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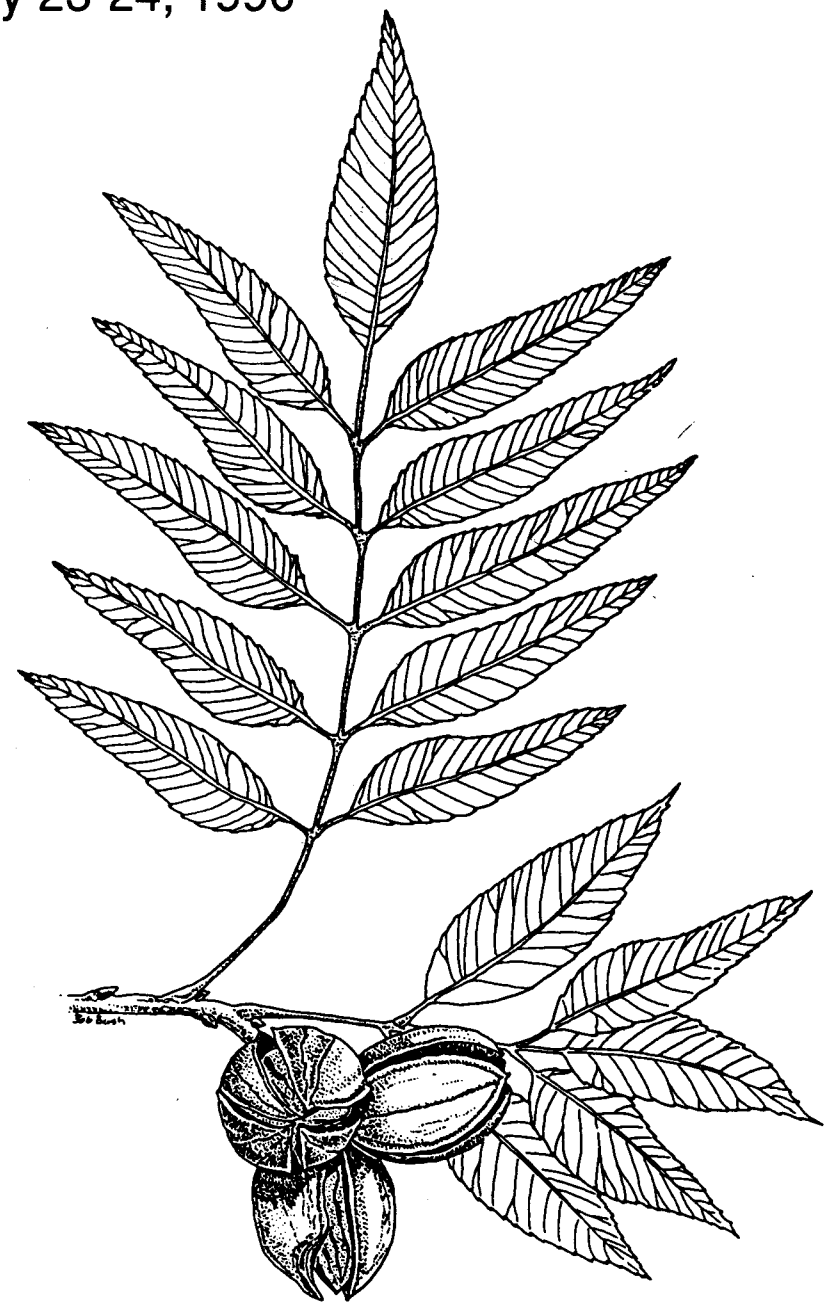

TRICHOGRAMMA PRETIOSUM TESTED AS A BIOLOGICAL CONTROL AGENT AGAINST THE HICKORY SHUCKWORM

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ABSTRACT

The egg parasitoid *Trichogramma pretiosum* Riley readily parasitized hickory shuckworm (HSW) [*Cydia caryana* (Fitch)] eggs in the laboratory, but failed to control hickory shuckworm in the orchard. HSW moths were allowed to oviposit on nuts in the laboratory. These eggs were exposed to *T. pretiosum* in the laboratory where at least 90% were parasitized. However, *T. pretiosum* released on three occasions in September and October in replicated trees in the station orchard resulted in a 42 and 38% HSW infestation in the treated and untreated trees, respectively.

The hickory shuckworm (HSW), *Cydia caryana* (Fitch), is considered by McQueen (1973) to be the most serious insect pest of pecan. Feeding by larvae in the shuck disrupts the flow of nutrients through the vascular system during the critical nut-filling period, causing poorly filled nuts, resulting in severe economic loss. Experiments were conducted with *Trichogramma minutum* Riley against the HSW from 1931 to 1935, but control was not achieved (Spencer et al. 1949). The present work was undertaken during 1989 to determine if *T. pretiosum* would parasitize HSW eggs in the laboratory and to determine if releases of *T. pretiosum* in an orchard situation would result in measurable differences in HSW infestation.

MATERIALS AND METHODS

T. pretiosum adults were isolated from the eggs of unidentified Lepidoptera, believed to be pecan bud moth, *Gretchena bolliana* (Slingerland), deposited on pecan seedlings at Byron, GA, during the spring of 1988. Successive generations of *T. pretiosum* were held in commercial colonization on Angoumois grain moth, *Sitotroga cerealella* (Oliver) eggs by Rincon-Vitova Insectaries (P.O. Box 95, Oak View, CA) until the tests began.

A black light trap mounted on top of a large cage was used to capture live HSW adults at Stoneville, MS. The cage was constructed of four wooden-framed screen doors (91.4 x 213.4 cm). A 22-watt circline black light which was level with the top of a funnel was mounted on top of the cage. The trap assembly was placed under a pecan tree in the test orchard.

The live trap was operated only when moths were needed, and was operated 8 nights from 9 September through 24 October 1989. A total of 709 male and 569 female moths were captured. These were placed in approximately equal numbers in 8 cages in the laboratory. Each cage measured 19.1 x 19.1 x 24.1 cm. The moths were provided with sugar water (5% w/v), supplied on cotton pads. Cages were misted with distilled water twice daily for the moths to drink. Cages were held under lab conditions of 22.2-26.7° C and 40-70% RH. Light was provided by overhead fluorescent lights during the day and a 125-watt incandescent bulb, reduced to 20% output by a rheostat, at night.

Twigs bearing 2-3 immature nuts were placed in water-filled 236 ml plastic cups, the lids of which had been slit to accommodate the stems. Nuts were placed in cages and HSW females were allowed to oviposit for 1-2 days. Nuts were then removed and placed in 1.9 l cardboard cartons which contained *Trichogramma* emerging from ca. 4200 parasitized *S. cerealella* eggs. Stems were inserted into small holes near the tops of the cartons, since *Trichogramma* are positively phototaxic and negatively geotaxic (Morrison 1985). Cartons were covered with the tops of 15.2 cm glass petri dishes onto which honey had been streaked with a very fine camel's hair brush. Nuts with HSW eggs were exposed to *Trichogramma* for one day, then removed to 236 ml plastic cups and held for parasite emergence. The centers of the lids had been cut out and the resulting rings used to secure 11 cm filter paper on the cups. This allowed ventilation to deter molding of the nuts, yet contained the minute *Trichogramma* adults. *Trichogramma pretiosum* had been previously identified to species by Dr. Gary Planter, University of California, Davis.

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The percentage of HSW eggs parasitized in the laboratory was determined daily by making estimates of the number of eggs on the nuts contained in each of the eight cups. Actual counts were made of dead *Trichogramma* which had hatched from the HSW eggs in each cup.

Field releases of *Trichogramma* were made by stapling flattened paper cups containing ca. 8,000 parasitized *S. cerealella* eggs to a tree. Two trees of each of five varieties received the treatment while two trees of the same varieties did not. Releases were made 26 September, 5 October and 11 October. *T. pretiosum* required about 8 days to develop to adults in *S. cerealla* eggs.

Twenty-nut samples were collected from each of the treated and untreated trees on 23 October. Nuts were placed in plastic cups and held for emergence of *Trichogramma*. Nuts were examined for evidence of HSW infestation on 31 October. A nut was considered to be infested if any of the following were found: Immature or mature larva(e), larval feeding damage (even if no larva was found), or adult exit hole. Data from the field test were subjected to analysis of variance to detect treatment difference.

RESULTS AND DISCUSSION

Although the majority of the HSW eggs on the nuts were visible, some were laid in crevices or on top of one another, which made it impossible to get an exact count. However, during a representative three day period, at least 1300 HSW eggs were counted, or a mean of 54.2/cup; correspondingly, 1427 dead *Trichogramma* were found in these same cups, or a mean of 59.1/cup. These counts, plus observations of blackened HSW eggs (which indicated parasitism) indicated that more than 90% of the HSW eggs were parasitized in the laboratory. This further confirms the wide host range of the genus *Trichogramma* shown by Morrison (1985).

In the field study, no emerged *Trichogramma* adults were found in the cups prior to removing the nuts to examine them for HSW larvae, nor were there any significant differences found between the number of nuts infested with HSW collected from trees treated with *T. pretiosum* and those from untreated trees ($f=0.24$, $df=1$, $p=0.63$). The number of infested nuts averaged 8.4 (SE $\pm$ 1.39) from the treated trees and 7.6 (SE $\pm$ 0.83) from the untreated trees. This converts to an infestation rate of 42% in the nuts from the treated trees and 38% from the untreated trees.

The reason for this is not understood, but these results concur with those of Spencer et al. (1949) who found HSW infestation levels to be 3.1% higher in trees treated with *T. minutum* than in untreated trees.

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LITERATURE CITED

McQueen, H.F. 1973. Occurrence of pecan insects - a 10 year summary. Proc. SE Pecan Grow. Assoc. 66:79-81.

Morrison, R.K. 1985. *Trichiogramma* sp., pp. 413-417. ***In:*** P. Singh and R.F. Moore (eds.) Vol. I, The Handbook of Insect Rearing. Elsevier Publ., New York.

Spencer, H., L. Brown and A.M. Phillips. 1949. Use of the parasite *Trichogramma minutum* for controlling pecan insects. USDA Circ. No. 818; 17 pp. Washington, D.C.

Table 1. x % nuts infested with HSW.

Variety	Treated[a]	Check[a]
Jackson	63	50
Choctaw	55	43
Cape Fear	53	30
Desirable	25	33
Caddo	15	35

[a]Represents mean of two replications, 20 nuts/replication.