J. New York Entomol. Soc. 95(4):469–473, 1987

FLIGHT ACTIVITY OF *NEOCURTILLA HEXADACTYLA* (PERTY) (ORTHOPTERA: GRYLLOTALPIDAE): ASYNCHRONOUS MOBILE POPULATIONS?

HAROLD G. FOWLER, VALDEMAR R. ORTEGA,[1] AND LUIZ LUCCAS TEIXEIRA[1]
Instituto de Biociências, Universidade Estadual Paulista,
UNESP, 13500 Rio Claro, São Paulo, Brazil

Abstract.—Flying mole crickets, *Neocurtilla hexadactyla* (Orthoptera: Gryllotalpidae) were attracted to light traps in Promissão, São Paulo, Brazil. Flights were strong throughout the year, peaking in June. Females significantly outnumbered males during the entire year. Females were generally reproductively mature, suggesting that populations do not develop synchronously. Data from Venezuela also fit this pattern, while data from Uruguay and other locations in São Paulo state, are characterized by annual periodicity of flight activity and a reduced number of crickets trapped, which is characteristic of univoltine, synchronously developing populations.

Many insect species are attracted to lights, but the reasons for this behavior are still unknown. Often, when large numbers of a particular insect species are attracted to lights, these species are considered pests. In the New World, the mole cricket *Neocurtilla hexadactyla* can be locally abundant and be attracted to lights in large numbers. This paper reports on the flight activity and reproductive condition of *N. hexadactyla* in Promissão, São Paulo, Brazil. These data are compared with data from Venezuela (Doreste, 1975), as well as from other locations throughout the Neotropics. They are used to infer certain life history traits of these crickets and to compare flight activity in *N. hexadactyla* with other mole cricket species.

METHODS AND MATERIALS

A modified Pennsylvanian light trap (Frost, 1957) fitted with an incandescent neon light, was placed in the field near a pasture-forest interface on the station grounds of the Compania Energetica de São Paulo (CESP) in Promissão, São Paulo, Brazil. The trap was run 3 nights weekly during the entire year of 1984. Collected crickets were preserved in alcohol and taken to the laboratory, where they were sexed. All females per bi-weekly sample were dissected, and ovarian development was noted.

RESULTS

During all times of the year, flight activity monitored by light traps was recorded for *N. hexadactyla* in Promissão, São Paulo (Fig. 1). Flight activity was most pronounced from February through June, corresponding to a tropical summer through fall. The sex ratio was strongly skewed in favor of females (Fig. 1), and annually this bias is highly significant ($P = 0.001$). The percentage of females with eggs present was high throughout the year (Table 1). All females without eggs had large fat bodies.

[1] Compania Energética de São Paulo—CESP. 01310 São Paulo, SP, Brazil.

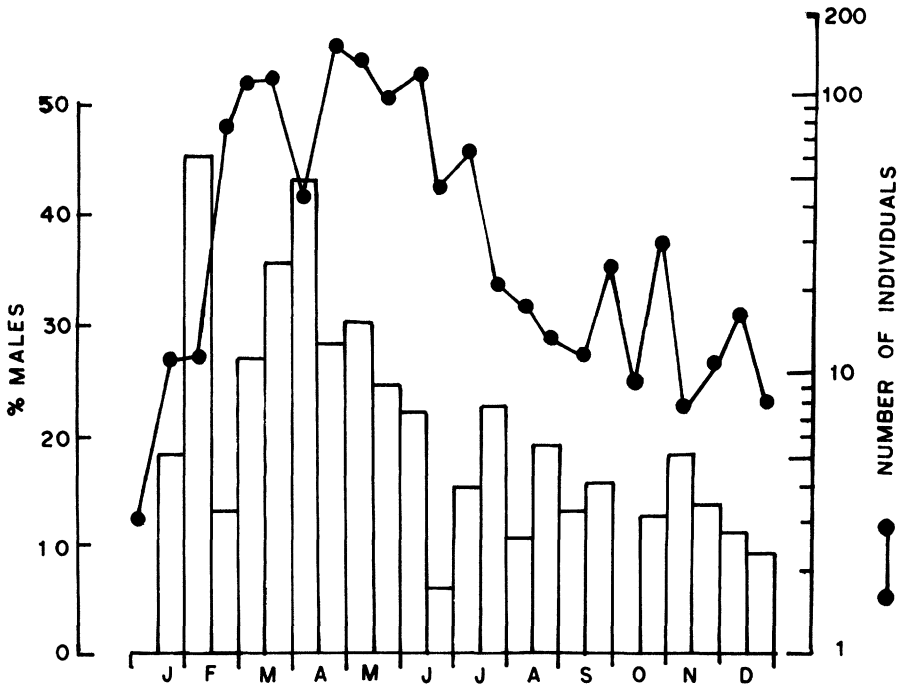

Fig. 1. Bi-weekly (3 trapping nights/week) captures at light traps of *Neocurtilla hexadactyla* in Promissão, São Paulo, as well as the respective percentage of males captured.

DISCUSSION

The numbers of *N. hexadactyla* captured at light traps during this study suggest that the population from which these crickets came was large. These data are unlike flight data for species of exotic mole crickets of the genus *Scapteriscus* in the United States (Ulagaraj, 1975; Walker et al., 1983; Fowler, 1987). These *Scapteriscus* species generally have a discrete annual peak of flight activity with often a second period of flight activity later in the year. This pattern occurs also in South American *Scapteriscus* (Fowler, 1987). A similar pattern in annual flights was recorded for *N. hexadactyla* in Venezuela (Doreste, 1975) (Fig. 2). The differences of annual peaks, September–December for Venezuela and January–April for São Paulo, easily fit a clinal model of flight periodicity (Fowler, 1987), explained solely by latitude. For other populations in the state of São Paulo, Brazil, and in Montevideo, Uruguay, however, only a late spring–early summer peak was found in light trap catches, with flying crickets not being registered for most of the year (Fowler, 1987).

During the entire year, females outnumbered males in the light trap catches, suggesting a skewed sex ratio in the population studied. As with all crickets, the males are relatively less mobile and captures of females always predominate (Alexander, 1968). A greater percentage of females also has been recorded for light trap captures of *Scapteriscus* mole crickets (Ulagaraj, 1975), light trap captures of *Gryllus integer* Scudder (Cade, 1979), pitfall trap captures of *Gryllus rubens* Scudder (Veazey et al.,

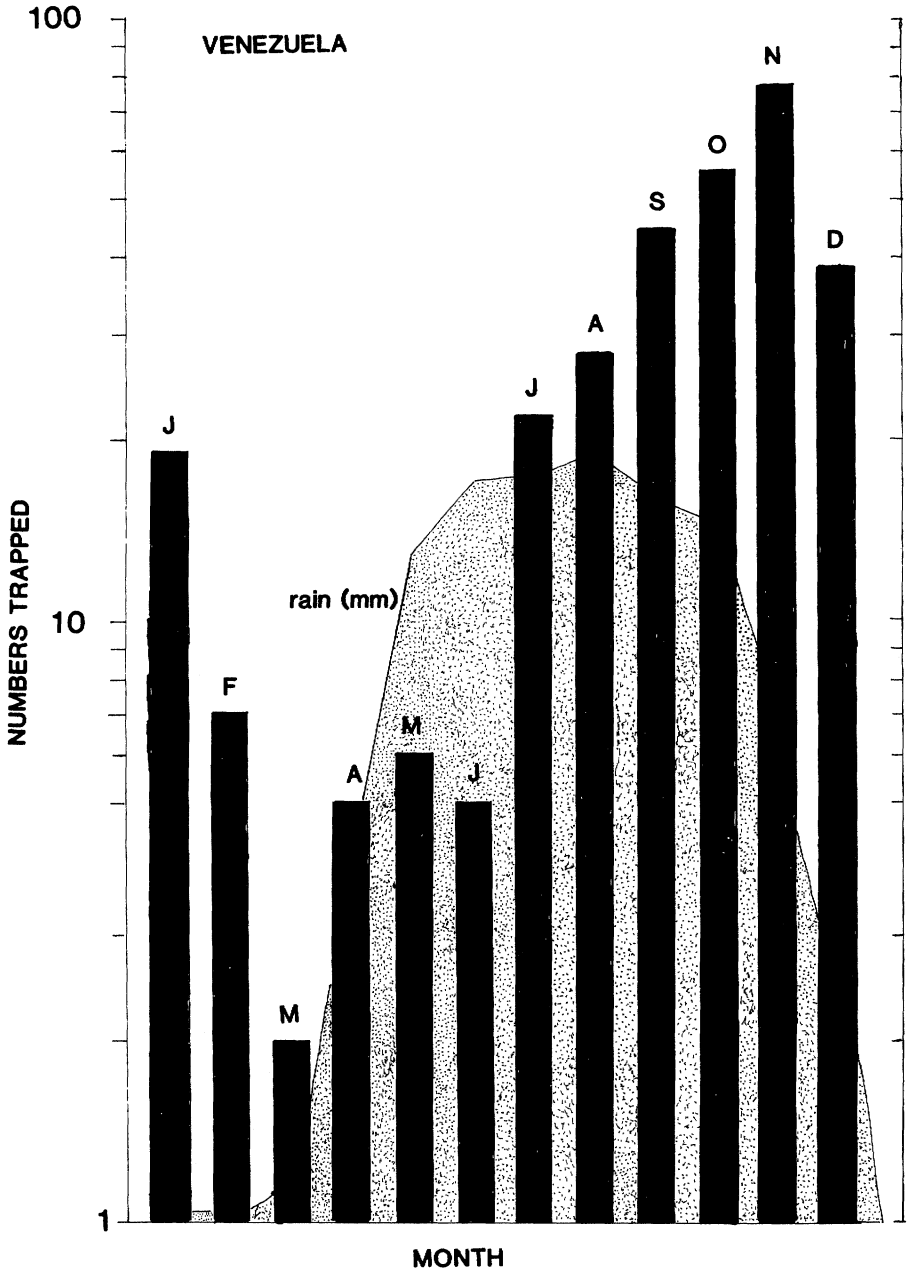

Fig. 2. Monthly catches of *Neocurtilla hexadactyla* at light traps in Cagua, Venezuela, as well as the respective precipitation. After Doreste (1975).

Table 1. Bi-weekly samples of female *Neocurtilla hexadactyla* collected at light traps indicating the percentage of well formed eggs in the reproductive tract.

Month (1984)	Bi-weekly sample	% females with eggs
January	01	86.7
	02	80.0
February	03	93.3
	04	83.3
March	05	100.0
	06	96.7
April	07	100.0
	08	93.3
May	09	100.0
	10	76.7
June	11	60.0
	12	100.0
July	13	93.3
	14	73.3
August	15	66.7
	16	86.7
September	17	93.3
	18	100.0
October	19	70.0
	20	83.3
November	21	76.7
	22	100.0
December	23	93.3
	24	96.7

1976), and sound-trap captures of *Scapteriscus* mole crickets (Ulagaraj and Walker, 1973). For many insect species, a female-biased sex ratio is characteristic in dispersal studies (Johnson, 1969).

Due to the large numbers of flying crickets throughout the year, dominated by gravid females, it appears unlikely that populations develop synchronously, as has been reported for other mole crickets (Ulagaraj, 1975). Dispersal by flight is important in the colonization of suitable habitats by mole crickets (Ulagaraj, 1975), and therefore adaptive (Kennedy, 1975). Studies of dispersal have generally focused on synchronously developing populations (Kennedy, 1975), but, as these data indicate, dispersal may also be important for asynchronously developing, highly mobile populations.

ACKNOWLEDGMENTS

We thank the Compania Energetica de São Paulo (CESP), for facilitating our sampling and authorizing the use of their property, and Maria Teresa Vieira de Camargo for assistance in sorting the crickets in the laboratory. This study received financial support from CESP, UNESP, as well as from a grant, USDA No.-83-CRSR-2-2162, "Biological control of tropical and subtropical mole crickets." Florida Agricultural Experiment Station journal series no. 7985.

LITERATURE CITED

Alexander, R. D. 1968. Life cycle origins, speciation and related phenomena in crickets. Quart. Rev. Biol. 43:1–33.

Cade, W. H. 1979. Field cricket dispersal flights measured by crickets landing at lights. Texas J. Sci. 31:125–130.

Doreste, E. 1975. Fluctuaciones de la población de algumas plagas en Cagua, Estado Aragua, Venezuela, según estudios realizados durante diez años con una trampa de luz. Rev. Fac. Agron. Maracay 8(4):5–24.

Fowler, H. G. 1987. Geographic variation in the flight periodicity of new world mole crickets. J. Interdiscip. Cycle Res. (in press).

Frost, S. W. 1957. The Pennsylvania insect light trap. J. Econ. Entomol. 50:287–292.

Johnson, C. G. 1969. Migration and Dispersal of Insects by Flight. Methuen and Co., London.

Kennedy, J. S. 1975. Insect dispersal. Pages 103–119 *in:* D. Pimentel (ed.), Insects, Science and Society. Academic Press, New York.

Ulagaraj, S. M. 1975. Mole crickets: ecology, behavior and dispersal flight (Orthoptera: Gryllotalpidae: *Scapteriscus*). Environ. Entomol. 4:265–273.

Ulagaraj, S. M. and T. J. Walker. 1973. Phonotaxis of crickets in flight: attraction of male and female crickets to male calling songs. Science 182:1278–1279.

Veazey, J. N., C. A. R. Kay, T. J. Walker and W. H. Whitcomb. 1976. Seasonal abundance, sex ratio, and macroptery of field crickets in northern Florida. Ann. Entomol. Soc. Am. 69:374–380.

Walker, T. J., J. A. Reinert and D. J. Schuster. 1983. Geographical variation in flights of mole crickets, *Scapteriscus* spp. (Orthoptera: Gryllotalpidae). Ann. Entomol. Soc. Am. 76:507–517.

Received December 3, 1986; accepted June 16, 1987.