



Mazax akephaloi sp. nov.—a new Neotropical spider species resembling ‘headless’ *Ectatomma* ants (Araneae: Corinnidae: Castianeirinae)

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Abstract

A new ant-like spider species of the subfamily Castianeirinae, *Mazax akephaloi* sp. nov., representing the second species of *Mazax* recorded from South America, is described from the Bolivian orocline and the Paraguayan Chaco region. The new species superficially resembles *Mazax ramirezi* Rubio & Danişman, 2014, but can be distinguished from this species and all other congeners by a combination of the following characters: feathery setae on the carapace, a tibia I spine formula of 5–4 in males and 5–5 in females, the embolus sub-apical with a spatulate extension, the lung-shaped spermathecae II and slightly undulating copulatory ducts. Adults of *M. akephaloi* sp. nov. were observed foraging in association with workers of the ant *Ectatomma permagnum* Forel, 1908 on the ground or leaf litter along forest edges. Although the spiders were lacking a structure imitating the head of the ants, they shared several characters (dark brown integument with distinct, coarse wrinkles and shiny reflections, abdomen anteriorly with dorsally pointing process and distinct median constriction) that increased the species-specific similarity to their potential ant models.

Key words: *Ectatomma*, Gran Chaco, mimic, myrmecomorph, new species, South America

Introduction

Within the spider family Corinnidae Karsch, 1880, the subfamily Castianeirinae Reiskind, 1969 is circumtropical and represented by slender, fast-running spiders generally considered good examples of Batesian mimics of ants (Reiskind 1969; Haddad 2012). The New World has a rich castianeirine fauna, including ant mimics with varying levels of mimetic accuracy (Reiskind 1969). While species of the genus *Castianeira* Keyserling, 1879 appear to be generalized ant mimics, *Sphecotypus niger* (Perty, 1833) is an accurate mimic of the ponerine ant *Neoponera villosa* (Fabricius, 1804), and the species of *Myrmecotypus* O. Pickard-Cambridge, 1894 and *Grismadox* Pett, Rubio & Perger, 2022 resemble specific models of the ant genera *Camponotus* Mayr, 1861 or *Dolichoderus* Lund, 1831 (Perger & Rubio 2020a; Perger 2021; Perger & Dupérré 2021).

The genus *Mazax* was described by O. Pickard-Cambridge (1898), subsequently synonymized with *Apochinomma* Pavesi, 1881 by Simon (1903), and later regarded as valid by Reiskind (1969). The genus is defined by having an abdomen with a distinct, rugose petiole, the eyes moderately large and approximately equal, the anterior eye row recurved, and the posterior eye row slightly recurved to straight (Reiskind 1969). All *Mazax* species (except *M. ajax* Reiskind, 1969) have the second pair of anterior abdominal setae sclerotized to spines (Reiskind 1969; Rubio & Danişman 2014). The distribution of the seven currently known species of *Mazax* suggests that the diversity center of this genus is situated in North and Central America (World Spider Catalog 2022). Only one species, *M. ramirezi* Rubio & Danişman, 2014, has been reported from South America (World Spider Catalog 2022). However, two Brazilian species of *Apochinomma*, *A. acanthaspis* Simon, 1896 and *A. armatum* Mello-Leitão, 1922, have the second pair of abdominal setae sclerotized to spines and may belong to *Mazax* (Perger &

Rubio 2020). Ant models were only proposed for *M. pax* Reiskind, 1969, which occurs in the same microhabitats as the ant *Ectatomma ruidum* Roger, 1861 and has a similar integument surface and color (Reiskind 1977).

In the current study, we describe a new species of *Mazax* based on specimens that were previously identified as *M. ramirezi*, from both the Bolivian orocline (see Perger & Perger 2017) and Paraguayan Chaco (housed in the MNHNP). Evidence for a further case of species-specific ant mimicry in *Mazax* is provided.

Materials and methods

Observations and collections of spiders and ants were made in ground habitats along the edges of Chiquitano forest fragments at the Bolivian orocline (Figs 1, 6A). Photographs of live spiders and ants and their habitats were taken with a Panasonic Lumix GX-80 system camera fitted with a Panasonic H-HS3030 macro lens. Colour was described from photos of live specimens. Spiders were euthanized with ethyl acetate and stored in 80% ethanol.

Preserved specimens were examined in 80% ethanol under a Nikon SMZ-U dissection microscope, or an AmScope ZM-4T microscope. A Nikon Coolpix 950 digital camera attached to the microscope was used to photograph all the structures to be illustrated. The epigyne was dissected using a custom-made hooked pin and digested by submersion in a glass vial filled with potassium hydroxide (10%) for approximately 3–4 minutes. The cleared epigyne was prepared on a temporary slide and examined with a compound microscope. Genitalic illustrations were made by BLP using a ‘Wacom One’ graphics tablet with images underlaid at 60% opacity using the program ‘Autodesk Sketchbook’ (see Cala-Riquelme 2021). All measurements are expressed in millimeters (to the nearest 0.01 mm) and were taken using a micrometric ruler on the microscope. High resolution images of specimens were produced at the Zoological Museum, University of Hamburg, using a BK Plus Lab System (Dun, Inc.) with integrated Canon camera, macro lens (65 mm) and Zerene focus stacking software.

Morphological terms and description formats follow the recent studies on Castianeirinae spiders (Rubio & Arbino 2009; Leister & Miller 2014; Perger & Rubio 2020a, 2021). Body length (BL) measurement refers to the distance from the anterior margin of the carapace to the posterior margin of the abdomen. The cephalic width was measured at the level of the posterior eye row when viewed dorsally. The length of the abdomen, dorsal and epigastric sclerite were measured without the petiole, which is separated from the former two sclerites by a slight groove.

The following indices (*sensu* Reiskind 1969) were calculated: a) carapace index = carapace width / carapace length x 100; b) cephalic width index = cephalic width / carapace width x 100; c) abdomen index = abdomen width / abdomen length x 100.

The following abbreviations are used in the text: AER—anterior eye row; AME—anterior median eye; ALE—anterior lateral eye; CD—copulatory ducts; CO—copulatory openings; dRTA—dorsal retrolateral apophysis; PER—posterior eye row; PLE—posterior lateral eye; PME—posterior median eye; RTA—retrolateral tibial apophysis; vRTA—ventral retrolateral tibial apophysis; ST—spermathecae (STI is the posterior portion, STII is the anterior portion).

Arachnological collections are abbreviated as follows (curators in parenthesis):

CBF Colección Boliviana de Fauna, La Paz, Bolivia (R. Perger)

MNHNP Museo Nacional de Historia Natural del Paraguay, San Lorenzo, Paraguay (J. A. Kochalka)

ZMH Zoological Museum Hamburg, Hamburg, Germany (D. Harms)

Ecoregion distribution. The ecoregion affinities of the species were investigated by visualizing the coordinates and a shapefile of the regionalization of ecoregions by Olson *et al.* (2001), by using the geographic information system QGIS (version 2.14.3, <http://www.qgis.org/en/site/>) (Fig. 1). Geographic coordinates are shown in decimal degrees with reference datum WGS84, and elevation in meters above sea level (m a.s.l.).

Ant mimicry. In this study, an indirect, correlative method was employed to support mimicry, without studying the impact of receiver responses on mimic fitness. In the absence of experimental evidence with possible selective agents, species-specific similarity with a sympatric putative model can provide indirect evidence for mimicry (Reiskind 1977; de Jager & Anderson 2019; Perger & Rubio 2020a, 2021a). For the analysis of ant resemblance, we considered all ants that were collected via beating tray sampling (see Perger & Rubio 2020a, 2021a) and manual search on the ground and leaf litter in the surveyed location and were about the same body length as the spiders. The similarity was analysed, based on a qualitative, descriptive assessment of integument colour and shine, shape of

body parts (e.g., abdomen shape: fusiform or ovate; apically pointed or rounded) and characteristics of setae (e.g., colour, relative length and proportion of integument coverage). The terminology of ant morphology follows Keller (2011).

Nomenclatural acts. This published work and the nomenclatural acts it contains have been registered in Zoobank: <http://zoobank.org/References/02E4F898-8E72-4F06-90D6-8A58CABDBE51>.

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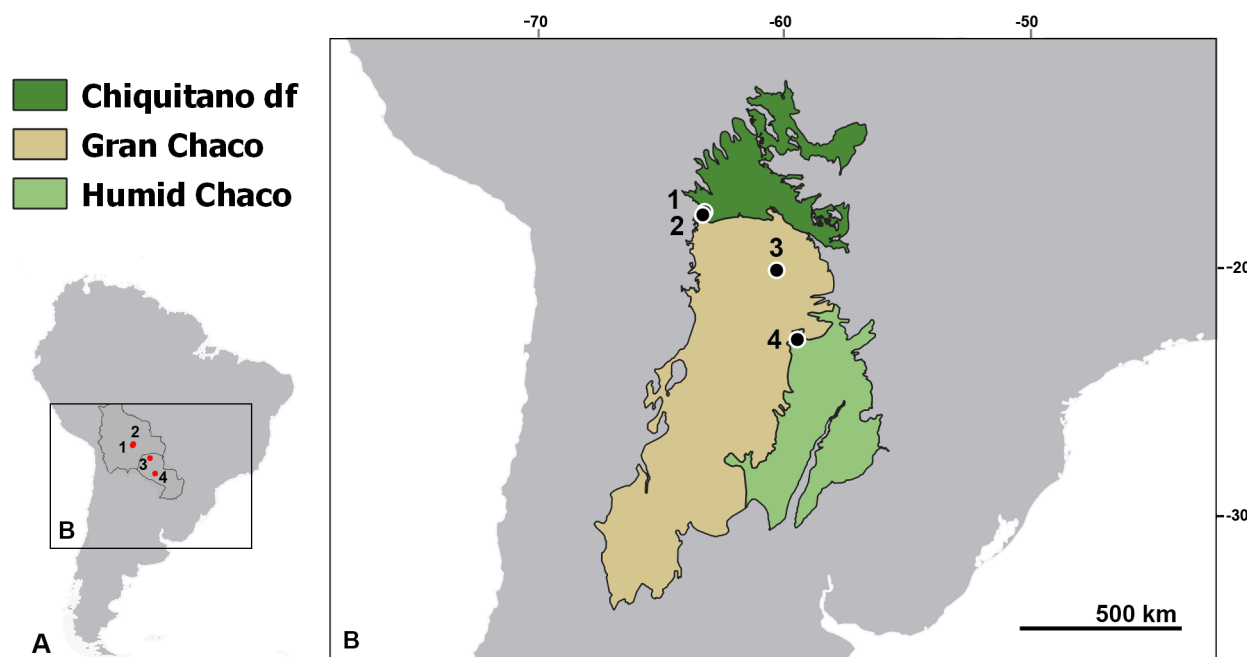


FIGURE 1. Ecoregion distribution of *Mazax akephaloi* **sp. nov.**, according to the regionalization by Olson *et al.* (2001); A, South America; country borders of Bolivia and Paraguay shown; B, ecoregions of *M. akephaloi* **sp. nov.**; Bolivia: Santa Cruz department: 1, Santa Cruz de la Colina; 2, La Guardia. Paraguay: 3, Alto Paraguay department, Parque Nacional Defensores del Chaco, Misión Cué, Tribu Nueva; 4, Presidente Hayes department, 25 Aguas; df, dry forest; map produced with QGIS (version 2.14.3, <http://www.qgis.org/en/site>).

Taxonomy

Family Corinnidae Karsch, 1880

Subfamily Castianeirinae Reiskind, 1969

Genus *Mazax* O. Pickard-Cambridge, 1898

Type species: *Mazax pax* Reiskind, 1969, replacement name for *Mazax spinosa* O. Pickard-Cambridge, 1898 (Reiskind 1969).

Diagnosis (modified from Reiskind (1969) and Rubio & Danişman (2014)). Abdomen with distinct, rugose petiole, second pair of abdominal spines sclerotized to spine-like tubercles and/or spines (except in *M. ajax*), AER recurved, PER slightly recurved to straight, eyes moderately large and approximately equal, with AME slightly smaller than ALE.

Remarks. A rugose petiole and abdominal spines can be found in the Asian genus *Serendib* Deeleman-Reinhold, 2001, but *Serendib* species have a sub-globose abdomen, a strongly recurved posterior eye row with widely separated eyes, and AME larger than ALE (Deeleman-Reinhold 2001). Species of *Grismadox* resemble *Mazax* in their habitus, subequal eyes and the sclerotized second abdominal setae, but can be separated from the latter by a short, smooth petiole, the male palp with both dRTA and vRTA, and females with anterior COs (Pett *et al.* 2022).

Mazax akephaloi sp. nov.

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Figs 2–5

Type material. Holotype ♂: **BOLIVIA:** Santa Cruz department, Santa Cruz de la Colina, Urubo, 17.760833°S, 63.24°W, 432 m a.s.l., 21–28.XII.2019, leg. R. Perger, edge of Chiquitano forest (ZMH-A0015362).

Allotype ♀: same data as for preceding (CBF).

Paratypes: 1♂, same data as for preceding (ZMH-A0015360); 6♂ 10♀, same data as for preceding (CBF); 3♂ 4♀, Santa Cruz department, La Guardia, 17.8830°S, 63.3177°W, 480 m a.s.l., 9.IX.2015, leg. R. Perger, edge of Chiquitano forest (CBF). **PARAGUAY:** 1♂, Alto Paraguay department, Parque Nacional Defensores del Chaco, Misión Cué, Tribu Nueva, 20.1227°S, 60.3246°W, 6.IX.1982, leg. J.A. Kochalka (MNHNP: IBNP-JAK-CR 000.00.2.717); 1♂; Presidente Hayes department, 25 Laguas, 22.924°S, 59.486°W, 11–12.XII.1983, leg. J.A. Kochalka (MNHNP: IBNP-JAK-CR 000.00.2.719).



FIGURE 2. *Mazax akephaloi* sp. nov., dorsal habitus: A, holotype male (ZMH-A0015362); B, female allotype (CBF). Scale bars 0.5 mm.

Other material examined. 1 subadult ♂: **PARAGUAY:** Parque Nacional Defensores del Chaco, Misión Cué, Tribu Nueva, 20.1227°S, 60.3246°W, 1–6.IX.1982, leg. J.A. Kochalka (MNHNP: IBNP-JAK-CR 000.00.2.718).

Diagnosis. *Mazax akephaloi* sp. nov. can be separated from all known congeners by a combination of the following characters: tibia I ventral spination 5–4 in males (5 at prolateral margin) and 5–5 in females, feathery setae on carapace, and embolus sub-apical with spatulate extension (males of all known congeners have the embolus tapering evenly, either twisted or straight, see Reiskind (1969)). Females can be diagnosed by a combination of lung-shaped ST II and slightly undulating CDs.

White feathery setae on the carapace are only shared with *M. pax* (tibia I spination 3–3) and *M. ramirezi* (tibia I spination 4–4) (Reiskind 1969). *Mazax spinosa* (Simon, 1898) and *M. xerxes* Reiskind, 1969 have a tibia I ventral spination of 5–5, but no feathery setae on the carapace (Reiskind 1969). The lung-shaped ST II of females of *M. akephaloi* **sp. nov.** are only shared with *M. ramirezi* (CDs more twisted) and the nearly straight CDs with *M. chickeringi* Reiskind, 1969 (ST II globose), but neither have both characters combined (Reiskind 1969; Rubio & Danişman 2014).

Remarks. *Apochinomma acanthaspis* and *A. armatum* possibly belong to *Mazax* but were not included in the most recent taxonomic works on this genus (Reiskind 1969; Rubio & Danişman 2014). The types of both species were not available for study. The type of *A. armatum* was likely destroyed in a recent fire (A. Kury, unpublished data) and the type of *A. acanthaspis* is likely lost (C. Rollard, *personal communication*). According to the original descriptions and illustration by Simon (1896), the holotype female of *A. acanthaspis* has a considerably less pronounced abdominal constriction and flatter ventral sclerite, lacks the first pair of abdominal setae (present in *M. akephaloi* **sp. nov.**), and has the metatarsus I with spine formula 3–3 (2–2 in *M. akephaloi* **sp. nov.**). The female holotype of *A. armatum* has a tibia I spine formula of 2–2 and whitish coxae II–III (Mello-Leitão 1922) (*M. akephaloi* **sp. nov.** with tibia I with spine formula of 5–5 in females and brownish coxae).

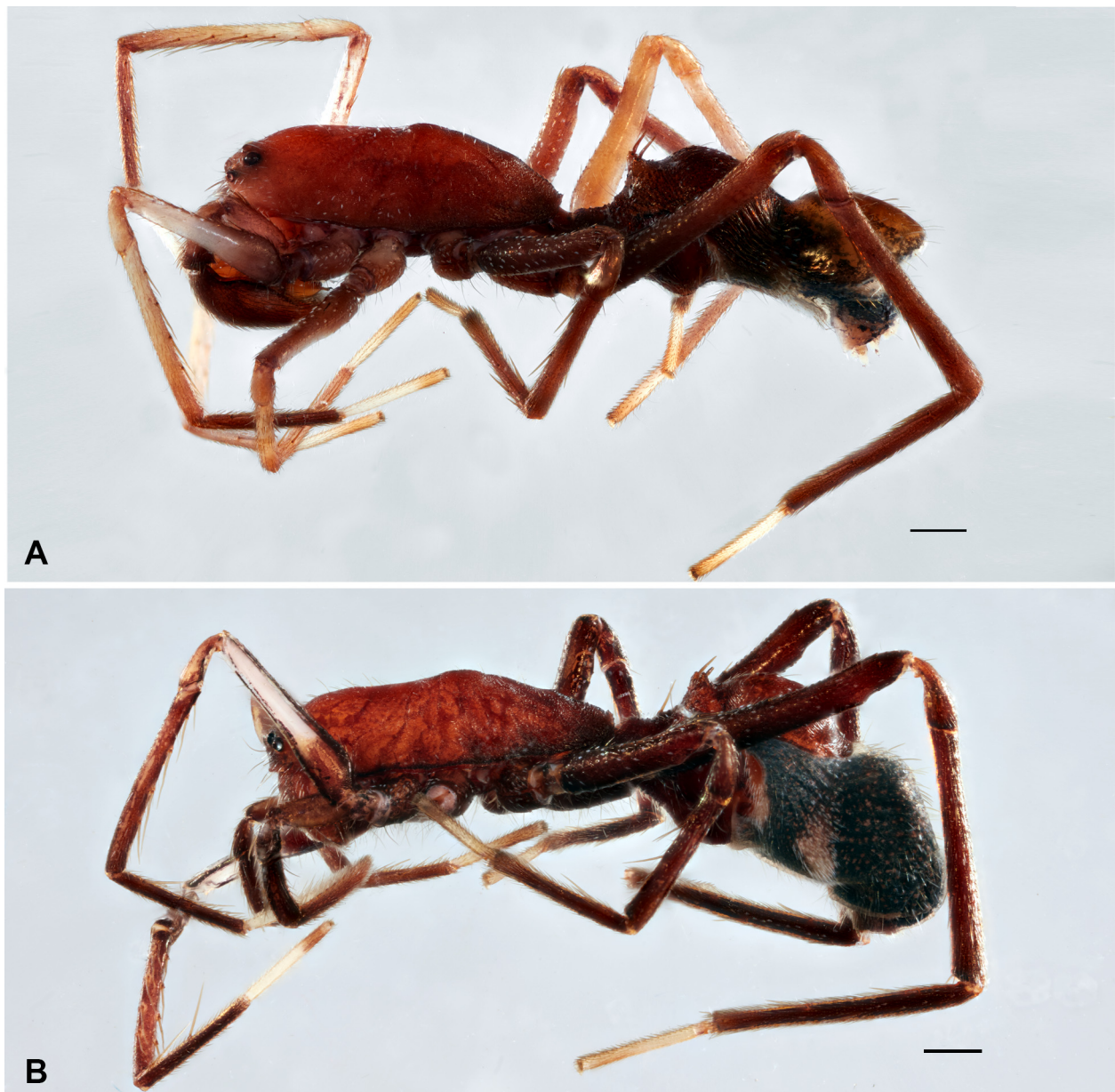


FIGURE 3. Lateral views of *Mazax akephaloi* **sp. nov.**: A, holotype male (ZMH-A0015362); B, female allotype (CBF). Scale bars 0.5 mm.

Etymology. The specific epithet, *akephaloi*, means "headless ones" (ἀκέφαλοι) in Greek, mythical headless men who were rumored, in antiquity and later, to inhabit remote parts of the world (Syropoulos 2018). One hypothesis for the origin of the myth of the *akephaloi* is the observation of the combat tactic of the North African Blemmyae tribe in which they keep their heads pressed close to the chest (Dijkstra 2013). The epithet refers to the observation that *M. akephaloi* **sp. nov.** lack a structure resembling the head of their ant model *E. permagnum* and have a skull-shaped sternum.

Male holotype. Body length 6.79; carapace length 2.96, width 1.5, carapace index 50.6; cephalic width 0.84, cephalic index 55.85; abdomen length 3.32, maximum width anterior part 1.21, maximum width posterior part 1.39, abdominal index 41.8; dorsal sclerite length 2.66, maximum width same as maximum abdomen width. Eyes: AER 0.55; AME–AME 0.09; AME–ALE 0.02; PER 0.64; PME–PME 0.14; PME–PLE 0.07.

Color and microsculpture. Dorsum dark blackish-brown in life, with purplish tinge when seen in sunlight (color faded to reddish-brown in ethanol; Figs 2A, 3A); carapace and posterior part of sclerite posterior of constriction weakly shiny, smooth, microsculpture finely reticulate, with evenly distributed, fine pits; petiole and anterior part of sclerite heavily wrinkled and shiny, wrinkles on petiole transverse and on anterior sclerite longitudinal, abdomen posterior of dorsal sclerite glabrous, shiny; legs glabrous, shiny, with regularly arranged narrow, transverse ridges from which emerge setae, dark brown; femora I–II translucent, yellowish to white prolateral to ventrally; tarsi I–IV cream with dark brown tips.

Setation. Dorsum with separate white feathery setae, forming dense transverse band in abdominal constriction; separate, erect, simple, moderately long yellowish-brassy setae all over dorsum, denser and longer on posterior part of abdomen, similar simple and feathery setae on legs. First pair of abdominal setae simple, indistinct, second pair of abdominal spines heavily sclerotized, emerging from two distinct tubercles (Fig. 4A).

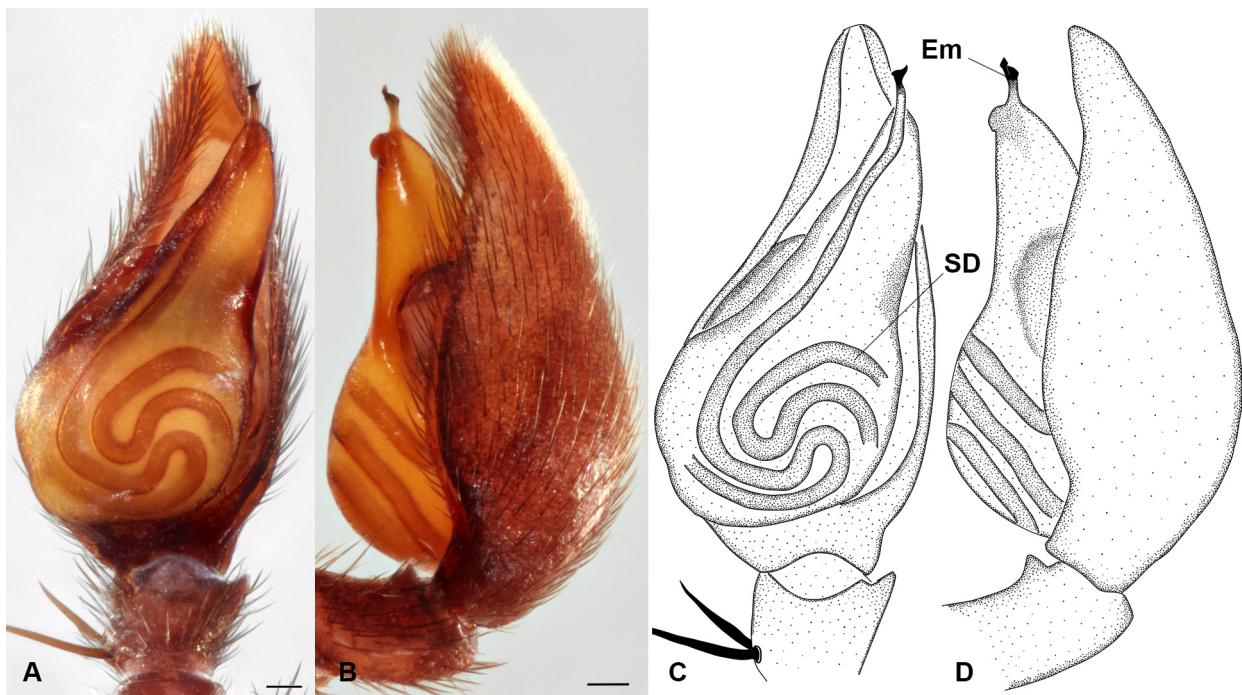


FIGURE 4. *Mazax akephaloi* **sp. nov.**, palp male holotype (ZMH-A0015362), A, C, ventral view; B, D, retrolateral view (Em = embolus, SD = sperm duct). Scale bars 0.1 mm

Carapace. Long pyriform, front slightly convex, cephalic area laterally somewhat narrowed, broadening towards middle, widest in middle, narrowing posteriorly, posterior margin truncate (Figs 2A, 3A).

Eyes. Both eye rows slightly recurved, eyes approximately equal, with narrow, slightly darker rings, remaining characters as in genus diagnosis.

Chelicerae. Two teeth on both the pro- and retromargins. Promargin with distal tooth about twice the size of basal tooth. Retromargin with two subequal teeth, slightly smaller than largest promarginal tooth.

Sternum. Skull-shaped, narrowing posteriorly with conspicuous indentation just anterior to coxa III.

Abdomen. Petiole conspicuous, elongated, with anterior margin concave; abdomen roughly obovate, distinctly

constricted dorsally and laterally at about middle, anterior part dorsally bulged out to transverse elliptic bead, posterior part orbicular, broader than anterior part; dorsal sclerite completely covering abdomen laterally, sclerite length 80% of abdomen length, slightly convex posteriorly; ventral sclerite not reaching to level of inframamillary sclerite, latter narrow, subrectangular, broader than long (Figs 2A, 3A).

Palp. Tibia with two distinct, long setae and several shorter setae, margin distinctly edged, RTA absent; maximum width of tibia 58% of maximum width of bulb when viewed retrolaterally; tarsus with globose genital bulb drawn out into moderately long, broad neck, with short, sclerotized embolus, sub-apical with spatulate extension, embolus ending in pointed tip with apical twist; sperm ducts with two loops, one retrolateral and one median to embolus tube (Fig. 4).

Female allotype. Body length 6.23; carapace length 3.05, width 1.59, carapace index 52.13; cephalic width 0.89, cephalic index 56; abdomen length 2.58, width 1.58, abdominal index 61.24; dorsal sclerite length (width agrees with abdominal width) 1.26; Eyes: AER 0.58, AME–AME 0.09, AME–ALE 0.04, PER 0.69, PME–PME 0.13, PME–PLE 0.14.

Color, microsculpture, setation, carapace shape and eye characteristics as in male. Abdomen larger, lateral constriction of abdomen much less pronounced as in male (cf. Figs 2, 3), dorsal sclerite suboval, only extending to abdominal constriction, ventral sclerite absent.

Epigyne. ST II large, lung-shaped, about four to five times the diameter of very small circular ST I. CD joins posterior end of ST II, almost straight and projected laterally leading to small oval CO that are posterolateral to ST II. FD arises at anterior margin of ST I (Fig. 5).

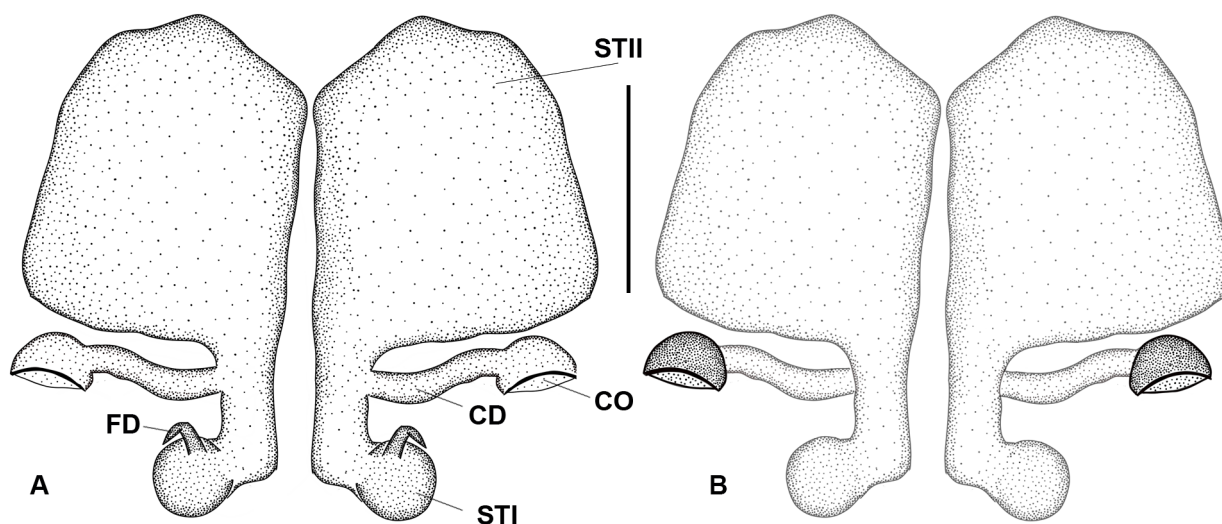


FIGURE 5. *Mazax akephaloi* sp. nov., epigyne female allotype (CBF), A, dorsal view; B, ventral view (CO = copulatory opening; CD = copulatory duct; ST = spermatheca; FD = fertilization duct). Scale bar 0.5 mm.

Variation. While the abdominal constriction of the male is determined by the shape of the large dorsal sclerite, it varied in females according to the nutritional or reproductive state.

Geographical and ecological distribution. *Mazax akephaloi* sp. nov. is known from the Bolivian locations of La Guardia and Santa Cruz de la Colina in the Santa Cruz Department and the Paraguayan locations of Misión Cué, Tribu Nueva (Alto Paraguay Department) and 25 Laguas (Presidente Hayes Department). According to the ecoregion delineation by Olson *et al.* (2001), the locations are situated in the Chiquitano dry forest (Santa Cruz de la Colina), the Chaco dry forest (La Guardia, Misión Cué, Tribu Nueva) and the Humid Chaco (25 Laguas) (Fig. 1).

In Bolivia, individuals of *M. akephaloi* sp. nov. were observed foraging diurnally on the ground and leaf litter along the edges of Chiquitano forest fragments that were surrounded by Cerrado-like forests and savanna grass (Fig. 6A). Despite several surveys employing beating tray sampling and manual search (Perger & Perger 2017; Perger & Rubio 2018, 2020a, b), the species was not observed in arboreal habitats or in other Bolivian forest ecoregions. Considering the distribution (Fig. 1) and observations in open habitats, this species is likely typical for Chaco dry forests. *Mazax akephaloi* sp. nov. is the only species of *Mazax* that is currently known from Bolivia and Paraguay. This species is possibly replaced by *M. ramirezi* south of the Chaco area in Argentina (Buenos Aires province), making it unlikely that the latter species occurs in Bolivia (as reported by Perger & Perger 2017).

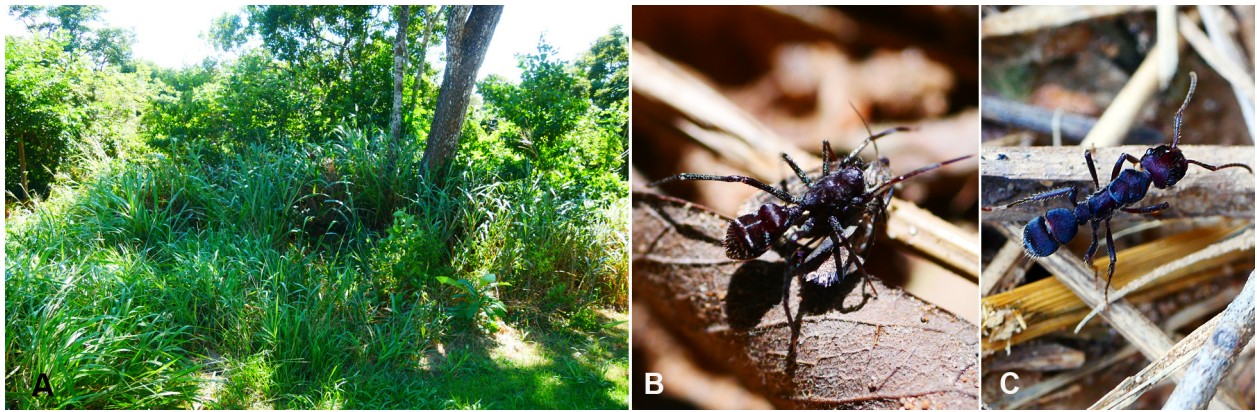


FIGURE 6. *Mazax akephaloi* **sp. nov.**: A, habitat at edge of Chiquitano forest; B, female with captured moth; C, potential ant model *Ectatomma permagnum* Forel, 1908, worker.

Ant mimicry. Seven ant species - *Ectatomma permagnum* Forel, 1908, *Acromyrmex* sp., *Odontomachus* sp., *Camponotus crassus* Mayr, 1862, *C. sericeiventris* (Guérin-Méneville, 1838), *Neoponera apicalis* (Latreille, 1802) and *N. villosa* (Fabricius, 1804) - with a similar or larger body length than adults of *M. akephaloi* **sp. nov.** (body length 6.23–7.24) were found in the investigated ground habitats in the two Bolivian locations. Among the ground-dwelling ants, only the two *Neoponera* spp., *Odontomachus* sp. and *E. permagnum* had an elongated metasoma.

Characters that increased the ant resemblance in *M. akephaloi* **sp. nov.**, but were not specific for this mimetic species pair (e.g., also found in the mimetic pair *N. villosa* and *Sphecotypus niger* (Perger 2021)), included long, erected yellowish-brassy setae on the abdomen, a horizontal band of hairs increasing the illusion of an abdominal segmentation between the ant post-petiole and tergite IV, and several transversal bulges posterior to the dorsal sclerite resembling the ant tergites (Fig. 7).

Ethological similarities between *E. permagnum* and *M. akephaloi* **sp. nov.**, such as relatively slow foraging speed, with frequent stops in which the ants lifted their heads and conspicuously moved their antennae (imitated by the spiders by moving the prolegs in a similar fashion), were also observed in the mimetic pair *N. villosa*/*S. niger* (Perger 2021) and appear to be typical for poneromorph ants and their mimetic spiders.

Microhabitat co-occurrence and species-specific resemblance

Species-specific mimicry was supported by close co-occurrence of *M. akephaloi* **sp. nov.** and *E. permagnum* in defined ground patches of several square meters in both Bolivian locations. The spiders were observed foraging on bare soil and leaf litter in close proximity to workers of *E. permagnum* in three subsequent years. Both shared following species-specific morphological similarities (not found in co-occurring ants or their resembling spiders): dark brown integument with distinct, coarse wrinkles and shiny reflections (the impression of the latter was increased by white feathery setae in the spiders), abdomen anteriorly with dorsally pointing process (petiole in ant, tubercles of second abdominal spines in spider) and distinct abdominal constriction (separating the third and fourth abdominal segment in the ant) (Fig. 7).

Mimetic accuracy

When assessing ant resemblance, it has to be taken into account that *E. permagnum* reached a larger body length than *M. akephaloi* **sp. nov.** The maximum body length of the spiders was about as long as the length of the ants excluding its head (Fig. 8). Depending on the vertical rotation of the large ant head, the body length of the ants could vary up to 15% of their maximum body length (Fig. 8). While the spider carapace appears to mimic the mesosoma of the ant, there is apparently no structure in the spider resembling the ant head, which is also indicated by the lack of a carapace constriction (Fig. 7).

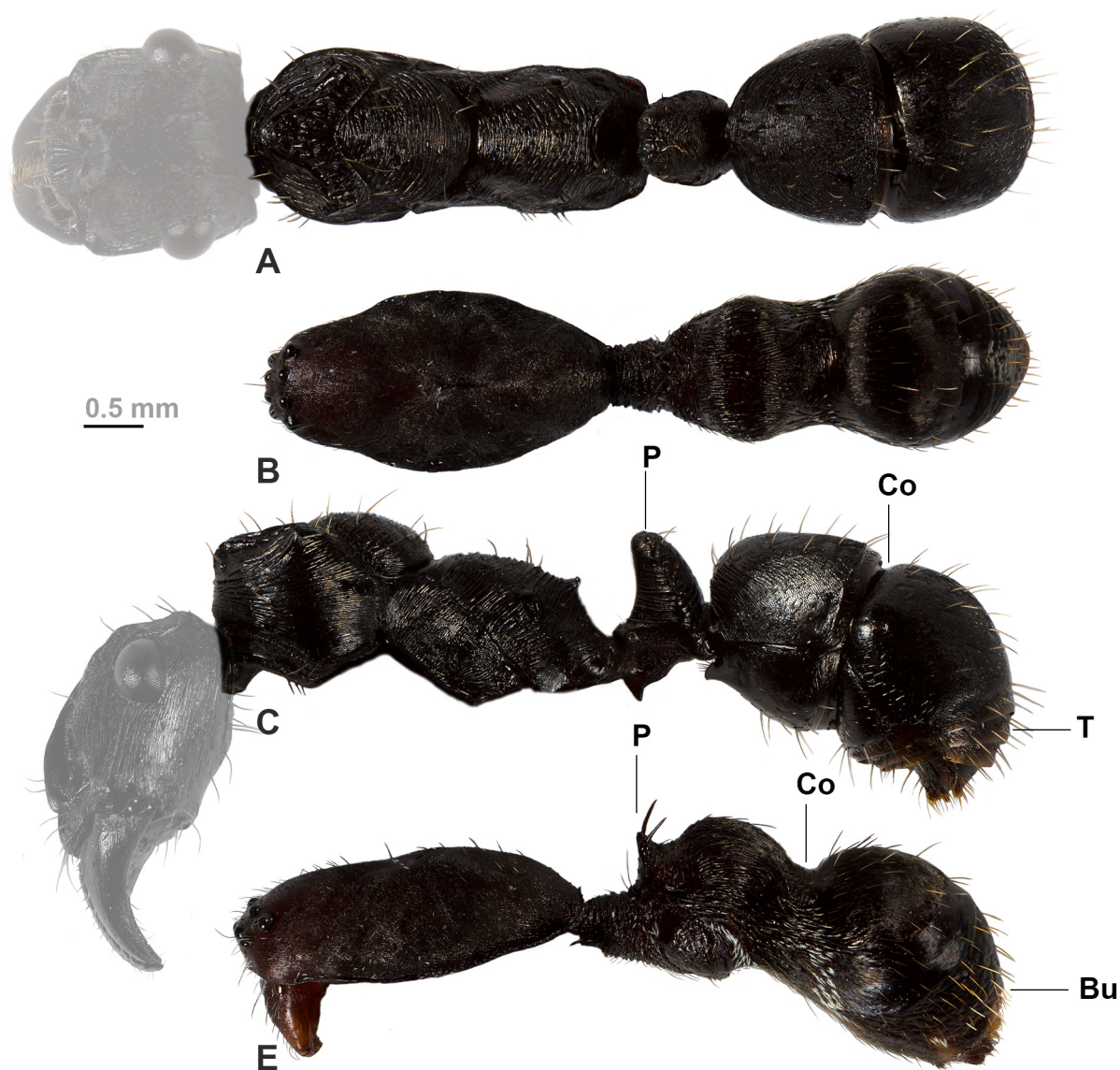


FIGURE 7. Morphological resemblance between possible ant model and spider mimic: A, C, *Ectatomma permagnum* Forel, 1908, worker (head semitransparent because it is not imitated by the spider); B, D, *Mazax akephaloi* sp. nov. (B, D), male, paratype (CBF); Bu, transversal bulges; P, process; Co, constriction; T, tergites. Scale bar 0.5 mm.

Discussion

Considering their large mandibles, potent stings and toxic venoms (Da Silva *et al.* 2018), *Ectatomma* ants are likely suitable models for mimetic relationships. Apart from *Mazax pax* (Reiskind 1977), another castianeirine species of the genus *Myrmecium* Latreille, 1824 (cf. *bifasciatum* Taczanowski, 1874, cited as cf. *velutinum* Simon, 1896) (Oliveira 1988), and nymphs of the bug *Hyalymenus tarsatus* (Fabricius, 1803) (Maderspacher & Stensmyr 2011), were suggested to mimic *Ectatomma* ants.

In the current study, microhabitat sympatry and resemblance of several morphological characters in *E. permagnum* and *M. akephaloi* sp. nov. indicated species-specific mimicry. The co-occurrence suggests that the spiders may actively select their models, e.g. by using kairomones, which was proposed for an ant mimicking gnaphosid spider (Pekár 2020). Co-occurrence in combination with species-specific morphological resemblance (white feathery setae imitating the reflections of the wrinkles, the horizontal band of light hairs imitating the segmentation of the ant gaster) were also mentioned in the mimetic pair *E. ruidum* and *M. pax* (Reiskind 1977).

However, the lack of a structure in *M. akephaloi* sp. nov. resembling the ant head (Fig. 7) appears to lower the

mimetic accuracy. In contrast, many arboreal castianeirines, such as species of *Sphecotypus* and *Myrmecium*, imitate the head-mesosoma segmentation of ants with a more elongated, constricted carapace (Candiani & Bonaldo 2017; Pett *et al.* 2022). We suggest that the *Ectatomma* head is difficult to imitate because its large size generates high variability during movements. The raising of the head and conspicuous movements of the antennae are commonly observed in poneromorph ants (Reiskind 1977; personal observations). At one side, while the species-specificity of the ant resemblance in *M. akephaloi* **sp. nov.** clearly supports mimicry, the lack of a head imitation questions if the mimetic accuracy as assessed in many studies under laboratory conditions (reviewed by Kelly *et al.* 2021) is representative for the *in situ* perception of the mimicry by predators. Even in spiders without a head imitation, the antennae-like movements of the spider prolegs and foraging in cryptic microhabitats (e.g., leaf litter) (Fig. 6B) may provide effective protection against visually hunting predators, such as reptiles and birds. Additional work is required to investigate the relationship between microhabitat conditions and mimetic accuracy.

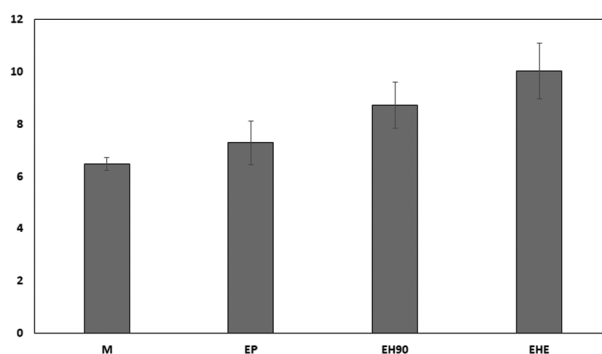


FIGURE 8. Mean and standard deviation of morphological measurements (mm) of adult *M. akephaloi* **sp. nov.** (M) (n=10) and workers of *E. permagnum* (n=10): EP, length from anterior margin of pronotum to abdomen tip; EH90, body length with head in position of 90° with respect to body; EHE, body length with fully extended head.

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