FECUNDITY OF THE SISAL WEEVIL, *SCYPHOPHORUS ACUPUNCTATUS* (COLEOPTERA: CURCULIONIDAE), ON *POLIANTHES TUBEROSA* (LILIALES: AGAVACEAE)

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The sisal weevil *Scyphophorus acupunctatus* Gyllenhal breeds in economically important agave varieties in México, including *Agave tequilana* Weber, *Agave fourcroides* Lemaire, and *Agave salmiana* Otto ex Salm Dick. These weevils also are associated with tuberose, *Polianthes tuberosa* L. in Morelos, México, (Camino et al. 2002). Although not fully understood, mating and oviposition apparently occur in the subterranean bulbs of the plants. Larvae develop inside the bulb where they make galleries. The last instars migrate to the fibrous periphery of the bulb and construct cocoons from fiber and mud.

Camino et al. (2002) reported tuberose as a new host and outlined damage the weevil causes in cultivated *P. tuberosa*. Solís et al. (2001) mention that *S. acupunctatus* is active throughout the year with overlapping populations. This is consistent with Waring and Smith (1986), who point out that it is a multivoltine species associated with wild and cultivated agaves. Adults drill holes in the base of the plant, causing mechanical damage and facilitating the entry of microorganisms that decompose the plant tissues. Ramírez (1993) reported that the adults of *S. acupunctatus* were most frequently found between the base of the leaves and the main root of the henequen. The weevil prefers mature plants and abandoned plantations. Adults can be detected every month of the year, but are more abundant in the rainy season. The adult's favorite habitat is the inferior stratum of the agave, with oviposition occurring in moist tissues of rotten leaves or in the base of the leaves (Lock 1969). The adults are rarely found on recently planted specimens. Copulation usually occurs on the rotten shafts of plants (Lock 1969; Hill 1983). In the field larvae of *S. acupunctatus* feed on *P. tuberosa* bulbs until completing

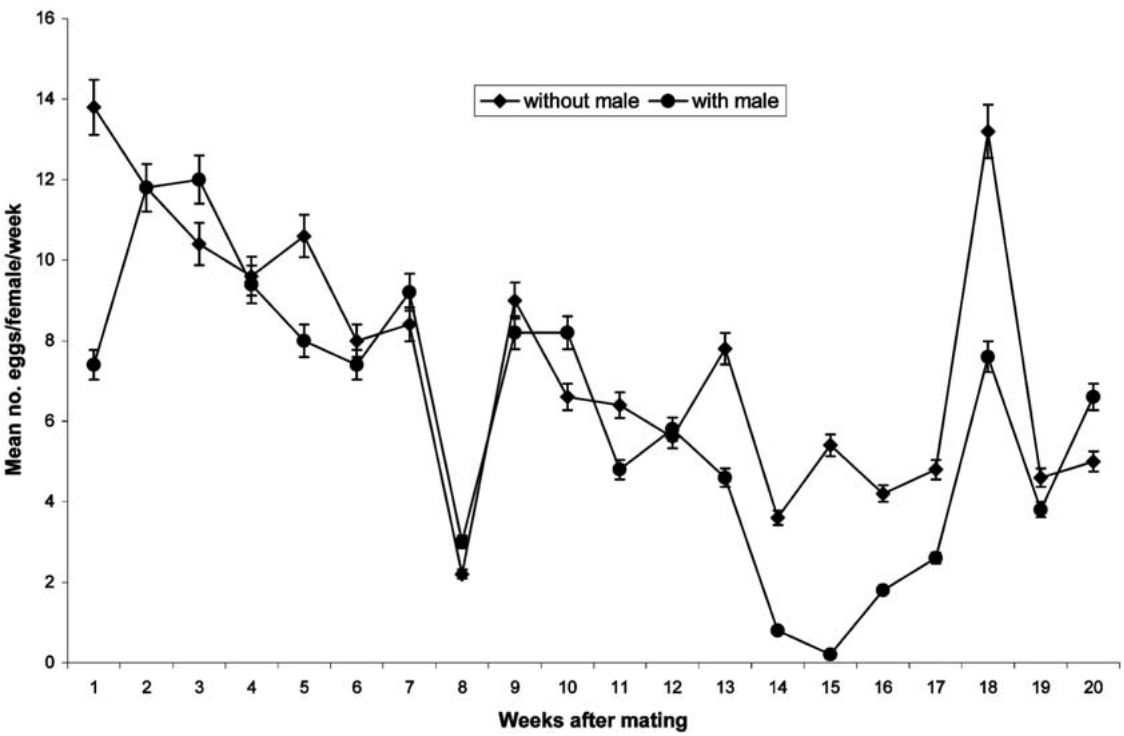

Fig. 1 Mean (±SEM) weekly egg production by newly-emerged *S. acupunctatus* female (n = 20) confined with and without males.

their larval development (pers. obs.). They pupate inside the bulb, from which the adult emerges. There are no published references about the fecundity and fertility of *S. acupunctatus*: However, we did find a report for *Rhynchophorus cruentatus* indicating that the average fecundity of the field female is of 26 ± 15 eggs (Giblin-Davis et al. 1989).

In this study we made observations on fecundity of *Scyphophorus acupunctatus* females confined with or without males, using tuberose bulbs as an ovipositional substrate. In Oct 2001, larvae and cocoons were harvested in the field from infested tuberose or in the laboratory from tuberose bulbs (*P. tuberosa*). Larvae and cocoons were placed individually in covered 100-mL plastic cups with moistened tissue paper (Giblin-Davis et al. 1989) and were stored at 29°C until adult emergence. One male and one female at 14 days post-emergence were placed in a 60-mL covered plastic container with moistened tissue and were stored at 29°C, 60% RH. One test was with confined females and males, and in a second test males were removed after 24 h and a thin slice (5-10 mm; 5-15 g wet weight) of tuberose was added. All containers were placed in an environmental chamber (Presicion, incubator 818, mod. FFU20FCACWO18, Electrolux home products, USA) at 29°C with photoperiod of 11:13 (L:D) 60% RH. Tuberose slices usually were replaced every day. The tests were repeated 4 times with 5 females per test (20 females total). Slices removed from containers were carefully dissected and eggs were removed. The tuberose bulb slices were inspected and changed daily for the duration of the experiment (Oct 2001-Feb 2002) until mortality began. During 2 tests, eggs were separated from tuberose bulb slices and placed in petri dishes (60 × 15 mm) with wet filter paper, sealed with parafilm, and stored at 29°C. Neonate larvae were inspected daily and dead ones were removed. The number of eggs and of larvae that emerged were recorded daily and were converted to eggs laid per female per week. The data were analyzed by Student-Newman-Keul means separation procedure in the Sigma Stat program. The Pearson's correlation test was applied to determine if the male's presence influenced the fecundity of females.

As an index of fecundity, the number of eggs oviposited and egg viability was recorded (Figs. 1 and 2). The two curves parallel each other, with greater oviposition and egg viability in the first

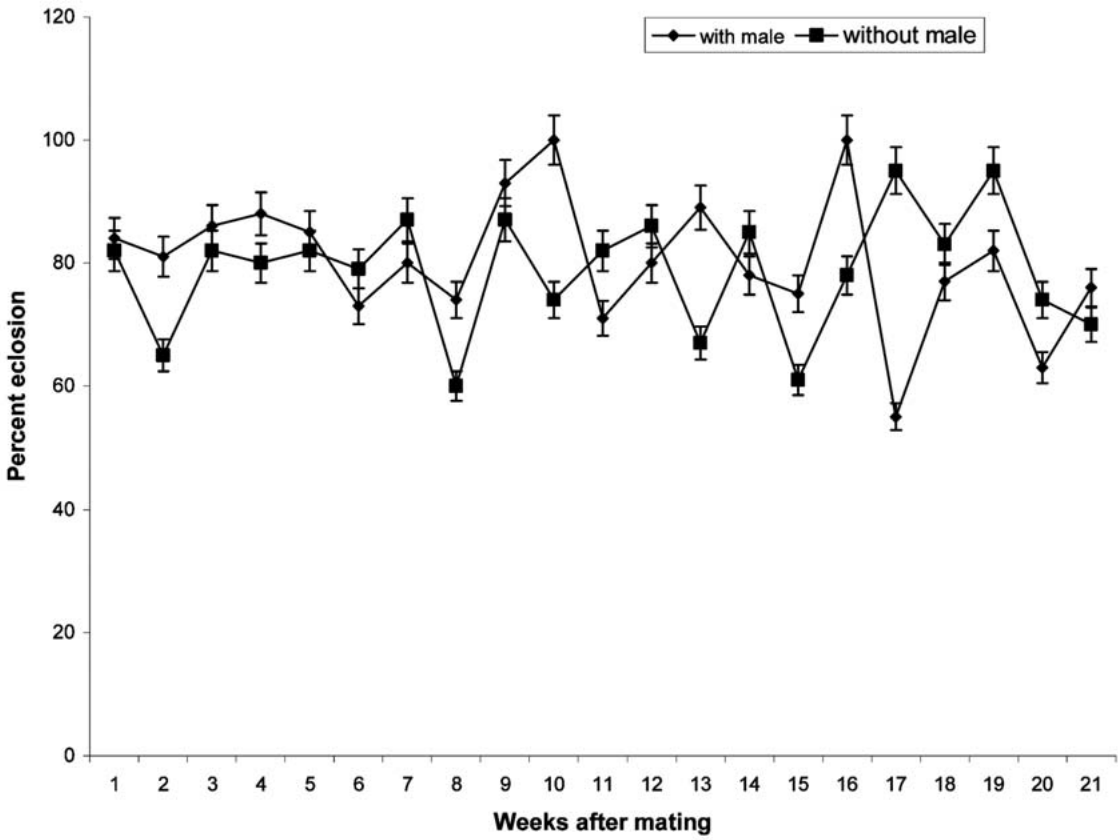

Fig. 2 Percent hatching (eclosion) of eggs produced by newly-emerged *S. acupunctatus* females (n = 20).

weeks. Fecundity was analyzed by ANOVA. We were unable to demonstrate a significant difference between the number of eggs for the group of females with males and that of females without males (P = 0.429). Nor were we able to demonstrate a significant difference between the two groups with regard to the viability of the eggs.

The effect of the different treatments doesn't depend on the time it is presented. We were not able to detect a statistically significant interaction between treatment and time (week) (P = 0.055). These results suggest that the presence of males does not significantly affect oviposition or egg viability, but these two factors are affected by the age of the adults, resulting in a general trend of diminishing number of eggs and decline in viability over time, with an intervening cyclical increase and decrease.

Figs. 1 and 2 suggest the existence of a cyclical pattern of oviposition and egg viability with a variable periodicity. This could be due to the reproductive physiology of the females or the existence of a mechanism of population self-regulation, as described by Padmanaban and Sathiamoothy (2001) for the banana tree borer *Odoiporus longicollis* Olivier. This reduces the number of eggs deposited as the borers become more frequent on their host, indicating the existence of a spacer pheromone, which may deter oviposition by females of the same species. Koppenhofer (1993) observed that females of the banana weevil, *Cosmopolites sordidus* Germar, laid an average of 2.7 eggs/week in rhizome and 0.7 eggs/week in banana pseudo stem in the laboratory, and oviposition declined in high populations. However, Gold and Messiaen (2000) found that the oviposition rate of *C. sordidus* is one egg per week. Adair et al. (1999) found that, under laboratory conditions, females of *Diaprepes abbreviatus* L., a weevil pest of citrus fruits, deposited approximately 60 masses of between 30 and 260 eggs each, with an average of 5000 eggs during their lifetime. The results suggest that females store enough sperm in their spermatheca to fertilize eggs for 20 wk, making multiple copulation unnecessary. The females may have the capacity to select the sperm to fertilize the eggs, as mentioned by (Córdoba 2000). In some cases the female is discriminatory in fertilization of her eggs, and can even avoid using the last male's sperm (Siva & Hooper 1996).

SUMMARY

As an index of fecundity, the number of eggs deposited by females, both with and without males, and egg viability (proportion of eggs hatched) on tuberose bulbs were measured. The results showed that the presence of males does not affect the number of eggs deposited or the viability of eggs.

REFERENCES CITED

ADAIR, R., H. N. NIGG, S. SIMPSON, AND L. LE FEVRE. 1999. Observations on the oviposition process of *Diaprepes abbreviatus* (Coleoptera: Curculionidae). Florida Entomol. 82(2): 362-365.

CAMINO, L. M., V. CASTREJON, R. FIGUEROA., L. ALDANA, AND M. E. VALDES. 2002. *Scyphophorus acupunctatus* Gyllenhall, (Coleoptera: Curculionidae) Attacking *Polianthes tuberosa* (Liliales: Agavaceae) in Morelos, México. Florida Entomol. 85(2): 392-393.

CORDOBA, A. A. 2000. Evolución y diversidad de la morfología de los genitales masculinos en insectos. Folia Entomológica Mexicana. 110: 95-111.

GIBLIN-DAVIS, R. M., K. GERBER, AND R. GRIFFITH. 1989. Laboratory rearing of *Rhynchophorus cruentatus* and *R. palmarum* (Coleoptera: Curculionidae). Florida Entomol. 72(3): 480-488.

GOLD, C., AND S. MESIAEN. 2000. El picudo negro del banano *Cosmopolites sordidus*. INIBAP. Red Internacional para el mejoramiento del banano y el plátano. Plagas de Musa. Hoja divulgativa. No. 4.

HILL, D. S. 1983. Agricultural Insect Pests of the Tropics and Their Control. Cambridge University Press. New York. pp. 393-394.

KOPPENHOFER, A. M. 1993 Observations of egg-laying behaviour of the banana weevil, *Cosmopolites sordidus* (Germar). Entomol. Exp. Appl. 68: 187-192.

LOCK, G. W. 1969. Sisal. Thirty Years´ Sisal Research in Tanzania, 2nd ed. Tanganyika Sisal Growers´ Association. Longmans Green and Co. Ltd. London. 365 pp.

PADMANABAN, B., AND S. SATHIAMOOTHY. 2001. El barrenador del tallo del banano *Odoiporus longicollis*. INIBAP. Red Internacional para el mejoramiento del banano y el plátano. Plagas de Musa. Hoja divulgativa. No. 5 pp. 1-5.

RAMIREZ, CH. J. L. 1993. Max del henequén *Scyphophorus interstitialis* bioecología y control. Serie libro técnico. Centro de investigación Regional del Sureste. INIFAP- SARH. Mérida, Yucatán, México.

SIVA–JOTHY, M. T., AND R. E. HOOPER. 1996. Differential use of stored sperm during oviposition in the damselfly *Calopteryx splendens xanthostoma* (Charpentier). Behavioral Ecol. and Sociobiol. 39: 389-391.

SOLIS, A. J. F., H. GONZALEZ, J. L. LEYVA V., A. EQUIUA, M. F. J. FLORES, AND G. A. MARTINEZ. 2001. *Scyphophorus acupunctatus* Gyllenhal plaga del agave tequilero en Jalisco, México. Agrociencia. 35(6): 663-670.

WARING, G. L., G. A. R. L. SMITH. 1986. Natural history and ecology of *Scyphophorus acupunctatus* (Coleoptera: Curculionidae) and its associated microbes in cultivated and native agaves. Ann. Entomol. Soc. Am. 79(2): 334-340.