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## Research article

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# Two new ant-mimicking spiders (Araneae: Salticidae) from Costa Rica

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**Abstract.** During a recent investigation of ant-mimicking arthropods in Costa Rica, two new species of salticid spiders were discovered. Here, I provide descriptions of the two species, *Myrmapana costaricaensis* sp. nov. and *Corcovetella galianoae* sp. nov. The former species has two forms; the dark form resembles *Neoponera* ants, while the light form resembles *Pseudomyrmex* ants. *Corcovetella galianoae* resembles *Camponotus* ants.

**Keywords.** Batesian mimicry, *Corcovetella*, *Myrmapana*.

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## Introduction

Ant-mimicry or myrmecomorphy has evolved in hundreds of spider species and in at least 17 spider families, with most myrmecomorphic genera and species belonging to two families, Salticidae Blackwall, 1841 and Corinnidae Karsch, 1880 (Cushing 2012; Pekár 2014a). The taxonomy of myrmecomorphic genera is complicated by morphological resemblance to ants, marked sexual dimorphism, transformational mimicry, and colour polymorphism. Due to their accurate resemblance to ants, these spiders are often overlooked in the field and thus under-sampled. Presumably, all myrmecomorphic spider species undergo transformational mimicry, i.e., the imitation of different ant species during ontogenetic development (Pekár *et al.* 2020), which makes the identification and matching of juvenile stages with adults difficult. Some species possess colour variations (forms) also in the adult stage due to their resemblance to different ant species, which further complicates correct determination to species (e.g., Nelson 2010; Pekár *et al.* 2017; Perger *et al.* 2021). In addition, due to frequent morphological sexual dimorphism, specifically the enlarged chelicerae in males of some salticid genera (e.g., *Myrmarachne* Macleay, 1839), the matching of sexes can be challenging.

Myrmecomorphic species occur throughout all zones of the earth but are most diversified in the tropics (Pekár 2014b, 2022). In Central America there are several genera of salticid spiders resembling ants, namely *Bellota* Peckham & Peckham, 1892, *Breda* Peckham & Peckham, 1894, *Corcovetella* Galiano, 1975, *Descanso* Peckham & Peckham, 1892, *Erica* Peckham & Peckham, 1892, *Martella* Peckham & Peckham, 1892, *Myrmarachne*, *Paradamoetas* Peckham & Peckham, 1885, *Peckhamia* Simon, 1900, *Pseudofluda* Mello-Leitão, 1928, *Scopocira* Simon, 1900, *Sympolymnia* Perger & Rubio, 2020,

*Synemosyna* Hentz, 1846, *Tutelina* Simon, 1901, *Uluella* Chickering, 1946, and *Zuniga* Peckham & Peckham, 1892 (Perger & Rubio 2020; Pekár 2022). Most of these genera belong to the Astoida clade (Maddison 2015). One of the most enigmatic genera is *Myrmarachne*, which was, until recently, one of the most speciose salticid genera (>200 species) occurring on almost all continents, but mainly in the tropical zone, with a few species extending to temperate zones (World Spider Catalog 2022). *Myrmarachne* is not strongly supported by phylogenetic analysis (Edwards & Benjamin 2009) and many taxonomic changes are expected.

In the past, species within the *Myrmarachne* genus were classified into ten groups on the basis of copulatory organ morphology (Wanless 1978; Edwards & Benjamin 2009). Recently, Prószyński (2016) split the *Myrmarachne* genus into 13 genera containing closely related species on the basis of morphology and distribution. Species from Central and southern America were placed into two new genera, *Myrmapeni* and *Myrmapana*. The former genus currently contains three species (*Myrmapeni chickeringi* (Galiano, 1969), *M. penicillata* (Mello-Leitão, 1933), and *M. sumana* (Galiano, 1974)) and the latter, five (*Myrmapana brasiliensis* (Mello-Leitão, 1922), *M. centralis* (Peckham & Peckham, 1892), *M. mocamboensis* (Galiano, 1974), *M. panamensis* (Galiano, 1969), and *M. parallela* (Fabricius, 1798)). All these species occur in Central (Mexico, Nicaragua, Panama) and/or South America (Argentina, Brasil).

Recently, a colleague of mine (Guadalupe Corcobado) found two species of ant-mimicking salticids while conducting research on their ecology at La Selva Biological Station and Reserve, Costa Rica. One of them belonged to *Myrmapana* and the other to a monotypic genus, *Corcovetella*, with *C. aemulatrix* (Galiano 1975) from Brasil. This paper presents descriptions of these two species.

## Material and methods

Diagnostic characters used to distinguish species of *Myrmarachne* included habitus, the shape of the chelicera (basal segment, fang), and the shape of the sexual organs (Wanless 1978; Ceccarelli 2010; Yamasaki & Ahmad 2013). Diagnostic characters for males included the morphology of the retrolateral tibial apophysis (RTA) and the embolus, and the sizes of the bulbus of the male palp and the chelicera. Diagnostic characters for females included the morphology of the epigynal plate, atria, median pocket, copulatory ducts, and spermathecae. In order to obtain figures for vulvae, dissected epigynes were cleared in 10% KOH at 60°C for 15 min.

Pictures of freshly killed specimens were photographed using an Olympus ColorView digital camera attached to an Olympus SZX-12 stereo microscope. Multi-focus montage images were composed using ANALYSIS ver. 1.9 software (Olympus). Pictures of genitalia were taken using a Keyence VHX-5000 digital microscope.

Drawings emphasize important structures and ignore distracting detail; for example, dense hair cover (on the cymbium and tibia) is not shown. Shading is utilised to indicate the colouration.

Single measurements are given for the holotype and one paratype specimen and minimum and maximum values for other specimens are given in parentheses. Carapace length excluded the eyes, carapace width was taken at the position of the PLE, sternum width was measured between the 2<sup>nd</sup> and 3<sup>rd</sup> pairs of legs, abdomen length excluded the spinnerets, and total body length included the chelicera and spinnerets. Measurements of appendages include the length of the femur, patella, tibia, metatarsus, and tarsus.

## Abbreviations

ALE = anterior lateral eyes  
AME = anterior median eyes  
Cx = coxa

Fe	=	femur
Mt	=	metatarsus
PLE	=	posterior lateral eyes
PME	=	posterior median eyes
Pt	=	patella
PTB	=	ratio of length of palpal Ti to bulbus width
RTA	=	retrolateral tibial apophysis
Ta	=	tarsus
Ti	=	tibia
Tr	=	trochanter

### Repositories

MUB	=	collection of Department of Botany and Zoology, Masaryk University, Brno
NMP	=	collection of the National Museum, Praha

### Results

Class Arachnida Cuvier, 1812  
Order Araneae Clerck, 1757  
Family Salticidae Blackwall, 1841

Genus *Myrmapana* Prószyński, 2016

Males of *Myrmapana* are characterised by long, flattened and broad chelicerae, with a row of teeth on ventral side, a circular coiled bulbus, and a short RTA, whereas females are characterised by spermatheca with a broad anterior dilation (Prószyński 2016).

*Myrmapana costaricaensis* sp. nov.  
urn:lsid:zoobank.org:act:4FBB9658-87A4-4519-B9D7-CB83DDAA37AA  
Figs 1A–B, D, 2–3

### Diagnosis

Males of *M. costaricaensis* sp. nov. are most similar in the shape of sexual organs to *M. parallela*. Males of *M. costaricaensis* differ from this species by a protuberance at the anterior margin of the cheliceral fang, the shape of the first strong tooth, and a sinusoidal RTA (Galiano 1969: figs 33, 43). Females can be recognised by spermathecae without prominent insemination ducts (“pipes”, see Prószyński 2016).

### Etymology

The name is derived from the country of origin.

### Type material

#### Holotype

COSTA RICA – **Heredia Province** • ♂; Puerto Viejo de Sarapiquí, La Selva Biological Station and Reserve; 10°25.87145' N, 84°0.45123' W; 25 Apr. 2015; G. Corcobado leg.; leaves of tropical plants; NMP (P6A 7397).

#### Paratypes

COSTA RICA – **Heredia Province** • 2 ♀♀; same collection data as for holotype; 15 Apr. 2015; NMP (P6A 7398) • 1 ♂; same collection data as for preceding; MUB • 3 ♂♂, 5 ♀♀; same collection data as for preceding; 16 Apr. 2015; MUB • 3 ♀♀; same collection data as for preceding; 25 Apr. 2015; MUB • 3 ♀♀; same collection data as for preceding; 7 May 2015; MUB • 2 ♂♂; same collection data as for

preceding; 8 May 2015; MUB. – **Puntarenas Province** • 1 ♂; La Gamba; Feb. 2012; E. Líznavá leg.; MUB.

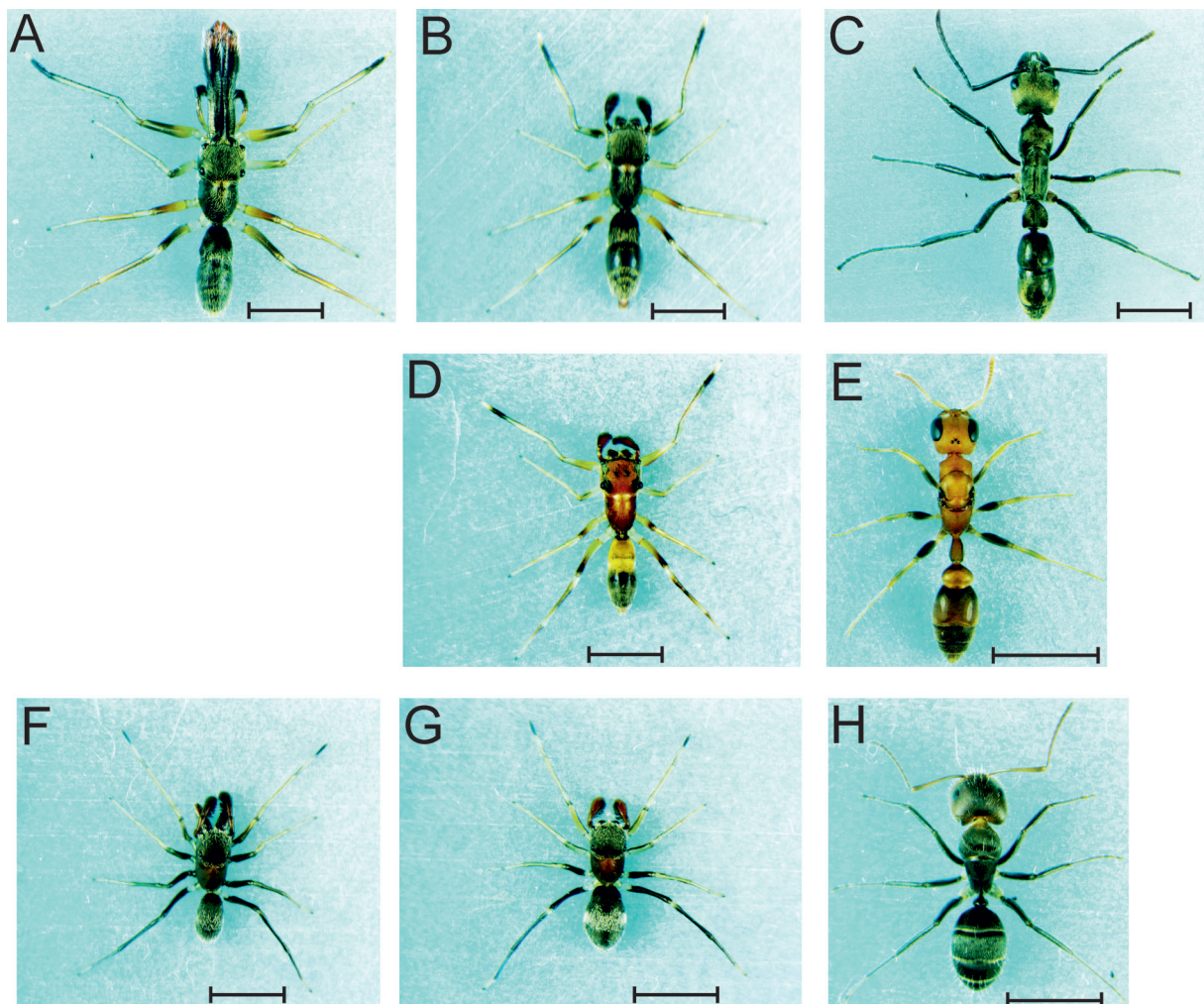
#### Other material examined

COSTA RICA – **Heredia Province** • 2 juvs; same collection data as for holotype; 16 Apr. 2015; MUB • 3 juvs; same collection data as for preceding; 25 Apr. 2015; MUB • 1 juv.; same collection data as for preceding; 7 May 2015; MUB • 1 juv.; same collection data as for preceding; 8 May 2015; MUB. – **Puntarenas Province** • 3 juvs; La Gamba; Feb. 2012; E. Líznavá leg.; MUB.

#### Description

##### Male

MEASUREMENTS (N = 9). Total body length 9.18 (6.70–10.70) mm; carapace 2.55 (1.49–2.97) mm long, 1.52 (1.16–1.67) mm wide; basal segment of chelicera 3.43 (2.27–4.05) mm long, 0.48 mm wide, cheliceral fang 3.35 mm long; abdomen 2.71 (1.53–3.67) mm long, 1.20 mm wide; labium 0.88 mm

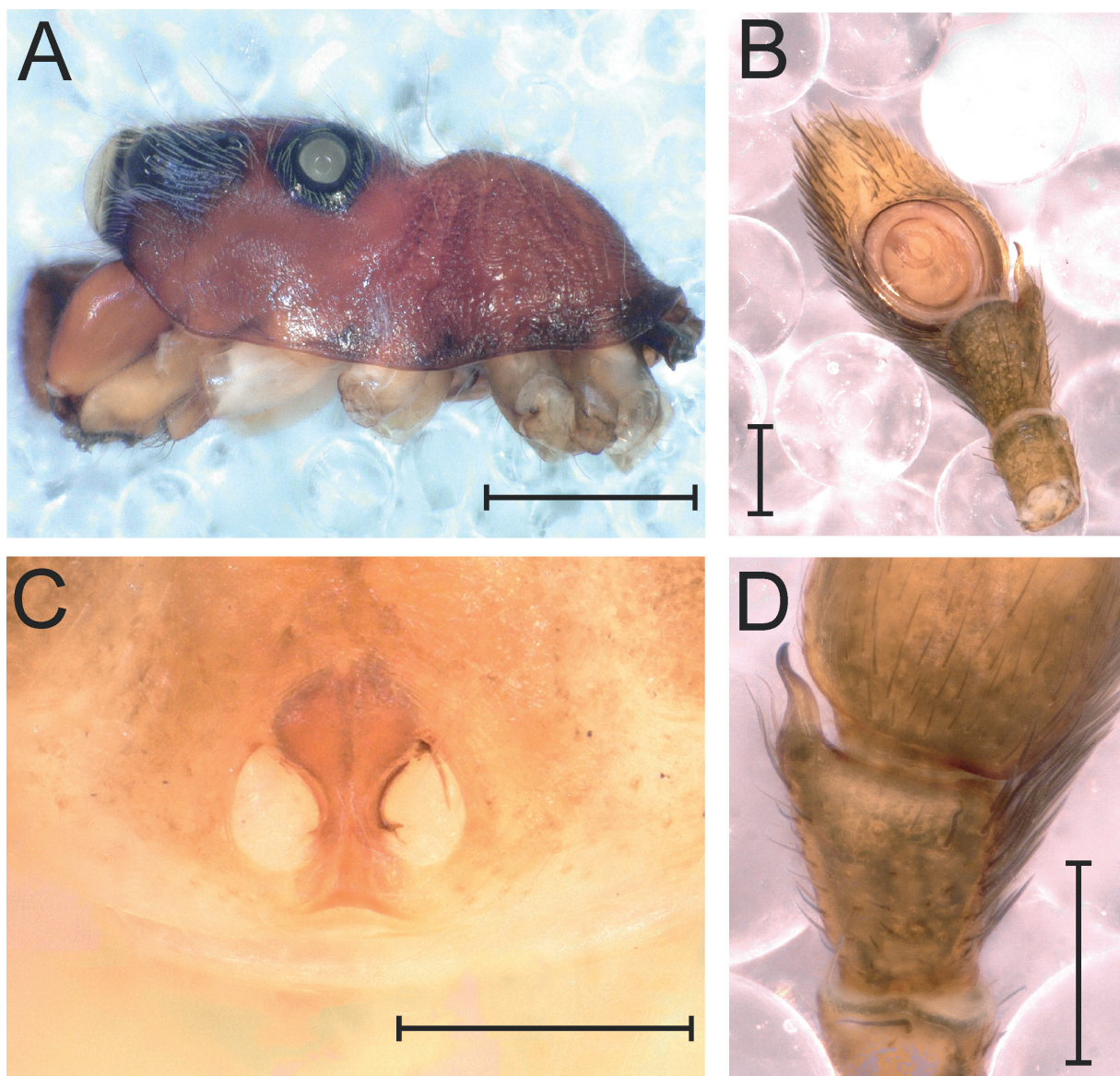


**Fig. 1.** A–B, D. *Myrmapana costaricaensis* sp. nov. A. Adult male, dark form. B. Adult female, dark form. C. Ant *Neoponera unidentata* Mayr, 1862. D. Adult female, light form. E. Ant *Pseudomyrmex* sp. F–G. *Corcovetella galianoae* sp. nov. F. Adult male. G. Adult female. H. Ant *Camponotus planatus* Roger, 1863. Scale bars = 2.5 mm.



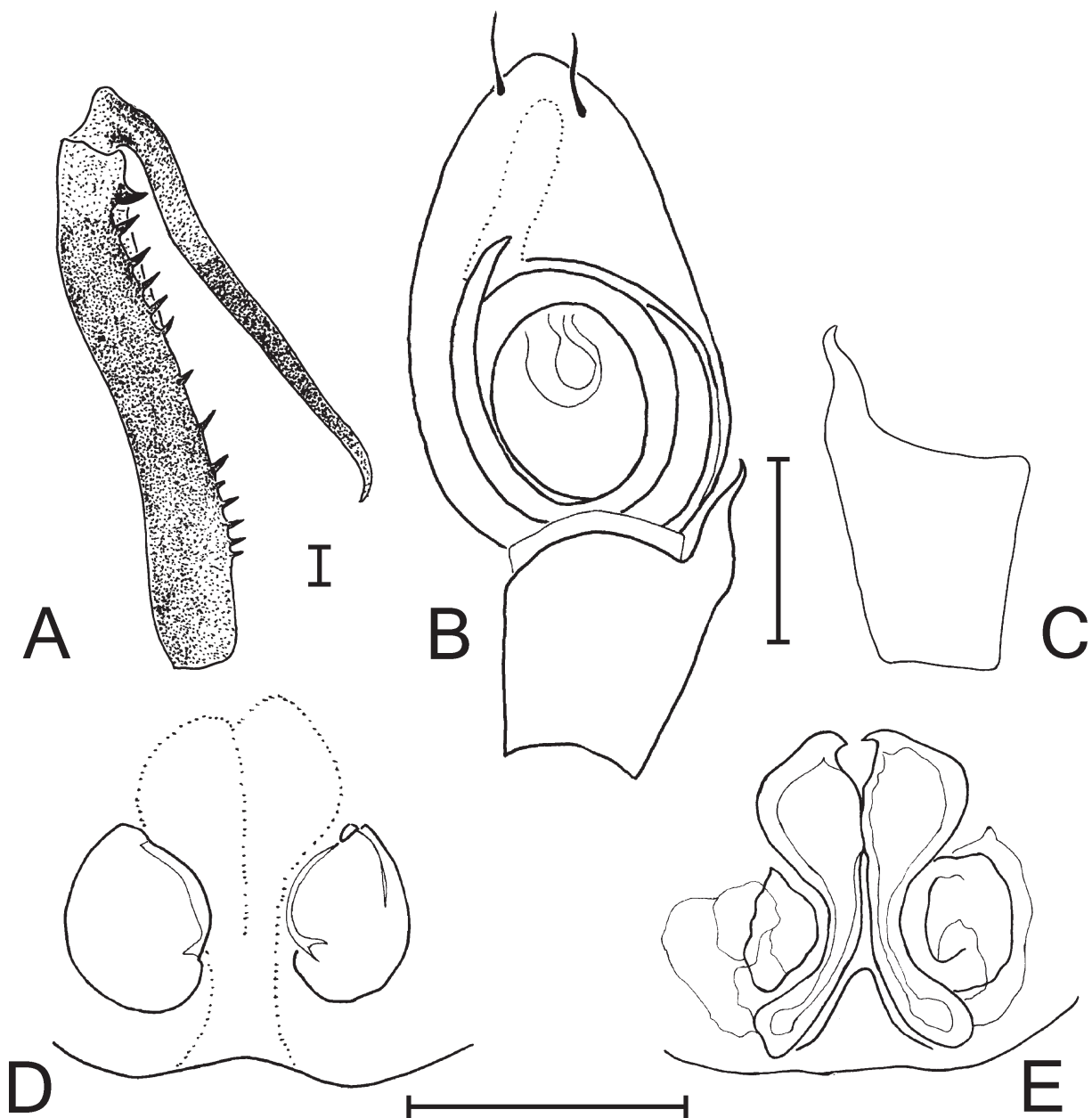
long; sternum 1.44 mm long, 0.40 mm wide. Diameter of eyes: AME = 0.42 mm, ALE = 0.21 mm, PME = 0.07 mm, PLE = 0.25 mm. Leg segments (mm): palp (0.77, 0.39, 0.49, 0.63), I (1.99, 1.04, 2.15, 0.79, 0.40), II (1.44, 0.72, 1.11, 0.72, 0.48), III (1.36, 0.56, 0.96, 0.72, 0.48), IV (1.84, 0.64, 1.60, 1.60, 0.56).

COLOUR. Chelicerae basal segment dark-brown with orange-brown distal tip, reticulated dorsally (Fig. 1A), covered with white sparse setae, fangs orange-brown, carapace dark-brown mostly covered by white setae, with brown spot in front of fovea, eyes surrounded by black patches; wedge of white setae on lateral sides behind head; sternum, endites light-brown; palpal Fe and Pt light-brown, palpal Ti and Ta dark-brown, all Cx pale, all Fe light-brown to dark-brown, all Pt pale, Ti I and II pale, Ti III and IV brown, Mt I dark-brown, all other Mt pale, all Ta pale, labium and gnathocoxae brown; abdomen dark-brown with white setae.



**Fig. 2.** *Myrmapana costaricensis* sp. nov. **A, C.** Paratype, ♀ (P6A 7398 NMP). **A.** Prosoma, lateral view. **B, D.** Holotype, ♂ (P6A 7397 NMP). **B.** Left male palp, ventral view. **C.** Epigyne, ventral view. **D.** Palpal tibia, dorsal view. Scale bars: A = 1 mm; B–D = 0.25 mm.

MORPHOLOGY. Chelicerae protruding, longer than cephalothorax, with 14 teeth on prolateral margin, the first teeth strong, triangular; fangs straight, at base with dorsal protuberance, tip curved (Fig. 3A); cephalothorax elongated (Fig. 1A), cephalic part dorsally flat and slightly higher than thoracic part which is hump-shaped; sternum elongated. Leg spines: Ti I ventrally 2.2.2.2.2.2.2, Mt I ventrally 2.2, Ti II ventrally 2.1, Mt II ventrally 2.2, Mt III and IV ventrally 2. Abdomen elongated with a constriction about one third of its length and two dorsal scuta (Fig. 1A). Palpal cymbium oval, with one apical spine, tegulum large, oval as wide as cymbium, embolus coiled 2 times, tip of embolus straight, pointing laterally (Figs 2B, 3B); RTA elongated, sinusoid apically pointed (Figs 2D, 3C).



**Fig. 3.** *Myrmapana costaricensis* sp. nov. **A–C.** Male. **A.** Chelicera, ventral view. **B.** Left palp, ventral view. **C.** Palpal tibia, dorsal view. **D–E.** Female. **D.** Epigyne, dorsal view. **E.** Vulva. Scale bars = 0.25 mm.

**Female**

MEASUREMENTS (N = 11). Total body 7.18 (5.40–7.34) mm, carapace 2.55 (2.48–2.96) mm long, 1.27 (1.08–1.39) mm wide, chelicera 0.63 (0.58–0.71) mm long, abdomen 2.87 (2.11–3.78) mm long, 1.20 mm wide; labium 0.49 mm long; sternum 1.27 mm long, 0.40 mm wide. Diameters of eyes: AME = 0.46 mm, ALE = 0.25 mm, PME = 0.07 mm, PLE = 0.25 mm. Leg segments (mm): palp (0.60, 0.31, 0.42, 0.60), I (1.52, 0.79, 1.60, 0.64, 0.40), II (1.12, 0.56, 1.04, 0.56, 0.48), III (1.28, 0.56, 0.96, 1.12, 0.48), IV (1.68, 0.56, 1.60, 1.52, 0.48).

COLOUR. As in males but abdomen ventrally pale (Fig. 1B).

MORPHOLOGY. As in males but chelicerae small, lateral margin of chelicerae with 6 teeth, retrolateral margin with 5 teeth; palpal Ta and Ti flattened (Fig. 1B, D); thoracic part of cephalothorax only slightly lower than cephalic part (Fig. 2A); abdomen with a single scutum. Epigyne with two large atria separated by a septum, atria approx. 1.5 times as wide as septum, median pocket rather triangular, situated below septum (Figs 2C, 3D); spermathecae large, oval, situated in the upper part of septum (Fig. 3E), without prominent insemination ducts.

**Variation**

The dark form is represented by both sexes (Fig. 1A–B), whereas the light form is known only in females (Fig. 1D). The two forms differ only by colouration. In the light form, palpal segments and carapace are orange-brown with dark spots around eyes, Fe I pale, frontal half of abdomen yellow, hind part dark-brown.

**Natural history**

This species was collected from tree foliage. The dark form appears to resemble *Neoponera unidentata* Mayr, 1862 ants (Fig. 1C), while the light form resembles *Pseudomyrmex* sp. ants (Fig. 1E).

**Barcode**

COI of this species is deposited in Genbank, accession no. OM321384.

**Distribution**

Known only from type locality in Costa Rica.

Genus *Corcovetella* Galiano, 1975

The genus *Corcovetella* is characterised by an elevated cephalic part of the cephalothorax, chelicera with many teeth, forelegs with 2.2.2 spines, and dense plumose setae on the palps of both sexes (Galiano 1975).

*Corcovetella galianoae* sp. nov.

urn:lsid:zoobank.org:act:150EC988-F9A0-439D-987B-8D13D5C1A1A0

Figs 1F–G, 4A–E, 5A–F

**Diagnosis**

Males of *C. galianoae* sp. nov. can be distinguished from *C. aemulatrix* by enlarged chelicera and a triangular and bent RTA. Females can be distinguished by an atrium wider than long and spermathecae aside of the atrium.

**Etymology**

The name is a matronym in honour of Maria Galiano, who has advanced salticid taxonomy in South America.



**Type material**

**Holotype**

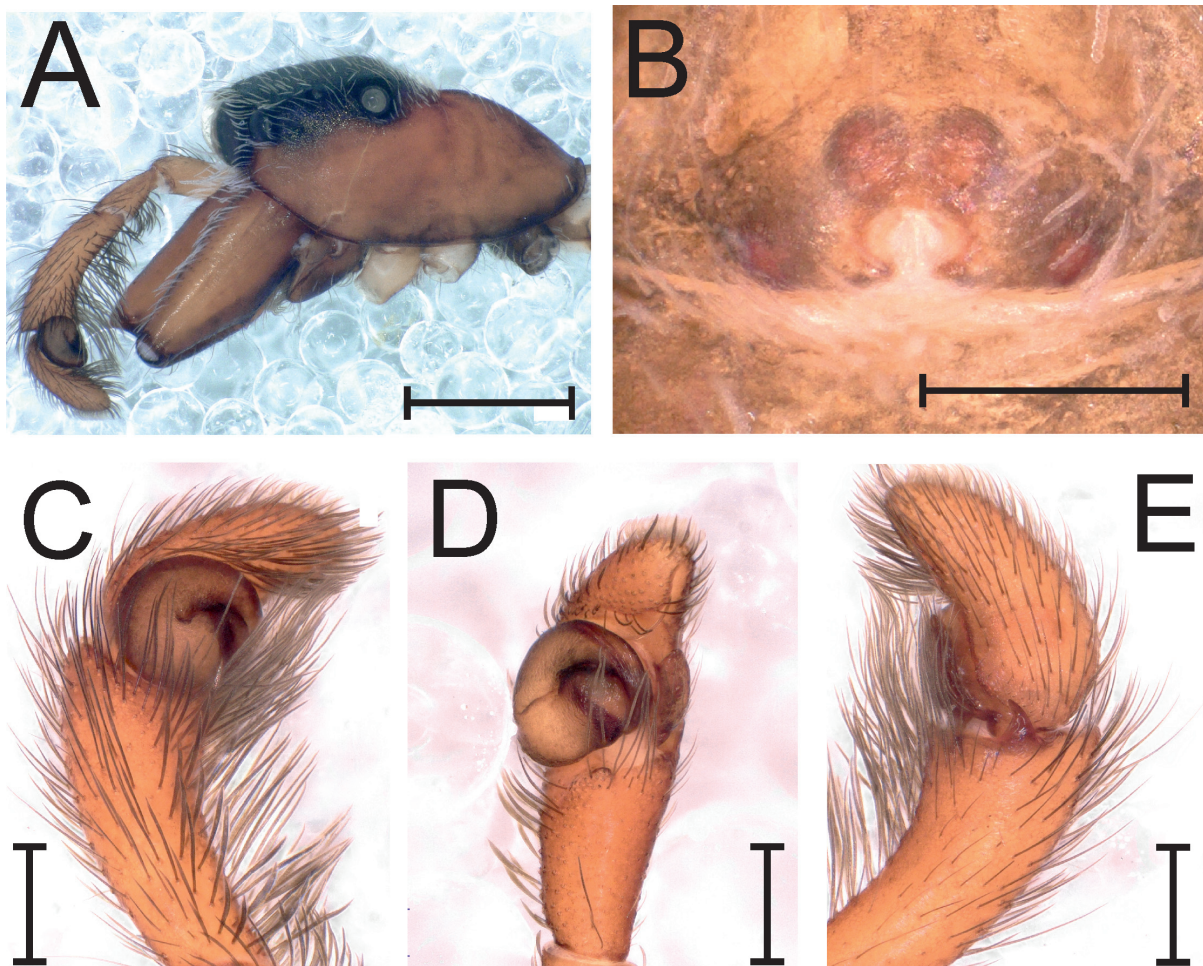
COSTA RICA – **Heredia Province** • ♂; Puerto Viejo de Sarapiquí, La Selva Biological Station and Reserve; 10°25.87145' N, 84°0.45123' W; 16 Apr. 2015; G. Corcobado leg.; litter; NMP (P6A 7399).

**Paratypes**

COSTA RICA – **Heredia Province** • 1 ♀; same collection data as for holotype; 2 May 2015; NMP (P6A 7400) • 1 ♂, 1 ♀; same collection data as for holotype; MUB • 1 ♀; same collection data as for preceding; 2 May 2015; MUB.

**Other material examined**

COSTA RICA – **Heredia Province** • 2 juvs; same collection data as for holotype; MUB • 1 juv.; same collection data as for holotype; 7 May 2015; MUB.



**Fig. 4.** *Corcovetella galianoae* sp. nov. **A, C–E.** Holotype, ♂ (P6A 7399 NMP). **A.** Prosoma, lateral view. **B.** Paratype, ♀ (P6A 7400 NMP), epigyne, ventral view. **C.** Left palp, retrolateral view. **D.** Left palp without plumose hairs, ventral view. **E.** Left palp, lateral view. Scale bars: A = 1 mm; B–E = 0.25 mm.

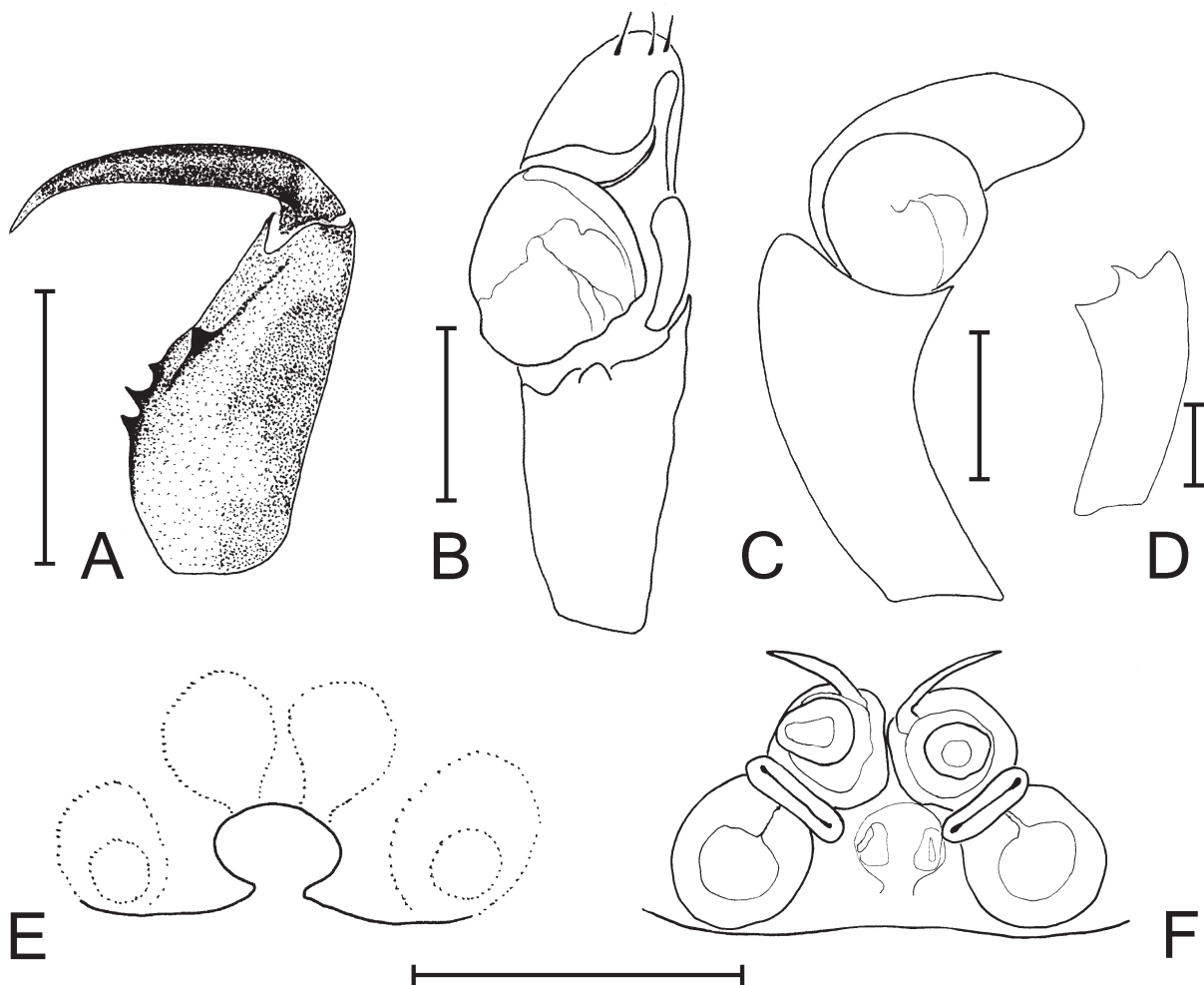


## Description

### Male

MEASUREMENTS (N = 2). Total body 3.56 (4.6) mm long; carapace 1.60 (1.87) mm long, 0.92 (1.19) mm wide; cheliceral basal segment 0.68 (1.02) mm long, 0.35 mm wide; cheliceral fang 0.64 mm long; abdomen 1.50 (1.60) mm long, 0.89 mm wide. Diameter of eyes: AME = 0.28 mm, ALE = 0.11 mm, PME = 0.04 mm, PLE = 0.14 mm; sternum 0.69 mm long, 0.35 mm wide. Leg segments: palp (0.35, 0.18, 0.35, 0.35), I (0.94, 0.45, 0.99, 0.64, 0.40), II (0.69, 0.39, 0.69, 0.49, 0.30), III (0.74, 0.30, 0.59, 0.69, 0.30), IV (1.14, 0.35, 0.94, 0.94, 0.35).

COLOUR. Chelicerae brown covered with white setae (Fig. 1F), carapace brown with cephalic part dorsally black, white setae around eyes, endites and palps brown, labium and sternum dark-brown, most leg segments with longitudinal black stripes on sides, all Cx pale, all Fe mostly black, Pt and Ti I+II pale, other black, Mt I-III pale, Mt IV black, Ta I black, other Ta pale; abdomen brown to black, dorsally and laterally with a transverse wide white stripe in the middle (Fig. 1F).



**Fig. 5.** *Corcovetella galianoae* sp. nov. **A–D.** Male. **A.** Chelicera, ventral view. **B.** Left palp, ventral view. **C.** Left palp, retrolateral view. **D.** Palpal tibia, lateral view. **E–F.** Female. **E.** Epigyne, dorsal view. **F.** Vulva. Scale bars = 0.25 mm.

**MORPHOLOGY.** Basal segment of chelicera enlarged, protruding anteriorly with 3 teeth on prolateral margin, 1 tooth on retrolateral margin (Fig. 5A); fangs straight, distally bent; cephalic part of carapace dorsally flat, higher than thoracic part, without constriction (Fig. 4A). Leg spines: Ti I ventrally with 2.2.2, Mt I, II, III ventrally 2.2, Ti II ventrally with 2.1. Abdomen elipsoid, with a dorsal scutum, without constriction. Palpal Pt, Ti and Ta with dense plumose setae on the ventral side. RTA triangular with bent tip (Figs 4E, 5D), cymbium with elongated apophysis (Figs 4C, 5C), bulbus oval split in the middle, embolus coiled (Figs 4D, 5B).

### **Female**

**MEASUREMENTS** (N = 2). Total body 4.86 (4.32) mm, carapace 1.84 (1.73) mm long, 1.12 (0.95) mm wide; cheliceral basal segment 0.48 (0.54) mm long, 0.35 mm wide, cheliceral fang 0.32 mm long; sternum 0.89 mm long, 0.45 mm wide, abdomen 2.24 (2.38) mm long, 1.21 mm wide. Diameter of eyes: AME = 0.35, ALE = 0.14, PME = 0.04, PLE = 0.14. Leg segments: palp (0.39, 0.35, 0.52, 0.60), I (0.89, 0.45, 0.74, 0.59, 0.39), II (missing), III (0.99, 0.45, 0.74, 0.79, 0.34), IV (0.94, 0.50, 1.24, 1.24, 0.44).

**COLOUR.** As in male (Fig. 1G).

**MORPHOLOGY.** As in male but chelicerae smaller, with 5 teeth on prolateral and 1 tooth on retrolateral margin. Palpal Ti and Ta bulbous with dense plumose setae on the ventral side. Epigyne with a single oval atrium, wider than long (Figs 4B, 5E); spermathecae composed of two chambers with ducts twisted in the middle and with fertilisation ducts in front (Fig. 5F).

### **Natural history**

The species was collected from litter. Both sexes appear to resemble *Camponotus planatus* Roger, 1863 ants (Fig. 1H).

### **Barcode**

COI of this species is deposited in GenBank, accession no. OM321372.

### **Distribution**

Known only from type locality in Costa Rica.

### **Discussion**

The two new species are the only ant-mimicking salticid species reported to occur in Costa Rica although several ant-mimicking species are known from surrounding countries (World Spider Catalog 2022).

Ant-mimicking spiders are known to undergo transformational mimicry, i.e., mimic different ant species during postembryonic development that match the body size of the particular instar (Pekár *et al.* 2020). In addition, several ant-mimicking species show mimetic polymorphism at adult stage (Nelson 2010; Pekár *et al.* 2017; Perger *et al.* 2021). We observed *Myrmapana costaricaensis* sp. nov. to mimic two different ant models, but *Corcovetella galianoae* sp. nov. to resemble only one ant species. Costa Rica has a high diversity of ants, amounting to more than 900 species (<https://antwiki.org/>), thus it is very likely that early instars of both species imitate very different ant species.

### **Acknowledgments**

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