Biological Control of Mole Crickets

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Introduction

This report summarizes the current status of biological control of *Scapteriscus* mole crickets in Florida. *Scapteriscus* mole crickets (tawny mole cricket, southern mole cricket, and short-winged mole cricket) are by far the most important insect pests of grasses in Florida and they do substantial damage in the coastal plains of the other southern states. *Scapteriscus* mole crickets arrived in Florida from southern South America over 90 years ago. More than 40 years later, their preferred food, bahiagrass, was imported deliberately from South America and planted widely in Florida pastures and road verges. Small wonder that these mole crickets cause problems in Florida pastures! Four biological control agents were imported to Florida from South America by the University of Florida/IFAS mole cricket research program, and three of these have thus far been released and established.

The Biological Control Agents

***Ormia depleta*.** This fly, which was dubbed by the press "the red-eyed Brazilian fly," attacks only *Scapteriscus* mole crickets. It was imported from Brazil by the UF/IFAS mole cricket research program and released first at Gainesville (Alachua County) and then at Bradenton (Manatee County) in 1988. Funds provided by 28 golf courses through the auspices of the Florida Turfgrass Association (FTGA) allowed rearing and releases of thousands of these flies in 1990–1991 (Frank et al. in press). By the end of 1994, its population had spread through 38 counties (Map 1). However, the population survives poorly in the winter months in the more northerly counties (Marion County and northward), and the fly does not seem to recolonize the northern counties from farther south until late each fall (Walker et al. in press). Its effects on mole cricket populations north of Ocala are probably slight, but *Ormia depleta* seems to cause a big reduction in mole cricket numbers each year in at least parts of south and central Florida.

***Larra bicolor*.** This digger wasp attacks only *Scapteriscus* mole crickets. There are two populations of *Larra bicolor* in Florida. The first stock was brought from Puerto Rico in 1981 by the UF/IFAS mole cricket research program and it became established at Davie (near Ft. Lauderdale, Broward County, Map 1). Releases in Alachua, Hillsborough, Manatee and Polk counties did not lead to establishment, perhaps because the stock came from a tropical region and was not cold-hardy. But the population at Davie spread only very slightly and had negligible effect on mole cricket populations. The second *Larra bicolor* stock was brought from Bolivia in 1989 and released in and near Gainesville (Map 1); it was clearly established in the Gainesville area by late 1994. This population was imported because of the likelihood that it is more cold-hardy because of its origin in the Bolivian mountains. It is spreading in the Gainesville area (Frank et al. 1995).

***Pheropsophus aequinoctialis*.** Larvae of this bombardier beetle *may* be specialized natural enemies of *Scapteriscus* mole cricket eggs. Laboratory research has not yet been completed in Gainesville. Therefore, the beetle, which is from South America, has not yet been released in Florida.

***Steinernema scapterisci*.** This nematode was brought from Uruguay in 1985 by the UF/IFAS mole cricket research program. It was imported as a classical biological control agent but is used as a biopesticide and is currently marketed commer-

Map 1. Map of Florida showing (shading) the 38 counties in which the introduced biological control agent *Ormia depleta* had established populations by late 1994. The map also shows (stars) the two locations where the introduced biological control agent *Larra bicolor* is established. These two organisms provide free partial biological control of *Scapteriscus* mole crickets.

cially under the trade name Proactant Ss. It kills adults of the tawny mole cricket and southern mole cricket (Parkman et al. 1993) but is less effective against the short-winged mole cricket and has very little effect against mole cricket nymphs. However, it can establish populations wherever it is applied, thus helping to reduce mole cricket populations indefinitely. Further, it has been shown to spread, even if slowly, from places where it is released.

***Steinernema riobravis*.** This nematode is believed to be native to North America. It is being marketed commercially under the trade name Vector MC. It was not imported by the UF/IFAS mole cricket program and has scarcely been investigated by the program. It seems to be about as good a biopesticide as *Steinernema scapterisci* in short-term control of mole crickets. However, there seems to be no evidence that it establishes populations where it is applied, so it does not provide long-term control.

The Effects on Mole Cricket Populations

The mole cricket research program has just two measures of the effectiveness of the biological control agents. First, the program has operated trapping stations for more than 15 years at 3 sites: two near Gainesville, and one near Bradenton. A comparison of the last 3 years of records with all the years of records before biological control agents were released suggests a big reduction in numbers of mole cricket trapped. Near Bradenton, mole cricket numbers are on average less than one eighth of those before release of biological control agents. At Gainesville they are on average one third. The difference may be due to the fact that near Bradenton both *Ormia depleta* and *Steinernema scapterisci* affect the catches, whereas near Gainesville *Ormia depleta* is near the northern limit of its range and has little effect. At Gainesville, however, *Larra bicolor* may soon begin reducing trap catches, whereas *Larra bicolor* is not present at Bradenton.

Second, when populations of *Ormia depleta* spread widely in 1991-1992-1993, two surveys were conducted by the FTGA. Golf course superintendents were asked to evaluate damage caused by mole crickets compared with damage levels of the previous year (1992 versus 1991, and 1993 versus 1992). Results of these surveys showed, for two years in a row, that counties ***with*** well-established *Ormia depleta* populations had significantly less damage by mole crickets than did counties ***without*** fly populations (Frank et al. in press).

The Future

Populations of *Steinernema scapterisci* should continue to spread, aided by commercial sales of Proactant Ss. Populations of *Larra bicolor* should spread slowly from Alachua County, at first to neighboring counties and then more widely. This should result in further reduction of mole cricket populations over wide areas.

Much research remains to be done on *Ormia depleta*, *Larra bicolor*, and *Pheropsophus aequinoctialis*. *Ormia depleta* is already widespread in central and southern Florida. It may not exert more reduction to mole cricket populations until research shows what are the plants that provide nectar to the adult flies—and the plants are grown deliberately to enhance fly populations locally. A biotype of *Ormia depleta* from farther south in South America may be better adapted to survival in northern Florida and states to the north, and such a biotype may be discovered in South America and imported.

Effects of the Bolivian strain of *Larra bicolor* have not been evaluated. *Pheropsophus aequinoctialis* will not be released until laboratory research is completed. Research is required to demonstrate whether or not the larvae of this beetle are specialist natural enemies of *Scapteriscus* mole cricket eggs. If they also attack eggs of the northern mole

cricket, a non-target species, a permit is unlikely to be granted. If they are specialists and are permitted to be released, then evaluation of their effects on *Scapteriscus* mole cricket populations will be required at initial sites of release.

The research that has been accomplished by the UF/IFAS mole cricket program began in 1978. The stimulus was an annual appropriation, earmarked for mole cricket research, from the Florida legislature. The appropriation was made at the request of the Florida Cattlemen's Association. The appropriation paid for stipends for graduate students who made the research the subject of their MS theses and PhD dissertations, and it paid the salary of a post-doctoral researcher. Part of the payoff was the training of seven MS students and six PhD students, and a great deal of new and essential information (about 200 publications) on mole cricket ecology, behavior, physiology, biochemistry, and taxonomy. All of this formed a necessary background to detection, selection, and importation of biological control agents. The other part of the payoff was the actual introduction into Florida of four biological control agents, only three of which have so far been released and established. The state funds (supplemented in 1986–1991 by funds from the IFAS Dean for Research) allowed travel to and from South America, and the hiring of temporary personnel to trap mole crickets and their natural enemies, and to rear them in the laboratory.

State funds lost their earmarking for mole cricket research in 1991. Without the research contributions by graduate students and post-doctoral researchers (the program no longer has the means to pay them), the rate of research progress has now slowed considerably.

Summary

Biological control agents imported from South America against *Scapteriscus* mole crickets are now well-established in parts of peninsular Florida. They seem to be producing area-wide control of mole crickets with no recurrent cost—this is the best bargain in mole cricket control. The level of control probably will be improved by continued spread of two of the already-established biological control agents. Further research probably can enhance the effect of one biological control agent, and release another one, but will make slow progress without funding.

References

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Endnote

MCRICKET, a computerized knowledgebase on mole crickets and their control, can now be accessed on the World Wide Web at:

http://gnv.ifas.ufl.edu/~ent1/mcricket/index.html

Copies of MCRICKET on diskettes can be bought from the IFAS Software Office, (352) 392–7853.