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

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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: Platygastridae, *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* [Platygastridae] 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 Platygastridae which includes a diagnosis, discussion and illustrations for each platygastrid 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.** |

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

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

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, bidentate; palpal formula 1-1; tongue (galea) with 1 central peg and 2 pairs of marginal pegs.

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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.

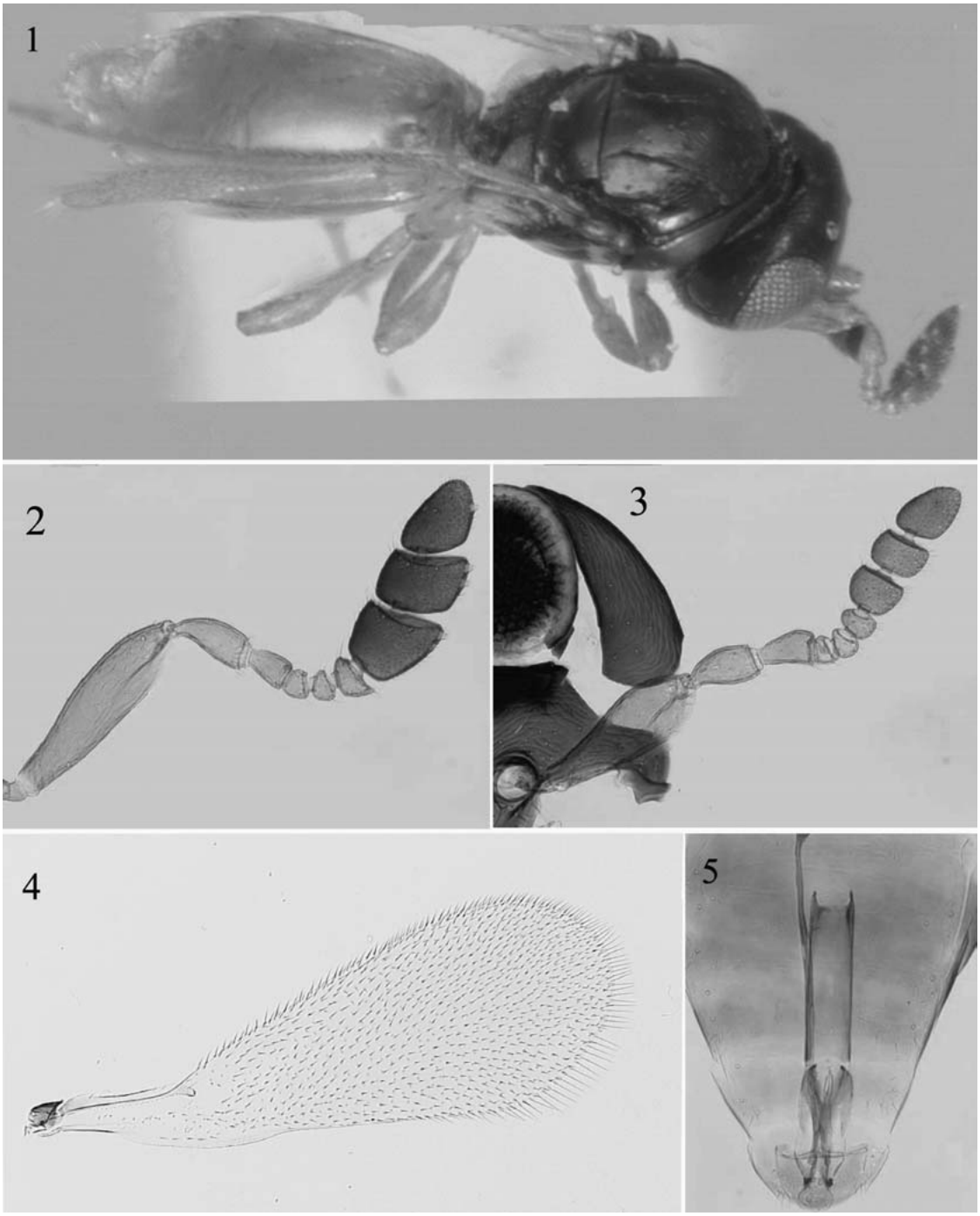
## Discussion

*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 *Fidiobia 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 | | | | |

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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*

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*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 *Diaprepres* 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.

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