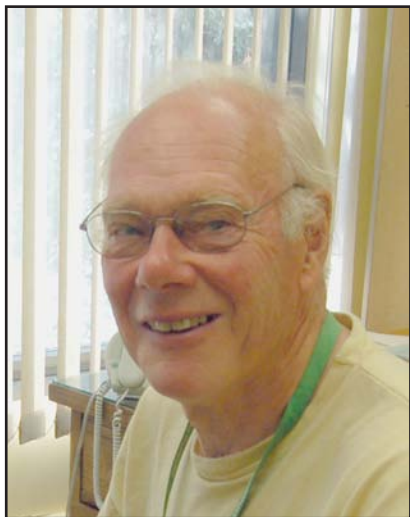


Heritage Lecture / Allocution du patrimoine

by Peter Harris



Shannon Little

Drifting and Diagonal Swimming in the Ag. Canada Flow

This is an account of Canadian biocontrol and particularly of weed biocontrol. My English school goal was forestry. However, I lacked the Latin required to enter Oxford University since I went blank when the teacher drummed me on the head with his silver pencil. A great uncle had immigrated to British Columbia where the war trapped my grandparents on a visit, so the University of British Columbia was a good alternative. I took forest entomology under Ken Graham and joined the track team of six which won against colleges in the United States. I came second in the half mile and won the one and two mile events.

Membership on the track team required a

Dr. Peter Harris presented the Heritage Lecture at this year's joint meeting of the Entomological Society of Canada and the Entomological Society of Saskatchewan, in Saskatoon, Sk, 29 September - 3 October.

summer job on campus. I was hired by the federal Division of Entomology to work at the Belleville Ontario substation at UBC by Jim McLeod. The work lacked variety for Ottawa's biweekly progress reports, so my reports were often on other insects such as the bark beetle with the melodic name of *Pseudohylesinus nebulosus*. I rewrote my Ottawa report on this insect for a student essay contest that in 1957, was my first publication. I also reported on a moth in white pine needle bundles that sometimes committed suicide by pupating the wrong way round. Editing of papers and reports was done in Ottawa by a process called 'wigmorization', after the editor, Wigmore. He was renown for long explanations about each correction. To focus him, I wrote that this moth committed insecticide and was delighted with two pages on the misuse of the term 'insecticide'. Life was good. I had met Irene, my future wife, and applied to do a PhD in Entomology at UBC, but was told it had to be in Forestry.

The federal research station at Belleville was established in 1929 by the Entomology Division, and had a national mandate for biocontrol with insects. The station was a mansion called 'Carman House'. It was near enough to Ottawa that you could get there rapidly, but far enough away that the brass never visited. A quarantine building of 40 rooms was added by the forest industry in 1935. In 1955, a red-brick building was built around the house, which was then torn down. The new building was known locally as 'The Bug House', of which Bryan Beirne became Director in 1956.

The European pine shoot moth project was a collaboration between five scientists at Belleville and Sault St. Marie, Ontario. I joined the project in 1955 as a PhD student in Forestry at London University. The university housed me with 30 or so postgraduate entomologists in a country house at Silwood Park, Ascot. The students (including the Canadians, Web Haufe and Norm Anderson) were multinational with wide experience so supervisors were



Carmen House in Belleville, Ontario

rarely needed. Ascot was on a sandy tract of the Windsor Castle estate planted to pines and watched by the police for escapees as it extended to Broadmoor, a lunatic asylum for criminals. My Royal permit did not convince the police that looking for caterpillars in pine buds was a sane activity. My supervisor then justified himself by assuring the police that I was a harmless lunatic. On graduation, a year later, Irene followed and we married in England.

I joined the Belleville station in 1959 after closure of the Vancouver substation (my first station closure) and after the federal government had reassigned stations into the Department of Forestry and the Department of Agriculture. Belleville opted for Agriculture. Many of its big successes had arisen from cooperative projects on forest insects with the lab in Sault Ste. Marie. Because the latter lab was reassigned to Forestry, such cooperative projects were terminated. Many Belleville staff changed projects and the quarantine building was underused. I published my thesis, but it was the last thing from the Belleville station published on a forest insect.

I inherited weed biocontrol from Morris

Smith. Many of the best targets for weed biocontrol are on forest lands in British Columbia. Smith picked the European St. John's wort, which was a huge problem on North American rangelands. Australia had released two European species of beetles that remained scarce for seven years before exploding to achieve control. The beetles also worked soon after their release in California. In British Columbia, however, beetles remained rare in 1958 following releases in 1952. Smith was re-assigned to another project after six years of poor results and then left the Department. However, by 1959, the beetles were providing successful weed control such that, after wigmorization, I had publishable results. Wigmorization continued until Don Chant, the Belleville mite expert, threw an ink bottle at Wigmore. It missed, but got him banned from seeing Wigmore without two senior staff being present. Perhaps fearing a hail of ink bottles, management subsequently excluded entomologists from wigmorization. Chant left in 1962 for high profile jobs California and then Ontario.

Weed biocontrol involved surveys, field and lab studies in Europe and then insect propagation, release, distribution and assessment in Canada. The European work was contracted to an organization now called CABI. Helmut Zwoelfer at the CABI lab in Delémont, Switzerland, and I at Belleville started and ran the program together which continued with Dieter Schroder. CABI surveyed insects in western Europe. The Iron Curtain prohibited access to eastern European localities that were better climatic matches to Canada. It seems unbelievable now, but post-war budgets gave Belleville ample funds that we were beseeched to spend to prevent lapsing. Smith's fate was a prod to supplement CABI's insects with quick successes, such as the cinnabar moth on tansy ragwort that already had been tested by Australia and the USA. At this time, I also supervised Ikram Mohyuddin from CABI for PhD research on Canadian bindweed.

Zwoelfer screened the nodding thistle seed-head weevil, *Rhinocyllus conicus*. The

chief concern was that crops not be attacked so with proof that the weevil starved on crops in no-choice tests the Director General (DG) - I moved in lofty circles then - approved a release that rapidly achieved control. Farmers were still wary; but finally, several near Regina, Saskatchewan, agreed to use the weevils and were given stock. Three years later I was phoned to ask why it had only worked on the property of a disliked neighbor. Apparently all of his neighbours had released their weevils on his farm. Colleagues in New Zealand wanted large numbers of the weevils, which I estimated by weight. My New Zealand colleagues counted the weevils they received and sent me a telegraphed apology that they had bad news - two of my rhinoceroses may have escaped on the plane!

The research was not without its challenges. Release of agents into Canada requires federal approval. However, because insects do not stop at borders, concurrence was needed with the United States. I obtained their agreement to share screening reports on biocontrol agents, which we agreed could be done without loss of sovereignty. The United States had a review committee. Ottawa appointed a similar committee to replace the DG. I gave the screening reports to provinces with the weed, but not the agent unless they wanted it. Tacit land user approval was obtained by field days to explain the program, provide bags and lend nets to those wanting agents. Sweep netting brings out the kid in farmers who then make their friends envious. This is the best advertising possible. At one memorable field day, two ranchers fought and a wife cried because they had felt they had collected too few beetles for knapweed control. This was a big change from the insect phobia present when I started. Land user distribution is cheap, rapid, gives the user a stake in the project and eliminated a job for which I did not have staff. Insects spread, so farmers not releasing agents, perhaps unknowingly, may have them on their property anyway.

Much work was done how to determine agent safety. When concern was limited to

crop plants host range limits proved a better indication of safety than no-choice tests and such limits became the international standard. Currently, an additional concern is for native plants related to the weed which needs a different approach.

Further, most research requires networks. Provincial field days took care of agent distribution. The provinces were also major clients. My first cooperator was Jim Milroy of the British Columbia Forest Service, who had worked with Smith and hated St. John's-wort. He believed in testing new PhDs by walking them off their feet. I knew that I had passed when he slowed a modicum without being asked. Smith's releases were in isolated places on random plots that, if occupied by a Douglas fir tree, had a 1/4 m² frame nailed to it. Milroy's successors, Jack King, Bob Drinkwater, Val Miller and Roy Cranston of British Columbia Agriculture made releases, collections, held field days, sent me samples and told me when to visit. Miller's MSc showed that biocontrol agents in knapweed seed heads made them acceptable winter deer forage.

I met Judy Myers, the ESC 2004 Gold Medal Winner, at my cinnabar moth site on Vancouver Island. She has eclectic interests including weed biocontrol to which she and students have made major contributions. Her delight in being a devil's advocate was often helpful. However, her suggestions that biocontrol is a lottery worried British Columbia Agriculture, a major sponsor, since governments cannot invest in lotteries. One losing lottery ticket was the cinnabar moth, because its host regrew after defoliation. Ragwort was controlled on the British Columbia coast by a root-feeding flea beetle from Rome, Italy, obtained via the USA. It starts laying with the October rains and, in mild winters, continues into January. In the Maritimes, however, oviposition stops with mid-October frosts. Sixteen years after release, Chris Majka (Nova Scotia Natural History Museum) noted a thriving population of overwintering third-instar larvae that emerged to breed in the spring. These are only a few examples of the people who have helped

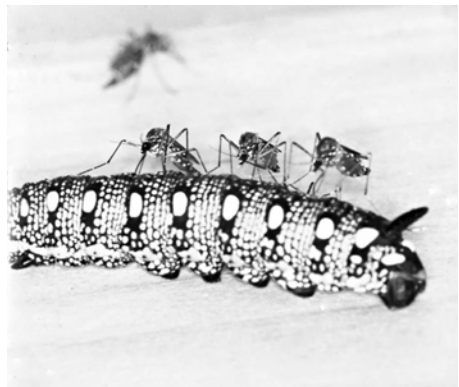
biocontrol research in Canada. Indeed, many people supplemented information on basic survival and impact with studies of their own such that we now know a fair amount about the insect-plant system. This has been compiled in a weed biocontrol web site for the Canadian species.

Zwoelfer in 1969 held a world weed biocontrol meeting at Delémont, Switzerland that became a four-year event. Remarkably it works without a constitution or an executive and funding is provided by the host country. Since 1982 the 70 countries practicing weed biocontrol have submitted weed-agent-outcome lists for collation and publication by Mic Julian of Australia. A hundred years of weed biocontrol has resulted in release of about 350 agents, many in the early days when the aim was to establish many agents per target weed. Julian's catalogue shows that one agent, or one per habitat often does the job at lower costs and risks. The international network helps in other ways. I sent Oleg Kovalev in Leningrad a leaf beetle to control North American ragweed in Russia. Air Canada only flew to Moscow with no connections to Leningrad. However, Kovalev arranged for the beetles to fly with the Bolshoi ballet company and was thrilled when the beetles were delivered to him by a ballet dancer. On release, the beetles formed 10 m wide bands that marched 3 m a day leaving defoliated ragweed stems on which the larvae ate the regrowth. This quadrupled potato yields and resulted in a 1986 invitation to collect knapweed insects from the Caucasus. When the United States Department of Agriculture (USDA) banned the importation of insects from the Soviet Union, Oleg collected the desired insects, which were sent to me for rearing so they would be 'Canadian' when forwarded to my American colleagues.

The ever cheerful Dieter Peschken joined the weed biocontrol program in 1964. When drifting snow threatened the roof of the research greenhouse in Regina, Dieter, singing in the storm, cleared it with only a few broken panes that a fuming carpenter replaced with plywood. In 1984, Alex McClay started an

Alberta program on additional weeds to maximize Canadian coverage and Alan Watson at McGill worked on weed pathogens. A sign of weed biocontrol acceptance was that projects started without federal initiation. Jim Corrigan (now of British Columbia) did an impact study of biocontrol on purple loosestrife in Ontario for Environment Canada. Cory Lindgren worked on purple loosestrife in Manitoba for Ducks Unlimited.

A setback to Belleville was Beirne's 1967 departure with eight scientists to Simon Fraser University, rumored to be the new national biocontrol center. In 1956, Belleville had 37 researchers and three visiting scientists. Reduced recruitment and the exodus reduced this number to 21. The new Director, Philip Corbet, fresh from a two-year mosquito survey at Hazen Lake, demonstrated his unbelievable concentration. Hearing a crash, his secretary opened Corbet's office door to find him on the floor still talking in a tangle of phone and three-legged government chair. The carpenter subsequently made Corbet a large round table with a slot to a hole in the middle where he sat with his work around him and no danger of falling. Corbet made biting flies a Belleville theme as they were pests without a study center. Even I published two mosquito papers as a coincidence of circumstances. I had nothing



Tom Stovel

Mosquitoes feed on a caterpillar of the Spurge Hawk-moth, *Hyles euphorbiae* (Sphingidae)

ing to publish one year on weed biocontrol to meet Ottawa's requirement of two papers a year in international journals. During this same year, I was eaten alive vainly counting caterpillars that had been released to control spurge. Later, at a seminar at Queens University by Al West, I asked if mosquitoes took insect blood meals to be told they only fed on vertebrates. I then tested this by caging mosquitoes with my caterpillars. The mosquitoes fed on the caterpillars and laid viable eggs. This discovery yielded papers in *Science* and *Nature*. Although switching research topics was taboo, I hoped to be challenged as I was proud of the finding. However, I don't think it was noticed!

Life settled until someone decided that biting flies were not in Agriculture Canada's mandate, because they are human pests. Clearly they had not seen cattle in fly season! The Belleville staff was re-aligned with Murray Maw joining weed biocontrol. Corbet left for the University of Waterloo, then New Zealand followed by the University of Dundee in Scotland. His passion was dragonflies so he moved to study unfamiliar populations and published the definitive book on dragonflies in 1999.

I was made Acting Director of the Belleville station in 1971. Hearing nothing, I went to Ottawa with ideas that I outlined for 20 minutes. I was thanked and informed that Ottawa had decided to close the station. However, I was sworn to secrecy for a month until after the Minister announced the closure. It was hard vetoing future plans from Belleville staff without apparent reason. On the fatal day I had a staff meeting at 9 a.m. Within 5 minutes of ending the meeting, I was the only one left to explain to the newspaper why the flag was at half mast. I beat the Minister's 3 p.m. announcement, which could have caused problems. However, I reported to Tony Ludwig, the former Director of the Plant Research Institute, whose strategy was to do anything sensible and he would deal with the flak. Hiring in the Research Branch was on hold, although stations without vacancies could add Belleville staff.

For two years I helped staff with problems. Corbet wanted his desk and the Branch didn't and so they were happy it disappeared. Government moving regulations covered the effects of an employee's wife, but not vice versa. Obviously, the wife should claim everything. However, one husband with a ton of weight-lifting equipment objected. I and the union talked to the couple, but to no avail. One person was mystified that he could not sell his house with geese under the billiard table and an iron boat sunk into his lawn. Removal solved the problems. The weed group destined for Winnipeg was re-directed to Regina. Finally, I was asked what was I going to do about the \$3/4 million spent without Treasury Board approval. This was my second station closure!

The 1972 Belleville closure almost ended the biocontrol program for agricultural pest insects. Such research was at a low ebb globally from lack of attention to agent habitat needs and release of untested species that often attacked non-target insects. Canada did the right thing in 1929 by establishing a biocontrol center in Belleville, but then killed this initiative by dividing biocontrol research between forestry and agricultural, moving staff to Simon Fraser University, and dispersing elsewhere those staff that were left. Recently, insect biocontrol has been rejuvenated with collaborations between nine entomologists and an agrologist variously located in Lethbridge, Saskatoon, Beaverlodge, the University of Alberta and Alberta Agriculture. Cooperation is now in!

To accommodate the staff acquired from Belleville, the Research Branch built an extension to the Regina station. Knud Mortensen was hired as a plant pathologist. He was the only interviewee who saw the potential for weed pathogens. I supervised Roberte Machowski's PhD research on a round-leaved mallow fungus. The aim was to develop host-specific pathogen sprays to be registered like herbicides. However, Canada lacked testing protocols for bioherbicides. The pathologists and Philom Bios, the company that sponsored the research, proved to be a powerful team. The

former located problems with existing requirements intended to register chemical herbicides that Philom Bios could get the Deputy Minister to remove. One such requirement called for the injection of 1.25 litres of the product into 10-day old ducklings! I supervised Alan Watson's PhD research on a Russian knapweed gall nematode and Joe Shorthouse's postdoctoral research on gall insects. Joe convinced me that gall insects were promising biocontrol agents, but I never convinced him that other insects were also fascinating. However, he and his associates did publish several papers on gall-forming weed agents. The year 1986 ended with large chunks of asbestos insulation falling from the ceiling. That winter was in comfortable but cramped trailers.

Funding from the Canadian government to CABI stagnated for 25 years, which reduced the overseas research program. In 1980, successful control of leafy spurge at spurge beetle release sites stimulated Saskatchewan's desire for more agents. They agreed to give me \$50,000/year, which I was able to match with funding from provinces, states, and other jurisdictions with spurge problems. Initial hostilities evaporated when everyone understood that their funds would be pooled to contract the work to CABI, but all would decide on priorities and share agents. This was the start of the Biocontrol Consortium. With funding for other weeds, Consortium funding exceeded \$600,000 in 1986 and led Ottawa to complain that they had lost control.

The Consortium obtained agents and spurge biocontrol was very successful. One person working for the USDA quit to collect spurge beetles in Canada. He sold these at a dollar each to perhaps make \$100 000 for a Sunday's work. I complained, but the United States said that they could not refuse importation of approved insects. Ottawa said that they already had enough issues with the United States and, besides, Canada lacked legislation making insect theft a crime. I finally stopped showing the USDA our release sites and the provinces agreed not to place biocontrol billboards near release sites.



Sign at a release site in British Columbia used to educate the public about biocontrol.

In 1970, it was noticed that Agriculture Canada had a higher ratio of entomologists than the USDA. In response, Canadian entomologists in weed biocontrol were made 'weed scientists' to be supervised by a 'weed coordinator' with whom I shared little vocabulary and no philosophy. He wanted to know which agent would win when several were released against a target weed. I explained about damage thresholds. Then, rather than throw ink bottles, which had almost disappeared, I wrote a paper on insect competition. I don't think he read it, but I found the process educational. Eleven agents released for knapweed had reduced knapweed seed production by 95% without achieving control. I added a bud weevil with few expectations, because it attacked the buds at a later developmental stage than the other agents. However, spring feeding stunted and twisted bolting stems that, with bud destruction and the death of small lateral branches, increased the dispersal of these agents to reduce competition for the weevil. All agents survived and seed production is now below the replacement threshold.

Word of the Regina station's pending closure leaked in 1991, and denied by the minister, occurred in 1992 with its land transferred to Swift Current. I went to Lethbridge, Mortenson to Saskatoon, and Maw and Peschken finished

manuscripts before retiring. Makowsky moved with her husband to the United States and is now a patent attorney. Rose De Clerck-Floate and Rob Bouchier filled vacancies transferred to Lethbridge to make a small weed biocontrol center. Lethbridge started downsizing shortly after I arrived. However, it did not signal my fourth station closure as I retired in 1995. I kept an office and completed supervision of Fang-Hoa Wans's postdoctoral research. Prospects brightened with design of a new

containment facility in 1996 that, with much effort by Rose, opened in 2004. Things have changed, both for good and bad, so Rob's and Rose's priorities are not the same as mine.

It has been a good 44 years. I received the Order of Canada in 1997 for the collective efforts of many. With Ottawa's rulings and my ignorance, it is remarkable how much was accomplished. I am still working on the Canadian weed biocontrol web site which is slow without bureaucrats to rile me into action.



Ron McCrystal

Staff from the Regina Research Station in 1973: Front centre - Peter Harris; Back row (left to right) - Marg Malloy, Murray Maw, Diether Peschken, Dick Voroney.