SCIENTIFIC NOTE

CALLING BEHAVIOR OF THE MOTH *COPITARSIA CONSUETA* (LEPIDOPTERA: NOCTUIDAE)

JULIO C. ROJAS,[1] AND JUAN CIBRIÁN-TOVAR[2]
[1]Centro de Investigaciones Ecológicas del Sureste.
Carretera antiguo aeropuerto km 2.5, Ap. Postal 36.
Tapachula, Chiapas, México. CP 30700.

[2]Centro de Entomología y Acarología,
Colegio de Postgraduados.
Chapingo, Estado de México, México. CP 56230.

Copitarsia consueta (Walker) is a noctuid moth distributed across Mexico and Central and South America (Gutierrez & MacGregor 1985, Castillo & Angulo 1991). In Mexico *C. consueta* is an important pest of cabbage, although on occasion it infests other cultivated plants (Gutierrez & MacGregor 1985). Few studies have been carried out on the biology and behavior of this species. Recently Rojas et al. (in press) have studied its mating behavior and the chemical identification of the female sex pheromone is in progress. The purpose of this study was to determine the effect of age, mating, and photoperiod on the calling behavior of *C. consueta*.

The colony of *C. consueta* was started from 30-40 larvae collected from cabbage in the field. The larvae were reared on an artificial diet (Rojas et al., in press) at 25 ±2 °C, 65 ± 5% RH and reversed 14: 10 (L:D) photoperiod with scotophase beginning at 0600 hours.

The females were held singly in plastic containers (5 x 7 cm) and observed with a red light (7.5-w bulb) at 15 min intervals during each scotophase until the last female stopped calling in the following photophase. Calling females were recognized by the extended terminal abdominal segments. The daily onset of calling time (time after lights off), and length of calling of each female were recorded.

In order to determine the effect of age on calling behavior, 28 virgin females were observed during the first six scotophases at 25 ± 2 °C, 65 ± 5% RH and reversed 14: 10 (L:D) photoperiod.

The influence of mating on calling behavior was studied in 17 females. Three-day-old moth pairs were placed in glass cages and observed until copulation occurred. After mating, the females were placed individually into plastic containers and observed during the following three scotophases at 25 ± 2 °C, 65± 5% RH, and reversed 14: 10 (L:D) photoperiod.

The influence of photoperiod on calling of virgin females was studied in virgin females. Three groups of 24 pupae were conditioned under three different photoperiodic regimes (16L: 8D, 14L: 10D, and 12L: 12D). After emergence the adults were maintained under similar photoperiodic regimens. At each photoperiod, observations were made during the fourth scotophase at 25 ± 2 °C and 65 ±5% RH.

The data were log transformed so that the variance among means was stabilized, subsequently subjected to analysis of variance (ANOVA). The level of probability considered significant was $P < 0.05$.

Of the 28 females observed, no individual called the day following their emergence, the most females (23) called for the first time during the second day, and the rest (5) the third day after eclosion (2.2 ± 0.39 days). Because not all individual called at the same chronological age, we used the calling age (Turgeon & McNeil 1982) for comparing calling behavior. Calling behavior occurs in the latter third of the scotophase. The

TABLE 1. CHANGES IN MEAN ONSET OF CALLING TIME AND MEAN LENGTH OF CALL WITH CALLING AGE OF *C. CONSUETA*.

Calling Age (day)	Mean (± SD) Onset Calling Time (min after lights off)	Mean (± SD) Length of Calling Period (min)
1	444 ± 29	77 ± 42
2	415 ± 20	138 ± 40
3	391 ± 20	179 ± 35
4	391 ± 40	208 ± 42
5	386 ± 41	210 ± 54

duration of calling bouts increased significantly with age although the number of bouts did not change significantly ($F = 0.66$, $df = 4, 130$; $P > 0.05$) with calling day. The mean daily onset of calling time differed significantly with age ($F = 17.10$; $df = 4, 130$; $P < 0.001$). As moths aged, they initiated calling earlier in the scotophase (Table 1). The mean length of the daily calling period varied significantly with age (Table 1). Other females had a longer duration of calling ($F = 43.3$; $df = 4, 135$; $P < 0.01$), and began calling earlier and with prolonged calling bouts.

The dissection of moths showed that 16 of 17 females had mated. A general trend was observed, as the time after copulation increased, the calling began earlier ($F = 5$; $df = 2, 42$; $P < 0.05$) and lasted longer ($F = 4.71$; $df = 2, 42$; $P < 0.05$). Thirteen females resumed the calling during the first scotophase after copulation. The mean onset of calling time was 422 ± 27 min, and the mean length of calling period was 136 ± 55 min. Two days after mating 15 females called. The calling began at 414 ± 33 min and had a duration of 171 ± 67 min. Seventy-two h after copulation 16 females called, the mean onset of calling time was 379 ± 29 min, and the mean length of calling period was 211 ± 70 min. The mean length of the non-calling period in *C. consueta* was 30 ± 10 h.

The mean onset of calling time differed significantly among the three photoperiod regimens ($F = 111.7$; $df = 2, 69$; $P < 0.001$). Females called earlier under short photophase conditions. The calling began at 318 min in the females mantained at 16L:8D, whereas moths that adapted at 14L:10D and 12L:12D called at means of 390 and 400 min after "light off", respectively. The differences between 14L:10D and 12L:12D are not significant ($P > 0.05$). The mean length of calling period varied significantly among the three groups of females held under different photoperiodic regimens ($F = 16$; $df = 2, 69$; $P < 0.01$). The longer the scotophase, the longer the time females spent calling. The calling duration for females maintained at 16L:8D was 156 min, whereas in photoperiodic regimens of 14L:10D and 12L:12D the females called 174 and 246 min, respectively.

We thank Jorge Leyva for suggesting corrections to the manuscript. JCR was sponsored by a CONACyT graduate scholarship (No. 62158).

SUMMARY

The influence of age, mating and photoperiod on calling behavior of the moth *Copitarsia consueta* was investigated under laboratory conditions.

REFERENCES CITED

CASTILLO, E. E., and A. O. ANGULO. 1991. Contribución al conocimiento del genero *Copitarsia* Hampson, 1906 (Lepidoptera: Glossata: Cuculinae). Guyana Zool. 55: 227-246.

GUTIERREZ, O., and R. MACGREGOR. 1983. Guía de insectos nocivos para la agricultura en México. Alhambra Mexicana. México, D.F.

ROJAS, J. C., J. CIBRIÁN-TOVAR, J. VALDEZ-CARRASCO, AND R. NIETO-HERNÁNDEZ. Análisis de la conducta de cortejo de *Copitarsia consueta* (Walker) y aislamiento de la feromona sexual. Agrociencia. (in press).

TURGEON, J., AND J. N. MCNEIL. 1982. Calling behaviour of the armyworm *Pseudaletia unipuncta*. Entomol. Exp. Appl. 31: 402-408.

EFFECTS OF FEEDING OF BROAD MITE (ACARI: TARSONEMIDAE) ON VEGETATIVE PLANT GROWTH

JORGE E. PEÑA[1] AND R. C. BULLOCK[2]
[1]University of Florida, IFAS
Tropical Research and Education Center
18905 S. W. 280th Street,
Homestead, FL 33031

[2]University of Florida, IFAS
Agricultural Research and Education Center
P.O. Box 248, Fort Pierce, FL 34954

The broad mite, *Polyphagotarsonemus latus* (Banks), is a polyphagous pest that has been reported on more than 100 different plant species including crops such as cotton, beans, citrus, potatoes, mango, papaya and several ornamental plant species (Schoonhoven et al. 1978, Beattie & Gellatley 1983, Aubert et al. 1981, Hooper 1957, Nemestothy et al. 1982, Laffi 1982). Because of this mite's short generation time (approx. 5 days), high fecundity, small size and protected habitat, the injury it produces is often confused with diseases and phytotoxicity. Jeppson et al. (1975) reported that some of the plant symptoms following broad mite attack were formerly considered to be due to various diseases including plant viruses (Aubert et al. 1981). Broad mite damage has also been confused with herbicide toxicity or micronutrient deficiency (Beattie & Gellatley 1983, Cross & Bassett 1982).

Gerson (1992) stated that the variety of symptoms on different hosts reflects specific plant reactions to the pest's feeding and putative toxins. Broad mites reduce market yield and injure plants by reducing and deforming leaves, flowers and fruits (Schoonhoven et al. 1978, Gerson 1992). Plants under heavy attack cease growing and die (Moutia 1958). Despite extensive descriptions of broad mite injury (Gerson 1992) the quantitative relationship between broad mite injury and reduction of vegetative plant growth has not been studied extensively.

The objective of this study was to relate broad mite injury to vegetative growth of potato (*Solanum tuberosum* L.), bean (*Phaseolus vulgaris* L.), lime [*Citrus aurantifolia* (Christ.) Swingle] and sour orange (*Citrus aurantium* L.).

Bean, potato, lime and sour orange plants were individually grown in 1 liter containers and kept in an air conditioned greenhouse with a temperature of 26 ± 2°C and relative humidity of 85-90%. Plant age at infestation was 3 and 4 weeks for bean and potato, respectively, and 3 and 4 months for lime and sour orange, respectively. Broad mite stock colonies were reared on pinto bean plants maintained under similar conditions as the treatment plants. Ten broad mite males and female pupae were individually transferred to all apical leaves of the treated plants. A set of uninfested plants of each species