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A brief history of Frederick D. Bennett's entomological career

J. H. Frank[1,*]

Abstract

Fred Bennett was a legend in biological control before he was hired by the University of Florida, which surely was the reason he was snapped up. The position he was offered was that of Graduate Research Professor made available by the retirement of Reece Sailer in 1985. Fred had been the Director of the Commonwealth Institute of Biological Control, based in Trinidad, West Indies, but also with station units at that time in England, India, Kenya, Malaysia, Pakistan, and Switzerland. Established to mitigate pest problems in Commonwealth countries, the Commonwealth Institute of Biological Control now worked also under contract in non-Commonwealth countries. That caused Fred to travel widely for research projects and to attend scientific meetings. Although biological control calls for expertise in applied ecology and ethology, knowledge of various taxonomic groups helps very much. Fred's taxonomic interests are in bees, Sphingidae, and in scale insects and their chalcidoid parasitoids (Aphelinidae, Encyrtidae, and Eulophidae). Fred was born and educated in Canada, performed his Ph.D. research in California, was employed briefly in Bermuda, then Trinidad, and finally Florida. As Graduate Research Professor at the University of Florida he was popular, mentored graduate students, and worked with faculty members of the Entomology & Nematology Department in Gainesville, and at various Research Stations in Florida. When he retired with his wife Betty in 1993, he moved to the Isle of Man in the Irish Sea, where he continued entomologizing and publishing. Why there? Because it was close to England where his daughter and 2 sons live.

Key Words: biological control; Commonwealth Institute of Biological Control; Ontario; Bermuda; Trinidad; Florida

Resumen

Fred Bennett era una leyenda en el control biológico antes de ser contratado por la Universidad de Florida, que seguramente fue la razón por la que fue forzado. La posición que se le ofreció fue la de Profesor de Investigación Graduado puesto a disposición por la jubilación de Reece Sailer en 1985. Fred había sido director del Commonwealth Institute of Biological Control, con sede en Trinidad, Indias Occidentales, pero también con unidades en ese momento en Inglaterra, India, Kenia, Malasia, Pakistán, y Suiza. Establecido para mitigar los problemas de plagas en los países de la Commonwealth, ahora trabajaba también bajo contrato en países no de la Commonwealth. Eso causó que Fred viajara extensamente para proyectos de investigación y para asistir a reuniones científicas. Aunque el control biológico requiere experiencia en ecología aplicada y etología, el conocimiento de diversos grupos taxonómicos ayuda mucho. Los intereses taxonómicos de Fred están en las abejas, los Sphingidae, y en los insectos a escala y sus parasitoides chalcidoides (Aphelinidae, Encyrtidae, y Eulophidae). Fred nació y se educó en Canadá, realizó investigaciones de doctorado en California, fue empleado brevemente en Bermuda, luego en Trinidad, y finalmente en Florida. Como profesor de investigación de posgrado en la Universidad de Florida fue popular, mentor de estudiantes graduados, y trabajó con los miembros de la facultad del Departamento de Entomología y Nematología en Gainesville, y en varias estaciones de investigación en Florida. Pero cuando se retiró con su esposa Betty en 1993, esto fue a la Isla de Man en el mar de Irlanda, donde continuó entomologización y publicación. ¿Por qué ahí? Porque estaba cerca de Inglaterra donde viven su hija y sus 2 hijos.

Palabras Clave: Ontario; Bermuda; control biológico; Trinidad; Commonwealth Institute of Biological Control; Florida

Frederick Douglas Bennett was born on September 16, 1925, at Spencerville, Ontario, Canada, about 50 miles south of the nation's capital, Ottawa. His higher education began at Kemptville Agricultural College in 1945 to 1947, where he was awarded a diploma in agriculture. On from there to the University of Toronto where he studied entomology, and was awarded the degree of BSc in Agriculture in 1950. The agricultural campus of the University of Toronto where he studied became the University of Guelph in 1964. At the University of Toronto he was Interyear Heavyweight Boxing Champion of 1950, and the Canadian Inter-University Light Heavyweight Wrestling Champion of 1950. Employment came first at Canada Forestry, 4 mo in 1948 as an Entomological Assistant. Then in 1949 the travel bug bit him, and he was appointed Entomological Assistant to the Bermuda Department of Agriculture. The next year, 1950, he was appointed Entomologist/Plant Pathologist to the Bermuda Department of Agriculture.

In Bermuda, he turned his attention to biological control of pest insects, which in following yr became his main occupation. He collected living pests and reared them to find parasitoids they might contain, and he learned to identify these parasitoids, and even to write descriptions and keys to identify these parasitoids. This led to considerable ability with hymenopterous families Aphelinidae, Encyrtidae, and Eulophidae, which attack scale insects (in the broad sense) and many other insects, so Fred learned much about their hosts, too. He also participated in a project to protect an endangered native tree, *Juniperus bermudiana* L. (Cupressaceae). Timber from this tree had been used for hundreds of yr for boatbuilding, and it had become uncommon. For that reason, other juniper trees (several species) had been imported from California, unfortunately with scale insect pests as contaminants: *Lepidosaphes pallida* (Maskell) and *Carulaspis minima* (Signoret) (both Diaspididae). These scale insects at-

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tacked the native Bermudan species, and were more deleterious to it than to the imported junipers. The project was begun in 1946 by W.R. Thompson, head of the Commonwealth Institute of Biological Control headquartered in Canada and was continued until 1951. A tiny aphelinid wasp, *Encarsia lounsburyi* (Berlese and Paoli) (Aphelinidae) seems to have arrived in Bermuda with scales on imported junipers, and it attacked *C. minima* heavily. Two coccinellids, were imported and released: *Rhyzobius lophanthae* (Blaisdell) (Coleoptera: Coccinellidae) was imported from Mauritius and was mass-reared in California (at a Commonwealth Institute of Biological Control station there) before being shipped to Bermuda; *Microweisia suturalis* (Schwarz) (Hymenoptera: Aphelinidae) was released in very large numbers and became abundant. Hybridization of Bermuda juniper with introduced junipers diluted the population. About 95% of the trees were defoliated as result of attack by 1 or other of the scales and died. Seed from the surviving 5% were found to be resistant and, when planted and cared for, are ever so slowly rebuilding the population. This biological control project was not successful. One suggested reason was heavy predation (proven by dissection) on *R. lophanthae* by 3 adventive *Anolis* (Dactyloidae) lizard species.

In 1952, W.R. Thompson turned 65. The directors of the Commonwealth Agricultural Bureaux had decided that the Commonwealth Institute of Biological Control should be moved from Canada to Trinidad, West Indies. After 2 yr in Bermuda, Fred was offered, and accepted, the position of Entomologist at the newly opened Commonwealth Institute of Biological Control station in Trinidad.

So, Fred moved to Trinidad and worked in part on the Trinidadian fauna of pest insects and of non-pests, for he joined the Trinidad Field Naturalists' Club and studied native bees and sphingids. But he was soon drawn into work on pests of sugar cane, in Trinidad and then in Jamaica, and the targets were two lepidopterous borers, *Elasmopalpus lignosellus* (Zeller) (Lepidoptera: Pyralidae) and *Diatraea saccharalis* Fabricius (Lepidoptera: Crambidae). If you have heard of the first, you probably think of it as "lesser cornstalk borer" but in Jamaica it is called "jumping borer," and its outbreaks are worsened by burning sugar cane fields before harvest. Why would you want to burn? To rid fields of a tangled mass of dead, dry leaves, and make the cane more accessible to harvesters with machetes, and it had become standard practice in Jamaica. *Saccharosydne saccharivora* (Westwood) (Hemiptera: Delphacidae) is a pest of sugar cane in several countries, including Jamaica and Florida, USA. In 1959 Fred collected parasitoids of this pest in Jamaica and shipped them to New Jersey, USA, for release in Florida. Of these, *Stenocranophilus quadratus* Pierce (Strepsiptera: Halictophagidae) is reported to have become established; it is an important parasitoid in Jamaica, but the pest has not subsequently become bothersome in Florida. In 1982, alarm was felt in the Florida sugar industry because of the detection there of another sugar cane delphacid, *Perkinsiella saccharicida* Kirkaldy (Hemiptera: Delphacidae), which had caused much damage in Hawaii many decades earlier. In Florida it was a non-issue, perhaps because of the parasitoids introduced by Fred Bennett against *S. saccharivora*.

In 1952 a request came from the island of Nevis to control species of prickly pears that infested pastures and injured cattle. Freddie Simmonds, the Commonwealth Institute of Biological Control Director, accepted. Fred Bennett visited Nevis to collect specimens of the plants and sent them for identification to the Royal Botanic Gardens at Kew (the principal botanic gardens of the United Kingdom); they were mainly *Opuntia triacantha* (Willd.) Sweet with some *Opuntia dillenii* (Kerr-Gawler) Haworth, and some *Opuntia lindheimeri* (Engelmann) (all Cactaceae). Not until 1957 were 112,000 *Dactylopius opuntiae* Cockerell and 2,000 *Dactylopius austrinus* DeLotto (both Coccoidea: Dactylopiidae), and 5,200 eggs and larvae of *Cactoblastis cactorum* (Berg) (Lepidoptera: Pyralidae) from South Africa introduced into Nevis, all of these having been reared at the Commonwealth Institute of Biological Control station in Trinidad. The dactylopiids did not become established, but the moth did, and was highly successful in controlling the prickly pear. Then followed requests from other Departments of Agriculture: in Antigua for control of *O. triacantha* in pastures, in the Cayman Islands for control of *O. dillenii* in pastures, and from Montserrat for control of *O. triacantha*. Release of *C. cactorum* in each of those islands succeeded and the cactus problem was controlled, although in Monserrat, through lack of management, the cactus was replaced by prickly *Acacia* spp. (Fabaceae) bushes. By 1964, the moth seemed to have spread from Nevis to St. Kitts, requiring a flight about 4 miles (6 km), if indeed this happened by flight–the moth has been noted to be a very poor flyer. And then it turned up in the US Virgin Islands. Given that pasture owners have no liking for prickly pear, and given that many West Indian farmers have friends in other nearby islands, you can see some possibilities. The moth was detected in Puerto Rico and then on Big Pine Key in Florida–many said that it must have flown from Cuba–but interception of its larvae by USDA Plant Inspectors in shipments of prickly pear imported to Miami as ornamental plants from the Dominican Republic was reported (Pemberton 1995). The method of arrival is uncertain, but the conclusion must be of a series of unfortunate events.

Fred's life was not totally filled with his work, for in 1953 he married Elizabeth (Betty) Rapsey, whose family lived in Trinidad. In 1954 was born his first son, Philip; in 1956 his second son, Horace; and in 1959 his daughter, Victoria.

In 1956 to 1958, Fred was a graduate student at the University of California, Berkeley, California, USA, working on taxonomy, life history, and parasitoids of *Leucopis* (Diptera: Chamaemyiidae). His dissertation was presented in 1961. The predatory larvae attack aphids, mealybugs, and scale insects. Work with *Aleurocanthus woglumi* Ashby (Hemiptera: Aleyrodidae) (citrus blackfly), in Barbados followed, and the aquatic weeds *Eichornia crassipes* (Mart.) Solms (Pontederiaceae) and *Salvinia auriculata* Aublet (Salviniaceae), and the terrestrial weed *Eupatorium odoratum* L. (Asteraceae) in Asia and Africa. Success was achieved in Barbados with control of *D. saccharalis* by *Cotesia flavipes* Cameron (Hymenoptera: Braconidae) (newly imported) and *Lixophaga diatraeae* (Townsend) (Diptera: Tachinidae).

Fred had been Entomologist-in-charge of the Trinidad station since 1958, and gained his Ph.D. in 1961. In 1975, he was appointed Director of the Commonwealth Institute of Biological Control. With that came new responsibilities, such as international consultancies, negotiating contracts with representatives of governments, and dealing with the whole Commonwealth Institute of Biological Control network with its stations in Europe, Africa, Asia, and the Americas (Table 1).

In 1985, Graduate Research Professor Reece Sailer had announced his impending retirement from the Entomology & Nematology Department of the University of Florida. Fred Bennett was tempted to apply in the belief that the management of the Commonwealth Agricultural Bureaux planned to move the headquarters of the Commonwealth Institute of Biological Control from Trinidad to England. He did apply, and was welcomed, and moved to Gainesville with Betty in October 1985. Jeff Waage became Director of the Commonwealth Institute of Biological Control, which then became Centre for Agriculture and Biosciences International (CAB International) Institute of Biological Control headquartered in England.

Within a few days of Fred's arrival in Gainesville in October 1985, the front page of the Miami Herald carried a news item of the detection in Little Haiti, Miami, Florida, USA, of a major pest of citrus, black

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Table 1. Fred Bennett's international consultancies and contracts.

Date	Sponsor area	Principal purpose
1964	World Health Organization, Brazil	Predators of mosquitoes
1969–1972	Bolivia	Biocontrol of agricultural pests
1970–1972	MOD England–Botswana	Biocontrol of *Salvinia*
1972	US National Academy of Sciences–Guyana	Biocontrol of aquatic weeds
1975–1977	Jamaica	Biocontrol of pine mite
1976	Egypt	Biocontrol of aquatic weeds
1976–1984	Sudan	Biocontrol of aquatic weeds
1979	Algeria	Biocontrol of agricultural pests
1980	Unilever–Cameroon and Malaysia	Oil palm pollination studies
1980	Cuba	Biocontrol of sugar cane pests
1980–1982	FAO–Nicaragua	Biocontrol of pests of basic grains
1982	Ecuador	Potential for biocontrol of coffee twig borer
1984	IDRC Canada–India	Assessment of proposals for use of *Microsporida* for control of locusts
1986	USAID Ecuador	Pests and pollinators of *Annona* spp.
1986–1993	CIMCA Bolivia	Pests of sugar cane

parlatoria scale (*Parlatoria ziziphi* [Lucas]) (Hemiptera: Diaspididae) for the first time in mainland USA. Fred formed a team of himself and Howard Frank of University of Florida, and Ru Nguyen of the Division of Plant Industry, Gainesville, Florida, USA. Our short-term objective was surveys each mo in Miami of the scale and its natural enemies, with a long-term objective of classical biological control. The leaders of the UF School of Agriculture and Life Sciences, and of the Division of Plant Industry approved. So, we would leave very early in the morning, drive to Miami, spend several hours taking our samples from 16 sites, and return to Gainesville. Then we would have the task of counting scales on lots of citrus leaves, and I would also have the task of identifying and counting coccinellids and other predators. First Fred, and then I, in 1987 travelled to Hong Kong and then to mainland China to search for black parlatoria scale, and air-freight the samples back to Gainesville to be placed in quarantine in hopes that parasitoids would emerge. The Dean for Research in Agriculture paid for our overseas trips. Parasitoids did emerge, but just then word reached us that the Director of the Division of Plant Industry had ordered the cutting and burning of citrus trees in Little Haiti. Black parlatoria scale was thus eradicated in Miami and it never reached commercial citrus trees. However, some of the *Aphytis* (Aphelinidae) parasitoids that emerged in quarantine were shipped to Puerto Rico for release against black parlatoria scale there (it was first detected there in 1975).

Two University of Florida graduate students were guided by Fred. One was Alfredo Rueda, whose thesis was on the behavior, ecology, and natural enemies of pest slugs in his homeland (Honduras) (Rueda 1989). A second was Gregory Evans, American, whose taxonomic dissertation was on the genus *Encarsia* Förster (Hymenoptera: Aphelinidae), and included a survey of parasitoids of *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) in Florida, the Caribbean, and Latin America (Evans 1993).

One of Fred's responsibilities was to coordinate the University of Florida–Brazil Cooperative Biological Control project, which ran from 1986 to 1991. He collaborated with Dale Habeck in the search for insects that would control Brazilian pepper, *Schinus terebinthifolia* Raddi (Anacardiaceae). He collaborated with Howard Frank in search for a strain of *Larra bicolor* F. (Hymenoptera: Crabronidae) that could survive in northern Florida and help control pest mole crickets (because the strain that was introduced in 1981 from Puerto Rico gave no evidence of establishment north of Broward County). In 1988 and again in 1989, Fred brought *L. bicolor* wasps from Santa Cruz de la Sierra, Bolivia, to Gainesville. Adult wasps were released at sites in and near



Fig. 1. Fred sitting at his worktable in Bythorn, 2019.

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Gainesville, and these wasps established a population which spread to most parts of Florida and to Mississippi, Alabama, Georgia, South and North Carolina.

In the UF Entomology & Nematology Department, my office was next to Fred's, and his door was often open. In 1992 to 1993, I often saw him kneeling on some contraption while typing. I suppose this was for the benefit of his back, but I am not convinced it helped. The point is that he was very often busy typing away on text for books. Then he and Betty left for the Isle of Man in the Irish Sea with a climate rather different from Florida's. The insect fauna there was unknown to Fred, so after getting his garden into shape he set about collecting insects, identifying them, and publishing quite a few new records. Doubtless you have heard the name Mark Cavendish. He lived up the road from Fred and Betty. A neighbor said Fred had nearly been clobbered by Mark, as the latter whizzed by silently on his racing bike while practicing for the Tour de France. But all cyclists are not quiet because annually is held the Isle of Man TT in which crowds of motorcyclists roar by on big noisy motorbikes. TT stands for tourist trophy; the race has been called one of the most dangerous racing events in the world. Dale and Phyllis Habeck visited the Bennetts at least 10 yr ago, but after Betty died in March 2016, Fred took up an offer from his daughter, Victoria, to live at Bythorn, England, about 40 miles west of Cambridge, on the farm that she and her husband, Chris, own. Audrey and I visited him there at the end of June 2018. Fred is now 93 (Fig. 1).

Acknowledgments

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Fred Bennett's publications are not cited here because all are cited in a dedicated and extensive bibliography of his works in this volume of Florida Entomologist.

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