

PARASITIZATION OF *DIATRAEA LINEOLATA* PUPAE AND DIAPAUSING LARVAE BY SEVERAL EXOTIC PARASITES

L. A. RODRIGUEZ-DEL-BOSQUE, AND J. W. SMITH, JR.

Department of Entomology
Texas A&M University
College Station, Texas 77843

The neotropical cornstalk borer (NCB), *Diatraea lineolata* (Walker), is a widely distributed species of the economically important genus *Diatraea* (Lepidoptera: Pyralidae) (Rodriguez-del-Bosque et al. 1988). A recent study on the parasitization of NCB in the corn agroecosystem of northern Tamaulipas, Mexico, revealed a minimal impact of native parasites. No pupal parasites were detected, and only three larval parasites appeared sporadically causing negligible levels of parasitization. The braconid larval parasite *Cotesia flavipes* (Cameron) was introduced into the corn agroecosystem of northern Tamaulipas in 1985, and rapidly became the most important parasite of both NCB and the sugarcane borer, *D. saccharalis* (F.) (Rodriguez-del-Bosque 1988). However, the impact of this exotic parasite was greatest on *D. saccharalis*, dictating the need for introduction of additional natural enemies against NCB. The successful establishment of potential parasites in this area could be limited by their ability to develop on diapausing NCB larvae, which are present during both summer and winter. Diapause of NCB is characterized by a change from a spotted to an immaculate morph, triggered by host plant maturation (Rodriguez-del-Bosque 1988). We investigated the suitability of NCB pupae and diapausing larvae to several exotic parasites. This report serves as a precursor for further detailed investigations and as a guide for selecting the best parasites for trial colonization.

Small-scale laboratory tests were conducted from January to May 1988 to determine the host suitability of NCB to several exotic larval and pupal parasites, cultured at the Biological Control Facility, Department of Entomology, Texas A&M University, as part of a biological control program aimed at graminaceous stalkborers in Texas. Diapausing NCB larvae used in the tests were field collected from maturing cornstalks in Rio Bravo, Tamaulipas, Mexico, placed in 20-ml cups with artificial diet (Martinez et al. 1988), and transported to College Station, Texas. Pupae (1-2 days old) were obtained from a NCB colony maintained in College Station (Rodriguez-del-Bosque 1988). Larval parasites tested included the braconids *Digonogastra kimballi* (Kirkland) and *Alorhogas pyralophagus* Marsh from Mexico, *C. flavipes* and *Rhacanotus roslinensis* Lal from Pakistan, *Apanteles minator* Muesebeck from Bolivia, and the bethylid *Goniozus natalensis* Gordh from South Africa. The braconids all developed successfully on non-diapausing (spotted) NCB larvae in preliminary trials. *Goniozus natalensis* was not tested against nondiapausing NCB larvae. Pupal parasites were the eulophids *Trichospilus diatraeae* Cherian & Margabandhu from India (founder culture obtained from Florida, U.S.A.) and *Pediobius furvus* Gahan from Kenya, and the ichneumonid *Xanthopimpla stemmator* Thunberg from Asia (founder culture obtained from Mauritius). Although *T. diatraeae* has previously been reared from NCB pupae (Bennett & Pschorn-Walker 1970), information on parasitization, emergence, progeny, and developmental time was not reported.

Twenty hosts (pupae or diapausing larvae) were used to determine NCB suitability and developmental time (host exposure to adult parasite emergence) for each parasite, except *X. stemmator*, in which 81 pupae were used. Host larvae and pupae were held at constant $26 \pm 0.5^\circ\text{C}$ and 14:10 (L:D) photoperiod during and after exposure to parasites. Host larvae were exposed for 24 h to >20 parasite females held in Plexiglas cages

(30 X 30 X 30 cm), except for *G. natalensis* which was placed individually in cups containing artificial diet and a host larvae. Host larvae were exposed freely in the cages to *C. flavipes* and *A. minator*, in petri dishes (in folds of corrugated cardboard covered with filter paper taped to the petri dishes) to *R. roslinensis* and *A. pyralophagus*, and in plastic grids (Kirkland 1982) to *D. kimballi*. Host larvae exposed to *C. flavipes* and *A. minator* were subsequently placed individually in cups with artificial diet. Host pupae were exposed freely for 24 h to >20 parasite females of *T. diatraeae* and *P. furvus* in glass vials (36 ml) in groups of 10 pupae per vial, and in paper straw sections holding five pupae each for *X. stemmator* in a plexiglas cage. Pupae were subsequently placed individually in plastic vials (14 ml) plugged with cotton for parasite emergence.

Digonogastra kimballi, *R. roslinensis*, and *C. flavipes* produced cocoons in 60, 50, and 40% of the diapausing larvae, respectively (Table 1). *Goniozus natalensis* was unsuccessful in parasitizing diapausing larvae, whereas *A. pyralophagus* and *A. minator* produced cocoons in only 10% of the hosts. Ninety percent of the diapausing larvae were paralyzed by *A. pyralophagus*, indicating that either oviposition did not occur after paralysis or parasite development was unsuccessful.

All pupal parasites developed successfully from NCB (Table 2). Adult parasite emergence was obtained from 90, 70, and 56% of the NCB pupae for *T. diatraeae*, *P. furvus*, and *X. stemmator*, respectively. *Trichospilus diatraeae* was very aggressive and prolific causing 100% parasitization, and producing 280-450 progeny per host with >99% females. The mean progeny for *P. furvus* was 134 parasites per host, whereas *X. stemmator*, a large solitary parasite, was consistent with its previously reported biology (one progeny per host).

TABLE 1. SUITABILITY OF *DIATRAEA LINEOLATA* DIAPAUSING LARVAE TO EXOTIC PARASITES CULTURED IN THE LABORATORY (N = 20).

Parasite	% paralyzed	% forming cocoons	\bar{X} progeny per host	% females	Developmental time (range)
<i>Digonogastra kimballi</i>	100	60	3.0	61	18-20
<i>Rhacanotus roslinensis</i>	80	50	7.4	65	19-20
<i>Cotesia flavipes</i>	—	40	24.5	85	17-18
<i>Allorhogas pyralophagus</i>	90	10	1.0	100	22
<i>Apanteles minator</i>	—	10	10.0	20	24
<i>Goniozus natalensis</i>	0	0	—	—	—

TABLE 2. SUITABILITY OF *DIATRAEA LINEOLATA* PUPAE TO EXOTIC PARASITES CULTURED IN THE LABORATORY (N = 20, EXCEPT *X. TEMMATOR* N = 81).

Parasite	% parasitized	% parasite emergence	\bar{X} progeny per host (range)	% females	Developmental time (range)
<i>Trichospilus diatraeae</i>	100	90	385 (280-450)	>99	15-17
<i>Pediobius furvus</i>	70	70	134 (35-223)	50	23
<i>Xanthopimpla stemmator</i>	59	56	1 (1)	84	17-23

The results suggest that *D. kimballi*, *R. roslinensis*, and all pupal parasites are good candidates for colonization against NCB. Although *T. diatraeae* has been reported to develop on tachinid puparia in laboratory tests, it usually functions as a primary pupal parasite of Lepidoptera in the field (Bennett et al. 1987).

ACKNOWLEDGMENT

We thank F. D. Bennett and Jorge L. Leyva for their comments on earlier drafts. Approved by the Texas Agricultural Experiment Station as TA 24371. Research supported by H-6796 and the Rio Grande Valley Sugar Growers, Inc.

REFERENCES CITED

- BENNETT, F. D., AND H. PSCHORN-WALCHER. 1970. Recent investigations on the biological control of *diatraea* spp. in Trinidad, and the Lesser Antilles and Barbados. Proc. Int. Soc. Sug. Cane Technol. 13: 1321-1330.
- BENNETT, F. D., H. GLENN, M. YASEEN, AND R. M. BARANOWSKI. 1987. Records of *Trichospilus diatraeae*, an Asian parasite (Hymenoptera: Eulophidae) from the Caribbean and Florida. Florida Entomol. 70: 184-186.
- MARTINEZ, A. J., J. BARD, AND T. HOLLER. 1988. Mass rearing sugarcane borer and Mexican rice borer for production of parasites *Allorhogas pyralophagus* and *Rhacanotus roslinensis*. U.S. Dept. Agric., APHIS 83-1. 27 pp.
- KIRKLAND, R. L. 1982. Biology of *Iphiaulax kimballi* (Hym.: Braconidae), a parasite of *Diatraea grandiosella* (Lep.: Pyralidae). Entomophaga 27: 129-134.
- RODRIGUEZ-DEL-BOSQUE, L. A. 1988. Population ecology of corn stalkborers (Lepidoptera: Pyralidae) in northeastern Mexico. Ph.D. dissertation, Texas A&M University, College Station. 160 pp.
- RODRIGUEZ-DEL-BOSQUE, L. A., J. W. SMITH, JR., AND H. W. BROWNING. 1988. Bibliography of the neotropical cornstalk borer, *Diatraea lineolata* (Lepidoptera: Pyralidae). Florida Entomol. 71: 176-186.



AN IMPROVED ARTIFICIAL NEST FOR
LABORATORY REARING OF THE IMPORTED FIRE ANT,
SOLENOPSIS INVICTA (HYMENOPTERA: FORMICIDAE)

D. F. WILLIAMS

Insects Affecting Man and Animals Research Laboratory
USDA-ARS
Gainesville, Florida 32604

Present research with the imported fire ant, *Solenopsis invicta* Buren, has necessitated the maintenance of large numbers of laboratory colonies of these insects. Because of the moisture requirements for proper development and growth of laboratory colonies, we continue to make improvements in our laboratory rearing methods and materials (Williams et al. 1980 and Banks et al. 1981). Two types of laboratory nests used by our fire ant laboratories in Gainesville, Florida, and Gulfport, Mississippi, were described by Bishop et al. (1980). One of these nests, the Williams nest, has been in continuous use since 1980. I report here some modifications which have increased its usefulness.