

**THE NORTH AMERICA ACROBAT ANTS OF THE
HYPERDIVERSE GENUS *CREMATOGASTER*
(HYMENOPTERA: FORMICIDAE)**

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PREFACE

Ants in the genus *Crematogaster* have always fascinated us as when disturbed, workers raise their gasters (\approx abdomens, excluding propodeum and waist) and exude a drop of poison, making them appear as tiny acrobats. They are increasingly becoming subjects of intensive study due to the habits of some species in living in specialized “ant plants” or living with other ant species, often genera known for their aggressive natures, such as carpenter and ponerine ants.

Identification has been difficult in the past, as the most complete keys to the species in the United States were not based on type specimens, leading to common misidentifications, especially of the most common species. Some of the more tropical species occur within the continental United States and are not included in these previous keys. Hopefully this work will allow entomologists, ecologists, behaviorists and other investigators to identify these fascinating ants and lead to further discoveries.

In this study, we examined the types of nearly all the species, and have found that many of the species are synonyms of other species. We include keys to the workers from Canada, United States and México, redcriptions of the species, illustrations, maps and lists of localities. We borrowed types and other specimens from museums throughout the world, have visited some of these museums for extended time periods, but have based most of the revision on specimens we collected over the past 50 years, especially for the Mexican and Canadian specimens.

This book has been carefully edited by Dr. Patricia Rojas and Joe MacGown and was greatly improved by including their suggestions.

DEDICATION

We dedicate this monograph to Cindy's children Linda, Noah, Joshua, and Aaron, as well as Brant, Ethan and Damien, who never gave up on her. It is published in remembrance of Joshua, who will always be with her.

ABSTRACT

The systematics and natural history of thirty-eight North American (Canada, USA and México) species of the genus *Crematogaster* are discussed and the distributions are mapped. A dichotomous key to the workers is included. The species richness of this genus is not as great as previously thought in North America. Many species had been defined based on sculpture or color, characters that are shown to be variable in many cases. The included species and changes include:

Crematogaster acuta (Fabricius, 1804), *C. ashmeadi* Mayr, 1886b, *C. atra* Mayr, 1870b, *C. cerasi* Fitch, 1855 (= *C. browni* Buren, 1968, **new synonymy**), *C. coarctata* Mayr, 1870b (= *C. mormonum* Emery, 1895, **new synonymy** and *C. californica* Emery, 1895, **returned to synonymy**), *C. corvina* Mayr, 1870b, *C. crinosa* Mayr, 1862, *C. curvispinosa* Mayr, 1862, *C. dentinodis* Forel, 1901a, *C. depilis* Wheeler, 1919 (= *C. larreae* Buren, 1968, **new synonymy**), *C. distans* Mayr, 1870a, *C. emeryana* Creighton, 1950 (= *C. marioni* Buren, 1968, **new synonymy**), *C. formosa* Mayr, 1870b (= *C. formosa* var. *aterrima* Wheeler, 1909, **new synonymy**), *C. isolata* Buren, 1968, *C. laeviuscula* Mayr, 1870b (= *C. atkinsoni*, Wheeler, 1919, *C. lineolata cedrosensis* Wheeler, 1934b and *C. hespera* Buren, 1968, **new synonymies**), *C. limata* F. Smith, 1858, *C. lineolata* Say, 1836, *C. minutissima* Mayr, *C. missouriensis* Emery, 1895, *C. montezumia* F. Smith, 1858, *C. mutans* Buren, 1968, *C. navajoa* Buren, 1968, *C. nigropilosa* Mayr, 1870a, *C. nocturna* Buren, 1968, *C. obscurata* Emery, 1895, *C. opaca* Mayr, 1870b, *C. patei* Buren, 1968, *C. pilosa* Emery, 1895, *C. pinicola* Deyrup and Cover, 2007, *C. punctulata* Emery, 1895, *C. quadrispinosa* Roger, 1863, *C. rifelna* Buren, 1968, *C. rochai* Forel, 1903, *C. saussurei* Forel, 1899, *C. sotobosque*

Longino, 2003, *C. sumichrasti* Mayr, 1870b, *C. torosa* Mayr, 1870a, *C. vermiculata* Emery 1895 (= *C. colei* Buren, 1968, *C. opuntiae* Buren, 1968 and *C. rossi* Buren, 1968, **new synonymies**).

Due to a lack of workers, *C. nocturna* Buren, 1968 and *C. quadrispinosa* Roger, 1863a have not been included in the worker key.

RESUMEN

Se presenta la sistemática y la historia natural de las 38 especies del género *Crematogaster* presentes en América del Norte, con la redesccripción y la distribución de cada una y una clave de identificación para las obreras. La riqueza de especies del género en América del Norte es menor de lo que se pensaba. En el pasado muchas especies fueron definidas con base en la escultura o el color de la cutícula, caracteres variables en muchos casos. Las especies y cambios son:

Crematogaster acuta (Fabricius, 1804), *C. ashmeadi* Mayr, 1886b, *C. atra* Mayr, 1870b, *C. cerasi* Fitch, 1855 (= *C. browni* Buren, 1968, **nueva sinonimia**), *C. coarctata* Mayr, 1870b (= *C. mormonum* Emery, 1895, **nueva sinonimia** y *C. californica* Emery, 1895, **regresar a sinonimia**), *C. corvina* Mayr, 1870b, *C. crinosa* Mayr, 1862, *C. curvispinosa* Mayr, 1862, *C. dentinodis* Forel, 1901a, *C. depilis* Wheeler, 1919 (= *C. larreae* Buren, 1968, **nueva sinonimia**), *C. distans* Mayr, 1870a, *C. emeryana* Creighton, 1950 (= *C. marioni* Buren, 1968, **nueva sinonimia**), *C. formosa* Mayr, 1870b (= *C. formosa* var. *aterrima* Wheeler, 1909 **nueva sinonimia**), *C. isolata* Buren, 1968, *C. laeviuscula* Mayr, 1870b (= *C. clara* Mayr, 1870b, *C. atkinsoni*, Wheeler, 1919, *C. cedrosensis lineolata* Wheeler, 1934b y *C. hespera* Buren, 1968, **nuevas sinonimias**), *C. limata* F. Smith, 1858, *C. lineolata* Say, 1836, *C. minutissima* Mayr, 1870b (= *C. minutissima thoracica* Creighton, 1939, **nueva sinonimia provisional**), *C. missouriensis* Emery, 1895, *C. montezumia* F. Smith, 1858, *C. mutans* Buren, 1968, *C. navajoa* Buren, 1968, *C. nigropilosa* Mayr, 1870a, *C. nocturna* Buren, 1968, *C. obscurata* Emery, 1895, *C. opaca* Mayr, 1870b, *C. patei* Buren, 1968, *C. pilosa* Emery, 1895, *C. pinicola* Deyrup y Cover, 2007, *C. punctulata* Emery, 1895, *C. quadrispinosa* Roger, 1863, *C. rifelna* Buren, 1968, *C. rochai* Forel, 1903, *C. saussurei* Forel, 1899, *C. sotobosque* Longino, 2003, *C. sumichrasti* Mayr, 1870b, *C. torosa* Mayr, 1870a, *C. vermiculata*

Emery 1895 (= *C. colei* Buren, 1968, *C. opuntiae* Buren, 1968 y *C. rossi* Buren, 1968, **nuevas sinonimias**).

Debido a la falta de obreras, *C. nocturna* Buren, 1968 y *C. quadrispinosa* Roger, 1863a no están incluidas en la clave de los trabajadores.

Introduction

The ant genus *Crematogaster* (Hymenoptera: Formicidae) is believed to have risen in the mid-Cretaceous (Moreau et al., 2006, Pie and Tscha, 2007) and the oldest recorded fossils are in Sicilian amber. The tribe Crematogastrini now contains several genera and appears to have diversified between 28.1 and 42.4 million years ago, in the Paleotropics and *Crematogaster* later colonized the New World (Ward et al., 2015). There are over 900 species, subspecies, varieties, races, strips and transferred names assigned to this genus making it the 7th largest genus of ants in the world (Bolton et al., 2006, Wilson, 2003).

Wilson (2003) refers to such large genera as hyperdiverse. Other hyperdiverse ant genera are *Pheidole*, *Camponotus*, *Temnothorax*, *Neivamyrmex*, *Pseudomyrmex*, and *Solenopsis*. Wilson observed several commonalities of hyperdiverse ant genera which include having a small size, generalist diet and the ability to exploit very diverse ecosystems. Another shared feature in hyperdiverse ant genera is the ability to become dominant within an ecosystem and not become displaced by other species in the same guild (Wilson, 2003). This may be due to their efficient chemical defense. Instead of injecting hydrophilic venoms produced by the poison gland as many ants do, they use their morphologically modified and reduced spatulate sting to apply surface-active lipophilic secretions from their hypertrophied Dufour's gland topically on the integument of enemies (Heredia et al., 2005).

Currently patterns of diversity within *Crematogaster* are poorly understood; distribution records for individual species are spread throughout the literature and localities for many species are only available in type descriptions. Prior to this work, 51 species were known from North America, with the highest diversity in the

southwestern United States. We recognize 38 species in this revision. Species richness appears to be higher in more southern climates as illustrated by the low diversity in Canada.

The genus *Crematogaster* has a distinctive morphology. The postpetiole is attached on the dorsal surface of the gaster, which allows this ant to bend its gaster over its mesosoma in a defensive stance enabling the ant to apply venom on an aggressor, hence the common name acrobatic ant. The gaster is heart-shaped and the sting is spatulate allowing the ant to dab rather than inject its venom onto an aggressor (Buren, 1958). The species within this genus are small (2 mm), but often medium sized (7 mm) and the worker caste of most are continuously polymorphic in size.

Lund described *Crematogaster* in 1831 from specimens he had collected in Brazil. Fitch (1855) described *C. cerasi* from New York, United States, Say (1836) described *C. lineolata* from Massachusetts and Roger (1863a) described *C. quadrispinosa* from a single queen from México. Later numerous taxa were described by Mayr (1862 1870a, 1870b, 1886a, and 1886b) and Emery (1895) from around the world. Wheeler (1904a, 1904b, 1912a, 1912b and 1919) described additional species; and the taxonomic confusion of the genus *Crematogaster* continued. In 1918, Santschi described subgenera to aid in the identification of species and made a list of species within each subgenus. The North American subgenera are no longer recognized and the genus consists of two clades: the *Crematogaster* clade and the *Orthocrema* clade (Blaimer, 2012a, 2012b). As the number of species of ants increased worldwide, Emery (1922) and Wheeler (1922) both developed lists of species within several genera of ants. Wheeler (1922, 1934a), Creighton (1950), Buren (1968) and Johnson (1988) have attempted to create some order in this complicated genus; however, they worked partially without the use of

type material so the confusion of the taxonomy of this genus has persisted. The keys in Creighton (1950) and Buren (1968) were developed using available material and not types of all species and several species using type specimens did not key correctly in either key. Buren (1968) described 14 new species occurring throughout North America. Longino (2003) compiled a survey and key of the *Crematogaster* of Costa Rica using type specimens and new material and made 22 synonymies, 20 subspecies were raised to species and 11 new species were described.

Although current alpha taxonomy of *Crematogaster* is based on morphology, ecological information is also informative in delineating species and understanding how they partition habitats and their ecological roles. In general, ants are an integral part of nearly every terrestrial ecosystem (Hölldobler and Wilson, 1990) and are among the earth's most productive organisms. Their biomass among animals is second only to termites (Hölldobler and Wilson, 1990). Ants are the custodian of many landscapes, functioning as major components of many ecosystems (Hölldobler and Wilson, 1990). Ants also aerate tremendous amounts of soil, and are often an integral part in nutrient cycling (Hölldobler and Wilson, 1990).

Crematogaster are small generalists that can be found in a wide variety of landscapes. In North America niches occupied can vary greatly in latitude, elevation, and nesting habits. They can be found in desert, riparian, mountainous, savanna, and tropical biomes. In low lying areas, many species such as *C. ashmeadi* and *C. laeviuscula* will build carton nests hung in trees, as bees do, to avoid any risk of flooding (Tschinkel 2002). Species such as *C. sumichrasti* and *C. isolata* build their nests under stones (personal observations). Some species are vegetative host-specific, including *C. pinicola* which nests

only in dead branches and under the bark of pine trees, particularly *Pinus elliotii* and *P. palustris* (Deyrup and Cover, 2007).

Crematogaster species, such as *C. vermiculata* and *C. coarctata*, feed on extrafloral nectar produced by *Opuntia* sp. Food scraps from humans will also attract workers of this genus (Buren, 1968). Some species are very important within the ecosystems they inhabit. *Crematogaster ashmeadi* and *C. pinicola* are the primary food source for the endangered red cockaded woodpecker, *Picoides borealis* (Tschinkel, 2002). Many *Crematogaster* will cultivate a “herd” of aphids as a food source, rendering some species of *Crematogaster* and their companions as pests. Thus, the ecological diversification of *Crematogaster* is extensive, supporting the hypothesis of Wilson (2003) that members of hyperdiverse genera are typically habitat generalists.

The goals of this revision are: 1) Define the species of North American *Crematogaster* based on morphological characters using type material or specimens identified by authorities in the field (Buren, Longino). 2) Redescribe workers and reproductives from type material. 3) Describe previously undescribed reproductives. 4) Illustrate species. 5) Summarize locality data to develop a geographic map for each species. 6) Most importantly, to develop a key to the worker caste for species found in North America.

Methods and Materials

Type material and specimens were borrowed from the following museums and private collections:

ABRS:	Archbold Biological Research Station, Highlands Co., Florida
BMNH:	The Natural History Museum, London, U. K.
COOK:	Jerry Cook collection, Sam Houston State University, Texas
CWEM:	Collection of William and Emma Mackay University of Texas at El Paso
DEIC:	Institut für Landwirtschaftswissen der Akademie der Landwirtschaftswissen, Germany
JTLC	John T. Longino collection, University of Utah
LACM:	Los Angeles Co. Museum of Natural History, Los Angeles, CA, U.S.A.
MCZC:	Museum of Comparative Zoology, Cambridge, MA,
NHMB:	Naturhistorisches Museum Basel
MHNG:	Museum d'Histoire Naturelle, Geneva, Switzerland.
NHMW:	Naturhistorisches Museum, Vienna, Austria.
STDC:	Shawn T. Dash collection, Hampton University
ZMUC:	Zoological Museum University of Copenhagen

Comparisons, observations and measurements were made using a Wild Heerbrugg dissection microscope with a micrometer at magnifications of 40x or 80x. All measurements are in millimeters (mm). Most type specimens and individual specimens from the different collections were measured to determine the range in size of

each morphological feature using the micrometer to the nearest 100th mm. At least two specimens were measured whenever possible.

Below we give the character states we used to identify and redescribe each species. The terminology follows that of Serna and Mackay (2010).

Measurements as defined by Longino (2003) were used for consistency except for Head Width which in Longino's description includes the eyes, but does not include the eyes in this study (Plate 1). Size of anatomical structures or proportions of length/width are often partially diagnostic in identifying species of *Crematogaster*.

- HL:** Head Length (full face view) is the perpendicular distance from the most posterior point on the head to the most anterior point of the clypeus (Plate 1).
- HW:** Head Width (in full face view) is the maximum distance between the most lateral points of the head in full face view just above the eyes and excluding the eyes (Plate 1).
- SL:** Scape Length is measured from the basal flange, not including the condyle, to the apex of the scape (Plate 1).
- EL:** Eye Length is measured from the side of the head along the longest axis of the eye, perpendicular to the shortest axis.
- ED:** Eye Diameter is measured from the side of the head along the short axis of the eye, perpendicular to the longest axis.
- CL:** Clypeal Length (full face view) is the perpendicular distance from the posterior border of the clypeus to the most anterior point of the clypeus (Plate 1).
- CW:** Clypeal Width (full face view) is the width between the tentorial pits (Plate 1).

- WL:** Weber's Length (measured in side view) is the maximum distance from the anterior edge of the pronotal shoulder to the posterior margin of the metapleural lobes (Plate 1).
- SPL:** Propodeal Spine Length is measured in side view from the tip of the spine to the closest point of the posterior lateral rim of the propodeal spiracle (Plate 1).
- PL:** Petiole Length (viewed dorsally) is measured along the greatest length from the anterior margin to posterior margin (Plate 1).
- PW:** Petiole Width (viewed dorsally) is measured perpendicular to the length at the widest portion of the petiole (Plate 1).
- PPL:** Postpetiole Length (viewed dorsally) is measured along the greatest length from the anterior margin to posterior margin (Plate 1).
- PPW:** Postpetiole Width (viewed dorsally) is measured perpendicular to the length at the widest portion of the postpetiole (Plate 1).

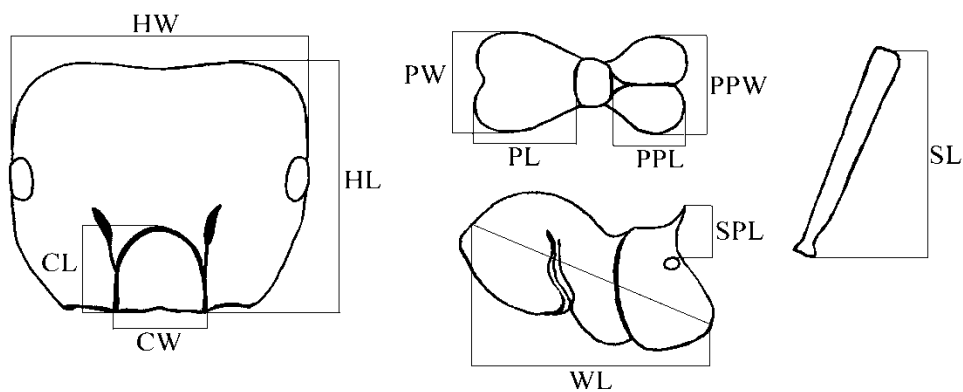


Plate 1. Morphometric measurements HL: Head Length; HW: Head Width; CL: Clypeal Length; CW: Clypeal Width; PL: Petiole Length; PW: Petiole Width; PPL: Postpetiole Length; PPW: Postpetiole Width; SL: Scape Length; WL: Weber's Length; SPL: Propodeal Spine Length.

Physical attributes of the face can also help in the identification of species. The anterior clypeal margin has four typical states: slightly convex (Plate 2 A), concave (Plate 2 B) slightly concave with a medial notch (Plate 2 C) or straight with a medial notch (Plate 2 D).

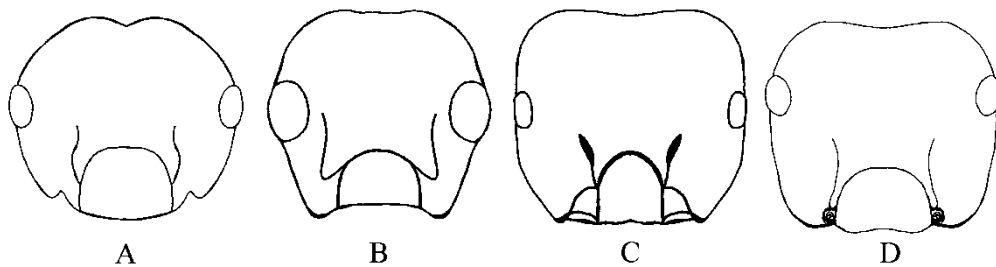


Plate 2. Anterior clypeal margin of workers: (A) *C. lineolata*; (B) *C. coarctata*, (C) *C. atra* and (D) *C. patei*.

Hairs on the different structures of each species also help identify a specimen. Below is the definition of each type of hair that can be found on North American *Crematogaster*. Most species of *Crematogaster* have more than one type of hair present on each structure.

Long erect hairs rise perpendicular to the surface, are $> 0.15\text{mm}$, stiff and straight to the tip (Plate 3 A).

Long flexuous hairs rise perpendicular to the surface, are $> 0.15\text{mm}$, thin and have a slight curve (Plate 3 B).

Short erect hairs rise perpendicular to the surface, are thick and bristle like. They are $< 0.15\text{mm}$ (Plate 3 C).

Decumbent hairs rise from the surface of the integument and curve such that they are parallel to the surface (Plate 3 D).

Appressed hairs lie flat along the surface of the integument (Plate 3 E).

Erect spatulate hairs rise perpendicular to the surface and are usually $> 0.10\text{mm}$ and each hair flattens as it rises away from the integument (Plate 3 F).

Semierect hairs rise from the integument at an angle but are straight as erect hairs (Plate 3 G).

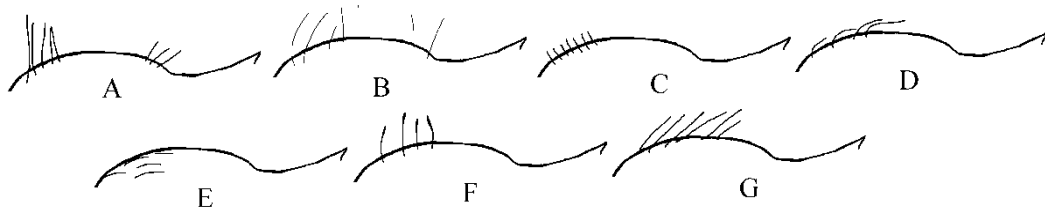


Plate 3. Hair character states: (A) Long erect hairs; (B) Long flexuous hairs; (C) Short erect hairs; (D) Decumbent hairs; (E) Appressed hairs; (F) Erect spatulate hairs; (G) Semierect hairs.

The propodeal spines on *Crematogaster* can be shaped and attached differently from species to species. Variation within species is usually only a matter of size. Spines in species such as *C. ashmeadi* are proportionally short or reduced and flattened at the base along the interior margin giving the spine a triangular appearance (Plate 4 A). The dorsal margin of the spines of most species is straight; however, in *C. cerasi* the top margin of the spine is sinuate (Plate 4 B). Some species such as *C. coarctata* have very long and pointed spines (Plate 4 C). The development of the spines can be as small as little more than propodeal teeth as in *C. montezumia* (Plate 4 D).

The size, shape and attachment of the spine can also vary. In most species, the spines are attached at the widest point of the propodeum as in Plate 4 A, B C and D; however, in *C. isolata* and *C. saussurei* the sides of the propodeum extend past the point of the insertions of the spines (Plate 4 E). The inside margins of the spines and the amount of divergence between the points can also vary greatly. The inside margin of the spines can be pointed posteriorly as in *C. ashmeadi* (Plate 4 A) or upturned as in *C. curvispinosa* (Plate 4 F).

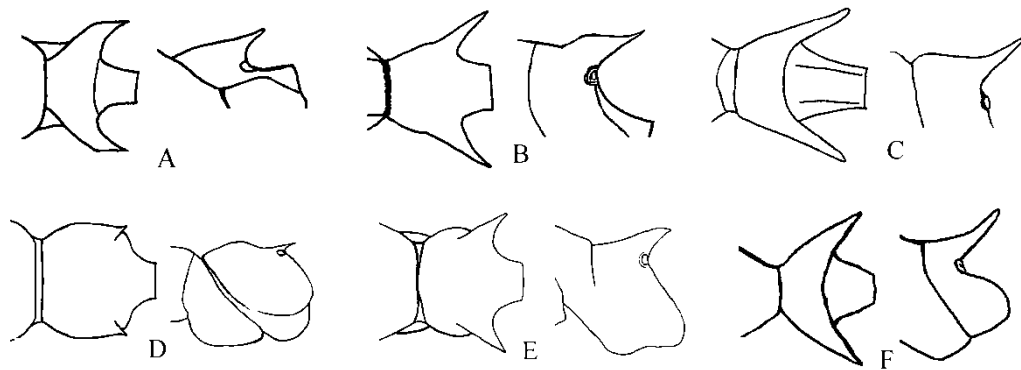


Plate 4. Dorsal and side view of the propodeal spines: (A) *Crematogaster ashmeadi*; (B) *C. cerasi*; (C) *C. coarctata*; (D) *C. montezumia*; (E) *C. saussurei*; and (F) *C. curvispinosa*.

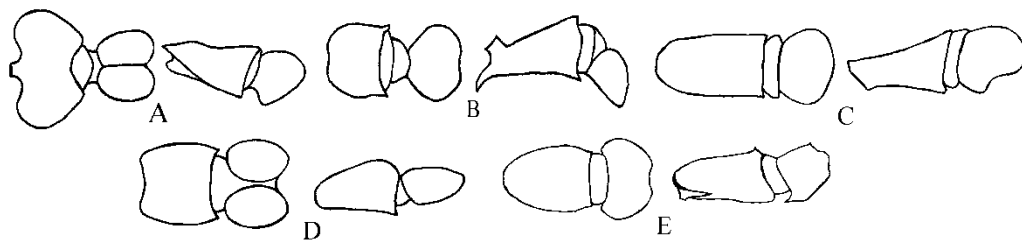


Plate 5. Dorsal and side views of the petiole and postpetiole: (A) *C. coarctata*; (B) *C. rochai*; (C) *C. nigropilosa*; (D) *C. distans*; (E) *C. acuta*.

The shape of the petiole and postpetiole are usually the first characters used to separate species of *Crematogaster* into the subgeneric groups described by Santschi (1918). There are two basic character states to describe the shape of the postpetiole when viewed from above: bilobed with a median sulcus as in *C. coarctata* (Plate 5 A) and globular as in *C. rochai* (Plate 5 B). There are at least three distinct character states for the shape of the petiole. One character state is triangular with two wider lobes anteriorly and narrowing posteriorly as in *C. coarctata* (Plate 5 A). A second character state for petiole shape is subquadrate with the length almost the same as the width, and the sides nearly parallel as in *C. rochai* (Plate 5 B). A third character state is elongate with parallel sides, the posterior edge is slightly wider than the anterior edge and the length longer than the width as in *C. nigropilosa* (Plate 5 C). Another character that can help in the identification of species is the presence and degree of development of a sternopetiolar and / or sternopostpetiolar process. Many species do not have any sternopetiolar or sternopostpetiolar processes such as *C. distans* (Plate 5 D). An anterior sternopetiolar process can be small as in *C. coarctata* (Plate 5 A), to well developed as in *C. rochai* (Plate 5 B). Few species have an anterior sternopostpetiolar process as in *C. acuta* (Plate 5 E).

Key to the workers of *Crematogaster* in North America

- 1** Postpetiole with two hemilobes, divided by longitudinal medial sulcus (look from above, Fig. 1 a; Plates 5 A and D); most common in temperate habitats **2**
- Postpetiole globular, not divided into two hemilobes by longitudinal medial sulcus (Fig. 1 b; Plates 5 B and C) or with slight emargination posteriorly (Fig. 1 c; Plate 5 E); most common in tropical and subtropical habitats **25**

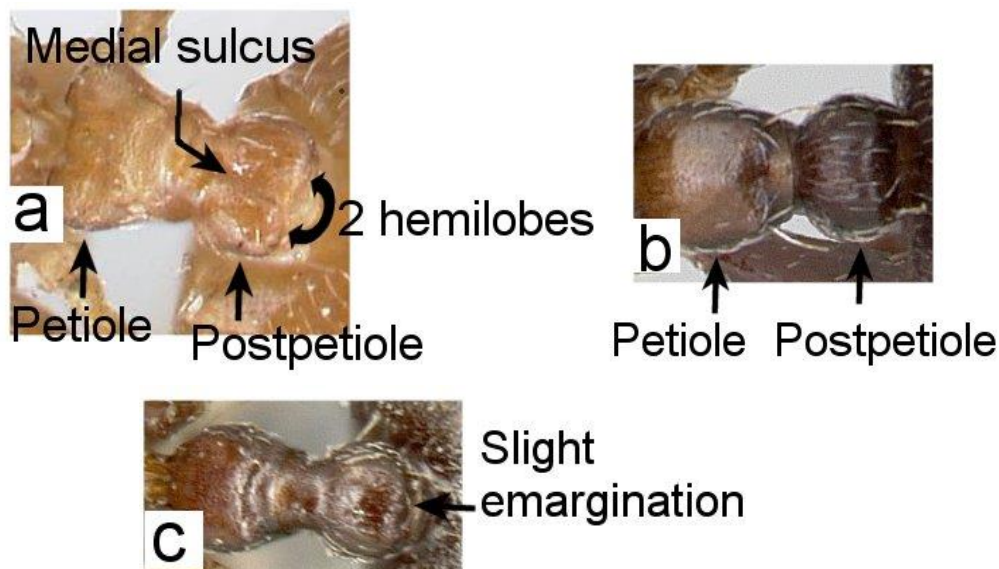


Fig. 1. Petioles and postpetioles of workers of a) *C. ashmeadi* (modified from www.AntWeb.org, April Nobile photographer). b) *C. crinosa* (from www.AntWeb.org, April Nobile photographer) and c) *C. atra* (paratype, from www.AntWeb.org, John Longino photographer).

- 2(1)** Petiole approximately as wide as long, trapezoidal, obviously widened anteriorly (Fig. 2, left; Plate 5 A) **3**
- Petiole subrectangular, not greatly widened anteriorly, sides nearly parallel (Fig. 2, right; Plate 5 D), if somewhat quadrate, widest medially not anteriorly **21**

*emeryana**montezumia*

Fig. 2. Petioles and postpetioles of workers of *C. emeryana* (from www.AntWeb.org, Michael Branstetter photographer) and *C. montezumia* (from www.AntWeb.org, Zach Lieberman photographer).

- 3(2)** Base of spines not connected at widest portion of propodeum (Fig. 3, left; Plate 4 E) **4**
- Base of spines connected at widest portion of propodeum (Fig. 3, right; Plates 4 A, B, C, D and F) **5**

Edge of
propodeum

*isolata**laeviuscula*

Fig. 3. Propodeum of a worker of *C. isolata* (from AntWeb, Bonnie Blaimer photographer) and of *C. laeviuscula* (from www.AntWeb.org, April Nobile photographer) as seen from above.

- 4(3)** Head and mesosoma punctate-lineolate (Fig. 4. left), following curvature of head and pronotal shoulder; México (southern Chihuahua to Veracruz) *saussurei* Forel
 - Head longitudinally striate below eye; mesosoma punctate (Fig. 4, right); SW USA to northern México
 *isolata* Buren¹

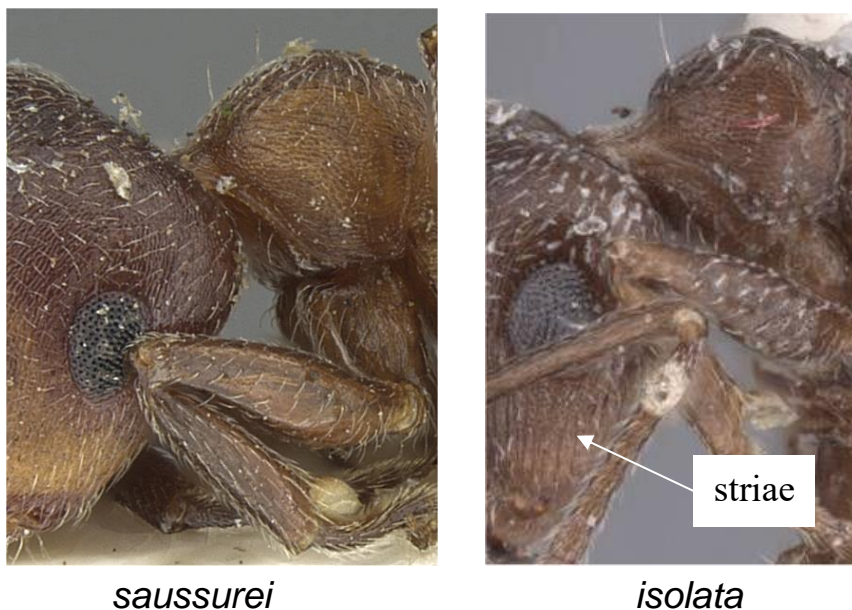


Fig. 4. Sides of head of pronotum of workers of *C. saussurei* (from www.AntWeb.org, Ryan Perry photographer) and *C. isolata* (From www.AntWeb.org, Alexandra Westrich photographer).

¹ Workers of *C. nocturna*, described only by queens and males collected at Rainbow Lodge, Navajo Mountains, Arizona, U. S. may key here due to similarities to the queens and males of *C. nocturna* with those of *C. isolata*.

- 5(3)** Spines reduced (length from posterior edge of propodeal spiracle to tip 0.16 mm or less, see Fig. 5, left; Plate 4 A) **6**
 - Spines longer (length as above 0.17 mm or more, see Fig. 5, right; Plate 4 B and C) **11**

*ashmeadi**laeviuscula*

Fig. 5. Pronotum and petiole of *C. ashmeadi* (from www.AntWeb.org, Christiana Klingenberg photographer) and *C. laeviuscula* (from www.AntWeb.org, April Nobile photographer) as seen from above.

- 6(5)** Head shiny and glossy medially, side of pronotum shiny, partially or completely smooth (Fig. 6, left); propodeal spines tiny, length approximately as long as width at base of spines (less than 0.13 mm in length) **7**
- Head at least partially sculptured medially in part of series; side of pronotum shiny or sculptured, usually punctate (Fig. 6, right); spines often longer than 0.13 mm, not greatly widened at base of spines **8**

*ashmeadi**cerasi*

Fig. 6. Side of the head and pronotum of a worker of *C. ashmeadi* (from www.AntWeb.org, Christiana Klingenberg photographer) and a worker of *C. cerasi* (from www.AntWeb.org, April Nobile photographer).

- 7(6) Concolorous light to dark brown, rarely bicolored (Fig. 7, left); rarely nesting in pine trees; common and widely distributed in southern and SE USA, southern Mexico ***ashmeadi* Mayr**
 - Bicolored with head and mesosoma red and gaster dark (Fig. 7, right); nesting in pine trees in Florida and Tennessee
 ***pinicola* Deyrup and Cover**



Fig. 7. Side view of *C. ashmeadi* (from www.AntWeb.org, April Nobile photographer) and *C. pinicola* (from www.AntWeb.org, April Nobile photographer).

- 8(6)** Dorsum of head completely or nearly completely punctate (Fig. 8, left); mesosoma densely punctate; southern Arizona to southern México ***opaca* Mayr**
- Dorsum of head partially smooth and glossy (Fig. 8, right); mesosoma rugose or shallowly costate; widely distributed ... **9**

*opaca**emeryana*

Fig. 8. Head of workers of *C. opaca* (from www.AntWeb.org, April Nobile photographer) and *C. emeryana* (from www.AntWeb.org, Jen Fogarty photographer).

9(8) Medial mesonotal carina sharp and raised from surface (Fig. 9, left); side of pronotum mostly smooth and glossy; southeastern Texas and eastern México ***rifelna* Buren**

- Medial mesonotal carina poorly developed, barely raised from surface (Fig. 9, right); side of pronotum may be shiny, but is usually completely or nearly completely sculptured; widely distributed **10**

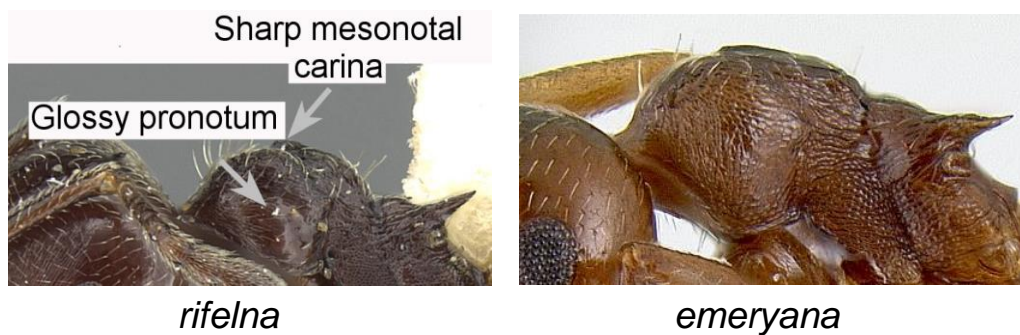


Fig. 9. Pronotum of *C. rifelna* (from www.AntWeb.org, Ryan Perry photographer) and *C. emeryana* (from www.AntWeb.org, Michael Branstetter photographer)

- 10(9)** Dorsal edge of propodeal spine sinuous (curved somewhat upwards distally) (Plate 4 B, Fig. 10); common in entire USA, northern Mexico ***cerasi* Fitch**
- Dorsal edge of propodeal spine straight (Fig. 9, right); southwestern USA and NW México ***emeryana* Creighton**



Fig. 10. Pronotum of *C. cerasi* (from www.AntWeb.org, Erin Prado photographer)

- 11(5)** Majority of specimens in series with 4 or fewer erect hairs on each pronotal shoulder (larger workers often have more hairs) (Fig. 11, left); mostly western USA and México **12**
- Pronotal shoulder of majority of workers with 5 or more erect hairs (Fig. 11, right); mostly eastern USA and eastern México **17**

*laeviuscula**lineolata*

Fig. 11. Mesosoma of a worker of *C. laeviuscula* (from www.AntWeb.org, April Nobile photographer) and of *C. lineolata* (from www.AntWeb.org, April Nobile photographer).

- 12(11)** Side of pronotum shiny (Fig. 11, left); strongly bicolored (gaster black, remainder red, see Fig. 7, right); entire southern USA, eastern USA and México ***laeviuscula* Mayr**
- Lateropronotum heavily sculptured (Fig. 11, right, Fig. 12); concolorous to slightly bicolored (see Fig. 7, left) **13**

- 13(12)** Pronotal shoulder with 1 to 4 erect hairs (Fig. 12, left) in majority of specimens in series **14**
 - Pronotal shoulders completely without erect hairs (Fig. 12, right) in all specimens in series; SW USA, México.....
 *depilis* Wheeler

*dentinodis**depilis*

Fig. 12. Mesosoma of a worker of *C. dentinodis* (from www.AntWeb.org Jen Fogarty photographer) and of a worker of *C. depilis* (from www.AntWeb.org, Andrea Walker photographer)

- 14(13)** Each posterior corner of petiole with small tooth (Fig. 13; Plate 25 B); southern and eastern USA to central México *dentinodis* Forel
- Posterior corners of petiole without teeth; widely distributed **15**



Fig. 13. Petiole of a worker of *C. dentinodis* (arrow indicates tiny tooth, from www.AntWeb.org, April Jen Fogarty).

- 15(14)** Pronotum coarsely vermiculate (Fig. 14, left); western and southeastern USA to central México ***vermiculata* Emery**
 - Pronotum shoulder with longitudinal rugae (Fig. 14, right); widely distributed **16**

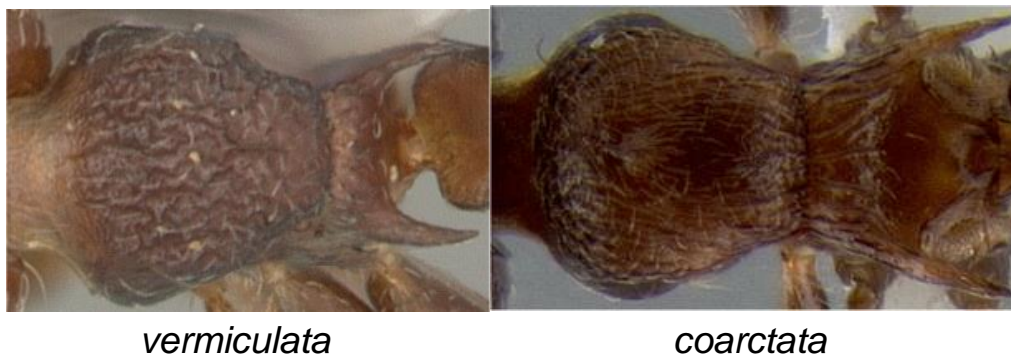


Fig. 14. Pronotum of a worker of *C. vermiculata* (from www.AntWeb.org, April Nobile photographer) and of a worker of *C. coarctata* (From www.AntWeb.org, Bonnie Blaimer photographer).

- 16(15)** Mesosoma of queen wider than head (Plate 17 A and B); common and widely distributed from western USA to southern México ***coarctata* Mayr²**
 - Mesosoma of queen narrower than head (Plate 54 A and B); rarely collected, Utah west to southern California, south to southern México ***mutans* Buren**

² Unfortunately, we have not been able to find consistent characters to separate the workers of these two species, but *C. coarctata* is very common, *C. mutans* is rarely collected.

- 17(11)** Dorsum of head with more than 10 erect hairs, dorsum of mesosoma with more than 15 erect hairs (Fig. 15 right) **18**
 - Dorsum of head usually with fewer than 10 erect hairs, dorsum of mesosoma usually with fewer than 15 (up to 20 may be present) short bristle-like erect hairs (Fig. 15, left); California east to SE Canada S to Florida and northern Mexico *lineolata* Say

*lineolata**navajoa*

Fig. 15. Head and mesosoma of a worker of *C. lineolata* (From www.AntWeb.org, April Nobile photographer) and of a worker of *C. navajoa* (From www.AntWeb.org, April Nobile photographer).

- 18(17)** Most of dorsum of head smooth and glossy, surrounding area finely striolate or areolate (Fig. 16 and 17) **19**
 - Dorsum of head nearly completely punctate (see Fig. 8, left), medial area may be glossy **20**



Fig. 16. Head and mesosoma of a worker of *C. pilosa* (From Ant WEB, Zach Lieberman photographer).



Fig. 17. Head of a worker of *C. pilosa* (From Ant WEB, April Nobile photographer).

- 19(18)** Most hairs on pronotal shoulder relatively short (less than 0.15 mm) (Fig. 16); Texas northeast to New Jersey, south to Florida ***pilosa* Wheeler**
 - Most hairs on pronotal shoulder relatively long (over 0.18 mm in length) (Fig. 15, right); Nevada, Colorado, Arizona and New Mexico ***navajoa* Buren**

- 20(18)** Longitudinal carina well developed in center of pronotum; southern half of the US south to central México *punctulata* Emery
- Longitudinal carina poorly developed on center of pronotum; eastern and central México *patei* Buren
- 21(2)** Dorsum of head (face) partially smooth and glossy (Fig. 18, left); México south to Argentina *distans* Mayr
- Dorsum of head predominantly or completely and densely punctate or vermiculate, dull (Fig. 18, right) **22**

*distans**corvina*

Fig. 18. Head of a worker of *C. distans* (From www.AntWeb.org, Zach Lieberman photographer) and of a worker of *C. corvina* (From www.AntWeb.org, Bonnie Blaimer photographer).

- 22(21)** Propodeal spines nearly as long or longer than width of petiole (Fig. 19, left); México to Brazil **23**
- Propodeal spine length much less than $\frac{1}{2}$ width of petiole (Fig. 19, right); southern Texas to Costa Rica **24**

*acuta**corvina*

Fig. 19. Mesosoma (top view) of a worker of *C. acuta* (From www.AntWeb.org, Zach Lieberman photographer) and of a worker of *C. corvina* (From www.AntWeb.org, C. Richart photographer).

- 23(22)** Dorsum of head and pronotum densely punctate (Fig. 20, left); México and Guatemala ***formosa* Mayr**
 - Dorsum of head and pronotum roughly rugose punctate or vermiculate punctate (Fig. 20, right); southern México south to Brazil ***acuta* Fabricius³**

*formosa**acuta*

Fig. 20. Head of a worker of *C. formosa* (From www.AntWeb.org, Bonnie Blaimer photographer) and of a worker of *C. acuta* (From www.AntWeb.org, Christiana Klingenberg photographer).

- 24(22)** Petiole elongate, almost 2X as long as wide (dorsal view), sides nearly parallel and straight (Fig. 2, right); propodeal spines reduced to tiny, sharp tooth; eastern and southern México to Brazil ...
 ***montezumia* F. Smith**
 - Petiole subquadrate, slightly wider than long, widest medially (Fig. 19, right); propodeal spines well developed but small (length about 2X diameter of propodeal spiracle); southern USA (southern tip of Texas) to Costa Rica ***corvina* Mayr**

³ Note: The unknown worker of *C. quadrispinosa* from México, may key here.

- 25(1)** Petiole slender, 1.5-2 times as long as wide, slightly wider posteriorly, as seen from above (Fig. 21, left) **26**
 - Petiole subquadrate (Fig. 21, right) **29**

*sotobosque**atra*

Fig. 21. Petiole and postpetiole of a worker of *C. sotobosque* (From www.AntWeb.org, Ryan Perry photographer) and of a worker of *C. atra* (From www.AntWeb.org, John Longino photographer).

- 26(25)** Dorsum of pronotum, including medial area, with several varicose or reticulate longitudinal carinae, which strongly contrast against smooth and shiny background (Fig. 22, left) **27**
 - Dorsum of pronotum shiny, without carinulae at least medially, but carinulae may be present along edges (Fig. 22, right) . **28**

*curvispinosa**sotobosque*

Fig. 22. Pronotum of a worker of *C. curvispinosa* (From www.AntWeb.org, April Nobile photographer) and of a worker of *C. coarctata* (From www.AntWeb.org, Zach Lieberman photographer).

27(26) Propodeal spines very long, longer than length of distance between bases (measured from posterior edge of propodeal spiracle, seen from above), extending to near posterior edge of petiole (when petiole is in same plane as mesosoma) (see Fig. 23), diverging as seen from above; pronotum with long (longer than greatest eye diameter) dark brown or bronze colored hairs; southern Mexico south to Bolivia

..... ***nigropilosa* Mayr**

- Propodeal spines about as long as distance between bases when measure as above, slightly incurved (Fig. 22, left); pronotum with shorter (most about greatest eye diameter) silver or white hairs; Florida and México to Brazil ***curvispinosa* Mayr**

28(26) Clypeus completely smooth and glossy, occasionally with poorly developed longitudinal carinulae; hairs on pronotum dark brown; posterior edge of mesonotum with small angle (Fig. 23, left); USA (southern Arizona) to Bolivia ***sotobosque* Longino**

- Clypeus usually with moderately well-defined longitudinal carinulae; hairs on pronotum whitish; mesonotum without small angle (Fig. 23, right); México to Brazil ***limata* F. Smith**



Fig. 23. Mesosoma of a worker of *C. sotobosque* (From www.AntWeb.org, Zach Lieberman photographer) and of a worker of *C. limata* (From www.AntWeb.org, C. Richart photographer).

- 29(25)** Dark brown (Fig. 24, left) **30**
 - Yellow or pale brown (Fig. 24, right) **34**

*obscurata**minutissima*

Fig. 24. Pronotum of a worker of *C. vermiculata* (From www.AntWeb.org, Zach Lieberman photographer) and of a worker of *C. minutissima* (From www.AntWeb.org, April Nobile photographer).

- 30(29)** Lateropronotum mostly or entirely covered by horizontal striolae, usually mixed with punctures, weakly to moderately shining (Fig. 25, left); rarely collected, central México to Argentina ***atra* Mayr**
 - Lateropronotum predominantly smooth and glossy, strongly shining (Fig. 25, right); common and widely distributed ... **31**

*atra**torosa*

Fig. 25. Pronotum of a worker of *C. atra* (From www.AntWeb.org, April C. Richart) and of a worker of *C. torosa* (From www.AntWeb.org, C. Richart photographer).

- 31(30)** Most of clypeus (at least medial area) smooth and glossy (Fig. 26, left); southern Texas, Louisiana and southern Florida south to Venezuela *obscurata* **Emery**
 - Clypeus covered with fine longitudinal striae (medial area may be slightly smooth and shining) (Fig. 26, right); widely distributed **32**

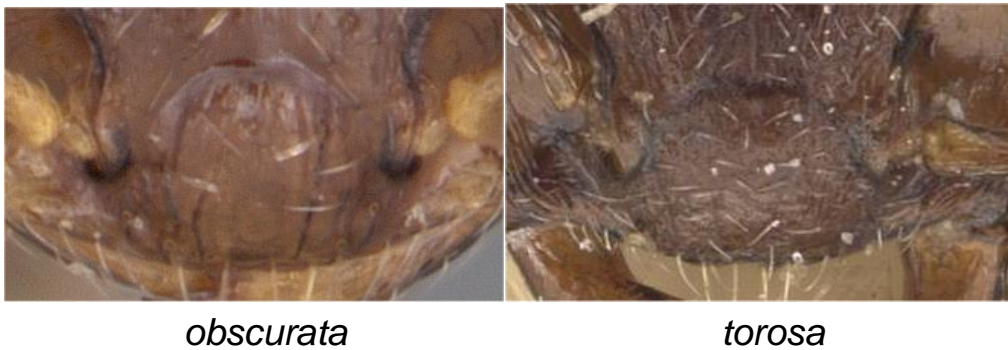


Fig. 26. Pronotum of a worker of *C. vermiculata* (From www.AntWeb.org, April Nobile photographer) and of a worker of *C. torosa* (From www.AntWeb.org, Will Ericson photographer).

- 32(31)** Sternopetiolar process absent to poorly developed (Fig. 27, left); SW USA to Brazil ***torosa* Mayr**
 - Sternopetiolar process well developed (Fig. 27, middle); widely distributed including SW USA and México **33**

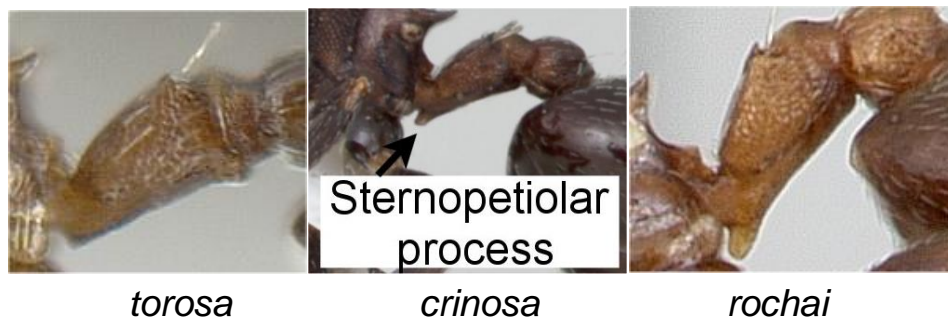


Fig. 27. Petiole of a worker of *C. torosa* (From www.AntWeb.org, C. Richart photographer), of a worker of *C. crinosa* (From www.AntWeb.org, April Nobile photographer) and of a worker of *C. rochai* (From www.AntWeb.org, April Nobile photographer).

- 33(32)** Gaster sparsely evenly covered with short erect hairs (Fig. 28, left); sternopetiolar process small (Fig. 27, middle); SW USA to Argentina ***crinosa* Mayr**
 - Gaster without erect hairs except along lateral margins (Fig. 28, right); sternopetiolar process well developed (Fig. 27, right); México south to Brazil ***rochai* Forel**



Fig. 28. Gaster of a worker of *C. crinosa* (From www.AntWeb.org, Will Ericson photographer) and of a worker of *C. rochai* (From www.AntWeb.org, April Nobile photographer).

- 34(29)** Erect hairs on pronotum very long, usually at least one hair longer than twice greatest eye diameter (Fig. 29. left); México to Argentina ***sumichrasti* Mayr**
- Erect hairs on pronotum shorter than 1.5 times maximum eye diameter (Fig. 29, right); United States to Costa Rica **35**



sumichrasti



minutissima

Fig. 29. Head and mesosoma of a worker of *C. sumichrasti* (From www.AntWeb.org, C. Richart photographer) and of a worker of *C. minutissima* (From www.AntWeb.org, C. Richart photographer).

- 35(34)** Propodeal spines relatively long (Fig. 30, left) as seen from above, length (measured from posterior edge of propodeal spiracle to tip) about $\frac{1}{2}$ length of distance between bases (seen obliquely from above), and slightly bent upwards; carinulae on pronotal dorsum mostly on sides; middle and eastern USA to southern México; possibly Cuba *missouriensis* Emery
- Propodeal spines relatively short (Fig. 30, right), length less than $\frac{1}{3}$ distance between bases, and not noticeably bent upwards; carinulae on pronotal dorsum also found in central region; S and SE USA to Costa Rica *minutissima* Mayr



missouriensis



minutissima

Fig. 30. Pronotum of a worker of *C. missouriensis* (From www.AntWeb.org, April Nobile photographer) and of a worker of *C. minutissima* (From www.AntWeb.org, C. Richart photographer)

Clave para las obreras de *Crematogaster* en América del Norte

- 1** Postpecíolo dividido en dos hemilóbulos por un surco medial longitudinal (Fig. 1 a, Lámina 5 A y D); especies comunes en hábitats templados **2**
- Postpecíolo globular, no dividido en dos hemilóbulos por un surco longitudinal medial (Fig. 1 b, Lámina 5 B y C) o con una ligera muesca en su margen posterior (Lámina 5 E); más comunes en hábitats tropicales y subtropicales **25**
- 2(1).** Pecíolo aproximadamente tan ancho como largo, trapezoidal, claramente más ancho en su parte anterior (Fig. 2, izquierda, Lámina 5 A) **3**
- Pecíolo rectangular, con los lados casi paralelos (Fig. 2, derecha, Lámina 5 D), cuando es algo cuadrangular, la parte media es más ancha que la anterior **21**
- 3(2).** Espinas cortas, no insertadas en la parte más ancha del propodeo (Fig. 3, izquierda, Lámina 4 E) **4**
- Espinas cortas o largas, insertadas en parte más ancha del propodeo (Fig. 3, derecha, Lámina 4 A, B, C, D y F) **5**

- 4(3).** Cabeza y mesosoma punteados y con estrías (Fig. 4, izquierda) que siguen la curvatura de la cabeza y el hombro pronotal; México (del sur de Chihuahua a Veracruz) ***saussurei* Forel**
- Cabeza longitudinalmente estriada por debajo del ojo; mesosoma punteado (Fig. 4, derecha); del suroeste de EU al norte de México ***isolata* Buren⁴**
- 5(3).** Espinas cortas (desde el borde posterior del espiráculo propodeal hasta la punta miden 0.16 mm o menos, ver Fig. 5, izquierda, Lámina 4 A) **6**
- Espinas más largas (desde el borde posterior del espiráculo hasta la punta miden 0.17 mm o más, ver Fig. 5, derecha, Lámina 4 B y C) **11**
- 6(5).** Parte media de la cabeza lisa y brillante, lados del pronoto brillantes, parcial o totalmente lisos (Fig. 6, izquierda); espinas propodeales pequeñas, aproximadamente tan largas como anchas en su base (menos de 0,13 mm de longitud) **7**
- Parte media de la cabeza al menos parcialmente esculpida en parte de la serie; lados del pronoto brillantes o esculpidos, generalmente punteado (Fig. 6, derecha); espinas muchas veces con más de 0,13 mm de largo, no muy anchas en su base **8**

⁴ Las obreras de *C. nocturna*, conocida solamente por hembras y machos colectados en Rainbow Lodge, Navajo Mountains en Arizona, pueden traernos hasta aquí, considerando que las hembras y machos de *C. nocturna* y *C. isolata* son muy similares.

7(6). De color marrón pálido a oscuro (Fig. 7, izquierda); no anida en árboles de pino; común, ampliamente distribuida en el sur y sureste de EU, sur de México ***ashmeadi* Mayr**

- La cabeza y el mesosoma de color rojo y el gáster oscuro (Fig. 7, derecha); anida en árboles de pino, Florida y Tennessee, EU ***pinicola* Deyrup y Cover**

8(6). Dorso de la cabeza casi o completamente punteado (Fig. 8, izquierda); mesosoma densamente punteado; desde el sur de Arizona hasta el sur de México ***opaca* Mayr**

- Dorso de la cabeza parcialmente liso y brillante (Fig. 8, derecha); mesosoma rugoso o superficialmente estriado; ampliamente distribuida **9**

9(8). Carina media longitudinal del pronoto aguda y prominente (Fig. 9, izquierda); lados del pronoto en su mayor parte lisos y brillantes; sureste de Texas y este de México ***rifelna* Buren**

- Carina media poco desarrollada, apenas elevada de la superficie (Fig. 9, derecha); los lados del pronoto pueden ser brillantes, pero están casi o completamente esculpidos; ampliamente distribuida **10**

10(9). Borde dorsal de la espina propodeal sinuoso (Fig. 10, Lámina 4 B); común en todo EU, norte de México ***cerasi* Fitch**

- Borde dorsal de la espina propodeal recto (Fig. 9, derecha); suroeste de EU y noroeste de México ***emeryana* Creighton**

- 11(5).** La mayoría de los especímenes de una serie con 4 o menos sedas erectas en cada hombro pronotal (las obreras mayores a veces tienen más sedas) (Fig. 11, izquierda); principalmente en el oeste de EU y México **12**
- Hombro pronotal de la mayoría de las obreras con 5 o más sedas erectas (Fig. 11, derecha); principalmente en el este de EU y en el este de México **17**
- 12(11).** Lados del pronoto brillantes (Fig. 11, izquierda); fuertemente bicolorada (gáster negro, el resto rojo, vea Fig. 7, derecha); todo el sur de EU, el este de EU y todo México ***laeviuscula* Mayr**
- Lados del pronoto muy esculpidos (Fig. 11, derecha, Fig. 12); de un solo color o ligeramente bicolorada **13**
- 13(12).** Hombro pronotal con 1-4 sedas erectas (Fig. 12, izquierda) en la mayoría de los especímenes de una serie **14**
- Hombros pronotales sin sedas erectas (Fig. 12, derecha) en todos los especímenes de una serie; suroeste de EU, todo México ***depilis* Wheeler**
- 14(13).** Cada esquina posterior del pecíolo con un diente pequeño (Fig. 13, Lámina 25 B); desde EU hasta el centro de México ***dentinodis* Forel**
- Esquinas posteriores del pecíolo sin dientes; ampliamente distribuida **15**

- 15(14).** Hombro del pronoto fuertemente vermiculado (Fig. 14, izquierda); desde el oeste y el sur de EU hasta el centro de México *vermiculata* Emery
- Hombro del pronoto con arrugas longitudinales (Fig. 14, derecha); ampliamente distribuida **16**
- 16(15).** Mesosoma de la reina más ancho que la cabeza (Lámina 17 A y B); común y ampliamente distribuida desde el oeste de EU hasta el sur de México *coarctata* Mayr
- Mesosoma de la reina más angosto que la cabeza (Lámina 54 A y B); rara vez recolectada, de Utah (EU) hacia el oeste hasta el sur de California, hacia el sur de México *mutans* Buren
- 17(11).** Dorso de la cabeza con más de 10 sedas erectas, dorso del mesosoma con más de 15 sedas erectas (Fig. 12, derecha) **18**
- Dorso de la cabeza con menos de 10 sedas erectas, dorso del mesosoma con menos de 15 sedas erectas cortas como cerdas (Fig. 15 izquierda); de California hacia el este hasta el sureste de Canadá y hacia el sur hasta Florida y México central *lineolata* Say
- 18(17).** La mayor parte del dorso de la cabeza lisa y brillante, áreas de alrededor finamente estriadas o areoladas (Fig. 16); no ha sido colectada en México **19**
- Dorso de la cabeza casi completamente punteado (vea Fig. 8, izquierda), la zona media puede ser brillante; de amplia distribución incluyendo México **20**

19(18). La mayoría de las sedas del hombro pronotal relativamente cortas (menos de 0.15 mm) (Fig. 17); Téxas hasta Florida y noreste de EU ***pilosa*** **Wheeler**

- La mayoría de las sedas del hombro pronotal relativamente largas (más de 0.18 mm de longitud) (Fig. 15, derecha); suroeste de EU ***navajoa*** **Buren**

20(18). Carina media longitudinal del pronoto bien desarrollada; desde la mitad sur de EU hasta el centro de México

..... ***punctulata*** **Emery**

- Carina media longitudinal del pronoto poco desarrollada; este y centro de México ***patei*** **Buren**

21(2). Dorso de la cabeza liso y brillante (Fig. 18, izquierda); desde México hasta Argentina ***distans*** **Mayr**

- Dorso de la cabeza opaco, casi o completamente punteado o vermiculado (Fig. 18, derecha) **22**

22(21). Espinas propodeales casi tan largas o más largas que la anchura del pecíolo (Fig. 19, izquierda); desde México hasta Brasil **23**

- Espinas propodeales mucho más cortas que ½ de la anchura del pecíolo (Fig. 19, derecha); desde el sur de Texas hasta Costa Rica **24**

23(22). Dorso de la cabeza y del pronoto densamente punteados (Fig. 20, izquierda); México y Guatemala ***formosa* Mayr**
 - Dorso de la cabeza y del pronoto fuertemente rugosos y punteados o vermiculados y punteados (Fig. 20, derecha); desde sur de México hasta Brasil ***acuta* Fabricius⁵**

24(22). Pecíolo alargado, casi 2 veces más largo que ancho (vista dorsal), con los lados casi paralelos y rectos (Fig. 2, derecha); espinas propodeales reducidas a dientes pequeños y agudos; desde el este y sur de México hasta Brasil ***montezumia* F. Smith**
 - Pecíolo casi cuadrado, ligeramente más ancho que largo, ensanchado en su parte media (Fig. 19, derecha); espinas propodeales bien desarrolladas, pero pequeñas (miden aproximadamente 2 veces el diámetro del espiráculo propodeal); desde el sur de EU (extremo sur de Texas) hasta Costa Rica ***corvina* Mayr**

25(1). Pecíolo alargado, 1.5 a 2 veces más largo que ancho, ligeramente más ancho posteriormente, visto desde arriba (Fig. 21, izquierda) **26**
 - Pecíolo casi cuadrado (Fig. 21, derecha) **29**

⁵ La obrera desconocida de *C. quadrispinosa* de México podría llegar aquí.

26(25). Dorso del pronoto, incluyendo su parte media, con varias carinas varicosas o carinas reticulares y longitudinales, lo que contrasta fuertemente contra el fondo liso y brillante (Fig. 22, izquierda) **27**

- Dorso del pronoto muy brillante, sin carinas finas al menos en su parte media, pero puede tenerlas a lo largo de sus bordes (Fig. 22, derecha) **28**

27(26). Espinas propodeales muy largas, de longitud aproximada al doble (medida desde el borde posterior del espiráculo propodeal, visto desde arriba) de la distancia entre sus bases, que se extienden hasta cerca del borde posterior del pecíolo (cuando el pecíolo está en el mismo plano que el mesosoma) (vea Fig. 23), divergentes vistas desde arriba; pronoto con sedas largas (más largas que el diámetro mayor del ojo), de color café oscuro o bronce; desde el sur de México hasta Bolivia ***nigropilosa* Mayr**

- Espinas propodeales aproximadamente tan largas como la distancia entre sus bases medida desde arriba, ligeramente curvadas (Fig. 22, izquierda); pronoto con sedas más cortas, blancas o plateadas (la mayoría del mismo tamaño que el diámetro mayor del ojo); desde EU (Florida) y México hasta Brasil ***curvispinosa* Mayr**

28(26). Clípeo completamente liso y brillante, en ocasiones con carinas longitudinales poco desarrolladas; sedas del pronoto de color café oscuro; borde posterior del mesonoto con un ángulo pequeño (Fig. 23, izquierda); desde EU (sur de Arizona) hasta Bolivia

..... ***sotobosque* Longino**

- Clípeo generalmente con carinulas longitudinales moderadamente bien definidas; sedas del pronoto blanquecinas; mesonoto sin un ángulo pequeño (Fig. 23, derecha); desde México hasta Brasil ***limata* F. Smith**

29(25). De color café oscuro (Fig. 24, izquierda) **30**

- De color amarillo o café pálido (Fig. 24, derecha) **34**

30(29). Lados del pronoto en su mayor parte o totalmente cubiertos por estrías finas horizontales, generalmente mezcladas con puntuaciones, débil a moderadamente brillantes (Fig. 25, izquierda); rara vez recolectada, desde el centro de México hasta Argentina

..... ***atra* Mayr**

- Lados del pronoto predominantemente lisos y muy brillantes (Fig. 25, derecha); común y ampliamente distribuida **31**

31(30). La mayor parte del clípeo (al menos su parte media) lisa y brillante (Fig. 26, izquierda); sur de Texas, Louisiana, sur de Florida y hacia el sur hasta Venezuela ***obscurata* Emery**

- Clípeo cubierto con estrías finas longitudinales (un área pequeña en su parte media puede ser ligeramente lisa y brillante) (Fig. 26, derecha); ampliamente distribuida **32**

32(31). Proceso esternopeciolar ausente o poco desarrollado (Fig. 27, izquierda); desde el suroeste de EU hasta Brasil ***torosa* Mayr**
 - Proceso esternopeciolar bien desarrollado (Fig. 27, en medio); con distribución amplia **33**

33(32). Gáster escaso pero uniformemente cubierto de sedas erectas cortas (Fig. 27, en medio), proceso esternopeciolar pequeño (Fig. 27, derecha); desde el sur de EU hasta Argentina
 ***crinosa* Mayr**
 - Gáster sin sedas erectas, con excepción de los márgenes laterales (Fig. 28, derecha), proceso esternopeciolar bien desarrollado y agudo (Fig. 27, derecha); desde México hasta Brasil
 ***rochai* Forel**

34(29). Sedas erectas del pronoto muy largas, por lo general al menos una seda más larga que dos veces el diámetro mayor del ojo (Fig. 29, izquierda); desde México hasta Argentina
 ***sumichrasti* Mayr**
 - Sedas erectas del pronoto más cortas, todas más cortas que 1.5 veces el diámetro mayor del ojo (Fig. 29, derecha); desde EU hasta Costa Rica **35**

35(34). Espinas propodeales relativamente largas (Fig. 30, izquierda) vistas desde arriba miden alrededor de $\frac{1}{2}$ de la distancia entre sus bases (vistas oblicuamente desde arriba, desde el borde posterior del espiráculo propodeal hasta la punta) ligeramente curvadas hacia arriba; carinas finas en el dorso del pronoto, sobre todo en los lados; desde el centro y este de EU hasta el sur de México; posiblemente Cuba *missouriensis* Emery

- Espinas propodeales relativamente cortas (Fig. 30, derecha) miden menos de $\frac{1}{3}$ de la distancia entre sus bases, y no curvadas hacia arriba; carinas finas en el dorso del pronoto también presentes en su región central; desde el sur y suroeste de EU hasta Costa Rica *minutissima* Mayr

Species Accounts

***Crematogaster acuta* (Fabricius)**

Plates 5 E, 6, 7, 8 and 95; Figs. 19 and 20; Map 1.

Formica acuta Fabricius, 1804: 411, worker, Guyana, Essequibo.

Roger, 1862: 291, *Crematogaster acuta*. Santschi, 1918: 182, combination in *C. (Eucrema)*. Wheeler & Wheeler, 1952: 258, larva. Longino, 2003: 32, queen.

C. quadriceps Smith, 1858: 140, worker, Brazil, no specific locality.

Roger, 1862: 291, junior synonym of *C. acuta*.

C. acuta centralis Santschi, 1932: 412, worker, queen, Panama.

Longino, 2003: 2, 32, junior synonym of *C. acuta*.

Descriptions:

Worker: This description is based on a worker determined by J. Longino, # 855 Magdalena, Colombia (LACM).

Mandibles with shallowly longitudinal lineolae; clypeus shiny areolate with long, translucent to white erect flexuous hairs, anterior margin slightly convex, with translucent to white flexuous hairs; scape long, surpassing posterior border of head, with translucent to white erect hairs; head subquadrate, punctate-rugose with shiny area in middle immediately posterior to clypeus, posterior border of head with medial depression.

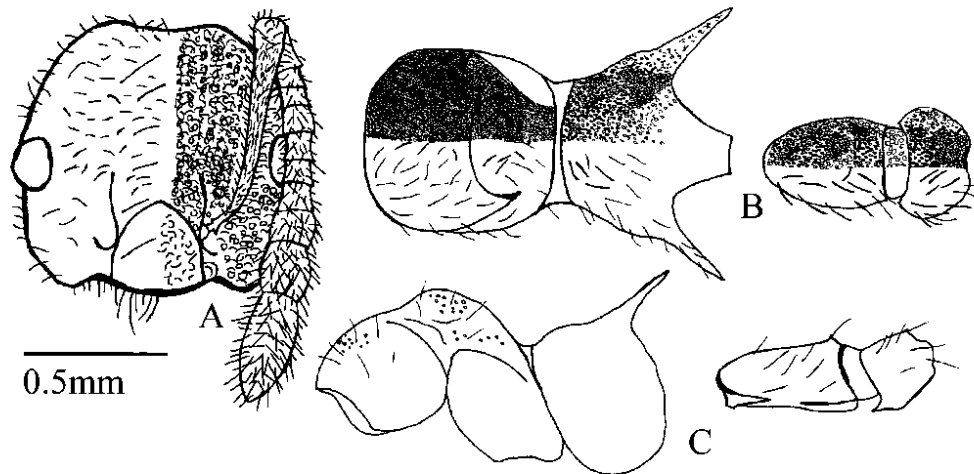
Compare with *evallans*

Plate 6. *Crematogaster acuta* worker: (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole (determined by J. Longino, # 855 Magdalena, Colombia, LACM).

Mesosoma evenly covered with translucent to white erect flexuous hairs; dorsum of mesosoma punctate-rugose, side punctate; pronotal shoulder rounded, humeri poorly developed; mesonotal boss inflated anteriorly; notopropodeal furrow wide and deep; dorsopropodeum punctate; posteropropodeum shiny and steep, spines shiny, thickened at base, long, tapering to points, widely diverging (viewed from above) and pointing upward ($\sim 45^\circ$ angle in side view).

Petiole and postpetiole punctate; evenly covered with long, translucent to white, flexuous, erect hairs; petiole longer than wide (viewed from above), rectangular; posterior lateral corners forming

acuta - México to Brazil

Compare with *evallans*

small points, anterior sternopetiole process small to absent; postpetiole wider than long, with slight medial dorsal depression, not developed into sulcus, anterior sternopostpetiole process well developed, sharp; gaster areolate, evenly covered with long, translucent to white, flexuous, erect hairs.

Concolorous reddish brown to black.

Worker measurements (mm): HL 0.86-0.94, HW 0.96-1.02, SL 0.94-1.00, EL 0.18-0.22, ED 0.19-0.20, CL 0.24-0.30, CW 0.31-0.38, WL 1.14-1.21, PSL 0.42-0.46, PL 0.38-0.48, PW 0.34-0.38, PPL 0.24-0.28, PPW 0.32-0.35; Indices: CI 90-92, SI 106-109, CLI 77-79, PI 1.11-1.26, PPI 75-80.

Queen: Mandibles shiny, with shallow longitudinal striae; clypeus and head shiny, evenly covered with long, translucent to white erect flexuous hairs; anterior margin of clypeus concave; scape surpassing posterior border of head, evenly covered with long, translucent to white, erect flexuous hairs; ocelli typical.

Mesosoma, petiole, postpetiole and gaster very shiny viewed from above, evenly covered with long, translucent to white, flexuous erect hairs, side of mesosoma with many thin short hairs along sutures; mesosoma hump-like viewed from side, propodeal spines very long for *Crematogaster* queens, diverging, worker-like.

Petiole without anterior sternopetiole process, rectangular when viewed from above; postpetiole globular, without medial depression, anterior sternopostpetiole process well developed and sharp, like worker.

Concolorous reddish brown.

acuta - México to Brazil

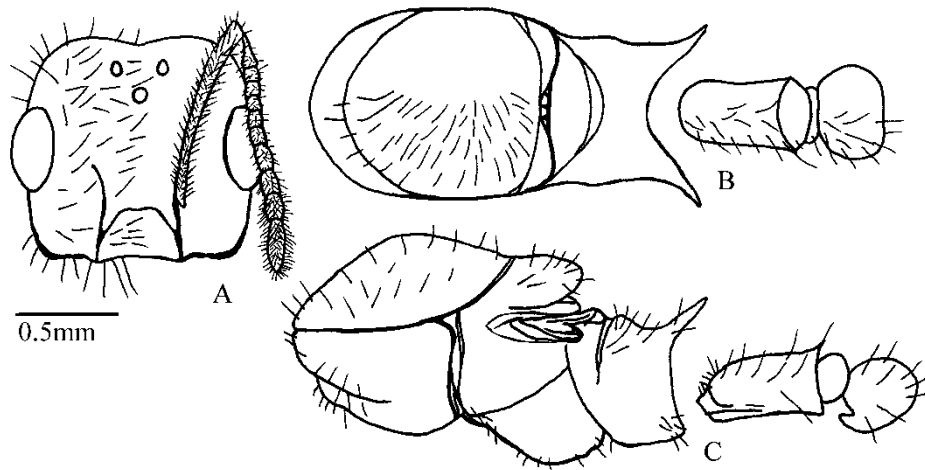
Compare with *evallans*

Plate 7. *Crematogaster acuta* queen: (A) Head (pilosity is shown on left); (B) Dorsal view of mesosoma, petiole and postpetiole (pilosity is shown on bottom); (C) Side view of mesosoma, petiole and postpetiole (determined by A. Wild, # 0445, Colonia, Canindeyú, Paraguay LACM).

Queen measurements (mm): HL 1.18-1.30, HW 1.25-1.32, SL 1.23-1.36, EL 0.36-0.48, ED 0.28-0.36, CL 0.46-0.50, CW 0.48-0.60, WL 2.11-2.45, PSL 0.50-0.51, PL 0.60-0.65, PW 0.36-0.43, PPL 0.36-0.42, PPW 0.53-0.55; Indices: CI 94-98, SI 104-105, CLI 83-96, PI 151-167, PPI 68-76.

Male: Mandibles covered with semierect hairs; clypeus shiny, shallowly punctate; anterior margin concave, protruding from face, with several long flexuous hairs; eyes and ocelli prominently protruding from head; head deeply punctate with shiny light brown medial strip between clypeus and ocelli.

acuta - México to Brazil

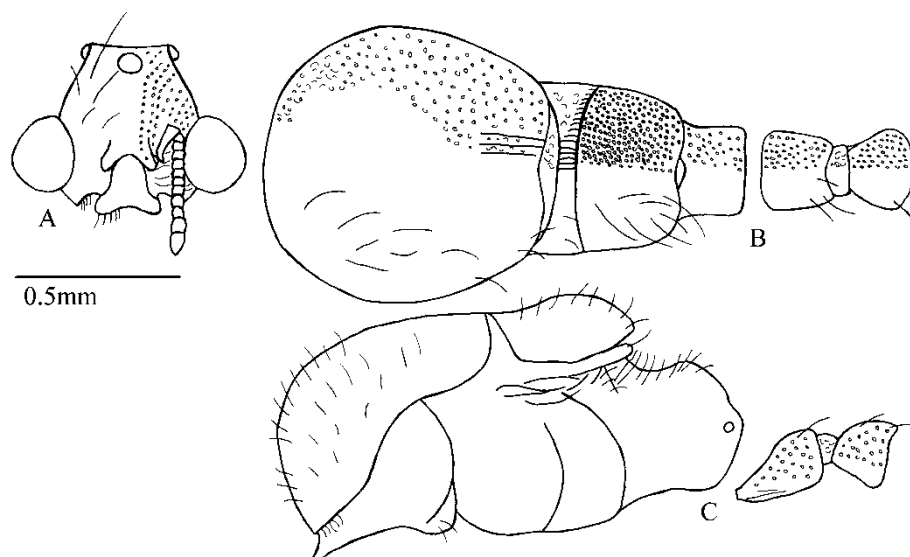


Plate 8. *Crematogaster acuta* male: (La Sabana, Panama, MCZC): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Mesosoma shiny but punctate along lateral margins of scutum, shiny with shallow areolae between shallow striae in middle; scutellum deeply punctate; mesosoma with few erect hairs dorsally; side of mesosoma deeply punctate with few long, white, flexuous hairs restricted to pronotum and katepisternum; pronotum barely visible viewed from above; dorsellum (medial lobe of metanotum) completely obscured by scutellum; propodeum shallowly punctate, long white flexuous hairs evenly distributed.

Compare with *evallans*

Petiole and postpetiole deeply punctate with long white flexuous hairs pointed posteriorly; petiole subquadrate; postpetiole globular; gaster areolate with long white flexuous hairs evenly distributed and pointed posteriorly.

Concolorous dark brown except for light brown strip on face and light brown mandibles.

Male measurements (mm): HL 0.60, HW 0.52, SL 0.11, EL 0.28, ED 0.24, CL 0.20, CW 0.23, WL 1.40, PL 0.24, PW 0.22, PPL 0.18, PPW 0.24; Indices: CI 115, SI 18, CLI 87, PI 109, PPI 75.

Distribution: México (Longino, 2003), Guatemala (Branstetter and Sáinz, 2012) to Brazil (Siqueira de Castro et al., 2010/2011; Cruz de Oliveira, 2013), Bolivia (Longino, 2003) and Paraguay.

Type series: *Crematogaster acuta* holotype worker from Guyana, Essequibo [ZMUC]; *Crematogaster quadricaps* holotype worker Brazil; *Crematogaster acuta* var. *centralis*, syntype worker, queen: Panama [NHMB].

Other material examined and literature citations: **BRAZIL:** **Amazonas** (Cruz de Oliveira, 2013); **Mato Grosso**, (1 ♀ CWEM); Río Madeira (6 ♀ LACM); **Mato Grosso do Sul**, 4 km N Posto Sinhozinho (CWEM), Blumenau (3 ♀ LACM); **BRITISH GUYANA:** Kartabo, (3 ♀ LACM). **COLOMBIA:** **Chocó**, Itsmina (4 ♀ CWEM), Quibdó (1 ♀ CWEM); **Huila**, Rivera (2 ♀ CWEM); **Magdalena**, Río Frío (12 ♀ LACM); **Meta**, Tinigua Estado Primitologica Bosas Río Duda (2 ♀ CWEM); Río Frío (3 ♀, LACM). **PANAMA:** **Panamá**, Barro Colorado, Gatún Lake, (3 ♀ MCZC);

acuta - México to Brazil

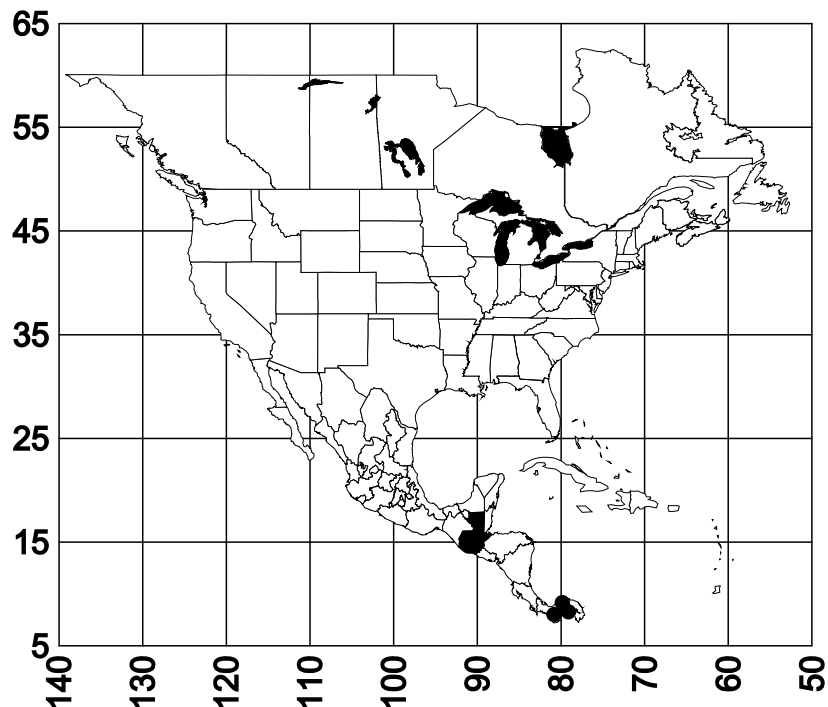
acuta

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Compare with *evallans*

Canal Zone, Las Cascadas (10 ♀ CWEM), Red Tank (4 ♀ MCZC); La Sabana (7 ♀, 2 ♀, 2 ♂ MCZC); Islas Perlas, Isla del Rey (3 ♀ LACM).

PARAGUAY: Canindeyú (2 ♀, 1 ♀ LACM); Canindeyú Reserve National Bosque (3 ♀ LACM). **PERU:** Madre de Dios, Biological Cocha Cashu (3 ♀ LACM).



Map 1. *Crematogaster acuta*.

Etymology: *Acuta* from *acūtus* in Latin meaning sharp or pointed, possibly for the sharp propodeal spines or the anterior sternopostpetiolar process.

acuta - México to Brazil

Compare with *evallans*

Discussion: The specimens used for this species account were collected and determined by W. M. Wheeler and J. Longino and compared to the description in Longino (2003). The key characteristic of the *Crematogaster acuta* worker is the very long and pointed propodeal spines.

The pronotum of *C. acuta* is punctate-rugose and has abundant erect hairs on all dorsal surfaces. Longino (2003) compares this species to *C. evallans*. He separates them by the presence of a sharp anterior sternopostpetiolar process on *C. acuta* and a blunt lobe on *C. evallans*.

Biology: *Crematogaster acuta* is an arboreal ant (Delabie et al., 2007) attracted to sardine baits (Souza da Conceição et al., 2015). It was found to be a ground dwelling ant in Ecuador (Ryder Wilkie et al., 2009). Longino's (2003) observations include large polydomous colonies nesting in dead wood. It is a common inhabitant in active and decadent nests of the termite *Nasutitermes* in cacao plantations (Pereira Santos et al, 2010). Larvae are parasitized by Eulophidae wasps closely related to *Paracrias* (Hansson et al., 2011) and possibly *Horismenus* sp. (Lachaud and Pérez Lachaud, 2012). It was found under bark of damaged areas and in holes in cacao trees and nesting in the soil in Colombia and was attracted to wiener bait tubes within 20 minutes in Brazil (Mackay, unpublished).

Longino (2003) states that *C. acuta* prefers open disturbed habitats. He collected specimens in vegetation along the edges of roadsides and pastures as well as in young second growth forest. The climate preference is wet and seasonally dry. His collections usually occur below 500m; however, 1000m is the highest elevation record. It is a common ant in dry forests in Colombia (Armbrecht and Ulloa-

acuta - México to Brazil

Chacón, 1999), in primary forest in Ecuador (Ryder Wilkie et al., 2009) and very wet tropical forest in Colombia (Mackay and Mackay, unpublished). It is found in pine forests, eucalyptus forests and in native mata forests in southern Brazil (Lutinski et al., 2008), as well as primary rainforest near Manaus (Vasconcelos et al., 2003) and in the states of Amazonas and Pará (Felizardo and Harada 2007) and in several habitats in Paraná (Lopes et al., 2010). It was collected in a grassland habitat in the Valle del Río Cauca in Colombia (Chacón de Ulloa et al., 2012). It is a common species in wetlands in the state of Minas Gerais, Brazil (Costa-Milanez et al. 2014) as well as Midwestern Brazilian dry forests (Silvestre et al., 2014).

Compare with *pinicola*, *rifelna*

***Crematogaster ashmeadi* Mayr**

Plates 4 A, 9, 10, 11 and 96; Figs. 1a, 5, 6 and 7; Map 2.

Crematogaster ashmeadi Mayr, 1886b: 463-464, worker and male, Florida, Georgia, and Virginia, United States (restricted to Florida by Creighton, 1950). Emery 1922: 141, combination in *C. (Acrocoelia)*. Buren, 1968: 91, combination in *C. (Crematogaster)*. Johnson, 1988: 315, queen, male. Deyrup, 2017:60-61, Plate 25, worker.

Crematogaster ashmeadi var. *matura* Wheeler, 1932: 7, Miami, Florida, United States. Creighton, 1950: 206, junior synonym of *C. ashmeadi*.

Descriptions:

Worker: Clypeus areolate, as wide as long, with 8 long erect hairs on surface, anterior margin slightly convex with medial notch and 6 long flexuous hairs; scape failing to reach posterior border of head, with decumbent hairs; head areolate, wider than long, with evenly, sparsely dispersed appressed and 2 short erect hairs; frontal groove apparent, shiny.

Mesosoma, shallowly scabrous, mesosoma with few appressed hairs and 1-2 long flexuous hairs on each pronotal shoulder, small medial notopropodeal carina; humeri small; promesonotal suture

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

apparent from breaks in sculpturing, notopropodeal groove steep and narrow; propodeal spines short and slightly curved inward, thickened at base.

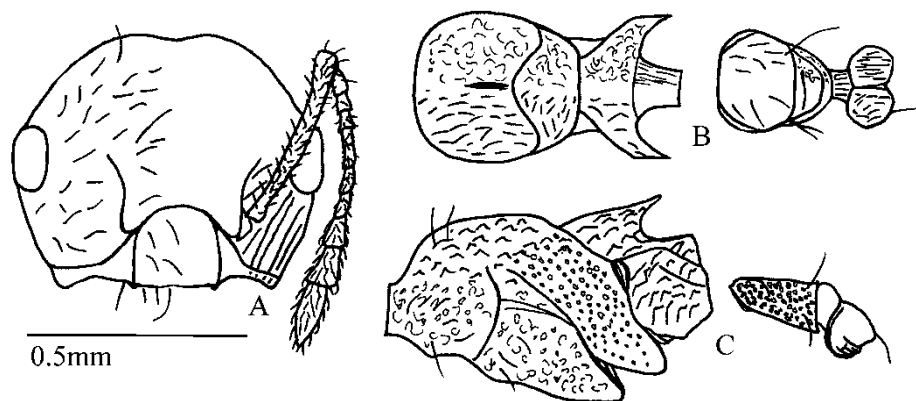


Plate 9. *Crematogaster ashmeadi* worker: (lectotype, Florida NHMW): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Petiole and postpetiole shallowly scabrous, with few appressed hairs and one erect hair on each posterior corner; petiole angularly trapezoidal, with anterior lateral flange upraised when viewed from behind; hemilobes of postpetiole almost round, spreading slightly posteriorly; gaster shallowly areolate, with sparsely distributed appressed hair.

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

Color variable, concolorous light to dark brown or bicolored with dark head and gaster and light mesosoma.

Worker measurements (mm): HL 0.62-0.85, HW 0.74-0.90, SL 0.50-0.65, EL 0.16-0.20, ED 0.11-0.18, CL 0.16-0.20, CW 0.18-0.24, WL 0.66-0.85, PSL 0.10-0.14, PL 0.18-0.26, PW 0.22-0.29, PPL 0.14-0.19, PPW 0.19-0.28; Indices: CI 84-94, SI 76-80, CLI 83-88, PI 82-90, PPI 68-74.

Queen: Clypeus about as long as wide with 2 long and about 12 short erect hairs along anterior margin; scape covered with semierect hairs, scape not reaching posterior border of head; head rugose with sparsely distributed short erect hairs and 3-4 long filamentous erect hairs.

Mesosoma shiny, shallowly, longitudinally carinate-areolate with many short erect hairs; pronotum typically narrow; posterior margin of scutellum rounded; metanotum visible when viewed from above; dorsellum (medial lobe of metanotum) broadly rounded; notopropodeal groove steep and angular; propodeal spines well developed for queen, divergent, thickening at base and curving very slightly posteriorly and with 2-3 erect hairs on dorsal edge of each spine.

Petiole and postpetiole shallowly areolate-punctate, each with 8-10 erect hairs, petiole slightly longer than wide, posterior lateral corners flaring upward, dorsal side flat; anterior sternopetiole process present; postpetiole oval with posterior of hemilobes spreading

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

laterally (seen from above), wider than long; gaster shallowly areolate with many evenly distributed erect hairs.

Concolorous reddish to dark brown.

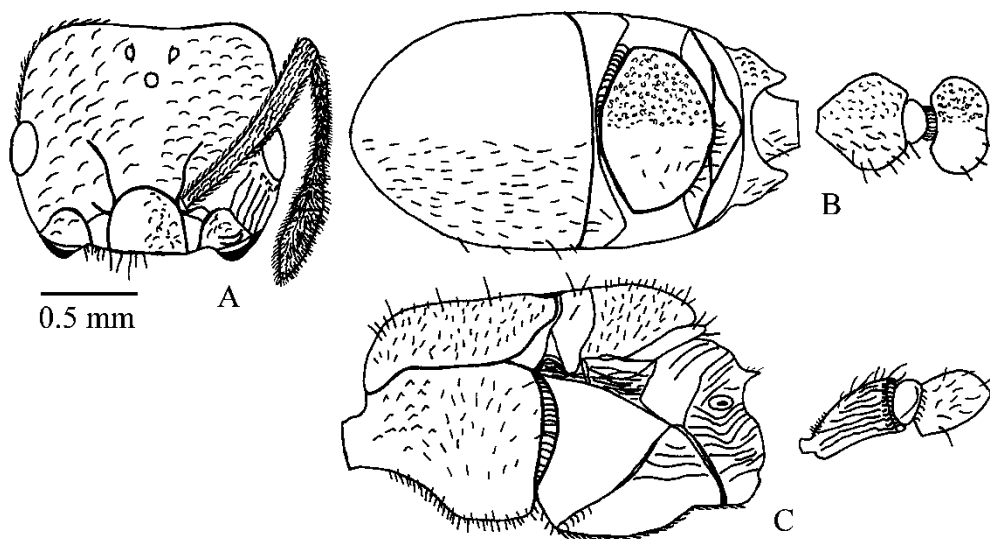


Plate 10. *Crematogaster ashmeadi* queen: (Blanco, Corral Co., Texas CWEM): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

Queen measurement (mm): HL 1.23, HW 1.42, SL 0.82, EL 0.36, ED 0.29, CL 0.31, CW 0.48, WL 2.04, PSL 0.21, PL 0.55, PW 0.50, PPL 0.55, PPW 0.53; Indices: CI 87, SI 67, CLI 65, PI 110, PPI 104.

Male: Clypeus slightly wider than long with 4 very long flexuous hairs along anterior margin; scape and pedicel with 2-4 flexuous hairs; ocelli protruding slightly from head; small round head with striate below eye and insertion of antennae, very shiny areolate above eye, with few long erect and semierect hairs sparsely dispersed.

Mesosoma shiny areolate from above, with few long and short erect hairs, micro-lineolate on side; pronotum not visible from above; metanotum small, narrow medially into knob; dorsellum (medial lobe of metanotum) broader than scutellum and position of metanotum can be seen dorsally; propodeum rounded, lacking hair; propodeal spines present as nubs which is unusual for males.

Petiole, postpetiole and gaster areolate, with many long erect hairs; petiole small, trapezoidal; postpetiole very small and oval (as seen from above), wider than long.

Concolorous pale yellow.

Male measurements (mm): HL 0.47-0.53, HW 0.56-0.62, SL 0.12-0.15, EL 0.19-0.24, ED 0.19-0.22, CL 0.11-0.13, CW 0.17-0.19, WL 1.22-1.25, PL 0.17-0.19, PW 0.19-0.20, PPL 0.14-0.22, PPW 0.22-0.24; Indices: CI 84-85, SI 26-28, CLI 65-68, PI 89-95, PPI 64-92.

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

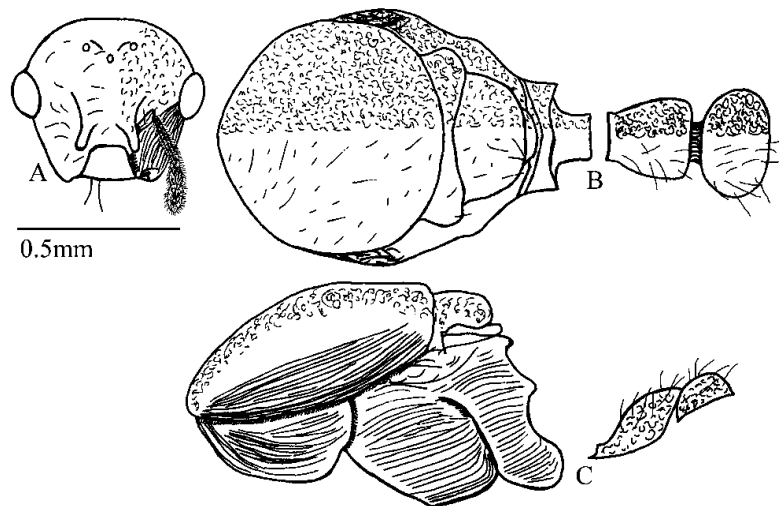


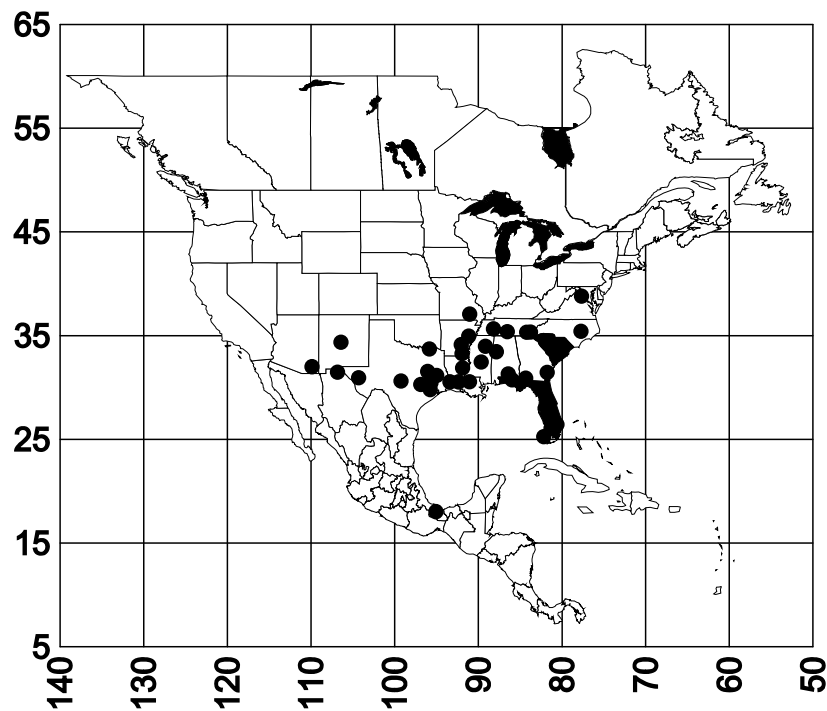
Plate 11. *Crematogaster ashmeadi* male: (paralectotype, Florida NHMW): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Distribution: *Crematogaster ashmeadi* has been found from the east coast of the U. S. including Worcester Co., Maryland (Frye and Frye, 2012), Virginia, the Duke Forest of North Carolina (Resasco et al., 2014), South Carolina (MacGown, Pers. Comm.) to the southern tip of Florida (Deyrup, 2017), southern Louisiana (Parys et al., 2013) western Texas and was intercepted in Arizona at an agricultural inspection station (diamond on map). It also occurs in the states of

ashmeadi - Eastern and southern USA, southern Mexico
Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees
Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

Chihuahua and Veracruz, México.



Map 2. *Crematogaster ashmeadi*.

Type series: *Crematogaster ashmeadi* lectotype [here designated] from Virginia, Pergande, 22 paralectotype workers; Florida, Ashmead, 2 worker, Pergande 10 workers, 6 males, Georgia, Pergande, 2 workers [NNHW]; *C. ashmeadi* var. *matura* United States [MCZC].

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

Other material examined and literature citations:

MÉXICO: **Chihuahua**, 2k N Zaragoza (CWEM); **Veracruz**, 6k N Tierra Blanca (6 ♀ CWEM). **UNITED STATES:** **Alabama**, **Geneva Co.**, Geneva State Forest (2 ♀ STDC), **Tuscaloosa Co.**, Sipsey River, 2k E Elrod (1 ♀ CWEM), see also Forster, 2003; MacGown and Forster, 2005; **Arizona**, Department of Agriculture Interception From Virginia (43 ♀ COOK); **Arkansas**, **Benton Co.**, Little Rock (47 ♀ CWEM), **Clark Co.**, 10k SW Gurdon (2 ♀ CWEM), **Hempstead Co.**, Hope (1 ♀ CWEM), **Hot Springs Co.**, Rest area near Social Hill (10 ♀ CWEM), **St. Francis Co.**, 32k NE Brinkley (2 ♀ CWEM), **Arkansas Co.**, see General and Thompson, 2007; **Florida**, (3 ♀ MCZC), **Broward Co.**, Indian River City (2 ♀ MCZC), Middle Keys (3 ♀ MCZC), Key Largo, Harry Harris Park (1 ♀ CWEM), **Highlands Co.**, Archbold Biological Station (5 ♀ CWEM, 1 ♀ COOK), Lake Placid (3 ♀ CWEM, 3 ♀ MCZC), **Monroe Co.**, West Summerland Key (11 ♀, 5 ♀ MCZC), E Big Pine Key (1 ♀, 1 ♀ CWEM), **Walton Co.** Eglin AFB (12 ♀ MCZC), **León Co.** (Cassill and Tschinkel, 1996), see also Deyrup et al., 1988); **Georgia**, **Barrow Co.**, James H. “Sloppy” Floyd State Park (46 ♀ CWEM), **M^cIntosh Co.**, Sapelo Island (20 workers COOK), see Ipser et al., 2004 and Graham et al., 2008), **Gadsden** and **Alachua** counties, Florida (Whitcomb et al., 1972); **Louisiana**, Wildlife Management Area (1 ♀ STDC), **Baton Rouge Parish**, Baton Rouge (6 ♀ CWEM, 1 ♀ STDC), LSU Burden Research Center (6 ♀ STDC), Spanish Town, **Calcasieu Parish**, Sam Houston Jones State Park (7 ♀ CWEM, 6 ♀ STDC), **Catahoula**

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

Parish, Silicy Island (5 ♂ STDC), **East Baton Rouge Parish**, Baton Rouge, Spanish Town Boorland Law Office (32 ♂ STDC), **East Feliciana Parish**, Tunica hills (1 ♂ STDC), **Crowley Parish** (3 ♂ MCZC), **Orleans Parish**, New Orleans Audubon Zoo Volunteer House (1 ♂ STDC), **West Feliciana Parish**, Feliciana Preserve (30°47'N; 91°15'W) (15 ♂ STDC), Port Hudson St (1 ♂ STDC), see Dash and Hooper-Bùi, 2008, **St. Tammany Parish**, see Colby and Powell, 2006; **Mississippi**, Lee Co., Tupelo (25 ♂ CWEM), **Newton Co.** (31 ♂ CWEM); **Missouri**, **Ripley Co.**, Doniphan (2 ♂ MCZC); **New Mexico**, **Otero Co.**, White Sands National Monument (CWEM); **North Carolina**, **Beaufort Co.**, Goose Creek State Park (1 ♂ CWEM), **Cherokee Co.**, 2k E Andrew rest area (8 ♂ CWEM), **Cherokee Co.**, Murphy (1 ♂ CWEM), see also Guénard et al., 2014; **Tennessee**, **Lincoln Co.**, Huntland (11 ♂ CWEM), **M'Ninn Co.**, Highway 39 8.6k W Junction Road 315 (1 ♂ CWEM), **Wayne Co.**, Clayton (3 ♂ CWEM); **Texas**, **Brazos Co.**, College Station, Texas A & M University Range Science Area (1 ♂ COOK), Peach Creek (11 ♂ CWEM), Foster Lane (4 ♂ CWEM), 10k N Kurten (17 ♂ CWEM), Hwy 6, 6mi N of Navasota (1 ♂ COOK), **Comal Co.**, 32.2k SE Blanco (12 ♂, 1 ♀ CWEM), **Hardin Co.**, Sandyland National Preserve (3 ♂ COOK), **Hays Co.**, San Marcos (2 ♂ CWEM), **Houston Co.**, Big Slough Wilderness Area (2 ♂ CWEM), **Jeff Davis Co.**, Fort Davis (2 ♂ STDC), **Lamar Co.**, Camp Maxey, site 1 (N33° 48.683'; W95° 34.234') (1 ♂ COOK), **Thus Co.**, Bob Sandlin State Park (5 ♂ CWEM), **Tyler Co.**, 5mi. E Spurger (19 ♂ COOK), **Walker Co.**,

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

Huntsville State Park (1 ♀ CWEM), Dodge, 119 Blythe Ranch Rd. (7 ♀ COOK); **Virginia, Fairfax Co.**, Potomac Bay (2 ♀ CWEM), **Spotsylvania Co.**, 14.77k S Fredericksburg (6 ♀ CWEM).

Etymology: Named for one of the original collectors, William H. Ashmead.

Discussion: *Crematogaster ashmeadi* is a small species with much reduced propodeal spines. It is highly variable in color, ranging from concolorous light brown to black and sometimes bicolored with head and gaster darker than the mesosoma. The worker of this species is morphologically identical to *C. pinicola* Deyrup & Cover in appearance, except that *C. pinicola* is always bicolored with a red head and mesosoma, and a dark gaster; and the shape of the base of the spine is flattened, whereas *C. ashmeadi* has spines that are typically rounded at the base. *Crematogaster pinicola* has only been found nesting in pine trees, preferring *Pinus elliotii* and *P. palustris* (Deyrup and Cover, 2007). *Crematogaster ashmeadi* has more diverse nesting sites.

Crematogaster ashmeadi is similar to *C. rifelna*, but lacks the depressed pronotum and the sharp carina on the promesonotum, both of which are present in *C. rifelna*.

We agree with Creighton (1950) who made *C. ashmeadi* var. *matura* a junior synonym of *C. ashmeadi* commenting that the slight color variation that would separate the two taxa was weak at best. Our observations indicate that there is some color variation within series, with some being concolorous to slightly bicolored, leading us to

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

conclude that color is not a distinguishing feature and one has to look at habitat. There appears to be a color transition from dark on the east coast to gradually lighter as one moves west (personal observation; Wheeler, 1932).

There is possibly a new species closely related to *C. ashmeadi*, which is dependent on fire maintained longleaf pine habitats (Colby, 2002). It is common in coastal plain habitats which include longleaf pine savannas (Colby, 2002).

Biology: Tschinkel (2002) provided extensive information on the biology of *Crematogaster ashmeadi*. They inhabit the chambers abandoned by bark mining caterpillars and galleries of wood boring beetles in dead branches and do little actual nest excavation. Mature colonies contain up to 80,000 individuals and have a life expectation of 10-15 years. *Crematogaster ashmeadi* prefers to nest in trees, nesting in beetle galleries in living oaks, however it has been found under stones, manure and in logs. They also nest in twigs of *Rhus copallina*, dead branches of *Pinus clausa*, in dead twigs of hickories, in *Eupatorium* stems, in dead *Quercus laevis*, in dead *Lyonia ferruginea* and in dead leaves of a large *Tillandsia* (Deyrup and Trager, 1986). Nests were found in dead tree limbs, hollow twigs, and in weed stems (Deyrup et al., 1988; Moreau et al., 2014, Mackay and Mackay, unpublished). Large nests are found in twigs or branches where it is common on 50% of the trees in Alabama, defending territories and excluding other ants (Forster, 2003). It consistently nests in plants in Mississippi, including in dead dogwood, black willow, sumac, white

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

ash, goldenrod, blackberry (*Rubus laciniatus*), common elder, mimosa, hickory, plume grass, rattan-vine, catalpa, bois d'arc, hawthorn, prickly ash, sweetgum, red oak, china-tree, pecan, black locust, and dead woody galls on red oak and do not move to logs and stumps when the colony increases in size, up to 300 workers (Tynes and Hutchins, 1964). It also nests in dead cedar-apple galls (Hill, 2006). It is often found nesting under stones and in/under logs in the southwestern USA and northern México, occasionally in the soil with small mounds (New Mexico) (Mackay and Mackay, unpublished). One nest was in an abandoned nest of *Solenopsis invicta* (Mackay and Mackay, unpublished).

Brood overwinter as larvae (Tynes and Hutchins, 1964) and brood production begins in late April or early May (Tschinkel, 2002) and sexuals are present in the nests from late May through June (Tschinkel, 2002) to October, flights occur in April, June-August, October and December; (Deyrup and Trager, 1986). Sexuals are attracted to lights (Mackay and Mackay, unpublished). Newly mated queens initiate nests in insect galleries, using shorter trees, and trees with more branches, but branch length has no effect (Baldacci and Tschinkel, 1999).

Workers are attracted to baits along with *Pheidole* species, especially sugar baits (Rowles and Silverman, 2009) and are attracted to meat bait (Lubertazzi and Tschinkel, 2003). We collected workers at Vienna sausage baits and fire ant bait, on the surface and in vegetation. *Crematogaster ashmeadi* is a seed disperser which is negatively affected by the invasion of the red imported fire ant,

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

Solenopsis invicta (Ness, 2004). *Crematogaster ashmeadi* raids the nests of the wasp *Mischocyttarus mexicanus* (Clouse, 1995) and are eaten by the red-cockaded woodpecker (Hess and James, 1998). They tend the caterpillars of the Miami blue butterfly, an endangered species (Saarinen and Daniels, 2006). Foragers visit extrafloral nectaries (Koptur, 1992) and tend aphids (Nielsson et al., 1971). Workers are commonly collected in leaf litter (Mackay and Mackay, unpublished).

Leuthold (1968) made a very interesting discovery while experimenting on the trail laying behavior of *C. ashmeadi*. While most ants deposit pheromones from the end of their gaster, *C. ashmeadi* has pheromone glands in the tibial gland of the hind legs that allow them to place “footprints” on the substrate for nest mates to follow.

Crematogaster ashmeadi is found in a wide variety of habitats (Lubertazzi and Tschinkel, 2003; Hill, 2006; Deyrup and Cover, 2007). Moist habitats are preferred such as pine and magnolia forests. They are common in pine forests (Colby and Powell, 2006). It is the dominant arboreal ant in pine forests of the coastal plain of northern Florida (Hahn and Tschinkel, 1997). Nests were found in mixed pine and hardwood upland forest, long leaf pine savanna and wet pine flatwoods, coastal prairie in Louisiana (Dash, 2004). They have been collected on sand pine, oak, mocker nut, magnolia, laurel, and other hard wood forests, as well as in cedar and ash trees (Hill and Brown, 2010). They have also been collected in hardwood hammocks that grade into red mangrove and in white mangrove at the forest edge. They are found in backdune areas of the coastal dunes of the Gulf of México (Chen et al., 2015). We found nests in habitats ranging from

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *pinicola*, *rifelna*

grasslands with pines/oaks, hardwood and mixed hardwood forest, mixed hardwood with pines, oaks woodlands to riparian cottonwood tree forest. In arid areas of Texas their nests can be found in arroyos and other riparian areas (Mackay and Mackay, unpublished). It adapts to urban ecosystems (Guénard et al., 2014), but in general do not do well in disturbed areas (Menke et al., 2011).

Nests are found in areas with soils ranging from white to orange to dark brown, including clay, clay loam, sandy, to rocky clay.

It is an occasional pest ant in buildings (Klotz et al., 1995), a house pest (Smith, 1965) and may be a common house pest in some areas (MacGown, pers. comm.). Cole (1980) constructed a social ethogram.

Deyrup (2017) includes details on the biology and distribution of this species as well as comparisons with other species occurring in Florida.

ashmeadi - Eastern and southern USA, southern Mexico

Nests in plant cavities, occasionally in logs or in soil, apparently
never in pine trees

Forests, occasionally other plant communities

Compare with *torosa* and *crinosa*

***Crematogaster atra* Mayr**

Plates 2 C, 12 and 97; Figs. 1c, 21 and 25; Map 3.

Crematogaster atra Mayr, 1870b: 994-995, worker, México. Emery, 1922: 134, combination in *C. (Orthocrema)*.

Description:

Worker: Mandibles longitudinal striate, with appressed hair; clypeus slightly wider than long with longitudinal striate, anterior margin slightly concave with medial notch, with several long flexuous hairs; scape with appressed hair, failing to reach posterior border of head; head wider than long, shiny with longitudinal striae and evenly covered with appressed hairs pointed medially, 2 rows of short erect hairs in middle of face, 2 long flexuous hairs on each frontal lobe.

Mesosoma very round in dorsal view with longitudinal striae following curvature of pronotum and many long flexuous and appressed hairs pointed medially; promesonotal suture not apparent when viewed dorsally, but clearly developed when viewed from side; notopropodeal groove steep and narrow; propodeal spines short, slender, almost parallel with tips slightly diverging (viewed from above) turned up viewed from the side with 2 long flexuous hairs; mesopleuron striate at top blending into punctate on lower surface.

atra - Central México south to Argentina
Nest in trees and swollen thorn *Acacia*
Desert shrubland to rain forest

Compare with *torosa* and *crinosa*

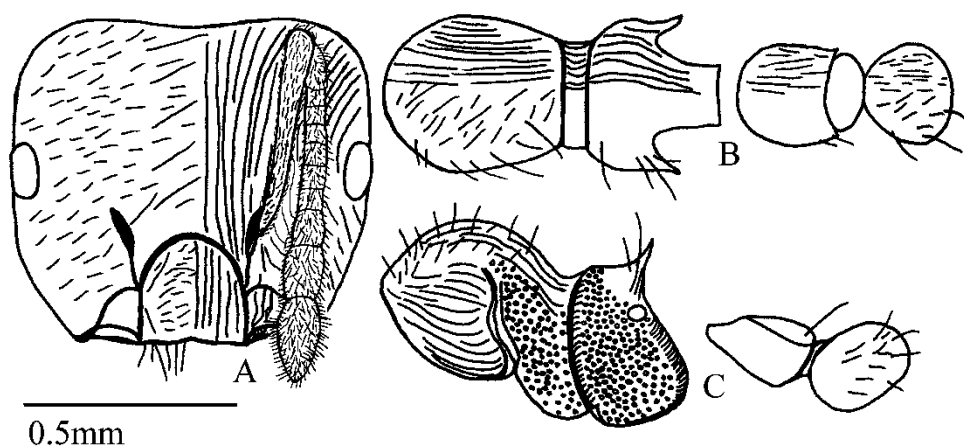


Plate 12. *Crematogaster atra* worker: (syntype, México NHMW): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

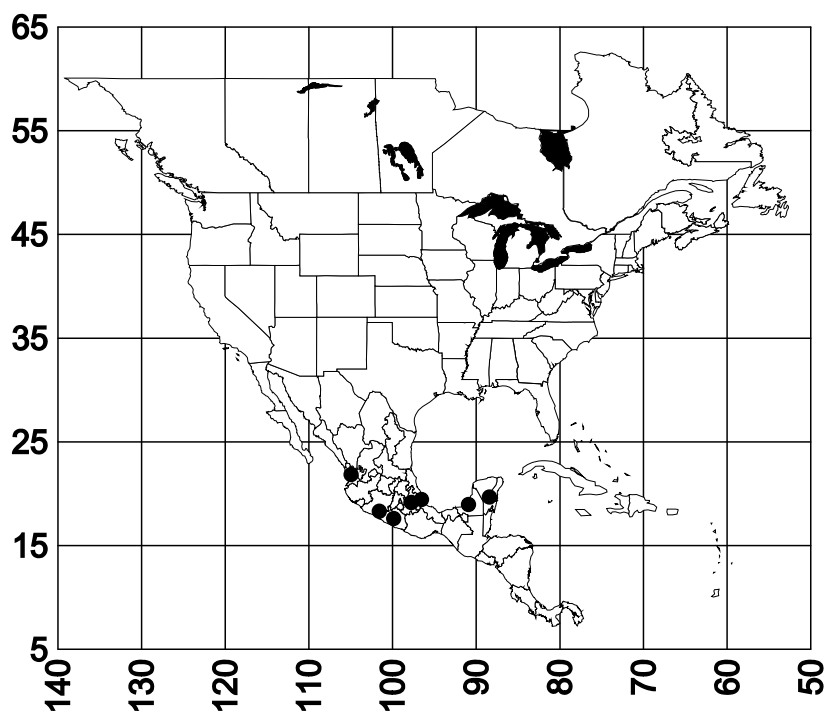
Petiole subquadrate, shallowly striate with appressed hairs along sides, 1 long flexuous hair on each posterior corner; anterior sternopetiole process variable, absent to well developed; postpetiole globular, shallowly striate with appressed hair and several long flexuous hairs pointed posteriorly; gaster dull areolate with appressed and erect hairs evenly distributed and pointed toward sting.

Concolorous dark brown.

atra - Central México south to Argentina
Nest in trees and swollen thorn *Acacia*
Desert shrubland to rain forest

Compare with *torosa* and *crinosa*

Worker measurements (mm): HL 0.71-0.74, HW 0.77-0.84, SL 0.50-0.53, EL 0.14, ED 0.11-0.12, CL 0.23-0.24, CW 0.22-0.25, WL 0.74-0.78, PSL 0.12-0.13, PL 0.24-0.25, PW 0.22-0.23, PPL 0.17-0.24, PPW 0.20-0.23; Indices: CI 88-92, SI 70-72, CLI 96-105, PI 109, PPI 85-104.



Map 3. *Crematogaster atra*.

Distribution: Central México to Argentina

Type series: 3 syntype workers of *Crematogaster atra* Mayr, México [NHMW].

atra - Central México south to Argentina

Nest in trees and swollen thorn *Acacia*

Desert shrubland to rain forest

Compare with *torosa* and *crinosa*

Other material examined: **BOLIVIA:** **Cochabamba**, Villa Tunari, 67.5k E Valle Salta (17° 19' S, 64° 47'W) (1 ♀ CWEM). **MÉXICO:** **Campeche**, Isla Agunda (10 ♀ CWEM), **Guerrero**, 74k N Acapulco (36 ♀, 36 ♂ CWEM), 86k Iguala (1 ♀ CWEM), 4k N Zumpango (1 ♀ CWEM); **Morelos**, Alpuyeca (7 ♀ CWEM), **Nayarit**, Tepic 1365m (4 ♀ CWEM), Oaxtepec (4 ♀ CWEM); **Quintana Roo**, El Edén Ecological Reserve (21°13'N 87°11'W) (2 ♀ CWEM); **Tamaulipas**, 13.9k W Padilla (1 ♀ CWEM); **Veracruz** (4 ♀, 4 ♀ MCZC).

Other material not seen: California Academy of Sciences, AntWeb (www.gbif.net): **ARGENTINA:** **Buenos Aires**, Isla Martín García (34.19°S, 58.28°W NHMB). **BRAZIL:** **Rio Grande do Sul**, Porto Alegre (30.03°S, 51.2°W syntype worker *peristericus*, DEIC), Rio Grande (32.03°S, 52.08°W NHMW); **São Paulo**, Botucatú (22.87°S, 48.43°W syntype worker *sericea*, MHNG), Cantareira (23.47°S, 46.63°W NHMW). **COLOMBIA:** **César**, San Sebastián de Rebajo (10.57°S, 73.6°W JTLC); **Cauca**, Popayán (6 specimens JTLC); Río Palacé, Totoró, (JTLC); **Valle del Cauca**, Sevilla (2 specimens JTLC). **PARAGUAY:** **Asunción**, Villa Morra (25.3°S, 57.57°W NHMB), Reserva Natural del Bosque Mbaracayú, Jejuimi, Canindeyú (24.1°S, 55.47°W JTLC). **URUGUAY:** Nueva Helvecia (34.3°S, 57.23°W syntype worker *uruguayensis*, NHMB). **VENEZUELA:** **Lara**, 5k SE Barbacoas (3 specimens at 9.8°N, 70.02°W JTLC).

atra - Central México south to Argentina
Nest in trees and swollen thorn *Acacia*
Desert shrubland to rain forest

Compare with *torosa* and *crinosa*

Etymology: *Atra* in Latin is blacking, or ink and is used as a prefix for nouns with a connotation for mourning or gloomy suggesting derivation from the color of the worker.

Discussion: The key characteristics of the *Crematogaster atra* worker are well defined longitudinal striate on the face and the short erect hairs covering most of the dorsal surface of the mesosoma. This species is similar to *C. crinosa* with small propodeal spines, head with mostly appressed hair and few (less than 8) short erect hairs. The sternopetiolear process is highly variable from none, to well developed as in *C. torosa* and *C. crinosa* respectively. The key character in distinguishing *C. atra* from *C. crinosa* is the sculpturing on the head. *Crematogaster atra* has longitudinal striate following the curvature of the eye and *C. crinosa* has shiny striate head. The dorsal surface of the mesosoma of *C. atra* has more erect hairs than does *C. crinosa*.

Biology: *Crematogaster atra* is not often collected, therefore little is known about its nesting habits. Two collections have been made by W. Mackay from Popayán, Colombia, one trailing up into a tree and the other a nest with pupae and males, inside a live fence post in a section damaged by insects. This nest was in muddy clay soil with pebbles. R. B. Root and W. L. Brown collected *C. atra* in an oak forest in Totoró, Colombia. A nest series collected by Mackay and Mackay near Alpuyeca, México was found in a swollen acacia spine. Foragers were collected loose on the ground and in vegetation and in litter extractions (Mackay and Mackay, unpublished).

Crematogaster atra is found in desert shrubland, in ravine

atra - Central México south to Argentina
Nest in trees and swollen thorn *Acacia*
Desert shrubland to rain forest

Compare with *torosa* and *crinosa*

riparian forest surrounded by dry scrub, oak woodland, scrubby disturbed rain forest and lowland rain forest (Mackay and Mackay, unpublished).

It occurs in soils ranging from dark brown clay, white sand, rocky-sandy loam to light brown sandy loam (Mackay and Mackay, unpublished).

atra - Central México south to Argentina

Nest in trees and swollen thorn *Acacia*

Desert shrubland to rain forest

Compare *coarctata*, *emeryana* and *vermiculata*

***Crematogaster cerasi* (Fitch)**

Plates 4 B, 13, 14 ,15 and 98; Figs. 6 and 10; Map 4.

Myrmica cerasi Fitch 1855: 129, worker, New York, United States.

Roger, 1863b: 37, Mayr 1886b: 463, combination in *C. (Crematogaster)*. Dalla Torre 1893: 83, junior synonym of *Crematogaster lineolata* Say. Emery, 1895: 282, revived as species *C. cerasi*. Emery, 1895: 282, combination in *C. (Acrocoelia)*. Creighton, 1950: 213, junior synonym *C. lineolata*. Smith, 1951: 809, revived from synonymy as *C. lineolata* var. *cerasi*. Talbot, 1957: 376, Smith, D. R. 1979: 1379, revived as species; Buren, 1968: 9, combination in *C. (Crematogaster)*. Wheeler & Wheeler, 1973: 28, larva. Deyrup, 2017:62-63, Plate 27, worker.

Crematogaster kennedyi Wheeler, 1930: 58, queen, male, Fort Wayne, Indiana, United States. Smith, D. R. 1979: 1379, junior synonym of *C. cerasi*.

Crematogaster browni Buren, 1968: 100-102, worker, queen, Garden Canyon, Huachuca Mountains, Arizona, United States, **NEW SYNONYMY**.

Descriptions:

There is no type material of *C. cerasi* available that we are aware of, although Creighton (1950) mentions specimens are in the USNM;

cerasi - southeastern Canada, US to northern Mexico
Nests in soil, under stones, occasionally in plant cavities
Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

therefore, we used a specimen from Lexington, Massachusetts determined by Buren (MCZC), that is consistent with the descriptions by Fitch (1855) and comments by Emery (1895), Creighton (1950) and Buren (1968) to define the species.

Worker: Mandibles shiny, longitudinal striate, with few erect and appressed hairs; clypeus longer than wide, shiny areolate with longitudinal striate and few appressed hairs, anterior margin slightly concave with small medial notch and 8 long hairs; frontal groove apparent; scape passing posterior border of head, evenly covered with appressed hairs; head with longitudinal striate below eye and shiny areolae above eye, with fewer than 8 erect hairs, but evenly covered with appressed hairs.

Dorsum of mesosoma scabrous-rugose, each pronotal shoulder with 3-5 erect hairs (1-3 very long and flexuous); medial pronotal carina small but sharp, humeri developed and rounded; dorsum of mesosoma scabrous-rugose, side of mesosoma shallowly scabrous-rugose; notopropodeal groove steep, with four erect hairs; propodeal spines slender, thickening at base, divergent (viewed from above), in profile, top margin sinuate; metapleuron striate-punctate.

Petiole and postpetiole shallowly scabrous with 1 erect hair on each posterior lateral corner, postpetiole with few appressed hairs dorsally; petiole trapezoidal, with anterior lateral flange upraised when viewed from behind, anterior sternopetiole process blunt; hemilobes of postpetiole slightly longitudinally elongate, spreading anteriorly, petiole wider and longer than postpetiole; gaster shallowly areolate with few erect and appressed hairs evenly distributed.

cerasi - southeastern Canada, US to northern Mexico

Nests in soil, under stones, occasionally in plant cavities

Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

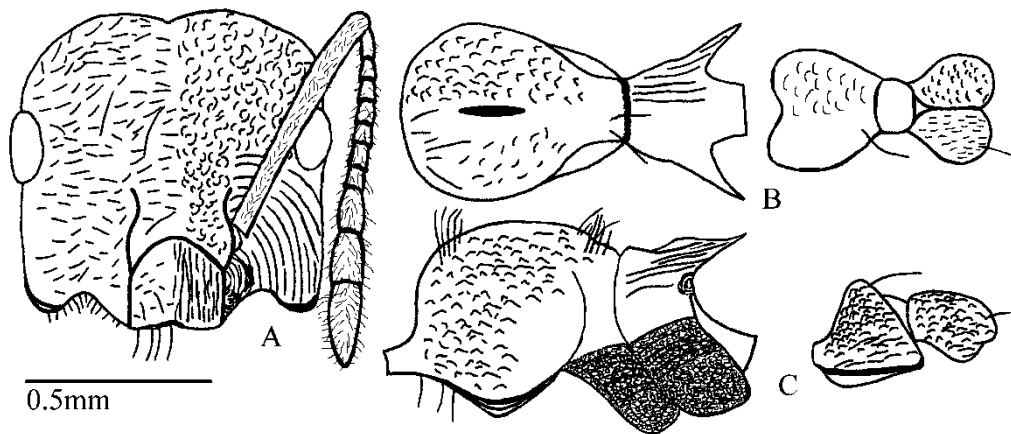


Plate 13. *Crematogaster cerasi* worker: (determined by Buren, from Lexington Massachusetts MCZC): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Concolorous light to dark brown or bicolored with head and mesosoma lighter colored than gaster.

Worker measurements (mm): HL 0.72-1.08, HW 0.77-1.49, SL 0.61-0.98, EL 0.16-0.32, ED 0.13-0.30, CL 0.18-0.28, CW 0.22-0.36, WL 0.78-1.34, PSL 0.13-0.25, PL 0.17-0.38, PW 0.35-0.38, PPL 0.14-0.26, PPW 0.25-0.36; Indices: CI 72-94, SI 85-91, CLI 78-82, PI 49-100, PPI 56-72.

cerasi - southeastern Canada, US to northern Mexico
 Nests in soil, under stones, occasionally in plant cavities
 Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

Queen: Mandibles shiny, with shallow longitudinal striae; clypeus smooth with few short erect hairs pointed medially, anterior margin slightly concave with small medial notch and 6 long, flexuous hairs; scape with decumbent hairs, reaching to passing posterior border of head; ocelli almost flush with surface of head; head with 4 long, flexuous and many appressed hairs pointed medially, longitudinal scabrous sculpture below eye, shiny, areolate above, striate between eye and antennal insertion.

Mesosoma with few long and short flexuous hairs and many appressed hairs, shiny areolate with 3-5 longitudinal striae perpendicular to anterior margin of metapleuron, side of mesosoma areolate developing into striae at edge of metapleural suture; pronotum not visible viewed from above; scutum overlapping pronotum, dorsellum visible under postscutellum as viewed from above, notopropodeal groove steep, propodeal spines well developed for queens.

Petiole and postpetiole shiny areolate dorsally, longitudinal striate viewed from side, with appressed hairs pointing posteriorly and 2 erect hairs on each posterior corner; petiole angularly trapezoidal; anterior sternopetiole process developed; postpetiole with hemilobes not well defined with medium sulcus, spreading slightly antroventrally; petiole wider and longer than postpetiole; gaster shallowly areolate with few erect hairs and appressed hairs evenly distributed.

Concolorous light to dark brown.

cerasi - southeastern Canada, US to northern Mexico
Nests in soil, under stones, occasionally in plant cavities
Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

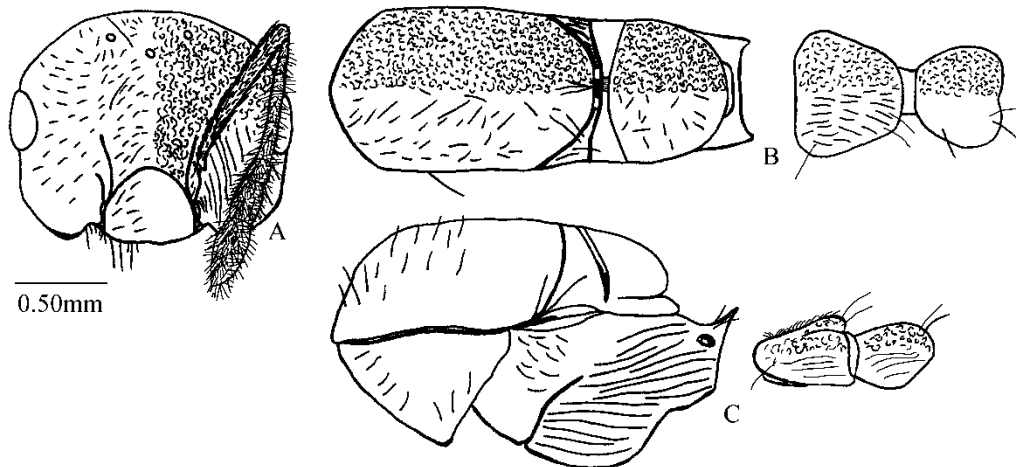


Plate 14. *Crematogaster cerasi* queen: (Las Cruces, New Mexico CWEM # 7431): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Queen measurements (mm): HL 1.34-1.49, HW 1.39-1.61, SL 1.08-1.10, EL 0.30-0.32, ED 0.29-0.31, CL 0.50-0.58, CW 0.35-0.37, WL 2.76-3.24, PSL 0.24-0.30, PL 0.53-0.55, PW 0.70-0.72, PPL 0.41-0.43, PPW 0.67-0.79; Indices: CI 93-96, SI 74-81, CLI 143-147, PI 76, PPI 54-61.

Male: Clypeus shiny, anterior margin almost straight with slight convex pleat in middle with 6-8 long hairs; ocelli slightly raised from surface of head; scape typically short, scape and funiculus with short erect hairs giving appearance of fur; head grainy areolate with 8 erect

cerasi - southeastern Canada, US to northern Mexico
Nests in soil, under stones, occasionally in plant cavities
Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

hairs in two longitudinal rows between lateral ocelli and insertion of antennae, decumbent hair on sides of head.

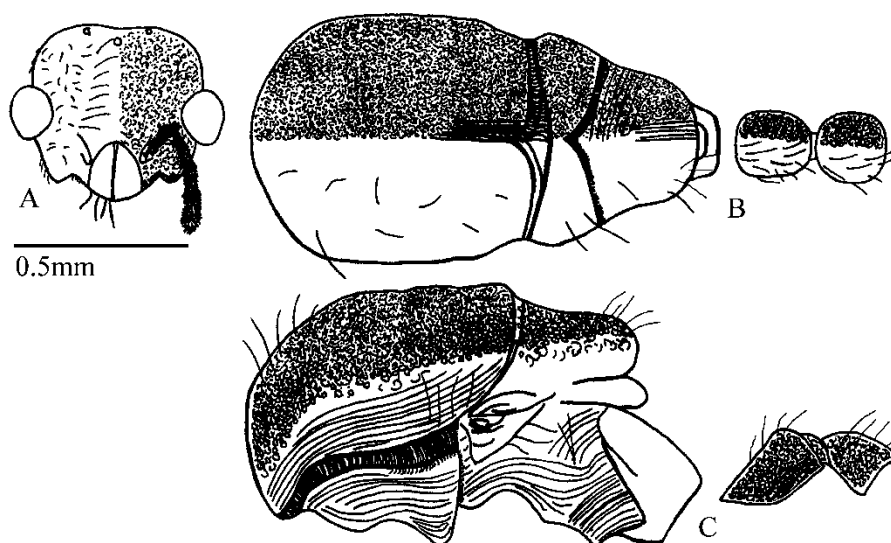


Plate 15. *Crematogaster cerasi* male: (Las Cruces, New Mexico CWEM # 7431): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Mesosoma grainy areolate with sparse appressed hairs; scutum with 1-2 long erect hairs on each shoulder and several long semierect hairs; pronotum completely hidden by scutum viewed dorsally; few erect hairs on postscutellum; metanotum can be seen under scutellum

cerasi - southeastern Canada, US to northern Mexico
 Nests in soil, under stones, occasionally in plant cavities
 Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

viewed dorsally; scutellum latitudinally striate with 6-10 long flexuous erect hairs along posterior margin.

Petiole, postpetiole and gaster grainy areolate; petiole and postpetiole about same size, petiole slightly trapezoidal with long flexuous hairs pointed posteriorly; postpetiole globular with no hint of medium sulcus and with appressed hairs; gaster with short erect and appressed hairs; overall size large for genus.

Concolorous dark brown.

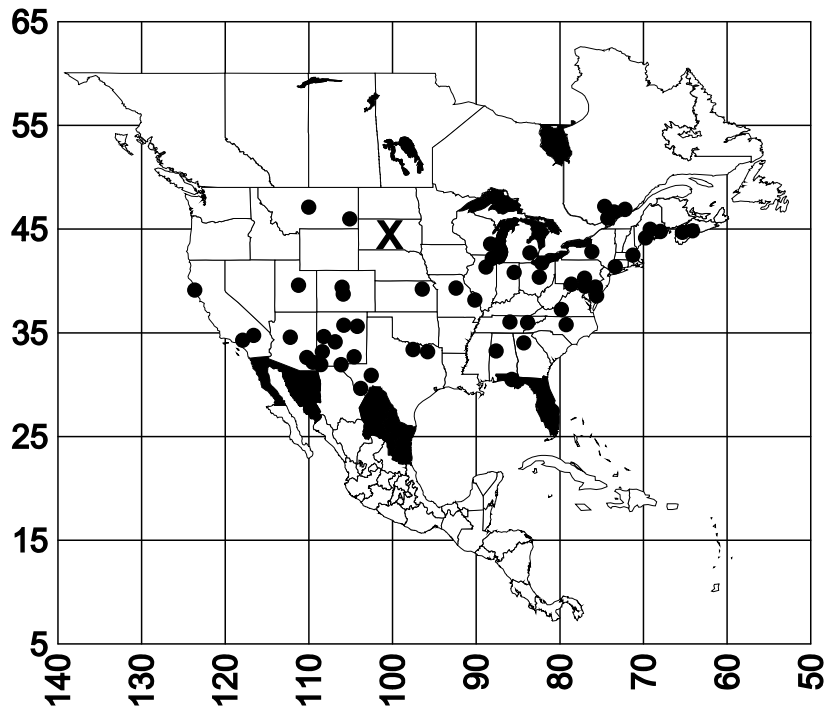
Male measurements (mm): HL 0.48-0.49, HW 0.57-0.58, SL 0.11-0.17, EL 0.20-0.22, ED 0.20-0.22, CL 0.11-0.13, CW 0.17-0.18, WL 1.37-1.45, PL 0.18-0.20, PW 0.24-0.28, PPL 0.17-0.19, PPW 0.29-0.30; Indices: CI 84, SI 23-35, CLI 65-72, PI 71-75, PPI 59-63.

Type series: *Crematogaster cerasi*, none found. *Crematogaster kennedyi* type from New York, United States [MCZC].

Distribution: Southeastern Canada (Ontario, Nova Scotia and Quebec), throughout the United States, including Wyoming (Lavigne and Tepedino, 1976), Maine (Ouellette and Francoeur, 2012), South Carolina (Davies 2009), Arkansas (General and Thompson, 2008, 2009; MacGown et al., 2011), Louisiana (Parys et al., 2013), Georgia (Ipser et al., 2004) and Florida (Deyrup, 2017), southwest into the states of Baja California, Coahuila, Nuevo León, Sonora and Tamaulipas, México (Vázquez-Bolaños, 2011; Coronado-Blanco et al., 2013).

cerasi - southeastern Canada, US to northern Mexico
Nests in soil, under stones, occasionally in plant cavities
Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*



Map 4. *Crematogaster cerasi*. The “X” in South Dakota indicates an unknown locality.

Material examined: **MÉXICO**, **Sonora**, Puerto Peñasco (1 ♀ CWEM). **CANADA:** **Nova Scotia**, Digby (3 ♀ MCZC); **Halifax Co.**, West Dover (3 ♀ MCZC); **Ontario**, Pelee (3 ♀ MCZC); **Quebec**, **Chelsea Co.**, de Gatineau (2 ♀, 1 ♀, 1 ♂ CWEM), Dundee, Co. de Huntingdon (2 ♀ CWEM), **St. Hippolite Co.**, de Terrebonne (1 ♀ CWEM), Hull (3 ♀ MCZC), Kingsman (2 ♀, 1 ♂ MCZC). **UNITED STATES:** **Alabama**, **Tuscaloosa Co.**, Tuscaloosa, Lake Lurleen State Park (6 ♀ CWEM); **Arizona**, **Cochise Co.**, Dragoon Mountains,

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Middlemarch Pass (8 ♂ CWEM), Portal, Chiricahua Mountains (13 ♂ CWEM), 14k W Portal (CWEM) Camp Rucker (CWEM), Southwest Research Station (10 ♂, 1 ♀ CWEM), Sunny Flat (CWEM), **Yavapai Co.**, Bradshaw Mountains, 8.9mi S. Jct. Rt. 69 on FSR 197 (1 ♂, 1 ♀ CWEM), 10mi N Kirkland Junction (12 ♂ CWEM), 1mi S Yarnell (CWEM); **California**, **Mendocino Co.**, rest area near Longvale (1 ♂ CWEM), **Orange Co.**, Trabuco Canyon (CWEM), **San Bernardino Co.**, Lake Arrowhead (5 ♂ CWEM); **Colorado**, **El Paso Co.**, Garden of the Gods State Park (34 ♂ CWEM), Manitou Springs (45 ♂ CWEM); **Connecticut**, **Litchfield Co.**, Robbins Swamp (1 ♂ MCZC); **Delaware**, **Kent Co.**, Woodland Beach (6 workers STDC), **New Castle Co.**, Summit (3 ♂ STDC), University of Delaware (1 worker STDC), near woodland beach (2 ♂ STDC), **Sussex Co.**, Bryan's Store Rd 435 (5 workers STDC), Trap Pond State Park Raccoon Pond (5 ♂ STDC), Wilmington Valley Run Apartments (1 ♂ STDC); **Florida**, **Martin Co.**, Stuart, mile 106, 1-95 Rest Area (2 ♂ STDC), **Okaloosa Co.**, Eglin AFB, Santa Rosa Island (20 ♂ CWEM); **Georgia**, **Barrow Co.**, Fort Yargo State Park (12 ♂ CWEM); **Indiana**, **Allen Co.**, Fort Wayne (3 ♂ MCZC); **Illinois**, **McHenry Co.**, McHenry (3 ♂ MCZC), Palos (3 ♂ MCZC); **Kansas**, **Riley Co.**, Manhattan (3 ♂, 8 ♂ CWEM); **Maine**, **Cumberland Co.**, Harpswell (1 ♂, 1 ♀ CWEM), **Hancock Co.**, Acadia National Park (2 ♂ MCZC), **Kennebec Co.**, Wayne (4 ♂ MCZC); **Maryland**, **Allegany Co.**, Little Orleans, 15 mile Creek (2 ♂ STDC), **Baltimore Co.**, Deer Park, Soldier's Delight (1 ♂ STDC), see Frye and Frye, 2012; **Massachusetts**, **Middlesex Co.**, Lexington (3 ♂ MCZC), Sherborn (3 ♂ MCZC); **Michigan**, **Wayne Co.**, Detroit (3 ♂

cerasi - southeastern Canada, US to northern Mexico

Nests in soil, under stones, occasionally in plant cavities

Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

MCZC); **Missouri**, **Boone Co.**, Columbia (2 ♀ CWEM), St. Louis (2 ♀ MCZC); **Montana**, **Fallon Co.**, 25mi SW Baker (CWEM), **St. Charles Co.** (3 ♀ MCZC); **New Mexico**, **Catron Co.** Catwalk (6 ♀ CWEM), Glenwood (40 ♀ CWEM), 20.6k N Glenwood (6 ♀ CWEM), **Doña Ana Co.**, Aguirre Springs Recreation Area (5 ♀ CWEM), 9 mi E Las Cruces (CWEM), 45k NE Las Cruces (44 ♀, 32 ♀, 33 ♂ CWEM), Organ Mountains, San Augustine Pass (CWEM), **Grant Co.**, Mimbres (15 ♀ CWEM), 100k E Silver City (19 ♀, 7 ♀, 8 ♂ CWEM), Soldier Hill, 100k N White Rock (12 ♀ CWEM), **Hidalgo Co.**, Coronado National Park, Clayton Canyon 52.5k (31°30'55"N 109°01'08"W) (4 ♀ CWEM), Clayton Draw (22 ♀ CWEM), **Los Alamos Co.**, Los Alamos (1 ♀ CWEM), Rio Grande (60 ♀, 4 ♀, 2 ♂ CWEM), Rio Grande, 1700m (34 ♀, 1 ♀, 1 ♂ CWEM), Rio Grande Canyon near White Rock (CWEM), **San Miguel Co.**, 9 mi E Las Vegas (CWEM), Villanueva State Park (15 ♀ CWEM), **Socorro Co.**, Magdalena Mountain (15 ♀ CWEM), 17 k S, 21.3k S, 22.2k, S 22.7k S Magdalena 1850m (33°54'46.9" 107°16'15.2) (5 workers CWEM), 8mi from HWY 107 on HWY 1452 (3 ♀ CWEM); **New York**, **Tompkins Co.**, Ithaca (3 ♀ MCZC); **North Carolina**, **Raleigh Co.**, Chandler (10 worker COOK), Fishville (2 ♀ MCZC), see also Guénard et al., 2014; **Ohio**, **Franklin Co.**, Columbus (3 ♀ MCZC), **Ottawa Co.**, East Harbor State Park 14 ♀ CWEM); **Pennsylvania**, **Adams Co.** Gettysburg National Military Park (1 worker CWEM); **South Dakota** (1 ♀, 1 ♂ MCZC); **Tennessee**, **Blount Co.**, Cades Cove (2 ♀ MCZC), **Putnam Co.**, Cookeville (2 ♀ CWEM); **Texas**, **Brewster Co.**, Pine Canyon Trail (33 ♀ COOK),

cerasi - southeastern Canada, US to northern Mexico

Nests in soil, under stones, occasionally in plant cavities

Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

Cass Co., Atlanta State Park (3 ♂ CWEM), **El Paso Co.**, Hueco Mountains Red Sands (N31° 49' 34.8"; W 106.07' 23.10") (3 ♂ CWEM), **Grayson Co.**, 6.16k N Denison (21 ♂ CWEM), **Jeff Davis Co.**, Fort Davis (12 ♂ CWEM); **Utah**, **Utah Co.**, Santaguin Canyon (3 ♂ CWEM); **Virginia**, **Patrick Co.**, (1 ♂ MCZC), **Spotsylvania Co.**, 14.77k S Fredericksburg (1 ♂ CWEM); **Wisconsin**, **Ozaukee Co.**, Mequon (1 ♂ CWEM).

Etymology: *Cerasi* from Latin *cerasus* meaning cherry tree or cherry, “the cherry ant”.

Discussion: The suite of characters that separate *Crematogaster cerasi* from other closely related species of *Crematogaster* is the combination of 1-5 long flexuous, erect hairs on each pronotal shoulder and shallow to robust scabrous-lineolate sculpturing on the dorsum of the mesosoma. Similar species such as *C. lineolata* Say and *C. coarctata* Mayr differ in one or more of these characters. *Crematogaster lineolata* has many short erect hairs on the pronotum, no anterior sternopetiolar process (or it is poorly developed); however, the sculpturing is similar. *Crematogaster coarctata* has similar pilosity on the pronotal shoulder and a variable anterior sternopetiolar process; however, the sculpturing of *C. coarctata* is more defined than in *C. cerasi*. *Crematogaster cerasi* has spines that are variable within nest series and can be reduced as in *C. emeryana*, to typically developed spines such as those of *C. lineolata*, it can be separated from the other two as in profile, the top margin of the spines of *C. cerasi* is sinuate, not straight as in *C. emeryana* and *C. lineolata*.

cerasi - southeastern Canada, US to northern Mexico
Nests in soil, under stones, occasionally in plant cavities
Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

It can be difficult to separate *C. cerasi* from *C. vermiculata*. Most specimens of *C. cerasi* have the pronotum mostly rugose, with some striae confined to the sides. The dorsum of the pronotum of all specimens of *C. vermiculata* has at least wavy striae across the top of the pronotum, but is usually with strong vermiculae.

We obtained paratype specimens of *Crematogaster browni* (LACM) and made comparisons with many specimens of *C. cerasi*. When using Buren's key, we found that the typical *C. cerasi* keys to *C. browni* in the key to the west species and the reverse true of *C. browni* keying to *C. cerasi* in the key to the east species. We have found extensive polymorphism in overall size and sternopetiole process development in large single nest series of *C. cerasi*. Some specimens in these large series are small and shallowly sculptured as in *C. browni*. Thus, we consider *C. browni* Buren to a junior synonym of *C. cerasi* Fitch.

Biology: *Crematogaster cerasi* is a very common cosmopolitan species with an extensive range. Mackay and Mackay (unpublished) found nests at sea level and up into the Huachuca Mountains of Arizona. The nesting habits are also varied. We found nests in the soil, sometimes with mounds, under stones, in and under sage brushes in the west and in hardwood hummocks in the southeast, in twigs, hollow stems, in rotten stumps including a standing dead *Celtis* stump at the soil surface level, and in/under logs (see also Carroll, 2011). Nests even occur in hickory nuts (Talbot, 1957). Large nests may have several hundred workers and can be aggressive. Brood were found in nests from March to September, sexuals in March, July, August and

cerasi - southeastern Canada, US to northern Mexico
Nests in soil, under stones, occasionally in plant cavities
Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

September; founding queens were found in May in southern New Mexico. They have been found near *Camponotus nearcticus* nests.

Crematogaster cerasi is a generalist in terms of feeding (Kjar, 2009). Foragers are active as early as February, foraging on the soil surface, and on cholla, and are attracted to peanut butter baits (Mackay and Mackay, unpublished). They readily come to baits of sausage or Keebler Pecan Sandies© cookies. In more arid landscapes *C. cerasi* has also been found foraging on *Opuntia imbricata*. Foragers steal nectar from *Catalpa speciosa* (Stephenson, 1981) and disperse diaspores (Beattie and Culver, 1981). The red imported fire ant, *Solenopsis invicta* has little effect on them (King and Tschinkel, 2013). Workers have been tested in mazes (Jander, 1990).

Several guests are found in nests, including *Myrmecophila* crickets, various beetles and pseudoscorpions. They carry phoretic mites (Campbell et al., 2013) and are attacked by the parasitic fly *Pseudacteon onyx* (Steyskal, 1944).

Crematogaster cerasi is found in a wide variety of habitats in the US (Lubertazzi and Tschinkel, 2003) and several different habitats in México (Alatorre-Bracamontes and Vázquez-Bolaños, 2010). They are found in desert shrubland, desert riparian vegetation, acacia, mesquite woodlands, chaparral, black grama grassland, clearing next to small creek, oaks and grasses, oak woodland, emory oak, pine alligator bark juniper, pinyon/juniper, cedar/pine forest, Chihuahuan pine, ponderosa pine/gamble oak, mixed hardwood, riparian, mixed hardwood, riparian sycamore/willow (Mackay and Mackay, unpublished), mixed pine hardwood forest, long leaf pine (Dash, 2004). Nests are more common in hardwood forest than in pine forest

cerasi - southeastern Canada, US to northern Mexico

Nests in soil, under stones, occasionally in plant cavities

Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

(Martelli et al., 2004). They are found in areas with introduced plants (Kjar and Barrows, 2004) and in disturbed habitats (Dash, 2004). They adapt to urban ecosystems (Guénard et al., 2014), where they are common (Carroll, 2011), but were unable to recover after house construction in urban area of Indiana (Buczowski and Richmond, 2012), and in general do not do well in disturbed areas (Menke, et al., 2011).

Nests are found in soils ranging from brown clay, sand (red, grey, light brown and dark brown), orange rocky loam, light brown rocky loam, rocky soil (red, light brown), sandy gravel and light brown gravel.

Crematogaster cerasi may be an agricultural pest, because they tend aphids (Bradshaw et al., 2010). They are a house pest (Smith, 1965).

Deyrup (2017) includes details on the biology and distribution of this species as well as comparisons with other species occurring in Florida.

cerasi - southeastern Canada, US to northern Mexico

Nests in soil, under stones, occasionally in plant cavities

Desert shrublands to forests, urban ecosystems

Compare *coarctata*, *emeryana* and *vermiculata*

***Crematogaster coarctata* Mayr**

Plates 2 B, 4 C, 5 A, 16, 17 and 99; Fig. 14; Map 5.

Crematogaster coarctata Mayr 1870b: 992-993, worker, San Mateo and San Francisco, California, United States. Mayr 1886b: 462, junior synonym of *C. lineolata*. Emery, 1895: 283 and Wheeler 1904b: 270, subspecies of *C. lineolata*. Wheeler, 1919: 111, revived status as species. Emery 1922: 141, combination in *C. (Acrocoelia)*. Enzmann, J., 1946: 94, *Crematogaster opaca* subsp. *coarctata*. Creighton, 1950: 207, revived status as species. Buren 1968: 94, revived status as species (in Key), combination in *C. (Crematogaster)*.

Crematogaster lineolata subspecies *coarctata* var. *mormonum* Emery 1895: 284, worker, Salt Lake City, Utah, United States [unavailable name]. Wheeler, 1919: 111, first available use, *Crematogaster* subspecies of *C. lineolata*. Emery, 1922: 141, combination in *C. (Acrocoelia)*. Creighton, 1950: 215, raised to species. Buren, 1968: 94, combination in *C. (Crematogaster)*, **NEW SYNONYMY.**

Crematogaster lineolata subsp. *laeviuscula* var. *californica* Emery, 1895: 285, worker [unavailable name]. *Crematogaster laeviuscula* var. *californica*, Wheeler, 1919: 111, first available use, Encinitas and Los Angeles, California. Wheeler, 1934b:

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare with *cerasi*, *dentinosis*, *mutans*, and *vermiculata*

135, subspecies of *C. lineolata*. Creighton, 1950: 207, junior synonym of *C. coarctata*. Smith, 1951: 808, revived status as species. Buren 1968: 94, combination in *C. (Crematogaster)* in key, **RETURNED TO SYNONYMY**.

Descriptions.

Worker: Clypeus wider than long, longitudinally striate, with few appressed hairs, anterior margin straight with 6-8 long hairs; scape reaching or surpassing posterior border of head, can vary within nest series (Chiricahua Mountains, Arizona CWEM # 6844), with decumbent hairs and funiculus with erect hairs (can have appressed to semierect hairs); head shiny punctate in longitudinal rows to completely striolate between and posterior to eyes and punctate between rugae anterior to eyes, evenly, sparsely covered with appressed hairs pointed toward one central point between eyes, 1 long erect hair on each frontal lobe.

Pronotal shoulder striate to rugose, mesonotum areolate to punctate between rugae (viewed from above), intensity of sculpturing can vary within nest series, (Chiricahua Mountains, Arizona CWEM # 6844); pronotal shoulder rounded with 1-5 long flexuous hairs and few scattered appressed hairs pointed medially on mesosoma (viewed from above), side of mesosoma shiny with striae and few costae; promesonotal suture apparent from breaks in sculpturing, notopropodeal groove wide and shallow, steep and angular; propodeal spines costate, long, slender, thickened at base, slightly divergent (seen from above).

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare *coarctata*, *emeryana* and *vermiculata*

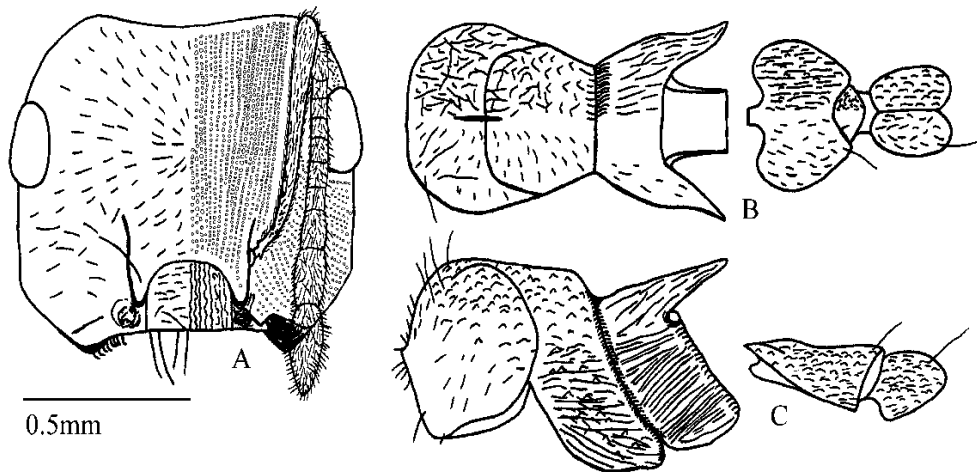


Plate 16. *Crematogaster coarctata* worker: (California, United States NHMW): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Petiole and postpetiole shallowly striate with several appressed hairs and 1 long flexuous hair on each posterior lateral corner, anterior sternopetiolar process very small, blunt to well developed, can vary within nest series (Chiricahua Mountains, Arizona CWEM # 6844); petiole angularly trapezoidal, postpetiole hemilobes longitudinally elongate, but overall wider than long; petiole wider and longer than postpetiole; gaster shallowly areolate with few erect hairs in row in middle of each of last 4 terga and appressed hairs sparsely dispersed; tibia with appressed to semierect hairs.

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare with *cerasi*, *dentinosis*, *mutans*, and *vermiculata*

Bicolored dark head and gaster, light mesosoma, or concolorous light to dark brown.

Worker measurements (mm): HL 0.82-0.97, HW 0.95-1.10, SL 0.71-0.88, EL 0.23-0.28, ED 0.17-0.22, CL 0.23-0.28, CW 0.26-0.30, WL 0.90-1.15, PSL 0.19-0.28, PL 0.26-0.38, PW 0.30-0.42, PPL 0.18-0.22, PPW 0.28-0.38; Indices: CI 86-88, SI 87-91, CLI 88-93, PI 87-90, PPI 56-64.

Queen: Mandibles longitudinally striate with decumbent hair; clypeus longitudinally striate with 4-6 long erect and decumbent hairs, anterior margin concave with slight medial notch, and many long flexuous hairs; scape passing posterior border of head, with semierect hairs; ocelli small, flush with surface of head with 2-4 long flexuous, erect hairs in between; head quadrate, longitudinal striate fading to smooth along frontal groove, with 5-6 long, fine flexuous hairs between frontal lobes to ocelli, and decumbent hairs evenly distributed and pointed medially.

Mesosoma slightly wider than width of head, dorsal view of mesosoma shiny areolate with many fine long erect and decumbent hairs pointed medially; dorsellum (medial lobe of metanotum) not visible from above; propodeum with latitudinal striae coming to points on spines; side of mesosoma longitudinally striate with many appressed and decumbent hairs and few scattered long, erect hairs; propodeal spiracle small.

Petiole trapezoidal, areolate with many fine decumbent hairs pointed to the middle of poster margin and 4-5 erect hairs along each

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare *coarctata*, *emeryana* and *vermiculata*

lateral margin; anterior sternopetiole process well developed; postpetiole shallowly bilobed, spreading slightly posteriorly, areolate, covered with fine decumbent hair pointed posteriorly with 2 erect on dorsum of each hemilobe, and 3 along each side; gaster areolate with many decumbent or appressed hairs and few long erect hairs.

Concolorous brown.

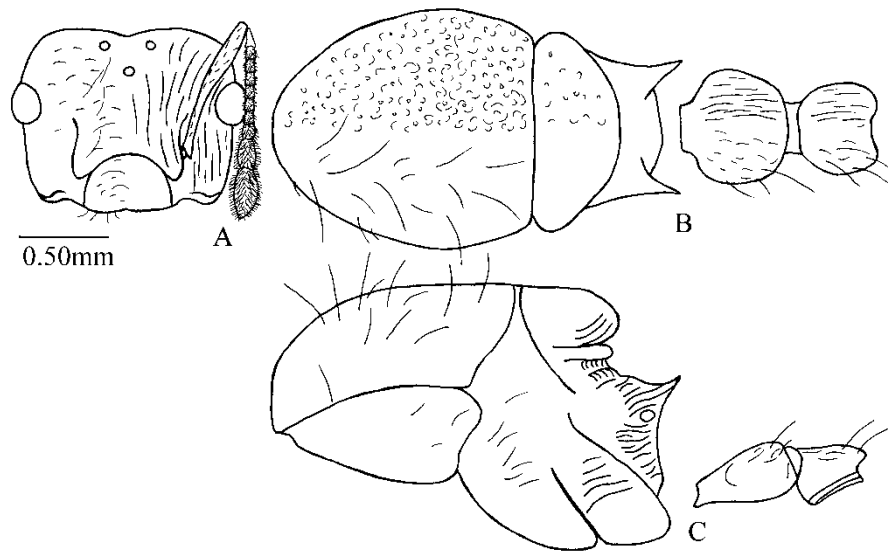


Plate 17. *Crematogaster coarctata* queen: (Grant Co., New Mexico CWEM): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

coarctata - western US south to central México

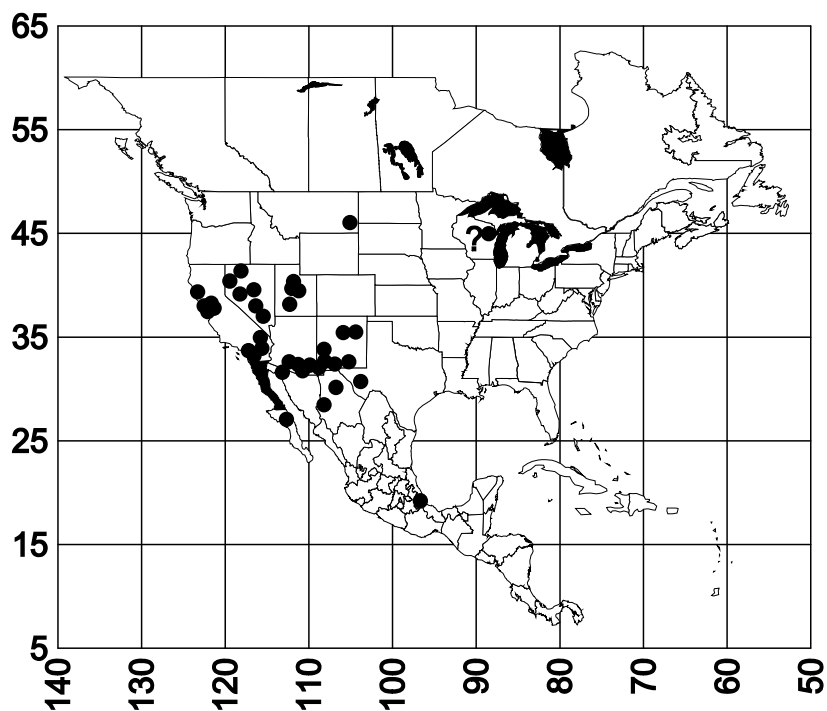
Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare with *cerasi*, *dentinosus*, *mutans*, and *vermiculata*

Queen measurements (mm): HL 0.71-1.50, HW 1.15-1.68, SL 0.63-1.25, EL 0.22-0.44, ED 0.18-0.36, CL 0.19-0.53, CW 0.28-0.92, WL 1.82-3.27, PSL 0.18-0.49, PL 0.31-0.56, PW 0.45-0.63, PPL 0.30-0.45, PPW 0.41-0.56; Indices: CI 62-89, SI 83-89, CLI 58-68, PI 69-88, PPI 73-80.

Distribution: Western United States from west Texas north to Montana; west to the Siskiyou Mountains of southwestern Oregon (Wittman et al., 2010), south to Baja California, Sonora, Chihuahua and Veracruz, México.



Map 5. *Crematogaster coarctata*.

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare *coarctata*, *emeryana* and *vermiculata*

Type series: Four syntype workers collected by Dr. Schaufuss from San Mateo and San Francisco, California [MCZC, NHMW]; 2 syntype workers, *C. californica*, California, United States [MNHG]; 1 possible type worker *C. mormonum* (Pergande), Salt Lake, Utah, United States [LACM]; 9 topotype workers *C. mormonum*, Salt Lake, Utah, United States [LACM].

Other material examined: **MÉXICO:** **Baja California**, Guerrero Negro (3 ♀ MCZC), also see Varela-Hernández and Jones (2013, as *C. mormonum*); **Chihuahua**, Madera (3 ♀ CWEM), 23k N Madera (3 ♀ CWEM), Buenaventura, 21k W Las Varas (8 ♀, 1 ♀ CWEM); **Sonora**, Puerto Peñasco (256 ♀ CWEM); **Veracruz**, Chiconquiaco (5 ♀ CWEM). **UNITED STATES:** **Arizona**, **Cochise Co.**, Chiricahua Mountains (52 ♀ CWEM), Portal (8 ♀, 2 ♂ MCZC, 4 ♀ CWEM), 2 mi NE Portal (CWEM), 3mi N Portal (63 ♀ CWEM), 5k N Portal (CWEM), W Turkey Creek 18.7km WSW Portal 1950m (31°51.3'N 109°19.7'W) (18 ♀ STDC), Santa Catalina Mountain, Fenner Canyon (3 ♀ MCZC), Huachuca Mountains, Montezuma Pass (20 ♀ MCZC), **Pima Co.**, 18 mi E Sells (8 ♀ CWEM), A.S.U. lab colony, D. Wheeler lab University of Arizona (26 ♀ COOK), **Santa Cruz Co.**, Santa Rita Mountains, Madera Canyon (CWEM), Pajarito Mountains 8.6mi SW Jct. Rt.289 on FSR39 (31°25.81'N 111°10.78'W, elev. 3550') (20 ♀ MCZC); **California**, without locality (10 ♀ NHMW), **Alameda Co.** Sierra Heights (3 ♀ MCZC), **Mendocino Co.**, rest area near Longvale (38°34'58.2"N,

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare with *cerasi*, *dentinosus*, *mutans*, and *vermiculata*

123°26'37.2"W) (21 ♀ CWEM), **Napa Co.**, Oakville (3 ♀ MCZC), **Orange Co.** Firestone Boy Scout Reservation (1 ♀ CWEM), Tonner Canyon, (3 ♀ CWEM), **Riverside Co.**, Box Springs (5 ♀ CWEM), 22mi E. San Juan Capistrano (30 ♀ CWEM), Rancho Dos Palmas, E of Salton Sea (3 ♀ MCZC), **San Bernardino Co.**, New York Mountains (3 ♀ CWEM), Running Springs (6 ♀ CWEM), **San Diego Co.**, 22mi E San Capistrano Mission (1 ♀ CWEM), Laguna Beach (2 ♀ MCZC), Old Town (4 ♀ MCZC), San Ysidro Canyon (4 ♀ MCZC), **Santa Clara Co.**, Palo Alto (23 ♀ MCZC), Stanford University (6 ♀ MCZC); **Montana**, **Fallon Co.**, 25k SW Baker (12 ♀ CWEM); **New Mexico**, **Catron Co.**, Glenwood (3 ♀ MCZC), **Doña Ana Co.**, 45k NE Las Cruces (13 ♀, 6 ♀, 6 ♂ CWEM), **Grant Co.**, 6.03k E Mule Creek (33°07'31.1"N 108°53'42.2"W) (2 ♀, 1 ♀ CWEM), Gila Mountains, Wright's Cabin (CWEM), **Hidalgo Co.**, Coronado National Forest, Clayton Draw (12 ♀ MCZC), same locality (31°31'22"N; 108° 56'58"W) (7 ♀ CWEM); 53k SW Clayton Draw, Coronado Nat. For., 53.6 K SW (204 degrees) Animas, (31°30'38"N 109°02'14"W) (1 ♀ CWEM), Gray Ranch (6 ♀ CWEM), **Los Alamos Co.**, Los Alamos (9 ♀ CWEM), **Luna Co.**, Deming (4 ♀ CWEM), **San Miguel Co.**, Las Vegas Hot Springs (3 ♀ MCZC), **Santa Fe Co.**, Santa Fe (3 ♀ CWEM), **Socorro Co.**, 8 mi from Highway 107 on Highway 52 (3 ♀ CWEM); **Nevada**, **Clark Co.**, Mount Charleston Wilderness Area (90 ♀ CWEM) **Mineral Co.**, White Mountains, 37.29k W Carson City (108 ♀ CWEM), **Nye Co.**, Belmont Campground (76 ♀ CWEM), Berlin Ichthyosaur State Park (142 ♀, 3 ♂ CWEM) Cactus Range (3 ♀ LACM), **Washoe Co.**, 12.99k NW

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare *coarctata*, *emeryana* and *vermiculata*

Carson City (6 ♀ CWEM), Rye Patch State Park (81 ♀ CWEM), south end Pyramid Lake (2 ♀ MCZC), Winter Creek, 22.19k NW Carson City (2 ♀ CWEM); **Texas**, **Jeff Davis Co.**, Davis Mountains, Madera Canyon Picnic Area (2 ♀ MCZC); **Utah**, **Beaver Co.**, Milford (3 ♀ MCZC), Mineral Mountains (5 ♀, 1 ♂ LACM), Wah Wah Mountains (3 ♀ LACM), **Lake Co.**, Great Salt Lake (19 ♀, 1 ♀, 4 ♂ MCZC), Salt Lake City (9 ♀ LACM), Stanbury Island (5 ♀, 1 ♀ LACM), **Utah Co.** Provo (1 ♀ MCZC); **Wisconsin**, **Ozaukee Co.**, Mequon (1 ♀ STDC, top of mesosoma difficult to see, questionable id).

Etymology: *Coarctata* in Latin *coartātiō* meaning crowding together.

Discussion: The key characteristics of *Crematogaster coarctata* are the intense striate-punctate sculpturing over the entire head and the pronotum being rounded with striae and with some punctures following the curvature of the pronotum. *Crematogaster coarctata* also has a highly variable anterior sternopetiole process. The scape is also of variable length, always at least reaching the posterior border of the head.

The worker of this species is apparently identical to the worker of *Crematogaster mutans* and they are sympatric in distribution. There is a slight difference in the width of the mesosoma of the queens; the width of the mesosoma of *C. coarctata*, viewed from above, is wider than the width of its head and in *C. mutans* the width of the mesosoma is narrower than the width of its head. It is possible that *C. mutans* is a

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare with *cerasi*, *dentinosis*, *mutans*, and *vermiculata*

synonym, but more research on habits must be conducted and more specimens need be collected to be sure.

Crematogaster coarctata can easily be confused with *C. cerasi* and *C. vermiculata*. All three species have 1-5 long flexuous hairs on the pronotal shoulder with similar but not identical sculpturing. Pronotal shoulder sculpturing differs in that *C. cerasi* is more lineolate, *C. vermiculata* is vermiculate and *C. coarctata* is striate-shallowly punctate to areolate in sculpturing. The scape of *C. coarctata* always reaches the posterior border of head and often surpasses it; the scape of *C. vermiculata* is shorter but can reach the posterior border of head; the scape of *C. cerasi* extends about the first funicular segment past the corner. The head of *C. coarctata* is shiny medially to very and completely punctate in neat longitudinal rows, appearing as striolae, while *C. vermiculata* has a shiny head. The head of *C. cerasi* is mostly smooth and glossy, especially medially. The propodeal spines of *C. coarctata* and *C. vermiculata* are always long and straight while *C. cerasi* has reduced to medium length spines with the upper edge sinuous when viewed from the side.

It can be difficult to separate *C. coarctata* workers from those of *C. dentinodis*. The size, sculpture and color are nearly identical. The lack of development of spines or angles on the posterior lateral corners of the petiole usually works, but sometimes tiny angles are present in that position of workers of *C. coarctata*. It is important to collect a large series of different sized workers, and sometimes arbitrarily decide to which species specimens belong.

Emery (1895) described *C. mormonum* a variety of *C. lineolata* subspecies *coarctata*. In his list of *Crematogaster*, Wheeler (1919)

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare *coarctata*, *emeryana* and *vermiculata*

raised *C. coarctata* to species and listed *C. mormonum* as a variety. Creighton (1950) stated that he had not seen intergrades between *C. coarctata* and *C. mormonum* and raised *C. mormonum* to species status. The differences between them have to do with longer scapes that surpass the head by at least the length of the first funicular segment in *C. mormonum* and less than the first segment in *C. coarctata* (Creighton, 1950, in key), or in difference in sculpturing of the head (Buren, 1968, in key) in which the head of the worker of *C. coarctata* is striato-punctate whereas the head of *C. mormonum* is smooth and shining behind the eyes or with only weak striation. There is so much variability in the first character, depending on the size of the worker (Creighton, 1950) and in the sculpturing of the head in many species of *Crematogaster*, even within some single series, to render both characters worthless. In comparing workers of type material of *C. coarctata*, to material labeled “possible type” and topotypes of *C. mormonum* from Salt Lake, Utah from the LACM, we find no significant differences. Both taxa share the same sculpturing on the head consisting of deep striae below the eyes fading to shiny punctate medially; and longitudinally striate-shallowly punctate to areolate sculptured on the mesosoma. All have the scape at least reaching the posterior border of head to variable lengths past the border. The most interesting feature of these ants is the highly variable anterior sternopetiolar process. All have it and within a single nest series the variability can be from a slight nub to a well-developed and pointed process. Based on this evidence we consider *C. mormonum* to be a synonym of *C. coarctata*.

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare with *cerasi*, *dentinosis*, *mutans*, and *vermiculata*

We have also compared workers of *C. lineolata* to the possible type of *C. mormonum* and observed differences in sculpturing and pilosity. The pronotal sculpturing and pilosity on *C. lineolata* is lineolate with many short bristle like hairs on the pronotum, *C. mormonum* differs in sculpturing with longitudinal rugae and 1-5 long flexuous erect hairs on the pronotum. They are clearly not the same taxon. Pilosity of the pronotal shoulder of *C. coarctata* is also variable, 1-5 long flexuous hairs, with 1-2 being the most common number.

Crematogaster lineolata subspecies *laeviuscula* var. *californica* was described by Emery in 1895. Creighton (1950) considered it to be a synonym of *C. coarctata*. Smith (1951) raised *C. californica* to species and Buren (1968) maintained this position in his key. We compared type workers of *C. coarctata* and *C. californica*, they appear to be essentially identical, and based on the lack of other evidence, and the arguments in Creighton (1950), we agree with Creighton that *C. californica* is a synonym of *C. coarctata*.

Biology: This common species is usually found in subterranean nests, sometimes with mounds and under stones or occupying downed logs. One nest was thatched (possibly an uninhabited *Formica* nest), others are craterlike in the soil surrounded by seed hulls, possibly abandoned *Pogonomyrmex* nests. They can also be found in cavities in plants and among exposed roots of plants. Brood were collected in nests in April, June, July and August, and sexuals were present in nests in March and July.

Workers forage in open areas on the soil surface diurnally and nocturnally and were collected in pitfall traps, and at Vienna sausage

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare *coarctata*, *emeryana* and *vermiculata*

baits on the soil surface and in vegetation. *Crematogaster coarctata* have been observed tending *Hemiargus isola* and visiting extrafloral nectaries on cholla (*Opuntia* sp.) throughout the day, especially in arid habitats. This species has also been observed on saltbush, live oak, pine juniper and other desert shrubs. They collect seeds of the exotic shrub *Cytisus scoparius* in California and removed the eliasome before discarding the remainder of the seed (Bossard, 1991). They are associated with gall inducing aphids (Valenti et al., 1996).

In northern California, they are only present in habitats when the Argentine ant (*Linepithema humile*) was absent (Human and Gordon, 1997). Various beetles are found in nests. It has been collected together with *Genuchinus* (Coleoptera: Scarabaeidae) beetles (Krikken, 1981) and with *Genuchinus ineptus* Horn (Cazier and Statham, 1962).

Crematogaster coarctata is found in a variety of habitats ranging from arid ecosystems to forested habitat. It has been collected in desert shrubland, thorn shrubland, shrubland in the Sonoran Desert of México, mesquite/grassland/creosotebush scrub, big sagebrush and in chaparral. It is common in chaparral vegetation in serpentine and non-serpentine soils (Fisher, 1997). It is the dominant ant in some forested habitats (Wittman et al., 2010, Wittman and Gotelli, 2011). It is found in burned and unburned fen and forest (Ratchford et al., 2005). Mackay and Mackay (unpublished) collected it in pinyon juniper forests with grama grass, oak/juniper grassland, oak woodland, riparian pine/oak forest, riparian Chihuahua pine forest, pines and junipers and in ponderosa pine/Douglas fir forests.

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare with *cerasi*, *dentinosus*, *mutans*, and *vermiculata*

It occurs in several soil types including white sand, light brown, orange to dark brown rocky loam soils, light brown rocky sandy loam, to orange rocky soil.

Holway and Suarez (2006) determined the critical thermal maxima.

coarctata - western US south to central México

Nest in the soil, usually under stones, occasionally in plant cavities

Desert scrub to pine and fir forests

Compare with *distans*

***Crematogaster corvina* Mayr**

Plates 18 and 100; Figs. 18 and 19; Map 6.

Crematogaster corvina Mayr, 1870b: 994, worker, México. Emery, 1922c: 134, combination in *C. (Orthocrema)*. Santschi, 1933: 114, combination in *C. (Neocrema)*.

Description:

Worker: Mandibles shiny, longitudinal striate with decumbent hairs; clypeus slightly longer than wide, longitudinal rugose-striate with 2 erect and several fine appressed hairs, anterior margin convex with slight medial notch and 4 long erect and several short erect hairs; scape failing to reach posterior border of head, with decumbent hairs; head deeply striate-punctate, with fewer than 10 long erect and many fine appressed hairs between eyes.

Mesosoma rugose-punctate with 1 long erect hair on each pronotal shoulder, several around mesonotal boss and 1-3 along lateral propodeal margin to spine, and many appressed hairs; notopropodeal groove very steep and wide with carina along lateral dorsal margin; propodeal spines short and thick at the base, diverging widely (dorsal view).

Petiole rectangular, slightly wider than long, areolate from above, rugose-punctate from side, with 2 long hairs on each posterior lateral corner; postpetiole wider than long, deeply areolate with 6-8

corvina - US (Texas) south to Costa Rica

Nest under tree bark, but nesting sites poorly known

Found in forests, especially riparian habitats

Compare with *distans*

long erect hairs evenly distributed dorsally, hemilobes round ventrally, posteriorly spreading slightly, medial sulcus faint; gaster areolate.

Concolorous dark brown.

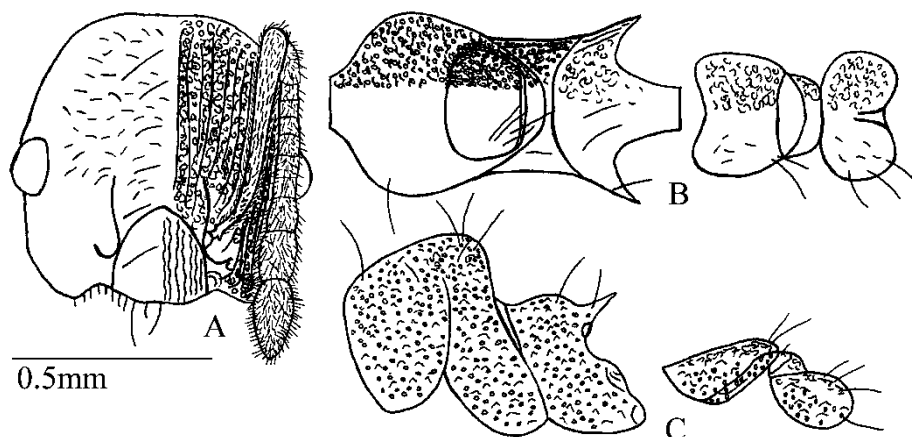


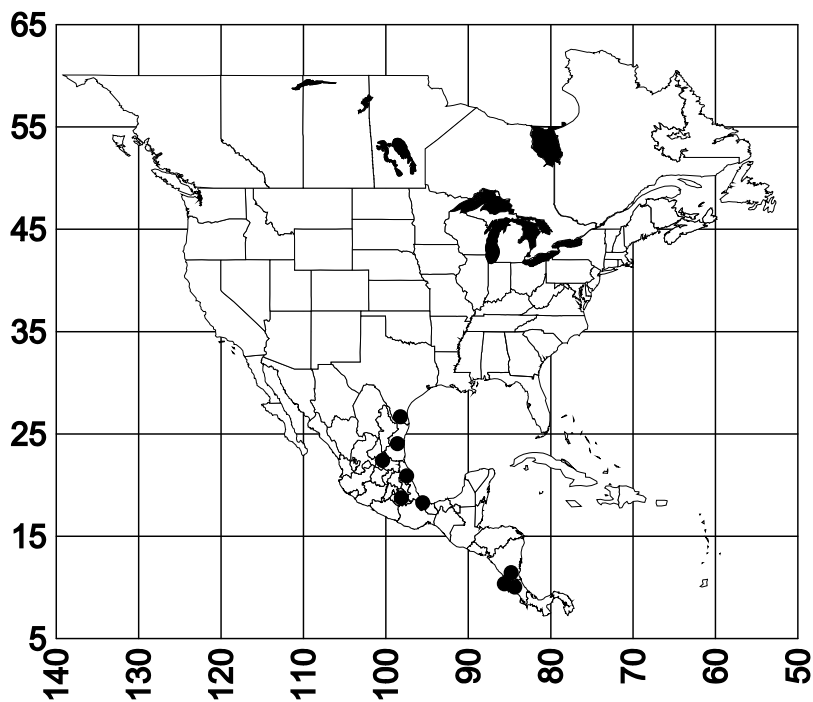
Plate 18. *Crematogaster corvina* worker: (syntype. México NHMW): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Worker measurements (mm): HL 0.62-0.70, HW 0.64-0.78, SL 0.56-0.58, EL 0.13-0.17, ED 0.12-0.13, CL 0.18-0.22, CW 0.18-0.22, WL 0.78-0.85, PSL 0.13-0.17, PL 0.24-0.3, PW 0.24-0.32, PPL 0.13-0.19, PPW 0.28-0.34; Indices: CI 90-97, SI 83-90, CLI 100, PI 94-100, PPI 46-55.

corvina - US (Texas) south to Costa Rica
Nest under tree bark, but nesting sites poorly known
Found in forests, especially riparian habitats

Compare with *distans*

Distribution: Southern Texas to Costa Rica.



Map 6. *Crematogaster corvina*.

Type series: Two syntype specimens collected by Mr. Norton from México, no locality mentioned [NHMW].

Other material examined and literature cited: **MÉXICO:**
Puebla, 10.5 k N Izúcar Matamoros (5 ♀ CWEM); **Veracruz,**

corvina - US (Texas) south to Costa Rica
Nest under tree bark, but nesting sites poorly known
Found in forests, especially riparian habitats

Mirador (3 ♀ MCZC), Tamarindo (3 ♀ MCZC); **Hidalgo** (Vázquez-Bolaños, 2011). **NICARAGUA**: **Granada**, Volcán Mombacho [Finca Progreso] 700m (4 ♀ CWEM); **Río San Juan**, Bartola 5.1mi SE El Castillo, 47m (10°58'22.9"N, 84°20'20.3"W) (20 ♀ CWEM).

Other material not seen: California Academy of Sciences, AntWeb (www.antweb.org): **COSTA RICA**: **Heredia** Braulio Carrillo National Park (JTLC). **MÉXICO**: **San Luis Potosí**, Chupaderos (1 ♀ JTLC); **Tamaulipas**, Linares (LACM); **Veracruz** (1 ♀ NHMB). **UNITED STATES**: **Texas**, Hidalgo Co., Santa Ana National Wildlife Refuge (1 ♀ JTLC).

Etymology: The derivation of *corvina* is from Latin, *corvus* meaning crow or raven, presumably referring to the dark color of this species.

Discussion: The presence of a medium sulcus on the postpetiole, though faint, and the subquadrate petiole are characteristic of this species. Key characters of *C. corvina* are an enlarged, bulging mesonotal boss and reduced propodeal spines. In very small workers of *C. corvina* the eye is round, but in larger workers, the eye is oval-shaped. This species is very punctate everywhere except the gaster.

Crematogaster corvina can be confused with *C. distans*. They can be distinguished by the sculpturing on the head; *C. corvina* is very striate-punctate and *C. distans* is shiny areolate.

Biology: Mackay and Mackay (unpublished) collected it in/under the bark of a tree. A collection was taken by D. Brenes in the

corvina - US (Texas) south to Costa Rica
Nest under tree bark, but nesting sites poorly known
Found in forests, especially riparian habitats

Compare with *distans*

Braulio Carrillo National Park, in Costa Rica, a mosaic of mature wet forest and second growth forest (Longino, www.antweb.org). P. Ward collected *C. corvina* in the Santa Ana National Wildlife Refuge, Hidalgo Co. Texas, which is a semi-dry deciduous forest with low vegetation (Longino, www.antweb.org). It is found in deciduous forest in La Mancha, Veracruz, México (Rojas et al., 2014).

Mackay and Mackay (unpublished) collected it loose on the ground and vegetation, in riparian forest (along an open sewage system), in tropical rain forest, and in an open area along rain forest, adjacent to a river.

It was collected in areas with dark brown clay and clay-loam soils to brown rocky loam.

corvina - US (Texas) south to Costa Rica
Nest under tree bark, but nesting sites poorly known
Found in forests, especially riparian habitats

Compare with *rochai*, *torosa*

***Crematogaster crinosa* Mayr**

Plates 19, 20, 21 and 101; Figs. 1b, 27 and 28; Map 7.

Crematogaster crinosa Mayr, 1862: 767, worker, Rio de Janeiro, Brazil. Mayr, 1887: 626-627, queen, male. Emery, 1922: 134, combination in *C. (Orthocrema)*. Longino, 2003: 49-50: queen.

Crematogaster brevispinosa Mayr, 1870a: 403-404, worker, Santa Fé de Bogotá, Colombia. Santschi, 1918: 182, combination in *C. (Orthocrema)*. Wheeler and Wheeler, 1952: 260, larva. Longino, 2003: 2-3, 49, junior synonym of *C. crinosa*.

Crematogaster brevispinosa var. *minutior* Forel, 1893: 399-400, worker, queen, Brazil. Forel, 1897: 300, race of *C. brevispinosa*. Emery, 1922: 134, combination in *C. (Orthocrema)*. Longino, 2003: 2-3, 49, junior synonym of *C. crinosa*.

Crematogaster brevispinosa var. *schuppi* Forel, 1901c: 299-300, worker, queen, Brazil. Emery, 1922: 134, combination in *C. (Orthocrema) brevispinosa* var. *schuppi*. Longino, 2003: 2-3, 49, junior synonym of *C. crinosa*.

Crematogaster brevispinosa var. *striatinota* Forel, 1912: 211, worker, Río Frio, Magdalena, Colombia. Longino, 2003: 2-3, 49, junior synonym of *C. crinosa*.

Crematogaster brevispinosa var. *recurvispina* Forel, 1912: 212-213, worker, Rio Janeiro, Brazil. Emery, 1922: 134, combination in

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

Compare with *rochai*, *torosa*

C. (Orthocrema). Santschi, 1925b 230, *brevispinosa* var. *recurvispina*. Longino, 2003: 2-3, 49, junior synonym of *C. crinosa*.

Crematogaster brevispinosa var. *sampaioi* Forel, 1912: 213-214, worker, queen, male, Brazil. Emery, 1922: 134, combination in *C. (Orthocrema) brevispinosa* var. *sampaioi*. Longino, 2003: 2-3, 49, junior synonym of *C. crinosa*.

Crematogaster brevispinosa var. *townsendi* Wheeler, 1925: 25, worker, Peru. Longino, 2003: 2-3, 49, junior synonym of *C. crinosa*.

Crematogaster brevispinosa var. *chathamensis* Wheeler 1933a: 58, worker, Chatham Island, Galapagos Islands. Longino, 2003: 2-3, 50, junior synonym of *C. crinosa*.

Descriptions.

Worker: Mandibles smooth, evenly covered with decumbent hair; clypeus slightly wider than long, shiny shallow striate, anterior margin convex with 12 long hairs; scape failing to reach posterior border of head, with decumbent hairs; head shiny shallow striate, evenly covered with decumbent hairs and none to few erect hairs.

Mesosoma with many short erect and decumbent hairs; pronotum with striae following curve of shoulder; medial notopropodeal carina small; humeri and promesonotal suture apparent from breaks in sculpturing; notopropodeal groove steep and angular; propodeal spines short, upturned (seen from the side) and divergent (seen from above).

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

Compare with *rochai*, *torosa*

Petiole, postpetiole and gaster rugose; petiole and postpetiole with several erect hairs on anterior margin; petiole subquadrate, slightly longer than wide, anterior sternopetiole process well developed; postpetiole globular; gaster sparsely but evenly covered with erect hairs.

Color ranges from reddish-brown to dark brown.

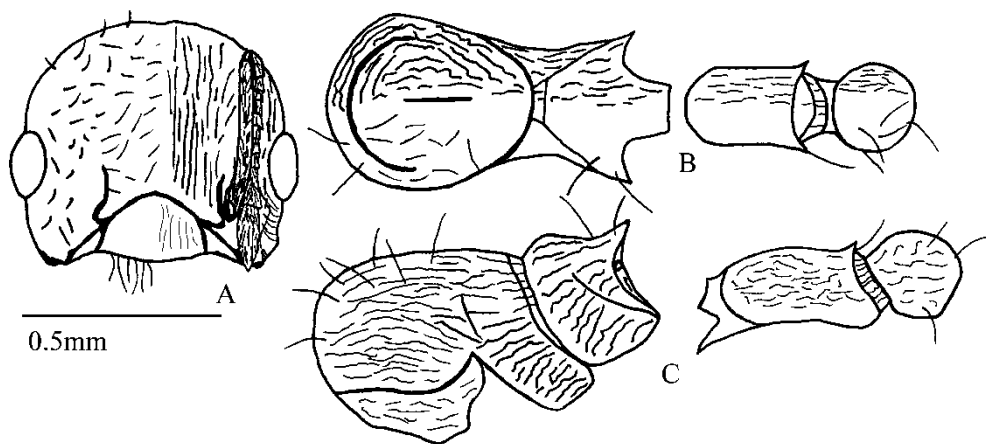


Plate 19. *Crematogaster crinosa* worker: (cotype of *C. brevispinosa* var. *minutior* Forel, Brazil, MCZC): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

Compare with *rochai*, *torosa*

Worker measurements (mm): HL 0.55-0.70, HW 0.62-0.69, SL 0.48-0.50, EL 0.12-0.17, ED 0.10-0.14, CL 0.18-0.26, CW 0.26-0.30, WL 0.68-0.80, PSL 0.10-0.13, PL 0.26-0.30, PW 0.18-0.31, PPL 0.19-0.26, PPW 0.14-0.31; Indices: CI 88-101, SI 71-87, CLI 69-87, PI 97-144, PPI 84-136.

Queen: Mandibles longitudinally striate, with decumbent and appressed hairs; clypeus striate with appressed hair, anterior margin convex with 10 long flexuous hairs; scape just reaching medial ocellus, with appressed and few erect hairs; ocelli small, flush with top of head; head striate following curvature of eyes, with appressed hairs.

Mesosoma shiny areolate, pilosity much like that of worker; dorsellum prominent under scutellum and metanotum, visible viewed dorsally; propodeum punctate; propodeal spines blunt poorly developed.

Petiole subquadrate, deeply areolate, with 1 long erect hair on each posterior lateral corner; postpetiole globular, very shiny with few short fine erect hairs pointed posteriorly; gaster shiny areolate, with erect and appressed hairs in rows on each tergum.

Color reddish-brown.

Queen measurements (mm): HL 1.13-1.26, HW 1.61-1.40, SL 0.66-0.88, EL 0.37-0.47, ED 0.29-0.36, CL 0.37-0.41, CW 0.47-0.48, WL 2.14-2.28, PSL 0.12-0.14, PL 0.71-0.72, PW 0.40-0.55, PPL 0.35-0.41, PPW 0.55-0.64; Indices: CI 70-90, SI 58-70, CLI 79-85, PI 178-131, PPI 64-65.

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

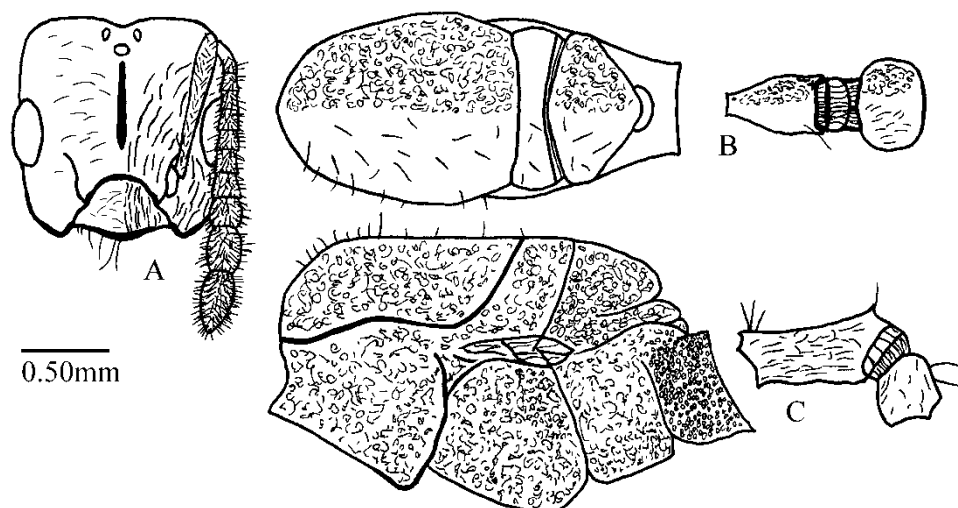
Compare with *rochai*, *torosa*

Plate 20. *Crematogaster crinosa* queen: (Jalisco, México, CWEM # 19216): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma and petiole.

Male: Clypeus longitudinally striate with few erect hairs, anterior margin straight with 8-10 long hairs; scape typical; ocelli prominently protruding from top of head; head shiny rugose with many short erect hairs.

Mesosoma areolate with sparse short erect hairs evenly distributed; dorsellum visible viewed from above.

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

Compare with *rochai*, *torosa*

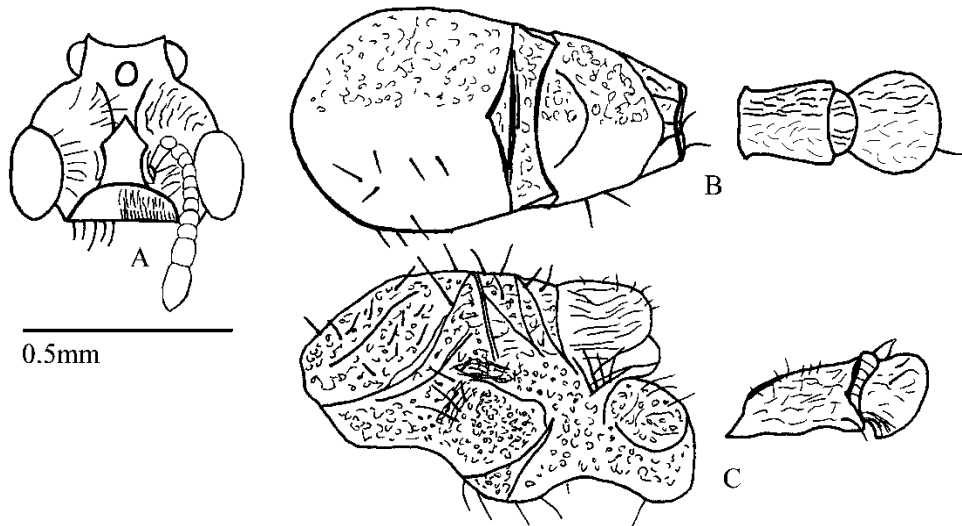


Plate 21. *Crematogaster crinosa* male: (Jalisco, México, CWEM # 19216): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Petiole and postpetiole rugose with short erect hairs; gaster areolate with few short erect hairs.

Color light yellow to reddish-brown.

Male measurements (mm): HL 0.42-0.74, HW 0.53-0.85, SL 0.12-0.22, EL 0.30-0.43, ED 0.28-0.40, CL 0.11-0.22, CW 0.22-0.41,

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

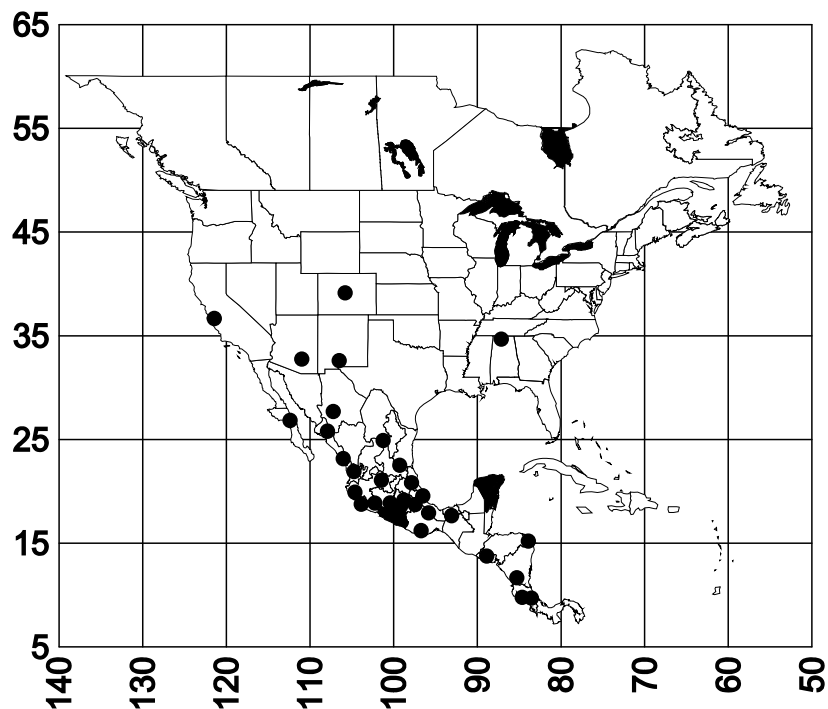
Arid ecosystems to tropical forests

crinosa

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Compare with *rochai*, *torosa*

WL 1.18-2.08, PL 0.36-0.54, PW 0.20-0.35, PPL 0.17-0.26, PPW 0.24-0.38; Indices: CI 79-87, SI 28-30, CLI 49-50, PI 154-180, PPI 68-71.



Map 7. *Crematogaster crinosa*.

Distribution: The range of this species is extensive from southern USA, south through México, Guatemala (Branstetter and Sáenz, 2012) Central America to Brazil (Nakayama Miranda et al., 2012), Bolivia and Argentina (Vittar and Cuezco, 2008).

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

Compare with *rochai*, *torosa*

Type series: Type from Rio de Janeiro, Brazil. Cotype worker of *Crematogaster brevispinosa* var. *minutior* Forel, Brazil; *C. brevispinosa* subsp. *townsendi* Wheeler, W. M., Perú.

Other Material examined and literature cited: **BOLIVIA:** **Santa Cruz**, Las Gammas (1 ♀, 2 ♂ MCZC), Pampa Grande (2 ♀, 1 ♀ MCZC). **BRAZIL:** **Amazonas**, Benjamin Constant (3 ♀ LACM, see also Cruz de Oliveira (2013); **São Paulo**, Rio Claro (2 ♀ CWEM). **COLOMBIA:** **Antioquia**, Caucaasia (2 ♀ CWEM), Turbo (3 ♀ CWEM), additional data in Vergara-Navarro and Serna (2013); **César**, Aguachica (5 ♀ CWEM), Valledupar (3 ♀ CWEM), El Copey (1 ♀ CWEM); **Cundinamarca**, Fusagasugá (12 ♀ CWEM); **Guajira**, Riohacha (4 ♀ CWEM); **Huila**, 8k N Neiva (2 ♀ CWEM), 14k N Neiva (3 ♀ CWEM) Rivera (3 ♀ CWEM); **Magdalena**, Aracataca (13 ♀ CWEM); **Meta**, Puerto López (3 ♀ CWEM), Porvenir (3 ♀ CWEM); **Norte de Santander**, Cúcuta (2 ♀, 1 ♂ CWEM); **Sucre**, Sincelejo (2 ♀ CWEM); **Tolima**, Ibagué (1 ♀ CWEM); **Valle**, Sevilla (9 ♀, 2 ♂ CWEM). **COSTA RICA:** **Puntarenas**, 2k NE Alturas, Estación Biológica Alturas (CWEM), Estación Biológica Las Cruces (CWEM), Cerro Helado 17k NE Rincón (8°45'30"N, 83°25'00"W) (1 ♀ CWEM), 10k W Rincón, Fundación Neotrópica (28 ♀, 2 ♂ CWEM), Guacimal 4500m (10°13'N 84°51'W) (2 ♀ LACM); **San José**, (3 ♀ MCZC) Pan Alturas, 19k N San Isidro (19 ♀ CWEM). **EL SALVADOR:** **Libertad**, La Libertad, San Andres (4 ♀ CWEM).

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

Compare with *rochai*, *torosa*

MÉXICO: Baja California Sur, San José del Cabo (21 ♀ COOK); Chihuahua, Terrero (1 ♀ CWEM); Colima, 39k N Colima (19° 28'0.41"N, 103°27'31"W) (1 ♀, 1 ♀, 1 ♂ CWEM), (13 ♀, 10 ♀, 10 ♂ CWEM); Jalisco, Ameca (2 ♀ CWEM), 39k N Guadalajara (12 ♀, 10 ♀, 9 ♂ CWEM); Morelos, Cocoyotla (1 ♀ CWEM), Cuernavaca (2 ♂ MCZC), La Calera (27 ♀ CWEM); Nayarit, 12.8k S Caponeta (3 ♀, 1 ♀ CWEM), Tepic (21°30'0.06"N, 104°55'25"W) (6 ♀ CWEM); Sinaloa, Esquinaba (22°49'0.58"N, 105°46' 54"W) (3 ♀ CWEM), Guasave Park by Río (25°34'0.37"N, 108°27'18"W) (6 ♀ CWEM), 132k N Mazatlán 1k N El Aviión (24°10'0.16"N, 107°01'02"W) (7 ♀ CWEM); Tabasco, Tabasco (3 ♀ CWEM), 13k W Border Chiapas, Rt. 186 (3 ♀ CWEM); Tamaulipas, Antiguo Morelos (2 ♀ CWEM); Veracruz, Tierra Blanca (1 ♀ CWEM), Jalapa (4 ♀ CWEM), Chiapas; Guerrero; Oaxaca; Quintana Roo; Hidalgo; Yucatán (Alatorre-Bracamontes and Vázquez-Bolaños, 2010; Vázquez-Bolaños, 2011; Coronado-Blanco et al., 2013). **NICARAGUA:** Granada, Domitila, 4.3mi N Pica Pica (8 ♀, 1 ♀ CWEM). **PERU:** Peru Islands (3 ♀ LACM). **UNITED STATES:** Alabama, Madison Co., Montesano Park (3 ♀ CWEM); Arizona, Pima Co., Catalina State Park Campground (3 ♀ CWEM); California, San Francisco Co., San Francisco Coast (4 ♀ MCZC); Colorado, Teller Co., Cripple Creek (2 ♀ CWEM).

Etymology: *Crinosa* from Latin *crinis* meaning hair.

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

Compare with *rochai*, *torosa*

Discussion: The key characteristics of the *Crematogaster crinosa* worker are the developed anterior sternopetiole process, short upturned propodeal spines, and the dorsum of the head is evenly covered with appressed pubescence and few erect hairs.

This species can be confused with *C. torosa* and *C. rochai*. One distinguishing character is the anterior sternopetiole process; on *C. crinosa* it is less developed than that of *C. rochai* and more developed than that of *C. torosa*. The gaster of *C. crinosa* is evenly covered with short erect hairs, *C. rochai* has few to no erect hairs on the gaster and *C. torosa* has erect hairs along a wide margin of the gaster. This is a small continuously polymorphic species that is mostly reddish-brown to dark brown in color.

Biology: *Crematogaster crinosa* is a cosmopolitan species most often found in dryer habitats, but can be found in the canopy of wet forests (Longino, 2003; Yanoviak and Kaspari, 2000). Nests are found in twigs, living tree cavities with termites and in beetle burrows and in the soil as well as under stones (Mackay and Mackay, unpublished). Colonies are large, polydomous and will occupy live or dead branches, fence posts or any cavity in a tree (Longino, 2003). This species does not build external carton chambers, but will use carton inside the chambers or to restrict openings (Longino, 2003). It nests in trees (Pringle and Gordon, 2013), where they are very common in Chamela, Jalisco, México (Castaño-Meneses, 2014). They also nest in the orchid *Caularthron bilamellatum* in Panama as well as in dead wood (Yanoviak et al., 2011) and live in domatia of *Cordia gerascanthus* in

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

Compare with *rochai*, *torosa*

Costa Rica (Tillberg, 2004a). They are the most common inhabitants in the pseudobulbs of the myrmecophilic orchid *Caularthron bilamellatum* (Gegenbauer et al., 2012).

Brood were found in nests in June (México, USA) and December (Colombia), sexuals in December (Colombia) (Mackay and Mackay, unpublished).

Crematogaster crinosa was found in shrubs and grassland in La Mancha, Veracruz, México (Rojas et al., 2014), in eucalyptus forests in Brazil (Lutinski et al., 2008), and associated with *Prosopis ruscifolia* in Argentina (Fuster, 2012). *Crematogaster crinosa* was found in natural vegetation as well as logged areas and areas with natural tree falls in the state of Acre, Brazil (Miranda et al., 2013). It is frequently collected in urban areas with more trees (Coriolano et al., 2014; Estrada et al., 2014). Mackay and Mackay (unpublished) found specimens in desert mesquite scrub, on partially dead mesquite (*Prosopis glandulosa*) trees near Tucson, in grasslands, riparian grassland with oaks and pines, oak forest, juniper/grassland habitat, lowland tropical forest, cloud forest, ridge forest, upper montane tropical oak, wet cloud forest and disturbed burned areas.

Crematogaster crinosa is omnivorous, feeding on dead insects, extrafloral nectaries, carries membracids and tends homopterans (Mackay and Mackay, unpublished). They are predators on the coffee pest *Hypothenemus hampei* in Costa Rica (Varón et al., 2004). It has been collected loose on ground, loose in vegetation and in litter extractions (Mackay and Mackay, unpublished).

It is found in areas with reddish brown clay soil, light brown to

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

Compare with *rochai*, *torosa*

red clay loam, brown sand, to red gravel (Mackay and Mackay, unpublished).

Deyrup (2017) includes details on the biology and distribution of this species as well as comparisons with other species occurring in Florida.

crinosa - US (southern) south to Bolivia and Argentina

Nests in plant cavities, occasionally under stones

Arid ecosystems to tropical forests

Compare with *longispinosa*, *nigropilosa*

***Crematogaster curvispinosa* Mayr**

Plates 4 F, 22, 23, 24 and 102; Fig. 22; Map 8.

Crematogaster curvispinosa Mayr, 1862: 768, worker, Rio Janeiro, Brazil Forel, 1911: 301, queen. Forel 1912: 216, male. Emery 1922: 134, combination in *C. (Orthocrema)*. Longino, 2003: 55, worker and queen.

Crematogaster curvispinosa var. *antillana* Forel, 1893b: 399, worker, Río Frio, Santa Lucia, Colombia. Forel, 1912: 216, queen. Emery, 1922: 134, combination in *C. (Orthocrema)*. Longino, 2003: 2-3, 55, junior synonym of *C. curvispinosa*.

Crematogaster sculpturata Pergande, 1896: 876-877, worker, Tepic, México Emery, 1922: 136, combination in *C. (Orthocrema)*. Wheeler 1934c: 171-173, worker. Longino, 2003: 2-3, 55, junior synonym of *C. curvispinosa*.

Crematogaster curvispinosa var. *kemali* Santschi, 1923: 250, worker, Santa Catarina, Brazil. Longino, 2003: 2-3, 55, junior synonym of *C. curvispinosa*.

Crematogaster fuliginea Santschi, 1925b: 231-232, worker, Minas Gerais, Brazil. Santschi 1929b: 88, junior synonym of *C. curvispinosa*.

Crematogaster curvispinosa var. *obscura* Santschi, 1929a: 293,

curvispinosa - USA (Florida) south to Brazil and Paraguay
Arboreal species nesting in twigs, stems and plant cavities
Found in forests, as well as urban habitats

Compare with *longispinosa*, *nigropilosa*

worker, Jujuy, Argentina. Longino, 2003: 2-3, 55, junior synonym of *C. curvispinosa*.

Crematogaster sculpturata subsp. *accola* Wheeler 1934c: 175, worker, Mirador, México, Longino, 2003: 2-3, 55, junior synonym of *C. curvispinosa*.

Crematogaster sculpturata subsp. *phytoaca* Wheeler, 1934c: 173-175, worker, queen and male, Mirador, México. Longino, 2003: 2-3, 55, junior synonym of *C. curvispinosa*.

Crematogaster curvispinosa var. *panamana* Wheeler, 1942: 195, worker and queen, Panama. Longino, 2003: 2-3, 55, junior synonym of *C. curvispinosa*.

Descriptions:

Worker: Mandibles shiny, with semierect hairs; clypeus slightly longer than wide, longitudinally striate and with appressed hair, anterior margin slightly convex with 6 long hairs; scape failing to reach posterior border of head, with many semierect or decumbent hairs and few scattered erect hairs; head shiny, evenly but sparsely covered with erect hair.

Mesosoma shiny varicose with 6 erect and few semierect hairs as viewed from above, areolate from side; humeri developed; notopropodeal groove well developed; propodeal suture proportionally wide for overall size, declivity steep and angular; propodeal spines long, slender, thickening at base, pointing almost straight back (viewed from above).

Petiole and postpetiole areolate; petiole flat dorsally, almost

curvispinosa - USA (Florida) south to Brazil and Paraguay

Arboreal species nesting in twigs, stems and plant cavities

Found in forests, as well as urban habitats

Compare with *longispinosa*, *nigropilosa*

quadrate, slightly longer than wide with 2 erect hairs on each posterior lateral corner, anterior sternopetiole process well developed; postpetiole almost round (viewed from above) with 6 erect hairs; petiole wider and longer than postpetiole; gaster shiny and shallowly areolate with evenly spaced erect hairs.

Concolorous brown.

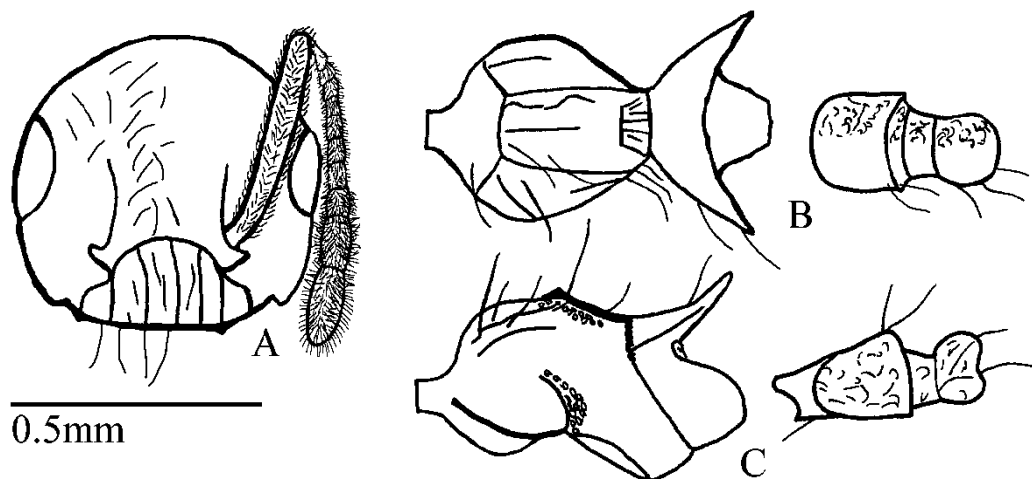


Plate 22. *Crematogaster curvispinosa* worker: (point second from the top of cotype of *Crematogaster curvispinosa* var. *panamana* Wheeler, MCZC): (A) Head (pilosity is shown on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

curvispinosa - USA (Florida) south to Brazil and Paraguay

Arboreal species nesting in twigs, stems and plant cavities

Found in forests, as well as urban habitats

Compare with *longispinosa*, *nigropilosa*

Worker measurements (mm): HL 0.54-0.62, HW 0.58-0.62, SL 0.47-0.52, EL 0.12-0.16, ED 0.10-0.12, CL 0.17-0.22, CW 0.18-0.24, WL 0.58-0.67, PSL 0.16-0.23, PL 0.16-0.18, PW 0.14-0.17, PPL 0.12-0.13, PPW 0.14-0.17; Indices: CI 93-100, SI 87-84, CLI 92-94, PI 105-141, PPI 76-86.

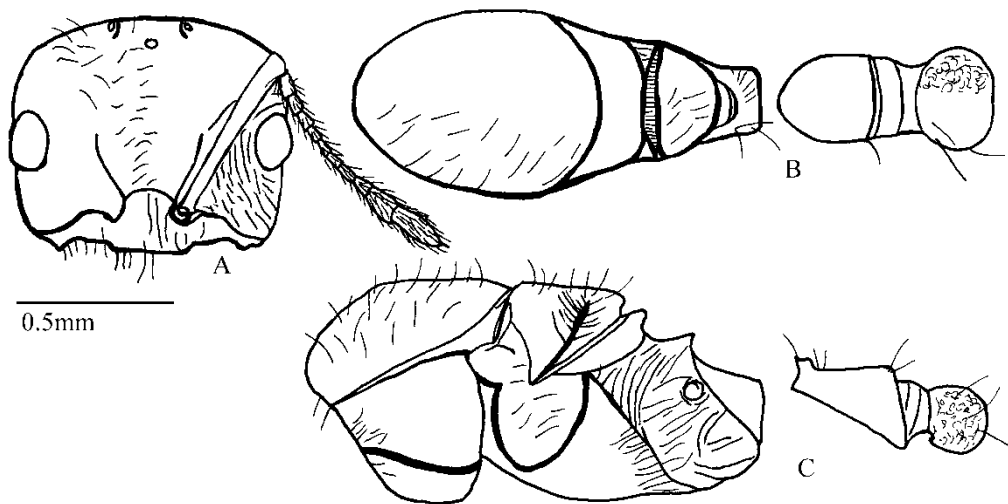


Plate 23. *Crematogaster curvispinosa* queen: (cotype of *C. curvispinosa* var. *panamana*, second point from top, Tumba Muerto, Panama, MCZC): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

curvispinosa - USA (Florida) south to Brazil and Paraguay
 Arboreal species nesting in twigs, stems and plant cavities
 Found in forests, as well as urban habitats

Compare with *longispinosa*, *nigropilosa*

Queen: Mandibles shiny, with semierect hairs; clypeus shiny with semierect hairs, anterior margin slightly concave with 4 long and several short hairs; scape failing to reach posterior border of head, with semierect hairs; ocelli typical; head shiny, shallowly lineolate around eye and antennal insertions, evenly but sparsely covered with short semierect hairs and fewer than 10 long erect hairs.

Mesosoma shiny viewed from above, with evenly spaced short erect hairs; dorsellum seen from above; propodeal spines simply nubs; mesopleuron with few longitudinal lineolae.

Petiole and postpetiole areolate with appressed hairs; petiole subquadrate, with 2 long hairs on posterior lateral corners; anterior sternopetiole process small; postpetiole globular with several long hairs on dorsal surface; petiole longer but narrower than postpetiole; gaster areolate, evenly covered with short erect and appressed hairs.

Concolorous brown to very dark brown.

Queen measurements (mm): HL 0.75-0.82, HW 0.86-0.97, SL 0.55-0.61, EL 0.22-0.26, ED 0.18-0.22, CL 0.25-0.29, CW 0.23-0.30, WL 1.44-1.62, PSL 0.02-0.03, PL 0.36-0.42, PW 0.26-0.35, PPL 0.24-0.30, PPW 0.31-0.37; Indices: CI 84-87, SI 73-74, CLI 97-109, PI 120-138, PPI 77-81.

Male: Mandibles creamy white, tiny, covered with semierect hairs; clypeus slightly wider than long, anterior margin slightly

curvispinosa - USA (Florida) south to Brazil and Paraguay
Arboreal species nesting in twigs, stems and plant cavities
Found in forests, as well as urban habitats

Compare with *longispinosa*, *nigropilosa*

concave, with 4 long hairs; scape with 2 – 3 erect hairs and abundant bristly suberect hairs; ocelli protruding from head; head shiny with few erect hairs.

Entire mesosoma shiny, with few erect hairs; promesonotal suture very well developed; dorsellum hidden by scutellum when viewed from above.

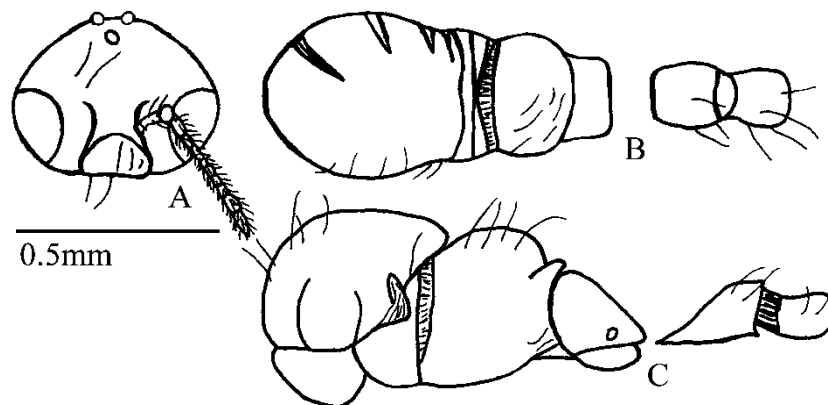


Plate 24. *Crematogaster curvispinosa* male: (*C. curvispinosa* var. *panamana*, third and fourth point from top, Tumba Muerto, Panama, MCZC): (A) Head (pilosity is shown on left); (B) Dorsal view of mesosoma, petiole and postpetiole (pilosity is shown on bottom); (C) Side view of mesosoma, petiole and postpetiole.

curvispinosa - USA (Florida) south to Brazil and Paraguay
 Arboreal species nesting in twigs, stems and plant cavities
 Found in forests, as well as urban habitats

curvispinosa

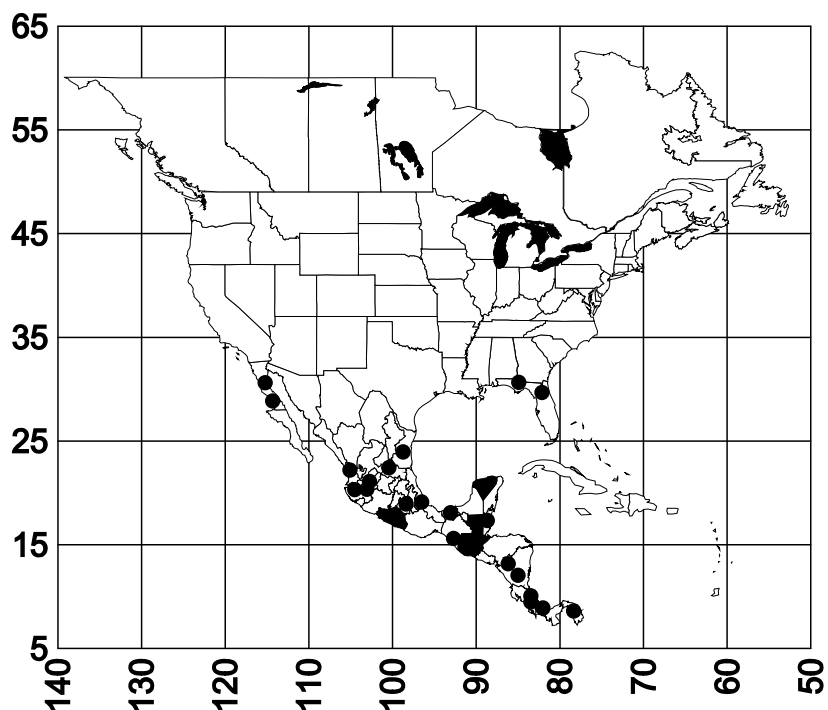
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Compare with *longispinosa*, *nigropilosa*

Petiole, postpetiole and gaster shiny with few erect hairs; petiole subquadrate; postpetiole almost square.

Concolorous amber.

Male measurements (mm): HL 0.35-0.45, HW 0.44-0.54, SL 0.06-0.08, EL 0.14-0.22, ED 0.12-0.17, CL 0.11-0.17, CW 0.17-0.19, WL 0.89-0.94, PL 0.12-0.17, PW 0.12-0.17, PPL 0.11-0.13, PPW 0.10-0.17; Indices: CI 80-83, SI 17-19, CLI 65-89, PI 100, PPI 76-110.



Map 8. *Crematogaster curvispinosa*.

curvispinosa - USA (Florida) south to Brazil and Paraguay

Arboreal species nesting in twigs, stems and plant cavities

Found in forests, as well as urban habitats

Compare with *longispinosa*, *nigropilosa*

Distribution: *Crematogaster curvispinosa* has been collected in México, Guatemala (Branstetter and Sáenz, 2012), Guiana (Hossaert-McKay et al., 2001) south into Brazil (Schütte et al., 2007; Pereira de Souza et al., 2012) in the state of Rondônia (Felizardo and Harada 2007) and Paraguay (Wild, 2007). It is also found in the USA in Gadsden and Alachua counties, Florida (Whitcomb et al., 1972).

Type series: Five workers, 2 queens and 1 male all syntypes [NHMW]. One cotype worker of *Crematogaster curvispinosa* var. *panamana* Wheeler [MCZC].

Other material examined and literature cited: **BELIZE:** **Orange Walk**, Lamanai (1 ♂ CWEM). **COLOMBIA:** **Antioquia** (Vergara-Navarro and Serna, 2013); **Caquetá**, Puerto Rico (2 ♂ CWEM); **Cundinamarca**, Anolaima (10 ♂, 3 ♀ CWEM), Bridge Quebrada Blanca (3 ♂ CWEM); **Huila**, La Plata (29 ♂, 1 ♀ CWEM), Rivera (13 ♂ CWEM), Neiva (2 ♂ CWEM); **Meta**, El Castillo (23 ♂, 1 ♀, 5 ♂ CWEM), 65k E Puerto López (11 ♂, 3 ♀ CWEM); **Valle del Cauca**, Sevilla (2 ♂ CWEM), Yotoco (CWEM), see also Achury et al., 2008,. **COSTA RICA:** **Limón**, Matina, (1 ♂ MCZC); **Puntarenas**, Corcovado National Park (1 ♂ MCZC). **ECUADOR:** **Los Rios**, Jaunes, Moche (3 ♂ CWEM); **Pichincha**, Maquipucuna (4 ♂, 1 ♀ MCZC). **MÉXICO:** **Baja California** (2 ♂ CWEM); **Chiapas**, Tapuchula (4 ♂ CWEM); **Morelos**, Cuernavaca (2 ♂ MCZC); **San Luis Potosí**, Tamazunchale (10 ♂, 4 ♀ CWEM); **Tamaulipas**, Gómez Farías (CWEM), Los Cedros at Gómez Farías (31 ♂ COOK);

curvispinosa - USA (Florida) south to Brazil and Paraguay
 Arboreal species nesting in twigs, stems and plant cavities
 Found in forests, as well as urban habitats

Compare with *longispinosa*, *nigropilosa*

Guerrero; **Hidalgo**; **Michoacán**; **Nayarit**; **Veracruz**; **Yucatán** (Vázquez-Bolaños, 2011); **Tabasco** (del Toro et al., 2009), **Jalisco** (Pringle and Gordon, 2013). **NICARAGUA**, **Granada**, Volcán Mombacho (CWEM). **PANAMA**, **Panamá**, Bella Vista (4 ♀ MCZC), Parque Gamboa (1 ♀ CWEM).

Etymology: *Curvispinosa* from Latin *curvus* meaning to bend and *spinus* meaning thorny, referring to curved propodeal spines.

Discussion: A key characteristic of *Crematogaster curvispinosa* is its long slender spines that curve slightly upwards.

This species can be confused with *C. longispinosa* and *C. nigropilosa* with their long slender spines; however, close examination of the sculpturing on the dorsum of the mesosoma can easily distinguish *C. curvispinosa* as varicose, *C. longispinosa* is shiny and *C. nigropilosa* has evenly spaced carina along the pronotal shoulder and the mesonotum is shiny.

Biology: *Crematogaster curvispinosa* prefers underbrush and disturbed areas (Longino, www.antweb.org). Longino states colonies are small and reproductive structure can vary with ergatogynes present. Nests can be found in dead grass stalks, narrow vine stems and single chambers of ant-plants (Longino, www.antweb.org). Some laboratory observations by Longino (www.antweb.org) are quite interesting. He states he collected a nest consisting of workers, brood and one ergatogyne to maintain in his laboratory. This colony did not

curvispinosa - USA (Florida) south to Brazil and Paraguay
Arboreal species nesting in twigs, stems and plant cavities
Found in forests, as well as urban habitats

Compare with *longispinosa*, *nigropilosa*

receive much attention except for sporadic feedings and observations. After a year, the ergatogyne had died; however, the colony had recovered, producing workers, queens and males (Longino, www.antweb.org).

It is an arboreal ant (Delabie et al., 2007; Lozano-Zambrano et al., 2009; Pringle and Gordon, 2013), which nests in twigs and stems of live plants (Tillberg, 2004b) and under logs (Schmid, 2010), as well as in mesophilic hammocks (Whitcomb et al., 1972). *Crematogaster curvispinosa* is very common in the Valle del Río Cauca in Colombia (Chacón de Ulloa et al., 2012). Mackay and Mackay (unpublished) found it in a termite mound (with several other ant species), in a large dirt filled cocoon (Lepidoptera), as well as in/under the bark of a living guayaba tree and a living caracolí-like tree. It is usually a rather sluggish species.

Brood were found in nests in July (Nicaragua), September (México) and December (Colombia), sexuals in September (México) and December (Colombia) (Mackay and Mackay, unpublished).

It is attracted to honey and sardine baits (Pereira de Souza et al., 2012; Souza da Conceição et al., 2015) and came to termite baits placed on the surfaces of leaves (Tillberg, 2004b). It visits the inflorescences of the bromeliad *Aechmea lindenii* (Schmid, 2010) and inhabits the domatia of *Cordia alliodora* with coccids and enriches the domatia with more than 3 other ant species and is the least expensive to the host plant (Tillberg, 2004b).

It is found in a variety of habitats including grassland near trees, second growth forest, tropical rain forest (Mackay and Mackay,

curvispinosa - USA (Florida) south to Brazil and Paraguay

Arboreal species nesting in twigs, stems and plant cavities

Found in forests, as well as urban habitats

Compare with *longispinosa*, *nigropilosa*

unpublished), deciduous and subdeciduous forests in La Mancha, Veracruz, México (Rojas et al., 2014), as well as coffee plantations in Costa Rica (Barbera et al., 2004). It is more frequent in urban areas with more trees in the state of Rio de Janeiro, Brazil (Coriolano et al., 2014).

Crematogaster curvispinosa can be found in dark brown clay, dark brown sandy-loam, loam and rocky loam (Mackay and Mackay, unpublished).

curvispinosa - USA (Florida) south to Brazil and Paraguay
Arboreal species nesting in twigs, stems and plant cavities
Found in forests, as well as urban habitats

Compare with *depilis*, *opaca*, *punctulata*

***Crematogaster dentinodis* Forel**

Plates 25, 26 and 103; Figs. 12 and 13; Map 9.

Crematogaster opaca var. *dentinodis* Forel, 1901a: 130, worker, Querétaro, México; Smith, D. R. 1979: 1379, raised to species. Buren, 1968: 91-121, combination in *C.* (*Crematogaster*).

Descriptions:

Worker: Clypeus wider than long, shiny, with shallow longitudinal striae, anterior margin slightly convex with slight medial notch, and many long erect hairs; scape reaching posterior border of head and evenly covered with decumbent hairs; head punctate-reticulate, evenly covered with appressed hair and sparsely covered with short erect hair.

Mesosoma deeply punctate-areolate, with few appressed hairs, 1-3 erect hairs on each pronotal shoulder and with well-developed humeri; medial mesonotal carina small; notopropodeal groove angular and narrow; propodeal spines medium length, stout, thickened at base, divergent (viewed from above).

Petiole and postpetiole punctate; petiole angularly trapezoidal, with anterior lateral corners flaring up when viewed from behind, each posterior lateral corner with tiny tooth (often very difficult to see) and one long hair, several erect hairs on anterior margin and appressed hairs on sides.

dentinodis - USA and México

Nests in soil, usually under stones, sometimes in stumps, logs or hollow twigs

Desert scrub, grasslands or arid forest habitats

Compare with *depilis*, *opaca*, *punctulata*

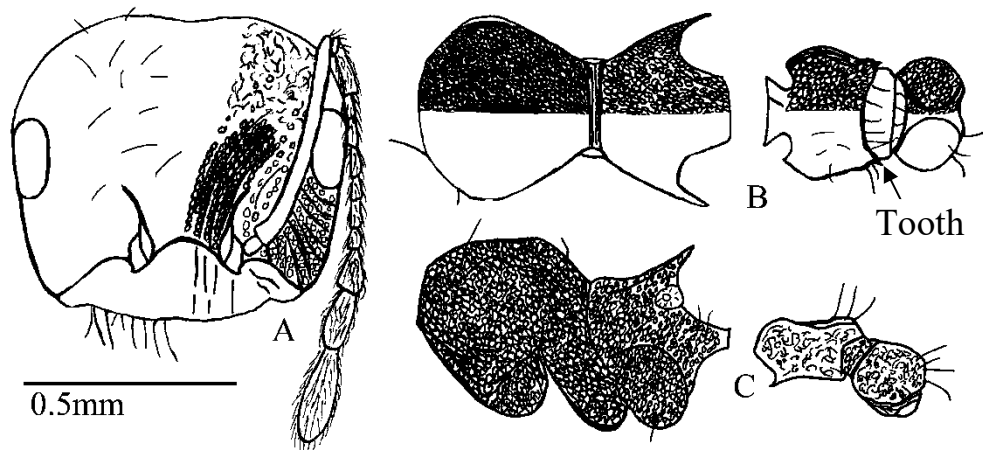


Plate 25. *Crematogaster dentinodis* worker: (Querétaro, México MCZC): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Anterior sternopetiole process pointed but variable in development, size and shape in type series; hemilobes of postpetiole slightly longitudinally elongate, spreading slightly posteriorly, with 3 erect hairs on each lobe pointed posteriorly; petiole wider and longer than postpetiole; gaster shallowly areolate, with several erect hairs in rows in middle of each of last 4 terga, appressed hairs sparsely covering remainder of gaster.

Concolorous reddish brown.

dentinodis - USA and México

Nests in soil, usually under stones, sometimes in stumps, logs or hollow twigs

Desert scrub, grasslands or arid forest habitats

Compare with *depilis*, *opaca*, *punctulata*

Worker measurements (mm): HL 0.66-0.84, HW 0.68-0.91, SL 0.62-0.70, EL 0.18-0.20, ED 0.14-0.19, CL 0.22-0.24, CW 0.24-0.30, WL 0.73-0.97, PSL 0.13-0.19, PL 0.16-0.22, PW 0.28-0.34, PPL 0.17-0.20, PPW 0.25-0.31; Indices: CI 92-97, SI 88-94, CLI 80-92, PI 57-64, PPI 65-68.

Queen: Mandibles latitudinal striate; clypeus wider than long, shallowly longitudinally striate, with appressed hair pointed medially, anterior margin straight, with 6-8 erect hairs; ocelli typical; scape failing to reach posterior border of head, with semierect hair; head shiny, longitudinally striate, smooth in middle, with appressed hairs directed medially.

Mesosoma shiny from above, with few evenly spaced short erect and many appressed hairs on dorsum of mesosoma to propodeal spine tips; propodeum rugose to spine tips; dorsellum slightly visible from above.

Petiole, postpetiole and gaster areolate; petiole saddle shaped with anterior lateral corners slightly flaring up, few appressed hairs and 1 long hair on each posterior lateral corner, which forms bump, not actually tooth; postpetiole bilobed with shallow medium sulcus, 2 long hairs on posterior edge of each hemilobe; gaster with appressed hair.

Concolorous light to dark brown.

dentinodis - USA and México

Nests in soil, usually under stones, sometimes in stumps, logs or hollow twigs

Desert scrub, grasslands or arid forest habitats

Compare with *depilis*, *opaca*, *punctulata*

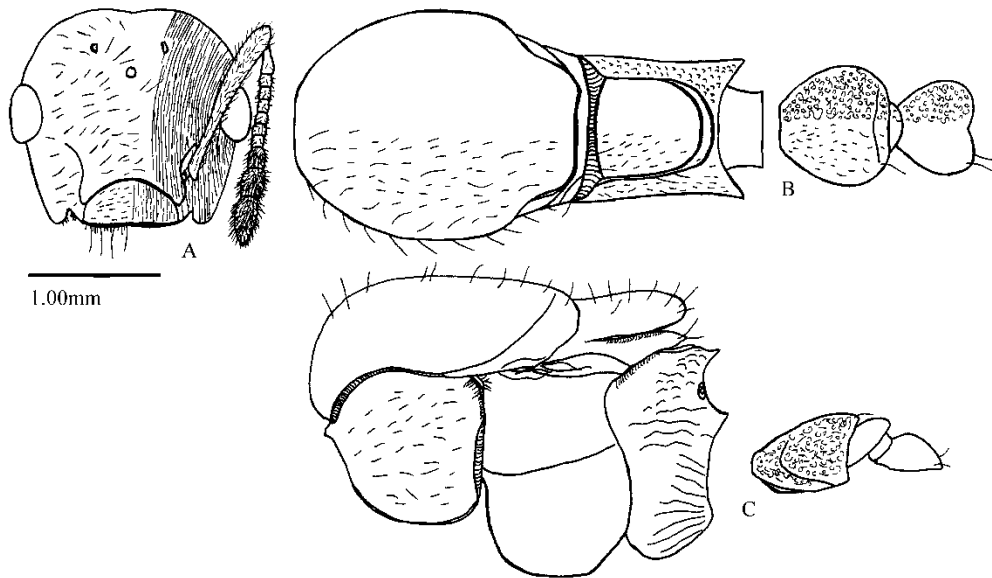


Plate 26. *Crematogaster dentinodis* queen: (Chiricahua Mountains, Arizona, United States CWEM # 7775): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Queen measurements (mm): HL 1.54, HW 1.75, SL 1.18, EL 0.43, ED 0.41, CL 0.46, CW 0.55, WL 3.14, PSL 2.64, PL 0.58, PW 0.98, PPL 0.53, PPW 0.91; **Indices:** CI 88, SI 77, CLI 84, PI 59, PPI 58.

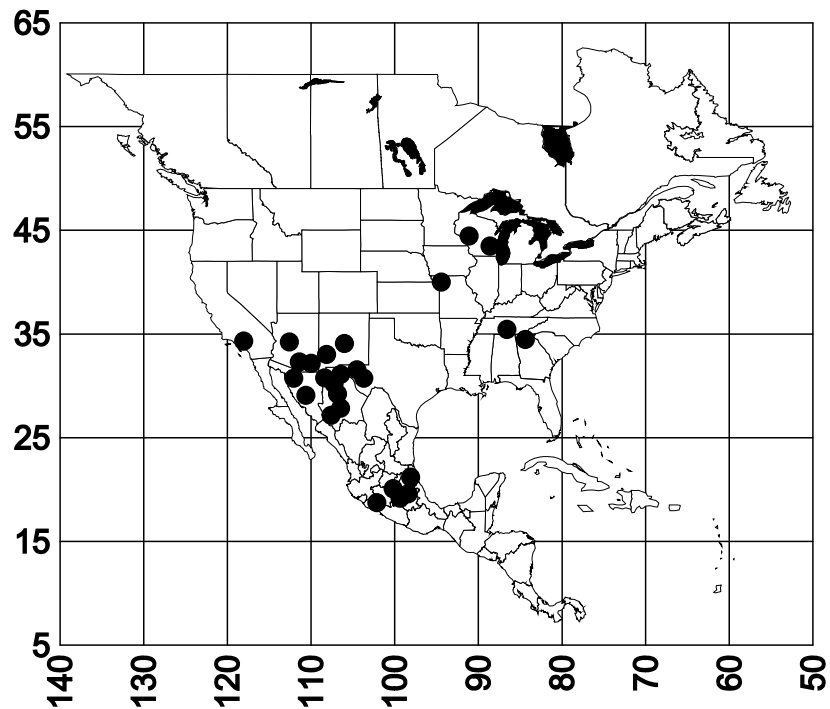
dentinodis - USA and México

Nests in soil, usually under stones, sometimes in stumps, logs or hollow twigs

Desert scrub, grasslands or arid forest habitats

Compare with *depilis*, *opaca*, *punctulata*

Distribution: Central southwest United States, Wisconsin, to central México.



Map 9. *Crematogaster dentinodis*.

Type series: Types from Querétaro, México. Middle card, worker on right designated as lectotype; 3 cards with 2 specimens on each card [MCZC]. Specimen on left of middle card was used for worker illustrations; 2 syntype workers [MNHG].

dentinodis - USA and México

Nests in soil, usually under stones, sometimes in stumps, logs or hollow twigs

Desert scrub, grasslands or arid forest habitats

Compare with *depilis*, *opaca*, *punctulata*

Other Material Examined and literature cited: MÉXICO:
Chihuahua, Basaseáchic (4 ♂ CWEM), Buenaventura, 21k W Las Varas (3 ♂ CWEM), Rancho El Kilo (6 ♂ CWEM), Janos, 18k NW Ojo Frío (10 ♂ CWEM), Villa Ahumada, 85k S Juárez (4 ♂ CWEM);
Guanajuato, 12.5k SE Guanajuato (39 ♂ CWEM); **Hidalgo**, Huichapan Hwy 45, 17mi NE Huichapan (5 ♂ STDC); **Jalisco**, 2mi NW Barranquillas (1 ♂ LACM), Guadalajara (13 ♂ MCZC), 12.25k SE of Guadalajara (39 ♂ CWEM), Sayula, (3 ♂ LACM); **Querétaro** (8 ♂ MCZC); **Sonora**, 37mi N Hermosillo, 1700' (3 ♂ LACM), Puerto Peñasco (3 ♂ CWEM), Sonora (Vázquez-Bolaños, 2011).
UNITED STATES: **Arizona**, Cochise Co., Chiricahua Mountains, 4mi N Paradise (14 ♂ 9 ♀ CWEM), 19mi W of Southwest Research Station, 24k W Portal (14 ♂ CWEM), 36k E Portal (5 ♂ CWEM), 2mi NW Portal, Cave Creek Rd. (1 ♂ LACM), Portal (40 ♂ CWEM, 1 ♂, 1 ♀ MCZC), Cave Creek Rd. (1 ♂ LACM), Douglas, Perogosa Hills (2 ♂ LACM), Montezuma Pass (2 ♂ MCZC), Huachuca (2 ♂ MCZC), 11 mi N Lochiel (CWEM), Tombstone (8 ♂, 1 ♀ CWEM), **Pima Co.**, Catalina Mountains (3 ♂ LACM), Molina Basin, Mountains (3 ♂ LACM), **Santa Cruz Co.**, Canelo (3 ♂ CWEM), 1mi SE Canelo HWY 83 (1 ♂ CWEM) Pajarito Mountains (32 ♂ MCZC), San Rafael Valley (11 ♂, 1 α ♀ MCZC), **Yavapai Co.**, Bradshaw Mountain (1 ♂, 1 ♀ CWEM), 8.9mi S. Jct. Rt.69 on FSR 197 elevation 6550ft (14 ♂, 2 ♀ MCZC); **California**, **Orange Co.**, Tonner Canyon (3 ♂ CWEM); **Georgia**, **Murray Co.**, Fort Mountain State Park (6 ♂ CWEM); **Missouri**, **Platte Co.**, Weston Bend State Park (CWEM); **New**

dentinodis - USA and México

Nests in soil, usually under stones, sometimes in stumps, logs or hollow twigs

Desert scrub, grasslands or arid forest habitats

Compare with *depilis*, *opaca*, *punctulata*

Mexico, **Grant Co.**, Gila Mountains Wright's Cabin (3 ♀ CWEM), 6.03k W Mule Creek (6 ♀ CWEM), **Lincoln Co.**, Sacramento Mnts., Maverick Canyon (12 ♀ CWEM), **Sierra Co.** 6.36mi W Rd. (32°45'34.9"N, 107°40'W) (4 ♀ CWEM), **Socorro Co.**, Bear Mountains, 11.0k NW Magdalena, (34°12'23"N, 107°17'45".7° W, 1952m) (1 ♀ CWEM), 3mi from Highway 107 (2 ♀ CWEM); **Tennessee**, **Lincoln Co.**, Stump Shoals (46°28'30.0"N, 35°08'24.9"W) (1 ♀ CWEM); **Texas**, **El Paso Co.**, El Paso (8 ♀ CWEM), **Hudspeth Co.**, Indio Mountains Research Station (8 ♀ CWEM); **Wisconsin**, **Barron Co.**, Comstock (19 ♀ CWEM), **Ozaukee Co.**, Mequon (1 ♀ STDC).

Etymology: *Dentinodis* from the Latin *dent* meaning tooth and *nodis* meaning knob. The workers of this species usually have a tiny tooth or knob on each posterior lateral corner of the petiole.

Discussion: *Crematogaster dentinodis* has a key character, a small tooth or knob on each posterior lateral corner of the petiole. There is however, a great deal of variability in the development of this tooth, from well-defined to almost absent. This species also has two queen sizes (large and small or alpha and beta).

This species can be confused with *C. depilis*, *C. opaca*, and *C. punctulata*. All four species have very punctate heads; however, *C. opaca* can be separated by the punctures being ordered in longitudinal lines, *C. punctulata* has longitudinally lineolate-punctate fading to

dentinodis - USA and México

Nests in soil, usually under stones, sometimes in stumps, logs or
hollow twigs

Desert scrub, grasslands or arid forest habitats

Compare with *depilis*, *opaca*, *punctulata*

shiny medially. Also, the dorsum of the pronotum of *C. dentinodis* has fewer than 10 erect hairs, *C. punctulata* has many erect hairs and *C. depilis* is devoid of hair.

Biology: *Crematogaster dentinodis* prefers arid habitats between elevations of 1000 - 1700m. Nests are found under stones, or simply in the soil (often with a small mound), under grass clumps and among the roots of shrubs. Nests can also be found in rotten stumps or in and under logs, in dead branches and rarely in hollow twigs.

Brood occur in nests in March and June.

Crematogaster dentinodis has been collected foraging on fishhook cactus, *Agave schottii* and loose on the ground. They have also been observed capturing termites from under a stone and tending pseudococcids. They tend aphids on thistles, tend pseudococcids, and are apparently granivores with seed hulls found around the nest entrance.

They are found in creosotebush, mesquite, yucca and acacia scrub, grasslands, dry black grama grassland, chaparral, scrub forest, *Mimosa* and thorn scrub, oak forests, oak/pine forest, deciduous forest, mixed hardwoods and a riparian forest with young trees, which was burned about 20 years ago. In Arizona, they can be found in Lehman's love grass areas and native grass communities (Whitford et al., 1999).

This species nests in dark brown clay, fine sandy-clay, light brown rocky loam, light brown sand, brown rocky gravel, and often on stony slopes of mountains.

dentinodis - USA and México

Nests in soil, usually under stones, sometimes in stumps, logs or
hollow twigs

Desert scrub, grasslands or arid forest habitats

Compare with *corvina*, *opaca*

***Crematogaster depilis* Wheeler**

Plates 27, 28, 29 and 104; Fig. 12; Map 10.

Crematogaster opaca var. *depilis* Wheeler, 1919: 111 [First available use of *Crematogaster lineolata* subsp. *opaca* var. *depilis* Wheeler, 1908c: 478, worker, Cerro Carrizal, México, unavailable name]. Emery, 1922: 141, combination in *C. (Acrocoelia)*. Enzmann, J., 1946: 93, *Crematogaster punctulata* var. *depilis*. Creighton, 1950: 209, *Crematogaster depilis*. Smith, D. R. 1979: 1379, in combination *C. (Crematogaster)*. Wheeler & Wheeler, 1973: 28, larva.

Crematogaster larreae Buren, 1968: 117, worker, queen, male, El Paso, Texas, United States **NEW SYNONYMY.**

Descriptions:

Worker: Clypeus areolate with appressed hair, slightly wider than long, anterior margin concave with 7-8 long hairs; scape failing to reach posterior border of head, with many semierect hairs; head areolate with appressed hair sparsely distributed.

Dorsum of mesosoma scabrous and deeply punctate, completely without hairs; pronotal humeri developed and rounded; mesonotum with medial carina, notopropodeal groove steep and angular; propodeal spines long, slender, thickening at base, divergent (viewed from above); side of mesosoma deeply punctate rugose;

depilis - southwestern USA to southern México

Nests in roots of desert plants and soil

Desert grasslands and shrublands

Compare with *corvina*, *opaca*

posteropropodeum longitudinally striate-punctate.

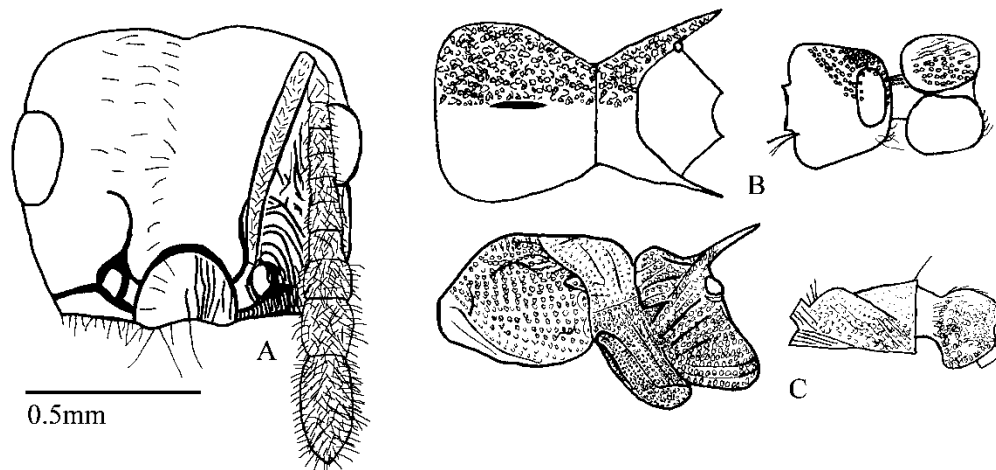


Plate 27. *Crematogaster depilis* worker: (syntype specimen with red dot on top card, Cerro Carrizal, México MCZC): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Petiole angularly trapezoidal with anterior lateral corners upraised when viewed from behind, anterior sternopetiolar process absent to well developed, punctate with several semierect hairs along posterior margin and 1 erect hair on each posterior lateral corner; postpetiole punctate with no erect hairs, hemilobes longitudinally elongate spreading slightly posteriorly; gaster shallowly areolate with

depilis - southwestern USA to southern México

Nests in roots of desert plants and soil

Most common in dry tropical forests

Compare with *corvina*, *opaca*

few erect hairs in rows in middle of each of last 4 terga, appressed hairs sparsely distributed over remainder of gaster.

Concolorous dark brown or bicolored, with dark brown head and gaster, light brown mesosoma.

Worker measurements (mm): HL 0.60-1.02, HW 0.84-1.14, SL 0.78-0.82, EL 0.24-0.28, ED 0.18-0.24, CL 0.24-0.26, CW 0.29-0.34, WL 0.86-1.14, PSL 0.18-0.24, PL 0.18-0.30, PW 0.36-0.42, PPL 0.22-0.29, PPW 0.30-0.34; Indices: CI 71-89, SI 80-130, CLI 76-83, PI 50-71, PPI 73-85.

Queen: Clypeus longer than wide, worker like, longitudinally striate with few erect and many appressed hairs pointed medially, anterior margin with many long hairs; scape failing to reach posterior border of head, with semierect hairs; head with longitudinal striae, few erect and many appressed hairs pointed medially.

Mesosoma shiny with many fine appressed hairs; metapleuron longitudinally striate; dorsellum visible when viewed from above; propodeal spines well developed for queens of this genus; sternopetiole process small.

Petiole and postpetiole much wider than long, longitudinally costate with punctures and few appressed hairs; postpetiole with poorly developed hemilobes and 1 long hair on each posterior edge of each hemilobe; gaster smooth and shiny with appressed hairs dorsally and erect hairs ventrally.

Concolorous dark brown.

depilis - southwestern USA to southern México

Nests in roots of desert plants and soil

Desert grasslands and shrublands

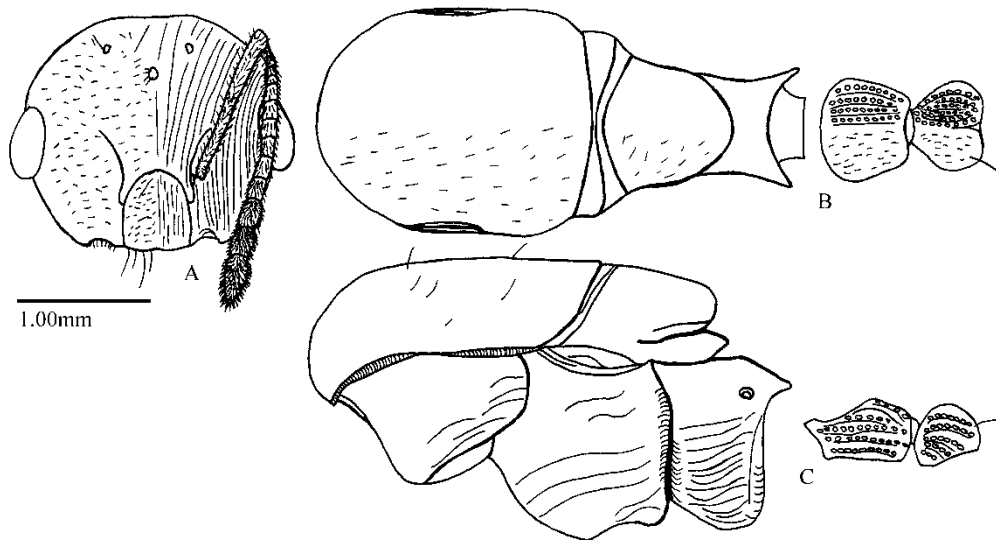
Compare with *corvina*, *opaca*

Plate 28. *Crematogaster depilis* queen: (Tucson, Arizona, USA CWEM #7290): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Queen measurements (mm): HL 1.54-1.63, HW 1.92-2.11, SL 1.25-1.27, EL 0.55-0.56, ED 0.46-0.50, CL 0.53-0.55, CW 0.60-0.62, WL 3.00-3.55, PSL 0.21-0.24, PL 0.48-0.53, PW 0.72-0.85, PPL 0.50-0.53, PPW 0.67-0.84; Indices: CI 77-81, SI 78-81, CLI 83-89, PI 62-67, PPI 63-75.

depilis - southwestern USA to southern México
Nests in roots of desert plants and soil
Most common in dry tropical forests

Compare with *corvina*, *opaca*

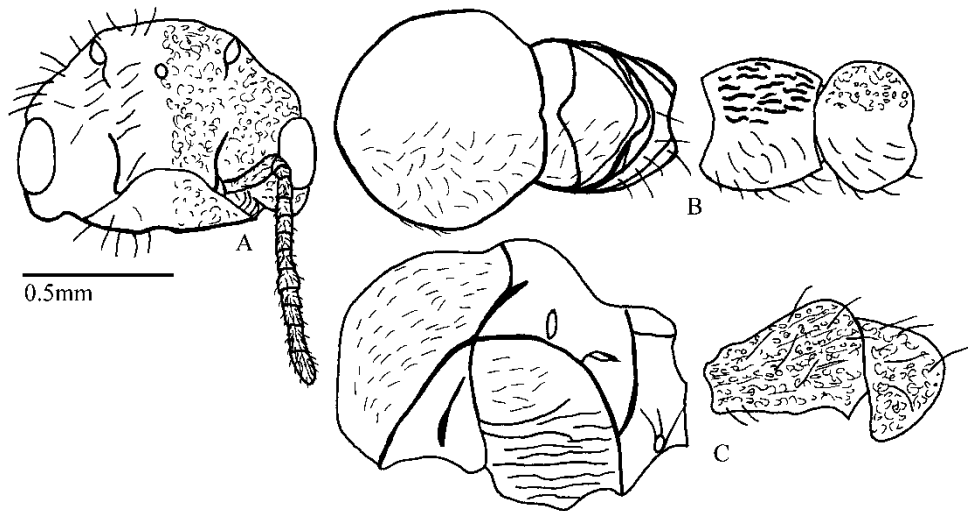


Plate 29. *Crematogaster depilis* male: (Chihuahua, México, CWEM #5202): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Male: Very large for this genus. Clypeus wider than long, anterior margin with many long erect hairs; scape and funiculus evenly covered with decumbent hair; ocelli slightly raised on head with 3-4 erect hairs between; head shallowly areolate, evenly sparsely covered with appressed hair.

Mesosoma without erect hair except on propodeum, sparsely covered with appressed hairs; pronotum, mesonotum, dorsopropodeum smooth; side of mesosoma areolate-rugose, very punctate,

depilis - southwestern USA to southern México

Nests in roots of desert plants and soil

Desert grasslands and shrublands

Compare with *corvina*, *opaca*

posteropropodeum longitudinally striate and punctate; dorsellum hidden by scutellum; propodeum rounded on corners producing nub-like bumps.

Petiole almost rectangular, coarsely carinate with several erect and suberect hairs, anterior sternopetiole process poorly developed; postpetiole areolate, with several erect hairs, hemilobes faintly developed; petiole and postpetiole wider than long; gaster shallowly areolate with many short erect hairs in rows on each tergum.

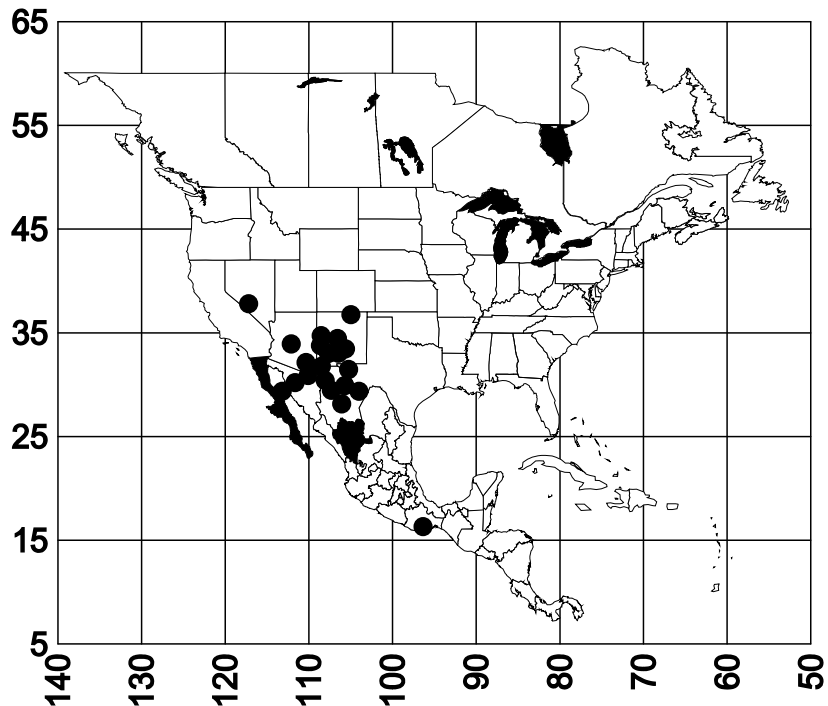
Concolorous dark brown to black.

Male measurements (mm): HL 0.60-0.68, HW 0.84-0.92, SL 0.31-0.36, EL 0.25-0.31, ED 0.29-0.35, CL 0.24-0.28, CW 0.29-0.30, WL 2.40-2.45, PSL 0.20-0.24, PL 0.28-0.36, PW 0.36-0.42, PPL 0.23-0.31, PPW 0.34-0.49; Indices: CI 61-73, SI 52-53, CLI 83-93, PI 78-86, PPI 63-68.

Distribution: *Crematogaster depilis* can be found throughout the Chihuahuan, Sonoran and Mohave deserts, in the southwestern USA and northern México; Baja California (Johnson and Ward, 2002).

Type series: Lectotype and 10 paralectotype workers, Type series from Chihuahua, México, Worker on far right of top card designated by red dot and labeled as lectotype, 4 paralectotype specimens on top card and 6 specimens on bottom card [MCZC]. Paratype series of *Crematogaster larreae* mixed [LACM].

depilis - southwestern USA to southern México
Nests in roots of desert plants and soil
Most common in dry tropical forests

Compare with *corvina*, *opaca*Map 10. *Crematogaster depilis*.**Additional material examined and literature cited:**

MÉXICO: Baja California, Isla Angel de la Guardia, (3 ♀ CWEM), Sierra San Borja (2 ♀ CWEM, 3 ♀ MCZC), Isla San Lorenzo (2 ♀ CWEM), also see Varela-Hernández and Jones (2013); **Chihuahua**, 9mi E Benito Juárez (CWEM), Buenaventura, Flores Magón (3 ♀, 31 ♂ CWEM), Camargo (1 ♀ CWEM), 30k NW Casas Grandes (5 ♀ CWEM), Janos, 14k N Janos (25 ♀ CWEM), Juárez (1 ♀ CWEM), 85k S Juárez (2 ♀ CWEM), 210k SE Juárez (1 ♂ CWEM), Lago Jacales (CWEM), 23k N Madera (76 ♀, 12 ♀, 20 ♂ CWEM), 20mi N

depilis - southwestern USA to southern México

Nests in roots of desert plants and soil

Desert grasslands and shrublands

Compare with *corvina*, *opaca*

Moctezuma (CWEM), Namiquipa (13 ♀ CWEM), 10k W Ojinaga (10 ♀ CWEM), Palomas (1 ♀ CWEM), Rancho 7 Leguas near El Kilo (21 ♀, 2 ♂ CWEM), Samalayuca (1 ♀, 2 ♂ CWEM), Villa Ahumada (50 ♀, 8 ♂ CWEM), Zaragoza (3 ♀ CWEM); **Oaxaca**, 13k S San José del Pacífico (1 ♀, 2 ♀ CWEM); **Sonora**, Plains of Sonora, Centro Ecológico de Sonora (14 ♀ CWEM), Punta Cirios (3 ♀ MCZC), **Baja California Sur**, **Nuevo León**, **Durango** (Vázquez-Bolaños, 2011). **UNITED STATES: Arizona**, Cochise Co., Chiricahua Mountains, Herb Martyr Dam (CWEM), John Hands Park (CWEM), 1mi N Paradise (51 ♀ CWEM, 16 ♀ MCZC), 4.0km N Portal (31°57'N, 109°08'W 360m) (2 ♀ CWEM), Southwest Research Station (CWEM), Sunny Flat (CWEM), **Coconino Co.**, Sunset Crater National Monument (CWEM), **Maricopa Co.** Gila Bend Mountains (3 ♀ MCZC), **Palmelee Co.** (8 ♀ MCZC), **Pima Co.**, 50k NW Tucson (5 ♀, 2 ♀ CWEM, 3 ♀ MCZC); **New Mexico**, **Catron Co.**, 18.9k NW Horse Springs (3 ♀ CWEM), **Colfax Co.**, Eagle Nest (2 ♀ CWEM), **Doña Ana Co.**, Las Cruces (83 ♀, 1 ♀, 15 ♂ CWEM), Jornada Experimental Range (1 ♀ CWEM), **Grant Co.**, Leopold Vista (2 ♀ CWEM), **Hidalgo Co.**, Clayton Draw (2 ♀ CWEM), **Lincoln Co.**, 5mi W Capitan (39 ♀ CWEM), Lordsburg (2 ♀ MCZC), **Sierra Co.**, Truth or Consequences (4 ♀ CWEM), 20.7k SSW Hillsboro (12 ♀ CWEM), **Socorro Co.**, Bear Mountains, 11.0k N Magdalena (14 ♀ CWEM), near Mount Wittington (CWEM); **Nevada**, **Nye Co.**, Berlin Ichthyosaur State Park (41 ♀ CWEM), Mercury (53 ♀ CWEM); **Texas**, **Brewster Co.**, Big Bend National Park (9 ♀ CWEM), **El Paso Co.**, El Paso (3 ♀ CWEM), 18mi N El Paso (18 ♀ CWEM), **Hudspeth**

depilis - southwestern USA to southern México

Nests in roots of desert plants and soil

Most common in dry tropical forests

Compare with *corvina*, *opaca*

Co., Van Horn, Indio Mountains Research Station (including several nearby sites) (44 ♀ CWEM); Squaw Spring (N30° 47.824', W105° 00.710'') (20 ♀ CWEM).

Etymology: *Depilis* from the Latin *de* meaning without and *pilis* meaning hair characterizing this species as being hairless.

Discussion: The key characteristic of *C. depilis* is the complete lack of erect hairs on the entire dorsum of the mesosoma. *Crematogaster depilis* is distinctly punctate on both dorsum and sides of the mesosoma. The worker has a postpetiole with well-defined hemilobes, is relatively large for this genus, and can generally be found nesting in the roots of desert shrubs such as *Opuntia* sp. and *Larrea tridentata*. We have examined the original series of *C. larreae* collected by William Buren from the west slope of Mt. Franklin in El Paso, Texas and found the series to be a mixture of *C. depilis* and *C. larreae*. Some were definitely concolorous dark brown, some were definitely bicolored with lighter colored head, mesosoma, petiole and postpetiole and dark gaster. Some, however, could be placed in either group where the distinction between light head and dark gaster were not very profound. Some specimens had a small sternopetiole tooth, but it was absent on other specimens. Types of these two taxa are indistinguishable and we have examined nest series that are mixtures from the Indio Mountains Research Station. These observations lead us to conclude that *Crematogaster larreae* is a junior synonym of *Crematogaster depilis*.

Crematogaster depilis could be easily confused with *C. opaca*,

depilis - southwestern USA to southern México

Nests in roots of desert plants and soil

Desert grasslands and shrublands

Compare with *corvina*, *opaca*

as the mesosomata of both species are punctated and opaque. They can be easily separated as the dorsal surface of the head of *C. depilis* is partially smooth and shiny, and is completely or mostly punctate and opaque in *C. opaca*. It might be confused with *C. corvina*, which has at least 2 erect hairs on the mesosoma.

Biology: Mackay and Mackay (unpublished) have collected extensive data on this species. *Crematogaster depilis* nests in the lower branches and roots of small desert shrubs, sotol and cacti (especially cholla), and especially in those of the creosotebush *Larrea tridentata* (Mackay et al., 1984), in the larval galleries of wood and stem boring beetles. It is also found under stones and in yucca logs. Occasionally it simply nests in open soil, usually with a small mound. To find this ant, look in shrubs (especially creosotebush) that have dead branches that come from the base of the plant.

Brood were found in nests in June and August, sexuals in June and July. Sexuals were attracted to blacklights in June and July, founding females found in March and June. Workers are usually timid, but large nests can be aggressive, although the workers do not often bite.

Crematogaster depilis forages diurnally and nocturnally, on the ground and in vegetation including cholla, creosotebushes, and oak (*Quercus arizonica*). It is very common foraging on *Larrea tridentata* and *Opuntia* sp. in the late afternoon and can be found on the extrafloral nectaries of *Opuntia* sp. These ants readily come to baits on the soil surface, subterranean and in the vegetation, including Vienna sausage (cholla, *Yucca*, *Prosopis*) or cookie baits and are often found

depilis - southwestern USA to southern México

Nests in roots of desert plants and soil

Most common in dry tropical forests

Compare with *corvina*, *opaca*

in pitfall traps. They also feed on dead insects.

They commonly visit the extrafloral nectaries of the barrel cactus *Ferocactus acanthodes* (Ruffner and Clark, 1986) and *F. gracilis* and nest near the base of the cactus (Blom and Clark, 1980). They also visit extrafloral nectaries of the senita cactus *Pachycereus schottii* (Chamberlain and Holland, 2008) as well as *Cylindropuntia arbuscula* and *C. bigelovii* (Chamberlain and Holland, 2009). It is the dominant consumer in a guild of 14 ant species (Holland et al., 2009, 2010). They are usually subordinate to ants of the subfamily Dolichoderinae, but achieve dominance where the latter are poorly represented (Bestelmeyer, 2005).

They are found in grasslands, creosotebush scrub, thorn scrub, mesquite shrublands, riparian shrubland, sagebrush, oak forests, pinyon juniper and pine forests (Mackay and Mackay, unpublished). Bestelmeyer and Wiens, (2001a) reported them from shrublands, associated with creosote bush plants (Bestelmeyer and Wiens, 2001b). Whitford et al., (1999) found them in creosote bush communities as well as shrubland mosaics and tarbush shrubland.

Crematogaster depilis is found in several soil types ranging from red clay, purple-gray fine sand/clay, red-purple fine sandy loam, rocky loam, light brown sand, light brown rocky sand to red and light brown rocky gravel.

Myrmecophila sp. crickets and various beetles are found in nests, (Mackay and Mackay, unpublished).

depilis - southwestern USA to southern México

Nests in roots of desert plants and soil

Desert grasslands and shrublands

Compare with *corvina*, *opaca*

***Crematogaster distans* Mayr**

Plates 5D, 30 and 105; Fig. 18; Map 11.

Crematogaster distans Mayr, 1870a: 402-403, worker, Colombia. Santschi, 1918: 182, *C. (Neocrema)*. Emery, 1922: 134, combination in *C. (Orthocrema)*. Kempf, 1968: 390, combination in *C. (Neocrema)*, queen. Longino, 2003: 58, worker, queen.

Crematogaster paraensis Forel, 1904: 37, worker, Brazil. Kempf, 1968: 390, junior synonym of *C. distans*.

Crematogaster distans parviceps Forel, 1908b: 369, worker, Brazil. Emery, 1922: 135, combination in *C. (Orthocrema)*. Kempf, 1968: 390, junior synonym of *C. distans*.

Crematogaster pevsnerae Forel, 1912: 218, worker, Venezuela. Emery, 1922: 135, combination in *C. (Orthocrema)*. Kempf, 1968: 390, junior synonym of *C. distans*.

Crematogaster cordinoda Forel, 1914: 12, worker, Colombia. Emery, 1922: 135, combination in *C. (Orthocrema)*. Kempf, 1968: 390, junior synonym of *C. distans*.

Crematogaster distans vanda Borgmeier, 1929: 209, worker, Brazil. Kempf, 1968: 390, junior synonym of *C. distans*.

Crematogaster descolei Kusnezov, 1949: 587, queen, Argentina. Longino, 2003: 59, junior synonym of *C. distans*.

distans - México to Argentina

Nests in twigs and logs and probably in trees

Most common in dry tropical forests

Compare with *corvina*, *opaca*

Description:

Worker: Mandibles shiny longitudinally striate with decumbent hair; clypeus slightly longer than wide, areolate with 4 erect and several fine appressed hairs, anterior margin straight with several long erect hairs; scape just passing posterior border of head with decumbent hairs and funiculus with 3 segmented club; head shiny, areolate, with fewer than 10 long erect and many fine appressed hairs between eyes.

Mesosoma punctate with 1 long erect hair on each pronotal shoulder, 4-6 long erect hairs around mesonotal boss, 1-3 long erect hairs along each lateral propodeal margin to spine, and many appressed hairs; notopropodeal groove very steep and wide with carina along lateral dorsal margin; propodeal spines short and thick at base, diverging widely in dorsal view.

Petiole rectangular, square to slightly wider than long, areolate from above, punctate from side, with 2 long hairs on each posterior lateral corner; postpetiole wider than long, areolate with 4-6 long erect hairs evenly distributed dorsally, hemilobes rounded, spreading slightly posteriorly, medial sulcus faint; gaster areolate.

Concolorous brown to dark brown.

Worker measurements (mm): HL 0.58-0.68, HW 0.61-0.73, SL 0.49-0.71, EL 0.14-0.17, ED 0.14-0.16, CL 0.19-0.20, CW 0.29-0.30, WL 0.58-0.73, PSL 0.13-0.18, PL 0.29-0.30, PW 0.34-0.35, PPL 0.18-0.19, PPW 0.35-0.38; Indices: CI 93-95, SI 84-104, CLI 66-67, PI 85-86, PPI 50-51.

distans - México to Argentina

Nests in twigs and logs and probably in trees

Most common in dry tropical forests

Compare with *corvina*, *opaca*

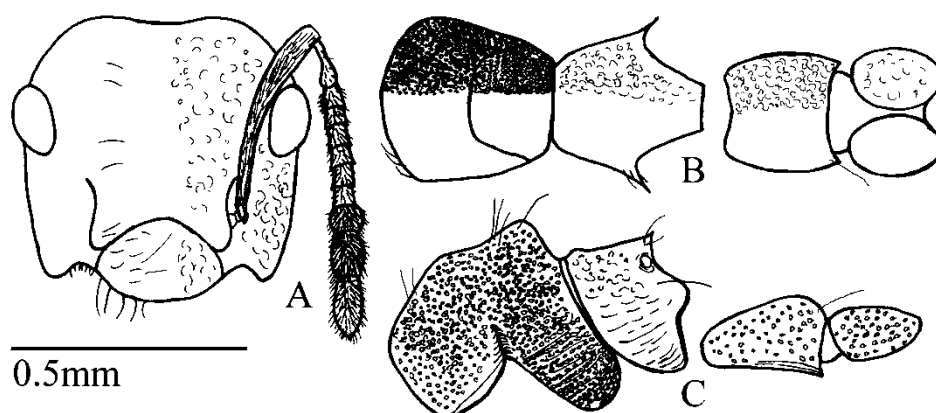


Plate 30. *Crematogaster distans* worker: (determined by J. Longino, Magdalena, Colombia LACM #821): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Distribution: México to Argentina, including the state of Antioquia, Colombia (Vergara-Navarro and Serna, 2013) and southern Brazil (Araújo et al., 2007).

Type series: Type from Colombia.

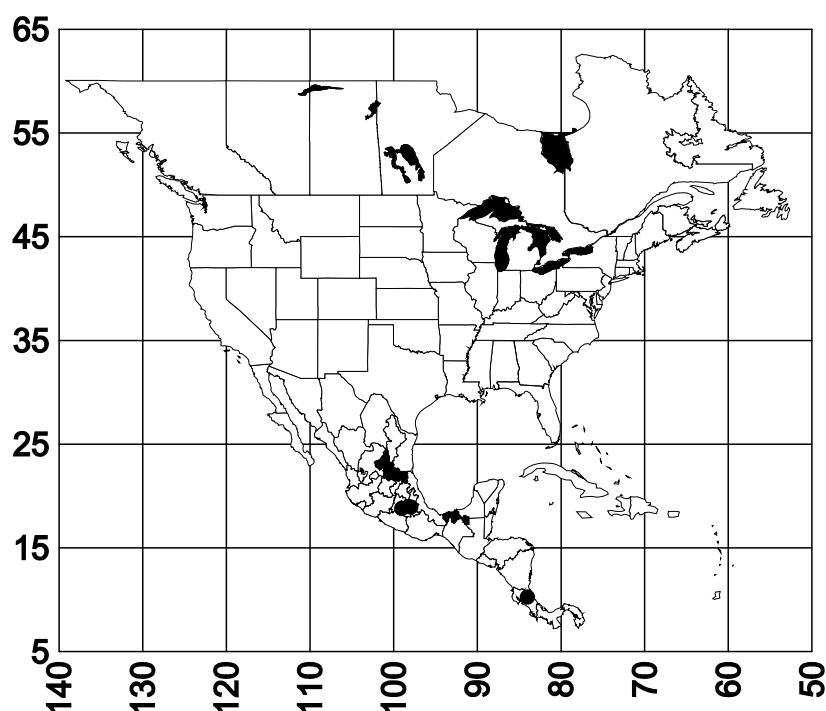
Material examined and literature cited: **ARGENTINA:** **Chaco**, Benítez (2 ♀, 3 ♂ MCZC). **BRAZIL:** **São Paulo**, Agudos (2 ♀ MCZC). **COSTA RICA** (1 ♀ MCZC); **Alajuela** (2 ♀ MCZC, 1 ♀ CWEM). **MÉXICO:** **Morelos**, Jantetelco (6 ♀ CWEM); **Puebla**, 10.5k N, Izúcar de Matamoros, 1200m (2 ♀ CWEM), see also (Rivas-Arancibia et al., 2014), **San Luis Potosí** (Vázquez-Bolaños, 2011), **Tabasco** (del Toro et al., 2009).

distans - México to Argentina

Nests in twigs and logs and probably in trees

Most common in dry tropical forests

Compare with *corvina*, *opaca*



Map 11. *Crematogaster distans*.

Etymology: *distans* comes from Latin *distantus* meaning full, reference to specimens unknown.

Discussion: The key characteristics of the *Crematogaster distans* worker are the enlarged mesonotal boss and reduced propodeal spines.

This species can be confused with *C. corvina*. The distinguishing character is that *C. distans* has a shiny head, and *C. corvina* has a very punctate head.

distans - México to Argentina

Nests in twigs and logs and probably in trees

Most common in dry tropical forests

Compare with *corvina*, *opaca*

Biology: Very little is known about *Crematogaster distans*; however, Longino has made some observations from La Selva Biological Station in Costa Rica. Longino states *C. distans* has large colonies that occur in low density. One colony was in a large, fallen, dead tree trunk. He found two alate queens with workers in a hollow stick but did not find brood or a central nest. In Santa Marta, Colombia, Longino found a nest in a dead stick and another nest with the workers tending coccids on *Cnidoscolus*. Longino observed columns of workers coming down a tree and onto an *Inga* sapling to tend scale insects (Longino, 2003).

It is a generalist (Rivas-Arancibia et al., 2014), most commonly found in trees (Lozano-Zambrano et al., 2009). Workers also visit the flowers of *Tapirira guianensis* (Anacardiaceae) in Brazil (Moreira Fernandes et al., 2012).

Crematogaster distans was found in canopy and litter assemblages in Panamá (Yanoviak and Kaspari, 2000). It was collected in several habitats in the Valle del Río Cauca in Colombia (Chacón de Ulloa et al., 2012). It is common in fragments of dry forest in northern Colombia (Fontalvo-Rodríguez and Solís-Medina, 2009) and found in semiarid vegetation in Venezuela (Pérez-Sánchez et al., 2012). It is most frequently found in urban areas with higher density of trees in the state of Rio de Janeiro, Brazil (Coriolano et al., 2014). It was collected in leaf litter of fragments of semi-deciduous seasonal forest in the Atlantic forest biome in Bahia, Brazil (Freitas et al., 2014).

distans - México to Argentina

Nests in twigs and logs and probably in trees

Most common in dry tropical forests

Compare with *cerasi*, *isolata*, *punctulata*

***Crematogaster emeryana* Creighton**

Plates 31, 32, 33 and 106; Figs. 2, 8 and 9; Map 12.

Crematogaster lineolata emeryana Creighton, 1950: 213-214, worker, Denver, Colorado (from unnamed variety in Emery, 1895:281); Buren, 1968: 94, *C. (Crematogaster) emeryana* (in key).

Crematogaster marioni Buren, 1968: 105-106, worker, Moreno Lake, San Diego Co., California, United States **NEW SYNONYMY.**

Descriptions:

Worker: Mandibles longitudinally striate with many short decumbent hairs; clypeus longitudinal striate with decumbent hairs pointed medially, anterior margin convex with many flexuous hairs; scape passing posterior border of head, with decumbent hair; head longitudinally striate along sides fading to shiny, shallow areolate in middle of face, few erect and many decumbent hairs.

Petiole and postpetiole shiny areolate with one long hair on each posterior lateral corner, sides punctate; gaster shiny areolate with few scattered erect and many appressed in rows on each tergum pointed posteriorly.

Concolorous light to dark brown.

Worker measurements (mm): HL 0.78-0.82, HW 0.84-0.89, SL 0.66-0.78, EL 0.18-0.22, ED 0.14-0.18, CL 0.22-0.30, CW 0.24-

emeryana - southwestern USA, northern México

Nests usually under stones, but also in dead branches and oak galls

Found in arid scrub and dry forests

Compare with *cerasi*, *isolata*, *punctulata*

0.26, WL 0.84-1.00, PSL 0.12-0.17, PL 0.18-0.26, PW 0.24-0.34, PPL 0.17-0.18, PPW 0.22-0.25; Indices: CI 92-93, SI 85-95, CLI 92-115, PI 75-76, PPI 72-77.

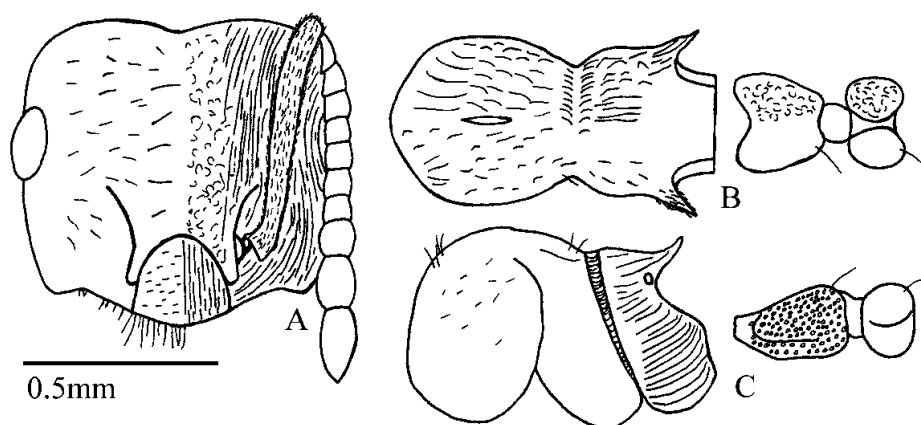


Plate 31. *Crematogaster emeryana* worker: (determined by Creighton, Mesa Verde National Park, Colorado LACM): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Queen: Mandibles longitudinally striate, evenly covered with decumbent hair; clypeus longitudinally striate with 4-6 long flexuous erect and several decumbent hairs pointed medially, anterior margin straight with slight medial notch; scape barely reaching posterior border of head, with decumbent hairs; ocelli small, flush with surface of head; head longitudinally striate fading to shiny medially, with many decumbent hairs pointed medially.

emeryana - southwestern USA, northern México

Nests usually under stones, but also in dead branches and oak galls

Found in arid scrub and dry forests

Compare with *cerasi*, *isolata*, *punctulata*

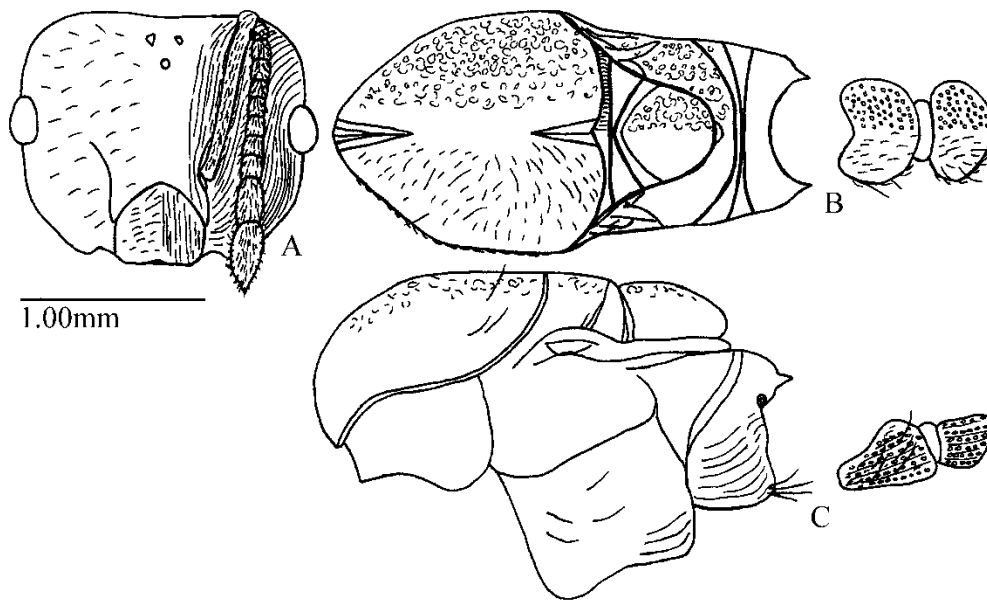


Plate 32. *Crematogaster emeryana* queen: (determined by Creighton, Mesa Verde National Park, Colorado LACM): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Mesosoma shiny areolate, with scattered long flexuous and many appressed and decumbent hairs pointed toward center of mesosoma; in dorsal view pronotum covered by scutum, and dorsellum visible beneath scutellum; propodeal spines well developed

emeryana - southwestern USA, northern México

Nests usually under stones, but also in dead branches and oak galls

Found in arid scrub and dry forests

Compare with *cerasi*, *isolata*, *punctulata*

for queens of this genus; from side mesosoma mostly shiny, mesopleuron shallowly striate, with few flexuous erect hairs.

Petiole and postpetiole striate-punctate viewed from side, petiole shallowly punctate dorsally, with several long flexuous erect hairs on sides and many decumbent hairs pointed posteriorly; postpetiole areolate with 6-8 long flexuous hairs along margins and many decumbent hairs pointed posteriorly; gaster shiny shallowly areolate with many erect and appressed hairs in rows along each tergum, pointed posteriorly.

Concolorous light to dark brown.

Queen measurements (mm): HL 1.25-1.37, HW 1.32-1.54, SL 0.90-0.91, EL 0.30-0.41, ED 0.12-0.17, CL 0.43-0.55, CW 0.43-0.48, WL 2.28-2.52, PSL 0.16-0.17, PL 0.30-0.43, PW 0.62-0.67, PPL 0.30-0.34, PPW 0.60-0.62; Indices: CI 89-95, SI 66-72, CLI 100-115, PI 48-64, PPI 50-54.

Male: Mandibles shiny with several erect hairs; clypeus slightly protruding from face, shiny areolate, anterior margin concave with slight medial notch and 4-6 long erect hairs; scape typically short with appressed hairs, ocelli small almost flush with surface of head; head shiny areolate, with 1 long flexuous hair on each frontal lobe, 2-4 around ocelli, appressed hair over rest of face, decumbent hair on occipital margin.

emeryana - southwestern USA, northern México

Nests usually under stones, but also in dead branches and oak galls

Found in arid scrub and dry forests

Compare with *cerasi*, *isolata*, *punctulata*

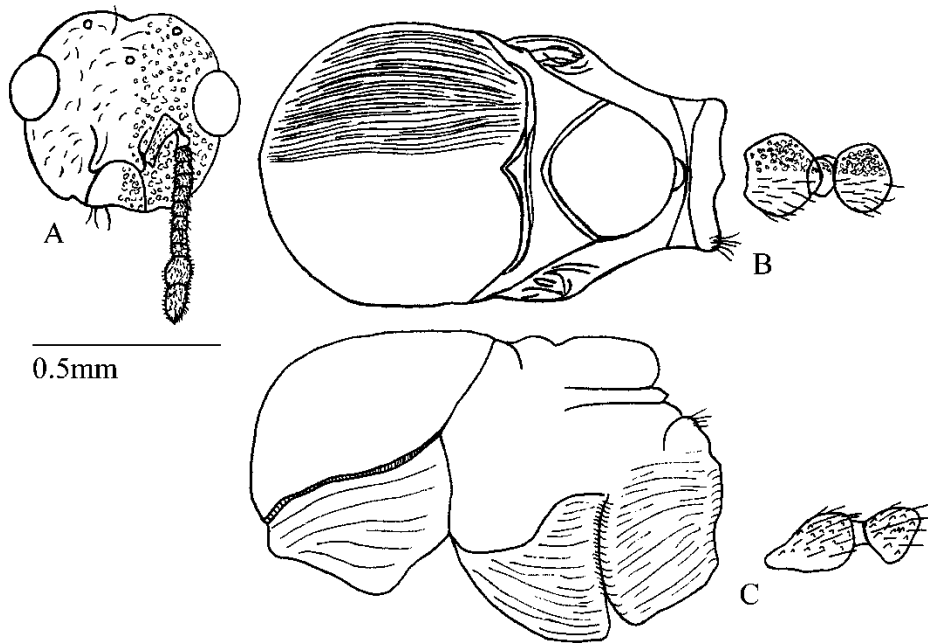


Plate 33. *Crematogaster emeryana* male: (Pinal Mountains, Arizona MCZC): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Mesosoma shallowly longitudinally striate-areolate from above; pronotum obscured by scutum in dorsal view; dorsellum can be seen from above; propodeum with tuft of hair where spines should be; mesosoma shiny striate in smooth flowing lines viewed from side.

Petiole and postpetiole shallowly rugose with many long stiff hairs along sides pointed posteriorly; gaster areolate, evenly covered

emeryana - southwestern USA, northern México

Nests usually under stones, but also in dead branches and oak galls

Found in arid scrub and dry forests

emeryana

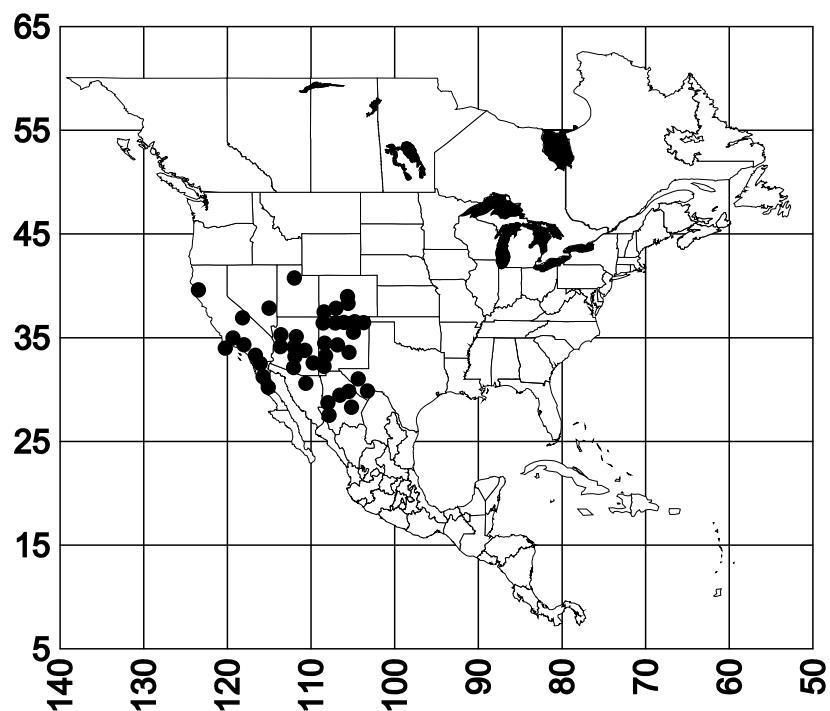
176

Compare with *cerasi*, *isolata*, *punctulata*

with appressed hairs and short stiff hairs becoming more numerous posteriorly.

Concolorous light to dark brown.

Male measurements (mm): HL 0.52-0.56, HW 0.50-0.64, SL 0.13-0.17, EL 0.22-0.26, ED 0.20-0.22, CL 0.11-0.13, CW 0.19-0.22, WL 1.25-1.54, PL 0.20-0.24, PW 0.23-0.29, PPL 0.17-0.23, PPW 0.23-0.29; Indices: CI 86-104, SI 25-30, CLI 58-59, PI 83-87, PPI 74-79.



Map 12. *Crematogaster emeryana*.

emeryana - southwestern USA, northern México

Nests usually under stones, but also in dead branches and oak galls

Found in arid scrub and dry forests

Compare with *cerasi*, *isolata*, *punctulata*

Distribution: *Crematogaster emeryana* has been collected in the southwestern United States and northwestern México, including Baja California (Johnson and Ward, 2002, as *C. marioni*).

Type series. Type from Colorado, U. S., 1 worker and 1 male, possible type series collected by T. Pergande from Denver, Colorado determined by Snelling; *C. marioni* Buren, Huachuca Mountains Arizona, 4 paratype ♀ [LACM].

Material examined and literature cited: **MÉXICO:** **Baja California**, Tecate (6 ♀ LACM), also see Varela-Hernández and Jones (2013, as *C. marioni*); **Chihuahua**, 10k E Cuauhtémoc (CWEM), Morales Ranch, Sierra de el Medio (3 ♀ LACM), 21k W Las Varas (CWEM), 2k N Zaragoza (CWEM). **UNITED STATES:** **Arizona**, **Cochise Co.**, Chiricahua Mountains (15 ♀, 1 ♀ LACM, 104 ♀, 16 ♀ CWEM), 6mi W Portal (3 ♀, 1 ♀ CWEM), Cave Creek Canyon (6 ♀ CWEM, 12 ♀, 1 ♀ LACM), (31°50'4 109°07'8"W) (6 ♀ CWEM) Herb Martyr Park (2 ♀, 2 ♀ CWEM), John Hand Park (CWEM), South Fork Campground (8 ♀ CWEM) Sunny Flat Campground (12 ♀ CWEM), Horseshoe Canyon Pass (6 ♀ CWEM), W Turkey Creek 18.7k (1950m) (9 ♀ STDC), **Gila Co.**, Pinal Mountains (2 ♀, 1 ♀, 1 ♂ MCZC), Preacher Canyon Area at jct. near HWY 260 (3 ♀ STDC), Sierra Ancha (3 ♀ MCZC), Indian National Monument (3 ♀ LACM); **California**, **Inyo Co.**, Death Valley National Monument, Grapevine Ranger Station (3 ♀ MCZC), **Los Angeles Co.**, Pasadena, San Rafael Hills (4 ♀ MCZC), **Mendocino**

emeryana - southwestern USA, northern México

Nests usually under stones, but also in dead branches and oak galls

Found in arid scrub and dry forests

Compare with *cerasi*, *isolata*, *punctulata*

Co., Orr Springs, Ukiah, (3 ♀ MCZC), **Orange Co.**, Tonner Canyon (CWEM) **San Bernardino Co.**, 2mi NW Fawnskin (CWEM) **San Diego Co.**, Cameron Corners (3 ♀ LACM, 2 ♀, 1 ♀ MCZC), Canyon City (2 ♀, 1 ♀ LACM), Moreno Lake, (2 ♀, 1 ♀ LACM), Santa Ysabel (3 ♀ LACM, 4 ♀ MCZC), **Santa Barbara Co.**, Santa Cruz Island (3 ♀ MCZC); **Colorado**, **Denver Co.**, Denver (1 ♀, 1 ♂ LACM), **Fremont Co.**, 11.5k N Canyon City, Phantom Canyon (CWEM) 21.8k NW Canyon City (38°33'0 34N; 105°25'26W) (21 ♀, 2 ♀, 5 ♂ CWEM), **Montezuma Co.**, Mesa Verde National Park (2 ♀, 1 ♀ LACM); **Nevada**, **Lincoln Co.**, Kershaw Canyon (8 ♀ LACM); **New Mexico**, **Catron Co.**, 20.6k N Glenwood (3 ♀ CWEM); **Cimarron Co.**, Cimarron Canyon (8 ♀, 1 ♂ LACM); **Doña Ana Co.**, Organ Mountains, San Augustine Pass (2 ♀ CWEM) **Grant Co.**, Leopold Vista (3°11'02.0"N, 108°49'42.1"W) (2 ♀ CWEM), **Guadalupe Co.**, Santa Rosa (2 ♀ CWEM), **Hidalgo Co.**, Clayton Draw, Gray Ranch (6 ♀ CWEM), **Lincoln Co.**, Cibola National Forest (34°11'26.63"N 105°43'36.94"W) (9 ♀ CWEM), Sacramento Mountains, Eagle Creek (6 ♀ CWEM), **San Miguel Co.**, Las Vegas (23 ♀ CWEM), 20k N Las Vegas (3 ♀ CWEM), **Union Co.**, Clayton (2 ♀ CWEM); **Texas**, **Brewster Co.**, Pine Canyon Trail (29 ♀ COOK), Big Bend National Park, Chisos Basin Pass (1 ♀ CWEM), Burnham's Ranch (3 ♀ LACM), **Jeff Davis Co.**, 11.3mi NW Fort Davis (9 ♀ COOK), Davis Mountains, Madera Canyon (30°42'07"N; 104°06'42"W) (12 ♀ CWEM), McIvor Ranch (19 ♀ CWEM) Merrill Roadside Park (2 ♀ MCZC), McIvor Ranch (18 ♀ CWEM); **Utah**, **Utah Co.**, Santaquin (2 ♀ LACM).

emeryana - southwestern USA, northern México

Nests usually under stones, but also in dead branches and oak galls

Found in arid scrub and dry forests

Compare with *cerasi*, *isolata*, *punctulata*

Etymology: *emeryana* after Carlo Emery. *Crematogaster marioni* is named for Buren's friend and colleague Marion R. Smith.

Discussion: The key characteristics of the *C. emeryana* worker are the combination of rugose sculpturing and short bristle-like hairs on the pronotum and the reduced propodeal spines. *Crematogaster emeryana* is nearly identical to *C. cerasi*, and can be separated as the dorsal surface of the propodeal spine is straight, not sinuate as in *C. cerasi*.

The types of *Crematogaster marioni* cannot be distinguished from specimens of *C. emeryana*. Buren describes the sculpturing on the face as weak, scapes as scarcely surpassing hind corners and the propodeal spines of moderate length, all typical character states of *C. emeryana*. We are therefore synonymizing *Crematogaster marioni* Buren as a junior synonym of *Crematogaster emeryana* Creighton. The spines are neither reduced as in *C. isolata* or long as in *C. punctulata*, other species found in overlapping geographical areas.

Biology: Mackay and Mackay (unpublished) have collected extensive data on *Crematogaster emeryana*. Most nests are found under stones, but they are also found in dead branches of oaks (*Quercus emoryi*), in/under the bark of logs and in an oak gall (5 cm diameter, about ¼ of gall occupied).

Brood were found in nests in March, April, June, July, August and October, sexuals in April and July. Several nests of *C. emeryana* from the South West Research Station in Arizona had 2 or more dealate queens under the same stone with brood and / or pupae

emeryana - southwestern USA, northern México

Nests usually under stones, but also in dead branches and oak galls

Found in arid scrub and dry forests

Compare with *cerasi*, *isolata*, *punctulata*

(Morgan, unpublished), as well as in other areas (Mackay and Mackay, unpublished). Workers tend to be relatively sluggish and escape when a nest is disturbed.

It forages during a soil surface temperature range of 14.4-62.2°C (Bernstein, 1979b), and can be found loose on the ground and in the litter of old forest and pine-oak litter (Mackay and Mackay, unpublished).

It is found in a variety of habitats including thorn scrub, mesquite thorn scrub, grassland with juniper trees, pinyon juniper forests, a grassy clearing with oak surrounded by pinyon pine/juniper forest, Apache and Chihuahuan pine/alligator bark juniper/cypress, and riparian forest (oak, cottonwood) (Mackay and Mackay, unpublished). It was reported from a pinyon pine community in northern Arizona (Trotter et al., 2008).

Several guests were found in nests, including the cricket *Myrmecophila* sp., pselphids and other beetles as well as pseudoscorpions. It is enslaved by the ant *Dorymyrmex insana* in the Mojave Desert (Bernstein, 1978).

It is found in several soil types including sandy loam, rocky, light brown sandy loam, light brown rocky sand, brown rocky loam, rocky sand and grey gravel.

Bernstein (1979a) discussed the evolution of niche breadth in *C. emeryana*.

emeryana - southwestern USA, northern México

Nests usually under stones, but also in dead branches and oak galls

Found in arid scrub and dry forests

Compare with *acuta*, *depilis*, *opaca*

***Crematogaster formosa* Mayr**

Plates 34 and 107; Fig. 20; Map 13.

Crematogaster formosa Mayr, 1870b: 994, worker, Jalapa, México, Emery, 1922, 135, *Crematogaster* (*Orthocrema*) *formosa*. The name *Crematogaster subnuda formosae* Wheeler, 1909 is a primary junior homonym of *Crematogaster formosa* Mayr, 1870b, and has been replaced with *Crematogaster subnuda nigrosubnuda* by Özdikmen, 2010:990.

Crematogaster formosa var. *aterrima* Wheeler, 1909: 234, Jalapa, México, worker, male, **NEW SYNONYMY**.

Description:

Worker: Mandibles shiny, with semierect and appressed hair; clypeus slightly wider than long, densely punctate in tight longitudinal rows, and with 2 erect hairs, anterior margin slightly convex with many long erect hairs; scape surpassing posterior border of head, with semierect hairs; head densely punctate in tight longitudinal rows, 2 erect hairs.

Mesosoma without erect hairs, few appressed hairs along anterior pronotal margin, dorsum of mesosoma densely punctate in tight lateral rows radiating down sides of mesosoma; promesonotal suture developed around large mesonotal boss; humeri well developed and rounded; notopropodeal groove shallow; propodeal spines average

formosa - México and Guatemala

Nesting site probably arboreal

Tropical cloud forest

length, widely divergent (seen from above), slender, thickening at base.

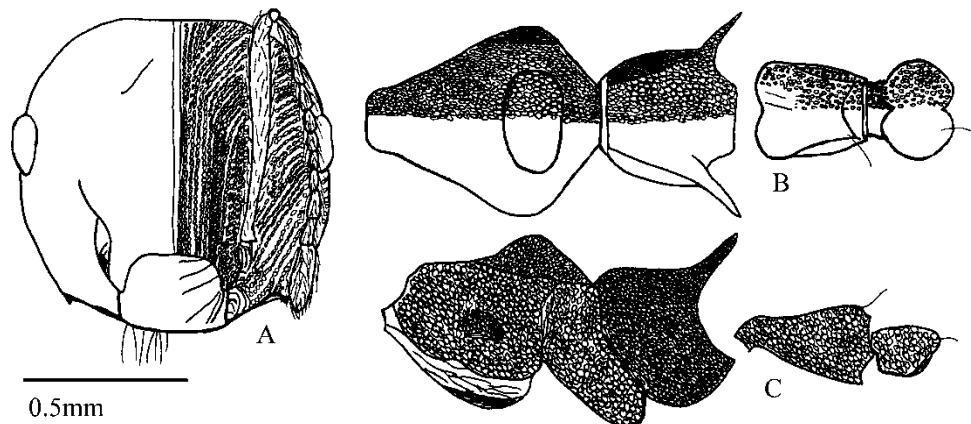


Plate 34. *Crematogaster formosa* worker: (México MCZC): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Petiole and postpetiole shiny and punctate with 1 erect hair on each posterior corner, appressed hairs on sides of petiole; petiole subquadrate (seen from above), with posterior lateral corners coming to points, dorsal surface flat, sides slightly expanded outward (viewed from above), anterior sternopetiolar process pointed and usually well developed; postpetiole posterior margin slightly emarginated; petiole narrower but longer than postpetiole; gaster shallowly shiny areolate

formosa - México and Guatemala

Nesting site probably arboreal

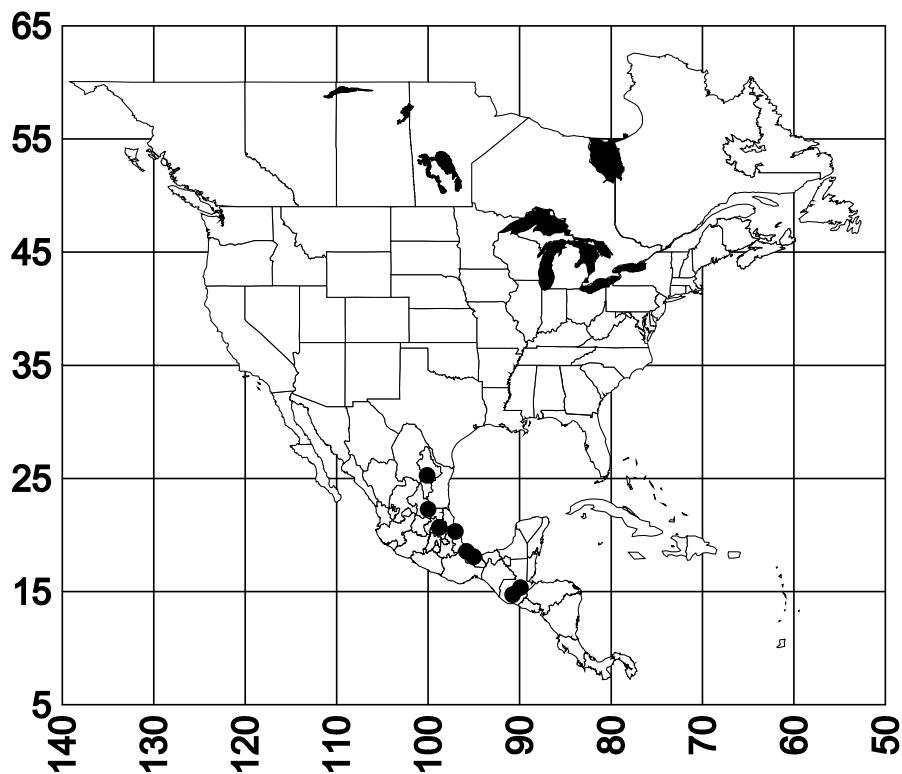
Tropical cloud forest

Compare with *acuta*, *depilis*, *opaca*

without erect hairs except at sting, appressed hairs sparsely dispersed.

Concolorous light brown.

Worker measurements (mm): HL 0.77-0.84, HW 0.88-0.90, SL 0.77-0.82, EL 0.17-0.22, ED 0.14-0.17, CL 0.22-0.24, CW 0.30-0.34, WL 0.92-1.02, PSL 0.19-0.25, PL 0.28-0.32, PW 0.18-0.22, PPL 0.14-0.17, PPW 0.25-0.29; Indices: CI 86-93, SI 98-100, CLI 71-73, PI 145-155, PPI 56-59.



Map 13. *Crematogaster formosa*.

formosa - México and Guatemala

Nesting site probably arboreal

Tropical cloud forest

Compare with *acuta*, *depilis*, *opaca*

Distribution: México, Guatemala (Branstetter and Sáenz, 2012).

Type series: Lectotype worker (designated with red dot) and 11 paralectotype workers [MCZC] and 2 paralectotype workers, México, Jalapa [NHMW]. *Crematogaster formosa* var. *aterrima* Wheeler, 12 cotype workers [LACM].

Material examined and literature cited: **MÉXICO:** **Hidalgo**, Highway 85, k 284, El Alamo (7 ♂ LACM), Puerto de la Zorra (2 ♂ LACM); **San Luis Potosí**, 30mi S Tamazunchale (20.75°N, 98.7833°W) (JTLC 0001451) (1 ♂ LACM); **Veracruz**, Coatepec (4 ♂ LACM), Jalapa Enríquez (19.5333°N, 96.9167°W) (12 ♂ LACM), “La Herradura” (2 ♂ LACM); **Chiapas** (Philpott et al., 2006).

Material not examined (www.antweb.org): **GUATEMALA:** **Chimaltenango**, Yepocapa (LACM 145023); **Sololá**, 2k SSE San Lucas Tolimán (14.6167°N, 91.15°W) (JTLC 000007576); **MÉXICO:** **Veracruz**, Jalapa (JTLC 055856), Orizaba (JTLC 055953); **Nuevo León**, La Estanzuela Reserve, near Monterrey (25.5833°N, 100.25°W) (LACM 141406).

Etymology: *Formosa* from Latin *fōrmōsus* meaning beautiful or handsome referring to the attractiveness of this species.

formosa - México and Guatemala
Nesting site probably arboreal
Tropical cloud forest

Compare with *acuta*, *depilis*, *opaca*

Discussion: The key characteristic of *Crematogaster formosa* is the small mesonotal boss. This species is large for this genus, and concolorous brown to nearly black and very punctate.

Crematogaster formosa could be confused with *C. opaca* and *C. depilis* as the mesosomata of all three are opaque and punctate, without erect hairs. It can easily be separated as these latter two species lack the mesonotal boss. It can be separated from *C. acuta*, as the latter has numerous erect hairs on the dorsum of the mesosoma.

Crematogaster formosa var. *aterrima* Wheeler is considered a junior synonym of *C. formosa* Mayr. As Wheeler (1909) pointed out the only distinguishing character is the color, *C. formosa* is a little darker than *C. formosa* var. *aterrima*. From comparing the type material of both taxa, there is very little difference in color and all other characters are the same. Two of the specimens from the type series of *C. formosa* var. *aterrima* borrowed from the LACM were very light brown, leading us to believe they were callows. The type material of *C. formosa* from the MCZC are all dark brown. Most cabinet specimens are almost black.

Biology: Very little is known about the biology of *Crematogaster formosa*. We have not collected it and find little information in the literature. Workers visit the foliar nectaries on the fern *Pleopeltis crassinervata* in Mexican cloud forest remnants (Koptur et al., 2013).

formosa - México and Guatemala
Nesting site probably arboreal
Tropical cloud forest

isolata

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Compare with *depilis*, *saussurei*

***Crematogaster isolata* Buren**

Plates 35, 36, 37 and 108; Figs. 3 and 4; Map 14.

Crematogaster isolata Buren, 1968: 93, in key and 106-107, worker, Davis Mountains (near McDonald Observatory), Texas, United States (by present restriction).

Descriptions:

Worker: Mandibles longitudinally striate; clypeus wider than long, longitudinally striate with appressed hairs, anterior margin slightly convex with 8 long hairs; scape length variable from just reaching to surpassing posterior border of head, with decumbent hair; head longitudinally striate below eye and areolate above eye, with appressed hairs pointed medially.

Mesosoma punctate, promesonotal suture defined by breaks in sculpturing; 0-1 erect hair on each pronotal shoulder, mesosoma to tips of spines sparsely covered with appressed hair; pronotal humeri rounded; notopropodeal groove shallow and wide; propodeal spines reduced, thickened at base and coming to point, diverging slightly (seen from above); propodeal spiracle not completely flush with curve of spine.

Petiole and postpetiole areolate with sparse semierect hairs and few long flexuous hairs on posterior margin; petiole triangular, slightly longer than wide, anterior sternopetiole process absent to small and

isolata - southwestern USA, northern México

Nest in soil, usually under stones, rarely in plant cavities

Arid desert habitats and dry forests

Compare with *depilis*, *saussurei*

rounded; postpetiole wider than long, hemilobes spreading slightly posteriorly; gaster sparsely but evenly covered with appressed hairs and few erect hairs.

Concolorous light brown to dark brown.

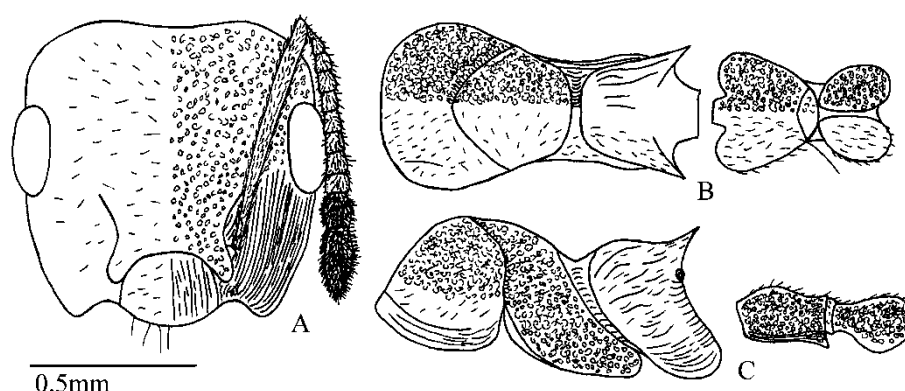


Plate 35. *Crematogaster isolata* worker: (holotype, Garden Canyon, Huachuca Mountains, Arizona, USA, red dot LACM): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Worker measurements (mm): HL 0.85-0.95, HW 0.84-1.10, SL 0.72-0.82, EL 0.22-0.26, ED 0.19-0.22, CL 0.22-0.24, CW 0.34-0.38, WL 1.06-1.14, PSL 0.16-0.20, PL 0.24-0.26, PW 0.34-0.36, PPL 0.22-0.24, PPW 0.28-0.34; Indices: CI 86-101, SI 85-86, CLI 63-65 PI 71-72, PPI 71-79.

isolata - southwestern USA, northern México

Nest in soil, usually under stones, rarely in plant cavities

Arid desert habitats and dry forests

Compare with *depilis*, *saussurei*

Queen: Clypeus wider than long, anterior margin straight with 6-8 long flexuous and many short flexuous hairs; ocelli almost flush with surface of head, small for genus; scape not reaching posterior border of head, with appressed hairs; head shiny, longitudinally striate following curves of face around eyes, with very sparse appressed hair, 3-4 long erect hairs between ocelli.

Mesosoma shiny micro-areolate with appressed hairs pointed medially and 2-4 short erect hairs on scutellum; metanotum and dorsellum visible under scutellum when viewed from above; propodeum striate, directed toward point of spine; propodeal spines with decumbent hairs pointed toward tips, well developed for queen.

Petiole and postpetiole shiny striate with many short, thin, flexuous hairs; anterior sternopetiole process very small; gaster shiny shallowly areolate, with sparse, short, erect and even rows of appressed hairs directed posteriorly.

Concolorous reddish-brown to dark brown.

Queen measurements (mm): HL 1.49-1.70, HW 1.68-1.92, SL 0.96-1.20, EL 0.42-0.48, ED 0.36-0.43, Ocelli Length 0.05-0.06, Ocelli Width 0.10-0.11, CL 0.46-0.48, CW 0.55-0.56, WL 2.81-3.10, PSL 0.38-0.40, PL 0.60-0.63, PW 0.70-0.91, PPL 0.43-0.48, PPW 0.60-0.70; Indices: CI 88-89, SI 64-71, CLI 86-87, PI 69-86, PPI 69-72.

isolata - southwestern USA, northern México

Nest in soil, usually under stones, rarely in plant cavities

Arid desert habitats and dry forests

Compare with *depilis*, *saussurei*

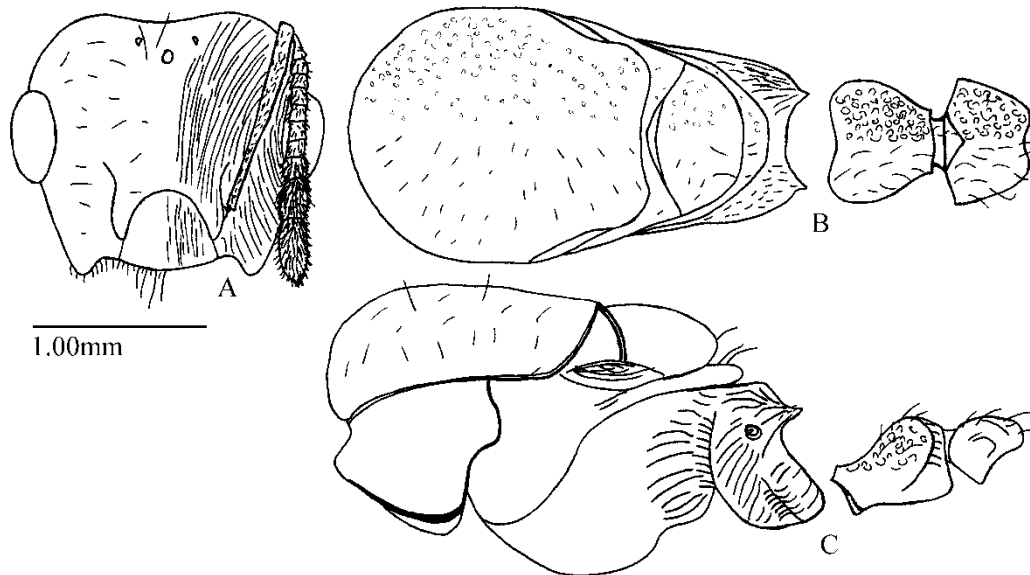


Plate 36. *Crematogaster isolata* queen: (Garden Canyon, Huachuca Mountains, Arizona, top point LACM): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Male: Clypeus snout-like, protruding from face (viewed from above, full face or side), anterior clypeal margin with many long and several short flexuous hairs, much more than on worker clypeus; ocelli protruding from head almost stalk-like; scape typically short; head micro-rugose posterior to clypeus blending to punctures around ocelli, with few long flexuous erect and semierect hairs pointed medially on face.

isolata - southwestern USA, northern México

Nest in soil, usually under stones, rarely in plant cavities

Arid desert habitats and dry forests

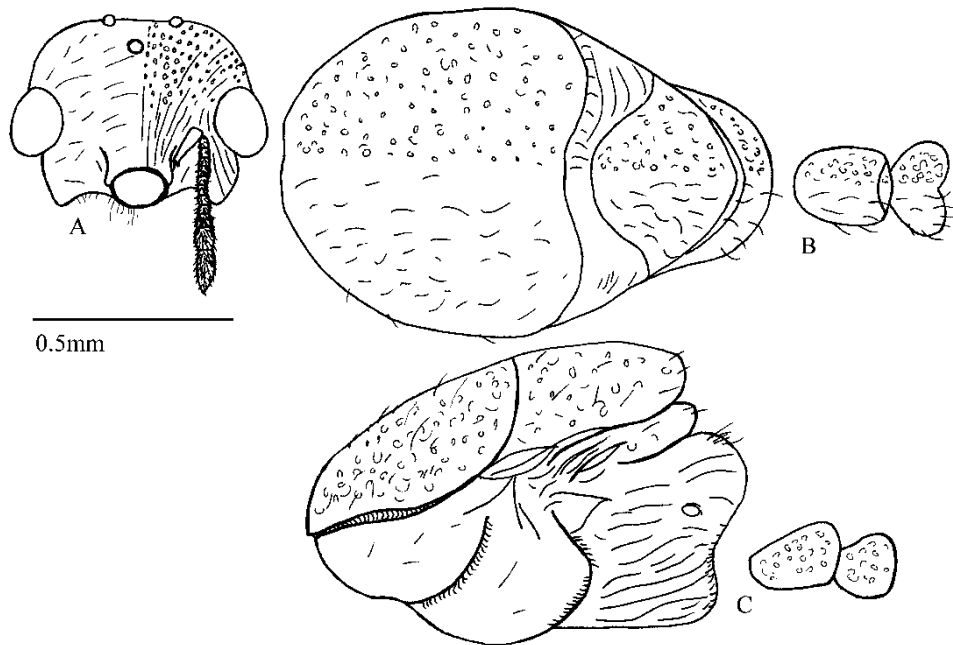
Compare with *depilis*, *saussurei*

Plate 37. *Crematogaster isolata* male: (Garden Canyon, Huachuca Mountains, Arizona, middle point LACM): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Mesosoma shallowly areolate with evenly spaced semierect hairs, much more than on worker; mesosoma wide, but short in length (side view); dorsellum can be seen from above; dorsal view of

isolata - southwestern USA, northern México

Nest in soil, usually under stones, rarely in plant cavities

Arid desert habitats and dry forests

Compare with *depilis*, *saussurei*

scutellum with semierect hairs pointed medially; metanotum and dorsellum with long flexuous hairs along posterior margin.

Petiole, postpetiole and gaster shallow areolate with long flexuous hairs pointed posteriorly; petiole and postpetiole small, petiole subquadrate; postpetiole heart shaped with no defined medial sulcus.

Concolorous dark brown.

Male measurements (mm): HL 0.54-0.56, HW 0.65-0.91, SL 0.12-0.17, EL 0.24-0.25, ED 0.24-0.26, Ocelli Length 0.05-0.06, Ocelli Width 0.07-0.08, CL 0.12, CW 0.23-0.24, WL 1.45-1.70, PL 0.29-0.34, PW 0.25, PPL 0.19-0.23, PPW 0.30-0.32; Indices: CI 62-83, SI 30-39, CLI 50-52, PI 116-136, PPI 63-72.

Distribution: It has been collected from Jeff Davis Co. Texas, west to central Arizona, north to Utah and northern New Mexico and south to Chihuahua, México.

Type series examined: Holotype from United States, Davis Mountains, McDonald Observatory, Texas. Paratype material: Madera Canyon, Santa Rita Mountains, Arizona, 3 ♀ [LACM]; Garden Canyon, Huachuca Mountains, 5 ♀, 1 ♀, 1 ♂ [LACM] San Luis Pass, Animas, New Mexico; Sweetwater, Santa Rita Mountains Arizona, 3 ♀ [LACM]; Sweetwater, Santa Rita Mountains, Arizona; Canelo Pass, Santa Cruz Co.; Chiricahua National Monument, Arizona; Limpia Canyon, Davis Mountains, Texas, 3 ♀ [LACM]; Guadalupe Mountains, Arizona.

isolata - southwestern USA, northern México

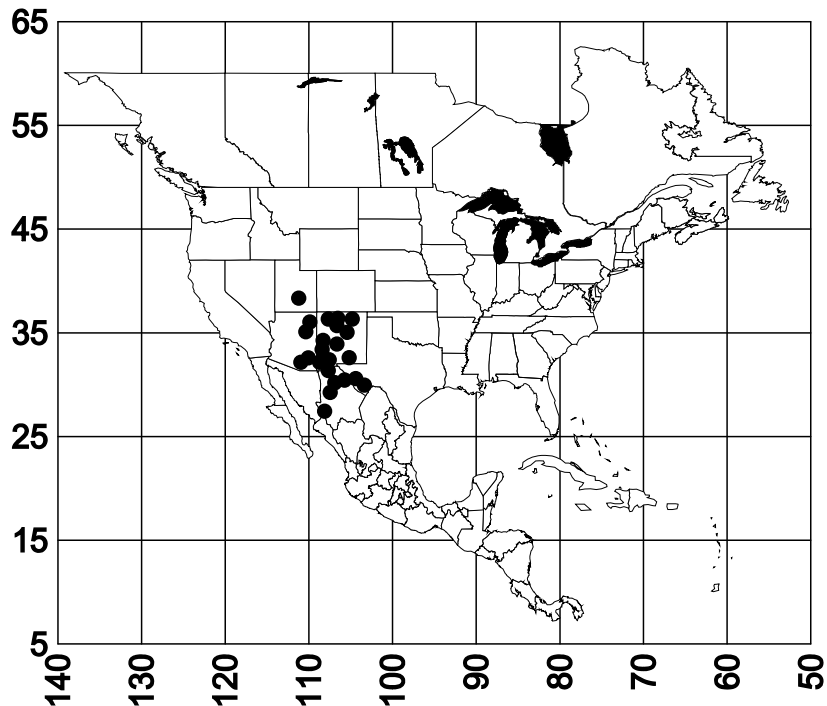
Nest in soil, usually under stones, rarely in plant cavities

Arid desert habitats and dry forests

isolata

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Compare with *depilis*, *saussurei*



Map 14. *Crematogaster isolata*.

Other material examined: MÉXICO: Chihuahua, Municipio Buenaventura (4 ♂ CWEM), Municipio Janos, Ojo Frío (48 ♂ CWEM), Municipio Namiquipa (11 ♂ CWEM), Municipio Villa Ahumada, 85k S Juárez, Rancho 7 Leguas (3 ♂ CWEM), 23k N Madera (CWEM), 11k NW Ojo Frío (CWEM), Terrero (10 ♂ CWEM), 2k N Zaragoza (12 ♂ CWEM). **UNITED STATES: Arizona**, Apache Co., Santa Rita Mountains, Sweetwater (2 ♂ MCZC), Madera Canyon (3 ♂ LACM), **Cochise Co.**, Chiricahua Mountains, Herb Martyr Dam (CWEM), 6mi W Portal (83 ♂, 1 ♀, 4

isolata - southwestern USA, northern México

Nest in soil, usually under stones, rarely in plant cavities

Arid desert habitats and dry forests

Compare with *depilis*, *saussurei*

♂ CWEM), 8mi NW Portal (CWEM), Rucker Canyon (CWEM), Stewart Camp (1 ♀ LACM), Texas Canyon (2 ♀ MCZC), 8.6mi W Jct. Rt. 80 on FSR 74 (31°409'N, 109°19.2'W 1615m) (2 ♀ CWEM), **Santa Cruz Co.**, Canelo Pass (3 ♀ LACM), 7mi SE Canelo (8 ♀ CWEM), Huachuca Mountains, Carr Canyon (3 ♀ LACM), Garden Canyon (5 ♀, 1 ♂ LACM), Miller Canyon (4 ♀ MCZC, 1 ♀ LACM), Pajarito Mountains (20 ♀ MCZC), Ramsey Canyon (3 ♀ LACM); **New Mexico**, **Catron Co.**, 20.6k N Glenwood (2 ♀ CWEM), **Colfax Co.**, Eagle Nest (7 ♀ CWEM), **Doña Ana Co.**, Aguirre Springs Recreational Area (7 ♀, 5 ♀, 5 ♂ CWEM), 45k NE Las Cruces (1 ♀ CWEM), Organ Mountains campground area (1 ♀, 1 ♀, 1 ♂ CWEM), Las Cruces (3 ♀ CWEM), Jornada Experimental Range (CWEM), 9mi E Las Cruces (CWEM), **Grant Co.**, Gila Mountains, Wright's Cabin (9 ♀ CWEM), 13mi N Kingston (9 ♀ CWEM), Silver City (4 ♀, 4 ♀, 4 ♂ CWEM), **Hidalgo Co.**, Animas Mountains, San Luis Pass (6 ♀ LACM), Clayton Draw, Gray Ranch (31°31'22"N 108°56'58"W) (15 ♀ CWEM), Cloverdale Creek, Coronado National Forest 59k S Animas (31°28'35"N 108°58'29"W) (112 ♀, 1 ♀ CWEM), **Lincoln Co.**, Sacramento Mountains, Eagle Creek (6 ♀ CWEM), **Los Alamos Co.**, Rio Grande (3 ♀ CWEM), **Rio Arriba Co.**, Dixon (9 ♀ CWEM), **Santa Fe Co.**, 12mi NE Santa Fe (12 ♀ CWEM), **Socorro Co.** (7 ♀ CWEM), Magdalena Mountain, 1946 meters (2 ♀ CWEM); **Texas**, **Brewster Co.**, 24.39k S Alpine, Elephant Mountain Wildlife Management Area (88 ♀ CWEM), **Jeff Davis Co.**, Davis Mountains (10 ♀ CWEM), Davis Mountains State Park (30°42'22.59N 104°6'16.72 W) (10 ♀ CWEM), Limpia Canyon (1 ♀ MCZC), Fort Davis (1

isolata - southwestern USA, northern México

Nest in soil, usually under stones, rarely in plant cavities

Arid desert habitats and dry forests

Compare with *depilis*, *saussurei*

♀ LACM, 3 ♀ MCZC), M^cIvor Ranch (9 ♀ CWEM); **Utah**, **Garfield Co.**, Henry Mountains, (3 ♀ LACM), **San Juan Co.**, White Canyon, Natural Bridges National Monument (3 ♀ LACM).

Etymology: *isolatus*: from New Latin for separate, apparently referring the condition of propodeal spines which separates this species from all the others in the United States.

Discussion: The key characteristics of the *Crematogaster isolata* worker are the reduced propodeal spines and the spines are not inserted at the widest point on the propodeum.

The *C. isolata* worker resembles those of *C. saussurei* and *C. depilis*. Distinguishing characters between *C. isolata* and *C. saussurei* are that *C. isolata* has 0-1 erect hairs on each pronotal shoulder; *C. saussurei* has 2-3. *Crematogaster isolata* is areolate to punctate while *C. saussurei* is lineolate-rugose with a medial notopropodeal carina.

The queens resemble their workers, but the queen of *C. isolata* has less developed spines than those of *C. saussurei*. The males are very different. The male *C. isolata* has disproportionately large eyes almost touching the clypeus, the clypeus is snout-like protruding from the face, and the ocelli also protrude from the top of head almost resembling eye stalks. *Crematogaster saussurei* males have a more typical male face with large eyes, clypeus almost flush with face and typical ocelli that are raised slightly above the top of the head. *Crematogaster isolata* and *C. depilis* can also be difficult to distinguish because *C. isolata* can be devoid of erect pronotal hair as in *C. depilis*; however, the spines on *C. isolata* are slightly reduced and

isolata - southwestern USA, northern México

Nest in soil, usually under stones, rarely in plant cavities

Arid desert habitats and dry forests

Compare with *depilis*, *saussurei*

not inserted at the widest part of the propodeum as in *C. depilis* which also has long slender spines. The sculpturing on *C. depilis* is very punctate while *C. isolata* is areolate to punctate.

Biology: Mackay and Mackay (unpublished) have collected data on this species. *Crematogaster isolata* commonly nests under stones (rarely under logs), occasionally in open soil with small mounds, but was also found in tunnels in creosotebush roots, in/under loose bark of a pinyon pine, in a dead branch of silver leaf oak with loose bark, 3m from soil surface, in a standing oak trunk and in oak galls. They have been collected from dead limbs and stumps of *Quercus emoryi*, and foraging and living under bark with brood on manzanita trees (Morgan, unpublished).

Brood were found in nests in March, April, June, July, August and October, sexuals in nests in June and July, sexuals escape by flying from excavated nests.

They occur in mesquite and acacia scrub, arid creosotebush scrub, pinyon pine forests, pinyon/juniper, oak forests, oak/juniper grassland, riparian forest, deciduous forest, ponderosa pines, Douglas fir as well as in burned forest and picnic areas.

They nest in soils including light brown rocky clay, light brown sandy loam, light brown rocky loam, brown rocky-loam, dark brown rocky loam, and brown rocky gravel.

Beetles are occasionally found in nests.

isolata - southwestern USA, northern México

Nest in soil, usually under stones, rarely in plant cavities

Arid desert habitats and dry forests

***Crematogaster laeviuscula* Mayr**

Plates 38, 39, 40 and 109; Figs. 3 and 5; Map 15.

Crematogaster laeviuscula Mayr, 1870b: 993, worker, Fort Cobb, Oklahoma, United States. Emery, 1895: 284-285, subspecies of *C. lineolata*. Wheeler, 1904a: 301, subspecies of *C. lineolata*. Wheeler, 1908c: 480, queen. Wheeler, 1919: 111, revived status as species. Emery 1922: 141, combination in *C. (Crematogaster)*, subspecies of *C. lineolata*. Creighton, 1950: 210, revived status as species. Buren, 1968: 92, combination in *C. (Crematogaster)*. Petralia and Vinson, 1980: 383, larva.

Oecodoma (Atta) arborea Buckley, 1867: 349-350, worker, queen, Central Texas, United States. M^cCook, 1879: 187; Dalla Torre, 1893: 83, junior synonym of *C. lineolata*. Smith, M. R. 1951: 809; Smith D. R. 1979: 1379, junior synonym of *C. laeviuscula*.

Oecodoma (Atta) bicolor Buckley, 1867: 350, worker, Northern Texas, United States. M^cCook, 1879: 188, senior synonym of *Crematogaster clara*. Mayr, 1886b: 463, senior synonym of *Crematogaster clara*. Dalla Torre, 1893: 83, variety of *C. laeviuscula*.

Crematogaster clara Mayr, 1870b: 993, worker, Fort Cobb, Oklahoma, United States. M^cCook, 1879: 188; Mayr, 1886b: 463, junior synonym of *C. bicolor*. Dalla Torre, 1893: 83, variety of *C. laeviuscula*. Wheeler, 1908c: 481, queen, male. Wheeler, 1919: 111, variety of *C. laeviuscula*. Emery 1922: 141, combination in *C. (Crematogaster)*. Enzmann, 1946: 93,

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

Compare with *lineolata*

variety of *C. laeviuscula*. Creighton, 1950: 210, junior synonym of *C. laeviuscula*. Buren, 1968: 92, combination in *C. (Crematogaster)*, revived from synonymy in key. Johnson, 1988: 322, junior synonym of *C. laeviuscula*.

Crematogaster atkinsoni Wheeler, 1919: 108, worker, Fort Myers, Florida, United States. Wheeler, 1932: 8, queen, male. Creighton, 1950: 207, combination in *C. (Acrocoelia)*. Buren, 1968: 92, combination in *C. (Crematogaster)*, **NEW SYNONOMY**.

Crematogaster haeveola Wheeler, 1919: 109, worker, queen, male, Okefenokee Swamp, Georgia, United States. Creighton, 1950: 207, junior synonym of *C. atkinsoni*.

Crematogaster lineolata cedrosensis Wheeler, 1934b: 136, worker, Cedros Island, México, Enzmann, 1946: 94, subspecies of *C. opaca*, **NEW SYNONOMY**.

Crematogaster hespera Buren 1968: 98, worker, queen; Phoenix, Arizona, United States, **NEW SYNONOMY**.

Descriptions:

Worker: Clypeus wider than long, shallowly areolate with 2 long and 2-4 short flexuous hairs, anterior margin straight, with several long erect hairs; scape reaching posterior border of head, with many decumbent hairs; head shallowly areolate, evenly, sparsely covered with short erect and decumbent hairs.

Mesosoma shiny, with shallowly to well-developed areolae, less developed in smaller specimens with many short erect and appressed hairs; pronotal shoulder with 2-4 long erect hairs, medial pronotal

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

Compare with *lineolata*

carina bluntly developed (like rounded carina); humeri developed; dorsum and side of propodeum longitudinally striate-rugose; notopropodeal groove steep and angular; mesopleuron very punctate; propodeal spines long, slender, slightly thickening at base, divergent (viewed from above.)

Petiole and postpetiole shallowly areolate with several appressed hairs and 1 erect hair on each posterior corner; anterior sternopetiole process absent to barely noticeable; petiole angularly trapezoidal, with anterior lateral flange upraised when viewed from behind; hemilobes of postpetiole almost round when viewed from above with wide medium sulcus; petiole longer but narrower than postpetiole; gaster shallowly areolate with sparse evenly covered with erect and appressed hairs.

Usually bicolored, with red to light brown head, mesosoma, petiole, and postpetiole; gaster, dark brown; however, can be concolorous light brown in smaller specimens.

Worker measurements (mm): HL 0.73-1.02 HW 0.89-1.14, SL 0.62-0.90, EL 0.18-0.25, ED 0.14-0.18, CL 0.22-0.34, CW 0.24-0.42, WL 0.80-1.46, PSL 0.13-0.18, PL 0.18-0.30, PW 0.30-0.42, PPL 0.14-0.19, PPW 0.25-0.37; Indices: CI 82-89, SI 85-88, CLI 81-92, PI 60-71, PPI 51-56.

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones
Occur in riparian habitats and forests, rarely in arid ecosystems

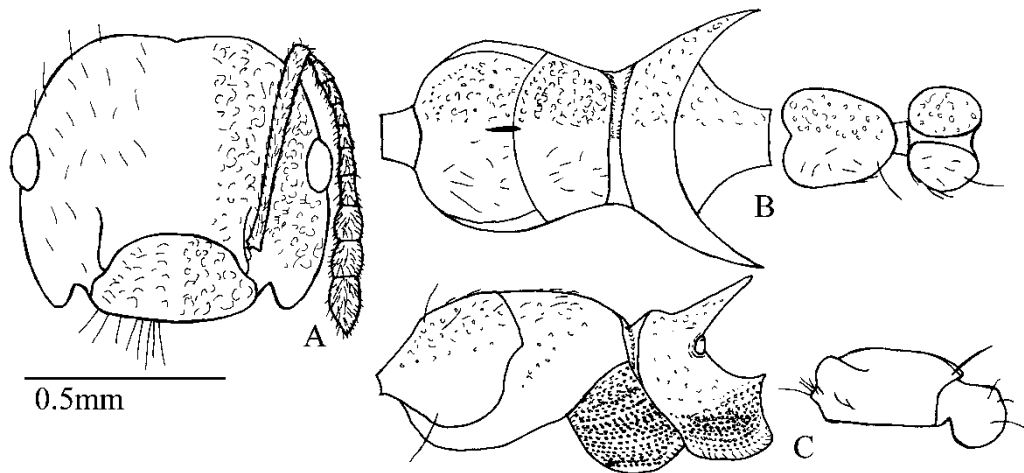
Compare with *lineolata*

Plate 38. *Crematogaster laeviuscula* worker: (Oklahoma NHMW): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Queen: Mandibles shiny shallowly longitudinally striate, with semierect hairs; clypeus shiny, with few fine hairs, anterior clypeal margin straight; scape just reaches posterior border of head, with appressed hairs; ocelli small, almost flush with surface of head; head with deep well defined longitudinally striae with few long fine erect and many semierect hairs pointed toward frontal groove.

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones
Occur in riparian habitats and forests, rarely in arid ecosystems

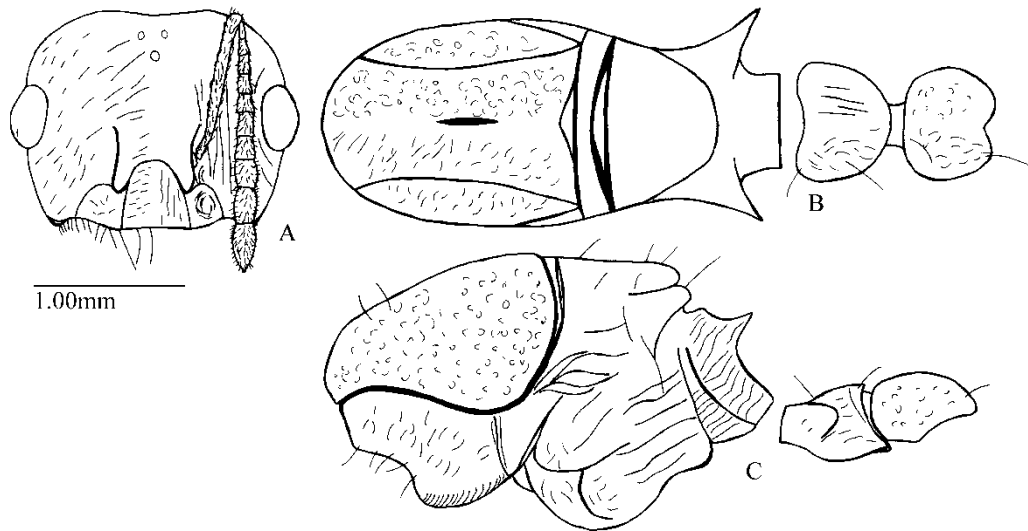


Plate 39. *Crematogaster laeviuscula* queen: (Sandoval Co., New Mexico CWEM # 6291): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma, petiole and postpetiole.

Mesosoma shiny shallowly areolate with few long and short erect and many short appressed hairs pointed toward medial carina; dorsellum not visible viewed from above; propodeal spines flattened and thickened at base.

Petiole and postpetiole areolate dorsally, side of petiole longitudinally striate, petiole with 4 erect and many appressed hairs; postpetiole with 2 erect and many appressed hairs; gaster areolate with scattered short erect hairs.

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones
Occur in riparian habitats and forests, rarely in arid ecosystems

Compare with *lineolata*

Bicolored, head, mesosoma, petiole and postpetiole dark amber to light brown, gaster darker; or concolorous light brown.

Queen measurements (mm): HL 1.27-1.51, HW 1.92-2.14, SL 1.20-1.34, EL 0.41-0.45, ED 0.31-0.36, CL 0.43-0.46, CW 0.48-0.58, WL 2.83-2.88, PSL 0.22-0.36, PL 0.36-0.43, PW 0.58-0.62, PPL 0.38-0.48, PPW 0.53-0.77; Indices: CI 66-71, SI 89-94, CLI 79-90, PI 62-69, PPI 62-72.

Male: Clypeus shiny, anterior margin straight; ocelli almost flush with top of head, scapes typically short; head shiny areolate, with 2-4 erect hairs by ocelli and few appressed hairs.

Mesosoma shiny, shallowly areolate with scattered appressed hairs; dorsellum barely seen viewed from above.

Petiole, postpetiole and gaster shiny, shallowly areolate, with fine erect hairs on posterior margin; gaster with few scattered appressed hairs.

Concolorous dark brown.

Male measurements (mm): HL 0.50-0.56, HW 0.64-0.76, SL 0.17-0.22, EL 0.26-0.29, ED 0.21-0.23, CL 0.14-0.20, CW 0.22-0.29, WL 1.51-1.74, PL 0.17-0.19, PW 0.25-0.34, PPL 0.16-0.23, PPW 0.22-0.35; Indices: CI 73-78, SI 34-39, CLI 64-69, PI 56-68, PPI 66-73.

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

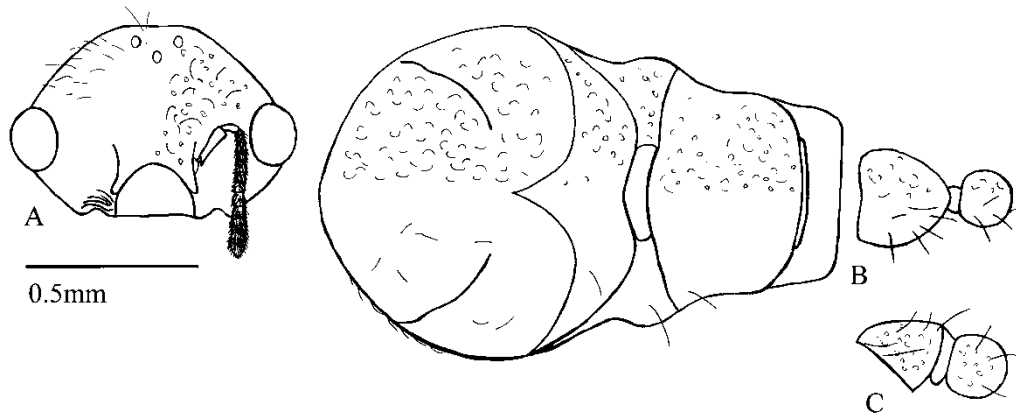


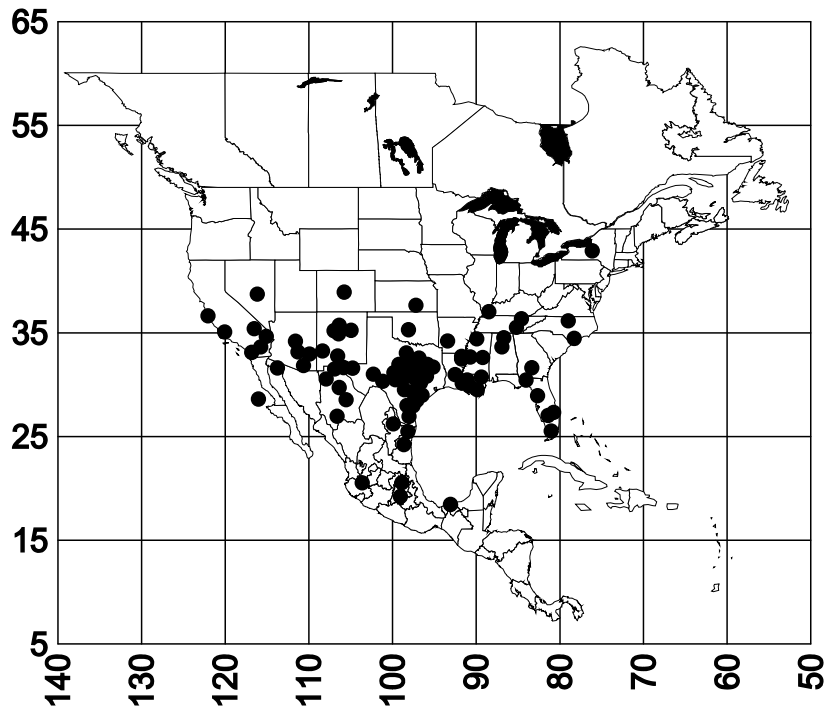
Plate 40. *Crematogaster laeviuscula* male: (Sandoval Co., New Mexico CWEM # 6291): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of petiole and postpetiole.

Distribution: This species is found throughout the United States, and has been collected as far south as Tabasco, México. Additional citations include Virginia (Guénard et al., 2012; Kjar, 2009), southeastern South Carolina (Davies, 2009, as *C. atkinsoni*), and Baja California (Johnson and Ward, 2002, as *C. opaca cedrosensis*, and *C. hespera*; Vázquez-Bolaños, 2011).

Type series: Oklahoma, Fort Cobb, USA, 3 syntype workers [NHMW].

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones
Occur in riparian habitats and forests, rarely in arid ecosystems

Compare with *lineolata*Map 15. *Crematogaster laeviuscula*.

Material examined and literature cited: **MÉXICO**, **Chihuahua**, Buenaventura (19 ♀ CWEM), Casas Grandes, Galeana (2 ♀ CWEM), Delicias (28 ♀ CWEM), 9mi N Flores Magón (CWEM), Ojo de la Casa (6 ♀ CWEM), 18k N Flores Magón (16 ♀ CWEM), 7k S San Lorenzo (7 ♀, 2 ♀, 1 ♂ CWEM); **Colima**, Colima (1 ♀, 1 ♀, 1 ♂ CWEM), 39k N Colima (19°28'0.41'N, 103°27'31'W) (1 ♀, 1 ♂ CWEM); **México**, Ciudad de México (2 ♀ CWEM); **Nuevo León**, Monterrey, Parque Chipinque (31 ♀ CWEM), 146k N Monterrey (7 ♀ CWEM); **Sonora**, Puerto Peñasco (11 ♀ CWEM);

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

Tabasco (del Toro et al., 2009); **Tamaulipas**, Matamoros (1 ♂, 1 ♀ CWEM), (Coronado-Blanco et al., 2013). **UNITED STATES:** **Alabama**, **Jefferson Co.**, Warrior (2 ♀ CWEM), **Madison Co.**, Monte Sano Park (3 ♀ CWEM), **Mobile Co.**, Alabama Port (13 ♀ CWEM), see also MacGown and Forster, 2005; **Arizona**, Arizona Department of Agriculture, Interception from North Carolina (32 ♀ COOK), **Cochise Co.**, Portal (5 ♀ CWEM), **Maricopa Co.**, Phoenix (3 ♀ MCZC), **Santa Cruz Co.**, Pajarito Mountains (2 ♀, 1 ♀ MCZC); **Arkansas**, **Arkansas Co.**, see General and Thompson, 2007, see also MacGown et al., 2011, **Hempstead Co.**, Hope (3 ♀ CWEM); **California**, **Monterey Co.**, Carmel (3 ♀ MCZC), Pacific Grove, (2 ♀ CWEM), **Riverside Co.**, San Jacinto Mountains, 6mi S Buckhorn (2 ♀ CWEM), 4mi SW Fulmore Lake (14 ♀, 10 ♀, 34 ♂ CWEM), Vista Grande Ranger Station (24 ♀, 12 ♀, 12 ♂ CWEM), **Santa Barbara Co.** (2 ♀, 1 ♂ MCZC), Romero Canyon (4 ♀ MCZC), **San Bernardino Co.**, Lake Arrowhead (4 ♀ CWEM), **San Diego Co.**, Dulzura at Route 94 (1 ♀ STDC), Santa Ysabel (3 ♀ MCZC); **Colorado**, (1 ♀ NHMW), **Park Co.**, 4.25k SW Florissant (60 ♀ CWEM); **Florida**, (31 ♀ NHMW), **Citrus Co.**, 13mi SW Crystal River (3 ♀ CWEM), **Highlands Co.**, Archbold Research Station (2 ♀ CWEM), **León Co.**, Woodville Natural Wells Rd (30°18'51'M 084°14'51'W) (3 ♀ STDC), **Martin Co.**, near Stuart, mile marker 106, 1-95 Rest Area (1 ♀ STDC), **Monroe Co.**, West Summerland Key (12 ♀, 6 ♀ CWEM), **Gadsden** and **Alachua** counties, Florida (Whitcomb et al., 1972), see also Deyrup et al., 1988; **Kansas**, **Cowley Co.**, Stone (2 ♀ MCZC), **Wallace Co.**, Sharon Springs (7 ♀ CWEM); **Kentucky**,

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

Compare with *lineolata*

Fulton Co., Redfoot Lake (3 ♀ MCZC); **Louisiana**, **Baton Rouge Parish**, Baton Rouge (3 ♀ MCZC), **East Carroll Parish**, Lake Providence (2 ♀, 1 ♂ MCZC), **Iberia Parish**, St. Bernard State Park (CWEM), **Madison Parish**, Quebec (3 ♀ MCZC), **Plaquemines Parish**, Saint Bernard State Park (30 ♀, 13 ♂ CWEM), Saint Landry Parish, Opelousas (3 ♀ MCZC), **Saint Mary Parish**, Morgan City (8 ♀ CWEM), **Terrebonne Parish**, Gibson (9 ♀ CWEM), see Dash and Hooper-Bùi, 2008, as *C. atkinsoni*; **Mississippi**, **Panola Co.**, Batesville (3 ♀ MCZC), **Sharkey Co.**, Rolling Fork (3 ♀ MCZC), **Oktibbeha Co.**, 4k NE Starkville (4 ♀ MCZC), **Washington Co.**, Deerfield Park (10 ♀ MCZC); **Missouri**, **Hancock Co.**, Saint Louis (4 ♀ MCZC); **Nevada**, **Nye Co.**, Mercury (2 ♀ CWEM); **New Mexico**, **Bernalillo Co.**, Bosque Forest (1 ♀ CWEM), **Doña Ana Co.**, Aguirre Springs (CWEM), **Grant Co.**, Gila Mountains, Wright's cabin (9 ♀ CWEM), **Otero Co.**, White Sands National Monument (7 ♀ CWEM), **Sandoval Co.**, Coronado State Park (52 ♀, 19 ♀, 21 ♂ CWEM), Coronado State Park (1 ♀, 1 ♀, 1 ♂ CWEM), Corrales (2 ♀ CWEM), **San Miguel Co.**, Villanueva State Park (1 ♀ CWEM), **Socorro Co.**, Sevilleta National Wildlife Reserve, Bosque Meadow (1 ♀ CWEM); **Nevada**, **Lyon Co.**, Fort Churchill State Historical Park (304 ♀ CWEM); **North Carolina**, **Brunswick Co.**, Baldhead Island Beach (4 ♀ STDC), **Durham Co.**, Duke University Forest (3 ♀ MCZC), see also Guénard et al., 2014; **Oklahoma**, **Oklahoma Co.**, 9.20kE Edmond (43 ♀ CWEM), **South Carolina**, **Barnwell Co.**, Savannah River Atomic Energy Plant (16 ♀ CWEM); **Tennessee**, **Putnam Co.**, Cookeville (1 ♀ CWEM), **Rhea Co.**, Airport Old Field

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

(2 ♂ MCZC), **Wayne Co.**, Clayton (2 ♂ CWEM), 10mi N Waynesboro (3 ♂ CWEM); **Texas, Anderson Co.** Eagling Wildlife Area (31° 56'53" N; 95° 53'14" W) (18 ♂ COOK), **Bastrop Co.**, Camp Swift (22 ♂ COOK), **Blanco Co.**, Blanco (21 ♂ CWEM), Pedernales State Park (13 ♂ CWEM), **Brazos Co.** Research Park (8 ♂ CWEM), Deer Lick Creek Park (1 ♂ CWEM), **Brown Co.**, Camp Bowie Lewis Cr. (6 ♂ COOK), Site 3 (N31° 38.610'; 98° 56.232') (20 ♂ COOK), Camp Bowie Pond 71; (N31° 36.614'; W98° 53.744') (6 ♂ COOK), Pond 66, 4-1 (1 ♂ COOK), Pond 65 (N31° 36.566'; W98° 53.875') (4 ♂ COOK), **Cameron Co.**, Brownsville (2 ♂, MCZC), Sugarcane Field (5 ♂ CWEM), 1.4mi. E Jct. 509 of Hwy106, W of Harlingen (2 ♂ COOK), N edge of Buena Vista (2 ♂ COOK), Jct. FM 509 & 106 (14 ♂ COOK), **Comanche Co.**, Bill Haney Orchard (2 ♂ COOK), **Comal Co.**, New Braunfels (3 ♂, 3 ♀, MCZC), **Crockett Co.**, Ranch Rd, 16.6mi W Ozona, 2398m (1 ♂ COOK), **Dallas Co.**, 4mi N Seagoville (7 ♂ CWEM), **El Paso Co.**, El Paso (40 ♂ CWEM), UTEP Campus E of library (1 ♂ CWEM, 14 ♂ COOK), **Fannin Co.**, Bonham State Park (5 ♂, 1 ♀ CWEM), **Fayette Co.**, La Grange (3 ♂ CWEM), **Hamilton Co.**, 7mi S Hamilton (1 ♂ MCZC, 23 ♂ CWEM), **Hays Co.**, San Marcos (5 ♂ CWEM), **Hudspeth Co.**, Indio Mountains Research Station (4 ♂ CWEM), **Jim Wells Co.**, 4k N Alice (3 ♂ CWEM), **Kendall Co.**, 2mi NW Nelson City on MM 531 at I-10 (3 ♂ STDC), **Kenedy Co.**, Santa Turcotte Ranch (7 ♂ COOK), **Kimble Co.**, Junction (1 ♂ CWEM), 9.7k SW Junction (1 ♂ CWEM), **Kleberg Co.**, Padre Island National Seashore (2 ♂ COOK), **Lavaca Co.**, La

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

Compare with *lineolata*

Orange (3 ♀ CWEM), **Llano Co.**, Enchanted stone Area (1 ♀ CWEM, 2 ♀ COOK), **Mason Co.**, Mason (32 ♀ CWEM), **Matagorda Co.**, 8.8mi SSE Sergeant Beach area (9 ♀ STDC), **McLennan Co.**, Tonkawa Park (41 ♀ CWEM), Palo Pinto Co., Rest Area # 40 (12 ♀ CWEM), **Parker Co.**, Ft. Wolters, Site 2 (N32° 51.242'; W98° 02.881') (9 ♀ COOK), **Pinto Co.**, rest area #4 on Parker Co. line (10 ♀ CWEM) **Rusk Co.**, Nacogdoches (1 ♀ CWEM), **Travis Co.**, Austin, (4 ♀, 3 ♂ MCZC), **Val Verde Co.**, Hwy 163, 4.9mi. S. Juno (20 ♀ COOK), 22mi N Comstock (24 ♀ COOK), **Walker Co.**, Huntsville State Park (5 ♀ CWEM), see additional Texas records in Jusino-Atresino and Phillips (1992) and Cokendolpher et al., 2009.

Etymology: *Laeviuscula* from Latin laevē meaning shiny, referring to many shining surfaces of the worker.

Discussion: This common species is one of the most attractive, generally being bright red with a shiny black gaster. Key characteristics of *C. laeviuscula* are the entirely smooth and glossy head; the pronotum is lightly sculptured, and at least partially smooth and shining. Most the specimens are bicolored, mostly red with a black gaster.

Mayr described two species in 1870 from Ft. Cobb, Oklahoma: *C. laeviuscula* and *C. clara*. These two species differed by size and intensity of sculpturing on the face and mesosoma. *Crematogaster laeviuscula* is smaller with less intense sculpture and *C. clara* is larger with more intense sculpture. Dalla Torre (1893) and Wheeler (1919)

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones
Occur in riparian habitats and forests, rarely in arid ecosystems

Compare with *lineolata*

made *C. clara* a variety of *C. laeviuscula*. Wheeler (1908b) found 2 nests with series of mixed sizes and sculpturing and contained ants that ranged from the largest *C. clara* to the smallest *C. laeviuscula* giving credence to synonymy. The smaller *C. laeviuscula* have been found in smaller nests, possibly because they are newer colonies that have been recently established. Wheeler concluded that *C. laeviuscula* were merely minors of *C. clara*, with which we agree, based on several series. Since *C. laeviuscula* had page preference, the species was assigned that name (Johnson, 1988).

Crematogaster lineolata var. *cedrosensis* has smaller spines, but the shape of the spines, pilosity and sculpture are consistent with *C. laeviuscula* and it is proposed as a synonym.

Crematogaster atkinsoni keys out to *C. laeviuscula* in both Creighton (1950) and Buren (1968) when using type material borrowed from the MCZC. We have also compared type material of *C. atkinsoni* and type material of *C. laeviuscula*. The types two species appear to be identical leading us to consider *Crematogaster atkinsoni* a junior synonym of *C. laeviuscula*.

MacGown (pers. comm.) does not agree with our synonymizing *C. atkinsoni*, which makes unique and distinctive carton nests in gulf coastal grasses and is not the same thing as *C. laeviuscula*, that nests in stumps, cavities, etc., west of the Mississippi River. He has had considerable experience with southeastern ants, and we could be wrong.

There is considerable variation in *C. laeviuscula* in terms of color and sculpturing. Color ranges from the common bicolored individuals, completely reddish yellow, to completely dark brown. The

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

Compare with *lineolata*

head is mostly smooth and glossy, but the pronotum may be completely smooth and glossy (polished) to lightly sculptured (striated) and weakly shining.

We have compared paratypes of *Crematogaster hespera* Buren to syntypes of *C. clara* (now *C. laeviuscula*) and find no apparent differences. Buren's description of *C. hespera* could also be applied to *C. clara*. In Buren's key to eastern species, *C. hespera* keys out to *C. laeviuscula*. We did not find much variation in the Buren paratypes; however, we have seen considerable variation within nest series from CWEM leading us to consider *Crematogaster hespera* Buren a junior synonym of *C. laeviuscula*.

Biology: The habits of *Crematogaster laeviuscula* are diverse, mostly arboreal and relatively well known. Mackay and Mackay (unpublished) found they occasionally nest under stones, but generally live in living trees, in hollow twigs, under the bark and in branches (full of beetle burrows or termite tunnels), in completely rotten stumps with loose bark and in/under logs. They have often been taken in oak galls (Morgan, unpublished). They consistently nest in plants in Mississippi, including in dead dogwood, black willow, sumac, white ash, goldenrod, blackberry (*Rubus laciniatus*), common elder, mimosa, hickory, plume grass, rattan-vine, catalpa, bois d'arc, hawthorn, prickly ash, sweetgum, red oak, china-tree, pecan, black locust, and dead woody galls on red oak, often in preformed cavities (Tynes and Hutchins, 1964). They would often move the nest to logs and stumps when the colony outgrew its home (Tynes and Hutchins, 1964). They make carton nests in grass tussocks (as *C. atkinsoni*,

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

Deyrup et al., 1988).

Mackay and Mackay (unpublished) collected brood in nests in March, May, June and August, sexuals in August. A founding queen with one worker was found in a hollow twig in March. Workers tend to be sluggish and escape when the nest is disturbed, but are more active under warmer temperatures, and large nests can be aggressive, and the workers attack and bite, relatively painfully for *Crematogaster*. Colonies have hundreds of workers and reproductives, as well as brood (Tynes and Hutchins, 1964). Brood overwinter as larvae (Tynes and Hutchins, 1964).

They forage in the vegetation as well as loose on the ground. Morgan (unpublished) noted that they utilize hollow vegetation to camouflage their trails. She found them at Squaw Spring at the UTEP Indio Mountains Research Station of Hudspeth Co., Texas, a riparian habitat in the Chihuahuan Desert, where they were traveling almost unseen on cattail stalks. Many eggs and pupae (worker and queen) were found in the hollow stalks that were exposed to the sun. Workers were seen eating a cicada thorax, others were feeding on a discarded piece of meat (Mackay and Mackay, unpublished). They were attracted to meat baits in open areas (Morrison, 2004). They tend Hemiptera and build earthen tents to protect the animals (Tynes and Hutchins, 1964).

They are generally found in mesic sites, including urban areas in arid regions, but are also found in open desert with creosote bush scrub, mesquite and acacia, mixed shrubland (mesquite, cholla, big lobed cactus), sagebrush, grassland, juniper forest, pinyon pine riparian, oak forests, oak woodland with spiny vegetation, riparian

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

Compare with *lineolata*

forest, riparian cottonwoods, deciduous forest, mixed pine/hardwood trees and pine/spruce/fir forest (Mackay and Mackay, unpublished). Whitford et al. (1999, as *C. hespera*) found them in riparian woodlands in New Mexico, and Feener (1981) reported them from semi-deciduous woodlands in eastern Texas. They are found in Florida scrub and pine flatlands in Florida upland ecosystems (King, 2007). They occur in fresh and salt water marshes, grasslands, sunflowers and mesquite, they normally nest arboreally, but can be found in logs (Jusino-Atresino and Phillips, 1992). They even occur in caves (Cokendolpher et al., 2009), and adapt to urban ecosystems (Guénard et al., 2014).

They are found in areas with soils ranging from light brown, brown to dark brown clay, light to dark brown clay/loam, dark brown loam, light brown fine sand/clay, orange sand, light brown to brown rocky-loam, and light brown rocky sand to rocky red soil.

They are codominant with the red imported fire ant *Solenopsis invicta*, as well as with *S. geminata*, and are parasitized by phorid flies, *Pseudacteon* sp. (Morrison et al., 2000). They are also parasitized by the strepsipteran *Caenocholax fenyesis* (Cook, 2009; Kathirithamby et al., 2010). *Crematogaster laeviuscula* are predators on egg cases and spiderlings of the spider *Peucetia viridans* (Oxyopidae) in South Carolina (as *C. clara*, Willey and Adler, 1989). They eliminate relatively few nests of the wasp *Polistes exclamans* (Strassmann, 1981). Hung and Vinson (1975) studied the male reproductive system.

Deyrup (2017) includes details on the biology and distribution of this species as well as comparisons with other species occurring in Florida, as *C. atkinsoni*.

laeviuscula - USA and México

Arboreal, occasionally nest in logs, stumps or under stones

Occur in riparian habitats and forests, rarely in arid ecosystems

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*

***Crematogaster limata* Smith**

Plates 41 and 110; Figs. 23; Map 16.

Crematogaster limata Smith, 1858: 139, worker, queen, male, St. Catarina, (Ega) Brazil. Wheeler, 1921: 151, combination in *C. (Orthocrema)*. Longino, 2003: 79, worker and queen.

Crematogaster palans Forel, 1912: 216-217, worker, Provence Espírito Santo (Christophersen), Panamá. Wheeler, 1921: 151, queen. Emery, 1922: 136, combination in *C. (Orthocrema)*. Wheeler, 1942: 197, male. Longino, 2003: 79, junior synonym of *C. limata*.

Crematogaster inca subsp. *ascendens* Wheeler, 1925: 28, worker, Santa Ana, Perú. Longino, 2003: 79, junior synonym of *C. limata*.

Crematogaster dextella Santschi, 1929b: 88-89, worker, Canal Zone, Barro Colorado, Panamá. Wheeler & Wheeler, 1952: 258, larva. Longino, 2003: 79, junior synonym of *C. limata*.

Descriptions:

Worker: Mandibles smooth, with erect hairs; clypeus smooth with 4-6 long flexuous and few appressed hairs, clypeal suture not well defined, blending into head, anterior clypeal margin convex with several long flexuous hairs; scape surpassing posterior border of head,

limata - México to Bolivia and Brazil

Arboreal dwelling species, usually in ant plants, also galls, posts and twigs

Tropical habitats and forests

Compare with *longispinosa*, *nigropilosa*, *sotobosque*

with erect hairs; head shiny with as many as 4 hairs on each frontal lobe and as many as 10 on posterior border of head.

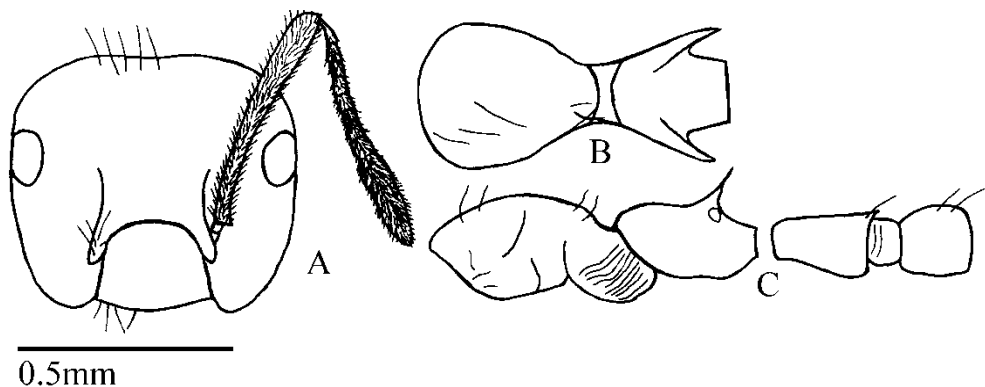


Plate 41. *Crematogaster limata* worker: (specimen to the left with pin at bottom BMNH): (A) Head (pilosity is shown on left); (B) Dorsal view of mesosoma (pilosity is shown on bottom); (C) Side view of mesosoma petiole and postpetiole.

Mesosoma very shiny, with few long erect hairs, notopropodeal groove steep and narrow, lateral margin of metanotum bridged by carina; propodeum rounded dorsally between spines, propodeal spines sharp, diverging (seen from above), pointed upward (seen from side); mesopleuron striate; few hairs along margin of mesosoma.

Petiole, postpetiole and gaster shiny; petiole elongate, longer than wide, rectangular with posterior lateral corners coming to points

limata - México to Bolivia and Brazil

Arboreal dwelling species, usually in ant plants, also galls, posts and twigs

Tropical habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*

each with one long flexuous hair; postpetiole elongate with no medial sulcus and 2-4 long flexuous hairs; gaster with many long flexuous hairs along lateral margins.

Types bicolored with brown head and mesosoma and dark gaster.

Worker measurements (mm): HL 0.55-0.61, HW 0.59-0.66, SL 0.66-0.67, EL 0.12-0.14, ED 0.10-0.12, CL 0.17-0.19, CW 0.22-0.25, WL 0.74-0.76, PSL 0.13-0.17, PL 0.22-0.24, PW 0.14-0.18, PPL 0.13-0.16, PPW 0.14-0.18; Indices: CI 92-93, SI 110-120, CLI 76-77, PI 133-157, PPI 89-93.

Distribution: México (Biosphere Reserve of Sian Ka'an, Quintana Roo [Dejean et al., 2003]), Guatemala (Branstetter and Sáenz, 2012), Colombia (Achury et al., 2008) to Bolivia and Brazil (Smith, 1858, Longino, 2003; Siqueira de Castro, 2010/2011; Nakayama Miranda et al., 2012, Pereira de Souza et al., 2012; Cruz de Oliveira, 2013).

Type series: Type from St. Catarina, (Ega) Brazil [not seen].

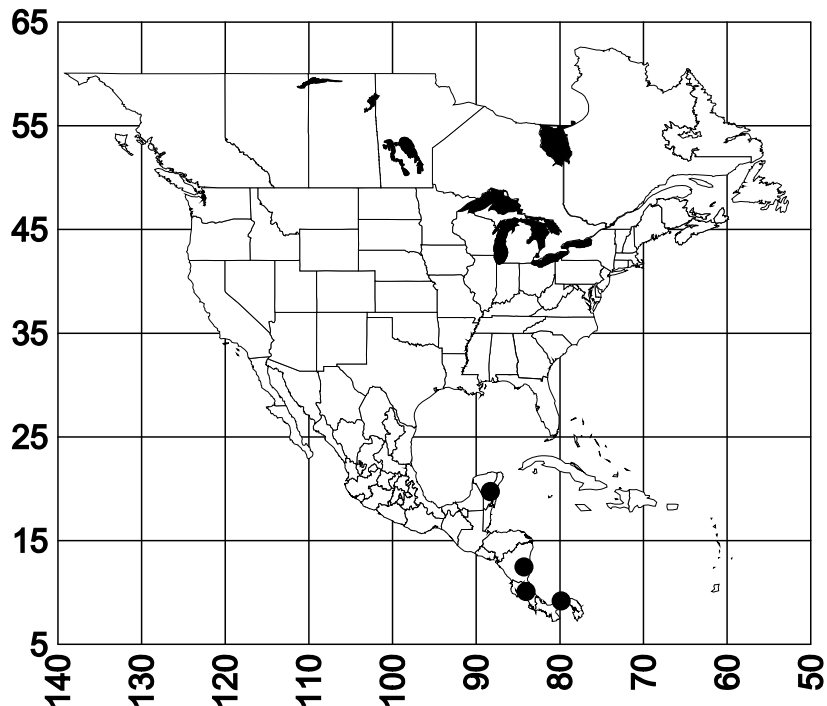
Material Examined: **BOLIVIA:** **Santa Cruz**, Yapacani, (3 ♀ LACM). **COLOMBIA:** Meta, Villavicencio (2 ♀ LACM); **Antioquia** (Vergara-Navarro and Serna, 2013).

limata - México to Bolivia and Brazil

Arboreal dwelling species, usually in ant plants, also galls, posts and twigs

Tropical habitats and forests

Compare with *longispinosa*, *nigropilosa*, *sotobosque*



Map 16. *Crematogaster limata*.

Etymology: *limata* comes from Latin *limatus* meaning polished, referring to most surfaces of the worker.

Discussion: The *C. limata* species group has a total of 10 species (Seixas Felizardo, 2010), of which only *C. limata* is found in México. As with many species in the genus *Crematogaster*, *C. limata* needs a suite of characters for positive identification. It is similar to *C.*

limata - México to Bolivia and Brazil

Arboreal dwelling species, usually in ant plants, also galls, posts and twigs

Tropical habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*

longispinosa, *C. nigropilosa* and *C. sotobosque*. The difficulty in identifying these species is that they all have long spines and long flexuous hairs on the dorsal surfaces of the mesosoma. The sculpturing on the dorsum of the mesosoma has some variation, but all are shiny to some degree. The presence or absence of either a sternopetiolar and/or sternopostpetiolar process of some kind and divergence of the propodeal spines are also identifying character states. The sculpturing on the dorsum of the mesosoma of *C. limata* is fairly smooth and shiny with a poorly developed carina near the lateral margins; it does not have either a sternopetiolar or sternopostpetiolar process, and the spines are only slightly divergent.

The dorsum of the mesosoma of *C. sotobosque* is entirely smooth and shiny with a lateral carina that comes to a point anterior to the notopropodeal groove, and has longer erect hairs on the pronotal shoulder, it has an absent to poorly developed sternopostpetiolar process, and widely divergent propodeal spines. The suite of characters for *C. longispinosa* varies little from those of *C. limata*, with the dorsal surface of the mesosoma being fairly smooth and shiny, with 2-4 small longitudinal carinae on the pronotal shoulder and without lateral carinae, a sternopetiolar process is absent, but does have a blunt sternopostpetiolar process and widely divergent propodeal spines. *Crematogaster nigropilosa* has shallow carinulae on the pronotal shoulder with lateral carinae that come to a point anterior to the notopropodeal groove, and has a small sternopostpetiolar process.

limata - México to Bolivia and Brazil

Arboreal dwelling species, usually in ant plants, also galls, posts and
twigs

Tropical habitats and forests

Compare with *longispinosa*, *nigropilosa*, *sotobosque*

Biology: Longino (www.antweb.org) describes the biology of *Crematogaster limata* as very generalized. He states that it can be found most often in wet or dry forest, second growth or mature vegetation, between sea level and 1000m elevation. It seems to prefer disturbed areas such as along roadsides or near forest edges. Nests can be mono- or polygynous [with multiple non-winged queens], with small nests usually containing one queen. There may be many satellite nests with the central nest containing the queen and brood. One nest in Hitoy Cerere Biological Reserve in Costa Rica was found to contain 21 physogastric queens. Longino also states that he once observed two foundress queens together suggesting pleometrosis, however, foundress queens are usually found alone. The workers are omnivorous and can be found foraging day or night on extrafloral nectaries or tending Hemiptera.

Crematogaster limata is an arboreal ant (Delabie et al., 2007; Lozano-Zambrano et al., 2009), which nests in a variety of plant cavities (Seixas Felizardo, 2010), as well as in fence posts (Mackay and Mackay, unpublished). They will nest in small cavities and have been observed in dead twigs, internodes of live *Cecropia* saplings and rotting cacao pods, as well as in *Passiflora* (Hossaert-McKey et al., 2001). It also nests in galls (Carvalho and Vasconcelos, 2002) and in the orchid *Myrmecophila christinae* (Dejean et al., 2003). Colonies are found in the domatia of *Cordia nodosa*, or they build carton nests (Dejean et al., 2004). It also occurs in rosettes of the bromeliad species *Aechmea lindenii* and *A. nudicaulis* (Schmid, 2010; Schmid et al., 2014), where they feed at the extrafloral nectaries on the flowers

limata - México to Bolivia and Brazil

Arboreal dwelling species, usually in ant plants, also galls, posts and twigs

Tropical habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*

(Schmid et al., 2010). Epiphytes grow from the nests (Schmit-Neuerburg and Blüthgen, 2007).

Brood were found in a nest in December (Colombia) (Mackay and Mackay, unpublished).

Workers foraged in the vegetation as well as on the ground, where it was a ground dwelling ant in Ecuador (Ryder Wilkie et al., 2009). Workers were captured in pitfall traps and extracted from Winkler samples (Pereira de Souza et al., 2012).

It is attracted to honey (Souza da Conceição et al., 2015) and sardine baits (Pereira de Souza et al., 2012; Souza da Conceição et al., 2015), but prefers crushed insect baits over a sucrose solution (Houadria et al., 2015). They tend the aphids *Aphis spiraecola* in Costa Rica (Espadaler et al., 2012), homopterans in Colombia (Ramírez et al., 2001) and tend *Strymon ziba* caterpillars (Schmid, 2010).

Crematogaster limata is found in a variety of habitats, as mentioned above. It is very common, in primary and secondary forest, from 0 - 1000m (Seixas Felizardo, 2010). Ryder Wilkie et al. (2009) found it in primary and secondary forest in Ecuador; it was collected in primary rainforest near Manaus (Vasconcelos et al., 2003) and in the states of Amazonas, Pará and Santa Catarina, Brazil (Felizardo and Harada 2007). *Crematogaster limata* was collected in several habitats in the Valle del Río Cauca in Colombia (Chacón de Ulloa et al., 2012). It is found in natural vegetation as well as logged areas and areas with natural tree falls in the state of Acre, Brazil (Miranda et al., 2013). It is a common species in wetlands in the state of Minas Gerais, Brazil (Costa-Milanez et al., 2012), as well as a common species along the

limata - México to Bolivia and Brazil

Arboreal dwelling species, usually in ant plants, also galls, posts and twigs

Tropical habitats and forests

Compare with *longispinosa*, *nigropilosa*, *sotobosque*

Amazon River (Vasconcelos et al., 2010). It is found in pine forests in Brazil (Lutinski et al., 2008) and occurs in eucalyptus forests in southern Brazil (Lutinski et al., 2008),

Crematogaster limata nests with other species of ants (Ryder Wilkie et al., 2010; Menzel and Schmitt, 2011), including *Camponotus femoratus* (Dejean et al., 1999; Orivel and Dejean, 1999), where they mimic *C. femoratus* (Oliveira, 1988), and *Pachycondyla goeldii* (Orivel and Dejean, 1999). *Crematogaster limata parabiatica* associated with *Camponotus femoratus* is a new species, *Crematogaster levior* (Longino, 2003). In habitats monopolized by the little fire ant *Wasmannia auropunctata* in French Guiana, it is one of 8 species that can exist in such habitats (Orivel et al., 2009). They are one of the dominant ants in a forest reserve near Manaus, Brazil (Beggiato Baccaro et al., 2010), and monopolize baits using aggressive behavior by aggregating around the bait, raising and shaking their gasters and exuding a drop of venom (Beggiato Baccaro et al., 2012). Workers raid the nests of the ant *Ectatomma tuberculatum* (Wheeler, 1986, Richard et al., 2004). Large numbers thoroughly inspect workers of the ant *Ectatomma tuberculatum* as they enter their nest and steal droplets of liquid from their mandibles (Hölldobler, 1986), robbing up to 75.2% of the returning workers, which also prey on *C. limata* (Richard et al., 2004). It is the prey of the army ant *Eciton rapax* (Salazar and Donoso, 2013). The ant *Daceton armigerum* protect their trails and snap their mandibles on *C. limata*, killing them and stealing their food items (Dejean et al., 2012).

Crematogaster limata is parasitized by the syrphid flies

limata - México to Bolivia and Brazil

Arboreal dwelling species, usually in ant plants, also galls, posts and twigs

Tropical habitats and forests

limata

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Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*

Pseudomicrodon biluminiferus (Schmid et al., 2014) and is mimicked by clubionid spiderlings of *Mymecium* cf. *gounelley* (Oliveira, 1988).

limata - México to Bolivia and Brazil

Arboreal dwelling species, usually in ant plants, also galls, posts and
twigs

Tropical habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

***Crematogaster lineolata* (Say)**

Plates 2 A, 42, 43, 44 and 111; Figs. 11 and 15; Map 17.

Myrmica lineolata Say, 1836: 290-291, worker, queen, male, Massachusetts, United States. Roger, 1863b: 37, Mayr, 1886b: 462-463, combination in *Crematogaster*. Emery, 1922: 141, combination in *C. (Crematogaster)*. Brown, 1949: 47-48, material of the unavailable names *wheldeni* Enzmann, 1946: 92-93, *punctinodis* Enzmann, 1946; 91-92 and *coachellai* E. Enzmann in lit., referred here. Wheeler & Wheeler, 1952: 250-252, larva. Buren, 1968: 93, combination in *C. (Crematogaster)*. Deyrup, 2017: 63, Plate 27, worker.

Crematogaster novaeboracensis Buckley, 1867: 337, queen, New York, United States. Mayr, 1886b: 462-463, junior synonym of *C. lineolata*.

Myrmica (Monomorium) marylandica Buckley 1867: 339, worker, Washington, D. C. and Druid Hill Park, Baltimore, Maryland, United States. Mayr, 1886b: 462-463, junior synonym of *C. lineolata*.

Myrmica (Monomorium) columbiana Buckley 1867: 340-341, worker and queen, Colombia College, Washington, D. C., United States. Mayr, 1886b: 462-463, junior synonym of *C. lineolata*.

Crematogaster lutescens Emery, 1895: 282, worker, Washington, D.

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

C, New Jersey, Virginia, United States. Creighton, 1950: 213,
junior synonym of *C. lineolata*.

Crematogaster subopaca Emery, 1895: 283, worker, queen, male,
Virginia, United States. Emery, 1922: 141, combination in *C.*
(*Acrocoelia*). Creighton, 1950: 213, subspecies of *C. lineolata*.
Wheeler & Wheeler, 1952: 252-254, larva. Smith, M. R., 1958:
127, junior synonym of *C. punctulata*. Johnson, 1988: 320,
junior synonym of *C. lineolata*.

Crematogaster opaca var. *texana* Santschi, 1929b: 91, worker,
Bonham, Farming Co., Texas, United States. Creighton, 1950:
213, junior synonym of *C. lineolata*.

Descriptions:

Worker: There is no type material of *Crematogaster lineolata*
available that we are aware; therefore, we used a worker specimen
from Crawford Co., Indiana, determined by Buren (MCZC) and that is
consistent with the descriptions by Say (1836), and comments by
Creighton (1950) and Buren (1968).

Mandibles shiny, longitudinally striate, with erect hairs; clypeus
wider than long, longitudinally striate with appressed hairs, anterior
margin convex with 8-10 long hairs; scape reaches posterior border of
head, covered with semierect hairs; head longitudinally striate from
eye to slightly above insertion of antennae and over cheek, shiny-
areolate above eye and antennal insertion, with fewer than 10 erect
hairs and evenly covered with appressed hair.

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

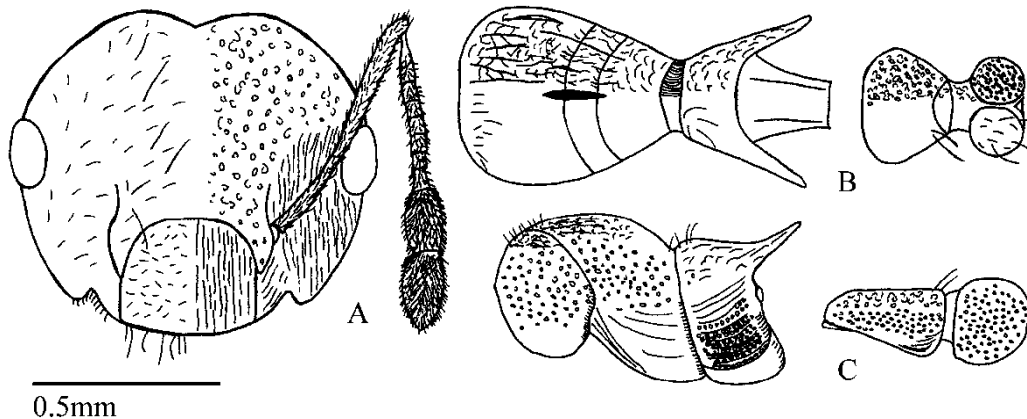


Plate 42. *Crematogaster lineolata* worker: (Crawford Co., Indiana determined by Buren, red dot, MCZC): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma petiole and postpetiole.

Mesosoma scabrous-rugose with longitudinal striae along metanotum (viewed from above), side punctate; pronotal shoulder with 10 to 20 erect bristle-like hairs; promesonotal; carinae small, but sharp; humeri developed; notopropodeal groove angular and narrow; propodeum with several erect hairs; metapleuron striate-punctate; notopropodeal groove steep and angular; propodeal spines medium in length, slender, thickening at base, divergent (viewed from above).

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

Petiole areolate from above, punctate from side, with 2 erect hairs on each posterior lateral corner, angularly trapezoidal, with anterior lateral flange upraised when viewed from behind; anterior sternopetiole process well developed; postpetiole punctate with few decumbent and several erect hairs, hemilobes almost round, slightly longitudinally elongate; petiole wider and longer than postpetiole; gaster shallowly areolate with few erect and appressed hairs evenly distributed.

Usually concolorous light to dark brown.

Worker measurements (mm): HL 0.71-0.88, HW 0.74-0.94, SL 0.65-0.72, EL 0.16-0.20, ED 0.16-0.18, CL 0.26-0.28, CW 0.24-0.25, WL 0.88-1.04, PSL 0.19-0.22, PL 0.22-0.24, PW 0.30-0.41, PPL 0.20-0.22, PPW 0.29-0.34; Indices: CI 94-96, SI 82-92, CLI 108-112, PI 59-73, PPI 65-69.

Queen: Mandibles shiny with semierect hairs; clypeus shiny, areolae with few semierect hairs, anterior margin straight with 20 long flexuous hairs; scapes not reaching posterior border of head, with decumbent hairs; head striate between eye and insertion of scape over cheek, fading into shallow areolae above eye; few short erect hairs pointed medially, few appressed hairs over cheeks.

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

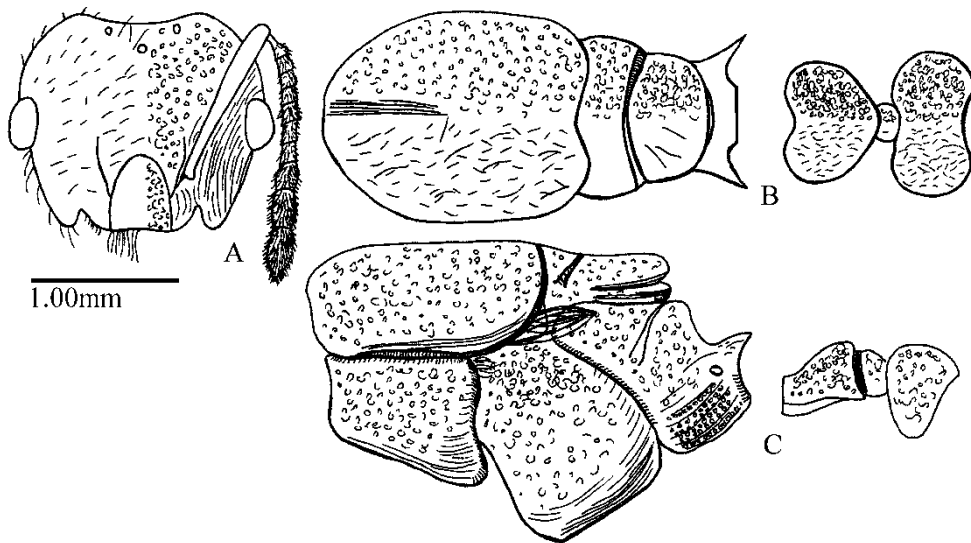


Plate 43. *Crematogaster lineolata* queen: (Fawnskin, San Bernardino Co., CA CWEM # 2142): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma petiole and postpetiole.

Dorsum of mesosoma shiny areolate with few long and short flexuous hairs, and many appressed hairs; viewed from side

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

sculpturing areolate developing into striae at edge of sutures; viewed dorsally, scutum has 3-5 longitudinal depressions medially on anterior edge; dorsellum barely visible viewed dorsally; propodeal spines typical for queen.

Petiole areolate and rounded, heart shaped at anterior edge, covered with appressed hairs all pointing posteriorly; postpetiole areolate, covered with appressed hairs all pointing posteriorly, bilobed spreading slightly posteriorly; gaster shiny microareolate, with few erect and many appressed hairs.

Concolorous brown.

Queen measurements (mm): HL 1.20-1.25, HW 1.51-1.63, SL 0.96-0.98, EL 0.34-0.36, ED 0.29-0.31, CL 0.38-0.41, CW 0.34-0.36, WL 2.35-2.47, PSL 0.22-0.24, PL 0.36-0.41, PW 0.58-0.60, PPL 0.34-0.41, PPW 0.58-0.70; Indices: CI 77-79, SI 78-80, CLI 112-114, PI 62-68, PPI 59-60.

Male: Mandibles typically small, faintly longitudinally striate, with erect hairs; clypeus with faint longitudinally striae, few erect hairs, anterior margin slightly convex; head longitudinally striate and faintly areolate; several long flexuous erect hairs between eyes, erect along margin just above eyes and short erect stubble across middle of face; scape and first segment of funiculus very shiny with 2-4 semierect hairs, next 10 segments and one segment club very hairy; eyes very large, protruding from side of head.

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

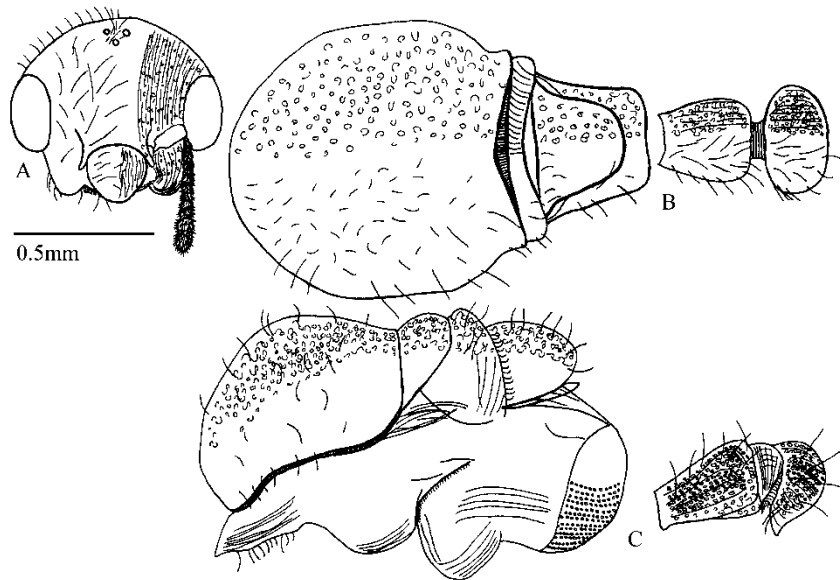


Plate 44. *Crematogaster lineolata* male: (Fawnskin, San Bernardino Co., CA CWEM # 2144): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma petiole and postpetiole.

Dorsum of mesosoma shiny, shallowly areolate, evenly and lightly covered with short erect hairs and 4-8 long flexuous hairs; dorsellum coming to point below scutellum; propodeum short and steeply angular.

Petiole and postpetiole with many long flexuous hairs and punctures between striations; gaster shiny.

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

Concolorous light brown.

Male measurements (mm): HL 0.58-0.64, HW 0.61-0.76, SL 0.14-0.17, EL 0.24-0.28, ED 0.22-0.26, CL 0.16-0.23, CW 0.20-0.22, WL 1.48-1.68, PL 0.22-0.36, PW 0.26-0.35, PPL 0.20-0.23, PPW 0.25-0.35; Indices: CI 85-95, SI 24-27, CLI 80-105, PI 85-103, PPI 66-80.

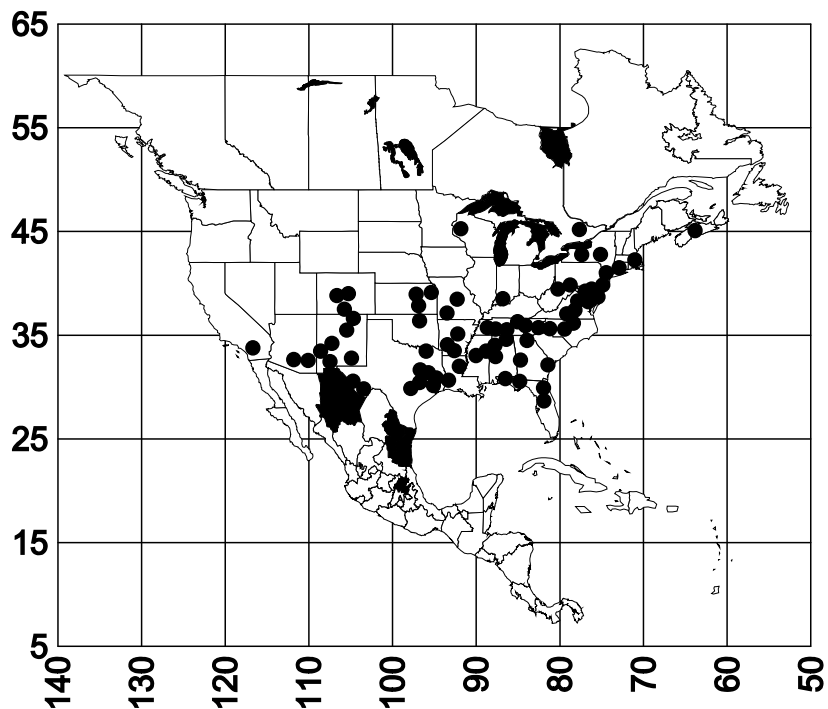
Distribution: *Crematogaster lineolata* can be found in southeastern Canada and throughout much of the United States, and has been reported as an exotic in Hawaii (Wheeler, 1934a). It has been reported from central Tennessee (Hill, 2012), South Carolina (Davies, 2009), Florida (Deyrup, 2017), south into México: Chihuahua, Hidalgo, Nuevo León, Tamaulipas (Alatorre-Bracamontes and Vázquez-Bolaños, 2010; Vázquez-Bolaños, 2011; Coronado-Blanco et al., 2013).

Type series: None available Type from U.S.A. Descriptions and drawings were based on a worker determined by Buren [MCZC].

Material examined: CANADA: **Nova Scotia**, Halifax Co., Upper Tantallon (3 ♀ MCZC); **Ontario**, (3 ♀ MCZC). UNITED STATES: **Alabama**, Franklin Co., Haleyville (6 ♀ CWEM) **Madison Co.**, Huntsville, Monte Sana (3 ♀ MCZC), **Marion Co.** (6 ♀ CWEM), see also Forster, 2003; **Arizona**, **Cochise Co.**, Dragoon Mountains, Cochise Stronghold (2 ♀ CWEM), Pinaleños Mountains, Post Canyon

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata



Map 17. *Crematogaster lineolata*.

(3 ♀ MCZC), also see MacGown and Foster, 2005; **Arkansas**, **Montgomery Co.**, Ouachita Mountains (2 ♀ MCZC), Eureka Springs (3 ♀ MCZC), **Pulaski Co.**, Pinnacle Mountain State Park (8 ♀ CWEM), **Union Co.**, 16k W Crossett (3 ♀ CWEM), **Arkansas Co.**, see General and Thompson, 2007, 2008 and MacGown et al., 2011; **California**, **San Bernardino Co.**, Fawnskin (10 ♀, 1 ♀, 1 ♂ CWEM), Santa's Village near Running Springs; **Colorado**, **Fremont Co.**, 6.94k

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

SW Canyon City (30 ♀ CWEM) 7.79k N Canyon City (9 ♀ CWEM) 12.54k NE Canon City (CWEM), 26.19k S Canyon City (3 ♀ CWEM), **Pueblo Co.**, 6k W Pueblo (30°18'0.37"N, 104°41'52"W) (32 ♀ CWEM); **Connecticut**, **New Haven Co.**, Milford (3 ♀ MCZC); **Delaware**, **Sussex Co.**, Trap Pond State Park, Raccoon Pond (10 ♀ STDC); **Florida**, **Okaloosa Co.**, Eglin AFB (2 ♀ MCZC), Santa Rosa Island, 4.0mi W Destin on Rt. 98 (20 ♀ MCZC), **Putnam Co.**, Melrose (3 ♀ CWEM), Jacksonville, Choccolocco Mountain (3 ♀ MCZC), **Santa Rosa Co.**, Weaver Creek (2 ♀ MCZC), **Gadsden** and **Alachua** counties, Florida (Whitcomb et al., 1972); **Georgia**, **Barrow Co.**, Fort Yargo State Park (1 ♀ CWEM) **Chatham Co.**, Savannah River (4 ♀ COOK), **Muscogee Co.**, Columbus area site 10 (32° 35.010'N; 84° 44.822') (5 ♀ COOK), see also Ipser et al., 2004 and Graham et al., 2008; **Indiana**, **Crawford Co.** (17 ♀ MCZC); **Kansas**, **Cowley Co.**, Winfield (2 ♀ MCZC), **Riley Co.**, Manhattan (5 ♀, 10 ♂ CWEM), **Wallace Co.**, Sharon Springs (8 ♀ CWEM) **Wyandotte Co.** (3 ♀ MCZC); **Louisiana**, **Calcasieu Parish**, Sam Houston Jones State Park (2 ♀ CWEM), **Catahoula Parish**, Catahoula Park, near Sicily Island Hills WMA NE Check Station (2 ♀ STDC), see Dash and Hooper-Bùi, 2008; **Maryland**, **Allegany Co.** Little, Orleans Old Town Rd 39 (37°56'N 8°24'27"W, ~240m) (17 ♀, 2 ♀ STDC), **Baltimore Co.**, Baltimore, SW Park (1 ♀ STDC), **Cecil Co.**, Fair Hill NRA (1 ♀ STDC), see Frye and Frye, 2012; **Massachusetts**, **Middlesex Co.** (2 ♀ MCZC), Woods Hole (3 ♀ MCZC), **Norfolk Co.**, Milton, N. Salem Pond (2 ♀ MCZC); **Mississippi**, **Carroll Co.**, Winina (24 ♀ CWEM),

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

Oktibbeha Co., 4k NE Starkville (45 ♀ CWEM); **Missouri**, **Barry Co.**, Ozark Mountains (2 ♀ MCZC), **Boone Co.**, Colombia (3 ♀, 3 ♂ CWEM, 1 ♀ MCZC); **New Jersey**, **Atlantic Co.** (3 ♀ MCZC), **Bergen Co.**, Fort Lee (1 ♀ MCZC), **Burlington Co.**, Aston (1 ♀, 1 ♀ MCZC), Newfoundland Co. (3 ♀ MCZC), Lake Hurst (13 ♀ MCZC), **Salem Co.**, Deepwater (4 ♀ STDC); **New Mexico**, **Bernalillo Co.**, Isleta Marsh (1 ♀ CWEM), **Colfax Co.**, 11k W Cimarron (44 ♀ CWEM) 41k E Eagle Nest (27 ♀, 16 ♀, 8 ♂ CWEM), **Doña Ana Co.**, Las Cruces (1 ♀, 1 ♀ CWEM), **Grant Co.**, Silver City (1 ♀, 1 ♀, 1 ♂ CWEM), **Los Alamos Co.**, Los Alamos (3 ♀ CWEM), **Luna Co.**, 14mi S Deming (1 ♀ CWEM), **Sierra Co.**, Truth or Consequences (21 ♀ CWEM), **Socorro Co.**, Grassy Lookout (3 ♀ CWEM), **Union Co.**, Kiosca National Grasslands (28 ♀, 1 ♀ CWEM); **New York**, **Tompkins Co.**, Lansing Village (1 ♀, 1 ♀ CWEM, 1 ♀ MCZC), Town of Newfield, Connecticut Hill (2 ♀ MCZC); **North Carolina**, **Buncombe Co.**, Black Mountain (3 ♀ MCZC), **Orange Co.**, Hillsboro, Duke Forest (3 ♀ MCZC), **Polk Co.**, Tryon (3 ♀ MCZC), **Transylvania Co.**, Belmont (15 ♀ MCZC), **Wake Co.**, Falls Lake Recreational Area (150 ♀ CWEM) Raleigh (3 ♀ MCZC), see also Guénard et al., 2014; **Oklahoma**, **Kay Co.**, Ponca City (1 ♀, 2 ♂ MCZC), **Oklahoma Co.**, Tinker Air Force Base Reserve 3 (9 ♀ CWEM); **South Carolina**, **Barnwell Co.**, Savannah River Atomic Energy Plant (16 ♀ CWEM), **Pickens Co.**, Table Rock State Park (30 ♀ CWEM) see Davies, 2009; **Tennessee**, **Blount Co.** Maryville (6 ♀

lineolata - southeastern Canada, USA and México

Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

CWEM) **Hardin Co.**, 11k E Lutts (6 ♂ CWEM), **Lawrence Co.** (8 ♂ CWEM), David Crockett State Park, (6 ♂ CWEM), **Madison Co.**, Jackson (3 ♂ MCZC), **McMinn Co.**, Highway 39, 8.6k W Junction 315 (1 ♂ CWEM), **Putnam Co.**, Cookeville (36°10'17.4"N 85°35'26.8"W) (5 ♂ CWEM), **Wayne Co.**, 10mi N of Waynesboro (3 ♂ CWEM); **Texas**, **Blanco Co.**, Pedernales Falls (1 ♂ CWEM), **Brazos Co.**, Research Park (1 worker COOK), **Brewster Co.**, Chisos Basin Pass, Big Bend National Park (1 ♂ CWEM), Pine Canyon Trail (15 ♂ COOK), **Houston Co.**, Big Slough Wild area (3 ♂ CWEM), **Jeff Davis Co.**, Davis Mountains (8 ♂ CWEM), **Lamar Co.**, Camp Maxey, site 2 (N33° 48.201', W95° 34.844') (10 ♂ COOK), site 3 (N33° 48.708'; W95° 32.580') (5 ♂ COOK), **Matagorda Co.**, 8.8 k SSE Sargent (8 ♂ STDC), **Sabine Co.**, 8mi E Hemphill (CWEM) 14k E Hemphill (CWEM), 14.5k E Hemphill (21 ♂ CWEM), **Trinity Co.**, Davy Crockett National Forrest (3 ♂, 1 ♀ MCZC), **Tyler Co.**, Big Thicket National Preserve (7 ♂ CWEM); **Virginia**, **Dinwiddie Co.** (3 ♂ MCZC), **Mecklenburg Co.** (1 ♂ MCZC); **West Virginia**, **Monongalia Co.**, West Virginia University Forrest (4 ♂ CWEM); **Washington, D. C.,** (8 ♂ MCZC); **Wisconsin**, **Washburn Co.**, 9mi W Trego (6 ♂ CWEM).

Etymology: *lineolata* from the Latin *linea* meaning line or string and *lātē* meaning widely or everywhere, possibly referring to the striae on many surfaces.

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

Discussion: A key characteristic of *Crematogaster lineolata* is the longitudinal rugose-lineolate sculpturing along the dorsum of the pronotum.

This species can be confused with *C. cerasi*, *C. laeviuscula*, and *C. punctulata*. The sculpturing on *C. cerasi* and *C. lineolata* are similar, but the two species can be distinguished by the pronotal pilosity: *C. cerasi* has fewer than six long flexuous hairs on the pronotum and *C. lineolata* has more than six short bristle like hairs on the pronotum. The propodeal spines are less than 0.15 mm in length in these three species, and greater than 0.17 mm in length in *C. lineolata*. The propodeal spines of *C. lineolata* diverge posteriorly, whereas they are incurved (MacGown, Pers. comm.) and point directly posteriorly in *C. punctulata*.

Crematogaster laeviuscula is very shiny and is shallow areolate to deeply areolate, and has both long and short erect hairs on the pronotum, as compared to the opaquer *C. lineolata*, with hairs approximately the same length on the pronotum.

Separating *C. lineolata* from *C. navajoa* can be difficult when the number of erect hairs on the head number around 15. In general, such hairs are approximately the same length (about 0.10 – 0.15 mm). In *C. navajoa* the hairs are mostly two distinct lengths (0.07 and 0.15 mm).

Crematogaster lineolata can be confused with *C. vermiculata*, but they can be separated as *C. lineolata* has abundant hairs on the

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

pronotum whereas *C. vermiculata* has few (MacGown, Pers. comm.) or none.

The males have an interesting character state; the dorsellum is more pointed than rounded as is the case of most *Crematogaster* males.

Biology: Mackay and Mackay (unpublished) have accumulated biological data on this species. *Crematogaster lineolata* is a ground dwelling species and nests can often be found under stones, sticks, downed logs, stumps or among the roots of understory plants and under the leaf litter, or simply nesting in the soil. Two nests were found in abandoned *Pogonomyrmex* harvester ant nests. They seem to prefer moister environments, in more arid parts of the US, they can be found in riparian areas, near waterways. In more arid areas they are often associated with cholla cactus. Forster (2003) reported that they nest in the ground or logs and stumps in wooded areas. They make nests in clumps of *Schizachyrium scoparium*, in forests or in leaf litter, or in hollow stems (Hill, 2006). They nest in hickory nuts in Mississippi (MacGown, 2006).

Nests can be large with hundreds or even thousands of workers, with multiple queens (up to 18). Workers tend to be rather sluggish, but can be very active on hot days and escape when the nest is disturbed. Colonies of this species are polydomous and usually rather large (Carroll, 2011).

Brood were found in nests in June, July, August, sexuals in July and August (Mackay and Mackay, unpublished).

Workers can be found foraging on the ground, on logs and on

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

the trunks of trees and on plants foraging up into the vegetation. They can be extracted from leaf litter, including magnolia litter, pine and hardwood litter and in dense forest litter. They are commonly collected in pitfall traps and are attracted to a variety of baits, including Vienna sausage (on soil surface and in vegetation), and fire ant bait (see Bhatkar and Whitcomb, 1970 for recipe) and live mealworms on the soil surface. They are also attracted to meat baits (Lubertazzi and Tschinkel, 2003) and disperse diaspores (Gaddy, 1986). Workers visit the extrafloral nectaries of *Campsis radicans* (Elias and Gelband, 1975), *Cassia fasciculata* (Kelly, 1986) and *Passiflora incarnata* (McLain, 1983). They also prey on the eggs of the red oak borer *Enaphalodes rufulus* (Coleoptera: Cerambycidae) (Mullenburg et al., 2008). They are predaceous, and secretions from glandular hairs of the pupae of the ladybird beetle *Subcoccinella vigintiquatuorpunctata* serves as potent antipredator defense (Smedley et al., 2002).

Crematogaster lineolata is found in a wide variety of habitats (Lubertazzi and Tschinkel, 2003). Mackay and Mackay (unpublished) found them in arid shrub land, grasslands, agricultural fields, pinyon pine, pinyon pine/juniper - oak woodland, oak savanna, alligator bark juniper, juniper/deciduous forest and grass, disturbed pine forest (recently burned), pine/hardwood forest, riparian forest, transition pine/fir to oak (Gambell's oak) and beech/magnolia forest. Dash (2004) found them in cotton fields, vineyards, upland forest litter and beech mixed hardwood forest, Hill (2006) reported they are common in prairies and Alatorre-Bracamontes and Vázquez-Bolaños (2010)

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

collected them in pine/oak forests. They are reported to adapt to urban ecosystems (Guénard et al., 2014), but not to do well in disturbed areas (Menke et al., 2011).

They have little effect of the red imported fire ant, *Solenopsis invicta* (King and Tschinkel, 2013) and can coexist with the imported fire ant hybrid *Solenopsis invicta* X *richteri* in Mississippi (MacGown and Brown, 2006). They are hosts of the myrmecophilous cricket *Myrmecophila pergandei* (Mann, 1918), as well as many other species of ants (MacGown and Hill, 2006). They do not produce bactericidal and fungicidal compounds which assist songbirds in eliminating parasites (Revis and Waller, 2004). They carry phoretic mites (Campbell et al., 2013).

Abouheif and Wray (2002) discussed the functioning of the genes in producing wings in the sexuals of *C. lineolata*.

In studies of the effect of climate change on ants, rising temperatures had either a weak negative impact on *C. lineolata* (Pelini et al., 2012) or a positive effect (Pelini et al., 2011; Stuble et al., 2013), but is a species with a high thermal tolerance (Oberg et al., 2012). It is a numerically dominant thermophilic species (Resasco et al., 2014), in which the population increased with an increase in growing degree days (global warming of the habitat) (Pelini et al., 2014)

It occurs in several different soil types, ranging from light brown, brown to red clay soils, dark brown clay-loam, light brown rocky clay, dark brown rocky loam, brown sand, to rocky gravel.

It is considered a house pest (Smith, 1965).

Deyrup (2017) includes details on the biology and distribution

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *cerasi*, *laeviuscula*, *lineolata*, *navajoa*, *punctulata*,
vermiculata

of this species as well as comparisons with other species occurring in Florida.

lineolata - southeastern Canada, USA and México
Ground dwelling species, also logs, stumps and twigs,
Riparian habitats and forests

Compare with *missouriensis*, *steinheili*, *sumichrasti*

***Crematogaster minutissima* Mayr**

Plates 45, 46 and 112; Figs. 24, 29 and 30; Map 18.

Crematogaster minutissima Mayr, 1870b: 995-996, worker, queen, Austin, Texas. Wheeler, 1908c: 484, male. Emery, 1922: 35, combination in *C. (Orthocrema)*. Wheeler & Wheeler 1960: 4, larva. Longino, 2003: 84, worker and queen. Deyrup, 2017: 63-64, Plate 28, worker.

Descriptions:

Worker: This species is one of the few that has a monomorphic worker caste, and is always very light yellow or amber in color.

Mandibles with semierect hairs; clypeus shallowly areolate with semierect hairs, anterior margin straight to slightly convex, with 6-8 long hairs; scapes reach to slightly past posterior border of head, with semierect hairs; head shiny, shallowly areolate with ~ 20 long and short erect and semierect flexuous hairs pointed medially.

Pronotum with three rows of long flexuous hairs on dorsum of mesosoma, with longest hairs on pronotum, mesonotum with long flexuous hairs, shorter than those on the pronotum; lateral margins of propodeum with long flexuous hairs shorter than those on mesonotum; promesonotal suture apparent from breaks in sculpturing, pronotum rugose, fading into striae along margins and shiny in middle, to entirely shiny across pronotal shoulder viewed from above, shallowly

minutissima - southern USA south to Brazil

Ground dwelling species under stones, also logs, stumps and twigs

Arid ecosystems, grasslands to forests

Compare with *missouriensis*, *steinheili*, *sumichrasti*

punctate from side; humeri somewhat square; notopropodeal groove shallow; propodeal spines reduced, interior margin flattened and spines thickened at base, pointing upward (side view), widely divergent (dorsal view).

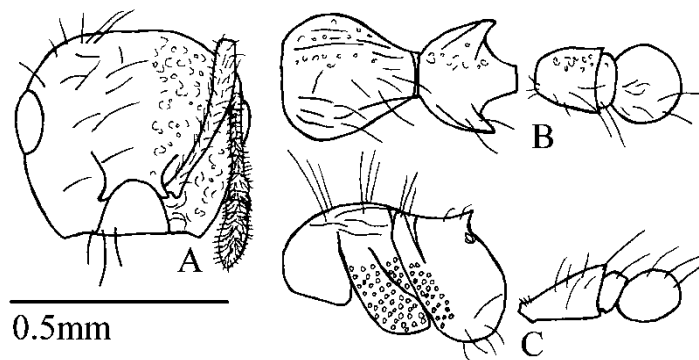


Plate 45. *Crematogaster minutissima* worker: (syntype, Austin Texas NHMW): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma petiole and postpetiole.

Petiole, postpetiole and gaster shallowly areolate from above, shallowly punctate from side; petiole subquadrate, slightly longer than wide, anterior sternopetiole process small to medium; postpetiole wider than long, globular; petiole and postpetiole with few long flexuous hairs near posterior margins; gaster evenly covered with erect hairs; tibia with appressed to decumbent hairs.

Concolorous light yellow.

minutissima - southern USA south to Brazil

Ground dwelling species under stones, also logs, stumps and twigs

Arid ecosystems, grasslands to forests

Compare with *missouriensis*, *steinheili*, *sumichrasti*

Worker measurements (mm): HL 0.50-0.54, HW 0.46-0.48, SL 0.42-0.48, EL 0.13-0.16, ED 0.10-0.12, CL 0.17-0.18, CW 0.20-0.22, WL 0.52-0.66, PSL 0.05-0.10, PL 0.19-0.24, PW 0.16-0.17, PPL 0.10-0.12, PPW 0.16-0.18; Indices: CI 109-123, SI 84-89, CLI 81-85, PI 119-141, PPI 63-67.

Queen: Clypeus shiny with many erect hairs, anterior margin straight to slightly concave with 6-8 long hairs; scape not reaching posterior border of head, with semierect hairs; head with shiny striae curving around antennal insertion and below eye, head slightly wider than long, hair denser than worker, pointed medially.

Mesosoma shiny from above, propodeum and propodeal spines shallowly rugose from side; mesosoma with hair denser than that of worker, with many very long (0.12-0.36 mm) flexuous hairs over entire mesosoma; pronotum not visible from above; dorsellum visible from above; propodeum broadly rounded; propodeal spines well developed for queens, diverging slightly.

Petiole and postpetiole areolate with many long erect hairs pointed posteriorly; postpetiole with small pointed anterior process; gaster shiny areolate with many erect hairs; tibia with semierect hairs.

Color concolorous yellow or amber.

Queen measurements (mm): HL 0.74-0.77, HW 0.74-0.86, SL 0.59-0.64, EL 0.24-0.26, ED 0.22-0.23, CL 0.26-0.27, CW 0.29-0.31, WL 1.39-1.50, PSL 0.12-0.14, PL 0.36-0.37, PW 0.29-0.30, PPL 0.18-0.23, PPW 0.35-0.36; Indices: CI 89-100, SI 80-84, CLI 87-90, PI 123-124, PPI 51-64.

minutissima - southern USA south to Brazil

Ground dwelling species under stones, also logs, stumps and twigs

Arid ecosystems, grasslands to forests

Compare with *missouriensis*, *steinheili*, *sumichrasti*

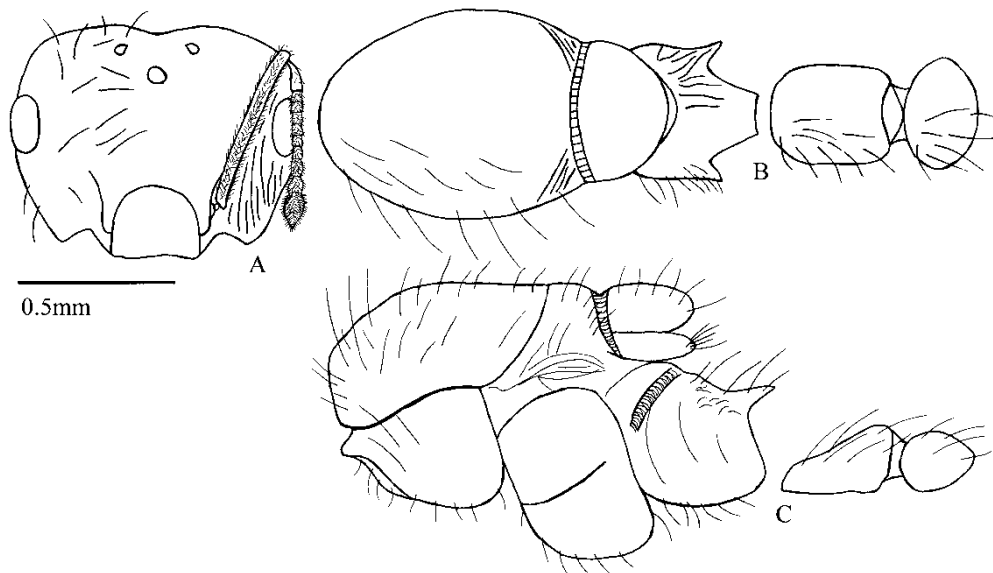


Plate 46. *Crematogaster minutissima* queen: (Winina Carroll Co., Mississippi CWEM, #9963): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma petiole and postpetiole.

Male: Clypeus slightly protruding from face, with few short, fine, erect hairs, anterior margin convex with many long, flexuous hairs; ocelli slightly raised; scape longer than most males; head deeply areolate with few erect hairs between ocelli.

minutissima - southern USA south to Brazil

Ground dwelling species under stones, also logs, stumps and twigs

Arid ecosystems, grasslands to forests

Compare with *missouriensis*, *steinheili*, *sumichrasti*

Mesosoma short and thick, areolate with many erect hairs evenly distributed; scutum with ventral medial boss; scutellum swelling over dorsellum; propodeum small, longitudinal striate, without propodeal spines.

Petiole quadrate, areolate with 2-4 long erect hairs pointed posterior; postpetiole globular, wider than long, areolate; gaster shiny areolate, with many long, flexuous hairs evenly distributed.

Concolorous pale yellow.

Male measurements (mm): HL 0.31, HW 0.32, SL 0.08, EL 0.22, ED 0.18, CL 0.16, CW 0.17, WL 0.86, PL 0.16, PW 0.16, PPL 0.10, PPW 0.17; Indices: CI 97, SI 26, CLI 94, PI 100, PPI 59.

Distribution: Throughout the southern and southeastern United States, as far west as southern Arizona north to Duke Forest, North Carolina (Resasco et al., 2014), Florida (Deyrup, 2017), south to Venezuela and Brazil (Vasconcelos and Vilhenma, 2006) and possibly Cuba (*C. cubaensis*, from which workers appear to not differ).

Type series: *Crematogaster minutissima*, syntype worker, syntype queen, Austin, Texas, United States [NHMW].

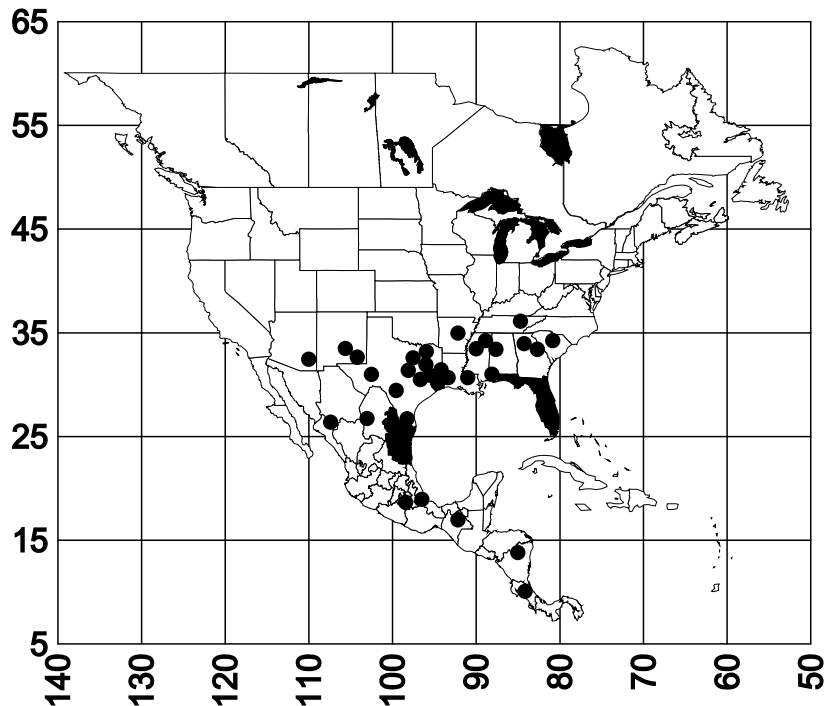
Material examined: COSTA RICA: **Heredia**, La Selva (3 ♀ LACM). MÉXICO: **Chiapas**, 24 km SW Cintalpa (1 ♀ CWEM); **Chihuahua**, Basaseáchic (7 ♀ CWEM), Estado Terrero (1 ♀ CWEM); **Veracruz**, Río Metlac, near Fortín (9 ♀ CWEM), Tierra Blanca (1 ♀, 1 ♀, 1 ♂ CWEM), **Nuevo León**, **Tamaulipas** (Vázquez-

minutissima - southern USA south to Brazil

Ground dwelling species under stones, also logs, stumps and twigs

Arid ecosystems, grasslands to forests

Compare with *missouriensis*, *steinheili*, *sumichrasti*



Map 18. *Crematogaster minutissima*.

Bolaños, 2011; Coronado-Blanco et al., 2013). **UNITED STATES:**
Alabama, **Fayette Co.**, Junction (6 ♀ CWEM) **Mobile Co.**,
 Mobile, Dog River (3 ♀ LACM), **Tuscaloosa Co.**, Tuscaloosa (33 ♀,
 13 ♀ CWEM), also see Forster, 2003; MacGown and Foster, 2005;
Arizona, **Cochise Co.**, Portal (3 ♀ CWEM); **Arkansas**, **Pulaski Co.**,
 Pinnacle Mountain State Park (18 ♀ CWEM), see General and
 Thompson, 2007, 2008; MacGown et al., 2011; **Florida**, **Highlands**
Co., Archbold Biological Station, Lake Placid (3 ♀ CWEM), **Marion**
Co., Rainbow Springs, Price Memorial Tract (1 ♀, 1 ♀, LACM), **León**

minutissima - southern USA south to Brazil

Ground dwelling species under stones, also logs, stumps and twigs

Arid ecosystems, grasslands to forests

Compare with *missouriensis*, *steinheili*, *sumichrasti*

Co. (Cassill and Tschinkel, 1996), see Deyrup et al., 1988; **Georgia**, **Barrow Co.**, Fort Yargo State Park (1 ♂ CWEM) **Richmond Co.**, Augusta (2 ♂, 1 ♀, LACM), see Ipser et al., 2004; **Louisiana**, **Baton Rouge Parish**, Baton Rouge Place Du Plantier Apts. (5 ♂ STDC); **Beauregard Parish**, DeRidder (1 ♀, 2 ♂, LACM), see Dash and Hooper-Bùi, 2008; **Mississippi**, **Carroll Co.**, 6.5 k W Winona (23 ♂, 8 ♀ CWEM), **Lee Co.**, Tupelo (6 ♂, 1 ♀ CWEM); **Missouri** (Shattuck and Cover, 2016); **New Mexico**, **Eddy Co.**, Sitting Bull Falls (6 ♂ CWEM), **Otero Co.**, Bates Park Turnoff (2 ♂ CWEM); **Oklahoma** (Shattuck and Cover, 2016); **South Carolina** (2 ♂ NHMW); **Tennessee**, **Blount Co.**, Maryville (20 ♂ CWEM); **Texas**, **Brazos Co.**, Foster Lane (1 ♂ CWEM), Porter Lane (1 ♂ CWEM), **Hardin Co.**, Big Thicket National Preserve (9 ♂, 1 ♀ CWEM), **Hidalgo Co.**, Anzalduas Co. Park (7 ♂, CWEM), Huntsville State Park (12 ♂ CWEM), **Jeff Davis Co.**, Davis Mountains, McIver Ranch (♂ CWEM), **Parker Co.**, Ft. Wolters site 3 (N32° 51.166'; W98° 02.133') (2 ♂ COOK), **Real Co.**, Leakey (19 ♂, 6 ♀ CWEM), 19.3k N Leakey (4 ♂ CWEM), **Sabine Co.**, 14.5 k E Hemphill (10 ♂, 1 ♀ CWEM); **Titus Co.**, Bob Sandlin State Park (9 ♂, 4 ♀ CWEM), **Tyler Co.**, Big Thicket Natural Preserve (9 1 ♀ CWEM), **Walker Co.**, Huntsville State Park, Section 27 (1 ♂ COOK), same locality (15 ♂ CWEM).

Etymology: *Minutissima* is Latin *minuscule* meaning smallish.

minutissima - southern USA south to Brazil

Ground dwelling species under stones, also logs, stumps and twigs

Arid ecosystems, grasslands to forests

Compare with *missouriensis*, *steinheili*, *sumichrasti*

Discussion: The *Crematogaster minutissima* worker is monomorphic within nest series, but can vary slightly in size between series and is always very light in color.

Crematogaster minutissima can be confused with *C. missouriensis* Emery, *C. steinheili* Forel and *C. sumichrasti*. The latter three taxa however, all have key differences from *C. minutissima*. *Crematogaster missouriensis*, *C. steinheili* and *C. sumichrasti* have short, slender and sharp spines that are larger and have continuous size polymorphism of the worker within nest series. The spines on *C. minutissima* are blunt, thicken at the base and are not well developed. The spines of queens are also different with the *C. minutissima* queen having a more developed spine than that of the *C. missouriensis*, *C. steinheili* and *C. sumichrasti* queens.

Biology: Based on unpublished data collected by Mackay and Mackay, nests are found in hollow twigs and in logs, as well as under stones. *Crematogaster minutissima* have also been found inhabiting dead litter in a Cacao Plantation and at the base of *Nyssa* sp. Nests have been found in deep humus (Deyrup et al., 1988; Moreau et al., 2014). Nests are found in soil at the base of trees or in stumps and logs (Forster, 2003). Hill (2006) collected it only from the base of several shagbark hickory, *Carya ovata* trees in an oak-hickory habitat. They nest in hickory nuts in Mississippi (MacGown, 2006).

Brood and sexuals were found in nests in June (Mackay and Mackay (unpublished). The colonies contain a single queen (Heinze et al., 1995) and are also polygynous (King and Tschinkel, 2006), with at least 5 dealate queens (Mackay and Mackay, unpublished). Micro

minutissima - southern USA south to Brazil

Ground dwelling species under stones, also logs, stumps and twigs

Arid ecosystems, grasslands to forests

Compare with *missouriensis*, *steinheili*, *sumichrasti*

and macrogyne queen forms are found in *C. minutissima* (Hölldobler and Wilson, 1977).

Workers forage in the leaf litter and can be collected with Winkler extractions. *Crematogaster minutissima* is a generalized ant (Hill, 2006), which can be captured in baits (Mackay and Mackay, unpublished), including Vienna sausage baits in vegetation, and Vienna sausage baits and fire ant formula baits (see Bhatkar and Whitcomb, 1970 for the recipe) on the soil surface. Workers are predators on egg cases and spiderlings of the spider *Peucetia viridans* (Oxyopidae) in South Carolina (Willey and Adler, 1989). The volume of food ingested during each worker-larva trophallaxis was both small and constant (Cassill and Tschinkel, 1996).

This species will exploit a wide range of moist habitats as well as the more xeric habitats of the Chihuahuan Desert in Texas and México. They were found in the desert with scattered oaks, grassland along a road surrounded by forest, grasslands with junipers, mixed hardwoods with a few pines and in openings in forests (Mackay and Mackay, unpublished). Hill (2006) found them in oak-hickory habitat and King (2007) in scrub and pine flatlands in Florida.

They have little effect of the red imported fire ant, *Solenopsis invicta* (King and Tschinkel, 2013).

They are found in areas with soils ranging from red and light brown to brown clay, light brown rocky loam, red sand to dark brown gravel (Mackay and Mackay, unpublished).

Deyrup (2017) includes details on the biology and distribution of this species as well as comparisons with other species occurring in Florida.

minutissima - southern USA south to Brazil

Ground dwelling species under stones, also logs, stumps and twigs

Arid ecosystems, grasslands to forests

Compare with *minutissima*, *steinheili*, *sumichrasti*

***Crematogaster missouriensis* Emery**

Plates 47, 48, 49 and 113; Fig. 30; Map 19.

Crematogaster victima subsp. *missouriensis* Emery, 1895: 287-288, worker, Missouri, United States. Emery, 1922: 136, combination in *C. (Orthocrema) victima missouriensis* [sic]. Creighton, 1950: 205, *Crematogaster minutissima* subsp. *missouriensis*. Wheeler & Wheeler 1952: 260, larva. Shattuck and Cover, 2016:10, 15-16, *Crematogaster missouriensis*. Deyrup, 2017:64-65, Plate 28, worker, spelling of name changed back to *C. missouriensis*.

Crematogaster minutissima subsp. *thoracica* Creighton, 1939: 137, worker, Miller Canyon, Huachuca Mountains, Arizona, United States. Creighton, 1950: 205, *Crematogaster (Orthocrema) minutissima* subsp. *smithi*, replacement name (preoccupied name). Shattuck and Cover, 2016: 10. 15-16 synonym of *C. missouriensis*.

Descriptions:

Worker: Mandibles have semierect hairs; clypeus shallowly areolate with semierect hairs, anterior margin convex, with several long hairs; scape swollen distally, reaching or slightly passing posterior border of head, with semierect hairs; head shiny, shallowly areolate with long and short erect and semierect flexuous hairs pointed

missouriensis - southern and eastern USA south into México
Ground dwelling species, usually under stones, also dead wood
Arid areas, grasslands and forests

Compare with *minutissima*, *steinheili*, *sumichrasti*

medially.

Pronotum with 1-2 shallow longitudinal costae along lateral margins of pronotal shoulder, shiny medially, costae along margins developing into carina that bridge notopropodeal furrow; mesosoma with many long flexuous hairs, with most lateral hairs longest becoming shorter medially and with pronotum having longest hairs becoming shorter toward propodeum; shallowly punctate viewed from side; humeri somewhat square; notopropodeal groove shallow; propodeal spines short, flattened at base, pointing almost straight up, diverging slightly.

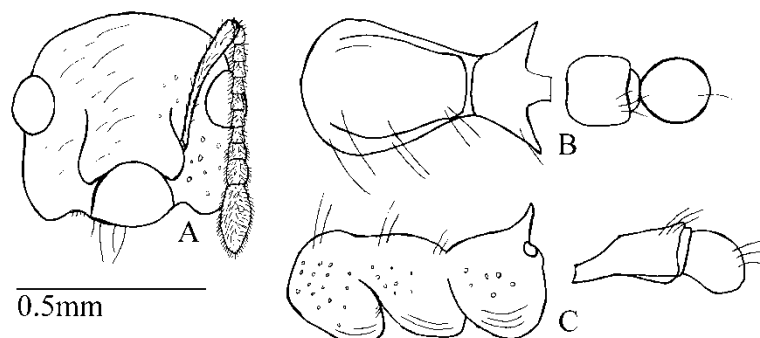


Plate 47. *Crematogaster missouriensis* worker: (syntype, Missouri, United States NHMW): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma petiole and postpetiole.

missouriensis - central USA south into México

Ground dwelling species, usually under stones, also dead wood

Arid areas, grasslands and forests

Compare with *minutissima*, *steinheili*, *sumichrasti*

Petiole, postpetiole and gaster shallowly areolate from above, shallowly punctate from side; petiole subquadrate, slightly longer than wide, sternopetiole process well developed; postpetiole wider than long, globular; petiole and postpetiole with few long flexuous hairs near posterior margin; gaster evenly covered with erect hairs; tibia with semierect hairs.

Concolorous light yellow to amber.

Worker measurements (mm): HL 0.50-0.61, HW 0.48-0.54, SL 0.48-0.52, EL 0.13-0.17, ED 0.12-0.14, CL 0.16-0.22, CW 0.19-0.23, WL 0.54-0.69, PSL 0.10-0.13, PL 0.20-0.24, PW 0.18-0.23, PPL 0.13-0.14, PPW 0.19-0.24; Indices: CI 104-113, SI 104-117, CLI 84-96, PI 104-111, PPI 58-68.

Queen: Mandibles shiny, with few longitudinal striae; clypeus shiny with many long flexuous hairs, anterior margin concave with many long hairs; scape reaching posterior border with many long and short erect hairs; ocelli almost flush with surface of head; head shiny, shallowly striate below eyes, with many long and short erect hairs pointed slightly medially.

Mesosoma shiny with many long and short hairs pointed medially; scutellum knob-like, almost obscuring view of dorsellum (viewed from above); propodeum with small nubs.

Petiole grainy, subquadrate with several long erect hairs pointed posteriorly, sternopetiole process blunt; postpetiole grainy, globular and slightly flattened dorsally with several long erect hairs pointed posteriorly; gaster shiny with many long, erect hair pointed

missouriensis - southern and eastern USA south into México
Ground dwelling species, usually under stones, also dead wood
Arid areas, grasslands and forests

Compare with *minutissima*, *steinheili*, *sumichrasti*

posteriorly.

Many hairs on dorsum of body longer than 0.24mm. Color concolorous yellow to dark amber.

Queen measurements (mm): HL 0.88, HW 0.90, SL 0.74, EL 0.36, ED 0.20, CL 0.26, CW 0.22, WL 1.26, PL 0.34, PW 0.36, PPL 0.20, PPW 0.28; Indices: CI 98, SI 84, CLI 1.18, PI 94, PPI 71.

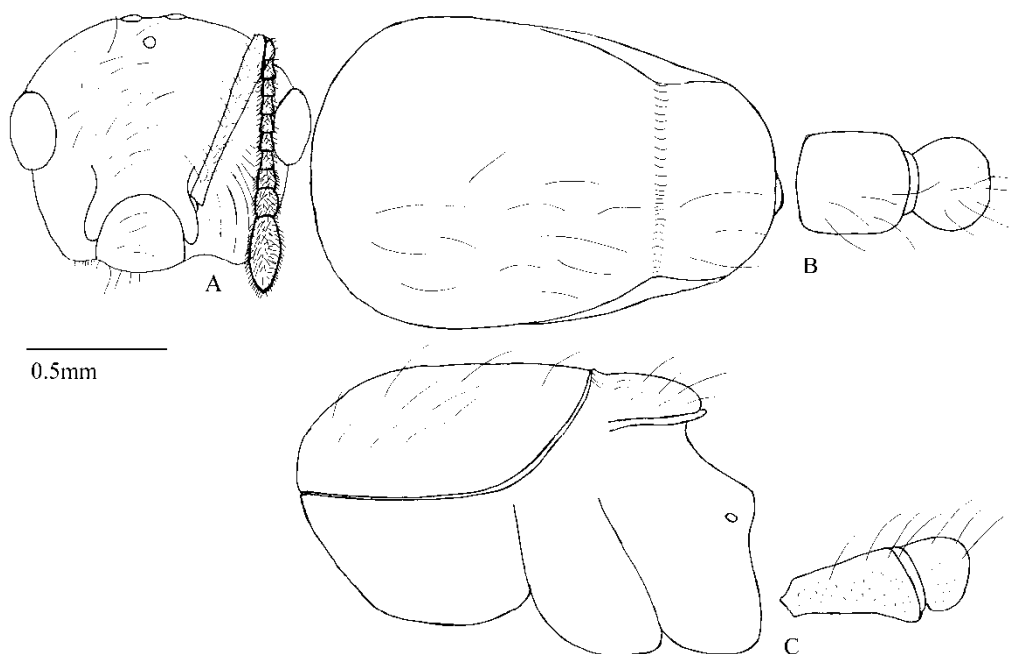


Plate 48. *Crematogaster missouriensis* queen: (Cloud Co., Kansas United States CWEM): (A) Head (sculpture is shown on right, pilosity on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma petiole and postpetiole.

missouriensis - central USA south into México

Ground dwelling species, usually under stones, also dead wood

Arid areas, grasslands and forests

Compare with *minutissima*, *steinheili*, *sumichrasti*

Male: This is an unusual male in *Crematogaster*. On this specimen, the mandibles are pincer-like with one tooth, another male has two teeth on the mandibles (from the same series); clypeus shiny snout-like, with 2 long hairs along anterior margin; scape longer but narrower than most males of this genus; ocelli almost flush with surface of head; head shiny, dark amber with fewer than 10 long erect hairs.

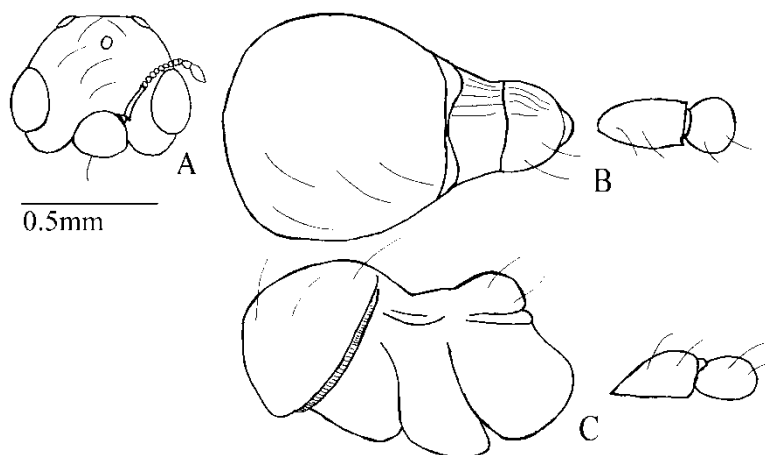


Plate 49. *Crematogaster missouriensis* male: (Cloud Co., Kansas United States CWEM): (A) Head (pilosity is shown on left); (B) Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); (C) Side view of mesosoma petiole and postpetiole.

missouriensis - southern and eastern USA south into México
 Ground dwelling species, usually under stones, also dead wood
 Arid areas, grasslands and forests

Compare with *minutissima*, *steinheili*, *sumichrasti*

Mesosoma clear with dark amber hue, shiny with several long, flexuous hairs; scutellum flattened anteriorly with shallow longitudinal striae, posterior bulbous; dorsellum and metanotum visible viewed dorsally.

Petiole, postpetiole and gaster pale yellow, shiny with many long erect hairs pointed posteriorly.

Concolorous pale yellow.

Male measurements (mm): HL 0.69, HW 0.71, SL 0.12, EL 0.17, ED 0.14, CL 0.10, CW 0.13, WL 1.32, PL 0.34, PW 0.22, PPL 0.24, PPW 0.26; Indices: CI 97, SI 17, CLI 77, PI 154, PPI 92.

Distribution: *Crematogaster missouriensis* can be found from Kansas and Missouri, west to Arizona, United States to San Luis Potosí, México in the south, including extreme southeastern Indiana (Carroll, 2011), Fairfax Co., Virginia (Kjar, 2009), Iowa (Shattuck and Cover, 2016), North Carolina (Guénard et al., 2012), South Carolina (Davies 2009), Florida (Deyrup, 2017), very common in Mississippi and Alabama (MacGown pers. comm.), Roosevelt Co., New Mexico (Shattuck and Cover, 2016), Oklahoma (Shattuck and Cover, 2016), Davis Mountains of Texas (Shattuck and Cover, 2016), Arkansas (General and Thompson, 2009; MacGown et al., 2011), Louisiana, St. Tammany Parish (Colby and Powell, 2006), Fort Benning, Georgia (Graham et al., 2008), south to Veracruz, México.

Type series: *Crematogaster missouriensis* 2 syntype workers from Missouri, United States [MNHG]; 1 syntype worker Texas

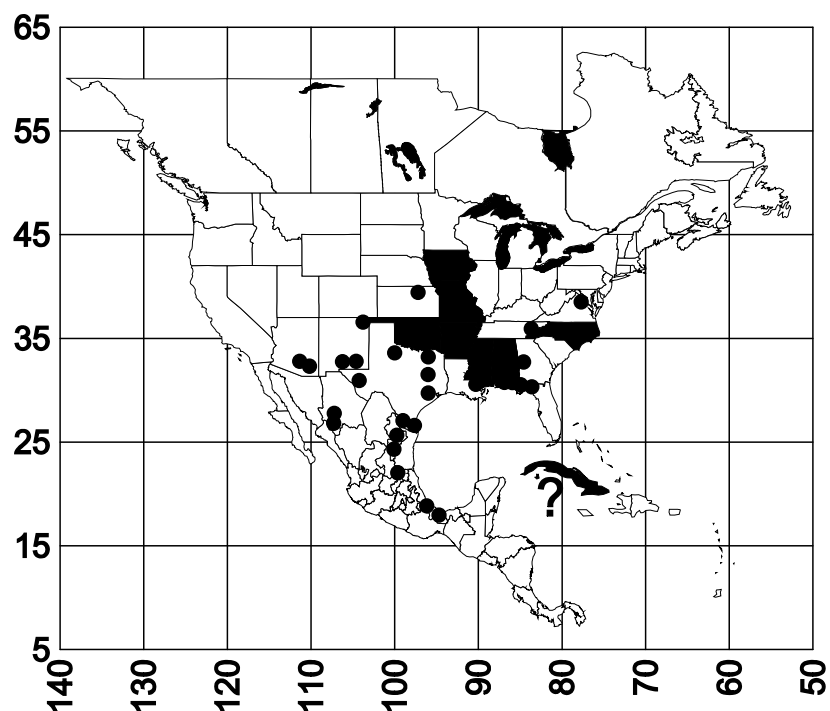
missouriensis - central USA south into México

Ground dwelling species, usually under stones, also dead wood

Arid areas, grasslands and forests

Compare with *minutissima*, *steinheili*, *sumichrasti*

[NHMW]. *Crematogaster smithi* 2 paratype males Miller Canyon, Huachuca Mountains, Arizona, United States [LACM, Stockholm Museum].



Map 19. *Crematogaster missouriensis*. The questionable Cuban record is based on *Crematogaster cubaensis*.

Material examined: MÉXICO: **Chihuahua**, Guerrero, Est. Terrero (2 ♂ CWEM); Basaseáchic (6 ♂, CWEM); **Nuevo León**, El Salto, Zaragoza (42 ♂, 1 ♀ CWEM); **San Luis Potosí**, Ciudad Valles, (5 ♂ CWEM); **Veracruz**, Coatepec (1 ♂ CWEM), Tierra Blanca (15

missouriensis - southern and eastern USA south into México
Ground dwelling species, usually under stones, also dead wood
Arid areas, grasslands and forests

Compare with *minutissima*, *steinheili*, *sumichrasti*

♂, 2 ♀ CWEM). **UNITED STATES:** **Alabama**, **Fayette Co.** Junction 43, 13 & 16 (6 ♀ CWEM), also see Forster, 2003; MacGown and Foster, 2005; **Arizona**, **Cochise Co.**, Huachuca Mountains, Miller Canyon (1 ♀ LACM), Southwest Research Station (3 ♀ CWEM), Portal (6 ♀ LACM), Santa Rita Mountains, Madera Canyon (11 ♀, 2 ♂ LACM); **Kansas**, **Cloud Co.**, 6.5mi W Miltonvale (3 ♀, 1 ♀, 2 ♂ CWEM); **New Mexico**, **Otero Co.**, Guadalupe Mountains, 41.1k NW Sitting Bull Falls (17 ♀ CWEM), Bates Park (2 ♀, CWEM), Bates Park turnoff Naider Rd. 41.4k NW Sitting Bull Falls (13 ♀ CWEM), **Union Co.**, Kiosca National Grassland (1 ♀ CWEM); **Tennessee**, **Blount Co.** Maryville (16 ♀, 1 ♂ CWEM); **Texas**, **Cameron Co.**, Sabal Palm Grove (11 ♀ CWEM), **Hidalgo Co.**, Anzalduas Co. Park (7 ♀ CWEM), **Jeff Davis Co.**, M^cIves Ranch (4 ♀ CWEM), **King Co.** 11mi S Guthrie (6 ♀ CWEM), **Tyler Co.**, Big Thicket National Preserve (11 ♀, 2 ♀ CWEM), **Walker Co.**, Huntsville State Park (15 ♀ CWEM) see additional Texas records in Jusino-Atresino and Phillips (1992).

Etymology: *Crematogaster missouriensis* is named for the state it was originally found.

Discussion: *Crematogaster missouriensis* is similar to *C. sumichrasti* and *C. steinheili*. Typically, *C. missouriensis* and *C. steinheili* are light yellow and *C. sumichrasti* is more amber to orange.

Creighton (1950) differentiated between *C. minutissima* and *C. minutissima* subsp. *smithi*, from *C. minutissima* subsp. *missouriensis*

missouriensis - central USA south into México

Ground dwelling species, usually under stones, also dead wood

Arid areas, grasslands and forests

Compare with *minutissima*, *steinheili*, *sumichrasti*

in his key by the intensity of the mesosomal sculpturing. Buren (1968) does not include any species of the subgenus *Orthocrema* that occur in North America. The differences between *C. missouriensis* and *C. minutissima* are more profound as *C. missouriensis* more closely resemble *C. sumichrasti* with larger more developed propodeal spines. The spines of queens are also different with *C. minutissima* having more developed propodeal spines than those of *C. missouriensis*. We find that *C. minutissima* subsp. *missouriensis* to have enough differences in overall size and sculpturing, as well as pronounced differences in spine development in the queens. We agree on the recognition of *C. missouriensis* as a species, and independently proposed specific status (Morgan, 2009).

Shattuck and Cover (2016) proposed *C. minutissima smithi* as a synonym of *C. missouriensis*, which seems reasonable. The separation of *C. missouriensis* from *C. minutissima* based on the size of the queens must be used with caution as *C. minutissima* has macrogyne and microgyne queens (Hölldobler and Wilson, 1977).

The worker of *Crematogaster minutissima* subsp. *smithi* appears to be identical to that of *C. cubaensis*; however, we have only been able to examine one syntype worker of the latter. We will not synonymize *C. cubaensis* at this time until specimens of the queens are available together with a more complete series.

Biology: Nests of *C. missouriensis* are usually found under stones (Mackay and Mackay, unpublished), in the soil or in dead wood (Forster, 2003). One nest was found in a fallen branch of a white oak under the bark (Morgan, unpublished).

missouriensis - southern and eastern USA south into México
Ground dwelling species, usually under stones, also dead wood
Arid areas, grasslands and forests

Compare with *minutissima*, *steinheili*, *sumichrasti*

Workers forage on the ground, logs, branches and foliage, and can be collected in pitfall traps. They are attracted to peanut butter and honey baits (Colby, 2002). Morgan (unpublished) collected it after spreading a mixture of molasses, beer and yeast on trees to attract moths.

It produces intermediate workers between normal workers and queens that lack a spermatheca and produce unfertilized eggs (as *Crematogaster smithi*, Peeters et al., 2013), which are mostly eaten by the larvae, but may develop into males in queenless colonies (Heinze et al., 1995, 1999).

Crematogaster missouriensis is found in a variety of habitats including more arid areas in the Chihuahuan desert, upland-hardwood forest and longleaf-pine savannas (Mackay and Mackay, unpublished, Morgan, unpublished). In forests, they are often found along the edges of wooded areas (Mackay and Mackay, unpublished). They have also been found to nest in open areas along the roadside (Carroll, 2011), grasslands (Jusino-Atresino and Phillips, 1992) and in prairie remnants (Hill, 2006). *Crematogaster missouriensis* has been collected in the tunica loess hills and the West Gulf Coastal Plain longleaf-pine forest of Louisiana (Dash, 2004).

Crematogaster missouriensis has little effect of the red imported fire ant, *Solenopsis invicta* (King and Tschinkel, 2013).

It is a household pest in Mississippi (Haug, 1934).

Deyrup (2017) includes details on the biology and distribution of this species as well as comparisons with other species occurring in Florida.

missouriensis - central USA south into México

Ground dwelling species, usually under stones, also dead wood

Arid areas, grasslands and forests

Compare with *corvina*

***Crematogaster montezumia* Smith**

Plates 4 D, 50, 51 and 114; Fig. 2; Map 20.

Crematogaster montezumia Smith, 1858: 139-140, (plate 1 1) worker, queen, México. Forel, 1912: 220, combination in (*Physocrema*). Emery, 1922: 135, combination in (*Orthocrema*). Santschi, 1922: 244, combination in (*Neocrema*). Longino, 2003: 91-93, worker, queen.

Crematogaster sulcata Mayr, 1870a: 403, worker, Colombia. Forel, 1899: 84, queen. Forel, 1901b: 65, junior synonym of *C. montezumia*. Forel, 1904: 36, variety of *C. montezumia*. Emery, 1922: 135, combination in (*Orthocrema*). Santschi, 1933: 111-113, combination in (*Neocrema*), junior synonym of *C. montezumia*.

Crematogaster ramulinida Forel, 1899: 84-85, worker, Sierra Nevada de Santa Marta, Pres de San Antonio, Colombia. Forel, 1904: 36, variety of *C. montezumia*. Emery, 1922: 135, combination in (*Orthocrema*). Kempf, 1968: 386-388, junior synonym of *C. montezumia*.

Crematogaster functa Forel, 1911: 300-301, worker, Cubatão, São Paulo, Brazil (Luederwaldt). Emery, 1922: 135, combination in (*Orthocrema*). Kempf, 1968: 386-388, junior synonym of *C. montezumia*.

montezumia - México to Argentina

Carton nests in shrubs

Wet to dry tropical forests

Compare with *corvina*

Crematogaster cristulata Santschi, 1925: 233-234, worker, queen, Santa Catharina, Brazil. Kempf, 1968: 386-388, junior synonym of *C. montezumia*.

Crematogaster proletaria Santschi, 1933: 111-113, worker, queen, Du Territoire de Misiones, Argentine. Kempf, 1968: 386-388, junior synonym of *C. montezumia*.

Descriptions:

Worker: Mandibles longitudinally striate with decumbent hairs; clypeus striate-punctate with 3-6 very long erect and 2-4 short erect hairs, anterior margin concave to straight with several long flexuous hairs; scape reaching to or surpassing posterior border of head, with erect hairs; head punctate in longitudinal rows, fading to shiny striate along medial frontal groove, with many long erect hairs evenly distributed.

Mesosoma deeply punctate, grainy looking from above and side, with many very long erect hairs pointed dorsally, notopropodeal groove steep and wide; propodeum swollen past spines; spines very small and acute; pronotal suture well developed from the side, metapleuron swollen past spine, with small propodeal spiracle.

Petiole rectangular, longer than wide, areolate with 3 long erect hairs on each posterior corner; postpetiole bilobed slightly diverging posteriorly, areolate with many erect hairs evenly dispersed; gaster areolate with many long erect hairs.

Concolorous dark brown.

montezumia - México to Argentina

Carton nests in shrubs

Wet to dry tropical forests

Compare with *corvina*

Worker measurements (mm): HL 0.62, HW 0.65, SL 0.72, EL 0.14, ED 0.13, CL 0.17, CW 0.22, WL 0.82, PSL 0.10, PL 0.28, PW 0.19, PPL 0.18, PPW 0.22; Indices: CI 85, SI 116, CLI 77, PI 147, PPI 82.

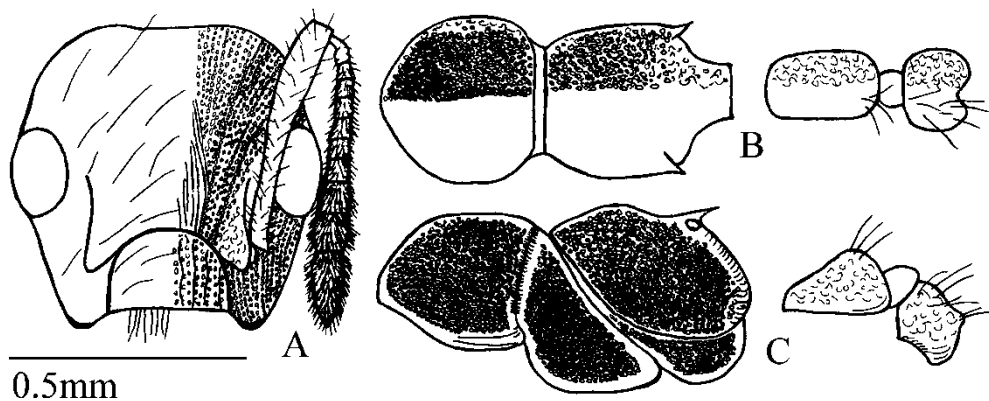


Plate 50. *Crematogaster montezumia* worker: (cotype, México, BMNH): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Queen: Very small compared to worker and not very worker like. Mandibles shiny with decumbent to appressed hairs; clypeus

montezumia - México to Argentina

Carton nests in shrubs

Wet to dry tropical forests

Compare with *corvina*

shiny with few long flexuous erect hairs, anterior margin concave with few flexuous long hairs; scape reaching or slightly surpassing posterior border of head, with decumbent and appressed hairs; ocelli almost flush with top of head; head almost round, shiny, shallowly rugose following curvature of face below eyes, with many long erect hairs pointed medially.

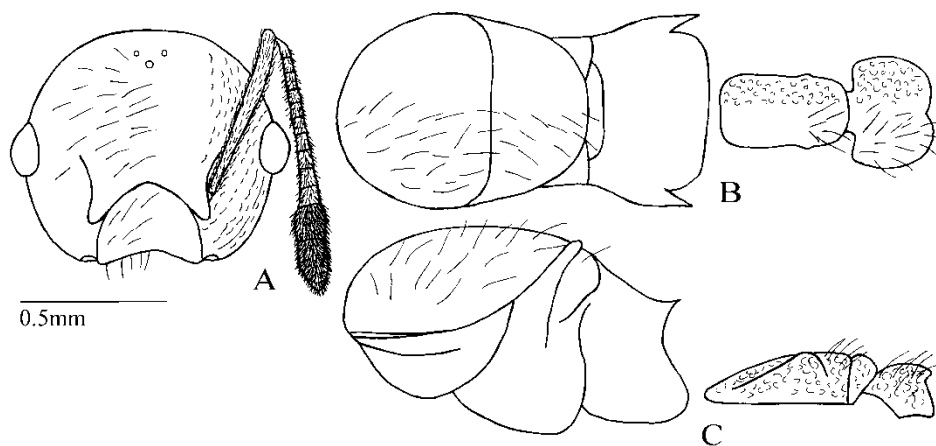


Plate 51. *Crematogaster montezumia* queen (cotype, México, BMNH): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Mesosoma very shiny with long erect hairs evenly distributed; dorsellum visible beneath scutellum; propodeum long with well-

montezumia - México to Argentina

Carton nests in shrubs

Wet to dry tropical forests

Compare with *corvina*

developed spines.

Petiole rectangular, longer than wide, shiny micro-areolate with several long flexuous hairs pointed posteriorly, clustered around posterior lateral corners, postpetiole bilobed, areolate with many long erect hairs evenly distributed and pointed posteriorly; gaster shiny areolate with many erect hairs.

Concolorous dark brown.

Queen measurements (mm): HL 0.78, HW 0.84, SL 0.82, EL 0.22, ED 0.20, CL 0.20, CW 0.31, WL 1.25, PSL 0.23, PL 0.48, PW 0.23, PPL 0.30, PPW 0.37; Indices: CI 93, SI 105, CLI 65, PI 201, PPI 81.

Distribution: *Crematogaster montezumia* has been collected from México, Guatemala (Branstetter and Sáenz, 2012) to Antioquia, Colombia (Vergara-Navarro and Serna, 2013), Brazil (Araújo et al., 2007) and northern Argentina (Theunis et al., 2005; Vittar, 2008).

Type series: Type from México; Cotype worker and queen of *Crematogaster montezumia* Smith [BMNH].

Material examined: **COLOMBIA:** **Magdalena**, Cañaveral (4 ♀ LACM). **COSTA RICA:** **Alajuela**, Santa Clara, Hamburg Farm (3 ♀ MCZC); **Puntarenas**, Corcovado, Laolla (1 ♀ MCZC). **GUATEMALA:** **Petén**, EL Mirador (3 ♀ MCZC). **MÉXICO:** **Quintana Roo**, Leona Vicario Ecological Reserve “El Edén” (1 ♀

montezumia - México to Argentina

Carton nests in shrubs

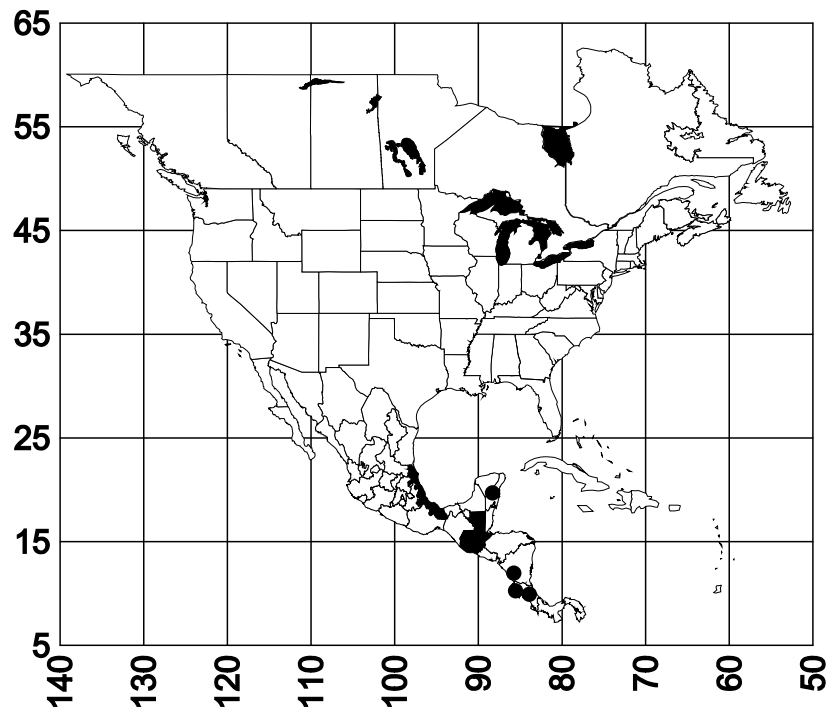
Wet to dry tropical forests

montezumia

262

Compare with *corvina*

CWEM); (21°13'N 87°11'W) (1 ♂ STDC); **Veracruz** (Vázquez-Bolaños, 2011).



Map 20. *Crematogaster montezumia*.

Etymology: *Montezumia*, named for Moctezuma the famous Aztec chief.

Discussion: *Crematogaster montezumia* is a very distinctive North America species. The key characteristics of the worker of this species are the poorly developed, very short and upturned propodeal

montezumia - México to Argentina

Carton nests in shrubs

Wet to dry tropical forests

Compare with *corvina*

spines, slightly incurved viewed from above and the completely punctate head and mesosoma.

Crematogaster montezumia could be confused with *C. corvina*. It can be separated from the latter species as it has several erect hairs on the dorsum of the mesosoma (generally only 2 present on the mesonotum in *C. corvina*) and it lacks the swollen mesonotum of *C. corvina*.

Biology: Longino (2003) states that *C. montezumia* can be found in a wide range of habitats including wet to dry forests. Most of his observations are from brushy second growth vegetation and forest edges and they occur in low density in Costa Rica, but are collected more often in South American countries. Longino has also observed their black carton nests hanging in shrubs over water and in a tree in an open field near a beach. He found workers, brood and alate queens or one single queen inside nests.

They visit inflorescences of the bromeliad *Aechmea lindenii* (Schmid, 2010).

montezumia - México to Argentina

Carton nests in shrubs

Wet to dry tropical forests

Compare with *cerasi*, *coarctata*, *vermiculata*

***Crematogaster mutans* Buren**

Plates 52, 53, 54 and 115; Map 21.

Crematogaster mutans Buren, 1968b: 115-117, worker, male, Moreno Lake, California, United States.

Descriptions:

Worker: Clypeus wider than long, longitudinally striate, with few appressed hairs, anterior margin straight with several long hairs; 1-3 long erect hairs on each frontal lobe; scape reaching to or surpassing posterior border of head, with decumbent hairs; head shiny shallowly punctate in longitudinal rows between and above eyes and punctate between rugae below eyes, evenly, sparsely covered with appressed hairs pointed toward one central point between eyes, long hairs on ventral surface of head.

Pronotum rugose with 1-4 long erect hairs, mesosoma rugose with semierect hairs intersecting other hairs and pointed medially (viewed from above), pronotal shoulder rounded, medial carina low, but long; side of mesosoma punctate; metapleuron rugose-punctate; promesonotal suture apparent from breaks in sculpturing, notopropodeal groove wide and steep; notopropodeal groove shiny, steep and angular; propodeal spines long, slender, thickened at base, divergent (viewed from above).

mutans - southwestern USA, México

Ground dwelling species, under stones and logs, plant cavities

Desert scrub

Compare with *cerasi*, *coarctata*, *vermiculata*

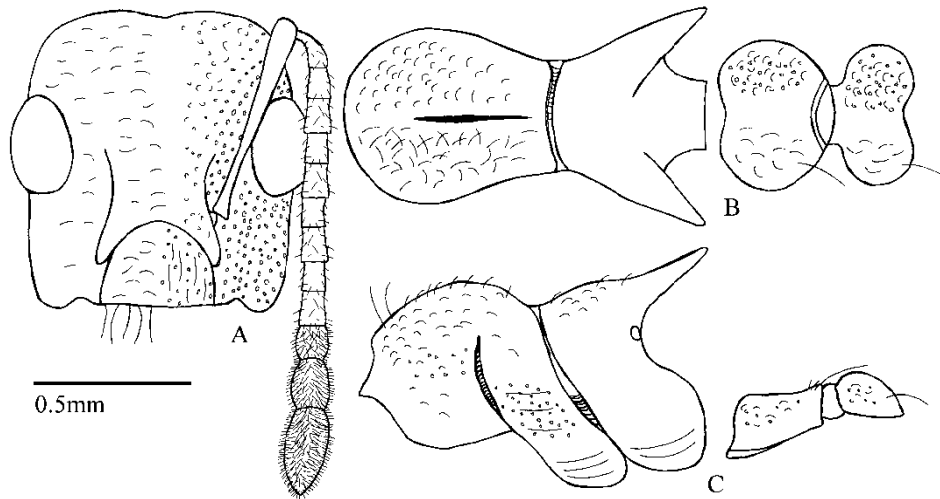


Plate 52. *Crematogaster mutans* worker: (paratype, Moreno Lake California LACM): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Petiole and postpetiole rugose punctate with several appressed hairs and 1 long flexuous hair on each posterior lateral corner, sternopetiolear process well developed; petiole angularly trapezoidal, postpetiole hemilobes longitudinally elongate, but overall wider than long; petiole wider and longer than postpetiole; gaster shallowly areolate with few erect and appressed hairs sparsely dispersed, erect hairs on ventral surface of gaster; tibia with decumbent hairs.

Bicolored, dark head and gaster, light colored mesosoma, or concolorous light to dark brown.

mutans - southwestern USA, México

Ground dwelling species, under stones and logs, plant cavities

Desert scrub

Compare with *cerasi*, *coarctata*, *vermiculata*

Worker measurements (mm): HL 0.81-0.97, HW 0.95-1.10, SL 0.71-0.88, EL 0.23-0.28, ED 0.17-0.22, CL 0.23-0.28, CW 0.26-0.30, WL 0.90-1.15, PSL 0.19-0.28, PL 0.26-0.38, PW 0.30-0.42, PPL 0.18-0.22, PPW 0.28-0.38; Indices: CI 86-88, SI 87-91, CLI 88-93, PI 87-90, PPI 56-64.

Queen: Mandibles longitudinally striate with decumbent hairs; clypeus longitudinally striate with 4-6 long erect and decumbent hairs, anterior clypeal margin convex and many long flexuous hairs; scape passing posterior border of head, with semierect hairs; ocelli small, flush with surface of head with 2-4 long flexuous, erect hairs between; head quadrate, longitudinally striate fading to smooth along frontal groove, with 5-6 fine, long flexuous hairs between frontal lobes to ocelli, and decumbent hair evenly distributed and pointed medially.

Mesosoma same width as head, dorsal view of mesosoma shiny areolate with many fine long erect and decumbent hairs pointed medially; dorsellum not visible from above; propodeum latitudinally striate coming to points on spines; side of mesosoma longitudinally striate with many appressed and decumbent hairs and few scattered long, erect hairs; propodeal spiracle small.

Petiole trapezoidal, areolate with many fine decumbent hairs pointed to middle of posterior margin and 4-5 erect hairs along each lateral margin and side; anterior sternopetiole process variable from poorly to well developed; postpetiole shallowly bilobed, spreading slightly posteriorly, areolate, covered with fine decumbent hair pointed posteriorly with 2 erect hairs on dorsum of each lobe, and 3 along each side; gaster areolate with many decumbent or appressed hairs and few

mutans - southwestern USA, México

Ground dwelling species, under stones and logs, plant cavities

Desert scrub

Compare with *cerasi*, *coarctata*, *vermiculata*

long erect hairs.

Concolorous brown.

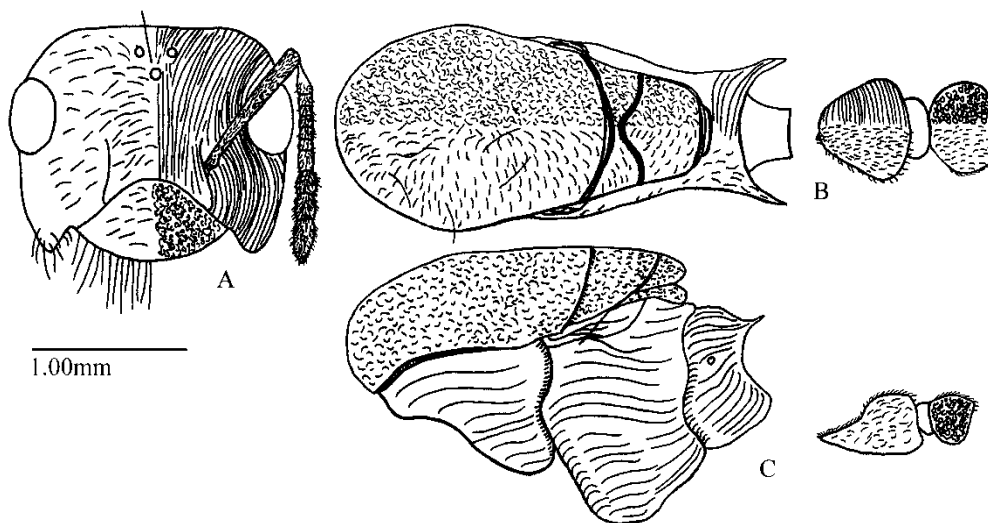


Plate 53. *Crematogaster mutans* queen: (Moreno Lake California LACM): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Queen measurements (mm): HL 0.73-1.48; HW 0.98-1.68; SL 0.66-1.22; EL 0.22-0.44; ED 0.18-0.36; CL 0.22-0.52; CW 0.28-0.92; WL 1.80-3.19; PSL 0.22-0.46; PL 0.30-0.58; PW 0.41-0.64; PPL 0.30-0.41; PPW 0.43-0.58; Indices: CI 74-88, SI 82-90, CLI 57-79, PI 73-90, PP 170-71.

mutans - southwestern USA, México

Ground dwelling species, under stones and logs, plant cavities

Desert scrub

Compare with *cerasi*, *coarctata*, *vermiculata*

Male: Mandibles longitudinally striate with decumbent hair; clypeus shiny with few erect hairs around margins, anterior clypeal margin convex with 4-6 long hairs; scapes typical, with few appressed or decumbent hairs; ocelli almost flush with surface of head; head shiny areolate, with decumbent to semierect hairs pointed toward ocelli, eyes smaller than in most males.

Mesosoma shiny, areolate on sides, with appressed hairs sparsely distributed; scutellum with few erect hairs and obscuring dorsal view of dorsellum; propodeum grainy punctate; propodeal spines simply nubs surrounded with cluster of long flexuous hairs.

Petiole and postpetiole costate with 1 long flexuous erect hair on each posterior lateral corner and many appressed hairs pointed posteriorly; gaster shiny areolate with few erect and many appressed hairs.

Concolorous brown.

Male measurements (mm): HL 0.55, HW 0.70, SL 0.17, EL 0.31, ED 0.31, CL 0.12, CW 0.43, WL 2.11, PL 0.36, PW 0.43, PPL 0.38, PPW 0.38; Indices: CI 73, SI 31, CLI 28, PI 84, PPI 100.

mutans - southwestern USA, México

Ground dwelling species, under stones and logs, plant cavities

Desert scrub

Compare with *cerasi*, *coarctata*, *vermiculata*

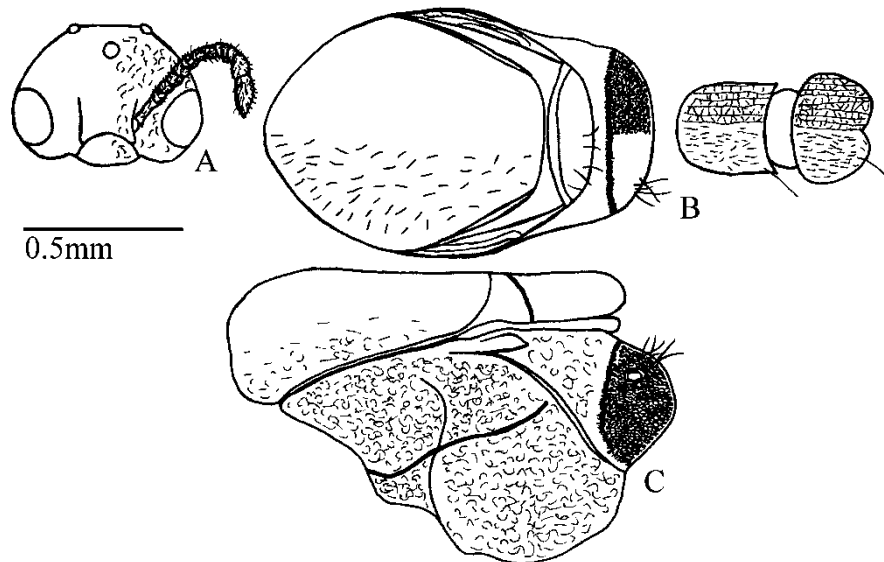


Plate 54. *Crematogaster mutans* male: (Moreno Lake California LACM): A. Head (sculpture on right, lack of pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture on top, pilosity on bottom); C. Side view of mesosoma.

Distribution: California, Utah and New Mexico, United States south into Chihuahua, México.

Type series: Type from Moreno Lake, California, United States. Paratype worker of *Crematogaster mutans* Buren [LACM].

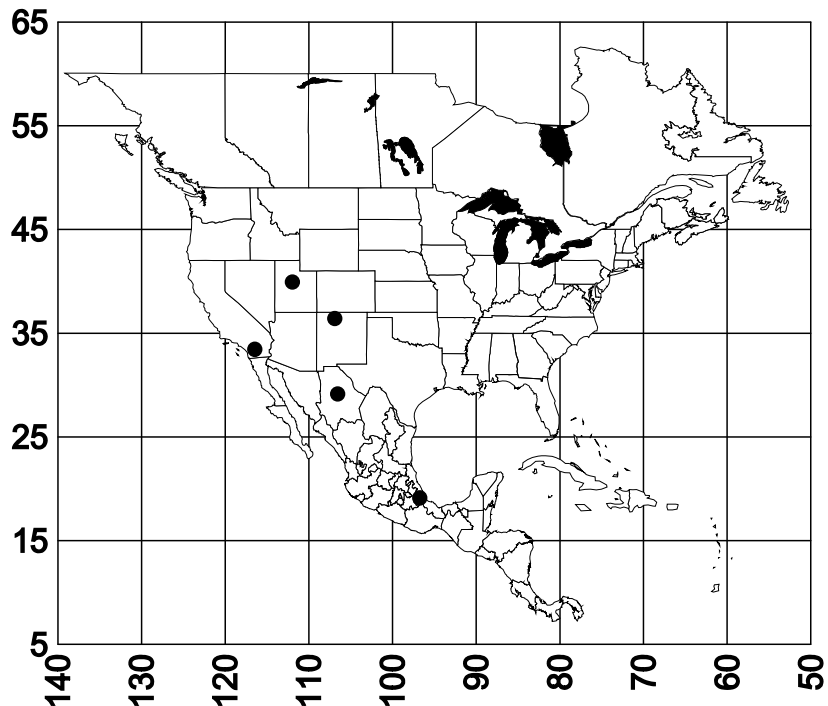
Material examined: **MÉXICO:** **Chihuahua**, Namiquipa, 14k E Benito Juárez (10 ♀ CWEM); **Veracruz**, 22.5k W Jalapa (1 ♀, 1 ♀, 1 ♂ CWEM). **UNITED STATES:** **New Mexico**, **Río Arriba Co.**, 2k N Dixon (3 ♀ CWEM); **Utah**, **Salt Lake Co.** (15 ♀, 1 ♀, 5 ♂ MCZC).

mutans - southwestern USA, México

Ground dwelling species, under stones and logs, plant cavities

Desert scrub

Compare with *cerasi*, *coarctata*, *vermiculata*



Map 21. *Crematogaster mutans*.

Discussion: The key characteristic of the *C. mutans* worker is the developed anterior sternopetiolar process. The worker of this species is nearly identical to the worker of *C. coarctata* and the two species are sympatric in range, making the identification of workers difficult. There is a slight difference in the width of the mesosoma of the queens. The mesosoma of the queen of *C. mutans* is slightly narrower than the head. The mesosoma of the queen of *C. coarctata* is as wide as or wider than the head. Therefore, we cannot synonymize

mutans - southwestern USA, México

Ground dwelling species, under stones and logs, plant cavities

Desert scrub

Compare with *cerasi*, *coarctata*, *vermiculata*

this taxon with *C. coarctata*.

As with *Crematogaster coarctata*, this species can easily be confused with *C. cerasi* and *C. vermiculata*. All four species have 1-5 long flexuous hairs on the pronotal shoulder with similar but not identical sculpturing. Pronotal shoulder sculpturing differs as *C. cerasi* is more lineolate, *C. vermiculata* is vermiculate and *C. mutans* has striate-shallowly punctate to areolate sculptured. The scape of *C. mutans* always reaches at least the posterior border of head and often surpasses it, and the scape of *C. vermiculata* is shorter but can reach the posterior border of head. The head of *C. coarctata* is very punctate in neat longitudinal rows, while *C. vermiculata* has a shiny head. The propodeal spines of *C. mutans*, *C. coarctata* and *C. vermiculata* are always long and straight while *C. cerasi* has reduced to medium length spines with the upper edge sinuous when view from the side.

Biology: *Crematogaster mutans* is a subterranean species with nests usually found under stones or logs. They can be found in cavities on plants and foraging among exposed roots of plants.

Crematogaster mutans workers have been observed in cavities of plants and visiting extrafloral nectaries on *Opuntia* sp. foraging on saltbush, live oak, pine juniper and other desert shrubs. This species has also been observed on saltbush, live oak, pine juniper and other desert shrubs. *Crematogaster mutans* have been observed tending larvae of *Hemiargus isola* (Reakirt's Blue a butterfly of the family Lycaenidae).

The common habit is arid desert scrub.

mutans - southwestern USA, México

Ground dwelling species, under stones and logs, plant cavities

Desert scrub

***Crematogaster navajoa* Buren**

Plates 55, 56, 57 and 116; Fig. 15; Map 22.

Crematogaster navajoa Buren, 1968b: 102-105, worker, queen and male; Seligman, Arizona, United States.

Descriptions:

Worker: Mandibles longitudinally striate with decumbent hairs; clypeus shiny with many long erect hairs, anterior margin convex; scape surpassing posterior border of head, with erect hairs; head shiny punctate in longitudinal rows, fading to shiny medially, with many fine long erect hairs evenly distributed.

Mesosoma punctate, pronotal shoulder and usually dorsal surface vermiculate with punctures, with many fine, very long flexuous hairs along pronotal shoulder and decumbent hairs pointed medially across rest of mesosoma; mesonotum swollen with deep and wide notopropodeal furrow; propodeum slightly swollen; spines long, coming to point; pronotal suture well developed (viewed from the side), mesopleuron swollen past spine, with small propodeal spiracle.

Petiole triangular, areolate with 1 long erect hair on each anterior and posterior lateral corner and several along sides; postpetiole bilobed, sides diverging posteriorly, areolate with one erect hair on each posterior corner; gaster areolate with few long erect hairs.

Concolorous light to dark brown.

navajoa - southwestern USA

Ground dwelling species, under stones and logs

Desert scrub, grasslands, shrublands and forests

Compare with *cerasi*, *lineolata*, *pilosa*

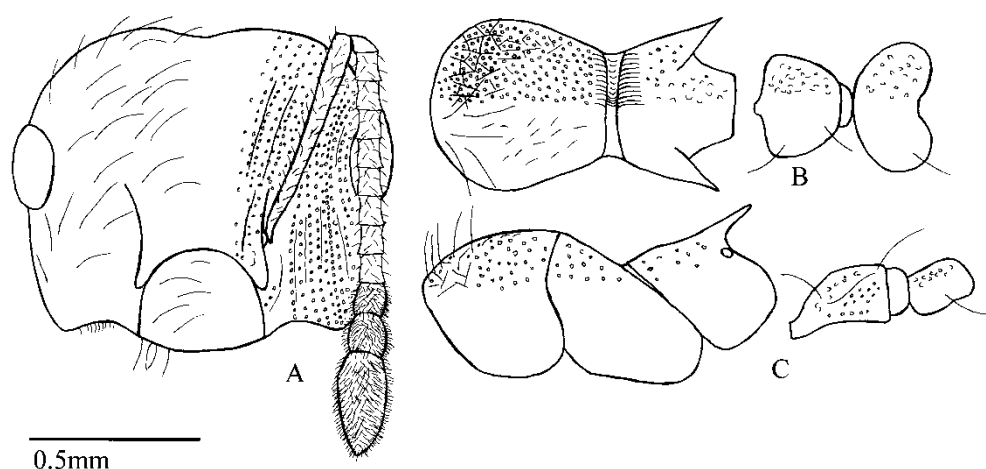


Plate 55. *Crematogaster navajoa* worker: (paratype, Seligman, Arizona, United States top point with queen LACM): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Worker measurements (mm): HL 0.90, HW 1.08, SL 0.78, EL 0.23, ED 0.18, CL 0.26, CW 0.34, WL 1.08, PSL 0.17, PL 0.26, PW 0.34, PPL 0.18, PPW 0.36; Indices: CI 83, SI 87, CLI 76, PI 76, PPI 50.

Queen: Mandibles shiny, longitudinally striate with decumbent hairs; clypeus shiny with many fine long erect hairs, anterior margin convex with many long hairs; scape failing to reach posterior border of head, with short erect hairs; ocelli small and flush with head; head shiny longitudinally striate with many very fine erect hairs.

navajoa - southwestern USA

Ground dwelling species, under stones and logs

Desert scrub, grasslands, shrublands and forests

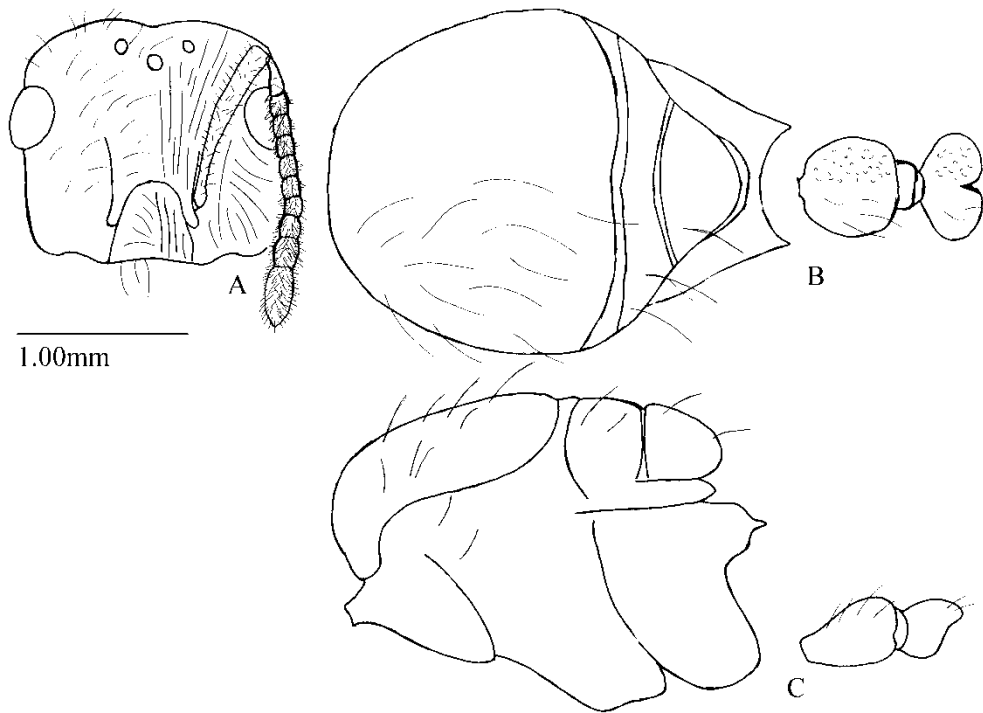


Plate 56. *Crematogaster navajoa* queen: (paratype, Seligman, Arizona, United States LACM): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Mesosoma very shiny with long erect hairs evenly distributed; edge of dorsellum visible from beneath scutellum; propodeum long with well-developed spines.

navajoa - southwestern USA

Ground dwelling species, under stones and logs

Desert scrub, grasslands, shrublands and forests

Compare with *cerasi*, *lineolata*, *pilosa*

Petiole rectangular, shiny micro-areolate with several long flexuous hairs pointed posteriorly; postpetiole shiny micro-areolate with poorly developed lobes spreading posteriorly; gaster shiny areolate with many erect hairs.

Concolorous dark brown.

Queen measurements (mm): HL 1.56, HW 1.73, SL 0.84, EL 0.39, ED 0.48, CL 0.46, CW 0.56, WL 1.88, PSL 0.20, PL 0.48, PW 0.65, PPL 0.36, PPW 0.70; Indices: CI 90, SI 54, CLI 83, PI 74, PPI 55.

Male: Mandibles shiny with erect hairs; clypeus very shiny, small beak-like, with anterior margin convex coming to point; ocelli flush with head; scape typical; head shiny striate, very worker-like with very fine long erect hairs.

Mesosoma shiny, micro-striate-areolate, with many fine erect hairs; scutellum overhangs dorsellum viewed from side.

Petiole, postpetiole and gaster shiny with many fine long erect hairs; petiole triangular viewed from above; postpetiole heart shaped viewed from above.

Concolorous dark brown.

Male measurements (mm): HL 0.54, HW 0.66, SL 0.12, EL 0.24, ED 0.24, CL 0.11, CW 0.18, WL 1.38, PL 0.44, PW 0.49, PPL 0.31, PPW 0.54; Indices: CI 82, SI 22, CLI 60, PI 90, PPI 57.

navajoa - southwestern USA

Ground dwelling species, under stones and logs

Desert scrub, grasslands, shrublands and forests

Compare with *cerasi*, *lineolata*, *pilosa*

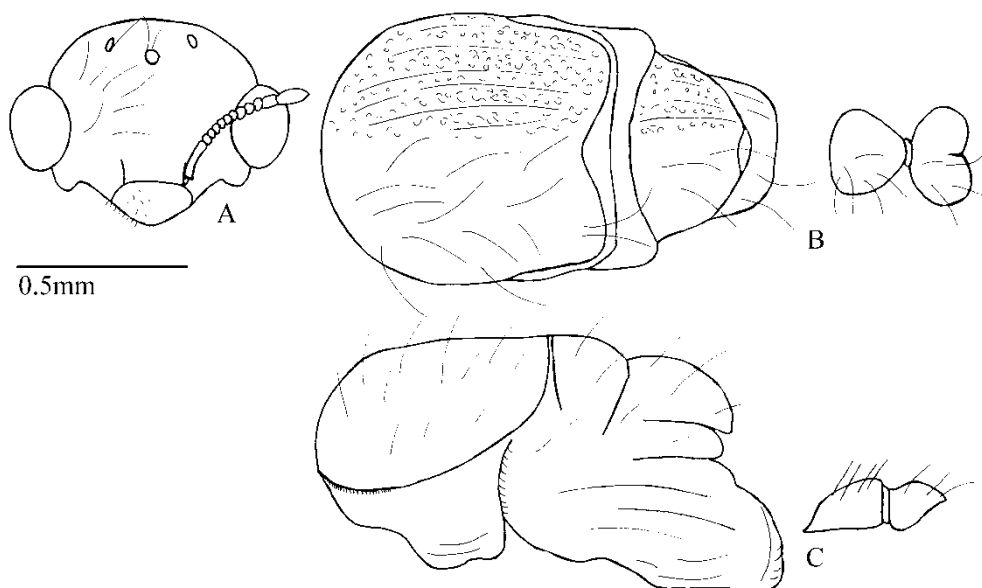


Plate 57. *Crematogaster navajoa* male: (paratype, Seligman, Arizona, United States top point LACM): A. Head (pilosity is shown on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

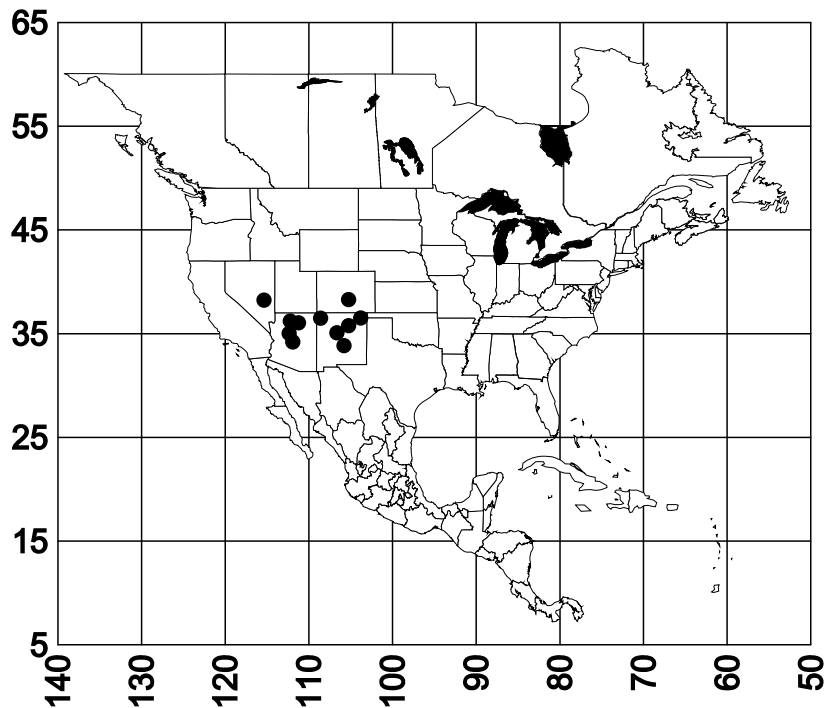
Distribution: Nevada, Arizona, Colorado and New Mexico, United States.

Type series: Type locality is from 8 miles east of Seligman Arizona. Paratype workers, queen and male from the Buren collection [LACM].

navajoa - southwestern USA

Ground dwelling species, under stones and logs
Desert scrub, grasslands, shrublands and forests

Compare with *cerasi*, *lineolata*, *pilosa*



Map 22. *Crematogaster navajoa*.

Material examined: **UNITED STATES:** **Arizona**, Coconino Co. (12 ♂, 1 ♀ CWEM), E. border Kaibab National Park, Highway 64 (7 ♂, 2 ♀ CWEM), **Yavapai Co.**, 10mi N Kirkland Junction (5 ♂ CWEM), 0.3mi W Junction Rt5 on FSR (34°49.95'N 112°39.29'W, elevation 4800') (20 ♂ MCZC), 1.0mi W Junction Rt5 on FSR (34°49.95'N 112°39.91'W, elev. 4850') (29 ♂, 3 ♀, 9 ♂ MCZC), Thirteen mile stone Butte 10.4mi E Clear Creek on Rt. 260 (elevation 5600') (4 ♂ MCZC); **Colorado**, **Pueblo Co.**, 6k W Pueblo (10 ♂ CWEM); **Nevada**, **Lincoln Co.**, Cathedral Gorge State Park (7 ♂ CWEM); **New Mexico**, **Bernalillo Co.**, Albuquerque (4 ♂ CWEM), **Lincoln Co.** Cibola Nat Forest (3 ♂ CWEM), **Mora Co.**, 2k E Wagon Mound (3 ♂ CWEM), **San Juan Co.**, 4k E Aztec (3 CWEM).

navajoa - southwestern USA

Ground dwelling species, under stones and logs
Desert scrub, grasslands, shrublands and forests

Compare with *cerasi*, *lineolata*, *pilosa*

Etymology: *Crematogaster navajoa* is named for the Navajo Indian Nation, part of the range of the species (Buren, 1968).

Discussion: The suite of characteristics of the *C. navajoa* worker include a shallowly rugose mesosoma like that in *C. cerasi*, many erect hairs of varying lengths on the dorsum of the mesosoma (much more than on *C. cerasi*) and the slightly reduced spines with sinuous upper margin like in *C. cerasi*.

Crematogaster navajoa is very similar to *C. lineolata*. Fortunately, *C. navajoa* is known only from the southwestern USA, but the distributions overlap in this area. Generally, the head of *C. navajoa* is covered with many erect hairs (more than 15), whereas *C. lineolata* has fewer than 10, and they are all approximately the same length (about 0.10 – 0.15 mm), not of 2 mostly different lengths (0.07 and 0.15 mm) as in *C. navajoa*.

Crematogaster navajoa and *C. pilosa* are both relatively hairy ants, but *C. navajoa* is found only in western USA and *C. pilosa* in eastern USA.

Crematogaster navajoa may be a recently evolved species due to its small, limited range has not spread from its small range to other ecologically similar areas or may be ancient impoverished relict species or have very restrictive cryptobiotic habits (Buren et al., 1974).

Biology: Nests of *C. navajoa* have been collected mostly in the soil and from under stones, or in and under logs. It has also been collected from nests in the soil at the base of a tree (Mackay and Mackay, unpublished).

Brood and sexuals were found in a nest in April. Workers are sluggish, and escape when the nest is disturbed (Mackay and Mackay,

navajoa - southwestern USA

Ground dwelling species, under stones and logs

Desert scrub, grasslands, shrublands and forests

Compare with *cerasi*, *lineolata*, *pilosa*

unpublished).

Workers forage on the soil surface and into vegetation.

Habitats include desert scrub, grasslands, sagebrush (silver sage), pinyon juniper, and juniper-grassland and cedar/pine, most commonly in openings in forests (Mackay and Mackay, unpublished). It was found in a pinyon pine community in northern Arizona (Trotter et al., 2008).

They are found in soil types ranging from white fine sand/clay, to sandy gravel (Mackay and Mackay, unpublished).

navajoa - southwestern USA

Ground dwelling species, under stones and logs

Desert scrub, grasslands, shrublands and forests

nigropilosa

280

Compare with *limata*, *longispinosa*

***Crematogaster nigropilosa* Mayr**

Plates 5 C, 58, 59, 60 and 117; Map 23.

Crematogaster nigropilosa Mayr, 1870a: 405, worker, Santa Fé de Bogotá, Colombia. Mayr, 1887: 624, queen. Emery 1922: 136, combination in *C. (Orthocrema)*.

Descriptions:

Worker: Mandibles longitudinally striate with many amber, erect hairs; clypeus shiny, striae developing toward anterior margin, surface with 2 long and several short flexuous hairs, anterior margin convex, with few long and several short stiff erect hairs; head very shiny between eyes, striate below eyes, with many long stiff hairs pointed medially; scape passing posterior border of head, with many erect hairs, first funicular segment long and narrow.

Mesosoma shiny (dorsal view) shallowly areolate, between several longitudinal carina starting at pronotal shoulder developing into lateral tubercles on mesonotum, many long, dark, stiff hairs and several appressed hairs on pronotal shoulder; mesonotum bilaterally inflated with medial depression (appearing as two adjacent bumps); notopropodeal groove deep and wide; carinulate from furrow fading to shallow areolate on dorsal face of propodeum, with 3 long erect hairs, posterior face steep, areolate, spines shiny, shallowly areolate, side view of mesosoma very shiny, shallowly areolate; lower mesopleuron

nigropilosa - southern México to Brazil
Arboreal, hollow twigs and soft wood
Rain forests, tropical plantations

Compare with *limata*, *longispinosa*

swollen outward, propodeal spiracle small; spines long, slender, coming to point, thickened at base.

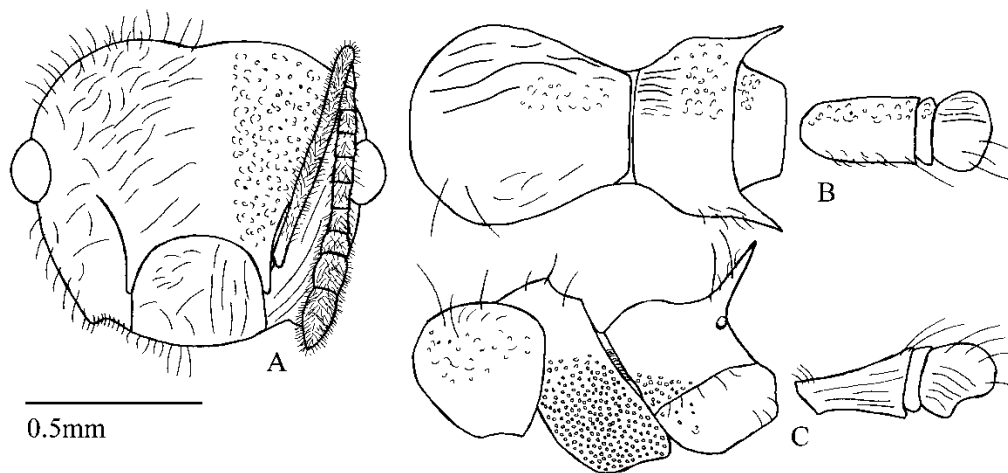


Plate 58. *Crematogaster nigropilosa* worker: (determined by J. Longino, Puntarenas Monte Verde, Costa Rica LACM # 689): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Petiole longer than wide, rectangular and shallowly areolate viewed from above, triangular and striate viewed from side, with 1 very long hair at each posterior corner and 2 long hairs between corners on posterior margin, several short erect hairs at posterior margin and decumbent hairs on sides, anterior sternopetiole process

nigropilosa - southern México to Brazil
 Arboreal, hollow twigs and soft wood
 Rain forests, tropical plantations

Compare with *limata*, *longispinosa*

absent to small right angle; first helcium long, punctate; postpetiole globular, wider than petiole and wider than long, shallow longitudinally striate, several long hairs pointed posteriorly; gaster areolate with short stiff dark hairs.

Concolorous brown to black.

Worker measurements (mm): HL 0.74-0.88, HW 0.82-0.96, SL 0.86-0.98, EL 0.18-0.19, ED 0.17-0.18, CL 0.25-0.34, CW 0.26-0.38, WL 1.02-1.15, PSL 0.26-0.35, PL 0.31-0.37, PW 0.18-0.26, PPL 0.24-0.30, PPW 0.24-0.36: Indices: CI 90-92, SI 1.11-1.16, CLI 89-96, PI 142-172, PPI 83-100.

Queen: Worker like, head, clypeus and scape shiny micro-areolate, with abundant long and short dark flexuous erect hairs; anterior clypeal margin convex, with several long and short, stiff erect hairs; scape passing posterior border of head.

Dorsum and side of mesosoma with pilosity and sculpture similar as worker; dorsal and side view of propodeum longitudinally striate converging on poorly developed spines; propodeal spiracle small.

Petiole subquadrate (dorsal view), longer than wide, triangular in side view, shiny areolate, with long erect hairs restricted to margins; postpetiole areolate, with abundant long dark erect hairs pointed posteriorly; gaster areolate with abundant, evenly distributed long thick dark erect hairs.

Concolorous light to dark brown to black.

nigropilosa - southern México to Brazil
Arboreal, hollow twigs and soft wood
Rain forests, tropical plantations

Compare with *limata*, *longispinosa*

Queen measurements (mm): HL 1.10, HW 1.15, SL 1.08, EL 0.41, ED 0.29, CL 0.41, CW 0.34, WL 2.35, PSL 0.29, PL 0.46, PW 0.38; PPL 0.38, PPW 0.41: Indices: CI 96, SI 98, CLI 120, PI 121, PPI 93.

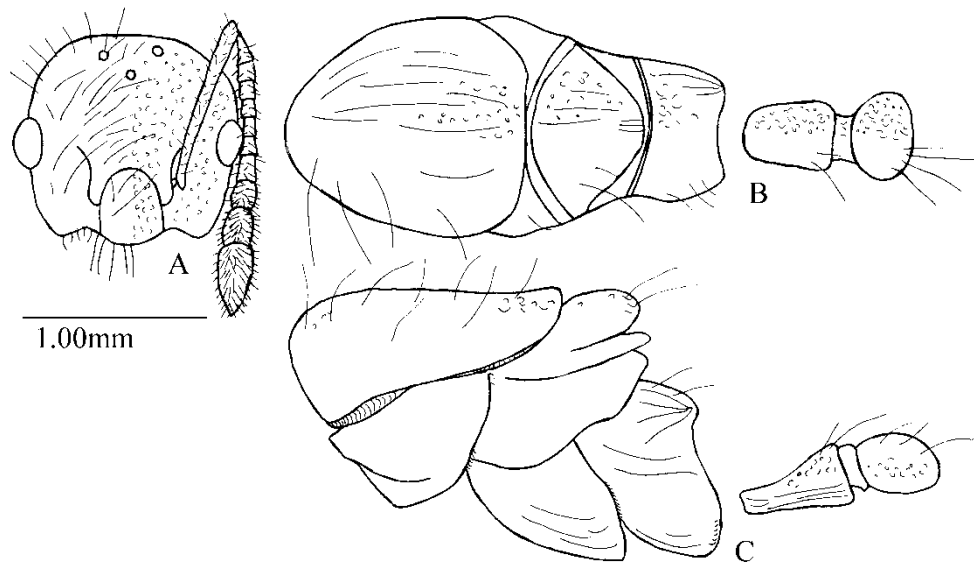


Plate 59. *Crematogaster nigropilosa* queen: (determined by J. Longino, Costa Rica LACM # 870): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Male: Mandibles small, head and clypeus shiny; head with few long dark erect hairs; clypeus triangular; ocelli slightly protruding from head; scape typically short.

nigropilosa - southern México to Brazil
 Arboreal, hollow twigs and soft wood
 Rain forests, tropical plantations

Compare with *limata*, *longispinosa*

Mesosoma very shiny with fewer erect hairs than worker, but still with long, dark and erect hairs; dorsellum and metanotum can be seen from above.



Plate 60. *Crematogaster nigropilosa* male: (determined by J. Longino, Costa Rica LACM # 870): A. Head (pilosity is shown on left); B. Dorsal view of mesosoma, petiole and postpetiole (pilosity is shown on bottom); C. Side view of mesosoma, petiole and postpetiole.

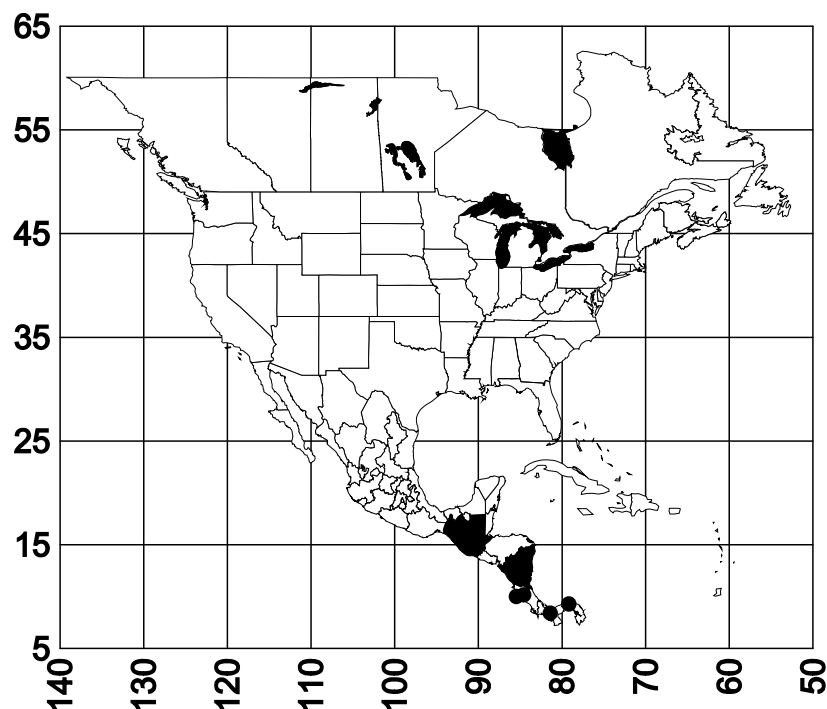
nigropilosa - southern México to Brazil
Arboreal, hollow twigs and soft wood
Rain forests, tropical plantations

Compare with *limata*, *longispinosa*

Petiole and postpetiole very shiny with several long dark erect hairs pointed posteriorly; gaster areolate with abundant evenly distributed long dark erect hairs.

Concolorous light brown.

Male measurements (mm): HL 0.50, HW 0.48, SL 0.11, EL 0.29, ED 0.23, CL 0.22, CW 0.47, WL 1.37, PL 0.32, PW 0.24, PPL 0.17, PPW 0.22; Indices: CI 104, SI 22, CLI 46, PI 133, PI 77.



Map 23. *Crematogaster nigropilosa*.

nigropilosa - southern México to Brazil
 Arboreal, hollow twigs and soft wood
 Rain forests, tropical plantations

Compare with *limata*, *longispinosa*

Distribution: Chiapas, México (Philpott et al., 2006), Guatemala (Branstetter and Sáenz, 2012), Costa Rica, Panamá, Antioquia, Colombia (Vergara-Navarro and Serna, 2013) south to Bolivia and northwestern Brazil (Siqueira de Castro, 2010/2011; Nakayama Miranda et al., 2012), Brazil (Araújo et al., 2007; Schütte et al., 2007; Ilha et al., 2009; Pereira de Souza et al., 2012; Cruz de Oliveira, 2013).

Type series. *Crematogaster nigropilosa*, Santa Fé de Bogotá, Colombia. [NHMB].

Material examined: **BOLIVIA:** **Cochabamba**, 5.5k W Llavini (CWEM), 67.5k E. Valle Sajta (17°06'19"S 64°46'57"W) (2 ♀ CWEM); **Santa Cruz**, 3.7k SSE Buena Vista Hotel (17°29'S 63°33'W) (1 ♀ CWEM). **COLOMBIA:** **Chocó**, Istmina (CWEM); **Cundinamarca**, Bridge over Quebrada Blanca (CWEM), Guayabetal (13 ♀ CWEM); see Achury et al., 2008; **Huila**, Concentración Jorge Villamil (near Gigante) (12 ♀ CWEM), La Vega (1 ♀ CWEM); **Valle del Cauca**, Bosque de Yotoco (62 ♀ CWEM), Medio Calima (5 ♀ CWEM). **COSTA RICA:** **Puntarenas**, 11k SW Estación Biológica Las Cruces (8°46'43"N 83°01'50"W) (12 ♀ CWEM), Estación Biológica Las Alturas (8°56'56"N 82°50'01"W) (2 ♀ CWEM), Corcovado National Park, 100m (3 ♀ MCZC). **GUATEMALA:** **Petén**, Estación Biológica Las Guacamayas (CWEM). **PANAMA:** **Chiriquí**, 2k NE Boquete, 1400m (1 ♀ CWEM), 11.0k W Boquete, 2150m (CWEM), 12k NE Santa Clara, 1850m (2 ♀ CWEM), 20.4k N

nigropilosa - southern México to Brazil
Arboreal, hollow twigs and soft wood
Rain forests, tropical plantations

Compare with *limata*, *longispinosa*

San Felix, 950m (CWEM), La Fortuna, Finca La Suisse (7 ♂ CWEM), Volcán, Hartman's Finca (1 ♂ CWEM).

Etymology: *Nigropilosa* is Latin, *nigro* meaning black and *pilosa* meaning hair referring to the black hairs on the mesosoma.

Discussion: *Crematogaster nigropilosa* is similar to *C. limata*, and *C. longispinosa*. All three taxa have long sharp propodeal spines and have similar pilosity. What separates *C. nigropilosa* from *C. limata* is the sculpturing and pilosity on the mesosoma and the divergence of the spines; *C. nigropilosa* has several more longitudinal carina and long flexuous dark erect hairs, and *C. limata* is shinier with white to light amber long flexuous erect hairs on the dorsum of the mesosoma. The spines on *C. nigropilosa* are widely divergent while the spines on *C. limata* are almost parallel. The sculpturing on the dorsum of *C. longispinosa* is very shiny, with white to light amber long flexuous hairs.

Biology: Nests have been found in low vegetation or in hollow twigs or soft wood in the understory. It also nests in galls (Carvalho and Vasconcelos, 2002).

Brood were collected in a nest in December (Colombia). Large nests have aggressive workers.

Crematogaster nigropilosa is collected mostly while foraging either on the ground or in the vegetation. It has been found in forest litter in montane forests and cloud forests (litter extractions) (Mackay and Mackay, unpublished) and were captured in pitfall traps and in

nigropilosa - southern México to Brazil
Arboreal, hollow twigs and soft wood
Rain forests, tropical plantations

Winkler samples by Pereira de Souza et al. (2012). This species will come to Vienna sausage baits in the vegetation (Mackay and Mackay, unpublished). They eat nectar and honeydew (Jacquemin et al., 2011), visiting inflorescences of the bromeliad *Aechmea lindenii* (Schmid, 2010) and extrafloral nectaries of 3 species of *Costus* in Panamá (Schemske, 1982).

Crematogaster nigropilosa is common in rainforest habitats and can exploit a wide range of elevations. Mackay and Mackay (unpublished) found it in mixed oak, riparian tropical forest, virgin rain forest, upper montane/cloud forest transition, wet cloud forest, recently cleared tropical rain forest, guayaba plantations and coffee plantations. It is very common in pine forests, eucalyptus forests and native mata in southern Brazil (Lutinski et al., 2008), as well as in the state of Amazonas, Brazil (Felizardo and Harada 2007), subforest (Schütte et al., 2007), and in coffee plantations in Colombia (Zabala et al., 2013).

It is found in areas with soils ranging from dark brown clay, red to brown clay-loam, brown rocky-loam to gray rocky soil.

Boudinot (2013) discussed the musculature of the male genitalia.

It is attracted to facilities where butterflies are reared and may be a pest (Sanabria-Blandón and Chacón de Ulloa, 2009).

nigropilosa - southern México to Brazil
Arboreal, hollow twigs and soft wood
Rain forests, tropical plantations

Compare with *isolata*

***Crematogaster nocturna* Buren**

Plates 61, 62 and 118; Map 24.

Crematogaster nocturna Buren, 1968b: 112-115, queen and male,
Rainbow Lodge, Navajo Mountains, Arizona, United States.

Descriptions:

The worker is unknown.

Queen: Clypeus wider than long, anterior margin straight with 6-8 long flexuous and many short flexuous hairs; eyes and ocelli large for this genus, almost flush with surface of head; scape not reaching posterior border of head, with appressed hairs; head shiny, longitudinally striate following curves of face around eyes, with very sparse appressed hair, 2 long, fine erect hairs between ocelli.

Mesosoma shiny micro-areolate with appressed hairs pointed medially and 2-4 short erect hairs on scutellum; metanotum and dorsellum visible under scutellum when viewed from above; propodeum shiny; propodeal spines with appressed hairs pointed toward tips, well developed for queen.

Petiole and postpetiole shiny striate with many short, thin flexuous hairs; anterior sternopetiole process very small; gaster shiny shallowly areolate, with sparse, short erect and even rows of appressed hairs directed posteriorly.

nocturna - USA (northern Arizona)

nocturna

290

Compare with *isolata*

Concolorous reddish-brown.

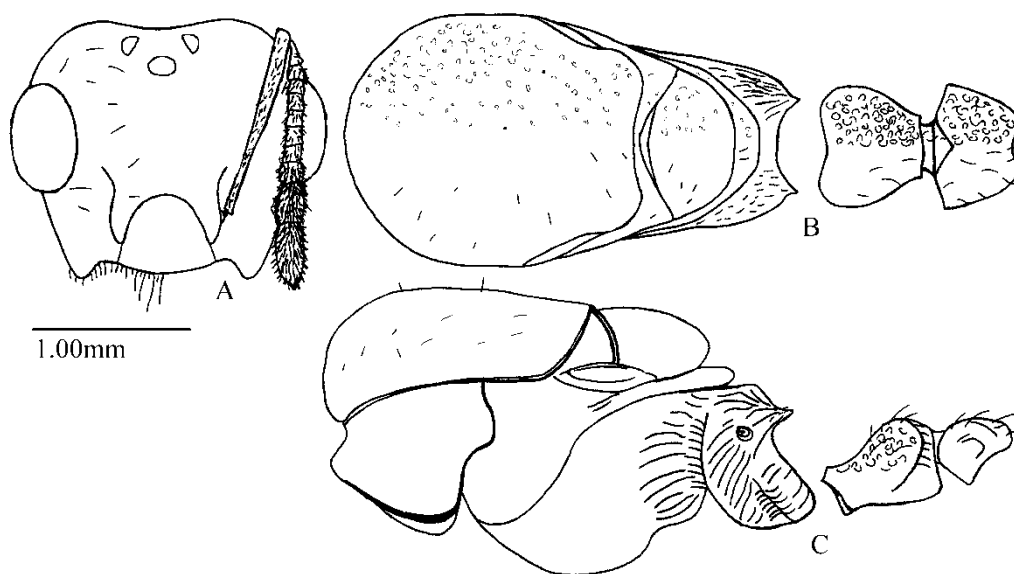


Plate 61: *Crematogaster nocturna* queen: (paratype, Rainbow Lodge, Navajo Mountains, Arizona, United States LACM): A. Head (pilosity is shown on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

nocturna - USA (northern Arizona)

Compare with *isolata*

Queen measurements (mm): HL 1.56, HW 1.87, SL 1.44, EL 0.57, ED 0.48, Ocelli Length 0.34, Ocelli Width 0.43, CL 0.57, CW 0.62, WL 3.12, PSL 0.43, PL 0.50, PW 0.84, PPL 0.36, PPW 0.77; Indices: CI 83, SI 92, CLI 92, PI 60, PPI 47.

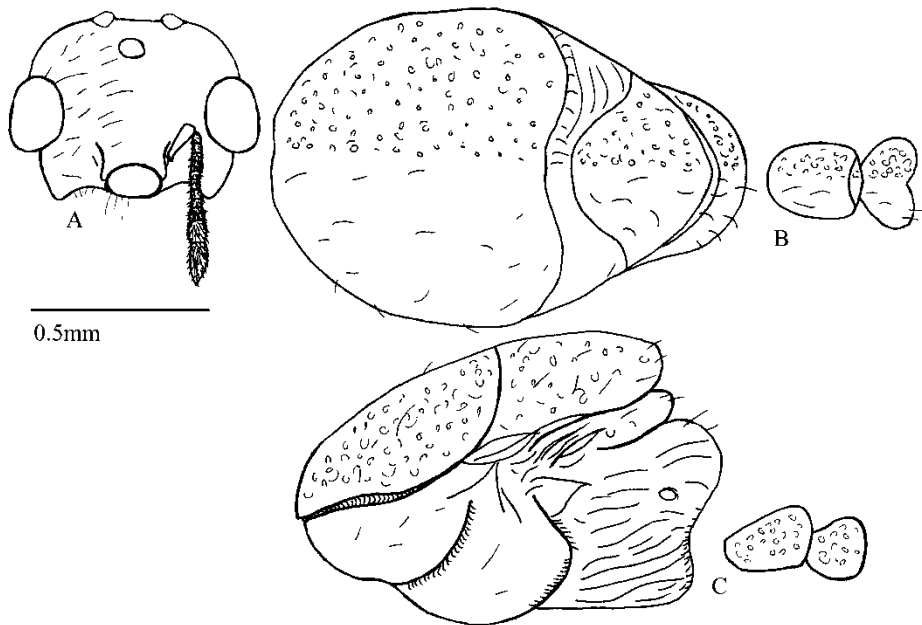


Plate 62: *Crematogaster nocturna* male: (paratype, Lodge, Navajo Mountains, Arizona, United States LACM): A. Head (pilosity is shown on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

nocturna - USA (northern Arizona)

Compare with *isolata*

Male: Clypeus protruding from face (viewed from above, full face or side), anterior clypeal margin with many long flexuous hairs; ocelli large for this genus, raised from surface of head; scape typically short; head shiny micro-areolate, with few long flexuous erect and semierect hairs pointed medially on face.

Mesosoma shiny, shallowly areolate with very few fine erect hairs; mesosoma wide, but short in length (side view).

Petiole, postpetiole and gaster shallowly areolate; petiole and postpetiole small.

Concolorous light brown.

Male measurements (mm): HL 0.61, HW 0.68, SL 0.30, EL 0.36, ED 0.32, Ocelli Length 0.12, Ocelli Width 0.14, CL 0.13, CW 0.25, WL 1.80, PL 0.24, PW 0.24, PPL 0.14, PPW 0.34; Indices: CI 90, SI 49, CLI 52, PI 100, PPI 41.

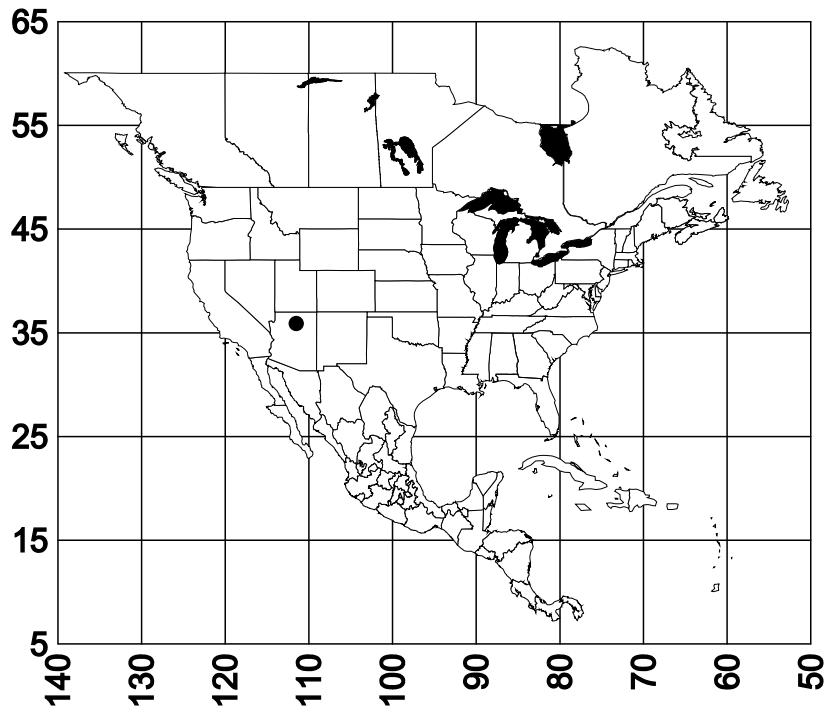
Distribution: Northern Arizona, United States.

Type series: Three male and nine female paratypes from Rainbow Lodge, Navajo Mountains, Coconino Co., Arizona, U. S. [LACM].

Etymology: This species was named for the large eyes and ocelli that may aid in nocturnal nuptial flights (Buren, 1968).

nocturna - USA (northern Arizona)

Compare with *isolata*



Map 24. *Crematogaster nocturna*.

Discussion: *Crematogaster nocturna* resembles the queen and male of *C. isolata*. The distinguishing characters are the size of the eyes and ocelli. The eyes and ocelli of *C. nocturna* are large for this genus, while the *C. isolata* queen and male have more typical eyes and ocelli.

Biology: This species was collected in northern Arizona close to the border of Utah in the Navajo Mountains, at an elevation of 6,500 feet (Buren, 1968).

nocturna - USA (northern Arizona)

***Crematogaster obscurata* Emery**

Plates 63, 64 and 119; Figs. 24 and 26; Map 25.

Crematogaster victima var. *obscurata* Emery, 1895: 287-288, worker, Venezuela. Emery, 1922: 136, combination in *C. (Orthocrema)*. Longino, 2003: 97, raised to species, worker, queen. Deyrup, 2017: 65, Plate 26, worker.

Crematogaster agnita Wheeler, 1934c: 175-177, worker, queen, Zacapa, Guatemala. Longino, 2003: 97, junior synonym of *C. obscurata*.

Descriptions:

Worker: Mandibles shiny, shallowly longitudinally striate with appressed hair; clypeus shiny with 2-8 erect hairs, anterior margin slightly convex; scape surpassing posterior border of head, evenly covered with semierect hairs; head areolate-lineolate along sides becoming very shiny in middle, evenly, sparsely covered with erect hairs.

Dorsum of mesosoma longitudinally striate-punctate with 6-10 erect hairs; side of mesosoma punctate; medial pronotal carina present; pronotal humeri can be seen viewed from above; notopropodeal groove shallow and rounded; propodeal spines short and divergent, pointed but very thick at base and curving very slightly posteriorly and 2 erect hairs on dorsal edge of each spine.

obscurata - USA (southern Texas, southern Florida) south to Brazil

Dead parts of living trees, hollow twigs and dead branches

Semiarid vegetation and wetlands

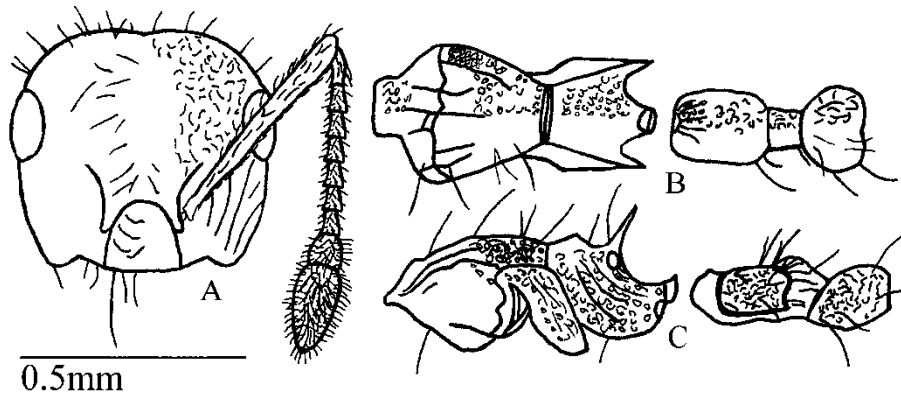
Compare with *crinosa*

Plate 63. *Crematogaster obscurata* worker: (holotype, Venezuela NHMG): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Petiole areolate, with 8 erect hairs, almost rectangular but slightly longer than wide when viewed from above, with dorsal surface flat; postpetiole areolate to shallowly punctate with 6 erect hairs and with small sternopostpetiolar process; gaster shallowly areolate with many erect hairs over entire surface of gaster (dorsal and ventral).

Concolorous light to dark brown.

obscurata - USA (southern Texas, southern Florida) south to Brazil

Dead parts of living trees, hollow twigs and dead branches

Semiarid vegetation and wetlands

Worker measurements (mm): HL 0.47-0.55, HW 0.48-0.57, SL 0.36-0.52, EL 0.11-0.14, ED 0.07-0.12, CL 0.14-0.19, CW 0.14-0.20, WL 0.49-0.56, PSL 0.10-0.12, PL 0.18-0.22, PW 0.16-0.17, PPL 0.11-0.12, PPW 0.17-0.18; Indices: CI 98-96, SI 77-95, CLI 100-95, PI 113-129, PPI 65-67.

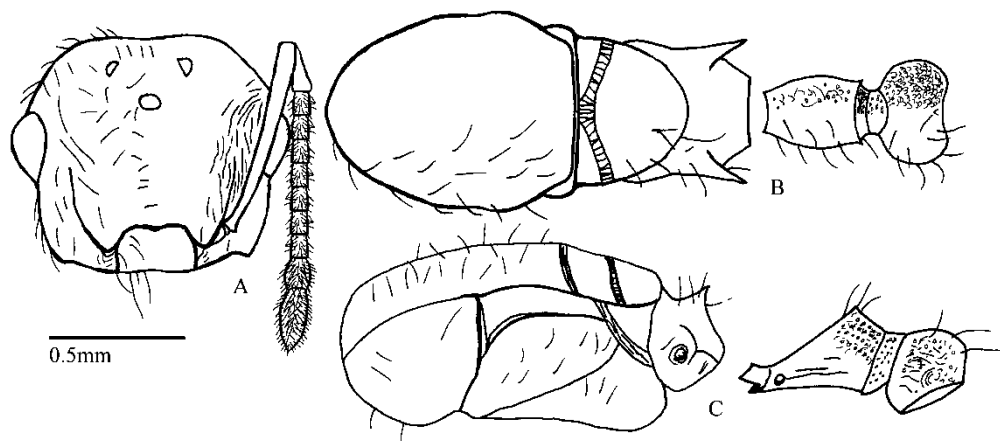


Plate 64. *Crematogaster obscurata* queen: (syntype *Crematogaster agnita* Wheeler, Zacapa, Guatemala MCZC): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

obscurata - USA (southern Texas, southern Florida) south to Brazil
 Dead parts of living trees, hollow twigs and dead branches
 Semiarid vegetation and wetlands

Compare with *crinosa*

Queen: Mandibles shiny with appressed hairs; clypeus shiny with 2-4 long erect hairs, about as long as wide, anterior margin straight with slight medial notch; scape evenly covered with semierect hairs, reaching posterior border of head; head rugose along sides, very shiny in middle, evenly sparsely covered with long and short filamentous erect hairs.

Mesosoma longitudinally carinate-punctate with many short erect hairs, posterior margin of scutum quadrate; scutellum rounded posteriorly; metanotum visible when viewed from above; dorsellum broadly rounded; notopropodeal groove rounded angular; propodeal spines well developed for queen, divergent, thickening at base, curving very slightly posteriorly with few erect hairs on dorsal edge of each spine.

Petiole shallowly areolate to shallowly punctate with 10 or more erect hairs, longer than wide, dorsal surface flat; anterior sternopetiole process well developed; postpetiole shallowly areolate to shallowly punctate with 8 or more erect hairs, oval and wider than long; gaster shallowly areolate with many erect hairs regularly spaced over entire surface of gaster (dorsal and ventral surfaces).

Concolorous reddish to dark brown.

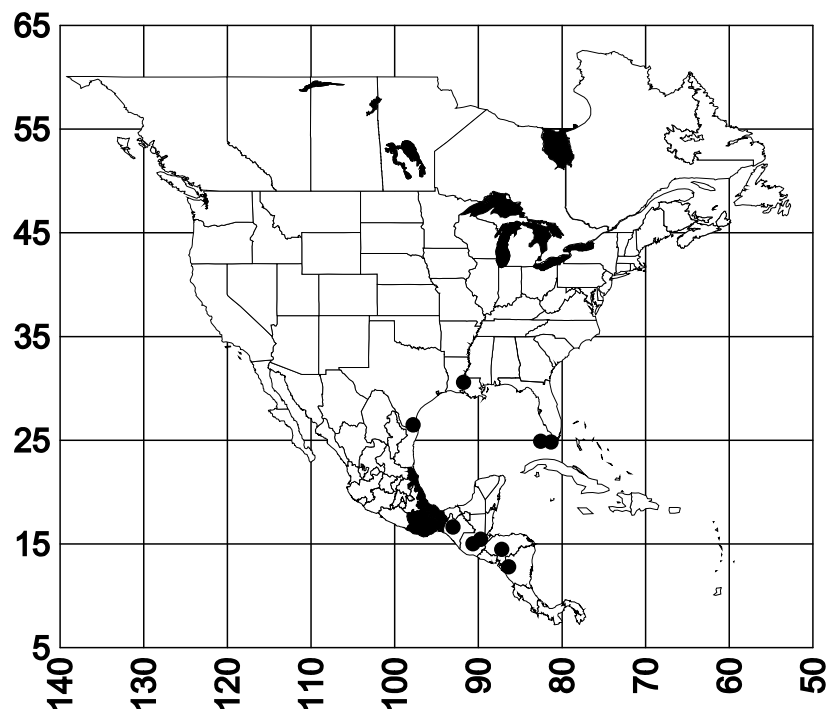
Queen measurements (mm): HL 0.78-0.84, HW 0.88-0.98, SL 0.64-0.73, EL 0.29-0.34, ED 0.24-0.25, CL 0.14-0.18, CW 0.24-0.26, WL 1.58-1.68, PSL 0.18-0.22, PL 0.35-0.42, PW 0.34-0.36, PPL 0.24-0.28, PPW 0.38-0.41; Indices: CI 89-86, SI 82-87, CLI 58-96, PI 119-151, PPI 63-68.

obscurata - USA (southern Texas, southern Florida) south to Brazil

Dead parts of living trees, hollow twigs and dead branches

Semiarid vegetation and wetlands

Distribution: South Florida (Deyrup, 2017), southern Louisiana (Parys et al., 2013) and south Texas, United States, México: Oaxaca (Vázquez-Bolaños, 2011), Veracruz (García-Martínez et al., 2013), Guatemala (Wheeler, 1934c; Branstetter and Sáenz, 2012), Nicaragua south to Brazil.



Map 25. *Crematogaster obscurata*.

It was intercepted at U. S. quarantine stations on *Oncidium* orchids from Guatemala (Longino, 2003). It was introduced from Central or South America, first discovered in the Florida Keys in 1995

obscurata - USA (southern Texas, southern Florida) south to Brazil
 Dead parts of living trees, hollow twigs and dead branches
 Semiarid vegetation and wetlands

Compare with *crinosa*

(Moreau et al., 2014). Deyrup (2007) asks an interesting question: should this apparently invasive ant be eradicated, as it is a rare introduced species? It is probably too late to ask about eradication as it is now in southern Louisiana (Parys et al., 2013), southern Texas and will probably be found in additional states between Texas and Florida when future collections are done. It is even doubtful that it is introduced as it is found in northeastern México.

There is a similar recently introduced undescribed species, *Crematogaster* sp. JTL-022, in San Cristóbal of the Galapagos Islands, which is also found in Colombia and Perú (Herrera et al., 2014).

Type series: *Crematogaster* victima var. *obscurata* Emery holotype worker, Venezuela [NMHG]; *Crematogaster agnita* Wheeler, syntype worker and queen: Guatemala, Zacapa [MCZC] and 3 cotype workers of *Crematogaster agnita* from Guatemala [MCZC].

Material examined: **BRAZIL:** Pará, Paragominas, Cantareira (8 ♂ NHMW). **GUATEMALA:** Guatemala, La Scala (3 ♂ MCZC). **NICARAGUA:** León, Volcano Telica (1 worker CWEM). **UNITED STATES:** Florida, Monroe Co., West Summerland Key (1 ♂, 1 ♀ MCZC), Atlantic side of the southwest end of Summerland Key (see also Deyrup, 2007); Texas, Cameron Co., 6.5mi N Junction FM 2925 & 106 (4 ♂ COOK). **VENEZUELA:** (9 ♂, 2 ♀ NHMW), La Cueva (2 ♂, 1 ♀ NHMW).

Etymology: *obscurata*; from Latin *obscurus* meaning dark.

obscurata - USA (southern Texas, southern Florida) south to Brazil
Dead parts of living trees, hollow twigs and dead branches
Semiarid vegetation and wetlands

Discussion: *Crematogaster obscurata* has small, but continuously polymorphic workers. The queen of this species is proportionally small; however, with less variation.

The smallest workers could be mistaken for *C. crinosa*, because they have few to no erect hairs on their heads and their heads are very shiny. These very small workers have the typical *C. obscurata* sculpturing and small spines. The distinguishing character is *C. obscurata* has an anterior sternopostpetiolar process that is absent on *C. crinosa*.

Biology: Deyrup (2007) reported that Florida colonies of *Crematogaster obscurata* were found in a tropical hardwood hammock and nearby coastal mangroves. Nests occurred in dead portions of living trees: hollow twigs and branches, and insect galleries in larger dead branches. One nest was in the stub of a dead branch of *Piscidia piscipula*, the others in *Rhizophora mangle*. Two nests in the red mangroves were in isolated trees in the intertidal zone, so foraging may be confined to a single tree. Nests had numerous queens that had shed their wings, so it is possible that colonies may spread by fission.

Crematogaster obscurata was found in semiarid vegetation in Venezuela (Pérez-Sánchez et al., 2012). It is found in the early successional wet and late successional dry seasons in Brazil (Neves et al., 2010). It is also found in the state of Pará, Brazil (Felizardo and Harada 2007). *Crematogaster* nr. *obscurata* is a common species in wetlands in the state of Minas Gerais, Brazil (Costa-Milanez et al., 2014).

Deyrup (2017) includes details on the biology and distribution

obscurata - USA (southern Texas, southern Florida) south to Brazil

Dead parts of living trees, hollow twigs and dead branches

Semiarid vegetation and wetlands

Compare with *crinosa*

of this species as well as comparisons with other species occurring in Florida.

obscurata - USA (southern Texas, southern Florida) south to Brazil

Dead parts of living trees, hollow twigs and dead branches

Semiarid vegetation and wetlands

Compare with *ashmeadi*, *depilis*

***Crematogaster opaca* Mayr**

Plates 65, 66, 67 and 120; Fig. 8; Map 26.

Crematogaster opaca Mayr, 1870b: 992, worker, México. Emery, 1895: 283; Wheeler, 1908c: 478; Wheeler, 1914: 44, subspecies of *C. lineolata*. Wheeler, 1919: 111, revived status as species. Emery, 1922: 141, combination in *Crematogaster* (*Acrocoelia*); subspecies of *C. lineolata*. Wheeler 1934b: 139, revived status as species.

Descriptions:

Worker: Mandibles deeply rugose with semierect hairs; clypeus slightly wider than long, punctate-rugose with appressed hairs, anterior margin straight; scape failing to reach posterior border of head, with semierect hairs; head punctate-rugose with appressed hair.

Entire mesosoma punctate with rugae, sparsely covered with appressed hair and none to 6 long flexuous hairs on each pronotal shoulder; humeri somewhat square; promesonotal suture developed; notopropodeal groove very steep, shaped like “V”; propodeal spines usually short, but can vary in length, robust and divergent (seen from above).

Petiole and postpetiole punctate-rugose with sparse appressed hairs and one long flexuous hair on each posterior corner and each

opaca - USA (southern Arizona), México

Ground dwelling species with mound or under stones, logs and
stumps

Dry deserts, grasslands, arid shrublands, pine/oak forests

Compare with *ashmeadi*, *depilis*

hemilobe; petiole triangulate (as seen from above), slightly longer than wide, anterior sternopetiolar process absent to well developed; postpetiole wider than long, hemilobes spreading slightly posteriorly (top view); gaster punctate with rugae, sparsely but evenly covered with appressed hair, and with 0-20 short erect hairs.

Color highly variable, from concolorous light brown to dark brown or bicolored.

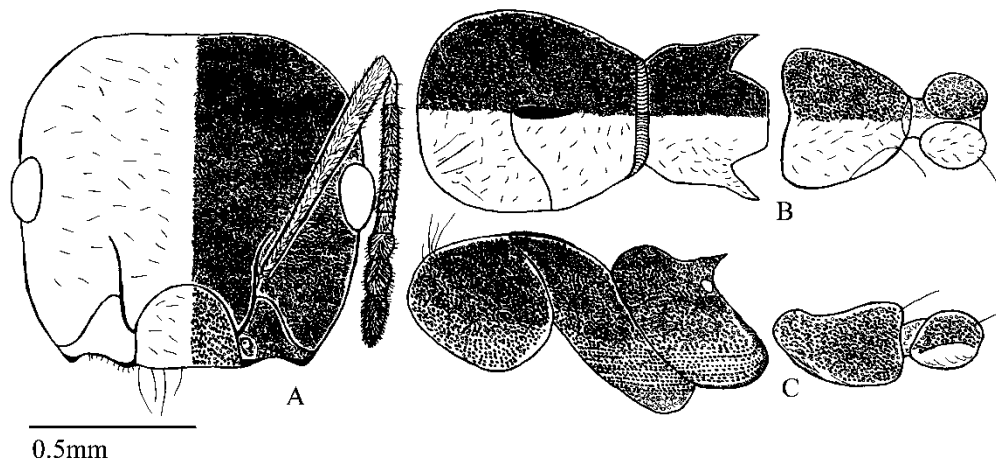


Plate 65. *Crematogaster opaca* worker: (syntype, México NHMW): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

opaca - USA (southern Arizona), México

Ground dwelling species with mound or under stones, logs and stumps

Dry deserts, grasslands, arid shrublands, pine/oak forests

Compare with *ashmeadi*, *depilis*

Worker measurements (mm): HL 0.97-1.01, HW 1.06-1.28, SL 0.82-0.90, EL 0.22-0.24, ED 0.18-0.22, CL 0.22-0.29, CW 0.25-0.35, WL 0.98-1.08, PSL 0.11-0.18, PL 0.36-0.40, PW 0.37-0.41, PPL 0.20-0.23, PPW 0.18-0.30; Indices: CI 79-92, SI 85-89, CLI 83-88, PI 97-98, PPI 77-111.

Queen: mandibles shiny, but shallowly longitudinally striate; clypeus wider than long; clypeus and head shiny, but shallowly punctate with few rugae, and many long flexuous hairs; scape surpassing posterior border of head, with decumbent hairs; ocelli flush with surface of face.

Mesosoma shiny areolate to shallowly rugose with shallow punctures between, pilosity denser than that of worker, with many flexuous hairs on mesosoma; metanotum not visible under scutellum when viewed dorsally, posterior border of propodeum rounded; propodeal spines well developed (for a queen).

Petiole and postpetiole shiny, rugose with shallow punctures between rugae and many very thin long flexuous and appressed hairs; anterior sternopetiole process absent to slightly developed; gaster with shallow sculpture, very shiny with decumbent and long flexuous hairs.

Color reddish-brown to dark brown.

opaca - USA (southern Arizona), México

Ground dwelling species with mound or under stones, logs and stumps

Dry deserts, grasslands, arid shrublands, pine/oak forests

Compare with *ashmeadi*, *depilis*

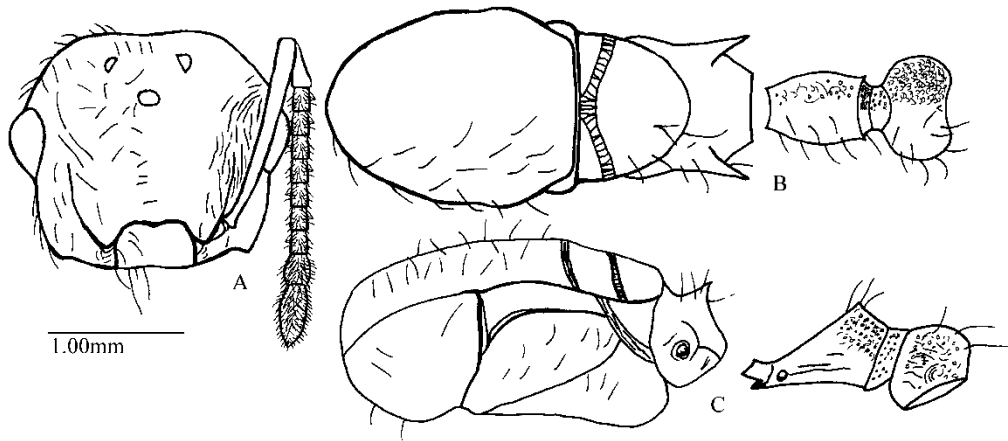


Plate 66. *Crematogaster opaca* queen: (Michoacán Parque Nacional Charro México CWEM #10354): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Queen measurements (mm): HL 1.44-1.87, HW 1.73-1.87, SL 1.08-1.20, CL 0.41-0.48, CW 0.48-0.62, EL 0.38-0.43, ED 0.34-0.43, WL 3.00-3.12, PSL 0.31-0.34, PL 0.47-0.49, PW 0.48-0.84, PPL 0.41-0.48, PPW 0.36-0.48; Indices: CI 82-100, SI 64-75, CLI 77-85, PI 58-98, PPI 100-114.

opaca - USA (southern Arizona), México

Ground dwelling species with mound or under stones, logs and stumps

Dry deserts, grasslands, arid shrublands, pine/oak forests

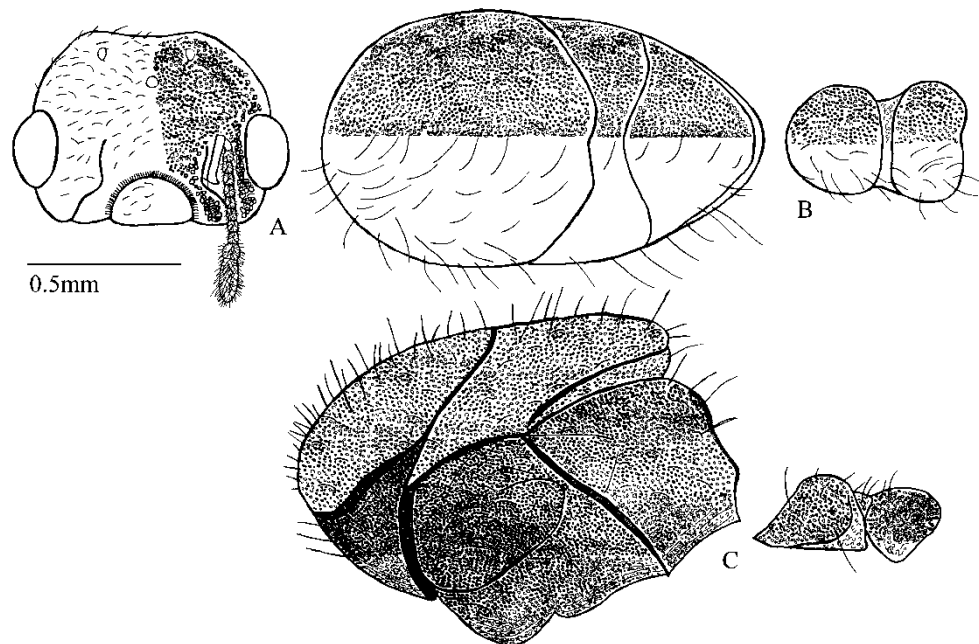
Compare with *ashmeadi*, *depilis*

Plate 67. *Crematogaster opaca* male: (Michoacán Parque Nacional Charro México CWEM #10354): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Male: mandibles typically small; clypeus snout-like, slightly protruding from head; ocelli slightly protruding from head, scape typically short; head punctate-rugose with short flexuous hairs pointed medially.

opaca - USA (southern Arizona), México

Ground dwelling species with mound or under stones, logs and stumps

Dry deserts, grasslands, arid shrublands, pine/oak forests

Compare with *ashmeadi*, *depilis*

Sculpturing on rest of body similar to worker, punctate-rugose, very grainy looking with many long (some as long as 0.3 mm, most are 0.12-0.18mm), very fine hairs; metanotum not visible under scutellum when viewed dorsally.

Petiole quadrate; postpetiole with hint of medium sulcus; gaster areolate.

Concolorous dark brown.

Male measurements (mm): HL 0.62-0.65, HW 0.77-0.84, SL 0.18-0.22, CL 0.14-0.17, CW 0.23-0.25, EL 0.30-0.31, ED 0.26-0.29, WL 1.68-1.74, PL 0.27-0.38, PW 0.33-0.34, PPL 0.21-0.23, PPW 0.37-0.38; Indices: CI 77-81, SI 29-34, CLI 61-74, PI 82-112, PPI 57-61.

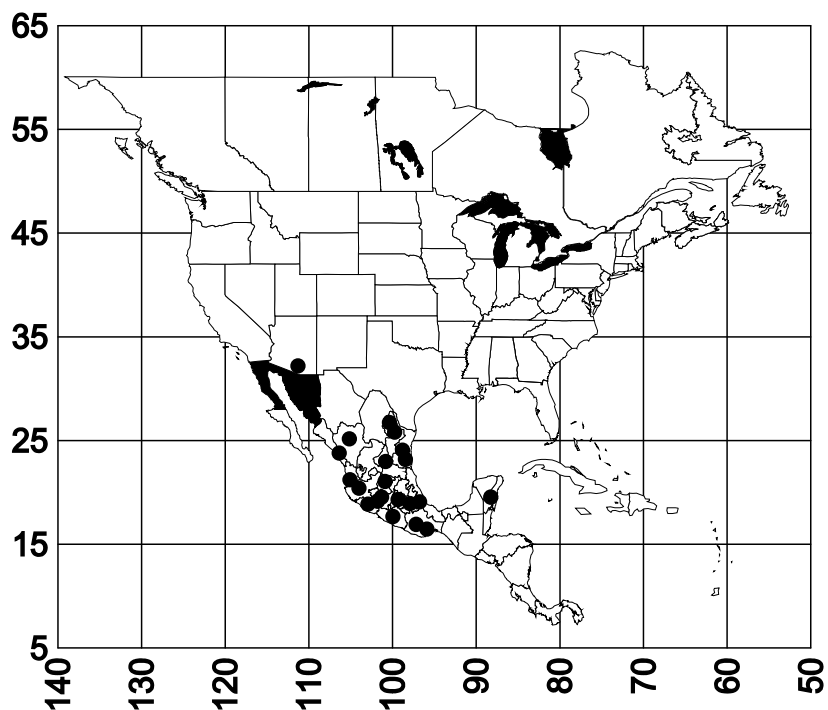
Distribution: Southern Arizona, United States, throughout México, including Baja California (Wheeler, 1934b; Vázquez-Bolaños, 2011), Hidalgo and Querétaro (Vázquez-Bolaños, 2011) and Sonora (Varela-Hernández and Jones, 2013).

Type series: Syntype worker of *Crematogaster opaca*, collected by Professor Bilimek and Dr. Sichel in México [#402, NHMW].

opaca - USA (southern Arizona), México

Ground dwelling species with mound or under stones, logs and
stumps

Dry deserts, grasslands, arid shrublands, pine/oak forests

Compare with *ashmeadi*, *depilis*Map 26. *Crematogaster opaca*.

Material examined: MÉXICO: **Durango**, La Cañada (5 ♀ CWEM); **Guanajuato**, 6k E Dolores Hidalgo (3 ♀ CWEM); San Miguel (3 ♀, 1 ♂ MCZC); **Guerrero**, 29k NE Filo de Caballos (2 ♀ CWEM); **Hidalgo** (Varela-Hernández, 2013); **Jalisco**, 10mi W Jiquilpán (7 ♀ CWEM); D.F., Ciudad de México (1 ♀ CWEM); **Michoacán**, Parque Nacional Cerro Garnica, 2330m (44 ♀, 1 ♀, 1 ♂ CWEM), 10k N Parque Nacional Garnica (4 ♀, 1 ♀ CWEM); **Nayarit**, San Blas, Tres Marías Island, María Madre (1 ♀ MCZC), 60k SW

opaca - USA (southern Arizona), México

Ground dwelling species with mound or under stones, logs and stumps

Dry deserts, grasslands, arid shrublands, pine/oak forests

Compare with *ashmeadi*, *depilis*

Tepic, 1159m (2 ♀ CWEM), Tepic, 788m (4 ♀ CWEM); **Nuevo León**, Doctor Arroyo (6 ♀ CWEM), El Salto (Zaragoza), 2540m (3 ♀ CWEM); **Oaxaca**, 116k NE Oaxaca Rt. 175, 2620m (6 ♀ CWEM), 18k NE Oaxaca, Highway 175, 2000m (2w ♀ CWEM), Ocotlán (10 ♀ CWEM), 14.5K S Ocotlán, 1500m (5 ♀ CWEM), 13k S San José del Pacífico, 2360m (6 ♀ CWEM); **Puebla**, Teziutlán (8 ♀ CWEM), see also Ríos-Casanova et al., 2004; **Quintana Roo**, Leona Vicario Ecological Reserve “El Edén” (2 ♀ CWEM), 21°13’N, 87°11’ W (1 ♀ CWEM); **San Luis Potosí**, Ruta 57 (3 ♀ CWEM), 11k N Cardas, 1220m (CWEM), 30.5k E Doctor Arroyo (3 ♀ CWEM), Matehuala (2 ♀ CWEM), 60k SW Santo Domingo, 1310m (30 ♀, 3 ♀, 2 ♂ CWEM), 60k NW Santo Domingo (8 ♀, 1 ♀, 3 ♂ CWEM); **Sinaloa**, Palmito (1 ♀ CWEM); **Sonora**, Plains of Sonora, Centro Ecológico de Sonora (86 ♀ CWEM); **Tamaulipas**, Municipio Tula, 1k W de San Pablo (3 ♀ CWEM); **Veracruz**, Jalapa (13 ♀, 6 ♀, 10 ♂ CWEM), 22.5k W Jalapa (8 ♀, 2 ♀, 2 ♂ CWEM). **UNITED STATES: Arizona, Santa Cruz Co.**, Nogales (1 ♀ MCZC).

Etymology: *Opaca* from Latin *opācō* meaning to shade or *opācus* shady or dark referring to the color of this species.

Discussion: Key characteristics of the *Crematogaster opaca* worker are the punctures between the rugae, giving nearly all surfaces a grainy appearance, and the reduced propodeal spines. This species closely resembles *Crematogaster ashmeadi* in size and shape;

opaca - USA (southern Arizona), México

Ground dwelling species with mound or under stones, logs and stumps

Dry deserts, grasslands, arid shrublands, pine/oak forests

Compare with *ashmeadi*, *depilis*

however, *C. ashmeadi* is shallowly sculptured and shiny, and *C. opaca* is very sculptured and dull. *Crematogaster opaca* is variable in color, size and pilosity. There is extreme variability in the shininess or dullness of this species, as well as the amount of development of the sternopetiolar process in the worker.

Crematogaster opaca could be easily confused with *C. depilis*, as both have punctated mesosomata that lacks erect hairs. They can be easily separated as *C. opaca* has the head mostly or entirely opaque and punctated, whereas the head of *C. depilis* is partially or mostly shiny.

The queen looks very much like the worker; the noticeable difference is the shininess of the queen and the dullness of the worker. The male has the same sculpturing as the worker and is larger than most other males of this genus. A very noticeable difference between the male and the worker is the pilosity. The male has many long flexuous hairs over his entire body; however, the worker has few erect hairs.

Biology: Mackay and Mackay (unpublished) found that *Crematogaster opaca* nests in the soil occasionally with a mound, often under stones, occasionally in/under logs or in stumps. One nest was intermixed with *Formica* sp.

Brood and sexuals were found in nests in May and June.

Workers are most active during or after rain showers, where they can be seen foraging on the soil surface and up into the vegetation. They are attracted to baits, including Vienna sausage baits in

opaca - USA (southern Arizona), México

Ground dwelling species with mound or under stones, logs and
stumps

Dry deserts, grasslands, arid shrublands, pine/oak forests

Compare with *ashmeadi*, *depilis*

vegetation and can be collected in pitfall traps (Mackay and Mackay, unpublished). It uses nectar from flowers, extrafloral nectaries and from other plant sources in semiarid sites of México (Rico-Gray, et al., 1998a, 1998b). *Crematogaster opaca* collects seeds of the columnar cactus *Neobuxbaumia macrocephala* in open areas in south central México and thus germination does not occur in these areas (Godínez-Alvarez and Valiente-Banuet, 2004).

It has been collected on sandy beaches and in dry deserts, grasslands, mesquite shrubland, desert shrubland (creosotebush, *Yucca*, *Prosopis*), temperate forest, pine/oak forests and pine forest (Mackay and Mackay, unpublished).

Crematogaster opaca is eaten by the lizards *Sceloporus gadoviae* and *S. jalapae* in México (Serrano-Cardozo et al., 2008).

It is found in red clay, dark brown clay/loam, light brown sandy-loam, dark brown rocky-loam, and gravel soils (Mackay and Mackay, unpublished).

opaca - USA (southern Arizona), México

Ground dwelling species with mound or under stones, logs and stumps

Dry deserts, grasslands, arid shrublands, pine/oak forests

***Crematogaster patei* Buren**

Plate 2 D, and 68; Map 27.

Crematogaster patei Buren, 1968: 108, worker, Tampico, Tamaulipas, México.

Description:

Worker: Mandibles longitudinally striate; clypeus punctate with few thin, flexuous hairs pointed medially, anterior margin slightly concave with many long, thin flexuous hairs; head deeply punctate in lines following curvature of face and with many short fine erect hairs evenly distributed and pointed medially on face; eyes not completely on sides of face in full face view; scapes not reaching posterior border of head, with semierect hairs.

Mesosoma deeply punctate with some longitudinal costae on pronotal shoulder and side of mesonotum; many long and short, fine flexuous erect hairs pointed toward medial carina on mesonotum and pointed posteriorly on propodeum and spines; humeri dropping sharply on sides; medial mesonotal carina short and sharp, notopropodeal groove dropping sharply, wide and leveling off on dorsum of propodeum; dorsopropodeum gently sloping between spines; propodeal spines long, diverging widely posteriorly.

patei - México

Desert scrub

Compare with *pilosa*, *punctulata*

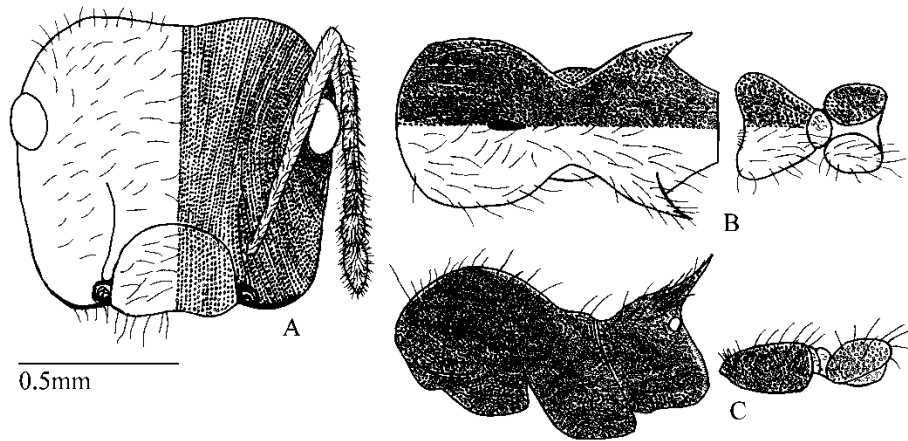


Plate 68. *Crematogaster patei* worker: (paratype, Tampico, Tamaulipas, México LACM): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Petiole and postpetiole punctate with many long and short, fine flexuous erect hairs pointed posteriorly; petiole triangular with anterior corners slightly flaring upward; postpetiole with wide median sulcus and hemilobes spreading posteriorly; gaster areolate, with many short stiff erect hairs evenly distributed.

Concolorous brown.

patei - México

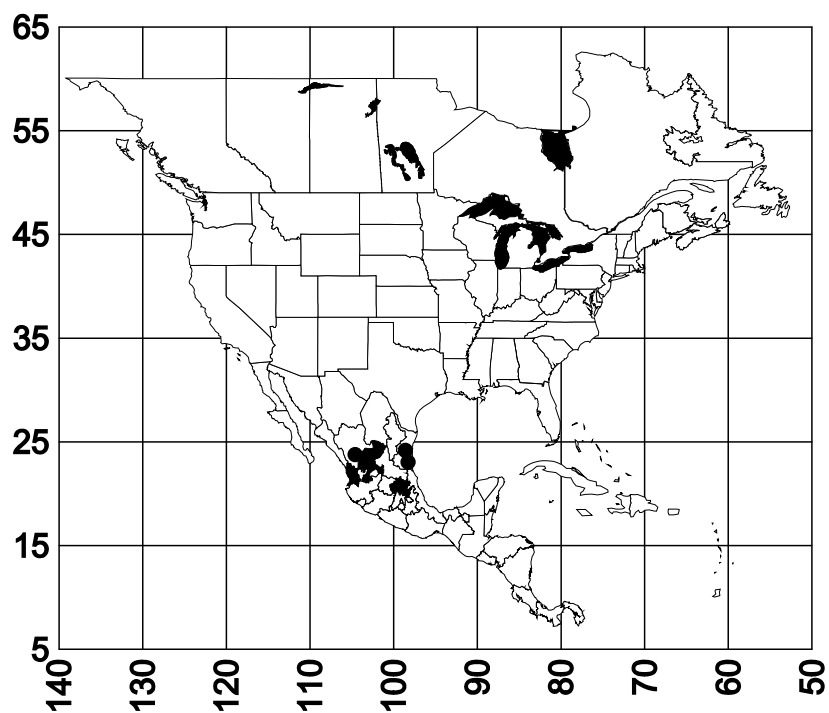
Desert scrub

patei

314

Compare with *pilosa*, *punctulata*

Worker measurements (mm): HL 0.91-0.94, HW 1.01-1.07, SL 0.78-0.88, EL 0.22-0.23, ED 0.18-0.19, CL 0.26-0.29, CW 0.34-0.36, WL 1.07-1.10, PSL 0.18-0.23, PL 0.29-0.34, PW 0.34-0.38, PPL 0.19-0.29, PPW 0.29-0.31; **Indices:** CI 88-90, SI 86-94, CLI 76-81, PI 85-89, PPI 66-94.



Map 27. *Crematogaster patei*.

Distribution: Central México

Type series: 1 paratype worker from Tampico, Tamaulipas,

patei - México

Desert scrub

Compare with *pilosa*, *punctulata*

México [LACM].

Material examined and literature cited: MÉXICO: **Tamaulipas**, 32.2k SE Ciudad Victoria (289m, 23°29'29.8"N, 98°58'39.9"W) (4 ♀, CWEM) see also Coronado-Blanco et al. (2013); **Zacatecas**, Calabazal, 7500m (6 ♀ LACM, 3 ♀ MCZC); **Hidalgo**, **Nayarit**; **Querétaro** (Vázquez-Bolaños, 2011).

Etymology: Buren named *patei* to honor Dr. V. S. L. Pate whom he greatly admired.

Discussion: The key characteristics of the *Crematogaster patei* worker are the head and body are almost entirely covered with punctures and the fine long flexuous hair distributed over most of the head and body.

Crematogaster patei can be confused with *C. pilosa* because both species have short erect hair evenly distributed over the head, several (8-10) long flexuous hairs on each pronotal shoulder and short erect hairs evenly distributed over the rest of mesosoma; *C. patei* has finer hairs, and on the gaster the hairs are completely erect, *C. pilosa* has coarser hairs, and gaster has a combination of erect and decumbent hairs pointed toward the sting. Their sculpturing is also different. *Crematogaster patei* is deeply punctate from the head to the postpetiole, *C. pilosa* is rugose on the mesosoma and shiny, shallowly areolate on head and gaster.

The worker of *C. patei* is similar to that of *C. punctulata* and it is probably a synonym. We will not propose synonymy at this time as

patei - México

Desert scrub

Compare with *pilosa*, *punctulata*

few worker specimens of *C. patei* are available and the males and females of *C. patei* are unknown. The workers of *C. patei* seem to differ in being slightly hairier (more than 50 suberect hairs on the first gastral tergum) and the mid mesonotal carina is poorly developed. Workers of *C. punctulata* usually have fewer than 40 suberect hairs on the first tergum and the mid mesonotal carina is well developed. Unfortunately, Buren (1968) did not compare the two species.

Biology: In his original description, Buren (1968) states the type series of *C. patei* was collected in Tampico, México and was on loan from the collection of Dr. W. M. Mann in the National Museum. He gives no other details on habitat or nesting habits. This species is rarely collected, but Mackay and Mackay found workers foraging in a desert scrub with stony clay soil in Tamaulipas.

patei - México

Desert scrub

Compare with *navajoa*, *patei*

***Crematogaster pilosa* Emery**

Plates 69, 70, 71 and 121; Figs. 16 and 17; Map 28.

Crematogaster lineolata subsp. *pilosa* Emery, 1895: 285, worker (attributed to Pergande), New Jersey, United States. Emery, 1922: 141, in combination *C. (Acrocoelia)*. *Crematogaster pilosa* Emery in Wheeler, 1919: 111, New Jersey, United States. Creighton, 1950: 216; Johnson, 1988: 321, Buren, 1968: 92, combination in *C. (Crematogaster)* (in key). Deyrup, 2017: 65-66, Plate 26, worker.

Crematogaster (Acrocoelia) creightoni Wheeler, 1933b:86, female. Buren, in Smith 1958: 127, junior synonym of *C. pilosa*.

Crematogaster lineolata subpilosa Wheeler 1913:115 *nomen nudum*. Buren, in Smith, M. 1958: 127. Referred here.

Descriptions:

Worker: Clypeus wider than long (seen directly from above), areolate with few erect hairs, anterior margin slightly convex with many long hairs; scape passing posterior border of head, with many erect hairs; head areolate, evenly covered with erect hairs.

Mesosoma rugose, evenly and completely covered with short erect hairs; pronotum with medial carina, humeri developed, rounded (viewed from above); side of mesosoma areolate-rugose, promesonotal suture apparent by breaks in sculpturing; notopropodeal

pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems
Marshes, coastal dunes, forests

groove steep and narrow; propodeal spines long, slender, thickening at the base, divergent (seen from above).

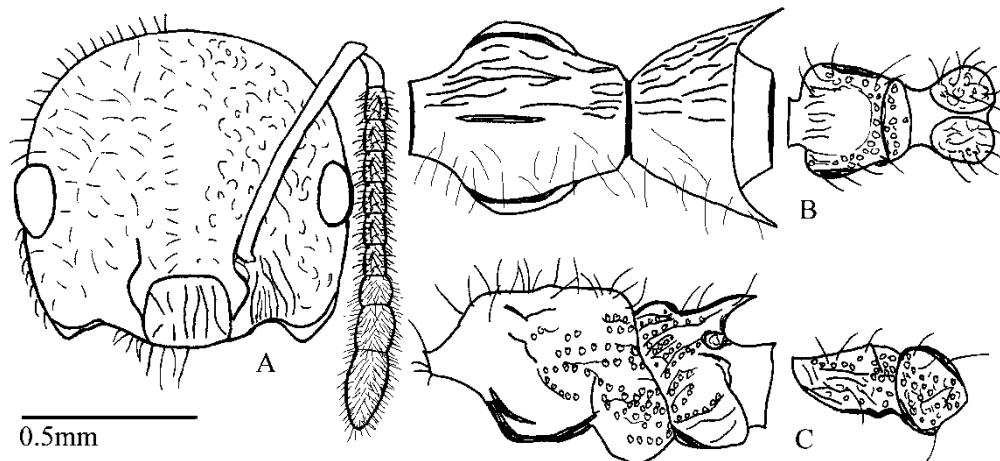


Plate 69. *Crematogaster pilosa* worker: (syntype, New Jersey, United States NHMG). A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Petiole angularly trapezoidal, with anterior lateral corners upraised when viewed from behind, shallowly rugose with several erect hairs on margin of petiole, anterior sternopetiolar process usually well developed; petiole wider and longer than postpetiole; postpetiole rugose with erect hairs on posterior margin, hemilobes longitudinally elongate, spreading slightly posteriorly (top view); gaster areolate with many erect and decumbent hairs.

pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems

Marshes, coastal dunes, forests

Compare with *navajoa*, *patei*

Concolorous medium to dark brown. They can be bicolored red and black (MacGown, pers. comm.).

Worker measurements (mm): HL 0.74-0.95, HW 0.82-1.14, SL 0.68-0.94, EL 0.19-0.24, ED 0.16-0.23, CL 0.25-0.30, CW 0.30-0.40, WL 0.85-1.18, PSL 0.22-0.31, PL 0.20-0.30, PW 0.29-0.42, PPL 0.14-0.23, PPW 0.16-0.38; Indices: CI 83-90, SI 92-99, CLI 75-83, PI 69-71, PPI 61-88.

Queen: This species has alpha and beta queen forms that are dimorphic in size. The α queen is distinctly larger than the β queen. These two forms are identical except where mentioned, the description is based primarily on the α queen.

Mandibles shiny, longitudinal striate, with erect hairs; clypeus wider than long (seen directly from above), longitudinally striate with short erect hairs pointed medially, anterior margin slightly concave with approximately 10 long flexuous hairs (α queen: anterior clypeal margin very concave); scape just reaches posterior border of head (β queen: scape slightly passes posterior border of head), with erect hairs, funiculus with semierect hairs; ocelli typically small; head wider than long, shiny striae below insertions of antennae and eye, with many erect and semierect hairs.

Dorsum of mesosoma shiny with many fine, long erect hairs; side of mesosoma with fine erect hairs; dorsellum barely visible from above.

pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems

Marshes, coastal dunes, forests

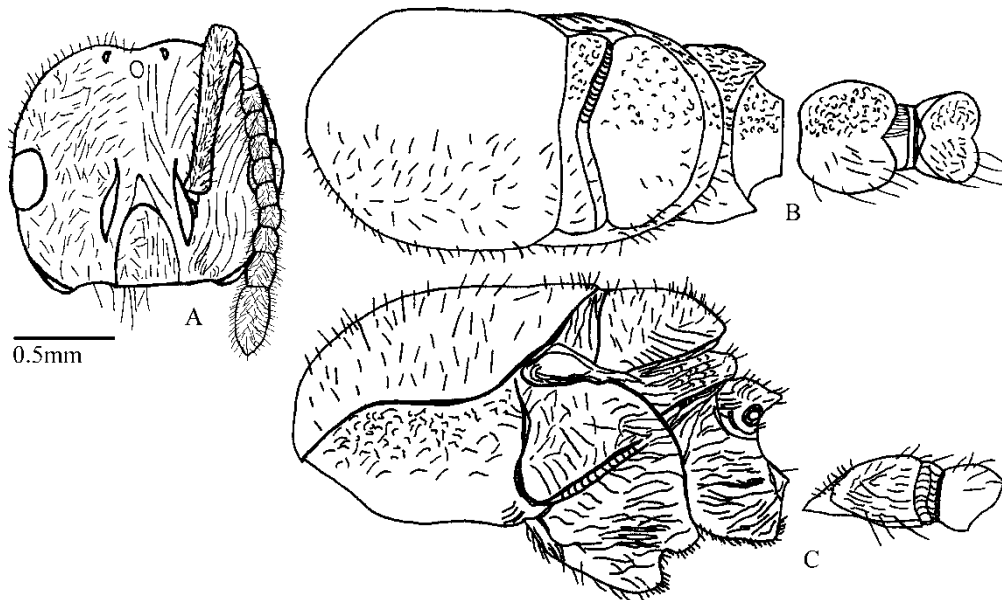


Plate 70. *Crematogaster pilosa* α queen: (Waynesboro, Tennessee, United States, CWEM #18361) A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Petiole, postpetiole and gaster shiny shallowly areolate, with few erect and semierect hairs (fewer than worker); petiole wider than long, small anterior sternopetiolar process.

Concolorous brown to dark brown.

pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems

Marshes, coastal dunes, forests

Compare with *navajoa*, *patei*

α Queen measurements (mm): HL 1.24-1.30, HW 1.56-1.80, SL 1.01-1.05, EL 0.36-0.39, ED 0.29-0.32, CL 0.36-0.43, CW 0.48-0.52, WL 2.42-2.59, PSL 0.07-0.17, PL 0.36-0.41, PW 0.54-0.84, PPL 0.34-0.43, PPW 0.62-0.82; Indices: CI 72-79, SI 81-81, CLI 75-83, PI 49-67, PPI 52-55.

β Queen measurements (mm): HL 0.96-1.13, HW 1.23-1.42, SL 0.84-0.96, EL 0.28-0.36, ED 0.24-0.29, CL 0.29-0.38, CW 0.36-0.41, WL 1.75-2.45, PSL 0.22-0.24, PL 0.29-0.46, PW 0.44-0.67, PPL 0.28-0.34, PPW 0.47-0.67; Indices: CI 78-80, SI 85-86, CLI 81-93, PI 66-69, PPI 51-59.

Male: Mandibles with many long erect hairs; clypeus shiny shallowly areolate, wider than long, with 4-6 long erect hairs, anterior margin straight with long and short erect hairs; ocelli almost flush with surface of head; scape typically short, with erect hairs, funiculus covered with semierect hairs (looks like fur); head wider than long, shiny shallowly areolate with erect hair around ocelli.

Mesosoma longitudinally striate with shallow areolae between striae, many short erect hairs on dorsum and fine erect hairs on side; scutellum shiny, knob-like, with few fine erect hairs; dorsellum visible from above; propodeal spines present as nubs.

Petiole, postpetiole and gaster areolate; petiole and postpetiole with long flexuous erect and appressed hairs; gaster with many erect hairs on dorsal and ventral surfaces; petiole and postpetiole wider than long.

pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems

Marshes, coastal dunes, forests

Compare with *navajoa*, *patei*

Concolorous dark brown.

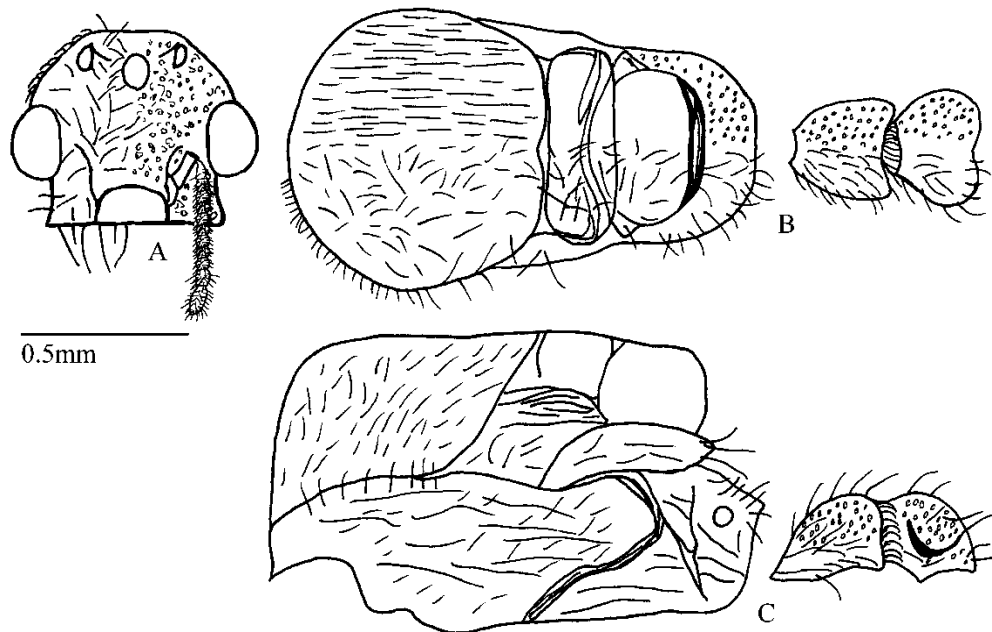


Plate 71. *Crematogaster pilosa* male: (Waynesboro, Tennessee, United States CWEM #18361): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Male measurements (mm): HL 0.52-0.58, HW 0.66-0.71, SL 0.16-0.18, EL 0.22-0.26, ED 0.22-0.24, CL 0.11-0.14, CW 0.22-0.23, WL 1.48-1.62, PSL 0.01-0.04, PL 0.13-0.14, PW 0.18-0.26, PPL 0.15-0.18, PPW 0.14-0.26; Indices: CI 79-82, SI 31-31, CLI 50-60, PI 53-

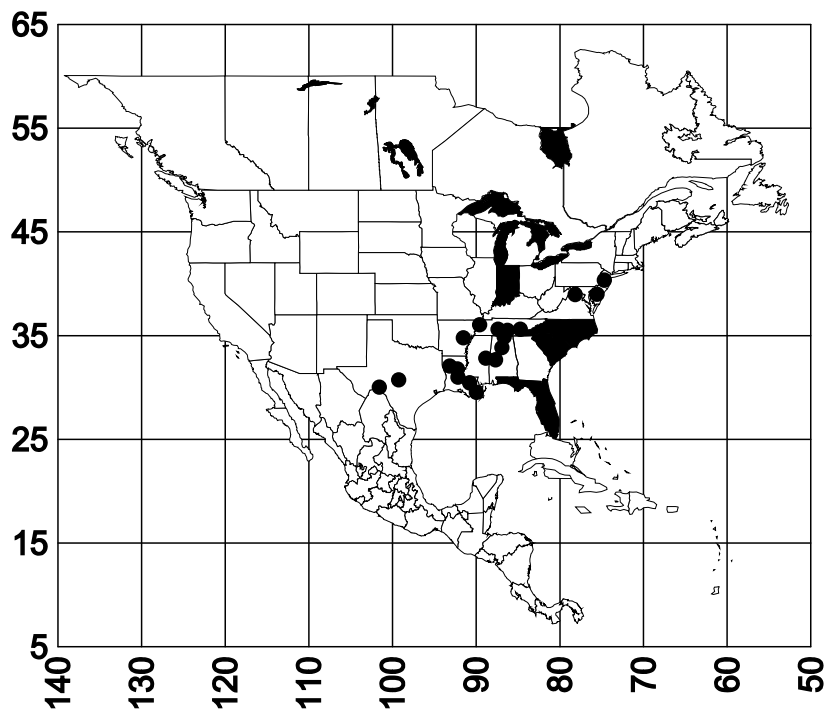
pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems

Marshes, coastal dunes, forests

Compare with *navajoa*, *patei*

72, PPI 69-107.



Map 28. *Crematogaster pilosa*.

Distribution: Eastern United States, Fairfax Co., Indiana Carroll, 2011), (Virginia (Kjar, 2009), North Carolina (Guénard et al., 2012, Guénard et al., 2014), South Carolina (Davies 2009), Florida (Deyrup, 2017), Louisiana, including Arkansas Co., see General and Thompson (2007) west to Texas.

Type series: New Jersey, United States. 20 syntype workers

pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems

Marshes, coastal dunes, forests

pilosa

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Compare with *navajoa*, *patei*

[MNHG], 3 syntype workers [MCZC].

Material examined:

UNITED STATES: Alabama, Jefferson Co., Warrior (33°48'28.8N, 86°48'35.8W) (1 ♀ CWEM), **Madison Co.**, Monte Sano Park (2 ♀ CWEM), also see Forster, 2003; MacGown and Foster, 2005; Delaware, **Kent Co.**, Woodland Beach (4 ♀ STDC), **New Castle Co.**, Kirkwood (1 ♀ STDC), **Sussex Co.**, Bryans Store Rd. 435 (5 ♀ STDC); Georgia, **Muscogee Co.**, Columbus area (1 ♀ COOK); Louisiana, **Natchitoches Parish**, Kisatchie National Forest, Red Dirt Area, Kisatchie Bayou Camp (1 ♀ STDC), **Plaquemines Parish**, St. Bernard State Park (3 ♀ CWEM), **Pointe Coupee Parish**, Sherburne Wildlife Management Area (N 30°32' W 110°42') (6 ♀ STDC), **Rapides Parish**, Woodworth, Alexander State Forest (1 ♀ STDC), see Dash and Hooper-Bùi, 2008, **St. Tammany Parish**, see Colby and Powell, 2006; Mississippi, **Kemper Co.**, 3.9mi E Preston (9 ♀ STDC); New Jersey (1 ♀ MCZC); Tennessee, **McMinn Co.**, Athens (5 ♀, 3 ♀, 3 ♂ CWEM), **Obion Co.**, Clayton (11 ♀, 6 ♀, 6 ♂ CWEM), **Lawrence Co.**, David Crockett State Park (1 ♀ CWEM), **Franklin Co.**, Huntland, (2 ♀ CWEM), **Giles Co.**, Pulaski (8 ♀, 1 ♀, 1 ♂ CWEM), **Wayne Co.**, 10mi N of Waynesboro (35°24'45"N 87°48'32.7"W) (1 ♀, 2 ♀, 2 ♂ CWEM); Texas, **Terrell Co.**, FM 2400 (1 ♀ COOK), **Travis Co.**, Austin (1 ♀ COOK).

Etymology: *Pilosa* is Latin *pilis* meaning hair, referring to the abundant pilosity.

pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems

Marshes, coastal dunes, forests

Compare with *navajoa*, *patei*

Discussion: Key characteristic of *C. pilosa* is its abundant pilosity. The head is evenly covered with short bristle-like erect hairs and long and short bristle-like hairs which are also evenly distributed over the mesosoma.

This species can easily be confused with *C. patei* because both species have short erect hair evenly distributed over the head, several 8-10 long flexuous hairs on each pronotal shoulder and short erect hair evenly distributed over the rest of the mesosoma; *C. patei* has finer hair, and on the gaster the hairs are completely erect, *C. pilosa* has coarser hair, and the gaster has a combination of erect and decumbent hair pointed toward the sting. Their sculpturing is also different. *Crematogaster patei* is deeply punctate from the head to the postpetiole, *C. pilosa* is rugose on the mesosoma and shiny, shallowly areolate on head and gaster.

Both *C. pilosa* and *C. navajoa* are relatively hairy ants, but *C. pilosa* is found in eastern USA and *C. navajoa* occurs in western USA.

Biology: *Crematogaster pilosa* is a ground dwelling species, usually found under stones or in grass litter. It has been found inhabiting dead stems of grass, which may be a day chamber for incubation of brood. It also nests in logs and stumps (Forster, 2003), is polydomous (each colony has multiple nests) and nests in dead *Spartina alterniflora* stems (Childress and Koning, 2013). Several colonies of this species were found nesting inside hollowed stems of *Silphium laciniatum* and *Silphium terebinthinaceum* (Asteraceae) and were also found nesting under *Juniperus virginiana* trees (Hill, 2006).

pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems
Marshes, coastal dunes, forests

It is a generalist forest species (Kjar, 2009). Workers were found foraging on the ground throughout leaf litter, on logs, tree trunks, and foliage (Carroll, 2011). Use of pitfall traps, baits, flight intercept traps, sweeping and sifting have produced specimens (Dash, 2004). They get most of the food from honeydew (Forster, 2003) and protect coccids with carton structures on pine shoots (Anderson and McShea, 2001). Workers were observed carrying fly eggs away from a snapping turtle, *Chelydra serpentina* carcass (Hill, 2006). *Crematogaster pilosa* avoided eggs of the chrysomelid beetle *Gastrophysa cyanea* (Howard et al., 1982).

Nests are found in semi-open and open areas, as well as wooded areas. They are common in pine forests (Martelli et al., 2004; Colby and Powell, 2006), as well as hardwood forests (Martelli et al., 2004). Their flexible habitat requirements include salt marshes (Childress and Koning, 2013), marsh lands or mesic habitats (Forster, 2003) and in prairies (Hill, 2006). Nests can be found in backdune areas of coastal dunes of the Gulf of México (Chen et al., 2015). They adapt to urban ecosystems (Guénard et al., 2014), but in general do not do well in disturbed areas (Menke et al., 2011), although they became more abundant following fires in Louisiana (Colby, 2002). They are found in areas with introduced plants (Kjar and Barrows, 2004).

In Louisiana *C. pilosa* has been collected in mixed flatwood, longleaf pine savannas, and mixed-hardwood longleaf-pine forest habitats. It can be found in the following ecoregions: tunica loess hills and east Gulf Coastal Plain longleaf-pine forest (Dash, 2004).

Crematogaster pilosa is possibly parasitized by the parasitic fly *Pseudacteon onyx* (Porter, 2000). They can be infected with a virus

pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems

Marshes, coastal dunes, forests

Compare with *navajoa*, *patei*

fire ant pathogen (Porter et al., 2013) and carry phoretic mites (Campbell et al., 2013).

Deyrup (2017) includes details on the biology and distribution of this species as well as comparisons with other species occurring in Florida.

This common species should not be collected as it has an IUCN Red List status of VU D2 (Carroll, 2011). It is difficult to know if it has been collected until one has access to a microscope or has the extensive field experience necessary to recognize it with a hand lens. The record of the IUCN Red listing of 1996 is e.T41983A10592704, see <http://dx.doi.org/10.2305/IUCN.UK.1996.RLTS.T41983A10592704.en>.

pilosa - eastern USA, west to Texas

Ground dwelling species, under stones also in logs, stumps and stems

Marshes, coastal dunes, forests

***Crematogaster pinicola* Deyrup & Cover**

Plate 121; Fig. 7; Map 29.

Crematogaster pinicola Deyrup & Cover 2007: 108-112, worker, queen and male, Highlands Co., Florida. Deyrup, 2017: 66-67, Plate 25, worker, queen and male.

The worker of *C. pinicola* is morphologically identical to those of *C. ashmeadi*, except for color. *Crematogaster pinicola* is always bicolored with a red head and mesosoma, and a dark gaster, whereas *C. ashmeadi* is usually concolorous light brown to black, but can be bicolored.

The nesting habits are different in that *C. pinicola* has only been found nesting in pine trees, preferring *Pinus elliotii* and *P. palustris* (Deyrup & Cover, 2007; Deyrup, 2017). *Crematogaster ashmeadi* has a much wider range of nesting habits, usually arboreal in moist habitats, but have been found in more arid areas, nesting in the ground or downed logs. The beetle *Gnostus floridanus* (Coleoptera: Ptinidae) is a guest in the nests of *C. pinicola* (“bicolored form” of *C. ashmeadi*), but not in the nests of *C. ashmeadi* (“black form”) (Thomas et al., 1992).

Crematogaster pinicola is primarily found in Florida (Deyrup, 2017), but is also found in Tennessee (Davis and Zigler, 2012;

pinicola - USA (Tennessee, Florida)

Apparently nests only in pine trees

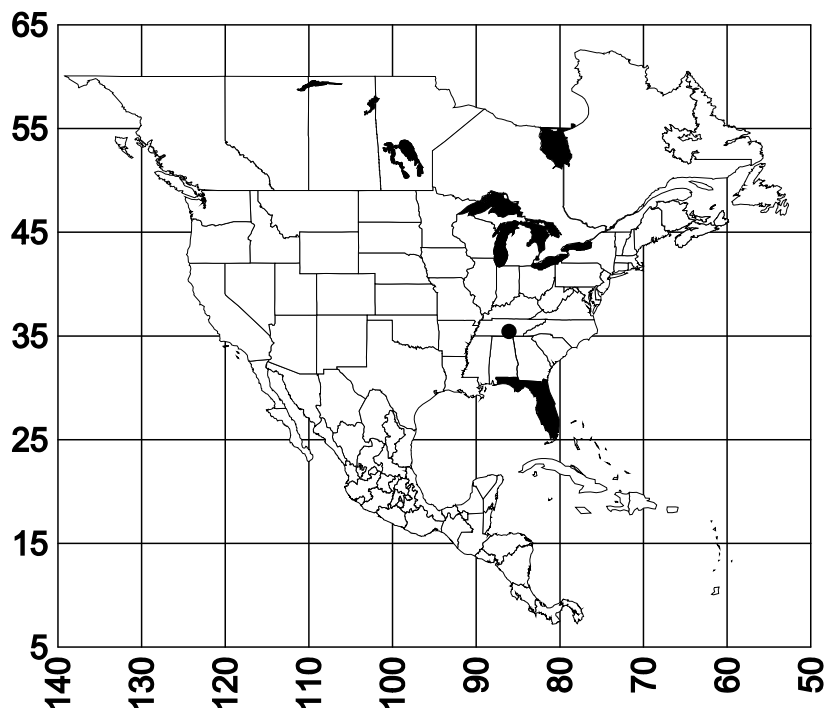
Pine forests

Compare with *ashmeadi*

Guénard et al., 2012) and in backdune areas of the coastal dunes of the Gulf of México (Chen et al., 2015).

These ants forage at extrafloral nectaries of *Opuntia* spp. in Florida, which are endangered by the South American cactus feeding moth *Cactoblastis cactorum* (Miller et al., 2010).

Deyrup (2017) includes details on the biology and distribution of this species as well as comparisons with other species occurring in Florida.



Map 29. *Crematogaster pinicola*. It is also found along the coastal dunes of the Gulf of Mexico (Chen et al., 2015).

pinicola - USA (Tennessee, Florida)

Apparently nests only in pine trees

Pine forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

***Crematogaster punctulata* Emery**

Plates 72, 73 and 74; Map 30.

Crematogaster punctulata Emery 1895: 287, worker, Colorado, United States. Wheeler, 1919: 111, *C. opaca* subsp. *punctulata*. Emery, 1922: 141, combination in *C. (Orthocrema)*. Enzmann, J., 1946: 93; Smith, D. R. 1979: 1379, raised to species. Creighton, 1950: 213, *C. lineolata* subsp. *punctulata*. Johnson, 1988: 314, junior synonym of *C. lineolata*. Bolton, 1995:160, restored as species.

Descriptions:

Worker: Mandibles longitudinally striate; head and clypeus longitudinally lineolate-punctate (curving around posterior edge of eye) with few erect and many appressed hairs pointed medially; clypeus slightly longer than wide, anterior clypeal margin slightly convex with small medial notch and several long flexuous hairs; scapes with semierect hairs, just reaching posterior border of head; posterior border of head rounded.

Mesosoma lineolate-punctate; pronotal humeri present, not well developed with up to 12 long, stiff hairs; 2-3 stiff hairs along lateral mesonotal margins and top of notopropodeal groove; promesonotal suture apparent from breaks in sculpture, short medial mesonotal

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other
objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

carina; notopropodeal groove steep and narrow; propodeal spines long, curving slightly inward (seen from above) with long stiff erect hairs.

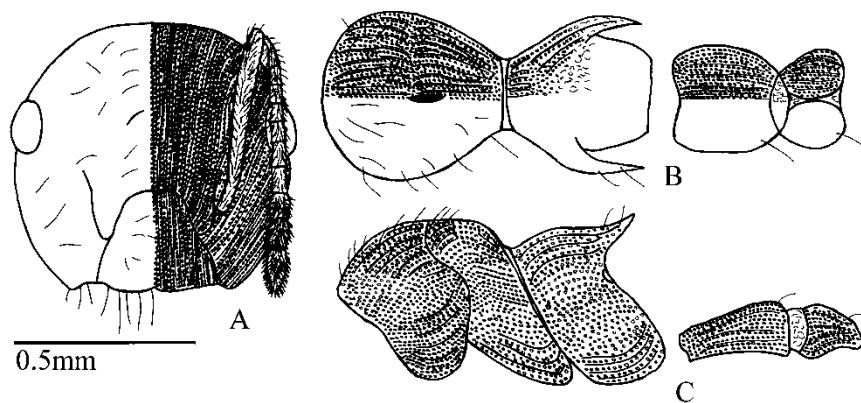


Plate 72. *Crematogaster punctulata* worker: (syntype, Colorado, United States top point with pink dot MNHG): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Petiole, and postpetiole lineolate-punctate, petiole with 1 long hair on each posterior lateral corner directed posteriorly, anterior sternopetiole process small to absent; postpetiole with several short erect hairs and 1 long erect hair on each posterior lateral corner; gaster areolate, evenly covered with short erect and many appressed hairs in

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

rows along each tergum.

Concolorous light to dark brown or bicolored, light brown head and mesosoma and dark brown gaster.

Worker measurements (mm): HL 0.71-0.94, HW 0.74-1.10, SL 0.53-0.74, EL 0.18-0.22, ED 0.13-0.24, CL 0.26-0.30, CW 0.25-0.38, WL 0.96-1.12, PSL 0.13-0.22, PL 0.29-0.30, PW 0.30-0.36, PPL 0.19-0.22, PPW 0.29-0.41; Indices: CI 85-96, SI 75-79, CLI 79-104, PI 83-97, PPI 54-66.

Queen: Clypeus areolate between longitudinal striae with short, fine erect hairs pointed medially, anterior margin convex, with 10-12 long flexuous hairs; head areolate between longitudinal striae; ocelli typical, slightly raised with long flexuous hairs between them; scape failing to reach posterior border of head, with fine appressed hairs.

Promesonotal suture more posterior than on most queens in this genus, (pronotum wider seen from side); dorsellum seen from above; pronotum punctate with several hairs on each shoulder; remainder of mesosoma shiny areolate viewed from above, longitudinally striate-punctate viewed from side, with short erect and appressed hairs pointed medially, propodeum and propodeal spines punctate-striate, with 2 erect hairs.

Petiole punctate, with 2-3 erect hairs on sides and many appressed (fur-like) hairs directed posteriorly; postpetiole punctate, with 2-3 erect hairs on sides and few appressed hairs directed posteriorly, with shallow but obvious medial sulcus, hemilobes

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

diverging posteriorly; gaster shiny shallowly areolate, with many appressed hairs pointed posteriorly.

Concolorous dark brown.

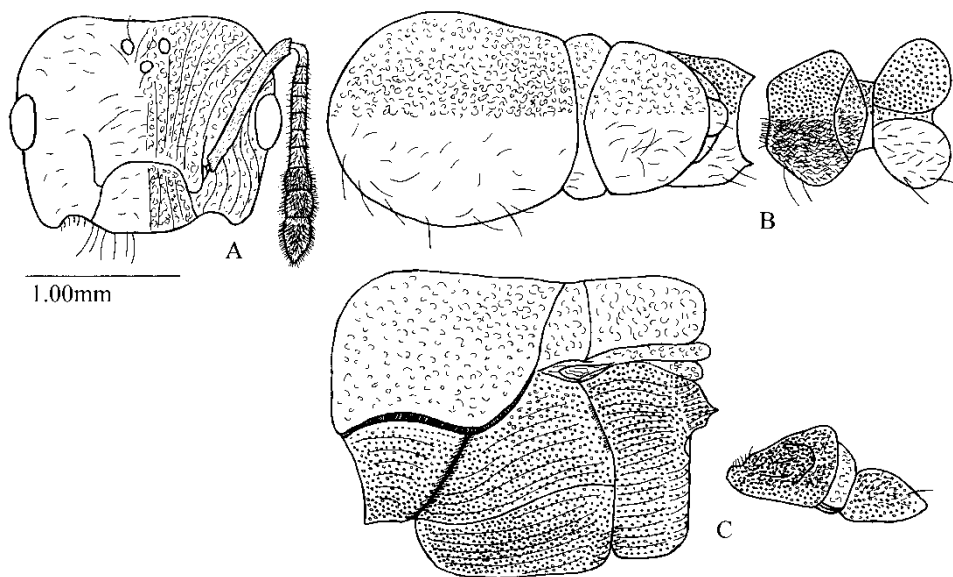


Plate 73. *Crematogaster punctulata* queen: (Torrance Co., New Mexico, United States CWEM #8270): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

Queen measurements (mm): HL 1.32-1.39, HW 1.58-1.92, SL 1.03-1.23, EL 0.31-0.36, ED 0.34-0.36, CL 0.42-0.46, CW 0.48-0.62, WL 2.88-2.90, PSL 0.29-0.36, PL 0.53-0.58, PW 0.82-0.91, PPL 0.41-0.48, PPW 0.84-0.96; Indices: CI 72-84, SI 78-88, CLI 74-88, PI 64-65, PPI 49-50.

Male: Clypeus coarsely punctate, with 6-12 long flexuous hairs along anterior clypeal margin, margin convex, protruding from head, snout-like (best seen in side view), anterior clypeal margin straight with many short hairs; ocelli raised; scapes with erect hairs, relatively elongated compared to other males; head wider than long, punctate, with semierect hairs pointing medially.

Pronotum punctate; scutum, scutellum, dorsellum and propodeum areolate from above with many long flexuous hairs; side of scutellum areolate; side of propodeum punctate.

Petiole, postpetiole and gaster with many long flexuous hairs; petiole and postpetiole punctate from above; petiole subquadrate; postpetiole without medial sulcus; gaster and side of postpetiole areolate.

Concolorous black.

Male measurements (mm): HL 0.52-0.58, HW 0.62-0.66, SL 0.12-0.19, EL 0.14-0.20, ED 0.12-0.18, CL 0.12-0.13, CW 0.22-0.24, WL 1.68-1.76, PL 0.22-0.26, PW 0.22-0.26, PPL 0.20-0.23, PPW 0.30-0.31; Indices: CI 84-88, SI 23-33, CLI 54-55, PI 100, PPI 67-74.

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

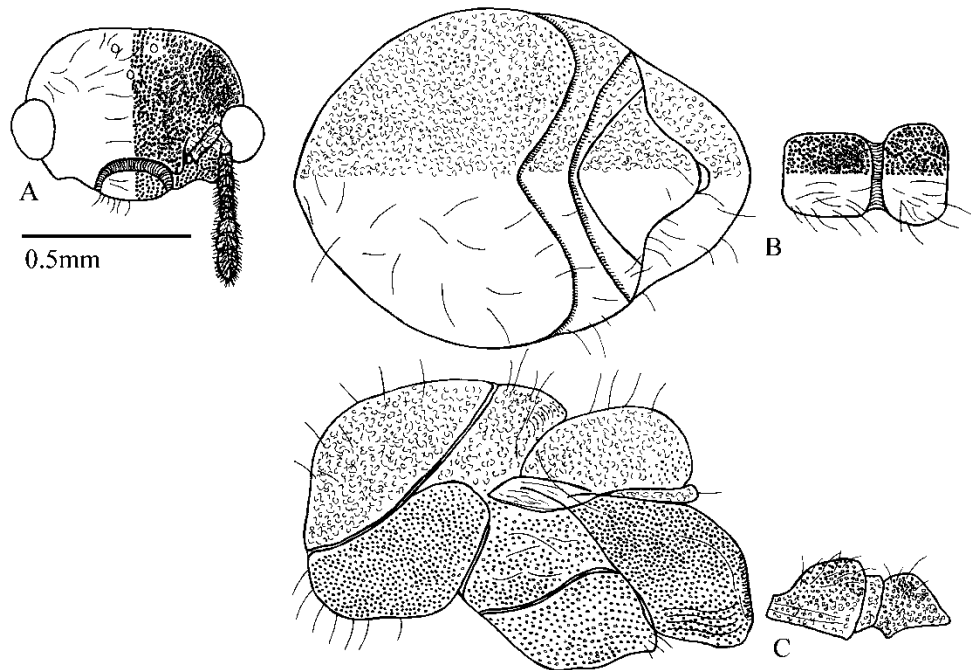


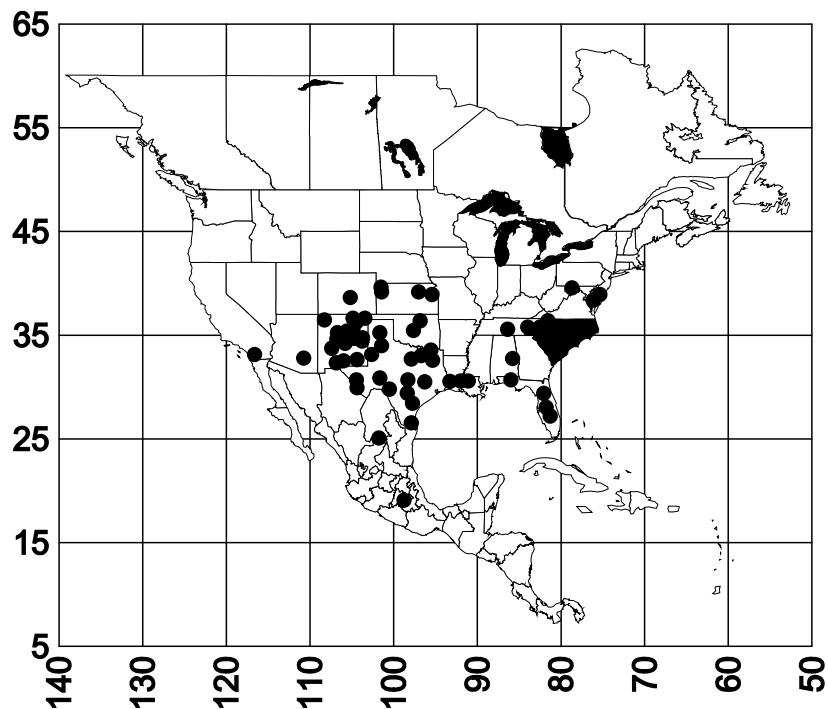
Plate 74. *Crematogaster punctulata* male: (Cimarron Co., New Mexico, United States, CWEM # 6491): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other
objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*



Map 30. *Crematogaster punctulata*.

Distribution: *Crematogaster punctulata* is found primarily in the southern United States, including South Carolina (Davies, 2009) and northern Illinois (Newman and Wolff, 1990) south into central México.

Type series: 30 syntype workers, Colorado, United States [MNHG].

punctulata - southern and eastern USA, México
Ground dwelling species, with mound or under stones and other
objects
Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

Other Material examined: **MÉXICO:** **Coahuila**, Arteaga, Cañón San Lorenzo (6 ♀ CWEM), 8k S Saltillo (39 ♀ CWEM); **México**, HWY 57, 127k (2 ♀, 1 ♀, LACM). **UNITED STATES:** **Alabama**, **Tallapoosa Co.**, Alexander City (1 ♀ MCZC); **California**, **San Diego Co.**, near Jamul, Junction 94 & Vista Sage Lane (3 ♀ STDC), Point Loma (32°44'9"N 117°13'5"W) (9 ♀ CWEM); **Colorado**, **El Paso Co.**, (2 ♀ MCZC); **Delaware**, **Sussex Co.**, Woodenha Marshy Hope WA (N38 46.12'; W75 42.69') (5 ♀ STDC); **Florida**, **Highlands Co.**, near Lake Placid, Archbold Research Station (1 ♀ STDC), **Okaloosa Co.**, Eglin AFB, 2.2mi W Jct. Rt. 85 on Rd 211 at Gopher Creek elevation <200' (14 ♀ MCZC), **Polk Co.**, Lakeland (25° 57.2'N 81°; 59'9'W) (1 ♀ STDC); **Kansas**, **Cheyenne Co.**, Arikaree River Bluffs (9 ♀ CWEM), **Douglas Co.** (4 ♀ MCZC), **Riley Co.**, Manhattan (4 ♀ MCZC), **Sherman Co.**, 9mi S Goodland (17 ♀ CWEM), Whitfield (3 ♀ MCZC), **Wallace Co.**, Sharon Springs (2 ♀ CWEM); **Louisiana**, **Calcasieu Parish**, Moss Bluff, Sam Houston, Jones State Park (3 ♀ STDC), **East Baton Rouge Parish**, Baton Rouge, Spanish Town (6 ♀ STDC), **La Salle Parish**, Tullos (3 ♀ MCZC), **Pointe Coupee Parish** Sherburne Wildlife Management Area (N 30°32'W 110°42') (1 worker STDC); **Maryland**, **Allegany Co.**, Little Orleans, Lot 4 (4 ♀ STDC), **Baltimore Co.**, Baltimore SW park (3 ♀ STDC); **New Mexico**, **Bernalillo Co.**, Albuquerque (1 ♀ MCZC), **Cimarron Co.**, (65 ♀, 6 ♂ CWEM), 8mi NE Felt (54 ♀, 3 ♂ CWEM), **Colfax Co.**, Jeffers Ranch (3 ♀ CWEM), **Curry Co.**, Clovis (1 ♀ CWEM), **De**

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

Baca Co., 4 mi N Taiban (9 ♀ CWEM), **Doña Ana Co.**, 45k E Las Cruces (19 ♀ CWEM), Mesilla Park (3 ♀ MCZC), **Eddy Co.**, Los Medanos (6 ♀ CWEM), **Lincoln Co.**, Road Runner Ranch (6 ♀ CWEM), 5 mi E Red Cloud Campground, 2080m (32 ♀ CWEM), 25mi SE Vaughn (12 ♀, 4 ♀, 1 ♂ CWEM), **Mora Co.**, 2k E Wagon Mound (CWEM), 12k Wagon Mound (30 ♀, 10 ♂ CWEM), **Quay Co.**, Logan, Ute Lake (CWEM), 6mi SW Nara Visa (CWEM), 7mi S Quay #6504 (83 ♀, 3 ♀, 16 ♂ & 3 homopteran larvae CWEM), **San Juan Co.**, 4k E Aztec, (3 ♀ CWEM), **San Miguel Co.**, Las Vegas (6 ♀ MCZC), **Santa Fe Co.**, Galisteo (9 ♀ CWEM) 34mi S Santa Fe (1 ♀ CWEM), **Socorro Co.**, Los Alamos State Park (1 ♀ CWEM), **Torrance Co.**, 5mi NE Corona (3 ♀ CWEM), 13k NW Mountain Air (CWEM), 24k S Mountain Air (15 ♀, 4 ♀ CWEM), **Union Co.**, 15mi SW Clayton (11 ♀ CWEM), Sharon Springs (2 ♀ CWEM); **North Carolina**, **Ashe Co.**, 1mi west Clifton (4 ♀ STDC), **Buncombe Co.**, Black Mountains (3 ♀ MCZC), **Polk Co.**, Tryon (3 ♀ MCZC); **Oklahoma**, Oklahoma, Bliss (6 ♀ MCZC), **Choctaw Co.** (4 ♀ MCZC), **Cimarron Co.**, 5mi E Boise City (CWEM), 8mi NE Felt (CWEM); **Tennessee**, **Lincoln Co.**, at Alabama border (8 ♀ CWEM), **McMinn Co.** Athens rest area (12 ♀ CWEM); **Texas**, **Bexar Co.**, San Antonio, Greenway neighborhood (12 ♀ COOK), **Cameron Co.**, 6.5mi N Jct. FM 2925 & 106 (11 ♀ COOK), **Collin Co.**, Plano Lone Star Park, (33°03' 40N 96° 45 40"W) (10 ♀ STDC), **Crockett Co.**, 2mi E Iraan (30° 55.972' N; 101° 52.602W) (23 workers COOK) Ranch Rd. (5 workers COOK), **Floyd Co.**, Floydada (3 ♀ CWEM),

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other
objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

Foard Co. (4 ♂ CWEM), **Gaines Co.**, Seminole (3 ♂ CWEM), **Jeff Davis Co.**, Davis Mountains, 23mi S Kent (11 ♂ CWEM), **Jim Wells Co.**, Alice (18 ♂, 1 ♀ MCZC), **Lamar Co.**, Camp Maxey site 1 (N33° 48.683'; W95° 34.234') (1 ♂ COOK), site 2 (N33° 48.201'; W95° 34.844') (1 ♂ COOK), site 3 (N33° 48.708'; W95° 32.580') (4 ♂ COOK), Paris (3 ♂ MCZC), **Presidio Co.**, Marfa (6 ♂ CWEM), **Randall Co.** picnic area along old US Hwy 87, 3.3mi N Junction with FM Rd 1714 (34°27.557'N, 101°55.211, elevation 3491ft) (9 ♂ CWEM), **San Jacinto Co.**, Big Creek Scenic Area (2 ♂ COOK), **Tarrant Co.**, 45mi W Fort Worth (9 ♂ CWEM), **Travis Co.**, Austin (9 ♂ MCZC, CWEM), **Val Verde Co.**, Langtry (7 ♂ CWEM), Hwy 163, 4mi N. Juno (12 ♂ COOK), Hwy 163, 4.9mi S. Juno (17 ♂ COOK), **Winkler Co.**, Kermit (1 ♂ COOK), **Wood Co.**, Mineola 3mi NW at Godwin farm (1 ♂ COOK).

Etymology: *Punctulata* comes from Latin *punctum* for point or dot, and *lata* meaning all over or everywhere, referring to the sculpture of this species.

Discussion: There are differences in morphology of *C. punctulata* when compared with *C. lineolata*. The sculpturing on the dorsum of the mesosoma of *C. lineolata* is scabrous-rugose with longitudinal striate while that of *C. punctulata* is very punctate. Another difference is the pilosity. *Crematogaster punctulata* has medium length bristly hairs evenly distributed over dorsum of

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other
objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

mesosoma while *C. lineolata* usually has short bristly hairs along the pronotal shoulder.

MacGown (pers. comm.) has specimens that fall at both ends of the spectrum in terms of sculpture, as well as specimens which are within the spectrum, which have punctate sculpture between reticulate sculpture on the mesosoma. It is difficult to know whether they are *C. lineolata* or *C. punctulata*. He also has specimens with reticulation and heavy punctation from the same locality and dates as the those with reticulae, but the mesosoma is not punctate. It can be very difficult to separate the workers of these two taxa. MacGown (pers. comm.) finds that the incurved propodeal spines are fairly consistent and may be a better character than the pilosity. The propodeal spines usually point directly posteriorly in *C. punctulata* and are definitely diverge posteriorly in *C. lineolata*.

Crematogaster punctulata can also be confused with *C. opaca*, *C. depilis* and *C. dentinodis*. Head sculpturing is punctate on all four species; however, *C. opaca* always has punctures in longitudinal rows. The lack of erect hairs on the pronotal shoulder can separate *C. depilis* from most other species. It is very difficult to separate *C. punctulata* from *C. dentinodis*. Much of the central part of the head of *C. punctulata* is generally smooth and shiny, whereas most of the head of *C. dentinodis* is sculptured. The pronotum of *C. punctulata* usually has more than a dozen erect hairs, whereas there are fewer than 10 erect hairs on the pronotum of *C. dentinodis*. Finally, the petiole of *C. punctulata* never has the tiny teeth on the posterior lateral corners, which are often present in *C. dentinodis*.

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other
objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

Specimens from México can be easily confused with *C. patei*, but have a well-developed mid mesonotal carina, which is poorly developed in *C. patei*.

Biology: *Crematogaster punctulata* nests in the soil, often with a small mound, usually under stones or cow manure, one was under a bottle, another under an old tire and two at the edges of *Pogonomyrmex* mounds (no aggressive interactions between the two genera) (Mackay and Mackay, unpublished).

Brood were found in nests in June and August, sexuals in August (Mackay and Mackay, unpublished).

Workers are often seen foraging on vegetation (daisies, cholla, mesquite, etc.) and tending membracids (Mackay and Mackay, unpublished). They visit the extrafloral nectaries of *Erythrina flabelliformis* (Fabaceae) and rob nectar (Sherbrooke and Scheerens, 1979). It is a generalist predator which plays an important role in predation on early instars of the range caterpillar, *Hemileuca oliviae* (Lepidoptera: Saturniidae) (Shaw et al., 1987). They tend the aphids *Lachrochaitophorus* sp., *Eriococcus sansobaenus* and the coccids *Kermes* (Wheeler, 1910; Richardson and Jones, 1982, as *C. lineolata*). Albrecht and Gotelli (2001) show niche partitioning of *C. punctulata* with 3 other species of dominant ants in Oklahoma grasslands.

Nests are found in grasslands, mesquite scrublands and pinyon juniper forests (Mackay and Mackay, unpublished). Whitford et al. (1999) found nests in Lehman's love grass communities in Arizona and in a shrub grass mosaic in New Mexico.

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other objects

Desert shrublands, grasslands to pinyon juniper forests

Compare with *dentinodis*, *depilis*, *lineolata*, *opaca*

Nests are found in clay loam, red rocky-clay, yellowish-red sandy-loam, light brown rocky loam and light brown gravel, (Mackay and Mackay, unpublished).

They are usually subordinate to ants of the subfamily Dolichoderinae, but achieve dominance where the latter are poorly represented (Bestelmeyer, 2005). They are household pests in Mississippi (Haug, 1934) and are attracted to electric fields (Mackay et al., 1992).

punctulata - southern and eastern USA, México

Ground dwelling species, with mound or under stones and other
objects

Desert shrublands, grasslands to pinyon juniper forests

***Crematogaster quadrispinosa* Roger**

Crematogaster quadrispinosa Roger, 1863a: 208-209, queen, México.

Emery: 1922: 137, combination in *C. (Eucrema)*.

Crematogaster quadrispinosa is not well known and the single holotype was apparently destroyed in World War II. We have not seen anything that matches the description to the exclusion of other species.

Roger's (1863a) translated description of *Crematogaster quadrispinosa* queen is as follows: 6mm long; mandibles shiny, individual strong punctures; clypeus shiny, smooth with individual striae; the club is three segmented; head square, thickly longitudinal striate.

Body shiny black with few erect and many yellowish hairs; scutum glossy, front with strong striated punctures becoming coarse dimpled almost rugose posteriorly (almost tile like); scutellum very coarsely punctate; propodeum longitudinally rugose, with 2 short, sharp, almost horizontal spines.

Petiole elongated rectangular, as wide anteriorly as posteriorly, with rounded corners, with distinct short triangular thorns posteriorly that are easily recognized; postpetiole wider than long, rounded without medial sulcus; gaster glossy with scattered appressed hairs; legs dark brown with appressed hairs.

México, a single female.

quadrispinosa - México

Compare with *ashmeadi*

***Crematogaster rifelna* Buren**

Plates 75, 76, 77 and 123; Fig. 9; Map 31.

Crematogaster rifelna Buren, 1968: 96-98, worker, queen, male; Riviera, Texas, United States.

Descriptions:

Worker: mandibles shiny, shallowly longitudinally striate with decumbent hairs; clypeus wider than long, striate with decumbent hairs, anterior margin slightly convex with small medial notch; scape reaching or surpassing posterior border of head, with many semierect hairs; head costate anteriorly fading to areolate, with appressed hairs and 4-6 long flexuous hairs along shiny medial margin.

Mesosoma with shallowly to moderately developed costae that follow curvature of pronotal shoulder, longitudinally medially, with several erect hairs on pronotal shoulders and evenly covered with decumbent hairs across mesosoma directed to medial carina; promesonotal carina very well developed; humeri well developed; promesonotal suture developed; notopropodeal groove steep and angular; propodeal spines relatively short and very divergent, thickened at base.

Petiole punctate with several erect hairs on posterior margin, almost usually triangular with dorsal surface flat, anterior sternopetiole process usually well developed; postpetiole areolate with 1 erect hair on each posterior corner; gaster shallow areolate with many erect and decumbent hairs.

rifelna - USA (southeastern Texas), northeastern México

Arboreal, nests in cynipid oak galls

Oak forests

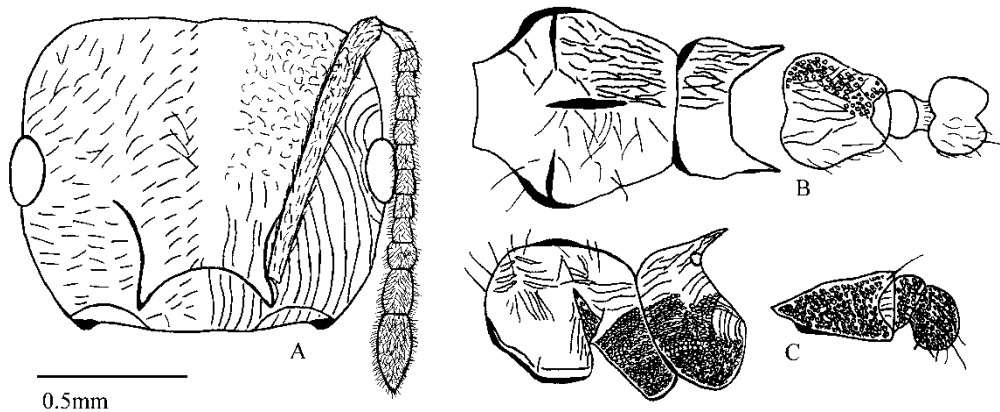
Compare with *ashmeadi*

Plate 75. *Crematogaster rifelna* worker: (paratype, Rivera, Texas, United States MCZC): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Usually concolorous light to dark brown.

Worker measurements (mm): HL 0.73-1.02, HW 0.84-1.18, SL 0.66-0.78, EL 0.17-0.22, ED 0.14-0.17, CL 0.22-0.26, CW 0.22-0.25, WL 0.84-1.18, PSL 0.22-0.24, PL 0.23-0.25, PW 0.28-0.37, PPL 0.16-0.22, PPW 0.26-0.34; Indices: CI 86-87, SI 74-90, CLI 100-104, PI 68-82, PPI 62-65.

rifelna - USA (southeastern Texas), northeastern México

Arboreal, nests in cynipid oak galls

Oak forests

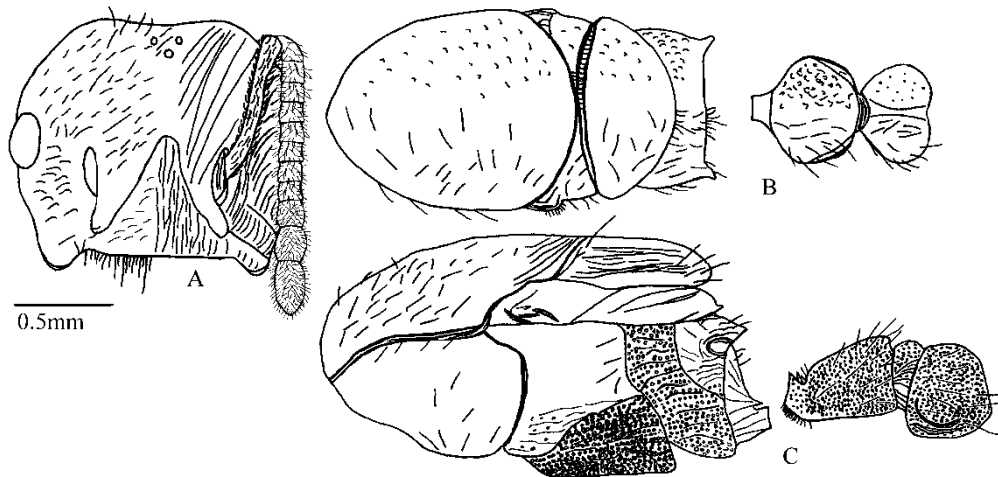


Plate 76. *Crematogaster rifelna* queen: (paratype, Rivera, Texas, United States MCZC): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Queen: Mandibles shiny shallowly striate; clypeus striate with appressed hairs, anterior margin straight; scape not reaching posterior border of head, with semierect hairs; ocelli flush with head; head shiny lineolate around insertions of antennae, with fine appressed hairs.

Mesosoma shiny, shallowly rugose with several fine erect hairs; dorsellum hidden by scutellum when viewed dorsally.

Petiole and postpetiole shallowly rugose to punctate with few

rifelna - USA (southeastern Texas), northeastern México

Arboreal, nests in cynipid oak galls

Oak forests

Compare with *ashmeadi*

fine erect hairs; gaster shallow areolate with few fine erect hairs.

Concolorous reddish brown.

Queen measurements (mm): HL 1.15-1.25, HW 1.39-1.73, SL 0.91-1.03, EL 0.30-0.32, ED 0.24-0.28, CL 0.24-0.26, CW 0.36-0.38, WL 2.04-2.09, PSL 0.17-0.24, PL 0.29-0.36, PW 0.50-0.60, PPL 0.34-0.38, PPW 0.55-0.62; Indices: CI 72-83, SI 79-82, CLI 67-68, PI 58-60, PPI 61-62.

Male: Clypeus wider than long, anterior margin shiny with fine flexuous hairs; scape typically short (from direct view) with 2-3 erect hairs, funiculus covered with fur-like semierect hairs; ocelli slightly protruding from top of head; head shiny, with long, fine flexuous hairs, mostly around ocelli.

Mesosoma shiny and shallowly areolate with few fine, erect hairs; dorsellum seen from above.

Petiole, postpetiole and gaster shiny shallowly areolate with few erect hairs.

Concolorous, dark brown.

Male measurements (mm): HL 0.48, HW 0.54, SL 0.13, EL 0.18, ED 0.20, CL 0.12, CW 0.22, WL 1.44, PL 0.26, PW 0.18, PPL 0.18, PPW 0.26; Indices: CI 89, SI 27, CLI 55, PI 144, PPI 69.

rifelna - USA (southeastern Texas), northeastern México

Arboreal, nests in cynipid oak galls

Oak forests

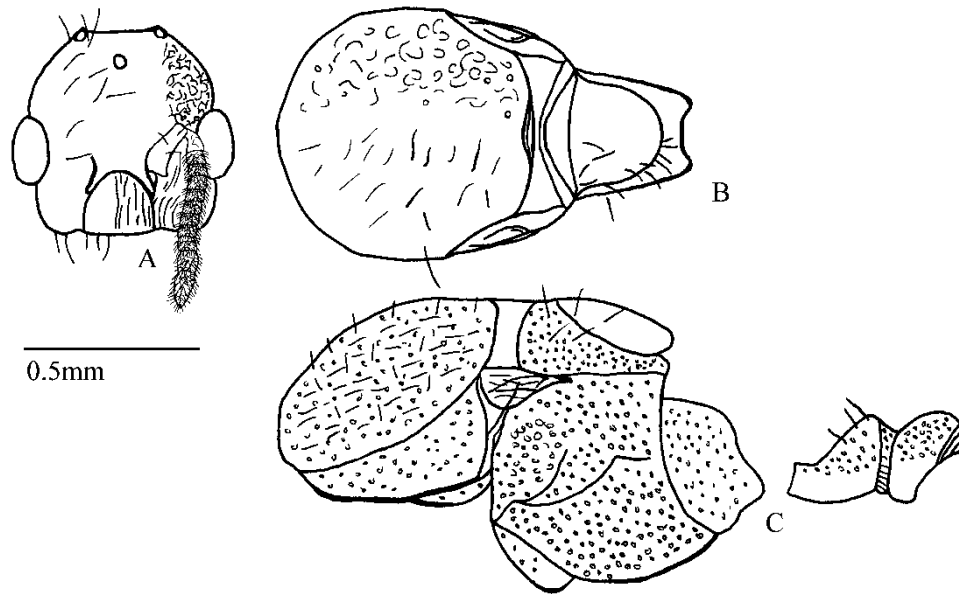
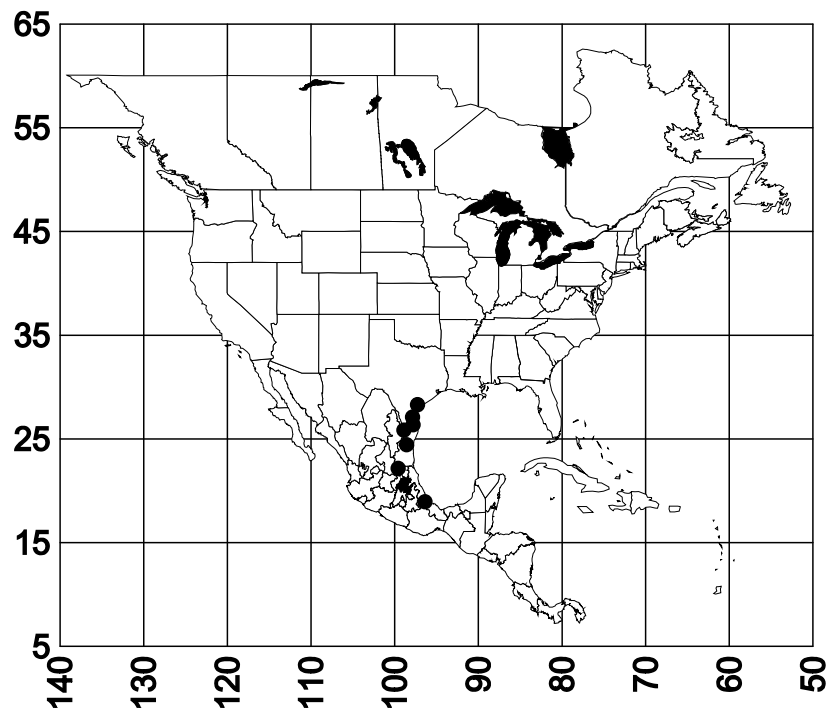


Plate 77. *Crematogaster rifelna* male: (paratype, Riviera, Texas, United States MCZC): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Distribution: Southeastern Texas, United States, south along the east Mexican coast.

Type series: Paratypes from Riviera, Texas, Kleberg Co., United States, 4 ♀, 1 ♀, 1 ♂ [MCZC] and from Barroso, Texas, 3 ♀, 1 ♀, 2 ♂ [LACM].

rifelna - USA (southeastern Texas), northeastern México
Arboreal, nests in cynipid oak galls
Oak forests

Compare with *ashmeadi*Map 31. *Crematogaster rifelna*.

Material examined: MÉXICO: Nuevo León, Montemorelos, El Pastor, elevation 2200' (9 ♀ LACM); **San Luis Potosí**, 6mi south of Valles (2 ♀, 1 ♀ MCZC), Valles, (2 ♀, 1 ♀ MCZC), 4mi N Valles, elevation 300' (4 ♀, 1 ♀, 1 ♂ LACM); **Tamaulipas**, 10mi North of Ciudad Victoria (3 ♀ LACM), see also Coronado-Blanco et al. (2013); **Veracruz**, Mirador (3 ♀, MCZC); **Hidalgo** (Vázquez-Bolaños, 2011). **UNITED STATES: Texas**, Gamble Creek HWY 22 (4 ♀, 2 ♀, 2 ♂, LACM), **Cameron Co.**, Brownsville (1 ♀ MCZC), **Kleberg**

rifelna - USA (southeastern Texas), northeastern México
 Arboreal, nests in cynipid oak galls
 Oak forests

Compare with *ashmeadi*

Co., Kingsville (3 ♀ CWEM), Riveria (3 ♀ LACM), **San Patricio Co.**, Welder Wildlife Area, found near Sinton NE M Kasztarab (3 ♀ LACM), **Victoria Co.**, Victoria (3 ♀ LACM), **Willacy Co.**, King Ranch 30mi NE of Raymondville (5 ♀, 1 ♂ LACM).

Etymology: *Rifelna* is derived from old German “rifeln” meaning to furrow (Buren 1968), referring to the longitudinal furrow of the dorsum of the mesosoma of the worker.

Discussion: *Crematogaster rifelna* is morphologically similar to *C. ashmeadi*. It can be separated as the pronotum is strongly depressed with swollen shoulders (best seen from behind with the body of the ant facing straight downward). A sharp carina is present on the promesonotum, which together with the depressed pronotum, makes it look like a gun sight (Buren, 1968). Workers of *C. ashmeadi* and all the other *Crematogaster* species of North America lack this characteristic. Unfortunately, the queens and males lack this characteristic.

Biology: This species is not commonly collected and little is known of its habits. It has been collected mostly in southern Texas, and is arboreal, found in *Quercus virginiana* (southern live oak Fagaceae), in *Disholcaspis* galls (bullet gall wasp, Cynipidae) and other cynipid oak galls.

rifelna - USA (southeastern Texas), northeastern México
Arboreal, nests in cynipid oak galls
Oak forests

Compare with *crinosa*, *torosa*

***Crematogaster rochai* Forel**

Plates 5 B, 78, 79, 80 and 124; Figs. 27 and 28; Map 32.

Crematogaster rochai Forel, 1903: 255-256, worker, queen, and male Ceará, Brazil. Forel, 1912: 213, *C. brevispinosa* race *rochai*. Emery, 1922: 134, *Crematogaster* (*Orthocrema*) *rochai*. Gallardo, 1934: 21-22, Figure 7 *Crematogaster* (*Orthocrema*) *brevispinosa* subsp. *rochai*. Longino, 2003: 120, worker, queen.

Descriptions:

Worker: Mandibles longitudinally striate; clypeus rugose with appressed hair, anterior margin slightly convex with medial notch; scape failing to reach posterior border of head, with many semierect hairs; head shallowly rugose, evenly covered with appressed hair.

Pronotum and mesonotum rugose, with few erect hairs and many appressed hairs; medial longitudinal pronotal carina developed; humeri developed; propodeum punctate; promesonotal suture developed; notopropodeal groove steep and angular; propodeal spines short and upturned, divergent (seen from above).

Petiole and postpetiole shallow areolate-punctate to punctate dorsally; petiole with 1 erect hair on each posterior corner; postpetiole usually with 1 or 2 erect hairs on each posterior corner; petiole subquadrate, slightly longer than wide, anterior sternopetiolar process very well developed; postpetiole globular, almost round; gaster very

rochai - México south to Brazil

Nests in soil as well as cavities of plants

Desert shrublands, forests

shallow areolate without erect hair except at very edge of margin.

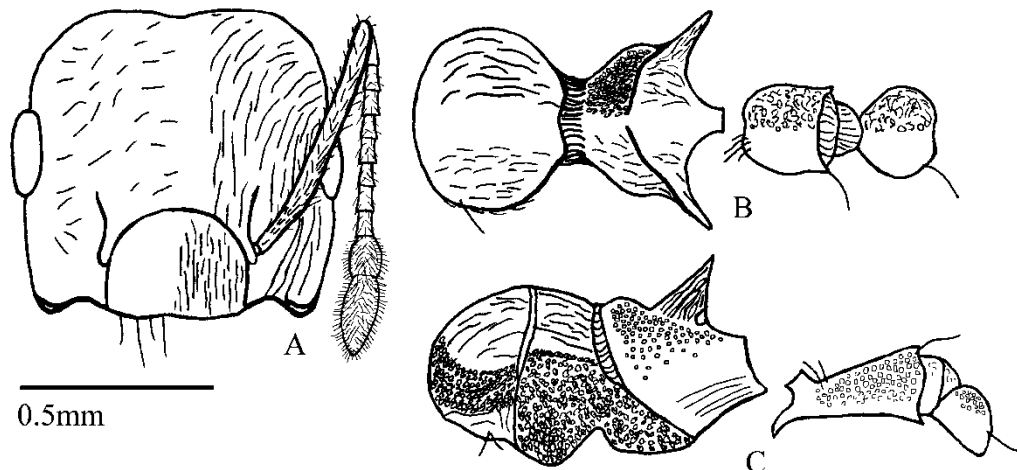


Plate 78. *Crematogaster rochai* worker: (lectotype, Ceará, Brazil MCZC) A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Concolorous reddish-brown to dark brown.

Worker measurements (mm): HL 0.65-0.77, HW 0.66-0.88, SL 0.49-0.59, EL 0.23-0.24, ED 0.13-0.14, CL 0.17-0.23, CW 0.22-0.30, WL 0.70-0.86, PSL 0.13-0.17, PL 0.22, PW 0.19-0.22, PPL 0.18-0.22, PPW 0.14-0.23; Indices: CI 88-98, SI 75-77, CLI 74-77, PI 100-116, PPI 96-129.

rochai - México south to Brazil
Nests in soil as well as cavities of plants
Desert shrublands, forests

Compare with *crinosa*, *torosa*

Queen: Mandibles shallowly striated; clypeus lineolo-rugose; anterior margin straight to slightly convex, same width as perpendicular height; scapes short, not reaching posterior border of head, with few erect and many appressed hairs; ocelli typical; head lineolate-rugose with few erect and appressed hairs.

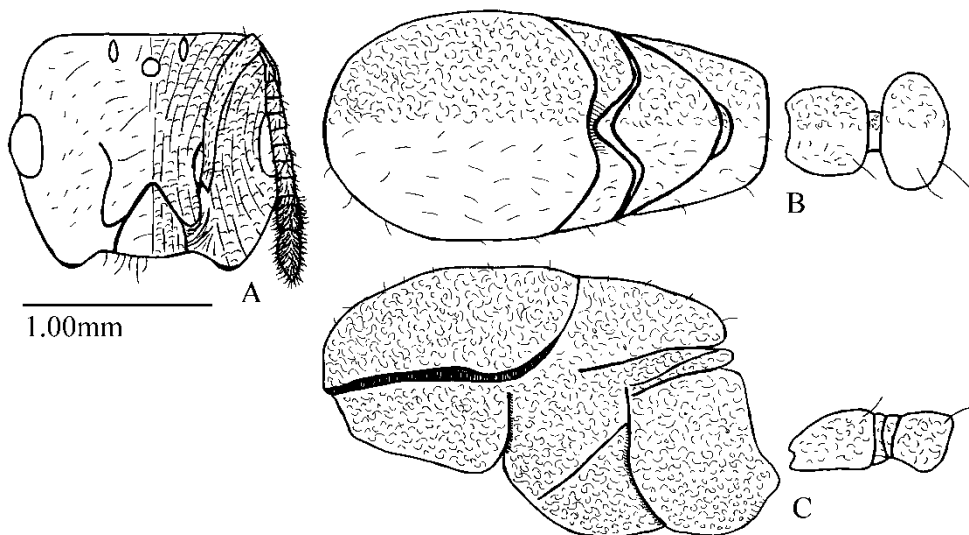


Plate 79. *Crematogaster rochai* queen: (Sinaloa, México CWEM): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

rochai - México south to Brazil
 Nests in soil as well as cavities of plants
 Desert shrublands, forests

Compare with *crinosa*, *torosa*

Mesosoma with scattered short erect and appressed hairs, dorsal surface areolate, side shiny areolate; propodeal spines absent.

Petiole and postpetiole shiny shallow areolate, with scattered short erect and appressed hairs, 1-2 erect hairs pointed posteriorly; postpetiole globular, wider than petiole, gaster shiny shallowly areolate with rows of appressed and few erect hairs.

Concolorous reddish-brown to dark brown.

Queen measurements (mm): HL 1.25-1.27, HW 1.58-1.63, SL 0.79-0.80, EL 0.43-0.48, ED 0.36-0.41, CL 0.36-0.41, CW 0.41-0.43, WL 2.66-2.83, PL 0.46, PW 0.50, PPL 0.38, PPW 0.62; Indices: CI 78-79, SI 63-64, CLI 88-95, PI 92, PPI 61.

Male: Head small, clypeus finely and longitudinally striate, wider than long, anterior margin straight; scapes very short without hair; eyes very large, covering most of face (seen in frontal view); ocelli typical; head shiny areolate with short erect hairs directed medially.

Dorsellum of mesosoma shiny areolate; side of mesosoma shallow longitudinally striate, with few short erect hairs; dorsellum can be seen from above.

Petiole and postpetiole areolate with few semierect hairs; petiole subquadrate, without sternopetiole process, postpetiole round; gaster areolate with semierect hairs in rows.

Concolorous light brown.

rochai - México south to Brazil

Nests in soil as well as cavities of plants

Desert shrublands, forests

Compare with *crinosa*, *torosa*

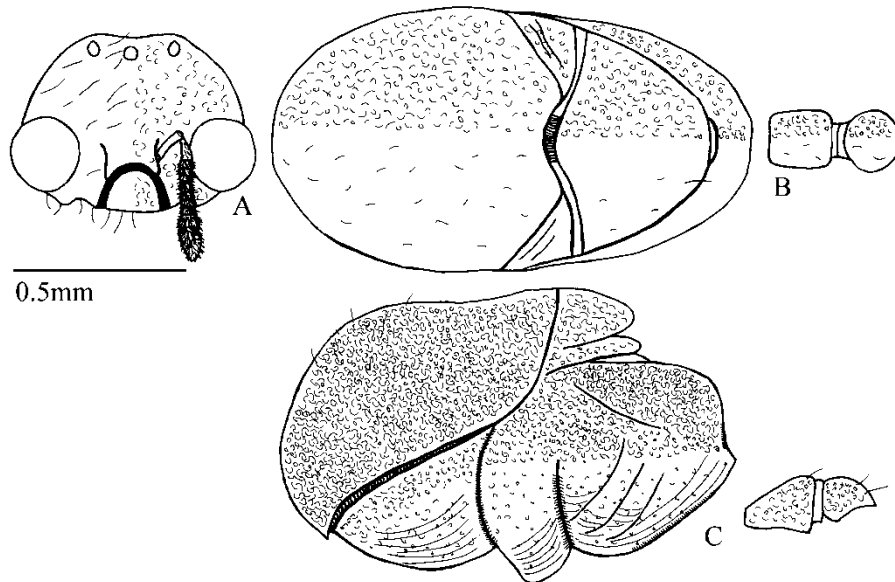


Plate 80. *Crematogaster rochai* male: (Sinaloa, México CWEM):
 A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Male measurements (mm): HL 0.48, HW 0.77, SL 0.08, EL 0.30, ED 0.22, CL 0.14, CW 0.18, WL 1.38, PL 0.18, PW 0.14, PPL 0.17, PPW 0.17; Indices: CI 62, SI 17, CLI 78, PI 129, PPI 100.

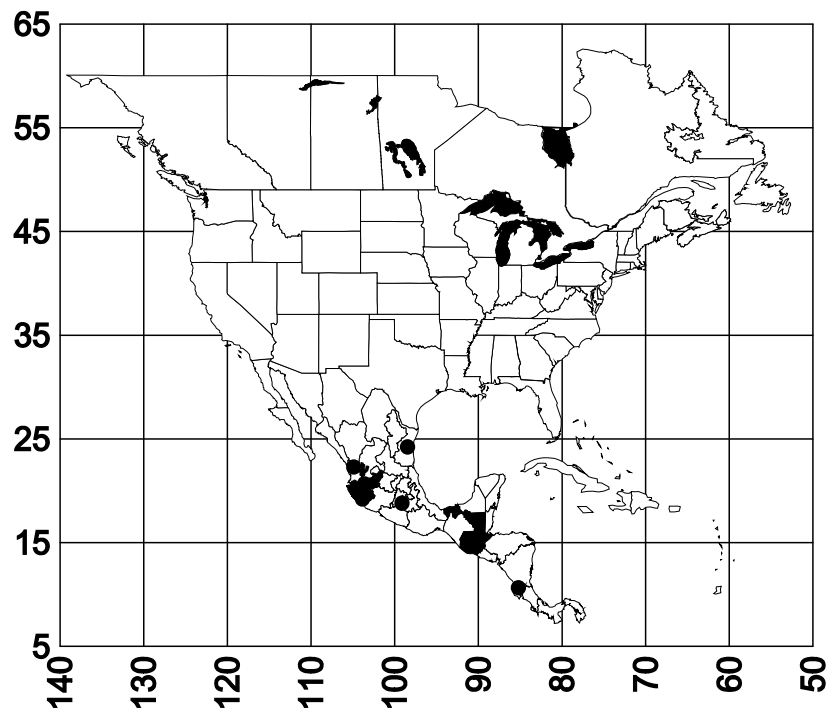
Distribution: *Crematogaster rochai* is found in México, Guatemala (Branstetter and Sáenz, 2012) south to Brazil (Forel, 1903).

rochai - México south to Brazil
 Nests in soil as well as cavities of plants
 Desert shrublands, forests

rochai

356

Compare with *crinosa*, *torosa*



Map 32. *Crematogaster rochai*.

Type series: Lectotype worker [here designated], paralectotype queen and male, Ceará, Brazil [MHNG].

Material examined: COLOMBIA: Valle del Cauca, Sevilla, (3 ♀ CWEM). COSTA RICA: Guanacaste, Lomas de Barbudal (1 ♀ CWEM). MÉXICO: Colima, Colima (7 ♀ CWEM); Jalisco, 7k N Colima, 460m (7 ♀ CWEM), 6.76k SW Mazamitla, 1997m (2 ♀ CWEM), 7k SW Tamazula, Puente Cobianes, 992m (5 ♀ CWEM);

rochai - México south to Brazil

Nests in soil as well as cavities of plants

Desert shrublands, forests

Compare with *crinosa*, *torosa*

Morelos (Vázquez-Bolaños, 2011); **Nayarit**, 12.8k S. Acaponeta (22°23'0.57"N, 105°20'09"W) (6 ♂ CWEM); **Sinaloa**, Escuinapa (18 ♂, 9 ♀ CWEM), (24°49'0.56"N, 105°46'54"W) (3 ♂, 2 ♀ CWEM); **Tabasco** (del Toro et al., 2009); **Tamaulipas**, 32.28k SE Ciudad Victoria, 289m (CWEM).

Etymology: Named for the collector M. F. Diaz da Rocha.

Discussion: The key characteristic of *C. rochai* is the highly developed anterior sternopetiolar process, short upturned propodeal spines and dorsum of head evenly covered with appressed pubescence and few erect hairs. This species can be confused with *C. torosa* and *C. crinosa*. One distinguishing character is the anterior sternopetiolar process on *C. rochai* is much more highly developed than in *C. crinosa* or *C. torosa*. The gaster of *C. rochai* has few to no erect hairs while the gaster of *C. crinosa* is evenly covered with short erect hairs and *C. torosa* has a wide margin of erect hair. The males have very small heads with the eyes almost touching the clypeus.

Biology: *Crematogaster rochai* nests in the soil (Mackay and Mackay, unpublished) as well as in cavities of plants and colonies are composed of multiple nests or are polydomous (Longino, 2003). It also lives in *Nasutitermes* (*corniger* and *ephratae*) termite arboreal nests, where it walls itself off from the termites (Quinet et al., 2005). Nests were found in the ant plant *Acacia collinsii* (Wood, 2005).

Foragers can be found on the soil surface (also collected in pitfall traps) and in the vegetation and are common in Jalisco, México

rochai - México south to Brazil

Nests in soil as well as cavities of plants

Desert shrublands, forests

Compare with *crinosa*, *torosa*

(Mackay and Mackay, unpublished). The type series was collected tending aphids on orange trees (Forel, 1903).

They are found in shrubland desert, pine forests, including burned forest and disturbed rain forest (Mackay and Mackay, unpublished). It is also found in semiarid vegetation in Venezuela (Pérez-Sánchez et al., 2012) and is a dominant species in the semiarid peninsula (Margarita Island) of Venezuela (Pérez-Sánchez et al., 2014). It is found in natural vegetation as well as logged areas and areas with natural tree falls in the state of Acre, Brazil (Miranda et al., 2013).

Nests are found in reddish brown clay, rocky clay and red clay-loam (Mackay and Mackay, unpublished).

The wasp *Polybia occidentalis* recognize scouting-and-recruiting *C. ?rochai* by their odor (London and Jeanne, 2005) and they may cause the wasp *Polybia occidentalis* to abandon their nests in Costa Rica (Bouwma et al., 2007).

Rubin et al., (2014) extracted and analyzed the bacterial DNA in *C. rochai*.

rochai - México south to Brazil

Nests in soil as well as cavities of plants

Desert shrublands, forests

Compare with *isolata*

***Crematogaster saussurei* Forel**

Plates 4 E, 81, 82, 83 and 125; Fig. 4; Map 33.

Crematogaster saussurei Forel, 1899: 86, worker, queen, male, Moyoapán, Veracruz, México. Emery, 1922: 140, *Crematogaster* (*Acrocoelia*).

Descriptions:

Worker: Mandibles longitudinally striate; clypeus lineolate-rugose with many semierect hairs, anterior margin convex with many long flexuous hairs; scape short, not reaching posterior border of head, with semierect hairs; head punctate-lineolate following curvature of eye, fading to shiny toward posterior border of head with 2-4 long flexuous hairs and many appressed and decumbent hairs pointing medially on face.

Dorsal view of mesosoma punctate-lineolate following curvature of dorsum, breaking slightly at promesonotal suture with appressed hair evenly scattered and directed toward medial carina, medial notopropodeal carina poorly developed; pronotal shoulder rounded with 2-3 long erect hairs on each pronotal shoulder; notopropodeal groove shallow; propodeum with appressed hair pointed and curving around spines propodeal spines short, not inserted at widest point of dorsopropodeum, diverging posteriorly, curving outward viewed from side.

saussurei - México

Loose on ground

Scrub vegetation, tropical deciduous forests, urban habitats

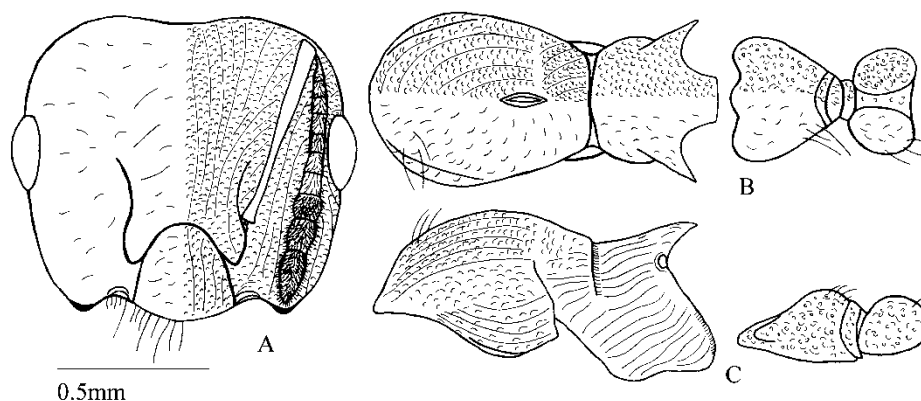
Compare with *isolata*

Plate 81. *Crematogaster saussurei* worker: (lectotype, Moyoapán, Veracruz, México MNHG): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Petiole triangular with anterior lateral corners flaring up slightly, areolate with 2-4 long erect hairs on each posterior corner and appressed hairs on dorsal surface; postpetiole areolate with wide median sulcus, hemilobes diverging posteriorly, with 2-4 long erect hairs on each posterior margin and appressed hairs on dorsal surface; gaster areolate with few erect and many appressed in rows pointed posteriorly.

Concolorous brown to black.

saussurei - México

Loose on ground

Scrub vegetation, tropical deciduous forests, urban habitats

Compare with *isolata*

Worker measurements (mm): HL 0.98-1.08, HW 0.98-1.14, SL 0.78-0.97, EL 0.24-0.25, ED 0.19-0.20, CL 0.26-0.32, CW 0.30-0.40, WL 1.22-1.22, PSL 0.14-0.20, PL 0.24-0.29, PW 0.37-0.42, PPL 0.22-0.29, PPW 0.34-0.35; Indices: CI 95-100, SI 80-90, CLI 80-87, PI 65-69, PPI 65-83.

Queen: Mandibles shiny, covered with semierect hairs directed toward teeth; clypeus shiny, lineolate, with few thin erect hairs, anterior margin slightly convex; scape short, failing to reach posterior border of head, with decumbent hairs; ocelli very small for queens in this genus; head shiny lineolate-rugose (worker like) with few long flexuous hairs.

Mesosoma areolate, with few short erect hairs, viewed from above; latitudinally lineolate with hairs intersecting with other hairs on sides; metanotum cannot be seen from above, dorsellum can be seen from above.

Petiole areolate with few erect hairs, rounded triangulate; postpetiole areolate, few erect hairs, and with shallow medium sulcus; gaster areolate with about 6-10 scattered short erect hairs and evenly spaced appressed hairs in rows pointed posteriorly.

Concolorous dark brown to black.

Queen measurements (mm): HL 1.49, HW 1.58, SL 1.15, EL 0.43, ED 0.38, CL 0.55, CW 0.50, WL 2.95, PSL 0.34, PL 0.67, PW 0.70, PPL 0.53, PPW 0.62; Indices: CI 94, SI 77, CLI 110, PI 96, PPI 85.

saussurei - México

Loose on ground

Scrub vegetation, tropical deciduous forests, urban habitats

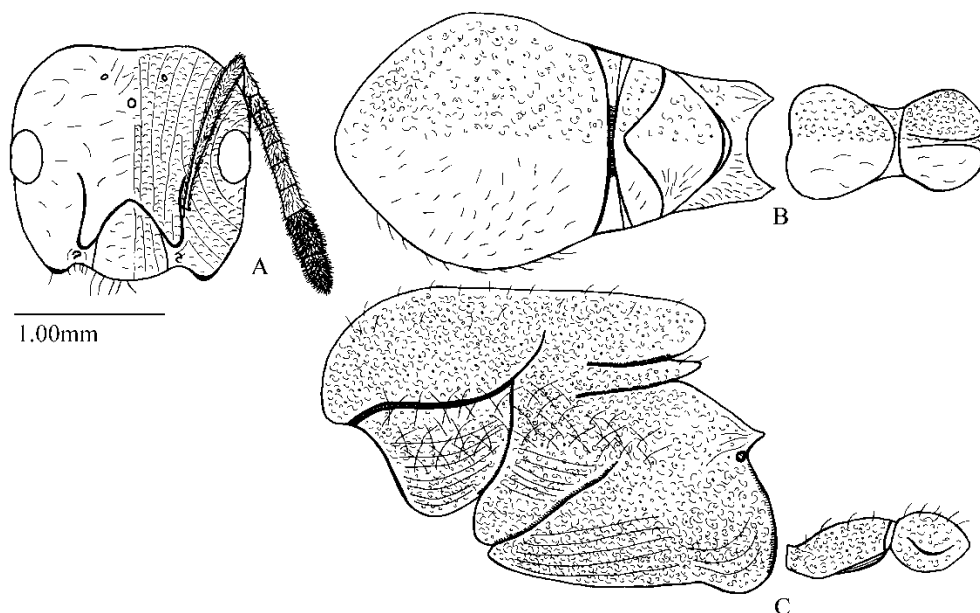


Plate 82. *Crematogaster saussurei* queen: (paralectotype, Moyoapán, Veracruz, México MNHG): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Male: Mandibles rugose-punctate; clypeus somewhat snout-like, protruding from face, shiny rugose with few long flexuous hairs, anterior margin slightly convex with many long flexuous hairs; scape typically short, without hair; ocelli small, almost flush with top of head; head heavily punctate with several long flexuous hairs pointed

saussurei - México

Loose on ground

Scrub vegetation, tropical deciduous forests, urban habitats

Compare with *isolata*

medially and many long decumbent hairs along margins of head, with cluster of long flexuous hairs around and in-between ocelli.

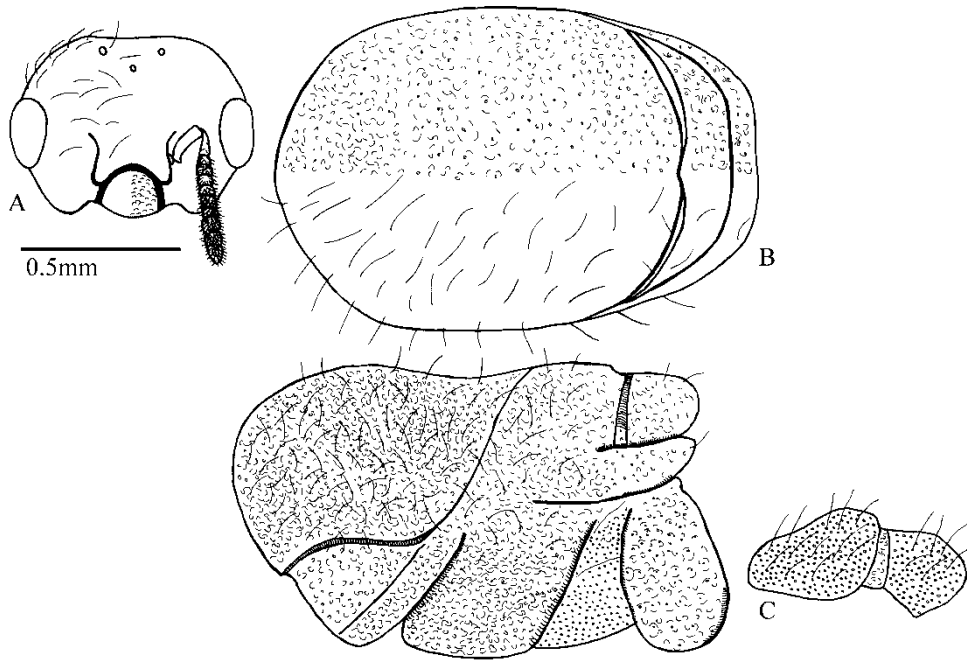


Plate 83. *Crematogaster saussurei* male: (paralectotype, Moyoapán, Veracruz, México MNHG): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Mesosoma shallowly areolate with many long flexuous erect hairs (viewed from above), hairs intersecting with other hairs on sides; lateropronotum longitudinally striate-punctate; katepisternum

saussurei - México

Loose on ground

Scrub vegetation, tropical deciduous forests, urban habitats

Compare with *isolata*

latitudinally striate-punctate; long flexuous hairs directed posteriorly on scutellum, dorsellum and metanotum (seen from side).

Petiole and postpetiole punctate with long flexuous hairs along posterior margin; gaster areolate with many erect hairs ventrally and dorsally (bristle-like appearance).

Concolorous black.

Male measurements (mm): HL 0.66, HW 0.85, SL 0.17, EL 0.31, ED 0.25, CL 0.10, CW 0.29, WL 1.98; Indices: CI 78, SI 26, CLI 34.

Distribution: Northern and central México.

Type series: Lectotype worker [here designated, top specimen], paralectotypes including 1 queen, 1 male and 4 workers of *Crematogaster saussurei* Forel, Moyoapán, Veracruz, México [NHMG].

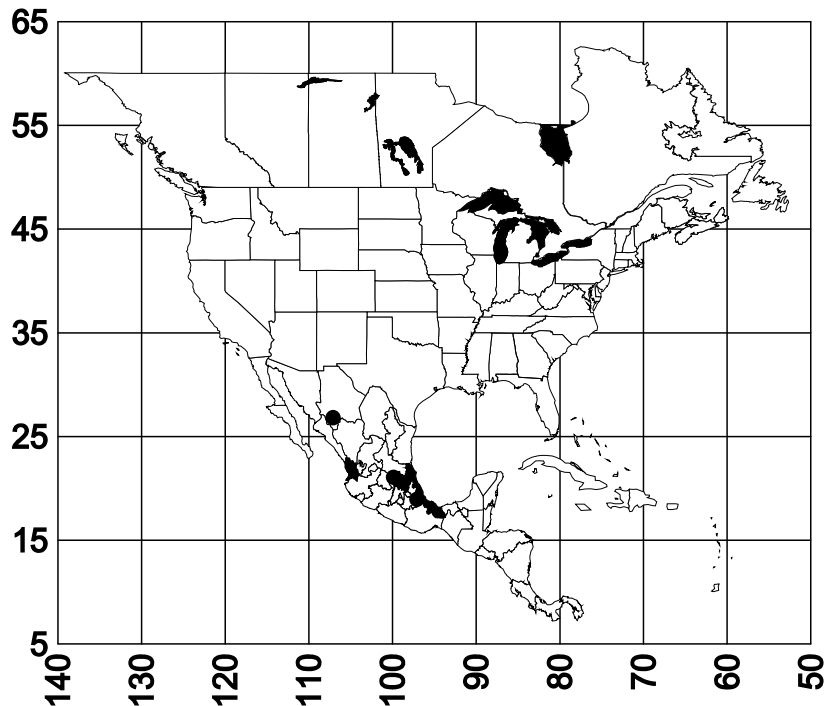
Material examined: MÉXICO: **Chihuahua**, Cuauhtémoc, Cuauhtémoc (15 ♀, 3 ♂ CWEM); **Nayarit**, Ermitaño (2 ♀ CWEM); **Querétaro**, Querétaro, La Barreta (3 ♀ CWEM), Cadereyta (1 ♀ CWEM), La Cañada (2 ♀ CWEM), La Cimatario (6 ♀ CWEM); **Hidalgo**; **Veracruz** (Vázquez-Bolaños, 2011).

saussurei - México

Loose on ground

Scrub vegetation, tropical deciduous forests, urban habitats

Compare with *isolata*



Map 33. *Crematogaster saussurei*.

Etymology: Named for the original collector Henri Saussure.

Discussion: The key characteristics of the *Crematogaster saussurei* worker are the reduced propodeal spines and the spines are not inserted at the widest point on the propodeum.

The *C. saussurei* worker resembles that of *C. isolata* in these two characters; however, *C. saussurei* has more erect pronotal hairs and the pronotal sculpturing is different. The dorsum of the mesosoma of *C. saussurei* is lineolate-rugose with a medial pronotal carina, while

saussurei - México

Loose on ground

Scrub vegetation, tropical deciduous forests, urban habitats

Compare with *isolata*

C. isolata is areolate.

The queens of these two species resemble the workers, but the queen of *C. saussurei* has more developed propodeal spines than those of *C. isolata*.

The males are very different. *Crematogaster saussurei* has a more typical face with large eyes, the clypeus is almost flush with the face and has typical ocelli. *Crematogaster isolata* has disproportionately large eyes, the clypeus is snout-like protruding from the face, and the ocelli also protrude from top of head almost like eye stalks.

Biology: *Crematogaster saussurei* has rarely been collected, but has been found foraging on the ground. It is found in scrub vegetation, tropical deciduous forests, as well as in an urban botanic garden.

saussurei - México

Loose on ground

Scrub vegetation, tropical deciduous forests, urban habitats

Compare with *limata*, *longispinosa*, *nigropilosa*

***Crematogaster sotobosque* Longino**

Plates 84, 85 and 126; Figs. 21, 22 and 23; Map 34.

Crematogaster sotobosque Longino, 2003: 106-109, worker, queen,
Prov. Heredia, La Selva Biological Station, Costa Rica.

Descriptions:

Worker: Mandibles shiny, yellow with semierect hairs; anterior margin straight turning up slightly at ends; clypeus and head very shiny, 4-6 very long erect hairs (longest are 0.18 mm) and many long erect hairs evenly spaced across head; scape passing posterior border of head, with long semierect hair.

Dorsum of mesosoma very shiny with 2 very long erect hairs (0.22mm) on each pronotal shoulder, 2 long erect hairs on mesonotum and other shorter erect hairs; lateral margins of mesonotum with short raised carina, anterior portions tooth like; propodeal spines long, sharp and almost parallel; legs yellow, front femur with decumbent hairs and posterior femora with erect hairs.

Petiole, postpetiole and gaster very shiny; petiole with 1 long erect hair on each posterior corner, postpetiole with 1 long erect hair on each anterior and posterior corner; gaster with many long erect hairs evenly spaced.

Body light to dark brown, legs and mandibles yellow.

sotobosque - USA (Arizona), Costa Rica south to Bolivia

Arboreal, in twigs or with carton nests

Deciduous and evergreen forests, wet montane forests, tropical
forests

Compare with *limata*, *longispinosa*, *nigropilosa*

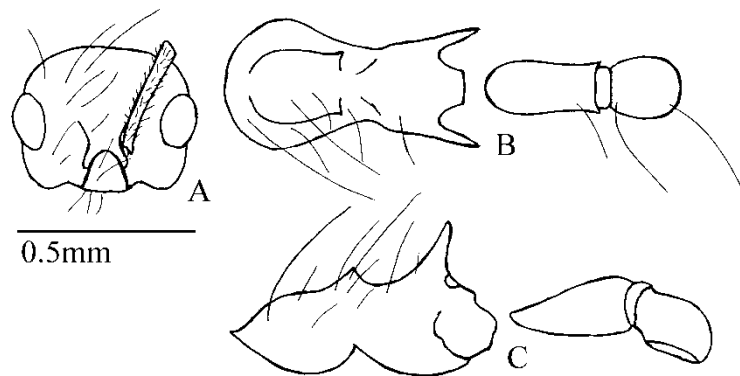


Plate 84. *Crematogaster sotobosque* worker: (paratype, La Selva Biological Station, Costa Rica LACM): A. Head (pilosity is shown on left); B. Dorsal view of mesosoma, petiole and postpetiole (pilosity is shown on left); C. Side view of mesosoma, petiole and postpetiole.

Worker measurements (mm): HL 0.50-0.54, HW 0.46-0.50, SL 0.48-0.54, EL 0.13-0.16, ED 0.10-0.12, CL 0.17-0.22, CW 0.20-0.24, WL 0.52-0.66, PSL 0.16-0.19, PL 0.19-0.24, PW 0.16-0.17, PPL 0.10-0.12, PPW 0.08-0.12; Indices: CI 108-109, SI 96-100, CLI 85-92, PI 119-141, PPI 100-125.

sotobosque - USA (Arizona), Costa Rica south to Bolivia

Arboreal, in twigs or with carton nests

Deciduous and evergreen forests, wet montane forests, tropical forests

Compare with *limata*, *longispinosa*, *nigropilosa*

Queen: Mandibles lighter in color than rest of head, shiny; clypeus, head and rest of body very shiny, worker like with many erect hairs; anterior clypeal margin straight with ends slightly curved up as in worker; scape reaching to slightly surpassing occipital margin, with erect-hair; ocelli flush with top of head.

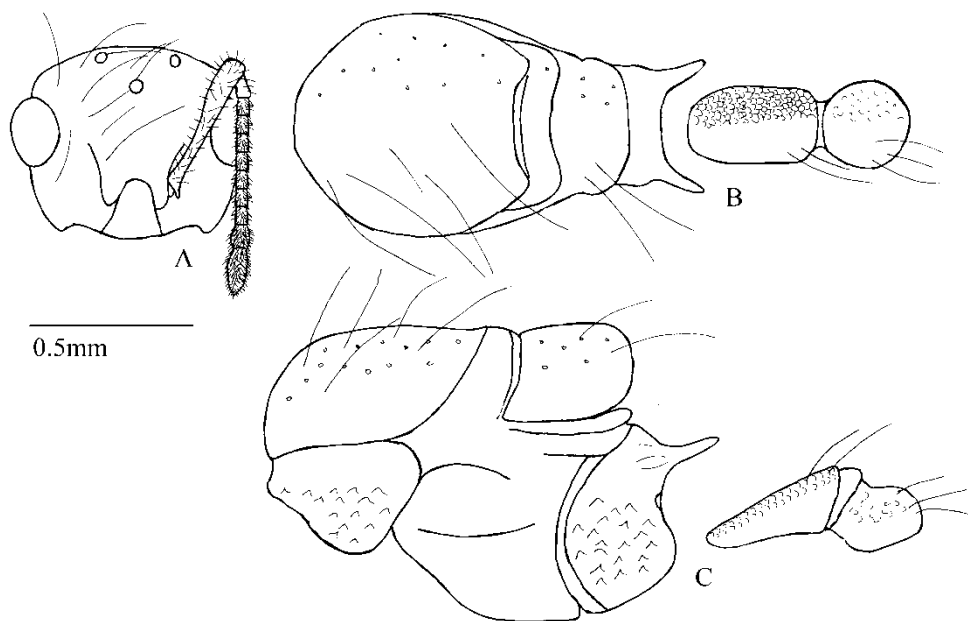


Plate 85. *Crematogaster sotobosque* queen: (paratype, La Selva Biological Station, Costa Rica LACM): A. Head (pilosity is shown on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

sotobosque - USA (Arizona), Costa Rica south to Bolivia

Arboreal, in twigs or with carton nests

Deciduous and evergreen forests, wet montane forests, tropical forests

Compare with *limata*, *longispinosa*, *nigropilosa*

Mesosoma shiny with large punctures and many long erect hairs viewed from above, metapleuron heavily rugose; dorsellum not visible viewed from above; propodeal spines very well developed (length 0.18mm) for queens in this genus.

Petiole scabrous with few long erect hairs; petiole shiny, shallowly areolate with several long erect hairs; gaster shiny with many long erect hairs.

Concolorous light to medium brown with legs and mandibles slightly lighter in color.

Queen measurements (mm): HL 0.77, HW 0.82, SL 0.60, EL 0.28, ED 0.18, CL 0.26, CW 0.34, WL 1.81, PSL 0.19, PL 0.53, PW 0.34 PPL 0.35, PPW 0.41; Indices: CI 94, SI 78, CLI 76, PI 156, PPI 85.

Distribution: Arizona, United States (Morgan et al., 2011) and Costa Rica (Longino, 2003), Colombia (Chacón de Ulloa et al, 2012), Tiputini Biodiversity Station in the province of Orellana, Ecuador (Ryder Wilkie et al., 2009), eastern Suriname (Sosa-Calvo, 2007) and in the state of Pará, Brazil (Felizardo and Harada 2007; Pereira de Souza et al., 2012; Cruz de Oliveira, 2013), Bolivia.

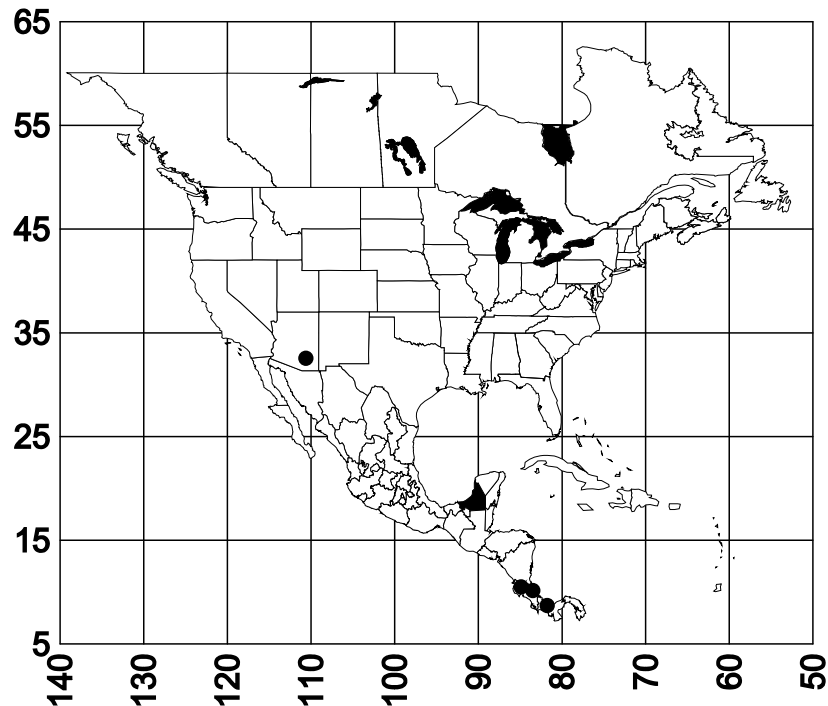
Type examined: Paratype worker and paratype queen from La Selva Biological Station, Prov. Heredia, Costa Rica [LACM].

sotobosque - USA (Arizona), Costa Rica south to Bolivia

Arboreal, in twigs or with carton nests

Deciduous and evergreen forests, wet montane forests, tropical forests

Compare with *limata*, *longispinosa*, *nigropilosa*



Map 34. *Crematogaster sotobosque*.

Other material examined: **BOLIVIA:** **Cochabamba**, 109k E Cochabamba at Lagunitas (17°06'22"S 85°40'57" W) (1 ♀ CWEM), 117 E Cochabamba at Lagunitas, 1000m (CWEM). **COSTA RICA:** **Heredia**, Estación Biológica La Selva (1 ♀ CWEM); **Puntarenas**, 6km WNW Las Alturas (8°58'N 82°53'W 1650m) (3 ♀ MCZC), Toro Amarillo Guápiles (1 ♀ MCZC). **MÉXICO:** **Campeche**, 5k NE Paraíso, 40m (18 ♀ CWEM). **PANAMA:** **Chiriquí**, La Fortuna, Finca La Suisse, 1200m (1 ♀ CWEM), 20.4k N San Félix 950m (1 ♀

sotobosque - USA (Arizona), Costa Rica south to Bolivia

Arboreal, in twigs or with carton nests

Deciduous and evergreen forests, wet montane forests, tropical forests

Compare with *limata*, *longispinosa*, *nigropilosa*

CWEM). **UNITED STATES:** Arizona, Pima Co., Tucson Mount Lemmon (32°26'25"N 11°47'14"W) (2 ♀ STDC).

Etymology: Sotobosque in Spanish means forest understory which is the favored habitat of this species (Longino, 2003.)

Discussion: *Crematogaster sotobosque* is distinguished by the long-pointed spines that are almost parallel and the dorsum of the entire body being very shiny.

This species resembles *C. limata*, *C. longispinosa*, and *C. nigropilosa* in having very long spines, however all of these species are sculptured in various ways and their spines are divergent rather than parallel. All of these species including *C. sotobosque* have long flexuous hairs on the dorsum of the mesosoma and a varying amount on the head.

Biology: In Longino's description (2003) he states that this species prefers mature wet forest habitats in Costa Rica. Longino states that *C. sotobosque* will build carton shelters, he has not found workers in association with a queen but found a queen in a hollow twig with brood a few centimeters from a carton shelter. It is a ground dwelling ant in Ecuador (Ryder Wilkie et al., 2009) and nests or aggregations were found under epiphyte mats covering trunks and major branches (Dubovikoff and Longino, 2004). Mackay and Mackay (unpublished) found it nesting in twigs.

Brood were present in a nest in July (México) and it nests

sotobosque - USA (Arizona), Costa Rica south to Bolivia

Arboreal, in twigs or with carton nests

Deciduous and evergreen forests, wet montane forests, tropical forests

Compare with *limata*, *longispinosa*, *nigropilosa*

together with *Camponotus rectangularis* (Mackay and Mackay, unpublished).

Foragers were collected on the soil surface and in litter extractions (Mackay and Mackay, unpublished). It comes to sardine baits, and is captured in pitfall traps and Winkler samples (Pereira de Souza et al., 2012).

It is found in montane evergreen forest, oak forest, oak ridge-bamboo forest in Panamá, wet montane forest, in montane evergreen forest in Bolivia and in wet tropical forest (Mackay and Mackay, unpublished). Ryder Wilkie et al. (2009) collected it in primary and secondary forest in Ecuador. *Crematogaster sotobosque* was collected in several habitats in the Valle del Río Cauca in Colombia (Chacón de Ulloa et al., 2012).

Two workers were found on top of Mount Lemmon, in Tucson Arizona, United States in the summer of 2002 (Morgan et al., 2011). In the spring of 2009, Dr. Shawn Dash and the junior author returned to the Arizona site on Mt. Lemmon, but did not find a nest or additional specimens. The junior author returned in September and October of 2009 with a UTEP Myrmecology class and thoroughly searched the site and the surrounding area, but could not relocate the species.

It nests in dark brown clay soil (Mackay and Mackay, unpublished).

sotobosque - USA (Arizona), Costa Rica south to Bolivia

Arboreal, in twigs or with carton nests

Deciduous and evergreen forests, wet montane forests, tropical forests

***Crematogaster sumichrasti* Mayr**

Plates 86, 87, 88 and 127; Fig. 29; Map 35.

Crematogaster sumichrasti Mayr, 1870b: 993-994, worker, México; Forel, 1908a: 46, combination in *C. (Orthocrema)*. Longino, 2003: 114-117, worker, queen.

Crematogaster sumichrasti st. *surdior* Forel, 1885: 134, worker, queen, Guatemala. Dalla Torre, 1893: 87, raised to species. Forel, 1899: 82-86, race / subspecies of *C. sumichrasti*. Emery, 1922: 136, combination in *C. (Orthocrema)*; race / subspecies of *C. sumichrasti*. Kempf, 1972: 89, race / subspecies of *C. sumichrasti*. Longino, 2003: 2, 114, junior synonym of *C. sumichrasti*.

Crematogaster (Apterocrema) atitlantica Wheeler, 1936: 47, fig. 1, queen, male; Guatemala. Wheeler & Wheeler, 1960: 13, larva. Longino, 2003: 2, 114, junior synonym of *C. sumichrasti*.

Crematogaster sumichrasti subsp. *maya* Wheeler, 1936: 48, worker, Guatemala. Longino, 2003: 2, 114, junior synonym of *C. sumichrasti*.

Descriptions:

Worker: Mandibles shiny, longitudinally striate with decumbent hairs; clypeus longitudinally striate with semierect hairs, anterior margin slightly concave with 6 very long (0.24-0.36 mm)

sumichrasti – México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
Grasslands, primary and secondary rain forest, ornamentals, urban

Compare with *minitissima*

hairs; scape reaching posterior border of head, scape and funiculus with many erect and suberect hairs; head shiny and longitudinally striate, and evenly, sparsely covered with long, flexuous erect and semierect hairs pointed medially.

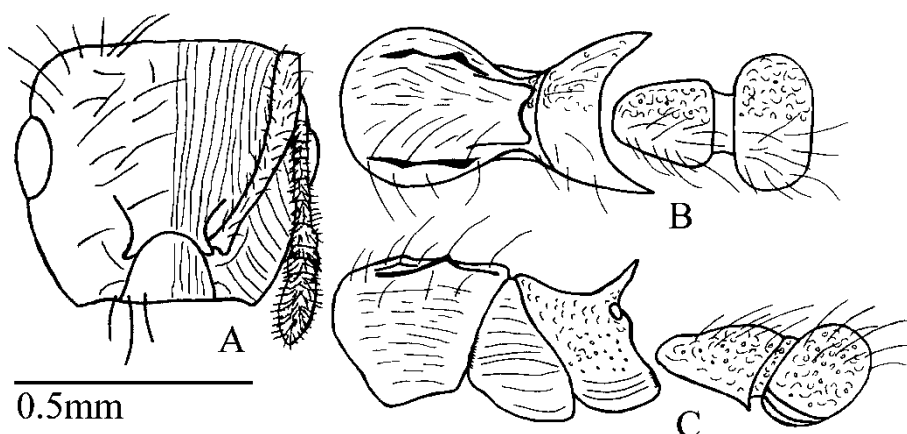


Plate 86. *Crematogaster sumichrasti* worker: (México MCZC): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Mesosoma shallowly striate with long and short erect hairs; pronotal humeri well developed; single longitudinal carina present along each dorsal lateral edge of pronotum and mesonotum, ending in point (nearly a spine) at notopropodeal furrow, longitudinal depression along medial dorsal surface of pronotum and mesonotum, continuing

sumichrasti - México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
Grasslands, primary and secondary rain forest, ornamentals, urban

Compare with *minitissima*

past notopropodeal suture onto propodeum; propodeal spines short to medium length and slender (seen from side), but thickened at base, slightly divergent (viewed from above); viewed from the side lateropronotum shallowly striate, mesopleuron striate, propodeum rugose; posteropropodeum shiny, shallowly areolate.

Petiole, postpetiole and gaster shallowly areolate with many long erect hairs; petiole striate on side; petiole almost rectangular (viewed from above), longer than wide; anterior sternopetiole process blunt or absent; postpetiole oval-shaped (viewed from above), wider than long; tibia with 2-4 long erect hairs and many decumbent hairs.

This species is usually concolorous golden yellow to dark brown.

Worker measurements (mm): HL 0.46-0.55, HW 0.38-0.58, SL 0.34-0.50, EL 0.08-0.17, ED 0.07-0.13, CL 0.12-0.20, CW 0.17-0.29, WL 0.50-0.66, PSL 0.10-0.14, PL 0.16-0.22, PW 0.11-0.18, PPL 0.11-0.17, PPW 0.16-0.28; Indices: CI 95-121, SI 74-91, CLI 69-71, PI 122-145, PPI 145-161.

Queen: Mandibles shiny, longitudinally striate, with long erect hairs; clypeus varies from slightly wider than long to slightly longer than wide, shiny striate, with long and short erect hairs, anterior margin straight to convex with approximately 10 long erect hairs; scape reaching or surpassing posterior border of head, evenly covered with long erect hairs; ocelli typical, flush with top of head; head shiny striate, evenly, sparsely covered with long and short erect hairs, frontal groove apparent.

sumichrasti – México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
Grasslands, primary and secondary rain forest, ornamentals, urban

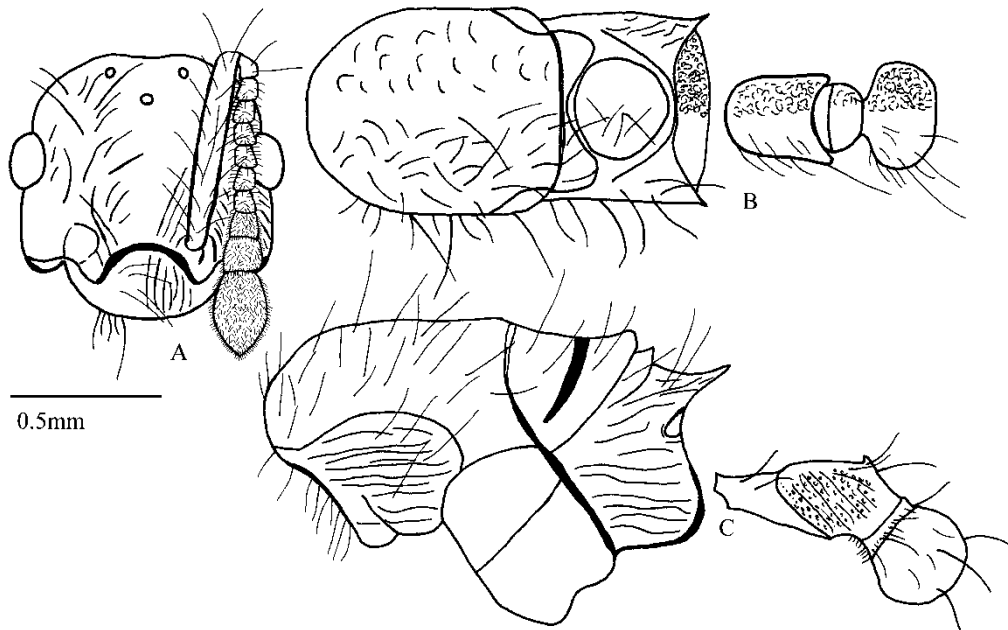
Compare with *minitissima*

Plate 87. *Crematogaster sumichrasti* queen: (syntype *C. atitlantica*, Tsanjuyo, Guatemala MCZC): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Mesosoma shiny, rugose with long and short erect hairs; dorsellum barely visible when viewed from above; posteropropodeum shiny, shallowly areolate; lateropronotum longitudinally striate; side

sumichrasti - México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
Grasslands, primary and secondary rain forest, ornamentals, urban

Compare with *minitissima*

of mesopleuron longitudinally striate; propodeal spines relatively long, slightly divergent (viewed from above); wing scars or buds present; however, all specimens seen without wings.

Petiole and postpetiole areolate, sides shallowly punctate with many long erect hairs; petiole subquadrate to rectangular (viewed from above), longer than wide; anterior sternopetiole process very small; postpetiole globular (viewed from above), wider than long; gaster shiny with many long erect hairs.

Queen usually concolorous golden yellow to dark brown, but may be bicolored with light head and mesosoma and dark gaster.

Queen measurements (mm): HL 0.73-0.94, HW 0.74-0.95, SL 0.58-0.64, EL 0.25-0.32, ED 0.18-0.25, CL 0.26-0.30, CW 0.26-0.32, WL 1.46-2.10, PSL 0.18-0.20, PL 0.34-0.48, PW 0.32-0.42, PPL 0.17-0.36, PPW 0.37-0.46; Indices: CI 99-99, SI 79-68, CLI 94-100, PI 106-114, PPI 46-277.

Male: Clypeus shiny, slightly wider than long (as seen in direct view), anterior margin straight to convex with 8 very long erect flexuous hairs; ocelli slightly protruding from head; scape and pedicel with medium erect flexuous hairs, head shiny with few long erect hairs.

Mesosoma shiny, with few long and short erect hairs, propodeum lacking hair; pronotum not visible from above; scutellum small, narrow in middle lobe-like; dorsellum broader than scutellum and position of metanotum can be seen dorsally; propodeum rounded without propodeal spines; wing scars or buds present, and all

sumichrasti – México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
Grasslands, primary and secondary rain forest, ornamentals, urban

Compare with *minitissima*

specimens without wings.

Petiole, postpetiole and gaster shiny with many long erect hairs; petiole quadrate; postpetiole small and oval-shaped (seen from above), slightly wider than long.

Male usually concolorous pale yellow.

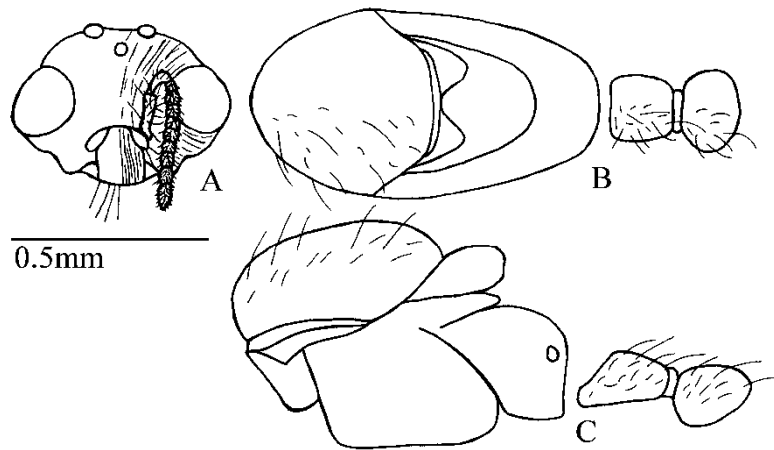


Plate 88. *Crematogaster sumichrasti* male: (syntype *C. atitlantica*, Tsanjuyo, Guatemala MCZC) specimen on the top point: A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (pilosity is shown on bottom); C. Side view of mesosoma, petiole and postpetiole.

sumichrasti - México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
Grasslands, primary and secondary rain forest, ornamentals, urban

Male measurements (mm): HL 0.37-0.38, HW 0.41-0.48, SL 0.12-0.13, EL 0.19-0.20, ED 0.18-0.18, CL 0.12-0.17, CW 0.14-0.20, WL 0.82-1.07, PL 0.18-0.23, PW 0.18-0.18, PPL 0.12-0.14, PPW 0.20-0.24; Indices: CI 79-90, SI 32-34, CLI 60-121, PI 100-127, PPI 58-60.

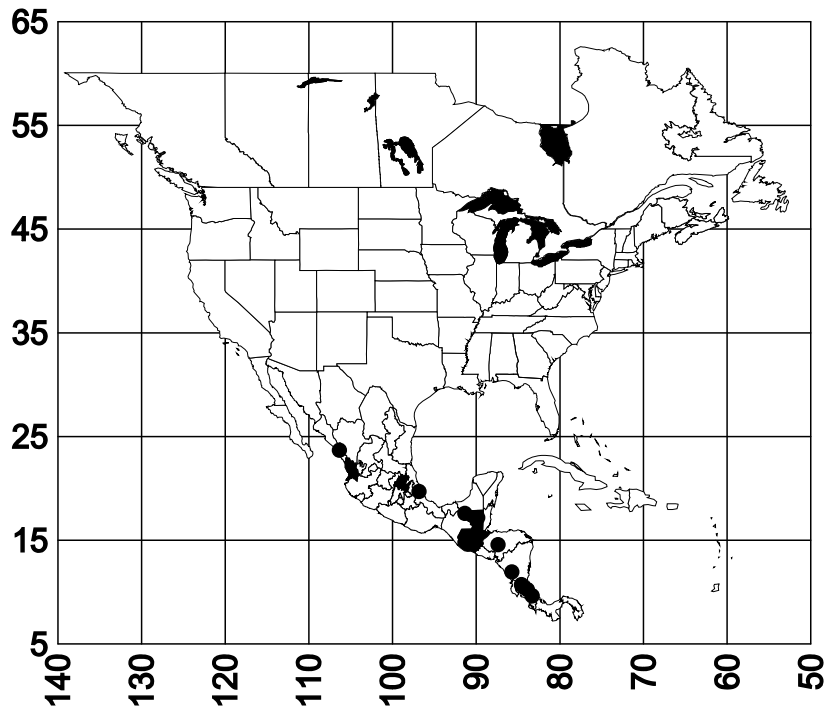
Distribution: México, Guatemala (Branstetter and Sáenz, 2012) to Argentina.

Type series: *Crematogaster sumichrasti* Mayr one syntype worker from México collected by Sumichrast and Norton [NHMW]; *C. atitlantica* Wheeler, 1 queen and 3 male syntypes [MCZC]; workers of *Crematogaster sumichrasti* subsp. *maya* Wheeler, 3 syntype workers [MCZC]; *Crematogaster sumichrasti* st. *surdior* Forel, 1 syntype worker [MHNG].

Material examined: **ARGENTINA:** **Córdoba** (3 ♀ MCZC), Quebrada de Huahuaca (3 ♀ MCZC). **COLOMBIA:** **Amazonas** Cerro La Pedrera (3 ♀ CWEM); **Meta**, 65k E Puerto López (12 ♀ CWEM), San Martín (5 ♀ CWEM). **COSTA RICA:** (6 ♀ MCZC), Biolley (3 ♀ NHMW); **Alajuela**, San Ramón (1 ♀ CWEM), San Francisco (5 ♀, 1 ♀ MCZC); **Guanacaste**, Provincia Rincón de la Vieja, Las Pailas (1 ♀ CWEM), San Ramón de Alajuela (1 ♀ CWEM); **Puntarenas**, Osa Península, Corcovado (2 ♀ MCZC). **FRENCH**

sumichrasti – México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
Grasslands, primary and secondary rain forest, ornamentals, urban

Compare with *minitissima*Map 35. *Crematogaster sumichrasti*.

GUIANA: Sinnamary (100 ♀, 8 ♀ CWEM), Tococa (CWEM).
GUATEMALA: Quetzaltenango, Tsanjuyo [Tzanjuyú] (1 ♀, 3 ♂ MCZC). **MÉXICO:** (6 ♀ NHMW), Nayarit, 19.3k S Rosamorada (16 ♀, 8 ♀, 2 ♂ CWEM), 19.3k S Rosamorada (2 ♀, 1 ♀, 1 ♂ CWEM); Chiapas, Palenque (6 ♀ CWEM); Veracruz, Mirador (16 ♀ MCZC), Orizaba (12 ♀, 4 ♀, 1 ♂ CWEM), 2k NE Orizaba (3 ♀, 2 ♀, 1 ♂ CWEM); Hidalgo (Vázquez-Bolaños, 2011). **NICARAGUA:** Granada, Volcán Mombacho, Finca Progreso (700m 11°50'21.1'N

sumichrasti - México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
 Grasslands, primary and secondary rain forest, ornamentals, urban

Compare with *minutissima*

85°59'36.2'W) (6 ♀ CWEM). **VENEZUELA:** Bolívar, Canaima, Orchid Island (16 ♀ CWEM).

Etymology: *C. sumichrasti* is named for Frances Sumichrast one of the original collectors.

Discussion: *Crematogaster sumichrasti* closely resembles *C. minutissima*. A distinguishing character between these two species is the shape of the spines; *C. sumichrasti* has small pointed spines and *C. minutissima* has short reduced blunt spines. *Crematogaster sumichrasti* is more continuously polymorphic in size and the workers have 1-3 long erect hairs on the middle and hind tibiae; the *C. minutissima* worker is monomorphic within a nest series and insignificantly varies in size between nests. A key characteristic of these two species is abundant very long flexuous erect hairs on most surfaces of its body. *Crematogaster sumichrasti* has very well developed pronotal humeri. The dorsal surface is longitudinally concave between longitudinal carinae on both sides of the mesosoma that end at the notopropodeal suture in small spines. The queen is not continuously polymorphic; it is either large or small. An interesting character is that the small queen has a wider clypeus than the large queen, but the length is proportionally shorter in the smaller queen. The male has a uniquely developed scutellum that looks like a knob. The metanotum can be seen dorsally due to the narrow scutellum.

Biology: Mackay and Mackay (unpublished) found nests in branches and in/under logs, in a partially live branch, in a corral post

sumichrasti – México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
Grasslands, primary and secondary rain forest, ornamentals, urban

Compare with *minitissima*

damaged by termites and in *Cecropia obtusa*. Longino (2003) describes the nesting habits as in any kind of cavity of plants dead or alive. Colonies are found in root clusters of the trash-basket epiphyte *Philodendron insigne*, which is abundant along streams in French Guiana (Gibernau et al., 2007).

Brood and sexuals were found in nests in May (México) and June (Colombia) (Mackay and Mackay, unpublished). *Crematogaster sumichrasti* was found to be a dimorphic species with two worker castes, and basically monogynous, although small colonies may be polygynous (Jaffe and Pino, 1989). The collection of nest series shows that nests can be polygynous and very large with workers numbering in the hundreds (Longino, 2003). Workers escape with brood, workers in larger nests are aggressive (Mackay and Mackay, unpublished). *Crematogaster sumichrasti* is very common in San Martín, Colombia, with nests found in nearly every tree (Mackay and Mackay, unpublished) and are also very common in Chamela, Jalisco, México (Castaño-Menesses, 2014). One colony was nesting together with *Pseudomyrmex* sp. (Mackay and Mackay, unpublished).

It is a ground foraging ant that works up into coffee plants (Perfecto and Snelling, 1995). They visit the floral nectaries of a Neotropical perennial plant, *Calathea ovandensis* (Marantaceae), which also produces extrafloral nectar (Horvitz and Schemske, 1984).

Crematogaster sumichrasti was found in a grassland with scrubby rain forest, a burned area near a stream, along a road surrounded by pine forest, secondary rain forest and in the rain forest (Mackay and Mackay, unpublished). It is found in ornamental agroecosystems in Veracruz, México (Landro-Torres et al., 2014).

sumichrasti - México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
Grasslands, primary and secondary rain forest, ornamentals, urban

Longino (2003) mentions that this species can be found in residential, urban or other disturbed areas.

Nests were found in dark brown sandy loam (Mackay and Mackay, unpublished).

Jaffe and Pino (1989) investigated the pheromonal system of *C. sumichrasti*. Workers mark their territory with colony specific volatile chemicals from the mesosoma, probably from the metapleural gland. The mark was effective for 30 to 60 min after deposition. Nestmates were recognized by the odor and differentiated from foreign conspecifics due to volatiles from the head and gaster. A trail pheromone was produced from glands in the legs, probably the tibial glands, and oriented workers up to 30 min after deposition. Extracts from the head and gaster induced alarm behavior in workers.

sumichrasti – México to Argentina

Arboreal, nesting in plant cavities and epiphytes, in/under logs
Grasslands, primary and secondary rain forest, ornamentals, urban

Compare with *rochai*, *crinosa*

***Crematogaster torosa* Mayr**

Plates 89, 90, 91, and 128; Figs. 25, 26 and 27; Map 36.

Crematogaster torosa Mayr 1870a: 402-405, worker; Santa Fé de Bogotá, Colombia. Emery, 1922: 130-136, *Crematogaster* (*Orthocrema*). Santschi, 1925b: 229, worker, queen. Longino, 2003: 24, 120-121.

Crematogaster brevispinosa subsp. *tumulifera* Forel, 1899: 84-85, worker; Chontales, Nicaragua. Forel, 1907: 25, 1908a: 47-48, queen, male. Forel, 1908b: 369; Forel, 1909: 258; Forel, 1912: 215, worker, queen and male; Emery, 1922: 134, combination in *Crematogaster* (*Orthocrema*). Wheeler & Wheeler, 1952: 260, larva. Longino, 2003: 2, 120-121, junior synonym of *C. torosa*.

Crematogaster arizonensis Wheeler, 1908c: 482-483, pl. 27, fig. 40, worker; Arizona, United States. Wheeler, 1912a: 132-133, queen, male. Emery, 1922: 130-136, combination in *Crematogaster* (*Orthocrema*). Longino, 2003: 2, 120-121, junior synonym of *C. torosa*.

Descriptions:

Worker: mandibles shiny with appressed hair; clypeus slightly longer than wide (as seen in full frontal view), shiny, shallowly striate-areolate with fine appressed hairs, anterior margin slightly convex; scape failing to reach posterior border of head, with many decumbent

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, Acacia and Cordia
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *rochai*, *crinosa*

hairs; head striate between antennal insertions and eyes and areolate above eyes, evenly covered with appressed hair, frontal groove apparent.

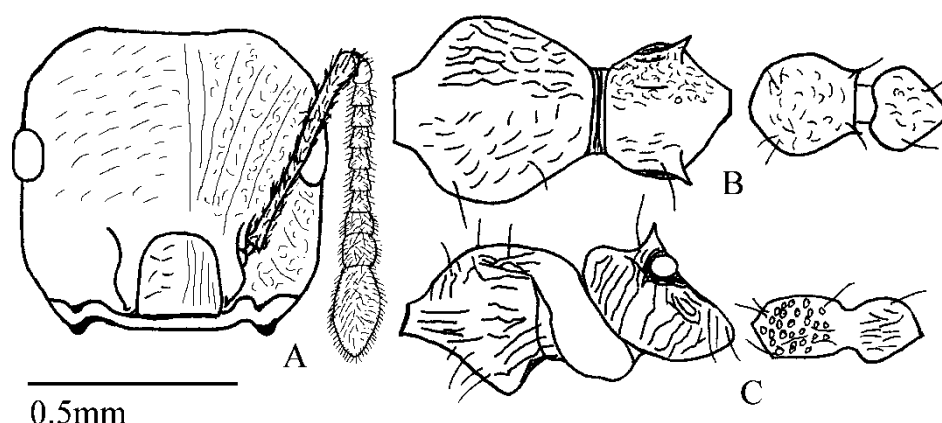


Plate 89. *Crematogaster torosa* worker: (syntype, *C. arizonensis* Arizona, United States MCZC): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Mesosoma striate with faint areolae and few erect hairs and many appressed hairs, side of mesonotum striate with punctures; medial pronotal carina apparent; humeri developed; promesonotal

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, *Acacia* and *Cordia*
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *rochai*, *crinosa*

suture apparent; notopropodeal groove steep and angular; propodeal spines reduced, short and thick, tapering abruptly forming point.

Petiole areolate with erect hairs on each posterior corner, almost square viewed from above, with posterior corners coming to points almost like spines, anterior sternopetiole process absent to very small nub; postpetiole without hemilobes, in shape of heart, areolate with 2 erect hairs; gaster shallow areolate sparsely covered with erect and appressed hairs in latitudinal rows.

Usually concolorous reddish-brown or dark brown to black.

Worker measurements (mm): HL 0.65-0.70, HW 0.67-0.70, SL 0.48-0.54, EL 0.14-0.16, ED 0.11-0.13, CL 0.18-0.25, CW 0.19-0.31, WL 0.66-0.94, PSL 0.06-0.10, PL 0.23-0.24, PW 0.20-0.30, PPL 0.18-0.22, PPW 0.20-0.30; Indices: CI 97-100, SI 74-77, CLI 81-95, PI 80-115, PPI 73-90.

Queen: Mandibles shiny, shallowly longitudinally striate, few fine appressed hairs; clypeus wider than long, shiny, shallow longitudinally striate-areolate, with few fine appressed hairs, anterior margin slightly convex; scape not reaching posterior border of head, with appressed hairs; ocelli almost flush with top of head; head longer than wide, shallow lineolate with few long erect hairs around frontal lobes and ocelli, and appressed hairs pointed medially.

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, Acacia and Cordia
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *rochai*, *crinosa*

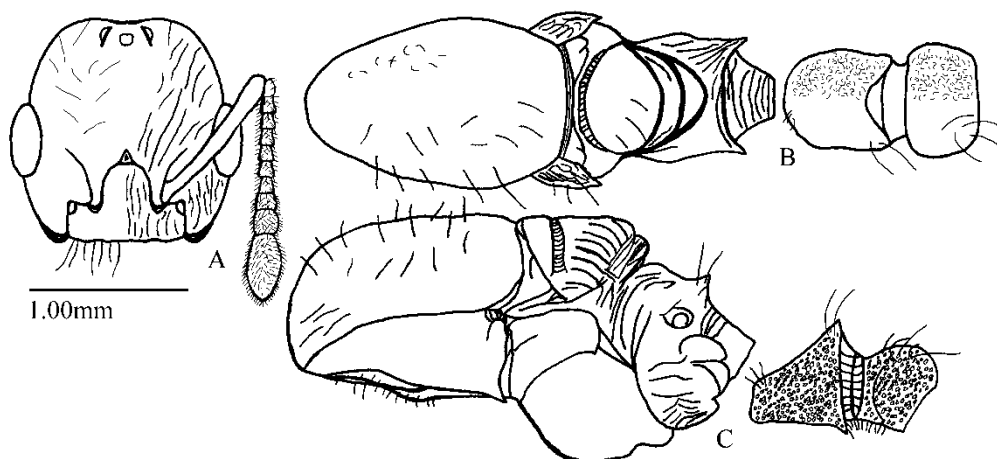


Plate 90. *Crematogaster torosa* queen: (São Paulo, Brazil CWEM # 12334): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Mesosoma shiny; propodeum areolate with few short erect and appressed hairs; dorsellum clearly visible when viewed from above; propodeal spines developed for a queen.

Petiole and postpetiole areolate dorsally and punctate from side with few long hairs on posterior border; gaster areolate; with evenly spaced short erect hairs.

Concolorous reddish-brown.

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, *Acacia* and *Cordia*
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *rochai*, *crinosa*

Queen measurements (mm): HL 1.20, HW 1.08, SL 0.77, EL 0.36, ED 0.36, CL 0.31, CW 0.41, WL 2.64, PSL 0.05, PL 0.46, PW 0.31, PPL 0.34, PPW 0.43; Indices: CI 111, SI 64, CLI 76, PI 148, PPI 79.

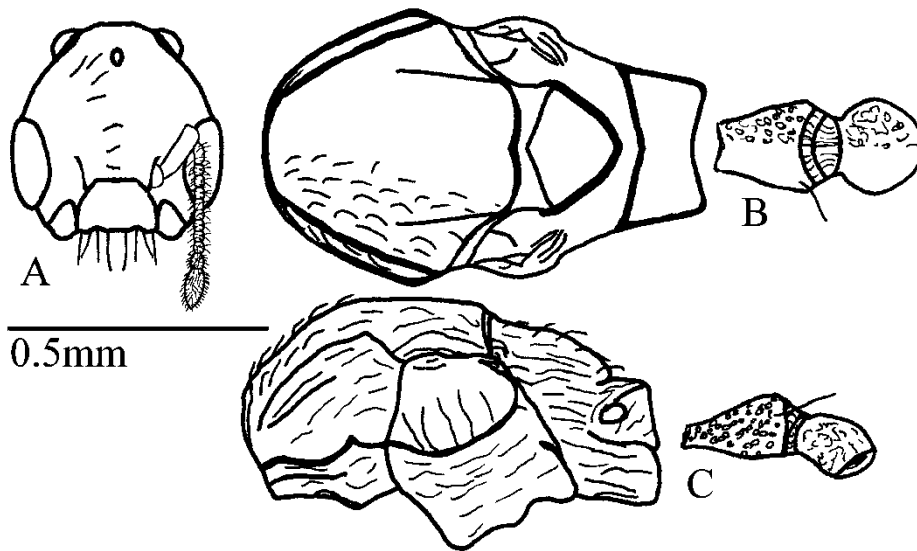


Plate 91. *Crematogaster torosa* male: (São Paulo, Brazil CWEM # 12334): A. Head (pilosity is shown on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, *Acacia* and *Cordia*
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *rochai*, *crinosa*

Male: Clypeus shiny, anterior margin convex; scape typically short with few short erect hairs; ocelli protruding from head; eyes very large compared to size of head; head shiny, with erect hair pointed medially.

Mesosoma shiny with very short erect hairs; dorsellum completely hidden by scutellum when viewed from above.

Petiole, postpetiole and gaster areolate with semierect hairs.

Color ranges from reddish-brown to dark brown.

Male measurements (mm): HL 0.38-0.49, HW 0.43-0.60, SL 0.06-0.10, EL 0.18-0.28, ED 0.13-0.22, CL 0.08-0.14, CW 0.18-0.22, WL 0.94-1.19, PL 0.13-0.18, PW 0.11-0.18, PPL 0.14-0.20, PPW 0.10-0.18; Indices: CI 80-82, SI 16-20, CLI 44-64, PI 100-118, PPI 111-140.

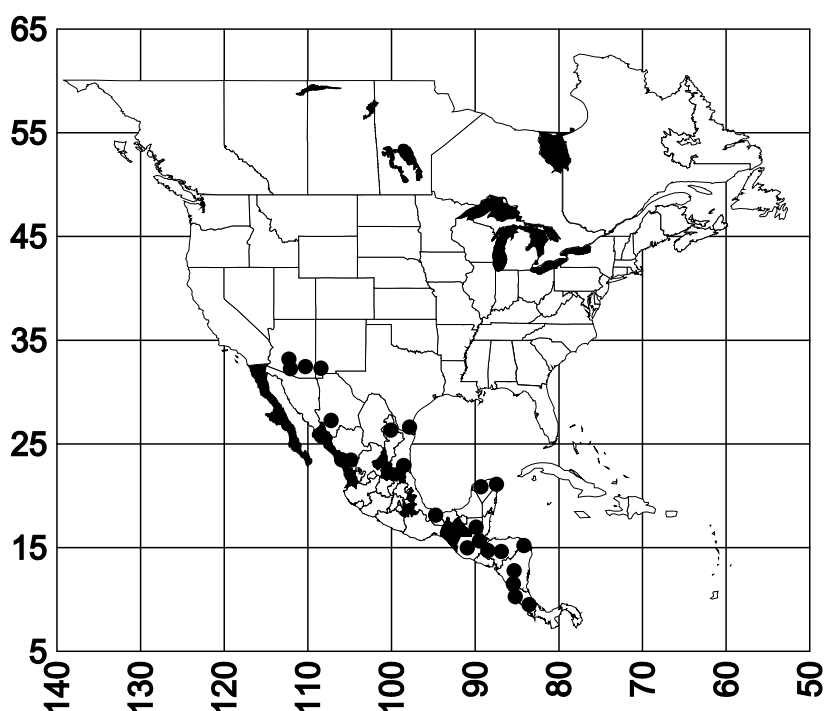
Distribution: *Crematogaster torosa* can be found throughout the Chihuahuan Desert in Arizona and New Mexico, southern Texas, United States, México (Varela-Hernández and Jones 2013), Baja California (Johnson and Ward, 2002, as *C. arizonensis*), Guatemala (Branstetter and Sáenz, 2012) to Brazil (Pereira de Souza et al., 2012).

Type Material Examined: One cotype worker of *Crematogaster arizonensis* Wheeler [MCZC].

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, *Acacia* and *Cordia*
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *rochai*, *crinosa*



Map 36. *Crematogaster torosa*.

Material examined: **BRAZIL:** **São Paulo**, Corumbatal (18 ♀ CWEM). **COLOMBIA:** **Cundinamarca**, Fusagasugá (1 ♀, 1 ♂ CWEM), 10k N. Honda (2 ♀ CWEM); **Huila**, Colombia (pueblo) (9 ♀, 9 ♂ CWEM, 1 ♀, 1 ♂, LACM), Hobo (2 ♀ CWEM), 7mi N Neiva (CWEM) 30k N Neiva, ~500m (8 ♀ CWEM), 1k N Villavieja, Desierto Tatacoa, 500m (4 ♀ CWEM); **Magdalena**, Santa Marta, 100m (2 ♀ CWEM); **Meta**, 2mi N Acacias (2 ♀ CWEM), Cumaral

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, Acacia and Cordia
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *rochai*, *crinosa*

(CWEM); **Valle del Cauca**, Cali (2 ♀ CWEM). **COSTA RICA:** **Guanacaste**, Palo Verde (2 ♀ MCZC), San José (7 ♀ MCZC), Zapotal (1 ♀ MCZC), Osa Península, (1 ♀ CWEM); **Puntarenas**, 5k SW Estación Biológica Las Cruces (CWEM). **GUATEMALA:** **Sololá**, San Lucas Tolimán, E side Lake Atitlán (14°38'28.0"N, 91°08'06.7"W) (1 ♀ CWEM); **Suchitepéquez**, Cocales, San Antonio (242m 14°23'31.4"N, 91°11'08'36.5"W) (3 ♀ CWEM), 12.3k N Patulul, Finca Tarrales (6 ♀ CWEM); **Zacapa**, Teculután 183m (14°59'43.5"N, 89°42'10.7"W) (4 ♀ CWEM). **MÉXICO:** **Chihuahua**, Morelos, Xochitepec (3 ♀, 1 ♂ CWEM); **Coahuila**, 3k E Saltillo (CWEM); **Michoacán**, Coyotes (18° 60'56"N 102° 16'58"W) (3 ♀ CWEM); **Nayarit**, 54k S. Rosamorada (21°39'0.58"N, 105°01'22"W) (20 ♀ CWEM); **Nuevo León**, Monterrey Chipinque Park (4 ♀ CWEM); **Puebla** (Rivas-Arancibia et al., 2014); **Quintana Roo**, Leona Vicario Ecological Reserve "El Edén" (21°13'N, 87°11'W) (5 ♀ CWEM); **Sinaloa**, Guasave Park by Río (25°34'0.37"N, 108°27'18"W) (4 ♀ CWEM); **Tamaulipas**, Gómez Farías (4 ♀ CWEM), Ciudad Madero (5 ♀ CWEM), Ciudad Victoria (2 ♀ CWEM), 28 K S Ciudad Victoria (16 ♀ CWEM), see also Coronado-Blanco et al. (2013); **Veracruz**, 1k S Acayucan, 133m (79 ♀, 11 ♀, 13 ♂ CWEM), 5 k N Tantoyuca, 480m (11 ♀ CWEM); **Yucatán**, Mérida Sisal (1 ♀ CWEM), **Baja California**; **Baja California Sur**; **Sonora**; **Chiapas**; **San Luis Potosí**; **Sinaloa** (Vázquez-Bolaños, 2011); **Tabasco** (del Toro et al., 2009). **NICARAGUA:** **Granada**, **Río San Juan**, 5.1mi SE El Castillo,

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, *Acacia* and *Cordia*
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *rochai*, *crinosa*

Bartola (1 ♀ CWEM), **Rivas**, Domitila, 4.3mi N PicaPica (60 ♀ CWEM), San Jorge (6 ♀ CWEM), 4.3mi SW San Jorge 88m (11°24'36.6"N, 85°50'28.9"W) (32 ♀ CWEM). **UNITED STATES:** **Arizona**, **Cochise Co.** (15 ♀ CWEM), Guadalupe Canyon, 12.4mi E turn off (31 ♀ CWEM), Guadalupe Canyon, 1mi E Arizona border (CWEM), **Maricopa Co.** (3 ♀ MCZC), **Pima Co.** (3 ♀ CWEM), 18mi E Sells (2 ♀ CWEM) Sabino Canyon, South Catalina Mountains (3 ♀ MCZC); **New Mexico**, **Hidalgo Co.** Guadalupe Canyon (9 ♀ CWEM); **Texas**, **Cameron Co.** 6.5 mi N Jct. FM 2925 & 106 (22 ♀ COOK), Junction FM 509 & 106 (1 ♀ COOK). **VENEZUELA:** **Bolívar**, Canaima, Orchid Island (2 ♀ CWEM).

Etymology: *torosa*; from Latin *torosus* meaning muscle or full of muscle.

Discussion: *Crematogaster torosa* can be confused with *C. rochai* and *C. crinosa*. *Crematogaster torosa* can be distinguished from *C. rochai* and *C. crinosa* by the absence of a highly developed anterior sternopetiole process. If the process is present, it is little more than a nub. Another distinguishing characteristic is the pilosity of the gaster. *Crematogaster torosa* has a wide margin of short erect hairs on the gaster, while the gaster of *C. rochai* is almost void of erect hair and *C. crinosa* is evenly covered with short erect hairs. This species is a small polymorphic ant that is mostly reddish-brown to dark brown.

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, Acacia and Cordia
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *rochai*, *crinosa*

Biology: *Crematogaster torosa* commonly nests in logs, hollow twigs, branches of living trees, in/under bark of living trees, in a small tree damaged by termites and beetles, in a living *Acacia* sp. tree (4 meters from the soil surface) and can often be found nesting in oak trees, but nests in the soil in grasslands (Mackay and Mackay, unpublished). Large nests are found in trees (Gove et al., 2005). They live in domatia of *Cordia gerascanthus* in Costa Rica (Tillberg, 2004a).

Brood were found in nests in March and June (Colombia), July (Nicaragua), October (Brazil) and December (Colombia); sexuals in March (Colombia), July (Nicaragua), October (Brazil) and December (Colombia). They are not normally aggressive, but larger nests have aggressive workers, which are easily alarmed, and drop from the vegetation when the nest is disturbed. They nest together with *Camponotus* sp. (Mackay and Mackay, unpublished). It is polydomous and forms outstations as well as multiple nests, depending on the distribution of food sources (Lanan et al., 2011).

Crematogaster torosa is a generalist (Rivas-Arancibia et al., 2014), which can be collected loose on the soil surface and vegetation using Vienna sausage baits, as well as from litter extractions (Mackay and Mackay, unpublished). It is the most common arboreal ant at ground level in Veracruz, México (Gove and Majer, 2006). Foragers visit the flowers of *Tapirira guianensis* (Anacardiaceae) in Brazil (Moreira Fernandes et al., 2012). They are predators on the coffee berry borer *Hypothenemus hampei* (Varón et al., 2004; Vázquez et al., 2012).

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, *Acacia* and *Cordia*
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *rochai*, *crinosa*

Nests are found in a wide variety of habitats, ranging from grasslands with few trees, a grassland near a stream, desert shrublands with *Acacia*, *Prosopis*, palo verde trees, cactus, spiny plants, oak forests, pinyon juniper forest, seasonal dry forest, riparian cottonwood forest, a mango plantation in very disturbed shrubland forest, coffee plantations, disturbed tropical rain forest, primary tropical rain forest and wet cloud forest (Mackay and Mackay, unpublished). *Crematogaster torosa* was found in deciduous and subdeciduous forest in La Mancha, Veracruz, México (Rojas et al., 2014). It is a common species in wetlands in the state of Minas Gerais, Brazil (Costa-Milanez et al., 2012). It is found in disturbed sites in Brazil (Lourenço et al., 2015) and is one of the most common species in cerrado and wetland habitats in the state of Minas Gerais (Costa-Milanez et al., 2014).

Nests are found in areas with red, brown to dark brown clay, brown rocky clay, light brown to dark brown clay loam, light brown sandy-loam, light brown rocky loam, to red sandy gravel (Mackay and Mackay, unpublished).

torosa - southern US to Brazil

Arboreal, nesting in plant cavities and epiphytes, *Acacia* and *Cordia*
Desert shrublands, grasslands, primary and secondary rain forest,
wetlands

Compare with *coarctata*, *lineolata*

***Crematogaster vermiculata* Emery**

Plates 92, 93, 94 and 129; Fig. 14; Map 37.

Crematogaster vermiculata Emery 1895: 286, worker, Los Angeles, California, United States. Emery, 1922: 141, combination in *C. (Acrocoelia)*. Brown, 1949: 48, Material of the *nomen nudum*. Creighton, 1950: 199-216, subspecies of *Crematogaster coarctata*. Wheeler & Wheeler, 1960: 10-13, Plate II, Figures 14 & 15, larva. Buren, 1968: 91, combination in *Crematogaster (Crematogaster)*, revived status as species. Deyrup, 2017: 67-68, Plate 27, worker.

Crematogaster colei Buren, 1968: 108, worker, queen, Wooten, Sacramento Mountains, New Mexico, United States, **NEW SYNONYMY**.

Crematogaster opuntiae Buren, 1968: 120, worker, Santa Rita Experimental Range Arizona United States, **NEW SYNONYMY**.

Crematogaster rossi Buren, 1968: 111-112, worker, queen, San José del Cabo, Baja California Sur, México, **NEW SYNONYMY**.

vermiculata - United States and México

Nests in soil, with mound or under stones, occasionally in wood
Desert shrublands, grasslands, deciduous and pine forests, urban
habitats

Compare with *coarctata*, *lineolata*

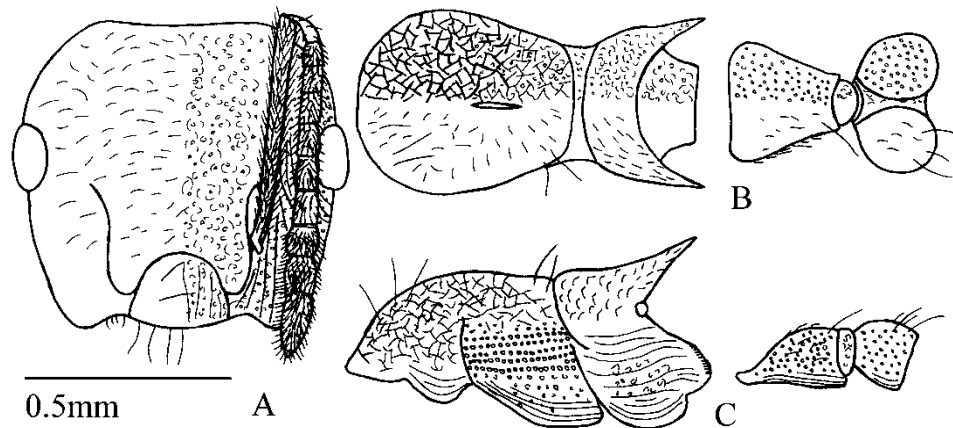


Plate 92. *Crematogaster vermiculata* worker: (syntype, green dot Los Angeles, California, United States MNHG) A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Descriptions:

Worker: Mandibles longitudinally striate; clypeus shallowly striate-areolate, slightly wider than long, with 2-3 long flexuous hairs, anterior margin slightly convex with about 8 long flexuous hairs; scape length variable from failing to reach to slightly surpassing posterior border of head, with semierect hairs; head very shiny, shallowly

vermiculata – United States and México

Nests in soil, with mound or under stones, occasionally in wood
Desert shrublands, grasslands, deciduous and pine forests, urban
habitats

Compare with *coarctata*, *lineolata*

striate-areolate between antennal insertions and eyes, areolate above eyes and evenly covered with appressed hairs pointed medially on face.

Mesosoma coarsely vermiculate, propodeum areolate viewed from above; side of mesonotum lineolate-punctate; pronotal shoulders each with 2-3 long erect hairs, rest of mesosoma with appressed hairs pointed toward notopropodeal carina; mesopleuron latitudinally lineolate; pronotal humeri small; medial mesonotal carina small, notopropodeal groove angular with 2 erect hairs; propodeal spines long, slender, tapering abruptly forming point, slightly diverging from base to points; propodeal spiracle protruding slightly from base of spine.

Petiole trapezoidal, anterior corners flaring slightly upward viewed from above; postpetiole with deep medial sulcus and well-developed hemilobes, much wider than long; petiole and postpetiole shallowly punctate; petiole with 1 erect hair on each posterior corner, several long decumbent hairs on sides; postpetiole with 4-6 erect hairs; gaster shallowly areolate with few erect and many appressed hairs.

Concolorous brown to dark brown.

Worker measurements (mm): HL 0.70-0.90, HW 0.70-0.90, SL 0.60-0.72 EL 0.14-0.18, ED 0.12-0.17, CL 0.18-0.22, CW 0.20-0.30, WL 0.76-0.90, PSL 0.13-0.18, PL 0.18-0.30, PW 0.25-0.35, PPL 0.14-0.22, PPW 0.25-0.30; Indices: CI 100, SI 80-86, CLI 73-90, PI 72-86, PPI 56-73.

vermiculata - United States and México

Nests in soil, with mound or under stones, occasionally in wood
Desert shrublands, grasslands, deciduous and pine forests, urban
habitats

Compare with *coarctata*, *lineolata*

Queen: Mandibles longitudinally striate with decumbent hair; clypeus triangular, shiny, longitudinally striate, with 2 flexuous hairs and many decumbent hairs pointed medially, anterior margin straight with 6-8 long hairs; ocelli slightly raised; scape short with appressed hairs, last 3-4 segments of funiculus swollen to form club; head shiny longitudinally striate curving around antennal insertion and eyes, with 2-4 long flexuous hairs between ocelli and 2-4 on each frontal lobe, remainder of head with appressed or decumbent hairs.

Mesonotum very different from worker, dorsum shiny areolate with few short erect and many fine appressed hairs; propodeum shiny longitudinally striate coming to point on spines, with short fine erect hairs pointed posteriorly; scutellum overhangs dorsellum viewed from above and side.

Petiole and postpetiole areolate with many appressed and 1 erect hair on each posterior corner viewed from above, side longitudinally striate, postpetiole without medial sulcus; gaster shiny, shallowly areolate with many appressed and few scattered erect hairs.

Concolorous light to dark brown.

Queen measurements (mm): HL 1.39, HW 1.58, SL 1.56, EL 0.53, ED 0.43, CL 0.50, CW 0.43, WL 3.46, PSL 0.34, PL 0.50, PW 0.77, PPL 0.48, PPW 0.65; Indices: CI 88, SI 112, CLI 116, PI 65, PPI 74.

vermiculata – United States and México

Nests in soil, with mound or under stones, occasionally in wood
Desert shrublands, grasslands, deciduous and pine forests, urban
habitats

vermiculata

400

Compare with *coarctata*, *lineolata*

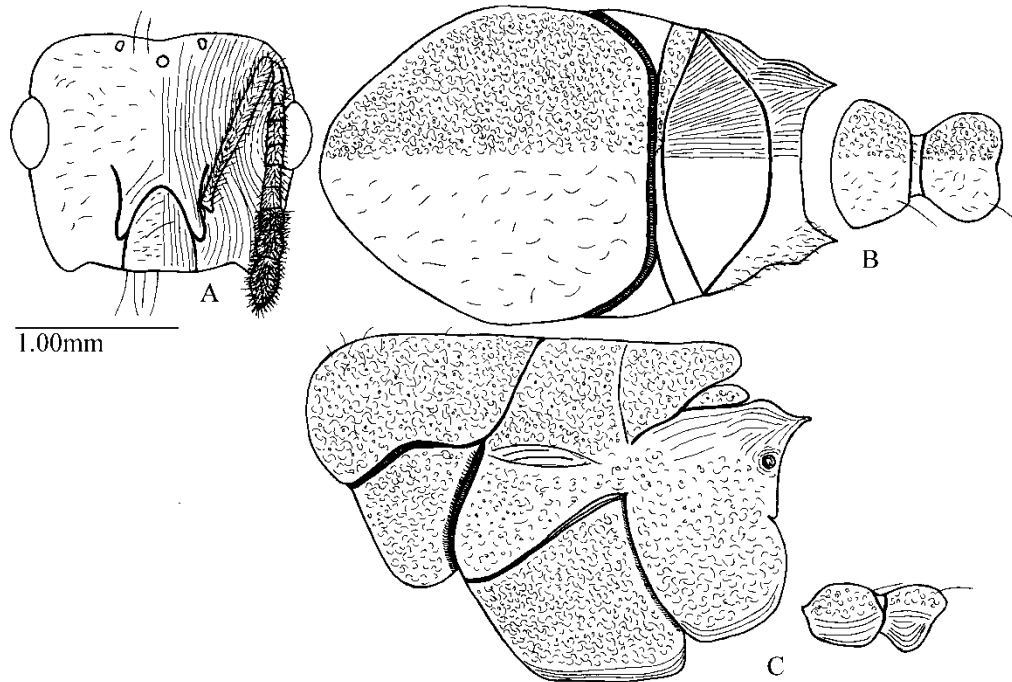


Plate 93. *Crematogaster vermiculata* queen: (Silver City, Grant Co., New Mexico, United States CWEM # 8325): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

vermiculata - United States and México

Nests in soil, with mound or under stones, occasionally in wood
Desert shrublands, grasslands, deciduous and pine forests, urban
habitats

Compare with *coarctata*, *lineolata*

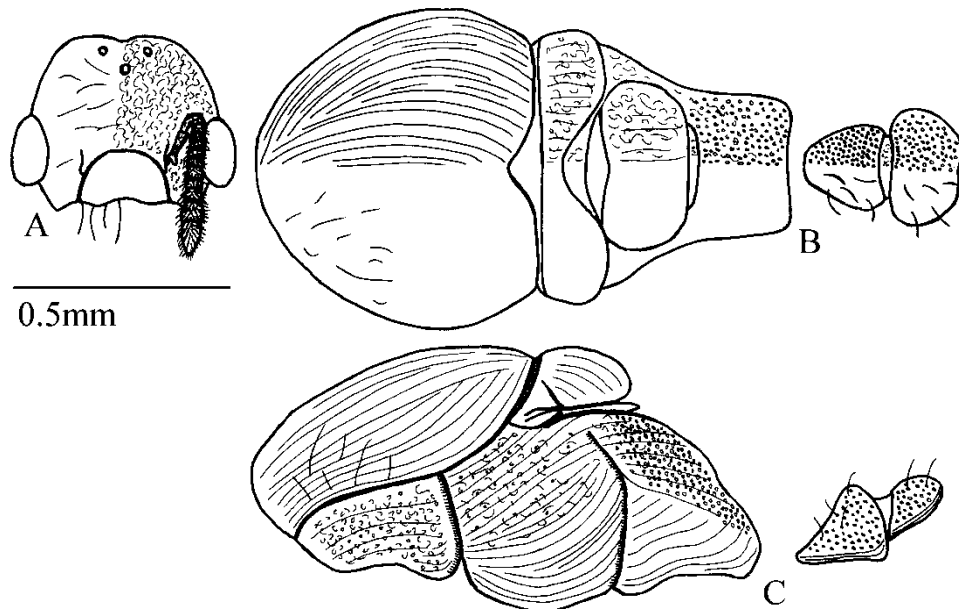


Plate 94. *Crematogaster vermiculata* male: (Silver City, Grant Co., New Mexico, United States CWEM # 8325): A. Head (sculpture is shown on right, pilosity on left); B. Dorsal view of mesosoma, petiole and postpetiole (sculpture is shown on top, pilosity on bottom); C. Side view of mesosoma, petiole and postpetiole.

Male: Mandibles shiny with decumbent hair; clypeus shiny, with few long erect hairs, anterior margin slightly concave with 4-8 long flexuous hairs; scape long in proportion to head for males of this

vermiculata – United States and México

Nests in soil, with mound or under stones, occasionally in wood
Desert shrublands, grasslands, deciduous and pine forests, urban
habitats

Compare with *coarctata*, *lineolata*

genus with appressed hairs and 3 segmented club; ocelli almost flush with top of head, eyes small for male; head shiny areolate and few long fine hairs sparsely scattered.

Mesosoma shiny shallowly striate that follows curvature of mesosoma (viewed from above), with few long and short erect hairs mostly on lateral margins; faintly striate-areolate with few erect hairs (viewed from the side); scutellum rounded posteriorly, very shiny; dorsellum barely visible from above; propodeum deeply punctate, propodeal spines tiny, presence unusual for males of this genus.

Petiole and postpetiole punctate, with few short erect hairs; gaster shiny areolate with few short erect hairs evenly dispersed over dorsum of gaster, pointed posterior.

Concolorous dark brown.

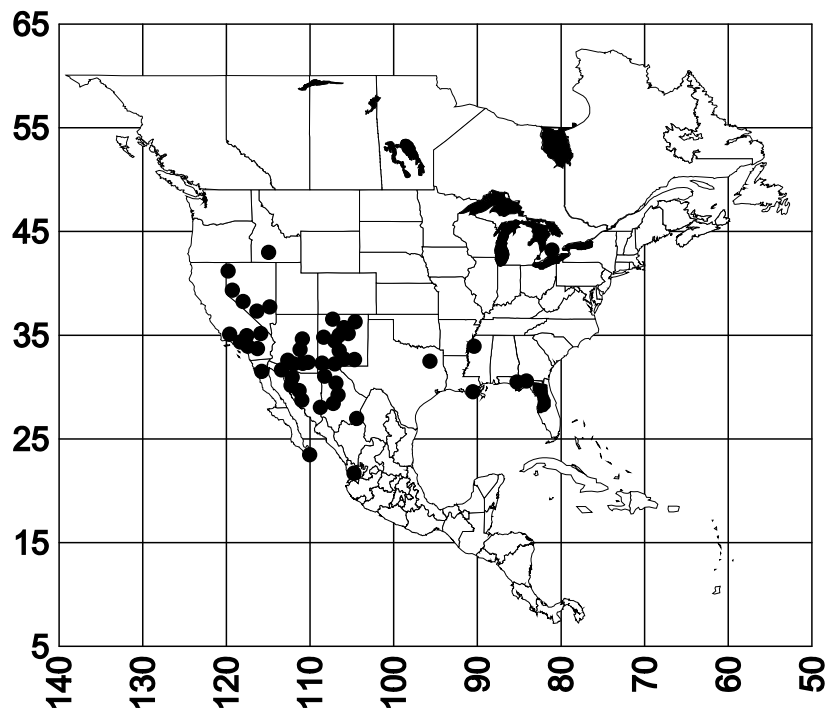
Male measurements (mm): HL 0.49, HW 0.58, SL 0.16, EL 0.20, ED 0.18, CL 0.11, CW 0.18, WL 1.26, PL 0.23, PW 0.22, PPL 0.12, PPW 0.26; Indices: CI 84, SI 39, CLI 61, PI 105, PPI 46.

Distribution: *Crematogaster vermiculata* is found along the Pacific coast of California east to Fairfax Co., Virginia (Kjar, 2009), North Carolina (Menke, et al., 2011; Guénard et al., 2012, 2014; Resasco et al., 2014), Tennessee (Davis and Zigler, 2012), Florida (Deyrup, 2017), Alabama (Forster, 2003; MacGown and Forster, 2005) and Louisiana (Parys et al., 2012) south to Baja California, México (Johnson and Ward, 2002, as *C. rossi*) to central México.

vermiculata - United States and México

Nests in soil, with mound or under stones, occasionally in wood
Desert shrublands, grasslands, deciduous and pine forests, urban
habitats

Compare with *coarctata*, *lineolata*



Map 37. *Crematogaster vermiculata*. In addition to the localities above, this is a common species in southeastern United States (MacGown, pers. comm.).

Type series: *Crematogaster vermiculata*, Los Angeles, California, United States, 2 syntype workers [MNHG]. *Crematogaster colei* Wooten, Sacramento Mountains, New Mexico, United States, 18 paratype workers [LACM], San José, Baja California, 1 paratype worker, 1 paratype queen [LACM], Tepic, México, 7 paratype workers

vermiculata – United States and México

Nests in soil, with mound or under stones, occasionally in wood
Desert shrublands, grasslands, deciduous and pine forests, urban
habitats

Compare with *coarctata*, *lineolata*

[LACM]. *Crematogaster rossi*: San José del Cabo, Baja California, México, paratype workers [LACM]. *Crematogaster opuntiae*, Ajo Mountains, Arizona. 3 paratype workers [LACM] Santa Rita Experimental Range, Arizona, 3 paratype workers [LACM], Benson, Arizona [LACM].

Material examined: **CANADA:** **Ontario**, 1.64k SE Wheatley, Wheatley Campground, 195m (4 ♀ CWEM). **MÉXICO:** **Baja California**, Sonora, (1 ♀ LACM), see also Varela-Hernández and Jones (2013, as *C. rossi*); **Chihuahua**, 9mi E Benito Juárez (10 ♀ CWEM) Buenaventura, Las Varas (7 ♀ CWEM), Estación El Terrero (CWEM) Guerrero, Terrera (10 ♀ CWEM), Janos, 18k NW Ojo Frío (52 ♀ CWEM), Madera (109 ♀, 23 ♀, 35 ♂ CWEM), Namiquipa (26 ♀ CWEM), Río Santa María (8 ♀ LACM), 2 k N Zaragoza (26 ♀ CWEM); **Sonora**, Libertad (3 ♀ MCZC), Magdalena (3 ♀ LACM), Puerto Peñasco (5 ♀ CWEM), Santo Tomás (3 ♀ LACM). **UNITED STATES:** **Arizona**, **Cochise Co.**, Benson (4 ♀ MCZC), Chiricahua Mountains (15 ♀, 1 ♀, 1 ♂ MCZC), Chiricahua National Monument (6 ♀ LACM), Herb Martyr Dam (46 ♀ CWEM), Paradise (10 ♀ CWEM), Portal (26 ♀, 1 ♀ CWEM, 2 ♀ MCZC), 3mi N Portal (3 ♀ CWEM), 8mi SW Portal (CWEM) Rucker (2 ♀ CWEM), Sunny Flat Campground (5 ♀ CWEM), Southwest Research Station (CWEM) Dragoon Mountains, Cochise Stronghold (8 ♀ CWEM), **Gila Co.**, Roosevelt Lake, Grapevine Site, 0.1mi N Jct. Rt. 88 on FSR 84 (33°37.24'N, 111°03.08'W elevation 2350') (18 ♀ MCZC), **Pima**

vermiculata - United States and México

Nests in soil, with mound or under stones, occasionally in wood
Desert shrublands, grasslands, deciduous and pine forests, urban
habitats

Compare with *coarctata*, *lineolata*

Co., 2.5 mi E Continental (CWEM), Tucson (11 ♀ MCZC), **Pinal Co.**, Oracle (3 ♀ MCZC), Oracle Junction (3 ♀ MCZC), **Yavapai Co.**, Congress (8 ♀ CWEM); **California**, **San Bernardino Co.**, New York Mountains, Drum Peak (3 ♀ MCZC), Pasadena (4 ♀ MCZC), **Los Angeles Co.**, San Gabriel Mountains (4 ♀ LACM), Juniper Hills (3 ♀ LACM), **Riverside Co.**, San Jacinto Mountains, Turkey Creek Camp (3 ♀ LACM), **San Diego Co.**, Torrey Pines State Reserve (3 ♀ MCZC), **Santa Barbara Co.**, Figueroa Station, Los Padres (3 ♀ MCZC); **Florida**, **León Co.** Tall Timbers Research Station, Anders Branch (3 ♀ LACM); **Idaho**, **Twin Falls Co.**, Twin Falls (3 ♀ MCZC); **Louisiana**, **Lafourche Parish**, Bayou Boeuf (3 ♀, LACM), see Dash and Hooper-Bùi, 2008; **Mississippi**, **Bolívar Co.**, Skene (4 ♀, 1 ♀, 1 ♂ LACM); **Nevada**, **Esmeralda Co.**, Fish Lake Valley (3 ♀ LACM), Goldfield (6 ♀ LACM), **Lincoln Co.**, Oak Spring Summit (4 ♀ LACM), Lovelock (4 ♀ LACM), **Lyon Co.**, Churchill Butte (3 ♀ MCZC), **Nye Co.**, Shoshone Mountains, Ione (6 ♀ LACM), **Washoe Co.**, Wadsworth (3 ♀ LACM); **New Mexico**, **Bernalillo Co.**, Bosque Forest (1 ♀ CWEM), **Catron Co.**, Luna (9 ♀ LACM), **Colfax Co.**, Eagle Nest, (13 ♀ CWEM), **Doña Ana Co.**, Las Cruces, (3 ♀ CWEM), Aguirre Springs Recreational Area, Organ Mountains campground (10 ♀, 6 ♀, 6 ♂ CWEM), NNE Hallelujah Jct. (39°54'N 120°00'W, 1400m) (3 ♀ MCZC), **Grant Co.**, 77k E Silver City (1 ♀, 1 ♀, 1 ♂ CWEM), Leopold Vista, 1590m (CWEM), **Hidalgo Co.**, Jct. Rt. 9 on Rt. 80 (31°55.20'N 109°02.16W, elevation 4500') (8 ♀ MCZC), Clayton Draw (2 ♀ CWEM), Coronado National Forest (25

vermiculata – United States and México

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Desert shrublands, grasslands, deciduous and pine forests, urban
habitats

Compare with *coarctata*, *lineolata*

♀ CWEM), Peloncillo Mountains at Granite Gap (3 ♀ LACM), **Los Alamos Co.**, Río Grande Canyon near White Rock (12 ♀ CWEM), **Luna Co.**, Deming (3 ♀ CWEM), 18.5k SE Deming, 1380m (4 ♀ CWEM), **Otero Co.**, Wooten, Sacramento Mountains (2 ♀, 1 ♂ LACM), **Río Arriba Co.**, Dixon (9 ♀ CWEM), **Santa Fé Co.**, Santa Fé (10 ♀ CWEM), **Socorro Co.** Interaction highways 330 and 107 (3 ♀ CWEM), near Mount Wittington, 2185m elevation (2 ♀, 1 ♂ CWEM); **Texas**, **Wood Co.**, Hains (5 ♀ CWEM).

Etymology: *vermiculata* from Latin *vermiculātus* meaning inlaid with wavy lines, referring to the coarse vermiculae on the mesosoma.

Discussion: *Crematogaster vermiculata* Emery as its name implies, is very vermiculate on the dorsal surface of the mesosoma. Creighton (1950) made *C. vermiculata* a subspecies of *C. coarctata* Mayr, but indicated that more research was needed to confirm that change in taxonomic status. Buren (1968) raised *C. vermiculata* to species in his key of North American *Crematogaster*. We concur that *C. vermiculata* is a valid species. Creighton's placement of *C. vermiculata* as a subspecies of *C. coarctata* is understandable because they are very much alike. They can be distinguished by a couple of characters. The head of *C. vermiculata* is very shiny with faint areolate between the eyes above the clypeus all the way back and around the posterior border of head while *C. coarctata* is striate-punctate all over the face to the back of the posterior border of head. The pronotum of

vermiculata - United States and México

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C. vermiculata is slightly flattened coming to corners along the lateral margins while *C. coarctata* has a rounded pronotum, both viewed from above and from the front. The vermiculate sculpturing is somewhat variable, blending with punctures on both species making the pronotal sculpturing not a great character to use for distinguishing these two species.

Crematogaster vermiculata can be confused with *C. lineolata*, but they can be easily separated as *C. vermiculata* has few or no erect hairs on the pronotum whereas the hairs are abundant on the pronotum of *C. lineolata*.

We are considering *C. colei* Buren, *C. opuntiae* Buren and *C. rossi* Buren as junior synonyms of *C. vermiculata*. Some of the *C. colei* and *C. opuntiae* paratypes have shiny heads and the pronotum drops directly on the sides as in *C. vermiculata*. Paratype specimens of *C. opuntiae* are identical to the type material we have examined of *C. vermiculata* having the intense vermiculae with punctures and the pronotum that drops flatly along the sides, and have the very shiny head. Buren's description of *C. opuntiae* describes the humeri as "not strongly developed, but nearly always distinct," giving *C. opuntiae* the same general build as *C. vermiculata*. *Crematogaster rossi* Buren is also identical to *C. vermiculata*, and we believe if there had not been some confusion as to the type locality of *C. vermiculata*, *C. rossi* would not have been described.

MacGown (pers. comm.) suggested that the form found in southeastern United States may not be the same species as *C. vermiculata* (type locality in California) as the southeastern form is

vermiculata – United States and México

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Compare with *coarctata*, *lineolata*

always found near wet areas such as swamps, seeps and creeks, and never nests in the soil.

Biology: *Crematogaster vermiculata* nearly always nests in the soil, occasionally with a small mound, or under stones (Mackay and Mackay, unpublished). Menke, et al. (2011) found that *C. vermiculata* prefers to nest in wood and leaf litter, under stones and in dead tree limbs on a variety of desert substrates such as halophytic soil, clay and sandy beaches. In the southeastern United States, they are found only nesting in cypress trees in swamps (MacGown, pers. comm.)

Brood were found in nests in April, May, June, September, sexuals in September (Mackay and Mackay, unpublished). Workers forage loose on ground and on vegetation. In arid sites, they are often found on cholla (*Opuntia bigelovii*, as well as other cactus species) (Mackay and Mackay, unpublished). They occasionally nest together with the ant *Monomorium* sp. and crickets (*Myrmecophila* sp.) are found in nests (Mackay and Mackay, unpublished).

Crematogaster vermiculata can be found in desert scrub (mesquite and cactus, junipers, *Acacia* and grass), grasslands (*Bouteloua* spp.), pinyon juniper forests, oak forest, alligator bark juniper/white oak forest, cottonwood riparian areas, deciduous forests, pine and fir forest, Apache and Chihuahua pines and burned forest (Mackay and Mackay, unpublished). It was reported from Lehman's love grass and native grass communities (Whitford et al., 1999, as *C. opuntiae*). In general, they do not do well in disturbed areas as they nest in logs, which are not available in such sites (Menke, et al. (2011).

vermiculata - United States and México

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They can adapt to urban ecosystems (Guénard et al., 2014).

Nests are found in red clay, dark brown sandy loam, brown rocky loam, light brown rocky sand and in sand (Mackay and Mackay, unpublished).

Crematogaster vermiculata population increase with an increase in growing degree days (warming of habitat) (Pelini et al., 2014).

Deyrup (2017) includes details on the biology and distribution of this species as well as comparisons with other species occurring in Florida.

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Conclusion

Hopefully, some of the taxonomic confusion in North American *Crematogaster* species has been clarified with this work, by using types of most of the species. In this region 51 taxa had been described, through taxonomic revisions here several species and subspecies have been synonymized, and one subspecies has been raised to species. When type material was unavailable, we used material identified by either Buren or Longino. The 51 recognized taxa were reduced to 38 species and one unresolved subspecies (see below). The ranges of almost all species have been extended through the integration of information found in species descriptions, associated with specimens and in the literature.

We have found disjointed distributions of some species. One species, *Crematogaster laeviuscula*, occurs in riparian areas surrounded by arid environments. It has been mostly collected north of México; however, our colleague Dr. Israel Del Toro, collected this species in Tamaulipas, México. We do not believe this collection is an outlier, just collecting bias between the southern border of the United States and central and southern México. Another species, *C. sotobosque*, is found in tropical Costa Rica; however, 2 individual workers were found loose on the ground on top of Mt. Lemmon in Arizona, United States. Several species have poorly known distributions such as *C. patei* and *C. formosa* both found in central México. Some species are widely collected, such as *C. cerasi* and *C. depilis* and have a wide distribution in cities, rural and unpopulated habitats. Other species such as *C. pinicola* are more specialized or prefer undisturbed habitats.

There are some species/subspecies in which we do not have enough material or field observations to make concrete taxonomic determinations. *Crematogaster coarctata* and *C. mutans* are one such case where the workers are identical but the queens are slightly different. We do not know if this is just variation of the queens within a species or the basis of two species. *Crematogaster cubaensis* appears to be a synonym of *C. missouriensis*, based on one syntype worker of the former, further examination of larger series and the queens will be necessary to confirm this suggestion.

Some specimens of type material were mounted poorly and many identifying structures were obscured by glue or missing. This is particularly true of older specimens. Therefore, some of our descriptions, illustrations and measurements were completed using additional non-type material. When available we have examined many specimens from different nest series so that we could best understand and describe the variation within the species.

A very important aspect of a taxonomic review is the knowledge of nesting habits and obligate resources. Most collections are associated with a city or along a highway, but species that prefer less disturbed ecosystems are usually collected as foragers and not with a nest series. Future work would include more field expeditions that allow scientists to spend more time in unpopulated areas.

Despite these obstacles, we hope that we have made progress in resolving the taxonomy of North American *Crematogaster*. The species richness of the genus *Crematogaster* in North America has not been fully described and taxonomic relationships fully resolved. Hopefully this work will stimulate more work on this fascinating genus.

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Literature Cited

- Abouheif, E. and G. Wray. 2002. Evolution of the gene network underlying wing polyphenism in ants. *Science* 297:249-252.
DOI: 10.1126/science.1071468 ,
- Achury, R., P. Chacón de Ulloa and A. Arcila. 2008. Composición de hormigas e interacciones competitivas con *Wasmannia auropunctata* en fragmentos de Bosque seco Tropical. *Revista Colombiana de Entomología* 34: 209-216.
- Alatorre-Bracamontes, C. and M. Vásquez-Bolaños. 2010. Lista comentada de las hormigas (Hymenoptera: Formicidae) del norte de México. *Dugesiana* 17: 9-36
- Albrecht, M. and N. Gotelli. 2001. Spatial and temporal niche partitioning in grassland ants. *Oecologia* 126: 134–141.
DOI10.1007/s004420000494
- Armbrecht, I. and P. Ulloa-Chacón. 1999. Rareza y diversidad de hormigas en fragmentos de bosque seco colombianos y sus matrices. *Biotropica* 31: 646-653.
- Anderson, C. and D. McShea. 2001. Intermediate-level parts in insect societies: adaptive structures that ants build away from the nest. *Insectes Sociaux* 48: 291-301.
- Araújo, M., A. Mayhé-Nunes and J. Queiroz. 2007. Diversidade de formigas do estado do Rio de Janeiro (Hymenoptera: Formicidae). *Biológico, São Paulo* 69, supplement 2: 285-287.
- Baldacci, J. and W. Tschinkel. 1999. An experimental study of colony-founding in pine saplings by queens of the arboreal ant, *Crematogaster ashmeadi*. *Insectes Sociaux* 46: 41-44.

- Barbera, N., L. Hilje, P. Hanson, J. Longino, M. Carballo and E. de Melo. 2004. Diversidad de especies de hormigas en un gradiente de cafetales orgánicos y convencionales. *Manejo Integrado de Plagas y Agroecología (Costa Rica)* No. 72: 60-71.
- Beattie, A. and D. Culver. 1981. The guild of myrmecochores in the herbaceous flora of West Virginia forests. *Ecology* 62:107-115.
- Beggiato Baccaro, F., S. Ketelhut and J. Wellington de Morais. 2010. Resource distribution and soil moisture content can regulate bait control in an ant assemblage in Central Amazonian forest. *Austral Ecology* 35: 274–281.
- Beggiato Baccaro, F., J. de Souza, E. Franklin, V. Landeiro and W. Magnusson. 2012. Limited effects of dominant ants on assemblage species richness in three Amazon forests. *Ecological Entomology* 37: 1–12.
- Bernstein, R. 1978. Slavery in the subfamily Dolichoderinae (F. Formicidae) and its ecological consequences. *Experientia* 34:1281-1282.
- Bernstein, R. 1979a. Evolution of niche breadth in populations of ants. *American Naturalist* 114: 533-544.
- Bernstein, R. 1979b. Schedules of foraging activity in species of ants. *Journal of Animal Ecology* 48: 921-930.
- Bestelmeyer, B. 2005. Does desertification diminish biodiversity? Enhancement of ant diversity by shrub invasion in southwestern USA. *Diversity and Distributions* 11: 45–55.
- Bestelmeyer, B. and J. Wiens. 2001a. Ant biodiversity in semiarid landscape mosaics: the consequences of grazing vs. natural heterogeneity. *Ecological Applications* 11: 1123–1140.

- Bestelmeyer, B. and J. Wiens. 2001b. Local and regional-scale responses of ant diversity to a semiarid biome transition. *Ecography* 24: 381-392.
- Bhatkar, A. and W. Whitcomb. 1970. Artificial diet for rearing various species of ants. *Florida Entomologist* 53: 229-232.
- Blaimer, B. 2012a. A subgeneric revision of *Crematogaster* and discussion of regional species-groups (Hymenoptera: Formicidae). *Zootaxa* 3482: 47-67.
- Blaimer, B. 2012b. Acrobat ants go global - origin, evolution and systematics of the genus *Crematogaster* (Hymenoptera: Formicidae). *Molecular Phylogenetics and Evolution* 65: 421–436.
- Blom, P. and W. Clark. 1980. Observations of ants (Hymenoptera: Formicidae) visiting extrafloral nectaries of the barrel cactus, *Ferocactus gracilis* Gates (Cactaceae), in Baja California, México. *Southwestern Naturalist* 25: 181-195.
- Bolton, B. 1995. *A New General Catalogue of the Ants of the World*. Harvard University Press. Cambridge, MA. 504 pp.
- Bolton, B., G. Alpert, P. Ward, and P. Naskrecki. 2006. *Bolton's Catalogue of Ants of the World: 1758-2005*. CD, Harvard University Press. Cambridge, Massachusetts.
- Borgmeier, T. 1929. Zur Kenntnis der brasilianischen Ameisen. *Eos Revista Española de Entomología* 5: 195-214.
- Bossard, C. 1991. The role of habitat disturbance, seed predation and ant dispersal on establishment of the exotic shrub *Cytisus scoparius* in California. *American Midland Naturalist* 126: 1-13.
- Boudinot, B. 2013. The male genitalia of ants: musculature, homology, and functional morphology (Hymenoptera, Aculeata, Formicidae). *Journal of Hymenoptera Research* 30: 29-49.

DOI: 10.3897/jhr.30.3535

- Bouwma, A., K. Howard and R. Jeanne. 2007. Rates of predation by scouting-and-recruiting ants on the brood of a swarm-founding wasp in Costa Rica. *Biotropica* 39: 719–724.
- Bradshaw J., J. Prasifka, K. Steffey and M. Gray. 2010. First report of field populations of two potential aphid pests of the bioenergy crop *Miscanthus x giganteus*. Panhandle Research and Extension Center, Paper 38
- Branstetter, M. and L. Sáenz. 2012. Las hormigas (Hymenoptera: Formicidae) de Guatemala. *Biodiversidad* 2: 221-268.
- Brown, W. 1949. Synonymic and other notes on Formicidae (Hymenoptera). *Psyche* 56: 41-49.
- Buckley, S. 1867. Descriptions of new species of North American Formicidae. *Proceedings of the Entomological Society of Philadelphia* 6: 335-350.
- Buczowski, G. and D. Richmond. 2012. The effect of urbanization on ant abundance and diversity: a temporal examination of factors affecting biodiversity. *PLoS ONE* 7(8): e41729.
DOI: 10.1371/journal.pone.0041729.
- Buren, W. 1958. A Review of the species of *Crematogaster*, sensu stricto, in North America (Hymenoptera: Formicidae) Part I. *Journal of the New York Entomological Society* 66: 119-134.
- Buren, W. 1968. A review of the species of *Crematogaster*, sensu stricto, in North America (Hymenoptera: Formicidae). Part II. Descriptions of new species. *Journal of the Georgia Entomological Society* 3: 91-121.
- Buren, W., G. Allen, W. Whitcomb, F. Lennartz and R. Williams. 1974. Zoogeography of the imported fire ants. *Journal of the New York Entomological Society* 82: 113-124.

- California Academy of Sciences, AntWeb (www.antweb.org). Last accessed 2017-06-02.
- Carroll, T. 2011. The ants of Indiana (Hymenoptera: Formicidae). Master's Thesis, Purdue University, xiv + 394 pp.
- Campbell, K., H. Klompen and T. Crist. 2013. The diversity and host specificity of mites associated with ants: the roles of ecological and life history traits of ant hosts. *Insectes Sociaux* 60:31-41. DOI:10.1007/s00040-012-0262-6
- Carvalho, K. and H. Vasconcelos. 2002. Comunidade de formigas que nidificam em pequenos galhos da serrapilheira em floresta da Amazônia Central, Brazil. *Revista Brasileira de Entomologia* 46: 115-121.
- Cassill, D. and W. Tschinkel. 1996. A duration constant for worker-to-larva trophallaxis in fire ants. *Insectes Sociaux* 43:149-166.
- Castaño-Meneses, G. 2014. Trophic guild structure of a canopy ant community in a Mexican tropical deciduous forest. *Sociobiology* 61: 35-42.
- Cazier, M. and M. Statham. 1962. The behavior and habits of the myrmecophilous scarab *Cremastocheilus stathamae* Cazier with notes on other species (Coleoptera: Scarabaeidae). *Journal of the New York Entomological Society* 70: 125-149.
- Chacón de Ulloa, P., A. Osorio-García, R. Achury and C. Bermúdez Rivas. 2012. Hormigas (Hymenoptera: Formicidae) del bosque seco tropical (Bs-T) de la Cuenca Alta del Río Cauca, Colombia. *Biota Colombiana* 13: 165-181.
- Chamberlain, S. and J. Holland. 2008. Density-mediated, context-dependent consumer–resource interactions between ants and extrafloral nectar plants. *Ecology* 89:1364-1374.

- Chamberlain, S. and J. Holland. 2009. Body size predicts degree in ant-plant mutualistic networks. *Functional Ecology* 23: 196-202.
- Chen, X., B. Adams, C. Bergeron, A. Sabo and L. Hooper-Bùi. 2015. Ant community structure and response to disturbances on coastal dunes of Gulf of México. *Journal of Insect Conservation* 19: 1–13. DOI:10.1007/s10841-014-9722-9
- Childress, E. and A. Koning. 2013. Polydomous *Crematogaster pilosa* (Hymenoptera: Formicidae) colonies prefer highly connected habitats in a tidal salt marsh. *Florida Entomologist* 96: 235-237.
- Clouse, R. 1995. Nest usurpation and intercolonial cannibalism in *Mischocyttarus mexicanus* (Hymenoptera: Vespidae). *Journal of the Kansas Entomological Society* 68: 67-73.
- Cokendolpher, J., J. Rendell, S. Taylor, J. Krejca, A. Suarez, and C. Pekins. 2009. Further ants (Hymenoptera: Formicidae) from caves of Texas. *Texas Memorial Museum Speleological Monographs*, 7. Studies on the cave and endogean fauna of North America, V. Pp. 151-168.
- Colby, D. 2002. Effects of fire frequency and the red imported fire ant on insects in a Louisiana longleaf pine savanna. Dissertation, Louisiana State University, v + 78 pp.
- Colby, D. and D. Powell. 2006. Ants (Hymenoptera: Formicidae) in wet longleaf pine savannas in Louisiana. *Florida Entomologist* 89: 266-269.
- Cole, B. 1980. Repertoire convergence in two mangrove ants, *Zacryptocerus varians* and *Camponotus (Colobopsis)* sp. *Insectes Sociaux* 27: 265-275.

- Cook, J. 2009. New host association, distribution, and morphological variation in *Caenocholax fenyesei* (Strepsiptera: Myrmecolacidae). *Proceedings of the Entomological Society of Washington* 111: 370-377.
- Coriolano, R., M. Andrade Estrada, N. Torres dos Santos, L. Ricardo Caixeiro, A. Barbosa Vargas, and F. Souto Almeida. 2014. Mirmecofauna associada à arborização urbana no município de Três Rios, RJ, Brazil. *Revista Brasileira de Biociências, Porto Alegre* 12: 210-214.
- Coronado-Blanco, J., D. Dubovikoff, E. Ruíz-Cancino, M. Vásquez-Bolaños, K. Flores-Maldonado and J. Horta-Vega. 2013. Formicidae (Hymenoptera) del estado de Tamaulipas, México. *Ciencia UAT* 4: 12-17.
- Costa-Milanez, C., G. Lourenço-Silva, P. Castro, J. Majer and S. Ribeiro, 2014. Are ant assemblages of Brazilian veredas characterized by location or habitat type? *Brazilian Journal of Biology* 74: 89-99.
- Creighton, W. 1939. A new subspecies of *Crematogaster minutissima* with revisionary notes concerning that species (Hymenoptera: Formicidae). *Psyche* 46: 137-140.
- Creighton, W. 1950. The ants of North America. *Bulletin of the Museum of Comparative Zoology of Harvard College* 104: 1-585.
- Cruz de Oliveira, A. 2013. Padrões temporais de diversidade: dinâmica de assembleias de formigas de liteira (Hymenoptera: Formicidae) em 25 km² de floresta Amazônica. Thesis, Instituto Nacional De Pesquisas Da Amazônia – INPA, xi + 44 pp.
- Dalla Torre, C. 1893. *Catalogus hymenopterorum hucusque descriptorum systematicus et synonymicus*, 7: Formicidae (Heterogyna). *Sumptibus Guilelmi Engelmann, Lipsiae*. 289pp.

- Dash, S. 2004. Species diversity and biogeography of ants (Hymenoptera: Formicidae) in Louisiana, with notes on their ecology. Thesis, Louisiana State University, v + 290.
- Dash, S. T. and L. M. Hooper-Bùi. 2008. Species diversity of ants (Hymenoptera: Formicidae) in Louisiana. *Annals of the Entomological Society of America* 101: 1056-1066.
- Davies, T. 2009. The ants of South Carolina. Dissertation, Clemson University, xii + 257 pp.
- Davis, R. and K. Zigler. 2012. Ant (Hymenoptera: Formicidae) communities of the Southern Cumberland Plateau. *Annals of the Entomological Society of America* 105: 484- 492.
- Dejean, A., B. Corbara and J. Orivel. 1999. The arboreal ant mosaic in two Atlantic rain forests. *Selbyana* 20: 133-145.
- Dejean, A., J. Delabie, B. Corbara, F. Azémar, S. Groc, J. Orivel, and M. Leponce. 2012. The Ecology and Feeding Habits of the Arboreal Trap-Jawed Ant *Daceton armigerum*. *PLoS ONE* 7(5): 8 pp, e37683. DOI:10.1371/journal.pone.0037683.
- Dejean, A., S. Durou, I. Olmsted, R. Snelling and J. Orivel. 2003. Nest site selection by ants in a flooded Mexican mangrove, with special reference to the epiphytic orchid *Myrmecophila christinae*. *Journal of Tropical Ecology* 19: 325-331.
- Delabie, J., B. Jahyny, I. Cardoso do Nascimento, C. Mariano S. Lacau, S. Campiolo, S. Philpott and M. Leponce. 2007. Contribution of cocoa plantations to the conservation of native ants (Insecta: Hymenoptera: Formicidae) with a special emphasis on the Atlantic Forest fauna of southern Bahia, Brazil. *Biodiversity and Conservation* 16: 2359–2384.

- Dejean, A., A. Quilichini, J. Delabie, J. Orivel, B. Corbara and M. Gibernau. 2004. Influence of its associated ant species on the life history of the myrmecophyte *Cordia nodosa* in French Guiana. *Journal of Tropical Ecology* 20: 701-704.
- Del Toro, I., M. Vázquez, W. Mackay, P. Rojas and R. Zapata-Mata. 2009. Hormigas (Hymenoptera: Formicidae) de Tabasco: explorando la diversidad de la mirmecofauna en las selvas tropicales de baja altitud. *Dugesiana* 16: 1-14.
- Deyrup, M. 2007. An acrobat ant, *Crematogaster obscurata* (Hymenoptera: Formicidae), poses an unusual conservation question in the Florida Keys. *Florida Entomologist* 90 :753-754. DOI:<http://dx.doi.org/10.1653/0015-4040> (2007)90 [753: AAACOH] 2.0.CO;2
- Deyrup, M. 2017. *Ants of Florida, Identification and Natural History*. CRC Press, xiii+ 423 pp.
- Deyrup, M., N. Carlin, J. Trager and G. Umphrey. 1988. A review of the ants of the Florida Keys. *Florida Entomologist* 71: 163-176.
- Deyrup, M. and S. Cover. 2007. A New Species of *Crematogaster* from the pinelands of the Southeastern United States. *Memoirs of the American Entomological Institute* 80: 108-112.
- Deyrup, M. and J. Trager. 1986. Ants of the Archbold Biological Station, Highlands Co., Florida (Hymenoptera: Formicidae). *Florida Entomologist* 69: 206-228.
- Dubovikoff, D. and J. Longino. 2004. A new species of the genus *Bothriomyrmex* Emery, 1869 (Hymenoptera: Formicidae: Dolichoderinae) from Costa Rica. *Zootaxa* 776: 1-10.
- Elias, T. and H. Gelband. 1975. Nectar: its production and functions in trumpet creeper. *Science, New Series* 189: 289-291. DOI: 10.1126/science.189.4199.289

- Emery, C. 1895. Beiträge zur Kenntniss der nordamerikanischen Ameisenfauna. (Schluss.) Zoologische Jahrbücher Abteilung für Systematik Ökologie und Geographie der Tiere 8: 282-288.
- Emery, C. 1922. Hymenoptera, Family Formicidae, subfam. Myrmicinae. Genera Insectorum 174B: 95-206.
- Enzmann, J. 1946. *Crematogaster lineolata cerasi*, the cherry ant of Asa Fitch (with a survey of the American forms of *Crematogaster*, subgenus *Acrocoelia*). Journal of the New York Entomological Society 54: 89-97.
- Espadaler, X., N. Pérez Hidalgo and W. Villalobos Muller. 2012. Ant-aphid relations in Costa Rica, Central America (Hymenoptera: Formicidae; Hemiptera: Aphididae). Sociobiology 59: 959-970.
- Estrada, M., R. Esteves Coriolano, N. Torres Santos, L. Caixeiro, A. Barbosa Vargas and F. Souto Almeida. 2014. Influência de áreas verdes urbanas sobre a mirmecofauna. Floresta e Ambiente 21: 162-169.
- Fabricius, J. C. 1804. Systema Piezatorum. Carolum Reichard, Brunsviga. 439 pp.
- Feener, D. 1981. Notes on the biology of *Pheidole lamia* (Hymenoptera: Formicidae) at its type locality (Austin, Texas). Journal of the Kansas Entomological Society 54: 269-277.
- Felizardo, S. and A. Harada. 2007. O gênero *Crematogaster* Lund, 1831 (Formicidae: Myrmicinae: Crematogastrini) da coleção de formigas do Museu Paraense Emílio Goeldi (MPEG). Biológico, São Paulo, v.69, Suplemento 2: 425-427.
- Fisher, B. 1997. A comparison of ant assemblages (Hymenoptera, Formicidae) on serpentine and non-serpentine soils in northern California. Insectes Sociaux 44: 23-33.

- Fitch, A. 1855. First report on the noxious, beneficial and other insects of the state of New York made to the State Agricultural Society, pursuant to an approbation for this purpose from the Legislature of the State. Transactions of the New York State Agricultural Society 1854: 705-880.
- Fontalvo-Rodríguez, L. and C. Solís-Medina. 2009. Ensamblaje de hormigas (Hymenoptera: Formicidae) en fragmentos de bosque seco en el complejo carbonífero El Cerrejón (La Guajira, Colombia). Revista del Instituto de Investigaciones Tropicales 4:5-15.
- Forel, A. 1885. Etudes myrmécologiques en 1884; avec une description des organes sensoriels des antennes. Bulletin de la Société Vaudoise des Sciences Naturelles 20: 316-380.
- Forel, A. 1893. Formicidés de l'Antille St. Vincent, récoltés par Mons. H. H. Smith. Transactions of the Entomological Society of London 1893 : 333-418.
- Forel, A. 1897. Quelques formicides de l'Antille de Grenada récoltés par M. H. H. Smith. Transactions of the Entomological Society of London 1897: 297-300.
- Forel, A. 1899. Biologia Centrali-Americana; or, contributions to the knowledge of the fauna and flora of México and Central America. Insecta. Hymenoptera. 3 (Formicidae), London. 169 pp.
- Forel, A. 1901a. Fourmis mexicaines, récoltés par M. le Professeur W. M. Wheeler. II. A propos de la classification des fourmis. Annales de la Société Entomologique de Belgique 45: 123-141.
- Forel, A. 1901b. Formiciden des Naturhistorischen Museums zu Hamburg. Neue *Calypatomyrmex*-, *Dacryon*-, *Podomyrma*-, und *Echinopla*-Arten. Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten 18: 45-82.

- Forel, A. 1901c. Einige neue Ameisen aus Südbrasilien, Java, Natal und Mossamedes. Mittheilungen der Schweizerischen Entomologischen Gesellschaft 10: 297-311.
- Forel, A. 1903. Mélanges entomologiques, biologiques et autres. Annales de la Société Entomologique de Belgique 47: 249-268.
- Forel, A. 1904. Miscellanea myrmécologiques. Revue Suisse de Zoologie 12: 1-52.
- Forel, A. 1907. Formicides du Musée National Hongrois. Annales Historico-Naturales Musei Nationalis Hungarici 5: 1-42.
- Forel, A. 1908a. Fourmis de Costa-Rica, récoltées par M. Paul Biolley. Bulletin de la Société Vaudoise des Sciences Naturelles 44: 35-72.
- Forel, A. 1908b. Ameisen aus São Paulo (Brasilien), Paraguay, etc. gesammelt von Prof. Herm. v. Ihering, Dr. Lutz, Dr. Fiebrig, etc. Verhandlungen der k. k. Zoologisch-Botanischen Gesellschaft in Wien 58: 340-418.
- Forel, A. 1909. Ameisen aus Guatemala usw., Paraguay und Argentinien (Hym.). Deutsche Entomologische Zeitschrift 1909: 239-269.
- Forel, A. 1911. Ameisen des Herrn Prof. v. Ihering aus Brazslien (São Paulo usw.) nebst einigen anderen aus Südamerika und Afrika (Hym.). Deutsche Entomologische Zeitschrift 1911: 285-312.
- Forel, A. 1912. Formicides Néotropiques. Part III. 3^{me} SOUS-FAMILLE MYRMICINÆ (suite). Genres *Crematogaster* et *Pheidole*. Mémoires de la Société Entomologique de Belgique 19: 211-237.

- Forel, A. 1914. Quelques fourmis de Colombie. In : Fuhrmann, O. and E. Mayor. Voyage D'exploration Scientifique en Colombie. Mémoires de la Société Neuchâteloise des Sciences Naturelles 5: 9-14 (1090 pp.).
- Forster, J. 2003. The ants (Hymenoptera: Formicidae) of Alabama. Thesis, Auburn University, xvii + 224 pp.
- Freitas, J., J. Delabie and S. Lacau. 2014. Composition and diversity of ant species into leaf litter of two fragments of a semi-deciduous seasonal forest in the Atlantic Forest Biome in Barra do Choça, Bahia, Brazil. *Sociobiology* 61: 9-20.
- Frye, J. and C. Frye. 2012. Associations of ants (Hymenoptera: Formicidae) on oaks and pines in inland dune and ridge woodlands in Worcester Co., Maryland. *Maryland Entomologist* 5: 37-46.
- Fuster, A. 2012. Especies de hormigas asociadas a *Prosopis ruscifolia* Griseb. en ambientes salinos del Chaco Semiárido. *Revista de Ciencias Forestales Quebracho (Santiago del Estero)* 20: 29-38.
- Gaddy, L. 1986. Twelve new ant-dispersed species from the southern Appalachians. *Bulletin of the Torrey Botanical Club* 113: 247-251.
- Gallardo, A. 1934. Las hormigas de la República Argentina. Subfamilia mirmicinas, segunda sección Eumyrmicinae, tribu Crematogastrini (Forel), género *Crematogaster* Lund. *Anales del Museo Nacional de Ciencias Naturales de Buenos Aires* 38: 1-84.
- García-Martínez, M., J. Valenzuela González, D. Martínez-Tlapa and L. Quiroz-Robledo. 2013. New ant species (Hymenoptera: Formicidae) records for Veracruz State and México. *Southwestern Entomologist*, 38: 661-666.
DOI: <http://dx.doi.org/10.3958/059.038.0411>

- Gegenbauer, G., V. Mayer, G. Zotz and A. Richter. 2012. Uptake of ant-derived nitrogen in the myrmecophytic orchid *Caularthron bilamellatum*. *Annals of Botany* 110: 757–765.
- General, D. and L. Thompson. 2007. Ants (Hymenoptera: Formicidae) of Arkansas Post National Memorial. *Journal of the Arkansas Academy of Science* 61:59-64.
- General, D. and L. Thompson. 2008. New distributional records of ants in Arkansas. *Journal of the Arkansas Academy of Science* 62: 148-150.
- General, D. and L. Thompson. 2009. New distributional records of ants in Arkansas for 2008. *Journal of the Arkansas Academy of Science* 63: 182-184.
- Gibernau, M., J. Orivel, J. Delabie, D. Barabé and A. Dejean. 2007. An asymmetrical relationship between an arboreal ponerine ant and a trash-basket epiphyte (Araceae). *Biological Journal of the Linnaean Society* 91: 341-346.
- Godínez-Alvarez, H. and A. Valiente-Banuet. 2004. Demography of the columnar cactus *Neobuxbaumia macrocephala*: a comparative approach using population projection matrices. *Plant Ecology* 174: 109-118.
DOI:org/10.1023/B%3AVEGE.0000046052.35390.59
- Gove, A. and J. Majer. 2006. Do isolated trees encourage arboreal ant foraging at ground-level? Quantification of ant activity and the influence of season, in Veracruz, México. *Agriculture, Ecosystems & Environment* 113: 272–276.
DOI:10.1016/j.agee.2005.09.019

- Gove, A., J. Majer and V. Rico-Gray. 2005. Methods for conservation outside of formal reserve systems: The case of ants in the seasonally dry tropics of Veracruz, México. *Biological Conservation* 126:328–338.
DOI:10.1016/j.biocon.2005.06.008
- Graham, J., A. Krzysik, D. Kovacic, J. Duda, D. Freeman, J. Emlen, J. Zak, W. Long, M. Wallace, C. Chamberlin-Graham, J. Nutter and H. Balbach. 2008. Ant community composition across a gradient of disturbed military landscapes at Fort Benning, Georgia. *Southeastern Naturalist* 7: 429-448.
- Guénard B., A. Cardinal-De Casas and R. Dunn. 2014. High diversity in an urban habitat: are some animal assemblages resilient to long-term anthropogenic change? *Urban Ecosystems* DOI:10.1007/s11252-014-0406-8.
- Guénard, B., K. McCaffrey, A. Lucky and R. Dunn. 2012. Ants of North Carolina: an updated list (Hymenoptera: Formicidae). *Zootaxa* 3552: 1–36.
- Hahn, D. and W. Tschinkel. 1997. Settlement and distribution of colony-founding queens of the arboreal ant, *Crematogaster ashmeadi*, in a longleaf pine forest. *Insectes Sociaux* 44: 323-336.
- Hansson, C., J.-P. Lachaud and G. Pérez-Lachaud. 2011. Entedoninae wasps (Hymenoptera, Chalcidoidea, Eulophidae) associated with ants (Hymenoptera, Formicidae) in tropical America, with new species and notes on their biology. *ZooKeys* 134: 65-82.
- Haug, G. 1934. Effect of argentine ant poison on the ant fauna of Mississippi. *Annals of the Entomological Society of America* 27: 621-632.

- Heredia, A., J. C. de Biseau and Y. Quinet. 2005. Toxicity of the venom in three Neotropical *Crematogaster* ants (Formicidae: Myrmicinae). *Chemoecology* 15: 235–242.
- Heinze, J., S. Cover and B. Hölldobler. 1995. Neither worker, nor queen: an ant caste specialized in the production of unfertilized eggs. *Psyche* 102: 173–185.
- Heinze, J., S. Foitzik, B. Oberstadt, O. Rüppell and B. Hölldobler. 1999. A female caste specialized for the production of unfertilized eggs in the ant *Crematogaster smithi*. *Naturwissenschaften* 86: 93–95.
- Herrera, H., J. Longino and W. Dekoninck. 2014. New records of nine ant species (Hymenoptera: Formicidae) for the Galapagos Islands. *Pan-Pacific Entomologist*, 90: 72–81.
DOI: <http://dx.doi.org/10.3956/2014-90.2.72>
- Hess, C. and F. James. 1998. Diet of the red-cockaded woodpecker in the Apalachicola National Forest. *The Journal of Wildlife Management* 62: 509–517.
- Hill, J. 2006. Environmental variables affecting ant (Formicidae) community composition in Mississippi's black belt and flatwoods regions. Thesis, Mississippi State University. x + 72 pp.
- Hill, J. 2012. The ant (Hymenoptera: Formicidae) fauna of the cedar glades and xeric limestone prairies of the central basin of Tennessee. *Journal of the Tennessee Academy of Science* 87: 135–142.
- Hill, J. and R. Brown. 2010. The ant (Hymenoptera: Formicidae) fauna of black belt prairie remnants in Alabama and Mississippi. *Southeastern Naturalist* 9:73–84.

- Holland, J. N., S.A. Chamberlain and K. C. Horn. 2009. Optimal defense theory predicts investment in extrafloral nectar resources in an ant–plant mutualism. *Journal of Ecology* 97: 89–96.
- Holland, J. N., S.A. Chamberlain and K. C. Horn. 2010. Temporal variation in extrafloral nectar secretion by reproductive tissues of the senita cactus, *Pachycereus schottii* (Cactaceae), in the Sonoran Desert of México. *Journal of Arid Environments* 74: 712–714.
- Hölldobler, B. and E. Wilson. 1977. The number of queens: an important trait in ant evolution. *Naturwissenschaften* 64: 8-15.
- Hölldobler, B. 1986. Food robbing in ants, a form of interference competition. *Oecologia* 69: 12-15.
- Hölldobler, B., and E. Wilson. 1990. *The Ants*. Belknap Press of Harvard University Press. Cambridge, MA. 732 pp.
- Holway, D. and A. Suarez. 2006. Homogenization of ant communities in mediterranean California: The effects of urbanization and invasion. *Biological Conservation* 127: 319-326.
- Horvitz, C. and D. Schemske. 1984. Effects of ants and an ant-tended herbivore on seed production of a Neotropical herb. *Ecology* 65: 1369-1378. <http://www.jstor.org/stable/1939117>
- Hossaert-McKey, M., J. Orivel, E. Labeyrie, L. Pascal, J. Delabie and A. Dejean. 2001. Differential associations with ants of three co-occurring extrafloral nectary-bearing plants. *Ecoscience* 8: 325-335.
- Houadria, M., A. Salas-Lopez, J. Orivel, N. Blüthgen and F. Menzel. 2015. Dietary and Temporal Niche Differentiation in Tropical Ants - Can They Explain Local Ant Coexistence? *Biotropica* 47: 208–217.

- Howard, D., M. Blum, T. Jones and D. Phillips. 1982. Defensive adaptations of eggs and adults of *Gastrophysa cyanea* (Coleoptera: Chrysomelidae). *Journal of Chemical Ecology* 8: 453-462.
- Human, K. and D. Gordon. 1997. Effects of Argentine ants on invertebrate biodiversity in northern California. *Conservation Biology* 11: 1242-1248.
- Hung, A. and S. B. Vinson. 1975. Notes on the male reproductive system in ants (Hymenoptera: Formicidae). *Journal of the New York Entomological Society* 83: 192-197.
- Ilha, C., J. Lutinski, D. Von Muller Pereira and F. Mello Garcia. 2009. Riqueza de formigas (Hymenoptera: Formicidae) da Bacia da Sanga Caramuru, município de Chapecó-SC. *Biotemas* 22: 95-105.
- Ipser, R., M. Brinkman, W. Gardner and H. Peeler. 2004. A survey of ground-dwelling ants (Hymenoptera: Formicidae) in Georgia. *Florida Entomologist* 87: 253-260.
- Jacquemin, J., M. Maraun, Y. Roisin and M. Leponce. 2011. Differential response of ants to nutrient addition in a tropical brown food web. *Soil Biology & Biochemistry* 46: 10-17.
- Jaffe, K. and E. Pino. 1989. On chemical communication in the ant *Crematogaster sumichrasti* Mayr (Hymenoptera, Formicidae, Myrmicinae). *Revista Brasileira de Entomologia* 33: 149-155.
- Jander, R. 1990. Arboreal search in ants: search on branches (Hymenoptera: Formicidae). *Journal of Insect Behavior*, 3: 515-527.
- Johnson, C. 1988. Species identification in the eastern *Crematogaster* (Hymenoptera: Formicidae). *Journal Entomological Science* 23: 313-322.

- Johnson, R. and P. Ward. 2002. Biogeography and endemism of ants (Hymenoptera: Formicidae) in Baja California, México: a first overview. *Journal of Biogeography* 29: 1009-1026.
- Jusino-Atresino R. and S. Phillips. 1992. New ant records for Taylor Co., Texas. *Southwestern Naturalist* 37: 430-433.
- Kathirithamby, J., A. Hayward, D. McMahon, R. Ferreira, R. Andreadze, H. Tadeu de Almeida-Andrade and D. Fresneau. 2010. Conspecifics of a heterotrophic heteronomous species of Strepsiptera (Insecta) are matched by molecular characterization. *Systematic Entomology* 35: 234-242.
- Kelly, C. 1986. Extrafloral nectaries: ants, herbivores and fecundity in *Cassia fasciculata*. *Oecologia* (Berlin) 69: 600-605.
- Kempf, W. 1968. Miscellaneous studies on Neotropical ants. IV. (Hymenoptera, Formicidae). *Studia Entomologica* (N.S.) 11: 369-415.
- Kempf, W. 1972. Catálogo abreviado das formigas da região Neotropical (Hym. Formicidae). *Studia Entomologica*. 15: 3-344.
- King, J. 2007. Patterns of co-occurrence and body size overlap among ants in Florida's upland ecosystems. *Annales Zoologici Fennici* 44: 189-201.
- King, J. and W. Tschinkel. 2006. Experimental evidence that the introduced fire ant, *Solenopsis invicta*, does not competitively suppress co-occurring ants in a disturbed habitat. *Journal of Animal Ecology* 75: 1370-1378.
- King, J. and W. Tschinkel. 2013. Experimental evidence for weak effects of fire ants in a naturally invaded pine-savanna ecosystem in north Florida. *Ecological Entomology* 38: 68-75. DOI: 10.1111/j.1365-2311.2012.01405.x.

- Kjar, D. 2009. The ant community of a riparian forest in the Dyke Marsh Preserve, Fairfax Co., Virginia, and a checklist of mid-Atlantic Formicidae. *Banisteria* 33: 3-17.
- Kjar, D. and E. Barrows. 2004. Arthropod community heterogeneity in a mid-Atlantic forest highly invaded by alien organisms. *Banisteria* 23: 26-37.
- Klotz, J., J. Mangold, K. Vail, L. Davis and R. Patterson. 1995. A survey of the urban pest ants (Hymenoptera: Formicidae) of Peninsular Florida. *Florida Entomologist*, 78: 109-118.
- Koptur, S. 1992. Plants with extrafloral nectaries and ants in everglades habitats. *Florida Entomologist* 75: 38-50.
- Koptur, S., M. Palacios-Ríos, C. Díaz-Castelazo, W. Mackay and V. Rico-Gray. 2013. Nectar secretion on fern fronds associated with lower levels of herbivore damage: field experiments with a widespread epiphyte of Mexican cloud forest remnants. *Annals of Botany* 115: 1-7.
- Krikken, J. 1981. Taxonomic review of the New World genus *Genuchinus* Westwood (Coleoptera: Cetoniidae). *Proceedings of the Koninklijke Nederlandse Akademie Van Wetenschappen, Series C*, 84: 403-417.
- Kusnezov, N. 1949. *Crematogaster (Neocrema) descolei* n. sp. *Acta Zoologica Lilloana* 8: 587-590.
- Lachaud, J.-P. and G. Pérez Lachaud. 2012. Diversity of species and behavior of Hymenopteran parasitoids of ants: a review. *Psyche* 2012, article 134746, 24 pp.
- Lanan, M., A. Dornhaus and J. Bronstein. 2011. The function of polydomy: the ant *Crematogaster torosa* preferentially forms new nests near food sources and fortifies outstations. *Behavioral Ecology and Sociobiology* 65: 959–968.

DOI10.1007/s00265-010-1096-8

- Landero-Torres, I., I. Madrid-Ñeco, J. Valenzuela-González, M. Galindo-Tovar, O. Leyva-Ovalle, J. Murguía-González, H. Lee-Espinosa and M. Garcia-Martinez. 2014. Myrmecofauna from three ornamental agroecosystems with different management and a forest remnant in Ixtaczoquitlán, Veracruz, México. *Southwestern Entomologist* 39: 783-796.
<http://dx.doi.org/10.3958/059.039.0409>
- Lavigne, R., and V. J. Tepedino. 1976. Checklist of the Insects in Wyoming. I. Hymenoptera. [Ants p. 24-26]. *Wyoming Agricultural Experiment Station Research Journal* 106: 1-61.
- Leuthold, R. 1968. A tibial gland scent-trail and trail-laying behavior in the ant *Crematogaster ashmeadi* Mayr. *Psyche* 75:233-248.
- London, K. and R. Jeanne. 2005. Wasps learn to recognize the odor of local ants. *Journal of the Kansas Entomological Society* 78: 134–141.
- Longino, J. T. 2003. The *Crematogaster* (Hymenoptera, Formicidae, Myrmicinae) of Costa Rica. *Zootaxa*. 151: 1-150.
- Longino, J. T. 2009. longinoj@evergreen.edu. Date last accessed 2009-06-22.
- Lopes, D., J. Lopes and J. Delabie. 2010. Diversidade de formigas epigéicas (Hymenoptera, Formicidae) em três ambientes no Parque Estadual Mata dos Godoy, Londrina, Paraná. *Iheringia, Série Zoologia*, Porto Alegre 100: 84-90.
- Lourenço G. M., R., Campos and S. Ribeiro. 2015. Spatial distribution of insect guilds in a tropical montane rainforest: effects of canopy structure and numerically dominant ants. *Arthropod-Plant Interactions*. DOI 10.1007/s11829-015-9359-y.

- Lozano-Zambrano, F., P. Ulloa-Chacón and I. Armbricht. 2009. Hormigas: relaciones especies-área en fragmentos de bosque seco tropical. *Neotropical Entomology* 38: 44-54.
- Lubertazzi, D. and W. Tschinkel. 2003. Ant community change across a ground vegetation gradient in north Florida's longleaf pine flatwoods. *Journal of Insect Science* 3:21, 17 pp.
- Lund, P. 1831. Lettre sur les habitudes de quelques fourmis du Brésil, adressée à M. Audouin. *Annales des Sciences Naturelles* 23: 113-138.
- Lutinski, J., F. García, C. Lutinski and S. Iop. 2008. Diversidade de formigas na Floresta Nacional de Chapecó, Santa Catarina, Brazil. *Ciência Rural, Santa Maria* 38: 1810-1816.
- MacGown, J. 2006. Hickory nuts used as nesting sites by ants (Hymenoptera: Formicidae). *Marginalia Insecta* 1: 1-3.
- MacGown, J. and J. Forster. 2005. A preliminary list of the ants (Hymenoptera: Formicidae) of Alabama, USA. *Entomological News* 116:61-74.
- MacGown, J., J. Hill and M. Skvaria. 2011. New records of ants (Hymenoptera: Formicidae) for Arkansas with a synopsis of previous records. *Midsouth Entomologist* 4: 29-38.
- MacGown, J. and R. Brown. 2006. Observations on the high diversity of native ant species coexisting with imported fire ants at a microspatial scale in Mississippi. *Southeastern Naturalist* 5:573-586.
- MacGown, J. and J. Hill 2006. The eastern ant cricket, *Myrmecophilus pergandei* Bruner (Orthoptera: Myrmecophilidae), reported from Mississippi, U. S. A. *Journal of the Mississippi Academy of Sciences* 51: 180-182.

- Mackay, W., S. Majdi, J. Irving, S. Vinson and C. Messer. 1992. Attraction of Ants (Hymenoptera: Formicidae) to Electric Fields. *Journal of the Kansas Entomological Society* 65: 39-43. <http://www.jstor.org/stable/25085325>
- Mackay, W., F. Pérez-Domínguez, L. Valdez and P. Orozco. 1984. La biología de *Crematogaster larreae* Buren (Hymenoptera; Formicidae). *Folia Entomológica Mexicana*. 62: 75-80.
- Mann, W. 1918. Myrmecophilous insects from Cuba. *Psyche* 25: 104-106. doi.org/10.1155/1918/59240
- Mann, W. M. 1920. Additions to the ant fauna of the West Indies and Central America. *Bulletin of the American Museum of Natural History* 42: 403-439.
- Martelli, M., M. Ward and A. Fraser. 2004. Ant diversity sampling on the southern Cumberland Plateau: a comparison of litter sifting and pitfall trapping. *Southeastern Naturalist* 3: 113-126.
- Mayr, G. 1862. Myrmecologische Studien. *Verhandlungen der k. k. Zoologisch-Botanischen Gesellschaft in Wien* 12: 649-776.
- Mayr, G. 1870a. Formicidae novogranadenses. *Sitzungsberichte der Koenigliche Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Classe* 61: 370-417.
- Mayr, G. 1870b. Neue Formiciden. *Verhandlungen der k. k. Zoologisch-Botanischen Gesellschaft in Wien* 20: 939-996.
- Mayr, G. 1886a. Notizen über die Formiciden-Sammlung des British Museum in London. *Verhandlungen der k. k. Zoologisch-Botanischen Gesellschaft in Wien* 36: 353-368.
- Mayr, G. 1886b. Die Formiciden der Vereinigten Staaten von Nordamerika. *Verhandlungen der k. k. Zoologisch-Botanischen Gesellschaft in Wien* 36: 417-464.
- Mayr, G. 1887. Südamerikanische Formiciden. *Verhandlungen der k. k. Zoologisch-Botanischen Gesellschaft in Wien* 37: 311-632.

- M^cCook. H. C. 1879. Family Formicidae, pages 182-189. In Comstock, J. H. Report upon cotton insects. Washington, DC. 511 pp.
- McLain, D. K. 1983. Ants, extrafloral nectaries and herbivory on the passion vine, *Passiflora incarnata*. American Midland Naturalist 110: 433-439.
- Menke, S., B. Guénard, J. Sexton, M. Weiser, R. Dunn and J. Silverman. 2011. Urban areas may serve as habitat and corridors for dry-adapted, heat tolerant species; an example from ants. Urban Ecosystems 14:135–163.
DOI:10.1007/s11252-010-0150-7.
- Menozi, C. 1925. Qualche formica nuova od interessante del Deutsch. Ent. Institut de Dahlem. Entomologische Mitteilungen 14:368-371.
- Menzel, F. and T. Schmitt. 2011. Tolerance requires the right smell: First evidence for interspecific selection on chemical recognition cues. Evolution 66: 896-904. DOI:10.1111/j.1558-5646.2011.01489.x
- Miller, T., J. Legaspi and B. Legaspi. 2010. Experimental test of biotic resistance to an invasive herbivore provided by potential plant mutualists. Biological Invasions 12: 3563–3577.
DOI:10.1007/s10530-010-9751-6
- Miranda, P., E. Morato, M. Oliveira and J. Delabie. 2013. A riqueza e composição de formigas como indicadores dos efeitos do manejo florestal de baixo impacto em floresta tropical no estado do Acre. Revista Árvore, Viçosa-MG 37: 163-173.
- Moreau, C., C. Bell and R. Vila. 2006. Phylogeny of the ants: Diversification in the age of angiosperms. Science 312: 101-104.

- Moreau, C., M. Deyrup and L. Davis. 2014. Ants of the Florida Keys: Species accounts, biogeography, and conservation (Hymenoptera: Formicidae). *Journal of Insect Science* 14: 1-8.
DOI:10.1093/jisesa/ieu157
- Moreira Fernandes, M., G. Venturieri and M. Gonçalves Jardim. 2012. Biologia, visitantes florais e potencial melífero de *Tapirira guianensis* (Anacardiaceae) na Amazônia Oriental. *Revista de Ciências Agrárias* 55: 167-175.
- Morgan, C. 2009. Revision of the ant genus *Crematogaster* (Hymenoptera: Formicidae) in North America. Ph. D. dissertation, xv + 243 pp. ETD Collection for University of Texas, El Paso. Paper AAI3390619.
<http://digitalcommons.utep.edu/dissertations/AAI3390619>.
- Morgan, C., W. Mackay and S. Dash. 2011. Discovery of the Neotropical ant *Crematogaster sotobosque* (Hymenoptera: Formicidae) near Tucson, Arizona. *Southwestern Naturalist* 56: 432–433.
- Morrison, L. 2004. Spatiotemporal variation in antlion (Neuroptera: Myrmeleontidae) density and impacts on ant (Hymenoptera: Formicidae) and generalized arthropod foraging. *Annals of the Entomological Society of America* 97: 913-922.
- Morrison, L., E. Kwazoe, R. Guerra and L. Gilbert. 2000. Ecological interactions of *Pseudacteon* parasitoids and *Solenopsis* ant hosts: environmental correlates of activity and effects on competitive hierarchies. *Ecological Entomology* 25: 433-444.
- Mullenburg, V., F. Goggin, S. Hebert, L. Jia and F. Stephen. 2008. Ant predation on red oak borer confirmed by field observation and molecular gut-content analysis. *Agricultural and Forest Entomology* 10: 205–213.
DOI:10.1111/j.1461-9563.2008.00371.x

- Nakayama Miranda, P., M. Oliveira, F. Beggiato Baccaro, E. Ferreira Morato and J. Delabie. 2012. Check list of ground-dwelling ants (Hymenoptera: Formicidae) of the eastern Acre, Amazon, Brazil. *Check List* 8: 722–730.
- Ness, J. 2004. Forest edges and fire ants alter the seed shadow of an ant-dispersed plant. *Oecologia* 138: 448-454.
- Nielsson, R., A. Bhatkar and H. Denmark. 1971. A preliminary list of ants associated with aphids in Florida. *Florida Entomologist* 54: 245-248.
- Neves, F., R. Braga, M. do Espírito Santo, J. Delabie, G. Fernandes and G. A. Sánchez-Azofeifa. 2010. Diversity of arboreal ants in a Brazilian tropical dry forest: effects of seasonality and successional stage. *Sociobiology* 56: 1-18.
- Newman, L. and R. Wolff. 1990. Ants of a northern Illinois savanna and degraded savanna woodland. *Proceedings of the twelfth North American Prairie Conference*, pages 71-73.
- Oberg, E., I. Del Toro and S. Pelini. 2012. Characterization of the thermal tolerances of forest ants of New England. *Insectes Sociaux* 59: 167–174. DOI:10.1007/s00040-011-0201-y
- Oliveira, P. 1988. Ant-mimicry in some Brazilian salticid and clubionid spiders (Araneae: Salticidae, Clubionidae). *Biological Journal of the Linnaean Society* 33: 1- 15.
- Orivel, J. and A. Dejean. 1999. Selection of epiphyte seeds by ant-garden ants. *Ecoscience* 6:51-55.
- Orivel, J., J. Grangier, J. Foucaud, J. Le Breton, F.-X. Andrès, H. Jourdan, J. Delabie, D. Fournier, P. Cerdan, B. Facon and A. Estoup. 2009. Ecologically heterogeneous populations of the invasive ant *Wasmannia auropunctata* within its native and introduced ranges. *Ecological Entomology* 34: 504–512.

DOI: 10.1111/j.1365-2311.2009.01096.x

- Oullette, G. and A. Francoeur. 2012. Formicidae [Hymenoptera] diversity from the Lower Kennebec Valley Region of Maine. *Journal of the Acadian Entomological Society* 8: 48-51.
- Özdikmen, H. 2010. New names for some preoccupied specific and subspecific epithets in the family Formicidae (Hymenoptera). *Munis Entomology and Zoology* 5 (supplement): 986-1000.
- Parys, K., M. Gimmel and S. Johnson. 2013. Checklist of insects associated with *Salvinia minima* Baker in Louisiana, USA. *Check List* 9: 1488–1495.
- Pelini, S., M. Boudreau, N. McCoy, A. Ellison, N. Gotelli, N. Sanders and R. Dunn. 2011. Effects of short-term warming on low and high latitude forest ant communities. *Ecosphere* Volume 2 Article 62: 12 pp. DOI:10.1890/ES11-00097.1
- Pelini, S., S. Diamond, H. MacLean, A. Ellison, N. Gotelli, N. Sanders and R. Dunn. 2012. Common garden experiments reveal uncommon responses across temperatures, locations, and species of ants. *Ecology and Evolution* 2: 3009–3015. DOI:10.1002/ece3.407
- Pelini, S., S. Diamond, L. Nichols, K. Stuble, A. Ellison, N. Sanders, R. Dunn and N. Gotelli. 2014. Geographic differences in effects of experimental warming on ant species diversity and community composition. *Ecosphere* Volume 5, Article 125: 12 pp.
- Pereira de Souza, J., F. Beggiato Baccaro, V. Lemes Landeiro, E. Franklin and W. Magnusson. 2012. Trade-offs between complementarity and redundancy in the use of different sampling techniques for ground-dwelling ant assemblages. *Applied Soil Ecology* 56: 63-73.

DOI:10.1016/j.apsoil.2012.01.004

- Pereira Santos, P., A. Vasconcellos, B. Jahyny and J. Delabie. 2010. Ant fauna (Hymenoptera, Formicidae) associated to arboreal nests of *Nasutitermes* spp. (Isoptera, Termitidae) in a cacao plantation in southeastern Bahia, Brazil. *Revista Brasileira de Entomologia* 54: 450-454.
- Pérez-Sánchez, A., J. Lattke and M. Riera-Valera. 2012. Composición y estructura de la fauna de hormigas en tres formaciones de vegetación semiárida de la Península de Paraguaná, Venezuela. *Inverciencia* 37: 506-514.
- Pérez-Sánchez, A., J. Lattke and A. Vilorio. 2012. The myrmecofauna (Hymenoptera: Formicidae) of the Macanao semi-arid peninsula in Venezuela: an altitudinal variation glance. *Journal of Biodiversity, Bioprospecting and Development* 1: 1-5.
- Perfecto, I. and R. Snelling. 1995. Biodiversity and the transformation of a tropical agroecosystem: ants in coffee plantations. *Ecological Applications* 5: 1084-1097.
<http://www.jstor.org/stable/2269356>
- Pergande, 1896. Mexican Formicidae. *Proceedings of the California Academy of Sciences* 5:858-896.
- Peeters, C., C. Lin, Y. Quinet, G. Segundo, and J. Billen. 2013. Evolution of a soldier caste specialized to lay unfertilized eggs in the ant genus *Crematogaster* (subgenus *Orthocrema*). *Arthropod structure & development* 42: 257-264.
<https://doi.org/10.1016/j.asd.2013.02.003>
- Petralia, R. and S. B. Vinson. 1980. Comparative anatomy of the ventral region of ant larvae and its relation to feeding behavior. *Psyche* 86:375-394.

- Philpott, S., I. Perfecto and J. Vandermeer. 2006. Effects of management intensity and season on arboreal ant diversity and abundance in coffee agroecosystems. *Biodiversity and Conservation* 15: 125-141.
- Pie, M. R. and M. K. Tscha. 2007. The macroevolutionary dynamics of ant Diversification. *Evolution*. 63-11: 3023-3030.
- Porter, S. 2000. Host specificity and risk assessment of releasing the decapitating fly *Pseudacteon curvatus* as a classical biocontrol agent for imported fire ants. *Biological Control* 19: 35-47.
DOI:10.1006/bcon.2000.0843
- Porter, S., S. Valles and D. Oi. 2013. Host specificity and colony impacts of the fire ant pathogen, *Solenopsis invicta* virus 3. *Journal of Invertebrate Pathology* 114: 1-6.
DOI.org/10.1016/j.jip.2013.04.013
- Pringle, E. and D. Gordon. 2013. Protection mutualisms and the community: geographic variation in an ant-plant symbiosis and the consequences for herbivores. *Sociobiology* 60: 242-251.
- Quinet, Y., N. Tekule and J. de Biseau. 2005. Behavioural Interactions between *Crematogaster brevispinosa rochai* Forel (Hymenoptera: Formicidae) and two *Nasutitermes* species (Isoptera: Termitidae). *Journal of Insect Behavior* 18: 1-17.
DOI: 10.1007/s10905-005-9343-y
- Ramírez, M., P. Chacón de Ulloa, I. Armbrrecht and Z. Calle. 2001. Contribución al conocimiento de las interacciones entre plantas, hormigas y homópteros en bosques secos de Colombia. *Caldasia* 23: 523-536.
- Ratchford, J., S. Wittman, E. Jules, A. Ellison, N. Gotelli and N. Sanders. 2005. The effects of fire, local environment and time on ant assemblages in fens and forests. *Diversity and Distributions* 11: 487-497.

- Resasco, J., S. Pelini, K. Stuble, N. Sanders, R. Dunn, S. Diamond, A. Ellison, N. Gotelli, D. Levey. 2014. Using historical and experimental data to reveal warming effects on ant assemblages. *PLoS ONE* 9: 8 pp. DOI:10.1371/journal.pone.0088029
- Revis, H. and D. Waller. 2004. Bactericidal and fungicidal activity of ant chemicals on feather parasites: an evaluation of anting behavior as a method of self-medication in songbirds. *Auk* 121: 1262-1268. DOI.org/10.1642/0004-8038(2004)121[1262:BAFAOA]2.0.CO;2
- Richard, F., A. Dejean and J. Lachaud. 2004. Sugary food robbing in ants: a case of temporal cleptobiosis. *Comptes Rendus Biologies* 327: 509–517.
- Richardson, J. and R. Jones. 1982. An ant-aphid association on threadleaf groundsel in the Davis Mountains area of west Texas. *Southwestern Naturalist* 27: 466-467.
- Rico-Gray, V., J. García-Franco, M. Palacios-Ríos, C. Díaz-Castelazo, V. Parra-Tabla and J. Navarro. 1998a. Geographical and seasonal variation in the richness of ant-plant interactions in México. *Biotropica* 30: 190-200.
- Rico-Gray, V., M. Palacios-Ríos, J. García-Franco and W. Mackay. 1998b. Richness and seasonal variation of ant-plant associations mediated by plant derived food resources in the semiarid Zapotitlán Valley, México. *American Midland Naturalist* 140: 21-26. DOI:http://dx.doi.org/10.1674/0003-0031(1998)140[0021:RASVOA]2.0.CO;2
- Ríos-Casanova, L., A. Valiente-Banuet and V. Rico-Gray. 2004. Las hormigas del Valle de Tehuacán (Hymenoptera: Formicidae): una comparación con otras zonas áridas de México. *Acta Zoológica Mexicana (n.s.)* 20: 37-54.

- Rivas-Arancibia, S., H. Carrillo-Ruiz, A. Bonilla Arce, D. Figueroa-Castro and A. Andrés-Hernández. 2014. Effect of disturbance on the ant community in a semiarid region of central México. *Applied Ecology and Environmental Research* 12: 703-716.
- Roger, J. 1862. Synonymische Bermerkungen. *Berliner Entomologische Zeitschrift* 6: 283-297.
- Roger, J. 1863a. Die neu aufgeführten Gattungen und Arten meines Formiciden-Verzeichnisses, nebst Ergänzung einiger früher gegeben Beschreibungen. *Berliner Entomologische Zeitschrift* 7: 206-209.
- Roger, J. 1863b. Verzeichniss der Formiciden-Gattungen und Arten. *Berliner Entomologische Zeitschrift* 7: 1-65.
- Rojas, P., C. Frago and W. Mackay. 2014. Ant communities along a gradient of plant succession in Mexican tropical coastal dunes. *Sociobiology* 61: 119-132.
- Rowles, A. and J. Silverman. 2009. Carbohydrate supply limits invasion of natural communities by Argentine ants. *Oecologia* 161:161-171.
- Rubin, B., J. Sanders, J. Hampton-Marcell, S. Owens, J. Gilbert and C. Moreau. 2014. DNA extraction protocols cause differences in 16S rRNA amplicon sequencing efficiency but not in community profile composition or structure. *Microbiology Open* 3: 910–921. DOI: 10.1002/mbo3.216
- Ruffner, G. and W. Clark. 1986. Extrafloral nectar of *Ferocactus acanthodes* (Cactaceae): composition and its importance to ants. *American Journal of Botany* 73: 185-189.
- Ryder Wilkie K., A. Mertl and J. Traniello. 2009. Diversity of ground-dwelling ants (Hymenoptera: Formicidae) in primary and secondary forests in Amazonian Ecuador. *Myrmecological News* 12:139-147.

- Ryder Wilkie K., A. Mertl and J. Traniello. 2010. Species diversity and distribution patterns of the ants of Amazonian Ecuador. PLoS ONE 5: e13146. DOI:10.1371/journal.pone.0013146
- Saarinen, E. and J. Daniels. 2006. Miami blue butterfly larvae (Lepidoptera: Lycaenidae) and ants (Hymenoptera: Formicidae): new information on the symbionts of an endangered taxon. Florida Entomologist 89: 69-74.
- Salazar, F. and D. Donoso. 2013. New ant (Hymenoptera: Formicidae) records for Ecuador deposited at the Carl Rettenmeyer ant collection in the QCAZ Museum. Boletín Técnico 11, Serie Zoológica 8: 150-175.
- Sanabria-Blandón, M. and P. Chacón de Ulloa. 2009. Hormigas como plagas potenciales en tres criaderos de mariposas del suroccidente de Colombia. Acta Agronomia (Palmira) 58:47-52.
- Sanabria, C., P. Lavelle and S. Fonte. 2014. Ants as indicators of soil-based ecosystem services in agroecosystems of the Colombian Llanos. Applied Soil Ecology 84: 24-30.
- Santschi, F. 1918. Sous-genres et synonymies de *Cremastogaster*. [Hym. Formic.] Bulletin de la Société Entomologique de France 1918 :182-185.
- Santschi, F. 1922. Description de nouvelles fourmis de l'Argentine et pays limitrophes. Anales de la Sociedad Científica Argentina 94: 241-262.
- Santschi, F. 1923. *Solenopsis* et autres fourmis néotropicales. Revue Suisse de Zoologie 30: 245-273.
- Santschi, F. 1925. Nouveaux formicidés brésiliens et autres. Bulletin et Annales de la Société Entomologique de Belgique 65: 221-247.

- Santschi, F. 1929a. Nouvelles fourmis de la République Argentine et du Brésil. *Anales de la Sociedad Científica Argentina* 107: 273-316.
- Santschi, F. 1929b. Mélange myrmécologique. *Wiener Entomologische Zeitung* 46: 84-93.
- Santschi, F. 1932. Quelques fourmis inédites de l'Amérique centrale et Cuba. *Revista de Entomología* 2: 410-414.
- Santschi, F. 1933. Fourmis de la République Argentine, en particulier du territoire de Misiones. *Anales de la Sociedad Científica Argentina* 116: 105-124.
- Say, T. 1836. Descriptions of new species of North American Hymenoptera, and observations on some already described. *Boston Journal of Natural History* 1: 209-305.
- Schemske, D. 1982. Ecological correlates of a neotropical mutualism: ant assemblages at *Costus* extrafloral nectaries. *Ecology* 63: 932-941.
- Schmid, S. 2010. Die Rolle von Bienen und anderen Blütenbesuchern in der Reproduktionsbiologie der Bromelien *Aechmea nudicaulis* und *Vriesea friburgensis* im Atlantischen Regenwald SüdBraziliens. Dissertation, Eberhard Karls Universität Tübingen, 176 pp.
- Schmid, V., M. Morales, L. Marinoni, R. Kamke, J. Steiner, and A. Zillikens. 2014. Natural history and morphology of the hoverfly *Pseudomicrodon biluminiferus* and its parasitic relationship with ants nesting in bromeliads. *Journal of Insect Science* Vol. 14, Article 38: 21 pp.
- Schmid, V., S. Schmid, J. Steiner and A. Zillikens. 2010. High diversity of ants foraging on extrafloral nectar of bromeliads in the Atlantic rainforest of southern Brazil. *Studies on Neotropical Fauna and Environment* 45: 39-53.

- Schmit-Neuerburg, V. and N. Blüthgen. 2007. Ant-garden epiphytes are protected against drought in a Venezuelan lowland rain forest. *Ecotropica* 13: 93-100.
- Schütte, M. de, J. Queiroz, A. Mayhé-Nunes and M. dos S. Pereira. 2007. Inventário estruturado de formigas (Hymenoptera, Formicidae) em floresta ombrófila de encosta na ilha da Marambaia, RJ. *Iheringia, Sér. Zool.*, Porto Alegre 97: 103-110.
- Seixas Felizardo, S. P. 2010. Revisão taxonômica do grupo *limata* de *Crematogaster* Lund, 1831 (Formicidae: Myrmicinae: Crematogastrini). Master's Thesis, Universidade Federal do Pará (Brazil). ix + 62 pp.
- Serna, F. and W. Mackay. 2010. A descriptive morphology of the ant genus *Procryptocerus* (Hymenoptera: Formicidae). *Journal of Insect Science* 10: 1-36.
- Serrano-Cardozo, V., J. Lemos-Espinal and J. Smith. 2008. Comparative diet of three sympatric *Sceloporus* in the semiarid Zapotitlán Valley, México. *Revista Mexicana de Biodiversidad* 79: 427-434.
- Shattuck, S. and S. Cover. 2016. Taxonomy of some little-understood North American ants (Hymenoptera: Formicidae). *Zootaxa* 4175: 10-22.
- Shaw, P., J. Owens, E. Huddleston and D. Richman. 1987. Role of arthropod predators in mortality of early instars of the range caterpillar, *Hemileuca oliviae* (Lepidoptera: Saturniidae). *Environmental Entomology* 16: 814-820.
<http://dx.doi.org/10.1093/ee/16.3.814>

- Sherbrooke, W. and J. Scheerens. 1979. Extrafloral (calyx and foliar) nectaries and nectar sugars of *Erythrina flabelliformis* Kearney in Arizona. *Annals of the Missouri Botanical Garden* 66: 472-481.
- Silvestre, R., M. Demétrio, B. Trad, F. Lima, T. Auko and P. Souza. 2014. Diversity and distribution of Hymenoptera Aculeata in Midwestern Brazilian Forest. Chapter 2, In: F. R. Greer, ed., *Dry Forests, Species Diversity and Sustainable Management*. Nova Publishers, New York, pp. 29-79.
- Siqueira de Castro, F., A. Bahia Gontijo, W. Duarte da Rocha and S. Pontes Ribeiro. 2010/2011. As comunidades de formigas de serapilheira nas florestas semidecíduas do Parque Estadual do Ríó Doce, Minas Gerais. MG. *BIOTA, Belo Horizonte* 3: 5-24.
- Smedley, S. R., K. Lafleur, L. Gibbons, J. Arce, J. Brown and M. Lozier. 2002. Glandular hairs: pupal chemical defense in a non-native ladybird beetle (Coleoptera: Coccinellidae). *Northeastern Naturalist*, 9: 253-266. DOI.org/10.1656/1092-6194(2002)009[0253:GHPCDI]2.0.CO;2
- Smith, F. 1858. Catalogue of hymenopterous insects in the collection of the British Museum. Part VI. Formicidae. London: British Museum, 216 pp.
- Smith, M. 1951. Formicidae. Pages 808-810 in Muesebeck, C., K. Krombein and H. Townes (eds.). *Hymenoptera of America north of Mexico -- Synoptic Catalog*. U.S. Dept. Agriculture Monograph No. 2, 1420 pp.
- Smith, M. 1958. Family Formicidae. Pp. 108-162 in: Krombein, K. (eds.). *Hymenoptera of America north of Mexico. Synoptic catalogue. First supplement*. U. S. Department of Agriculture. Agricultural Monograph 2 (suppl. 1):1-305.

- Smith, M. 1965. House-infesting ants of the eastern United States, their recognition, biology, and economic importance. Technical Bulletin No. 1326, Agricultural Research Service, United States Department of Agriculture. 105 pp.
- Smith, D. 1979. Superfamily Formicoidea. Pp. 1323-1467 in: Krombein, K., P., Hurd, D. Smith and B. Burks (eds.). Catalog of Hymenoptera in America North of Mexico. Volume 2. Apocrita (Aculeata). Washington, D.C., Smithsonian Institution Press, pp. i-xvi, 1199-2209.
- Sosa-Calvo, J. 2007. Ants of the leaf litter of two plateaus in eastern Suriname. RAP Bulletin of Biological Assessment: A Rapid Biological Assessment of the Lely and Nassau Plateaus, Suriname (with additional information on the Brownsberg Plateau): 92-98.
- Souza da Conceição, E., J. Delabie, T. Castro Della Lucia, A. Oliveira Costa-Neto and J. Major. 2015. Structural changes in arboreal ant assemblages (Hymenoptera: Formicidae) in an age sequence of cocoa plantations in the south-east of Bahia, Brazil. Austral Entomology 54:315-324.
- Stephenson, A. 1981. Toxic nectar deters nectar thieves of *Catalpa speciosa*. American Midland Naturalist 105: 381-383.
- Steyskal, G. 1944. A new ant-attacking fly of the genus *Pseudacteon*, with a key to the females of the North American species (Diptera, Phoridae). Occasional Papers of the Museum Of Zoology, University Of Michigan, Number 489: 4 pp.
- Strassmann, J. 1981. Parasitoids, predators, and group size in the paper wasp, *Polistes exclamans*. Ecology 62: 1225-1233.

- Stuble, K., S. Pelini, S. Diamond, D. Fowler, R. Dunn and N. Sanders. 2013. Foraging by forest ants under experimental climatic warming: a test at two sites. *Ecology and Evolution* 3:482-491.
- Talbot, M. 1957. Populations of ants in a Missouri woodland. *Insectes Sociaux* 4: 375-384.
- Theunis, L., M. Gilbert, Y. Roisin and M. Leponce. 2005. Spatial structure of litter-dwelling ant distribution in a subtropical dry forest. *Insectes Sociaux* 52: 366–377.
- Thomas, M., P. Skelley and R. Lundgren. 1992. New records for *Gnostus floridanus* (Coleoptera: Ptinidae) and observations on its behavior. *Florida Entomologist* 75: 287-289.
- Tillberg, C. 2004a. *Cordia gerascanthus* (Boraginaceae) produces stem domatia. *Journal of Tropical Ecology* 20: 355-357. DOI:10.1017/S0266467404001324.
- Tillberg, C. 2004b. Friend or foe? A behavioral and stable isotopic investigation of an ant–plant symbiosis. *Oecologia* 140: 506-515. DOI:10.1007/s00442-004-1601-8
- Trotter, R., N. Cobb and T. Witham. 2008. Arthropod community diversity and trophic structure: a comparison between extremes of plant stress. *Ecological Entomology* 33: 1–11.
- Tschinkel, W. 2002. The natural history of the arboreal ant, *Crematogaster ashmeadi*. *Journal of Insect Science* 12: 1-15.
- Tynes, J. and R. Hutchins. 1964. Studies of plant-nesting ants in east central Mississippi. *American Midland Naturalist* 72: 152-156.
- Valenti, M., A. Berryman and G. Ferrel. 1996. Arthropods associated with a manzanita gall induced by the aphid *Tamalia coweni* (Cockerell) (Homoptera: Aphididae). *The Canadian Entomologist* 128: 839-847.

- Varela-Hernández, F. 2013. Variación temporal de las comunidades de hormigas en matorral xerófilo con dominancia de *Cephalocereus senilis* y *Stenocereus dumortieri* en la Reserva de la Biosfera Barranca de Metztitlán, Hidalgo, México. *Revista Peruana de Entomología* 48: 1-8.
- Varela-Hernández, F. and R. Jones. 2013. Patrones biogeográficos de hormigas (Hymenoptera: Formicidae) de la península de Baja California y Sonora, México, mediante el uso de PAE. *Dugesiana* 20: 111-119.
- Varón, E., P. Hanson, O. Borbón, M. Carballo and L. Hilje. 2004. Potencial de hormigas como depredadoras de la broca del café (*Hypothenemus hampei*) en Costa Rica. *Manejo Integrado de Plagas y Agroecología (Costa Rica)* No. 73: 42-50.
- Vasconcelos, H. and J. Vilhena. 2006. Species turnover and vertical partitioning of ant assemblages in the Brazilian Amazon: A comparison of forests and savannas. *Biotropica* 38: 100-106. DOI:10.1111/j.1744-7429.2006.00113.x
- Vasconcelos, H., A. Macedo and J. Vilhena. 2003. Influence of topography on the distribution of ground-dwelling ants in an amazonian forest. *Studies on Neotropical Fauna and Environment* 38: 115-124.
- Vasconcelos, H., J. Vilhena, K. Facure and A. Albernaz. 2010. Patterns of ant species diversity and turnover across 2000 km of Amazonian floodplain forest. *Journal of Biogeography* 37: 432-440. DOI:10.1111/j.1365-2699.2009.02230.x

- Vázquez, L., J. Alfonso, Y. Ramos, A. Martínez, D. Moreno and Y. Matienzo. 2012. Relaciones de *Hypothenemus hampei* Ferrari (Coleoptera: Curculionidae: Scolytinae) con el suelo del cafetal como base para su manejo agroecológico. *Agroecología* 7: 81-90.
- Vásquez-Bolaños, M. 2011. Lista de especies de hormigas (Hymenoptera: Formicidae) para México. *Dugesiana* 18: 95-133.
- Vergara-Navarro, E. and F. Serna. 2013. Lista de las hormigas (Hymenoptera: Formicidae) del departamento de Antioquia, Colombia, y nuevos registros para el país. *Agronomía Colombiana* 31: 324-342.
- Vittar, F. 2008. Hormigas (Hymenoptera: Formicidae) de la Mesopotamia Argentina. In: *Temas de la Biodiversidad del Litoral III INSUGEO*, F.G. Aceñolaza (Cordinator-Editor) Tucumán, *Miscelánea* 17: 447-466.
- Vittar, F. and F. del C. Cuezso. 2008. Hormigas (Hymenoptera: Formicidae) de la provincia de Santa Fe, Argentina. *Revista de la Sociedad Entomologica Argentina* 67: 175-178.
- Ward, P., S. Brady, B. Fisher and T. Schultz. 2015. The evolution of myrmicine ants: phylogeny and biogeography of a hyperdiverse ant clade (Hymenoptera: Formicidae). *Systematic Entomology* 40:61–81. DOI: 10.1111/syen.12090
- Wheeler D. 1986. *Ectatomma tuberculatum*: Foraging biology and association with *Crematogaster* (Hymenoptera: Formicidae). *Annals of the Entomological Society of America* 79: 300-303.
- Wheeler, G. and J. Wheeler. 1952. The ant larvae of the myrmicine tribe Crematogastrini. *Journal of the Washington Academy of Sciences* 42: 248-262.

- Wheeler G. and J. Wheeler. 1960. Supplementary studies on the larvae of the Myrmicinae (Hymenoptera: Formicidae). Proceedings of the Entomological Society of Washington. 62: 1-32, Plate II, Figures 14 & 15.
- Wheeler G. and J. Wheeler. 1973. The ant larvae of six tribes: second supplement (Hymenoptera: Formicidae: Myrmicinae). Journal of the Georgia Entomological Society 8: 27-39.
- Wheeler, W. 1904a. The ants of North Carolina. Bulletin of the American Museum of Natural History 20: 299-306.
- Wheeler, W. 1904b. A new type of social parasitism among ants. Bulletin of the American Museum of Natural History 20: 347-375.
- Wheeler, W. 1908a. The ants of Casco Bay, Maine, with observations on two races of *Formica sanguinea* Latreille. Bulletin of the American Museum of Natural History 24: 619-645.
- Wheeler, W. 1908b. Comparative ethology of the European and North American ants. Journal für Psychologie und Neurologie 13: 404-435.
- Wheeler, W. 1908c. The ants of Texas, New Mexico and Arizona. (Part 1.). Bulletin of the American Museum of Natural History 24: 399-485, Plate 27, Fig. 40.
- Wheeler, W. 1909. Ants collected by Prof. F. Silvestri in México. Bollettino del Laboratorio di Zoologia Generale e Agraria della R. Scuola Superiore d'Agricoltura in Portici 3: 228-238.
- Wheeler, W. 1910. *Ants, Their Structure, Development and Behavior*. Columbia University Press, xxv + 663 pp.
- Wheeler, W. 1912a. Notes on a mistletoe ant. Journal of the New York Entomological Society 20: 130-133.

- Wheeler, W. 1912b: Observations on the Central American acacia ants. Transactions of the Second Entomological Congress 2: 109-139.
- Wheeler, W. 1913. Ants collected in Georgia by Dr. J. C. Bradley and Mr. W. T. Davis. Psyche 20: 112-117.
- Wheeler, W. 1914. Ants collected by W. M. Mann in the state of Hidalgo, Mexico. Journal of the New York Entomological Society 22: 37-61.
- Wheeler, W. 1919. A new paper-making *Crematogaster* from the southeastern United States. Psyche. 26: 107-112.
- Wheeler, W. 1921. The *Tachigalia* ants. Zoologica Scientific Contributions of the New York Zoological Society 3:137-168.
- Wheeler, W. 1922. The ants of the Belgian Congo: Keys to the genera and subgenera of ants, pp 631-710. Bulletin of the American Museum of Natural History 45: 1-1139.
- Wheeler, W. 1925. Neotropical ants in the collections of the Royal Museum of Stockholm. Part I. Arkiv för Zoologi 17: 1-55.
- Wheeler, W. 1930. A new parasitic *Crematogaster* from Indiana. Psyche 37: 55-60.
- Wheeler, W. 1932. A list of the ants of Florida with descriptions of new forms. Journal of the New York Entomological Society 40: 1-17.
- Wheeler, W. 1933a. The Templeton Crocker Expedition of the California Academy of Sciences, 1932. No. 6. Formicidae of the Templeton Crocker Expedition. Proceedings of the California Academy of Sciences 21: 57-64.
- Wheeler, W. 1933b. A second parasitic *Crematogaster*. Psyche 40:83-86.
- Wheeler, W. 1934a. Revised list of Hawaiian ants. Occasional Papers Bernice P. Bishop Museum 10:1-21.

- Wheeler, W. 1934b. Ants from the islands off the west coast of Lower California and Mexico. *Pan-Pacific Entomologist* 10: 132-144.
- Wheeler, W. 1934c. Neotropical ants collected by Dr. Elisabeth Skwarra and others. *Bulletin of the Museum of Comparative Zoology at Harvard College* 77: 157-240.
- Wheeler, W. 1936. A singular *Crematogaster* from Guatemala. *Psyche*. 43: 40-48.
- Wheeler, W. 1942. Studies of Neotropical ant-plants and their ants. *Bulletin of the Museum of Comparative Zoology at Harvard College* 90:1-262.
- Whitcomb, W., H. Denmark, A. Bhatkar and G. Greene. 1972. Preliminary studies on the ants of Florida soybean fields. *Florida Entomologist*, 55: 129-142.
- Whitford, W., J. van Zee, M. Nash, W. Smith and J. Herrick. 1999. Ants as indicators of exposure to environmental stressors in North American desert grasslands. *Environmental Monitoring and Assessment* 54: 143–171.
- Wild, A. 2007. A catalogue of the ants of Paraguay (Hymenoptera: Formicidae). *Zootaxa* 1622: 1–55.
- Willey, M. and P. Adler 1989. Biology of *Peucetia viridans* (Araneae, Oxyopidae) in South Carolina, with special reference to predation and maternal care. *Journal of Arachnology* 17: 275-284.
- Wilson, E. O. 2003. *Pheidole in the New World. A Dominant, Hyperdiverse Ant Genus*. Harvard University Press, Cambridge, MA. 818 pp.
- Wittman, S. and N. Gotelli. 2011. Predicting community structure of ground-foraging ant assemblages with Markov models of behavioral dominance. *Oecologia* 166: 207-219.

- Wittman, S., N. Sanders, A. Ellison, E. Jules, J. Ratchford and N. Gotelli. 2010. Species interactions and thermal constraints on ant community structure. *Oikos* 119: 551-559.
- Wood, W. 2005. A comparison of mandibular gland volatiles from ants of the bull horn acacia, *Acacia collinsii*. *Biochemical Systematics and Ecology* 651-658.
DOI:10.1016/j.bse.2004.12.009
- Yanoviak, S., S. Berghoff, K. Linsenmair and G. Zotz. 2011. Effects of an epiphytic orchid on arboreal ant community structure in Panama. *Biotropica* 43 731-737.
- Yanoviak, S. and M. Kaspari. 2000. Community structure and the habitat templet: ants in the tropical forest canopy and litter. *Oikos* 89: 259-266.
- Zabala, G., L. Arango and P. Chacón de Ulloa. 2013. Diversidad de hormigas (Hymenoptera: Formicidae) en un paisaje cafetero de Risaralda, Colombia. *Revista Colombiana de Entomología* 39: 141-149.

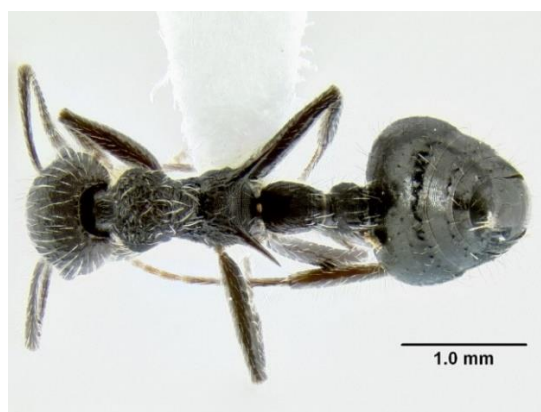


Plate 95. *Crematogaster acuta* (from www.AntWeb.org, Michael Branstetter photographer).



Plate 96. *Crematogaster ashmeadi* (type, from www.AntWeb.org, Christiana Klingenberg photographer).



Lectotype *Crematogaster atra* Mayr. Image by J. Longino, Jun'03.



Lectotype *Crematogaster atra* Mayr. Image by J. Longino, Jun'03.



Lectotype *Crematogaster atra* Mayr. Image by J. Longino, Jun'03.

Plate 97. *Crematogaster atra* (paratype, from www.AntWeb.org, John Longino photographer).



Plate 98. *Crematogaster cerasi* (from www.AntWeb.org, April Nobile photographer).



Plate 99. *Crematogaster coarctata* (syntype, from www.AntWeb.org, Ryan Perry photographer).



Plate 100. *Crematogaster corvina* (from www.AntWeb.org, Bonnie Blaimer photographer).



Plate 101. *Crematogaster crinosa* (from www.AntWeb.org, April Nobile photographer).



Plate 102. *Crematogaster curvispinosa* (from www.AntWeb.org, April Nobile photographer).



Plate 103. *Crematogaster dentinodis* (type, from www.AntWeb.org, Will Ericson photographer).



Plate 104. *Crematogaster depilis* (from www.AntWeb.org, Andrea Walker photographer).



Plate 105. *Crematogaster distans* (cotype, from www.AntWeb.org, Will Ericson photographer).



Plate 106. *Crematogaster emeryana* (from www.AntWeb.org, Michael Branstetter photographer).



Plate 107. *Crematogaster formosa* (types, from www.AntWeb.org, Ryan Perry and Zach Lieberman photographers).



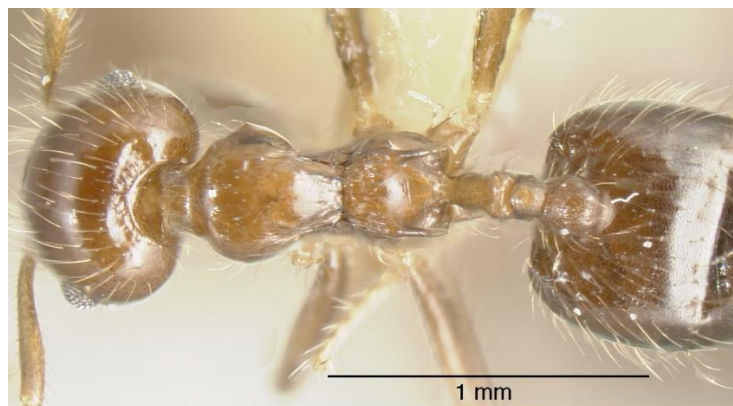
Plate 108. *Crematogaster isolata* (from www.AntWeb.org, Alexandra Westrich and Bonnie Blaimer photographers).



Plate 109. *Crematogaster laeviuscula* (from www.AntWeb.org, April Nobile and Ryan Perry photographers).



INBIOCRI002280498. Costa Rica. Image taken by C. Richart. Jan'03



INBIOCRI002280498. Costa Rica. Image taken by C. Richart. Jan'03



INBIOCRI002280498. Costa Rica. Image taken by C. Richart. Jan'03

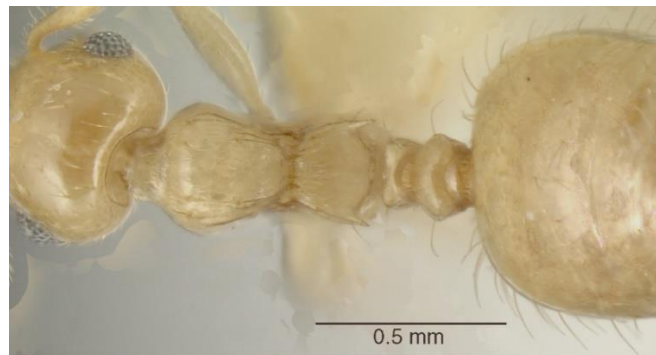
Plate 110. *Crematogaster limata* (from www.AntWeb.org, C, Richart photographer).



Plate 111. *Crematogaster lineolata* (from www.AntWeb.org, Zach Lieberman photographer).



CASENT0628109 Costa Rica.
Image by C. Richart. Jan'03



CASENT0628109 Costa Rica. Image by C. Richart. Jan'03



CASENT0628109 Costa Rica. Image by C. Richart. Jan'03.

Plate 112. *Crematogaster minutissima* (from www.AntWeb.org, C Richart photographer).



Plate 113. *Crematogaster missouriensis* (from www.AntWeb.org, Jan Fogarty photographer).



Plate 114. *Crematogaster montezumia* (from www.AntWeb.org, Zach Lieberman photographer).



Plate 115. *Crematogaster mutans* (from www.AntWeb.org, April Nobile photographer).



Plate 116. *Crematogaster navajoa* (from www.AntWeb.org, April Nobile photographer).



Plate 117. *Crematogaster nigropilosa* worker (From www.AntWeb.org, April Nobile photographer).



Plate 118. *Crematogaster nocturna* male (holotype, from www.AntWeb.org, April Nobile photographer).

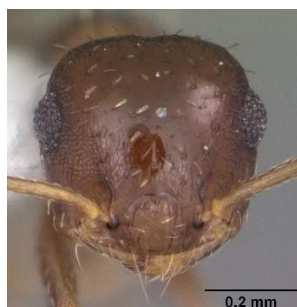


Plate 119. *Crematogaster obscurata* (from www.AntWeb.org, Bonnie April Nobile).

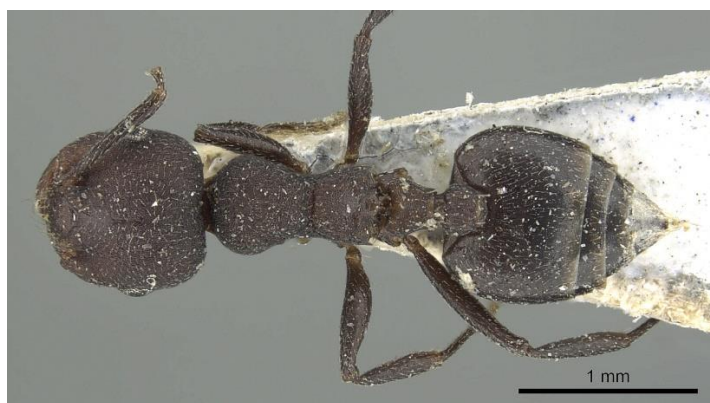


Plate 120. *Crematogaster opaca* (syntype, from www.AntWeb.org, Ryan Perry photographer).



Plate 121. *Crematogaster pilosa* (from www.AntWeb.org, Zach Lieberman photographer).



Plate 122. *Crematogaster pinicola* (from www.AntWeb.org, Zach Lieberman photographer).



Plate 123. *Crematogaster rifelna* (from www.AntWeb.org, Ryan Perry photographer).



Plate 124. *Crematogaster rochai* (from www.AntWeb.org, Will Ericson photographer).



Plate 125. *Crematogaster saussurei* (type, from www.AntWeb.org, Will Ericson photographer).



Plate 126. *Crematogaster sotohosque* (paratype, from www.AntWeb.org, Ryan Perry photographer).



Plate 127. *Crematogaster sumichrasti* (type, from www.AntWeb.org, Will Ericson photographer).



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<i>curvispinosa</i>	143
<i>depilis</i>	161
<i>emeryana</i>	177
<i>laeviuscula</i>	202
<i>opaca</i>	309
<i>torosa</i>	393, 395
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<i>crinosa</i>	132
<i>depilis</i>	162
<i>torosa</i>	395
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<i>crinosa</i>	132
<i>curvispinosa</i>	143
<i>formosa</i>	184
<i>minutissima</i>	243
<i>nigropilosa</i>	288
<i>sumichrasti</i>	384
<i>torosa</i>	395

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<i>coarctata</i>	111
<i>crinosa</i>	132
<i>dentinodis</i>	152
<i>depilis</i>	161
<i>emeryana</i>	177
<i>isolata</i>	192
<i>laeviuscula</i>	203
<i>lineolata</i>	228
<i>minutissima</i>	243
<i>missouriensis</i>	255
<i>mutans</i>	271
<i>saussurei</i>	367
<i>torosa</i>	395
<i>vermiculata</i>	407

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<i>cerasi</i>	97
<i>punctulata</i>	339
<i>torosa</i>	395

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<i>crinosa</i>	132
<i>laeviuscula</i>	203
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<i>dentinodis</i>	152
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<i>atra</i>	88
<i>crinosa</i>	132
<i>curvispinosa</i>	144
<i>opaca</i>	310

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<i>corvina</i>	122
<i>crinosa</i>	132
<i>curvispinosa</i>	144
<i>dentinodis</i>	152
<i>formosa</i>	184
<i>lineolata</i>	228

<i>opaca</i>	309
<i>patei</i>	317
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<i>crinosa</i>	132
<i>curvispinosa</i>	144
<i>dentinodis</i>	152
<i>opaca</i>	310
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<i>opaca</i>	310
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<i>opaca</i>	310
<i>torosa</i>	395
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<i>crinosa</i>	132
<i>curvispinosa</i>	143
<i>distans</i>	168
<i>rochai</i>	360

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<i>atra</i>	88
<i>crinosa</i>	132
<i>curvispinosa</i>	136, 144
<i>opaca</i>	310
<i>patei</i>	317
<i>rochai</i>	360
<i>saussurei</i>	367
<i>sumichrasti</i>	384
<i>torosa</i>	395

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<i>cerasi</i>	97
<i>depilis</i>	162
<i>formosa</i>	184
<i>laeviuscula</i>	203
<i>lineolata</i>	228
<i>minutissima</i>	243
<i>missouriensis</i>	255
<i>opaca</i>	311
<i>rifelna</i>	351
<i>torosa</i>	395

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<i>crinosa</i>	132
<i>depilis</i>	162
<i>obscurata</i>	300
<i>opaca</i>	311

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<i>corvina</i>	121
<i>distans</i>	168
<i>opaca</i>	311
<i>torosa</i>	395

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<i>dentinodis</i>	152
<i>opaca</i>	309
<i>patei</i>	317
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<i>atra</i>	88
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<i>limata</i>	214
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<i>opaca</i>	311
<i>torosa</i>	395

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<i>corvina</i>	122
<i>curvispinosa</i>	143
<i>distans</i>	168
<i>formosa</i>	184
<i>missouriensis</i>	255
<i>opaca</i>	311
<i>rifelna</i>	351
<i>torosa</i>	395

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<i>crinosa</i>	132
<i>opaca</i>	311
<i>rochai</i>	360
<i>torosa</i>	395

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<i>cerasi</i>	98
<i>coarctata</i>	111
<i>dentinodis</i>	152
<i>depilis</i>	162
<i>laeviuscula</i>	203
<i>opaca</i>	311
<i>torosa</i>	395
<i>vermiculata</i>	407

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<i>crinosa</i>	132
<i>curvispinosa</i>	144
<i>distans</i>	168
<i>laeviuscula</i>	204
<i>rochai</i>	360
<i>torosa</i>	396

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<i>atra</i>	88
<i>cerasi</i>	97
<i>corvina</i>	122
<i>crinosa</i>	132
<i>curvispinosa</i>	143
<i>laeviuscula</i>	204
<i>lineolata</i>	228
<i>minutissima</i>	243
<i>opaca</i>	311
<i>patei</i>	317
<i>rifelna</i>	351
<i>rochai</i>	360
<i>torosa</i>	395

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<i>ashmeadi</i>	78
<i>atra</i>	88
<i>coarctata</i>	111
<i>corvina</i>	121
<i>crinosa</i>	132
<i>curvispinosa</i>	137, 144
<i>formosa</i>	184
<i>minutissima</i>	243
<i>missouriensis</i>	255
<i>montezumia</i>	263
<i>mutans</i>	271

<i>obscurata</i>	300
<i>opaca</i>	311
<i>rifelna</i>	352
<i>saussurei</i>	362, 367
<i>sumichrasti</i>	384
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<i>crinosa</i>	132
<i>curvispinosa</i>	144
<i>sumichrasti</i>	384
<i>torosa</i>	396

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<i>corvina</i>	122
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<i>cerasi</i>	98
<i>crinosa</i>	132
<i>laeviuscula</i>	204
<i>lineolata</i>	229
<i>minutissima</i>	243
<i>missouriensis</i>	255
<i>pilosa</i>	326
<i>punctulata</i>	339
<i>vermiculata</i>	405

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<i>ashmeadi</i>	78
<i>cerasi</i>	98
<i>coarctata</i>	111
<i>crinosa</i>	132
<i>dentinodis</i>	152
<i>depilis</i>	162
<i>emeryana</i>	177
<i>isolata</i>	192
<i>laeviuscula</i>	204
<i>lineolata</i>	229
<i>minutissima</i>	244
<i>missouriensis</i>	255
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<i>torosa</i>	396
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<i>ashmeadi</i>	78
<i>cerasi</i>	97
<i>laeviuscula</i>	204
<i>lineolata</i>	230
<i>minutissima</i>	244
<i>missouriensis</i>	253
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<i>cerasi</i>	99
<i>coarctata</i>	111
<i>crinosa</i>	132
<i>dentinodis</i>	152
<i>emeryana</i>	177
<i>laeviuscula</i>	204
<i>lineolata</i>	230
<i>mutans</i>	266
<i>punctulata</i>	339
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Colorado

<i>cerasi</i>	99
<i>crinosa</i>	132
<i>emeryana</i>	178
<i>laeviuscula</i>	204
<i>lineolata</i>	230
<i>navajoa</i>	279
<i>punctulata</i>	339

Connecticut

<i>cerasi</i>	99
<i>lineolata</i>	230

Delaware

<i>cerasi</i>	99
<i>lineolata</i>	230
<i>pilosa</i>	326
<i>punctulata</i>	339

Florida

<i>ashmeadi</i>	78
<i>cerasi</i>	99
<i>curvispinosa</i>	143
<i>laeviuscula</i>	204
<i>lineolata</i>	230
<i>minutissima</i>	244
<i>missouriensis</i>	253
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<i>cerasi</i>	99
<i>laeviuscula</i>	197
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<i>cerasi</i>	99
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<i>cerasi</i>	99
<i>lineolata</i>	230
<i>missouriensis</i>	253
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<i>cerasi</i>	99
<i>laeviuscula</i>	204
<i>lineolata</i>	230
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<i>ashmeadi</i>	78
<i>cerasi</i>	97
<i>laeviuscula</i>	205
<i>lineolata</i>	230
<i>minutissima</i>	244
<i>missouriensis</i>	253
<i>obscurata</i>	300
<i>pilosa</i>	326
<i>punctulata</i>	339
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<i>ashmeadi</i>	76
<i>cerasi</i>	99
<i>lineolata</i>	231
<i>punctulata</i>	339

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<i>cerasi</i>	99
<i>lineolata</i>	231

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<i>cerasi</i>	99
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Mississippi

<i>ashmeadi</i>	79
<i>laeviuscula</i>	205
<i>lineolata</i>	231
<i>minutissima</i>	244
<i>missouriensis</i>	253
<i>pilosa</i>	326
<i>vermiculata</i>	408

Missouri

<i>ashmeadi</i>	79
<i>cerasi</i>	100
<i>laeviuscula</i>	205
<i>lineolata</i>	231
<i>minutissima</i>	244
<i>missouriensis</i>	248

Montana

<i>cerasi</i>	100
<i>coarctata</i>	112

Nevada

<i>coarctata</i>	112
<i>depilis</i>	162
<i>emeryana</i>	178
<i>laeviuscula</i>	205
<i>navajoa</i>	279
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New Jersey

<i>lineolata</i>	231
<i>pilosa</i>	319

New Mexico

<i>ashmeadi</i>	79
<i>cerasi</i>	100
<i>coarctata</i>	112
<i>dentinodis</i>	153
<i>depilis</i>	162
<i>emeryana</i>	178
<i>isolata</i>	193
<i>laeviuscula</i>	205
<i>lineolata</i>	231
<i>minutissima</i>	244
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<i>cerasi</i>	100
<i>laeviuscula</i>	205
<i>lineolata</i>	231
<i>minutissima</i>	242
<i>missouriensis</i>	253
<i>pilosa</i>	325
<i>punctulata</i>	340
<i>vermiculata</i>	405
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<i>cerasi</i>	100
Oklahoma	
<i>laeviuscula</i>	205
<i>lineolata</i>	232
<i>minutissima</i>	244
<i>missouriensis</i>	253
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<i>coarctata</i>	110
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<i>cerasi</i>	100

South Carolina

<i>ashmeadi</i>	76
<i>cerasi</i>	97
<i>laeviuscula</i>	205
<i>lineolata</i>	232
<i>minutissima</i>	244
<i>missouriensis</i>	253
<i>pilosa</i>	325
<i>punctulata</i>	338

South Dakota

<i>cerasi</i>	100
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Tennessee

<i>ashmeadi</i>	79
<i>cerasi</i>	100
<i>dentinodis</i>	153
<i>laeviuscula</i>	205
<i>lineolata</i>	232
<i>minutissima</i>	244
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<i>pilosa</i>	326
<i>pinicola</i>	330
<i>punctulata</i>	340
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Texas

<i>ashmeadi</i>	79
<i>cerasi</i>	100

<i>coarctata</i>	113
<i>corvina</i>	122
<i>dentinodis</i>	153
<i>depilis</i>	162
<i>emeryana</i>	178
<i>isolata</i>	193
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<i>coarctata</i>	113
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<i>ashmeadi</i>	80
<i>cerasi</i>	101
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