A REVISION OF THE SPECIES OF COCCOPHAGUS, A GENUS OF HYMENOPTEROUS, COCCID-INHABITING PARASITES

By Harold Compere

Of the University of California, Graduate School of Tropical Agriculture and Citrus Experiment Station, Riverside, Calif.

INTRODUCTION

The beneficial insect investigations of the citrus experiment station are conducted primarily for the purpose of introducing and establishing in California parasitic and predacious insects that may be of aid in combating our insect pests. A certain amount of taxonomic work is necessary to acquaint us with the parasites with which we are dealing. Probably no genus of coccid-inhabiting parasites is of more economic value than is *Coccophagus*, for the species of this genus appear to be the most numerous and widely distributed. So far as known, the species of *Coccophagus* are essentially primary parasites mostly inhabiting lecaniine scales. Accidental secondary parasitism is frequently encountered when species of *Coccophagus* compete with other parasites for the possession of a host. One species, *C. leptospermi* Girault, is recorded as having been reared from a gall on *Leptospermum*, but it is suspected that this parasite issued from a gall-like coccid. *C. javensis* Girault is recorded from a *Pseudococcus* species collected on Mango. *C. gurneyi* Compere is a parasite of *Pseudococcus gahani* Green, a serious pest of fruit trees and ornamental trees and shrubs. The introduction of *C. gurneyi* Compere from New South Wales into California gives promise, at this writing, of being one of the most valuable importations of recent years. The extensive collecting of Mr. E. W. Rust, formerly parasite collector for the citrus experiment station, has revealed a number of different *Coccophagus* inhabiting certain species of *Ceroplastes* which occur in South Africa. The parasites of *Ceroplastes* that occur in Africa may prove of value if established in certain parts of the Orient and Australia where several species of *Ceroplastes* are serious pests of cultivated plants.

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The host records of *Coccophagus* are meager and many of them are incorrect, due to unsatisfactory determinations. Practically all of the Australian species obtained by Girault were described from one or several poorly preserved specimens captured by sweeping; consequently their hosts are unknown. The life histories of only a few species have been studied and, so far, they have proven to be essentially primary in habit. It is not safe to conclude that all the species will prove to be primaries, since they are adaptable when competing for the possession of a host and under certain conditions develop as secondary parasites. It is but a short step from accidental secondary parasitism to obligatory secondary parasitism. A species of *Euxanthellus*, a genus very closely related to *Coccophagus*, is known to be an obligatory hyperparasite.

This paper is No. 172, of the studies made at the University of California, Graduate School of Tropical Agriculture and Citrus Experiment Station, Riverside, California. It is based largely on a study of specimens in the United States National Museum, the Brisbane Museum, the E. W. Rust collection, the Silvestri collection, and the British Imperial Bureau of Entomology collection. The types of all species described as new in this paper are to be deposited in the United States National Museum. For the privilege of studying this material the author expresses his appreciation to Dr. L. O. Howard, Dr. H. A. Longman, Dr. F. Silvestri, Dr. Guy Marshall, Mr. A. B. Gahan, and Mr. E. W. Rust. To Dr. F. Silvestri I am indebted for his kindness in loaning me the cotypes of the species which he described and for the privilege of describing several new species which he collected. To Mr. Gahan and Mr. Timberlake I am especially indebted for much assistance freely given. Mr. Timberlake loaned his unpublished notes, Mr. Gahan critically read the first draft of the manuscript and suggested changes which have been made. The help which Mr. Gahan and Mr. Timberlake have given is more fully acknowledged in the text.

GEOGRAPHICAL DISTRIBUTION

The distribution of *Coccophagus* has been greatly influenced by commerce, for like the coccids which they inhabit, species of *Coccophagus* are particularly liable to accidental transportation through the interchange of nursery stock. They pass the greater part of their life cycle within their hosts, and when inhabiting coccids they are easily transported from one locality to a new one. Many of the coccids that serve as hosts of *Coccophagus*, infest plants of economic importance and are transported with nursery stock from one country to another. For this reason it is not always possible to determine the native habitat of a cosmopolitan species nor is it safe to assume that a species is an indigene of the particular country

where it was first discovered. The following cases are cited as examples: *C. ochraceous* Howard was first reared in 1887 from *Lecanium* species infesting a native Californian plant at Alameda. In recent years the same species was discovered to be a common parasite of *Saissetia olea* (Bernard) at Cape Town, South Africa, but its true identity was not known at the time and it was purposely introduced into Southern California from Africa. *Coccophagus scutellaris* (Dalman), first described from Europe in 1825, is of world-wide distribution. It was again described as a new species from Europe in 1852, from California in 1894, and from Australia in 1917.

PRESERVATION OF SPECIMENS

If specimens of *Coccophagus* are not immediately mounted, they are preserved best if the specimens are placed in small vials and packed or held firm by loose absorbent cotton so as to prevent movement and avoid breakage. Some workers prefer the specimens preserved in alcohol but this causes the colors to fade. If only one specimen is obtained, it is of most value if mounted on a tag. The antennae and wings of tag-mounted specimens can be removed from the body at any time and mounted in balsam, or the entire insect can be removed from the tag, treated and mounted on a slide if desired. It is unsatisfactory to make a tag mount of a specimen that has been once preserved in balsam. Certain characters, especially coloration, are studied to best advantage in tag mounted specimens and other characters are seen to best advantage in slide mounts, so if sufficient material is obtained, a few of the specimens can be advantageously mounted in balsam on slides. Unfortunately, most. if not all, the species of *Coccophagus* shrink soon after death. This shrinkage, which causes the head and abdomen to partially collapse or fold, prevents the use of certain characters that would prove of good taxonomic value if it were not for this distortion. Dry and shriveled specimens can be distended by several methods before mounting them in balsam. If, before mounting in balsam, specimens are boiled in an 8 per cent solution of caustic potash, then passed through a bath of acetic acid and afterwards soaked in oil of cloves, they are distended, and the soft internal parts destroyed. Specimens treated in this manner, and then mounted in balsam, clearly show details of structure not readily seen in untreated specimens. The coloration of boiled specimens is partly destroyed and they are distorted by distention of the intersegmental tissue, but the chitinous parts are not affected. Shriveled antennae can be removed from tag mounted specimens and made suitable for study by treating them as described before, mounting them in balsam. Wings are best preserved by mounting them in balsam without any preliminary treatment other than cleaning them if necessary. Because

of their shape, mandibles assume different positions when mounted in balsam and it is extremely difficult to orient all of them in the same position after the cover glass is in place. For this reason mandibles are best studied in oil of cloves or soft balsam so they can be manipulated with dissecting needles before a permanent mount is made.

Unfortunately, a great many species of *Coccophagus* are known only from single poorly preserved specimens. A scientific classification of the group based on fundamental characters can not be made until additional properly preserved specimens are obtained. In this paper, especially in the key, superficial, unstable characters have of necessity been used. Coloration is the most conspicuous and easily seen character but unfortunately it is the most unreliable.

SYSTEMATIC POSITION

The genus *Coccophagus* is imperfectly defined, as it is a heterogeneous assemblage containing species that partially intergrade with other genera. The characters that separate *Coccophagus* from *Prospaltella*, *Encarsia*, *Aneristus*, *Prococcophagus*, *Aspidiotiphagus*, and *Coccophagoides* are relative and cannot be sharply defined. As a matter of convenience, the original generic grouping is adhered to in this paper, thus excluding the *Prospaltella*-like species described as *Coccophagus* by Girault. Girault recognized that *Prospaltella* and *Coccophagus* intergrade in the case of certain species and synonymized *Prospaltella*. In doing so, he wrote: "For extreme *Prospaltella* forms compare *abnormicornis* and allies. These form a distinct genus but there may be intervariations." In the same article Girault removes the so-called extreme *Prospaltella* forms, namely *abnormicornis*, *singularis*, and *regulus* from *Coccophagus* to the genus *Coccophagoides* which he established for their reception.[1] It seems inconsistent to synonymize one genus while erecting a new genus for the reception of the annectant species. Regardless of this inconsistency, *abnormis*, *singularis*, and *regulus* seem to represent a group more unlike typical *Coccophagus* than is *Prospaltella* and as such are probably entitled to generic rank. In the assemblage of species included under *Coccophagus* in this paper are some specimens that differ from the type species more than do certain other species for which separate genera have been erected. Until these parasites are better understood it is thought best to maintain the present generic concepts.

[1] Girault, A. A., Memoirs Queensland Museum, vol. 4, pp. 47, 53–55, 58, 1915.

The following key may aid in defining the position of *Coccophagus* in its relation to allied genera.[2]

1. Antennae eight-jointed 2
   Antennae nine-jointed, funicle four-jointed ..... **Euxanthellus** Silvestri.
2. Scape usually fusiformly subcylindrical, not strongly expanded nor strongly compressed 3
   Scape strongly compressed and expanded ..... **Prococcophagus** Silvestri.
3. Flagellum not compressed, funicle joints usually plainly longer than wide 4
   Flagellum compressed, funicle joints about as wide as long or wider than long ..... **Aneristus** Howard
4. Mesoscutum with a reduced number of small setae, less than 18, arranged in bilateral symmetry 6
   Mesoscutum usually plainly densely setose, in a few species with a reduced number of setae or microscopic pale setae; *Coccophagoides* with about 24 setae in bilateral symmetry 5
5. Flagellum of antenna plainly differentiated into club and funicle. Marginal vein plainly more than one-half as long as the submarginal vein ..... **Coccophagus** Westwood
   Flagellum not differentiated into club and funicle, flagellum tapering toward the apex. Marginal vein unusually short, about one-half as long as the submarginal vein. Stigmal vein intermediate between *Coccophagus* and *Prospaltella* ..... **Coccophagoides** Girault.
6. Antennal club composed of three joints differentiated from the funicle 7
   Antennal club composed of two joints, or the club and funicle not differentiated ..... **Encarsia** Forster
7. Fore wings very slender with the marginal fringe usually longer than the greatest width of the wing ..... **Aspidiotiphagus** Howard
   Fore wings not so narrow as in the foregoing and the marginal fringe usually plainly less than the width of the wing ..... **Prospaltella** Howard

MORPHOLOGICAL CHARACTERS

Head.—Due to shrinkage if the specimens are preserved dry, and because of distortion or concealment if mounted in balsam, such characters as the proportions and shape of the head are not easily utilized. In fresh material, these characters can be noted but the taxonomist rarely obtains specimens that have not partly shriveled.

Mandibles.—These are extremely variable, ranging from sharply tridentate in some species to edentate in others, with the greater number having a more or less typical mandible characterized by a well-developed apical tooth and a broad dorsal truncation that may be more or less incised so as to form a median and inner tooth. The mandibles usually possess two stout peg-shaped ventral spines and a similar but weaker dorsal spine in addition to the setae. Unfor-

[2] I am unable to detect good generic characters to distinguish these genera, but believe that since the genus is an arbitrary category established to aid in the recognition of species, better results are obtained if group distinctions are perpetuated where hundreds of species are involved even though certain species intergrade and exact generic concepts can not be established. With a little practice it is not difficult to assign most species to one genus or another and confusion results only when the intergrading species are encountered.

tunately, the mandibles can not be seen in many species known only from a single poorly preserved type specimen so the value of this character can not be fully utilized.

Antennae.—These have been used to a great extent in this paper, for with few exceptions the antennae of all the type specimens can be more or less clearly seen. However, in the use of the illustrations and of the table of measurements, some allowance should be made, since many of the drawings were made from poorly mounted specimens. Even when actually viewing the specimens, it is not always possible to perceive the true proportions since there may be a foreshortening due to an oblique position, or the lateral aspect showing the greatest width may be seen in one specimen and not in another. In a few cases some of the antennal joints were obscured by the head or other parts, and such obscured parts are indicated in the drawings by broken lines; such reconstruction is more or less hypothetical and can not always be interpreted as being accurate. Also, some of the antennae had shriveled before being mounted in balsam and in such cases the outlines were drawn with the idea of depicting the parts as they appeared before shrinkage. In preparing the descriptions of the antennae, a camera lucida drawing was first made, then the individual joints were measured; the descriptions were based on the drawings and measurements thus obtained. As a result, differences were noted that were not appreciable to the unaided eye. The detailed measurements were obtained for the purpose of making the descriptions more accurate and not with the intention of including them in the paper for publication. It has been found that these measurements are of some aid in separating certain closely allied species and that the descriptions can be better understood if the actual dimensions are given, since very slight differences, not always apparent to the unaided eye, have been described. The species of *Coccophagus* may be divided into two groups on the basis of antennal characters. Many of the small yellow species have the pedicel longer than the first funicle joint, the first funicle joint the shortest, the second and third funicle joints successively longer. The great majority of species have the pedicel distinctly shorter than the first funicle joint, the first funicle joint the longest, the second and third funicle joints successively shorter and wider. A few species are intermediate and not easily assigned to one group or the other. With few exceptions, the funicle joints are plainly longer than wide. The number and arrangement of the sensoria is of taxonomic value and this detail is shown in the drawings.

Palpi.—Maxillary palpi two-jointed, labial palpi one-jointed. The relative lengths of the palpal joints differ among certain species but this character has not been used as the differences are not especially marked and frequently none of the specimens are mounted in a way that reveals the mouth parts.

Thorax.—The notal sclerites of the thorax offer characters of good taxonomic value. The scutellum may be strongly transverse and much shorter than the mesoscutum or it may be almost as long as wide and longer than the mesoscutum. Many species appear to have the scutellum longer than wide but this is an optical illusion for measurements always showed the scutellum to be actually a trifle wider than long. The so-called "post-scutellum" or median part of the metanotum, which is usually differentiated by sculpture and coloration, may be small and inconspicuous or large and prominent. A large prominent median piece is usually correlated with a transverse scutellum. The shape of the propodeum is variable but this character has been generally disregarded because of the difficulty of obtaining specimens in which this sclerite is mounted in a uniform position.

Abdomen.—The shape and size of the abdomen offers an excellent character, easily seen, but it can not be satisfactorily used since it is particularly liable to distortion by shrinkage in dried specimens on tags and by crushing or flattening in slide mounted specimens. Some species have a relatively narrow abdomen and exserted ovipositor, others have a rotund abdomen and concealed ovipositor. The relative lengths of the ovipositor as seen through the body wall of semi-transparent, balsam mounted specimens have proven of value and they have definitely enabled the recognition of certain species previously confused. *C. bivittatus*, new species was confused with *C. longifasciatus* Howard before the marked difference in the relative lengths of the ovipositors was discovered. The outer plates of the ovipositor are extremely variable and would prove of value in a system of classification if properly prepared specimens were available for study. On the sides of the third, fourth, and fifth tergites of many dark colored species are small areas of microscopic markings which have been of aid in the recognition of certain species very closely alike.

Wings.—Many species of *Coccophagus* have a characteristically shaped fore wing, in which the anterior and posterior margins expand evenly without an accentuated, posterior, apical bulge and the apical anterior curvature is evenly rounded. The relative lengths of the submarginal and marginal veins furnish taxonomic characters of considerable value. The postmarginal vein is short and is present in most species, although in a few it is entirely absent. The stigmal vein is short with an apical knob or swelling and is of value in enabling the recognition of species. The greater part of the forewing is usually densely ciliated and the marginal fringe is short. There is no hairless streak obliquely descending from under the stigmal vein but in some species there is a more or less complete hairless streak extending from beneath the apical termination of the sub-

marginal vein towards the basal posterior margin. There are numerous departures from the typical wing and in such cases an effort has been made to figure the wing or describe it in detail. The wings may be hyaline, faintly infuscated or with a well marked infuscated pattern.

Legs.—Aside from noting the length of the basitarsus relative to the length of the tibial spur of the middle legs, and the length of the basitarsus relative to the succeeding joints, no other leg characters have been used except in the case of *C. zebratus* Howard which is anomalous in having the hind coxae and femora greatly swollen. The short tarsal joints of certain species aid in their recognition but the great majority of *Coccophagus* have the basitarsus of the middle legs about as long as its succeeding three or four joints united and the tibial spur slightly shorter than the basitarsus.

Vestiture.—The vestiture furnishes a very convenient character for the separation of the species into two groups. Those having the scutellum about as densely setose as the mesoscutum are placed in one group while those having the scutellum furnished with but three pairs of bristles are placed in the other group. This division is not a fundamental one, since some species of one group are structurally similar to some of those of the other group. *C. trifasciatus* Compere is intermediate between these two groups, for in addition to the three pairs of bristles a varying number of small setae are scattered near the anterior pair of bristles. A few species contain individuals having two or three supernumerary setae in addition to the paired bristles. The great majority of species of *Coccophagus* have the mesoscutum densely setose, only a few of the small yellow species having fewer setae on the mesoscutum. In all the species of *Prospaltella* seen by me, the setae are few and arranged in longitudinal rows, while in *Coccophagus* the setae are more numerous and not arranged in four parallel rows. However, this character seems very superficial and may not apply to all the species. Each axilla is usually furnished with two setae or bristles. *C. redini* Girault has the axillae as densely and conspicuously setose as the mesoscutum, while *C. mariformis*, new species and *C. malthusi* Girault have, in addition to the two large setae, some supernumerary setae that are easily overlooked. An undescribed African species, known only from a single individual in the Rust collection, has the axillae setose. The size, arrangement, and abundance of the setae on the head, body and legs are of taxonomic importance in some cases and can be conveniently used to distinguish certain species.

Sculpture.—The character of the sculpture is best studied in cleared balsam-mounted specimens. The sculpture as seen in a cleared balsam-mounted specimen appears quite different from the same sculpture seen in a tag-mounted specimen. The sculpture of

Coccophagus is composed primarily of reticulated lines and setigerous punctures. The varied punctulate and shagreened effects seen in tag mounts are due to the differences in the fineness of the pattern and size of the raised lines or reticulations and to the size and abundance of the setigerous punctures.

Color.—The varied color patterns furnish the most conspicuous and easily seen taxonomic characters. Unfortunately, coloration is not always reliable, for certain species are extremely variable. Other species have a very uniform color pattern. *C. ishiii*, new species, has been described as new on the basis of the different coloration of the fore coxae. This species is not readily separated from *C. scutellaris* (Dalman) by any structural characters known to me. It differs from *C. scutellaris* (Dalman) principally by having the fore coxae black, in contrast to the remainder of the fore legs, which are yellow, and in contrast to the fore coxae of *C. scutellaris* which are yellow and concolorous with the remainder of the fore legs. In this case, the distinction seems justified, for *C. scutellaris* is represented in our collection by a large series of specimens and the coloration of the legs is constant. On the other hand, a color difference such as this is not of sufficient value to justify separating certain other forms. A series of *C. malthusi* Girault exhibits an amazing range of color variation and if it were not for the intergrading specimens the extreme variants could not be recognized as being specifically alike. On the basis of coloration three species described by Girault, namely, *C. leptospermi*, *C. triguttatus*, and *C. triangulatinotus* seem quite distinct, yet in structure and size they seem suspiciously alike. If they prove to be as variable in coloration as is *C. malthusi* Girault, it is not unlikely that they will prove to be specifically identical; however, this can not be determined from an examination of the badly mounted types. Many of the species are most conveniently separated on the basis of coloration, for this can be seen at a glance. However, coloration can not be used as the basis for an exact and scientific classification.

DESCRIPTIONS OF GENERA AND SPECIES

Genus COCCOPHAGUS Westwood

Coccophagus Westwood, Philosophical Mag., vol. 3, p. 344, No. 32, 1833.
Aphelinus Walker (part), Monographia Chalciditum, p. 11, 1839.
Coccobius Ratzeburg (part), Ichneumonen der Först-Insekten, vol. 3, p. 15, 1852.
Coccophagus Howard, U. S. Dept. Agr. Rept. for 1880, pp. 353–54, 1881; U. S. Dept. Agr. Bur. Ent. Bull. 5, pp. 24–25, 1885; Aphelininae of N. Amer. Div. Ent., U. S. Dept. Agr. Tech. Series No. 1, pp. 10–11, 31–32, 1895.—Ashmead, Mem. Carnegie Mus., vol. 1, pp. 344–46, 1904.—Masi, Boll. Lab. Zool. Gen. Agr., vol. 1, pp. 238–246, 1907.—Schmiedeknecht, Gen. Insect., fasc. 97, 1909.—Mercet, Trab. Mus. Cienc. Nat., No. 10, pp. 219–20, 1912.

The genus *Coccophagus* was erected by Westwood in 1833 to include four species; namely, *Entedon scutellaris* and *Entedon insidiator* of Dalman, described in 1825, and *C. pulchellus* and *C. obscurus* described as new. In 1840, Westwood designated *C. scutellaris* (Dalman) as the type of the genus *Coccophagus*.[3] Since then a total of 130 species has been described under *Coccophagus* or referred to it. In 1834, Nees ab Esenbeck under *Eulophus* described the species *flavovarius* and *impeditus* and in the supplement referred *E. flavovarius* to *C. scutellaris* (Dalman) and *E. impeditus* to *C. obscurus* Westwood.[4] *Eulophus flavovarius* is now recognized as a species of *Tetrastichus*. Walker, 1839, overlooked the genus *Coccophagus* and described five species under *Aphelinus;* namely, *argiope*, *inaron*, *moeris*, *idaeus*, and *lycimnia*.[5] Three species, *argiope*, *inaron*, and *moeris* are accepted as valid by certain European authors and *idaeus* and *lycimnia* placed in synonymy but authorities do not agree regarding the synonymy. Förster, 1841, described the species *semicircularis* under the genus *Myina* Nees.[6] The genus *Myina* is a synonym of *Aphelinus* but the species *semicircularis* is a *Coccophagus* and has been synonymized. A second species was described by Förster as *Myina scutellaris*. Dalla Torre referred the species to *Aphelinus* and proposed the new specific name *försteri*. Silvestri cites this as doubtful synonymy of *Coccophagus howardi* Masi. Ratzeburg, 1852, erected the genus *Coccobius*, and described five species.[7] Of these, *notatus* was transferred to *Coccophagus* by Howard.[8] Howard made *Coccophagus citrinus* Craw the type of his genus *Aspidiotiphagus*.[9] *Coccophagus aurantii* described by Howard, 1894, was transferred by its author to *Prospalta*, 1895.[10] The name *Prospalta* was found to be preoccupied and Ashmead proposed the new name *Prospaltella*, 1904. *Coccophagus varicornis* Howard was made type of Howard's genus *Physcus*.[11] *Coccophagus orientalis* Howard was synonymized with *Aneristus ceroplastae* by Gahan in 1924. According to Howard, *Coccophagus annulipes* Ashmead belongs to *Aphycus*; *C. brunneus* Provancher and *C. compressicornis* Provancher probably belong to the Tetrastichinae; while *C. pallipes* Provancher belongs to *Sympiesis*.[12]

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[3] Westwood, Introduction to the Modern Classification of Insects, vol. 2, 1840, Synopsis of the British Genera of Insects, p. 73.

[4] Nees ab Esenbeck, Hymenopterum Ichneumonibus affinium Monographie, vol. 2, pp. 163–64, 178. Addenda et amendada ab., vol. 2, p. 428, 1834.

[5] Walker, Monographia Chalciditum, pp. 5, 9–12, 1839.

[6] Förster, Beitrage zur Monographie der Pteromalinen, p. 44, 1841.

[7] Ratzeburg, Ich. die Först-Insecten, vol. 3, pp. 188, 196, 1852.

[8] Howard, U. S. Dept. Agr. Div. Ent. Bull. 1, p. 10, 1895.

[9] Howard, Insect Life, vol. 6, p. 231, 1894.

[10] Howard, U. S. Dept. Agr. Div. Ent. Tech. Ser. No. 1, p. 41, 1895.

[11] Idem, pp. 43–44.

[12] Idem, p. 32, 1895.

In this paper the following 22 species described by Girault under *Coccophagus* are referred to *Prospaltella: albiscutellum*, *aleurodici*, *antiopa*, *ashmeadi*, *aureolus*, *boswelli*, *brittanicus*, *clariscutellum*, *filius*, *lautus*, *magniclavis*, *nigriventris*, *perbellus*, *perpulchellus*, *perseus*, *picithorax*, *pulliclavus*, *schilleri*, *seminigriclavus*, *swifti*, *thoreauini*, and *unifasciata*. *Coccophagus lucani* Girault is known to me only by the original description, and from this it is impossible to judge whether the species should be included under *Coccophagus* or referred to *Prospaltella*.[13] In the same article where *C. lucani* is described, Girault refers to *C. tennysoni* as being notably different. I am unable to find any other reference to this species in the literature and suppose it to be *nomen nudum*. In his diagnosis of the Australian species of *Coccophagus*, Girault gives the distinguishing characters of a male specimen, *C. poei*, and says: "See description." In a footnote he writes that the description was lost and that the species *poei* is a *nomen nudum*. However, the diagnostic characters given in the table describe the species more completely than do many of Girault's formal descriptions, so it seems that the name is valid even though it is doubtful if the species can be recognized by the meager description of a male specimen.[14] *Coccophagus sophia* Girault and Dodd [15] and *C. clarus* Dodd are here referred to *Prospaltella*.[16] Brèthes, 1913, erected the genus *Paracharitopus* for the reception of the species *lecanii*. In his unpublished catalogue, Timberlake transferred this species from *Paracharitopus* to *Coccophagus*. If judgment may be based on Brèthes' description, this species is not greatly unlike *C. lecanii* (Fitch). The status of this species can not be determined without making a study of the types. *Coccophagus nubeculus* Brèthes is accepted as a valid species.[17] *Coccophagus subochraceus* Howard is a species of *Euxanthellus*.

KEY TO THE SPECIES OF COCCOPHAGUS, FEMALES [18]

1. Species with the scutellum furnished with only three pairs of bristles, rarely with a few supernumerary setae scattered near the anterior pair of bristles 2
   Species with the scutellum usually about as densely setose as the mesoscutum, in some species setose only on the disk, the sides and apex bare; paired bristles usually present 57
2. Pedicel usually plainly shorter than the first funicle joint. First funicle joint usually the longest, never the shortest, occasionally the funicle joints subequal in length to each other and to the pedicel 3

[13] Girault, Insecutor Inscitiae Menstruus, vol. 10, Nos. 1–3, p. 108, 1922.
[14] Girault, Memoirs Queensland Mus., vol. 4, p. 55, 1915.
[15] Girault and Dodd, Memoirs Queensland Mus., vol. 4, p. 49, 1915.
[16] Dodd, Trans. Royal Soc. So. Aust., vol. 41, p. 352, 1917.
[17] Brèthes, Anal. Mus. Noc. Bo. As., vol. 24, pp. 97, 105, 1913.
[18] The following species are not included in this key: *C. insidiator* (Dalman), *C. argiope* (Walker), *C. moeris* (Walker), *C. inaron* (Walker), *C. notatus* (Ratzeburg), *C. försteri* (Dalla Torre), *C. obscurus* Westwood, *C. purpureus* Ashmead, *C. nigrifrons* Wollaston, *C. poei* Girault, *C. lucani* Girault, *C. funeralis* Girault, *C. nubeculus* Brèthes. *C. fuscipes* Howard, and *C. eleaphilus* Silvestri run to *C. lecanii* (Fitch).

Pedicel usually plainly longer than the first funicle joint, or if subequal or a trifle shorter than the first funicle joint, the first funicle joint is shorter than the second and third 41

3. Each axilla usually with two setae. In *C. mariformis*, new species and *C. malthusi* Girault there are supernumerary setae, easily overlooked, and in *C. gregarius*, new species three distinct setae 4

Axillae about as densely and conspicuously setose as the mesoscutum. First funicle joint four times as long as wide. Head, legs, and most of thorax yellow. Abdomen blackish. (Australia) ..... 1. **redini** Girault.

4. Coloration of legs normal. Not spotted or banded suggestive of *Marietta* 5

Femora and tibiae pale with brown spots and bands suggestive of *Marietta*. Antennae particolored. An area of transparent cilia on disk of fore wings. (Africa) ..... 2. **lepidus**, new species.

5. Species with the body black, or brownish black, without any yellow markings except the median part of metanotum which may be yellow.[19] 6

Species with the body particolored, or predominately yellow, or purplish 9

6. Legs predominantly black or dark brown, sometimes with the bases or apices yellow. Face and cheeks usually predominantly black or brown 7

Legs predominantly yellow, only the hind tibiae more or less black. Face and cheeks mostly yellow. Tegulae and parapsides suffused with brownish. Scrape concolorous with face, flagellum dark brown. (Florida) ..... 3. **flavifrons** Howard.

7. Face, cheeks and antennae usually completely blackish. Setae on middle knees and dorsal margin of hind tibiae not especially strong, normal 8

Face, cheeks, and antennae usually yellowish or orange, sometimes face and cheeks more or less brown or blackish. Setae on dorsal margin of hind tibiae suberect and slightly stronger than normal. Setae on middle knees rather strong. (Africa) ..... 4. **anthracinus** Compere.

8. Femora and tibiae distinctly tipped with yellow or brownish yellow. Scutellum anteriorly sometimes furnished with two or three supernumerary setae in addition to the three paired bristles. Setae of the knees and fore coxae weak. (Utah) ..... 5. **timberlakei**, new species.

Femora and tibiae not distinctly tipped with yellow but pallid at the ends. The antennae more slender and with fewer sensoria than the foregoing two species. This species can be definitely distinguished from *C. anthracinus* Compere and *C. timberlakei*, new species, by the possession of characteristic markings an the sides of the fifth and sixth tergites as shown in figure 166. (Africa) ..... 6. **atratus** Compere.

9. Fore wings hyaline, or faintly and uniformly tinted, or with a faint cloud beneath the stigmal vein 12

Fore wings distinctly infuscated 10

10. Abdomen pale suffused with brownish. Fore wings generally infuscated. Antennae unusually long 11

Abdomen black. Axillae and scutellum brownish, or ferruginous, sometimes suffused with fuscous. Median part of metanotum and propodeum yellow. Hind coxae, trochanters, and femora yellow. First funicle joint slightly more than twice as long as wide. Third funicle joint only slightly longer than wide. Forewings with a large, distinct, infuscated cloud beneath the marginal vein, more or less interrupted by a diagonal hyaline streak. (Africa) ..... 7. **rusti** Compere.

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[19] The word body as used in this paper refers to the thorax and abdomen combined.

11. Only center of pronotum blackish and sides of propodeum dusky. Dorsum of abdomen on apical three-fourths brownish. Wings generally infuscated, the infuscation not especially pronounced. First funicle joint about three times as long as wide. Third funicle joint almost twice as long as wide. (Ceylon)----------8. flavescens Howard.

12. Scutellum more or less extensively yellow, remainder of thorax and the abdomen predominantly blackish. *C. lecanii* (Fitch) and related forms. Figure 3 illustrates species of this group----------30

Otherwise----------13

13. Abdomen black or brown, or pale with dark spots or bands, or purplish, or blackish with basal one-third or so yellow----------14

Abdomen entirely pale. General color orange with only the meson of pronotum and a spot behind the wing articulations black. (Australia)----------9. perhisidis Girault.

14. Basal one-third or so of abdomen yellow, remainder black. Thorax black. Habitus of *C. lecanii* (Fitch) and related species. Parasitic on *Pseudococcus* spp. (Australia and California)----------10. gurneyi Compere.

Otherwise----------15

15. Setae on the mesoscutum, axillae and scutellum plainly visible when viewing tag-mounted or uncleared specimens in balsam----------16

Setae on mesoscutum, axillae and scutellum delicate, microscopic, hardly visible unless the specimen is cleared and viewed under high magnification. Predominantly yellow. Center of pronotum, anterior part of mesoscutum or meson, a large blotch on each axilla, anterior margin of scutellum, metanotum, propodeum, and dorsum of abdomen brownish or blackish. (Australia)----------11. tarongaensis, new species.

16. Abdomen pale with darker spots or bands----------24

Abdomen completely black, or brown, or purplish. In balsam-mounted specimens if the abdomen is crushed the intersegmental tissue may appear as pale transverse cross stripes----------17

17. Abdomen black or brownish----------18

Abdomen originally described as purple. Parts described as purple now appear brownish in the balsam-mounted type. Scutellum, median part of metanotum, scape, legs except the fore and middle coxae and base of fore femora, yellow. Abdomen small, shorter than thorax. A robust species with scutellum plainly wider than long. Mesoscutum with rather coarse, sparse setae. (Australia)----------12. signus Girault.

18. Pedicel almost if not actually wider than long and plainly shorter than the third funicle joint----------21

Pedicel plainly longer than wide and subequal in length to the third funicle joint----------19

19. Stigmal vein normal. Postmarginal wanting or slightly developed. All club joints wider than long----------20

Stigmal vein abnormally swollen. Postmarginal vein well developed. All club joints plainly much longer than wide, subequal; each a trifle longer than any funicle joint. Club not much wider than the funicle. Sensoria and other antennal details as shown in figure 27. Head and thorax mostly orange yellow. Face iridescent pearly white. Middle and hind coxae more or less blackish, remainder of legs yellow. (Africa)----------13. mariformis, new species.

20. Abdomen not much longer than wide. Hind coxae black in contrast to the remainder of the legs which are yellow. A moderately small species with the following parts blackish: Pronotum, anterior part of mesoscutum, a spot on either parapsis, axillae, metanotum, except median part,

propodeum, abdomen, most of lateral and ventral parts of thorax. Dorsum of head distintly orange with the ocellar area blackish. The following parts yellow: Face, cheeks, mesoscutum except anteriorly, parapsides except the spots, scutellum, median part of metanotum. (Australia)----------14. **emersoni** Girault.

21. Abdomen rounded at apex; ovipositor sheaths not exserted----------22
Abdomen pointed at apex, plainly longer than wide; seventh tergite long, strongly compressed after shrinkage; ovipostor sheaths exserted. Legs mostly lemon yellow, hind coxae and basal half of hind tibiae blackish. Head mostly lemon yellow, occiput mostly black. Mesoscutum black or with a variabe amount of orange on the sides. Scutellum orange, or orange with black anteriorly. Median part of metanotum yellow. Parapsides orange and black. (Africa)----------15. **flaviceps**, new species.

22. Scutellum black with yellow laterally----------23
Head and thorax yellow except for blackish or brownish markings as follows: occiput on either side of foramen, exposed part of pronotum medially, anterior part of mesoscutum in a median -shaped blotch, wedged-shaped bases and a median spot on parapsides, axillae (suffused), sides of metanotum, median part of propodeum between the longitudinal carinae, petiole, tegulae, and dorsal part of mesosternum. Abdomen completely black. Legs completely yellow. Eyes and ocelli reddish. (India)----------16. **tschirchii** Mahdihassan.

23. Head mostly yellow. Mesoscutum black, yellow laterally. Parapsides yellow spotted with black. Scutellum black, yellow laterally. Metanotum, propodeum, and abdomen black. Hind coxae mostly black, remainder of legs yellowish. Each axilla with three setae. (Australia.)
17. **gregarius**, new species.

24. First funicle joint plainly the longest----------25
Funicle joints subequal in length. A small black and yellow species with the habitus of *C. ochraceus* Howard. General color yellow with the following dark brown or blackish markings: upper part of occiput, center of pronotum, anterior margin of mesoscutum, sides of metanotum, center of propodeum, a broad band across middle of abdomen. Antennae and legs yellow. (Java)----------18. **javensis** Girault.

25. Abdomen with rows of spots on either side, or with cross bands, or rows of transverse spots that may coalesce, not with three distinct spots----26
Abdomen yellow with three distinct black spots, one on either side of middle, another at apex. Thorax yellow marked with blackish as follows: center of pronotum, apex of each axilla, anterior margin of scutellum. Legs and antennae yellow. (Australia)----------19. **triguttatus** Girault.

26. First funicle joint plainly much less than three times as long as wide and third funicle joint plainly much less than twice as long as wide. Club joints wider than long. Cilia of forewings normal----------27
First funicle joint almost three times as long as wide, third funicle joint about twice as long as wide. First club joint plainly longer than wide. Cilia of fore wings translucent, abnormally long and dense toward base of wings. Abdomen on either side with two longitudinal rows of dots which on the outer rows are contiguous so as to form more or less continuous lateral bands. Predominantly yellow, face and cheeks white,

frontovertex orange blotched with pearly white. First and second tarsal joints of the middle and hind legs fuscous. An aberrant species with the habitus of *Euxanthellus*. (Africa)_____20. **specialis**, new species.

27. Abdomen with bands or obscure cross stripes_____28

Originally described as having three spots on the abdomen broadly joined together. General color pale yellow marked with blackish as follows: center of pronotum, anterior margin of mesoscutum, axillae, scutellum anteriorly, most of metanotum and propodeum, dorsum of abdomen except approximately first two tergites and sides of fifth and sixth tergites. Head, antennae, and legs yellow. So far as can be determined, structurally similar to *C. triguttatus* Girault and *C. leptospermi* Girault. (Australia)_____21. **triangulatinotus** Girault.

28. Abdomen with a broad band across the middle_____29

Abdomen with a rather obscure cross stripe on the anterior half of each of the first five tergites. Face, cheeks, antennae, legs, sides, and venter of thorax yellow. Thorax yellow marked with blackish as follows: Most of pronotum, anterior margin of mesoscutum on meson, sutures of mesoscutum posteriorly, scutellum anteriorly, axillae anteriorly. (Australia)_____22. **leptospermi** Girault.

29. General color orange. Legs whitish. Abdomen black at apex and with a rather wide black band across the middle. (Australia.)

23. **inkermani** Girault.

30. At least one pair of coxae or one pair of femora entirely pale or yellow__31

All coxae black, or predominantly blackish, or dark brown. All femora usually more or less extensively black or brownish_____37

31. Femora of at least one pair of legs distinctly marked with blackish____35

Femora of all legs pale or yellow_____32

32. Middle and hind coxae partly black_____34

All coxae pale or yellow_____33

33. Face and cheeks pale yellow, frontovertex reddish. Legs pale yellow, only hind femora and tibiae slightly suffused with dusky. Venter and sides of thorax brownish. Fore wings finely and closely ciliated with a small rounded hairless spot near base. Neck of stigmal vein not constricted. Sensoria of antennae more abundant than in the following species. (Java)_____24. **bogoriensis** (Köningsberger).

Face, cheeks, and frontovertex blackish. Legs completely yellow. Venter and sides of thorax yellow. Compared to the foregoing species fore wings rather coarsely and sparsely ciliated. Neck of stigmal vein constricted. Postmarginal vein distinct. (Cuba)__25. **cubaensis**, new species.

34. Fore coxae yellow, middle and hind coxae black. All femora yellow except for a faint brownish suffusion at apex of middle pair. All tibiae and tarsi yellow with a trace of brownish. (Africa.)

26. **pulvinariae**, new species.

35. All femora usually more or less brown or blackish, especially the middle pair_____36

Middle femora yellow; fore femora yellow but often marked with blackish; hind femora blackish. All tibiae usually yellow, fore tibiae occasionally with some fuscous. All coxae more or less blackish. (Japan.)

27. **japonicus** Compere.

36. Hind coxae usually yellow in sharp contrast to the blackish coloration. Middle femora with a distinct pale annulus at base. Tibiae of middle and hind legs either entirely yellow or marked with fuscous. (Hawaii, Japan)----28. **hawaiiensis** Timberlake.[20]

37. Middle tibiae entirely yellow or more or less uniformly faintly dusky----38
Middle tibiae blackish or dark on the basal two-thirds, yellow or whitish at apex. Coxae, trochanters, and femora of all legs black or dark brown except the femora of the fore and middle legs which are pale at the ends and the latter with a distinct annulus at base. Hind tibiae completely blackish or dark brown. Head and antennae blackish to dark brown. (Philippine Islands)----29. **tibialis**, new species.

38. Hind tibiae usually distinctly blackish on the basal third or more----39
Hind tibiae usually entirely yellow, sometimes faintly dusky at the base. Fore wings usually faintly and uniformly smoky, densely and closely ciliated with a small rounded hairless spot near the base. (Africa, Italy.) 30. **cowperi** Girault.[21]

39. Face and cheeks usually blackish or brownish. Femora of fore and middle legs usually definitely and distinctly blackish in part----40
Face, cheeks, and antennae yellowish; frontovertex orange, occasionally more or less suffused with fuscous. Fore and middle femora rather vaguely and distinctly dusky. (Natal, Africa)-31. **isipingoensis**, new species.

40. Face and cheeks usually blackish or brownish; frontovertex usually brown or fuscous. Scape usually fuscous in contrast to the yellow flagellum. There are exceptions. Femora usually definitely blackish with the ends yellowish. (N. America)----32. **lecanii** (Fitch). 32*a*. **fuscipes** Howard.
In the female sex hardly separable from the foregoing species. (Consult key to the male forms.) (Eritrea, Africa)----33. **eleaphilus** Silvestri.

41. Ovipositor concealed or shortly exserted----42
Ovipositor exserted about one-fourth the length of abdomen. General color honey yellow. Axillae and center of pronotum blackish. (Australia.) 34. **biguttatus** Girault.

42. Hind coxae and femora not abnormally swollen----43
Hind coxae and femora abnormally swollen. Antennae parti-colored. Abdomen whitish with transverse brown bands. (Ceylon)-35. **zebratus** Howard.

43. Scutellum without supernumerary setae scattered near the anterior pair of bristles----44
Scutellum with a varying number of small setae scattered near the anterior pair of bristles. Funicle joints all about as wide as long or occasionally wider than long. A small species. Face and cheeks yellow: frontovertex orange. Notum of thorax and abdomen black with conspicuous yellow markings roughly defined as three cross bands: first band across the posterior two-thirds of mesoscutum, parapsides, and tegulae; second band across base of abdomen; third band across abdomen near apex. Scutellum mostly black, the sides yellow. (Africa)----36. **trifasciatus** Compere.

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[20] *C. hawaiiensis* Timberlake may be a synonym of *C. japonicus* Compere. Typical specimens are strikingly different in the coloration of the legs but there are intergradations. In the United States National Museum is a series of specimens, all supposedly reared from the same host taken from the same locality, which includes individuals that agree with both the types of *C. japonicus* Compere and *C. hawaiiensis* Timberlake. On the basis of this evidence Gahan concludes that the two forms represent a single species. On the other hand, Timberlake is inclined to the belief that two distinct species are involved. I have spent considerable time comparing the two forms without being able to reach a decision. In the case of *C. pulvinariae*, new species, and *C. isipingoensis*, new species, we are again confronted with two forms that co-exist and have at least one host in common.

[21] Consult key to males on p. 60 for aid in recognition of species in the *C. lecanii* (Fitch) group.

44. Species marked with some black or brownish_____47
Species completely pale yellow, without any dark markings. Marginal fringe long _____45

45. Spur of middle tibia subequal in length to the basitarsus. Basitarsus of middle legs as long as the three succeeding joints combined_____46
Tibial spur slightly longer than the basitarsus. Basitarsus of middle legs as long as the succeeding two joints combined. Funicle joints plainly much less than twice as long as wide. Face, cheeks, and venter of thorax white. (Africa)_____37. **lutescens**, new species.

46. Funicle joints a trifle more than twice as long as wide. (Wisconsin.)
38. **perflavus** Girault.

47. Fore wings hyaline, or with a cloud beneath the stigmal vein, or with normal infuscation. Cilia of fore wings normal_____48
Fore wings with a large, elongated, central infuscation with fuscous cilia. On the hyaline area at apex of wing the cilia are transparent in balsam and probably refractive in tag-mounts. Pedicel about as long as the first funicle joint. All funicle joints subequal, each a trifle longer than wide. Club as long as the funicle. A small species, silvery white to yellow with blackish markings. (Australia)_____39. **argenteus** Girault.

48. Second funicle joint not the longest, or if the longest, not more than twice as long as wide_____49
Second funicle joint slightly longer than the first or third and about two and one-half times as long as wide. First funicle joint a trifle longer than the pedicel. First and third funicle joints subequal and each about two and one-fourth times as long as wide. Fore wings relatively slender and smaller than normal. A small species mostly orange yellow; abdomen black with a broad silvery cross band. (Australia.)
40. **argentifascia** Girault.

49. Body not marked on either side with a longitudinal dark brown stripe___51
Body yellowish, marked on either side with a longitudinal, dark brown stripe continuous from pronotum to apex of abdomen_____50

50. Fore wings with a small infuscated cloud beneath the stigmal vein. Ovipositor shorter than in the following species, extending from middle of abdomen to the apex. (Africa)_____41. **bivittatus**, new species.
Fore wings without a cloud beneath the stigmal vein. Ovipositor extending almost the entire length of the abdomen. (Ceylon, China.)
42. **longifasciatus** Howard.

51. Stigmal vein normal or if with a long slender neck the postmarginal vein is developed_____52
Stigmal vein with an abnormally long slender neck; postmarginal vein absent. Predominantly black with only the basal one-third of the abdomen yellow in striking contrast. (Maryland)__43. **cinguliventris** Girault.

52. Thorax yellow or predominantly yellow with some brownish_____53
Thorax predominantly blackish, parapsides and scutellum more or less ferruginous. Head mostly pearly white. Basal one-third or so of the abdomen pale yellow to white, apical one-fourth yellow with dark spots, intermediate part fuscous. Middle and hind coxae black, remainder of legs white to pale yellow. First funicle joint about one-half as long as the second, second and third plainly longer than wide. (Africa.)
44. **margaritatus**, new species.

53. Third funicle joint plainly longer than wide----54
Third funicle joint as wide or wider than long. Thorax light lemon yellow with the concealed part of the pronotum blackish. Abdomen with distinct cross bands. (Australia)----45. **pulcini** Girault.
54. Abdomen yellow, or yellow with black markings----55
Abdomen entirely black; thorax orange yellow. Legs lemon yellow with the hind coxae fuscous. (Australia)----46. **auricaput** Girault.
55. Predominantly yellow without a broad blackish cross band on abdomen---56
Ochraceus to honey yellow marked with blackish to dark brown as follows: collar of pronotum, anterior margin of mesoscutum, occasionally the notal sutures more or less, axillae in some specimens, usually metanotum and propodeum, a broad band across basal half of abdomen, a spot between the cercal plates. First funicle joint about twice as long as wide. (California, Africa)----47. **ochraceus** Howard.
56. Bright yellow, only the tip of scape, flagellum, border of pronotum, tips of tegulae, border of metanotum (propodeum?), and incomplete bands between the abdominal segments fuscous. (Canada)--48. **fletcheri** Howard.[22]
57. Fore wings hyaline or subhyaline, or with a faint small cloud beneath the stigmal vein----65
Fore wings with a large and usually distinct infuscated cloud beneath the apical half of the marginal vein----58
58. Body particolored, at least suffused or spotted with yellowish on the parapsides and tegulae, or basal angles of abdomen with yellow marks----61
Body entirely black----59
59. As seen through the derm walls, the ovipositor extends from the middle of the abdomen to the apex----60
As seen through the derm walls, the ovipositor extends from near the base of the abdomen to the apex. Frontovertex, face, and part of the cheeks ferrugino-testaceous with fuscous suffusions on the latter. Antennae testaceous. (South Africa)----49. **nigritus**, new species.
60. Frontovertex, face, and cheeks brownish or blackish. Antennae fuscous. A robust species of large size with thick legs. Hind tibiae furnished with a row of coarse, suberect black setae on the dorsal margin. (Dahomey, Cotonou)----50. **modestus** Silvestri.
(Union of South Africa)----51. **modestus** var. **capensis**, new variety
61. Thorax entirely black, or predominantly black, at most only touched with yellow in parts----62
Head, dorsum of thorax except metanotum and propodeum, basal abdominal segments ferruginous to yellow. Metanotum and propodeum black. Abdomen mostly black, yellow basally. (Africa)----52. **nubes** Compere.
62. Abdomen black with a conspicuous yellow spot on either side at base----63
Abdomen entirely black. Thorax black except the extreme apex of scutellum and median part of metanotum which are yellow. Hind femora pale yellow in striking contrast. (Africa)----53. **saintebeauvei** Girault.
63. Fore and middle legs entirely pale yellow----64
Fore and middle legs plainly partly blackish. A robust species. Head and antennae mostly, if not entirely, yellow. Thorax mostly black, tegulae, and median part of metanotum yellow. All coxae mostly, if not entirely, black. All trochanters more or less yellow. Fore and middle femora black with yellow ends. Hind femora entirely black. Fore tibiae mostly,

[22] I have not seen this species. It is placed in the key on the basis of the original description.

if not entirely yellow. Middle and hind tibiae black, the latter pale or yellow at ends. All club joints plainly wider than long. (Africa.)

54. **spectabilis**, new species.

64. Differs from the foregoing species principally by the different coloration of the legs. Coxae and trochanters of hind legs yellow in sharp contrast to the blackish coloration of the femora and tibiae. (Africa.)

55. **speciosus**, new species.

65. Abdomen pointed at the apex; seventh tergite long; ovipositor sheaths plainly exserted. Antennal club about as long as the first funicle joint; first two club joints plainly wider than long. First funicle joint about twice as long as wide and provided with three whorls of sensoria. Pedicel slightly longer than wide. Submarginal vein about two-thirds as long the marginal vein. Knees of middle legs with conspicuous, coarse black setae. Dorsal margin of hind tibiae with a row of suberect, strong setae and the paired setae at apex subequal in length ---------- 66

Without the above combination of characters ---------- 69

66. Hind coxae black ---------- 67

Hind coxae and trochanters pale yellow in contrast to the completely black femora and partially black tibiae; tibiae mostly black, pale yellow apically. Fore and middle legs predominantly, if not entirely, pale yellow. Mesoscutum and scutellum mostly yellow or ferrugino-testaceous, the sides of the former blackish. Median part of metanotum pale, the sides blackish. Head yellow except the upper half of the occiput which is blackish. (Africa) ---------- 56. **princeps** Silvestri.

67. Fore and middle femora and tibiae entirely lemon yellow ---------- 68

Extremely variable in coloration. Hind tibiae black, only the apex yellow. Hind coxae black in contrast to the femora which are predominantly yellow. Femora and tibiae of fore and middle legs usually yellowish with variable fuscous markings. Head and thorax ranging from bright orange yellow to black with innumerable intermediates. In the predominantly black forms usually traces of yellowish can be detected on some of the notal sclerites of the thorax. Intermediates occur having some thoracic sclerites yellow and others black. Abdomen black. (Africa.)

57. **malthusi** Girault.

68. Legs bright yellow except the hind coxae which are blackish and a fuscous suffusion at base of hind tibiae. Head, thorax, and antennae pale orange to yellow, only occasionally slightly marked with blackish. Structurally similar to *C. princeps* Silvestri and *C. malthusi* Girault. (Africa.)

58. **clavellatus**, new species.

69. Species agreeing with the combination of characters given in the first part of couplet 65 except that the first club joint is a trifle longer than wide and the club slightly longer than the first funicle joint. Large species with pale hind coxae in contrast to the blackish coloration ---------- 70

Otherwise ---------- 72

70. Propodeum entirely black ---------- 71

Legs black except the hind coxae and trochanters and all tarsi which are yellow to testaceous. Head and body black except the apex of the scutellum and more or less of the metanotum and propodeum which are orange to yellow. The largest species seen ranging near 2.5 mm. in length. (California) ---------- 59. **albicoxa** Howard.

71. According to Gahan extremely like the foregoing species but differs by having the propodeum entirely black, the frons and face brownish

yellow, vertex similarly colored but darker, occiput, temples, and cheeks black, apical one-fourth of scutellum yellow. (Mexico).
60. **mexicanus** Girault.

72. Body entirely black or dark brown---73
Body particolored---79
73. Hind tibiae marked with blackish or entirely black---74
Hind and middle tibiae yellow to whitish. All femora mostly black to dark brown. (Italy)---61. **niger** Masi.
(Mexico)---62. **mexicensis** Girault.[23]
74. Middle tibiae predominantly black or dark brown---76
Middle tibiae entirely pale yellow or whitish---75
75. All femora predominantly black or dark brown, the apices pale. (Japan)---63. **yoshidae** Nakayama.
All femora pale yellow to whitish. (New York)---64. **gossypariae** Gahan.
76. Paired bristles at apex of scutellum plainly less than one and one-half times as long as the scutellum---77
Paired bristles at apex of scutellum one and one-half times as long as the scutellum. Head predominantly dark. Legs entirely blackish brown, only the tarsi obscurely pale. Marginal vein nearly twice as long as the submarginal vein. Scutellum about one and one-half times as wide as long. (India)---65. **acanthosceles** Waterston.
77. Second and third funicle joints plainly longer than wide---78
Second and third funicle joints plainly wider than long. Head and antennae yellow. (Africa)---66. **robustus**, new species.
78. Head and antennae fuscous. Legs mostly blackish brown; fore tibiae pale; middle and hind femora pale at ends. Marginal vein slightly longer than the submarginal vein. (Africa)---67. **quaestor** Girault.
79. Body, exclusive of scutellum, marked with yellow, alutaceous or whitish---83
Body entirely black except for the scutellum which is more or less extensively yellow or orange---80
80. Hind femora mostly, if not entirely, blackish or dark brown. Head blackish or dark brown. Scutellum extensively marked with yellowish---81
Legs mostly whitish, only the hind tibiae blackish, the apex pale. Head mostly lemon yellow; occiput above and ocellar area blackish. Apical curvature of scutellum very narrowly margined with yellow. (Panama)---68. **saissetiae** Gahan.
81. Fore coxae black---82
Fore coxae yellow; middle and hind coxae and hind femora black, remainder of legs yellow. (Europe, Africa, Australia, California).
69. **scutellaris** (Dalman).
82. Similar to the foregoing species except that all the coxae are black. (Japan)---70. **ishii**, new species.
83. Scutellum particolored, or yellow, or ferruginous, or black with a pale blotch on either side---86
Scutellum entirely black or brownish---84
84. Mesoscutum uniformly black or brownish---85
Mesoscutum particolored, a broad band of yellow or orange extending from tegula to tegula including most of axillae and posterior part of mesoscutum; remainder of thorax and the abdomen black. (California.)
71. **scutatus** Howard.

[23] I have not seen *C. niger* Masi. *C. mexicensis* Girault is in agreement with Masi's description so that it may prove to be a synonym.

85. Propodeum pale or yellow, remainder of thorax and head entirely dark brown or blackish. A moderately small species without any striking characters. (Washington, D. C.)_____72. **immaculatus** Howard.

86. Mesoscutum particolored, or yellow, or alutaceous or ferruginous_____89

Mesoscutum entirely black or brownish_____87

87. Coxae of middle and hind legs black. (Fore legs not seen)_____88

Legs, head, and antennae entirely yellow. Parapsides and axillae mostly yellow. Pronotum, mesoscutum, and abdomen entirely black; median part of propodeum black; remainder of body mostly pale yellow. (France)_____73. **pulcheilus** Westwood.

88. Legs yellow except for the middle and hind coxae which are black. (Fore legs missing on specimen studied.) Face and cheeks blackish to dark brown. Pronotum, mesoscutum, axillae, and abdomen black. Parapsides and tegulae suffused with brownish. Scutellum with the anterior part black or entirely orange yellow. Metanotum and propodeum mostly yellow. (Italy)_____74. **howardi** Masi.

89. Apex of scutellum furnished with small setae in addition to a pair of bristles as long as the scutellum_____90

Disk of scutellum about as setose as the mesoscutum, the sides and apex bare except for the paired bristles. Orange yellow with the following parts black: center of occiput, pronotum, anterior margin of mesoscutum, a spot on the expanded part and the wedge-shaped base of each parapsis, metanotum except the median part, abdomen except the basal angles and posterior to the cercal plates. Sternites mostly yellow. According to Girault, antennal scape yellow, remainder black. (Africa.)

75. **nigropleurum** Girault.

90. Lemon yellow marked with dark brown or fuscous as follows: exposed part of pronotum, anterior one-half or so of mesoscutum arcuately, sides of metanotum, center of propodeum between the longitudinal carinae, petiole, and abdomen. Legs entirely pale yellow. (China.)

76. **silvestrii**, new species.

DESCRIPTIONS OF SPECIES

1. COCCOPHAGUS REDINI Girault

Plate 7, Figure 15; Plate 12, Figure 138

Coccophagus redini GIRAULT, Homo Perniciosus and New Hymenoptera. (Chalcidoidea, Braconidae). Brisbane, Australia, April 1924, p. 4. (Author's publication.)

The type female has been crushed beneath the cover glass (fig. 138). Cracks in the cover glass and excess balsam obscure parts to some extent. This species should be recognized without any difficulty by the unusually long first funicle joint and by the axillae which are as densely setose as the mesoscutum.

Female.—Face and cheeks light lemon yellow, dorsum of head more brownish. Thorax yellow except the pronotum, which is entirely black, and the propodeum, which is blackish laterally. Abdomen entirely blackish. Legs pale yellow. Parts of antennae missing in the type; apparently pedicel and first two or three funicle joints fuscous; scape supposedly concolorous with face; club yellowish. The coloration of antennae is difficult to observe.

Scape obscured by cracks and dirt in the balsam; pedicel about one and one-third times as long as wide and very much shorter than the first funicle joint; first funicle joint about four times as long as wide and more than twice as long as the pedicel; second funicle joint twice as long as wide and about two-thirds as long as the first funicle joint; third funicle joint shortest, one and one-half times as long as wide and about three-fourths as long as the second funicle joint. All funicle joints very slightly increase in width distad. Club joints combined not quite as long as the first and second funicle joints combined, and very slightly decreasing in length distad; club slightly wider than the funicle (fig. 15).

Mesoscutum rather densely clothed with short black setae. Each parapsis with about nine setae as strong or slightly stronger than those on the mesocutum. The exact position of the setae as shown in Figure 138 may not be accurate. Axillae with setae like those of the mesoscutum. Scutellum with three pairs of bristles, anterior pair the smallest and not so widely spaced as the center pair; center pair intermediate in size; apical pair on posterior margin and placed slightly further apart than the center pair. (One apical seta is missing and the other broken.) Propodeum with a few small setae in proximity to the spiracles (fig. 138).

Thorax crushed and flattened. Scuto-axillar sutures slightly longer than the scuto-scutellar suture. Possibly as a result of crushing, the scutellum is distinctly wider than long. Metanotum and propodeum without visible sculpture.

Mandibles with a ventral tooth and a broad truncation.

Wings clear hyaline, clothed with rather coarse cilia. Marginal vein almost imperceptibly longer than the submarginal vein. Stigmal vein and postmarginal vein apparently not unlike those of *C. perhispidis* Girault; the outline is two indistinct to be drawn with a camera lucida and the shape can not be accurately determined.

Basitarsus of the middle legs almost as long as the following joints combined; tibial spur as long as the basitarsus.

Ovipositor sheaths shortly exserted but this may be due to distortion.

Measurements in mm.: Thorax 0.6 long. Abdomen 0.54 long. Scutellum 0.18 long by 0.24 wide. Pedicel 0.0560 long by 0.376 wide. First funicle joint 0.1424 long by 0.0360 wide; second 0.0896 long by 0.04 wide; third 0.0712 long by 0.0456 wide. First club joint 0.0680 long by 0.0520 wide; second 0.0672 long by 0.0528 wide; third 0.0640 long by 0.0416 wide. Fore wings 0.98 long. Marginal vein 0.32 long; submarginal 0.30 long. Longest marginal fringe 0.0216.

Redescribed from type female in the Brisbane Museum. No data on slide other than name and designation female type.

2. COCCOPHAGUS LEPIDUS, new species

Plate 7, Figure 16; Plate 14, Figure 186

This species is conspicuously colored, maculated in a way suggestive of *Marietta*. It differs from the type species probably more than any other form included in this revision. The particolored antennae are unusually long. The stigmal vein is abnormally enlarged. Fore wings with a conspicuous large area of hyaline cilia posteriorly, opposite the junction of the marginal and submarginal veins. The ovipositor seems to differ from that of typical *Coccophagus*.

Female.—Frontovertex orange; face and cheeks iridescent, pearly white with a conspicuous black stripe extending from side to side across the clypeus. Coloration of the antennae variable. The majority of specimens have the scape pearly white with a black spot ventrally on the apical third, and a median brownish blotch on the sides and dorsum. Pedicel and first funicle joint brown with testaceous suffusions. Second and third funicle joints testaceous in contrast to the black club. Eyes and ocelli reddish. Exposed sides of pronotum iridescent, pearly white with a black spot on either corner; concealed part blackish. Mesoscutum, parapsides, axillae, scutellum, and sides of metanotum mostly orange yellow; sometimes sides of mesoscutum narrowly edged with iridescent pearly white; parapsides with a small pearly white spot marking the posterior border on the expanded part. Median part of metanotum and sometimes median part of propodeum iridescent pearly white, remainder of propodeum blackish. Abdomen mostly blackish, the dorsum with a broad, conspicuous, white band across the base. The following sternal and pleural parts appear iridescent pearly white: proepisternum, either side of prepectus, and a spot on either end of episternum. Sides of abdomen towards base and extreme apex yellow, when viewed ventrally. Legs iridescent, pearly white to pallid with all joints spotted or banded with fuscous. Apical two tarsal joints of middle and hind legs fuscous. All tarsi of fore legs fuscous.

Pedicel slightly but appreciably shorter than the first funicle joint. Unless actually measured, all funicle joints appear subequal. By actual measurement, the second joint is a trifle longer than the first or third which are of equal length. Each funicle joint about one and three-fourths times as long as wide. Club elongate, as long as the first, second, and one-half of the third funicle joints combined; all joints plainly longer than wide (fig. 16).

Mandibles shown in Figure 186.

Fore wings hyaline except for a small infuscated area beneath the stigma; on the basal third beneath the junction of the submarginal and marginal veins occurs an area of fine, hyaline cilia contrasting with the short coarse dense cilia of the disk. Marginal fringe moderately long, 0.0252 mm. Submarginal a trifle longer than the marginal vein, the difference hardly appreciable. Stigmal vein greatly enlarged at apex.

Scutellum large, slightly wider than long (15:13), about as long as the mesoscutum. Median part of metanotum prominent. Abdomen longer than wide, pointed at apex.

Frontovertex with numerous brown, fine, comparatively long setae. Setae of mesoscutum, except the posterior pair, only slightly stronger than the setae on the frontovertex; the lateral posterior pair much stronger. Each parapsis with three setae, the median one slightly the largest. Each axilla with two strong setae, the posterior one the strongest. Scutellum with three pairs of strong, brownish setae, the apical pair not much stronger than the median pair. Setae of the fourth tergite not forming a row across the dorsum as usual; six setae in transverse alignment across the sixth tergite; scattered setae on the seventh; sides of second, third, and fourth with the lateral setae in irregular transverse alignment.

Measurements in mm.: Head and body 1.20. Scape 0.16 long. Pedicel 0.0520 long by 0.0352 wide. First funicle joint 0.0704 long by 0.0416 wide; second 0.0776 long by 0.0416 wide; third 0.0704 long by 0.0424 wide. First club joint 0.0624 long by 0.0480 wide; second 0.0560 long by 0.0464 wide; third 0.0584 long by 0.0376 wide.

Male.—Coloration of legs and head somewhat like that of female. Antennae ferrugino-testaceous, the scape pale. Mesoscutum with the anterior half occupied by a V-shaped blackish area. Axillae mostly blackish. Disk of scutellum fusco-testaceous, the lateral and apical margins paler. Propodeum and abdomen black. Parapsides orange with a faint central fuscous blotch.

Pedicel small, about two-thirds as wide and less than one-half as long as the first funicle joint. Club not differentiated from the funicle, the joints subequal except the apical one which is obviously smaller; sensoria numerous and extending the entire length of the segments.

Length of head and body 1.20 mm.

Type.—Cat. No. 42089, U.S.N.M.

Described from seven females, six males (holotype, allotype, and paratypes), collected by E. W. Rust at Signal Hill, Cape Town, South Africa, December, 1924, and January, 1925, and bearing. Rust's numbers M–4 and M–5. Questionably parasitic on *Baccacoccus* sp.

3. COCCOPHAGUS FLAVIFRONS Howard

Plate 7, Figure 17; Plate 11, Figure 99

Coccophagus flavifrons Howard, U. S. Dept. Agr. Bur. Ent. Bull. 5, 1885, p. 25.
Coccophagus koebelei Howard, U. S. Dept. Agr. Bur. Ent. Bull. 5, 1885, p. 25.
Coccophagus flavifrons Howard, U. S. Dept. Agr. Div. Ent. Tech. Ser. No. 1, 1895, p. 36.—Mercet, Trab. Mus. Cienc. Nat. No. 10, 1912, p. 228.

A rather distinctive species, predominantly black except for the face and cheeks which are mostly yellow.

Female.—Body black except for the parapsides and tegulae which are suffused with brownish. Frontovertex ferrugino-testaceous and blackish, the latter color predominant; face and cheeks mostly yellow.

Scape yellow, flagellum dark brown. Hind tibiae mostly blackish, paler at the apices, remainder of the legs yellow with faint brownish suffusions.

Pedicel plainly longer than wide and shorter than the first funicle joint. First funicle joint longest, the following successively shorter; all slightly increasing in width distad. First club joint subequal in length to the third funicle joint and a trifle longer than either of the following club joints (fig. 17). The figure of the antenna may not be quite accurate since the funicle and the club of the specimen studied were partly shriveled.

Much of the thorax of the specimen studied is obscured by glue, but apparently the scutellum is slightly wider than long and about as long as the mesoscutum.

Setae of the mesoscutum more or less regularly longitudinally arranged and slightly paler than the integument. Each parapsis with three or four setae. Only a portion of the scutellum visible but presumably provided with three pairs of bristles.

Fore wings hyaline, densely and closely ciliated. Marginal fringe short. Submarginal vein a trifle longer than the marginal; postmarginal shortly produced and shown with stigmal vein in figure 99.

Measurements in mm.: Length of head and body 1.0. Scape 0.1344 long by 0.0344 wide. Pedicel 0.0488 long by 0.0336 wide. First funicle joint 0.0640 long by 0.0384 wide. Beyond the first the funicle joints are shriveled so that the exact widths can not be measured; the lengths of these joints are 0.0536, 0.0496, 0.0496, 0.0448, 0.0456. Fore wings 0.82 long by 0.40 wide. Marginal vein 0.21 long; submarginal 0.24 long. Longest marginal fringe 0.0320.

Male.—Mostly black, tegulae and parapsides slightly brownish. Median part of metanotum yellowish. Mesopleura somewhat brownish. Face and cheeks in proximity to the mouth testaceous. Antennae yellow or testaceous; sensoria fuscous. All femora more or less fuscous, the ends pale. Hind tibia faintly fuscous toward the base.

Redescribed from one female and one male in the United States National Museum determined by Gahan as *C. flavifrons* Howard. Reared from *Toumeyella liriodendri* (Gemelin), Prince Georges County, Md., June 16, 1911, Gahan, Coll.

4. COCCOPHAGUS ANTHRACINUS Compere

Plate 7, Figure 18; Plate 11, Figure 128; Plate 13, Figures 159, 164; Plate 14, Figure 168.

Coccophagus anthracinus COMPERE, Univ. Calif. Publ. Ent., vol. 2, No. 3, 1925, pp. 309–11; Univ. Calif. Publ. Ent. vol. 4, No. 1, 1926, p. 11.

This species can be separated from the majority of *Coccophagus* species by the completely black body, hyaline wings, and three pairs of bristles on the scutellum. It is most likely to be confused with *C. atratus* Compere and *C. timberlakei*, new species. The Rust collection includes a good series of *C. anthracinus* of both sexes. The supposed male of this species was described from two specimens collected in a breeding cage in association with female *C. anthracinus* with which they were attempting to mate. These males are not in agreement with the males associated with *C. anthracinus* in the Rust collection. Since it has been observed that male *Coccophagus* of one species often attempt to mate with females of a different species, it is not safe to conclude that the two sexes are correctly associated just because of their intimate contact. It is more likely that Rust's specimens are correctly associated and that the male previously described as *C. anthracinus* is another species.

Female.—Body usually entirely black to dark brown in parts, in certain lights with metallic reflections. Coloration of the head variable; light colored variants with the face, cheeks, and antennae yellow or orange with occasional traces of fuscous; at the other extreme these parts may be entirely black or dark brown. Frontovertex usually more or less blackish, except the triangular dorso-lateral angles, occipital margin, and ocellar lines which are orange or yellow. Legs predominantly black to brown with pale markings as follows: apices of all femora, the tibiae with variations ranging from pallid with a faint suffusion of brownish to predominantly brown with only the apices rather broadly pallid. Tarsi usually pallid, the apical joints dusky. Generally the hind tibiae are plainly darker than the fore and middle tibiae.

Pedicel not quite one and one-third times as long as wide and plainly shorter than the first funicle joint. First funicle joint longest, not quite one and one-half times so long as wide; second and third subequal in length, each slightly shorter than the first; all almost imperceptibly increase in width distad so that the third is almost as wide as long. First club joint a trifle longer and wider

than the third funicle joint; second and third successively smaller (fig. 18).

Scutellum a trifle wider than long and as long as the mesoscutum. Abdomen, after shrinkage, about as long and as wide as the thorax. Ovipositor concealed.

Fore wings hyaline, densely and finely ciliated with a short fringe; a rounded spot bare of cilia on the posterior basal part. Marginal vein a trifle shorter than the submarginal, the difference only 0.02 mm. and hardly appreciable. In the original description it was said that the marginal vein was longest; this was because of the inclusion of the basal downward bend as a part of the marginal instead of the terminal part of the submarginal vein. Postmarginal vein shortly produced (fig. 128).

Basitarsus of middle legs as long as the succeeding three joints united; tibial spur slightly shorter than the basitarsus.

Antennae clothed with numerous fine, pale setae. Mesoscutum with numerous, short, black setae. Scutellum with the apical bristles longest, the median pair most widely spaced. Each parapsis with four setae. Propodeum with a few, fine setae laterad of the spiracles. Fifth and sixth tergites with a row of setae extending across the dorsum, the rows interrupted on the preceding three tergites and absent on the first; seventh tergite with longer scattered setae.

Mesoscutum rather coarsely reticulated, scutellum not so strongly sculptured. Metanotum with a strong transverse lineolation on either side. Propodeum with two, strong, sublateral carinae. First abdominal tergite and part of the second smooth and shining. Tergites from three to six about as coarsely sculptured as the mesoscutum.

Measurements in mm.: Length of average sized specimen 1.2. Pedicel 0.0536 long by 0.0416 wide. First funicle joint 0.0736 long by 0.0496 wide; second 0.06 long by 0.0552 wide; third 0.06 long by 0.0568 wide. First club joint 0.0624 long by 0.0608 wide; second 0.0480 long by 0.0576 wide; third 0.0416 long by 0.04 wide. Marginal vein 0.26 long; submarginal 0.28 long.

Male.—Except for the usual sexual differences, the males are quite similar to the females. All tibiae predominantly dark brown, the apices pale. Expanded part of parapsides usually faintly suffused with testaceous.

Redescribed from paratypes and many additional specimens in the Rust collection as follows: 15 females and 2 males reared from *Pulvinaria mesembrianthemi* (Vallot), Rosebank, Cape Town, 1923, 1925; 8 females and 4 males reared from *Baccacoccus* species, Signal Hill, Cape Town, 1924; 8 females reared from *Saissetia oleae*

(Bernard), Greenpoint, Rosebank and Mobray, Cape Town, South Africa, 1919, 1924. Rust's numbers M, M–2, and G.

Large colonies of *C. anthracinus* Compere were repeatedly liberated in a number of black scale infested districts of California but so far as we know, the species failed to become established.

5. COCCOPHAGUS TIMBERLAKEI, new species

Plate 7, Figure 19; Plate 11, Figure 124

This species closely resembles *C. anthracinus* Compere and *C. atratus* Compere; in size and coloration it most closely resembles the latter but in antennal and venational characters it is most like *C. anthracinus*. It does not have the distinctive, microscopic markings on the fifth and sixth tergites characteristic of *C. atratus* and the setae of the middle knees are weakly developed unlike those of *C. anthracinus*. In some specimens, this species has a few supernumerary setae on the scutellum in addition to the three pairs of bristles.

Female.—General color black, occasionally with some brownish on the sclerites at the base of fore wings. Antennae brownish black. Coxae of all legs blackish, sometimes with brownish beneath. Trochanters of all legs brownish. Femora of all legs black, distinctly tipped at ends with testaceous or pure yellow, middle pair with an annulus at base. Tibiae of fore legs testaceous suffused with fuscous; those of middle and hind legs black tipped at ends with testaceous. Tarsi of all legs testaceous, more fuscous at apices.

Pedicel somewhat more than one and one-half times as long as wide and slightly shorter than the first funicle joint. First funicle joint slightly the longest, a trifle more than one and one-half times as long as wide; second and third subequal, each a trifle shorter and wider, the difference hardly appreciable with measurements. First club joint slightly wider than long and slightly wider than the third funicle joint; second slightly wider than long and slightly smaller than first club joint; third about as long as the second but much narrower, rounded at apex (fig. 19).

Mandibles with an acute ventral tooth and a broad, slightly concave, dorsal truncation.

Fore wings hyaline. Submarginal vein a trifle longer than the marginal; postmarginal produced as far distad as the stigmal; stigmal as shown in Figure 124. At the base of wing, parallel to the posterior margin, occurs an elongated hairless area which is separated by two rows of cilia from a rounded bare spot. Disk of wing moderately densely ciliated, cilia of moderate size. Marginal fringe short.

Scutellum slightly wider than long (6:5) and about as long as the mesoscutum. Abdomen short, about as wide as long. As seen through the abdominal walls in balsam-mounted specimens, the ovipositor arises near the middle, not exserted.

Basitarsus of middle legs about as long as the four succeeding joints united; tibial spur shorter than the basitarsus. Hind tibial spurs unequal.

Mesoscutum densely setose. Scutellum usually with two or three small setae, similar in size to those of mesoscutum, scattered near the anterior pair of bristles. Each parapsis with four or five setae.

Measurements in mm.: Length of head and body, 1.0. Scape, 0.1488 long by 0.0360 wide. Pedicel, 0.0640 long by 0.0384 wide. First funicle joint, 0.0760 long by 0.0496 wide; second, 0.0656 long by 0.0560 wide; third, 0.0624 long by 0.0640 wide. First club joint, 0.0640 long by 0.0688 wide; second, 0.0576 long by 0.0664 wide; third, 0.0616 long by 0.0432 wide. Marginal vein, 0.25 long; submarginal, 0.31 long.

Type.—Cat No. 42093, U.S.N.M.

Described from 14 females (holotype and paratypes) from collection of P. H. Timberlake with the following data on labels: "Bred from *Pulvinaria bigeloviae* Ckll., collected at Murray Utah, June 7, 1914, by Timberlake; U. S. D. A. No. 14709E."

6. COCCOPHAGUS ATRATUS Compere

Plate 7, Figure 20; Plate 11, Figure 104; Plate 13, Figure 166; Plate 14, Figure 167

Coccophagus atratus COMPERE, Univ. Calif. Publ. Ent., vol. 4, Aug. 18, 1926, pp. 2–4.

A single male designated allotype taken in association with the series of type females, led to the recognition of this form as a species distinct from *C. anthracinus* Compere, for the males associated with the latter were quite different. It is now thought that the males associated with *C. anthracinus* belong to another species although they were paired with females. It is believed, however, that *C. atratus* is a distinct species even though the males of the two forms are not greatly unlike as first supposed.

In addition to the characters given in the original description that supposedly separated the females of *C. atratus* from *C. anthracinus* attention is called to the difference in venation as shown in the figures of the stigmal and postmarginal veins (fig. 104). Also, in this species the sixth tergite in proximity to the abdominal spiracles and a more extensive area on the fifth tergite is marked as shown in Figure 166. In *C. anthracinus* and *C. timberlakei* these peculiar marks are not evident.

7. COCCOPHAGUS RUSTI Compere

Plate 6, Figure 13; Plate 7, Figure 21; Plate 10, Figure 75; Plate 11, Figure 112; Plate 14, Figure 174

Coccophagus rusti COMPERE, Univ. Calif. Publ. Ent., vol. 4, No. 9, 1928, pp. 261–62, fig. 12.

This is a distinctive species, fore wings generally infuscated beneath the marginal vein; in tag-mounted specimens, the abdomen shrinks in a characteristic manner, appearing plainly smaller than the thorax, spatulate in shape; also, in tag mounts the thorax appears wider than usual. The coloration is also distinctive.

Female.—In general, head, mesoscutum, and parapsides ferruginotestaceous. Axillae and scutellum dark brown or testaceous with some fuscous. Metanotum medially and entire propodeum light yellow; sides of metanotum light yellow. Mesopleura blackish brown. Abdomen entirely blackish. Frontovertex ferrugino-testaceous; face more brownish, deepening to fuscous under the eyes. Scape concolorous with the face, remainder of antennae blackish. Hind coxae, trochanters, and femora light yellow, concolorous with propodeum; tibiae suffused with fuscous basally. Middle coxae mostly blackish; trochanters, femora, and tibiae brownish touched in parts with fuscous. Fore legs similar to the middle legs except that the coxae are not so dark. All tarsi brownish.

Pedicel somewhat more than one-half as long as the first funicle joint, almost one and one-half times as long as wide. First funicle joint plainly the longest, slightly more than twice as long as wide; second and third successively decreasing in length and increasing in width so that the third is only slightly longer than wide. First club joint a trifle shorter and wider than the third funicle joint; succeeding club joints slightly decreasing in size distad; third almost one and one-half times as long as wide (fig. 21).

Mandibles shown in Figure 174.

Fore wings rather extensively infuscated beneath the marginal vein with a diagonal pale streak extending from the base of marginal vein downward and outward to near the posterior margin opposite the end of the marginal vein (fig. 75). Cilia of disk, dense, short; noticeably coarser under marginal vein. Marginal fringe short. Marginal vein plainly longer than submarginal; postmarginal shortly produced; stigmal as shown in Figure 112.

Scutellum wider than long (7:6), not quite so long as the mesoscutum. In tag mounts after shrinkage, the thorax from tegula to tegula is apparently unusually wide, especially in proportion to the abdomen. After shrinkage the abdomen appears narrower than the thorax and not quite as long; about one and one-fourth times as long as wide. Figure 13 is more or less diagrammatic and does not give

an accurate picture of the abdomen after shrinkage. Seventh tergite short, strongly transverse. Ovipositor not exserted.

Frontovertex with scattered, rather coarse, short black setae, those on face and cheeks much finer. Eyes microscopically pubescent. Mesoscutum with numerous rather coarse, short, black setae. Each parapsis with four, strong, black setae. Middle tibiae at base with five strong, black setae, apex of femora with a strong seta beneath.

Measurements in mm.: Length of average sized specimen 1.3. Scape 0.20 long by 0.0392 wide. Pedicel 0.0664 long by 0.0408 wide. First funicle joint 0.1184 long by 0.0592 wide; second 0.0880 long by 0.0656 wide; third 0.0824 long by 0.0736 wide. First club joint 0.0776 long by 0.0760 wide; second 0.0760 long by 0.0704 wide; third 0.0696 long by 0.0480 wide. Marginal vein 0.40 long; submarginal 34 long.

Redescribed from type specimens. This species was reared by Rust, October 21, 1925, from *Saissetia oleae* (Bernard) infesting *Chaetachme aristata*, "Unkawoti trees," at Durban, Natal, South Africa, and from the same host collected at Pretoria, Transvaal September 1, 1919.

8. COCCOPHAGUS FLAVESCENS Howard

Plate 7, Figure 22; Plate 11, Figure 135

Coccophagus flavescens HOWARD, Proc. U. S. Nat. Mus., vol. 18, 1896, p. 634.—MERCET, Trab. Mus. Cienc. Nat. No. 10, 1912, pp. 227–28.

An elongated species; the habitus somewhat different from most species but this may be due to shriveling. Predominantly yellow with dark markings. Fore wings generally infuscated.

Female.—General color yellow, marked as follows: Center of pronotum blackish; sides of propodeum tinged with fuscous; dorsum of abdomen on apical three-fourths brown, setae of thorax dusky. Antennae yellow, sensoria fuscous. Legs yellow.

Antennae unusually long. Pedicel almost twice as long as wide but shorter than the first funicle joint. First funicle joint longest, almost three times as long as wide; second and third successively shorter, the latter not quite twice as long as wide. Club well separated from the funicle, the basal joint almost as long and plainly wider than the preceding funicle joint. By actual measurement the second club joint a trifle the shortest, but to the eye the club joints appear of about equal length (fig. 22).

Scutellum plainly wider than long but not strongly transverse. Mesoscutum apparently comparatively short, not much if any longer than the scutellum. Abdomen almost twice as long as wide and longer than the thorax.

Mesoscutum moderately setose. Each axilla with two rather strong, black setae; each parapsis with three or four similar setae.

Fore wings slightly but plainly infuscated and finely and densely ciliated. Marginal vein longer than the submarginal; stigmal shown in Figure 135.

Measurements in mm.: Length 1.10. Scape 0.1480 long by 0.0312 wide. Pedicel 0.0520 long by 0.0280 wide. First funicle joint 0.0712 long by 0.0296 wide; second 0.0648 long by 0.0296 wide; third 0.0584 long by 0.0368 wide. First club joint 0.0560 long by 0.0440 wide; second 0.0488 long by 0.0424 wide; third 0.0520 long by 0.0360 wide. Fore wings 0.84 long by 0.38 wide. Marginal vein 0.31 long; submarginal 0.25 long.

Male.—Unlike the female in coloration and structure. Head and body black, lateral and ventral parts faintly brownish. Scape pale yellow in contrast to the brownish pedicel; flagellum appearing blackish due to the numerous sensoria. Apex of fore and middle femora pale and the latter with an annulus at base. Fore tibiae mostly dirty white; middle tibiae dirty white on apical one-third. So far as can be seen all tarsi whitish.

Antennae unlike that of the female. Pedicel short, about as long as wide and much shorter than the first funicle joint. Funicle joints all slightly increase in width and probably slightly decrease in length distad, but to the eye they appear subequal in length. First funicle joint probably a trifle more than one and one-half times as long as wide; third probably a trifle less than one and one-half times as long as wide. Club slightly wider than the funicle. The male antenna is quite different from that of the female yet it is not unlike the antennae of many different species.

Habitus of the male unlike that of the female; thorax longer and abdomen much smaller; vestiture also different and the mesothorax is finely reticulated. Mesoscutum longer than scutellum and rather sparsely setose, there being only two setae on the posterior margin. Scutellum proportionately longer than that of the female, by measurement about as long as wide, but to the eye appearing longer than wide. Scutellum with three pairs of bristles in longitudinal alignment, apical pair the longest.

Fore wings crumpled and glued over the abdomen and not suitable for study.

Length 0.9 mm.

Redescribed from one female and one male (cotypes), U.S.N.M. No. 3249. Labeled "par. on *Lecanium coffeae*, Punduloya, Ceylon, E. E. Green" (?).[24]

[24] *Lecanium coffeae* Signoret is given as a synonym of *Saissetia hemisphaerica* (Targioni) in Fernald's catalogue.

9. COCCOPHAGUS PERHISPIDIS Girault

Plate 7, Figure 23; Plate 11, Figure 97

Coccophagus perhispidis GIRAULT, New Pests from Australia, III. Brisbane, Queensland, August 25, 1926. (Published by author.)

Girault's original description follows: "As *triguttatus* but only pronotum widely across middle and a mark behind insertion of the wings, black: Upper thorax with coarse black setae but axillae with only pair moderate bristles. Nelson, jungle."

Of the type, only the head, fragments of the legs, and a portion of the wings remain. The head is badly crushed and partly protruding under the edge of the cover glass in an excess of balsam.

The antennae are in fragments and partially obscured. The antenna shown in Figure 23 is in part hypothetical. Scape appears unusually wide but this may be due to crushing. Pedicel slightly longer than wide. First funicle joint longest, the following successively shorter; all of about the same width. Club about as long as the first and second funicle joints united and not much wider than the funicle. Funicle and club furnished with numerous sensoria that extend the entire length of the segments.

Fore wings with the disk densely and uniformly ciliated. Marginal fringe of average length. Postmarginal and stigmal veins as shown in Figure 97.

Mandibles almost edentate.

All fragments of the type remaining on slide light yellow.

Middle tibial spur just a trifle shorter than the basitarsus; basitarsus not quite as long as the succeeding joints united.

Measurements in mm.: Fore wing 0.36 wide. Marginal vein 0.28 long. Marginal fringe 0.0224 long. Five tarsal joints of the middle legs united 0.24; basitarsus 0.1080 long; tibial spur 0.0916 long. Scape 0.1240 long by 0.0496 wide. Pedicel 0.0464 long by 0.0416 wide. First funicle joint 0.0824 long by 0.0408 wide; second 0.0640 long by 0.0440 wide; third 0.0464 long by 0.0416 wide. First club joint 0.0472 long by 0.0496 wide; second 0.0432 long by 0.512 wide; third 0.0432 long by 0.0368 wide. The club of the second antenna, which remains on the slide, gave the following set of measurements: First club joint 0.0448 long by 0.0560 wide; second 0.0448 long by 0.0560 wide; third 0.424 long by 0.440 wide.

Redescribed from the fragments of the type female in the Queensland Museum. No data on slide other than name and designation type.

10. COCCOPHAGUS GURNEYI Compere

Plate 4, Figure 5; Plate 7, Figure 24

Cocophagus gurneyi COMPERE, Univ. Calif. Publ Ent., vol. 5, No. 1, 1929, pp. 1–3, 2 figures in text.

This distinctive species has recently been adequately described and figured. It is one of the few species parasitic on *Pseudococcus* spp. This species was introduced into California from Sydney, New South Wales, where it was discovered parasitizing *Pseudococcus gahani* Green and *Pseudococcus longispinus* (Targioni). It is now established in southern California and in the San Francisco Bay region.

11. COCCOPHAGUS TARONGAENSIS, new species

Plate 7, Figure 25; Plate 11, Figure 95; Plate 12, Figure 140; Plate 13, Figure 151; Plate 14, Figure 173

A medium sized, robust species, yellow and black, with sparse, very fine setae on the mesoscutum and three pairs of short, delicate setae on the scutellum. This species is closely allied to *C. leptospermi* Girault and is best separated from the latter by the finer, sparser setae of the mesoscutum, by a difference in the arrangement of the cilia at the base of the fore wings and by coloration.

Female.—Head predominantly yellow; ocellar area blotched with brown or black; in some specimens, upper part of scrobes brown or black; occiput on either side of foramen black or brown. Antennae yellow with brownish sensoria. Thorax predominantly yellow; collar of pronotum, anterior margin of mesoscutum, a rounded spot on either parapsis, most of axillae, anterior margin of scutellum, metanotum except median part, propodeum except lateral of spiracles, blackish. Abdomen mostly black above; sides of sixth tergite and seventh tergite except cercal plates, yellow. Venter of abdomen yellow. Legs yellow, the tibiae and tarsi obscurely brownish. Wing veins pale white.

Pedicel about one and one-half times as long as wide and only a trifle shorter than the first funicle joint. First funicle joint the longest, about twice as long as wide, plainly narrower than the succeeding joint; second about one and one-third times as long as wide, third about as wide as long and twice as wide as the first. Club as long as second and third and one-half of the first funicle joints (fig. 25).

Mandibles as shown in Figure 173.

Fore wings hyaline; cilia of disk fine and short, rather dense. A hairless streak from the base of the marginal vein projects obliquely basad and is separated from the basal hairless streak by five rows of cilia. Basal hairless streak well developed, its distal portion extending obliquely outward. Marginal fringe short. Mar-

ginal vein plainly shorter than the submarginal. Postmarginal vein distinct, shortly produced. Stigmal vein shown in figure 95.

Scutellum large, slightly wider than long (13:10) and as long as the mesoscutum. Ovipostor sheaths not reaching the apex of abdomen (fig. 140).

Scutellum furnished with three pairs of small setae comparable in size to those of the mesoscutum. Mesoscutum sparsely setose, the setae very small and inconspicuous. Small setae on sides of first four tergites; on the fifth and sixth tergites the setae form a complete row across the dorsum; seventh tergite with longer and paler setae at the apex.

Basitarsus of middle legs almost as long as the succeeding joints united; tibial spur about two-thirds as long as the basitarsus.

Length 1.1 mm.

Male.—Yellow and black to brown. Head colored like that of female. Pronotum blackish, the sides yellow. Mesoscutum on either side with a wide band of yellow, the disk occupied by a blackish V-shaped area. Parapsides with a rounded, dark blotch anteriorly, remainder yellow. Axillae entirely blackish. Meson of scutellum with a broad, longitudinal blackish blotch, which in some specimens is more or less V-shaped. Median part of metanotum pale yellow, remainder of metanotum and propodeum blackish. Abdomen blackish above; seventh tergite suffused with yellow. Sides and under parts of thorax and abdomen yellow. Legs yellow, tarsi of fore legs and apical joints of middle and hind legs fuscous. Wing veins pale white.

Antennae shown in Figure 151.

Type.—Cat. No. 42102, U.S.N.M.

Described from 10 females and 2 males (holotype, allotype, and paratypes) reared from *Inglisia* species, Taronga Zoological Park, Sydney, New South Wales, October 28, 1927, collected by H. Compere.

12. COCCOPHAGUS SIGNUS Girault

Plate 7, Figure 26; Plate 10, Figure 85; Plate 11, Figure 120

Coccophagus signus GIRAULT, Insecutor Inscitiae Menstruus, vol. 8, 1920, p. 45.

Girault's original description follows: "Like the robust purple species. Purple, wings clear, scutellum, postscutellum, scape, and legs save first two pairs, coxae, base of first femora, lemon. Mouth orange. Scutellum naked, with four setae in a rectangle (wider than long). Meringa, on a window, female."

The type female is fairly well preserved, the head detached from body. It is almost impossible to determine the original body color. So far as can be seen the legs are light yellow and the head and body brownish, or blackish in part suffused with yellow. It apparently belongs to the group of *Coccophagus* related to *C. rusti* Compere.

This is a medium sized species with a large scutellum furnished with three pairs of strong bristles. Mesoscutum with strong setae. Eyes distinctly hairy.

Mesoscutum and axillae rather coarsely reticulated. Metanotum with striae on sides. Propodeum with a strong sublateral carina on either side.

Pedicel plainly longer than wide and more than one-half as long as the first funicle joint. First funicle joint the longest, about twice as long as wide; succeeding two joints successively shorter; all almost imperceptibly increase in width distad; third about one and one-third times as long as wide. Club slightly wider than the funicle and not so long as the funicle joints united (fig. 26).

Fore wings probably slightly infuscated, at least under the veins. Disk of wing clothed with rather coarse and abundant cilia. Arrangement of cilia at base of fore wing shown in Figure 85. Marginal vein slightly longer than the submarginal. Detail of stigmal and postmarginal veins as shown in Figure 120. Postmarginal vein developed a trifle more than usual.

Abdomen small, shorter than the thorax. Ovipositor hardly exserted.

Basitarsus of middle legs about as long as the succeeding three joints united; tibial spur slightly shorter than the basitarsus.

Measurements in mm.; length of body, head excluded, 0.92. Abdomen 0.44 long. Scutellum 0.16 long by 0.2256 wide. Fore wings 0.76 long by 0.34 wide. Marginal vein 0.02696 long; submarginal 0.20 long. Marginal fringe 0.0160 long. Scape 0.1320 long by 0.03136 wide. Pedicel 0.0464 long by 0.0352 wide: First funicle joint 0.0744 long by 0.0368 wide; second 0.0640 long by 0.0424 wide; third 0.060 long by 0.0464 wide. First club joint 0.0560 long by 0.0480 wide; second 0.0464 long by 0.0464 wide; third 0.0496 long by 0.0384 wide. Five tarsal joints of middle legs united 0.28 long; basitarsus 0.1344 long; tibial spur 0.1008 long.

Redescribed from type female in the Queensland Museum. No data on slide other than name and "Queensland Museum." Not designated as type specimen on slide label.

13. COCCOPHAGUS MARIFORMIS, new species

Plate 7, Figure 27; Plate 11, Figure 114; Plate 13, Figure 148

The arrangement of the cilia on the basal part of the fore wing, the male-like character of the antennal sensoria, and the enlarged stigmal vein are good characters for the recognition of this species.

Female.—Head mostly orange yellow; face marked with iridescent pearly white; occiput blotched with fuscous. Antennae yellow; outer side of scape pearly white, the dorsal margin dusky. Thorax orange yellow except as follows: pronotum, anterior mar-

gin of mesoscutum, propodeum, proepisterna, ventral part of prepectus, mesosternum, and mesoepisterna varying from blackish to brownish. Median part of metanotum pale yellow. Axillae slightly brownish. Tegulae spotted with fuscous. Eyes and ocelli vermilion. Wing veins pale yellow. Abdomen black to brownish. Legs pale yellow except for the middle and hind coxae which are more or less suffused with blackish.

The antennae offer the best character for the recognition of this species. The funicle joints are articulated ventrally and the ventral part of each joint is produced further distad than the dorsal part. The sensoria are characteristic; on each funicle joint, in lateral view, five or more sensoria are visible extending the entire length of the joints on which they occur. In appearance the antennae is not unlike that of a male *Prococcophagus*. Scape slightly wider than usual, about four times as long as wide. Pedicel one and one-half times as long as wide, slightly but appreciably shorter than the first funicle joint. Funicle joints all subequal, slightly less than one and one-half times as long as wide. Club not markedly different from the funicle, hardly any wider and with similar sensoria (fig. 27).

The two females available for study are poorly mounted and a satisfactory view of the mandibles can not be had. Apparently mandibles sharply tridentate.

Fore wings hyaline; an oblique hairless streak cut off from the basal hairless streak by three rows of cilia; the oblique hairless streak continuous with the hairless streak beneath the marginal vein. Cilia of disk moderately coarse and sparse. Marginal fringe moderately long. Submarginal vein only a trifle longer than the marginal, the difference hardly appreciable without actual measurement. Postmarginal vein distinct, well developed, but not produced so far distad as the stigmal vein; stigmal vein with a slender neck and widely expanded knob (fig. 114).

Frontovertex with slender, scattered black setae. Mesoscutum with rather sparse, slender, black setae, those arranged along the lateral and posterior margins much longer. Each parapsis with three rather long, slender, black setae. The setae of the axillae are distinctive; anteriorly there are two setae about as long as those on the disk of the mesoscutum and posteriorly a much stronger setae comparable in length to the anterior pair of scutellar bristles. Scutellum with three pairs of long, slender bristles, the anterior pair a trifle closer together than the median and apical pairs that are in longitudinal alignment. The three pairs of scutellar bristles subequal in length, the apical pair thickest. Setae on the tergites rather long and slender; on the fifth, sixth, and seventh tergites arranged across the dorsum.

Basitarsus of middle legs about as long as the succeeding three joints united; tibial spur a trifle shorter than the basitarsus.

This species has several structural aberrations. The prominent median part of the metanotum is separated from the scutellum by a distance equal to its own length and is not contiguous to the scutellum as usual. The scutellum is slightly more rounded than usual; almost one and one-half times as long as wide (24:17 and plainly shorter than the mesoscutum. Abdomen rather slender toward the apex.

Length 1.3 mm.

Male.—Frontovertex orange yellow; face iridescent pearly white; cheeks yellow with a suffusion of brownish; occiput blackish. Pronotum blackish. Mesoscutum broadly brownish orange laterally and posteriorly, the center with V-shaped blackish area. Parapsides yellow, suffused with fuscous on the expanded part. Axillae black. Scutellum blackish brown with an irregular median longitudinal stripe that expands anteriorly and posteriorly. Tegulae yellow with a dusky suffusion. Median part of metanotum light lemon yellow. The following parts blackish: propodeum, abdomen, ventral and lateral parts of thorax. Hind coxae blackish, fore and middle coxae blackish at base, pale toward the apex. Apical tarsal joints of middle and hind legs fuscous, all fore tarsi slightly dusky, remainder of legs mostly light yellow.

Antenna as shown in Figure 148.

Length 1.3 mm.

Type.—Cat. No. 42095, U.S.N.M.

Described from two females and one male (holotype, allotype, and paratype) mounted in balsam and slightly pressed. Two females reared by E. W. Rust from *Baccacoccus* species collected at Signal Hill, Cape Town, South Africa, February 6, 7, 1925; male obtained from the same locality by Rust on February 10, 1925, but the slide label does not give a host. Rust's No. M–3.

14. COCCOPHAGUS EMERSONI Girault

Plate 11, Figure 116

Coccophagus emersoni GIRAULT, Insecutor Inscitiae Menstruus, vol. 5, 1917, pp. 29–30.

A moderately small species. The coloration as described by Girault is no longer discernible, the orange having faded so that parts originally described as orange now appear yellowish. The derm on the yellowed portions of the mesoscutum and scutellum is semitranslucent. Parts of the antennae are missing in the paratype examined.

Female.—The following parts black: pronotum, anterior part of mesoscutum, a spot on either parapsis, axillae, metanotum except

median part, propodeum, abdomen, most of thoracic sternites and pleurites, and hind coxae. Sternites in proximity to roots of wings more or less yellowish. Dorsum of head distinctly orange with the ocellar area blackish; face and cheeks yellow. Mesoscutum except anteriorly, parapsides except spots, entire scutellum, and median part of metanotum yellow. Legs yellow, except the dark hind coxae; fore legs faintly brownish. Scape yellow, concolorous with face; flagellum dark brown.

Pedicel longer than wide and plainly shorter than the first funicle joint. First funicle joint longest, not quite twice as long as wide. According to Girault: "Club distinct but not much wider than the funicle; funicle three a little longer than wide; one nearly twice longer than wide; pedicel barely as long as funicle three, subequal to club two; all club joints wider than long." Funicle and club with numerous dark sensoria.

Fore wings hyaline or subhyaline, finely and densely ciliated. Posterior basal hairless streak well developed, bending upward at its distal end. Submarginal vein plainly longer than marginal. Stigmal and postmarginal veings as shown in Figure 116.

Scutellum plainly wider than long (11:8) but not strongly transverse, and shorter than the mesoscutum (8:12). Abdomen not much longer than wide (16:15) and shorter than the thorax. Ovipositor not exserted. Median part of metanotum large.

Scutellum with three pairs of rather small bristles. Mesoscutum with rather numerous small setae. Each axilla with two setae about as large as those of the mesoscutum.

The yellow parts of the mesoscutum and scutellum with distinct areolate reticulations.

Middle tibial spur plainly shorter than the basitarsus.

Length 1.1 mm.

Redescribed from one female (paratype), U.S.N.M. No. 20684. West Australia, George Compere, Coll.

15. COCCOPHAGUS FLAVICEPS, new species

Plate 6, Figure 11; Plate 7, Figure 28; Plate 11, Figure 126; Plate 14, Figure 170

This species is readily separable from the described African forms by the hyaline wings, three pairs of bristles on the scutellum, elongated seventh tergite, conformation of the antennae, and distinctive coloration.

Female.—General color of the body black. Head lemon yellow, except the upper half of the occiput which is black, and the dorsum which becomes fuscous in proximity to the ocelli. Flagellum black; scape yellow except toward the apex on dorsal margin which is blackish. Mesoscutum black marked with a variable amount of

orange. In some specimens the orange color forms a small elongated blotch or streak posteriorly on either lateral margin; other specimens have the mesoscutum more extensively orange colored, the pattern arranged so that the blackened portion is in the shape of a V. Scutellum mostly, if not entirely, orange colored, sometimes the base very narrowly black. Median part of metanotum yellow. Parapsides orange and black. Legs mostly lemon yellow; basal half of hind tibiae and somewhat more than the basal half of hind coxae black; middle coxae touched beneath with black; apical two or three tarsi of hind legs fuscous; apical tarsi of middle legs fuscous; all tarsi of fore legs faintly fuscous. Tibiae not pure lemon yellow like the femora but with a faint suffusion of brownish.

Pedicel small, hardly longer than wide and about one-third as long as the first funicle joint. First funicle joint plainly the longest, more than twice as long as wide; second and third joints each plainly shorter than the preceding, the third about two-thirds the length of the first. Club about as long as the first two funicle joints combined and not much wider than the funicle. Funicle and club furnished with numerous sensoria which on the third funicle joint and on club joints extend the entire length of the segments; sensoria on the first two funicle joints approximately one-half as long as the segment on which they occur (fig. 28).

Mandibles with one small ventral tooth and a broad, dorsal truncation (fig. 170).

Fore wings hyaline. Marginal vein about as long as the submarginal vein; stigmal vein as shown in Figure 126. Disk of wing with abundant small cilia. Marginal fringe very short.

Scutellum convex, slightly wider than long (24:21) and not quite so long as the mesoscutum (21:22). Abdomen about as long as the thorax; seventh tergite long. Ovipositor shortly exserted. In dried specimens the abdomen is strongly laterally compressed. Thorax and abdomen as shown in Figure 11.

Basitarsus of middle legs not quite as long as the succeeding joints united; tibial spur slightly shorter than the basitarsus. Paired spurs of hind tibiae plainly of unequal length.

Mesoscutum densely setose. Scutellum with three pairs of strong, black bristles. Each parapsis with three setae about as strong as those of the mesoscutum. Each axilla with two setae somewhat stronger than those of mesoscutum. The transverse rows of setae on the abdomen incomplete on the dorsum of the first, second, and third tergites.

Measurements in mm.: Length 1.1. Scape 0.1464 long by 0.04 wide. Pedicel 0.0456 long by 0.0440 wide. First funicle joint 0.1240 long by 0.0584 wide; second 0.0984 long by 0.0504 wide; third 0.08

long by 0.0552 wide. First club joint 0.0704 long by 0.0592 wide; second 0.08 long by 0.0576 wide; third 0.0704 long by 0.0432 wide.

Type.—Cat. No. 42098, U.S.N.M.

Described from 12 females (holotype and paratypes) received from E. W. Rust with the following data: "Reared only twice since I have been here (Natal); first from *Ceroplastes* n. sp. on custard apple, *Anona cherimolia* (*A. cherimoya?*), taken at Congella, Natal, March 18, 1926, and later from *Ceroplastes destructor* on a wild plant, Durban, August 16, 1926." Rust's No. C–19.

16. COCCOPHAGUS TSCHIRCHII Mahdihassan

Plate 7, Figure 29; Plate 11, Figure 109

Coccophagus tschirchii MAHDIHASSAN, Journ. Sci. Assoc., Maharajah's Coll., India, vol. 1, 1923, p. 82.—FERRIÈRE, Bull. Ent. Res., vol. 19, pt. 2, Oct. 1928, pp. 173–74, fig. 2.

This striking species was recognized and adequately described by Ch. Ferrière.

Female.—Head and thorax yellow except for blackish or brownish markings as follows: occiput on either side of foramen; center and the exposed dorsal part of pronotum; anterior part of mesoscutum with a rounded U-shaped blotch; wedge shaped base of parapsides and a median spot; axillae suffused; sides of metanotum, median part of propodeum between the carinae; petiole; tegulae; a part of mesosternum. Abdomen entirely black. Legs entirely yellow. Eyes and ocelli reddish.

Mandibles plainly tridentate.

Abdomen short, rounded.

Antennae as shown in Figure 29.

Stigmal vein as shown in Figure 109.

Redescribed from a series of specimens loaned by the Imperial Bureau of Entomology that were determined by Ch. Ferrière and labeled: "India, Bengal, Kuudari, 1927, C. S. Misra. Ex. Lac insect on *Butea frondosa.*" This species was first reared by Mahdihassan from the Mysore lac insect.

17. COCCOPHAGUS GREGARIUS, new species

Plate 7, Figure 30; Plate 13, Figure 149; Plate 14, Figure 183.

A medium sized, robust species, black with yellow markings. The pedicel which is about as wide as long is a character that readily separates this species from the great majority of *Coccophagus.*

Female.—Head yellow except for the ocellar area and concealed part of the occiput which are blackish. Antennae mostly yellow, a part of scape and of pedical slightly dusky; sensoria fuscous. Pronotum and proepisternum black. Mesoscutum black with a band of yellow on either side. Parapsides yellow with a black spot on the expanded part. Axillae black. Scutellum black, yellow laterally.

Tegulae yellow. Metanotum, propodeum, and abdomen black. Prosternum yellowish. Prepectus yellow with more or less blackish suffusions. Mesoepisternum mostly black. Metapleura black. Hind coxae mostly black, their apices yellow; apical tarsal joints fuscous, remainder of legs yellow with faint traces of dusky in parts.

Antennae somewhat thicker than usual. Pedicel short, as wide as long and one-half as long as the first funicle joint. First funicle joint the longest, not quite twice as long as wide; second and third successively slightly increasing in width and decreasing in length, the latter only slightly longer than wide. First club joint slightly wider than long and not quite as long as the third funicle joint; second like the first; third as long as wide (fig. 30).

Mandibles as shown in Figure 183.

Fore wings hyaline; cilia fine and short; a well developed basal hairless streak extending obliquely distad. Marginal fringe short. Marginal vein appreciably shorter than the submarginal.

Scutellum large, slightly wider than long (1:10) and not quite as long as the mesoscutum. Ovipositor short, not reaching to the apex of abdomen.

The setae on the thorax are small and inconspicuous yet easily detected on tag-mounted specimens. In cleared balsam-mounted specimens, three setae are plainly seen on the anterior margin of each axilla in the majority of specimens; in a few specimens only two setae occur.

Basitarsus of the middle legs about as long as the succeeding joints united; tibial spur plainly shorter than the basitarsus.

Length 1.2 mm.

Male.—Very similar to the female except for sexual differences, antennal differences, and more extensive blackish coloration, especially on the mesoscutum. Antenna as shown in Figure 149.

Type.—Cat. No. 42101, U.S.N.M.

Described from 35 females and 20 males (holotype, allotype, and paratypes) reared from *Eriococcus* species on *Acacia*, Taronga Zoological Park, Sydney, New South Wales, collected by H. Compere, October 19, 1927. In addition to the type specimens about 1000 individuals were obtained from *Ericoccus* that infested several small twigs. The large scales were densely packed with the *Coccophagus*, each scale containing a great number of parasites. Scales from which the parasites issued were perforated with from 10 to 25 exit holes.

18. COCCOPHAGUS JAVENSIS Girault

Plate 7, Figure 31; Plate 10, Figure 80; Plate 11, Figure 111; Plate 12, Figure 144; Plate 14, Figure 182

Coccophagus javensis GIRAULT, Proc. U. S. Nat. Mus., vol. 51, 1916, pp. 482–83.

The cotypes are mounted in balsam and slightly crushed. It is now impossible to determine the exact coloration. The habitus of this species is similar to that of *C. ochraceus* Howard, but a careful examination shows that it is not so closely related as a first glance indicates. Apparently the mandibles are sharply tridentate, more like those of *C. zebratus* Howard than they are like those of *C. ochraceus*. Also, unlike many of the small yellow species, this form has the pedicel smaller than the first funicle joint. Because of fading, the following color description may be misleading to the extent that, in life, the yellow coloration may be of different shades.

Female.—General color yellow (perhaps ochraceous), with dark brown or blackish markings as follows: upper part of occiput; center of pronotum; anterior margin of mesoscutum on the meson; sides of metanotum; center of propodeum; a broad, transverse band across the middle of abdomen. Legs and antennae yellow.

Pedicel about one and one-third times as long as wide and slightly but appreciably shorter than the first funicle joint. The funicle joints appear subequal to the eye, but measurements show that they increase very slightly in length distad. First club joint about as long as the preceding funicle joint; second and third each slightly decrease in length. Funicle and club with more abundant sensoria than usual for the small yellow species as shown in Figure 31.

Mandibles plainly tridentate as shown in Figure 182.

Scutellum rather large, wider than long (19:15) and not quite as long as the mesoscutum (15:16) as shown in Figure 144. Abdomen of almost uniform width for the greater part, broadly rounded at apex; cercal plates large; ovipositor sheaths shortly protruded.

Frontovertex with abundant, fine, dark setae. Eyes distinctly hairy. Mesoscutum with sparse, rather strong, dark setae. Each parapsis with four or five setae similar in size to those two on each axilla. Tergites with some moderately strong setae, but because of shrinkage their positions can not be determined.

Sides of metanotum with intricate striae and faint reticulations. Mesothorax without visible sculpture.

Basitarsus of middle legs about as long as the three succeeding joints united; tibial spur slightly shorter than the basitarsus. Paired spurs at apex of hind tibiae very unequal.

Fore wings hyaline, broad, a trifle more than twice as long as wide; disk with moderately coarse cilia; a small narrow hairless area beneath basal half of marginal vein, separated by about three rows of cilia from another hairless area extending to base of wing

as shown in Figure 80. Marginal vein slightly longer than the submarginal; postmarginal shortly produced as shown in Figure 111.

Length 0.8 mm.

Redescribed from five females (cotypes U. S. N. M. No. 19894). According to the original description this species was reared from a *Pseudococcus* species on wild *Mangifera*, Salatiga, Java, by P. Van der Goot.

19. COCCOPHAGUS TRIGUTTATUS Girault

Plate 7, Figure 32; Plate 11, Figure 103; Plate 12, Figure 145

Coccophagus triguttatus GIRAULT, Memoirs Queensland Museum, vol. 4, 1915, pp. 48–49.

Fortunately the type of this species is in good condition, the body being bulged only because of pressure. The head is detached from the body and the remnants of a second head are present. In his description, Girault compares *C. perhispidis* Girault, *C. pulcini* Girault, and *C. triangulatinotus* Girault to this species, also *C. inkermani* Girault is said to follow *perhispidis*. Girault states that this species differs from the generic diagnosis in bearing a very short ring joint and in having the hind tibial spurs double. So far as I know all the species of *Coccophagus* possess a ring joint and double hind tibial spurs. The species of *Coccophagus* of the *triguttatus* group seem to be intermediate between those of the *ochraceus* group, characterized by a strongly transverse scutellum, and typical species having the scutellum almost as long as wide.

Girault's color description is at follows: "Intense golden yellow (greenish yellow), the wings hyaline, the antennae and legs concolorous. On the distal half of the abdomen, three conspicuous round black spots from dorsal aspect arranged in a triangle, the apical one at tip, the basal two at lateral margin, one on each side just beyond proximal half (sometimes if the segments are stretched, split transversely into two more or less rectangular spots); a small triangular spot at apex (cephalad) of each axilla, also jet black, as well as the cephalic margin of scutellum between the parasidal furrow ends. Base of fore wings very slightly dusky and a curved, narrow, black line down propodeum on each side near margin." The dusky coloration of the fore wings is no longer evident even though one wing is clearly visible. The center of the pronotum is black.

Pedicel longer than wide and shorter than the first funicle joint. First funicle joint plainly the longest, a trifle more than twice as long as wide; second and third each successively shorter and wider; third slightly longer than wide. Club slightly longer than first and second funicle joints united and about one and one-third times as wide as the third funicle joint (fig. 32).

Scutellum plainly wider than long but not strongly transverse (fig. 145). Axillae large, apparently not closely fused with the scutellum. Mesoscutum plainly longer than the scutellum (Mesopleura bulged outward in the types). Scutellum at apex rather broadly truncate. Median piece of metanotum distinct. Propodeum widely expanded with distinct longitudinal carinae. Spiracles reniform. Abdomen slightly longer than wide but not quite as long as the thorax. As seen through the derm, ovipositor arises near the middle and is very shortly exserted. (The exsertion of the ovipositor may be due to crushing.)

The setae of the body are now transparent and can only be seen with difficulty under high magnification. Mesoscutum moderately, densely setose, the setae arranged along the lateral and posterior margin apparently stronger than elsewhere. Each axilla with two setae. A wing is folded over the scutellum obscuring it, but the anterior pair of bristles can be detected and without much doubt a median and apical pair are also present (fig. 145).

Mandibles with an acute ventral tooth and a dorsal tooth broadly concave along the margin.

Fore wings large and furnished with abundant cilia of moderate size. Marginal vein as long as the submarginal; stigmal and postmarginal as shown in Figure 103.

Basitarsus of the middle legs as long as the succeeding four joints united; tibial spur a trifle shorter than the basitarsus; plantar surface of the tarsi with numerous peg-shaped spines.

Measurements in mm.: Girault gives the total length as 1.0. The specimen studied measures 1.02 from the pronotum to the apex of abdomen. Mesoscutum 0.2520 long. Scutellum 0.1704 long by 0.2248 wide. Thorax 0.56 long. Abdomen 0.48 long by 0.40 wide. Fore wing 0.92 long by 0.420 wide. Marginal vein 0.28 long; submarginal 0.28 long. Marginal fringe 0.0168 long. Tarsi of middle legs 0.30 long; basitarsus 0.1544 long; tibial spur 0.1296 long. Scape 0.1336 long by 0.03136 wide. Pedicel 0.0488 long by 0.0304 wide. First funicle joint 0.0616 long by 0.0296 wide; second 0.0432 long by 0.0304 wide; third 0.0408 long by 0.0304 wide. First club joint 0.0440 long by 0.0512 wide; second 0.0288 long by 0.0488 wide; third 0.0256 long by 0.0376 wide.

Redescribed from one female and an additional head marked "type" in the Queensland Museum. Girault, in his description gives data as follows: "Described from five females reared in connection with a cecidomyiid gall on the stem of a young *Eucalyptus corymbosa* (Bloodwood) but which was infested with unarmored coccids. November 13, 1913 (A. P. Dodd). Habitat: Northern Queensland (Gordonvale near Cairns). Types: No. Hy/2926 Queensland Museum, Brisbane, the above specimen on a slide."

20. COCCOPHAGUS SPECIALIS, new species

Plate 7, Figure 33

This unusual species has the habitus of *Euxanthellus*. Wings, hyaline, the cilia translucent and abnormally long and dense basally. Predominantly yellow. Abdomen on either side with two longitudinal rows of brown dots, which on the outer rows coalesce or are contiguous so as to form a more or less continuous stripe. First funicle joint about three times as long as wide.

Female.—Face and cheeks white, in life probably iridescent pearly white. Frontovertex orange blotched with iridescent pearly white contiguous to the ocelli. Eyes and ocelli reddish. Center of occiput and a transverse band on either side of the foramen blackish. Concealed part of pronotum and a spot on either posterior angle blackish. Thorax lemon yellow; propodeum near spiracles iridescent pearly white. Middle of abdomen on dorsum more or less yellowish, the sides widely marked with iridescent pearly white interrupted by elongated brownish spots. Legs pale yellowish; first and second tarsal joints of hind legs fuscous, those of the middle legs slightly fuscous; remaining tarsi of middle and hind legs yellow to whitish; first three or four tarsal joints of fore legs more or less faintly fuscous, apical joints pale, claws fuscous.

The antennae are mounted so that the scape can not be accurately viewed but apparently the scape is longer than usual. Pedicel almost twice as long as wide, plainly shorter than the first funicle joint. First funicle joint plainly the longest, about three times as long as wide; second and third successively decrease in length and slightly increase in width so that the third is about one and one-half times as long as wide. Club large, all joints a trifle longer than wide (fig. 33).

Fore wings clothed with translucent, "silky" cilia. Marginal vein as long as the submarginal; postmarginal produced as far distad as the apex of stigmal. Wing veins pale.

Frontovertex slightly wider than long (8:7) and one-half as wide as the head (8:16). Head plainly much wider than the mesoscutum (16:11). Mesoscutum moderately long. Scutellum wider than long (8:6) and shorter than the mesoscutum (6:8). Scutellum squarely truncate at apex; somewhat hexagonal. Median piece of metanotum, distinct, well developed appearing like an apical part of scutellum separated by a broad cross suture. Like *C. triguttatus* Girault, this species presents conspicuous bulged mesopleura that are translucent showing the transverse striae. Abdomen plainly shorter than the thorax, slightly wider than long (32:27), the lateral curvatures from base to apex almost uniform; as seen through the derm the ovipositor arises under the posterior margin of the third tergite and very slightly projects at the apex.

Frontovertex with fine dark setae that are not conspicuous. Mesoscutum with conspicuous, moderately strong, blackish setae, those along the sides not much, if any stronger than elsewhere; posterior margin with only two similar setae. Each parapsis with three setae about as strong as those on the mesoscutum and each axillae with two similar setae. Scutellum with three pairs of bristles, the median and apical pairs about twice as long as the mesoscutar setae, the anterior pair hardly any longer than the two setae on the posterior margin of the mesoscutum. The tergites seem to be bare, or if setae are present, they do not appear in an untreated specimen.

Basitarsus of middle legs about as long as the succeeding joints combined; tibial spur about as long as the basitarsus. Hind tibiae with one long apical spur paired with a short one.

Length 1.7 mm.

Male.—Face, cheeks, and antennae white. Frontovertex yellow; eyes and ocelli red. Occiput at sides and above foramen black. Concealed part of pronotum black; exposed sides of pronotum, sides and under parts of thorax, basal one-third of abdomen, and all of legs white. Propodeum between the spiracles, petiole, and dorsum of abdomen on last four tergites black to dark brown.

Pedicel small, wider than long. Club not differentiated from the funicle. Flagellum with numerous close set sensoria which are as long as the segment which they occupy.

Abdomen small, sides subparallel, almost truncate at apex. Head and thorax about the same size and proportions as that of the female. Since these male specimens are not appreciably pressed by the cover glass and present bulged mesopleura, this characteristic may be a normal development.

Length 1.4 mm.

Type.—Cat. No. 42085, U.S.N.M.

Described from two females and two males (holotype, allotype, and paratypes) on two slides mounted in balsam. Reared by E. W. Rust from *Saissetia oleae* (Bernard) collected at Durban, Natal, January 10, 1927.

21. COCCOPHAGUS TRIANGULATINOTUS Girault

Plate 7, Figure 34; Plate 11, Figure 119

Coccophagus triangulatinotus GIRAULT, New Pests from Australia, III, Brisbane, Queensland, August 25, 1926. (Published by author.) Insecutor Inscitiae Menstruus, vol. 14, Nos. 7–9, July–September, 1926, p. 133.

Girault's original description follows: "As *triguttatus* but marks on abdomen joined widely, basal two across, distal joined to this along meson. Dayboro forest, October 8, 1922."

The female type is partly obscured by some deposit on the insect. General color light yellow, liberally marked with blackish as fol-

lows: center of pronotum; anterior part of mesoscutum; axillae; scutellum in part (perhaps anteriorly); most of metanotum and propodeum; dorsum of abdomen except the first or first and second tergites and sides of the sixth or fifth and sixth tergites, which are yellow. Head, antennae, and legs yellow.

Scape and pedicel of both antennae concealed by the head. (Presumably, pedicel shorter than first funicle joint and longer than wide.) First funicle joint the longest; the succeeding progressively shorter and wider. Club about as long as the preceding two funicle joints combined and about one and one-half times as wide as the third funicle joint (fig. 34).

The outlines of the scutellum cannot be seen nor can the vestiture be studied; however, the size and shape of the surrounding parts indicate that the scutellum is not strongly transverse but almost as long as wide. It is also likely that the scutellum bears three pairs of bristles for if densely setose, some of the setae would likely be detected.

Fore wings relatively large and closely and densely ciliated. A hairless streak under the marginal vein is separated from a basal hairless streak by two rows of cilia. Hairless streaks of the wings somewhat similar in arrangement to those of *C. pulcini* Girault as shown in Figure 79. Marginal vein a trifle longer than the submarginal; stigmal and postmarginal as shown in Figure 119.

Basitarsus of middle legs almost as long as the four succeeding joints united; tibial spur slightly shorter than the basitarsus.

Measurements in mm.: Length of body (exclusive of head) 0.80. Fore wings 0.92 long by 0.46 wide. Marginal vein 0.30 long; submarginal 0.28 long. Marginal fringe 0.0192 long. Five tarsal joints of middle legs combined 0.28 long; basitarsus 0.12 long; tibial spur 0.1008 long. First funicle joint 0.0552 long by 0.0216 wide; second 0.0432 long by 0.0304 wide; third 0.0392 long by 0.0368 wide. First club joint 0.0408 long by 0.056 wide; second 0.0360 long by 0.0560 wide; third 0.0216 long by 0.0416 wide.

Redescribed from the female type, Queensland Museum. No. data on slide label other than name and designation "type female."

22. COCCOPHAGUS LEPTOSPERMI Girault

Plate 8, Figure 35; Plate 11, Figure 88; Plate 12, Figure 142; Plate 13, Figure 150; Plate 14, Figure 177

Coccophagus leptospermi GIRAULT, Insecutor Inscitiae Menstruus, vol. 5, 1917, p. 92.

So far as can be seen, structurally closely related to *C. triguttatus* Girault and *C. triangulatinotus* Girault; the detailed measurements and bulged mesopleura look suspiciously alike, yet on the basis of coloration, the three forms seem distinct. These three species of

small size and predominantly yellow coloration are at once distinguished from the other small yellow species by the antennae, which in this group have the pedicel smaller than the first funicle joint and the funicle joints decrease in length and slightly increase in width distad.

Female.—General color yellow; lateral and ventral parts of the thorax and the face and cheeks pale. Pronotum mostly blackish. Anterior margin of mesoscutum on meson more or less suffused with blackish. Sutures of scutellum and axillae anteriorly and the mesoscutum posteriorly vaguely suffused with blackish. Abdomen with five rather obscure dusky cross stripes, the first five tergites dusky on basal half. Eyes and ocelli reddish. Mandibles mostly brown. Fore tarsi entirely slightly brownish, and tarsi of other legs dusky apically; remainder of legs yellowish. Antennae yellow with brownish sensoria.

None of the antennae show the scape and pedicel clearly. Apparently the pedicel is about one and one-third times as long as wide and slightly shorter than the first funicle joint. First funicle joint plainly the longest, somewhat more than one and one-third times as long as wide; second and third successively slightly decreasing in length and slightly increasing in width. Club large, basal joint plainly larger than the third funicle joint; second as wide as the first and slightly shorter; third much the smallest (fig. 35).

Mandibles as shown in Figure 177.

Mesopleura prominent, bulged outward. Scutellum wider than long but not strongly transverse (11:8) and not quite as long as the mesoscutum (8:10). Abdomen not quite as long as the thorax, broadly rounded at apex; ovipositor as seen through the derm short, very slightly exerted beyond apex. Spiracles reniform. Median piece of metanotum well developed (fig. 142).

Fore wings hyaline, rather finely and densely ciliated; the basal posterior hairless streak bent upward at its distal end. Submarginal vein distinctly longer than the marginal; stigmal about as shown in Figure 88. Marginal fringe moderately short.

Mesoscutum moderately densely setose, setae along the sides and posterior margin slightly stronger than elsewhere. Scutellum with three pairs of strong bristles. Each parapsis with three setae and each axilla with two. The setae somewhat darker than the derm but not strongly contrasting.

Basitarsus of middle legs almost as long as the succeeding four joints united; tarsi moderately short and furnished with numerous peg-shaped spines; tibial spur slightly shorter than the basitarsus. Paired spurs at apex of hind tibiae very unequal.

Male.—The males differ from the females in coloration and antennal characters.

General color yellow with extensive blackish to dark brown markings as follows: Occiput on either side and above foramen; ocellar triangle; pronotum; large triangular blotch on anterior part of mesoscutum; posterior half of parapsidal grooves; a faint rounded spot on each parapsis; axillae; triangular blotch on base of scutellum; sides of metanotum; propodeum; and the whole abdomen. Tegulae and median piece of metanotum pale yellow. Face and cheeks, venter of thorax, legs and antennae pale yellow. Tarsi of fore legs entirely dusky, apical joint of middle tarsi and apical two joints of hind tarsi dusky. Sensoria on flagellum dusky.

Pedicel short, wider than long. Flagellum large with numerous sensoria; joints symmetrical and medially articulated. Club differentiated, rather small, narrower than funicle. First funicle joint the longest, about twice as long as wide; second and third successively shorter. Club about as long as the first and one-half of the second funicle joints combined. First club joint much smaller than the third funicle joint (fig. 150).

Length 0.84 mm.

Redescribed from eight females and five males (cotypes) on a single slide, U.S.N.M. No. 20668, also labeled "Queensland Museum." The original description gives the following data: "From many pairs reared from galls on *Leptosperum flavescens*, September, 1915 (H. Hacker). Types in the Queensland Museum, Brisbane, 9 females 4 males on slide. U. S. Nat. Mus., 1 male, 17 females on slide." Presumably the gall referred to as a host was actually a gall-like coccid.

23. COCCOPHAGUS INKERMANI Girault

Plate 8, Figure 36; Plate 11, Figure 101

Cocophagus inkermani GIRAULT, New Pests from Australia, III; Brisbane, Queensland, August 25, 1926. (Published by author.)

Girault's original description follows: "Follows *perhispidis*. Abdomen with rather wide stripes across middle (less than ½ surface). Orange, legs white, apex, abdomen black. Funicle 1 longest, twice longer than wide. Inkerman, Q."

Owing to the condition of the type it is difficult to add much of value to the original description. The type specimen is split longitudinally, the head is missing, the wings folded, and obscured. Cracks in the balsam and a piece of glass adhering to the specimen add to the difficulty of obtaining a clear view.

One antenna remains intact but it is folded and distorted. This antenna is shown in Figure 36. Of the other antenna, the club and distal two funicle joints remain. The remnants of the second antenna indicate that the apical funicle joint and club are more

elongate than that shown in the figure. It is likely that the club is more nearly like that of *C. perhispidis* Girault than the figure shows. No suture can be detected separating the apical two club joints and the suture between the first and second is hardly discernible. The pedicel appears slightly longer than wide. First funicle joint plainly the longest, almost twice as long as wide; second and third successively shorter and wider. It is suspected that the club as seen in the type is distorted almost beyond recognition. In Figure 36 the curvature of the scape is probably due to a dorsal view instead of the usual lateral view.

Fore wings with the disk finely and densely ciliated. Marginal fringe very short. Submarginal vein about as long as the marginal and furnished with about twelve setae. The shape of the stigmal and postmarginal veins can not be determined with accuracy. A hypothetical reconstruction based on the position of the setae, clear pustules and wing margin is shown in Figure 101.

Scutellum apparently almost as long as wide and furnished with three pairs of bristles.

So far as can be ascertained, the coloration is as described by Girault with the addition that the center of the pronotum and median anterior portion of the mesoscutum are black. Wings clear hyaline.

Basitarsus of middle legs almost as long as the succeeding joints united; tibial spur slightly shorter than the basitarsus; tarsi with numerous peg-shaped setae.

Measurements in mm.: Length of body (exclusive of head) 0.8. Marginal vein 0.26; submarginal 0.26; longest marginal fringe 0.0096. Five tarsal joints of middle legs united 0.3; basitarsus 0.12 long; tibial spur 0.104 long. Scape 0.12 long by 0.0264 wide. Pedicel 0.0344 long by 0.0296 wide. First funicle joint 0.0496 long by 0.0288 wide; second 0.03128 long by 0.0312 wide; third 0.034 long by 0.04 wide. Club 0.0680 long by 0.0520 wide.

Redescribed from female type, Queensland Museum. No locality or collection data on slide label.

24. COCCOPHAGUS BOGORIENSIS (Köningsberger)

Plate 8, Figure 37; Plate 11, Figure 98; Plate 12, Figure 141

Encyrtus bogoriensis KÖNINGSBERGER, Meded. Plant., vol. 20, 1897, pp. 14–15, pl. 1, fig. 9.

Coccophagus javae GIRAULT, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 482.

The specimens described by Girault as *Coccophagus javae* agree fairly well with the description of *C. bogoriensis* (Köningsberger). The fact that series of specimens were reared from the same host collected in the same locality tends to support the belief that the two forms are identical. In his description of *C. javae*, Girault said

that according to Van der Goot the species had been described by Köningsberger *as Encyrtus bogoriensis*, but that he had been unable to see the description of this species. Köningsberger wrote that the species is a common parasite of *Coccus viridis* (Green) in Java, where the coccid is a pest of coffee.

Coccophagus bogoriensis is related to *C. Lecanii* (Fitch) and its allies.

Female.—Scutellum mostly yellow, anterior margin dark. Thorax dark brown; abdomen darker than the thorax, blackish. In the balsam-mounted specimens, the ocellar triangle appears dark; eyes and ocelli red and the remainder of the frontovertex yellowish. Face and cheeks yellowish, becoming paler toward the mouth, in life, possible appearing white. Scape whitish, flagellum brownish yellow with darker sensoria. Legs mostly pale yellow or whitish, only the hind femora and tibiae with a variable amount of dusky.

The comparative lengths of the funicle joints vary slightly among the different specimens or else the apparent variations are due to the different positions of the antennae. Apparently the first funicle joint is slightly the longest and the succeeding joints each a trifle shorter and wider. The antenna that appeared to be best preserved was measured with the following results: first funicle joint a triflle more than one and one-half times as long as wide; third one and one-third times as long as wide; second intermediate between the first and third. None of the pedicels is clearly shown, but so far as can be judged it appears to be about one and one-third times as long as wide and much shorter than the first funicle joint (fig. 37).

Proportions of the body and arrangement of the setae not unlike those of *C. lecanii* (Fitch); however, a study of properly mounted specimens may reveal differentiating characters that are not apparent in the specimens at hand. A portion of the thorax is shown in Figure 141.

Fore wings hyaline, finely and closely ciliated; a small rounded, hairless spot near the base. Marginal vein slightly longer than the submarginal; stigmal shown in Figure 98.

Measurements in mm.: Length 1.10. Pedicel 0.044 long by 0.0344 wide. First funicle joint 0.0640 long by 0.04 wide; second 0.0560 long by 0.0416 wide; third 0.0568 long by 0.0424 wide. First club joint 0.0584 long by 0.0456 wide; second 0.0560 long by 0.0448 wide; third 0.0504 long by 0.0336 wide. Fore wings 0.78 long by 0.36 wide. Marginal vein 0.25 long; submarginal 0.22 long.

Redescribed from 10 females (cotypes of *C. javae* Girault) U.S.N.M. No. 19888. According to Girault's description, reared from *Lecanium viride* [*Coccus viridis* (Green)], Salataga, Java, January, 1915, P. Van der Goot, collector.

25. COCCOPHAGUS CUBAENSIS, new species

Plate 8, Figure 38; Plate 11, Figure 113

This species from Cuba is another form closely related to *C. lecanii* (Fitch). It is most easily distinguished from the related species by coloration; legs entirely pale yellow, venter and most of the sides of thorax yellow.

Female.—General color black, or blackish to dark brown in parts, with the antennae, scutellum, median piece of metanotum, venter of thorax, tegulae, prepectus, mesopleura, and metapleura lemon yellow. Anterior margin of scutellum sometimes narrowly blackish and sometimes with more or less blackish or brownish suffusing the yellowish coloration on the sides of the thorax. Legs entirely pale lemon yellow.

The antennal proportions are not unlike those of the other species of this group, namely, first funicle joint slightly the longest, the second and third succesively a trifle shorter and wider. In this species the sensoria are not so numerous as in *C. bogoriensis* (Köningsberger), *C. pulvinariae*, new species, and *C. tibialis*, new species. Antennae shown in Figure 38.

Stigmal vein as shown in Figure 113. In other details the fore wings are not essentially different from those of *C. lecanii.*

Length 0.95 mm.

Type.—Cat. No. 42094, U.S.N.M.

Described from 20 females (holotype and paratypes) reared by Dr. F. Silvestri from *Pulvinaria* (A) on citrus, Santiago de las Vegas, Cuba, October, 1928.

26. COCCOPHAGUS PULVINARIAE, new species

Plate 8, Figure 39; Plate 11, Figure 127

This is another species of the *C. lecanii* (Fitch) group that is distinguished by coloration.

Female.—General color black. Face, cheeks, and antennae orange yellow. Scutellum entirely pale lemon yellow, or at most the anterior margin very narrowly blackish. Middle and hind coxae more or less blackish basally, remainder of the legs usually entirely yellow.

Scape fusiform, slightly widest just beyond the middle, a trifle more than four times as long as wide. Pedicel about one and two-fifths times as long as wide and plainly shorter than the first funicle joint. First funicle joint the longest, one and three-fifths times as long as wide; second and third each successively a trifle shorter and wider so that the third is slightly less than one and one-fourth times as long as wide. First club joint as long as the pre-

ceding funicle joint and a trifle wider; second and third successively shorter and narrower; all longer than wide (fig. 39).

Mandibles with the ventral and median tooth subequal and with a broadly rounded dorsal tooth.

Fore wings subhyaline, faintly and uniformly smoky, cilia fine and dense. Marginal vein slightly longer than the submarginal. Stigmal vein as shown in Figure 127. Marginal fringe short.

Basitarsus of middle legs as long as the four succeeding joints united; tibial spur plainly shorter than the basitarsus. Paired spurs of hind tibiae subequal.

Ovipositor as seen through the derm arises near the middle of abdomen.

Sculpture and vestiture similar to *C. lecanii* (Fitch).

Measurements in mm.: Length 0.90. Scape 0.456 long by 0.0352 wide. Pedicel 0.0520 long by 0.376 wide. First funicle joint 0.0760 long by 0.0480 wide; second 0.0672 long by 0.0488 wide; third 0.0648 long by 0.0512 wide. First club joint 0.0648 long by 0.0544 wide; second 0.0544 long by 0.0488 wide; third 0.0464 long by 0.344 wide. Fore wings 0.84 long by 0.38 wide. Marginal vein 0.26 long; submarginal 0.24 long. Longest marginal fringe 0.016.

Male.—Face, cheeks, and antennae pale lemon to orange yellow; frontovertex with a variable amount of fuscous. Parapsides, especially the expanded parts, often suffused with orange. Legs yellow; middle and hind coxae black, apical joint of the middle and hind tarsi fuscous, and the fore tarsi faintly brownish.

Type.—Cat. No. 28971, U.S.N.M.

Described from 35 females and 10 males (holotype, allotype, and paratypes) reared by E. W. Rust as follows: 17 females, 1 male reared from *Pulvinaria merwei* on fern (and other hosts?) Durban, Natal, October, September, 1925, and February, 1927, Rust's No. C–12; 2 females and 1 male reared from *Coccus hesperidum* Linnaeus, Durban, Natal, September, 1925, and May, 1927; 15 females and 1 male reared from *Pulvinaria jacksoni* June, 1926, and May, 1927, Rust's No. C–34; 3 males reared from *Inglisia* species, Mayville, Natal, May, 1926, Rust's No. C–12.

27. COCCOPHAGUS JAPONICUS Compere

Plate 8, Figure 40

Coccophagus japonicus Compere, Bull. So. Calif. Acad. Sci., vol. 23, pt. 4, 1924, pp. 122–23.—Gahan, Proc. Ent. Soc. Wash., vol. 28, No. 1, 1926, p. 24.

This is a Japanese species belonging to the *C. lecanii* (Fitch) group.

Female.—General color black, posterior two-thirds of the scutellum yellow. Head black. Scape blackish; flagellum brown with

darker sensoria. Some specimens with all legs pallid white or yellow except for more or less blackish on the hind femora and the basal part of fore coxae black. Others have the fore and middle coxae black and hind femora black except the ends which are yellow. Again some specimens agree with the foregoing except that the fore femora and tibiae are more or less suffused with blackish. Femora of middle legs of all specimens entirely yellow. Tibiae and tarsi of all legs yellow or pallid white except the apical tarsi, which are fuscous, and the fore tibiae which are occasionally brownish or suffused with blackish.

Antennae as shown in Figure 40.

Redescribed from paratypes received June 2, 1923, from C. P. Clausen, who collected the material in the vicinity of Yokohoma, Japan. Parasitic on *Coccus pseudomagnoliarum* (Kuwana).

28. COCCOPHAGUS HAWAIIENSIS Timberlake

Plate 8, Figure 41; Plate 14, Figure 185

Coccophagus hawaiiensis TIMBERLAKE, Proc. Haw. Ent. Soc., vol. 6, No. 2, 1926, pp. 315–17, fig. 3.

This form has been adequately described by Timberlake. Typical specimens are rather easily distinguished from *C. japonicus* Compere by the different coloration of the legs. There are, however, certain specimens in the collection of the United States National Museum showing intergradations and in one series of specimens, all of which were supposedly reared from the same host, there are individuals that agree with types of both *C. japonicus* and *C. hawaiiensis*. Typical specimens of *C. hawaiiensis* are most readily distinguished from *C. japonicus* by the coloration of the middle legs, *C. hawaiiensis* having the middle femora more or less black or brown.

Antennae as shown in Figure 41. Mandibles as shown in Figure 185.

The species studied by T. I. Ishii under the name *C. lecanii* (Fitch) is referred to this form.[25] Gahan has shown that the records of *C. lecanii* from Japan were based on an incorrect determination.[26] His notes on the coloration of *C. japonicus* are in better agreement with typical *hawaiiensis* than they are with typical *C. japonicus*. However, it is not unlikely that the two forms are specifically alike as supposed by Gahan. If there is a specific distinction, the species studied by Ishii is to be referred to *C. hawaiiensis* rather than to *C. japonicus*.

[25] Ishii, Jap. Bull. Imp. Plant Quar. Sta., No. 3, 1923, pp. 66–95, pl. 17, figs. 1–8.
[26] Gahan, Proc. Ent. Soc. Wash., vol. 28, No. 1, 1926, p. 24.

29. COCCOPHAGUS TIBIALIS, new species

Plate 8, Figure 42

This is a Philippine Island species of the *C. lecanii* (Fitch) group. It can be most conveniently distinguished by the hind tibiae, which are entirely black or dark brown.

Female.—General color black; scutellum and median piece of metanotum bright lemon yellow except that the anterior margin of the former may be very narrowly black. Face and scape brownish, flagellum piceous due to the dark sensoria. Coxae, trochanters, and femora of all legs black or dark brown except that the femora of the fore and middle legs are paler at the apices and the middle pair have a faint annulus at base. Fore tibiae mostly brown, pale at apices. Middle tibiae dark brown or black on basal two-thirds or so and yellow or sordid white on the remainder. Hind tibiae entirely dark brown or black. All tarsi yellow or sordid white.

Scape slightly fusiform about three and three-fourth times as long as wide. Pedicel about one and one-third times as long as wide and much shorter than the first funicle joint. First funicle joint the longest, about one and two-thirds times as long as wide; second and third each successively a trifle shorter and wider, the third about one and one-fourth times as long as wide. First club joint subequal in length and a trifle wider than the third funicle joint; second and third successively shorter (fig. 42).

Mandibles with the ventral and median teeth subequal, the dorsal broadly rounded.

Fore wings hyaline; cilia fine and dense; the posterior basal hairless streak bent upward at its distal end. Marginal vein slightly longer than the submarginal. Length of longest marginal fringe 0.0352 mm.

Basitarsus of middle legs a trifle shorter than the succeeding joints united: tibial spur plainly shorter than the basitarsus. Paired spurs at apex of hind tibiae unequal.

Ovipositor as seen through the derm arises near the middle of abdomen.

Sculpture and vestiture similar to *C. lecanii* (Fitch).

Length 0.9 mm.

Male.—Body entirely black. Face in proximity to mouth and the scape and pedicel brownish; flagellum dark due to blackish sensoria. Except for the tarsi, all legs entirely dark brown to blackish. Tarsi brownish yellow except the apical joints, which are fuscous.

Type.—Cat. No. 42092, U.S.N.M.

Described from 18 females and 2 males (holotype, allotype, and paratypes) reared by Harold Woodworth from *Saissetia oleae* (Bernard), *Saissetia hemisphaerica* (Targioni), and *Coccus viridis* (Green), Los Banos, Philippine Islands, 1921.

30. COCCOPHAGUS COWPERI Girault

Plate 3, Figure 3

Coccophagus flavoscutellum Masi (not Ashmead) Boll. Lab. Zool. Gen. Agr. Portici, vol. 1, 1907, p. 239, fig. 4.

Coccophagus cowperi Girault, Descriptiones Stellarum Novarum, 1917, p. 1.

Coccophagus lecanii Gahan, Proc. U. S. Nat. Mus., vol. 71, Art. 4, 1927, pp. 24–25.—Smith and Compere, Univ. Calif. Pub. Ent., vol. 4, No. 9, 1928, pp. 247–254.

In a recent paper on the Parasites of *Saissetia oleae* (Bernard),[27] the writer treated this form under the name *C. lecanii* (Fitch) and in a footnote stated that there was doubt concerning its identity and that the figure and life history notes were based on a study of specimens received from Cape Town, South Africa. Gahan,[28] makes *C. cowperi* Girault a synonym of *C. lecanii* (Fitch) and expresses the belief that the African specimens represent merely a variation or at most a geographical race of *C. lecanii*. He also says that the types of *C. cowperi* were reared from *Stictococcus gowdeyi* Newstead, collected at Nagunga, Uganda, Africa. Since it is necessary to recognize the existence of this form, race, variety, or species, as the case may be, it is for uniformity treated as a species so as to be in agreement with the rank tentatively given to *C. eleaphilus*, Silvestri, *C. pulvinariae*, new species. *C. isipingoensis*, new species, *C. tibialis*, new species and *C. cubaensis*, new species.

A series of specimens collected in Italy and loaned for study by Doctor Silvestri were determined as *C. flavoscutellum* Ashmead by Masi and were mentioned by him under this name. So far as I can determine, all the specimens studied by Masi are in exact agreement with the South African form treated as *C. cowperi* Girault in this paper.

Figure 3, illustrating the adult of *C. cowperi* Girault, is a typical, medium sized species and it is set as the standard when statements of comparison are made. The slight differences that serve to distinguish this form from *C. lecanii* are given in the keys.

31. COCCOPHAGUS ISIPINGOENSIS, new species

Plate 5, Figure 7; Plate 8, Figure 43; Plate 11, Figure 130; Plate 13, Figure 163

The females of this species resemble those of *C. lecanii* (Fitch) closely enough to cause confusion but in the male sex the coloration of the legs is strikingly unlike.

Female.—Frontovertex orange yellow; coloration of face variable ranging from slightly dusky to black; antennae yellow; occiput blackish. Scutellum mostly yellow only the anterior margin more

[27] Smith and Compere, Univ. Calif. Pub. Ent., vol. 4, No. 9, 1928, p. 247.
[28] Gahan, Proc. U. S. Nat. Mus., vol. 71, Art. 4, 1927, p. 24.

or less black; median piece of metanotum yellow; occasionally the expanded part of the parapsides suffused with ferrugineous; mesosternum and ventral part of the prepectus and mesoepisterna shading to ferrugino-testaceous; remainder of thorax black. Abdomen black. All coxae black; trochanters apt to be pale with more or less blackish suffusions; fore femora blackish on basal half; middle femora with an annulus at base and yellow on apical one-third; hind femora more extensively black only the apical one-fourth yellow. Fore tibiae yellow or slightly brownish; middle tibiae completely yellow; hind tibiae mostly black, apical one-third or so yellow. Fore tarsi slightly brownish; apical joint of all tarsi dusky.

Pedicel almost one and one-half times as long as wide, plainly shorter than the first funicle point. First funicle point the longest, a trifle more than one and one-half times as long as wide; second and third successively shorter and slightly wider so that the third joint is not much longer than wide. Club joints successively decreasing in size; first and second about as wide as long; third plainly longer than wide (fig. 43).

Fore wings hyaline. Marginal vein a trifle longer than the submarginal; stigmal as shown in Figure 130.

Basitarsus of middle legs as long as the four succeeding joints united; tibial spur slightly but plainly shorter than the basitarsus. Paired spurs at apex of hind tibiae slightly unequal. Setae near articulation of middle femur and tibia moderately strong, black, as shown in Figure 163.

As seen through the derm, the ovipositor arises near the center of abdomen.

Length 0.95 mm.

Male.—Face and cheeks lemon yellow; frontovertex usually more or less suffused with fuscous and the ocellar area blackish; dorsal portion of occiput blackish, the ventral yellow. Expanded part of the parapsides more or less ferruginous; remainder of thorax and abdomen black. Legs lemon yellow except that the basal part of the coxae are more or less fuscous, the hind tibiae are blackish on the basal two-thirds, and the apical tarsal joints are fuscous.

The antennae are somewhat thicker than in the female and the sensoria on the first funicle joint are differently arranged.

Type.—Cat. No. 42090, U.S.N.M.

Described from 49 females and 15 males (holotype, allotype, and paratypes), reared by E. W. Rust as follows: 32 females and 7 males from *Coccus hesperidum* Linnaeus on *Hibiscus*, Durban and Isipingo, Natal, S. Africa, September 1925; 8 females from *Saissetia nigra* (Nietner), *Barberton*, Transvaal, May 1926; 2 females from *Saissetia persimile* (Newstead), Durban, Natal; 7 females and 8

males from *Filippia carissae* Brain, Durban, Natal, September 1925 and July 1926.

32. COCCOPHAGUS LECANII (Fitch)

Plate 11, Figure 131

Platygaster lecanii FITCH, Fifth Rept. Insects, New York, 1858, pp. 25–26.
Coccophagus lecanii A. E. SMITH, Amer. Nat., Phil., vol. 12, 1878, p. 661, fig. 6, *a–b*.—SMITH, Seventh Rept. State Ent., Ill., 1878, p. 130.—PUTMAN, Proc. Davenport Acad. Nat. Sci., vol. 2, 1879, pp. 297, 332–33.—HOWARD, U. S. Dept. Agr. Rept. Ent. for 1880, 1881, p. 357.
Coccophagus ater HOWARD, Rept. Ent. U. S. Dept. Agr. for 1880, 1881, pp. 359–60.
Coccophagus cognatus HOWARD, Rept. Ent. U. S. Dept. Agr. for 1880, 1881, p. 359.
Coccaphagus flavoscutellum ASHMEAD, Florida Agr., vol. 4, 1881, p. 65.
Coccophagus vividus HOWARD, U. S. Dept. Agr. Div. Ent., Bull. 5, 1885, p. 25.
Coccophagus cognatus HOWARD, U. S. Dept. Agr. Div. Ent. Bull. 5, 1885, p. 25.—HUBBARD, Insects Affecting the Orange, U. S. Dept. Agr. Div. Ent., 1885.
Coccophagus californicus HOWARD, Insect Life, vol. 1, 1889, p. 269.
Coccophagus lecanii GAHAN, Proc. U. S. Nat. Mus., vol. 65, art. 4, 1924, p. 12; Proc. Ent. Soc. Wash., vol. 28, No. 1, 1926, p. 24; Proc. U. S. Nat. Mus., vol. 71, art 4, 1927, pp. 24–25.
? *Coccophagus cowperi* GIRAULT, Descriptiones Stellarum Novarum, 1917, p. 1.
Coccophagus coccidis GIRAULT Descriptiones Stellarum Novarum, 1917, p. 2.

Except for *C. californicus* Howard, the above synonomy is that given by Howard and Gahan. In the literature *C. lecanii* (Fitch) is indirectly synonymized with *C. scutellaris* (Dalman) through *C. flavoscutellum* Masi (not Ashmead). The chain of synonomy linking *lecanii* (Fitch) and *scutellaris* (Dalman) is undoubtedly incorrect, for Dalman's original description applies to the species that has previously been known as *Coccphagus lunulatus* Howard.

In the past, *Coccophagus lecanii* (Fitch) has led to more confusion and synonomy than has any other species and unless more refined and exact methods of study are developed, it is likely to continue to be an enigma. The characters used in this paper to distinguish the females of certain so-called species are not essentially different from the characters used by Howard to separate his departures that have been synonymized. In this study, however, with one exception both sexes are represented in the series of specimens and even though the females are similar enough to cause confusion the males are strikingly different. In certain groups of insects it has been found that polymorphic males from different geographical localities are referrable to one species and if this proves to be the case in regard to *Coccophagus*, then the so-called species *C. cowperi* Girault, *C. pulvinariae*, new species, *C. isipingoensis*, new species, *C. cubaensis*, new species, and *C. eleaphilus* will probably be relegated to synonomy. It is possible that the forms of the *C. lecanii* group can not be accurately defined or understood on the basis of taxonomic studies and that it will be necessary to discover their genetic rela-

tionship before they can be assigned to their proper systematic position.

Coccophagus cowperi Girault is the common form in the vicinity of Cape Town. This form can not be satisfactorily separated from certain individuals found in North America which are referred to *C. lecanii* (Fitch). The specimens at hand seem to indicate that *C. cowperi* Girault is intermediate between *C. eleaphilus* Silvestri, *C. pulvinariae*, new species, *C. isipingoensis*, new species on the one side and C. lecanii (Fitch) of North America on the other side. *C. pulvinariae*, new species and *C. isipingoensis*, new species are represented in the collection of the Citrus Experiment Station by good series of specimens that do not show any intermediates, yet the two forms co-exist and are recorded from a common host, *Coccus hesperidum* Linnaeus.

KEY TO THE MALES OF CERTAIN SPECIES CLOSELY RELATED TO COCCOPHAGUS LECANII (FITCH)

1. Femora or tibiae of all or at least one pair of legs marked with blackish or brownish----2.
   All femora and all tibiae yellow, only the middle and hind coxae black. **pulvinariae**, new species.
2. Femora of at least one pair of legs marked with blackish or brownish----3.
   All femora and fore and middle tibiae yellow. Middle and hind coxae black. Hind tibia mostly black, the apex yellow----**isipingoensis**, new species.
3. Fore and middle femora yellow----4.
   All femora mostly black, the ends tipped with yellow. All coxae black. Fore and middle tibiae yellow. Hind tibiae more or less extensively suffused with blackish at base----**lecanii** (Fitch).
4. Hind tibia predominantly black, yellowish at apex----5.
   Hind tibiae yellow, hind femora mostly black, yellow at apex. **cowperi** Girault.[29]
5. Hind tibiae as well as the hind femora mostly black or dark brown. All coxae black. Fore and middle femora and tibiae yellow. **eleaphilus** Silvestri.

The following description applies to what is considered a typical specimen of *C. lecanii* (Fitch) from North America.

Female.—Face, cheeks, and frontovertex predominantly blackish or brownish, the latter with a pattern of orange colored lines. Scape and pedicel fuscous, the flagellum yellowish. Apical two-thirds of scutellum and the median piece of the metanotum bright lemon yellow, the remainder of thorax and abdomen black. All coxae black. All trochanters yellow. All femora with a sharply defined narrow, yellow annulus at base and at apex tipped with yellow, the yellow more extensive at the apices of the fore and middle femora than on the hind femora; the intermediate parts blackish. Fore tibiae predominantly yellow, more or less suffused with fuscous near the base.

[29] The males of *C. japonicus* Compere run to *cowperi* in this key yet the two forms are undoubtedly distinct as the females offer good characters for their separation and the larvae are unlike.

Middle tibiae entirely yellow. Hind tibiae more or less extensively fuscous at base, the apical half or so yellow, the two colors gradually blending without a sharp line of demarcation. Apical tarsal joints fuscous, the other tarsal joints yellow.

Usually the flagellum has fewer sensoria than is commonly seen in the related African species. As seen from one side, on each joint of the funicle two sensoria are usually sharply defined in one focal plane; the first and second club joints usually show three sensoria, while the third joint shows one. In the African forms the sensoria are more numerous and closer together so that in one focal plane three and four sensoria can be clearly seen on the funicle joints. The antennal differences are not at all constant and can not be relied upon unless taken in combination with other characters.

As a rule the fore wings are less densely setose and the setae are finer than in the African forms. As with the antennal differences, the character of the wings is variable.

Male.—Face, cheeks, frontovertex, antennal scape, and pedicel fuscous. Flagellum yellow. All coxae black, all trochanters yellowish. All femora mostly black, the ends yellow. Fore and middle tibiae yellow. Hind tibiae suffused at base with more or less blackish, the remainder yellow. Apical tarsal joint fuscous, the other tarsal joints yellow. Entire thorax and abdomen black.

Coccophagus californicus Howard is undoubtedly another synonym of *C. lecanii* (Fitch). The type female is mounted in balsam on a slide and crushed. If the under side of the specimen is viewed in a subdued light or against a dark background the coloration appears exactly as described by Howard, namely "mesoscutellum lighter in color than the rest of the thorax, except at immediate base, its posterior edge with a narrow band of bright lemon yellow extending from one lateral angle around the curved border to the opposite lateral angle, of nearly equal width throughout, at its widest portion measuring 0.027 mm." This appearance of distinctive coloration is due to a difference of refraction caused by a deposit of body fluids that accumulated and dried around the apical curvature of the scutellum when the specimen was crushed. So far as can be seen, the type female does not otherwise differ from typical specimens of *C. lecanii* from California. Actually the apical two-thirds of the scutellum is yellow with the basal third blackish.

32a. COCCOPHAGUS FUSCIPES Howard

Coccophagus fuscipes HOWARD, U. S. Dept. Agr. Rept. Ent. for 1880, 1881, p. 359.
Coccophagus fraternus HOWARD, U. S. Dept. Agr. Rept. Ent. for 1880, 1881, p. 359; U. S. Dept. Agr. Div. Ent., Tech. Ser. No. 1, 1895, p. 34.

I have had the privilege of examining the female cotype of *C. fuscipes*, a paratype of *C. fraternus* and four additional specimens

determined by Gahan as *C. fraternus*. So far as can be determined, *C. fraternus* is not unlike *C. fuscipes* and not essentially different from *C. lecanii* (Fitch). In my opinion *C. fuscipes* will ultimately be synonymized with *C. lecanii* (Fitch), but the separate identity of *C. fuscipes* is retained owing to my uncertainty.

In his Revision of the Aphelininae,[30] Howard makes *C. fuscipes* a synonym of *C. fraternus* although the latter has priority by reason of page precedence.

The following description is based on a study of the specimens labeled *C. fraternus*. The notes on the female cotype of the specimen labeled *C. fuscipes* were accidentally lost.

Female.—The paratype of *C. fraternus* has the apical half of the scutellum yellow and the basal half black. Median piece of metanotum yellow, remainder of thorax and the abdomen black. (Fore legs and antennae missing.) Middle femora with a narrow pallid annulus at base, apex slightly brownish yellow. Hind femora entirely blackish. Middle tibiae dark brown on basal two-thirds, apical third yellowish; hind tibiae similarly colored. Tarsi yellowish with the apical joints dusky. Sides of thorax, face, and cheeks faintly suffused with brownish. Frontovertex faintly brownish, basal corners orange.

The specimens determined by Gahan as *C. fraternus* are blacker than the paratype. Scutellum with the basal part blackish. Median piece of metanotum yellow. Flagellum brownish yellow with blackish sensoria; scape and pedicel dark brown. Face and cheeks black. All coxae black. All femora mostly black, tipped at ends with yellowish. Fore tibiae mostly dark brown, pale at ends. Middle tibiae suffused with dark brown or blackish on basal half, remainder yellowish. Hind tibiae more extensively blackish than the middle tibiae, only the apical third yellowish. Tarsi yellow with the apical joints dusky.

Fore wings very faintly and uniformly infumated.

Male.—Similar to the female except for the scutellum which is entirely black and for the usual sexual differences.

Redescribed from one female, paratype, *C. fraternus* Howard, U.S.N.M. No. 2603, and from three females and one male determined as *C. fraternus* by Gahan and labeled: "Reared from *Lecanium nigrofasciatum*, College Park, Md., November 28, 1925. H. S. McConnell, collector."

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[30] Howard, U. S. Dept. Agr., Tech. Ser. Bull. 1, 1895, p. 34.

33. COCCOPHAGUS ELEAPHILUS Silvestri

Coccophagus cleaphilus SILVESTRI, Boll. Lab. Zool. Gen. Agr., Portici, vol. 9, 1915, p. 318, fig. 69.—MASI, Novitate Zoologicae, vol. 24, 1917, pp. 122, 211–12.

I have had the opportunity of studying the cotypes of this form. It is closely related to *C. lecanii* (Fitch) and as in the case of *C. cowperi* Girault, and other species of the complex, an effort is made to maintain its separate identity until its genetical relationship is established. In his description, Silvestri compares this species with *C. flavoscutellum.* The form known to Silvestri as *C. flavoscutellum* is the same as the form treated as *C. cowperi* in this article.

Female.—All coxae and trochanters blackish. All femora more or less extensively blackish basally, the apices pale, straw colored. Fore and middle tibiae straw colored; hind tibiae mostly blackish, pale on apical one-fourth. Tarsi straw colored becoming dusky toward the apices. Head and body black except the scutellum which is more or less yellow apically.

Male.—Dorsum of head and the face marked with orange. Body black. All coxae blackish. Fore and middle femora and tibiae yellow; hind femora black, pale at ends. Hind tibiae black, pale on apical one-fourth.

The male of *C. cowperi* differs from this form by having the hind tibiae entirely yellow; sensoria fewer and those of the first funicle joint in two overlapping whorls.

Redescribed from one female and two males (cotypes) loaned by Doctor Silvestri. According to the original description reared from *Philippia* [*Filippia*] *chrysophyllae* Silvestri collected at Eritrea, Nefasit.

Masi records this form from the Seychelles Islands.

34. COCCOPHAGUS BIGUTTATUS Girault

Plate 10, Figure 78; Plate 12, Figure 139

Coccophagus biguttatus GIRAULT, Memoirs Queensland Museum, vol. 4, 1915, p. 51.

The body of the type female is in fairly good condition but the head is missing (fig. 139). This species can be recognized by the ovipositor which is exserted two-sevenths the length of the abdomen. Girault's description will enable recognition of the species. The sclerites of the thorax are very indistinct and the setae transparent. Apparently the scutellum is slightly wider than long but it is too indistinct to allow an accurate measurement. Scutellum furnished with three pairs of bristles.

Fore wings rather large, closely and finely ciliated (fig. 78). Submarginal vein slightly but plainly longer than the marginal. Stigmal vein of one wing obscured by a speck of dirt and that of the other wing too indistinct for study.

Basitarsus of middle legs about as long as the succeeding joints combined; tibial spur a trifle longer than the basitarsus.

Girault's description in part follows: "Pale honey yellow, the wings hyaline; pronotum at middle rather widely and a diamond shaped spot on each side of the thorax in vicinity of the axillae black. Stigmal vein very short, nearly sessile. Funicle joints not long, 3 quadrate, the other two a little longer than wide, subequal to the pedicel; the club well defined. Ovipositor valves dusky blackish. Abdomen distad with faintly indicated narrow cross stripes (just before apex). The two spots seem to be on the cephalic two-thirds of each axillae.

"From two specimens taken by sweeping *Lantana*, October 20, 1911.

"Habitat: Mackay, Queensland.

"Type: No. Hg/2933, Queensland Museum, Brisbane, one female on a slide."

The color pattern as described by Girault is now only faintly discernible. Center of pronotum and anterior margin of mesoscutum at center, blackish. Anterior two-thirds of axillae blackish with distinct reticulations.

Measurements in mm.: According to Girault the length of head and body is 0.72. Length of body, exclusive of head, and exserted ovipositor, 0.56. Length of exserted ovipositor sheaths 0.08. Length of thorax 0.28. Length of abdomen 0.28. Fore wings 0.56 long by 0.26 wide. Marginal fringe 0.028 long. Marginal vein 0.12 long; submarginal 0.18 long. Tarsi of middle legs 0.1456 long; basitarsus 0.056 long; tibial spur .0784 long.

Redescribed from type female. No data on slide other than name, female type, and Queensland Museum number.

35. COCCOPHAGUS ZEBRATUS Howard

Plate 8, Figure 44; Plate 11, Figure 91; Plate 14, Figure 178

Coccophagus zebratus Howard, U. S. Dept. Agr. Tech. Ser. No. 12, pt. 4, 1907, p. 81, Fig. 18.—Mercet, Trab. Mus. Cien. Nat. Madrid, No. 10, 1912, p. 246

This aberrant species is recognizable by the original description. Aside from distinctive coloration, it possesses unusual structural characters, notably, the swollen hind coxae and femora, and sharply tridentate mandibles. The original color pattern of the two type females is difficult to detect because of fading, the yellows and browns appearing somewhat alike.

Female.—Club dark brown, almost black; first two funicle joints lighter than the club; third funicle joint white in sharp contrast. Pedicel light brown basally, paler towards the apex. Dorsal margin of scape light brown, the remainder whitish, concolorous with face. According to Howard, frontovertex lemon yellow, as is the occiput,

pronotum, and mesonotum. Also, according to Howard, metascutum (metanotum and propodeum?) brown. Face and remainder of the thorax whitish. Abdomen whitish with a broad, transverse, brownish band on each segment. Exserted ovipositor sheaths brownish. All coxae and femora and fore tibiae whitish. Middle and hind tibiae slightly brownish at base. Basitarsus of middle and hind legs dark brown in contrast to the other tarsal joints.

Mandibles sharply tridentate as shown in Figure 178.

Scape a trifle wider than usual, slightly less than three and one-half times as long as wide. (The figure shows the scape to be a trifle longer.) Pedicel apparently just a trifle shorter than the first funicle joint, the difference not appreciable without actual measurement; about one and one-third times as long as wide. Second funicle joint a trifle the longest, by measurement, but to the eye it appears equal. All funicle joints of approximately the same width and all plainly longer than wide, slightly asymmetrical, ventrally articulated. Club well developed, somewhat wider than the funicle (fig. 44).

Scutellum strongly transverse, much shorter than the mesoscutum. Abdomen elongate, more than twice as long as wide. Ovipositor, as seen through the derm, arising far anterior to the center and exserted about one-eighth the length of abdomen.

Mesoscutum with relatively few, scattered, moderately long setae, there being two on the posterior margin, three along each side and about thirty-six scattered on the disk. Scutellum with three pairs of bristles, the anterior pair as long as those of the mesoscutum and placed directly behind the two setae on the posterior margin of the mesoscutum. The median pair of scutellar bristles is widely spaced and intermediate in size; apical pair the longest and also widely spaced. Each axilla with three setae instead of the usual two. Each parapsis with three setae. Seventh tergite with long dark setae. Fifth and sixth tergites with setae aligned across the dorsum; the second, third, and fourth tergites with a few weak pale setae on the sides.

Coxae and femora of hind legs noticeably swollen. Basitarsis of the middle legs about as long as the three succeeding joints combined; tibial spur slightly longer than the basitarsus. Hind tibiae at apex with one spur almost one-half as long as the basitarsus, paired with another one-half as long and somewhat stronger; in addition there are several peg-shaped spines at apex.

Fore wings hyaline, cilia moderately dense and coarse for a small species. A hairless streak extends along the posterior margin at base. Wings somewhat more narrow than usual, about three times

as long as wide. Marginal vein slightly longer than the submarginal; stigmal as shown in Figure 91.

Redescribed from two females (cotypes) U.S.N.M. No. 10308, reared from *Aclerda distorta* Green, collected by E. E. Green at Punduloya, Ceylon.

36. COCCOPHAGUS TRIFASCIATUS Compere

Plate 8, Figure 45; Plate 11, Figure 89.

Coccophagus trifasciatus COMPERE, Univ. Calif. Pub. Ent., vol. 3, No. 3, 1925, pp. 311–13, pl. 26, fig. 14 A–D.—SMITH and COMPERE, Univ. Calif. Pub. Ent., vol. 4, No. 3, 1926, p. 53.—MERCET, Eos, Rev. Esp. Ent., vol. 3, No. 4, 1927, p. 496.

This is one of the few species without a postmarginal vein. The antennae are distinctive. In addition to the three pairs of bristles on the scutellum there are from five to thirteen small setae scattered near the anterior pair. The striking coloration of this species will also aid in its recognition.

Female.—Head yellowish to brownish, dorsum suffused with a variable amount of fuscous. Tips of the mandibles brown. Antennae brownish yellow. Pronotum blackish, the sides sometimes marked with yellow. Anterior one-third of mesoscutum blackish, the remainder, as well as parapsides, tegulae, and prepectus yellow. Scutellum mostly black, occasionally on the sides towards apex with elongate yellow spots. Axillae, metanotum, propodeum, and metapleura black. Mesopleura range from blackish to yellow. Venter of thorax and abdomen mostly yellowish. First tergite yellow with a black spot on either basal angle; second blackish on about the posterior third; third and fourth entirely blackish; fifth tergite blackish medially and yellowish laterally; sixth and seventh mostly yellowish medially and blackish laterally. Legs mostly yellowish. Hind tibiae suffused with blackish on basal two-thirds. Coxae of hind legs blackish basally. Femora and tibiae of fore and middle legs slightly tinged with dusky. All tarsi more or less faintly dusky.

Pedicel one and one-third times as long as wide and slightly longer than the first funicle joint. Funicle joints successively decrease very slightly in length and increase in width. First funicle joint a trifle longer than wide; second and third joints each a trifle wider than long. First club joint slightly longer than any of the funicle joints; second and third each a trifle smaller than first (fig. 45).

Scutellum about as long as wide and as long as mesoscutum. Abdomen about as long as thorax, sides subparallel for a greater part of their length. First and second abdominal segments fused without a traceable suture, these two comprising about one-third the length

of abdomen. Abdomen broadly rounded at apex. Ovipositor short and not exserted.

Fore wings hyaline, densely and closely ciliated, with a very short marginal fringe. Submarginal vein one-fourth longer than marginal; postmarginal absent. Stigmal vein not enlarged at apex nor much constricted at base, as shown in Figure 89.

Basitarsus of middle legs about as long as the three succeeding joints united; tibial spur slightly shorter than basitarsus.

Scutellum with three pairs of bristles and from five to thirteen small setae scattered in proximity to anterior pair of bristles. Pronotum and mesoscutum with numerous small, black setae. Each parapsis with four setae and each axilla with two setae, these being about as large as those scattered on scutellum. Metanotum, on either side, with two small setae set in punctures on anterior margin. Propodeum with small setae scattered on sides. Sides of second, third, and fourth tergites with a few small, dark setae in transverse alignment; fifth and sixth with the rows of setae complete across dorsum; seventh tergite with a median semicircle of setae and a few scattered, stronger ones.

Blackened portions of mesoscutum, axillae, and scutellum with areolate reticulations. Metanotum on either side with four wavy striations. Propodeum with two strong, sublateral carinae a short distance mesad of spiracles.

Length 0.9 mm.

Male.—Aside from sexual differences, the males differ from the females mostly in coloration. Body black, except for tegulae, a large part of parapsides and a spot on pleura close to root of fore wings which are yellowish. Tegulae sometimes marked with a black dot. Face and legs, except a greater part of hind tibiae bright yellow. Eyes a trifle smaller than in female, so that antennae are inserted about midway between oral margin and basal orbital line. Abdomen shorter than thorax.

Redescription based on the original description and additional specimens reared from *Saissetia oleae* received from South Africa. According to Rust *C. trifasciatus* is the most effective black scale parasite occurring in South Africa. Attempts were made to establish this species in California, and it was at least temporarily established, as specimens were reared from scales collected in California.

37. COCCOPHAGUS LUTESCENS, new species

A small species, yellow to pale white. Tibial spur of middle legs a trifle longer than the basitarsus; basitarsus as long as the succeeding two joints united.

Female.—General color pale yellow on the dorsum, fading to white on the sides and venter of thorax and on the face and cheeks.

Pedicel plainly larger than the first funicle joint, almost one and one-half times as long as wide. First funicle joint the smallest, about one and one-fourth times as long as wide, broadly fused to the second funicle joint; second and third successively wider and longer and each with a well-developed neck; both plainly longer than wide. Club large, as long as the funicle and at its widest point almost one and one-half times as wide as the third funicle joint. Second club joint with the dorsal margin much longer than the ventral. Pedicel and funicle furnished with sparse, large, pale setae.

Setae of the thorax hardly visible in the balsam-mounted specimens available for study. Mesoscutum with sparse, large, pale setae. Scutellum with three pairs of pale bristles.

Fore wings hyaline furnished with sparse, rather coarse setae. Marginal fringe 0.0492 mm. long. Submarginal vein slightly longer than the marginal; stigmal vein large, swollen at apex; postmarginal hardly developed.

Ovipositor, as seen through the derm, arises near the middle of abdomen.

Length 0.58 mm.

Male.—Face and cheeks white, frontovertex yellowish. Center of pronotum and anterior margin of mesoscutum in middle faintly dusky. Each axilla with a fuscous spot or suffusion anteriorly. Propodeum medially and dorsum of the abdomen, especially toward the apex, suffused with brownish or fuscous. Flagellum yellowish, scape white.

Club not differentiated from funicle; flagellar joints successively decreasing in size, ventrally articulated; sensoria numerous and as long as the segments.

Length 0.52 mm.

Type.—Cat. No. 42086, U.S.N.M.

Described from two females and one male (holotype, allotype, and paratype) on one slide mounted in balsam, reared by E. W. Rust from *Pulvinaria jacksoni*, Durban, Natal, September 9, 1925.

38. COCCOPHAGUS PERFLAVUS Girault

Plate 8, Figure 46; Plate 11, Figure 132; Plate 12, Figure 143

Coccophagus perflavus GIRAULT, Societas Entomologica, vol. 31, 1916, p. 31.

A pale yellow species without any dark markings. *C. lutescens*, new species is closely allied to this form. *C. lutescens* has the face, cheeks, and venter of the thorax white, different antennal proportions, and longer basitarsus.

Female.—Head, body, legs, and antennae pale yellow. Ocelli and eyes red.

The exact proportions of the scape, pedicel, and first funicle joint are not easily seen and there may be a slight error due to the fact that these joints are partially obscured and shriveled. Scape subcylindrically fusiform, somewhat more than four times as long as wide. Pedicel more than one and one-half times as long as wide and about equal in length to first funicle point. First funicle joint shortest, slightly more than twice as long as wide; second and third successively longer and wider and each about twice as long as wide. Club strongly developed, its basal joint slightly shorter than third funicle joint and plainly wider, about one and one-half times as wide; second as long as first; third a trifle longer than preceding (fig. 46).

Mandibles partially obscured but apparently not greatly unlike those of *C. ochraceus* Howard.

Scutellum transverse, plainly much wider than long and plainly shorter than mesoscutum. Median piece of metanotum large, transverse (fig. 143). Abdomen crushed, showing ovipositor sheaths shortly exserted.

The vestiture of the mesonotum appears about as shown in Figure 143. On the anterior portion of the mesoscutum, the setae are obscured, as are the setae of the parapsides, and only one seta remains on the axillae. It is likely that the vestiture is similar to that of the male, which is revealed more distinctly and is described in more detail.

Fore wings hyaline, veins light, disk densely clothed with moderately coarse cilia. Marginal fringe moderately long, 0.0344 mm. Wings somewhat more than twice as long as wide. Submarginal vein slightly longer than marginal vein. Postmarginal shortly produced. Stigmal vein as shown in Figure 132.

Tibial spur of middle legs as long as basitarsus; basitarsus as long as three succeeding joints united.

Length approximately 0.8 mm. The specimens will not allow an accurate measurement.

Male.—Unlike the female in coloration and in antennal characters. Male antennae of the same structure as *C. ochraceus* Howard.

General color slightly brownish yellow or perhaps ochraceus, with fuscous or dark-brown markings as follows: Meson of pronotum, anterior margin of mesoscutum of the meson, propodeum between spiracles, basal angles of abdomen, and about the posterior half of the abdomen except the apex. A portion of each axilla faintly dusky.

Funicle and club not differentiated. Joints of flagellum ventrally articulated, dorsal margins at apex cut away, furnished with numerous sensoria which extend entire length of each segment. Pedicel short, apparently wider than long. Flagellar joints subequal in

length; first four roughly twice as long as wide, apical two joints more slender.

Mesoscutum with a reduced number of setae posteriorly, only a single strong pair near the posterior margin and anterior to these another pair not quite so strong. Most species have about five stronger setae in alignment along the parapsidal sutures, but this species has only one seta anteriorly on either side. The anterior two-thirds of the mesoscutum with moderately strong, sparse setae. Each parapsis with three setae. Each axilla with two setae.

Length about 0.68 mm.

Redescribed from two females and one male (cotype) U.S.N.M. No. 20002, labeled, " Bred from *Lecanium corni*, Madison, Wis., June 22, 1915, F. A. Fenton." One female is obscured under the excess of balsam squeezed out under the cover glass, the other is crushed. The male specimen is in the best condition but the antennae are partly concealed.

39. COCCOPHAGUS ARGENTEUS Girault

Plate 8, Figure 47; Plate 10, Figure 76; Plate 11, Figure 106, Plate 12, Figure 136

Coccophagus argenteus, GIRAULT, Memoirs Queensland Museum, vol. 4, 1915, p. 52.

The type female has been crushed beneath the cover glass but the important structural characters are to be seen as shown in Figure 136. The species can be recognized by the unusual wings as shown in Figure 76, and by the transverse scutellum. The wings of this species are unlike those of any other described species of *Coccophagus*.

Scape obscured beneath head but apparently about as shown in Figure 47. Pedicel slightly longer than wide and about as long as first funicle joint. Funicle joints ventrally articulated, all slightly longer than wide and about of same size and shape. Club as long as funicle joints combined and about one and one-half times as wide as distal funicle joint.

The character of the fore wing is best shown by the illustration, Figure 76. The wing from which the drawing was made is twisted at the base. The center of the wing is occupied by a slightly infuscated area, which is clothed with blackish cilia. The shape of this area is shown in the figure. Distad of the infuscated area the cilia are very fine and transparent. Marginal fringe long. Marginal vein as long as submarginal vein; stigmal and postmarginal as shown in Figure 106.

Thorax about as shown in Figure 136. The setae are rather coarse and blackish so as to be easily seen. Mesoscutum with about 40 setae, of about the same size as those on the axillae and the

anterior pair on the scutellum. Left axilla with only two setae present. Right axilla with four setae present. Apparently the left axilla never possessed more than two setae, for only two setiferous punctures are discernible. Scutellum with three pairs of setae or bristles.

Basitarsus of middle legs short, about one-third as long as five tarsal joints combined, or about as long as two succeeding tarsal joints combined; tibial spur slightly longer than basitarsus.

Girault's description gives many characters which are no longer discernible:

"Silvery white; the following parts honey yellow: Center of vertex, scutum, parapsides, and scutellum. The following parts jet black: Dorsum of abdomen excepting for three round spots in a triangle, one at apex, the other two opposite, at the lateral margin of the distal two-thirds; center of occiput; and the club except the distal half or more of distal joint. Lateral halves of each funicle joint and the axillae dusky.

"From one female taken on a window, January 16, 1914.

"Habitat: Gordon Vale (Cairns), Queensland.

"Type: No. Hg/2936, Queensland Museum, Brisbane, the female on a slide."

Measurements in mm.: Girault gives the length as 0.65. Pedicel 0.0312 long by 0.0224 wide. First funicle joint 0.0304 long by 0.0216 wide; second funicle joint 0.0360 long by 0.0240 wide; third funicle joint 0.0312 long by 0.0264 wide. First club joint 0.0376 long by 0.0384 wide; second club joint 0.0360 long by 0.0376 wide; third club joint 0.0360 long by 0.0368 wide. Fore wings, 0.48 long by 0.18 wide. Marginal vein 0.16 long; submarginal 0.16 long. Middle tarsi 0.1296 long; basitarsus 0.04 long; tibial spur 0.0496 long.

Redescribed from the type female in the Queensland Museum. No data on slide other than name, type designation, and museum number.

40. COCCOPHAGUS ARGENTIFASCIA Girault

Plate 8, Figure 48; Plate 10, Figure 83; Plate 11, Figure 93; Plate 12, Figure 137

Coccophagus argentifascia GIRAULT, Memoirs Queensland Museum, vol. 4, p. 54, 1915.

Girault, in his original description, describes the coloration of this species in detail and his description will probably enable identification of the species on the basis of coloration. The color pattern described by Girault is now only vaguely discernible. The species can be easily recognized by good structural characters, however, especially by the narrow fore wings. It belongs to the group of *Coccophagus* species which have the transverse scutellum. The fe-

male type is crushed on a slide but many of the important characters are shown in Figure 137.

Scape concealed beneath crushed head. Pedicel plainly longer than wide and a trifle shorter than first funicle joint. First funicle almost imperceptibly shorter than the third; second funicle joint plainly the longest; all of about same width and ventrally articulated so that the shape is not symmetrical, the ventral margin being the longest. Club large, about as long as first two joints and half of third funicle joint combined, and about one and one-half times as wide as third funicle joint (fig. 48).

Scutellum wider than long and furnished with three pairs of bristles. Each axilla with two setae. Each parapsis with three setae. Mesoscutum crushed, but on one-half there are about twenty-five setae and on the posterior margin there are two longer setae comparable in size with those of scutellum. On either side of tergites one, two, and three are two paired setae which are rather large for a delicate species; on either side of the fourth are five setae in transverse alignment.

Fore wings small, slender, clothed with rather coarse cilia. Marginal vein slightly longer than submarginal. Wing shown in Figure 83. Stigmal and postmarginal veins shown in Figure 93. The light brownish stripe mentioned by Girault no longer visible.

In life, the ovipositor may be shortly exserted. It is distinctly shortly exserted in the type specimen but this may be due to crushing.

Girault's description of the coloration is as follows: "Orange yellow; lower face, pronotum, propodeum, and immediate base of abdomen dusky. Abdomen black with a broad silvery white band across just out from base (occupying a little over a third of the surface). Legs except proximal half of coxae, silvery white. Antennae lemon yellow, distal club joint dusky. Fore wings with a light brownish stripe across them beginning a little distad of proximal third of marginal vein and ending a little distance distad of venation."

Measurements in mm.: Girault gives the length of female as 0.70. Fore wing, length 0.562; width 0.19. Length of marginal vein 0.18; length of submarginal 0.15. Longest marginal fringe 0.0224. Middle legs, length of five tarsi combined 0.16; length of basitarsus 0.0656; length of tibial spur 0.0582. Pedicel 0.04 long by 0.028 wide. First funicle joint 0.0448 long by 0.0216 wide; second funicle joint 0.0616 long by 0.0256 wide; third funicle joint 0.0520 long by 0.0240 wide; first club joint 0.0432 long by 0.0360 wide; second club joint 0.0428 long by 0.0360 wide; third club joint 0.0464 long by 0.0304 wide.

Redescribed from the type female, Queensland Museum No. Hg/2942. Girault gives the following data in his description:

"From one female taken from a window, February 24, 1914. Habitat: Gordon Vale (Cairns), Queensland."

41. COCCOPHAGUS BIVITTATUS, new species

Plate 8, Figure 49; Plate 10, Figure 84; Plate 11, Figure 105; Plate 13, Figures 147 and 153.

This form is closely related to *C. longifasciatus* Howard from which it is separated by the shorter ovipositor, small infuscated cloud beneath the stigma, and a slight difference in coloration. In this species the ovipositor arises near the middle, or approximately under the posterior margin of the fourth tergite, while in *C. longifasciatus* Howard, the ovipositor arises nearer the base, or approximately under the middle of the second tergite.

Female.—General color, lemon yellow with a longitudinal blackish band on either side of the body from pronotum to sixth tergite; sixth tergite yellow; seventh tergite blackish. A blackish blotch on either side of foramen. Upper portion of face and beneath the eyes iridescent pearly white. Eyes red. Antennal club and fore tarsi faintly fuscous. (Color description made from a freshly killed specimen.)

Pedicel plainly longer than the first funicle joint. Funicle joints asymmetrical, ventrally articulated. First funicle joint plainly the shortest, a trifle longer than wide; second and third subequal. Club large, broadly rounded at apex, as long as the funicle joints united, and about one and one-half times as wide as the third funicle joint (fig. 49).

Mandibles with a well-developed ventral tooth separated by a deep emargination from the dorsal truncation.

Fore wings with a small fuscous spot beneath the stigma and a trace of an infuscation beneath the upward bend of the submarginal vein. Marginal vein planly longer than the submarginal; postmarginal very shortly produced; stigmal vein large and of distinctive shape as in Figure 105. Marginal fringe moderately long as shown in Figure 84.

Basitarsus of middle legs short, about as long as the succeeding two tarsal joints united; tibial spur plainly longer than the basitarsus.

Ocelli in an equilateral triangle, posterior pair remote from eye and occipital margin. Scutellum much wider than long and not so long as the mesoscutum. Median piece of the metanotum well developed, in tag mounts, appearing as a separate, triangular sclerite coalesced with the scutellum. Outline of body and vestiture as shown in Figure 147.

Length about 0.9 mm.

Male.—Mesoscutum, scutellum, median piece of metanotum, sides and venter of thorax and apex of abdomen lemon yellow. In colora-

tion head like that of female. The following parts blackish or dark brown: Pronotum, a blotch on the expanded part of the parapsides, most of axillae, sides of metanotum, propodeum, and most of abdomen.

Infuscated spot beneath the stigma obsolete or nearly so.

Antennae as shown in Figure 153.

Type.—Cat. No. 42100, U.S.N.M.

Described from 20 females and 1 male (holotype, allotype, and paratypes). Females reared by E. W. Rust from *Filippia carissae* Brain, collected at Durban, Natal, South Africa, October, 1925; and from *Inglisia elytropappi* Brain, Signal Hill, Cape Town, South Africa, December, 1924. Allotype male from *Saissetia oleae* (Bernard) Durban, Natal, Oct. 26, 1925.

42. COCCOPHAGUS LONGIFASCIATUS Howard

Plate 8, Figure 50; Plate 10, Figure 82; Plate 11, Figure 110

Coccophagus longifasciatus Howard, U. S. Dept. Agr. Bur. Ent. Tech. Ser. No. 12, pt. 4, 1907, pp. 80–81, fig. 17.—Girault, Psyche, vol. 16, No. 4, 1909.—Mercet, Trab. Mus. Cien. Nat., Madrid, 1912, pp. 238–39.—Smith and Compere, Univ. Calif. Pub. Ent., vol. 4, No. 9, 1928, p. 254.

Two female specimens from Foochow, China, collected by F. Silvestri, were determined by us as *C. longifasciatus* Howard on the basis of the original description. Rust reported the species from South Africa and sent specimens for study. The South African form is described as new in this paper under the name *C. bivittatus.* The principal differences between these two forms are given in the key and mentioned under *C. bivittatus*, new species.

C. longifasciatus was originally described from specimens reared by E. E. Green from *Saissetia nigra* (Nietner) collected at Manaar, Ceylon. The Chinese specimens in our collection are supposed to be identical with the Ceylon specimens but the determination is not positive.

43. COCCOPHAGUS CINGULIVENTRIS Girault

Plate 11, Figure 87

Coccophagus cinguliventris Girault, Psyche, vol. 16, no. 4, 1909, pp. 79–80.—Mercet, Trab. Mus. Cien. Nat., No. 10, 1912, pp. 225–26.

Coccophagus cinguliventris is very distinct, not being closely related to any other described species. The comparatively long stigmal vein is strikingly different from that of any other described species. The habitus of this species is vaguely suggestive of *Aphelinus.* The sutures of the mesoscutum, axillae, parapsides, and scutellum are well impressed and the setae of the mesoscutum are less numerous than usual. This species has a distinctive coloration. The antennae also offer good characters for its recognition.

Female.—Mostly black, except for basal one-third of the abdomen, which is yellow in sharp contrast. Parapsides faintly brownish. Dorsum of head mostly orange yellow, ocellar triangle blackish. Eyes bright red. Face and antennae yellow. Cheeks blackish, the genal suture being the line of demarcation between the yellow of the face and the blackish of the cheeks. Legs pallid white, faintly suffused with yellowish in parts, especially on tarsi.

One antenna of the specimen studied was lost in an attempt to transfer it to balsam, the other antenna stuck to the glue on the tag. The following description of the antenna was made without measurements. Pedicel rather large, plainly larger than first funicle joint. First funicle joint plainly the smallest, about two-thirds as long as second funicle joint, and not much longer than wide. Second and third funicle joints subequal in length and a trifle wider than first. Sensoria not in marked contrast and hardly discernible in the tag mount. Setae of antenna pale and fine.

Forewings very faintly and indistinctly infuscated beneath stigma, cilia slightly coarse and moderately thick. Marginal fringe slightly longer than normal, 0.04 mm. Wings slightly longer than usual, about two and one-half times as long as wide. Marginal vein slightly longer than submarginal vein. Postmarginal vein absent. Stigmal vein long as shown in Figure 87.

Scutellum wider than long (9:6), rather broadly rounded at apex, not so long as mesoscutum (6:8). Parapsidal sutures well impressed. Axillae and scutellum not closely fused, the sutures distinct. Median piece of the metanotum large and prominent. Propodeum strongly elevated on the meson but this median ridge may be the result of shrinkage. Abdomen about one and one-half times as long as wide and about as long as thorax. Ovipositor not exserted.

Mesoscutum with a reduced number of setae, more closely arranged along the posterior and lateral margins. Each axilla with two setae similar to those of mesoscutum. Scutellum with three pairs of bristles, anterior pair closest together and no longer than those of mesoscutum, median pair also small but more widely spaced, apical pair longest but not as long as usual.

Mesoscutum, axillae, and scutellum strongly but finely areolate reticulated, the raised lines rather coarse and close, forming small aeroles, giving the scaly appearance described by Girault.

Length 0.9 mm.

The male is easily associated with the female by means of the several unusual characters mentioned in the description of the female.

Male.—Mostly blackish to brownish. Parapsides brownish yellow marked with blackish. Abdomen entirely black. Dorsum of

head orange, ocellar triangle blackish. Face mostly orange above merging to yellow below, including all the portion between genal sutures. Laterad of genal sutures, cheeks black. Blackish of cheeks continuous in a line arching above oral margin. Eyes red. Antennae slightly brownish yellow. Lateral and under parts of thorax more or less brownish. Legs pallid white to yellowish.

Antennae unlike those of female, club not differentiated and flagellum furnished with numerous sensoria. Pedicel short, apparently wider than long. Funicle and club joints apparently subequal in length.

Length 0.77 mm.

Redescribed from one female and one male in the United States National Museum, determined by A. B. Gahan; reared from *Lecanium nigrofasciatum*, Kent County, Maryland, June 1, 1911. A. B. Gahan, Coll.

44. COCCOPHAGUS MARGARITATUS, new species

Plate 5, Figure 10; Plate 8, Figure 51; Plate 10, Figure 77; Plate 11, Figure 108; Plate 13, Figure 154; Plate 14, Figure 184

This species is slightly suggestive of *Prospaltella* in certain respects. The fringe of the forewings is longer than usual in *Coccophagus* and the cilia of the disk are rather sparse and large. It is a distinctive species readily recognized.

Female.—Most of the head lustrous, pearly white, the face and frontovertex with some yellowish; occiput blackish. Antennae mostly yellow; scape whitish, yellow at apex. Eyes and ocelli scarlet. The following parts black to dark brown: Mesoscutum, axillae, median part of metanotum, propodeum, petiole, posterior margin of second tergite, third, fourth, and fifth tergites, procpisterna, mesopleura, prepectus, mesosternum, middle and hind coxae, venter of abdomen on apical half, and ovipositor sheaths. Parapsides and scutellum more or less ferruginous. Tegulae more or less yellow. Basal one-third or so of abdomen pale yellow to white. Sixth tergite yellow with a dark blotch on either side of the center. Seventh tergite yellow with dark median blotch. Cercal plates margined with dark brown posteriorly. Legs mostly white, in parts faintly yellowish, the middle and hind coxae black.

Scape slender, a trifle more than five times as long as wide. Pedicel, large, about one and one-half times as long as wide and plainly longer than the first funicle joint. First funicle joint the smallest, slightly longer than wide and slightly more than one-half as long as the second. Second and third funicle joints subequal, each somewhat more than one and one-half times as long as wide. Club large, as long as the funicle joints combined. First and second

club joints subequal, slightly wider than long, the third slightly longer and narrower than the preceding joint (fig. 51).

Manibles shown in Figure 184.

Fore wings hyaline, cilia on disk sparse and coarse; a row of cilia in straight alignment parallels the frenular fold. Marginal fringe long for *Coccophagus*, the longest cilia measuring 0.0288 mm. Marginal vein plainly longer than the submarginal; stigmal with a slender neck and widely expanded at apex; postmarginal indistinct and not produced so far forward as the stigmal. Entire fore wing as shown in Figure 77. Stigmal vein as shown in Figure 108. Scutellum plainly wider than long (5:3) and much shorter than the mesoscutum (6:11). Ovipositor suggestive of *Prospaltella*, the outer plates very wide. Ovipositor sheaths plainly exserted. The relative proportions of the abdomen as shown in Figure 10 are presumably a trifle broader than in life due to pressure of the cover glass on the balsam-mounted specimen from which the drawing was made.

In the balsam-mounted material, the setae on the frontovertex not discernible, setae on the face and cheeks fine and pale. Eyes densely, finely ciliated. Setae of the thorax and abdomen as shown (fig. 10). The arrangement of the setae on the abdomen is a good character for the identification of this species. Tibial spur of middle leg about as long as the basitarsus. Hind tibiae with one very long spur paired with a short spur.

Length about 1.0 mm.

Male.—Frontovertex yellow; face and cheeks lustrous, pearly white. Antennae yellow. Occiput, pronotum, mesoscutum, axillae, metanotum, propodeum, abdomen except apex, proepisterna, prepectus and mesopleura blackish to dark brown; remainder of the body yellow. Legs mostly pale yellow to whitish, except for the hind coxae, which are dark. In the single specimen at hand, it is difficult to see the coloration of the middle coxae which may be dark. Hind tibiae a trifle dusky toward the base.

Antennae as shown in Figure 154.

Fore wings with a longer marginal fringe and fewer cilia on the disk than in the female. Also, the arrangement of the cilia differs in this sex.

In the male as well as the female there is only one seta on either lateral margin of the mesoscutum located anteriorly. Frontovertex with short, moderately coarse, black setae which are not apparent in the female.

Scutellum proportionately longer than that of the female.

Length about 0.52 mm.

Type.—Cat. No. 42083, U.S.N.M.

Described from five females and one male (holotype, allotype, and paratypes) mounted in balsam. One female, holotype, "Ex. *Ceroplastes* sp. on 'umkavoti,' Durban, Natal, Sept. 10, 1925;" one male, allotype, "Ex. *?Chrysomphalus* sp., Amanzimtati, Natal, May 28, 1927;" four females dismembered and crushed, "On window, Durban, Natal, Sept. 14, 1925." All specimens collected by E. W. Rust. Rust's Nos. C–13, C–13A, and C–13D.

45. COCCOPHAGUS PULCINI Girault

Plate 8, Figure 52; Plate 10, Figure 79; Plate 11, Figure 134

Coccophagus pulcini GIRAULT, New Pests from Australia, III; Brisbane, Queensland, August 25, 1926. (Published by author.)

Girault's original description follows: "As *triguttatus* but abdomen above with 5 distinct cross stripes, 2–4 close; funicle 1 somewhat longer than wide, equal 2, latter shorter than pedical. Wynnum, 4. October, 1921."

The type female is badly crushed but all the fragments are present. The distinct cross stripes mentioned by Girault are no longer apparent. General color light lemon yellow with concealed center of pronotum black. Some blackish appears on abdomen but the sclerites are so badly separated and crushed as to make the original color pattern impossible of recognition.

An antenna is well preserved and intact so that the general shape and proportion can be pictured (fig. 52.) Scape fusiform, of usual shape. Pedicel plainly longer than wide, and longer and wider than first funicle joint. First funicle joint the smallest, the two succeeding subequal in length and slightly increasing in width distad. Club as long as funicle joints combined and about one and one-third times as long as distal funicle joint. The sensoria and vestiture as shown in Figure 52.

Fore wings as shown in Figure 79. Posterior, basal hairless area separated from the hairless streak under the marginal vein by three rows of cilia. Submarginal vein slightly longer than marginal vein; stigmal and postmarginal as shown in Figure 134. Disk of wing with medium sized cilia. Marginal fringe of normal length. Wings clear, hyaline.

Scutellum in the crushed condition plainly wider than long. Ovipositor shortly exserted.

Setae on the body not readily seen and many misplaced by the mutilation. The setae are light-colored, and the scutellum is probably furnished with three pairs of bristles although only the apical pair remain. Mesoscutum with 30 or more moderately stout setae.

Mandibles with the ventral tooth well differentiated from the broad trucation.

Basitarsus of middle legs about as long the three succeeding joints combined; tibial spur about as long as the basitarsus.

Measurements in mm.: Fore wing, length 0.66; greatest width 0.032. Length of marginal vein 0.16; length of submarginal 0.22. Length of marginal fringe 0.0192. Middle legs, length of tarsi 0.16; length of basitarsus 0.0576; length of tibial spur 0.0696. Ovipositor sheaths exserted 0.04 beyond apex of abdomen; however, this may be a distortion. Scape 0.1244 long by 0.0304 wide. Pedicel 0.0456 long by 0.0280 wide. First funicle joint 0.0304 long by 0.0224 wide; second 0.0360 long by 0.03128 wide; third 0.0368 long by 0.0360 wide. First club joint 0.0440 long by wide; second 0.040 long by 0.0480 wide; third 0.0304 long by 0.0296 wide.

Redescribed from the type female in the Queensland Museum. No data on slide label other than name and designation "Female type."

46. COCCOPHAGUS AURICAPUT Girault

Plate 8, Figure 53; Plate 11, Figure 102

Coccophagus auricaput GIRAULT, Memoirs Queensland Museum, vol. 4, 1915, p. 49.

This species must be recognized mainly from Girault's original description. The body of the type female is squeezed out from under the cover glass and is obscured in the excess of balsam. The head is crushed and in fragments on the slide. It is possible to observe some characters of taxonomic value not mentioned in the original description.

Scutellum transverse and furnished with three pairs of bristles.

Mandibles with a distinct ventral tooth and a broad truncation.

Antennae. Scape not seen. Pedicel plainly longer than wide and as long as first funicle joint. Funicle joints very slightly increasing in length distad, almost subequal in length and width, and about twice as long as wide. Club about as long as funicle joints combined and not much wider than distal joint. A drawing of a portion of one antenna is shown in Figure 53. The apical funicle joint and the club of the other antenna remain on the slide and they differ slightly from those figured in that the first two club joints are plainly wider than the apical funicle joint.

The following quotation from the original description pertains to characters no longer discernible. "Orange yellow, the abdomen black, the legs lemon yellow except the dusky hind coxae. Antennae lemon yellow. * * * Fore wings densely, finely ciliate, the stigmal vein short, sessile (fig. 102). Hind wings acutely pointed with about eight lines of fine discal cilia where widest. * * * Wings hyaline.

"From one female taken in forest, January 4, 1912.

"Habitat: Capeville (Pentland), Queensland.

"Type: No. HG/2927. Queensland Museum, Brisbane, the specimen on a slide * * *."

Measurements in mm.: Pedicel 0.0376 long by 0.0256 wide. First funicle joint 0.0376 long by 0.0240 wide; second funicle 0.0432 long by 0.0224 wide; third joint 0.048 long by 0.032 wide. First club joint 0.0408 long by 0.0232 wide; second 0.0384 long by 0.0248 wide; third 0.0488 long by 0.0232 wide.

Redescribed from the type female, Queensland Museum. No data on slide label other than name, designation type female, and museum number.

47. COCCOPHAGUS OCHRACEUS Howard

Plate 8, Figure 54; Plate 10, Figure 81; Plate 11, Figure 123

Coccophagus ochraccus Howard, U. S. Dept. Agr. Div. Ent. Tech. Bull. No. 1, 1895, p. 38.

Coccophagus bifasciaticorpus Girault, Soc. Ent., vol. 31, 1916, p. 44.

Coccophagus ochraceus Gahan, Proc. U. S. Nat. Mus., vol. 56, art. 4, 1924, p. 13.

Female.—Ochraceous to honey yellow with conspicuous dark-brown or blackish markings that are decidedly variable in extent and degree. The blackish to brownish markings are as follows: A broad band across dorsum on apical half of abdomen, a small median spot between cercal plates, a transverse area across center of occiput, collar of pronotum, anterior margin of mesoscutum, notal sutures more or less, axillae in some specimens more or less, metanotum, propodeum, and a blotch on metapleura below. The outer aspect of tibiae and apical tarsal joints slightly suffused with dusky. Eyes bright red. On dorsum of head, orbits paralleled by a narrow iridescent white margin which expands below on the cheeks.

Frontovertex about one and one-third times as wide as long. The posterior ocelli several times their own diameter from the eye margins and not quite as distant from the occipital margin. Frontovertex slightly punctate reticulate. Mesoscutum and scutellum finely reticulated.

Scape slightly fusiform, slender, slightly more than five times as long as wide, and about as long as funicle joints. Pedicel noticeably longer than first funicle joint, a trifle more than twice as long as wide. Funicle joints asymmetrical, ventral side longer, dorsal margin obliquely shortened at apex; all ventrally articulated. First funicle joint plainly the smallest, slightly less than twice as long as wide; second a trifle the longest, but the difference in length between this joint and third hardly appreciable without actual measurement; second slightly more than twice as long as wide; third a trifle shorter than second and appreciably wider so that it is about one and three-fourths times as long as wide. Antennae strongly

clavate. First club joint almost as wide as long and a trifle shorter but plainly wider than third funicle joint; second and third equal in length, second a trifle wider than first, and third narrower (fig. 54).

Scutellum plainly wider than long (5:3) and not so long as mesoscutum (3:5). Abdomen slightly longer than wide, about as wide as thorax and not quite so long. Ovipositor sheaths shortly exserted.

Cheeks with a row of small, dark setae extending downward from eyes and a few setae of lighter color and not so closely placed, scattered between scrobes. Mesoscutum with numerous, scattered, short, black setae and with the two setae near the mesoscutar-scutellar suture appreciably the largest. Each axilla with two strong setae. Scutellum with three pairs of strong black bristles.

Fore wings hyaline, veins yellowish. Marginal vein plainly longer than submarginal; postmarginal shortly produced; stigmal as shown in figure 123. Disk of wings finely and densely ciliated with a characteristic row of cilia as shown in Figure 81. Marginal fringe of moderate length.

Length of average-sized specimens 0.8 mm.

Male.—The antennae of the male are different from those of the female. The coloration is also somewhat different. As a rule the dark coloration is more extensive and intensive, the antennae are fuscous, and the legs have more dusky.

Antennal club not differentiated. Scape slender. Pedicel short, as wide as long. Flagellar joints gradually decrease in width, the apical joint somewhat more than one-half as wide as the first; first five joints subequal in length. Flagellum with numerous sensoria.

Redescribed from numerous specimens reared from *Saissetia oleae* (Bernard), collected by E. W. Rust at Cape Town, South Africa, and from specimens collected in southern California.

48. COCCOPHAGUS FLETCHERI Howard

Coccophagus fletcheri HOWARD, U. S. Dept. Agr. Bur. Ent. No. 7, 1897, p. 63.

This species is known to me only by the original description.

49. COCCOPHAGUS NIGRITUS, new species

Plate 5, Figure 9; Plate 8, Figure 55; Plate 11, Figure 121; Plate 14, Figure 179

This species resembles *C. modestus* var. *capensis* Silvestri from which it is separated by the differently shaped abdomen, longer ovipositor, fainter infuscation of the fore wings, and coloration of the head. In this species, the ovipositor arises near the base of the abdomen while in *C. modestus* Silvestri it arises near the middle.

Mr. Rust, who observed the behavior of these parasites in life, wrote that they walked differently from *C. modestus* var. *capensis*.

Female.—Thorax and abdomen black. Frontovertex, face, and a part of the cheeks ferrugino-testaceous and usually with some fuscous in parts, the fuscous pronounced on the posterior part of the cheeks. Antennae testaceous. Legs blackish or dark brown except as follows: Apices of all femora and an annulus at base of the middle pair, fore tibiae, middle tibiae at ends, and tarsi except the apical joints, the latter pallid in balsam mounts, in life probably white or faintly yellowish white.

Pedicel about one and one-half times as long as wide. First funicle joint slightly more than twice as long as wide and about twice as long as the pedicel; second and third successively shorter and wider, the third only a trifle longer than wide. Club short and wide, only slightly longer than the first funicle joint; all joints wider than long, the first and second very much wider than long. Antennae as in Figure 55.

Mandibles as shown in Figure 179.

Fore wings with an indefinite infuscated area beneath the apical half of the marginal vein. Marginal vein almost one and one-half times as long as the submarginal; postmarginal slightly variable, sometimes produced as far distad as the stigmal. Postmarginal and stigmal veins as in Figure 121.

Proportions, shape, and vestiture of thorax and abdomen as in Figure 9.

Middle femur with a strong black spine at apex and middle tibia with smaller but conspicuous spines at base. Hind tibia with the dorsal margin furnished with strong, suberect spines. Middle tibial spur slightly shorter than the basitarsus. Hind tibia with two strong, subequal spurs.

Length 2.08 mm.

Type.—Cat. No. 42097, U.S.N.M.

Described from 17 females (holotype and paratypes) reared by E. W. Rust from *Saissetia persimile* (Newstead) collected at Durban, Natal, February and March, 1927. The specimens are all mounted in balsam and 12 of them are dismembered and partly flattened.

50. COCCOPHAGUS MODESTUS Silvestri

Plate 8, Figure 56

Coccophagus orientalis var. *modesta*, SILVESTRI, Boll. Lab. Zool. Agr., Portici., vol. 9, 1914, pp. 355–57.

In this paper, the name *C. modestus* Silvestri is restricted to the form occurring at Dahomey, Cotonou. There is uncertainty as to whether the form occurring in Cape Town and Durban is specifi-

cally identical with the Dahomey form as heretofore supposed. Doctor Silvestri kindly loaned two female cotypes for study. The type specimens differ from the South African specimens by having the antennae thicker (Figs. 56, 57), the spurs at apex of hind tibiae slightly unequal, setae of the mesocutum a trifle coarser, two conspicuous setae on either side of the first tergite, microscopic markings on the sides of the third tergite, as well as on the fourth and fifth, and the outer plates of the ovipositor slightly proportionately wider and shorter.

51. COCCOPHAGUS MODESTUS Silvestri var. CAPENSIS, new variety

Plate 9, Figure 57; Plate 14, Figure 176

Coccophagus modestus SMITH and COMPERE, Univ. Calif. Pub. Ent., vol. 4, No. 3, 1926, pp. 51–61, 2 figs.

The South African form previously treated by us under the name *C. modestus* is here tentatively classed as a new variety as there is uncertainty regarding its identity. Our earlier description applies to this form[31] and not to typical *C. modestus*.

Type.—Cat. No. 42105, U.S.N.M.

In the Rust collection there is a good series of specimens reared from *Saissetia oleae* (Bernard) collected at Cape Town, South Africa, and from *Saissetia persimile* (Newstead) collected at Durban, Natal, South Africa. The holotype is from Cape Town.

52. COCCOPHAGUS NUBES Compere

Plate 6, Figure 12; Plate 9, Figure 58; Plate 11, Figure 86

Coccophagus nubes COMPERE, Univ. Calif. Pub. Ent., vol. 4, No. 9, 1928, pp. 257–58.

This is a distinctive species of medium size. Head, dorsum of thorax except metanotum and propodeum, and basal abdominal segment yellow to orange or fulvous. Metanotum, propodeum, and abdomen except base black. Fore wings with a smoky cross band under the apical portion of marginal vein. Scutellum densely setose. Postmarginal vein wanting.

Female.—Face and cheeks pale brownish yellow; frontovertex yellow to fulvous; occiput mostly black. Antennae about concolorous with face, sensoria blackish. Eyes chocolate. Ocelli dark red. Concealed portion of pronotum blackish, exposed portion more or less concolorous with the mesoscutum. Mesoscutum, scutellum, median piece of metanotum, axillae and prepectus mostly yellowish, the mesoscutum slightly paler without dilute reddish or orange which slightly suffuses scutellum, axillae, and parapsides. Mesopleura and most of sternum blackish. Metanotum except median piece, propo-

[31] Univ. Calif. Pub. Ent., vol. 4, No. 3, 1926, pp. 50–61.

deum, and abdomen except for basal segments, black. Basal abdominal segments yellow. Fore and middle legs mostly straw-colored to pale yellow. Femora of fore legs on outer aspect at base with some fuscous. Femora and tibiae of hind legs mostly blackish, the extremities yellowish. Apical tarsal joints faintly brownish. Ovipositor sheaths, as seen from beneath, brownish.

In the tag-mounted specimens, the head is shriveled, face deeply sunken and frontovertex folded. Antennal sockets with their upper margin about tangent to basal ocular line and spaced about as far apart as they are above oral margin. Cheeks without discernible suture. Posterior ocelli less than their own diameter from eye margins and about the same distance from occipital margin. Posteriorly the eyes contiguous with occipital margin.

Antennal scape of usual shape, slightly fusiform, about four times as long as wide. Pedicel about one and one-half times as long as wide and distinctly shorter than the first funicle joint. First funicle joint slightly longest, slightly more than one and one-half times as long as wide; following funicle joints successively very slightly shorter and wider, the third only slightly longer than wide. Club as seen in tag mounts slightly wider than funicle. In the balsam mount the antenna is oriented so that the club appears slightly narrower than the funicle (fig. 58).

Mandibles broad and truncate at apex, the margin very slightly and indistinctly incised.

Scutellum a trifle wider than long and as long as mesoscutum. Spiracles slightly oval, almost rotund. Abdomen of moderate size; in tag-mounted specimens after shrinkage, longer than wide and not as long as thorax. Ovipositor concealed. In the cleared balsam-mounted specimen, the ovipositor is seen to be less than one-half as long as the abdomen (fig. 12).

Fore wings with an infuscated area under distal half of marginal vein. Marginal vein longer than submarginal; postmarginal vein absent; stigmal as shown in Figure 86. Ciliation of the disk slightly coarse on basal half and moderately dense.

Mesoscutum clothed with numerous short, black setae arranged in somewhat irregular, longitudinal files; setae on lateral and posterior margins stronger and about same size as the two setae located on each axilla. Each parapsis with three setae. Scutellum about as densely setose as mesoscutum and with a pair of long apical bristles. Middle femur at apex beneath with a strong black spine and a few smaller pale spines; base of the tibia with a few short spines. Eyes with short fine setae. Face and cheeks with yellowish setae, those on the frontovertex slightly stronger and blackish.

Measurements in mm.: Length 1.3. Scape 0.1352 long by 0.0336 wide. Pedicel 0.0520 long by 0.0344 wide. First funicle joint

0.0580 long by 0.04 wide; second 0.0568 long by 0.0424 wide; third 0.0512 long by 0.0448 wide. First club joint 0.0488 long by 0.0424 wide; second 0.0464 long by 0.0416 wide; third 0.0456 long by 0.0320 wide.

Redescribed from the original description and from specimens compared with the types. According to E. W. Rust, the species was reared from *Saissetia oleae* (Bernard) and *Saissetia persimile* (Newstead) on *Chaetachme aristata*, Berea, Durban, August 25, 1925; and from *Saissetia perseae* Brain, September 3, 1925, and from *Coccus hesperidum* Linnaeus. On various hosts at later dates. Also from an undetermined species, a bluish or blackish *Ceroplastes* sp., on *Ficus natalensis*.

53. COCCOPHAGUS SAINTEBEAUVEI Girault

Plate 9, Figure 65; Plate 11, Figure 118

Coccophagus saintebeauvei GIRAULT, Descriptiones Stellarum Novarum, Wash., D. C. (Published by author), 1917, p. 1.

A moderately large species with the wings infuscated beneath the marginal vein. Body black except the extreme apex of scutellum and median piece of metanotum which are yellow. Scutellum densely setose. Hind femora pure pale yellow in striking contrast. Structurally this species is probably most closely related to *C. malthusi* Girault.

Female.—Body black except very narrowly around the apical curvature of the scutellum and the median piece of metanotum which is lemon yellow. Dorsum of the head with the posterior triangular corners yellow to brownish orange; face somewhat brownish, remainder of the head black except for the pattern of lines margining the ocelli. Antennae brownish, the flagellum more dusky because of the numerous black sensoria. All coxae blackish or dark brown. Femora of fore and middle leg blackish, becoming brownish at the apices; middle femora with a brownish annulus at the base; hind femora pale lemon yellow, the trochanters more sordid. Fore and middle tibiae brownish yellow, the former somewhat more dusky because of the clothing of black hairs; hind tibiae blackish, becoming brownish at the extreme apex. All tarsi brownish yellow, the apical joints a trifle dusky.

Pedicel plainly longer than wide and plainly shorter than the first funicle joint. First funicle joint the longest, somewhat more than twice as long as wide; second and third successively shorter and wider; third plainly longer than wide, in this respect not in agreement with the original description. First club joint wider than long and shorter than the preceding funicle joint (fig. 65).

Scutellum slightly wider than long (5:4) and not quite as long as the mesoscutum. Abdomen not quite twice as long as wide and about as long as the thorax. Ovipositor shortly exserted.

Fore wings distinctly infuscated beneath the marginal vein; densely and coarsely ciliated with a short marginal fringe. Marginal vein much longer than the submarginal; postmarginal shortly produced as shown in Figure 118.

Face and cheeks rather coarsely areolate reticulate, a trifle coarser than that of the mesoscutum. Mesoscutum and scutellum with the usual areolate reticulations. Frontovertex punctulate reticulated. The median carina of the propodeum mentioned by Girault is the normal ridge formed by the median line being somewhat elevated, probably as a result of shrinkage. Propodeum mostly obscured by the wings but laterally the reticulations can be viewed; they appear a trifle coarser than usual.

Eyes with microscopic, fine, white pile. Frontovertex with numerous short, black setae, those on the face and cheeks slightly finer. Mesoscutum with numerous dark setae. Scutellum, except approximately the apical one-fourth, with setae about as numerous as those of the mesoscutum; apex of scutellum with a pair of moderately long, pale bristles, and a second preapical pair about half as long located at the posterior margin of the setose area. Each axilla apparently with two setae similar to those of the mesoscutum and each parapsis with about four similar setae.

Tibial spur of middle legs shorter than the basitarsus. Paired spurs at apex of hind tibiae partially concealed.

Girault states that the species is robust. As compared to the other large, or medium-sized species, this form is not robust, being more closely related to *C. malthusi* and its allies than to the shorter, more robust species such as *C. anthracinus*, *C. modestus*, etc.

Measurements in mm.: Length 1.5. Pedicel 0.0640 long by 0.0432 wide. First funicle joint 0.1144 long by 0.0480 wide. Second 0.0904 long by 0.0568 wide; third 0.0784 long by 0.06 wide. First club joint 0.0544 long by 0.0672 wide; second 0.0504 long by 0.0656 wide; third 0.0552 long by 0.0472 wide. Fore wings 1.04 long by 0.48 wide. Marginal vein 0.38 long; submarginal 0.28 long. Longest marginal fringe 0.0368.

Redescribed from one female (paratype) U.S.N.M. No. 20074, reared from *Saissetia oleae* (Bernard), September, 1925, Nagunga, Uganda, South Africa, C. C. Gowdey.

54. COCCOPHAGUS SPECTABILIS, new species

Plate 4, Figure 6; Plate 9, Figure 60

A large, robust species; body black with a yellow spot on either side of the first tergite; head yellow. Structurally suggestive of *C. modestus Silvestri*. Fore wings infuscated.

Female.—Head yellow except that the concealed part of the occiput and a blotch contiguous to the mesal margin of each lateral ocellus are black. Antennae yellow with a touch of fuscous suffusing the dorsum of the pedicel. Mentum, stipes, and palpi more or less fuscous. Thorax usually shining black with the margins of the sclerites in proximity to the insertion of the fore wings edged with yellow and the tegulae and median piece of metanotum yellow. Abdomen shining black with the basal corners marked with sharply defined, angular yellow spots. All coxae mostly, if not completely, black. All trochanters more or less yellow. Fore and middle femora black with yellow apices; hind femora entirely black. Fore tibiae mostly if not entirely yellow; middle and hind tibiae black, the latter pale or yellow at apices. Tarsi yellow to whitish, apical joints dusky.

Pedicel one and one-half times as long as wide and about one-half as long as the first funicle joint. First funicle joint the longest, a trifle more than twice as long as wide; second and third only slightly longer than wide. Club short and wide, the three joints united are not much longer that the first funicle joint; all club joints plainly wider than long. Antennae similar to those of *C. modestus* Silvestri and *C. speciosus*, new species (fig. 60).

Mandibles almost edentate, the apical tooth small.

Fore wings with a distinct infuscated area beneath the apical third of the marginal vein; cilia of disk normal. Marginal vein slightly longer than the submarginal; postmarginal shortly but distinctly produced.

Scutellum wider than long (20:17) and as long as the mesoscutum. Ovipositor extending about two-thirds the length of abdomen, not exserted.

Frontovertex with numerous rather coarse black setae, those on cheeks and upper part of face smaller and pale. Clypeus with coarse, strong, black setae, larger than those of the frontovertex. Mesoscutum with dense, coarse, black setae, those along the lateral and posterior margins twice as large as the others. Each parapsis with four setae. Each axilla with two or three setae. Scutellum, except the apical one-fourth, about as densely setose as the mesoscutum, the apex furnished with a very strong pair of setae and a preapical pair about one-half as strong. The rows of setae incomplete across the second and third tergites. Fourth, fifth, sixth, and seventh tergites each with black setae entirely across the dorsum. Middle femur with a stout seta at apex. Middle tibia with five stout black setae at base. Outer aspect of hind tibia furnished with stout black setae, the paired spurs at apex large and of equal size.

Mesoscutum, scutellum, axillae, median part of propodeum, and blackened part of abdomen appear rather closely and heavily reticulated in the balsam-mounted specimens studied.

Length 1.8 mm.

Male.—Unknown.

Type.—Cat. No. 42087, U.S.N.M.

Described from 12 females (holotype and paratypes), mounted in balsam on slides, reared by E. W. Rust from *Saissetia persimile* (Newstead) collected at Durban, Natal, February, and March, 1927.

55. COCCOPHAGUS SPECIOSUS, new species

In structure this species appears to be similar to the foregoing species, *C. spectabilis.* In coloration it appears so unlike *spectabilis* as to warrant its tentative description as a new species. It is possible that a large series of specimens may reveal intergrading forms that will necessitate synonymizing the name *speciosus.*

Female.—It is in the coloration of the legs that this form shows such a marked difference from *C. spectabilis.* The fore and middle legs are entirely pale yellow. Coxae and trochanters of the hind legs are yellow, in sharp contrast to the femora and tibiae which are black. Apical tarsal joints of the middle legs fuscous, the remaining tarsal joints yellowish or pallid.

Except for the differences in the coloration of the parts described above, the figures of *C. spectabilis* and the description of that species will apply equally well to this form.

Male.—Except for the abdomen which is entirely black, the color is similar to that of the female. Wings hyaline, the cilia much finer than that of the female. Antennal proportions and shape of segments similar to that of the female.

Type.—Cat. No. 42088, U.S.N.M.

Described from one female, 17 males, (holotype, allotype, and paratypes) reared by E. W. Rust from *Saissetia persimile* (Newstead), *Filippia carissae* Brain, and *Coccus hesperidum* Linnaeus, collected at Durban, Natal, February, March, August, and September, 1927. It is to be noted that *C. spectabilis* was reared from *S. persimile* collected at the same time and from the same locality as *C. speciosus* which substantiates the suspicion that perhaps the latter is but a color variant.

56. COCCOPHAGUS PRINCEPS Silvestri

Coccophagus princeps Silvestri, Boll. Lab. Zool. Agr. Portici, vol. 9, 1914, pp. 357–59, fig. 16.—Compere, Univ. Calif. Pub. Ent., vol. 4, No. 1, 1926, pp. 6–7.

This species is structurally similar to *C. malthusi* Girault and to *C. clavellatus*, new species.

Female.—Head yellow except for blackish on the occiput above and on either side of foramen. Mesoscutum, scutellum, and median piece of metanotum yellowish, remainder of body black. Hind

femora entirely black; hind tibia black except the apical one-fourth which is yellow and concolorous with the remainder of the legs.

Male.—Body black, head yellow, legs yellow except for fuscous suffusing the basal half of hind tibiae.

For the purposes of comparison, Doctor Silvestri loaned the types for study and Dr. Guy Marshall loaned a series of specimens determined as this species by Ch. Ferrière, labeled: "British Sudan Wad Mehadi, H. B. Johnston, No. 4126, 10/4/1927, Ex. *Ceroplastes africanus* ? on *Acacia arabica.*"

57. COCCOPHAGUS MALTHUSI Girault

Plate 1; Plate 2; Plate 14, Figure 180

Coccophagus malthusi GIRAULT, Descriptiones Stellarum Novarum, Wash., D. C. (Published by author) May, 1917.—COMPERE, Univ. Calif. Pub. Ent., vol. 4, No. 1, 1926, pp. 5–9.

This species has previously been redescribed.[32] An additional series of specimens has been received since the redescription was published. The new specimens were sent by Rust, who said that they were reared from an undescribed dark brown *Ceroplastes* on *Ficus natalensis* collected at Durban, Natal, September 22, 1926. Rust's No. C–18. The great majority of specimens in this series have the body almost completely black, but the parapsides with the posterior margin narrowly marked with orange and the postscutellum yellow. As a rule the dorsum of the head is orange, the face and cheeks yellow suffused with more or less fuscous. The hind femora may be entirely yellow or liberally marked with blackish. As already mentioned this species is extremely variable in coloration, some specimens having the mesoscutum and scutellum brownish. This species, more than any other, illustrates how unreliable is a classification based on color differences.

58. COCCOPHAGUS CLAVELLATUS, new species

Plate 9, Figure 61; Plate 11, Figure 90; Plate 13, Figures 162 and 165; Plate 14, Figure 181

Due to the marked difference in coloration, this form was at first confidently considered to be a distinct species. A more careful study in comparison with specimens of *C. princeps* Silvestri and *C. malthusi* Girault failed to reveal any fundamental structural differences among the three forms and *C. clavellatus* as well as *C. malthusi* may possibly prove to be synonymns. So far as I am aware, the figures given as illustrative of this species equally well represent *C. princeps* and *C. malthusi.*

[32] Univ. Calif. Pub. Ent., vol. 4, No. 1, 1926, pp. 5–9.

Female.—Head, antennae, and thorax pale orange to yellow except for the following parts which are marked with blackish: occiput about the foramen, pronotum except the lateral angles, wedge shaped part of parapsides, axillae more or less, metanotum except median piece, propodeum, mesosternum, mesoepisterna and mesopleura. Sometimes the expanded part of parapsides and tegulae are more or less suffused. Abdomen black; ovipositor sheaths yellow, edged with black. Coloration of coxae variable, usually fore coxae mostly yellow and middle and hind coxae mostly black; hind tibiae more or less black on basal half or more; apical tarsal joints fuscous, remainder of the legs yellow.

Pedicel about one and one-third times as long as wide and not quite one-half as long as the first funicle joint. First funicle joint plainly the longest, a trifle more than twice as long as wide; second and third successively shorter and almost imperceptibly wider so that the third is a trifle more than one and one-third times as long as wide. Club short, the three joints united not much longer than the first funicle joint; basal club joint the largest, almost one and one-half times as wide as long; second and third successively smaller, second plainly wider than long, third almost as wide as long (fig. 61).

Mandibles as shown in Figure 181.

Fore wings hyaline; cilia normal; marginal fringe short. Marginal vein plainly longer than the submarginal; stigmal as shown in Figure 90.

Scutellum only slightly wider than long (6:5) and about as long as the mesoscutum. Abdomen rather long, and slender; seventh tergite long. Ovipositor very long, extending from near the base of the abdomen to beyond the apex, the sheaths projecting 0.08 mm.

Frontovertex with numerous, short, moderately coarse, dark setae, those on face and cheeks fine and pale. Mesoscutum densely setose, the setae moderately coarse, those along the sides and posterior margins not quite twice as large as those on the disk. Each parapsis with five or so setae. Each axillae with two prominent setae anteriorly and usually with a row of five or so smaller setae paralleling the scutellar suture. Scutellum about as densely setose as the mesoscutum, and in addition with a moderately long pair of apical setae and a subapical pair about one-half as long. The setae arranged across the dorsum on the tergites from three to seven inclusive, those on the sixth and seventh tergites scattered. Middle femur with a stout black spine at apex on outer side and base of middle tibia with three smaller yet prominent black spines at base on outer side as shown in Figure 162. Tibial spur slightly shorter than the basitarsus, the basitarsus not quite as long as the succeeding joints

united. Dorsal margin of hind tibia with a row of stout, suberect setae.

Length 1.6 mm.

Male.—Not known.

Type.—Cat. No. 42084, U.S.N.M.

Described from 12 females (holotype and paratypes). Ten specimens reared from *Ceroplastes* sp. on "pop corn" collected at Durban, Natal, by E. W. Rust, August 12, 20, and 27, 1926. One specimen reared from *Ceroplastes destructor*, same locality, August 11, 1926. One specimen reared from *Coccus hesperidum*, same locality, June 18, 1926. Rust's No. C20.

59. COCCOPHAGUS ALBICOXA Howard

Plate 9, Figure 62; Plate 14, Figure 171

Coccophagus albicoxa HOWARD, Journ. Econ. Ent., vol. 4, 1911, p. 276.
Coccophagus coxalis GIRAULT, Ent. News, vol. 27, 1915, p. 34.

The above synonymy should be credited to A. B. Gahan, who furnished the data in private correspondence and authorized its publication.

C. albicoxa Howard is one of the largest and most distinctive species, ranging near 2.5 mm. in length, with distinctive yellowish white hind coxae and elongated abdomen.

Female.—General color black with yellow markings as follows: Apical half of scutellum, metanotum and propodeum except the sides and center. Scape and pedicel dark brown. Hind coxae and trochanters pale yellow; fore and middle coxae black. Fore and middle tibiae brownish or blackish, paler at ends; hind tibiae black. All femora black. Tarsi pallid whitish to brownish, the brownish more pronounced on the fore pair, apical joints dusky.

Scape about as long as pedicel and first funicle joint united. Pedicel longer than wide (4:3) and about one-half as long as first funicle joint. First funicle joint longest, succeeding joints each slightly shorter and a trifle wider. First funicle joint about twice as long as wide; third about one and one-third times as long as wide Club short, hardly as long as two preceding funicle joints united. First club joint longer than wide and slightly wider and slightly shorter than preceding funicle joint; second wider than long; third slightly longer than wide (fig. 62).

Mandible with two ventral teeth only slightly developed and a board truncation as shown in Figure 171.

Fore wings hyaline. Marginal vein plainly longer than submarginal; stigmal broad, only slightly constricted at base; postmarginal not extending distad quite so far as stigmal. Cilia of disk rather coarse and sparse on basal half and much finer toward apex. Marginal fringe short.

Basitarsus of middle legs about as long as succeeding three joints united; tibial spur plainly shorter than basitarsus. Paired tibial spurs of hind legs slightly unequal.

Scutellum about as long as wide and as long as mesoscutum. Abdomen elongate, twice as long as wide, as long as thorax, pointed at apex; seventh tergite elongate, but wider than long (17:14). Ovipositor long, slightly exserted, as seen through the derm in balsam-mounted specimens arising a short distance from base of abdomen.

Mesoscutum and scutellum densely setose, the scutellum in addition with a pair of strong apical bristles at apex. Each axilla with two setae on anterior margin. Frontovertex and cheeks with numerous coarse, short, black setae, those on former set in setigerous punctures. Eyes with extremely fine, pale, almost imperceptible hairs. Anterior margin of metanotum on either side with four small setae. Propodeum with a group of fine, dusky or pale setae on either side laterad of the spiracles. Abdomen with rather numerous black setae; first and second tergites with incomplete transverse rows of setae across dorsum; setae on following tergites more numerous and scattered and extending entirely across dorsum. Base of middle tibia with a group of about five stout setae or bristles; the tibia more setose than usual. Hind tibia on dorsal margin with a row of moderately coarse setae.

Mesoscutum, axillae, and scutellum rather strongly reticulated, the reticulations on the sides of the axillae longitudinally lengthened. Face and cheeks strongly reticulated. Frontovertex reticulated and impressed with numerous setigerous punctures. Metanotum on either side with a longitudinal carina and three short, transverse carinae. Propodeum on either side with longitudinal carina mesad of the spiracles. Basal abdominal tergite mostly smooth and shining, the following closely reticulated.

Length 2.5 mm.

Redescribed from 8 females reared from *Physokermes insignicola* (Craw) on *Pinus radiata* collected at Santa Maria, Calif., by R. C. Wylie, May 14, 1912.

60. COCCOPHAGUS MEXICANUS Girault

Coccophagus mexicanus GIRAULT, Ent. News, vol. 27, No. 1, 1915, p. 34.

I have not seen this species. In reply to an inquiry, A. B. Gahan wrote as follows: "I have reexamined *C. mexicanus* Girault and hope that you will be able to place it in your key from the following notes: *C. mexicanus* is extremely like *C. albicoxa* Howard but differs by having the propodeum entirely black, the frons and face brownish yellow, the vertex similarly colored but darker, the occiput, temples, and cheeks black, and apical one-fourth of the scutel-

lum yellow. Resembles *C. saissetiae* Gahan but the head is much darker and the legs are quite differently colored, the hind coxae and trochanters white, fore and median tibiae fusco-testaceous, all tarsi testaceous, the rest of legs black. This may be but a variant of *C. albicoxa* but the two known specimens agree in the above cited color characters and since the form is easily recognized so far as present material is concerned it should be retained."

This form was reared from a lecaniine scale collected in Panama.

61. COCCOPHAGUS NIGER Masi

Coccophagus niger Masi, Boll. Lab. Zool. Gen. Agr., Portici, vol. 4, 1909, pp. 35–36.

This species was described by Masi from specimens reared from *Lichtensia viburni* collected at Portici. I have not seen samples of this species. The following species, *C. mexicensis* Girault, is in agreement with the original description of *C. niger* Masi, and may prove to be a synonym.

The following note is extracted from the original description: General color black. Frontovertex with dull yellow bands. Coxae and femora black; fore femora on apical third and fore tibiae dusky yellowish; apices of other femora and corresponding tibiae sulphur yellow; tarsi rusty. Antennae dusky yellowish. Wings faintly dusky. Scutellum setose with longer bristles at apex.

62. COCCOPHAGUS MEXICENSIS Girault

Plate 9, Figure 63; Plate 11, Figure 96; Plate 13, Figure 157

Coccophagus mexicensis Girault, Descriptiones Stellarum Novarum (published by author), Wash., D. C., 1917, p. 2.

A robust, black species of medium size, without any striking characters aside from the coloration of the legs. Wings very faintly and uniformly infuscated, appearing iridescent in tag mounts. Scutellum densely setose. This species can not be separated from *C. niger* Masi on the basis of Masi's original description.

Female.—Head, thorax, and abdomen mostly black, sides and underparts brownish black. All femora blackish to dark brown, the middle pair slightly but noticeably paler at apices and with a brownish annulus at base. Tibiae of middle and hind legs pale yellow to whitish, those of the fore legs brownish. All tarsi pale yellow or whitish to slightly brownish yellow, middle tarsi the palest, fore tarsi the brownest; remainder of legs dark brown to blackish.

The antennae of the only female available for study are shriveled. Pedicel short, not much longer than wide, plainly much shorter than first funicle joint. First funicle joint longest, described by Girault as being twice longer than wide but is apparently less than twice as long as wide. Second and third funicle joints each very slightly,

successively shorter and wider than first, all longer than wide. Basal club joint not as long as third funicle joint and wider. All club joints subequal in length (fig. 63). The figure of the antenna may not be entirely accurate as the specimen from which the drawing was made was considerably distorted.

Measurements in mm.: Length 1.25. Scape 0.16 long by 0.0320 wide. Pedicel 0.0448 long by 0.0328 wide. First funicle joint 0.0784 long by 0.0504 wide; second 0.0760 long; third 0.0640 long by 0.0544 wide. First club joint 0.0496 long by 0.0584 wide; second 0.0456 long by 0.0560 wide; third 0.0480 long by 0.0408 wide. Fore wings 1.08 long by 0.52 wide. Marginal vein 0.28 long; submarginal 0.32 long. Longest marginal fringe 0.0280.

Redescribed from 1 female (paratype) U.S.N.M. No. 20078, Mexico, Koebele, Coll.

63. COCCOPHAGUS YOSHIDAE Nakayama

Plate 6, Figure 14; Plate 9, Figure 74; Plate 11, Figure 100; Plate 14, Figure 169

Coccophagus yoshidae NAKAYAMA, Philippine Journ. Sci., vol. 18, No. 1, 1921, pp. 98–99, pl. 1, fig. 1.—COMPERE, Bull. So. Calif. Acad. Sci., vol. 23, pt. 4, 1924, p. 119.

A large black species with hyaline wings and densely setose scutellum.

Female.—Head and body wholly black, sometimes the face suffused with brownish. Antennal scape with some brownish, pedicel and flagellum darker. Legs black, marked with pale yellow as follows: fore and middle tibiae entirely; fore and hind femora narrowly at apex. The light-colored portions of the fore legs with a trace of brownish; tarsi yellowish except the apical joints, which are dusky; middle femora with a faint brownish annulus at base.

Antennal scape a trifle wider than usual, hardly more than three times as long as wide. Pedicel about one and one-half times as long as wide and plainly much shorter than the first funicle joint, which is almost twice as long as wide. Second and third funicle joints almost imperceptibly decreasing in length and increasing in width so that the third is only about one and one-sixth times as long as wide. Basal club joint plainly but slightly wider than long, plainly shorter than third funicle joint and slightly wider; second club joint also wider than long; third as long as wide (fig. 74).

Mandibles slightly incised, with a ventral tooth and a broad, dorsal truncation (fig. 169).

Scutellum a trifle wider than long and about as long as mesoscutum. Abdomen about as long and as wide as thorax. Ovipositor sheaths not exserted. Figure 14 is drawn with the first tergite too short.

Frontovertex with numerous short, black setae, those on face and checks finer and sometimes paler. Mesoscutum with numerous short, black setae. Scutellum except apex about as densely setose as mesoscutum. Apical portion of scutellum without the small setae but with a strong pair of bristles. Size and arrangement of setae as shown in Figure 14. Each axilla with two strong setae. Each parapsis with four strong setae.

Mesoscutum and densely setose portion of scutellum slightly more coarsely reticulated than is usual in *Coccophagus*.

Fore wings hyaline; densely and closely ciliated, the posterior portion in an area beneath the base of the marginal vein with cilia finer and pale, almost evanescent. Marginal vein plainly longer than the submarginal; postmarginal produced distad a trifle farther than the stigmal; stigmal shown in Figure 100.

Measurements in mm.: Length of average-sized specimen 1.6. Scape 0.1404 long by 0.0464 wide. Pedicel 0.0656 long by 0.0440 wide. First funicle joint 0.1104 long by 0.0560 wide; second 0.0792 long by 0.0560 wide; third 0.0736 long by 0.0640 wide. First club joint 0.0560 long by 0.0656 wide; second 0.0528 long by 0.0624 wide; third 0.0488 long by 0.0448 wide.

Described from many female specimens collected in Japan by Clausen and Ishii. Specimens received from Clausen issued from *Coccus hesperidum* Linnaeus and *Coccus pseudomagnoliarum* (Kuwana), collected at Yokohama, June 1922. Specimens received from Ishii issued from *Coccus hesperidum* Linnaeus collected at Nagaski.

The determination of this species was made by Gahan and Timberlake. Gahan made his identification after comparison with paratypes in the United States National Museum.

This is a primary parasite and an effort was made to establish it in California. In captivity, females were seen to oviposit in *Saissetia oleae* (Bernard) but no progeny were obtained.

64. COCCOPHAGUS GOSSYPARIAE Gahan

Coccophagus gossypariae GAHAN, Proc. U. S. Nat. Mus., vol. 71, art. 4, 1927, p. 24.

This species can be recognized on the basis of Gahan's original description. Related to *mexicensis* Girault and *quaestor* Girault, from which it can be distinguished by different coloration of the legs.

Female—Scutellum setose. Body entirely black. All coxae mostly black. Hind femora black, remainder of the legs mostly pale yellow to whitish; only tarsi of fore legs and apical tarsal joints of middle and hind legs dusky. Wings hyaline.

65. COCCOPHAGUS ACANTHOSCELES Waterston

Coccophagus acanthoceles WATERSTON, Bull. Ent. Res., vol. 7, 1916, p. 141, fig. 3.

Specimens of this species have not been available for study. The original description is very precise and there should be no difficulty in recognizing this species. It differs from all other predominantly blackish species by having the pedicel longer than the first funicle joint (10:7).

66. COCCOPHAGUS ROBUSTUS, new species

Plate 5, Figure 8; Plate 9, Figure 64; Plate 11, Figure 122; Plate 13, Figures 160, 161

This species is most closely allied to *C. modestus* Silvestri, *C. spectabilis*, new species and *C. speciosus*, new species from which it is easily separated by the hyaline wings, different antennal proportions, and absence of stiff, coarse, suberect setae on the dorsal margin of the hind tibiae.

Female.—Frontovertex orange yellow; face and cheeks similarly colored except for more or less fuscous suffusions which are more pronounced on the latter. Antennae yellow with dusky sensoria. Occiput mostly blackish. Thorax and abdomen black except the median piece of the metanotum, which is yellow in sharp contrast. Legs mostly black marked as follows with a variable amount of yellow: apices of fore femora, ends of middle femora, apices of hind femora, fore tibiae more or less generally, middle tibiae narrowly at bases. Tarsi pallid with more or less dusky.

Pedicel almost one and one-half times as long as wide, plainly shorter than the first funicle joint. First funicle joint the longest, about one and one-fourth times as long as wide; second and third successively decreasing in length and increasing in width so that the third is about one and one-half times as wide as long. The thick third funicle joint is a good character for the recognition of this species. First club joint subequal to the two following joints and to the third funicle joint (fig. 64).

Fore wings hyaline; cilia rather dense and coarse. Marginal vein plainly longer than the submarginal; stigmal as shown in Figure 122.

Scutellum slightly wider than long and about as long as the mesoscutum. Abdomen apparently as long and as wide as the thorax, broadly rounded at the apex. General proportions of body as shown in Figure 8.

Frontovertex with numerous, short, black setae. Setae of thorax and abdomen as shown in Figure 8. Apex of middle tibia with one long, curved black seta (fig. 161). Apex of hind tibia with a pair of subequal strong setae beneath and a pair about one-half as strong on the dorsum (fig. 160).

Length 1.2 mm.

Type.—Cat. No. 42096, U.S.N.M.

Described from 19 females (holotype and paratypes) mounted in balsam; 14 of the specimens with appendages dissected and body sclerites separated. Reared by E. W. Rust from *Saissetia persimile*, February and March, 1927, Durban, Natal, South Africa. Rust's No. C–33.

67. COCCOPHAGUS QUAESTOR Girault

Plate 9, Figure 59; Plate 11, Figure 94; Plate 13, Figure 156

Coccophagus quaestor GIRAULT, Descriptiones Stellarum Novarum. (Published by author.) Wash., D. C., 1917, p. 2.

A robust, black species of medium size, most easily distinguished from the closely related *C. mexicensis* Girault by different coloration of the tibiae, which in this species are dark brown. This species and *C. mexicensis* are of a more robust type than is *C. immaculatus*, to which they are compared by their author. Fore wings faintly, uniformly infuscated. Scutellum densely setose.

Female.—Head, thorax, and abdomen mostly black, becoming dark brown on sides and under parts. Legs dark brown to blackish except as follows: middle femora at ends pale, fore tibiae pale, all tarsi yellowish to whitish, apical tarsal joints slightly brown, middle tibiae very slightly pale at ends. Antennae brown.

Pedicel short, about as wide as long, much shorter than first funicle joint. First funicle joint the longest, not quite twice as long as wide; second and third each successively slightly shorter and slightly wider than first, and all longer than wide. Basal club joint slightly shorter than third funicle joint and slightly wider; second subequal in length to first; third plainly shorter. The antenna of this species is slightly different from that of *C. mexicensis* Girault. Figure 59 is drawn from a slightly shriveled specimen.

Fore wing about twice as long as wide, faintly and uniformly infuscated, closely and densely ciliated, ciliation of basal portion as shown in Figure 156. Submarginal vein slightly shorter than the marginal; postmarginal and stigmal as shown in Figure 94. Marginal fringe short. Submarginal vein furnished with eleven setae.

Scutellum a trifle wider than long (14:13) and about as long as mesoscutum. Abdomen (shriveled) slightly shorter than thorax, about one and one-third times as long as wide. Ovipositor not at all exserted. Dorsum of thorax rather conspicuously reticulated.

Mesoscutum furnished with numerous, rather small setae. Each axilla with two setae no stronger than those of the mesoscutum. Scutellum densely setose and with a pair of moderately long setae at apex and a preapical pair about one-half as long.

Middle tibial spur slightly shorter than basitarsus; basitarsus as long as following joints united. Paired spurs at apex of hind tibiae equal in length.

Measurements in mm.: Length 1.25. Pedicel 0.0528 long by 0.0504 wide. First funicle joint 0.1080 long by 0.0520 wide; second 0.08 long by 0.0568 wide; third 0.0696 long by 0.0608 wide. First club joint 0.06 long by 0.0618 wide; second 0.0520 long by 0.06 wide; third 0.0464 long by 0.0480 wide. Fore wings 1.0 long by 0.47 wide. Marginal vein 0.32 long; submarginal 0.20 long. Longest marginal fringe 0.0312.

Redescribed from one female (paratype), U.S.N.M. No. 20079, Morelos, Mexico, Koebele.

68. COCCOPHAGUS SAISSETIAE Gahan

Plate 9, Figure 66; Plate 11, Figure 125

Coccophagus saissetiae GAHAN, Proc. U. S. Nat. Mus., vol. 61, art. 24, 1922, p. 17.

A distinctive species of about the same general shape and size as *C. scutellaris* (Dalman) and *C. ishiii*, new species, from which it is readily distinguished by the different coloration of the legs and head. Fore wings faintly infuscated beneath the stigma.

Female.—General color black. Head mostly lemon yellow; occiput above black and ocellar triangle fuscous. According to the original description, the scutellum is apically bordered with yellow, this border comprising approximately one-fourth the length of the scutellum. In the paratype examined, this yellow is not evident although the derm is somewhat paler and differentiated toward the apex. Antennal scape mostly whitish, the flagellum brownish with darker sensoria. Legs mostly whitish, hind tibiae blackish except at apex.

Scape of usual shape, four times as long as wide. Pedicel slightly longer than wide and almost one-half as long as the first funicle joint. First funicle joint plainly longest, a trifle more than twice as long as wide; second and third successively shorter and very slightly wider so that the third is almost one and one-fourth times as long as wide. First club joint plainly shorter than third funicle joint, slightly wider than long and slightly wider than funicle; second club joint a trifle smaller than first; third club joint plainly the smallest, and plainly longer than wide. Funicle and club with rather abundant sensoria (fig. 66).

Fore wings faintly and indistinctly infuscated beneath stigmal vein, cilia moderately short and coarse, marginal fringe short. Wings slightly more than twice as long as wide. Marginal vein as long as the submarginal; postmarginal and stigmal as shown in Figure 125.

Scutellum slightly wider than long (13:12) and slightly shorter than the mesoscutum (12:14). Abdomen after shrinkage longer than wide (21:16) and shorter than the thorax (21:24). Ovipositor not at all exserted.

Mesoscutum furnished with numerous short, brownish setae. Each axilla with two setae similar to those of mesoscutum. Scutellum densely setose, the setae similar in size to those of mesoscutum, and with a pair of moderately long apical bristles and a preapical pair about one-half as long.

Dorsum of thorax rather conspicuously reticulated.

Tibial spur of middle legs a trifle shorter than basitarsus; basitarsus about as long as four following joints united. Paired spurs at apex of hind tibiae of equal length.

Measurements in mm.: Length 1.12. Scape 0.16 long by 0.04 wide. Pedicel 0.0544 long by 0.0472 wide. First funicle joint 0.12 long by 0.0528 wide; second 0.0880 long by 0.0544 wide; third 0.08 long by 0.0624 wide. First club joint 0.0576 long by 0.0656 wide; second 0.0520 long by 0.0592 wide; third 0.0480 long by 0.0392 wide. Fore wings 0.92 long by 0.43 wide. Marginal vein 0.28 long; submarginal 0.28 long. Longest marginal fringe 0.0232.

Male.—Head and body mostly black, becoming dark brown on sides and underparts of thorax and brownish on lower portion of face and cheeks. Antennal scape whitish, flagellum dark brown. Hind legs black, except for yellowish tarsi. Femora of fore and middle legs mostly blackish, pale at apices and the latter with an annulus at base. Fore and middle tibiae whitish with a faint suffusion of brownish or yellowish toward base. Tarsi of middle legs concolorous with apex of tibiae, those of the fore legs slightly brownish.

Length 0.7 mm.

Redescribed from one female and one male (paratypes) U.S.N.M. No. 24989. Reared from *Saissetia nigra* (Nietner), Ancon, Canal Zone, J. Zetek.

69. COCCOPHAGUS SCUTELLARIS (Dalman)

Plate 3, Figure 4; Plate 9, Figure 67; Plate 11 Figure 117; Plate 14 Figure 175

Entedon scutellaris DALMAN, Svensk. vet. Akad. Handl., vol. 46, 1825, p. 365.

Coccophagus scutellaris WESTWOOD, Philos. Mag., vol. 3, No. 32, 1833, p. 344; Intro. Mod. Class. Insects, Syn. of British genera, vol. 2, 1840, p. 73.

Myina semicircularis FÖRSTER, Beitrage Monog. Pterom., 1841, p. 44.

Encyrtus xanthostictus RATZEBURG, Ichneu. Forstins, vol. 3, 1852, p. 188.

Coccophagus lunulatus HOWARD, Insect Life, vol. 6, 1894, p. 232; U. S. Dept. Agr., Div. Ent., Tech. Ser. No. 1, 1895, pp. 37–38.—MASI, Boll Lab. Zool Gen. Agr., Portici, vol. 1, 1907, pp. 245–46.—HOWARD, Journ. Econ. Ent., vol. 4, 1916, p. 277.—QUAYLE, Calif. Agr. Expt. Sta. Bull. No. 223, 1911, p. 191.—MERCET, Trab. Mus. Cienc. Nat., Madrid, No. 10, 1912, pp. 240–41.—TIMBERLAKE, Journ. Econ. Ent., vol. 6, No. 3, 1913, pp. 299–300.—ESSIG,

Injurious and Beneficial Insects of Calif., ed. 2, 1915, p. 377.—COMPERE, Bull. So. Calif. Acad. Sci., vol. 22, part 4, 1924, pp. 113–16.—SMITH and COMPERE, Univ. Calif. Pub. Ent., vol. 4, No. 9, 1928, pp. 254–57.

Coccophagus australiensis GIRAULT, Insc. Inscit. Menst., vol. 5, 1917, p. 30.

In addition to the species listed in the above synonomy Mercet,[33] includes the following:

Coccophagus pulchellus WESTWOOD, Philos. Mag., vol. 3, 1833.
Aphelinus scutellaris WALKER, Monog. Chalcid., vol. 1, 1839.
Aphelinus lycimnia WALKER, Monog. Chalcid., vol. 1, 1839.
Aphelinus idaeus WALKER, Monog. Chalcid., vol. 1, 1839.
Coccophagus scutellaris WALKER, Entomologist, 1841.
Aphelinus insidiator var. *scutellaris* THOMPSON, Hymen. Scandin., vol 4, 1875.

Coccophagus pulchellus Westwood is a valid species and obviously an error was made in synonomyzing it. I do not have any first hand knowledge regarding the other species synonomyzed by Mercet.

The evidence strongly indicates that the cosmopolitan species now known by the name *C. lunulatus* Howard is identical with *C. scutellaris* (Dalman), the type species. The species can be definitely traced back to *C. xanthostictus* (Ratzeburg), described from Europe in 1852. In 1895, Howard wrote: "Mr. Ashmead possesses a pair of specimens from Germany labeled in Försters hand writing *Coccophagus xanthostictus*," I have had the privilege of examining this pair of specimens and so far as can be determined they are identical with the species previously known as *C. lunulatus* Howard. In a recent letter Mr. Gahan wrote: "When in Europe I saw the Ratzeburg collection and while I did not make complete notes on it I did see the types of *C. xanthostictus* (Ratzeburg) and recognized them at once as *C. lunulatus* Howard. While I had no specimens to compare, I feel certain of this and suggest that you change your manuscript name to include this synonomy." From this it is evident that the species existed in Europe as early as 1852. The evidence linking *C. xanthostictus* (Ratzeburg) with *C. scutellaris* (Dalman) is not so positive. Dalman's original description is as follows: "Niger, scutelli macula flava, antennis fuscis; pedibus fulvis, femoribus posticis nigris; alis immaculatis." *C. lunulatus* Howard is in agreement with the original description of Dalman and with the exception of *C. ishiii*, new species, it is the only known species to which the description can apply. The portion of the description which states that the legs are yellow with the posterior femora black eliminates all the species of the *C. lecanii* group and, since no other known species is in agreement with Dalman's description, the evidence seems to justify the recognition of this important species as *C. scutellaris* (Dalman).

[33] Marcet, Trab. Mus. Cienc. Nat. Madrid, No. 10, 1912, p. 251.

C. australiensis Girault is undoubtedly a synonym. In the collection of the Citrus Experiment Station is a specimen labeled "George Compere, No. 766, Perth, W. Australia, bred from *Lecanium hesperidum*." Girault's description was based on four females from Perth with George Compere's No. 766. The specimen in our collection is identical with the form known as *C. lunulatus* Howard and presumably Girault's types are the same.

C. scutellaris (Dalman) is a remarkably stable species subject to slight or no variation regardless of its habitat. Specimens in a series from one locality or specimens in a series from Europe, Africa, Australia, and America are remarkably uniform and except for *C. ishiii*, new species there are no closely related species to cause confusion. With the possible exception of Australia, *C. lecanii* (Fitch), or one of its allied forms, occurs in company with *C. scutellaris* (Dalman) throughout its known range and these two parasites have in common at least two hosts, notably *Coccus hesperidum* Linnaeus and *Saissetia oleae* (Bernard). It is the assumption that the world-wide distribution of the coccids was effected through the interchange of nursery stock and that the parasites were transported at the same time as inhabitants of the coccids and were subsequently influenced by the same environmental factors. On the basis of this reasoning, it is inconsistent to treat all the different geographical races of one form as a single species and to give specific rank to the various geographical variants of the other form. However, it is reliably established that more than one species is involved in the *C. lecanii* complex and at present there is no way to determine their genetical relationship and refer them to their ancestral stock.

Female.—Head and body black with the apical portion of scutellum more or less extensively yellow or orange. Occasionally imperfectly colored specimens are encountered, the portions usually black being brown or suffused with brownish. Extreme apex of scutellum not infrequently blotched with black. Legs yellow or orange yellow except middle and hind coxae and hind femora, which are black.

Scape of usual shape, slightly fusiform, about four times as long as wide. Pedicel a trifle more than one and one-half times as long as wide and about two-thirds as long as first funicle joint. First funicle joint longest, slightly more than twice as long as wide; second and third each successively slightly shorter and almost imperceptibly wider so that the third is slightly less than one and one-half times as long as wide. First club joint slightly the longest and widest; slightly longer than wide and not quite as long as the preceding funicle joint. Second and third club joints each progressively shorter and narrower (fig. 67).

Mandibles with two slightly developed ventral teeth and a broad dorsal margin as shown in Figure 175.

Fore wings faintly and uniformly infumated. Marginal vein plainly longer than submarginal vein; postmarginal produced about as far distad as stigmal; stigmal as shown in Figure 117. Wings finely and densely ciliated. Marginal fringe short.

Basitarsus of middle legs about as long as the three succeeding joints united; tibial spur plainly shorter than basitarsus. Paired spurs of hind tibiae slightly unequal.

Scutellum only a trifle wider than long and about as long as mesoscutum. In the dried, tag-mounted specimens, the abdomen appears about as long as the thorax and rounded at apex. Ovipositor not exserted.

Mesoscutum and scutellum clothed with dense, short, black setae; a pair of strong bristles at apex of scutellum. Eyes with numerous fine dark setae. Anterior margin of metanotum with two small setae on either side. Propodeum on either side with small, scattered setae. On the first and second tergites, the transverse rows of setae are not complete across the dorsum; on the following tergites, the hairs extend completely across the dorsum. Seventh tergite with many scattered setae.

Mesoscutum, scutellum, and axillae areolate reticulated on blackened portions. Metanotum on either side with one distinct wavy transverse carina. Propodeum on either side with a longitudinal carina mesad of the spiracles. Surface of most of the propodeum finely reticulated.

Measurements in mm. Length of average-sized specimen 1.1. Scape 0.1440 long by 0.0376 wide. Pedicel 0.0648 long by 0.0416 wide. First funicle joint 0.0992 long by 0.0464 wide; second 0.0896 long by 0.0512 wide; third 0.0760 long by 0.0520 wide. First club joint 0.0688 long by 0.0584 wide; second 0.0504 long by 0.0576 wide; third 0.0496 long by 0.0408 wide. Length of marginal vein 0.38; length of submarginal 0.28.

Male.—Similar to the female except that the scutellum is entirely black.

Redescribed from a large series of specimens including material from California; Italy; Cape Town, South Africa; Sydney, New South Wales; and Perth, Western Australia. This species attacks many different coccids including *Coccus hesperidum* (Linnaeus), *Coccus pseudomagnoliarum* (Kuwana), *Saissetia oleae* (Bernard), *Saisetia hemisphaerica* (Targioni), and *Pulvinaria mesembrianthemi* (Vallot).

70. COCCOPHAGUS ISHII, new species

Plate 9, Figure 68; Plate 11, Figure 92

This species is closely related to *C. scutellaris* (Dalman), from which it can be separated at a glance by the fore coxae, which are black in distinct contrast to the yellow fore coxae of *C. scutellaris*. Slight structural differences also separate the two species *C. ishii* having the antennae slightly thicker and the propodeum sculptured differently.

Female.—General color black, including head and antennae. Posterior two-thirds of scutellum lemon yellow Legs lemon yellow except all coxae which are black, and hind femora which are black except very narrowly at base. Tarsi of fore legs slightly brownish.

Antennae slightly thicker than those of *C. scutellaris*, but the differences are not pronounced. The slight differences in antennal proportions are best illustrated by the first funicle joint, which in this species is less than twice as long as wide, measuring 0.1136 mm. in length by 0.0632 mm. in width, while in *C. scutellaris* the first funicle joint is a trifle more than twice as long as wide, measuring 0.0992 mm. long by 0.0464 mm. wide. Pedicel about one and one-half times as long as wide and slightly more than one-half as long as first funicle joint. First funicle joint plainly longest, the following two successively slightly shorter and wider so that the third is about as wide as long (0.0768 mm. long by 0.0752 mm. wide). Club about twice as long as wide and broadly rounded at apex; all club joints wider than long (fig. 68). *C. scutellaris* has the first club joint a trifle longer than wide.

Mandibles very faintly and obscurely tridentate, almost emarginate except for the median tooth, which slightly projects and is broadly rounded.

Scutellum strongly convex, slightly wider than long (6:5) and about as long as mesoscutum, sutures closely fused. Abdomen about as long as thorax. Ovipositor not exserted.

Fore wings hyaline, closely and densely ciliated on disk, marginal fringe very short. Marginal vein plainly longer than submarginal, postmarginal very short as shown in Figure 92.

Mesoscutum, parapsides, axillae, and scutellum with network reticulation except on yellow portion of the scutellum which is not visibly sculptured. Propodeum between the longitudinal carinae mesad of spiracles with sculpture obsolete or very faint. In *C. scutellaris* the mesal portion of the propodeum is distinctly and more or less evenly reticulated.

Eyes clothed with numerous fine, pale hairs. Face, cheeks, and dorsum of head with numerous short, black setae. Mesoscutum with numerous short, black setae. Each parapsis with four or five short

setae. Each axilla with two short setae. Blackened portion of the scutellum with numerous short, black setae comparable to those of mesoscutum. Yellowed portions of scutellum with white or pale setae and at apex with a single pair of long black bristles. Anterior margin of the metanotum with two small setae on either side. Propodeum laterad of each spiracle with numerous short, black setae. First two abdominal tergites with small, black setae in transverse alignment on either side; on the succeeding tergites, the setae extend completely across dorsum. On the tergites beyond the third, the setae are more numerous and are not in transverse alignment.

Spur of middle tibia more than one-half as long as basitarsus; basitarsus of middle leg about as long as following joints combined. Paired spurs at apex of hind tibiae of about equal length.

Measurements in mm.: Length 1.4. Scape 0.1672 long by 0.0544 wide. Pedicel 0.0664 long by 0.0432 wide. First funicle joint 0.1136 long by 0.0632 wide; second 0.0896 long by 0.0680 wide; third 0.0768 long by 0.0752 wide. First club joint 0.0656 long by 0.0816 wide; second 0.0440 long by 0.0776 wide; third 0.04 long by 0.0552 wide.

Male.—Very similar to the female except for the usual sexual differences and the color of scutellum which is entirely black.

Type.—Cat. No. 42091, U.S.N.M.

Described from two females and one male (holotype, allotype, and paratype) obtained from T. I. Ishii with the following data: Females reared from *Eulecanium* sp. on *Euonymus*, Nagasaki, Japan; male reared from *Pulvinaria camelicola* Signoret, Kanajawa-ken, Japan.

71. COCCOPHAGUS SCUTATUS Howard

Plate 9, Figure 69; Plate 14, Figure 172

Coccophagus scutatus Howard, U. S. Dept, Agr. Bur. Ent. Tech. Bull. 1 1895, p. 38.

From other prevailing black species, *C. scutatus* differs conspicuously by the possession of a broad orange-colored band across the mesoscutum between the tegulae and embracing most of the axillae. Scutellum entirely black.

Female.—General color black. Posterior one-third of mesoscutum and axillae orange-colored, axillae sometimes yellow with a blackish median blotch. Portions of sclerites in proximity to bases of fore wings occasionally pale. Face and cheeks dark brown to ferruginous. Antennae brown. Color of legs variable. Fore legs usually with coxae paler than succeeding joints which are more or less brownish. Middle legs with coxae brown to blackish, trochanters and basal two-thirds of femora concolorous, latter pale brown on apical portion; tibiae light brown, concolorous with apices of femora. Hind legs

with coxae, trochanters, and femora pale or faintly brownish to whitish, sometimes touched with fuscous. Hind tibiae blackish or dark brown on basal half, apical portion brownish. Tarsi of all legs light brown, apices tipped with dusky.

Antennal scape of usual shape, slightly fusiform, and slightly longer than club. Pedicel about one and one-third times as long as wide and about three-fifths as long as first funicle joint. Funicle joints successively slightly shorter and slightly wider distad. First funicle joint a trifle more than twice as long as wide; third funicle joint about one and one-half times as long as wide. Club as long as two preceding funicle joints united and about one and one-third times as wide as third funicle joint (fig. 69).

Mandibles with one small but well defined ventral tooth and a broad dorsal truncation. One of the ventral peg-shaped spines unusually stout as shown in Figure 172.

Fore wings faintly infumated. Submarginal vein plainly longer than marginal, postmarginal produced as far distad as stigmal. Cilia on disk rather coarse beneath veins, becoming finer and denser toward apex of wing. Marginal fringe short.

Basitarsus of middle legs about as long as following joints united; tibial spur about two-thirds as long as basitarsus. Paired tibial spurs of hind legs slightly unequal.

Scutellum (in tag mount) about as long as wide and as long as mesoscutum. Abdomen slightly longer than wide (6:5) and as long as thorax, broadly rounded at apex. In balsam-mounted specimens, the abdomen appears almost rotund; ovipositor short, arising near middle and not at all exserted.

Mesoscutum and scutellum densely setose, scutellum also with a pair of strong apical bristles. Each parapsis with six setae. Each axilla with two setae. Eyes with pubescence extremely fine and pale, almost imperceptible. First three abdominal tergites with black hairs on either side, following tergites with a complete band of hairs across dorsum.

Blackened portion of mesoscutum, axillae, and scutellum strongly reticulated. The reticulations on sides of axillae only slightly longitudinally lengthened, the difference hardly appreciable in tag-mounted specimens.

Measurements in mm.: Scape 0.2256 long by 0.0392 wide. Pedicel 0.06 long by 0.0448 wide. First funicle joint 0.1080 long by 0.0504 wide; second 0.1024 long by 0.0560 wide; third 0.0880 long by 0.0568 wide. First club joint 0.0880 long by 0.0752 wide; second 0.0512 long by 0.0712 wide; third 0.0464 long by 0.0504 wide. Marginal vein 0.34 long; submarginal 0.42 long.

Redescribed from 25 females reared from a *Kermes* on oaks collected at different times and from various localities in southern California.

72. COCCOPHAGUS IMMACULATUS Howard

Plate 9, Figure 70; Plate 11, Figure 107; Plate 13, Figure 158

Coccophagus immaculatus HOWARD, U. S. Dept. Agr. Rept. Ent. for 1880, 1881, p. 358; U. S. Dept. Agri. Div. Ent. Tech. Series, No. 1, 1895, p. 35.—MERCET, Trab. Mus. Cienc. Nat. No. 10, 1912, p. 236.

This species is of moderate size and slender stature, with hyaline wings and densely setose scutellum. The other prevailingly black or dark-brown species with a setose scutellum are usually of stouter stature than is this species. The tag-mounted specimen is badly shriveled.

Female.—General color dark brownish black with the propodeum yellowish. Originally described as black in color but the paratype examined is distinctly suffused with brownish, especially on the mesopleura. The propodeum (metanotum of Howard) originally described as lemon yellow, now appears slightly marked with brownish across the meson. Flagellum of antenna brownish yellow, sensoria blackish. Scape blackish. Cheeks and face dark brown. Fore coxae brown; middle and hind coxae pallid white. All trochanters pale, those of fore legs somewhat yellowish, the others pallid white. Femora of fore legs brownish, slightly pale at ends. Basal third of middle femora pallid white, extreme apex pale, intermediate portion brownish. Basal third of hind femora pallid white, remainder brown. Fore tibiae slightly brownish; middle and hind tibiae distinctly yellow. All tarsi yellowish, those of middle and hind legs paler than those of fore legs. All apical tarsal joints slightly dusky.

Antennal scape of usual shape, slender and slightly subfusiformly cylindrical. Pedicel plainly longer than wide and much shorter than first funicle joint. First funicle joint longest, a trifle more than twice as long as wide; second and third each successively shorter and a trifle wider, all plainly longer than wide. First club joint almost as long as third funicle joint and plainly wider, a trifle wider than long; second the shortest, wider than long; third a trifle longer than second, and not quite as wide as long. The short second club joint may be an abnormality. To the eye the club joints appear subequal in length (fig. 70). In the figure, the dotted outline of the pedicel and scape was drawn by eye from the parts remaining on the tag mount.

Fore wings hyaline, with basal cilia arranged as shown in Figure 158. Submarginal vein slightly longer than the marginal, stigmal and postmarginal shown in Figure 107. Marginal fringe short, 0.0248 mm.

Scutellum about as long as wide (10:11) and about as long as mesoscutum. Abdomen distorted in the specimen examined but presumably about as long as thorax.

According to the description in the Revision of the Aphelininae, the punctured scutellum of this species is unique. The scutellum is furnished with setigerous punctures and is reticulated. Mesoscutum with the setigerous punctures in more or less regular, longitudinal alignment and a trifle coarse, especially those aligned along parapsidal and scutellar sutures, but in this respect not unlike certain other species. Disk of the scutellum about as densely setose as mesoscutum, its apical third or so without the small setae but with a rather weak pair of apical bristles and a smaller preapical pair. Setae appear somewhat pale in certain lights and bristles distinctly so.

Measurements in mm.: Length 1.05. First funicle joint 0.0840 long by 0.0376 wide; second 0.0704 long by 0.04 wide; third 0.0648 long by 0.0464 wide. First club joint 0.0624 long by 0.0640 wide; second 0.0456 long by 0.0608 wide; third 0.0536 long by 0.0440 wide. Fore wings 0.94 long by 0.43 wide. Marginal vein 0.24 long; submarginal 0.28 long. Longest marginal fringe 0.0248.

Male.—Differs from the female principally in having propodeum and all coxae blackish.

Length 0.75 mm.

Redescribed from one female and one male (paratypes) U.S.N.M. No. 2600. Parasitic on *Eriococcus azaleae*, Washington, D. C. Female collected January 22, 1881, and male collected February 5, 1881.

73. COCCOPHAGUS PULCHELLUS Westwood

Plate 9, Figure 71; Plate 11, Figure 133; Plate 13, Figure 155

Coccophagus pulchellus WESTWOOD, Philos. Mag., vol. 3, No. 17, 1833, p. 344.

In a series of specimens borrowed from the United States National Museum are two females on a single tag labeled in what is believed to be Ashmead's handwriting, "*Coccophagus pulchellus* Westwood." The pin bears the additional data, "*P. Marchal*, France, No. 2." This is a distinct species that agrees very well with Westwood's original description. It is a medium-sized species liberally marked with yellow, wings hyaline, scutellum setose, abdomen rotund and hardly longer than wide.

Female.—Pronotum, mesoscutum, and abdomen completely black; median portion of the propodeum black; remainder of head and body mostly pure pale yellow. Axillae with a brownish suffusion. Prepectus brownish. Antennae yellow, the numerous sensoria of the flagellum blackish. Legs pure pale yellow except the apical tarsal joints of all legs which are slightly dusky, and the tarsi of the fore legs which are slightly brownish. All hairs and bristles of the legs pale yellow. Mandibles slightly brownish. Eyes dark chocolate.

Antennal scape apparently of usual size and shape. Pedicel somewhat longer than wide and plainly much shorter than the first funicle joint. First funicle joint the longest, approximately twice as long as wide; second and third progressively shorter and slightly wider so that the third is only slightly longer than wide. First club joint not quite as long as the preceding funicle joint and slightly wider (fig. 71). The figure of the antenna is in part a hypothetical reconstruction based on a shriveled specimen.

Posterior ocelli about twice their own diameter from the eye margins and probably a trifle less than once their own diameter from the occipital margin.

Mandibles with two ventral teeth and a truncation.

Cheeks with a faint suture from the base of the eyes to the mouth. Fronto-facial suture deeply lined, distinct; a well impressed median longitudinal suture extending to the anterior ocellus. Face and cheeks without a distinct sculpture. Frontovertex faintly punctulate reticulate. Mesoscutum finely areolate reticulate, the reticulations on the scutellum fainter.

Face, cheeks, and eyes with extremely fine, short, pale, hardly discernible hairs. Frontovertex with moderately coarse, short, black setae which are rather conspicuous because of the contrast in colors. Mesoscutum with black setae. Scutellum except about the apical fifth nearly as densely setose as the mesoscutum, the apex furnished with a pair of moderately stout bristles. Each axilla with two rather weak setae or bristles, these somewhat stronger than the strongest setae of the mesoscutum. Each parapsis with about four setae of the same size as those on the axillae. Sides of propodeum with fine white hairs.

Scutellum wider than long (5:4) and slightly shorter than the mesoscutum. Abdomen, in tag mount, rotund, only a trifle longer than wide and plainly much shorter than the thorax. Ovipositor not exserted.

Fore wings clear hyaline, slightly more than twice as long as wide. Marginal vein rather thick, slightly shorter than the submarginal; postmarginal well developed, produced farther distad than the stigmal as shown in Figure 133. Cilia on the basal portions of the wing arranged in a pattern as shown in Figure 155. Cilia small, those beyond the figured basal portion smaller and very dense. Marginal fringe very short.

Measurements in mm.: Length 1.25. Scape 0.1880 long. Pedicel 0.0584 long. First funicle joint 0.0920 long; second 0.08 long; third 0.0712 long. First club joint 0.0512 long; second 0.0440 long; third 0.0440 long. Fore wings 1.28 long by 0.60 wide. Marginal vein 0.34 long; submarginal 0.38 long. Longest marginal cilia 0.0280.

Redescribed from two specimens as noted above.

74. COCCOPHAGUS HOWARDI Masi

Plate 9, Figure 72; Plate 11, Figure 115

Coccophagus howardi Masi, Boll. Lab. Zool. Gen. Agr. Portici, vol. 1, 1907, pp. 243–45, figs. 6–7.—Martelli, Boll. Lab. Zool. Gen. Agr. Portici, vol. 2, 1908, pp. 238–40, fig. 8.—Mercet, Trab. Mus. Cienc. Nat. No. 10, 1912, pp. 232–36, fig. 56.—Silvestri, Boll. Lab. Zool. Gen. Agr. Portici, vol. 13, 1919, pp. 91–92.

Francis Walker [34] described what he supposed to be *Entedon scutellaris* Dalman and placed it in the genus *Aphelinus*. Mercet refers this description doubtfully to synonymy with *Coccophagus howardi* Masi and Silvestri confirms this synonymy. The latter author also lists *Aphelinus idaeus* Walker [35] and *Myina scutellaris* Foerster [36] together with the new name *Aphelinus foersteri* given the latter by Dalla Torre [37] as doubtful synonyms of *C. howardi*. The writer is unable to confirm or deny this synonymy.

Coccophagus howardi Masi is a rather distinctive species and should be easily recognized providing the coloration is not too variable. Masi, in his description, notes that the color is variable but does not mention the fact that one cotype has the scutellum entirely yellow. Masi's well known figure of the adult shows the scutellum mostly blackish with only the apex yellow. It is probable that the single female studied by me represents an extreme variant and that the average specimen can best be recognized by Masi's excellent description.

Female.—Pronotum, mesoscutum, and axillae black. Parapsides and tegulae suffused with brownish. Scutellum completely orange yellow. Metanotum, including the small, median piece, slightly dingy lemon yellow. Propodeum mostly lemon yellow, on the meson between the longitudinal carinae suffused with fuscous. Abdomen mostly shining black. Frontovertex orange yellow with the ocellar triangle blackish. Face and cheeks blackish to dark brown. Antennae including the scape and pedicel yellow. Sensoria brownish.

In the specimen seen by me, the sensoria are more numerous than are shown in Masi's figure; as an example the basal club joint, in lateral view, shows six linear sensoria. A small spot on body at the base of the fore wing beneath the tegulae brownish orange. Mesopleura mostly blackish with some brownish or orange suffusions. Mesosternum yellow. Prepectus including the ventral part blackish. Except for the coxae which are black (the fore legs are missing but the missing parts are presumably concolorous with the middle and hind legs) the legs are entirely pale lemon yellow.

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[34] Monog. Chalcid., vol. 1, 1839, p. 6.
[35] Idem, p. 12.
[36] Beitr. Monog. Pterom., 1841, p. 441.
[37] Cat. Hym., vol. 5, 1898, p. 221.

Pedicel of antenna plainly shorter than the first funicle joint and about one and one-half times as long as wide. First funicle joint the longest, almost twice as long as wide; second and third each slightly shorter and slightly wider than the preceding. Third funicle joint plainly longer than wide, about one and one-half times as long as wide. Basal club joint about as long as the preceding funicle joint and wider so that the club joint appears wider than long. First club joint about as long as the second and narrowed distally; third club joint the smallest (fig. 72).

Scutellum slightly wider than long (12:10) and almost as long as the mesoscutum (10:11). After shrinkage the abdomen is comparatively small and of distinctive shape. It is plainly much shorter than the thorax, about as wide as long, strongly depressed, and the sides widen from the base to shortly before the apex, where the cercal plates are located. The apex is widely rounded. Ovipositor not at all exserted.

Mesoscutum furnished with numerous small setae which are paler than the black derm. Parapsides and axillae apparently with the usual number of setae, that is, four and two on each, respectively. Scutellum with numerous fine, pale setae and a pair of bristles at the apex.

Fore wings hyaline, of usual shape, finely and densely ciliated. The hairless area parallel to the posterior margin of the wing at the base joins with a short, diagonal, hairless streak extending upward and outward. Marginal vein and submarginal subequal; postmarginal produced about as far distad as the apex of the stigmal as shown in Figure 115. Wing veins distinctly yellow.

Measurements in mm.: Length 1.0. Scape 0.16 long by 0.0360 wide. Pedicel 0.0536 long by 0.0368 wide. First funicle joint 0.0720 long by 0.0376 wide; second 0.0616 long by 0.6384 wide; third 0.0576 long by 0.0416 wide. First club joint 0.0464 long by 0.0632 wide; second 0.0424 long by 0.0560 wide; third 0.0368 long by 0.0432 wide. Fore wings 0.84 long by 0.46 wide. Marginal vein 0.26 long; submarginal 0.32 long. Longest marginal cilia 0.0224.

Male.—Entire thorax mostly black, only the parapsides, tegulae, and mesopleura faintly tinged with some brownish. Head mostly lemon yellow, the ocellar triangle and the occiput above the insertion of the neck blackish. Legs entirely pale lemon yellow. Except for the genital characters and a differently shaped abdomen, similar to the female.

Length 0.97 mm.

Redescribed from one female and one male (cotypes), U.S.N.M. No. 40214. The specimen labeled as follows: "On *Philippia* [*Filippia*] *oleae*. Catanzaro, Italy. Masi, Coll."

75. COCCOPHAGUS NIGROPLEURUM Girault

Coccophagus nigropleurum GIRAULT, Descriptiones Stellarum Novarum. Wash., D. C. (Published by author) 1917, p. 1.

Redescribed from a single female paratype that has lost the head. If the coloration of this species is variable, it may be difficult to recognize from this redescription as well as from the original description. An orange yellow and black species with hyaline wings and with the scutellum less densely setose than is the mesoscutum.

Female.—Orange yellow with the following parts black: center of occiput; anterior margin of the mesoscutum; a spot on the anterior mesal margin of each parapsis; the slender wedge-shaped posterior portion of each parapsis lying between the axillae and mesoscutum; metanotum except the median piece; a slight infusion on the propodeum; abdomen, except the basal angles and behind the cercal plates where it fades to brownish orange; and the pleurites except near the sutures. Sternites mostly yellowish. Middle tibiae with the median part slightly suffused with dusky. Hind tibia slightly dusky toward the base. Remainder of the legs pallid yellow to faintly brownish yellow. According to Girault, antennal scape yellow, the rest of the antenna black.

First funicle joint originally described as twice as long as wide.

Scutellum wider than long (12:9) and plainly shorter than the mesoscutum (9:11). Abdomen slightly shorter than the thorax, longer than wide (10:7). Ovipositor not exserted.

Mesoscutum with numerous black setae in more or less regular longitudinal alignment. The disk of the scutellum about as densely setose as the mesoscutum but bare on the sides and toward apex, the apex with a pair of black bristles. Each axilla with two setae and each parapsis with four similar setae.

Fore wings hyaline, densely and closely ciliated. Marginal fringe moderately short. Submarginal vein about equal in length to the marginal.

Redescribed from one female (paratype) U.S.N.M. No. 20076 reared from *Tachardia decorella*, collected by C. C. Gowdey at Kampala, Uganda, Africa, October 4, 1915.

76. COCCOPHAGUS SILVESTRII, new species

Plate 9, Figure 73; Plate 11, Figure 129

This striking species is easily recognized by the coloration and unusually long apical scutellar bristles.

Female.—Lemon yellow marked with dark brown or fuscous as follows: exposed part of pronotum, anterior half of mesoscutum arcuately, sides of metanotum, center of propodeum, and entire abdomen. In certain lights the dark coloration, especially on the mesoscutum, has metallic bluish reflections. Legs entirely pale yellow.

Pedicel about one and one-half times as long as wide and about one-half as long as the first funicle joint. First funicle joint plainly the longest, twice as long as wide; following funicle joints successively shorter and almost imperceptibly wider so that the third joint is hardly longer than wide. Club about as long as the first and second funicle joints combined; basal club joint subequal to the third funicle joint. Antenna with details of sensoria as shown in Figure 73.

Mandibles with a slightly developed apical tooth and a broad truncation. The mandibular peg-shaped spines large and conspicuous.

Fore wings hyaline or very faintly uniformly smoky; cilia of disk moderately dense. Marginal vein plainly longer than the submarginal; stigmal as shown in Figure 129. Exact length of postmarginal vein not ascertainable in the balsam-mounted specimen available for study.

Scutellum slightly wider than long (5:4) and as long as the mesoscutum. Abdomen about as long and as wide as the thorax; in dried tag-mounted specimens truncate at apex. Ovipositor arises near the base of abdomen.

Frontovertex with strong, brown setae which are very conspicuous in contrast to the yellow parts. Face and checks with fine, pale setae. Dorsum of thorax strongly setose. Each axilla with two setae. Scutellum about as densely setose as the mesoscutum and at apex furnished with an unusually long pair of bristles; two pairs of preapical lateral bristles are not much larger than the discal setae. Second and third tergites with a broadly interrupted row of setae. Fourth, fifth, and sixth tergites with a row of setae completely across the dorsum. Seventh tergite with scattered setae. Knees of middle legs with conspicuous large brown setae. Tibial spur slightly shorter than the basitarsus.

Length 1.2 mm.

Type.—Cat. No. 42104, U.S.N.M.

Described from 4 females (holotype and paratypes) reared by Dr. F. Silvestri from a *Lecanium* sp., Foochow, China, July 1, 1924.

SPECIES OF COCCOPHAGUS UNRECOGNIZED

Some species, mostly European, remain unrecognized. A few of the older European descriptions are not available to me but Spanish translations of the originals were consulted in the work of Mercet.[38] Certain species are known to me only by Mercet's Spanish translations and since very few European specimens are available for study, I am unable to clarify the confused European synonomy.

[38] Mercet, Trab. Mus. Cienc. Nat., No. 10, Madrid, 1912, pp. 221–252.

C. pulchellus Westwood is recognized as valid in this paper, although previously synonymized, and it is suspected that certain other species now in synonomy may eventually be rediscovered. Since the European authors are not in agreement regarding the synonomy of some of the older, inadequately, described species and because of my uncertainty, references to only the original descriptions are given in the following pages.

COCCOPHAGUS INSIDIATOR (Dalman)

Entedon insidiator DALMAN, Svensk. Vet. Akad. Handl., vol. 46, 1825.

Without much doubt *C. lecanii* (Fitch) or one of its closely related forms will be eventually referred to this species. For a list of the species that have been referred to *C. insidiator* (Dalman), the work of Mercet should be consulted.

COCCOPHAGUS OBSCURUS Westwood

Coccophagus obscurus WESTWOOD, London and Edin. Philos. Mag., No. 3, vol. 17, 1833, p. 344.

This species now stands as a synonym of *C. insidiator* (Dalman) but I suspect an error, for the descriptions are not in agreement nor have I seen any specimens that agree with Westwood's original description.

COCCOPHAGUS INARON (Walker)

Aphelinus inaron WALKER, Monog. Chalcid., vol. 1, 1839.

COCCOPHAGUS MOERIS (Walker)

Aphelinus moeris WALKER, Monog. Chalcid., vol. 1, 1839.

COCCOPHAGUS ARGIOPE (Walker)

Aphelinus argiope WALKER, Monog. Chalcid., vol. 1, 1839.

COCCOPHAGUS FÖRSTERI (Dalla Torre)

Myina scutellaris FÖRSTER, Beitr. Monog. Pterom., 1841, p. 441 (not *scutellaris* Dalman).

Aphelinus försteri DALLA TORRE, Cat. Hym., vol. 5, 1898, p. 221.

This species is doubtfully placed in synonymy with *C. howardi* Masi by Silvestri.[39]

COCCOPHAGUS NOTATUS (Ratzeburg)

Coccobius notatus RATZEBURG, Ichn. Forst. Inst., 1852.
Coccophagus notatus HOWARD, Div. Ent., U. S. D. A. Tech. Ser. No. 1, 1895, p. 11.

Dr. L. O. Howard is authority for the statement that this species is a *Coccophagus*.[40] According to Mercet's translation of the original description, this species is not unlike *C. lecanii* (Fitch) or one of its allies.

[39] Boll. Lab. Zool. Gen. Agr. R. Scuola Sup. Agr. Portici, vol. 13, 1919, p. 91.
[40] U. S. Dept. Agri., Div. Ent., Tech. Bull. 1, 1895, p. 11.

COCCOPHAGUS NIGRIFRONS Wollaston

Coccophagus nigrifrons WOLLASTON, Ann. and Mag. Nat. Hist., vol. 3, 1858, p. 27.

From the island of Madeira, in 1858, Wollaston described a species in the following words: "C. foem. niger; antennis piceis, clavatis, corporis dimidio brevioribus; scutello flavo apice nigro; abdomine nigro-aeneo; femoribus nigris, tarsis anticis fulvis; alis hyalinis.—Long. corp. ⅓, alar ¾ lin."

In a recent publication Mercet questionably refers a species, reared by Doctor Paoli from *Coccus hesperidum* Linnaeus, collected on the Island of Madeira, to *C. nigrifrons* Wollaston.[41] Mercet says that the specimens obtained by Doctor Paoli are not in entire agreement with Wollaston's description, since they have the legs yellow except for the middle and hind coxae and hind femora which are blackish. He also said that the specimens collected by Paoli have the scutellum setose and the species is related to *C. scutellaris* (Dalman). On the basis of the published evidence, it appears that the specimens studied by Mercet are referable to *C. scutellaris* (Dalman) and are not the same as the species described by Wollaston. Since *C. scutellaris* (Dalman) and *C. lecanii* (Fitch), or one of its forms, usually coexist and share *Coccus hesperidum* Linnaeus as a host, it seems likely that Wollaston studied *C. lecanii*, or one of its closely allied forms, for his description states that the femora are black and the logical assumption is that the reference is to all the femora and not to the hind femora as interpreted by Mercet.

COCCOPHAGUS PURPUREUS Ashmead

Coccophagus purpureus ASHMEAD, Trans. Amer. Ent. Soc., vol. 13, 1886, p. 132.—HOWARD, Div. Ent. U. S. D. A. Tech. Ser. No. 1, 1895, p. 36.

COCCOPHAGUS NUBECULUS Brèthes

Coccophagus nubeculus BRÈTHES, Ann. Nac. Mus. Buenos Aires, vol. 24, 1913, p. 97.

COCCOPHAGUS LUCANI Girault

Coccophagus lucani GIRAULT, Insec. Insc. Menst., vol. 10, 1922, p. 108.

COCCOPHAGUS POEI Girault

Coccophagus poei GIRAULT, Mem. Queensland Mus., vol. 4, 1915, p. 55.

COCCOPHAGUS FUNERALIS Girault

Plate 12, Figure 146; Plate 13, Figure 152

Coccophagus funeralis GIRAULT, Mem. Queensland Mus., vol. 4, 1915, p. 185.

In the original description, it is said that the type specimen is a female. I have had the privilege of examining the specimen and believe that it is a male.

[41] Mercet, Eos, Rev. Esp. Ent., vol. 3, No. 4, 1927, pp. 494–496.

COCCOPHAGUS PANTHERINUS Giraud

This name was included in a list of parasitic hymenoptera and their hosts published by Giraud [42] and was again mentioned by Howard [43] in connection with a list of parasites of *Kermes*. So far as known, the species has never been described and is apparently a *nomen nudum*.

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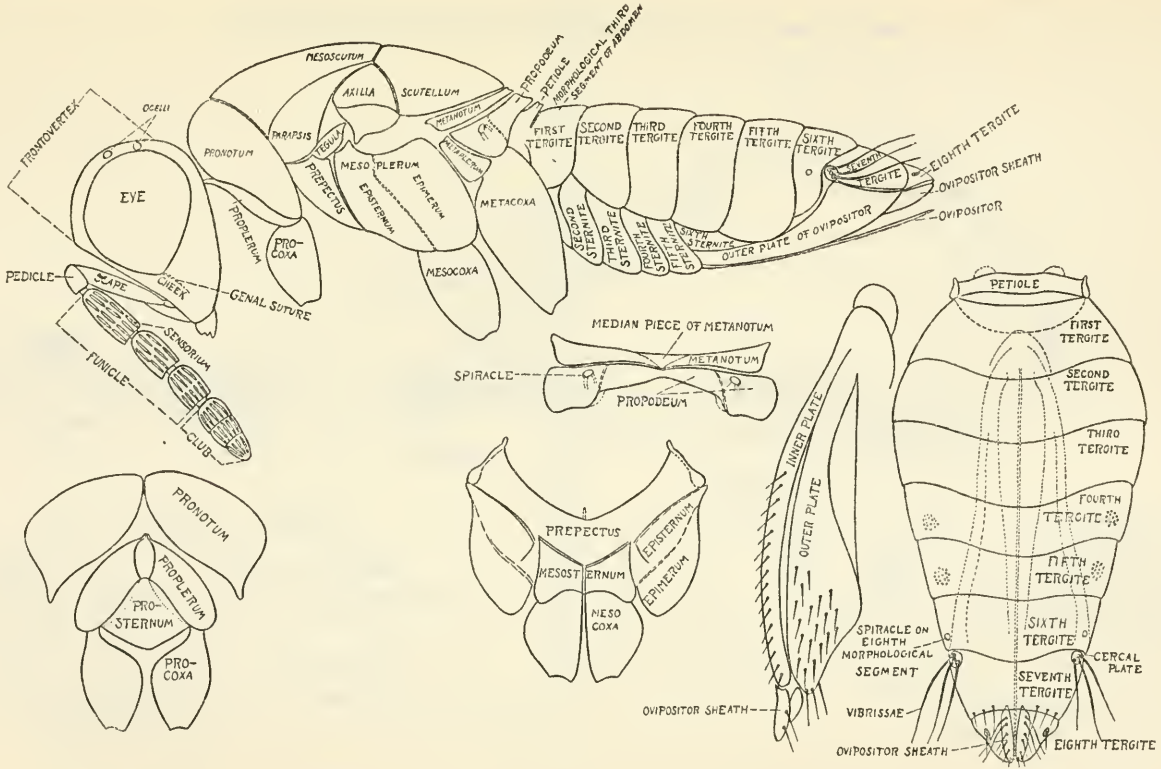
[42] Ann. Soc. Ent. Fr., 1877, p. 419.
[43] Ent. News, vol. 30, 1919, p. 258.

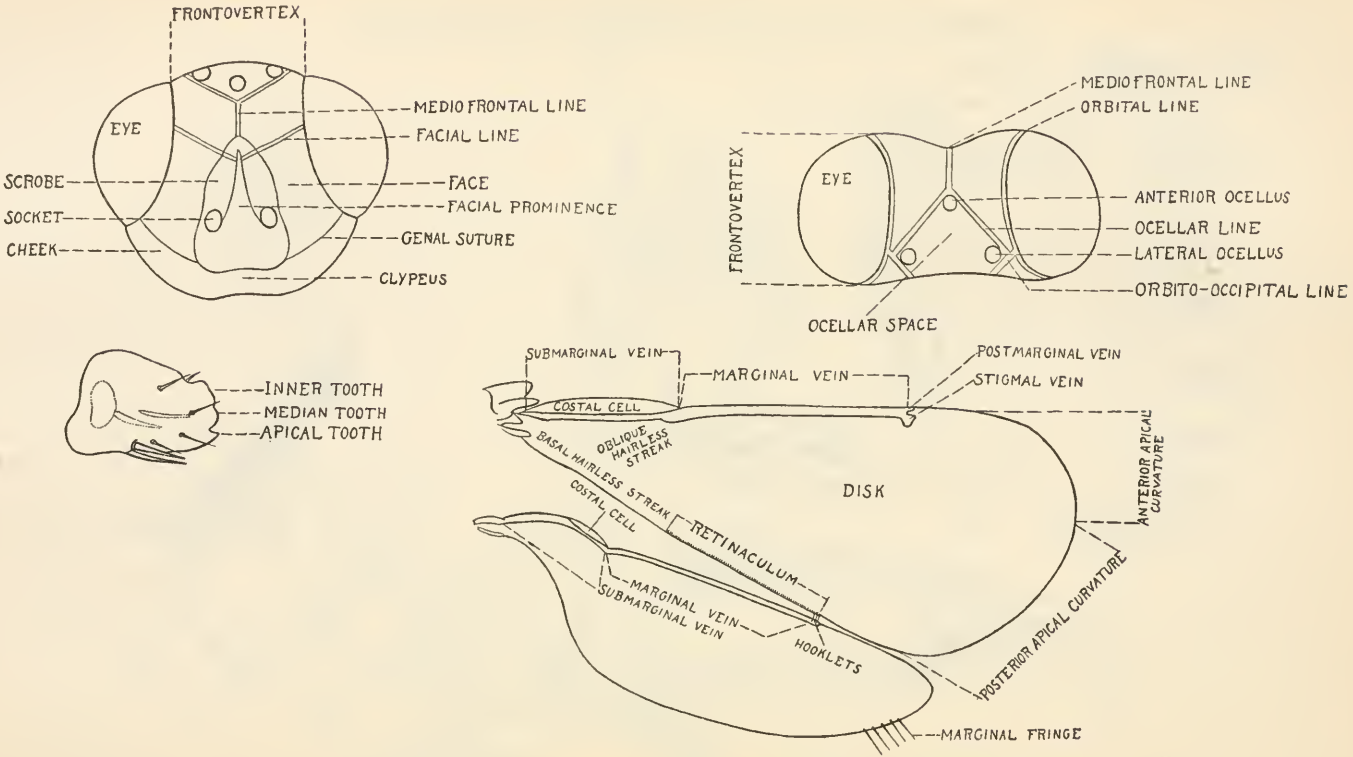
EXPLANATION OF PLATES

Plate 1

Figure 1. *Coccophagus malthusi* Girault; female with parts named.



COCCOPHAGUS MALTHUSI GIRAULT; FEMALE WITH PARTS NAMED



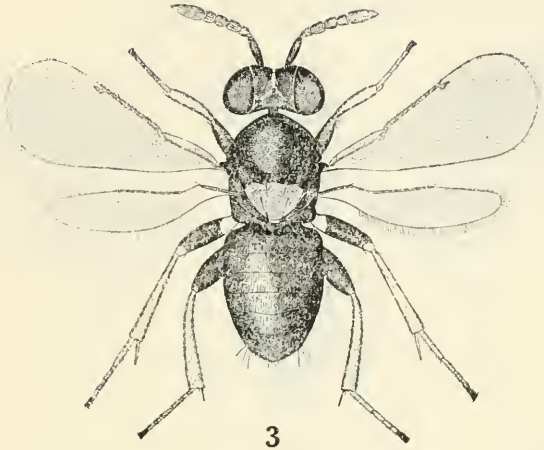
COCCOPHAGUS MALTHUSI GIRAULT; FEMALE WITH PARTS NAMED

PLATE 2

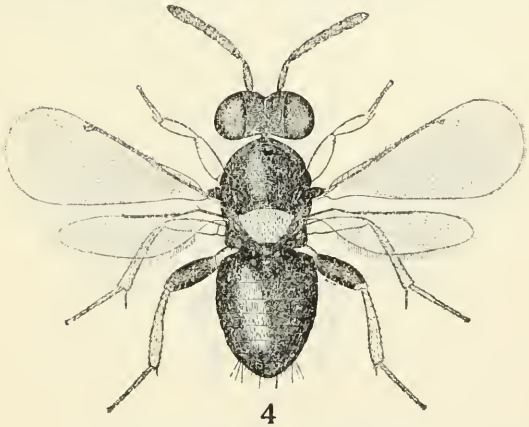
FIGURE 2. *Coccophagus malthusi* Girault; female with parts named.

PLATE 3

FIGURE 3. *Coccophagus cowperi* Girault; female.
4. *Coccophagus scutellaris* (Dalman); female.



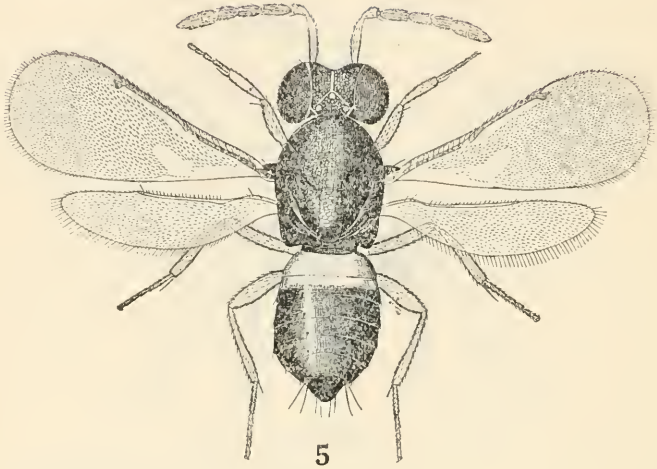
3



4

SPECIES OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 118



5

6

SPECIES OF COCCOPHAGUS

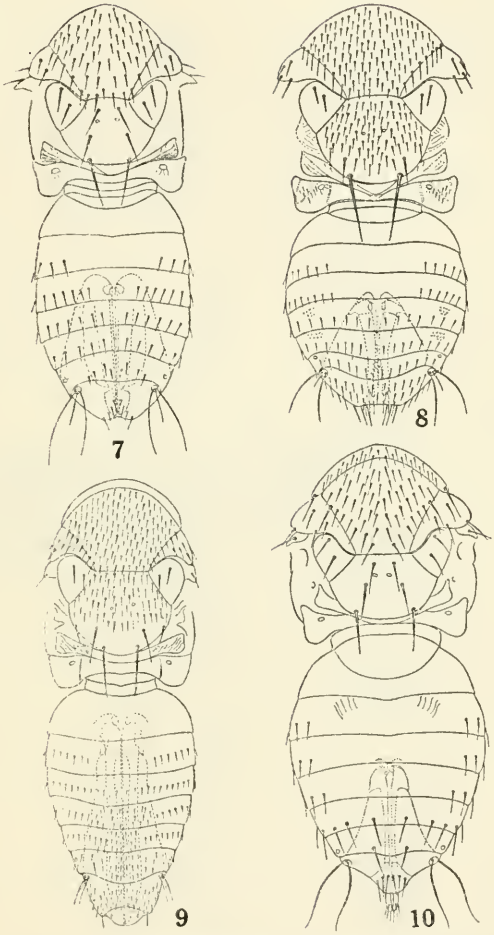
FOR EXPLANATION OF PLATE SEE PAGE 119

PLATE 4

FIGURE 5. *Coccophagus gurneyi* Compere; female.
6. *Coccophagus spectabilis*, new species; female.

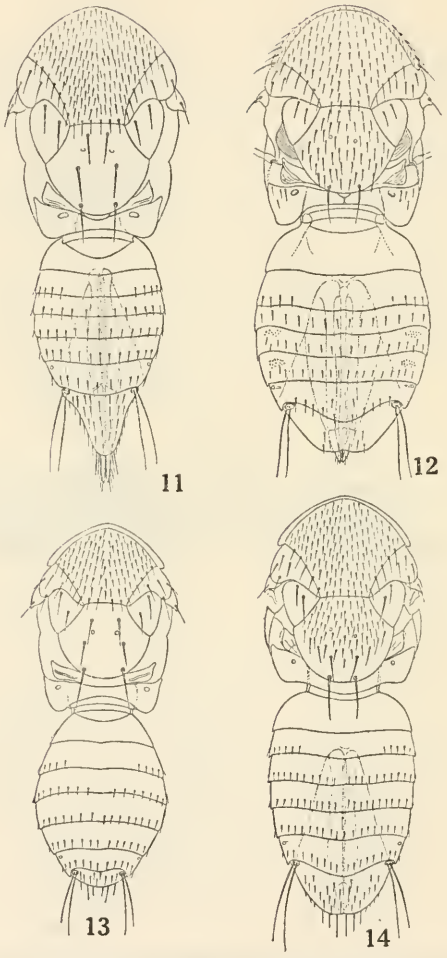
Plate 5

Figure 7. *Coccophagus isipingoensis* new species; female.
8. *Coccophagus robustus*, new species; female.
9. *Coccophagus nigritus*, new species; female.
10. *Coccophagus margaritatus*, new species; female.



DETAILS OF THE THORAX AND ABDOMEN OF SPECIES OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 120



DETAILS OF THE THORAX AND ABDOMEN OF SPECIES OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 121

PLATE 6

FIGURE 11. *Coccophagus flaviceps*, new species; female.
12. *Coccophagus nubes* Compere; female.
13. *Coccophagus rusti* Compere; female.
14. *Coccophagus yoshidae* Nakayama; female.

Plate 7

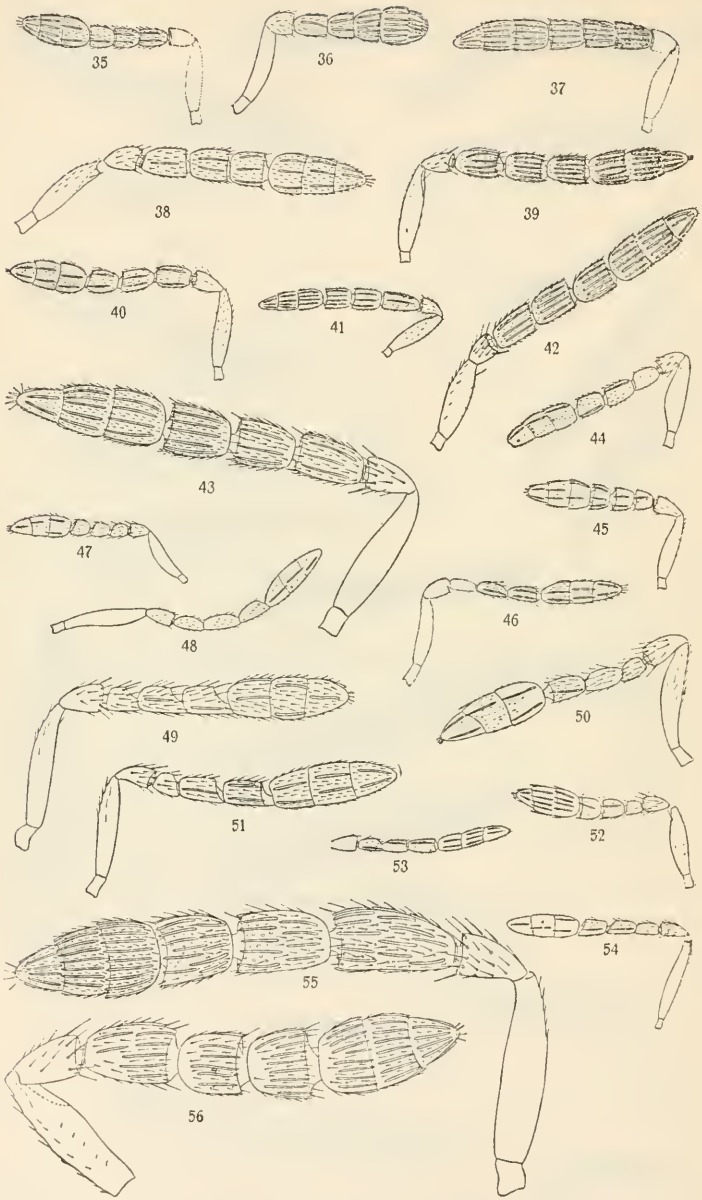
Coccophagus antennae, females

Figure 15. *Coccophagus redini* Girault.
16. *Coccophagus lepidus*, new species.
17. *Coccophagus flavifrons* Howard.
18. *Coccophagus anthracinus* Compere.
19. *Coccophagus timberlakei*, new species.
20. *Coccophagus atratus* Compere.
21. *Coccophagus rusti* Compere.
22. *Coccophagus flavescens* Howard.
23. *Coccophagus perhispidis* Girault.
24. *Coccophagus gurneyi* Compere.
25. *Coccophagus tarongaensis*, new species.
26. *Coccophagus signus* Girault.
27. *Coccophagus mariformis*, new species.
28. *Coccophagus flaviceps*, new species,
29. *Coccophagus tschirchii* Mahdihassan.
30. *Coccophagus gregarius*, new species.
31. *Coccophagus javensis* Girault.
32. *Coccophagus triguttatus* Girault.
33. *Coccophagus specialis*, new species
34. *Coccophagus triangulatinotus* Girault.

ANTENNAE OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 122

2610—31——9



ANTENNAE OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 123

PLATE 8.

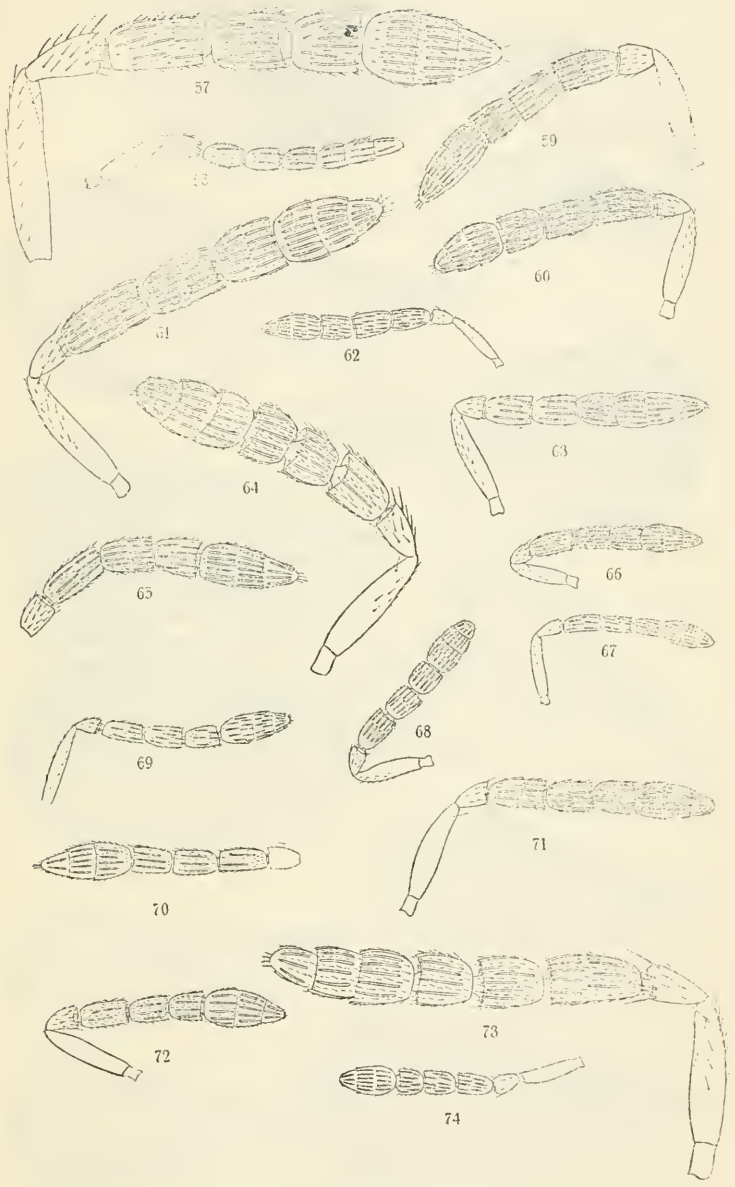
Coccophagus antennae, females

FIGURE 35. *Coccophagus leptospermi* Girault.
36. *Coccophagus inkermani* Girault.
37. *Coccophagus bogoriensis* (Köningsberger).
38. *Coccophagus cubaensis*, new species.
39. *Coccophagus pulvinariae*, new species.
40. *Coccophagus japonicus* Compere.
41. *Coccophagus hawaiiensis* Timberlake.
42. *Coccophagus tibialis*, new species.
43. *Coccophagus isipingoensis*, new species.
44. *Coccophagus zebratus* Howard.
45. *Coccophagus trifasciatus* Compere.
46. *Coccophagus perflavus* Girault.
47. *Coccophagus argenteus* Girault.
48. *Coccophagus argentifascia* Girault.
49. *Coccophagus bivittatus*, new species.
50. *Coccophagus longifasciatus* Howard.
51. *Coccophagus margaritatus*, new species.
52. *Coccophagus pulcini* Girault.
53. *Coccophagus auricaput* Girault.
54. *Coccophagus ochraceus* Howard.
55. *Coccophagus nigritus*, new species.
56. *Coccophagus modestus* Silvestri.

Plate 9

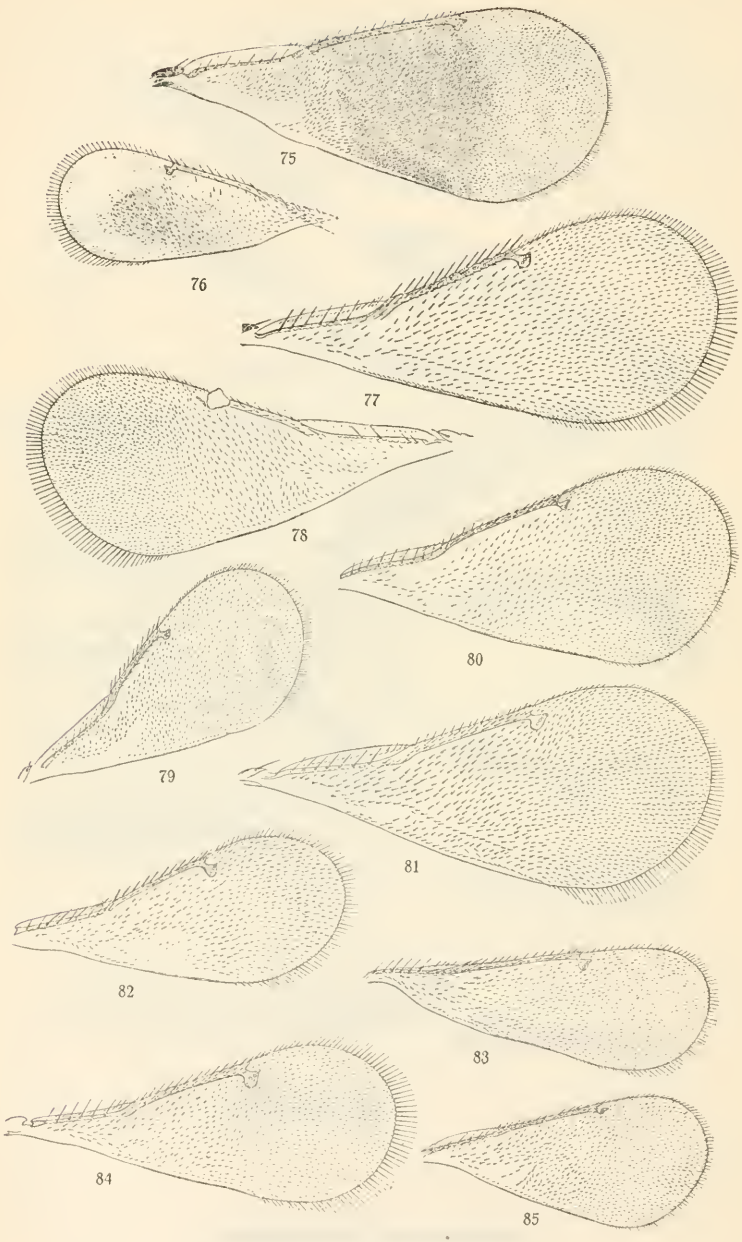
Coccophagus antennae, females

Figure 57. *Coccophagus modestus*, var. *capensis*, new variety.
58. *Coccophagus nubes* Compere.
59. *Coccophagus quaestor* Girault.
60. *Coccophagus spectabilis*, new species.
61. *Coccophagus clavellatus*, new species.
62. *Coccophagus albicoxa* Howard.
63. *Coccophagus mexicensis* Girault.
64. *Coccophagus robustus*, new species.
65. *Coccophagus saintebcauvei* Girault.
66. *Coccophagus saissetiae* Gahan.
67. *Coccophagus scutellaris* (Dalman).
68. *Coccophagus ishiii*, new species.
69. *Coccophagus scutatus* Howard.
70. *Coccophagus immaculatus* Howard.
71. *Coccophagus pulchellus* Westwood.
72. *Coccophagus howardi* Masi.
73. *Coccophagus silvestrii*, new species.
74. *Coccophagus yoshidae* Nakayama.



ANTENNAE OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 124



WINGS OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 125

PLATE 10

Coccophagus fore wings, females

FIGURE 75. *Coccophagus rusti* Compere.
76. *Coccophagus argenteus* Girault.
77. *Coccophagus margaritatus*, new species.
78. *Coccophagus biguttatus* Girault.
79. *Coccophagus pulcini* Girault.
80. *Coccophagus javensis* Girault.
81. *Coccophagus ochraceus* Howard.
82. *Coccophagus longifasciatus* Howard.
83. *Coccophagus argentifascia* Girault.
84. *Coccophagus bivittatus*, new species.
85. *Coccophagus signus* Girault.

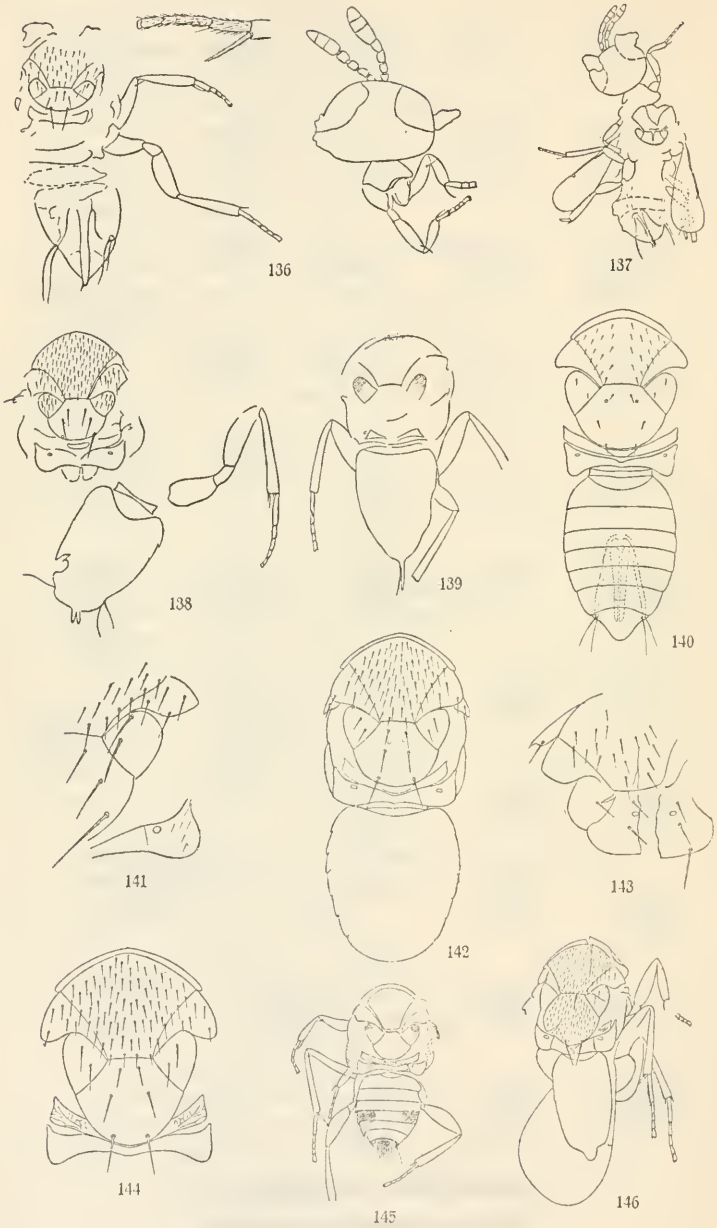
Plate 11

Coccophagus stigmal veins, females

Figure 86. *Coccophagus nubes* Compere.
87. *Coccophagus cinguliventris* Girault.
88. *Coccophagus leptospermi* Girault.
89. *Coccophagus trifasciatus* Compere.
90. *Coccophagus clavellatus*, new species.
91. *Coccophagus zebratus* Howard.
92. *Coccophagus ishiii*, new species.
93. *Coccophagus argentifascia* Girault.
94. *Coccophagus quaestor* Girault.
95. *Coccophagus tarongaensis*, new species.
96. *Coccophagus mexicensis* Girault.
97. *Coccophagus perhispidis* Girault.
98. *Coccophagus bogoriensis* (Köningsberger).
99. *Coccophagus flavifrons* Howard.
100. *Coccophagus yoshidae* Nakayama.
101. *Coccophagus inkermani* Girault.
102. *Coccophagus auricaput* Girault.
103. *Coccophagus triguttatus* Girault.
104. *Coccophagus atratus* Compere.
105. *Coccophagus bivittatus*, new species.
106. *Coccophagus argenteus* Girault.
107. *Coccophagus immaculatus* Howard.
108. *Coccophagus margaritatus*, new species.
109. *Coccophagus tschirchii* Mahdihassan.
110. *Coccophagus longifasciatus* Howard.
111. *Coccophagus javensis* Girault.
112. *Coccophagus rusti* Compere.
113. *Coccophagus cubaensis*, new species.
114. *Coccophagus mariformis*, new species.
115. *Coccophagus howardi* Masi.
116. *Coccophagus emersoni* Girault.
117. *Coccophagus scutellaris* (Dalman).
118. *Coccophagus saintebeauvei* Girault.
119. *Coccophagus triangulatinotus* Girault.
120. *Coccophagus signus* Girault.
121. *Coccophagus nigritus*, new species.
122. *Coccophagus robustus*, new species.
123. *Coccophagus ochraceus* Howard.
124. *Coccophagus timberlakei*, new species.
125. *Coccophagus saissetiae* Gahan.
126. *Coccophagus flaviceps*, new species.
127. *Coccophagus pulvinariae*, new species.
128. *Coccophagus anthracinus* Compere.
129. *Coccophagus silvestrii*, new species.
130. *Coccophagus isipingoensis*, new species.
131. *Coccophagus lecanii* (Fitch).
132. *Coccophagus perflavus* Girault.
133. *Coccophagus pulchellus* Westwood.
134. *Coccophagus pulcini* Girault.
135. *Coccophagus flavescens* Howard.

STIGMAL VEINS OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 126



ANATOMICAL DETAILS OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 127

Plate 12

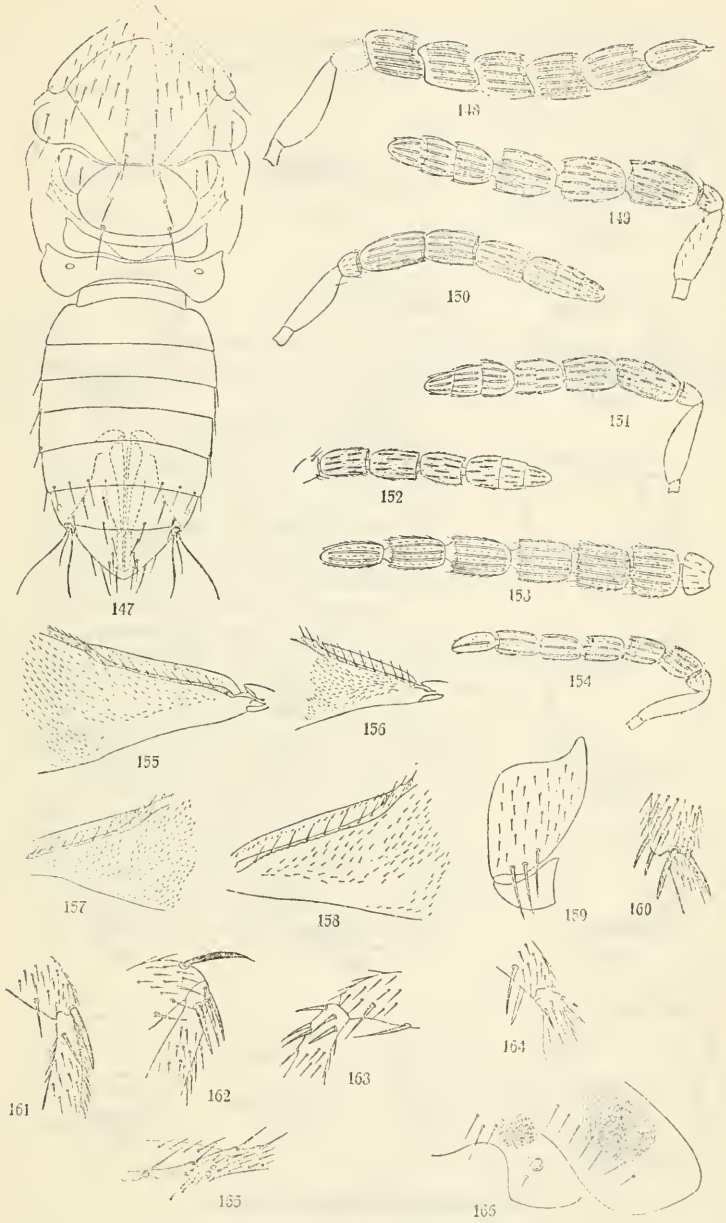
Coccophagus females and male. The drawings of the crushed and mutilated specimens shown on this plate are the outlines of the actual types as they appear on the slides.

Figure 136. *Coccophagus argenteus* Girault female.
137. *Coccophagus argentifascia* Girault female.
138. *Coccophagus redini* Girault female.
139. *Coccophagus biguttatus* Girault female.
140. *Coccophagus tarongaensis*, new species, female.
141. *Coccophagus bogoriensis* (Köningsberger) female.
142. *Coccophagus leptospermi* Girault female.
143. *Coccophagus perflavus* Girault female.
144. *Coccophagus javensis* Girault female.
145. *Coccophagus triguttatus* Girault female.
146. *Coccophagus funeralis* Girault male.

Plate 13

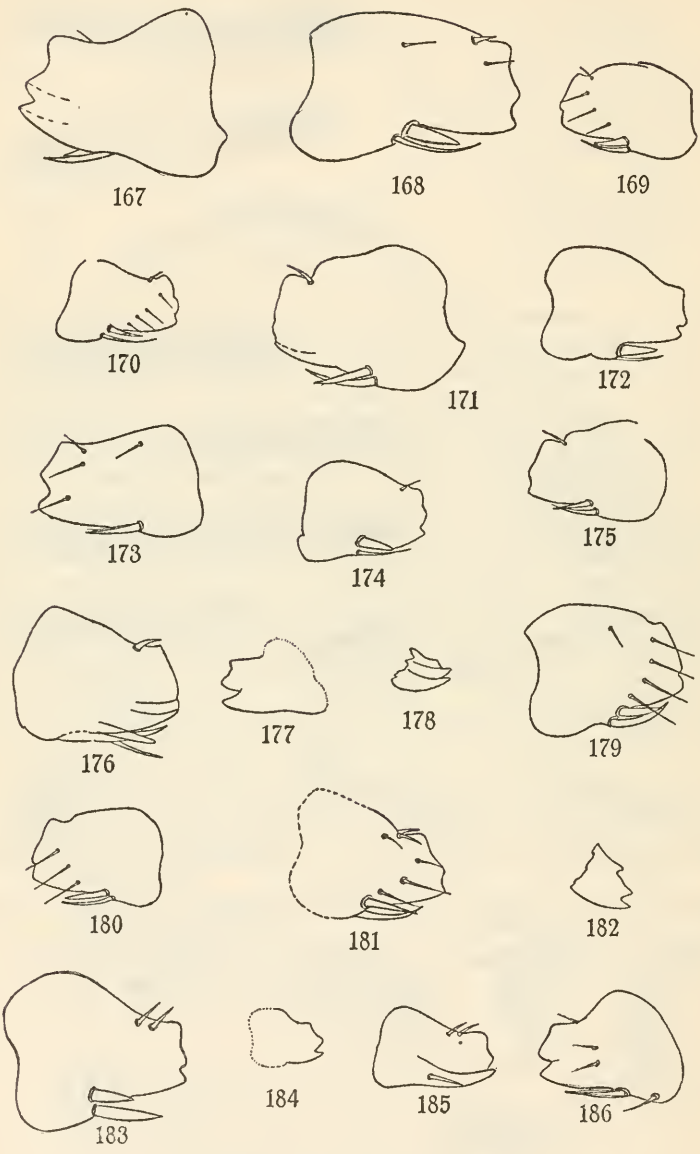
Coccophagus details

Figure 147. *Coccophagus bivittatus*, new species; body, female.
148. *Coccophagus mariformis*, new species; antenna, male.
149. *Coccophagus gregarius*, new species; antenna, male.
150. *Coccophagus leptospermi* Girault, antenna, male.
151. *Coccophagus tarongaensis*, new species; antenna, male.
152. *Coccophagus funeralis* Girault, antenna, male.
153. *Coccophagus bivittatus*, new species; antenna, male.
154. *Coccophagus margaritatus*, new species; antenna, male.
155. *Coccophagus pulchellus* Westwood; basal part of fore wing, female.
156. *Coccophagus quaestor* Girault; basal part of fore wing, female.
157. *Coccophagus mexicensis* Girault; basal part of fore wing, female.
158. *Coccophagus immaculatus* Howard; basal part of fore wing, female.
159. *Coccophagus anthracinus* Compere; setae on fore coxa, female.
160. *Coccophagus robustus*, new species; paired setae at apex of hind tibia, female.
161. *Coccophagus robustus*, new species; setae on femur and tibia, female.
162. *Coccophagus clavellatus*, new species; setae on femur and tibia, female.
163. *Coccophagus isipingoensis*, new species; setae on femur and tibia, female.
164. *Coccophagus anthracinus* Compere; setae on femur and tibia, female.
165. *Coccophagus clavellatus*, new species; hyaline break at end of submarginal vein, female.
166. *Coccophagus atratus* Compere; characteristic markings on sides of fifth and sixth tergites, female.



ANATOMICAL DETAILS OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 128



MANDIBLES OF COCCOPHAGUS

FOR EXPLANATION OF PLATE SEE PAGE 129

Plate 14

Coccophagus, mandibles, females. The mandibles shown on this plate were not uniformly oriented before drawing so that inner and outer aspects are shown.

Figure 167. *Coccophagus atratus* Compere.
168. *Coccophagus anthracinus* Compere.
169. *Coccophagus yoshidae* Nakayama.
170. *Coccophagus flaviceps*, new species.
171. *Coccophagus albicoxa* Howard.
172. *Coccophagus scutatus* Howard.
173. *Coccophagus tarongaensis*, new species.
174. *Coccophagus rusti* Compere.
175. *Coccophagus scutellaris* (Dalman).
176. *Coccophagus modestus* var. *capensis*, new variety.
177. *Coccophagus leptospermi* Girault.
178. *Coccophagus zebratus* Howard.
179. *Coccophagus nigritus*, new species.
180. *Coccophagus malthusi* Girault.
181. *Coccophagus clavellatus*, new species.
182. *Coccophagus javensis* Girault.
183. *Coccophagus gregarius*, new species.
184. *Coccophagus margaritatus*, new species.
185. *Coccophagus hawaiiensis* Timberlake.
186. *Coccophagus lepidus*, new species.

SPECIES INDEX

[Valid names appear in Roman, synonyms in *italics*, and the most important page reference in boldface. The generic name in brackets follows species assigned to genera other than *Coccophagus*.]