PARASITOIDS OF COMSTOCKIELLA SABALIS (HOMOPTERA: DIASPIDIDAE) IN FLORIDA AND DESCRIPTION OF A NEW SPECIES OF THE GENUS COCCOBIOUS (HYMENOPTERA: APHELINIDAE)

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ABSTRACT

Coccobius donatellae Pedata and Evans, spec. nov. is described and illustrated from specimens reared from Comstockiella sabalis (Comstock) on palmetto palm (Sabal palmetto) in Florida. Coccobius donatellae is the most common parasitoid that attacks this host in Florida and is believed to be the same species reported in the literature as “Physcus sp.” that was introduced into Bermuda from Florida in the 1920’s. Evidence suggests that earlier reports of Encarsia portoricensis (Howard) as a parasitoid of the palmetto scale are based on erroneous identifications of what were probably Coccobius donatellae males. Recent collections in Florida confirm Aphytis diaspidis (Howard), reported previously as Aphytis fuscipennis, and Encarsia citrina
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(Craw) as parasitoids of C. sabalis. Intraspecific variation occurring in C. donatellae and in Coccobius testaceus (Masi), is discussed.

Key Words: Coccobius, Aphelinidae, Diaspididae, Comstockiella, armored scale, biological control, parasitoid

RESUMEN

Se describe y se ilustra Coccobius donatellae Pedata and Evans, spec. nov., criado de Comstockiella sabalis (Comstock) sobre la palma palmetto (Sabal palmetto) en Florida. Coccobius donatellae es el parasito más común que ataca este hospedero en Florida y se cree que es la misma especie reportada en la literatura como "Physcus sp. que fue introducida a Bermuda de Florida en los años 1920. Se presenta evidencia que indica que los informes anteriores de Encarsia portoricensis (Howard) como parasito de C. sabalis son basados sobre identificaciones erróneas de los machos de Coccobius donatellae. Se confirma Aphytis diaspidis (Howard), reportado anteriormente como, Aphytis fuscipennis, y Encarsia citrina (Craw) como parásitos de C. sabalis basado en las recolecciones recién hechas en Florida. Se incluye información sobre la variación intraspecífica que ocurre en C. donatellae y en Coccobius testaceus (Masi).

Comstockiella sabalis (Comstock) is an armored scale insect (Homoptera: Diaspididae) known from the southern United States, Mexico, several of the Caribbean Islands, and from greenhouses in Germany (Nakahara, 1982). Although it is commonly found on palm species, it rarely causes economic damage due to the severe attack of parasitoids on this species throughout its geographic range. However, this has not always been the case. C. sabalis invaded Bermuda in 1921 and quickly spread throughout the islands, severely damaging or killing Sabal bermudana Bailey trees (Russell 1934a). Parasitized C. sabalis specimens were collected in Florida and sent to Bermuda in 1926 and 1929. No mention was made of the specific identity of parasitoids introduced into Bermuda from Florida at that time; however, in a survey of the natural enemies of the palmetto scale in Bermuda conducted in 1933, Physcus sp., Encarsia portoricensis Howard, Aphytis fuscipennis Howard and two undetermined Hymenoptera were reported as being reared from this host (Russell, 1934b). The parasitoid referred to in the survey as "Physcus sp.", now placed in the genus Coccobius, was particularly effective against the scale. Russell (1934b) reported that "the palmettos on which this species was placed that were once badly infested, were later free from scale". Bennett and Hughes (1959) reared Physcus sp. and Aphytis fuscipennis from C. sabalis collected in Bermuda in 1956 and stated that "it would seem that E. portoricensis is no longer of importance as a control for this scale".

Recent collections of C. sabalis in Florida have helped to clarify our knowledge of the natural enemies of C. sabalis in Florida and provided insight as to the identity of the parasitoid species introduced into Bermuda from Florida in the 1920s. We suggest that specimens identified in the Bermuda survey as "Physcus sp." and Encarsia portoricensis, represent the female and male of Coccobius donatellae, respectively. This species is the most common parasitoid reared from C. sabalis in Florida, and undoubtedly plays a key role in its control. Evidence supporting our hypothesis that specimens reared from C. sabalis in the Bermuda survey that were identified as Encarsia portoricensis were actually males of Coccobius donatellae consists of: Encarsia portoricensis is a whitefly parasitoid that is not known to occur in Florida; males of Coccobius donatellae are similar to females of E. portoricensis in color, and in the number
of and relative lengths of antennal segments (6-segmented); and specimens deposited in the Museum of Natural History, London from the 1933 Bermuda survey, identified by Ferriere as Encarsia sp., were later identified as Coccobius males (A. Polaszek, personal communication).

The third species mentioned in the survey, Aphytis fuscipennis Howard, was synonymized with Aphytis diaspidis (Howard) by Rosen and DeBach (1979), who did not list C. sabalis as one of its hosts. We confirm the identity of A. diaspidis based on three specimens of Aphytis diaspidis reared from C. sabalis from the 1933 Bermuda survey and deposited in the Florida State Collection of Arthropods, Gainesville, Florida. Our collections in Florida confirm Aphytis diaspidis and Encarsia citrina (Craw) as parasitoids of C. sabalis; it appears that both of these species play minor roles in controlling populations of the scale.

The majority of the 79 described species of the genus Coccobius are parasitoids of diaspine scales; 10 species have been reported as parasitoids of soft scales (Coccidae), 1 species from a mealybug (Pseudococcidae), and 1 species from a lac scale (Kerridae). Hayat (1984) reviewed the 58 Coccobius species known worldwide at that time and provided a taxonomic key to 48 of those species. Since then, twenty-one species have been described; of these are, 7 from South Africa (Prinsloo, 1995), 10 from China (Huang, 1990), 1 from Japan (Tachikawa, 1988), 2 from Turkmenia (Myartseva, 1995) and 1 from Azerbaijan (Jasnosh and Mustafeva, 1992). Only 6 species are known to occur in the continental United States; of these, 2 species (howardi, stanfordi) were described from California, 1 species (varicornis) from Washington, DC, and 3 (flaviventris, fulvus, testaceus) are introduced species. Coccobius donatellae is the fourth species of this genus to be described from the continental United States.

Terminology follows that used by Hayat (1984). Figure 1 shows the mesosoma divided medially with the surface sculpturing on the left side and the setation on the right side. The metasoma is divided medially showing the dorsum on the left side and the venter on the right side.

Coccobius donatellae Pedata and Evans, **NEW SPECIES**
(Figs. 1-6)

**Female** (Figs. 1-4)

Length: 0.70-0.90 mm, mean of 5 specimens = 0.82 mm. Coloration: Body (Fig. 1) yellowish; basal half of head dark brown; pronotum, metanotum, metasomal tergites I-VI, fuscous; legs white with central portion of femora and basal two-thirds of tibiae, faintly fuscous; antennae yellowish, basal half of scape, dorsal margin of pedicel, F1 and club, grayish; fore wing hyaline. Structure: **Head** slightly wider than mesosoma. Antenna (Fig. 3) consists of radicle (R), scape (S), pedicel (P), 3 funicle segments (F1-F3) and 2 club segments (F4-F5), length:width ratio for each segment as follows: R:3.2, S:3.5, P:1.4, F1:1.5, F2: 1.7, F3:1.6, F4:1.4, F5:2.5; relative length of each segment to length of F1 segment: R:1.1, S:2.8, P:1.1, F1:1.0, F2:1.3, F3:1.3, F4:1.3, F5:2.2; flagellar segments F1-F6 with 2,2,2,2 and 5-6 linear sensilla, respectively. **Mesosoma** with broad mesocutum, 1.8× as wide as long with approximately 40 setae and small, reticulate cells each with internal striations; scutellum with 3 pairs of setae, and sculpturing similar to that of mesocutum; mesepimeron reaching base of metasomal tergite II. **Fore wing** 2.6× as long as wide, discal setation uniformly distributed with narrow asetose area basally near posterior margin; marginal vein as long as costal cell with 10-12 marginal setae; submarginal vein with 6-7 setae; longest marginal cilia 0.2× as long as the maximum width of fore wing. **Metasoma** slender, 1.7× as long...
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as mesosoma, tergites I-VI with reticulate lateral margins, tergites V-VI with stipules, centrally; tergites I-VII with 1,4,4,4,3,6,6 pairs of setae, respectively; ovipositor arises at level of tergite II, slightly protruding from apex, 1.7-1.9× as long as tibia II (Fig. 2) and 4.1× as long as valvular III.

Male (Figs. 5-6)

Coloration: Head with occiput yellow and basal half, dark brown; mesoscutum, scutellum and axillae, light brown; pronotum, metanotum, metasoma and coxae, dark brown; femora, except for pale apices, and proximal two thirds of tibiae, brownish; tarsi yellow; antennae fuscous, fore wing hyaline. Differs structurally from the female primarily by the 6-segmented flagellum (Fig. 5) and by the scape which has a ventral, circular glandular area (Viggiani et. al., 1986) separated from the 6 medial pores.

Length:width ratios of antennal segments R-F6 as follows: R:2.1, S:2.8, P:1.3, F1:1.4, F2:1.5, F3:1.5, F4:1.5, F5:1.6, F6:1.8; relative length of each segment to length of F1: R:0.8, S:2.1, P:0.9, F1:1.0, F2:1.1, F3:1.1, F4:1.1, F5:1.2, F6:1.2.

Morphological variation

Individuals of Coccobius donatellae vary primarily in body size, number of mesoscutal setae, number and size of reticulated cells of the mesoscutum, relative lengths of the flagellar segments, and the relative length of the marginal fringe of the fore wing to its maximum width. In general, smaller individuals have fewer mesoscutal setae (30-36), larger and fewer reticulate cells on the mesoscutum, and longer marginal fringes (0.22-0.26× maximum width of fore wing) than do larger individuals (40-46 mesoscutal setae, marginal fringe = 0.12-0.16× maximum width of fore wing). The F1 antennal segment tends to be shorter (Figs. 4, 6) in smaller individuals, at times, almost quadrate, 1.1-1.4× as long as wide, and 0.8× as long as the F2; whereas in larger individuals, the F1 is usually more elongate, 1.5-1.7× as long as wide and approximately as long as the F2.

Relationships

The female of Coccobius donatellae can easily be distinguished from females of the other 3 species described from the continental United States by the coloration of its body which is almost entirely yellow; whereas the head, mesosoma and at least part of the metasoma of the other species are dark brown. Coccobius donatellae is most similar in coloration and structure to Coccobius testaceus (Masi), a European species introduced into California for the control of Lepidosaphes ulmi L. and L. conchiformis (Gmelin) (Flanders 1942). Females of C. testaceus can be distinguished from females of C. donatellae by the grayish F2 segment (Fig. 7), reported in the past as being pale, and the pale apical half of F5 segment and relative length of the ovipositor:tibia II (1.4-1.5:1). Males of C. testaceus differ from C. donatellae males by having the head completely dark brown, the length of the pedicel only about one half as long as the F1 segment, and by the larger, contiguous glandular area on the scape. Most C. testaceus males have 2 rows of linear sensilla on the F1 (Fig. 8); however in smaller individuals there may be a single row (Fig. 9).

Material examined

Female holotype (in Canada Balsam), 12♀, 6♂ paratypes (in Modified Hoyer's Mounting Medium), 7♀, 5♂ paratypes (in Canada Balsam), 10♀, 3♂ paratypes (card
mounted) as follows: United States, Florida, Levy County, Cedar Key, 18 VI 1988, by F. D. Bennett, reared from Comstockiella sabalis on Sabal palmetto. Additional collections: 4♀, Florida, Escambia Co., Pensacola, 10 III 1991, by F. D. Bennett, reared from Comstockiella sabalis on Sabal palmetto; 4♀, Florida, Osceola Co., Canoe Creek, 1 IV 1991, by F. D. Bennett, reared from Comstockiella sabalis on Sabal palmetto; 7♀, Florida, Lee Co., Ft. Myers, 23 XI 1991, by F. D. Bennett, reared from Comstockiella sabalis on Sabal palmetto; 2♀, 1♂, Florida, Alachua Co., Gainesville, 10 V 1996, by P.A. Pedata, reared from Comstockiella sabalis on Sabal palmetto.
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Deposition

Female holotype and 5♀, 5♂ paratypes are deposited in the United States National Museum of Natural History, Washington, D.C.; remaining paratype specimens are deposited in Florida State Collection of Arthropods, Gainesville, Florida; the Natural History Museum, London, England; and the Dipartimento di Entomologia e Zoolgia Agraria, Università di Napoli “Federico II”, Portici, Italy.

Etymology

Coccobius donatellae is named in memory of Donatella Pedata.

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REFERENCES CITED

Bennett, F. D., and I. W. Hughes. 1959. Biological control of insect pests in Bermuda. Bulletin of Entomological Research 50: 423-436.

Flanders, S. E. 1942. The introduction of Physcus testaceus Masi into California. Journal of Economic Entomology 35: 290-291.

Hayat, M. 1984. Notes on some species of Coccobius and Prophyscus (Hymenoptera: Aphelinidae), with special reference to Girault and Howard types. Oriental Insects 18: 289-334.

Huang, J. 1990. Systematic studies on Aphelinidae of China (Hymenoptera: Chalcidoidea). Contributions of the Biological Control Research Institute. Fujien Agricultural University. Special Publication No. 5. 348 pp.

Jasnosh, V. A., and G. A. Mustafeva. 1992. A new parasite of the pomegranate scale, Coccobius granati sp. n. (Hymenoptera: Aphelinidae). Zool. Zh. 71(2): 142-144.

Myartseva, S. N. 1995. New species of aphelinids (Hymenoptera, Aphelinidae) parasites of scale insects on Tamarix in Turkenia. Entomol. Oboz. 74(2): 432-440.

Nakahara, S. 1982. Checklist of the armored scales (Homoptera: Diaspididae) of the conterminous United States. USDA, APHIS-PPQ, 110 pp.

Prinsloo, G. L. 1995. Revision of the southern African species of Coccobius Ratzeburg (Hymenoptera: Aphelinidae), parasites of armoured scale insects. Journal of Natural History 29: 1517-1541.

Rosen, D., and P. Debach. 1979. Species of Aphytis of the World (Hymenoptera: Aphelinidae) Series Entomologica vol. 17, Dr. W. Junk BV Publishers, The Hague, 810 pp.

Russell, T. A. 1934a. An account of the palmetto scale. Agricultural Bulletin, Bermuda Department of Agriculture 13(3): 17-24.

Russell, T. A. 1934b. The use of parasites against the palmetto scale. Agricultural Bulletin, Bermuda Department of Agriculture 13(11): 81-86.

Tachikawa, T. 1988. A new and economically important species of Coccobius (Hymenoptera: Aphelinidae) parasitic on Hemiberlesia pitysophila Takagi (Homoptera: Diaspididae) in Okinawa, Japan. Transactions of the Shikoku Entomological Society 19: 67-71.
VIGGIANI, G., BATTABLA, D, AND R. JESU. 1986. L'accoppiamento di Physcus testaceus Masi (Hym. Aphelinidae), con notizie preliminari sulle strutture dello scapo antennale maschile. Bollettino del Laboratorio di Entomologia Agraria Filippo Silvestri 43: 1-6.