

A NEW *FIDIOBIA* SPECIES (HYMENOPTERA: PLATYGASTRIDAE)
 REARED FROM EGGS OF *DIAPREPES DOUBLIERII*
 (COLEOPTERA: CURCULIONIDAE) FROM DOMINICA

GREGORY A. EVANS¹ AND JORGE E. PEÑA²

¹ARS, USDA/APHIS-PPQ/BARC-West, Bldg. 005, Room 137, Beltsville, MD 20705

²Tropical Research and Educational Center, University of Florida, Homestead, FL 33031

ABSTRACT

A new species of the genus *Fidiobia* reared from the eggs of *Diaprepes doublierii* collected in Dominica is described and illustrated. A key to the New World species of the genus *Fidiobia*, a host and distribution table of the 13 known *Fidiobia* species, and a summary of the efforts made to introduce natural enemies of *Diaprepes* species into Florida are provided.

Key Words: Platygastriidae, *Fidiobia*, Curculionidae, *Diaprepes*, citrus weevil, biological control

RESUMEN

Se describe y se ilustra una nueva especie del género *Fidiobia* criada de los huevos de *Diaprepes doublierii* recolectados en Dominica. Se provee una clave de las especies de *Fidiobia* presentes en el Nuevo Mundo, y un cuadro del los hospederos y distribución de las 13 especies de *Fidiobia* conocidas. Se comentan los esfuerzos hechos para introducir enemigos naturales de especies de *Diaprepes* en el estado de Florida.

Translation provided by the authors.

In April of 2003, J. Peña, R. Duncan, C. McCoy, and J. Alegria, while conducting a survey of the egg parasitoids of *Diaprepes* species on citrus in Dominica, reared a new species of *Fidiobia* [Platygastriidae] from eggs of *Diaprepes doublierii*, and transported it to the quarantine facility in Homestead, Florida for testing and subsequent introduction into Florida. After commenting on the species to Dr. Lubomir Masner, he suspected that it was the same undescribed species that he had collected in Dominica in 1994 and that J. Etienne had reared from *Diaprepes abbreviatus* in Guadeloupe in 1994. Dr. Masner sent specimens from these collections to the senior author, who determined that they were the same species that is described herein.

Ashmead (1894) erected the genus *Fidiobia* based upon specimens collected in Ohio (USA) and

designated *Fidiobia flavipes* Ashmead as the type species. Including the new species described herein, the genus contains 13 species (Table 1); of these, 3 were described from the Nearctic, 4 from the Neotropical, 4 from the Palearctic and 2 from the Afrotropical region. Although no species of this genus have yet been described from the Oriental region, Masner and Huggert (1989) stated that the genus is worldwide in distribution with many undescribed species. With the exception of *Fidiobia flavipes*, which was reared from chrysomelid eggs, all of the other *Fidiobia* species for which the host records are known were reared from curculionid eggs. Readers are referred to Masner & Huggert (1989) for a key to the genera of Platygastriidae which includes a diagnosis, discussion and illustrations for each platygastriid genus, and to Schauff (1987) for the key to the parasites of citrus weevils.

KEY TO NEW WORLD SPECIES OF *FIDIOBIA* (FEMALES)

1. Notauli absent; head and thorax black, gaster lighter; legs brown except for yellow tarsi and apices of tibia *citri* (Nixon)
- 1b. Notauli present, either 2 thin, hairline streaks or 2 very broad, wedge-shaped cavities; body and leg color variable 2
- 2(1) Notauli consisting of 2 thin, hairline streaks. 3
- 2b. Notauli consisting of 2 very broad, wedge-shaped cavities 4
- 3(2b) Gaster bright yellow; head and mesoscutum brown; legs yellow; F2 quadrate. *dominica*, **n. sp.**

TABLE 1. HOST AND DISTRIBUTION OF *FIDIOBIA* SPECIES.

Species	Host	Distribution	Citation
<i>Fidiobia asina</i> (Loiacano)	Curculionidae: <i>Naupactus xanthographus</i>	Argentina	Loiacano (1982)
<i>Fidiobia benjamini</i> (Nixon)	Curculionidae: <i>Entypotrachelum micans</i>	Kenya	Nixon (1969)
<i>Fidiobia bonariensis</i> (Brethes)	unknown	Argentina	Brethes (1916)
<i>Fidiobia citri</i> (Nixon)	Curculionidae: <i>Diaprepes</i> spp.	Jamaica	Nixon (1969)
<i>Fidiobia danielssoni</i> Buhl	unknown	South Africa	Buhl (2001)
<i>Fidiobia dominica</i> Evans & Peña	Curculionidae: <i>Diaprepes doublerii</i> , <i>D. abbreviatus</i>	Dominica, Guadeloupe	Evans & Peña (current paper)
<i>Fidiobia drakei</i> (Oglobin)	unknown	USA: Iowa	Oglobin (1944)
<i>Fidiobia flavipes</i> Ashmead	Chrysomelidae: <i>Fidia viticida</i>	USA: Ohio, New York	Ashmead (1894) Fouts (1924) Ellis (1973)
<i>Fidiobia hofferi</i> Kozlov	unknown	Czech Republic, Norway, Sweden	Kozlov (1978)
<i>Fidiobia polita</i> Buhl	unknown	Sweden	Buhl (1999)
<i>Fidiobia pronotata</i> Szabo	unknown	Hungary, Moldavia	Szabo (1958)
<i>Fidiobia rugosifrons</i> Crawford	Curculionidae: <i>Hypera postica</i>	Canada, USA: Indiana, Pennsylvania; Panama; Central Asia, Sweden, Norway	Crawford (1916) Buhl (1998, 1999, 2002)
<i>Fidiobia syngorgum</i> (Keiffer)	unknown	Norway	Buhl (1999)

- 3b. Body dark brown to black with metasoma gradually becoming lighter towards apex; coxae, femora and central portion of tibia II and III brown; F2 transverse. *asina* (Loiacano)
- 4(2b) Antennae completely yellow; body brown *flavipes* Ashmead
- 4b. Antennae yellow with dark brown club; body black 5
- 5(4b). F1 short, rectangular, about as long as F2; head and mesoscutum apparently without fine thimble-like sculpture *drakei* (Oglobin)
- 5b. F1 long, trapezoidal, about 1.5× as long as F2; head and mesoscutum with fine, thimble-like sculptures *rugosifrons* (Crawford)

**Fidiobia bonariensis* (Brethes) was not included in key because the description of the species lacked sufficient detail to distinguish it from other species; however based on the coloration and the shape the antennal segments, we suspect that it is very similar to, if not conspecific with, *F. rugosifrons* (Crawford).

Fidiobia dominica Evans and Peña, **n. sp.**

Female (Figs. 1, 2, 4). Length: 1.4-1.45 mm.

Diagnosis

Fidiobia dominica can be distinguished from all of the other *Fidiobia* species by having the gaster entirely yellow and the notauli represented by thin, hairline streaks. It is most similar to *F. asina* in that both species have the notauli represented by a thin, hairline streak, but can be distinguished from the latter species by having the gaster and legs bright yellow and the F2 antennal segment quadrate; whereas in *F. asina*, the body is dark brown to black with the gaster

becoming lighter towards the apex; the coxae, femora and central portion of tibia II and III are brown, and F2 is transverse.

Description

Color (Fig. 1). Head and thorax dark brown to black; gaster, legs and antennal scape, pedicel and funicle yellow; antennal club dark brown; wings slightly infusate.

Head (Fig. 1). About as wide as thorax, subellipsoidal with rounded vertex; eyes glabrous with scattered minute setae; malar sulcus absent; cheeks smooth; mandibles short, bifid; palpal formula 1-1; tongue (galea) with 1 central peg and 2 pairs of marginal pegs.

Antennae (Fig. 2). With 4 funicle segments, club 3-segmented and compact. Length, width and length/width measurements for antennal segments as given in Table 2.

Thorax (Fig. 1). Midlobe distinctly wider than long with elongate reticulations along the anterior margin and sublaterally with smooth central area and lateral margins, and 34-36 short, thin setae; notauli thin, hairstreak-like extending from the posterior margin to about 3/4 to the anterior margin; scutellum smooth with placoid sensillae widely separated (42.5) and with 10 slender setae along the posterior margin; metanotum smooth, slightly shorter than half the length of the scutellum; propodeum long with numerous long hairs.

Forewing (Fig. 4). Elongate and slender 2.73 as long as wide, submarginal vein short (87.5) about 0.24× as long as the forewing, stigmal vein with 3 sensoriae and a single long seta, marginal fringe 0.15× as long as maximum width of forewing.

Legs (Fig. 1). Middle leg tibia (200) and basitarsus (67.6), tibial spur (25).

Gaster (Fig. 1). Tergite I wider than long, 0.88 times as long as gastral tergites II-VI, smooth except for elongate reticulations along the submarginal area extending from the anterior margin to about 3/4 to the posterior base, with long hairs along the anterior margin and in a pair of elliptical-shaped areas along the submarginal area, tergites II-IV reticulate centrally and smooth laterally, tergites V-VI smooth; ovipositor arising at base of gaster and extending to the posterior apex, not exserted.

Male (Figs. 3, 5). Similar to female in color and structure with segments of antennal club more separated (Fig. 3) with measurements as given in Table 2 and genitalia as shown in Figure 5.

Specimens Examined and Deposition

Holotype female: Dominica: Parish, Cuba, 26.vi.2003, R. Duncan and J. Alegria, ex. egg mass of *Diaprepes doublierii* on *Citrus* sp., deposited in the U.S. National Museum of Natural History (USNM); Paratypes—Dominica: Grand Bay, 28.iv.2003, J. Peña and C. McCoy, ex. egg mass of *Diaprepes doublierii* on *Citrus* sp.; Dominica: Syndicate, 28.iv.2003, J. Peña and C. McCoy, ex. egg mass of *Diaprepes doublierii* on *Citrus* sp.; 2 females, Dominica, St. Peters Parish, Morne, Diabloton, 700-900 m 26.xi.1004, L. Masner, virgin forest; 7 females and 9 males, Guadeloupe, Bouillante Pigeon, 24.vi.1994, J. Etienne, ex. *Diaprepes abbreviatus* egg mass on *Citrus* sp., deposited in the Florida Collection of Arthropods, Gainesville, Florida and in the Canadian National Collection, Ottawa, Canada.

ETYMOLOGY

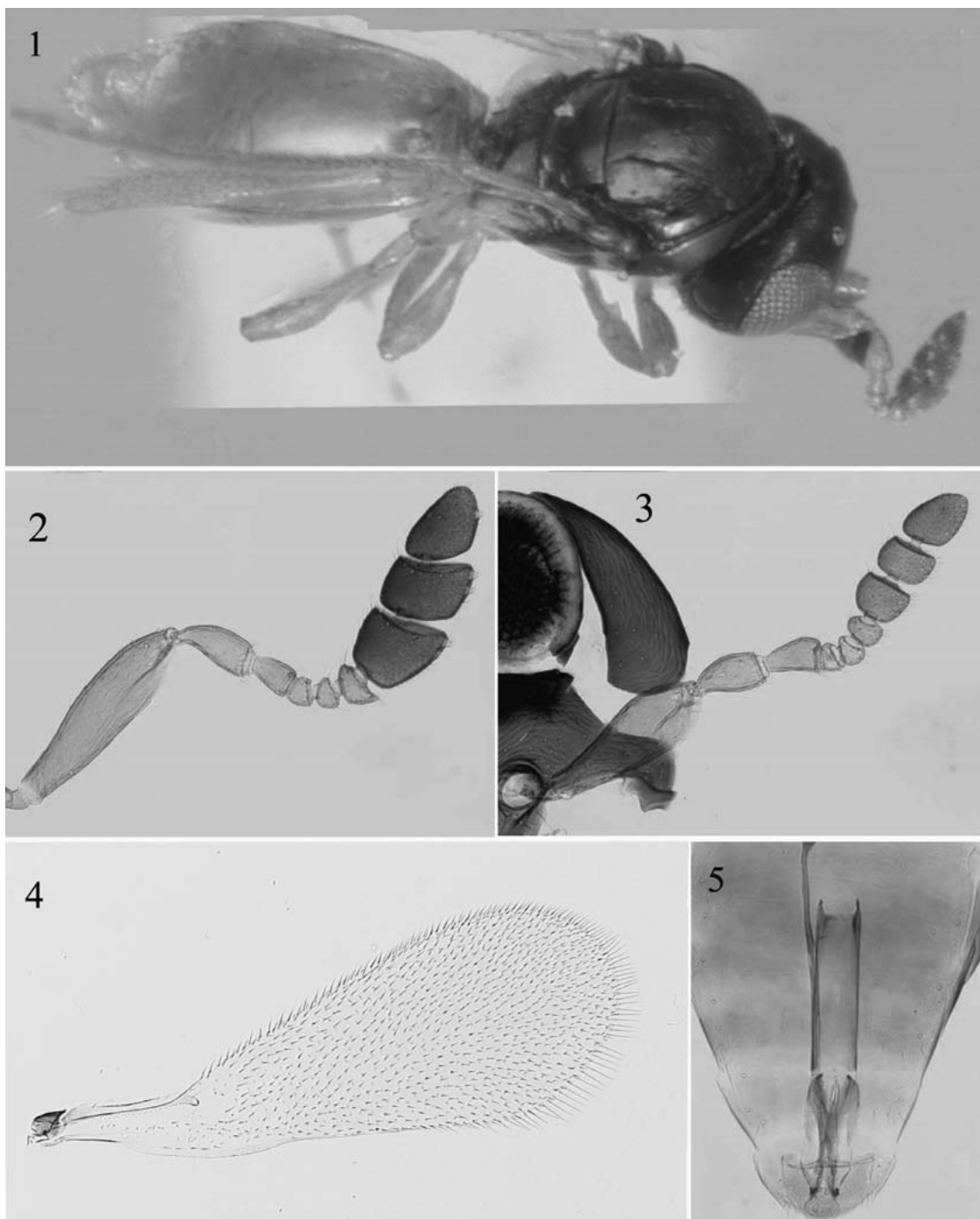
This species is named for the country where it was discovered.

DISCUSSION

Diaprepes abbreviatus (Linnaeus) was introduced into Florida in 1964 (Woodruff 1964) and since has become a serious pest of citrus throughout much of the central and southern Florida. A biological control program was initiated to develop and implement strategies to manage the root weevil, *D. abbreviatus* in response to the spread of the weevil in Florida and latest infestations in Texas and California (Knapp 1985; Woodruff 1968; McCoy & Simpson 1994; Mannion et al. 2003; Godfrey et al. 2002). Because of a lack of

TABLE 2. MEASUREMENTS (μM) OF HOLOTYPE FEMALE AND ALLOTYPE MALE *FIDIOWIA DOMINICA*.

Female (holotype)				Male (Allotype)			
segment	length	width	length/width	segment	length	width	length/width
Scape	152.5	42.5	3.59	Scape	125.0	47.5	2.63
Pedicel	62.5	22.5	2.78	Pedicel	52.5	27.5	1.91
F1	30.0	20.0	1.50	F1	43.7	25.0	1.75
F2	17.5	22.5	0.78	F2	17.5	20.0	0.88
F3	15.0	22.5	0.67	F3	17.5	22.5	0.78
F4	17.5	30.0	0.58	F4	17.5	25.0	0.70
C1	60.0	57.5	1.04	C1	30.0	37.5	0.80
C2	37.5	57.5	0.65	C2	25.0	37.5	0.67
C3	50.0	47.5	1.05	C3	42.5	35.0	1.24
Forewing	362.5	132.5	2.73				
Scutellum	62.5	170.0	0.36				
Metanotum	30.0	200.0	0.15				
Propodeum	80.0	237.5	0.37				
Gaster T1	265.0	315.0	0.84				
Gaster T2-T6	300.0	315.0	0.95				



Figs. 1-5. *Fidiobia dominica*. 1) female habitus, 2) female antenna, 3) male antenna, 4) female forewing, 5) male genitalia.

native egg parasitoids found attacking this weevil in citrus orchards in Florida (Hall et al. 2001) and past failures of classical biological control of this weevil (Beavers et al. 1980), renewed efforts were

initiated to introduce, release, and evaluate candidate egg parasitoids from the Caribbean Region into Florida (Peña et al. 1998; Peña & Amalin 2000; Hall et al. 2002). For instance, *Brachyufens*

osborni (Dozier), a trichogrammatid wasp described from specimens reared from *Diaprepes abbreviatus* in Puerto Rico was introduced into Florida but has not been recovered from *D. abbreviatus* in Florida, although it has been reared from eggs of *Pachnaeus opalus* on citrus.

Foreign exploration for egg parasites of *Diaprepes* and other genera of citrus weevils has been conducted in several Caribbean and Central American countries (Peña et al. 2000; Hall et al. 2002) to introduce them into Florida for classical biological control of *Diaprepes abbreviatus*. *Quadrastichus haitiensis* (Gahan) (Hymenoptera: Eulophidae), previously reported under the name *Tetrastichus haitiensis* (Schauff 1987), was released during the 1970s in Apopka (central Florida) and in West Palm Beach (southeastern Florida) (Beavers & Selhime 1975), but failed to establish (Beavers & Selhime 1975). In 1998, Hall, Nguyen and Stansly obtained the parasitoid from Puerto Rico and attempted to introduce it into Florida again. In 2002, subsequent releases of the parasitoid were made in citrus and ornamental fields in Florida. *Quadrastichus haitiensis* (Gahan) is established in the southern part of the state (Miami-Dade County), but has failed to establish in mid, central, and southwest Florida (Peña et al., unpublished data).

Ceratogramma etiennei Delvare (Hymenoptera: Trichogrammatidae), is a highly specific egg parasitoid of *D. abbreviatus* from Guadeloupe (Etienne et al. 1990). This species was introduced into Florida from Guadeloupe in 1997 (Peña et al. 1998) and released during 1998 in citrus, ornamental fields and natural habitats infested with the *Diaprepes* root weevil but failed to establish (Peña et al. unpublished data).

A third parasitoid, *Aprostocetus gala* (Walker) (Hymenoptera: Eulophidae), also known as *Tetrastichus gala* Walker and *Aprostocetus vaquitarum* Wolcott, was found in high numbers parasitizing *Diaprepes* root weevil eggs in the Dominican Republic during 2000 (Peña & McCoy, pers. obs.) and was subsequently released during 2001 at several sites across Florida. Again, while the parasitoid is successfully established in ornamental and citrus groves in Miami-Dade County, its recovery continues to be erratic in other parts of the state (Peña et al. unpublished data).

Fidiobia dominica was found parasitizing 11% of collected eggs ($n = 35$ eggs) in the survey for egg parasitoids of *Diaprepes* spp. conducted in Dominica. In quarantine, when egg masses of *Diaprepes abbreviatus* are exposed to the parasitoid, percent parasitism ranged from 26-65%, depending on the substrate on which the host eggs are laid, e.g., host plant versus wax paper or concealed eggs versus non-concealed eggs (Duncan & Peña, unpubl.). Under quarantine conditions, 25°C, 75-80% Rh., 12:12 L:D h photoperiod, *Fidiobia dominica* deposits eggs singly in eggs of the

Diaprepes weevil. The eggs hatch in approximately 1 d and the free-living first instar feeds directly upon the fluid of the weevil egg. Parasitized eggs are a dark gold color. Parasitoids will emerge from parasitized eggs within approximately 10-12 days. If fed honey and water, *Fidiobia dominica* adults live a range of 4 to 8 days. A parasitized egg mass can produce 7 to 19 parasitoids depending on the substrate where the weevil eggs are laid. For instance, a higher parasitoid emergence is observed when eggs are laid on leaves compared to artificial substrates, such as wax paper (Duncan & Peña, unpubl.). *Fidiobia dominica* has been successfully reared for several generations on *Diaprepes abbreviatus* eggs in quarantine; when approved, it will be released at various sites in Florida.

ACKNOWLEDGMENT

We thank C. McCoy, R. Duncan, and J. Alegria, who along with the junior author, discovered this species in Dominica, and L. Masner for comments on the genus *Fidiobia* and this new species and for the loan of specimens from Dominica and Guadeloupe. We thank J. Etienne, who collected the specimens in Guadeloupe, and P. Hill for providing assistance during exploratory trips. This study was funded in part by grants from CSREES, T-STAR and FCPAC. This is Florida Agricultural Experiment Station Journal Series R-10557.

REFERENCES CITED

- ASHMEAD, W. H. 1894. A new genus and species of Proctotrypidae and a new species of Brachysticha, bred by Prof. F. M. Webster. *J. Cincinnati Soc. of Natural History* 17: 170-172.
- BEAVERS, J. B., S. A. LOVESTRAND, AND A. G. SELHIME. 1980. Establishment of the exotic parasite *Tetrastichus haitiensis* (Hym: Eulophidae) and recovery of a new *Trichogramma* (Hym: Trichogrammatidae) from root weevil egg masses in Florida. *Entomophaga* 25: 91-94.
- BEAVERS, J. B., AND A. G. SELHIME. 1975. Further attempts to establish the weevil egg parasite, *Tetrastichus haitiensis* in Florida. *Florida Entomol.* 58: 29-31.
- BRETHES, J. 1916. Hyménoptères parasites de l'Amérique meridionale. *Anales del Museo Nacional de Historia Natural de Buenos Aires* 27:401-430.
- BUHL, P. N. 1998. On some new or little known NW European species of Platygasteridae (Hymenoptera, Proctotrupoidea). *Fragmenta Entomologica*, Roma 30: 295-334.
- BUHL, P. N. 1999. A synopsis of the Platygasteridae of Fennoscandia and Denmark (Hymenoptera, Platygastroidea). *Entomofauna, Zeitschrift für Entomologie* 20(3): 17-52.
- BUHL, P. N. 2001. Taxonomic notes on Platygasteridae (Hymenoptera, Platygastroidea) *Entomofauna, Zeitschrift für Entomologie* 22(3): 17-40.
- BUHL, P. N. 2002. Contributions to the platygasterid fauna of Panama. *Entomofauna, Zeitschrift für Entomologie* 23: 309-332.
- CRAWFORD, J. C. 1916. Some new American Hymenoptera. *Insector Inscitiae Menstruus*. 4: 135-144.

- DELVARE, G. 1988. *Ceratogramma etiennei* n. sp., Parasite a la Guadeloupe de *Diaprepes abbreviatus* L. (Hymenoptera: Trichogrammatidae; Coleoptera: Curculionidae). Revue française Entomologie 10: 1-4.
- ELLIS, C. R. 1973. Parasitism of *Hypera postica* eggs at Guelph, Ontario, by *Patasson luna* and *Fidiobia rugosifrons*. J. Econ. Entomol. 66: 1059-1061.
- ETIENNE, J., H. MAULEON, AND B. PINTURAU. 1990. Biologie et dynamiques de *Ceratogramma etiennei* (Hymenoptera: Trichogrammatidae) parasite de *Diaprepes abbreviatus* (L.) (Coleoptera: Curculionidae) en Guadeloupe. Les Colloques. INRA 58: 459-68.
- FOUTS, R. M. 1924. Revision of the North American wasps of the subfamily Platygasterinae. Proceedings of the United States National Museum 63(15): 1-145.
- GODFREY, K., B. GRAFTON-CARDWELL, J. PEÑA, C. MCCOY, AND R. LUCK. 2002. *Diaprepes* root weevil. UC Statewide IPM Program and Center for Invasive Species Research booklet, 4 p.
- HALL, D. G., J. E. EGER, J. PEÑA, R. DUNCAN, C. O'BRIEN, G. A. EVANS, AND C. MCCOY. 2002. Exploration in Belize for parasitoids attacking eggs of citrus weevils, and an evaluation of *Pediobius irregularis* and *Horismenus bennetti* (Hymenoptera: Eulophidae) as potential biological control agents of *Diaprepes abbreviatus* and *Pachnaeus litus* (Coleoptera: Curculionidae). Florida Entomologist 85(4): 660-663.
- HALL, D., J. PEÑA, R. FRANQUI, R. NGUYEN, P. STANSLY, C. MCCOY, S. LAPOINTE, R. ADAIR, AND B. BULLOCK. 2001. Status of biological control by egg parasitoids of *Diaprepes abbreviatus* (Coleoptera: Curculionidae) in citrus in Florida and Puerto Rico. BioControl 46: 61-70.
- KNAPP, J. L. 1985. The citrus root weevils in Florida: an extension service perspective. Florida Entomol. 68: 368-370.
- KOZLOV, M. A. 1978. Superfamily Proctotrupeoidea, pp. 538-664 In G. S. Medvedev [ed.], Determination of Insects of the European Portion of the USSR. Vol. 3, part 2. Nauka, Leningrad. 758 pp.
- LOIACONO, M. S. 1982. Un nuevo platygátrido (Hymenoptera-Platygastridae) criado de huevos de *Naupactus xanthographus* Germ. (Coleoptera-Curculionidae). Revista de la Sociedad de Entomología de Argentina 41(1-4) 85-88.
- MANNION, C., A. HUNSBERGER, J. E. PEÑA, AND L. OSBORNE. 2003. Oviposition and larval survival of *Diaprepes abbreviatus* on different host plants. Florida Entomol. 86: 165-173.
- MASNER, L., AND L. HUGGERT. 1989. World review and keys to genera of the subfamily Inostemmatinae with reassignment of the taxa to the Platygastrinae and Sceliotrachelinae (Hymenoptera: Platygastridae). Mem. Entomol. Soc. Canada 147: 1-214.
- MCCOY, C., AND S. E. SIMPSON. 1994. Past and current IPM strategies to combat the spread of *Diaprepes abbreviatus* in Florida citrus. Proc. Caribbean Food Crops Soc., St. Thomas 30: 247-255.
- NIXON, G. E. J. 1969. Two new species of *Platystasius* Nixon with a note on the generic relationship between *Platystasius* and *Fidiobia* (Hymenoptera: Platygasteridae). Proc. Entomol. Soc. Washington. 71: 445-449.
- OGLOBIN, A. A. 1944. Two new species of Proctotrupeoidea from Iowa (Hymenoptera). Proc. Entomol. Soc. Washington 46: 155-158.
- PEÑA, J. E., AND D. M. AMALIN. 2000. Biological control of *Diaprepes abbreviatus* by parasitoids, pp. 66-76 In S. H. Futch [ed.] *Diaprepes* Short Course. Cooperative Extension Service Florida Agricultural Experiment Station. Citrus Research & Education Center, Lake Alfred, FL. March 22, 2000.
- PEÑA, J. E., J. ETIENNE, R. DUNCAN, AND J. PINTO. 1998. Introduction of *Ceratogramma etiennei* (Hymenoptera: Trichogrammatidae) for biological control of *Diaprepes abbreviatus* in Florida, USA, pp. 145-148 In S. Hassan [ed.], Egg Parasitoids, 5th International Symposium, IIBC, Cali, Colombia, Berlin.
- PEÑA, J. E., D. G. HALL, R. NGUYEN, R. DUNCAN, D. AMALIN, P. STANSLY, C. MCCOY, R. ADAIR, S. LAPOINTE, H. BROWNING, AND J. KNAPP. 2000. Efforts toward establishment of biological control agents of *Diaprepes* root weevil: Fact Sheet ENY-643, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL. 5 pp.
- SCHAUFF, M. E. 1987. Taxonomy and identification of the egg parasites (Hymenoptera: Platygastridae, Trichogrammatidae, Mymaridae, and Eulophidae) of citrus weevils (Coleoptera: Curculionidae). Proc. Entomol. Soc. Washington 89(1): 31-42.
- SUTTON, R. A., G. SELHIME, AND W. MCCLOUD. 1972. Colonization and release of *Tetrastichus haitienensis* as a biological control agent for citrus root weevils. J. Econ. Entomol. 65: 184-185.
- SZABO, J. B. 1958. Ergänzende Beobachtungen über die holarktische Gattung *Fidiobia* Ashmead 1894. Folia Entomologica Hungarica 11: 457-464.
- WOODRUFF, R. E. 1964. A Puerto Rican Weevil New to the United States (Coleoptera: Curculionidae). Florida Department of Agriculture & Consumer Services, Division of Plant Industry, Entomology Circular (30):1-2, illus.
- WOODRUFF, R. E. 1968. The Present Status of a West Indian Weevil (*Diaprepes abbreviatus* (L.)) in Florida. Florida Department of Agriculture & Consumer Services, Division of Plant Industry, Entomology Circular. No. 77, 4 p.