The Heritage Lecture

Early Prairie Entomology and Entomologists

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"In the beginning..." the Good Book tells us there was a separation of the sea from the land "and it was good." The continents were formed and the land was populated with a multitude of beasts and the birds, including the insects. Geologists tell us that the continent of North America appeared in the tropical equatorial region of Earth in the Carboniferous Era some 320 million years ago. Then it moved ever so slowly northward in the next 200 million years, through various periods of time to its present location during the Cretaceous Era some 65 million years ago. The Great Inland Sea with its muddy bottom, dried up, the flora and fauna changed and then glaciation marked its passage by carving its indelible signature on the landscape, leaving behind the remains that are the physical landmarks of the present era.

The insects that abounded were invariably confined within the ecological pallisades of restricted ecosystems. In Western Canada the largest distinctive system was that which encom

passed the vast grassland plains of the southern region. It was ringed by a transitional grass-tree complex — the aspen parkland — and receded northward through a forested area to end in the tundra of arctic Canada. The Province of Saskatchewan included all of these four regions: grassland, aspen-parkland, forest and tundra. When man invaded these regions after the last Ice Age — some 20,000 years ago — he preferred the milder climate and the gentler climes of the southern districts. Even today the vast majority of the human population may be found in the lower half of the province.

But the insects were not so choosy. They quickly adapted to specific conditions to live and thrive in all parts of the province. The early explorers soon learned of the mosquitoes, blackflies, tabanids, and culicoides that haunted them wherever they went. The new settlers tried to ignore and live with these self-same insects, but were sometimes confronted by the devastation caused by the Rocky Mountain locust. All too well did they become acquainted with head lice, cockroaches and larder beetles; those that were unknowingly brought into the settlements with their grain and personal belongings. More was learned of the insect populations in Saskatchewan by the early collectors and naturalists such as those of the Geological Survey of Canada. Well-known individuals of that Survey — Robert Bell, John Macoun and J.B. Tyrell — soon had compiled long lists of indigenous insects, most of them new to the scientific world and appealing to collectors world-wide.

There were no entomologists per se in Saskatchewan to lend a hand in identifying them and to distinguish friend from foe. In Ottawa, the Dominion Entomologist, James Fletcher, had been appointed in 1884 to oversee, regulate and perform all entomological research in the Dominion. Consequently he, together with about 400 observers and correspondents, kept a close watch on insects, both noxious and beneficial, and attempted to keep outbreaks under control. But ancillary help was on hand. In Alberta, from 1898-1902, he had Percy Gregson and the North-West Entomological Society to lead the way. In Manitoba there was Norman Criddle to assist in the entomological tasks. An enthusiastic help-mate in Saskatchewan was Thomas N. Willing, (see *Bull. Ent. Soc. Can.* 16(2):32-33. 1983. And *Dictionary of Canadian Biographies* 14: 1066-1067. 1998) who from 1880 onwards until his death, both as an employee of the Territorial Department of Agriculture and as a Professor of Biology at the University of Saskatchewan, aided the cause of entomology by competent extension work and teaching.

But, one may ask, why was there a need for extensive entomological work? The settlement of Saskatchewan, from the early 1880s onward, increased the amount of land that was being disturbed for extensive agricultural purposes. The insects that had been indigenous to the prairie and forest of the fledgling province, were suddenly presented with a great variety of other food, plants of the domesticated variety. This cafeteria of food was not ignored, but readily accepted by the insects. In 1885, Fletcher discovered the wheat stem sawfly near some domestic wheat fields near Indian Head, Saskatchewan. It had been content to survive in the natives grasses of the plains, but when supplied with seemingly unlimited fields of grain, it quickly adapted to the new food (and home) and became a pest of note to the farmers. It soon caused losses of up to 10% of harvested crops. This amounted from two to 22 million dollars annually.

Cutworms and wireworms that had lived contentedly in the soil and were nurtured in the past by a multitude of grass stems and roots, now found more succulent food in the cereal grain fields, and became instant enemies of the farmers. Then there were the numerous insects of gardens and small shrubs, of coniferous and deciduous trees, of large and small animals, and of stored products and homes. There seemed to be insects all over the place, as rightly there were, but hitherto there had been no one, other than the few roaming indigenous bands of Plains Indians, to take note of their presence. But soon after the settlers arrived, along with infestations of injurious insects, came loud notes of protest and cries for help. As could be expected, there were

demands that the government do something — get someone on hand to help the general population to not only understand what was going on, but also to do something about "getting rid" of the pests that seemed to increase with every passing year.

The Entomological Branch of the federal Department of Agriculture — specifically James Fletcher, his assistant Arthur Gibson, and his successor, C. Gordon Hewitt, — were aware that more help was needed in the western provinces to combat insect infestations and curb outbreaks. Although Norman Criddle in Manitoba and E.H. Strickland in Alberta, had been a great help in attending to most of the insect problems in Saskatchewan, there was a need for a "resident" entomologist in Saskatchewan. Alfred E. Cameron, a recent addition to the staff of the Entomological Branch, had in 1915 been assigned to help Reginald C. Treherne of the Agassiz Laboratory in British Columbia, to combat the ravages of the pear thrip in that province. By 1917, this task had been accomplished, so Cameron was free to go elsewhere, and thus he was assigned to go to Saskatoon to tackle problems brought on by mosquitoes, horseflies, botflies, warble flies and blackflies. Here he established the first Dominion Entomological Laboratory (DEL) on the campus of the University of Saskatchewan.

The new laboratory was actually just a small room in the basement of the Physics Building where Cameron established an office with borrowed furniture, a borrowed miscroscope and a rented automobile. All he got from Ottawa was some paper and pencils, a hand lens, tweezers, a Schmitt Box and some insect pins. How would any of you like to start a laboratory and undertake research of the biology of blackflies and tabanids with that kind of equipment? Nevertheless, he did some detailed and careful work and published a very respectable and insightful paper that still is of value today (see *Can. Dept. Agric. Tech. Bull.* No 5, 1918). But more pressing insect problems came to the fore in Saskatchewan, in particular, the outbreak of and destruction by hordes of grasshoppers. Cameron was delegated to take an active part in the provincial control campaign, as well as to look after some of the problems associated with cutworms. Field crop insects and economic entomology were not Cameron's strongpoints; he preferred research on insects of medical-veterinary importance and in academia. When Walter Murray, then President of the University of Saskatchewan, offered him a position in which he was to teach Entomology and Parasitology, he accepted.

That left a vacancy in the ranks of federal entomology in Saskatchewan, a position that Hewitt soon filled by appointing Kenneth M. King, who arrived in Saskatoon on 17 August 1922 to take up his new position. He too found a paucity of equipment on hand. The legacy left to him by Cameron was a well-used typewriter, a chair, and a 1920 Model T Ford car, along with two desk-top trays, one wastepaper basket, 24 Schmitt boxes without insects, 12 lamp chimneys, and 20 flower pots. All other furnishings and records were removed to an upstairs office in the Physics Building, the first floor of which housed the Department of Biology.

Almost immediately after King's arrival an "ecological" atmosphere was established in the province. King, a graduate of the University of Illinois and a student of the Shelford school of ecological thought, incepted studies involving the insects in a prairie grassland ecosystem. The project continued for many years, and every new staff member who came to work at the laboratory — up to WW II— was involved in some aspect of it. All insects found on the plots were painstakingly collected by sweep net and more often by soil sampling, to obtain larval and pupal specimens. All collections were bottled or pinned and preserved for later identification. Alas, the incredible mass of material collected was overwhelming and remained on shelves and in storage cabinets for more than 20 years. There was no qualified taxonomist on hand who would willingly take on the colossal task. The project data were never fully analysed (statisticians refused to collate the information because it was not collected in a manner that (they said!) lent itself to statistical analyses), nor were the insects fully identified. A waste, one may ask? Yes to some, but it's

effects were widespread. When any insect research was incepted at the laboratory, it was immediately charged with the ecological concept of interdependence of all insect activity with the environment, a concept that is still very much in vogue today. This concept — the holistic approach to biological studies — was never relaxed throughout the life of the laboratory.

But there was more to the work of the DEL in Saskatoon than ecology. Not only were the grasshoppers causing havoc to all crops, including gardens and forage crops, the pale western cutworm, wireworms and the wheat stem sawfly needed urgent attention because they too always seemed to be present in outbreak proportions. Then also, research was needed to find viable methods of controlling the insects. This invariably would demand, first of all, the true identification of the insects, followed by a very detailed study of their life history and habits. Only then could extensive and intensive trials and experiments on chemical, cultural or biological control by undertaken.

On another front, in southern Saskatchewan, a similar situation prevailed. The insect threat to trees and shelterbelts on the prairies was very real. The larch sawfly, spruce budworm, pine needle scale, wood borers and tent caterpillars, often epidemic in native forest stands in the central and northern parts of the province, spilled over during periodic outbreaks in the man-made shelterbelts, shade trees and ornamental plantings in small towns and settlers' farms. J.M. Swaine, Head of the Division of Forest Insects of the Entomological Branch, consulted with A. Gibson, the Dominion Entomologist, and decided to send an entomologist to the prairies to investigate the problem(s).

J.J. de Gryse took up these new duties at Indian Head on 14 August 1923, and established the second DEL on the grounds of the Experimental Farm. Here he was immediately involved in quelling a tent caterpillar outbreak as well as staving off the hoards of grasshoppers that threatened the farmers' livelihood. When time permitted he made a quick survey of the province to determine what other insect pests needed attention and found a dozen species that required control. But by November he had had enough of the desolate prairies and returned to Ottawa.

However, the tent caterpillar outbreak in Saskatchewan had increased in 1924 and de Gryse was ordered back to Indian Head; arriving there in late April. The pine needle scale outbreak increased his work load, but he quickly devised a method of control comprising dormant sprays as opposed to the arsenical stomach poison used on the caterpillars. 1925 was even more devastating for deciduous trees. The forest tent caterpillar came out in force in spring and reduced the trees to November-like skeletons. He was glad to return to Ottawa by October to get away from the wilds of Saskatchewan, the harsh winters and the lack of social and entertainment arts.

Although the University of Saskatchewan had some entomological expertise in its rank by the presence of T.N. Willing, this was terminated by his death in 1920. When L.G. Saunders was appointed to the Biology Department by President Murray in 1925, there was some renewal of entomological expertise. However, these talents were not in the field of economic entomology, thus of no immediate help to the farmer and his problems.

In the spring of 1926 the Livestock Insect Division of the Entomological Branch, had decided that a man was urgently needed in Saskatchewan to investigate livestock insect problems, especially warble flies and the many biting flies. Consequently Eric Hearle was dispatched to Indian Head where he was to make his headquarters in the already established DEL on the Experimental Farm. It was argued that one man, on site, should be capable of handling all insect problems of livestock and forest, especially since K.M. King — and his assistant Ellis McMillan who had come on stream in 1925 — was also on hand to cover the problems in central and northern parts of the province. Alas, very little work was done with livestock insects until mid summer because the tent caterpillar once more required Hearle's full attention. After that he had time to only advise farmers of their shade tree, shelterbelt, and livestock insect problem and had no time to investigate control strategies. Thus it became abundantly clear that one man in southern

Saskatchewan could not handle all of the entomological problems that developed there.

The following spring (1926) Kenneth Stewart, a recent Master's graduate from McGill, was appointed to fill the gap and was assigned the task of studying and devising control methods to combat the noxious insects of shade trees and shelterbelts. Eric Hearle confined his activities to studies of life histories, surveys of abundance and assisting in the control of mosquitoes and warble flies. However, his work was short lived for he was re-assigned to Kamloops in June of 1928 to found and develop the Livestock Insect Laboratory in that city.

But what about the DEL in Saskatoon. The weighty problems of grasshoppers, wireworms, and cutworms were exceeding the capabilities of King and McMillan. In 1927, Arni P. Arnason was appointed to assist King with the wireworm problem, one that was receiving a great deal of attention and involved King's ecological, holistic, biological investigation of wireworm populations. To determine the causes of population fluctuations they had started the "Rotation Project" in co-operation with the Swift Current Experimental Farm one that encompassed enormous amounts of labour of soil sampling in annual counts made in soil of plots that were subjected to systematized, rotational crop plantings and summerallow. In 1928, Robert Glen — who later became Research Director, Dominion Entomologist, and finally the Director General of today's Research Branch — joined the staff of the Saskatoon DEL and was also assigned to the wireworm project. His job was to determine what species of worms were present and ferret out their morphological structure and life histories. In the same year, 1928, Lorne C. Paul was also added to the roster of entomological workers. His duties comprised the supervision of surveys and control strategies of grasshoppers. These insects had long been the chief culprits that decimated farmers' crops and it was time that someone devoted full time attention to their control.

The cadre of the five entomologists, King, McMillan, Arnason, Glen and Paul, was the nucleus of the DEL's dynamicity. Although the mandate of the Entomological Branch was research, i.e. to determine the identity and life histories of insects and to devise control strategies of noxious insects, these men permitted their duties to extend far beyond those parameters. King's policy of operation was to help the farmer in any way he could. That meant the DEL would, and was, involved in actual control campaigns and extension work. This policy was to be in force for many years to come.

Almost from the day these workers were hired, they were not only researchers, but extension specialists in entomology. Every inquiry concerning an insect problem was investigated, the insects were identified and a control remedy was given - and often demonstrated. This meant many hours on the telephone, but primarily it meant actual visits to farmers in the field. Many days were spent "on the road", examining fields where either cutworms or wireworms had thinned seedling crops to near extinction, or showing farmers the best way to spread arsenic-laced sawdust baits. Then there were lectures and seminars, and field days to attend. Talks and demonstrations on insect life histories and control were commonplace. Actual participation in provincial control campaigns involving grasshoppers, cutworms and sawflies was not only expected by the farming public but willingly performed by all the entomologists.

Of course, there was also the research to attend to. This involved — at least in the spring — the drudgery of sifting soil in the on-going studies of wireworm populations to determine how crop rotations, climatic factors, and tillage methods affected the survival and well-being of the insects and the severity of damage to the farmers' crop. When the "Great Depression" settled on the western world, it had a devastating effect on agriculture in western Canada. The drought conditions, when added to the severe distress of the economic situation, demanded that every effort be made to maintain agricultural production at its highest possible level. Thus it was incumbent upon all who were concerned with insects, to pay paramount attention to their control.

All insect control studies, as well as those associated with the ecological project, demanded an immense amount of manpower. Willing students, when they graduated, joined the staff of

DEL. In 1933, Howard McDonald, William B. Fox and Virgil L. Berg were added to the roster of entomological manpower. McDonald was soon to take over the cutworm project, especially that of the red-backed cutworm which was causing serious destruction of cereal crops in central and northern districts. Fox lent a hand to the wireworm project and ably directed the field staff who worked on the rotation project. Virgil Berg was assigned to the grasshopper project. When not involved in the annual adult and egg abundance surveys — used to prepare the annual outbreak forecast — he studied the parasites. His work on the life history and habits of the beefly predator (Systoechus vulgaris), netted him an M.Sc. from the University of Saskatchewan in 1936. Despite their best efforts, surveillance and detailing of damages to crops and control efforts by provincial authorities, the losses of crop were astounding. As the drought continued the grasshopper plague increased to levels never before experienced on the prairies. Manpower was extracted from many sources to help fight the plague.

Harry Williamson was added to the DEL staff in 1935. P.C. Brown, a member of the staff of the Plant Protection Office in Estevan, Saskatchewan, was seconded to conduct the annual surveys of abundance of grasshoppers in southern Saskatchewan. All available staff from the DEL in Saskatoon were put to the task. Ken Stewart from the DEL in Indian Head, dropped his research work on shelterbelt insects and helped with extension duties in the grasshopper and pale western cutworm control campaigns. This action did not mean that all work with shelterbelt insects ceased. In 1928 and 1929 he had the help of Dave Arnott for the summer months. The forest tent caterpillar was the chief insect of concern, but there were a host of other pests — including pine needle scale, red spider mite, Bruce spanworm, willow leaf beetle, caragana blister beetle and poplar borer — whose outbreaks had to be investigated and control methods devised. Then control recommendations had to be devised as well as supervising their application by farmers.

When Arnott left in October 1929 for Chatham, Ontario, there were other seasonal employees on hand to lend assistance, viz. Allan Ross, Robert Williamson, Cecil Douglas and Lloyd Peterson. The latter two remained in the employ of the DEL and did most of the research work at the Indian Head facility. Research was on-going to find control methods to curb the onslaught of fall cankerworm, willow leaf beetles, spruce aphids and several other insect pests. This left Stewart free — despite the objections of his Chief of Forest Insect Investigations, J.M. Swaine, and the Acting Director of the Division of Forest Insects, J.J. de Gryse — to lend assistance in the control of the pale western cutworm outbreak that had reduced by 50%, the seedling stands of more than 10,000 acres of cereal crops in the southern Saskatchewan. Luckily this outbreak centered around Indian Head and thus Stewart was right in the thick of surveys, damage assessments, and giving farmers advice on control. When the outbreak continued for two more years the entomologists of DEL Saskatchewan, were relieved and gratified to have someone on hand nearby to do the extension work to help the farmers.

By 1935, Harold McMahon had been added to the staff at the DEL Saskatoon. He was immediately assigned duties related to grasshopper control along with all other employees. The drought had continued and the prolonged outbreak of grasshoppers and intensified to the point where more than one million acres of land (1,562 square miles) were very severely infested and another 49 million acres (76,562 square miles) were threatened by variable densities of marauding hordes of insects. Two-thirds of the agricultural land of the province was threatened. Such infestations had never before been witnessed in the province. Provincial control authorities were putting forth an all-out effort to control the grasshoppers and welcomed every federal entomologist (as well as many provincial and municipal governmental personnel) who gave them assis

tance in directing control operations, instructing farmers in ways to control the pests, and investigating every local complaint and call for help that came from the farming public. When the events of the day are examined in retrospect, it was the prolonged outbreak of grasshoppers — especially from 1932 to 1939 — that boosted the presence of entomologists and entomological endeavour in the province. The need for information concerning the biology and control of these insects loomed large enough in the minds of administrative personnel of the Entomological Branch, that they utilized to the fullest the authority given them by the Agricultural Pest' Control Act of 1910, to increase the staff to meet the needs of the time. In 1939, Lloyd G. Putman joined the ranks of the "grasshopper fighters" at DEL Saskatoon, and Herman W. Moore and Paul W. Riegert in 1944.

The early entomologists, comprising the members of the DEL Saskatoon up to the Second World War, were the basic building blocks that resulted in the blossoming of entomological science in the next two decades. The scientists, beginning with Alfred E. Cameron in 1917, through to Paul W. Riegert in 1944, were steadily immersed in all aspects of the various insect outbreaks. Although they were research personnel, they were weighted down with the immediate need to serve the farmers. This need was met by an intensive search for, and resolution of a method of insect control — be that chemical control for a "quick fix" but more often than not it was resolved by cultural and biological control schemes that fitted into the daily routine of agriculture as practiced by prairie farmers.

The DEL Indian Head had also increased in the number of staff and the duties that they performed. The inauguration of the Forest Insect Survey in 1940 added a cadre of active workers that detailed the location and occurrence of a multitude of insects affecting shelterbelt plantings and ornamental trees. This facility also mushroomed in numbers of trained entomologists and eclipsed in the immediate post-war years to a viable and energetic aggregation of workers the likes of which had never before been seen in the province. Added to this was the influx of special-expertise entomologists to take part in expanded programs of physiology, toxicology, and ecology at the DEL Saskatoon. They were all included in the second-wave of entomological excellence, reaching a pinnacle of research which may well be regarded as the "Golden Age" of entomology in Saskatchewan. But that is another story.