

Systematics, Morphology and Biogeography

Notes on social wasps of the group of *Mischocyttarus* (*Omega*) *punctatus* (Ducke), with description of six new species (Hymenoptera, Vespidae, Polistinae)



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ABSTRACT

A revision of the taxonomic status and an identification key for wasp species of the genus *Mischocyttarus* related to *M. punctatus* (Ducke, 1904) are presented here. Six new species are proposed (*M. tayrona* Silveira **sp. nov.**; *M. anchicaya* Silveira **sp. nov.**; *M. caxiuana* Silveira **sp. nov.**; *M. verissimoi* Silveira **sp. nov.**; *M. rodriguesi* Silveira **sp. nov.**; *M. ryani* Silveira **sp. nov.**), raising to nine the number of species in the *M. punctatus* group. The highest diversity of the group concentrates in northern South America, in Andean areas and Amazonia. New information concerning the very peculiar nests of these wasps is also given.

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Introduction

Megacanthopus punctatus was described by Ducke (1904) based on a single specimen found on a small nest in Alcântara, a coastal locality in the Brazilian state of Maranhão. The Latin description is rather long and detailed, but does not mention the unusual nest architecture of this species group (certainly because the specimen nest examined was too small). Ducke's only reference to the nest of that new species appears in a short section describing the material examined: "... (a female) on a very small nest". Just in a subsequent paper, after collecting additional material of the species in a locality more than a thousand kilometers westward (in the state of Pará), Ducke provided a description and photograph of an exceptional nest form in which "new cells are fixed to the distal rim of older ones" (Ducke, 1907: 189, Plate III, Fig. 9). Forty-five years later, a second closely related species was described from Peru by Zikán (1949) under the name *Mischocyttarus vaqueroi*. More recently, Snelling (1983) described *Mischocyttarus chaluca* from Mexico [Richards (1978: 371) anticipated that Mexican specimens mentioned by Ducke (1918) would possibly be an unrecognized species]. The *M. punctatus* group is part of the subgenus *Omega* de Saussure 1854, which also comprises the species groups of *M. filiformis* (de Saussure, 1854), *M. surinamensis* (de Saussure, 1854), and *M.*

prominulus Richards, 1941. The latter two groups were added to the subgenus after a cladistic study by Silveira (2008). The subgenus is referred to by the name *Monacanthocnemis* (Ducke, 1905) in Richards (1978), a junior synonym of *Omega* (see Carpenter and Day, 1988).

A revision of the group of *M. punctatus*, derived from the study of the types of all of the described species and additional material found in several museums, is presented here with the recognition of nine species, six of them new to science.

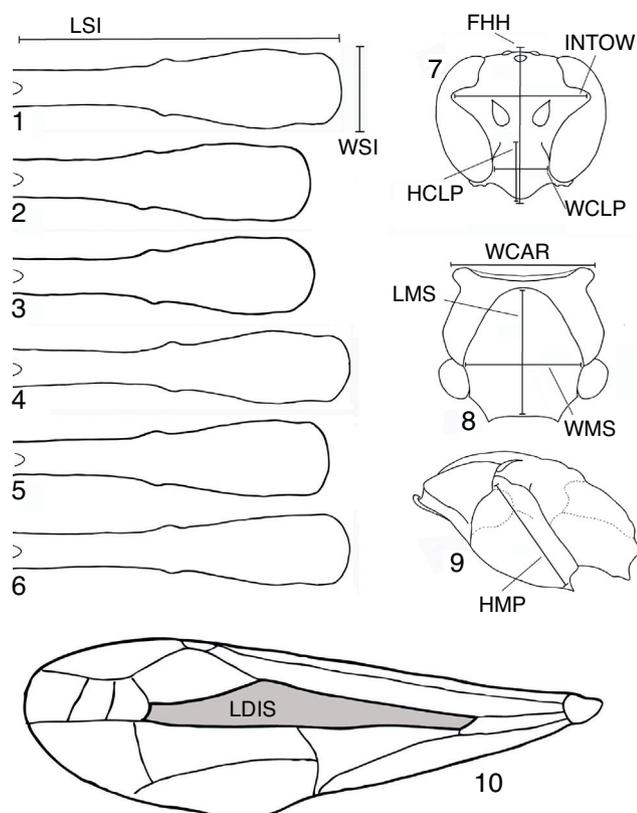
Material and methods

Source collections. Coleção Entomológica Pe. Jesus Santiago Moure, Curitiba (UFPR-DZUP), Dr. Gabriel de Melo; Bohart Museum, University of California at Davis, Davis (UCDC), Dr. S.L. Heydon; Fundação Instituto Oswaldo Cruz, Rio de Janeiro (IOC), Dr. Márcio Félix; Instituto Nacional de Pesquisas da Amazônia, Manaus (INPA), Dr. Augusto Henriques; Museo Nacional de Historia Natural del Paraguay, Asunción (INBP), Dr. John Kochalka and Bolívar Garcete-Barrett; Museu Paraense Emílio Goeldi, Belém (MPEG); Natural History Museum, London (NHM), Dr. Gavin Broad; Universidad Nacional de Colombia, Bogotá (ICN), Dr. Carlos Sarmiento.

The present study benefited from loans from the institutions mentioned above, and especially from visits to Fundação Oswaldo Cruz (Rio de Janeiro, December/2009 and November/2011) and the Natural History Museum (London, April/2010; October, 2013). The specimens were examined under dissecting stereomicroscopes ZEISS SV-11 and LEICA MZ-16.

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Figs. 1–10. Schematic drawings showing proportions and measurements of body parts. 1–6: first metasomal segment in dorsal view respectively of: (1) *Mischocyttarus ryani* sp. nov.; (2) *M. punctatus*; (3) *M. anchicaya* sp. nov.; (4) *M. rodriguesi* sp. nov.; (5) *M. caxiuana* sp. nov.; (6) *M. verissimoi* sp. nov. (length = 2.78 mm); (7) head, frontal; (8) pronotum and mesoscutum, dorsal; (9) mesosoma, lateral; (10) left anterior wing. FHH: height of head; INTOW: distance between eyes at the level of ocular sinus; HCLP, WCLP: height and width of clypeus; WCAR: width of pronotal carina; LMS, WMS: length and width of mesoscutum; HMP: height of mesopleuron; LDIS: length of discal cell of fore wing; LSI, WSI: length and apical width of first metasomal segment.

Measurements. The following measurements and ratios were obtained from observations using a ZEISS SV-11 stereomicroscope fitted with an ocular micrometer (Figs. 1–10): LSI: length of first metasomal segment from the ligament aperture to the apex, WSI: width of first metasomal segment at the apex (Fig. 1); FHH: height of head in frontal view, INTOW: distance between eyes at the level of ocular sinus, HCLP: height of clypeus, WCLP: width of clypeus (Fig. 7); WCAR: width of pronotal carina from above, LMS: length of mesoscutum, WMS: width of mesoscutum (Fig. 8); HMP: height of mesopleuron from secondary spiracular entrance to articulation of mid coxa (Fig. 9); LDIS: length of discal cell of fore wing (Fig. 10).

Ratios: FHH/INTOW: aspect ratio of head in frontal view; H/WCL: aspect ratio of clypeus; OOL/POL: ratio between ocello-ocular and postocellar distances; WCA/WMS: ratio between the width of pronotal carina and the width of mesoscutum; L/WMS: aspect ratio of mesoscutum; LDIS/HMP: ratio between the length of discal cell and height of mesopleuron; LSI/HMP: ratio between the length of first metasomal segment and height of mesopleuron.

Photographs of specimens were obtained using a LEICA DFC-420 camera coupled to a LEICA MZ-16 stereomicroscope (Figs. 11 and 12), and photos of nests with cameras SONY-Cybershot and CANON-EOS (Figs. 13 and 14). Male genitalia were not investigated, as previous observations (Silveira, 2008) did not reveal significant interspecific variations. The terminology here is the same used by Silveira (2008, 2013).

Geographic distributions. Species distributions are based on the examined material. Geographic coordinates were obtained from the collection labels and through the Google Earth program (version 5.2.1.1588), and the distribution map of the species was generated using DIVA-GIS 7.5.0 (Fig. 15).

Results

The group of *Mischocyttarus punctatus* (Ducke, 1904)

Refers to a group of nine known species sharing the following characteristics: posterior part of the head near the occipital foramen forming a deep cavity, its ventral portion horizontal and sharply margined, like a shelf; pronotum without fovea, and with anterior lamella strongly raised medially and reflexed, the region immediately posterior without a secondary margin, pronotal carina usually very high and projecting at sides, often lobated; proepisternum with anterior margin strongly raised and reflexed, with a pre-marginal raised crest (double margined); male antenna short, apex hook-like or subspirally rolled; male aedeagus dorsally with distal portion rapidly expanded and angular at sides, base of aedeagus as a linear elongate dorsal lobe developed anteriorly up to the paramere basal processes; paramere spine nearly glabrous; nest comb vertical with one elongated row of cells (rarely several and forked rows of cells).

Key to species of the *M. punctatus* group (for females, except as noted)

1. Occipital carina less developed in lateral view, fading down at the level of ocular sinus, and (from behind) positioned more inwards in a direction that is coincident with the lower lateral margin of pre-foraminal concavity situated just below, which is sharply margined throughout (Fig. 11N); yellow marks on head and mesosoma very extensive, including most of median ventral areas 2

1'. Occipital carina well developed in lateral view, ending fairly below the level of ocular sinus, and (from behind) positioned outwards in relation to lower lateral margin of pre-foraminal concavity, which has the lower margin as a more rounded edge (Fig. 11M); yellow marks developed as usual, mesopleuron with just two spots, remaining areas black or reddish; pronotum mainly black; metasomal segments mainly black or dark brown with distal yellow bands 3

2(1). Clypeus about as high as wide, with a black or dark brown median elongated mark; metasomal segments black or very dark brown with distal yellow bands; metasomal petiole very long and narrow (Fig. 6); size of punctures on mesoscutum grading rather continuously from small to moderately large *Mischocyttarus verissimoi* Silveira sp. nov. (Fig. 12D; northwestern S. America)

2'. Clypeus narrower, distinctly higher than wide, practically entirely yellow; metasomal terga and sterna light testaceous with distal yellow bands; metasomal petiole long but a little more robust, wider at apex (Fig. 5); punctures on mesoscutum of two distinct size-classes *Mischocyttarus caxiuana* Silveira sp. nov. (Fig. 12C; eastern Amazonia)

3(1). Sculpture of mesoscutum with disordered aspect, puncture diameter grading rather continuously from ca. 0.02 to 0.05 mm; if the upper size is a little larger, then the small punctures tend to be predominantly larger than 0.02 mm, never very small (Figs. 11C–D, G and J); first metasomal sternum yellow from base to apex; propodeal yellow spots always large and lung-shaped 4

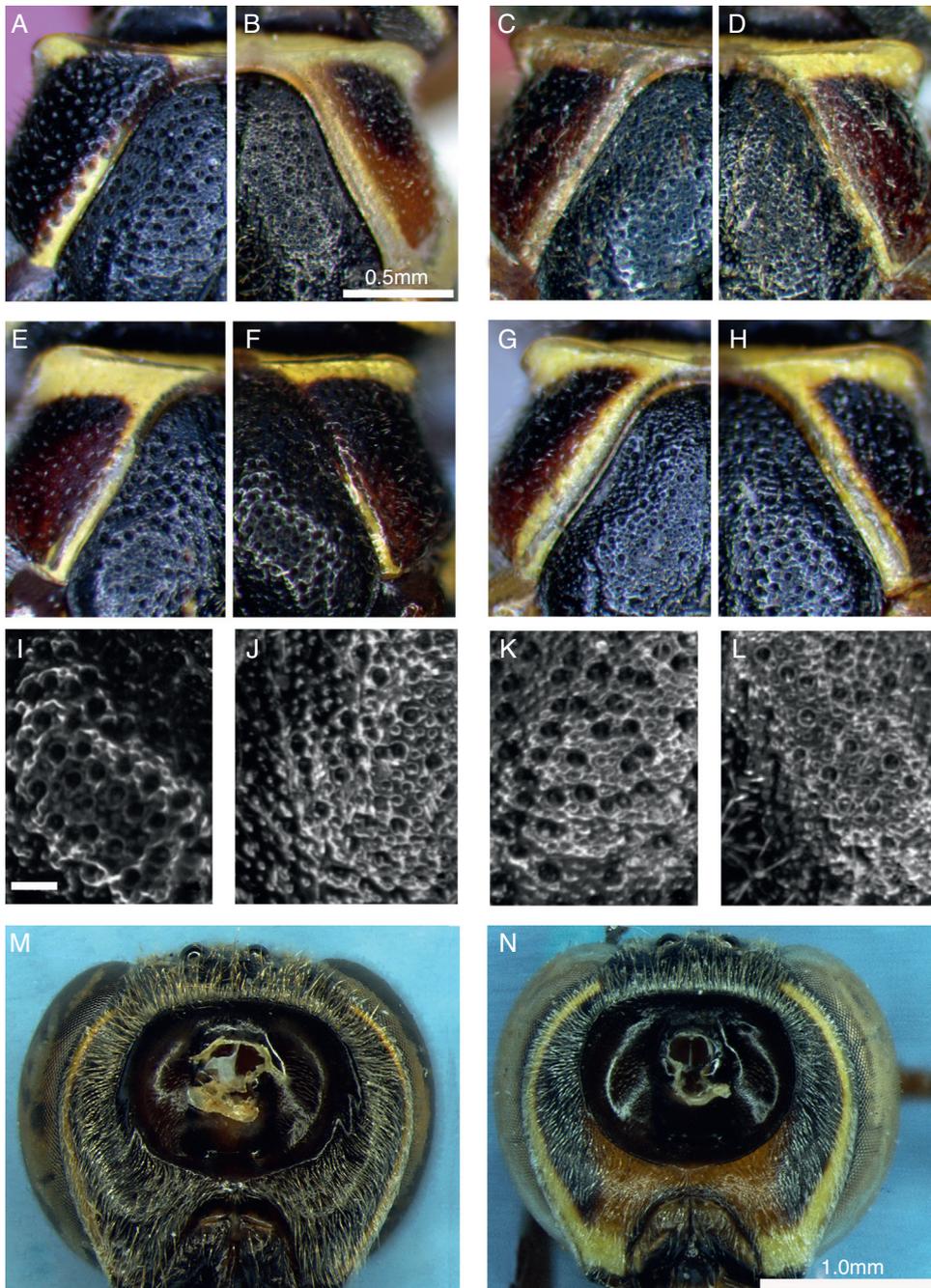


Fig. 11. (A–H) Partial halves of anterior mesosoma to show pronotal carina and mesoscutal sculpture (scale as in B): (A) *Mischocyttarus rodriguezi* **sp. nov.**; (B) *M. caxiuana* **sp. nov.**; (C) *M. punctatus*; (D) *M. ryani* **sp. nov.**; (E) *M. tayrona* **sp. nov.**; (F) *M. anchicaya* **sp. nov.**; (G) *M. verissimoi* **sp. nov.**; (H) *M. vaqueroi*. (I–L) Detail of mesoscutal sculpture (scale bar = 0.1 mm): (I) *M. anchicaya* **sp. nov.**; (J) *M. ryani* **sp. nov.**; (K) *M. rodriguezi* **sp. nov.**; (L) *M. caxiuana* **sp. nov.**. (M–N) Posterior view of head showing pre-foraminal region and occipital carina (scale as in N): (M) *M. vaqueroi*; (N) *M. caxiuana* **sp. nov.**

3'. Sculpture of mesoscutum with ordered aspect, punctures of two very distinct size-classes, the larger ones being numerous and very distinct measuring ca. 0.06 mm or more, the smaller with 0.02 mm or less (Figs. 11A–B, E–F, H, I and K–L); first metasomal sternum yellow only at or near the expanded apical region; propodeal yellow spots small to medium-sized, rarely large and lung-shaped

4(3). Metasomal petiole longer and narrower (Fig. 1); pronotal carina a little more lobated and reflexed at sides, with more concave profile; reddish areas on pronotum of a darker tone (Fig. 11C); male antennal article 13 more than three times longer

than broad *Mischocyttarus ryani* Silveira **sp. nov.** (Figs. 12F and 14A–C; southeastern S. America)

4'. Metasomal petiole shorter and more robust (Fig. 2); pronotal carina a little less lobated at sides; reddish areas on pronotum of a lighter tone; male antennal article 13 shorter, up to three times longer than broad *Mischocyttarus punctatus* (Ducke) (northern S. America and Trinidad)

5(3). Small-sized punctures on mesoscutum indeed very small and shallow, often hard to visualize, interspaces shining (Figs. 11E–F and I); head frontal sculpture formed by well visible medium-sized

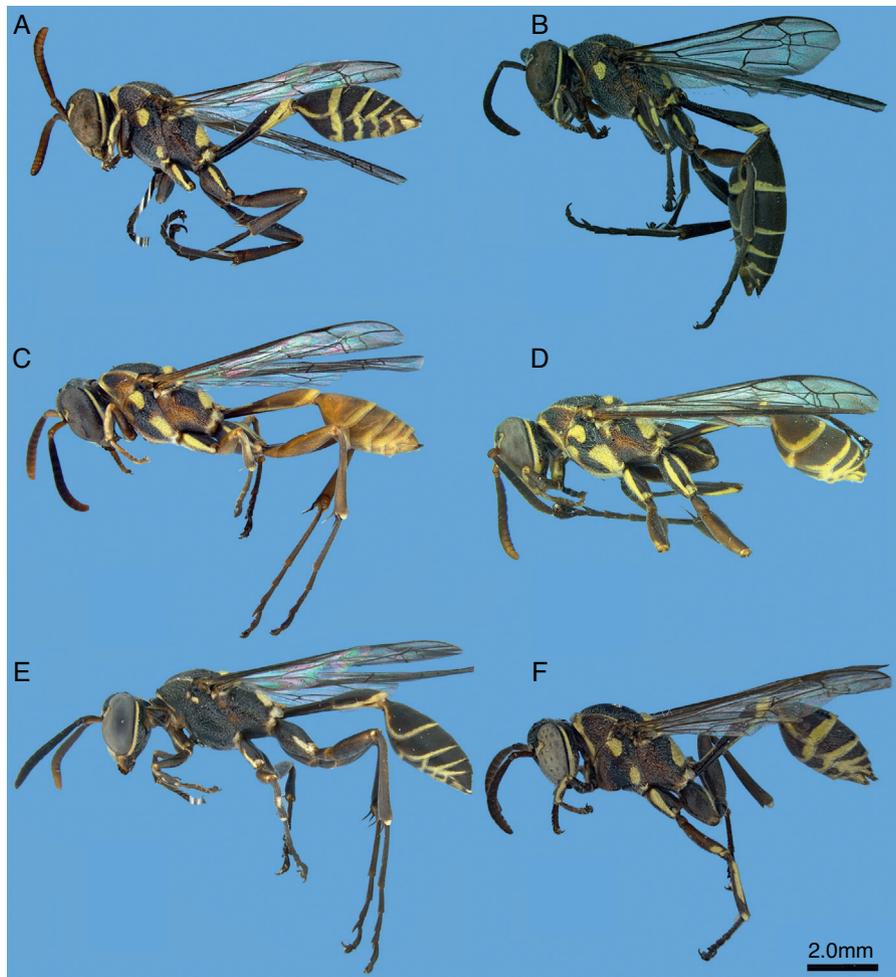


Fig. 12. General lateral views of holotype females of: (A) *Mischoctytarus tayrona* **sp. nov.**; (B) *M. anchicaya* **sp. nov.**; (C) *M. caxiuana* **sp. nov.**; (D) *M. verissimoi* **sp. nov.**; (E) *M. rodriguessi* **sp. nov.**; (F) *M. ryani* **sp. nov.**

punctures and nearly indistinguishable micropunctures; paired oblique yellow streaks adjacent to antennal sockets more often narrower; ratio between length of first metasomal tergum and height of mesopleuron (LSI/HMP) ca. 1.5, quite frequently lower than this value 6

5'. Small-sized punctures on mesoscutum not so small, despite being very different in size from the larger ones (Figs. 11A-B, H and K-L); head frontal sculpture with puncture diameter more variable, small punctures larger and more easily distinguishable; paired oblique yellow streaks above antennal sockets more often wider; length of first metasomal tergum variable but often longer than described above 8

6(5). Lamella of pronotal carina exceptionally low at sides for this group; lamella of anterior margin of pronotum medially distinctly less reflexed than in other species; yellow colored parts often more restricted, propodeal spots small 7

6'. Lamella of pronotal carina not so low, well developed in spite of hardly forming lobes nor being notably reflexed at sides; light colored parts more extensive, propodeal spots medium to large *Mischoctytarus tayrona* Silveira **sp. nov.** (Fig. 12A; Panama and northern Colombia)

7(6). Female clypeus wider than high; punctures on head just anterior to occipital carina stronger; female clypeus almost

entirely reddish tinged, pronotum laterally and mesopleuron similarly colored, with black areas much reduced *Mischoctytarus chalucas* Snelling (Mexico to Costa Rica)

7'. Female clypeus narrower, distinctly higher than wide; punctures on head just anterior to occipital carina weaker; female clypeus yellow with black or blackish marks, pronotum and mesopleuron with extensive black areas *Mischoctytarus anchicaya* Silveira **sp. nov.** (Fig. 12B; northern S. America west of Andes and "intervalles")

8(5). Metasomal petiole very long and narrow, LSI ca. 1.56 or more times the height of the mesopleuron (HMP), its apical width only ca. 0.29 HMP (Fig. 4); color deep black with yellow marks reduced on head and thorax, virtually without reddish areas (Fig. 12E), yellow transversal stripe on pronotal carina interrupted symmetrically on two sectors near the center (Fig. 11A); integument sculpture very strong (Figs. 11A and K) *Mischoctytarus rodriguessi* Silveira **sp. nov.** (Figs. 12E and 14E; southeastern Amazonia)

8'. Metasomal petiole less elongated and slender; yellow marks more extensive, transversal stripe on pronotal carina continuous from side to side (Fig. 11H); mesosoma often with reddish areas *Mischoctytarus vaqueroi* Zikán (Fig. 14F; Bolivia, Peru, Ecuador, Colombia, northern Brazil)

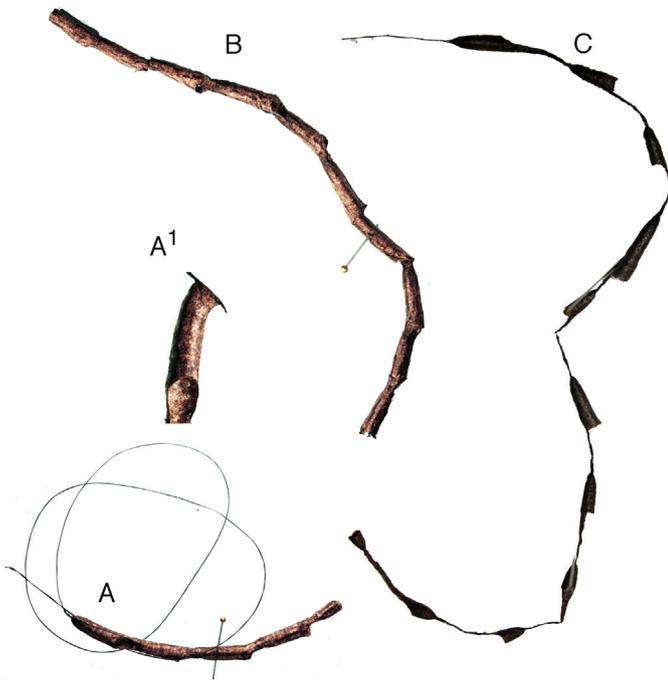


Fig. 13. (A) Nest of *M. rodriguesi* sp. nov. (nest A; Caxiuaná, PA) showing attachment to stem of *Cuscuta trichostyla*; (A1) detail of attachment of basal cell of nest A to the substrate plant; (B) nest fragment of *M. rodriguesi* sp. nov. (nest B; Caxiuaná, PA); (C) large fragment of abandoned nest of the *M. punctatus* group (Juruti, PA) showing several incomplete cells and long “interconnecting stalks”.

Mischocyttarus punctatus (Ducke, 1904) (Figs. 2 and 11C)

Megacanthopus punctatus Ducke, 1904: 363; Holotype: Female, Brazil, MA, Alcântara, 27 ix 1903, A. Ducke (MPEG) [examined].

Megacanthopus punctatus: Ducke, 1907: 189, pl. 3, Fig. 9; Overall, 1978: 6.

Mischocyttarus punctatus: Ducke, 1918: 353, 370 (in part); Richards, 1945: 404, Figs. 72, 73 (in part); Zikán, 1949: 118; Overall, 1978: 6; Richards, 1978: 370 (in part); Snelling, 1983: 279; Carpenter, 1999: 22; Garcete-Barrett, 1999: 27 (misidentification); Silveira, 2008: 517 (in part).

Short redescription. Wing length 7.0–8.0 mm. Clypeus about as high as wide, ratio H/WCL 0.98–1.04; first metasomal segment relatively robust (Fig. 6), LSI/HMP 1.40–1.45, with the apex ca. 1.88–2.0 times wider than the basal petiole; sculpture of mesoscutum with disordered aspect, puncture diameter grading rather continuously from ca. 0.02 to 0.05 mm (Fig. 11C); pronotal carina more or less lobated at sides, but not very strongly concave forward. Reddish areas on pronotum of a lighter tone; propodeal marks very large and lung-shaped; first metasomal sternum yellow from base to apex. Male antennal article 13 well elongate but relatively broad, measuring about 0.25 mm, and being 2.54 times longer than broad (width measured in dorsal view), ca. 0.9 times as long as article 12+11, these articles proportionally quite broad, nearly quadrate, article 12 ca. 1.11 and article 11 ca. 0.90 times as long as broad. Nest comb as a single vertical row of cells.

Distribution: Trinidad; Surinam (1); Brazil: MA, PA (1; Richards, 1978: 371).

Remarks. Richards, 1978: 371 (but not 1945) described the male of *M. punctatus* without informing the collecting data of the

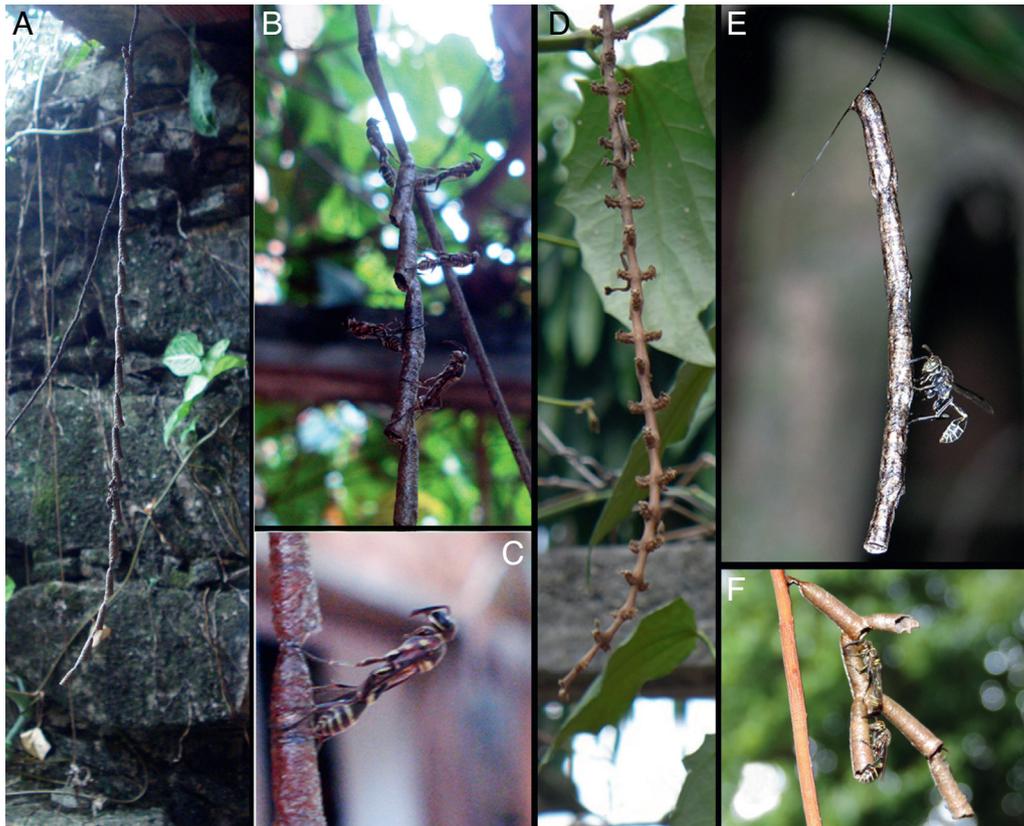


Fig. 14. (A) Large colony (ca. 40 cm) of *Mischocyttarus ryani* sp. nov. (Lençóis, BA); (B and C) details of other two colonies of *M. ryani* sp. nov. showing individuals raising their bodies on mid and hind legs (same place); (D) mature inflorescence of a vine wherein colonies of *M. ryani* sp. n. were also found (same place); (E) small colony (nest A) with individual female of *M. rodriguesi* sp. nov., hanging from a *Cuscuta trichostyla* filiform stem in deep Amazonian rainforest (Caxiuaná, PA); (F) small colony with three females on a forked nest of *M. vaquerói*, hanging from a suspense root, in Caxiuaná (PA).

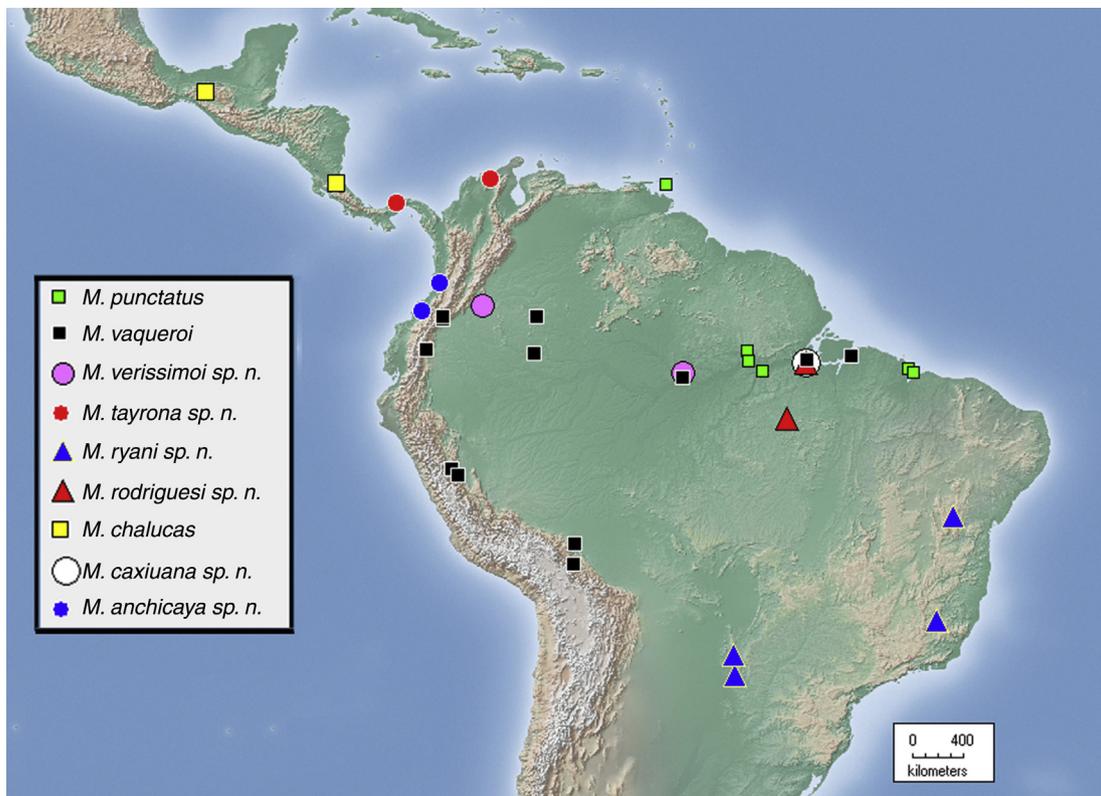


Fig. 15. Map with distribution of the studied species of the *M. punctatus* group.

specimen(s). The character conditions described are those normally referable to sexual differences, and the antennal characteristics reported by the author agree reasonably well with those described here, although article 13 may have been slightly longer in Richards' specimen. The proportions of the antennal apical articles described here are based on a male specimen from Trinidad deposited in the London Museum (NHM).

The only confirmed recent record for *M. punctatus* is from Maranhão, São José de Ribamar (see below), and all other citations by recent authors refer to other species. So *M. punctatus* is considerably less widespread than previously thought. Extreme northern records (i.e., Mexico; in [Ducke, 1918](#)) proved to be of a different species, described by [Snelling \(1983\)](#) as *M. chalucas*. In the appendix of [Ducke \(1918\)](#), the author refers to strong punctures on the vertex and thorax of the Mexican specimens examined at the Genève Museum – which are precisely the key diagnostic characters of the species described by Snelling. Specimens from various localities in Colombia deposited in the London Museum (NHM), and identified by Richards as *punctatus*, are actually representatives of four other species, three of them new (see below). Records from Paraguay ([Strand, 1912](#); [Richards, 1945](#); [Garcete-Barrett, 1999](#)) refer to *M. ryani* **sp. nov.**, described here based on specimens from the Brazilian states of Bahia and Minas Gerais as well as from Paraguay (see below).

Examined material. Trinidad: 1 male, v/1926, Fitzgerald, 1 female, 1 male, [n. 421] (92–53) (NHM); Brazil: Maranhão, 1 male, 1 female (with fragment of nest), São José de Ribamar, Sítio Aguahy, 28/vii/2006, Azevedo, G. (MPEG); other specimens in Universidade Federal do Maranhão; Pará, 3 females, 1 male (an extracted pupa) (MPEG), 1 female (NHM), Oriximiná, Rio Cuminá-mirim (R. Trombetas), 13/xii/1906; 2 females, Óbidos, xii/1913, A. Ducke (MPEG), 1 female, Santarém, 8/v/1969, R.L. Jeanne (NHM).

Mischocyttarus vaqueroi [Zikán, 1949](#) (Figs. 11H and 14F)

Mischocyttarus vaqueroi [Zikán, 1949](#): 119, Figs. 203, 291; Holotype, female, Peru, Pozuzo, Pe. Pascual Vaquero (IOC) [examined]

Mischocyttarus vaqueroi: [Richards, 1978](#): 371; [Silveira, 2008](#): 517.

Mischocyttarus punctatus: [Silveira, 2008](#): 529, 532, 533 (misidentification)

Short redescription. Wing length 7–8.5 mm. Clypeus usually a little higher than wide, ratio H/WCL 1.0–1.09; length of first metasomal segment variable, LSI/HMP 1.42–1.58, with the apex 1.86–2.24 times wider than the basal petiole; sculpture of mesoscutum with ordered aspect, punctures of two very distinct size-classes, the larger ones very distinct measuring ca. 0.06 mm or more, the smaller with 0.02 mm ([Fig. 11H](#)); frons with puncture diameter variable, small punctures quite visible. Female clypeus with hairs longer in lateral view. Paired oblique yellow streaks above antennal sockets usually wider; clypeus almost always with some kind of dark maculation, often quite extensive; mesosoma often with reddish areas, yellow marks moderately extensive, mark on pronotal carina always well developed, propodeal marks never exceedingly large and lung-shaped, distal yellow band on first metasomal tergum sometimes with lateral forward extension to the spiracle area; metasomal sterna sometimes with discal yellow marks in addition to marginal bands. Male antennal article 13 well elongate, measuring about 0.26 mm, and being ca. 2.7 times longer than broad, ca. 0.7 times as long as article 12+11, these articles proportionally quite elongate, article 12 ca. 1.7 and article 11 ca. 1.4 times as long as broad. Nest comb as a single vertical row of cells, or in several chains, bi- or multifurcated.

Nest. As originally described by [Zikán \(1949\)](#), the nest of *M. vaqueroi* is a “single row of cells, similar to the nest of *M. punctatus*”. Richards, in an unpublished manuscript prepared as a supplement

to his 1978 book, mentioned a certain number of colonies collected by M. Cooper in Bolivia (incorrectly cited “Ecuador”), with forked nests. The author mentions nests “55” (10 cells, one fork) and “62” (9 cells, one fork) both from Caranavi, near La Paz, and “nest 83” (26 cells, with seven forks) from Beni, Rurrenabaque, adding that “Mr. Cooper notes that he saw several other forked combs in this locality” (Rurrenabaque). Nest 83 above was figured in a photograph in Wenzel (1998: 29; Fig. 16B), but only six forks are apparent. A similarly ramified nest was recently collected in Brazil, Pará, Caxiuanã (Silveira & Felizardo colls.; see Fig. 14F), with six cells, and presenting two forks.

Distribution: Colombia, Peru, Ecuador, Bolivia, Brazil: AM, PA.

Remarks. As in the case of the preceding species, Richards (1978: 371) described the male of *M. vaqueroi* without informing the collection data of the specimen(s). The proportions of the antennal apical articles described here are based on male specimens from Colombia deposited in the London Museum (NHM). A male from Bolivia, Caranavi, had slightly more robust antennal articles 12 and 11 (in photograph), more like *M. punctatus*. These specimens from Bolivia are associated with ramifying nests, and Richards (unpublished) gave these specimens a manuscript name accompanied by a lengthy description. He diagnosed his new species from *M. vaqueroi* as follows: “apart from its nest, in the female by the larger black spot on the clypeus, the more shiny frons, the shorter thoracic hairs, the rather stronger thoracic punctures, and the longer anterior stalk of the gastral petiole. The male differs in the much larger black spot on the clypeus which has a number of large punctures. Punctures more distinct on the thorax. Antennal segment 13 shorter, less curved.”

Consistent morphological or color differences could not be detected between the Bolivian specimens and other *M. vaqueroi* specimens when considering variations across the entire known range of these very similar forms. The first author (OTS) also did not see any of the forked nests mentioned in Richard’s unpublished manuscript during visits to the London Museum (2010, 2013). One of these nests was figured in Wenzel (1998) showing seven forks, and may indeed be considered suggestive that Bolivian populations are a distinct species. However, the apparent lack of diagnostic morphological characters, allied to the fact that a forked nest we recently found in Caxiuanã (Fig. 14F) is associated with quite typical *M. vaqueroi* specimens, indicate that more information is needed on architectural variation in Bolivian populations.

Examined material. Colombia: Putumayo, Mocoa, 1 female (nest 92), 3 females (nest 93), 15/vi/1974, 1 female, 600 m, 31/v-7/vi/1976, 5 females, 2 males, 1-10/i/1977, 2 females (note 10), Villa Garzon, 8 mi. S Mocoa, 22/vii/1978, 4 females, 3 males (nest 39), Alto Afan, 7kn NE Mocoa, 20/iv/1974; Vaupés, 1 female (nest 82) Mitu, 19/v/1974, M. Cooper (NHM); Peru: Huánuco, 1 female, Tingo Maria, 10/xi/1980, K.G. Preston Nathan (NHM); Madre de Dios, 6 km NE Mazuko, 13.048 S 70.346 W, 380 m, 18/viii/2012, G. Melo (UFPR); Ecuador: Napo, 1 female, Tena, viii-ix/1924, R. Benoist (NHM); Bolivia: La Paz, 2 females, 2 males (note 83), Caranavi, 600 m, 16/v/1979; Beni, Rurrenabaque, 270 m, 1 female, 18/iv/, 1 female, 2 males, 23/iv/1979, M. Cooper (NHM); Brazil: Amazonas, Manaus, 1 female, Campus Universitário, 4/vi/1982, J.A. Rafael (INPA), 1 female, 1 km W Tarumã Falls, 100 m, 11/i/1981, G. Ekis (MPEG), 3 females, 29/ix/1991, Melo & Garcia, 1 female (with part of nest), Hotel Tropical, 19/vi/2002, G.A.R. Melo (UFPR); Pará, 1 female, Baker collection (UCDC), 2 females, Belém, 12/xi/1974 (nest 27), D. Dias (NHM); 3 females, Melgaço, Caxiuanã, ECFPn, 11/iii/2015, Silveira & Felizardo (MPEG).

Mischocyttarus chaluca Snelling, 1983

Mischocyttarus chaluca Snelling, 1983: 277, Figs. 8–11; Holotype, female, Mexico, Chiapas, Tuxtla Gutierrez, 7 vi 1964, J.D. &

D. Pallister (AMNH) [photographs of holotype and a male paratype examined]

Mischocyttarus punctatus: Ducke, 1918: 58; Richards, 1978: 371 (misidentification).

Mischocyttarus chaluca: Silveira, 2008: 512.

Short redescription. Female: wing length 7.0–7.5 mm. Female clypeus wider than high, ratio H/WCL 0.93–0.96; first metasomal segment extremely short, LSI/HMP 1.28–1.39, with the apex ca. 2.14 times wider than the basal petiole; pronotal carina exceptionally low at sides for this group, with very narrow lamella; lamella of anteromedial margin of pronotum distinctly less reflexed at middle than in other species; mesoscutum with punctures of two very distinct size-classes, the larger ones ca. 0.06 mm or more, the smaller typically with less than 0.02 mm, often hard to visualize; frons with medium-sized punctures and nearly indistinguishable micropunctures; punctures on head just anterior to occipital carina stronger. Yellow colored parts often more restricted, female clypeus almost entirely reddish tinged, pronotum laterally and mesopleuron similarly colored, with black areas much reduced, propodeal spots small. Male antennal article 13 well elongate, measuring about 0.27 mm, and being ca. 2.7 times longer than broad, ca. 0.7 times as long as article 12 + 11, these articles proportionally rather robust, article 12 ca. 1.4 and article 11 ca. 1.1 times as long as broad.

Detailed color description: ground color black. Antenna above, most of legs, disk of metasomal terga, dark brown. Ventral side of antenna, very light brown; clypeus almost entirely, connected to an interantennal dark mark. Apical and distal margins and teeth of mandible; posterior region of head and mouth parts, large area on pronotum at sides; anterior half of mesepisternal plate; mesopleuron almost entirely; large median area on mesosternum; antero-lateral aspect of tegula; whole metapleuron and latero-anterior region of propodeum; extensive areas on fore coxa, femur, tibia and tarsus; anterior aspects of mid coxa, femur and tibia; mid tarsus beneath; anterior aspects of hind coxa, femur and tibia, and hind tarsus beneath, light reddish brown. Most of mandible; small spot on apical region of clypeus; inner and outer orbits; narrow supra-antennal concave wave-like mark, interrupted at center; anterior narrow band encircling anterior region of pronotum (over carina and descending on sides) and narrow strip along posterior margin; posterior half of mesepisternal plate; small posterior ventral spot and articular region of mesopleuron; small posterior spot on tegula; anterior half of scutellum (divided by a median line); mesoaxillae; metanotum anteriorly; metaxillae; two medium-sized spots on propodeum; valvular region; outer marginal area of fore coxa; distal spot on fore femur; dorso-lateral stripe on fore tibia; dorsum of first and last segment of fore tarsus; one stripe on mid coxa; two stripes on hind coxa; distal mark on mid and hind femora; elongated stripe on dorsal aspect of mid tibia; apical spot on mid and hind tibia; distal band on metasomal tergum I; distal and lateral margins narrowly of terga II to VI; distal expanded region of sternum I just posterior to spiracle, and distal margin (broadened medially) of sterna II to VI, yellow; wings hyaline with brown veins.

Nest: unknown.

Distribution: Mexico, Costa Rica.

Remarks. The record of *M. chaluca* from Costa Rica is new, being distant one thousand kilometers from the original type locality in Mexico (Chiapas), although their conspecificity is unequivocal. Sculpture and the very extensive reddish areas (including clypeus) are distinctive. Ducke’s (1918) recording of “*M. punctatus*” from Córdoba (further north in Mexico) probably refers to *M. chaluca*.

Examined material: Costa Rica: 3 females, 1 male, Heredia, Estación Biol. La Selva, 10 25' N 84 0' W, 80 m, 15/vi/1996, G.A.R. Melo (UFPR).

Mischocyttarus tayrona Silveira **sp. nov.** (Figs. 11E and 12A)

Mischocyttarus vaqueroi: Sarmiento, 1994: 361 (misidentification).

Holotype: female (N1), Colombia, Magdalena, Santa Marta, Filo Cartagena, 600 m, “rastroy”, 19/xi/1995, C. Sarmiento (ICN)

Diagnosis. Female: wing length 6.5–7.5 mm; clypeus distinctly higher than wide; first metasomal segment variable, but never very long, LSI/HMP 1.42–1.53; pronotal carina not forming large lobes nor being notably reflexed; mesoscutum with punctures of two very distinct size-classes; frons with medium-sized punctures and nearly indistinguishable micropunctures; paired oblique yellow streaks adjacent to antennal sockets often very narrow; light colored parts relatively extensive, propodeal spots medium-sized.

Description. Female: wing length 6.5–7.5 mm. Head nearly as high as wide in frontal view; clypeus higher than wide, H/WCL 1.08–1.14, apex truncate; malar space nearly obsolete; tentorial pit much closer to eye margin than to antennal socket; ocelli as in an equilateral triangle, narrowly separated from eyes, POL/OOL about 1.6; occipital carina well developed, distinct in lateral view and ending fairly below the level of ocular sinus and outwards in relation to margin of pre-foraminal concavity; gena considerably narrower than the upper lobe of the eye. Pronotum without a lateral fovea, central part of the anterior margin of pronotum with the lamella raised and reflexed, with contour reaching just a little more than 180 degrees, much less reflexed than in other species of this group; region immediately behind the lamella without secondary margin; humeral angle well developed, pronotal carina well developed at sides in spite of not forming large lobes nor being notably reflexed, lamella very narrow measuring at sides only ca. 0.11 mm, total width of carina (WCAR) only about 1.11 to 1.13 times larger than that of mesoscutum. Fore wing well-elongated, LDIS/HMP 2.22. Inner claw of hind tarsus with the apex uniformly rounded, but not enlarged or spoon-shaped; propodeum with median furrow shallow and narrow, developed on 4/5 of the length of dorsum, propodeal valve with upper lamellar border narrow and strongly oblique, with subtriangular outline. First metasomal segment variable, but never very long (Fig. 12A), LSI/HMP 1.42–1.53, with the apex 1.77 to 2.15 times wider than the basal petiole; spiracles weakly prominent.

Sculpture: very strong and conspicuous. Disk of clypeus with medium-sized punctures and nearly indistinguishable micropunctures, area close to the ventral margin finely reticulate without punctures, shining; upper interantennal area and frons with well visible medium-sized punctures and nearly indistinguishable micropunctures; punctures on head just anterior to occipital carina weaker. Mesoscutum sculpture with ordered aspect, punctures of two very distinct size-classes, the larger ones very distinct measuring ca. 0.06 mm or more, the smaller very small and shallow, with less than 0.02 mm, often hard to visualize (Fig. 11E); mesopleuron and propodeum sculpture similar to that of mesoscutum, but with small-sized punctures still finer; integument in general very shining.

Vestiture: eyes bare; head and mesosoma with very conspicuous whitish appressed or decumbent pilosity; erect, longer and stouter hairs on clypeus, frons and mesoscutum, those on mesopleuron and propodeum still longer but finer and rather decumbent; metasomal terga with appressed pubescence, and more erect hairs on distal segments; first metasomal sternum with very smooth and shining integument, nearly absolutely glabrous except for rather sparse fine and curved hairs; remaining sterna with appressed pubescence,

with longer and more erect hairs on distal segments, besides those of glandular brushes.

Color: black (see Fig. 12A). Antenna above, most of legs, disk of metasomal terga, dark brown. Ventral aspect of antenna very light brown, yellowish at apex. Spot on clypeus with grading tones of brown, connected to an interantennal dark mark. Apical teeth and margins of mandible; posterior region of head and mouth parts; postero-lateral area on pronotum; anterior half of mesepisternal plate; posterior area on mesopleuron; large median area on mesosternum; antero-lateral region of tegula; whole metapleuron and latero-anterior region of propodeum; extensive areas on fore coxa, femur, tibia and tarsus; base of mid coxa and anterior aspect of mid femur and tibia; mid tarsus beneath; base of hind coxa, and anterior aspect of hind femur and tibia; hind tarsus beneath, light reddish brown. Most of mandible and clypeus (around central dark mark); inner and outer orbits; narrow supra-antennal concave wave-like mark; band encircling anterior region of pronotum (on carina and descending at sides); narrow strip along pronotal posterior margin; posterior half of mesepisternal plate; posterior ventral spot and articular region of mesopleuron; posterior spot on tegula; mark on base of anterior wing; anterior two-thirds of scutellum (divided by a median line); mesoaxillae; most of metanotum anteriorly; metaxillae, two large spots on propodeum; valvular region; outer marginal region of fore coxa; distal spot on fore femur; lateral stripe on fore tibia; dorsum of first and fifth segments of fore tarsus; one stripe on mid coxa; two stripes on hind coxa; distal mark on mid and hind femora; elongated stripe on dorsal aspect of mid tibia; apical spot on mid and hind tibia; basal window-like mark and distal marginal band on metasomal tergum I, extending forward at sides and almost reaching the spiracle; distal and lateral margins of terga II to VI; distal expanded region of sternum I from a point just posterior to spiracle; trilobed discal mark on sternum II; distal margin (broadened medially) of sterna II to VI, yellow. Wings hyaline with brown veins.

Male: unknown.

Nest. Carlos E. Sarmiento collected and photographed a nest of *M. tayrona* **sp. nov.** It is composed of a vertical, single-row comb with 22 cells (plus one unfinished cell) measuring ca. 30 cm in length; the first basal cell has a short pedicel connected to a small circular attachment surface, indicating its earlier attachment to a flat substrate. It is similar to the nest of *M. punctatus*, but the cell rims tend to face in the same direction, not in opposite directions (or in a zigzag fashion) as described by Richards (1978) for *M. punctatus*. Small interconnecting stalks can be seen between cells more distally positioned along the nest (see below).

Distribution: Panama, Colombia (Magdalena).

Etymology: the specific epithet is in reference to the people who inhabited northern Colombia in pre-Columbian times. The Tayrona had constructed a large and complex society, but declined during the first hundred years after the Spanish conquest. Some indigenous communities that now live in the region of Sierra Nevada de Santa Marta are considered their descendants.

Remarks. *Mischocyttarus tayrona* **sp. nov.** shares some important similarities with *M. anchicaya* **sp. nov.** and *M. chaluca*: reduced development of the pronotal carina, anteromedial lamella of pronotum less reflexed, and sculpture of the frons and mesoscutum with punctures of two very distinct size classes. The first metasomal segment also tends to be considerably short for species of the *M. punctatus* group. A colony collected by C.E. Sarmiento was found in low regrowth vegetation (rastroy).

Examined material (Paratypes): Panama: Canal Zone, 1 female, Barro Colorado Island, 29/vii/1956, Carl W. & Marian E. Rettenmeyer, no. 2216 (UCDC); Colombia: Magdalena, Santa Marta, Filo Cartagena, 600 m, “rastroy”, 19/xi/1995, C. Sarmiento, (N1) 1

female (ICN), 1 female (MPEG); 1 female N Sierra Nevada de S. Marta, Rio Buritaca, 24/iii/1974, nest 257, 3 females (note 150), 10–15 km E Santa Marta, 4–5/xii/1976, M. Cooper (NHM).

Mischocyttarus anchicaya Silveira **sp. nov.** (Figs. 3, 11F, I and 12B)

Holotype: female, Colombia, Valle, Anchicaya, nr. Buenaventura, 16/i/1977, M. Cooper (NHM).

Diagnosis. Female: wing length 6.5–7.0 mm; clypeus higher than wide; first metasomal segment distinctly short, LSI/HMP 1.37–1.45; pronotal carina exceptionally low at sides, with very narrow lamella; lamella of anteromedial margin of pronotum less reflexed at middle than in other species; mesoscutum with punctures of two very distinct size-classes, the smaller ones often hard to visualize; frons with medium-sized punctures and nearly indistinguishable micropunctures; punctures on head just anterior to occipital carina weaker; yellow colored parts often more restricted, propodeal spots very small; female clypeus yellow with black or blackish marks, pronotum and mesopleura with extensive black areas.

Description. Female: length of fore wing 6.5–7.0 mm. Head nearly as high as wide in frontal view, FHH/INTOW about 1.02–1.05; clypeus distinctly higher than wide, H/WCL 1.04–1.13, apex narrowly truncate; malar space nearly obsolete; tentorial pit much closer to eye margin than to antennal socket; ocelli as in an equilateral triangle, narrowly separated from eyes, POL/OOL about 1.6; occipital carina well developed, distinct in lateral view and ending fairly below the level of ocular sinus and outwards in relation to margin of pre-foraminal concavity; gena considerably narrower than the upper lobe of the eye. Pronotum without a lateral fovea, central part of the anterior margin of pronotum with the lamella raised and reflexed, with contour reaching just a little more than 180 degrees, much less reflexed than in other species of this group; region immediately behind the lamella without secondary margin; humeral angle well developed, produced into a very weak lobe, pronotal carina exceptionally low at sides for this group, lamella very narrow measuring at sides only ca. 0.09 mm, total width of carina (WCAR) only about 1.07–1.17 times larger than that of mesoscutum; mesoscutum only a fraction longer than wide, L/WMS 1.04–1.09. Fore wing well-elongated, LDIS/HMP 2.0–2.10. Inner claw of hind tarsus with the apex uniformly rounded, but not enlarged or spoon-shaped. Propodeum with median furrow narrow and rather deep for this group, developed on 4/5 of the length of propodeal dorsum, propodeal valve with upper lamellar border narrow and strongly oblique, with subtriangular outline. First segment of metasoma relatively short (Figs. 3 and 12B), LSI/HMP 1.37–1.45, with the apex 1.83–1.94 times wider than the basal petiole; spiracles weakly prominent.

Sculpture: very strong and conspicuous. Disk of clypeus with medium-sized punctures and nearly indistinguishable micropunctures, area close to the ventral margin finely reticulate without punctures, shining; upper interantennal area and frons with well visible medium-sized punctures and nearly indistinguishable micropunctures. Mesoscutum sculpture with ordered aspect, punctures of two very distinct size-classes, the larger ones very distinct measuring ca. 0.06 mm or more, the smaller very small and shallow, with less than 0.02 mm, often hard to visualize (Figs. 11F and I); mesopleuron and propodeum sculpture similar to that of mesoscutum, but with small-sized punctures still finer; integument in general very shining.

Vestiture: eyes bare; head and mesosoma with very conspicuous whitish appressed or decumbent pilosity; longer and stouter hairs on clypeus, frons and mesoscutum, those on pleura and propodeum still longer but finer and rather decumbent; metasomal terga with appressed pubescence, and more erect hairs on distal segments; first metasomal sternum with very smooth and shining integument, nearly absolutely glabrous except for rather sparse fine and

curved hairs; remaining sterna with appressed pubescence, with longer and more erect hairs on distal segments, besides those of glandular brushes.

Color: black (see Fig. 12B). Antenna above, most of legs, disk of metasomal terga and sterna, dark brown. Ventral side of antenna very light brown. Large spot on clypeus with grading tones of brown, connected to an interantennal dark mark. Apical and distal margins and teeth of mandible; posterior region of head and mouth parts; posterior area on pronotum at sides; anterior half of mesepisternal plate; posterior area on mesopleuron; large median area on mesosternum; antero-lateral aspect of tegula; whole meta-pleuron and latero-anterior region of propodeum; extensive areas on fore coxa, femur, trochanter, tibia and tarsus; anterior aspect of mid and hind coxae; femora, trochanters, tibiae, and tarsi beneath, light reddish brown. Most of mandible, lateral region and small spot on apical region of clypeus; inner and outer orbits; narrow supra-antennal concave “V-like” mark, interrupted at center; narrow band encircling anterior region of pronotum (over carina and descending on sides) and narrow strip along posterior margin; posterior half of mesepisternal plate; articular region of mesopleuron; small posterior spot on tegula; anterior half of scutellum (divided by a median line); mesoaxillae; two spots at sides on metanotum; metaxillae; two small spots on propodeum; valvular region; dorso-lateral stripe on fore tibia; dorsum of first and fifth segment of fore tarsus; one stripe on mid coxa; two stripes on hind coxa; distal mark on mid femora; elongated stripe on dorsal aspect of mid tibia; apical spot on mid tibia; distal band on metasomal tergum I; narrow distal and lateral margins of terga II to VI (broadened sublaterally); distal expanded region of sternum I; distal margin (broadened medially) of sterna II to VI, yellow. Wings hyaline with brown veins.

Male: unknown.

Nest: unknown.

Distribution: Colombia (Nariño, Valle).

Etymology: the specific epithet is in reference to the Anchicayá River in Colombia.

Remarks. This new species is very similar to *M. chaluca* in many important aspects, such as the scarce development of the pronotal carina and anterior pronotal lamella medially, as well as the relatively short first metasomal segment. However, it can be readily differentiated by the narrower clypeus in the female, the weaker punctures of the head just anterior to the occipital carina, and by its color pattern: female clypeus yellow with black or blackish marks and pronotum and mesopleura with extensive black areas (Fig. 12B).

Examined material (Paratypes): Colombia, Nariño, 1 female, Barbaças, 2–6/v/1976; Valle, 1 female (N. 171), 1 female (N. 172), 3 females, Anchicaya, nr. Buenaventura, 16/i/1977, M. Cooper (NHM).

Mischocyttarus caxiuana Silveira **sp. nov.**

(Figs. 5, 11B, L, N and 12C)

Mischocyttarus (*Monacanthocnemis*) *punctatus*: Silva and Silveira, 2009: 320 (misidentification)

Holotype: female, Brazil, Pará, Melgaço, Caxiuana, 4/iii/2006, S.S. Silva and J. Dias (MPEG).

Diagnosis. Female: wing length 6.5–7.5 mm; clypeus distinctly higher than wide; first metasomal segment moderately elongated, LSI/HMP 1.50–1.54; occipital carina less developed in lateral view, fading down at the level of ocular sinus, and (from behind) positioned more inwards in a direction that is coincident with the lateral margin of pre-foraminal concavity situated just below; yellow marks on head and mesosoma very extensive, including most of median ventral areas; pronotum at sides largely reddish; metasomal segments light testaceous with distal yellow bands.

Description. Female: length of fore wing 6.5–7.5 mm. Head nearly as high as wide in frontal view; clypeus distinctly higher than wide, H/WCL 1.09–1.11, apex narrowly truncate; malar space nearly obsolete; tentorial pit much closer to eye margin than to antennal socket; ocelli as in an equilateral triangle, narrowly separated from eyes, POL/OOL about 1.0; occipital carina less developed at sides in lateral view, fading down at the level of ocular sinus, and (from behind) positioned more inwards in a direction that is coincident with the lateral margin of pre-foraminal concavity situated just below (Fig. 11N); gena considerably narrower than the upper lobe of the eye. Pronotum without a lateral fovea, central part of the anterior margin of pronotum with the lamella raised and strongly reflexed, with contour profile reaching more than 180 degrees; region immediately behind the lamella without secondary margin; humeral angle well developed, produced into a strong lobe, pronotal carina very high at sides, lamella very wide measuring ca. 0.19 mm, total width of carina (WCAR) about 1.16 times larger than that of mesoscutum; mesoscutum a fraction longer than wide, L/WMS ca. 1.10. Fore wing well-elongated, LDIS/HMP ca. 2.0. Inner claw of hind tarsus with the apex uniformly rounded, but not enlarged or spoon-shaped. Propodeum with median furrow narrow and shallow, developed on 4/5 of the length of propodeal dorsum, propodeal valve strongly expanded backward, with outline more semioval than triangular. First metasomal segment moderately elongated (Figs. 5 and 12C), LSI/HMP 1.50–1.54, with the apex 2.05–2.27 times wider than the basal petiole; spiracles weakly prominent.

Sculpture: moderately strong and conspicuous, largely covered by the abundant appressed pubescence. Disk of clypeus with medium-sized punctures and nearly indistinguishable micropunctures, area close to the ventral margin finely reticulate with sparse larger punctures, shining; upper interantennal area and frons with puncture diameter variable, small punctures larger and more easily distinguishable; Mesoscutum sculpture with punctures of two size-classes, the larger ones very distinct measuring ca. 0.06 mm or more, the smaller about 0.02 mm or a little larger in front, but any way being very different in size from the larger ones (Fig. 11B and L); mesopleuron and propodeum sculpture similar to that of mesoscutum, but with small-sized punctures still finer; propodeum central area around median furrow smooth, unpunctured; integument in general very shining.

Vestiture: eyes bare; head and mesosoma with very conspicuous whitish appressed or decumbent pilosity; longer and stouter hairs on clypeus, frons and mesoscutum, those on pleuron and propodeum still longer but finer and more decumbent; metasomal terga with appressed pubescence, and more erect hairs on distal segments; first metasomal sternum with very smooth and shining integument, nearly absolutely glabrous except for rather sparse fine and curved hairs; remaining sterna with appressed pubescence, with longer and more erect hairs on distal segments, besides those of glandular brushes.

Color: black (see Fig. 12C). Antenna above (especially proximal articles); posterior and lateral areas on mid and hind coxae; posterior and ventral surfaces of trochanters, femora and tibiae; mid and hind tarsi; ground color of first metasomal tergum and sternum, dark brown. Inner and ventral aspects of antenna (especially distal articles) very light brown. Mandible apical and lateral margins narrowly dark reddish brown. Main surface of mandible teeth; faint narrow spot on clypeus (connected to an interantennal darker mark); posterior region of head medially; posterior lateral area on pronotum; mesopleural areas bordering a large “Y-shaped” black mark; area adjacent to mesopleural posterior margin narrowly; median areas on mesosternum; extensive areas on metapleuron and latero-anterior region of propodeum; extensive areas especially on anterior aspect of all femora, trochanters and tibiae; main discal area of metasomal terga and sterna II to VI, light

reddish brown. Most of mandible and clypeus (around a central faint mark); inner and outer orbits; narrow supra-antennal concave “V-shaped” mark; gena and posterior lateral aspect of head and estipes of maxilla; band encircling anterior region of pronotum (over carina and descending on sides), widening at ventral corner; strip along posterior margin, very narrowly on postero-lateral margin along pretegular carina; very extensive areas on mesopleuron and mesosternum around dark marks, including a posterior spot on mesepisternal plate; dorsal spot on upper metapleural plate; posterior spot on lower metapleural plate; inner margin of tegula (outer area amber-like, translucent); small mark on base of anterior wing; anterior half of scutellum (divided by a median line), with spots on mesoscutellar crest and axilla; most of metanotum anteriorly with small spot on axilla; two medium sized spots on propodeum; valvular region; most of anterior and lateral surfaces of fore coxa; distal margin of all trochanters narrowly; distal spot on fore femur; dorso-lateral stripe on fore tibia; dorsum of first and fifth segments of fore tarsus; most of anterior surface of mid coxa; two dorsal stripes and one ventral mark on hind coxa; distal mark on mid and hind femora; elongated stripe on dorsal surface and distal spot on mid tibia; basal and apical spots on hind tibia; basal elongate window-like mark and distal marginal band on metasomal tergum I, extending forward at sides up to the spiracle; distal and lateral margins of terga II to VI; distal expanded region of sternum I; distal margin of sterna II to VI, yellow. Wings hyaline with light brown veins.

Male: unknown.

Nest. The only known nest of this species is from Caxiuanã (Nest E, 04/iii/2006: 10 cells + 1 unfinished): a vertical, single-row comb fastened to the substrate by a short thin secretion-made pedicel (in this case, a thin filiform stem of the parasitic plant *Cuscuta trichostyla* Engelm., Convolvulaceae; see Figs. 13A–C and 14D for the same substrate being used by other species). A blackish wasp-secretion covers the plant stem near the pedicel attachment point. Complete cells measure ca. 13 mm in length and 3 mm in width at their distal rim and they are made with light gray wood pulp. One cell is still capped and three others show the remains of pupal caps, made of translucent secretion without any wood pulp fragments. Each one of the more distal cells is attached through a small stalk-like extension to the wall of the preceding cell, indicating that new cells can be added to the nest before completing the serially preceding cells (see Fig. 13C). Each of these connecting stalks (representing the distal 30% of a cell's length), in fact, consists of just a partial precursory cell-wall constructed on just one side of the cell-chain. The lines demarcating these precursory distal elements can be distinguished in fully constructed cells by careful inspection under a dissecting microscope. Interestingly, the position of the precursory inter-cell connections in this nest specimen alternate between cell sides producing a zigzag profile as described by Richards (1978).

Distribution: Brazil (PA).

Etymology: the specific epithet refers to “Caxiuanã”, a beautiful and luxuriant rain forest along the lower course of the Anapu River, where the Museu Goeldi maintains a field research station.

Remarks. This new species and the next one (*M. verissimoi* sp. nov.) are very similar regarding the form of the occipital carina and the topologically related pre-foraminal concavity. In these species, the concavity is very deep, sharply margined below and the contour projects dorsolaterally, producing a subquadrangular shape (Fig. 11N) that deviates from the more normal oval shape observed in other species of the *M. punctatus* group (Fig. 11M). However, in *M. caxiuanã* sp. nov. the female clypeus is narrower, distinctly higher than wide, and almost entirely yellow. The metasomal petiole is a little more robust, wider at the apex, and the metasomal terga and sterna are light testaceous with distal yellow bands (Fig. 12C) (black

or dark brown in *M. verissimoi* **sp. nov.**; Fig. 12D). A single colony of *M. caxiuana* **sp. nov.** was found deep in Amazonian rainforest.

Examined material (Paratypes): Brazil: Pará, 2 females (with part of nest), Melgaço, Caxiuanã, 4/iii/2006, S.S. Silva and J. Dias (MPEG).

Mischocyttarus verissimoi Silveira **sp. nov.** (Figs. 6, 11G and 12D)

Holotype: female, Brazil, Amazonas, 60 km N Manaus, 18.1 km E Campinas field station, 02 30' S 60 15' W, 22/ii/1979, Montgomery, Erwin, Schimmel, Krischik, Date, Bacon colls. (canopy fogged with Pyrethrum) (INPA).

Diagnosis. Female: wing length 7.5–8.0 mm; clypeus practically as high as wide; first metasomal segment considerably long and narrow, LSI/HMP 1.55–1.6; occipital carina less developed in lateral view, fading down at the level of ocular sinus, and (from behind) positioned more inwards in a direction that is coincident with the lateral margin of pre-foraminal concavity situated just below; punctures on mesoscutum grading rather continuously from ca. 0.02 to 0.05 mm; yellow marks on head and mesosoma very extensive, including most of median ventral areas; metasomal segments black or dark brown with distal yellow bands.

Description. Female: length of fore wing 7.5–8.0 mm. Head nearly as high as wide in frontal view; clypeus practically as high as wide, ratio H/WCL 1.0–1.04, apex narrowly truncate; malar space nearly obsolete; tentorial pit much closer to eye margin than to antennal socket; ocelli as in an equilateral triangle, narrowly separated from eyes, POL/OOL about 1.0; occipital carina less developed in lateral view, fading down at the level of ocular sinus, and (from behind) positioned more inwards in a direction that is coincident with the lateral margin of pre-foraminal concavity situated just below (see as reference Fig. 11N); gena considerably narrower than the upper lobe of the eye. Pronotum without a lateral fovea, central part of the anterior margin of pronotum with the lamella raised and strongly reflexed, with contour profile reaching more than 180 degrees; region immediately behind the lamella without secondary margin; humeral angle well developed, produced into a strong lobe, pronotal carina very high at sides, lamella very wide measuring 0.16–0.19 mm, total width of carina (WCAR) from 1.11 to 1.16 times larger than that of mesoscutum; mesoscutum a fraction longer than wide, L/WMS ca. 1.05. Fore wing well-elongated, LDIS/HMP ca. 2.05. Inner claw of hind tarsus with the apex uniformly rounded, but not enlarged or spoon-shaped. Propodeum with median furrow relatively wide and shallow, developed on 4/5 of the length of propodeal dorsum, propodeal valve strongly expanded backward, with outline more semioval than triangular. First metasomal segment considerably long and narrow (Fig. 6), LSI/HMP 1.55–1.6, with the apex 1.88–2.12 times wider than the basal petiole; spiracles considerably prominent.

Sculpture: moderately strong and conspicuous, largely covered by rather abundant pubescence. Disk of clypeus with medium-sized punctures and nearly indistinguishable micropunctures, area close to the ventral margin finely reticulate with sparse larger punctures, shining; upper interantennal area and frons with puncture diameter variable, small punctures larger and more easily distinguishable. Mesoscutum sculpture with disordered aspect, puncture diameter grading rather continuously from ca. 0.02 to 0.05 mm (Fig. 11G), if the upper size is a little larger, then the small punctures tend to be predominantly larger than 0.02 mm, never very small; mesopleuron and propodeum sculpture with small-sized punctures finer; propodeum central area around median furrow smooth, unpunctured; integument in general very shining.

Vestiture: eyes bare; head and mesosoma with very conspicuous whitish appressed or decumbent pilosity; longer and stouter hairs on clypeus, frons and mesoscutum, those on pleuron and propodeum still longer but finer and more decumbent; metasomal

terga with appressed pubescence, and more erect hairs on distal segments; first metasomal sternum with very smooth and shining integument, nearly absolutely glabrous except for rather sparse fine and curved hairs; remaining sterna with appressed pubescence, with longer and more erect hairs on distal segments, besides those of glandular brushes.

Color: black (see Fig. 12D). Antenna above (sometimes dorsum of scape lighter); areas on metapleuron and latero-anterior region of propodeum (sometimes lighter); posterior and lateral areas on mid and hind coxae, posterior surfaces of trochanters; posterior and ventral surfaces of femora and tibiae; mid and hind tarsi; ground color of all metasomal terga and sterna, dark brown. Inner and ventral aspects of antenna (especially distal articles), very light brown. Mandible teeth and apical and lateral margins narrowly, dark reddish brown. Narrow spot on clypeus (connected to an interantennal darker mark); posterior region of head medially; posterior lateral area on pronotum (sometimes darker); sometimes mesopleural areas bordering a large “Y-shaped” black mark; sometimes median area on mesosternum; extensive areas on legs especially on anterior aspect of all femora, trochanters and tibiae, light reddish brown. Most of mandible and clypeus (around a central elongate mark); inner and outer orbits; narrow supra-antennal concave “V-shaped” mark; gena and posterior lateral aspect of head and estipes of maxilla; band encircling anterior region of pronotum (over carina and descending on sides), widening at ventral corner and strip along posterior margin, very narrow on postero-lateral margin along pretegular carina; very extensive areas on mesopleuron and mesosternum around dark marks, including most of mesepisternal plate; dorsal spot on upper metapleural plate; posterior spot on lower metapleural plate; inner posterior mark on tegula (outer area amber-like, translucent); small mark on base of anterior wing; anterior half of scutellum (divided by a median line), with spots on mesoscutellar crest and axilla; most of metanotum anteriorly with small spot on axilla; two large-sized spots on propodeum (circular or more lung-shaped); valvular region; most of anterior and lateral surfaces of fore coxa; distal margin of anterior trochanter narrowly; distal spot on fore femur; dorso-lateral stripe on fore tibia; dorsum of first and fifth segments of fore tarsus; most of anterior surface of mid coxa; two dorsal stripes and a ventral mark on hind coxa; distal mark on mid and hind femora; elongated stripe on dorsal surface and distal spot on mid tibia; apical spot on hind tibia; basal elongate window-like mark (sometimes absent) and distal marginal band on metasomal tergum I, extending forward at sides up to a point just anterior to the spiracle; distal and lateral margins of terga II to VI; distal expanded region of sternum I; distal margin of sterna II to VI, yellow. Wings hyaline with brown veins.

Male: unknown.

Nest. There are two nests from La Macarena (Colombia) in the London Museum (NHM), one of them with associated data agreeing with one of the two paratypes (9-18/xi/1976, M. Cooper; Note 144). This is a fragmentary comb with four completed cells, attached by a narrow pedicel to a filiform plant stem similar to that of *Cuscuta trichostyla*, which is also used as substrate by *M. caxiuana* **sp. nov.** and *M. rodriguesi* **sp. nov.** (see Figs. 13A, C and 14D). The other nest is a similar fragment of just three cells attached by a pedicel to a more robust vegetal stem, more like a narrow vine, about five times wider than the filiform stem of *Cuscuta*.

Distribution: Brazil (AM); Colombia (Meta).

Etymology: the specific epithet is in homage to José Veríssimo Dias de Matos (1857–1916), a Brazilian writer and former director of the Pará State Board of Education who had a very important role in the reorganization of the “Museu Paraense” in 1891.

Remarks. As stated before, *M. verissimoi* **sp. nov.** is very similar to *M. caxiuana* **sp. nov.**, but the female has the clypeus as high as wide,

the first metasomal segment more slender, and the metasomal segments darker, black, or brown. The sculpture of the mesoscutum is also distinct, with the pattern of grading puncture sizes more similar to that of *M. punctatus* and *M. ryani* **sp. nov.** The holotype of *M. verissimoi* **sp. nov.** was collected by fogging the canopy of an Amazonian rainforest.

Additional material examined (Paratypes): Colombia, Meta, La Macarena, 1 female, 1/iii/1976, 1 female, 9-18/xi/1976, (Note 144) M. Cooper (NHM).

Mischocyttarus rodriguesi Silveira **sp. nov.**

(Figs. 4, 11A, K, 12E, 13A, B and 14E)

Holotype: female, Brazil, Pará, Melgaço, Caxiuanã, 06/xi/2006, S.S. Silva & J. Dias (MPEG).

Diagnosis. Female: wing length 8.0; clypeus higher than wide; first metasomal segment very long and narrow, LSI/HMP 1.56–1.70 with the apex only 1.7–2.06 times wider than the basal petiole; sculpture very strong, mesoscutum with punctures of two very distinct size-classes, the larger ones being numerous and very distinct measuring ca. 0.06 mm or more, the smaller with 0.02 mm or less; color deep black with yellow marks reduced on head and thorax, virtually without reddish areas, yellow transversal stripe on pronotal carina interrupted on two sectors around the center.

Description. Female: length of fore wing 8.0 mm. Head nearly as high as wide in frontal view; clypeus higher than wide, ratio H/WCL 1.04–1.11, apex narrowly truncate; malar space nearly obsolete; tentorial pit much closer to eye margin than to antennal socket; ocelli in an equilateral triangle, narrowly separated from eyes, POL/OOL about 1.0; occipital carina well developed, distinct in lateral view and ending fairly below the level of ocular sinus and outwards in relation to margin of pre-foraminal concavity; gena considerably narrower than the upper lobe of the eye. Pronotum without a lateral fovea, central part of the anterior margin of pronotum with the lamella raised and strongly reflexed, with contour profile reaching more than 180 degrees; region immediately behind the lamella without secondary margin; humeral angle well developed, produced into a strong lobe, pronotal carina just moderately high at sides, lamella measuring about 0.14 mm, total width of carina (WCAR) about 1.12 times larger than that of mesoscutum; mesoscutum about as long as wide, L/WMS ca. 1.0. Fore wing well-elongated, LDIS/HMP ca. 2.12. Inner claw of hind tarsus with the apex uniformly rounded, but not enlarged or spoon-shaped. Propodeum with median furrow relatively wide and shallow, developed on 4/5 of the length of propodeal dorsum, propodeal valve strongly expanded backward, with outline more semioval than triangular. First metasomal segment very long and narrow (Figs. 4 and 12E), LSI/HMP 1.56–1.70 with the apex only 1.7–2.06 times wider than the basal petiole; spiracles moderately prominent.

Sculpture: very strong and conspicuous. Disk of clypeus with medium-sized punctures and well distinguishable micropunctures, area close to the ventral margin finely reticulate with sparse larger punctures, smooth but not really shining; upper interantennal area and frons with puncture diameter variable, small punctures larger and more easily distinguishable. Mesoscutum with punctures of two very distinct size-classes, the larger ones being numerous and very distinct measuring ca. 0.06 mm or more, the smaller with 0.02 mm or less (Figs. 11A and K); mesopleuron sculpture similar to that of mesoscutum, but with larger punctures denser; propodeum with larger punctures strong but more sparse, central area around median furrow with distinct punctures; integument in general shining.

Vestiture: eyes bare; head and mesosoma with very conspicuous appressed or decumbent pilosity; longer and stouter hairs on clypeus, frons and mesoscutum, those on pleura and propodeum

still longer but finer and more decumbent; metasomal terga with appressed pubescence, and more erect hairs on distal segments; first metasomal sternum with very smooth and shining integument, nearly absolutely glabrous except for rather sparse fine and curved hairs; remaining sterna with appressed pubescence, with longer and more erect hairs on distal segments, besides those of glandular brushes.

Color: black (see Fig. 12E). Lateral and ventral surfaces of scape and ventral surface of apical articles of antenna light orange brown. Main surface of mandible, including apical teeth; ventral corner of pronotum at sides; most of anterior surface of fore and mid coxa; mid and hind trochanters; elongate mark on anterior dorsal aspect of mid and hind femora; upper metapleural plate, reddish brown. Most of mandible and clypeus (around a central elongate dark mark), inner and outer orbits, narrow supra-antennal concave and interrupted “V-shaped” mark; pronotal carina discontinuously (a central mark, and a lateral mark hardly reaching the ventral extreme of the carina); strip along posterior pronotal margin; small spot on mesepisternal plate and ventral articular region of mesopleuron; inner posterior mark on tegula; most of anterior two-thirds of scutellum (divided by a median line), with faint spot on mesoscutellar crest; most of metanotum anteriorly; two medium-sized spots on propodeum (widening posteriorly); valvular region; lateral stripe on fore coxa; very narrow distal margin of all trochanters; distal spot on fore femur; interrupted dorso-lateral stripe on fore tibia; small streaks on dorsum of first and fifth segments of fore tarsus; lateral spots on mid and hind coxae; distal mark on mid and hind femora, elongated interrupted stripe on dorsal surface and distal spot on mid tibia; apical spot on hind tibia; distal marginal band on metasomal tergum I, extending forward at sides up to the spiracle; narrow band on distal and lateral margins of tergum II and distal margin of terga III to V (interrupted medially); distal expanded region of sternum I; distal margin (broadened medially) of sterna II to VI, yellow. Wings hyaline with brown veins.

Male: unknown.

Nest. Three nests are known for this species, two from Caxiuanã (Nest A, 02/xi/2006: 4 cells + 1 unfinished, Figs. 13A, A1 and 14E; Nest B, 06/xi/2006: 14 cells + 1 broken, Fig. 13B) and a third from a different locality (Serra do Pardo, Nest C, 27/iv/2012: 8 cells + 1 broken). They consist of a single-row comb fastened by a broad and direct attachment of the first basal cell (i.e., without a pedicel; see Figs. 13A, A1 and 14E) to the thin filiform stem of a parasitic plant (*Cuscuta trichostyla* Engelm., Convolvulaceae). A dark, blackish wasp-secretion covers the plant stem near the basal cell attachment. Complete cells are ca. 13 mm long and 3 mm wide at distal rim, and are composed of gray wood pulp that appears darker because of secretions applied to their external walls, creating longitudinal blackish stripes (see Figs. 13A, A1, B, and 14E). Nests B and C have some capped cells; the pupal caps consist of darkened secretion without pulp fragments.

Most cells in the nests of *M. rodriguesi* **sp. nov.** appear to be directly connected to the border rim of the preceding cell (although small interconnecting stalks are sometimes visible), in variable positions on that cell rim. Cell connections are sometimes aligned on the same side along a series, resulting in a curved section of comb (Figs. 13A and 14E). Sometimes, position varies as to form a spiraling series of cell connections (the same applying to cell opening direction) (Fig. 13B).

Distribution: Brazil (PA).

Etymology: the specific epithet is in homage to Rodolfo Siqueira Rodrigues, a staff member of the Museu Goeldi for 47 years (from 1998 to 1945). Rodrigues was a great defender of this institution and especially of natural history collections in the very difficult times after the “rubber debacle”.

Remarks. This new species is morphologically related to *M. vaqueiroi*, but the very slender shape of its first metasomal segment (Fig. 4) and its deep black color, with reduced yellow marks, renders it very distinct (Fig. 12E). The broad attachment of the basal nest cell to a filiform substrate (without a pedicel) seems unique among the known architectures of this species group (Fig. 13A and A1). Two colonies of *M. rodriguesi* sp. nov. from Caxiuana were found deep in Amazonian rainforest (Figs. 13A–B and 14E).

Examined material (Paratypes): Brazil, Pará, Melgaço, Caxiuana, 1 female (with part of nest), 06/iii/2006, 1 female (with part of nest), 02/xi/2006, S.S. Silva & J. Dias, 1 female (with part of nest), São Félix do Xingu, PARNA Serra do Pardo, 27/iv/2012, S.S. Silva (MPEG).

Mischocyttarus ryani Silveira sp. nov.

(Figs. 1, 11D, 12F and 14A–C)

Mischocyttarus punctatus: Richards, 1978: 371; Garcete-Barrett, 1999: 27 (misidentification)

Holotype: female, Brazil, Bahia, Lençóis, 6/iv/2010, R. Funch (MPEG).

Diagnosis. Wing length 8.0 mm; clypeus most often a little wider than high, ratio H/WCL 0.96–1.06; first metasomal segment considerably elongated but not actually very slender, LSI/HMP 1.42–1.50, with the apex 2.0–2.22 times wider than the basal petiole; punctures on mesoscutum with diameter grading rather continuously from ca. 0.02 to 0.05 mm; pronotal carina considerably lobated at sides, with concave profile; reddish areas on pronotum of a darker tone; propodeal marks very large and lung-shaped; first metasomal sternum yellow from base to apex; male antennal article 13 rather short, but a little more than three times (3.2) longer than broad, about 0.7 times as long as 11+12.

Description. Female: length of fore wing 8.0 mm. Head nearly as high as wide in frontal view; clypeus often wider than high, ratio H/WCL 0.96–1.06, apex narrowly truncate; malar space nearly obsolete; tentorial pit much closer to eye margin than to antennal socket; ocelli as in an equilateral triangle, narrowly separated from eyes, POL/OOL about 1.0; occipital carina well developed, distinct in lateral view and ending fairly below the level of ocular sinus and outwards in relation to margin of pre-foraminal concavity; gena considerably narrower than the upper lobe of the eye. Pronotum without a lateral fovea, central part of the anterior margin of pronotum with the lamella raised and strongly reflexed, with contour profile reaching more than 180 degrees; region immediately behind the lamella without secondary margin; humeral angle well developed, produced into a distinct lobe, pronotal carina moderately high at sides, lamella measuring from 0.12 to 0.15 mm, total width of carina (WCAR) 1.13 to 1.18 times larger than that of mesoscutum; mesoscutum a fraction longer than wide, L/WMS ca. 1.02–1.06. Fore wing well-elongated, LDIS/HMP ca. 2.14–2.19. Inner claw of hind tarsus with the apex uniformly rounded, but not enlarged or spoon-shaped. Propodeum with median furrow relatively wide and shallow, developed on 4/5 of the length of propodeal dorsum, propodeal valve strongly expanded backward, with outline more semioval than triangular. First metasomal segment moderately elongated but not actually very slender (Fig. 1), LSI/HMP 1.42–1.50, with the apex 2.0–2.22 times wider than the basal petiole; spiracles moderately prominent.

Sculpture: moderately strong and conspicuous. Disk of clypeus with weak medium-sized punctures and well distinguishable micropunctures, area close to the ventral margin finely reticulate with sparse punctures, smooth but not really shining; upper inter-antennal area and frons with puncture diameter variable, small punctures larger and more easily distinguishable. Mesoscutum sculpture with disordered aspect, puncture diameter grading rather continuously from ca. 0.02 to 0.05 mm (Fig. 11D); mesopleuron sculpture with smaller punctures finer; propodeum with larger

punctures strong but more sparse, central area around median furrow with shallow punctures; integument in general shining.

Vestiture: eyes bare; head and mesosoma with very conspicuous appressed or decumbent pilosity; longer and stouter hairs on clypeus, frons and mesoscutum, those on pleura and propodeum still longer but finer and more decumbent; metasomal terga with appressed pubescence, and more erect hairs on distal segments; first metasomal sternum with very smooth and shining integument, nearly absolutely glabrous except for rather sparse fine and curved hairs; remaining sterna with appressed pubescence, with longer and more erect hairs on distal segments, besides those of glandular brushes.

Color: black (see Fig. 12F). Antenna above, most of legs; discal area of metasomal segments, dark brown. Inner lateral and ventral aspects of antennal scape; ventral aspect of flagellum especially distally, light brown. Mandible teeth and margins; posterior region of head, extensive lateral areas on pronotum; anterior part of mesepisternal plate; lateral anterior and posterior areas on mesopleuron; extensive median areas on mesosternum; most of metapleuron and anterior lateral area of propodeum; extensive areas on anterior surface of legs, reddish brown. Most of mandible and clypeus (around a central diffuse brown mark); inner and outer orbits, moderately broad supra-antennal “V-shaped” mark; band encircling anterior region of pronotum (over carina and descending on sides), weak strip along posterior margin and very narrowly on postero-lateral margin, along pretegular carina; posterior mark on mesepisternal plate; posterior ventral mark on mesopleuron; articular region of mesopleuron; narrow faint posterior streak on upper metapleural plate; inner posterior mark on tegula (outer area amber-like, translucent); scutellum almost entirely, with very small axillar spot; most of metanotum anteriorly; two large-sized (lung-shaped) spots on propodeum; valvular region; most of anterior and lateral surfaces of fore coxa; distal margin of all trochanters narrowly; distal spot on fore femur; dorso-lateral stripe on fore tibia; spot on dorsum of first and fifth segments of fore tarsus; extensive parts of mid coxa especially laterally; two dorsal stripes and one ventral mark on hind coxa; distal mark on mid and hind femora; elongated stripe on dorsal surface and distal spot on mid tibia; apical spot on hind tibia; elongate basal window-like mark and distal marginal band on metasomal tergum I, extending forward at sides up to a point fairly anterior to the spiracle; distal and lateral margins of terga II to VI; most of sternum I from base to distal expanded region; distal margin of sterna II to VI, broadening medially, yellow. Wings hyaline with brown veins.

Male. Apart from sexually dimorphic characters, the male of *M. ryani* sp. n. is very similar to the female. There is a larger extent of yellow on the mesosternum, and black areas are better developed on humeral region and mesopleuron, with a sharper contrast between black and lighter yellow or brown marks on thorax and head as well. Antennal article 13 is rather short, but relatively slender, a little more than three times (3.2) longer than broad, about 0.7 times as long as 11+12.

Nest. Several colonies of *M. ryani* sp. nov. were observed by the first author in Lençóis, Bahia State (see Figs. 14A–C). Most were found at a single site, with nests attached to various natural or artificial substrates associated with a human habitation (i.e., attached to vines in a garden terrace, iron wires under a marquee, etc.), and some had been active for a relatively long period of time (more than six months; R. and L. Funch, personal communication). The largest of these nests had 26 cells, and was ca. 40 cm long. Completed cells of these nests were ca. 15 mm long and 3.5 mm wide at their distal rim, being made from gray wood pulp. Attachment of the basal cell to the substrate always involved a broad pedicel-like structure.

Distribution: Brazil (BA, MG); Paraguay (Concepción, Amambay).

Etymology: the specific epithet is homage to first author's nephew Ryan, a very smart little boy who shared his home with colonies of this new species in Lençóis, Bahia, in the Chapada Diamantina.

Remarks. This species is morphologically very close to *M. punctatus*, but can be distinguished by the slender first metasomal segment (compare Figs. 1 and 2), the slightly more-developed humeral lobes of the pronotal carina, and minor differences in the color of the mesosoma. A very interesting aspect of individual behavior of *M. ryani* **sp. nov.** is the way the wasps occasionally perch on their nests with their bodies raised on their mid and hind legs, and apparently using also the tip of the metasoma as supporting element (Fig. 14B and C). This apparently correlates with nest architecture, as we have observed similar behavior in colonies of species of subgenus *Megacanthopus* and also of *M. (Phi) suzannae* Silveira (see Silveira, 2013: 185; Fig. 6A), which construct very narrow and elongated nests that look like thin, dry twigs (compare Figs. 14B–C and D). The posture of the wasps on these nests may aid in altering the colony's silhouette in the context of nesting amidst sparse vegetation.

Examined material (Paratypes): Brazil: Minas Gerais, 1 female, Parque Rio Doce, 13/ii/2010, Souza, M., Ladeira, T., Ferreira, M. & Pires, E. (MPEG); Bahia, Lençóis, 1 female, 1 male, Hotel Fazenda Guaxo, 5/v/2000, G. Melo (UFPR), 2 males, 11/iii/2011, Silveira, O. T. (MPEG); Paraguay: Concepción, 1 female, Cororô, 26/ii/1996, Amambay, 3 females, Bella Vista Norte, 23/ii/1999, B. Garcete (INBP).

Concluding remarks

Species diversity in the *M. punctatus* group was found to be higher than previously recognized, with six new species being added – thus tripling the previously known number of taxa (Richards, 1978; Snelling, 1983). The map (Fig. 15) show the confirmed distributions of the species discussed here. While phylogenetic analyses were not attempted (in light of the relative paucity of morphological characters), it is interesting to note the general congruence of morphological similarities and geographic distributions. *Mischocyttarus chaluca*, *M. tayrona* **sp. nov.**, and *M. anchicaya* **sp. nov.** share several similarities in terms of pronotum form and integument sculpture – and seem to be restricted to a region encompassing Central America and northwestern South America (west of the Andes). *Mischocyttarus punctatus* and *M. ryani* **sp. nov.** are very similar in most respects, and may be restricted to the eastern regions of South America. A third grouping involves the very similar *M. vaqueroi* and *M. rodriguessi* **sp. nov.** – with northerly distributions east of the Andes. Finally, *M. caxiuana* **sp. nov.** and *M. verissimoi* **sp. nov.** share unique shapes of occipital carina and pre-foraminal concavity, as well as close resemblance in their color patterns – and have apparent Amazonian distributions.

Nest architecture. Richards (1978: 371) pointed out two aspects of *M. punctatus* nests largely based on a photograph in Ducke (1907): as cells were attached to the rim of preceding cells in a linear series, the author inferred that (A) “one cell should be completed at a time instead of building the beginning of several cells and lengthening them, in the usual way, as the larva grow”; and (B) that the general shape of the nest would depend on the attachment positions of new cells, so that “completed nest has a zigzag but approximately straight course, instead of being circular or spiral as would happen if they (cells) were all attached to the same side”. One of us (S.S. Silva), while observing nests of species of this group, noted that Richards' inferences do not necessarily apply, as provisional stalk-like walls are made by the wasps to interconnect a series of cells that are still under construction (as reported here for some species, and especially for *M. caxiuana* **sp. nov.**). An abandoned nest suspended from

a *Cuscuta* stem and made by an unknown wasp species (collected by S.S. Silva in Juruti, Pará state; Fig. 13C) demonstrated this alternative “method” of adding various cells simultaneously in a very extreme manner: it had eleven cells, and at least seven of them were incomplete but interconnected by very long, linear cell-wall segments. This was very different from adding just one cell at a time, and such provisional stalk-like walls have been observed in most of the species whose nests have been known.

Regarding the general shape of the nest, it can be seen (even in Ducke's photograph of the nest of *M. punctatus*) that the pattern of cell attachment on alternating sides is not perfect, and that the resulting nest is slightly curved (Ducke, 1907: plate III, Fig. 9). A type of “course correction” appears to be eventually applied here and there by changing the side of attachment of new cells. The nests of *M. rodriguessi* **sp. nov.** illustrate very well the variations observed in nest shape. The small “nest A” of Figs. 13A and 14E shows that despite some rotation, the second to fifth cells are attached at the same side, and the comb is slightly curved; in the larger “nest B” (Fig. 13B), however, the positions of attachment vary, forming a spiral series of cell rims. So, instead of a regular zigzag course (as in the nests of *M. caxiuana* **sp. nov.**), irregular and mixed patterns, or spiraling series of cell attachments (with changes in direction of the cell opening), appear to be expected in larger nests of the *M. punctatus* group. In a large nest of *M. ryani* **sp. nov.** (ca. 40 cm; Fig. 14A), the cells indeed are not arranged in zigzag, and comb shape is straight for most of its length, only curved near the distal extremity.

Most of the forked nests of *M. vaqueroi* mentioned in Richard's manuscript and the one recently found in Caxiuana (PA, Brazil) are relatively small nests (9–10 cells) with just one or two forks. However, Bolivian “nest 83”, with several forks, has a similar number of cells to that of the above mentioned nest of Fig. 14A (*M. ryani* **sp. nov.**) with 26 cells, and nearly 40 cm of length. Based on the photograph published in Wenzel (1998) of “nest 83”, one can see that such forked architecture may be much more compact and possibly less fragile for a same number of cells. Very remarkable in that nest is also the asymmetry of forking occurrences, most located on one of the basal “branches”.

Recently collected nest specimens from Amazon localities indicate that the peculiar filiform stems of the plant *Cuscuta trichostyla* (“dodder”) represent an important nesting substrate in those rainforests (Figs. 13A, C and 14E). This plant species is parasitic and presents a mesh of tangled filiform stems that give rise to very fine roots (haustoria) that penetrate host plants to access their nutrients.

Conflicts of interest

The authors declare no conflicts of interest.

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