

ESTABLISHMENT OF THE EXOTIC PARASITE
TETRASTICHUS HAITIENSIS [HYM. : EULOPHIDAE]
 AND RECOVERY OF A NEW *TRICHOGRAMMA*
 [HYM. : TRICHOGRAMMATIDAE]
 FROM ROOT WEEVIL EGG MASSES IN FLORIDA

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The exotic root weevil egg parasite, *Tetrastichus haitiensis* GAHAN, imported from Puerto Rico and released in Florida between 1969 and 1971, was found established on citrus root weevil egg masses in 1978 near Oakhill, Florida. It was also recovered there from field-collected weevil egg masses from June to August 1978 and from citrus bouquets containing egg masses placed in the grove during July and August 1978. In addition, a new species of *Trichogramma* was discovered. In the laboratory, this species parasitized egg masses of 4 species of weevils that attack citrus in Florida. These are *Diaprepes abbreviatus* (L.), *Pachnaeus litus* (GERMAR), *P. opalus* (OLIVIER) and *Artipus floridanus* HORN.

Diaprepes abbreviatus (L.), a curculionid pest of citrus and sugarcane in the West Indies, was first reported attacking citrus in the United States near Apopka, Florida (WOODRUFF, 1964). The egg masses of this weevil are deposited between leaves, along with an adhesive secretion that bonds the leaves together. The neonate larvae drop to the ground and feed on the roots, which causes severe host decline and loss of fruit production. Adult weevils damage leaves by making characteristic notches on the leaves while feeding, but this is of secondary importance when the trees are mature. An area of ca. 2,500 ha was placed under quarantine when the pest was first discovered attacking citrus. Presently an area of ca. 20,000 ha is under quarantine. Chemical control measures were implemented as previously reported by SELHIME & BEAVERS (1972). In addition, biological control program was initiated by Agricultural Research, Science and Education Administration, U.S.D.A., in which *Tetrastichus haitiensis* GAHAN, an eulophid egg parasite, imported from Puerto Rico, was colonized and released in the *D. abbreviatus* — infested area, first at Apopka (SUTTON *et al.*, 1972) and later at Apopka and near West Palm Beach, Fla (BEAVERS & SELHIME, 1975), areas where a high population of the citrus root weevil, *Pachnaeus litus* (GERMAR), a known host for *T. haitiensis* in Cuba (BRUNER, 1934) and Jamaica (anon., 1954), was present. *Brachyufens (ufens) osborni* DOZIER, a trichogrammatid parasitoid of *D. abbreviatus* eggs in Puerto Rico (DOZIER, 1932) that was previously reported attacking *P. litus* eggs in Florida (BARANOWSKI, 1960), was also present in this area.

Tetrastichus haitiensis is a primary endoparasite that oviposits into the weevil egg masses through the leaves. After ca. a 16-day development period, the adult parasites emerge through round exit holes in the leaf. This parasitoid was first described by GAHAN (1929) from egg masses of *Exophthalmus quadrivittatus* OLIVIER from Haiti.

Since *T. haitiensis* was released in Florida, periodic searches for parasitized weevil egg masses have been made in the original release areas and in other areas where indigenous root weevil populations attack citrus.

The present paper reports the establishment of *T. haitiensis* on citrus root weevil egg masses in Florida and the discovery of a new *Trichogramma* sp. that attacks weevil egg masses.

MATERIALS AND METHODS

Visual searches of the canopy of citrus trees for egg masses of *D. abbreviatus* were made periodically throughout the quarantine area and in other areas where indigenous populations of citrus root weevils such as *P. litus*, *P. opalus* (OLIVIER) and *Artipus floridanus* HORN occur. Also bouquets of citrus foliage containing egg masses deposited by caged weevils in the laboratory were placed at preselected sites within weevil-infested areas 2-3 days and then returned to the laboratory. The egg masses were removed from the bouquet, placed in individual plastic containers (25 dram), and held in the laboratory at ambient temperature (ca. 26°C) for observation of parasite emergence. Bouquets containing *D. abbreviatus* egg masses were placed only in the quarantine area, while bouquets containing *P. opalus* egg masses were placed in other weevil-infested areas outside the quarantine area.

Emerging parasites were identified by Dr. E. E. GRISSELL at the Systematic Entomology Laboratory, Agricultural Research, Science and Education Administration, U.S.D.A., U.S. National Museum. The *Trichogramma* n. sp. was identified by L. R. ERTLE, U.S.D.A.-S.E.A., Newark, Delaware.

RESULTS

WEST PALM BEACH. From 1975 through 1978, periodic attempts to recover *T. haitiensis* from the release sites at West Palm Beach were unsuccessful. Unfortunately, no adult *P. litus* or egg masses were recovered from this area. Earlier soil application of aldrin combined with the high rate of parasitism by *B. osborni* (BEAVERS & SELHIME, 1975) apparently effectively controlled *P. litus* at this site.

OAKHILL. In late 1977, a high population of *A. floridanus* was found on citrus near Oakhill, Florida. Subsequently, in June 1978, we returned to the same area for further collections. At this time we also collected another citrus root weevil, *P. opalus*, as well as egg masses of both species. The egg masses were placed individually in vials as described, for possible parasite emergence. Both *B. osborni*, which was known to be present in Florida (BARANOWSKI, 1960), and *T. haitiensis* emerged from the *P. opalus* masses (table 1). Subsequent collections were made in the area, and in July, 45 egg masses were collected. Thirty-three (73 %) of these masses were parasitized, i. e., parasitoids emerged or exit holes were present in the leaves. *Tetrastichus haitiensis* and *B. osborni* were again recovered. In one instance, both species emerged from a single egg mass. FENNAH (1942) reported this as a common occurrence in St. Lucia on *D. abbreviatus* egg

TABLE 1

Parasitism of weevil egg masses individually collected or placed on citrus bouquets in a root weevil-infested citrus grove, Oakhill, Florida, 1978

Date	No. collected	No. parasitized	Parasitism (%)
INDIVIDUALLY COLLECTED			
June	(^a)		
July	45	33	73.3
Aug.	15	3	20.0
Sept.	8	0	—
BOUQUET			
July	8	3	37.5
Aug.	7	1	14.4

(a) *T. haitiensis* and *B. osborni* recovered; egg masses not counted.

masses. In August, 15 egg masses were found, and *T. haitiensis* emerged from 3 (20 %). In September, 8 egg masses were found; none was parasitized.

Also, on July 11, we placed a bouquet of citrus foliage containing *P. opalus* egg masses in a tree in the same grove. After 3 days of exposure, 8 egg masses were recovered; 3 masses (37.5 %) were parasitized, 1 with *T. haitiensis* and *B. osborni*, 1 with *T. haitiensis* and 1 with a new species of *Trichogramma*. On July 27, a bouquet containing 7 egg masses was put out. *Tetrastichus haitiensis* emerged from 1 mass (14.4 %).

APOPKA. During the period 1975 through 1978, 126 weevil egg masses were collected within the *D. abbreviatus* quarantine areas. None was parasitized. In 1978, after the recovery of *T. haitiensis* near Oakhill, we put out bouquets of citrus containing *D. abbreviatus* egg masses weekly from August 15 to September 26 in areas where parasites had been released previously (SUTTON *et al.*, 1972, BEAVERS & SELHIME, 1975). A total of 63 egg masses was recovered from the bouquets. No parasitoids were recovered.

DISCUSSION

Although SUTTON *et al.* (1972) reported that *T. haitiensis* parasitized egg masses of *P. opalus* in the laboratory, we believe this to be the first record of parasitization of *P. opalus* egg masses in the field.

Recovery of *T. haitiensis* 6-7 years after it was last released (BEAVERS & SELHIME, 1975) indicates the successful establishment of this parasitoid in Florida. DEBACH & BARLETT (1964) indicate that at least 3 years should pass from the time of release before establishment can be claimed.

The *Trichogramma* n. sp. recovered at Oakhill has been colonized in the laboratory on egg masses of *D. abbreviatus*, *P. litus*, *P. opalus* and *A. floridanus*. It may be possible to release this parasitoid into areas of Florida having indigenous populations of these root weevils. The parasitoid completes its development in ca. 12 days, and 3-4 parasites emerge from each weevil egg. This *Trichogramma* works its way between the leaves to

attack the egg masses instead of ovipositing through the leaf as do *T. haitiensis* and *B. osborni*. It may also be beneficial to release *Trichogramma* n. sp. into sugarcane-producing areas such as Puerto Rico, which are infested with *D. abbreviatus*, since earlier reports indicate that the toughness of sugarcane inhibits oviposition by *T. haitiensis* (TUCKER, 1936).

RÉSUMÉ

Établissement d'un parasite exotique *Tetrastichus haitiensis* [Hym. : Eulophidae] et découverte d'un nouveau *Trichogramma* [Hym. : Trichogrammatidae] chez les pontes de charançons des racines en Floride

On a observé en 1978 l'établissement dans les pontes du charançon des racines de citrus du parasite exotique du charançon des racines, *Tetrastichus haitiensis* Gahan, lâché en Floride entre 1969 et 1971. Ce parasite a été signalé dans des pontes du charançon récoltées dans les champs de juin à août 1978 et dans des bouquets de citrus renfermant des pontes placées dans les vergers en juillet et août 1978. Une nouvelle espèce de *Trichogramma* a été découverte. En laboratoire ce trichogramme parasite les pontes de 4 espèces de charançons nuisibles aux Citrus en Floride : *Diaprepes abbreviatus* (L.), *Pachnaeus latus* (GERMAR) *P. opalus* (OLIVIER) et *Artipus floridanus* HORM.

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