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Parasitoids (Hymenoptera: Chalcidoidea) of Toumeyella scales (Hemiptera: Coccidae) in the New World, with description of a new species from Mexico

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Abstract

Coccophagus funiculatus Myartseva sp. nov. (Hymenoptera: Aphelinidae), reared from the soft scale genus Toumeyella (Hemiptera: Coccidae), is described, and the aphelinid species associated with Toumeyella species in the New World are discussed and compared.

Key Words: beneficial insect; biological control; Coccophagus

Resumen

Se describe Coccophagus funiculatus Myartseva sp. nov. (Hymenoptera: Aphelinidae), criado de una especie de escama blanda del género Toumeyella (Hemiptera: Coccidae) y se discute la información de las especies de afelínidos asociados con las especies de Toumeyella en el Nuevo Mundo.

Palabras Clave: insectos benéficos; control biológico; Coccophagus

The world fauna of the soft scale genus Toumeyella Cockerell (Hemiptera: Coccidae) includes 17 species (Kondo & González 2014). Toumeyella is widely distributed in the New World with most species described from the USA (Kondo & Pellizzari 2011) (Table 1). In Mexico, 6 species are known: T. erythrinae Kondo & Williams, T. fontanai Kondo & Pellizzari, T. martinezi Kondo & González, T. mirabilis (Cockerell), T. parvicornis (Cockerell), and T. sallei (Signoret) (Kondo & Pellizzari 2011; Kondo & González 2014).

Most Toumeyella species are oligophagous. Five Mexican Toumeyella species have been collected on species in the plant families Fabaceae, Rosaceae, and Pinaceae, and T. martinezi occurs on “garambullo” cac-

Table 1. Checklist of Toumeyella parasitoids in the New World, and their global distribution (after Noyes 2014).

| Parasitoids                  | Other hosts (except Toumeyella) | Distribution |
|------------------------------|---------------------------------|--------------|
| Aphelinidae                  |                                 |              |
| Mexidalgus toumeyellus Myartseva |                                | Mexico (Hidalgo) |
| Coccophagus albica Howard    | Physokermes insignicola (Craw)  | USA, Panama  |
| C. bivittatus Compere        | Akermes bruneri Cockerell, Ceroplastes pseudoceriferus Green, Coccus hesperidum L., Pulvinaria polygonata Cockerell, Cardio-coccus bivalvatus (Green), Cryptinglisia elytropappi (Brain), Kilifia acuminata (Signoret), Saissetia oleae (Oliver) | Argentina, Egypt, India, Israel, Italy, South Africa |
| C. flavifrons Howard         | Coccus hesperidum, Mesolecanium nigrofasciatum (Pergande) | USA, India |
| C. funiculatus sp. nov.      |                                | Mexico (Puebla) |
| C. immaculatus Howard        | Coccus hesperidum L., Pulvinaria bigeloviae Cockerell, Saissetia coffeae (Walker) | USA, Chile |
| C. lycimnia (Walker)         | More than 100 species of Coccidae and other families of Coccoidea | Cosmopolitan |
| C. quaestor Girault          | Coccus hesperidum L., Paraissetia nigra (Nietner), Saissetia coffeae, S. miranda (Cockerell & Parrott), S. oleae (Oliver) | Canada, USA, Mexico, El Salvador, Peru |

Encyrtidae

| Anicetus toumeyellae Milliron | Ceroplastes sp. | USA |
| Gahaniella saissetiae Timberlake | Coccus hesperidum, Milvicutulus mangiferae (Green), C. viridis (Green), Paraissetia nigra, Saissetia coffeae, S. miranda, S. neglecta De Lotto, S. oleae | Cuba, USA, South America |
| Metaphycus flavus (Howard)    | More than 40 species of Coccidae and other families of Coccoidea | Almost cosmopolitan |
| Microterys fuscicornis (Howard) | Only known from Toumeyella | USA |

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Table 2. Toumeyella species and their parasitoids in the Neotropical and Nearctic regions.

| Soft scales          | Distribution    | Parasitoids                                                                 | References                  |
|----------------------|-----------------|------------------------------------------------------------------------------|-----------------------------|
| *T. lirioides* (Gmelin) | USA, Cuba       | Aphelinidae: *Coccophagus bivittatus*, *C. flavifrons*, *C. lycimnia*        | Frank & Foltz (1997); Evans (2000); Myartseva & Ruiz-Cancino (2004); Myartseva et al. (2004); Trjapitzin & Ruiz-Cancino (2009) |
| *T. martinezi* Kondo & González | Mexico | Aphelinidae: *Mexidalus toumeyellus*                                         | Myartseva et al. (2014) |
| *T. parvicornis* (Cockerell) | Canada, USA, Mexico, Puerto Rico, Turks & Caicos Islands | Aphelinidae: *Coccophagus albicauxa*, *C. immaculatus*, *C. quaestor*, *Coccophagus* spp. | Myartseva & Ruiz-Cancino (2011); Malumphy et al. (2012); Clarke (2013); Kondo & González (2014) |
| *T. pini* (King)       | Canada, USA     | Aphelinidae: *Coccophagus albicauxa*                                         | Clarke & DeBarr (1989)     |
| *T. pinicola* Ferris   | USA             | Aphelinidae: *Coccophagus lycimnia*                                          | Noyes (2014)                |
| *Toumeyella* sp.       | Mexico          | Aphelinidae: *Coccophagus funiculatus* sp. nov.                              | New data                   |
| *T. turgida* (Cockerell) | USA             | Aphelinidae: *Coccophagus immaculatus*                                       | Noyes (2014)                |

Table 3. Differences between 3 closely related species of *Coccophagus*.

| Characters                  | *funiculatus* sp. nov. | *albicauxa* | *mexicanus* |
|-----------------------------|------------------------|-------------|-------------|
| Scutellum                  | apical 1/2–2/3 whitish | apical half whitish | apical 1/4 whitish |
| Propodeum                  | whitish yellow, medial part black | yellow, sides and center black | entirely black |
| Frons and face              | black                  | black        | yellow      |
| Scape and pedicel           | dark yellow            | dark brown   | yellowish   |
| Pedicel: 1st funicular segment | pedicel subequal to 0.35 of 1st funicular segment | pedicel subequal to 0.5 of 1st funicular segment | — |
| First funicular segment     | 3.0–3.3 times as long as wide | 2.0 times as long as wide | slightly longer than wide |
| Third funicular segment     | 2.0 times as long as wide | 1.3 times as long as wide | slightly longer than wide |
| Club                        | shorter than 3rd and 2nd funicular segments combined | about as long as 3rd and 2nd funicular segments combined | — |
| Scape                       | shorter than pedicel and 1st funicular segment combined | as long as pedicel and 1st funicular segment combined | — |
| Length of body              | 1.75–2.1 mm            | 2.5 mm       | 1.6 mm      |

Materials and Methods

Adults and larvae of *Toumeyella* sp. were collected on “tejocote” in May 2014 in Chiautcingo, State of Puebla, Mexico. Parasitic wasps of the families Aphelinidae and Encyrtidae (Chalcidoidea) were reared in the laboratory from this material. Some specimens were used for preparing microslides, following Noyes (1982). Morphological characters were examined using a Leica GME compound microscope. Compere (1931), Woolley (1997), Myartseva (2006), and Trjapitzin et al. (2008) were used for identification. Other specimens were preserved on small pegs located in the middle.

*Coccophagus funiculatus* sp. nov. is the 2nd species in Mexico reared from species in the genus *Toumeyella*. The new species belongs to a group that includes *C. mexicanus* Girault and *C. albicauxa* and is characterized by having pale hind coxae and a densely setose scutellum; see Table 3 for a comparison of *C. funiculatus* sp. nov. with *C. mexicanus* and *C. albicauxa*.
rectangular cards. Type material was preserved in UCRC (Research Entomological Museum, University of California, Riverside, California), BMNH (The Natural History Museum, London, United Kingdom), CNIN (Colección Nacional de Insectos, Instituto de Biología, Universidad Nacional Autónoma de México), CEAM (Colección de Insectos del Colegio de Postgraduados, Campus Montecillo, Texcoco, Estado de México), and UAT (Insects Museum, Universidad Autónoma de Tamaulipas, Ciudad Victoria, Mexico).

Figs. 1–8. Coccophagus funiculatus, sp. nov., female. 1, Lateral view of body; 2, mesoscutum, dorsal view; 3, mandible; 4, antenna; 5, stigmal and postmarginal veins; 6, mid-tarsus and mid-tibial spur; 7, antenna with sensilla; 8, 1st funicular segment.
Results

*Coccophagus funiculatus* Myarsteva, sp. nov.
(Figs. 1–8)

**TYPE MATERIAL**

**HOLOTYPE**: female, MEXICO, Puebla, Municipio de Chiautcingo, San Nicolás Zecalaocoyan, 19.199167°N, 98.488333°W, 2,460 m, 8-V-2014, ex *Toumeyella* sp. on *Crataegus mexicana* (col. R. C. Hernández-De la Cruz). Paratypes: same data as holotype, 14 females, and 1 female collected on 1-VII-2014, all point-mounted, and 3 additional females on slides. Holotype and 4 paratypes preserved at UCRC, 4 paratypes at BMNH, 4 paratypes at CNIN, 3 paratypes at CEAM, and 3 paratypes on slides at UAT.

**DESCRIPTION**

Length: 1.75–2.1 mm. Coloration: Head black; scape and antennal pedicel dark yellow, flagellar dark brown. Mesosomal black, tegulae whitish-yellow with dark apical margin, scutellum whitish-yellow on apical 1/2–2/3, with black setae; forewings hyaline with brown venation. Propodeum whitish-yellow laterally, black medially. Legs black, except the following, which are yellow: apices of fore and mid-femur, fore and mid-tibiae ventrally and on apical half, apices of hind tibiae; all tarsi whitish, without infuscate apical segment; white hind coxae and trochanters; gaster bright black.

Body: (Figs. 1 and 2; female, lateral view and dorsal view of mesoscutum). Head slightly wider than mesosoma, slightly wider than height. Frontovertex about 0.5 times as wide as width of head. Ocelli obtuse triangle. Eyes finely setose, 1.5 times as wide as cheeks. Mandible (Fig. 3) with 2 ventral teeth only, slightly developed, with wide truncation. Antenna (Fig. 4) arising at level of lower margin of eye. Radicle short, slightly longer than wide (5:4). Scape long, 6.0 times as long as wide. Pedicel 1.4 times as long as wide. First funicular segment longest, 3.0–3.3 times as long as wide. Second and 3rd segments subequal in length and width, each about 2.0 times as long as wide. Club shorter than 3rd and 2nd funicular segments combined. First segment of club about 1.3 times as long as wide and slightly wider than funicle; 2nd segment slightly wider than long (3:4), apical segment subequal in length and width. Flagellar segments with numerous longitudinal sensilla, situated in rows of 4, 3, 3, 2, 1, 1, respectively, from 1st to 6th segments (Figs. 7 and 8). Mid-lobe of mesoscutum with many scattered setae. Scutellum with many short setae and 2 pairs of long, strong bristles, apical pair longer. Forewings 2.4 times as long as wide, with very short marginal fringe. Submarginal vein with 7 long setae on anterior margin. Marginal vein longer than submarginal vein. Stigmal and post-marginal veins as in Fig. 5. Mid-tibial spur (Fig. 6) long and slightly shorter than basitarsus; basitarsus with a row of peg-like setae. Dorsal margin of hind tibia with a row of stout, suberect setae. Ovispositor slightly exerted, 1.7 times as long as mid-tibia; 3rd valvula about 0.3 times as long as 2nd.

Male: Unknown.

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