

and between *S. imitatus* and *S. acletus*. Matheny (1981) determined *S. vicinus* to be herbivorous and *S. acletus* to be principally carnivorous in their feeding preferences. The data presented here add to a list of existing behavioral and morphological affinities of *S. didactylus* with *S. vicinus* and *S. imitatus* with *S. acletus* (Nickle and Castner 1984) and support the theory that they may have evolved from 2 different ancestral forms.

We thank Dr. Ellis L. Matheny, Jr. for his instruction and advice in the dissecting techniques of mole crickets, and who with Dr. Thomas J. Walker critically reviewed this manuscript. We thank Mr. Wes Barrios (Golf Director, Punta Borinquen Golf Club) for his cooperation in collecting material. We also thank Janice Castner for typing the manuscript, and Sue Winewriter for drawing the figure.

REFERENCES CITED

- BARRETT, O. W. 1902. The changa, or mole cricket in Puerto Rico. Puerto Rico Agr. Exp. Sta. Bull. 2: 1-19.
- MATHENY, E. L., JR. 1981. Contrasting feeding habits of pest mole cricket species. J. Econ. Ent. 74: 444-5.
- NICKLE, D. A., AND J. L. CASTNER. 1984. Introduced species of mole crickets in the United States, Puerto Rico, and the Virgin Islands (Orthoptera: Gryllotalpidae). Ann. Ent. Soc. America 77(4): 450-65.
- ULAGARAJ, S. M. 1975. Food habits of mole crickets (Orthoptera: Gryllotalpidae). Ann. Ent. Soc. America. 77(4): 450-65.
- WALKER, T. J. 1982. Sound traps for sampling mole cricket flights (Orthoptera: Gryllotalpidae: *Scapteriscus*). Florida Ent. 65(1): 105-10.

DISTRIBUTION OF MOLE CRICKETS
(ORTHOPTERA: GRYLLOTALPIDAE: *SCAPTERISCUS*)
AND THE MOLE CRICKET PARASITOID
LARRA BICOLOR (HYMENOPTERA: SPHECIDAE)
IN PUERTO RICO

JAMES L. CASTNER AND H. G. FOWLER
Department of Entomology and Nematology
University of Florida
Gainesville, FL 32611 USA

Three species of *Scapteriscus* mole crickets originating from South America have been introduced on the island of Puerto Rico (Nickle and Castner 1984): the changa mole cricket, *S. didactylus* (Latreille); the short-winged mole cricket, *S. abbreviatus* Scudder; and the imitator mole cricket, *S. imitatus* Nickle and Castner. The absence of specialized natural enemies has allowed them to become economic pests of turf and agriculture, causing extensive damage since the early 1900's (Barrett 1902). At present, the destruction of turf on golf courses causes great expense and necessitates the costly periodic application of insecticides. Although their feeding habits

vary (Castner and Fowler unpublished data), mechanical injury from subterranean tunneling is probably caused by all species.

In the late 1930's a biological control program was initiated against *S. didactylus* (the changa) in Puerto Rico. Williams (1928) reported that *Larra bicolor* F. (= *Larra americana* Saussure) parasitized *S. didactylus* (mistakenly identified as *S. vicinus*). *L. bicolor* wasps were collected from Brazil during 1936-1939, and released at the following Puerto Rican sites: Punta Borinquen and Isabela (Aguadilla Province); Laguna de Tortuguero (Arecibo Province); Palo Seco and Rio Piedras (Bayamon Province); Luquillo, Rio Blanco, and Yabucoa (Humacao Province) (Wolcott 1938). Successful establishment was reported at 3 locations by 1941 (Wolcott 1941).

Live parasitized mole crickets were shipped simultaneously with adult wasps as an assurance that viable parasitoids would be received. Misidentification of the parasitized mole crickets imported, however, may have resulted in *S. imitatus* having been released instead of *S. didactylus*. Nickle and Castner (1984) theorized that *S. imitatus* was mistakenly introduced and established in this manner.

During the period 26 May-14 June 1983, we searched an area from Rincon (Aguadilla Province) in the west to Humacao (Humacao Province) in the east for mole crickets and *L. bicolor*. Palo Seco, Rio Piedras, and Yabucoa of the original wasp release sites were not visited. Mole crickets were found by searching the ground for surface galleries or signs of damage. Specimens were obtained by using detergent flushes, digging, or by operating sound traps (Walker 1982). *L. bicolor* was monitored by searching the blossoms of *Spermacoce verticillata* (Meyer), a native plant formerly classified in the genus *Borreria* (Wunderlin 1979). Hunting female wasps were located by scanning the soil surface during morning hours in mole cricket infested areas.

Figure 1 represents the distribution of mole crickets and *L. bicolor* in Puerto Rico. *S. abbreviatus* was found only in a sandy field in an urban area of Arecibo (Arecibo Province). However, other specimens have been collected at Rio Piedras (Nickle and Castner 1984) and at Isabela (T. G. Forrest pers. com.). *S. imitatus* was collected in a rural area near Isabela, and at Arecibo, in the same habitat with *S. abbreviatus*. *S. didactylus* was found causing extensive damage to golf courses at 3 widely dispersed locations: Punta Borinquen (Punta Borinquen Golf Club), Dorado (Cerromar Beach Hotel), and Mediania Alta (Berwind Country Club). Specimens from many additional locations have been reported (Nickle and Castner 1984) and are indicated in Fig. 1. Heavy populations (≥ 20 wasps sighted during a 15 minute survey) of *L. bicolor* were observed at Isabela and Arecibo. Several wasps were sighted at Laguna de Tortuguero and Mediana Alta.

The results of this search and previous records indicate that *S. didactylus* is widespread throughout the coastal areas of the island, and abundant at scattered inland locations. Its extensive range may have resulted from a single or multiple introductions coupled with natural dispersal. *S. abbreviatus* appears to occur in distinct local populations situated near port cities. The non-functional wings prohibit flight, severely limiting the amount of natural dispersal that occurs. Misidentification of this species may also occur, since the short-winged adults resemble late instar nymphs of other

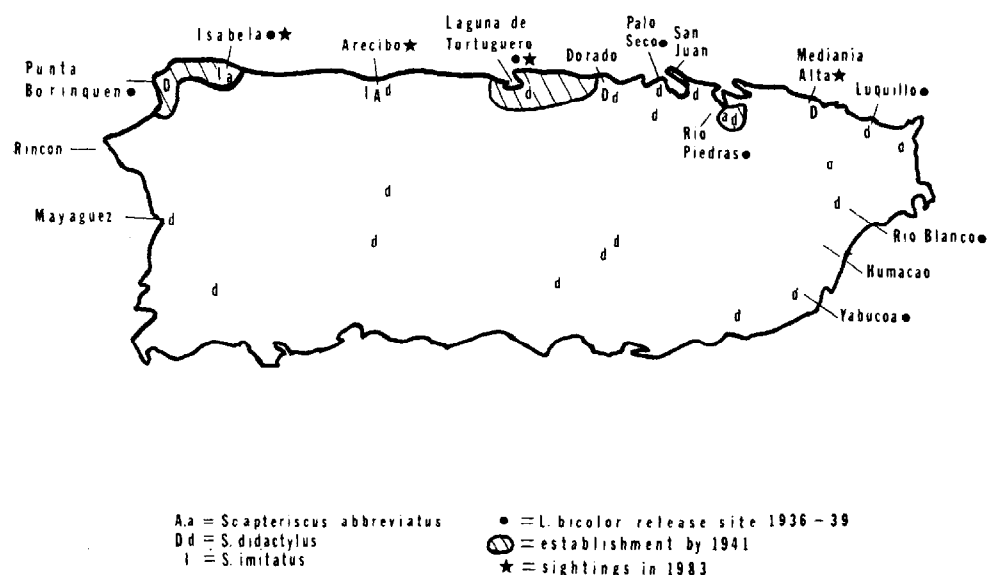


Fig. 1. Distribution of mole crickets (*Scapteriscus* spp.) and *Larra bicolor* in Puerto Rico. Mole cricket records prior to 1983 are taken from Nickle and Castner (1984) and are indicated by lower case letters.

species. *S. imitatus* was collected at Isabela where parasitized mole crickets from Brazil were originally released, and Arecibo, ca. 20 miles away. Since parasitism is not always successful (Castner 1984), it is feasible that some of the parasitized mole crickets released could have survived and reproduced. Walker and Nickle (1981) have shown that *S. vicinus* has spread approximately 200 miles from its single point of introduction in ca. 30 years. If *S. imitatus* is similar in its dispersal capabilities, it could have easily spread throughout Puerto Rico in the 40-45 years since its introduction. However, interspecific competition and natural geographical barriers may have restricted its range.

The most recent record describes the range of *L. bicolor* in Puerto Rico as continuous along the north coast from Mayaguez in the west to Humacao in the east (Wolcott 1950). Our survey does not show *L. bicolor* to be any more widespread than in 1950. Wolcott (1941) observed that the greatest limiting factor to the establishment and spread of *L. bicolor* in Puerto Rico was the abundance of 2 plants, upon which they foraged: *S. verticillata* and *Hyptis atrorubens* Poit. Both appear especially attractive to *L. bicolor*, although the wasps will forage at other plants. Experiments have shown differential survival and development of *L. bicolor* on mole cricket hosts, with *S. didactylus* the least suitable species (Castner 1984). This may partially explain the low number of wasps seen in areas where only *S. didactylus* is known to exist.

The authors would like to acknowledge and thank the following people whose cooperation and hospitality greatly facilitated this research: Dr. Edwin Abreu (Agricultural Experiment Station, Isabela), Mr. Carl James and Mr. Gregg Sheffield (Golf Professionals, Cerromar Beach Hotel), Mr. Wes Barrios (Golf Director, Punta Borinquen Golf Club), Mr. Tony Ruiz (Golf Professional, Berwind Country Club), Mr. and Mrs. Dino Torres, and

Mr. and Mrs. Joseph Laws. We would like to thank Drs. Reece Sailer and Tom Walker for reviewing this manuscript.

REFERENCES CITED

- BARRETT, O. W. 1902. The changa, or mole cricket in Puerto Rico. Puerto Rico Agr. Exp. Sta. Bull. 2: 1-19.
- CASTNER, J. L. 1984. Suitability of *Scapteriscus* spp. mole crickets (Orthoptera: Gryllotalpidae) as hosts of *Larra bicolor* (Hymenoptera: Sphecidae). Entomophaga. In press.
- NICKLE, D. A., AND J. L. CASTNER. 1984. Introduced species of mole crickets in the United States, Puerto Rico, and the Virgin Islands (Orthoptera: Gryllotalpidae). Ann. Ent. Soc. America. 77(4): 450-65.
- WALKER, T. J. 1982. Sound traps for sampling mole cricket flights (Orthoptera: Gryllotalpidae: *Scapteriscus*). Florida Ent. 65(1): 205-10.
- WALKER, T. J., AND D. A. NICKLE. 1981. Introduction and spread of pest mole crickets: *Scapteriscus vicinus* and *S. acletus* reexamined. Ann. Ent. Soc. America 74: 158-63.
- WILLIAMS, F. X. 1928. Studies in tropical wasps—their hosts and associates. Ent. Ser. Exp. Sta. Hawaiian Sugar Planters' Ass. Bull. 19: 1-79.
- WOLCOTT, G. N. 1938. The introduction into Puerto Rico of *Larra americana* Saussure, a specific parasite of the "changa", or Puerto Rican mole cricket, *Scapteriscus vicinus* Scudder. J. Agr. Univ. Puerto Rico 22(2): 193-218.
- . 1941. The establishment in Puerto Rico of *Larra americana* Saussure. J. Econ. Ent. 34(1): 53-6.
- . 1950. The insects of Puerto Rico. J. Agr. Univ. Puerto Rico 32(1): 53-8.
- WUNDERLIN, R. P. 1979. Notes on *Spermacoce* and *Mitracarpus* (Rubiaceae) in the southeastern United States. Phytologia 41(5): 313-6.

POLYGYNOUS COLONIES OF THE RED IMPORTED
FIRE ANT, *SOLENOPSIS INVICTA*
(HYMENOPTERA: FORMICIDAE) IN FLORIDA

C. S. LOFGREN AND D. F. WILLIAMS
Insects Affecting Man & Animals Research Laboratory
ARS, USDA
Gainesville, FL 32604 USA

We report here the first occurrence in Florida of polygynous (multiple queen) colonies of the red imported fire ant (RIFA), *Solenopsis invicta* Buren. Polygynous strains of RIFA have been reported previously in Mississippi (Glancey et al. 1973 and Glancey et al. 1975), Texas (Hung et al. 1974 and Mirenda and Vinson 1982), Georgia and Louisiana (Fletcher 1983).

Our discovery of polygynous colonies was made while conducting ecological studies at the Horse Research Center, Institute of Food and Agricultural Science, University of Florida. The Center is located about 13 km north of Ocala, Florida midway between Highways 301 and old 441. The first indica-