

A parasitic fly that kills mole crickets: its use in states north of Florida

ANNUAL REPORT TO USGA - NOVEMBER 1998

J.H. Frank and T.J. Walker
Entomology & Nematology Dept.
University of Florida
Gainesville, FL 32611-0630

EXECUTIVE SUMMARY

Ormia depleta is a tachinid fly specialist on some species of *Scapteriscus* mole crickets. It is known from Brazil and Paraguay. A stock of this fly, captured at Piricicaba in subtropical Brazil (about 23°S) was brought to Florida in 1987 and cultured in quarantine. Beginning in 1988, progeny of these flies were released in all areas of Florida in attempt to establish a population - about 10,000 flies were released. A population became established in peninsular Florida and persists year-round to about 28°N, and seasonally (the fall of each year) in a marginal area extending to about 29°N. Subsequent releases in Georgia, North Carolina, and Alabama did not result in establishment of populations there.

Although the established populations of the fly exhibit strong seasonality in Florida, with much greater numbers trapped in May-June and in November-December than at other times of year, the fly seems capable of breeding throughout the year. That is, there is no dormant period (diapause) in winter. In the laboratory, adult flies need artificial nectar as a dietary item. Thus, it seems that the established stock of the fly, from subtropical Brazil, fares poorly in winter in northern Florida perhaps because it is not adapted to diapause during those months of the winter when plant nectars are in short supply (after freezes).

But, the fly is known to exist in southern Brazil to 30°S. It is possible that flies at 30°S are adapted to withstand colder winters by entering diapause. Therefore, they might be expected to survive in the southern USA at 30°N, and perhaps much farther north. The objective of this project is to obtain a stock of the fly from extreme southern Brazil, bring it to quarantine in Gainesville, culture it, and provide stock to collaborating turfgrass entomologists in Alabama, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Texas.

In November 1998, two entomologists will travel to southern Brazil to spend almost 4 weeks collecting living *Scapteriscus* mole crickets as hosts for the fly. When scores of mole crickets have been assembled and maintained in containers in a laboratory in southern Brazil, flies will be trapped. Larvae of the flies will be reared on the mole crickets, and brought to the pupal stage. Fly pupae will be brought to quarantine in Florida for establishment of a laboratory culture. The timing of the visit (early summer) is based upon what is known about abundance and seasonality of *Scapteriscus* mole crickets and the fly in subtropical and temperate Brazil.

Work in 1999 will focus on labor-intensive culturing of large numbers of the fly for distribution to other southern states.

GRADUATE STUDENTS

None of the five students is working on this project, although one (Craig Welch) is working on another aspect of biology of *Ormia depleta*. All five students are working (or worked) on some aspect of biology of biological control agents of pest mole crickets. The biological control agents in question are *Ormia depleta*, a parasitoid fly (imported from subtropical Brazil and established

throughout peninsular Florida as far north as 29°); *Larra bicolor*, a parasitoid wasp (one strain from tropical Brazil via Puerto Rico imported in the early 1980s and established only in southern Florida and not spreading; a second strain imported in the late 1980s from a higher altitude in Bolivia and established in northern Florida and now spreading); *Steinernema scapterisci*, a specialist entomopathogenic nematode which functions both as a classical biological control agent and as a biopesticide (imported from Uruguay and distributed by research and by commercial sales as a biopesticide, now established in various places in Florida and spreading - also distributed to some other states by research and commercial sales, but its establishment outside Florida has not been investigated); *Pheropsophus aequinoctialis*, a bombardier beetle whose larvae are specialist predators of mole cricket eggs (imported from Bolivia but not yet released pending thorough investigation of whether its larvae pose a risk to a non-target species, the native northern mole cricket, which is seldom if ever a pest).

María Bertorelli - M.S. 1998 - María's research investigated the invertebrate fauna (insects, molluscs, earthworms, etc.) living on lakeshores in northern Florida because these are the first habitats where the bombardier beetle will establish populations if it is released. It is necessary to know what are the invertebrate animal species that might be affected if the bombardier beetle is released in order to evaluate non-target effects. State and national permits for release of the beetle are highly unlikely without evaluation of non-target effects. María's thesis is filed in the UF libraries - no publications have yet resulted from it. Her stipend was paid by the government of Venezuela, to train her as a professional entomologist. Her work served to identify the invertebrate animals living on lake shores to family, genus and, in some instances, species level, but it did not test these animals as potential prey of the beetle, so more work is necessary.

Craig Welch - M.S. student - Craig's research is aimed at identifying the sugars found in the crops (digestive system) of adult *Ormia depleta* flies. Numerous kinds of sugars are produced in plant nectars and in honeydew secreted by homopterous insects such as aphids. Identification of these sugars - and knowledge of the plants or Homoptera that produce them - will help us to know whether the adult flies feed on nectars from a narrow range of plants or from a broad range of plants. If the former, it probably will be necessary to provide these special plants in landscaping. If the latter, it may or may not help to provide additional plants in landscaping. Craig has a teaching assistantship, which requires him to spend much time teaching undergraduate students, and cuts into his research time. His research may not provide answers to all the basic questions posed; it will not provide applied answers, such as how many plants of what species we need to place in the landscaping of a golf course situated in (name a state and county) to enhance populations of the fly, to achieve maximal control of pest mole crickets by this fly. Thus, much more research will be necessary before we can reliably manipulate populations of the fly. Craig is expected to finish his work and obtain his M.S. in 1999.

Hector Cabrera - Ph.D. student - Hector was enrolled as a graduate student in 1997. He has much experience as entomologist working with fruitflies in Mexico, but he wanted to learn how to make mathematical models of pest insect populations and their control as a step toward Integrated Pest Management. His coursework is heavy in mathematics. His research is on the interaction of the three biological control agents (*Ormia depleta*, *Larra bicolor*, and *Steinernema scapterisci*) that have been introduced and established in Florida against pest mole crickets. Hector's assistantship is from the government of Mexico. His research will lead us toward Integrated Pest Management - which biological control agents to augment under varying

circumstances, and when and where to use chemicals.

Lucinda Treadwell - PhD student - Lucy began her work in fall 1998 and is still in the planning stages. She expects to investigate the various plants used by the wasp *Larra bicolor* as nectar sources. At present, only one good nectar source - the wildflower *Spermacoce verticillata* - is known. In northern Florida it consistently provides nectar between early May and mid-December and is much-visited by *Larra bicolor* adults. There may be many others. Knowledge of them should enable us to provide a "list of suitable nectar sources for *Larra bicolor*" to superintendents, so that landscaping may be enriched to enhance wasp populations. Lucy has a special UF teaching assistantship for older women seeking to obtain higher academic training - this, of course, requires that she spend much time teaching undergraduate students, and it reduces the time available to her for research. Lucy's results will have to be fine-tuned by later applied studies on golf courses in various geographical areas - her work will not provide a recipe for immediate use by superintendents.

Phillip Lake - M.S. student - Phillip began his work in fall 1998 and is still in the planning stages. He will work with the bombardier beetle *Pheropsophus aequinoctialis* and will try to determine (a) how its larvae detect egg chambers of pest mole crickets, and (b) whether the native northern mole cricket (a non-target species) is resistant to this bombardier beetle because females of the northern mole cricket (unlike the pest species) guard their eggs. The northern mole cricket has not been well-studied because it has not been considered a pest, so there is a lot to do. Phillip has a departmental teaching assistantship which, of course, requires that he spend much time teaching undergraduate students, and it reduces the time available to him for research. Phillip's results will go a long way in deciding whether *P. aequinoctialis* is a useful biological control agent (and will be extremely important in obtaining a permit for the release of this beetle in the USA), but it will not provide a recipe for use by golf course superintendents. The recipe will only be achieved by practical studies on golf courses by later students.

PUBLICATIONS IN 1998

- Bertorelli, M.V. 1998. The invertebrate fauna of the edges of three north Florida lakes. M.S. thesis, University of Florida, xiii + 143 p.
- Frank, J.H. 1998. How risky is biological control? Comment. *Ecology* 79: 1829-1834.
- Frank, J.H., Fasulo, T., Short, D.E. 1998. MCRICKET. (a CD-ROM about mole crickets in the USA and their control - for IBM-compatible computers) University of Florida SW-89.
- Frank, J.H., Kelsey, W.E., Hendricks, C.A., Noonan, R. 1998. Mole crickets and their natural control. A VHS tape of 15 min 39 sec. This, strictly speaking, is not yet a publication because so far it has been distributed only privately. It may later be released, perhaps slightly modified, as a publication.
- Parkman, J.P., Frank, J.H. 1998. Development and reproduction of mole crickets (Orthoptera: Gryllotalpidae) after treatments with hydroprene and pyriproxyfen. *J. Econ. Entomol.* 91: 392-397.