Lateral sclerites present or absent in aptera, where present usually small, broken into spots, present or absent in alata. Spiracles (Fig. 2047) subcircular, without opercula. Siphunculus elongate, cylindrical, without setae, with apical flange, with conspicuous reticulations on apical one-sixth to one-half. Abdominal tergum VIII entire. Cauda elongate, tapering or parallel-sided, apex always pointed not broadly rounded, short in some species, but then with one or more capitate setae (e.g., Uroleucon taraxaci (Kaltenbach)). Anal plate (Fig. 2042) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo (Fig. 2048). Antenna normally 4-segmented, occasionally obscurely 5-segmented; each side of disc with 4 setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; prothoracic lateral tubercles rarely evident; eyes present, triommatidium present; each side of abdominal segments with 1 submedian and 1 lateral seta; segments I–V each usually with 1 pleural seta; siphunculus short, cylindrical where evident; basitarsi
Figs. 2035-2037. Aptera of *Uroleucon* species with abdominal setae on sclerites. 2035, head and prothorax; 2036, clypeus; 2037, terminal abdominal segments.
Figs. 2038–2040. Aptera of *Uroleucon* species without dorsal sclerites. 2038, head and prothorax; 2039, clypeus; 2040, terminal abdominal segments.
Figs. 2041–2050. Embryonic chaetotaxy and alata of *Uroleucon*. 2041, right fore wing; 2042, anal plate and gonapophyses; 2043, left fore femur; 2044, second and base of third antennal segments; 2045, base of apical antennal segment; 2046, apical rostral segment; 2047, abdominal spiracle; 2048, dorsal chaetotaxy of embryo; 2049, left hind tarsus; 2050, venter of head.
each with 2 ventral setae, without dorsal setae; distitarsi elongate, without preapical capitate setae; plantar setae acuminate.

**Economically important species.** *Uroleucon rudbeckiae* (Fitch).

**Range of plants infested in Canada.** Restricted to many genera of the Compositae.

**Biology.** All species are holocyclicly associated with their host plants.

**Comments.** The best recognition characters for this genus are the long cylindrical and extensively reticulate siphunculi, the pointed cauda, and the association with the Compositae. Annotated lists of, and keys to, the species are found in Robinson (1985, 1986). Richards (1972b) provided a key to, and descriptions of, the species found on *Solidago* (as *Dactynotus*).

Subgenera included in this genus are *Lambersius* Olive, *Satula* Olive, and *Uromelan* Mordvilko. The name *Dactynotus* Rafinesque was formerly used for this genus. Although no ruling has been made by the International Commission on Zoological Nomenclature on proposals to suppress Rafinesque's names (with the possible exception of *Dactynotus*) (Hottes 1963, Stoetzel 1982), most current authors have switched to the next available name, *Uroleucon*.

**Genus Utamphorophora** Knowlton

**Figs. 2051–2063**

Type species: *Utamphorophora timpanogos* Knowlton, 1946:1.

**Adult** (Figs. 2051, 2053). Length 2.0–3.0 mm.

Integument: Antenna with smooth imbrications; head and body without sculpturing other than scabrous antennal tubercles, with wrinkles on some parts of the body, with spiculose imbrications on apical abdominal segments; cauda and anal and genital plates spiculose; tibiae unsculptured; tarsi with smooth imbrications.

Head (Fig. 2063): Antennal tubercle developed; mesal margin swollen, scabrous; front of head U-shaped. Ventral margin of antennal socket protuberant (Fig. 2052). Discal setae short, clavate, arranged on each side of disc in anterior and posterior group of 2 setae each. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic suture absent; ventral cephalic sutures evident on each side of disc and ventrad of median ocellus. Disc without gland facets or tubercles. Antenna 6-segmented; processus terminalis elongate, without numerous setae; primary sensoria (Fig. 2058) ciliate; accessory sensoria not fused; secondary sensoria (Fig. 2057)
Figs. 2051–2053. Aptera of *Utamphorophora*. 2051, head and prothorax; 2052, ventral margin of antennal socket; 2053, terminal abdominal segments.
Figs. 2054–2063. Embryonic chaetotaxy and alata of Uiamphorophora. 2054, right fore wing; 2055, anal plate and gonapophyses; 2056, left fore femur; 2057, second and base of third antennal segments; 2058, base of apical antennal segment; 2059, apical rostral segment; 2060, abdominal spiracle; 2061, dorsal chaetotaxy of embryo; 2062, left hind tarsus; 2063, venter of head.
circular, situated on segment III of alata, usually also 1–4 sensoria on segment III of aptera. Rostrum 4-segmented; apical segment (Fig. 2059) subconical, rounded distad of preapical primary setae.

Thorax: Prothoracic setae short, pointed or blunt in alata, short, clavate in aptera; each side of prothorax with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax with or without lateral tubercles; tubercles small and atrophied if present. Femora (Fig. 2056) and tibiae with setae mostly pointed, blunt especially in aptera. Tibiae without peglike setae, gland facets, rastral setae, or rastral spines. Basitarsi (Fig. 2062) each with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitae setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 2054) with normal venation; media with 3 branches; branches of cubitus widely separated at base, divergent.

Abdomen: Abdomen in alata with intense pigmentation or with only intersegmental dashes, without pigmentation in aptera. Abdomen without dorsal tubercles. Lateral abdominal tubercles small and inconspicuous, or absent. Spiracles (Fig. 2060) circular, with sclerotic rims. Siphunculus elongate, clavate, without setae, with apical flange, usually somewhat scabrous. Abdominal tergum VIII entire. Cauda elongate, triangular, rounded distally. Anal plate (Fig. 2055) entire. Abdomen with gland facets. Gonapophyses 3.

Embryo (Fig. 2061). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta; disc and prothorax without gland facets, without evident tubercles; each side of abdomen with 1 lateral and 1 submedian seta; abdominal segments I–V usually also with 1 pleural seta; basitarsi triangular, with 2 ventral setae; distitarsi elongate, without preapical capitae setae; plantar setae acuminate.

Economically important species. None.

Range of plants infested in Canada. Physocarpus species and Gramineae.

Biology. Some of the species in this genus are heterocyclic between Physocarpus species and the Gramineae.

Comments. Recognition characters for this genus include the prominent scabrous antennal tubercles, the presence of three setae on the ventral surface of each basitarsus, and the clavate siphunculi. Cook (1984b) provided a key to, and taxonomic notes on, the North American species.
Genus *Vesiculaphis* Del Guercio

*Vesiculaphis* Del Guercio, 1911b:463.
Type species: *Toxoptera caricis* Fullaway, 1910:32.

**Adult** (Figs. 2064, 2065). Length 1.0–3.0 mm.

Integument: Antenna with smooth imbrications; head and body without obvious sculpturing other than some spiculose imbrications on apical abdominal terga and posteriad of base of siphunculus; legs without sculpturing other than some spicules on hind tibiae and smooth imbrications on tarsi in some species; cauda and anal and genital plates with spicules; cauda with some more or less well defined reticulations apically.

Head: Antennal tubercle weakly developed, but with large setigerous laterofrontal tubercle in some species; median tubercle absent or extremely well developed and conspicuous. Ventral margin of antennal socket not protuberant. Discal setae blunt, capitate, or clavate; each side of disc with 2 anterior (situated on laterofrontal tubercle where present) and 2 posterior setae. Eye present; triommatidium distinct in aptera and alata. Ventral and dorsal cephalic sutures absent in aptera, (alata not studied). Disc without tubercles or gland facets. Antenna 5- or 6-segmented; processus terminalis elongate, tapering almost to a point, without numerous setae; primary sensoria without ciliate margins; accessory sensoria not fused; secondary sensoria absent in aptera. Rostrum 4-segmented; apical segment short, subcylindrical to nearly triangular in outline.

Thorax: Prothoracic setae short, inconspicuous, blunt or weakly capitate, with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta. Prothorax without dorsal or lateral tubercles or gland facets. Tibial setae pointed at least apically, weakly capitate or blunt basally, or mostly capitate or blunt. Tibiae without peglike setae, gland facets, sensoria, rastral spines, or rastral setae. Basitarsi triangular, without dorsal setae; fore and hind basitarsi with 3 and hind basitarsus with 2 ventral setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple.


701
Figs. 2064, 2065. Aptera of *Vesiculaphis*. 2064, head and prothorax; 2065, terminal abdominal segments.
Embryo. Not observed.

Economically important species. None.

Range of plants infested in Canada. None; elsewhere species associated with *Carex* species.

Biology. As far as is known the species are holocyclicly associated with the host plant.

Comments. Recognition characters for this genus include the association with *Carex*, the elongate heavily scabrous and abruptly narrowed siphunculi, and the three prominent lobes on the front of the head of the apterae.

This is an Asian genus. One species, *Vesiculaphis caricis* (Fullaway), has been collected in North America.

Genus *Wahlgreniella* Hille Ris Lambers

Figs. 2066–2077

*Wahlgreniella* Hille Ris Lambers, 1949:246.
Type species: *Rhopalosiphum arbuti* Davidson, 1910:378, now subspecies of *Rhopalosiphum nervata* Gillette, 1908:63

Adult (Figs. 2066, 2067). Length 2.0–3.0 mm.

Integument: Antennal segments with smooth imbrications; head and body smooth other than some poorly formed spiculose imbrications laterally on abdominal segments and on apical abdominal terga; tibiae unsculptured; tarsi with smooth imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 2077): Antennal tubercle moderately developed, smooth or sparsely spiculose. Ventral margin of antennal socket not protuberant. Discal setae pointed or blunt; each side of disc with 2 anterior and 2 posterior setae. Cephalic gland facets absent. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic suture absent; ventral cephalic suture evident between median ocellus and clypeus. Disc without gland facets, commonly with 1 or 2 tubercles near posterior margin. Antenna 6-segmented; primary sensoria (Fig. 2072) with ciliate margins; accessory sensoria circular, with ciliated margins; secondary sensoria (Fig. 2071) situated on segment III and rarely IV of alata, rarely 1 or 2 sensoria on segment III of aptera. Rostrum 4-segmented; apical segment (Fig. 2073) conical, apex rounded.

Thorax: Prothoracic setae about same size and shape as discal setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Prothoracic lateral tubercles present or absent, usually tiny where present, with diameters not much greater than diameters of setal sockets. Prothorax without gland facets. Femora (Fig. 2070) with setae pointed; tibial setae
Figs. 2066, 2067. Aptera of *Wahlgreniella*. 2066, head and prothorax; 2067, terminal abdominal segments.
Figs. 2068–2077. Embryonic chaetotaxy and alata of Wahlgreniella. 2068, right fore wing; 2069, anal plate and gonapophyses; 2070, left fore femur; 2071, second and base of third antennal segments; 2072, base of apical antennal segment; 2073, apical rostral segment; 2074, abdominal spiracle; 2075, dorsal chaetotaxy of embryo; 2076, left hind tarsus; 2077, venter of head.
mostly pointed, but some blunt ones usually evident dorsally and basally. Tibiae without gland facets, peglike setae, rastral spines, or rastral setae. Basitarsi (Fig. 2076) triangular, each with 3 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 2068) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent, nearly parallel.

Abdomen: Abdomen without pigment other than in some species faintly pigmented lateral sclerites and faintly transverse dashes on terga VII or VIII or both. Lateral abdominal tubercles present on segments II–IV in some species. Dorsal and lateral abdominal setae about same size and shape as discal and prothoracic setae, but generally longer on apical terga; arranged in single transverse row on each tergum. Dorsal abdominal tubercles commonly present on tergum VIII. Abdominal gland facets absent. Spiracles (Fig. 2074) with sclerotic rims, without opercula. Siphunculus elongate, swollen on apical half, without setae, with apical flange, usually with a few transverse subapical reticulations, with spicules and nodules and spiculose imbrications. Abdominal tergum VIII entire. Cauda elongate, with nearly parallel sides; apical spicules reduced in number in some species but usually about same size as more basal spicules. Anal plate (Fig. 2069) entire. Gonapophyses 3.

**Embryo** (Fig. 2075). Antenna 4-segmented; each side of disc with 2 anterior and 2 posterior setae; prothorax without gland facets or tubercles, with 1 posterior submedian seta and 1 anterior and 1 posterior lateral seta on each side; abdomen without gland facets; each tergum with 1 submedian and 1 lateral seta and usually with 1 ventral seta; basitarsi triangular, without dorsal setae; distitarsi without preapical capitate setae; plantar setae acuminate.

**Economically important species.** None.

**Range of plants infested in Canada.** Species of *Arbutus, Empetrum, Rosa,* and *Vaccinium.*

**Biology.** Apparently all species are holocyclicly associated with their host plants.

**Comments.** Recognition characters for this genus include the host associations, the swollen and scabrous siphunculi, and the ciliated margins of the secondary sensoria.

**Genus Zyxaphis Knowlton**

Figs. 2078–2088

*Zyxaphis* Knowlton, 1947:35.
Type species: *Zyxaphis utahensis* Knowlton, 1947:35.

706
Adult (Figs. 2078, 2079). Length 1.25–2.00 mm.

Integument: Antenna with smooth imbrications; head and body with fine network of spicules and nodules generally producing a reticulate pattern; tibiae unsculptured; tarsi with smooth or in some species minutely denticulate imbrications; cauda and anal and genital plates spiculose.

Head (Fig. 2088): Antennal tubercle slightly to not developed; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae slender, acuminate to blunt, arranged in anterior group of 1 or 2 and posterior group of 2 on each side. Eye present; triommatidium distinct in aptera and alata. Dorsal cephalic suture absent; ventral suture barely evident between median ocellus and clypeus. Disc of head without tubercles or gland facets. Antenna 6-segmented, with segments III and IV fused in some species; processus terminalis shorter than to almost twice as long as base of segment VI, without numerous setae; primary sensoria (Fig. 2084) with ciliate margins; accessory sensoria not fused; secondary sensoria (Fig. 2083) circular, without ciliate margins, situated on segment III, in some species on IV and V of alata, absent in aptera. Rostrum 4-segmented; apical segment (Fig. 2085) slender, with sides weakly concave, elongate and pointed distad of preapical primary setae.

Thorax: Prothoracic setae similar in length and shape to discal setae; each side of prothorax with 1 anterior and 1 posterior lateral seta and 1 posterior submedian seta. Prothoracic lateral tubercles present, large, well-developed. Prothorax without gland facets. Femora (Fig. 2082) with pointed setae; tibial setae pointed or blunt. Tibiae without gland facets, peglike setae, rastral setae, or rastral spines. Basitarsi (Fig. 2087) triangular, without dorsal setae, each with 3 ventral setae; some specimens with 2 ventral setae on hind basitarsus. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate. Claws simple. Fore wing (Fig. 2080) with normal venation; media with 3 branches; branches of cubitus widely separated at base, slightly divergent, nearly parallel.

Abdomen: Abdomen of alata without pigment except for dashes on apical abdominal terga; aptera usually with median irregular patch of pigment on anterior segments; lateral abdominal sclerites present or absent. Dorsal and lateral abdominal setae about same length and shape as discal and prothoracic setae, arranged in single transverse row on each tergum. Dorsal abdominal tubercles usually absent. Lateral abdominal tubercles present on segments II–VII, large, conspicuous. Spiracles (Fig. 2086) with sclerotic rims. Siphunculus dark-colored, without apical flange, variously sculptured, spiculose, imbricate or nodulose. Abdominal tergum VIII entire. Cauda short, triangular to nearly semicircular. Anal plate (Fig. 2081) entire. Abdomen without gland facets. Gonapophyses 3.

Embryo. Not observed.

Economically important species. None.
Figs. 2078, 2079. Aptera of *Zyaphis*. 2078, head and prothorax; 2079, terminal abdominal segments.
Figs. 2080–2088. Alata of Zyxaphis. 2080, right fore wing; 2081, anal plate and gonapophyses; 2082, left fore femur; 2083, second and base of third antennal segments; 2084, base of apical antennal segment; 2085, apical rostral segment; 2086, abdominal spiracle; 2087, left hind tarsus; 2088, venter of head.
Range of plants infested in Canada. Shrubby *Artemisia* and *Chrysothamnus* species in south-central British Columbia.

**Biology.** Nothing is known about the species in this genus, but collection data indicate that they are holocyclicly associated with their host plants.

**Comments.** Recognition characters for this genus include the association with *Artemisia* and *Chrysothamnus*, the long and slender apical rostral segment, and the short cauda.

**Generic descriptions of superfamily Phylloxeroidea**

**Genus Adelges** Vallot

Figs. 2089–2105

*Adelges* Vallot, 1836:72.

Type species: *Adelges laricis* Vallot, 1836:72.

**Adult** (Fig. 2089). Length 0.5–2.0 mm.

Integument: Antenna in alata with well-developed imbrications and ridges and striae, with these less well developed or absent in aptera; head and body without obvious sculpturing or in some species with ridges and striae in no particular arrangement; tibiae in some species with smooth and nodulose or spiculose imbrications in alata, but these usually absent in aptera; imbrications evident on tarsi of alata, commonly obscure or absent in aptera.

Head (Fig. 2105): Antennal tubercle not developed; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae tiny, obscure; each side of disc with one to several anterior and posterior setae situated in clusters of gland facets. Disc without tubercles; each side of disc usually with large cluster of gland facets anteriorly, and with 2 posteriorly. Ventral cephalic sutures evident in some species; dorsal suture absent. Eyes present in alata, absent in aptera; triommatidium present. Antenna in aptera 3-segmented, with segment III (Fig. 2090) usually having primary sensoria at apex and middle, with secondary sensoria absent, in alata 5-segmented (Fig. 2101), with segments III–V each having large membranous sensorium. Rostrum (Fig. 2092) 4-segmented; apical segment (Fig. 2102) broadly rounded.

Thorax: Head and prothorax fused in aptera in some species, forming pigmented sclerotic “cephalothorax.” Prothoracic setae about same size and shape as discal setae; each side of prothorax with one to several anterior and posterior submedian setae and one to several anterior and posterior lateral setae. Prothorax without tubercles, with anterior and posterior submedian cluster and 1 or 2 large lateral clusters of gland facets. Femora (Fig. 2100) and tibiae with pointed setae. Tibiae without gland facets, peglike setae, rastral setae, or
Figs. 2089–2096. Aptera of Adelges. 2089, dorsal view of aptera; 2090, apex of left antenna; 2091, wax facets of head; 2092, mouthparts; 2093, abdominal spiracle; 2094, ovipositor; 2095, ventral view of apex of abdomen; 2096, right hind tarsus.
Figs. 2097–2105. Alata of *Adelges*. 2097, right fore wing; 2098, ovipositor; 2099, ventral view of apex of abdomen; 2100, left fore femur; 2101, right antenna; 2102, apical rostral segment; 2103, abdominal spiracle; 2104, left hind tarsus; 2105, venter of head.
rastral spines. Basitarsi (Figs. 2096, 2104) triangular, with 2 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate, occasionally obscurely capitate. Claws normal, without dorsal tunicalike structure. Fore wing (Fig. 2097) broadly rounded, with 3 nearly parallel transverse veins.

Abdomen: Abdomen without pigmented, sclerotic areas. Abdominal setae arranged in 1 or 2 irregular transverse rows on each tergum, mostly minute, obscure, about same size as discal and prothoracic setae, with those on posterior 1–3 segments usually longer. Abdomen without tubercles or papillae. Each side of abdomen commonly with a lateral and a submedian and a pleural cluster of gland facets on each segment. Spiracles (Figs. 2093, 2103) not operculate, with incomplete sclerotic rims, and with 5 on each side of abdomen. Siphunculus absent. Cauda tiny, evident only as arc-shaped sclerite. Abdominal tergum VIII entire. Anal plate (Fig. 2099) entire. Ovipositor well-developed, sclerotic (Figs. 2094, 2095, 2098). Gonapophyses absent.

Economically important species. Adelges piceae (Ratzeburg).


Biology. Most of the species in this genus are heterocyclic between Picea, on which galls are produced, and the bark and needles of Larix, Pseudotsuga, and Tsuga, where flocculent colonies are produced. However, some species such as A. piceae, the balsam woolly adelgid, are holocyclicly associated with their hosts in Canada.

Comments. Recognition characters for this genus include the associations with conifers, the well-developed ovipositor, the presence of gland facets (Fig. 2091), the absence of capitate setae on the apical tarsal segments, the presence of five pairs of abdominal spiracles, and the presence of three antennal segments in the apterae and five in the alatae.

Adelges is sometimes subdivided into several groups variously used as genera or subgenera: Adelges in the strict sense, Cholodkovskya Börner, Gilletteella Börner, Sacchiphantes Curtis, Aphrastasia Börner, and Dreyfusia Börner. There is a large body of older literature using the name Chermes L. for this genus.

Genus Pineus Shimer

Figs. 2106–2121

Pineus Shimer, 1869:383.
Type species: Coccus pinicorticis Fitch, 1855:871 = Coccus strobus Hartig, 1839:643.
**Adult** (Fig. 2106). Length 0.5–2.0 mm.

***Integument***: Antenna in alata with well-developed imbrications and ridges and striae, in aptera these less well developed or absent; head and body without obvious sculpturing other than in some species ridges and striae having no particular arrangement; tibiae in some species with smooth and nodulose imbrications in alata, usually absent in aptera; imbrications evident on tarsi of alata, commonly obscure or absent in aptera.

**Head** (Fig. 2121): Antennal tubercle not developed; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae tiny, obscure; each side of disc with one to several anterior and one to several posterior setae, with most situated in clusters of gland facets. Disc without tubercles; each side of disc usually with 1 large anterior and 2 posterior clusters of gland facets. Ventral cephalic sutures evident in some species; dorsal suture rarely obscurely evident. Eyes present in alata, absent in aptera; triommatidium present. Antenna in aptera 3-segmented, with third segment (Fig. 2107) usually with primary sensoria apically and a sensorium medially, with secondary sensoria absent, or with whole antenna reduced to a small papilla having setae at apex, in alata 5-segmented, with segments III–V usually with a large membranous sensorium (Fig. 2117). Rostrum (Fig. 2109) 4-segmented; apical segment (Fig. 2118) broadly rounded.

**Thorax**: Head and prothorax in some species fused in aptera, forming pigmented sclerotic “cephalothorax.” Prothoracic setae about same size and shape as discal setae; each side of disc with one to several anterior and posterior submedian setae and one to several anterior and posterior lateral setae. Prothorax without tubercles, usually with 1 anterior and 1 posterior submedian cluster and 1 or 2 lateral clusters of gland facets. Femora (Fig. 2116) and tibiae with pointed setae. Tibiae without gland facets, sensoria, peglike setae, rastral setae, or rastral spines. Basitarsi (Figs. 2112, 2120) triangular, each with 2 ventral setae, without dorsal setae. Distitarsi elongate, without preapical capitate setae. Plantar setae acuminate, weakly capitate in some species. Claws normal, without dorsal tuna-like structure, not bifid. Fore wing (Fig. 2113) broadly rounded, with 3 transverse veins.

**Abdomen**: Abdomen without pigmented sclerotic areas. Abdominal setae arranged in 1 or 2 irregular transverse rows on each tergum, mostly minute, obscure, about same size as discal and prothoracic setae, with those on posterior segments usually longer. Abdomen without tubercles or papillae. Each side of abdomen commonly with 1 lateral and 1 submedian and 1 pleural cluster of gland facets on each segment. Spiracles (Figs. 2110, 2119) not operculate, without complete sclerotic rims, with 4 present on each side of abdomen. Siphunculus absent. Cauda tiny, evident only as arc-shaped sclerite. Abdominal segment VIII entire. Anal plate (Fig. 2115) entire. Ovipositor well-developed, sclerotic (Figs. 2111, 2114). Gonapophyses absent.
Economically important species. Species of *Pineus* may cause unsightly damage to ornamental trees; persistent heavy infestation may affect tree physiology.

**Range of plants infested in Canada.** Species of *Abies*, *Picea*, and *Pinus*.
Biology. Some species in this genus are heterocyclic between Picea species, where galls are produced, and the needles and bark of Pinus species, where flocculent colonies are produced. Some species are apparently anholocyclicly associated with Abies or Pinus.
Comments. Recognition characters for this genus include the associations with various conifers, the well-developed ovipositor, the presence of gland facets, the absence of capitate setae on the apical tarsal segments, the presence of four pairs of abdominal spiracles, and the presence of three antennal segments in the apterae and five in the alatae. Species of this genus are sometimes separated into several groups variously considered genera or subgenera: *Pineus* in the strict sense, *Pineodes* Börner, and *Eopineus* Steffan.

Genus *Phylloxera* Boyer de Fonscolombe

Figs. 14, 2122-2143

*Phylloxera* Boyer de Fonscolombe, 1834:223.

Type species: *Phylloxera quercus* Boyer de Fonscolombe, 1834:223.

Adult (Figs. 2122, 2127). Length 0.7–2.0 mm.

Integument: Alata without obvious sculpturing other than some smooth or nodulose or spiculose imbrications on tibiae and usually on tarsi, with wrinkles and striae and ripples on head and prothorax in some species; aptera with antennae usually having imbrications; head and body commonly with spicules, nodules, striae, and ripples; tibiae and tarsi commonly with imbrications.

Head (Fig. 2143): Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae commonly inconspicuous, difficult to find in aptera, more readily visible in alata, arranged on each side of disc in anterior and posterior group of 2 each, commonly situated on short spiculose imbricate or scabrous papillae. Eyes present in alata, absent in aptera; triommatidium present. Disc without tubercles or wax glands. Ventral cephalic sutures absent; dorsal suture partially evident in aptera and alata in some species. Antenna 3-segmented; aptera with apical segment (Figs. 2123, 2128) usually having a small preapical sensorium with reticulate margins; alate usually with large elongate secondary sensorium basally and apically (Fig. 2139). Rostrum 4- (Fig. 2131) or 5-segmented (Fig. 2140).

Thorax: Head and prothorax fused in aptera, not fused in alata. Prothoracic setae short, inconspicuous, especially in aptera; each side with 1 anterior and 1 posterior lateral seta and 1 anterior and 1 posterior submedian seta; setae commonly situated on spiculose imbricate or scabrous papillae. Prothorax without tubercles or gland facets. Femora (Fig. 2138) and tibiae with pointed setae. Tibiae without gland facets, sensoria, peglike setae, rastral setae, or rastral spines. Basitarsi (Figs. 2126, 2134, 2142) triangular, each with 2 ventral setae, without dorsal setae. Distitarsi elongate, with 2 or 3 preapical capitate setae. Plantar setae acuminate, but usually at least faintly capitate. Claws simple. Fore wing (Fig. 2135) broadly rounded apically, with only radial sector and cubital veins present, and with basal parts of latter fused.

717
Abdomen: Abdomen usually without pigmented sclerotic regions in alata, without gland facets or tubercles. Each tergum with 1 or 2 irregular transverse rows of short inconspicuous setae; setae commonly on short spiculopectate imbricate or scabrous papillae. Spiracles (Figs. 2125, 2129, 2141) usually small opercula, commonly absent on abdomen. Siphunculi absent. Abdominal tergum VIII entire. Cauda small, bluntly rounded. Anal plate (Fig. 2136) entire where evident.
Figs. 2127–2134. Aptera of Phylloxera from oak. 2127, dorsal view of aptera; 2128, apex of left antenna; 2129, abdominal spiracle; 2130, clypeus and labrum; 2131, apical rostral segment; 2132, vestiges of ovipositor; 2133, ventral view of apex of abdomen; 2134, right hind tarsus.

Ovipositor represented by internal sclerotized rudiments (Figs. 2132, 2133, 2137), quite indistinct in some species. Gonapophyses absent.

**Economically important species.** Phylloxera vitifoliae (Fitch), the grape phylloxera.
Figs. 2135–2143. Alata of *Phylloxera* from hickory. 2135, right fore wing; 2136, ventral view of apex of abdomen; 2137, vestiges of ovipositor; 2138, right fore femur; 2139, right antenna; 2140, apical rostral segment; 2141, abdominal spiracle; 2142, right hind tarsus; 2143, venter of head.
Range of plants infested in Canada. Species of Carya, Castanea, Quercus, and Vitis.

Biology. Little is known of the biological details of this genus. The grape phylloxera has a monoecious heterocyclic association with its host plant (gall, Fig. 14). The seasonal history of the root-infesting stages in Ontario was studied by Stevenson (1964). It had been believed that all other species were holocyclic, but Stoetzel (1985) found that at least one species is heterocyclic between Quercus and Carya.

Comments. Recognition characters for this genus include the host associations, the three-segmented antennae, the absence of circular or oval or slitlike secondary sensoria, the capitate setae on the apical tarsal segments, the much-reduced wing venation, and the usual presence of imbrications on the tibiae and tarsi.

The grape phylloxera (Figs. 2122–2126), which lacks prominent tuberculate dorsal and marginal processes and lives on the leaves and roots of Vitis, is usually placed in a separate genus. According to Russell ([1974] 1975), the correct generic name for the grape phylloxera is Daktulosphaira Shimer (but not Dactylosphaera Shimer; the commonly encountered name Viteus Shimer is a junior synonym). The species inhabiting Carya are sometimes placed in the genus Xerophylla Walsh, but such action is inappropriate given the demonstrated heterocycly between Quercus and Carya.

Genus Phylloxerina Börner

Figs. 2144–2151

Phylloxerina Börner, 1908:94.
Type species: Pemphigus salicis Lichtenstein, 1884:916.

Adult (Fig. 2144). Length 0.5–1.0 mm.
Integument: Body without pronounced sculpturing except for striae and ridges occurring dorsally and mostly associated with margins of gland facet clusters.
Head: Antennal tubercle undeveloped; front of head convex. Ventral margin of antennal socket not protuberant. Discal setae short, pointed; each side of disc with 2 anterior and 2 posterior setae. Disc without tubercles, with clusters of gland facets around bases of all discal setae. Eyes absent; triommatidium present. Ventral and dorsal cephalic sutures absent. Antenna 3-segmented; apical segment (Fig. 2145) with a subapical sensorium having accessory sensoria in some species; secondary sensoria absent. Rostrum 4-segmented (Fig. 2148).
Thorax: Head and prothorax fused in aptera (alata unknown). Prothoracic setae about same size and shape as discal setae; each side of pronotum with 1 anterior and 1 posterior lateral seta and 1
Figs. 2144–2151. Aptera of *Phylloxerina*. 2144, dorsal view of aptera; 2145, apex of left antenna; 2146, wax gland facets on head; 2147, clypeus and labrum; 2148, apical rostral segments; 2149, abdominal spiracle; 2150, ventral view of apex of abdomen; 2151, right hind tarsus.

anterior and 1 posterior submedian seta. Prothorax without tubercles, but with all setae surrounded by a cluster of gland facets (Fig. 2146). Thoracic spiracles (Fig. 2149) with hinged opercula. Femora and tibiae with setae pointed. Tibiae without gland facets, sensoria, peglike setae, rastral setae, or rastral spines. Basitarsi
triangular, each with 2 ventral setae, without dorsal setae. Distitarsi, with preapical capitate setae. Plantar setae acuminate, evidently weakly capitate in some species. Claws simple.

Abdomen: Abdomen without pigmented regions, without lateral tubercles. Abdominal setae short, pointed; each side of abdomen with 1 lateral and 1 pleural and 1 submedian seta. All abdominal setae surrounded by clusters of gland facets. Abdominal spiracles not evident. Siphunculus absent. Abdominal tergum VIII entire, not bilobate. Cauda obscure, undeveloped. Anal plate (Fig. 2150) entire. Gonapophyses absent.

**Economically important species.** None.

**Range of plants infested in Canada.** *Populus* and *Salix* species.

**Biology.** Little is known about this genus, other than the species are apparently anholocyclic associated with their hosts; alatae are not known to be produced. Flocculent colonies are produced in crevices of the bark of the host plants.

**Comments.** Recognition characters for this genus include the host associations, the flocculent colonies produced on them, the absence of alatae, the presence of clusters of gland facets, the three-segmented antennae, and the capitate setae on the apical tarsal segments.
Glossary of anatomical terms

**abdomen**  The third major body division behind the leg-bearing division.

**abdominal**  Pertaining to the abdomen.

**aberrant**  Departing from regular or normal condition.

**abnormal**  Departing from normal or regular condition.

**accessory sensoria**  Cluster of smaller primary sensoria on apical antennal segment, additional to the main sensorium. (See **primary sensoria**).

**accessory setae**  Secondary setae.

**acuminate**  Tapering to a long point.

**aedeagus**  Penis.

**aleurodiform**  Resembling the “pupae” of Aleyrodoidea (whiteflies) in form.

**anal**  Pertaining to, or in the vicinity of, the anus or last segment of the abdomen.

**anal plate**  Rectangular, quadrate, or bilobate sclerotic plate ventrad of anus.

**analogous**  Similar in function but differing in structure and origin.

**annulus**  (pl. annuli)  Ringlike structure.

**antenna**  (pl. antennae)  Paired, elongate, segmented sensory organs borne on each side of head.

**antennal tubercle**  Swelling of the anterolateral part of the head bearing the antennal socket.

**anteriad**  Toward the front or head end.

**anterior**  In front, at the head end.

**anterior discal setae**  One or more setae on each side of anterior part of disc.

**anterior lateral setae**  One or more setae situated at anterior outer margin or angle of pronotum.

**anterior submedian setae**  One or more pairs of setae situated near the midline of the anterior half of the pronotum.

**antero-**  Front part (prefix).

**anus**  Opening at end of digestive tract; in aphids situated below cauda.

**apex**  (pl. apices)  That part of any structure that is opposite to its base or fixed end.

**apical**  Pertaining to the apex.

**approximate**  Close together.

**asetose**  Without setae.

**atrium**  Chamber at entrance of the spiracle or any other similar body opening.

**attenuate**  Gradually tapering.

**basad**  Toward the point of attachment.

**basal**  Pertaining to, at, or near point of attachment.

**base**  Part of a structure at its point of attachment.
basitarsus (pl. basitarsi)  The first segment of the tarsus.
bifid  Cleft or divided.
bilobate  Divided into or bearing two lobes.
broken  Interrupted in continuity (in reference to a vein or other linear structure).
campaniform  Lens- or bell-shaped; describes sensory domes in the integument.
capitate  With apex abruptly enlarged or bulbous; used by aphid workers mostly to describe setae (Fig. 98). (Compare clavate, flabellate, spatulate.)
carapace  Hard covering of abdomen in some aphids, formed by fusion of segments.
carina (pl. carinae)  Elevated ridge.
cauda (pl. caudae)  "Tail"; in aphids, the apical piece of the abdomen resembling a tail.
cephalic  Pertaining to the head.
chaetotaxy  Arrangement and nomenclature of setae or bristles.
cibarium  The food pocket of the preoral mouth cavity under the surface of the clypeus.
clavate  Becoming gradually enlarged toward apex; clubbed. (Compare capitate, flabellate, spatulate.)
clypeus  In aphids the large plate from which the rostrum appears to arise.
compound eye  Aggregate of separate visual elements or ommatidia.
concave  Dish-shaped, excavated.
convex  Curved outward.
cornicle  Siphunculus.
costa  Vein along leading edge of wing.
coxa (pl. coxae)  Basal segment of leg.
cribriform  With perforations like those of a sieve; in aphids referring to discrete clusters of minute pores, hence cribriform discs.
cryptic  Hidden or concealed.
cubitus  Basal (posterior) vein of the wing; in aphid fore wing, consisting of two branches that usually separate within the common longitudinal vein thus appearing as two distinct veins (Fig. 1).
dimorph  In aphids used to denote the structurally distinct, aestivating, first-instar nymph of the maple-infesting genus Periphyllus.
disc  In aphids the upper, nearly flat surface of the head.
discal  Pertaining to the disc.
distad  Away from the base; toward the apex.
distitarsus (pl. distitarsi)  The last segment of the tarsus.
dorsad  Towards the dorsum; towards the dorsal midline.
dorsal  Pertaining to back or upper surface.
dorsal sclerites  Pigmented, hardened areas of various sizes and shapes that can occur on the dorsum of abdominal segments.
dorsal suture  Median, longitudinal line, or suture, on disc of head.
dorsal tubercles  Membranous, more or less protuberant structures that occur mesally from head to abdominal segment VIII. See first definition of tubercle.
dorsolateral  Pertaining to structures between the dorsal midline and lateral margin of a body segment.
dorsolateral setae  Setae on abdominal or thoracic segments located between the submedian and lateral setae.
dorsum  In general, the upper surface.

embryo  Young aphids before leaving the body of the parent.
erect  Standing upright, but not necessarily perpendicular; in aphids, used mostly to describe setae.
evanescent  Fading, weakening.
explanate  Expanded to form a platelike surface.
external  Belonging to, or on, the outside.
exudate  Any discharge from body; in aphids, used for waxy exudate, honey dew.

facet  A small face or surface; used to denote one lens of compound eye, or a poriferous surface that produces wax (gland facet).
femur  Large segment of upper leg situated between trochanter and tibia.
filament  Thread.
filiform  Threadlike.
flabellate  Fan-shaped; in aphids, used to describe setae that are markedly broadened and flattened on apical part (Fig. 100). (Compare capitate, clavate, peltate, spatulate.)
flocculent  In aphids loosely used to describe any woolly or cottony, tuftlike, waxy exudate.

gall  Abnormal growths on a plant caused by the feeding of other organisms; here, restricted to a hollow growth in which the aphids are completely enclosed by plant tissue. (Compare pseudogall.)
genital  All genital structures collectively.
genital plate  Rectangular, quadrate, or circular sclerotic plate situated just anteriad of genital orifice.
gland  Cellular structure that secretes characteristic products, such as wax.
gland facet  See facet.
gonopophysis (pl. gonapophyses)  Small setiferous papillae along margin of genital orifice in Aphidoidea; absent in Phylloxeroidea.

hair  Used erroneously in aphidology for seta.
honeydew  Sugary secretion produced by some insects, but especially aphids and scale insects.
imbricate  More or less resembling the scales of a fish, or the shingles of a roof.

instar  Period, or stage, between molts.

integument  Skin.

lateral  Relating, pertaining, or attached to side.
lateral sclerites  Pigmented, hardened areas of various sizes and shapes that can occur on the lateral margins of abdominal segments.
lateral setae  One or more setae situated on lateral margin of each abdominal segment.
lateral tubercles  Membranous, more or less protuberant structures that can occur laterally from prothorax to abdominal segment VII. (See first definition of tubercle.)

maculate  With large spots or markings.
mealy  Covered with fine granules of wax.
media, median vein  One of the main wing veins, usually branched (Fig. 1).
median  At, or in, the middle.
membrane, membranous  Any thin, transparent, apparently flexible tissue.
mesal  On, or pertaining to, the middle or meson.
meso-  Pertaining to middle (prefix).
meta-  Pertaining to posterior or last (prefix).

neoteny  Retention of immature characteristics in adult forms.
notum (pl. nota)  Upper or dorsal part of any body segment, usually used with thoracic segments. (Compare tergum.)

obtuse  Blunt.
ocellus  Simple eyes in alate aphids, one on anterior part of head and one on each side of disc.
ocular  Of, or pertaining to, eyes.
ommatidium  One of visual elements of compound eye.
operculum (pl. opercula)  Lid or cover.
opisthognathous  Mouthparts projecting backwards or posteriorly.
ovipositor  Apparatus by which eggs are placed or directed when laid. Among aphids two distinct structures are given this label: the sclerotized structure of adelgids and phyloxerids, and the prolonged posterior abdominal segments of the oviparae of some Drepanosiphidae.

papilla (pl. papillae)  Projection of body wall; in aphids usually conical or fingerlike; in aphids, sometimes used interchangeably with the term tubercle.
peltate  Shield- or mushroom-shaped; used to describe setae with a broad, flat apex set perpendicularly on a stalk (Figs. 102, 103). (Compare flabellate.)
placoid  Platelike, used to describe sensoria.
plantar setae  The pair of setae on the bottom surface of the pretarsus between the claws. Also called empodial setae.
pleural  In aphids pertaining to structures situated between the dorsal midline and lateral areas of the abdomen. This definition conflicts with the normal use of this term in insect morphology and we use dorsolateral instead.
pleural setae  Dorsolateral setae.
poriform  Porelike; in reference to siphunculi, reduced to a simple opening on the surface of the abdomen.
post-  After, or behind (prefix).
postclypeus  In aphids pertaining to prominent bulge, or swelling, on anterior half of clypeus.
posteriad  Toward the rear.
posterior  Hind or hind most; opposite of anterior.
posterior discal setae  One or more setae situated on each side of posterior half of disc of head.
posterior lateral setae  One or more setae situated laterally on each side of posterior half of pronotum.
posterior submedian setae  One or more pairs of setae situated near the midline on the posterior half of the pronotum.
postero-  Prefix denoting the hind part.
preapical  Before the apex; not quite apical.
pretarsus  That part of tarsus, or foot, bearing claws and arolia.
primary sensoria  Sensoria present on the ultimate and penultimate antennal segments in all nymphal and adult stages of aphids.
primary setae  The two basal and four to six preapical setae on the fourth rostral segment.
processus terminalis  Slender portion of apical antennal segment distad of primary sensoria.
pronotum  Upper surface of prothorax.
prothorax  First thoracic segment, bearing the anterior pair of legs.
pruinose  Covered with fine dust of wax.
pseudogall  Any distortion or deformation of plant tissue caused by aphids, but which does not completely enclose them. (Compare gall.)
pseudosensorium (pl. pseudosensoria)  Scent glands on the hind tibiae of oviparae (rarely also on vivipara), similar in appearance to placoid sensoria.
pterothorax  The wing-bearing segments of the thorax collectively (i.e., the mesothorax plus metathorax).
pterostigma (pl. pterostigmata)  Thickened, usually pigmented area on costal or anterior margin of forewing at the end of the longitudinal vein.
pulverulent  Powdery.
quadrate  Square or nearly so.
radial sector  Posterior branch of the radius (radial vein) of the wing; in aphids arising on the posterior margin of the stigma and commonly strongly curved (Fig. 1).

radius, radial vein  One of the main veins of the insect wing.

rastral setae  Comb of enlarged setae at apices of the tibiae.

rastral spines  Comb of immovable, thornlike spines at apices of the tibiae.

reniform  Kidney-shaped.

reticulate  Netlike, in reference to the form of surface sculpturing.

rhinarium (pl. rhinaria)  Used in aphids for antennal sensoria.

rostrum  Beak; prolongation of head and outer mouthparts, in which piercing and sucking mouthparts are contained.

rugose, rugulose  Wrinkled, corrugated.

scabrous  Rough; rough and irregularly rugose.

sclerite  Hardened, usually pigmented areas of integument.

scleroite  Small area of thickened, pigmented integument surrounding the base of a seta.

secondary sensoria  Antennal sensoria that occur only in adult apterae and alatae. (Compare primary sensoria.)

secondary setae  Setae situated between the basal and apical primary setae on the fourth rostral segment.

segment  Ring or subdivision of body or appendage.

sensorium (pl. sensoria)  Membranous, commonly slightly protuberant areas of integument, especially that of the antennae; sensory in function.

serrate  With toothed, or notched, edges or margins.

seta (pl. setae)  Hairlike extension of the integument, set in a socket, derived from a single epidermal cell. (Compare spine.)

setiform  Hairlike, bristle-shaped.

setigerous  Bearing setae.

sigmoid  S-shaped.

sinuous  Undulating.

siphunculus (pl. siphunculi)  Pair of orifice-bearing structures on apical half of abdomen of aphids, typically long and tubular; also called cornicles.

siphuncular  Pertaining to the siphunculi.

spatulate  Gradually enlarged and flattened toward the apex; spoon-shaped; used to describe setae (Fig. 91, Ar). (Compare capitate, clavate, flabellate.)

spicule  A minute, pointed spine or process on the integument.

spiculose  With spicules.

spinal  Near the dorsal midline. This term is peculiar to aphid workers. We prefer the terms median or submedian, as appropriate.

spine  Elongate, usually pointed multicellular extension of the integument, fixed (unsocketed) at the base. (Compare seta.)

spiracle  Breathing pore, located laterally on abdominal and thoracic segments.
**spiracular**  Pertaining to spiracles.

**squamate, squamose**  Covered with scales, or flattened, somewhat scale-like setae.

**sternal**  Pertaining to sternum.

**sternite**  Pigmented, hardened part of sternum.

**sternum** (pl. sterna)  Entire ventral area of any segment of body.

**stigma** (pl. stigmata)  A mark; the pterostigma.

**stridulatory organ**  Integumentary structures rubbed together to produce sound.

**stylet**  The elongate, threadlike mouthparts (derived from the mandibles and maxillae) of aphids (and related insects) used to pierce and suck fluids from the plant tissue.

**sub-**  Under; near, nearly, almost, as in submedian, subparallel (prefix).

**tail**  See cauda.

**tarsal**  Pertaining to tarsus or foot.

**tarsus** (pl. tarsi)  Foot, usually consisting of two segments, in aphids.

**tergite**  Dorsal sclerite, or part of body segments.

**tergum** (pl. terga)  Upper or dorsal part of any body segment; used especially for abdominal segments. (Compare **notum**.)

**thorax**  Second or intermediate part of body, bearing the legs and wings.

**tibia** (pl. tibiae)  Segment of leg between femur and tarsus.

**tibial**  Of, or pertaining to, tibia.

**transverse**  Running across, from side to side.

**trochanter**  A small sclerite attached to base of each femur.

**triommatidium** (pl. triommatidia)  Cluster of three ocular facets on each side of head.

**tubercle**  1) Rounded or slightly bulbous areas, with surface distinguished from surrounding integument at least by lack of sculpture, occurring dorsally and laterally on head and body; 2) large protuberance of the anterior margin of the head; 3) often used for the structures we refer to as **papillae**.

**unguis**  As used by aphid workers, the processus terminalis of the apical antennal segment. Literally, "claw."

**vasiform**  Vessel- or vase-shaped.

**veins**  Hardened, threadlike areas in membranes of wings.

**ventral**  Pertaining to lower surface or underside.

**ventral sutures**  Sutures on ventral surface of head, running from the upper edge of the clypeus, diverging on either side of the position of the anterior ocellus.

**vertex**  In aphids front, or anterior, margin of head.
Glossary of biological terms

*aestivosistens* (pl. *aestivosistentes*)  See *sistens.*

*alata* (pl. *alatae*)  Winged individual.

*andropara* (pl. *androparae*)  Individual that parthenogenetically gives birth to males.

*anholocycle, anholocyclic*  Term used to indicate that reproduction is completely asexual or parthenogenetic; sexual forms are unknown.

*alienicola* (pl. *alienicolae*)  Individuals of all morphs of heterocyclic species living on the secondary host.

*alatoid nymph*  Nymph destined to become an alata.

*aptera* (pl. *apterae*)  Wingless adult individual.

*crawler*  Active first-instar stage of Adelgidae and Phylloxeridae.

*diapause*  Arrested development.

*dioecious*  REquiring two hosts, or two different parts of the same plant to complete life cycle.

*exulis* (pl. *exules*)  Collective term for all morphs on the secondary host in heterocyclic species, e.g., *exulis vivipara* and *exules sexuparae; alienicola.*

*fall migrant*  Alatae that return to primary host in heterocyclic species.

*fundatrix* (pl. *fundatrices*)  Morph that hatches from the fertilized egg.

*fundatrigenia* (pl. *fundatrigeniae*)  Offspring of the fundatrix. Often restricted to the immediate offspring, but in heterocyclic species may refer to more than one generation of descendants on the primary host.

*gynopara* (pl. *gynoparae*)  Individual that parthenogenetically gives birth only to sexual females.

*heteroeocious*  Needing an alternation of hosts or feeding sites to complete development.

*heterocycly, heterocyclic*  Here used to indicate species that produce sexuales but need to change host plants or feeding site during season.

*hiemosistens* (pl. *heimosistentes*)  See *sistens.*

*holocycly, holocyclic*  Here, used only for species in which sexuales are produced and that does not change its species of host plant or feeding site. Also, broadly used for all species that produce sexuales, including heterocyclic species.
intermediate Used to indicate that an individual has characters of both an alata and an aptera.

migrans (pl. migrantes) Migrant.
migrant Here used for alatae that change host plants, as opposed to those that start new colonies on the same species of host plant.
monoeccious Requiring only one host and feeding site to complete life cycle.
morph Morphologically or physiologically distinctive form in a life cycle, e.g., fundatrix, vivipara alata, vivipara aptera, gynopara, sexualis, male, and ovipara.

neosistens (pl. neosistentes) First instars of sistens.

ovipara (pl. oviparae) Producer of eggs either parthenogenetically or fertilized.

parthenogenesis Asexual reproduction; reproduction without mating.
primary host Host on which fertilized eggs are laid; winter host.
progrediens (pl. progredientes) Adelgid individual produced on the secondary host that does not arise from an aestivating or diapausing larva. (Compare sistens.)

secondary host Host plant of host-alternating species on which only asexual reproduction occurs, no fertilized eggs are laid; summer host. Sometimes the term is also used in a historical sense for the host of species that are hypothesized to have developed from host-alternating ancestors but that now reproduce sexually on the former secondary host.
sexualis (pl. sexuales) Sexual or mating morphs: males and oviparae.
sexupara (pl. sexuparae) Forms that give rise to sexual forms. Sometimes restricted to individuals bearing both males and oviparae, but often used collectively to include dedicated gynoparae and androparae.
sistens (pl. sistentes) Adelgid individual developing from an aestivating (aestivosistens) or overwintering (hiemosistens) crawler. (Compare progrediens.)
spring migrant In heterocyclic species, the alatae that arise on the primary host and fly to and colonize the secondary host.
summer host Secondary host.
summer migrant Alatae that arise in colonies on the summer host and colonize additional plants of the summer host. This term is not used here. (See migrant.)
vagrant Alatae that arise in colonies on the summer host and colonize additional plants of the summer host.
virginogenia (pl. virginogeniae) An individual borne parthenogenetically, i.e., all individuals except the fundatrix.

virginopara (pl. virginoparae) The parent of an individual that reproduces parthenogenetically; opposite of a sexupara.

vivipara (pl. viviparae) Individual that gives birth to living young rather than laying eggs.

winter host Primary host.
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Davidson, W.M. 1912. Aphid notes from California. J. econ. Ent. 5:404–413.


741


743


Signoret, M. 1875. Schizeziura passerinii, sp. nov. Annls Soc. ent. Fr. 5:ccii–cciv.


Thomas, C. 1878. A list of the species of the tribe Aphidini family Aphidae, found in the United States, which have been heretofore named, with descriptions of some new species. Bull. Ill. St. Lab. nat. Hist. 2:3–16.


Host list

A host list is not entirely practical at the generic level for the aphids, but some broad associations can be used as an aid to identifying the many genera.

Members of certain genera may be found on a wide range of host plants, either because the different species have quite different host requirements, or because certain species accept many different plants. The following genera are listed only when they constitute an especially important component of the aphids occurring on the indicated host: *Acythosiphon*, *Aphis*, *Aulacorthum*, *Illinoia*, *Macrosiphum*, and *Myzus*.

Plants known or expected to host aphids in Canada are listed alphabetically by genus, except groups that are treated in the aggregate as follows: Bryophyta, Pteridophyta, Arecaceae, Cruciferae, Gramineae, Labiatae, Umbelliferae, and miscellaneous Compositae (composites with special associates are listed separately).

<table>
<thead>
<tr>
<th>Host plant</th>
<th>Aphid genus</th>
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</thead>
<tbody>
<tr>
<td><em>Abies</em> Mill.</td>
<td><em>Adelges</em></td>
</tr>
<tr>
<td></td>
<td><em>Cinara</em></td>
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<td></td>
<td><em>Elatobium</em></td>
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<td></td>
<td><em>Mindarus</em></td>
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<td><em>Pineus</em></td>
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<tr>
<td><em>Acer</em> L.</td>
<td><em>Drepanaphis</em></td>
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<tr>
<td></td>
<td><em>Drepanosiphum</em></td>
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<td></td>
<td><em>Longistigma</em></td>
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<td></td>
<td><em>Neoprociphilus</em></td>
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<td><em>Periphylus</em></td>
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<td></td>
<td><em>Prociphilus</em></td>
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<tr>
<td><em>Achillea</em> L.</td>
<td><em>Brachycaudus</em></td>
</tr>
<tr>
<td></td>
<td><em>Macrosiphoniella</em></td>
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<tr>
<td></td>
<td><em>Pleotrichophorus</em></td>
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<tr>
<td><em>Alnus</em> B. Ehrh.</td>
<td><em>Boernerina</em></td>
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<td></td>
<td><em>Calaphis</em></td>
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<td><em>Euceraphis</em></td>
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<td></td>
<td><em>Glyphina</em></td>
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<tr>
<td></td>
<td><em>Illinoia</em></td>
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<tr>
<td></td>
<td><em>Oestlundiella</em></td>
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<td><em>Prociphilus</em></td>
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<td></td>
<td><em>Pterocallis</em></td>
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751
### Host list (continued)

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Genus</th>
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<tbody>
<tr>
<td>Ambrosia L.</td>
<td>Brachycaudus</td>
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<td></td>
<td>Pleotrichophorus</td>
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<tr>
<td><em>Amelanchier Medic.</em></td>
<td>Acyrthosiphon</td>
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<td>Eriosoma</td>
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<td>Macrosiphum</td>
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<td></td>
<td>Nearctaphis</td>
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<td></td>
<td>Prociphilus</td>
</tr>
<tr>
<td><em>Amsinkia Lehm.</em></td>
<td>Pleotrichophorus</td>
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<tr>
<td><em>Anaphalis DC.</em></td>
<td>Illinoia</td>
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<td></td>
<td>Uroleucon</td>
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<tr>
<td><em>Aquilegia L.</em></td>
<td>Nasonovia</td>
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<td>Longicaudus</td>
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<tr>
<td><em>Arbutus L.</em></td>
<td>Wahlgreniella</td>
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<td><em>Arctostaphylos Adans.</em></td>
<td>Tamalia</td>
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<td><em>Arecaeeae Schultz-Bip.</em></td>
<td>Cerataphis</td>
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<tr>
<td><em>Artemisia L.</em></td>
<td>Coloradoa</td>
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<td></td>
<td>Epameibaphis</td>
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<td>Flabellomicrosiphum</td>
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<td>Macrosiphoniella</td>
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<td>Microsiphoniella</td>
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<td>Misturaphis</td>
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<td>Obtusicauda</td>
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<td></td>
<td>Pleotrichophorus</td>
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<td>Pseuopeameibaphis</td>
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<td></td>
<td>Zyxaphis</td>
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<tr>
<td><em>Asclepias L.</em></td>
<td>Aphis</td>
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<tr>
<td></td>
<td>Myzocallis</td>
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<tr>
<td><em>Asparagus L.</em></td>
<td>Brachylcolus</td>
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<td>Longicaudus</td>
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<tr>
<td><em>Berberis L.</em></td>
<td>Liosomaphis</td>
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<tr>
<td><em>Betula L.</em></td>
<td>Betulaphis</td>
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<td></td>
<td>Calaphis</td>
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<td></td>
<td>Callipterinella</td>
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<td>Ceppegillettea</td>
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<td></td>
<td>Euceraphis</td>
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<tr>
<td></td>
<td>Glyphina</td>
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</tbody>
</table>

752
Host list (continued)

Hamamelistes
Hormaphis
Symydoius

Bryophyta
Aspidaphium
Decorosiphon
Melaphis
Myzodium
Pseudacaudella

Caragana Lam.
Acyrthosiphon

Carduus L.
Brachycaudus
Capitophorus

Carex L.
Atheroides
Carolinaia
Ceruraphis
Gharesia
Glabromyzus
Iziphya
Rhopalosiphum
Saltusaphis
Schizaphis
Subsaltusaphis
Thripsaphis
Vesiculaphis

Carpinus L.
Myzocallis

Carya Nutt.
Monellia
Phylloxera
Protopterocallis

Castanea Mill.
Calaphis
Myzocallis
Phylloxera

Castilleja Mutis ex L.f.
Nasonovia
Nearctaphis

Chenopodium L.
Hayhurstia

Chrysanthemum L.
Brachycaudus
Coloradoa
Macrocephoniella
Pleotrichophorus
Host list (continued)

Chrysothamnus Nutt.  Zyxaphis

Cirsium Mill.  Bipersona  

Brachycaudus  

Capitophorus  

Uroleucon  

Compositae Giseke  

Capitophorus  

Nasonovia  

Uroleucon  

Comptonia L'Hér.  

Cepegillettea  

Illinoia  

Convallaria L.  Illinoia  

Cornus L.  Anoecia  

Aphis  

Corylus L.  Myzocallis  

Crataegus L.  Dysaphis  

Eriosoma  

Fimbriaphis  

Hyalomyzus  

Muscaphis  

Nearctaphis  

Ovatus  

Prociphilus  

Rhopolosiphum  

Cruciferae Juss.  Brevicoryne  

Hyadaphis  

Lipaphis  

Myzus  

Cytisus L.  Ctenocallis  

Delphinium L.  Brachycaudus  

Nasonovia  

Desmodium Desv.  Microparsus  

Dryas L.  Acyrthosiphon  

Echium L.  Brachycaudus  

Elaeagnus L.  Capitophorus  

754
Host list (continued)

Empetrum L.           Wahlgreniella
Epilobium L.           Acrysthosiphon
                      Aphis
                      Macrosiphum
Eriogonum Michx.       Amphicercidus
Eriophorum L.          Ceruraphis
Erodium L'Hér.          Acrysthosiphon
Euonymus L.            Aphis
Fagus L.               Grylloprociphilus
                      Longistigma
                      Phyllaphis
Fragaria L.            Aphis
                      Chaetosiphon
                      Fimbriaphis
                      Macrosiphum
Fraxinus L.            Meliarhizophagus
                      Prociphilus
Geranium L.            Acrysthosiphon
                      Amphorophora
                      Macrosiphum
Gramineae Juss.         Acrysthosiphon
                      Anoecia
                      Atheroides
                      Cryptaphis
                      Diuraphis
                      Forda
                      Geoica
                      Hyalopteroides
                      Hyalopterus
                      Hysteroneura
                      Kaltenbachiella
                      Macrosiphum
                      Rhopalomyzus
                      Rhopalosiphum
                      Schizaphis
                      Sipha
                      Takecallis
**Host list (continued)**

<table>
<thead>
<tr>
<th>Host</th>
<th>Hosts</th>
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<tbody>
<tr>
<td><strong>Grindelia Willd.</strong></td>
<td>Tetraneura, Utamphorophora</td>
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<tr>
<td></td>
<td>Atarsos, Uroleucon</td>
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<tr>
<td><strong>Hamamelis L.</strong></td>
<td>Hamamelistes, Hormaphis</td>
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<tr>
<td><strong>Heuchera L.</strong></td>
<td>Nasonovia</td>
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<tr>
<td><strong>Hieracium L.</strong></td>
<td>Nasonovia</td>
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<tr>
<td><strong>Humulus L.</strong></td>
<td>Phorodon</td>
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<td><strong>Hypericum L.</strong></td>
<td>Aphis, Bipersona, Hyalomyzus</td>
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<tr>
<td><strong>Impatiens L.</strong></td>
<td>Catamergus</td>
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<td><strong>Inula L.</strong></td>
<td>Capitophorus</td>
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<td><strong>Juglans L.</strong></td>
<td>Chromaphis, Monelliopsis, Panaphis</td>
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<td><strong>Juncaceae</strong></td>
<td>Glabromyzus, Schizaphis</td>
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<td><strong>Juniperus L.</strong></td>
<td>Cinara, Illinoia, Sanbornia, Siphonatrophia</td>
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<td><strong>Kalmia L.</strong></td>
<td>Neoamphorophora</td>
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<td><strong>Labiatae Juss.</strong></td>
<td>Cryptomyzus, Hyalomyzus, Kaltenbachiella, Ovatus</td>
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<tr>
<td><strong>Larix Mill.</strong></td>
<td>Adelges, Cinara</td>
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<tr>
<td><strong>Ledum L.</strong></td>
<td>Illinoia</td>
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<tr>
<td><strong>Lesquerella S. Wats.</strong></td>
<td>Brevicoryne</td>
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756
Host list (continued)

Linnaea L.  Illinoia
Liriodendron L.  Illinoia
Lonicera L.  Alphitoaphis
            Amphicercidus
            Gypsoaphis
            Hyadaphis
            Nasonovia
            Rhopalomyzus
            Stagona
Lupinus L.  Aphis
            Macrosiphum
Malus Mill.  Aphis
            Dysaphis
            Eriosoma
            Hyalomyzus
            Rhopalosiphum
Malva L.  Acrthosiphon
Medicago L.  Acrthosiphon
            Macrosiphum
            Nearctaphis
            Theroaphis
Melilotus Mill.  Theroaphis
Menziesia Sm.  Illinoia
Mespilus L.  Fimbriaphis
Oenothera L.  Anoea
            Aphis
            Macrosiphum
Pedicularis L.  Acrthosiphon
            Nasonovia
Physocarpus (Camb.) Maxim.  Utamphorophora
Picea A. Dietr.  Adelges
            Cinara
            Elatobium
            Mindarus
            Pachypappa
Host list (continued)

Pieris D. Don.

Pinus L.

Plantago L.

Polemonium L.

Polygonum L.

Populus L.

Potentilla L.

Prunus L.
Host list (continued)

*Pseudotsuga* Carrière

- Adelges
- Cinara
- Essigella
- Illinoia

Pteridophyta

- Idiopterus
- Macrosiphum
- Mastopoda
- Papulaphis

*Purshia* DC. ex Poir.

- Acrthosiphon

*Pyrus* L.

- Dysaphis
- Eriosoma
- Ovatus

*Quercus* L.

- Diphylaphis
- Hoplochaitophorus
- Lachnophaitophorus
- Lachnus
- Myzocallis
- Neosymydobius
- Phylloxera
- Stegophylla
- Thelaxes
- Tuberculatus

*Ranunculus* L.

- Thecabius

*Rhamnus* L.

- Aphis

*Rhododendron* L.

- Illinoia

*Rhus* L.

- Glabromyzus
- Hyalomyzus
- Melaphis

*Ribes* L.

- Cryptomyzus
- Nasonovia

*Robinia* L.

- Appendiseta

*Rosa* L.

- Acrthosiphon
- Chaetosiphon
- Eomacrosiphon
- Longicaudus
- Macrosiphum
- Maculolachnus
Host list (continued)

<table>
<thead>
<tr>
<th>Plant Family</th>
<th>Hosts</th>
</tr>
</thead>
</table>
| Rubus L.     | Myzaphis  
|              | Placoaphis  
|              | Pseudocercidis  
|              | Wahlgreniella  |
|              | Amphorophora  
|              | Aulacorthum  
|              | Illinoia  
|              | Macrosiphum  
|              | Placoaphis  |
| Rumex L.     | Aphis  
|              | Brachycaudus  |
| Salix L.     | Aphis  
|              | Aspidaphis  
|              | Cavariella  
|              | Chaitophorus  
|              | Fullawaya  
|              | Paducia  
|              | Phylloxerina  
|              | Pterocomma  
|              | Tuberolachnus  |
| Sambucus L.  | Macrosiphum  |
| Saxifraga L. | Nasonovia  |
| Scirpus L.   | Ceruraphis  
|              | Rhopalosiphum  
|              | Schizaphis  |
| Sequoia Endl.| Illinoia  |
| Shepherdia Nutt.| Capitophorus  |
| Smilax L.    | Neoprociphilus  |
| Solanum L.   | Aulacorthum  
|              | Macrosiphum  
|              | Myzus  
|              | Rhopalosiphoninus  |
| Solidago L.  | Cachryphora  
|              | Macrosiphum  
|              | Uroleucon  |
Host list (continued)

**Sonchus L.**
- Acyrthosiphon
- Nasonovia
- Uroleucon

**Sorbus L.**
- Dysaphis
- Eriosoma
- Muscaphis

**Spiraea L.**
- Aphis
- Aspidaphis
- Brachycaudus
- Illinoia

**Stellaria L.**
- Brachycolus

**Symphoricarpos Duh.**
- Amphicercilus
- Aphthargelia

**Tanacetum L.**
- Macrosiphoniella

**Taraxacum Wiggers**
- Aphis
- Trama
- Uroleucon

**Thalictrum L.**
- Acyrthosiphon
- Illinoia
- Longicaudus

**Thuja L.**
- Cinara

**Tilia L.**
- Eucalipterus
- Longistigma
- Tiliphagus

**Trifolium L.**
- Acyrthosiphon
- Nearctaphis
- Therioaphis

**Tsuga Carrière**
- Adelges
- Cinara
- Illinoia

**Tulipa L.**
- Dysaphis
- Macrosiphum
- Rhopalosiphoninus

**Typha L.**
- Macrosiphum
- Rhopalosiphum
## Host list (continued)

<table>
<thead>
<tr>
<th>Plant Family</th>
<th>Insects</th>
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<tr>
<td><em>Ulmus</em> L.</td>
<td>Colopha&lt;br&gt;Eriosoma&lt;br&gt;Georgiaphis&lt;br&gt;Georgiaphis&lt;br&gt;Kaltenbachiella&lt;br&gt;Tetranemura&lt;br&gt;Tinocallis</td>
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<tr>
<td><em>Umbelliferae</em> Juss.</td>
<td>Cavariella&lt;br&gt;Dysaphis&lt;br&gt;Hyadaphis</td>
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<tr>
<td><em>Urtica</em> L.</td>
<td>Microlophium</td>
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<td><em>Vaccinium</em> L.</td>
<td>Fimbriaphis&lt;br&gt;Illinoia&lt;br&gt;Macrosiphum&lt;br&gt;Wahlgreniella</td>
</tr>
<tr>
<td><em>Valeriana</em> L.</td>
<td>Macrosiphum</td>
</tr>
<tr>
<td><em>Viburnum</em> L.</td>
<td>Ceruraphis</td>
</tr>
<tr>
<td><em>Vicia</em> L.</td>
<td>Aphis</td>
</tr>
<tr>
<td><em>Vitis</em> L.</td>
<td>Phylloxera</td>
</tr>
</tbody>
</table>
Index of generic and subgeneric names

All generic and subgeneric names mentioned in the generic descriptions are included. For genera that are fully described, page numbers refer to the first page of the description. For other names page numbers refer to the Comments section of the appropriate main entry.

Acyrthosiphon Mordvilko 118
Adelges Vallot 710
Allaphis Mordvilko
= Thripsaphis 671
Alphitoaphis Hottes 122
Amphicercidus Oestlund 126
Amphorinophora MacGillivray,
subgenus of Illinois 396
Amphoraphora Buckton 130
Anoecia Koch 133
Aphis Linnaeus 137
Aphrastasia Börner, subgenus
of Adelges 713
Aphthargelina Hottes 141
Appendiseta Richards 145
Artemisaphis Knowlton &
Roberts, subgenus of
Obtusicauda 519
Asiphonaphis Wilson & Davis
148
Asiphum Koch = Pachypappa
531
Aspidaphis Gillette 152
Aspidaphium Börner 157
Atarsos Gillette 161
Atheroides Haliday 164
Aulacorthum Mordvilko 168
Betulaphis Glendenning 171
Bipersona Hottes 175
Boerlnerina Bramstedt 178
Brachycaudus van der Goot
183
Brachycoccus Buckton 186
Brachycorynella Aizenberg
= Brachycoccus 188
Brevicoryne van der Goot 188
Byrsocryptoides Dzhibladze, see
Gharesia 341
Cachryphora Oestlund 192
Calaphis Walsh 196
Callaphis Walker = Panaphis
537
Callipterinella van der Goot
200
Capitophorus van der Goot 203
Capitosiphon Heie, subgenus of
Nasonovia 498
Carolinaia Wilson 207
Catamergus Oestlund 211
Cavareilla Heinze, subgenus
of Cavariella 156, 218
Cavariella Del Guercio 214
Cepeiillettea Granovsky 218
Cerataphis Lichtenstein 222
Ceruraphis Börner 225
Chaetosiphon Mordvilko 229
Chaitophorus Koch 232
Chermes Linnaeus = Adelges
Vallot 713
Cholodkovskaya Börner,
subgenus of Adelges 713
Chromaphis Walker 236
Clydesmithia Danielsson, see
Pachypappa 531
Cinara Curtis 239
Colopa Monell 243
Coloradoa Wilson 247
Cornaphis Gillette 250
Cryptaphis Hille Ris Lambers
254
Cryptomyzus Oestlund 258
Ctenocallis Klodnitzki 261
Dactynotus Rafinesque
= Uroleucon 697
Daktulosphaira Shimer, see
Phylloxera 721
Decorosiphon Börner 265
Delphiniobium Mordvilko, see Nasonovia 498
Diphyllaphis Takahashi 268
Diuraphis Aizenberg 271
Drepanaphis Del Guercio 275
Drepanosiphum Koch 279
Dreyfusia Börner, subgenus of Adelges 713
Dysaphis Börner 283
Elatobium Mordvilko 286
Eoessigia David, Rajasingh & Narayanan, see Aspidaphis 156
Eokakimia Heie, subgenus of Nasonovia Mordvilko 498
Eomacrosiphon Hille Ris Lambers 290
Eopineus Steffan, subgenus of Pineus 717
Epameibaphis Oestlund 293
Ericobium MacGillivray = Illoina 396
Eriosoma Leach 297
Essigella Del Guercio 301
Eucallipterus Schouteden 305
Euceraphis Walker 309
Eulachnus Del Guercio 312
Fagiphagus Smith = Grylloprociphilus 354
Fimbriaphis Richards 316
Flabellomicrosiphum Gillette & Palmer 320
Forda von Heyden 323
Fullawaya Essig 327
Geoica Hart 330
Georgiaphis Maxson & Hottes 334
Gharesia Stroyan 337
Gilletteella Börner, subgenus of Adelges 713
Glabromyzus Richards 341
Glendenningia MacGillivray 344
Glyphina Koch 348
Gobaisha Matsumura = Kaltenbachiella 404
Grylloprociphilus Smith & Pepper 351
Gypsoaphis Oestlund 354
Hamamelistes Shimer 357
Hayhurstia Del Guercio 361
Holcaphis Hille Ris Lambers, subgenus of Diuraphis 275
Hoplochaitophorus Granovsky 364
Hormaphis Osten Sacken 368
Hyadaphis Kirkaldy 372
Hyalomyzus Richards 376
Hyalopteroides Theobald 379
Hyalopterus Koch 382
Hyperomyzus Börner, subgenus of Nasonovia 498
Hysteroneura Davis 386
Idiopterus Davis 389
Illinoia Wilson 393
Iziphya Nevsky 396
Jacksonia Theobald 400
Kakimia Hottes & Frison, subgenus of Nasonovia 498
Kaltenbachiella Schouteden 402
Lachnochaitophorus Granovsky 405
Lachnus Burmeister 408
Lambersius Olive, subgenus of Uroleucon 697
Liosomaphis Walker 411
Lipaphis Mordvilko 414
Longicaudus van der Goot 418
Longistigma Wilson 421
Macroaphioniella Del Guercio 425
Macrosiphum Passerini 428
Maculolachnus Gaumont 432
Masonaphis Hille Ris Lambers, subgenus of Illinoia 396
Mastopoda Oestlund 435
Melaphis Walsh 439
Meliarhizophagus Smith 442
Metopolophium Mordvilko, subgenus of Acyrthosiphon 122
Microlophium Mordvilko 446
Microparsus Patch 449
Microsiphoniella Hille Ris Lambers 452
Mindarus Koch 456
Misturaphis Robinson 459
Monella Oestlund 463
Monelliopsis Richards 466
Mordwilkoja Del Guercio 470
Mycaphis Börner 473
Mycaphis van der Goot 477
Myzocallis Passerini 481
Myzodium Börner 486
Myzus Passerini 489
Nasonovia Mordvilko 493
Nearctaphis Shaposhnikov 498
Nectarosiphon Schouteden, subgenus of Myzus 493
Neoamphorophora Mason 502
Neokakimia Doncaster & Stroyan = Kakimia, subgenus of Nasonovia 498
Neomyzus van der Goot, subgenus of Aulacorthum 171
Neonasonovia Hille Ris Lambers, subgenus of Nasonovia 498
Neoparacletus Strom, subgenus of Prociphilus 572
Neoprociphilus Patch 505
Neosymydobius Baker 509
Neotoxoptera Theobald 512
Obtusicauda Soliman 516
Oestlundia Hille Ris Lambers, subgenus of Illinoia 396
Oestlundiella Granovsky 519
Ovatus van der Goot 523
Pachypappa Koch 526
Pacificallis Richards, subgenus of Tuberculatus 689
Paducia Hottes & Frison 531
Panaphis Kirkaldy 535
Papulaphis Robinson 539
Paraprociphilus Mordvilko, subgenus of Prociphilus 572
Parathecabius Börner, subgenus of Thecabius 660
Peliphiaphis Frison & Ross, subgenus of Thripsaphis 671
Pemphigus Hartig 542
Pentatrichopus Börner, subgenus of Chaetosiphon 232
Periphyllus van der Hoeven 546
Phloemyzus Horvath 549
Phorodon Passerini 553
Phyllaphis Koch 556
Phylloxera Boyer de Fonscolombe 717
Phylloxyra Börner 721
Pineodes Börner, subgenus of Pineus 717
Pineus Shimer 713
Placophis Richards 561
Pleotrachiphorus Börner 564
Plocamaphilus Oestlund = Fullawaya 330
Pomaphis Börner, subgenus of Dysaphis 286
Prociphilus Koch 568
Prototrichocallis Richards 572
Pseudacaudella Börner 575
Pseudasiphonaphis Robinson, see Asiphonaphis 152
Pseudocercidis Richards 579
Pseudepameibaphis Gillette & Palmer 582
Pseudopterocomma MacGillivray 586
Pterocallis Passerini 589
Pterocomma Buckton 594
Pulvius Sanborn, subgenus of Prociphilus 572
Ranakimia Heie, subgenus of Nasonovia 498
Rhizomaria Hartig = Pachypappa Koch 531
Rhodobium Hille Ris Lambers, see Acyrthosiphon 122
Rhopalomyzus Mordvilko 598
Rhopalosiphoninus Baker 601
Rhopalosiphum Koch 605
Roepkea Hille Ris Lambers, see Nearctaphis 502
Rungsia Mimeur, subgenus of Sipha 625

Sacchiphantes Curtis, subgenus of Adelges 713
Saltusaphis Theobald 608
Sanbornia Baker 612
Satula Olive, subgenus of Uroleucon 697
Schizaphis Börner 615
Schizolachnus Mordvilko 619
Schizoneura Hartig, subgenus of Eriosoma 301
Sipha Passerini 622
Siphonatrophia Swain 625
Sitobion Mordvilko, subgenus of Macrosiphum 432
Smynthurodes Westwood 629
Stagona Koch 632
Stegophylla Oestlund 635
Subsaltusaphis Quednau 639
Symydobius Mordvilko 642

Takecallis Matsumura 646
Tamalia Baker 649
Tetraneura Hartig 653
Thecabius Koch 657
Thelaxes Westwood 660
Therioaphis Walker 664
Thripsaphis Gillette 668
Tilaphagus Smith 671
Tinocallis Matsumura 675
Toxoptera Koch 678
Toxopterella Hille Ris Lambers = Muscaphis 477
Trama von Heyden 682
Trichocallis Börner, subgenus of Thripsaphis 671
Tuberculatus Mordvilko 685
Tuberculoides van der Goot, subgenus of Tuberculatus 689
Tuberolachnus Mordvilko 689

Uroleucon Mordvilko 692
Uromelan Mordvilko, subgenus of Uroleucon 697
Utamphorophora Knowlton 697

Vesicularaphis Del Guercio 701
Viteus Shimer = Daktulosphaira, see Phylloxera 721

Wahlgreniella Hille Ris Lambers 703

Xerophylla Walsh = Phylloxera 721

Zyxaphis Knowlton 706