

New species of *Coccophagus* Westwood, 1833 from Mexico (Hymenoptera: Chalcidoidea: Aphelinidae)

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Four new species of the genus *Coccophagus* Westwood, 1833 (Hymenoptera: Aphelinidae) from Mexico are described and illustrated: *C. clypeator* sp. n. and *C. dentatus* sp. n. are associated with citrus in Chiapas and Tamaulipas; *C. falderus* sp. n. and *C. longisetus* sp. n. were collected in Chiapas and Jalisco. Host of *C. clypeator*, the soft scale *Akermes* sp. (Hemiptera: Coccidae), is a new record for Chiapas and a new citrus pest in that Mexican state.

Key words: Hemiptera, Aphelinidae, *Coccophagus*, new species, Mexico

INTRODUCTION

Coccophagus Westwood, 1833 is one of the largest genera in the family Aphelinidae (Hymenoptera). It includes 248 recognized species (Noyes, 2003) and has a cosmopolitan distribution. *Coccophagus* includes many species of economic importance for biological control of soft scales (Hemiptera: Coccidae). In Mexico, there have not been many studies on this genus, with only 23 species currently known, most of them (13 species) described by the author recently (Myartseva, 2004a, 2004b, 2004c, 2006a, 2006b; Myartseva & Ruíz Cancino, 2005). These new species were collected in different states of Mexico: Baja California Sur, Campeche, Chiapas, Guerrero, Michoacán, Morelos, Nuevo León, Sinaloa, Tamaulipas, and Veracruz. Some species were reared from known soft scale hosts.

MATERIAL AND METHODS

Reared or collected parasitoids were mounted partly on slides in Canada balsam and partly on cards. Identifications were made using the publications with keys and descriptions of the *Coccophagus* species (Compere, 1931, 1936; De Santis, 1948; Nikolskaya & Yasnosh, 1966; Annecke & Insley, 1974; Woolley, 1997; Hayat, 1998; Myartseva, 2006a).

RESULTS AND DISCUSSION

Coccophagus clypeator sp. n. (Figs 1-8)

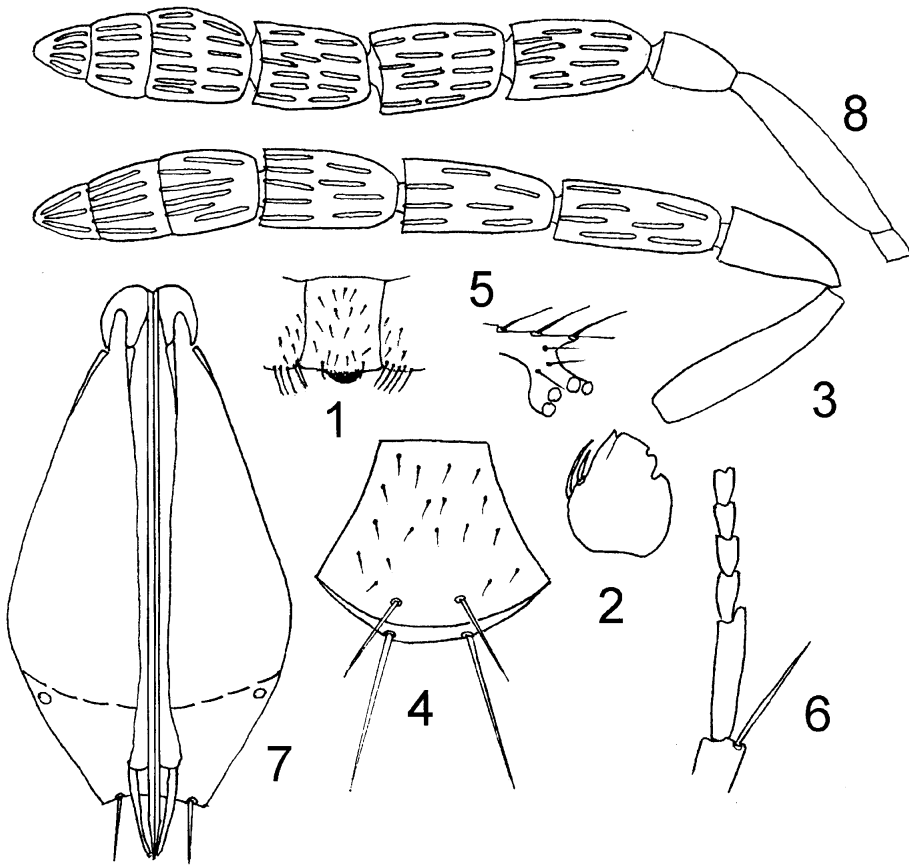
Holotype. Female, **Mexico**, Chiapas, Tapachula, ex. *Akermes* sp. (probably *A. townsendi* Cockerell, 1898) on *Citrus persa*, 27 Sept. 2006; coll. S.N. Myartseva.

Paratypes. 6 females, same data as holotype, 27 Sept. 2006; coll. S.N. Myartseva.

The holotype and 2 paratypes are deposited in the Entomology Research Museum, University of California, Riverside, California, USA (hereafter UCRC); two paratype females are in the National Museum of Natural History, Washington, District of Columbia, USA; and two paratype females are in the Entomological Museum of the Autonomous University of Tamaulipas, Ciudad Victoria, Tamaulipas, Mexico.

Description. Female. Length of body: 2.0-2.2 mm.

Colour. Head black; antenna black, scape dark yellow, pedicel brownish. Maxillary and labial palpi black; mandible dark yellow, brownish at apex. Mesosoma black, scutellum light yellow at apical 0.33-0.5. Propodeum dark yellow, with brownish-black medially and on side margins. Fore wings infusate, marginal and stigmal veins brownish. Fore legs black except profemur apically and protibia yellow; middle legs black except mesofemur apically yellow and mesotibia brownish-yellow, lighter at apex;



Figs 1-8. *Coccophagus clypeator* sp.n., female. 1, clypeus, median part; 2, mandible; 3, antenna; 4, scutellum; 5, stigmal vein; 6, mesotibial spur and mesotarsus; 7, ovipositor; 8, antenna of *C. albicoxa* (from Compere, 1931).

metafemur and metatibia black, metacoxa white; all tarsi yellow, with apical tarsal segments slightly infuscate. Gaster black.

Structure. Head slightly wider than mesosoma and slightly wider than high. Frontovortex about 0.4 head width. Ocelli forming an obtuse apical angle; posterior ocelli slightly more than one diameter of an ocellus from eye margins and about 0.5 diameter of an ocellus from occipital margin. Eye setose, about 1.7 times as long as cheek. Cheek without genal suture. Mandible (Fig. 2) with two short teeth and a wide truncation. Maxillary and labial palpi two- and one-segmented, respectively. Clypeus (Fig. 1) long, more than 2 times longer than distance to lower level of toruli (48:20) and with me-

dian tooth short and obtuse. Frontovortex, cheeks, and clypeus with short setae, longer near clypeal tooth laterally.

Antenna (Fig. 3) inserted immediately above level of lower eye margin. Radicle short, subquadrate. Scape about 5.3 times as long as wide, shorter than pedicel and first funicle segment combined. Pedicel about 2 times as long as wide and about 1.5 times shorter than first funicle segment. First funicle segment the longest, about 2.6 times as long as wide; second segment about 2 times as long as wide; third segment about 1.7 times as long as wide. Club shorter than two preceding funicle segments combined, its second segment slightly wider than long. All flagellar segments with many longitu-

dinal sensilla, in three rows on first funicle segment, in two rows on second and third funicle segments, and in one row on club segments.

Mesosoma with mesoscutum densely setose and reticulate sculptured. Scutellum (Fig. 4) slightly longer than midlobe of mesoscutum, widely rounded on apex, with many short setae and two pairs of strong long bristles on apex; apical pair of bristles 1.8 times longer than than central pair. Axilla with two setae, each side of lateral lobe of mesoscutum with 2 long and 3 short setae. Fore wing slightly more than 2 times as long as wide, with a short marginal fringe. Submarginal vein with 7-8 long setae along anterior margin. Marginal vein about 1.6 times as long as submarginal vein. Stigmal vein (Fig. 5) very short. Hind wing about 3.2 times as long as wide, its marginal fringe about 0.2 maximal width of wing. Mesotibial spur (Fig. 6) slightly shorter than mesobasitarsus; mesobasitarsus about as long as next three tarsal segments combined. Hind tibia with a row of moderately coarse setae on dorsal margin.

Gaster slightly elongate, longer than mesosoma. Seventh tergite wider than long. Ovipositor (Fig. 7) very slightly exerted, with base near base of gaster, and about 2 times as long as mesotibia. Third valvula short, about 0.2 times as long as second valvifer.

Male. Unknown.

Diagnosis. *Coccophagus clypeator* is very similar (particularly the body color) to *C. albicoxa* Howard, reared from *Physokermes insignicola* (Craw) in California, USA and redescribed by Compere (1931) [females also were reared from the same host on *Pinus radiata* in California], but the former has fore wings infusate and fore tibia yellow. More differences are in the antennal structure (Fig. 8): in *C. albicoxa*, the scape is about as long as pedicel and first funicle segment combined; the pedicel is longer than wide (4:3) and about 0.5 times as long as first funicle segment, which is about 2 times as long as wide; the club is hardly

as long as two preceding funicle segments combined; in *C. clypeator*, the scape is distinctly shorter than pedicel and first funicle segment combined; the pedicel is about 2 times as long as wide and about 2.5 times shorter than first funicle segment, which is about 2.6 times as long as wide; and the club is shorter than two preceding funicle segments combined.

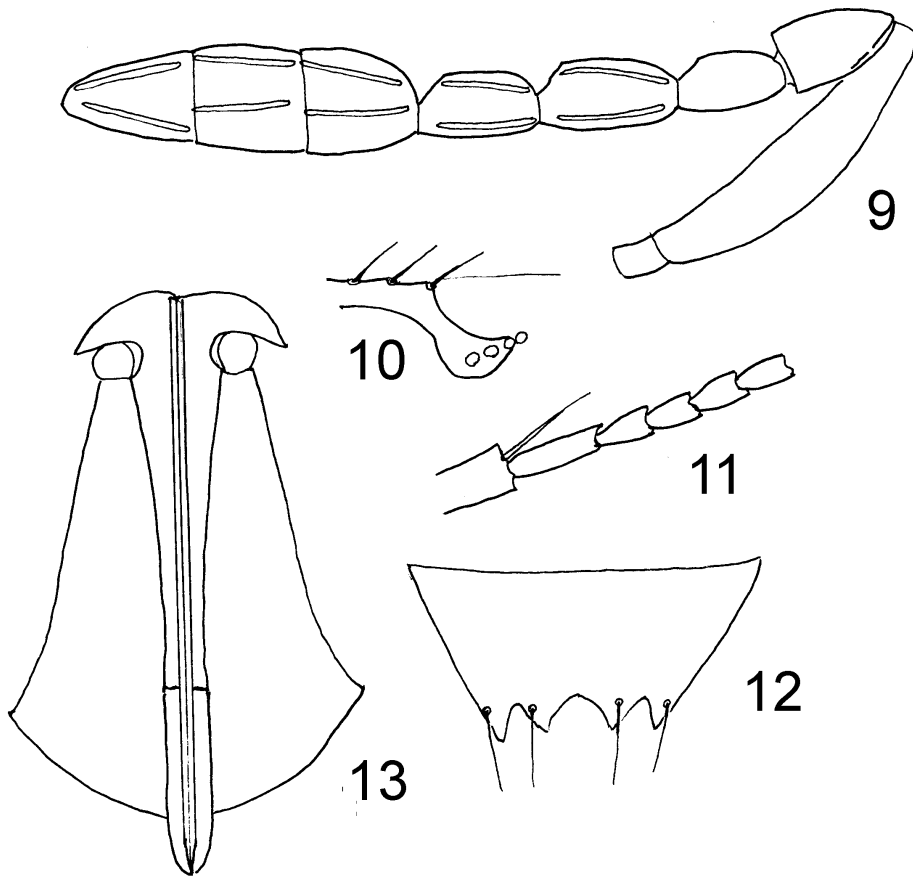
Coccophagus clypeator is the second described species in the genus with white metacoxa in contrast to the black colour of the legs, and also characterized by presence of one small median tooth on the clypeus and two pairs of long bristles on apex of the scutellum. The new species (collected on a citrus tree in the mixed orchard) is also very similar to *C. teeceeni* Myartseva, described from Chiapas, Mexico (Myartseva, 2004a), but differs by having an uniformly infusate fore wing; propodeum yellow but marked with black; scape more than 5 times as long as wide; pedicel 2 times as long as wide; first funicle segment 2.6 times as long as wide; second funicle segment 2 times as long as wide; body length 2.0-2.2 mm; clypeus more than 2 times longer than distance to toruli (48:20). In *C. teeceeni* (collected on shrubs), the fore wing has a large and distinct infuscation beneath the apical half of the marginal vein; the propodeum is entirely black; the scape is about 3 times as long as wide; the pedicel is 1.4 times as long as wide; the first funicle segment is 1.6 times as long as wide; the second funicle segment is 1.6 times as long as wide; the body length is 1.50 mm; and the clypeus is slightly shorter than the distance to toruli (20:27).

***Coccophagus dentatus* sp. n.**
(Figs 9-13)

Holotype. Female, **Mexico, Tamaulipas**, El Salvador, on *Citrus* sp., 24 Oct. 2003; coll. J.F. Luna-Salas (UCRC).

Description. *Female.* Length of body: 0.75 mm.

Colour. Head whitish-yellow, frontover-tex dark yellow, antenna light yellow, edges



Figs 9-13. *Coccophagus dentatus* sp. n., female. **9**, antenna; **10**, stigmal vein; **11**, mesotibial spur and mesotarsus; **12**, seventh gastral tergite; **13**, ovipositor.

of mouth black. Mesosoma and metasoma yellow, fore wings hyaline, legs whitish-yellow.

Structure. Head wider than mesosoma and about 1.4 times as wide as high. Frontovortex slightly more than 0.4 head width. Ocelli in right triangle, posterior ocelli separated from eyes by about one diameter of an ocellus. Eye glabrous and slightly shorter than cheek. Mandible with ventral tooth and a wide truncation.

Antenna (Fig. 9) inserted below lower eye margin. Radicle about 1.5 times as long as wide. Scape 4.5 times as long as wide. Pedicel longer than first funicle segment and 1.9 times as long as wide. First funicle segment about 1.6 times as long as

wide; second segment the longest, about 2 times as long as wide; third segment about 1.7 times as long as wide. Funicle segments connected ventrally. Club distinctly wider than funicle (about 1.5 times) and as long as funicle. First funicle segment without sensilla, second and third segments and all club segments with two sensilla each being longitudinal.

Mesoscutum about 1.3 times as wide as long, with setae arranged almost symmetrically. Scutellum with three pairs of long setae, about 0.6 times as long as midlobe of mesoscutum and about 1.6 times as wide as long. Propodeum medially as a single plate, its posterior margin without triangular projection medially. Axilla with two long setae,

each side lobe of mesoscutum with three long setae. Fore wing hyaline, about 2.4 times as long as wide and with a short marginal fringe. Submarginal vein with 4 long setae along anterior margin and distinctly shorter than marginal vein (3:4). Postmarginal vein absent (Fig. 10). Hind wing about 7.5 times as long as wide, its marginal fringe about 0.7 wing width. Mesotibial spur (Fig. 11) slightly longer than mesobasitarsus; mesobasitarsus about as long as next two tarsal segments combined. Seventh gastral tergite (Fig. 12) with apical margin divided to four wide teeth, each tooth with one thin, long seta. Ovipositor (Fig. 13) with base at level of second tergite, slightly exserted and distinctly longer than mesotibia (103:90); third valvula about 0.5 times as long as second valvifer.

Male. Unknown.

Diagnosis. *Coccophagus dentatus* is very similar to *C. lutescens* Compere, but can be separated from the latter by the following: in *C. dentatus*, the submarginal vein has 4 long setae along then anterior margin; the second funicle segment is longer than third segment; the base of ovipositor is close to the base of gaster; the seventh gastral tergite is dentate; and the body length is 0.75 mm; in *C. lutescens*, the submarginal vein has 6-7 setae along the anterior margin; the second and third funicle segments are subequal in length; the ovipositor arises near the middle of gaster; the seventh tergite is normal, without teeth; and body length is 0.58 mm.

***Coccophagus falderus* sp. n.**

(Figs 14-19)

Holotype. Female, **Mexico**, *Chiapas*, El Encanjonado, 27 July 1997; coll. A. González-Hernández by sweeping, CIB 97-069 (UCRC).

Description. *Female.* Length of body: 0.8 mm.

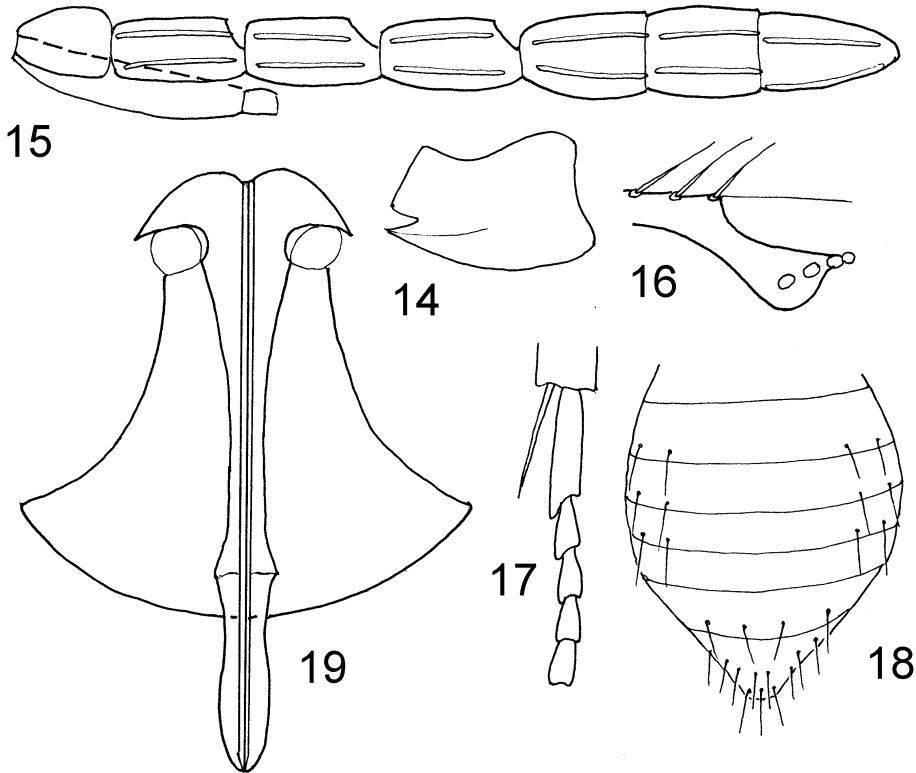
Colour. Head yellow, frontovertex infuscate, occiput above foramen infuscate, mandible and antenna yellow, angles of mouth black, eyes reddish. Mesosoma brownish,

side lobes of mesoscutum brownish-yellow, scutellum brownish with yellow longitudinal band medially. Fore wings subhyaline, venation slightly infuscate. Legs dark yellow except coxae brownish. Gaster brownish with base light yellow.

Structure. Head as wide as mesosoma and slightly wider than high. Frontovertex about 0.5 head width. Eye setose, 1.5 times as long as cheek. Mandible (Fig. 14) with a strong ventral tooth and a dorsal truncation.

Antenna (Fig. 15) inserted below lower eye margin, close to mouth margin. Radicle short, slightly longer than wide. Scape about 4.7 times as long as wide. Pedicel 1.5 times as long as wide and slightly shorter than first funicle segment. Funicle segments slightly compressed and connected ventrally. First funicle segment slightly shorter than each of next two segments; first and second segments about 2 times as long as wide, third segment about as long as second and slightly less than 2 times as long as wide. Club slightly wider than funicle, with segments more than 1.5 times as long as wide, and about as long as funicle. All flagellar segments with two longitudinal sensilla each (visible on one level).

Mesoscutum about 1.4 times as wide as long, setose, with strong setae along sides and basal margin. Scutellum with three pairs of long and strong setae, about 1.2 times shorter than midlobe of mesoscutum and slightly less than twice as wide as long. Axilla with two long setae. Dorsum of mesosoma with fine areolate-reticulate sculpture. Fore wing uniformly setose, 2.5 times as long as wide, with short marginal fringe. Submarginal vein with 4 long setae along anterior margin. Marginal vein about as long as submarginal vein, stigmal vein with neck and apex produced towards apex of wing, postmarginal vein absent (Fig. 16). Hind wing about 4 times as long as wide, its marginal fringe about 0.7 wing width. Mesotibial spur (Fig. 17) about as long as mesobasitarsus; mesobasitarsus longer than two next tarsal segments combined. Mesofemur



Figs 14-19. *Coccophagus falderus* sp.n., female. **14**, mandible; **15**, antenna; **16**, stigmal vein; **17**, mesotibial spur and mesotarsus; **18**, setation of gaster dorsally; **19**, ovipositor.

with one long seta near apex. Gaster slightly longer than mesosoma. Second- to sixth tergites (Fig. 18) with 2+2, 2+2, 2+2, 2+2, 2+2 setae, seventh with 6+3 setae in two rows. Ovipositor (Fig. 19) not exerted, distinctly longer than mesotibia; third valvula about 0.5 times as long as second valvifer. Outer plates of ovipositor strongly widened towards apex of gaster, its form resembling falls of skirt.

Male. Unknown.

Diagnosis. *Coccophagus falderus* may belong to the *ochraceus* species group, because it has funicle segments with excentric articulations, the mandible with an acute lower tooth deeply separated from the upper truncation, and the propodeum as a single plate (but without a median triangular projection). Within this species group, this new

species is close to the African species *Coccophagus mariformis* Compere and *C. angolensis* Annecke and Insley (Compere, 1931; Annecke and Insley, 1974). From these two species, *C. falderus* differs mainly by the color: in *C. mariformis*, the face and cheeks are white, the gaster is entirely black, the postmarginal vein is present, and there is an oblique hairless streak beneath the marginal vein; in *C. falderus*, the face and cheeks are yellow, the gaster has a yellow base, the postmarginal vein is absent, and the disc of fore wing beneath the marginal vein is uniformly setose. In *C. angolensis*, the mesoscutum is yellow, the scutellum is yellowish except narrowly blackish anteriorly, the gaster is black except the basal first tergite sometimes is dusky brownish, and the third valvula is as long as or slightly shorter than

the mesotibial spur; and in *C. falderus*, the mesoscutum is brownish, the scutellum is also brownish but with yellow longitudinal band medially, the gaster is brownish with the base yellow, and the third valvula is 1.4 times as long as the mesotibial spur.

***Coccophagus longisetus* sp. n.**

(Figs 20-25)

Holotype. Female, **Mexico**, Jalisco, La Huerta, Estación Biológica Chamela, UNAM, Vereda Tejón, 19°30'559''N 105°02'464''W, 162 m, 27 July 2000, sweeping weeds (coll. Y. Castillo O., A. Dávila L. & A. González H., CIB 00-0039 (UCRC)).

Description. *Female*. Length of body: 0.7 mm.

Colour. Head light yellow, occiput above foramen infuscate, eyes reddish. Antenna light yellow. Mesosoma yellow except pronotum medially, midlobe of mesoscutum on anterior margin, and propodeum infuscate. Setation of mesoscutum yellowish-white. Fore wing slightly infuscate below apical half of marginal and stigmal vein, with a pattern of hyaline and dark setae. Legs whitish-yellow. Base of gaster yellow, third to seventh tergites brownish, with posterior margins near sides whitish. Ovipositor brown.

Structure. Head as wide as mesosoma and 1.2 times wider than high. Frontovortex about 0.5 head width. Eye glabrous, small, as long as cheek. Mandible (Fig. 20) with two short teeth and a wide oblique truncation.

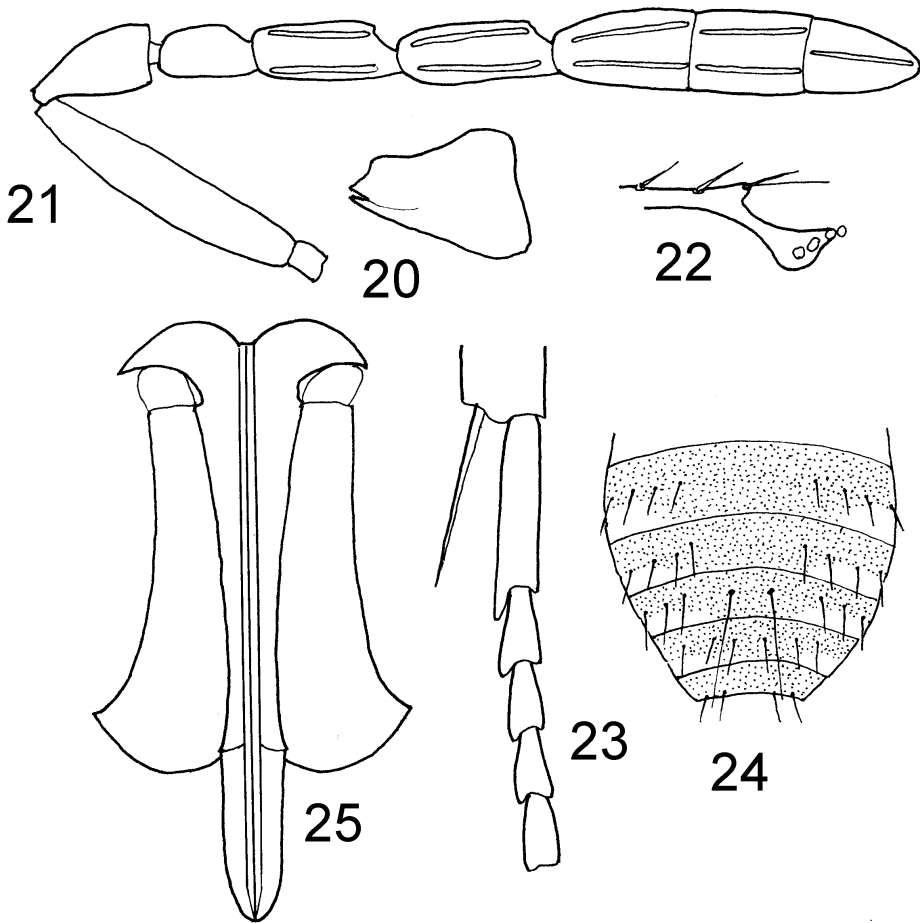
Antenna (Fig. 21) inserted close to mouth margin. Radicle short, slightly longer than wide. Scape about 5.7 times as long as wide. Pedicel about 2 times as long as wide and distinctly longer than first funicle segment. Funicle segments connected ventrally, all longer ventrally than dorsally. First funicle segment the shortest, about 1.5 times as long as wide; second segment about 2 times as long as wide; third segment 2.2 times as long as wide. Club about as long as funicle, all segments about 1.5-2 times as long as wide.

Mesoscutum about 1.4 times as wide as long, with thin and poorly visible setae. Scutellum short, about 1.4 times shorter than midlobe of mesoscutum and slightly less than 2 times as wide as long. Three pairs of scutellar setae long, apical pair 1.4 times as long as basal pair. Axilla with two setae. Fore wing 2.5 times as long as wide, with short marginal fringe. Setae on infuscate part of disc slightly longer and stronger. Submarginal vein with 4 long setae along anterior margin. Marginal vein longer than submarginal vein (5:3). Stigmal vein (Fig. 22) with a long, slender neck. Hind wing about 6 times as long as wide, its marginal fringe about 0.7 wing width. Mesotibial spur (Fig. 23) about as long as mesobasitarsus, the latter about as long as next three tarsal segments combined.

Gaster oval, third to seventh tergites with 3+3, 3+3, 3+2+3, 3+3 and 4 setae, respectively (Fig. 24); fifth tergite medially also with a pair of unusually very long setae, extending to apex of gaster, its length subequal to third valvula. Ovipositor (Fig. 25) exerted, distinctly shorter than mesotibia (11:12); third valvula about 0.5 times as long as second valvifer.

Male. Unknown.

Diagnosis. Only one species, *C. samarae*, described from India (Hayat, 1998), has been known in *Coccophagus* to have a pair of unusually very long setae on the fifth gastral tergite medially. *Coccophagus longisetus* is the second species with two very long setae on the fifth gastral tergite medially, and it is similar to *C. samarae*. *Coccophagus longisetus* and *C. samarae* have the following morphological differences: in *C. samarae*, the first funicle segment is longer than pedicel; all funicle segments are more than 2 times as long as wide; the club is slightly longer than two preceding funicle segments combined; the hind wing is 4.7 times as long as wide, its marginal fringe is about 0.4 wing width; the submedian pair of long setae on fifth gastral tergite extends past the apex of gaster; the axilla is dark brown, the scutellum is marked with brown; the mes- and metacox-



Figs 20-25. *Coccophagus longisetus* sp.n., female. **20**, mandible; **21**, antenna; **22**, stigmal vein; **23**, mesotibial spur and mesotarsus; **24**, setation of gaster dorsally; **25**, ovipositor.

ae are dark brown, the mesofemur except apices, the metafemur, and the metatibia are marked with brown; and the body length is 1.35 mm. In *C. longisetus*, the first funicle segment is shorter than pedicel and 1.5 times as long as wide; the second segment is 2 times as long as wide; the club is about as long as funicle; the hind wing is about 6 times as long as wide, its marginal fringe is about 0.7 wing width; the submedian pair of long setae on fifth gastral tergite extends to the apex of gaster; the axilla and scutellum are yellow; all legs are whitish-yellow; and the body length is 0.7 mm.

Thus, four new species of the genus *Coccophagus* are described in this article: two

species were collected in the States of Chiapas and Jalisco, and two species from the States of Chiapas and Tamaulipas, where are associated with citrus.

C. clypeator sp.n. was reared from the soft scale *Akermes* sp. collected on *limón persa* (*Citrus latifolia* Tanaka) in Tapachula, Chiapas. Soft scale of this genus earlier was known only from the State of Tabasco, which is one of principal regions producing this citrus in Mexico; thus, genus *Akermes* (fam. Coccidae) is new record for the State of Chiapas and new pest of citrus here, and parasitoid species is reared from this host (probably *A. townsendi* Cockerell, pers. com. of T. Kondo) for the first time.

Coccophagus dentatus sp. n. has an unusual dentate apical margin of seventh tergite. *C. falderus* sp. n. has unusual outer plates of ovipositor, which are wide on the apical margin. *C. longisetus* sp. n. is the second species of genus *Coccophagus* in world fauna with an unusual long pair of setae on fifth tergite (the other species, *C. samarae* Hayat, was described from India in 1998).

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