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# The genus *Maculiparia* (Phaeopariini, Romaleinae, Romaleidae) in Panama

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## Abstract

Two new species of *Maculiparia* Jago 1980 are described from Panama, one (*M. coibensis* n. sp) from the Island of Coiba, and another from Darién province (*M. embera* n. sp.). Both are brachypterous, unlike the previously described *M. rotundata* Stål, which is common only in the central part of the country.

## Introduction

The Phaeopariini (Giglio-Tos 1898, revised by Carbonell 2002) are a distinctive tribe of neotropical romaleine grasshoppers, most of which feed on grasses in wet lowland forest environments. The genus *Maculiparia* was erected by Jago (1980) to accomodate the two Central American species *annulicornis* (Stål 1873) and *rotundata* (Stål 1878); a considerable number of new South American species have since been added to it by Carbonell (2002). These include several brachypterous species: the two new species here described are, however, the first brachypterous members of the genus recorded from Central America. *M. rotundata* is the only other species of the genus reported from Panama, and it is fully alate.

## Methods

Specimens of *M. rotundata* and of *M. embera* were caught in Panama during the last 5 y by the author and Dr. A. Bentos-Pereira. Additionally, many of the specimens described below were captured by members of the staff of the Museo de Invertebrados G.B. Fairchild of the Universidad de Panama, and were made available by the courtesy of its Director, Prof. D. Quintero.

Standard taxonomical methods of dissection and measurement were employed.

### Abbreviations of depositaries

| | |
|---|---|
| ANSP | Academy of Natural Sciences, Philadelphia |
| GBFM | Museo de Invertebrados G.B. Fairchild, Universidad de Panama |
| RC | the author's collection. |

In the following text, calendric dates are given in the European convention (d.m.y).

### *Maculiparia* Jago 1980

Jago 1980: 21

*Type species*.— *Phaeoparia annulicornis* Stål 1873, by original designation.

*Type locality*.— Colombia: Antioquia: Remedios.

*Location of type specimen*.— Naturhistoriska Rijksmuseet, Stockholm, Sweden.

*Subsequent literature*.— Carbonell 2002: 53.

*No. of species currently known*.— 13.

*Range*.— Peru, Ecuador, Brazil, Colombia, Guyana, Venezuela, Panama.

*Etymology*.— Latin *macula*, spot, referring to the typical black spots on the female tegmen, and *-paria*, derived from the type genus *Phaeoparia*.

*Diagnosis*.— The generic characters have been presented and discussed in detail by Jago (1982) and Carbonell (2002).

#### 1. *M. rotundata* (Stål 1878)

This is the commonest and best known Panamanian species of the genus, distinguished from most other members of the genus by its almost full-sized elytra which [in the nominate (Panamanian) subspecies] terminate in smoothly rounded tips (Fig. 4 A-C), whereas most other fully alate species have obliquely truncated tips [except *M. immaculata* (Bruner 1908) of Guyana]. This species has been recently described and illustrated thoroughly by Carbonell (2002). It is included in this article for purpose of comparison, but no new specific descriptions are given.

*Distribution*.— (For map, see Fig. 10). *M. rotundata* is common in woodlands in the central part of the country, especially in the former Canal Zone, but also extends westward at least as far as Veraguas province, and is common in Provincia Coclé, *e.g.*, at Cerro Gaital and Cerro Copé. The type locality is yet further west, in Chiriquí province, but there are no modern records of it from this area, the lowland portions of which are largely deforested. To the east of the Canal Zone, it is found in the eastern part of Panama province, *e.g.*, in the Altos de Pacora, but in most of Darién appears to be replaced by *M. embera* n. sp. (see below). It extends eastward along the Caribbean coast at least as far as Ustupo (Kuna Yala) and perhaps further.



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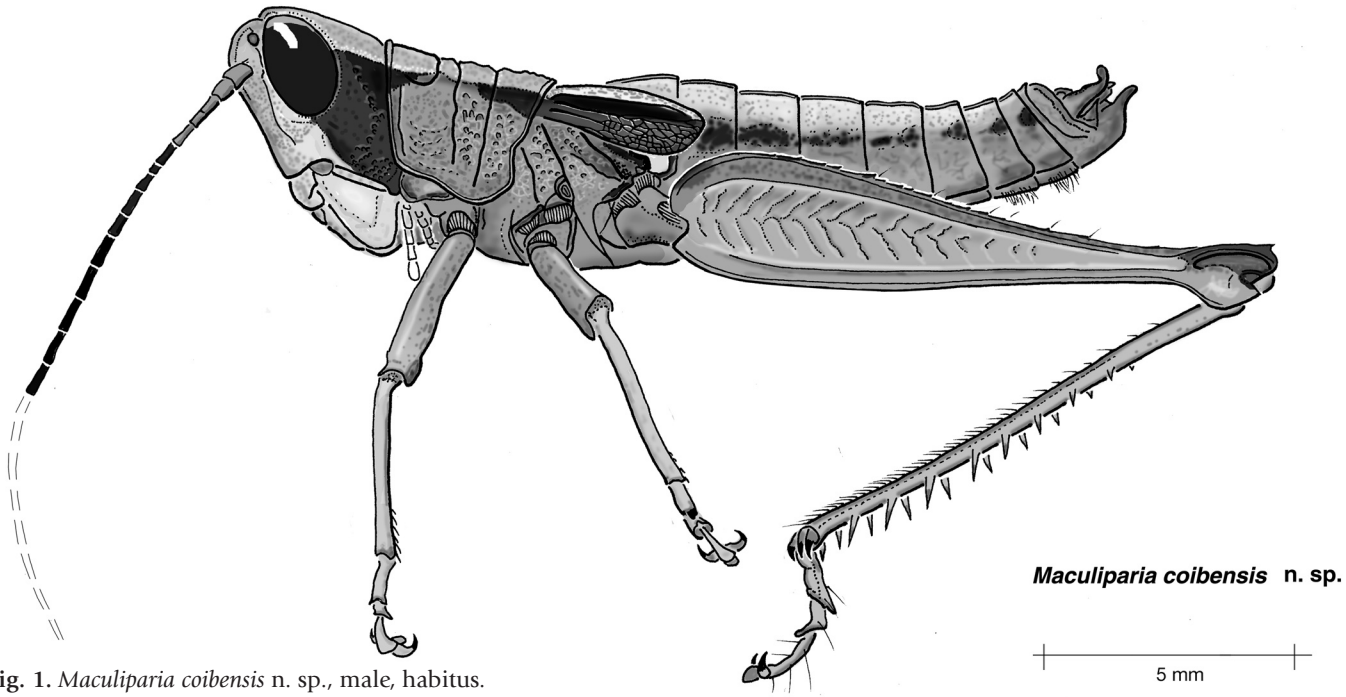



**Fig. 1.** *Maculiparia coibensis* n. sp., male, habitus.

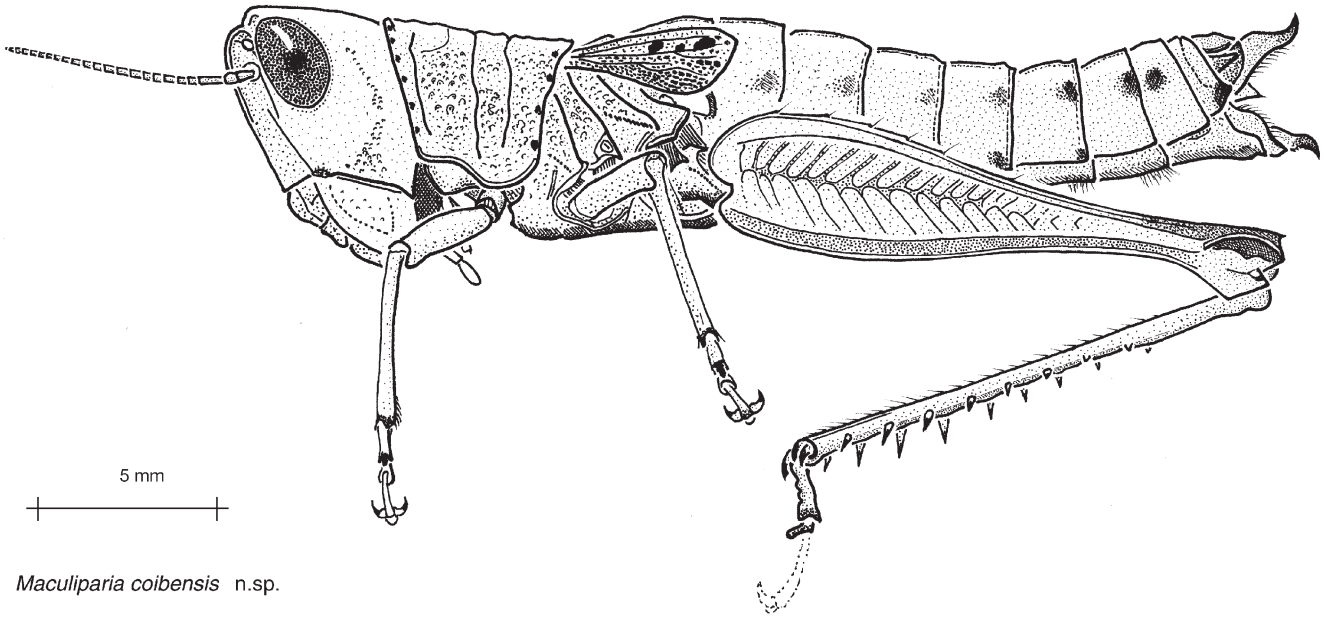



**Fig. 2**. *Maculiparia coibensis* n. sp., female, habitus.

**2. *Maculiparia coibensis* n. sp.**

*Holotype male*.— PANAMA: Prov. Veraguas: Isla Coiba: Playa Blanca-Cativales. 10 m, 31.7.1998 (De Gracia L), specimen no. 2001242 (ANSP).

*Paratype female*.— PANAMA, Prov. Veraguas: Isla Coiba: Cerro La Torre, 410 m, *ex* Malaise trap, 1.8.1998 (Cambra R Santos A), specimen no. 2001240 (ANSP).

*Other specimens examined*.— 5 larvae, data as holotype, 1 larva, data as paratype female (GBFM).

*Etymology*.— Coming from Coiba, a large island off the southwestern coast of Panama.

*Diagnosis*.—Habitus, see Figs 1, 2.

Smaller than *M. rotundata*; P (pronotum in midline), L (fastigium to tip of abdomen), and F (length of hind femur) respectively 3.81/5.53, 19.01/31.20, and 12.69/16.50 mm (male/female). Sexual dimorphism pronounced, L male/L female = 0.61, P male /P female = 0.69. See Table of Dimensions, Table 1. Eight external and 10 internal hind tibial spines present. External apical spine of hind tibia absent.

Apex of fastigium truncated and rounded in lateral view. Frons



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straight in profile, whereas in *rotundata* and *embera* it is slightly concave (Fig. 3A). In dorsal view the carinae of the fastigium diverge rearwards, in the other two species they tend to remain parallel (Fig. 3B). The antennae of the holotype are broken at the 11th segment (Fig. 1 ) but were obviously long when intact. Brachypterous: tegmina extend only into the second abdominal tergite ( Figs 1, 2, 4G, H) and do not touch or overlap in the midline. Dorsal and lateral surfaces of thorax moderately rugose; integument of abdomen smooth and polished. Anterior medial margin of pronotum very slightly convex; posterior margin of pronotum obtusely angulate in midline, lacking the smooth curves of the other two species (Fig. 3B).

Male furcula (Fig. 3D) similar in form to that of *M. rotundata*, but the processes more pointed and melanised; male cerci (Fig. 3C, D) slender, slightly clubbed at apex, curved inwards by > 90°, much more abruptly than in *rotundata*. The proximal part of the supra-anal plate (Fig. 3D) has the distal corners slightly produced, but the margin does not bear the tubular processes seen in r*otundata* (arrowed in 3D). Internal genitalia (Fig. 5) typical of the genus, and only slightly different from those of *M. rotundata*. Lophi (Figs 5F, H) more concave on their posterior face, and more rounded in axial view, while the ventrolateral plate (Fig. 5A) is more angular. Female subgenital plate (Fig. 6) with a short rounded medial projection and rather angulate posterior corners. Ovipositor valves strong, smooth edged, typical for the genus. The allotype female has only one hind leg, and the third tarsal segment is missing (Fig. 2). Antennae with 21 segments, much shorter than in the male. To avoid damage, the unique female allotype was not dissected to examine the spermatheca.

*Coloration*.—Male (Figs 1, 3A, B). Antennae pale basally, dark brown from third flagellar segment to apex. Frons and anterior part of genae, entire dorsal surface from fastigium to supra-anal plate, including the dorsal region of the eyes and the trailing edges of the elytra, pale straw color. Remainder of eye, postocular stripe, leading edge of elytron, and abdominal pleura, dark brown. Lobes of pronotum, thoracic pleura, upper and outer faces hind femora, light chestnut. Hind knee, tibae and tarsi darker colored, brown tinged olive green. Front and middle legs, straw. The male tegmen does not bear black spots, but has a black stripe separating its upper and lower parts (Figs 1, 4G). Wings reduced to short, colorless rudiments.

Female (Figs 2, 4H). Dull brown throughout, with three blackish brown spots on the tegmen, and small black markings at the anterior and posterior margins of the pronotum. The hind knees darker than the general body color. It should be noted that this specimen was pinned out of 70% alcohol and may be discolored; however, the coloration as reported above is typical of females of this genus.

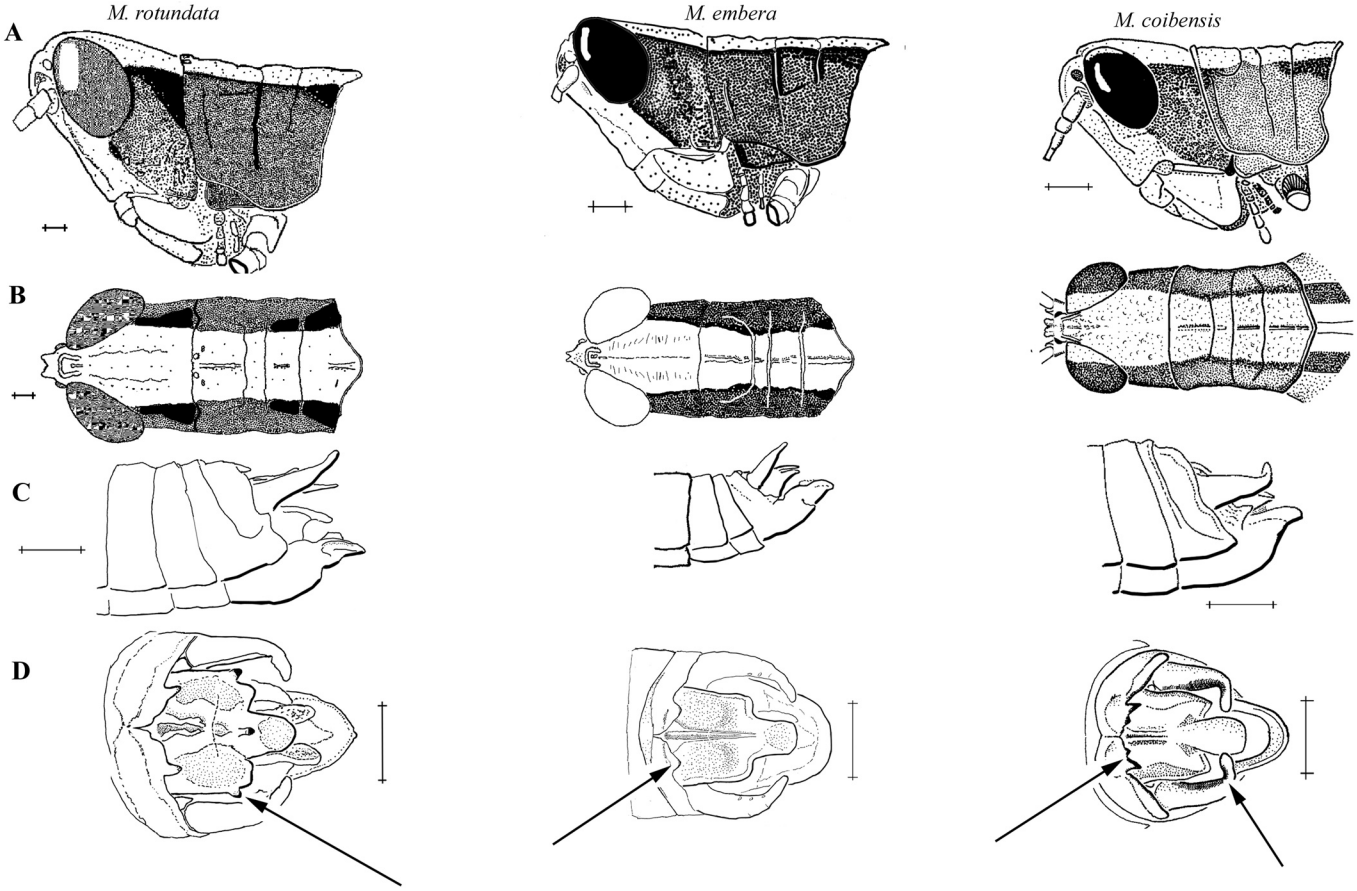



**Fig. 3.** Anatomical features of male Panamanian *Maculiparia* species: A. Head and pronotum, lateral view; B. Head and pronotum, dorsal view; C. Terminalia, lateral view; D. Terminalia, dorsal view. The main diagnostic features of the different species are indicated with arrows: *M. rotundata*, the tubular processes arising from the sides of the proximal part of the supra-anal plate. *M. embera*, the small, rounded and closely adjacent points of the furcula. *M. coibensis*, the pointed, melanized and doubled furcula, and the abruptly inflected cerci. Scale bars 1 mm throughout. This figure is designed to be a supplement to Figs 49 - 52 of Carbonell (2002).



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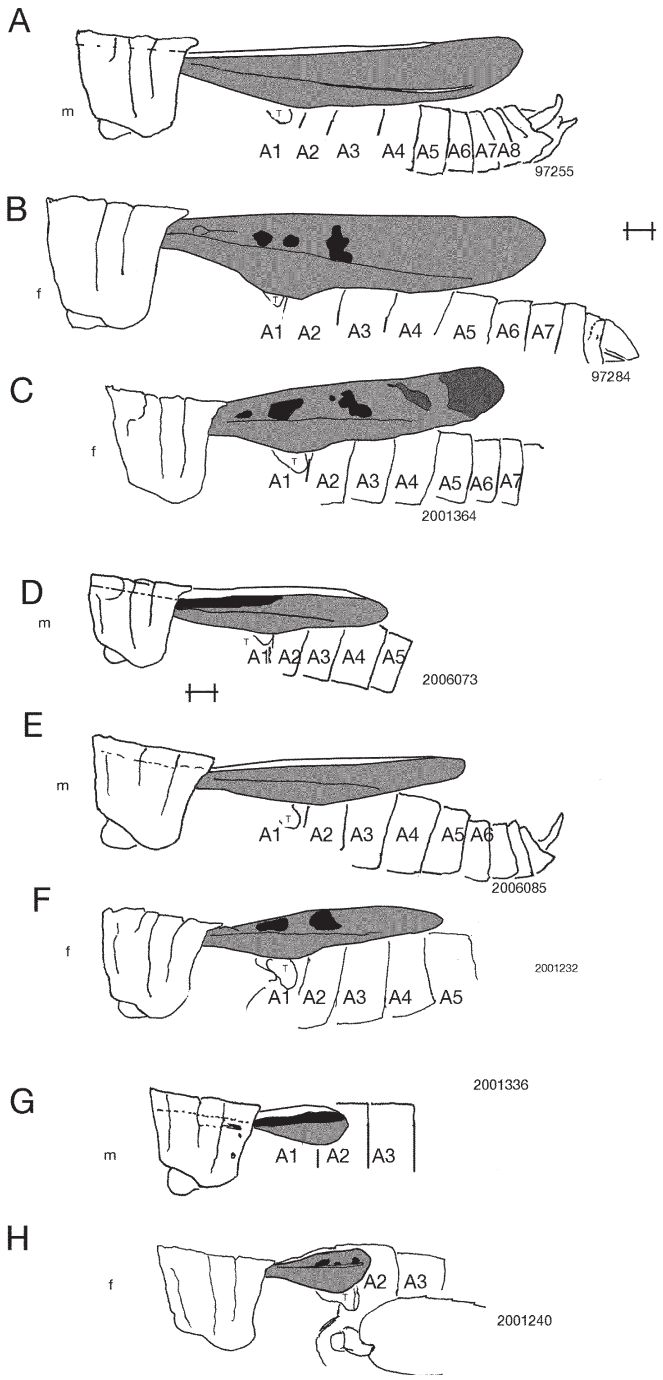



**Fig. 4.** Tegmina of Panamanian *Maculiparia* spp., to show variation in size between and within species. Symbols: m, f: male, female. T, tympanum. A1-A8, abdominal segments 1 to 8. Stippled areas brown (except in G, where grey with yellow reticulum); denser stipple indicates a darker shade of brown. Black areas, black. White areas (of tegmina only), straw yellow. Scale, 1 mm throughout. A-C *M. rotundata* Stål; A, B from Gamboa (Prov. Panama), C from Ustupo (Kuna Yala). Note that although C is much smaller than B, at first giving the impression of brachyptery, the actual extent of the elytron, to the border of the 6th and 7th abdominal segments, is the same in both individuals. D-F *M. embera* n. sp. D and F from Pirre, E from Sambú. D and E represent the approximate limits of variation in elytron length in this species. G, H *M. coibensis* n. sp. from Isla Coiba. The figure is designed as a supplement to Figs 41-43 of Carbonell 2002.

*Distribution*.— (Map, Fig. 10). Known to date only from the island of Coiba, off the southwest coast of Panama. The mainland in this region is largely deforested, but the species has not yet been found in the relict forests of the area, and *M. coibensis* may be a true island endemic. It should however be noted that *M. rotundata* is also present on Coiba, and thus the two species are there sympatric and presumably genetically isolated.

**3. *Maculiparia embera* n. sp.**

*Holotype male*.— PANAMA: Prov. Darien: Comarca Emberá: Rio Sambú: Jigurundó, *ca* 40 m. 21.1.2006 (Rowell C.H.F., Bentos A.), specimen no. 2006080 (ANSP).

*Paratype female*.— PANAMA: Prov. Darien: P.N. Darién: Pirre: Est. Rancho Frio. *ca* 80 m. 20. 3. to 5.4.2001 (Cambra R, Santos A, Bermudez S), specimen no. 2001231 (ANSP).

*Further paratype males*.—
PANAMA: data as holotype, but specimen no. 2006081.
PANAMA: Prov. Darien: Comarca Emberá: Rio Sambú: Puerto Indio: Serrania Bagre, lat 8° 10′ N, long 78° 20′ W 22.1.2006 (Rowell CHF), specimen no. 2006085 (RC).
PANAMA: Prov. Darien: Comarca Emberá: Rio Sambú: Puerto Indio: Serrania Bagre, lat 8° 10′ N, long 78° 20′ W 22.1.2006 (Rowell CHF), specimen no. 2006084.
PANAMA: Prov. Darien: Comarca Emberá: Rio Sambú: Bocas del Río Tigre lat 7°45′ N, long 78°20′ W, 20.1.2006. (Rowell CHF & Bentos A), specimen no. 2006052.

Numerous additional males and females from Pirre are deposited in GBFM.

*Etymology*.— Named for our gracious Emberá hosts, who permitted and assisted us to collect in their tribal country in 2005.

*Diagnosis*.— Smaller than *M. rotundata*; P (pronotum in midline), L (fastigium to tip of abdomen), and F (length of hind femur) respectively 4.09/6.02, 20.16/29.43, and 13.44/18.50 mm (male/female). Sexual dimorphism pronounced, L male/L female = 0.68, P male/P female = 0.68. (See Table 1, Dimensions). Seven to eight external hind tibial spines, median value eight; nine to 10 internal hind tibial spines, median value nine. External apical spine of hind tibia absent.

Rostrum slightly longer than in *rotundata*, and frons more concave in lateral view (Fig. 3A). Slightly brachypterous: tegmina vary in length, and in different individuals extend into the third, fourth or fifth abdominal segment (Figs 4D-F). Trailing edges of the tegmina touching and overlapping slightly in the midline. Dorsal and lateral surfaces of thorax moderately rugose, integument of abdomen smooth and polished. Anterior medial margin of pronotum slightly convex; posterior margin produced rearwards to a bluntly rounded point, which is not truncated as it often is in *M. rotundata* (Fig. 3B).

Male furcula (arrowed in Fig. 3D) distinctly different from that of *M. rotundata* and *M. coibensis*, with two small, rounded projections placed close to the midline. Supra-anal plate (Fig 3D) subquadrate proximally, with a medial groove and rounded distal corners; terminating distally in a rather truncate lingulate process. Male cerci slender, slightly clubbed at apex, but curved gently inwards by less than 90° in dorsal view; the other two species have more abruptly incurved cerci. Internal male genitalia (Fig. 5) differ from those of



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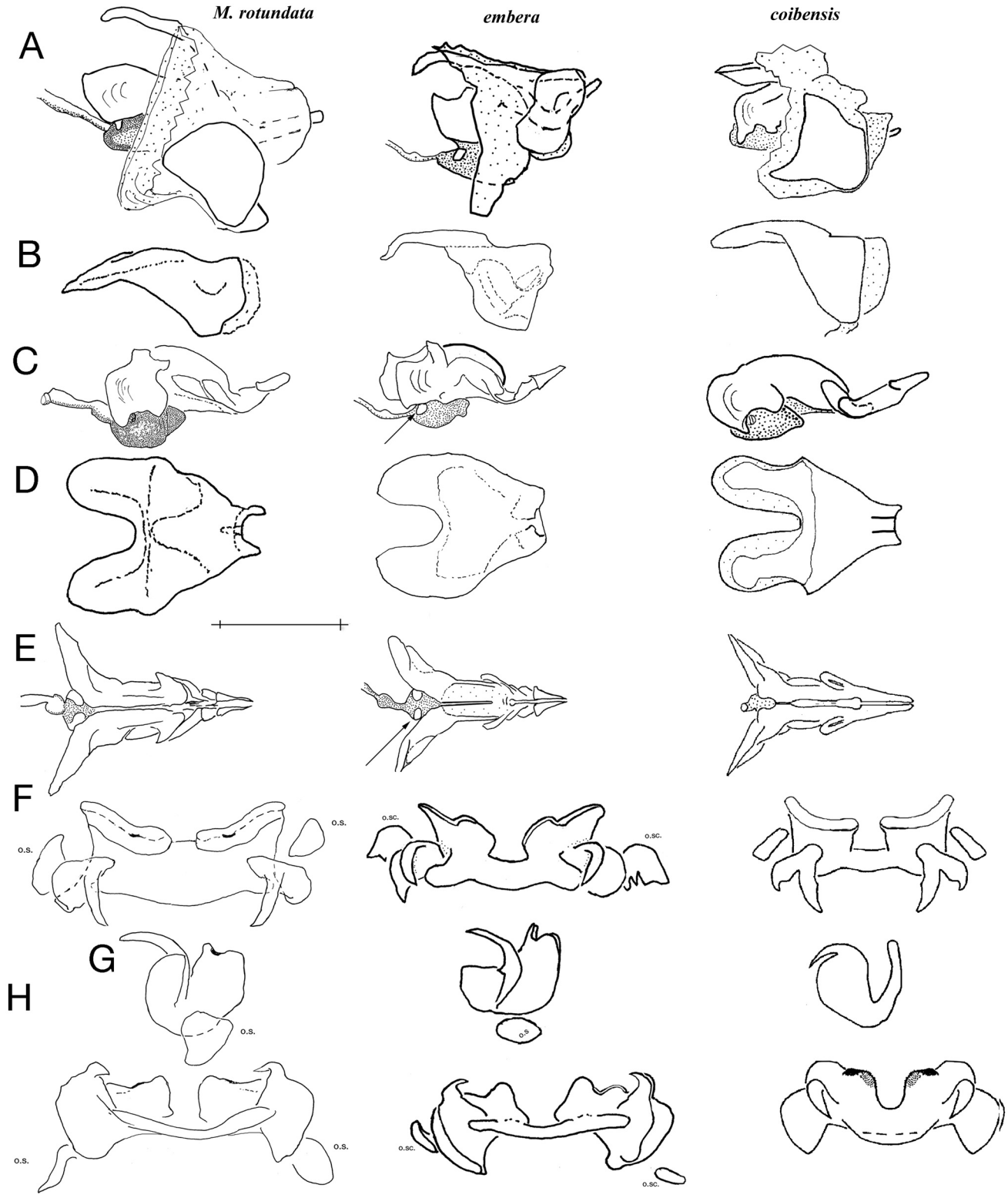



**Fig. 5.** Phallic structures of Panamanian *Maculiparia* spp. A. Phallic complex, lateral view. B. Cingular rami and apodemes, lateral view. C. Endophallus, lateral view. D. Cingular apodemes, dorsal view E. Endophallus, dorsal view. F. Epiphallus, dorsal view. G. Epiphallus, lateral view. H. Epiphallus, axial view. Arrows in C and E indicate paired sclerites at base of ejaculatory duct, a characteristic of the Tribe Phaeopariini (Amedegnato 1978). o. s. & o. sc.: oval sclerites of epiphallus (F, G, & H). Scale, 1 mm throughout. The figure is designed as a supplement to Figs 63-66 of Carbonell 2002.



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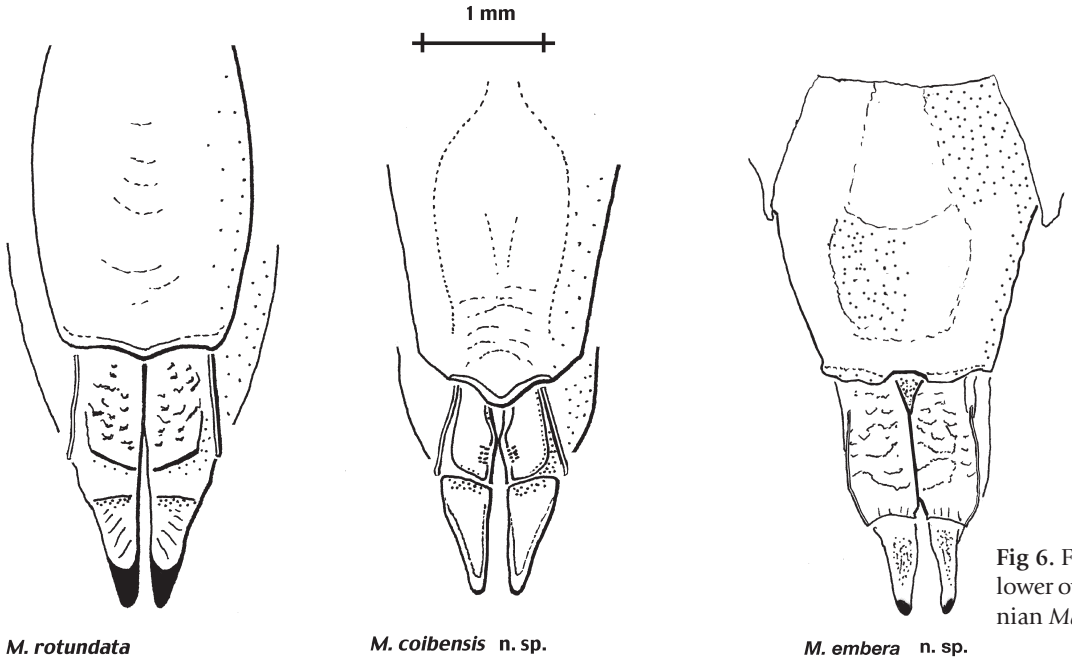



**Fig 6.** Female subgenital plate and lower ovipositor valves in Panamanian *Maculiparia* spp.

## *Maculiparia embera* n. sp.

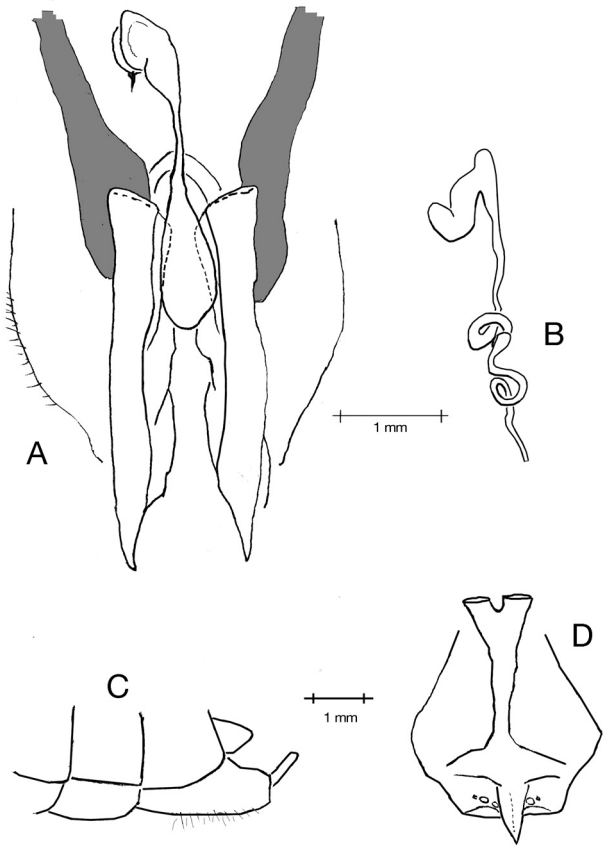



**Fig. 7**. Female reproductive structures in *M. embera* n. sp. A. Bursa copulatrix, spermathecal duct and spermatheca *in situ*. B. Spermatheca and duct after maceration. C. Subgenital plate in lateral aspect. D. Subgenital plate, dorsal surface.

*M. rotundata* and *coibensis* principally in having the dorsal margin of the plate-like lophi prominently excavated by a V-shaped notch (Fig. 5F). The cingular apodemes even shorter and wider than in the other two species, the cingulum tending towards a discoidal shape in dorsal view (Fig. 5D)

Female subgenital plate (Fig. 6) with an almost straight posterior edge, slightly notched in the midline, and a sharply inflected egg guide, its tip pointed in dorsoventral view, rounded in lateral view (Figs 7 C, D). Ovipositor valves smooth and pointed, typical for the genus (Figs 9, 7A). Antennae with 23 segments, slightly shorter than in the male. Bursa copulatrix short and simple. Most of the length of the spermathecal duct is wound into a coil which is bundled with the spermathecal ampulla by connective tissue (Fig. 7A). After maceration the spermatheca itself (Fig. 7B) is revealed as simple, and identical with that figured for *Maculiparia annulicornis* Stål (given as *Phaeoparia maculipennis* Stål) by Amedegnato (1977: Fig 69). Carbonell's review (2002) makes no mention of the internal female genitalia, but this identity indicates that the spermatheca is relatively invariable within this genus.

*Coloration*.—Male (Figs 3A, B; habitus: Fig. 8). Antennae pale yellow basally, dark blackish brown from 3rd flagellar segment to apex. Entire face (*i.e.*, frons, clypeus and labrum, palps, anterior edges of genae) pale yellow, with sparse darker spotting. Dorsal surface of head and thorax, from fastigium to ends of the trailing edges of the elytra, pale straw color. Eye, postocular stripe, upper lobes of pronotum, leading edge of elytron, thoracic pleura, dark brown, shading to blackish in the more dorsal areas bordering the straw-colored dorsal stripe. Lower lobes of pronotum chestnut; abdomen, upper and outer faces of hind femora,varying shades of brown, lighter than thoracic pleura. The lower external carina of the femur bears a narrow yellow stripe, more conspicuous in fresh specimens. Hind knee dorsally darker-colored than the rest of the femur, ventrally lighter. Rarely the hind femur of the male is dark green, not brown; this color variant is also present in *M. rotundata*. Hind tibiae and tarsi, bright red, the tarsi rather duller in hue. Front and middle tibiae and tarsi, straw, femora dark brown. The male tegmen bears traces of black spots similar to those of the female. Wing orange.



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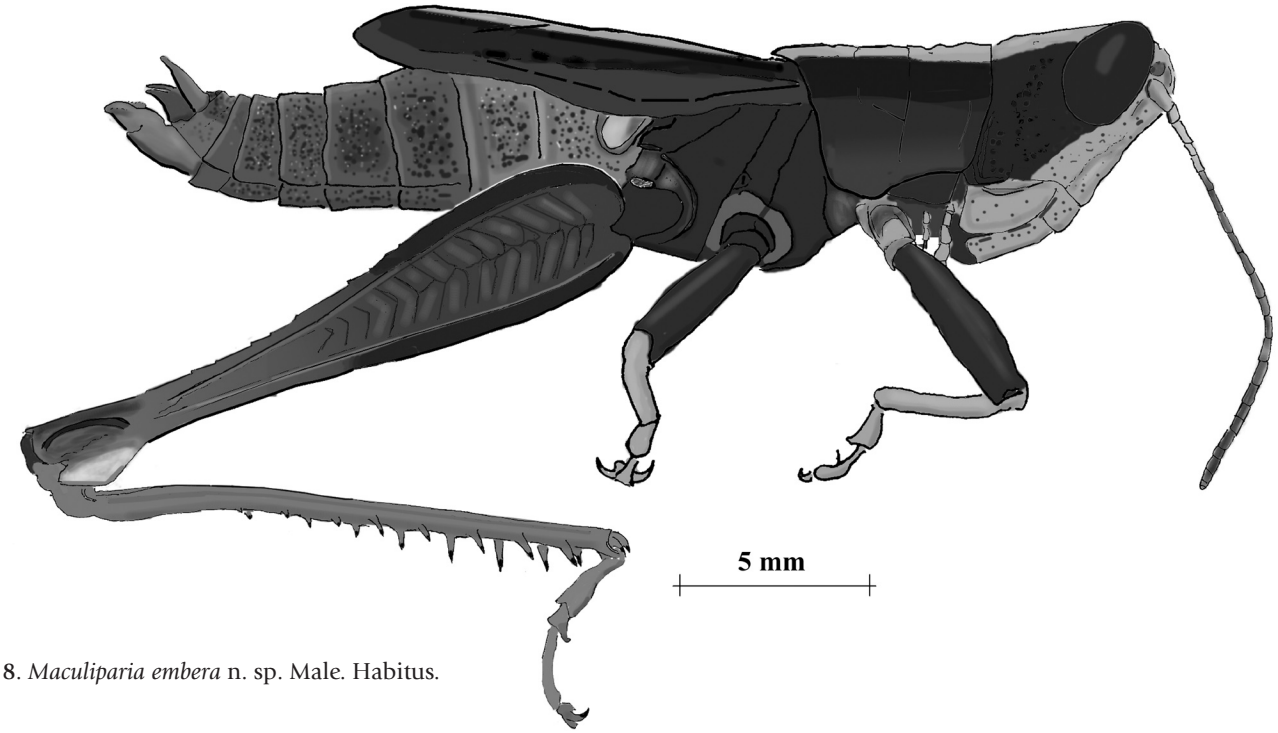



**Fig. 8**. *Maculiparia embera* n. sp. Male. Habitus.

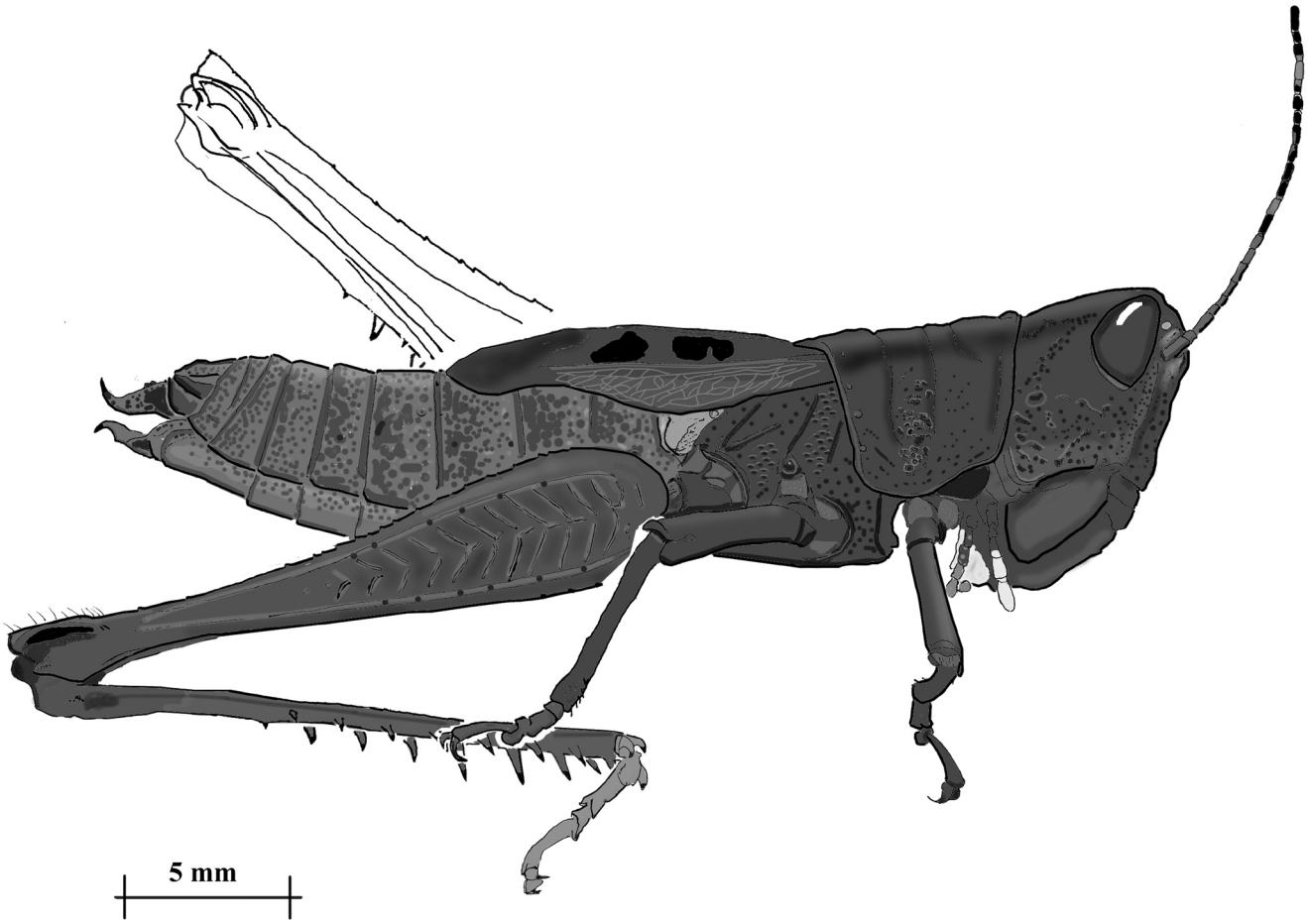



**Fig. 9**. *Maculiparia embera* n. sp. Female. Habitus.



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Male larvae are colored similarly to the adult, but the hind tibiae are brown, not red.

**Female** (habitus: Fig. 9). Dull brown throughout, including bases of antennae, except as noted below; slightly lighter on the underside and in a dorsal stripe running from apex of fastigium to posterior margin of pronotum. Tegmina each with two to three well-marked black spots, or a black bar caused by their fusion; wings orange-pink. Apices of palps flattened and pale yellow in color. Antennal flagellum mostly black with some patches of light brown. The hind knees are darker than the general body color. The yellow stripe on the external ventrolateral carina of the hind femur and the red coloration of the hind tibiae and feet are less vivid than in the male. (*NB*: In specimens which have been pinned from alcohol, *e.g.*, those caught in a Malaise trap, colors are lighter than in life).

Female larvae are dark brown throughout; the inner faces of their hind femora are lightly banded in a paler color.

*Distribution*.— (Map, Fig. 10) Widely distributed in the province of Darién, from near sea level on the Pacific coast (Rio Sambú) to at least 800 m in the Serrania de Pirre. Not as yet recorded from the Kuna Yala, which borders the northeastern (Caribbean) coast of the Darién.

*Natural history*.— In light gaps with some grass and along trails in forest, like other members of the genus. Both adults and late larvae were present in the Rio Sambú area in January, in the dry season when few other grasshoppers were to be found. As in other species of this genus, the males are active and conspicuous, the females sluggish and harder to find. At Pirre, females were much more often caught in Malaise traps than were males.

*Systematic position*.— *M. coibensis* and *M. embera*, like their other Central American congener *M. rotundata*, appear to be members of the annulicornis species group (Carbonell 2002), and if so are its only brachypterous members.

## Discussion

Carbonell (2002: 57) divided *M. rotundata* (Stål) into two subspp., a nominate one in Central Panama and another (*M. r. carrikeri*) in Colombia and Ecuador. He speculated that their zone of contact might lie in Darién. Rather, the present results indicate that the two forms are separated from each other by a third taxon, *M. embera*, which extends across almost the entire width of the Darién. It is however still possible that the two subspp. of *rotundata* adjoin each other on the Caribbean coast of Panama or Colombia, from which records are missing.

## Acknowledgements

I am grateful to Prof. D. Quintero, Director of the Museo de Invertebrados G.D. Fairchild, Universidad de Panama, for allowing me to examine and describe the specimens of *Maculiparia* detailed above. I thank Dr. Alba Bentos for her aid and companionship in the field in Sambú and Gamboa, the authorities of ANAM, Panama, for permits to collect and export specimens, and the Cacique General of the Emberá for permission to visit and collect in their territory in 2005.

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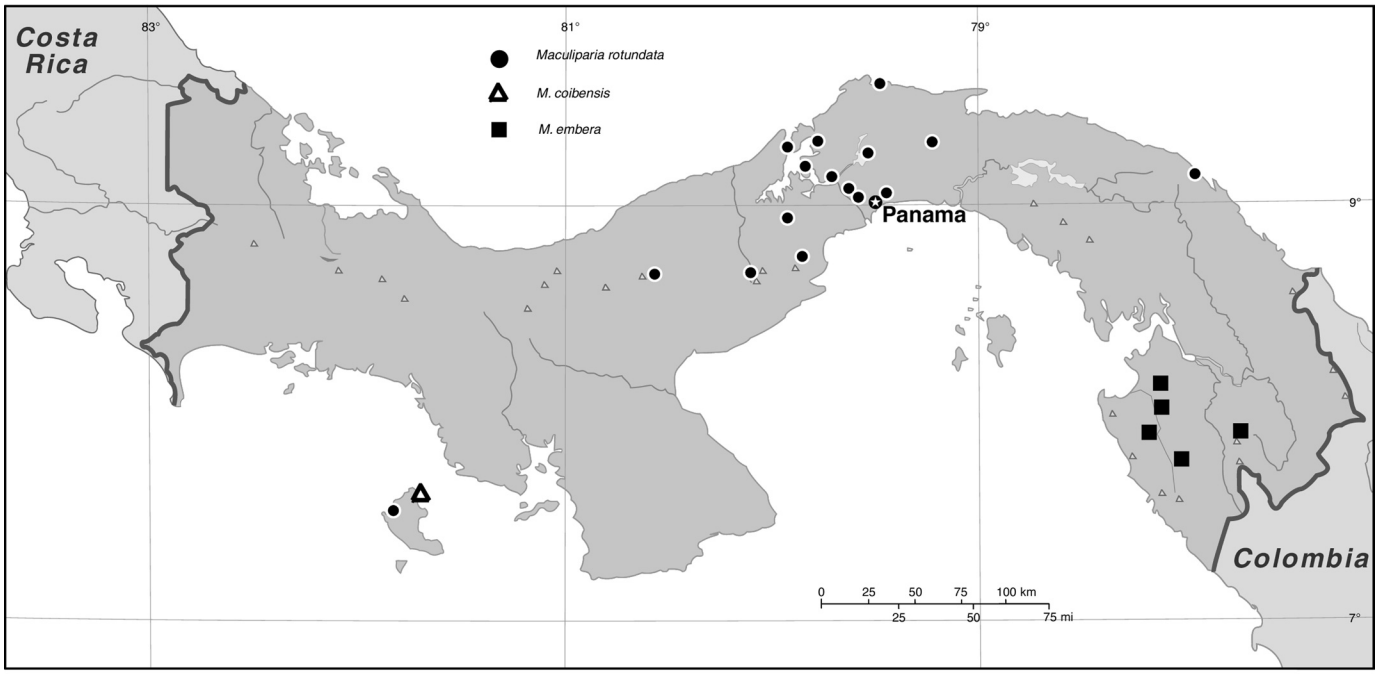



**Fig. 10.** Distribution map of known localities for *Maculiparia* spp. in Panama. The type locality for *M. rotundata* in Chiriquí province in extreme western Panama, is not given, as the precise locality is unknown and the species has not been found in Chiriqui in modern times.



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**Table 1.** Dimensions of Panamanian *Maculiparia* spp. The measured structures are: P: pronotum in midline, viewed from above; L: total length, from tip of fastigium to end of abdomen; Ant: length of antennal flagellum; IOS: interocular space; F: length of hind femur; FD: maximum width of hind femur; Tegmen: length of tegmen; TA1-Ta3: lengths of tarsal segments 1 to 3.

| | | Dimensions in mm | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | P | L | Ant | IOS | F | FD | Tegmen | Ta1 | Ta2 | Ta3 | Ta1+2+3 |
| *Maculiparia rotundata* | | | | | | | | | | | | |
| Males | Maximum | 4.75 | 23.85 | 12.29 | 0.76 | 16.10 | 3.55 | 13.00 | 1.96 | 0.65 | 1.96 | 4.45 |
| | Minimum | 4.13 | 20.90 | 10.79 | 0.62 | 13.87 | 2.94 | 11.64 | 1.52 | 0.43 | 1.74 | 3.69 |
| | Average | 4.44 | 22.60 | 11.75 | 0.70 | 14.80 | 3.21 | 12.30 | 1.73 | 0.52 | 1.84 | 4.09 |
| | $s_{\bar{x}}$ | 0.20 | 1.05 | 0.50 | 0.05 | 0.71 | 0.22 | 0.50 | 0.16 | 0.07 | 0.07 | 0.27 |
| | $s_{\bar{x}}$/average | 0.05 | 0.05 | 0.04 | 0.07 | 0.05 | 0.07 | 0.04 | 0.09 | 0.13 | 0.04 | 0.07 |
| | n | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | | | | | | | | | 0.42 | 0.13 | 0.45 | |
| Females | Maximum | 6.85 | 34.45 | 11.03 | 1.32 | 21.35 | 4.67 | 19.40 | 2.30 | 0.69 | 2.38 | 5.31 |
| | Minimum | 5.72 | 31.41 | 7.51 | 1.03 | 17.54 | 4.03 | 16.38 | 2.00 | 0.48 | 2.01 | 4.66 |
| | Average | 6.46 | 33.54 | 9.02 | 1.17 | 19.88 | 4.24 | 18.43 | 2.14 | 0.63 | 2.21 | 4.97 |
| | $s_{\bar{x}}$ | 0.36 | 1.10 | 1.20 | 0.11 | 1.34 | 0.20 | 1.10 | 0.11 | 0.08 | 0.14 | 0.25 |
| | $s_{\bar{x}}$/average | 0.06 | 0.03 | 0.13 | 0.10 | 0.07 | 0.05 | 0.06 | 0.05 | 0.12 | 0.06 | 0.05 |
| | n | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 |
| | | | | | | | | | 0.43 | 0.13 | 0.45 | |
| Sex. Dimorph. (M/F) | | 0.69 | 0.67 | 1.30 | 0.60 | 0.74 | 0.76 | 0.67 | 0.81 | 0.83 | 0.83 | 0.82 |
| *Maculiparia coibensis* n. sp. | | | | | | | | | | | | |
| | Maximum | 4.18 | 19.42 | 12.77 | 0.78 | 13.62 | 2.97 | 4.11 | 1.62 | 0.52 | 1.66 | 3.76 |
| | Minimum | 3.81 | 19.02 | 7.21 | 0.68 | 12.69 | 2.68 | 3.60 | 1.53 | 0.48 | 1.56 | 3.61 |
| | Average | 4.00 | 19.22 | 9.99 | 0.73 | 13.16 | 2.83 | 3.90 | 1.58 | 0.50 | 1.61 | 3.69 |
| | n | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| | | | | | | | | | 0.43 | 0.14 | 0.44 | |
| Females | Maximum | 5.53 | 31.20 | 8.32 | 1.12 | 16.72 | 3.57 | 5.87 | 1.91 | 0.58 | 1.85 | 4.28 |
| | Minimum | 5.53 | 30.37 | 7.15 | 1.09 | 16.50 | 3.52 | 4.89 | 1.74 | 0.52 | 1.85 | 4.28 |
| | Average | 5.53 | 30.79 | 7.74 | 1.11 | 16.61 | 3.55 | 5.44 | 1.83 | 0.55 | 1.85 | 4.28 |
| | n | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 1 |
| | | | | | | | | | 0.43 | 0.13 | 0.43 | |
| Sex. Dimorph. (M/F) | | 0.72 | 0.62 | 1.29 | 0.66 | 0.79 | 0.80 | 0.72 | 0.86 | 0.91 | 0.87 | 0.86 |
| *Maculiparia embera* n. sp. | | | | | | | | | | | | |
| Males | Minimum | 3.76 | 16.05 | 9.66 | 0.44 | 12.52 | 2.48 | 7.46 | 1.41 | 0.39 | 1.56 | 3.56 |
| | Maximum | 4.44 | 22.89 | 12.03 | 0.75 | 14.18 | 3.22 | 10.38 | 1.79 | 0.58 | 1.87 | 4.24 |
| | Average | 4.09 | 20.16 | 10.77 | 0.64 | 13.44 | 2.92 | 8.63 | 1.57 | 0.51 | 1.76 | 3.84 |
| | $s_{\bar{x}}$ | 0.23 | 1.97 | 0.79 | 0.09 | 0.67 | 0.21 | 0.80 | 0.12 | 0.06 | 0.09 | 0.22 |
| | $s_{\bar{x}}$/average | 0.06 | 0.10 | 0.07 | 0.15 | 0.05 | 0.07 | 0.09 | 0.07 | 0.12 | 0.05 | 0.06 |
| | n | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | | | | | | | | | 0.41 | 0.13 | 0.46 | |
| Females | Minimum | 5.67 | 26.97 | 8.06 | 1.02 | 16.59 | 3.42 | 11.37 | 1.74 | 0.52 | 1.56 | 4.30 |
| | Maximum | 6.45 | 32.40 | 10.63 | 1.16 | 20.09 | 4.12 | 12.48 | 2.21 | 0.80 | 2.34 | 5.10 |
| All females | Average | 6.02 | 29.43 | 9.37 | 1.10 | 18.50 | 3.91 | 11.89 | 1.92 | 0.63 | 2.01 | 4.56 |
| | $s_{\bar{x}}$ | 0.29 | 2.01 | 1.16 | 0.06 | 1.39 | 0.26 | 0.47 | 0.19 | 0.11 | 0.29 | 0.33 |
| | $s_{\bar{x}}$/average | 0.05 | 0.07 | 0.12 | 0.05 | 0.08 | 0.07 | 0.04 | 0.10 | 0.18 | 0.14 | 0.07 |
| | n | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 |
| | | | | | | | | | 0.42 | 0.14 | 0.44 | |
| Sex. Dimorph. (M/F) | | 0.68 | 0.69 | 1.15 | 0.58 | 0.73 | 0.75 | 0.73 | 0.82 | 0.80 | 0.88 | 0.84 |



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**Table 1.** cont. In the section headed "ratios" these measurements are normalised with respect to P, to allow interspecific comparison. The boxed numbers for each section correspond to the Foot Formula, the relative proportions of the 3 tarsal segments to the length of the entire foot. In the present instance this formula is essentially identical for all species and sexes. Sexual dimorphism is expressed as the ratio of average of the male and female measurements, and is close to 0.7 for all three species (Pm/Pf). Where the dimorphism ratio is larger than 0.7, it indicates that that structure is relatively larger in males than in females, *e.g.*, the antenna, where the ratio for Ant/P varies from 1.30 and 1.69, showing that the antenna is relatively almost twice as long in males as in females.

| Ratios: | | | | | | | | | | Numbers: | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| L/P | Ant/P | IOS/P | F/P | FD/P | Tegmen/P | Ta1-3/P | F/FD | Ta1-3/F | | Ext spines | Int Spines |
| *Maculiparia rotundata* | | | | | | | | | | | |
| 5.26 | 2.88 | 0.17 | 3.45 | 0.76 | 2.94 | 1.02 | 4.87 | 0.30 | | 9 | 10 |
| 4.96 | 2.41 | 0.14 | 3.22 | 0.67 | 2.61 | 0.86 | 4.41 | 0.27 | | 8 | 9 |
| 5.09 | 2.65 | 0.16 | 3.33 | 0.72 | 2.77 | 0.92 | 4.62 | 0.28 | | 8 | 10 |
| 0.12 | 0.19 | 0.01 | 0.08 | 0.03 | 0.14 | 0.05 | 0.16 | 0.01 | | | |
| 0.02 | 0.07 | 0.06 | 0.02 | 0.05 | 0.05 | 0.06 | 0.04 | 0.04 | | | |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | | 7 | 7 |
| 5.49 | 5.16 | 0.20 | 3.27 | 0.72 | 2.98 | 0.82 | 5.01 | 0.27 | | 8 | 10 |
| 4.95 | 1.26 | 0.16 | 2.82 | 0.62 | 2.68 | 0.71 | 4.35 | 0.23 | | 7 | 9 |
| 5.20 | 2.03 | 0.18 | 3.08 | 0.66 | 2.86 | 0.78 | 4.69 | 0.25 | Median: | 8 | 10 |
| 0.18 | 1.54 | 0.01 | 0.16 | 0.04 | 0.12 | 0.04 | 0.26 | 0.01 | | | |
| 0.03 | 0.76 | 0.08 | 0.05 | 0.06 | 0.04 | 0.06 | 0.06 | 0.04 | | | |
| 7 | 6 | 7 | 7 | 7 | 7 | 6 | 7 | 6 | | 7 | 7 |
| 0.98 | 1.31 | 0.87 | 1.08 | 1.10 | 0.97 | 1.19 | 0.99 | 1.10 | | 1 | 1 |
| *Maculiparia coibensis* n. sp. | | | | | | | | | | | |
| 4.99 | 3.06 | 0.19 | 3.33 | 0.71 | 1.05 | 0.95 | 4.74 | 0.28 | | 8 | 10 |
| 4.65 | 3.06 | 0.18 | 3.26 | 0.70 | 0.98 | 0.90 | 4.59 | 0.28 | | 8 | 10 |
| 4.82 | 3.06 | 0.18 | 3.29 | 0.71 | 1.02 | 0.92 | 4.66 | 0.28 | Median: | 8 | 10 |
| 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | 2 | 2 |
| 5.64 | 1.50 | 0.20 | 3.02 | 0.65 | 1.06 | 0.77 | 4.69 | 0.26 | | 8 | 10 |
| 5.49 | 1.29 | 0.20 | 2.98 | 0.64 | 0.88 | 0.77 | 4.68 | 0.26 | | 8 | 10 |
| 5.57 | 1.40 | 0.20 | 3.00 | 0.64 | 0.97 | 0.77 | 4.69 | 0.26 | Median: | 8 | 10 |
| 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | | 2 | 2 |
| 0.87 | 2.18 | 0.91 | 1.10 | 1.10 | 1.05 | 1.19 | 0.99 | 1.09 | | | |
| *Maculiparia embera* n. sp. | | | | | | | | | | | |
| 4.27 | 2.29 | 0.12 | 3.18 | 0.66 | 1.83 | 0.87 | 4.11 | 0.26 | | 7 | 9 |
| 5.29 | 2.99 | 0.18 | 3.46 | 0.80 | 2.34 | 1.02 | 5.05 | 0.30 | | 8 | 10 |
| 4.92 | 2.64 | 0.15 | 3.29 | 0.71 | 2.11 | 0.94 | 4.62 | 0.29 | Median: | 8 | 9 |
| 0.33 | 0.20 | 0.02 | 0.08 | 0.05 | 0.15 | 0.05 | 0.29 | 0.01 | | | |
| 0.07 | 0.08 | 0.11 | 0.02 | 0.07 | 0.07 | 0.05 | 0.06 | 0.05 | | | |
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | 10 | 10 |
| 4.29 | 1.30 | 0.18 | 2.81 | 0.58 | 1.91 | 0.29 | 4.46 | 0.22 | | 7 | 9 |
| 5.71 | 1.87 | 0.19 | 3.26 | 0.72 | 2.05 | 0.34 | 4.97 | 0.26 | | 8 | 9 |
| 4.90 | 1.56 | 0.18 | 3.07 | 0.65 | 1.98 | 0.32 | 4.73 | 0.24 | Median: | 8 | 9 |
| 0.49 | 0.21 | 0.00 | 0.16 | 0.05 | 0.05 | 0.02 | 0.21 | 0.02 | | | |
| 0.10 | 0.14 | 0.02 | 0.05 | 0.08 | 0.03 | 0.07 | 0.04 | 0.06 | | | |
| 6 | 6 | 6 | 6 | 6 | 6 | 5 | 6 | 5 | | 6 | 6 |
| 1.00 | 1.69 | 0.85 | 1.07 | 1.10 | 1.07 | 2.97 | 0.98 | 1.17 | | | |



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