

A new species of *Metagovea* Rosas Costa, 1950 from Napo Province, Ecuador (Opiliones, Cyphophthalmi, Neogoveidae)

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Abstract

As a result of an expedition to Ecuador in 2014, a new species of mite harvestman was discovered. This new species belonging to the genus *Metagovea* Rosas Costa, 1950 – *Metagovea ligiae* sp. n. – is described, based on male and female specimens from Napo Province, Ecuador. This is the fourth species described for the genus and the second from Ecuador. A simple terminology is proposed for the microtrichiae of the spermatopositor and genital characters in the family are discussed. The genus *Brasiliogovea* Martens, 1969 is consistently misspelled in the literature as *Brasilogovea*. The description of *Metagovea ligiae* offered opportunity to discuss some aspects of systematics of the family.

Keywords

Neotropical fauna, conservation, Ecuador, taxonomy, harvestmen

Introduction

Cyphophthalmi is the least diverse suborder of Opiliones arachnids, and is represented in tropical and temperate ecosystems worldwide. It includes six families and around 200 described species, although this number is heavily underestimated (Kury

2013; Giribet 2000; 2000+). The smaller diversity of Cyphophthalmi rests in the New World, with little more than 30 described species.

Neogoveidae has 26 species arranged in 8 genera, mostly Neotropical, but also Nearctic and Afrotropical (Rosas Costa 1950; Giribet 2000; DaSilva et al. 2010; Benavides and Giribet 2013; Karaman 2013; Clouse and Wheeler 2014): *Brasiliogovea* Martens, 1969 (2 spp.), *Canga* DaSilva, Pinto-da-Rocha & Giribet, 2010 (1 sp.), *Huitaca* Shear, 1979 (7 spp.), *Metagovea* Rosas Costa, 1950 (3 spp.), *Neogovea* Hinton, 1938 (5 spp.), *Tucanogovea* Karaman, 2013 (1 sp.), *Metasiro* Juberthie, 1960 (3 spp.), *Parogovia* Hansen, 1921 (3 spp.) and also Genus? *enigmaticus* Martens, 1969.

The genus *Brasiliogovea* Martens, 1969 is consistently misspelled in the literature as “*Brasilogovea*”, beginning with Shear (1980), including the important Giribet’s (2000) catalogue through the recent publications (Benavides and Giribet 2013; DaSilva et al. 2010; Karaman 2013). Both in Neave’s Nomenclator (Neave 2005) and in Zoological Record (ZSL 1871+), *Brasiliogovea* is correctly spelled, but in Hallan’s synopsis (Hallan 2005), *Brasiliogovea* is misinterpreted as a misspelling of the Zoological Record.

Metagovea is only known from South America, in the Andean and Amazonian regions. There are only three described species, but a plethora of undescribed species are already known (Benavides and Giribet 2007): *Metagovea disparunguis* Rosas Costa, 1950 (Colombia), *Metagovea oviformis* Martens, 1969 (Brazil: Manaus) and *Metagovea philipi* Goodnight & Goodnight, 1980 (Ecuador). In the present work a fourth species of *Metagovea* is described from Pacto Sumaco, in the Napo Province, in the eastern Andean slope.

Methods

The specimens were collected during 15th–16th February 2014 through meticulous visual search throughout the floors of the forest and buildings. All specimens were captured with a fine brush and placed in vials containing 75% and 100% ethanol.

Nomenclature of body parts and measurements follows the model of Benavides and Giribet (2013). Terminology of the structures of spermatopositor follows Juberthie (1970; 1979) and Karaman (2013), with some modifications: (1) recognition of apical movable fingers (**dma**, *digitus mobilis apicalis*) which might not be homologous with **dml** (*doigt mobile latéral*) of Juberthie/Karaman, and (2) naming of three groups A, B, C of microtrichiae, hitherto unnamed, which are clearly recognizable also in other families of Cyphophthalmi (Fig. 6).

The following abbreviations are used: MNRJ = Museu Nacional, Universidade Federal do Rio de Janeiro, Brazil; QCAZ = Museo de Zoología, Pontificia Universidad Católica del Ecuador – Quito, Ecuador; MCZ = Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA.

Illustrations of the spermatopositor and ovipositor were made through a Carl Zeiss Primo Star microscope and AxioVision LE image capture system, with the stacking software Combine ZP Suite (by Alan Hadley). SEM images were made at JEOL JSM-6390 LV.

Taxonomy

Family Neogoveidae Shear, 1980

Genus *Metagovea* Rosas Costa, 1950

Type species. *Metagovea disparunguis* Rosas Costa, 1950, by original designation.

Included species. *Metagovea disparunguis* Rosas Costa, 1950 (Colombia), *Metagovea ligiae* sp. n. (Ecuador), *Metagovea oviformis* Martens, 1969 (Brazil: Manaus) and *Metagovea philipi* Goodnight & Goodnight, 1980 (Ecuador).

Metagovea ligiae sp. n.

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Figs 1–8

Etymology. The new species is named after friend and fellow arachnologist Ligia Benavides for her work on Neotropical Neogoveidae.

Type material. ♂ holotype: Ecuador, Napo, Sumaco-Galeras National Park, Pacto Sumaco (-0.66577°, -77.59813°, 1526 m), 15–16 February 2014, A.B. Kury and A.P.L. Giupponi leg.; ♀ (1) paratype: same data as holotype (QCAZ 322). ♂ (1) and ♀ (1) paratypes: same data as holotype (MCZ 45452); ♂ (3, of which 1 mounted for SEM) and ♀ (8, of which 1 mounted for SEM) paratypes: same data as holotype (MNRJ 8434).

Diagnosis. Small animals, maximum body length 1.5 mm; body outline on dorsal view oblong (Fig. 1A); eyes and eye lenses absent (Figs 1A, C, D); spiracles circular (Fig. 2B) (*sensu* Giribet and Boyer 2002: 115); ventral prosomal complex with coxae II–IV fused, coxae I free, sternum absent, area of contact with coxal lobe III forming a complex arch delimiting the coxal pores (Figs 1B–2D); gonostome semicircular with concave posterior margin (Fig. 2D); ventral opisthosomal region with anal glands on sternal part of corona analis (Figs 1C–2C); spermatopositor with two pairs of shorter robust microtrichiae A, four pairs of much elongate microtrichiae B, three pairs of subapical microtrichiae C not as long as B, two pairs of movable fingers: small apical **dma** located between left and right groups of microtrichiae C; much larger **dmm**, arising from dorso-medial lobe. *M. ligiae* may be distinguished from *M. disparunguis* and *M. oviformis* by the body longer than 1.4 mm and adenostyle sinuous changing curvature (Fig. 4D) instead of parabolic. *M. ligiae* may be distinguished *M. philipi* by the much shorter basichelicerite, with only one ventral protuberance; pedipalpal trochanter clearly shorter than femur and incrassate distally; femur III dorso-apically with a protuberance; adenostyle double curved, single-pointed, pointing distally.

Description of male. Measurements. Male holotype: total length: 1.5 mm, greatest width: 0.8 mm, in the posterior part of prosoma; length/width ratio: 1.88; length of chelicerae: 1.0 mm, pedipalps (trochanter to tarsus): 1.0 mm; legs I: 1.5 mm, II: 1.2 mm, III: 1.0 mm, IV: 1.3 mm.

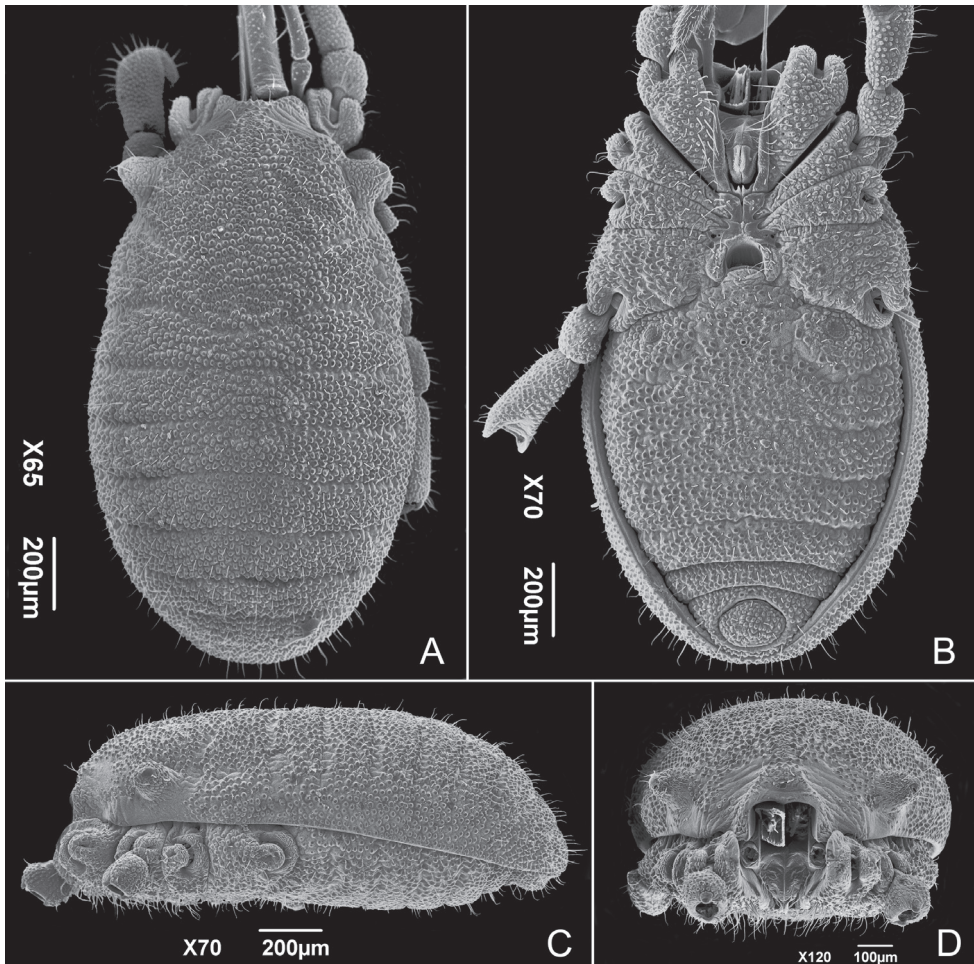


Figure 1. *Metagovea ligiae* sp. n., male paratype (MNRJ 8434). **A** Habitus, dorsal view **B** Same, ventral view **C** Same, without appendages, lateral view **D** Same, frontal view.

Color (in ethanol) and tegument. Body and appendages dark brown with most of dorsal and ventral surfaces and legs showing a dense tuberculate-microgranulate structure (Murphree 1988: 239).

Body (Fig. 1A). Prosomal region occupying less than half of the body size (Fig. 1A). Anterior margin of dorsal scutum with a pair of processes lateral to chelicerae. Lateral margin of prosoma bulging considerably behind ozophores, at widest part of body. Eyes and eye lenses absent. Ozophore conical of type 2 (*sensu* Juberthie 1970: 1373; i.e. dorso-laterally oriented) (Figs 1A, C, D, 2A). Dorsal scutum without special modifications. Opisthosomal mid-dorsal longitudinal sulcus absent (Fig. 1A).

Ventral prosomal complex (Fig. 1B) with coxae II-IV fused, coxae I free, sternum absent, coxae IV separated by gonostome (Fig. 1B); gonostome semicircular with concave posterior margin (Fig. 2D). Coxal lobes I much longer than wide, narrower

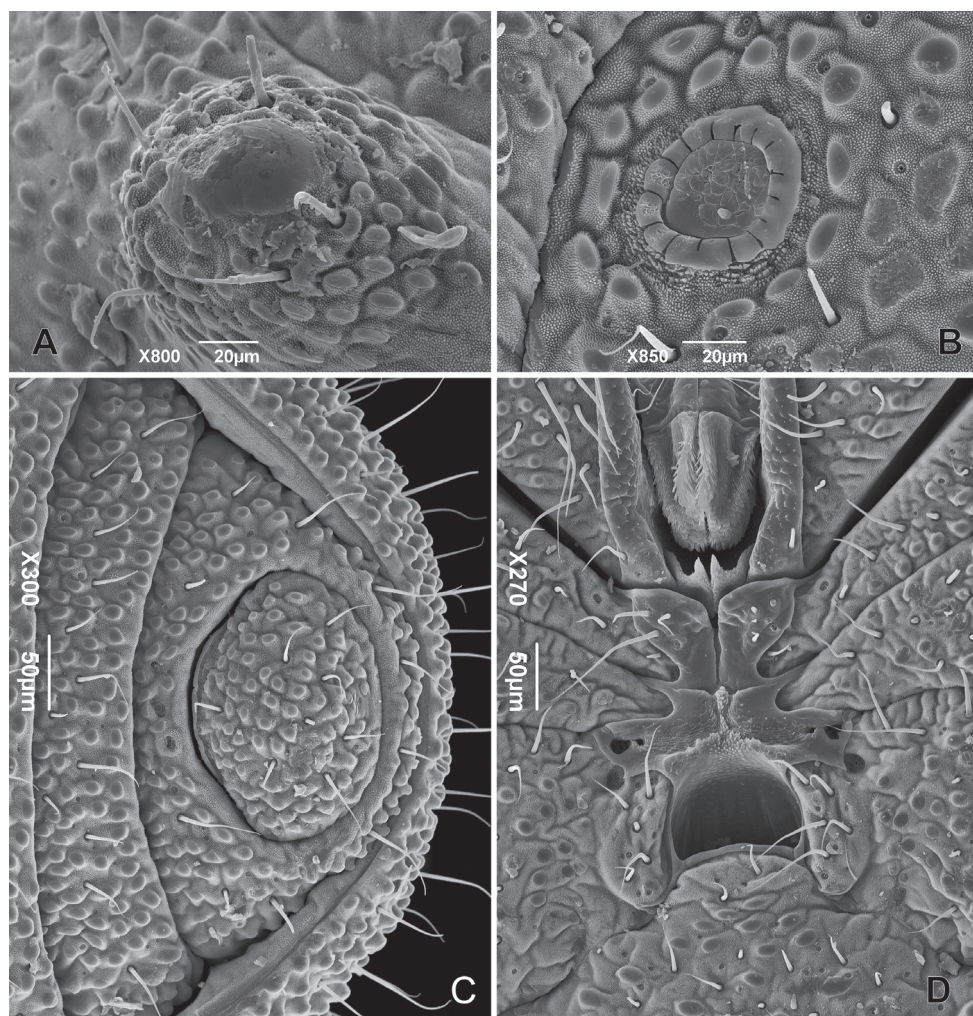


Figure 2. *Metagovea ligiae* sp. n., male paratype (MNRJ 8434). **A** Ozophore, oblique view **B** Tracheal stigma, ventral view **C** Anal region **D** Ventral prosomal complex.

anteriorly, subparallel, each armed with 2 posterior setae. Coxal lobes II anteriorly extremely thin, abruptly widening until mid-length where they start to narrow posteriorly, with 4 setae on wider part. Coxal lobes III longer than main part of coxal lobes IV; coxal lobes IV coarsely spiked in the middle, forming anterior-lateral margins of the gonostome. On the area of contact with coxal lobe III forming a complex arch delimiting the coxal pores. Coxae II-IV with rounded glandular fields at the concave part of respective coxal lobes.

Spiracles circular (Fig. 2B) (*sensu* Giribet and Boyer 2002: 115). Ventral opisthosomal region with anal glands on sternal part of corona analis (Fig. 2C, see also female). Opisthosomal tergite IX and sternites 8 and 9 fused into a corona analis (Fig. 2C).

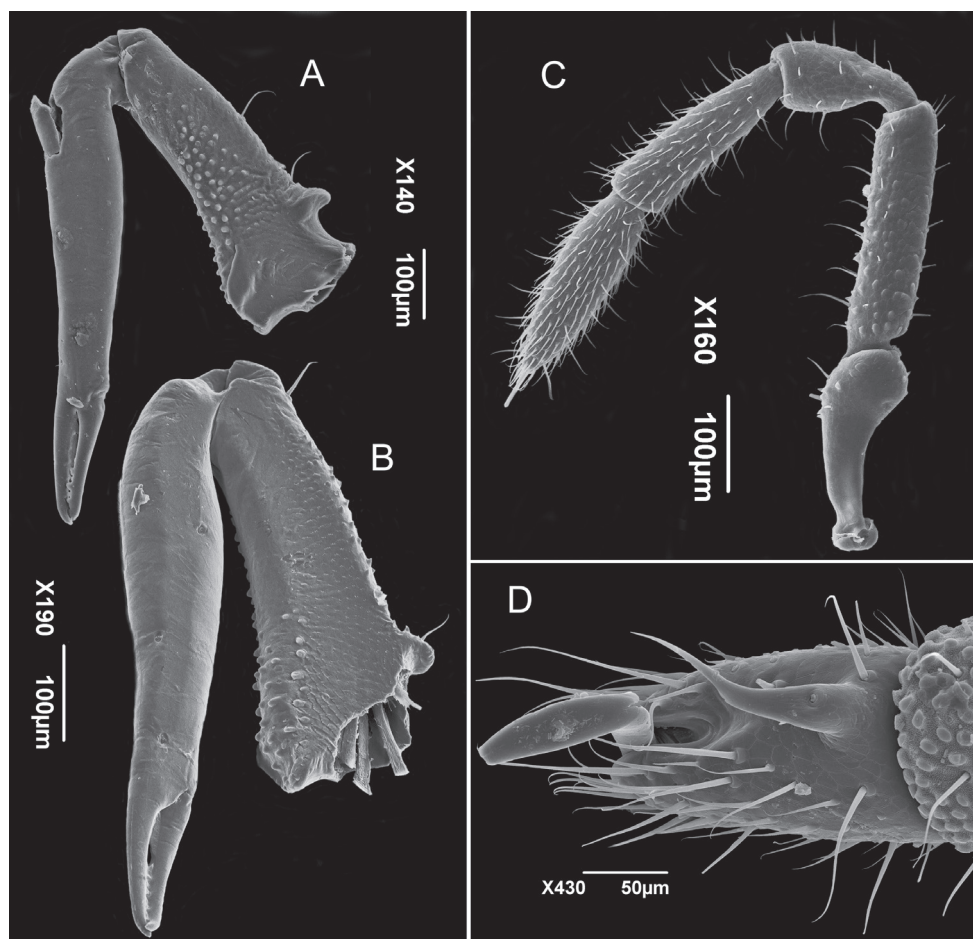


Figure 3. *Metagovea ligiae* sp. n., male paratype (MNRJ 8434). **A** Left chelicera, ectal view **B** Right chelicera, mesal view **C** Left pedipalpus, ectal view **D** Left tarsus IV, dorsal view.

Anal plate oval. This and sternites densely covered by small conical granules and large flattened tubercles, some of them pectinate (Fig. 2C, see also female).

Chelicera (Fig. 3A–B) elongate, with few and spaced dorsal setae; non-protruding type (sensu Giribet 2003). Basichelicerite with ectal surface granular, denser than ventro-mesal surface, but mesal with scale-bristles; dorso-mesal granules; with conspicuous dorsal crest and without ventral process. Second article elongate, widest near the base, without ornamentation. Dentition concentrated at the ends of the both cheliceral fingers.

Pedipalp (Fig. 3C) Trochanter unarmed, with few ventro-distal setae, much thickened at distal third, doubling its height. Femur cylindrical, with few rows of setae, all over its length; surface coarsely granulose, more so on basal and middle thirds. Patella thin on basal third, abruptly thickening in middle third up to the apex where it is twice

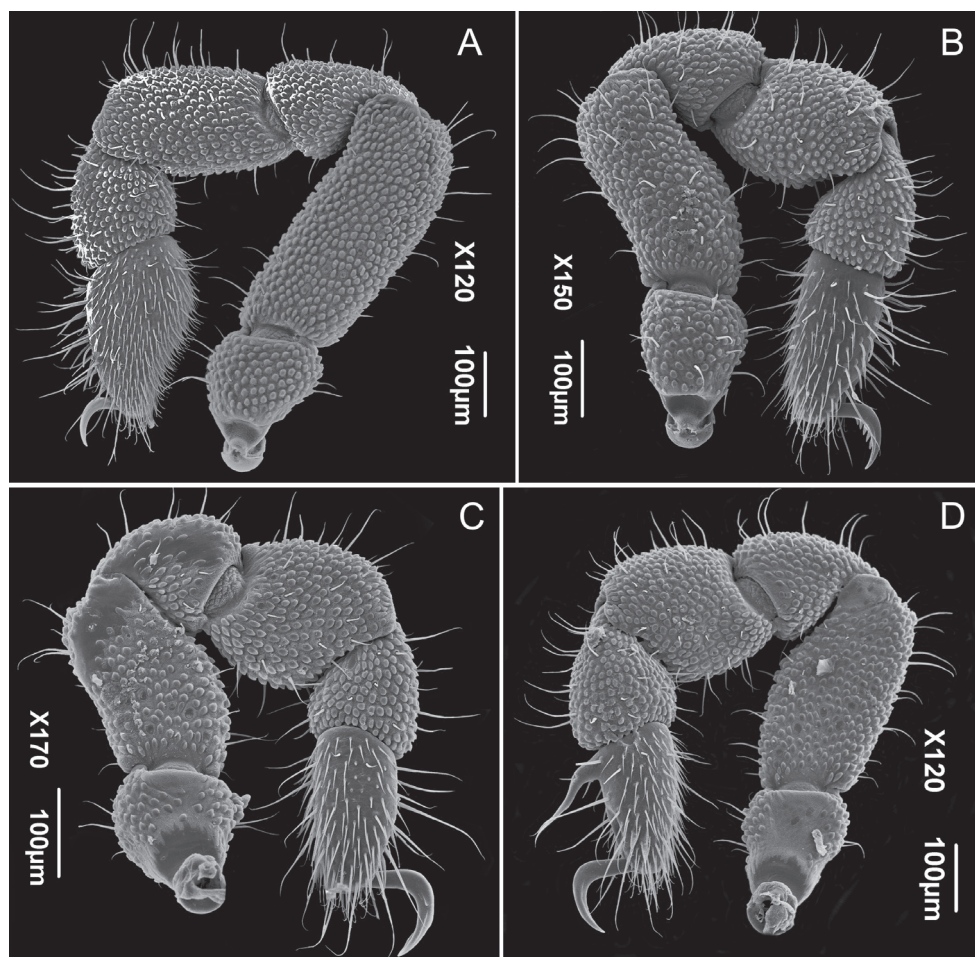


Figure 4. *Metagovea ligiae* sp. n., male paratype (MNRJ 8434). **A** Left leg I, retrolateral view **B** Right leg II, retrolateral view **C** Right leg III, retrolateral view **D** Left leg IV, retrolateral view.

as thick as basal third. Tegument smoother than femur and setation pattern similar to it. Tibia with abundant rows of setae, much denser than basal articles, slightly thinner at base, gradually thickening to apex. Tarsus fusiform, still more densely setose than tibia, ending in straight tubular claw.

Legs (Figs 4A–D). Robust, leg formula I, IV, II, III. Trochanter to metatarsus of legs I–IV densely granulated, less on Tr–Pa III, Tr IV, smooth on Ta I–IV. All articles setose, density of setae increasing distally, reaching maximum on tarsi I–IV. Tarsus I with a distinct solea (subapical modification where sensory hairs concentrate, Fig. 4A) taking up about 2/3rds of the tarsus length. Tarsus of leg IV undivided (Fig. 4D), with a lamelliform elongate, sinuous and acuminate adenostyle, positioned basally on the dorsal side on tarsus IV (Figs 3D–4D). Claw of leg II (Figs 4B). With a distinct row of five teeth. Claws of legs III–IV beveled laterally.

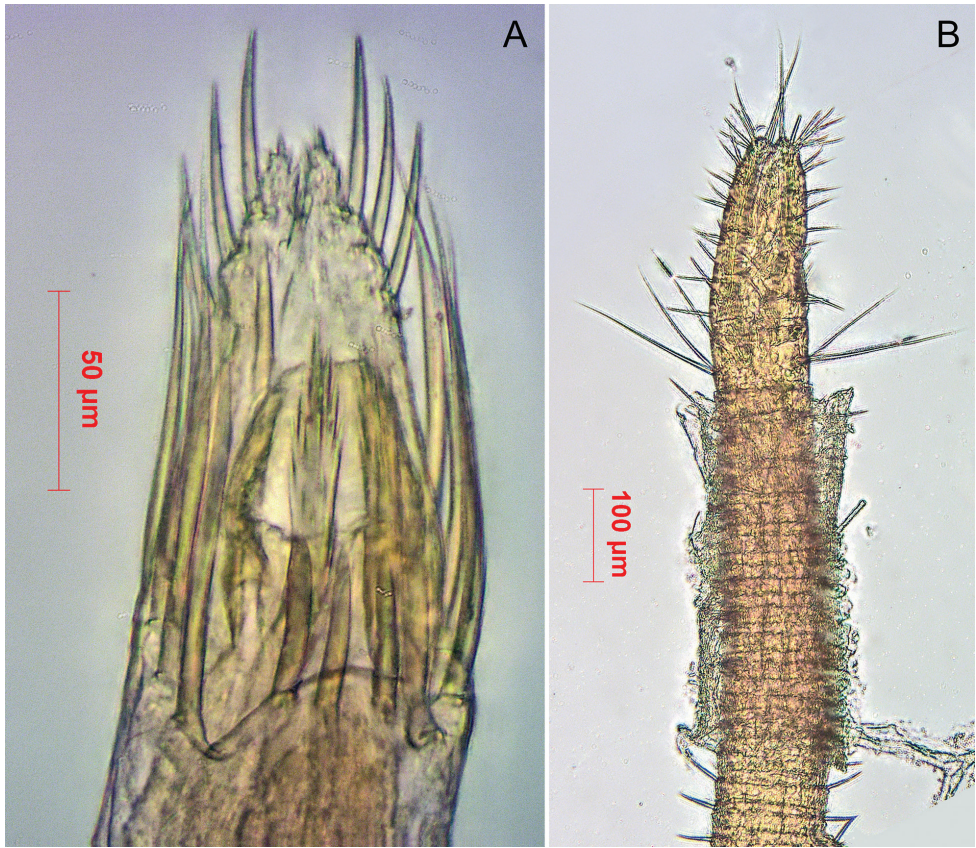


Figure 5. *Metagovea ligiae* sp. n., male paratype (MCZ 45452). **A** Spermatopositor, dorsal view **B** Female paratype (MCZ 45452), ovipositor, lateral view.

Spermatopositor (Figs 5A, 6). Two pairs of shorter robust microtrichiae A close together on a proximal lobe. Four pairs of microtrichiae B much elongate, on the laterals. Three pairs of subapical microtrichiae C not as long as B. Two pairs of terminally fimbriate movable fingers: small apical **dma** located between left and right groups of microtrichiae C; much larger **dmm**, arising from dorso-medial lobe. More basally, near the genital orifice, a pair of sensory papillae and another of inner papillae.

Distribution. Known only from the type locality, Pacto Sumaco, Napo, Ecuador (Fig. 9).

Female (Figs 7–8). Ventral opisthosomal region with anal glands on sternal part of corona analis as in male, consisting of isolated (on laterals, Fig. 8C) and clustered pores (Figs 8A–B). Sternal large tubercles often pectinate (Fig. 8D). Gonostome pentagonal, with coxal lobes IV and posterior margin of gonostome much wider than in male (Fig. 7B).

Natural history. All specimens were collected in an area of about 10 m², under a house built partly on a small slope in a nature conservation area (Fig. 10A), but with a strongly disturbed secondary forest. The specimens were found beneath stones, wood

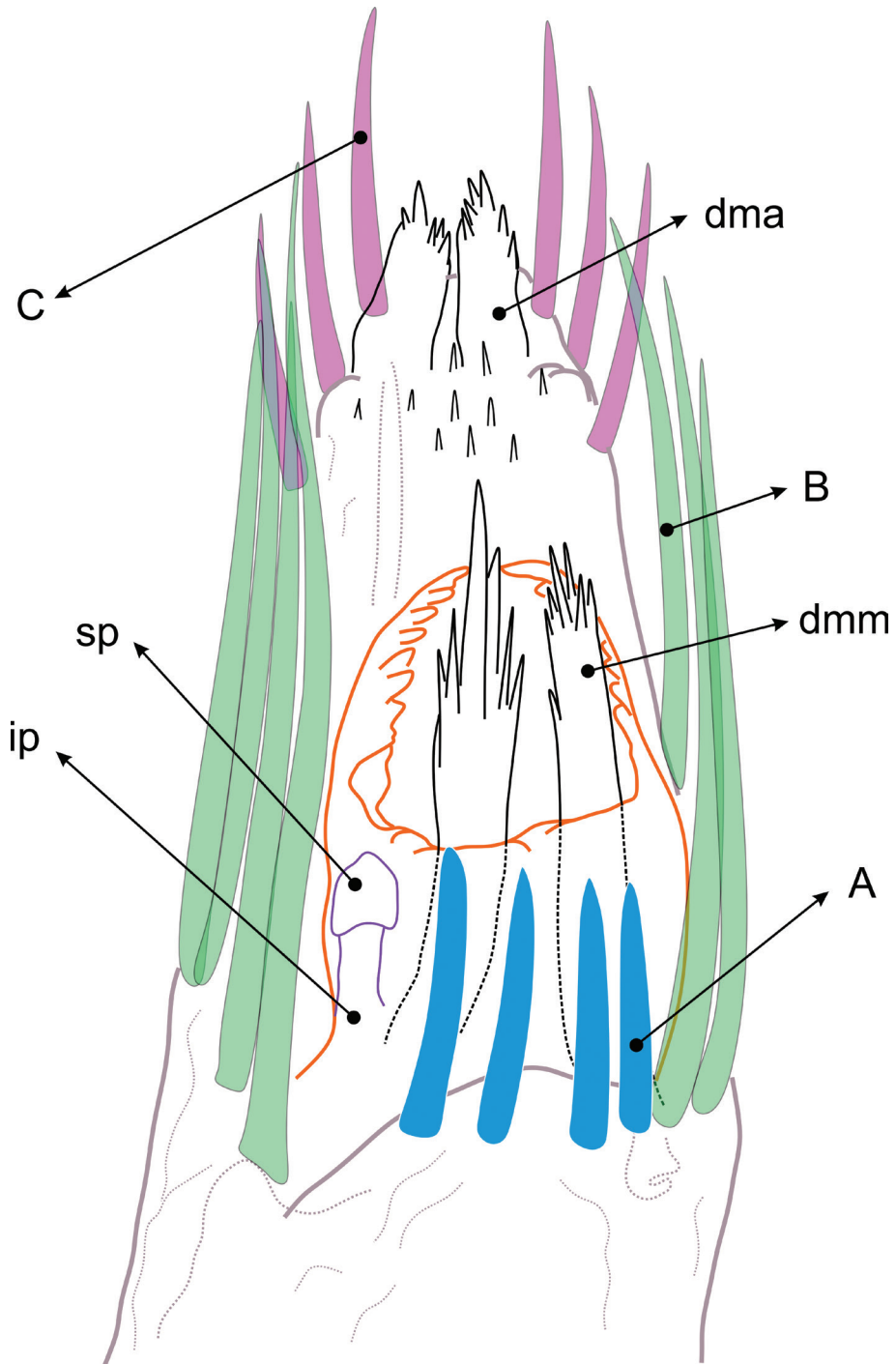


Figure 6. *Metagovea ligiae* sp. n., male paratype (MCZ 45452). Spermatopositor, interpretative drawing of photograph in Figure 5A. Abbreviations: **A** = microtrichiae A **B** = microtrichiae B **C** = microtrichiae C **dma** = digiti mobiles apicales **dml** = digiti mobiles laterales **ip** = inner papillae **sp** = sensory papillae.

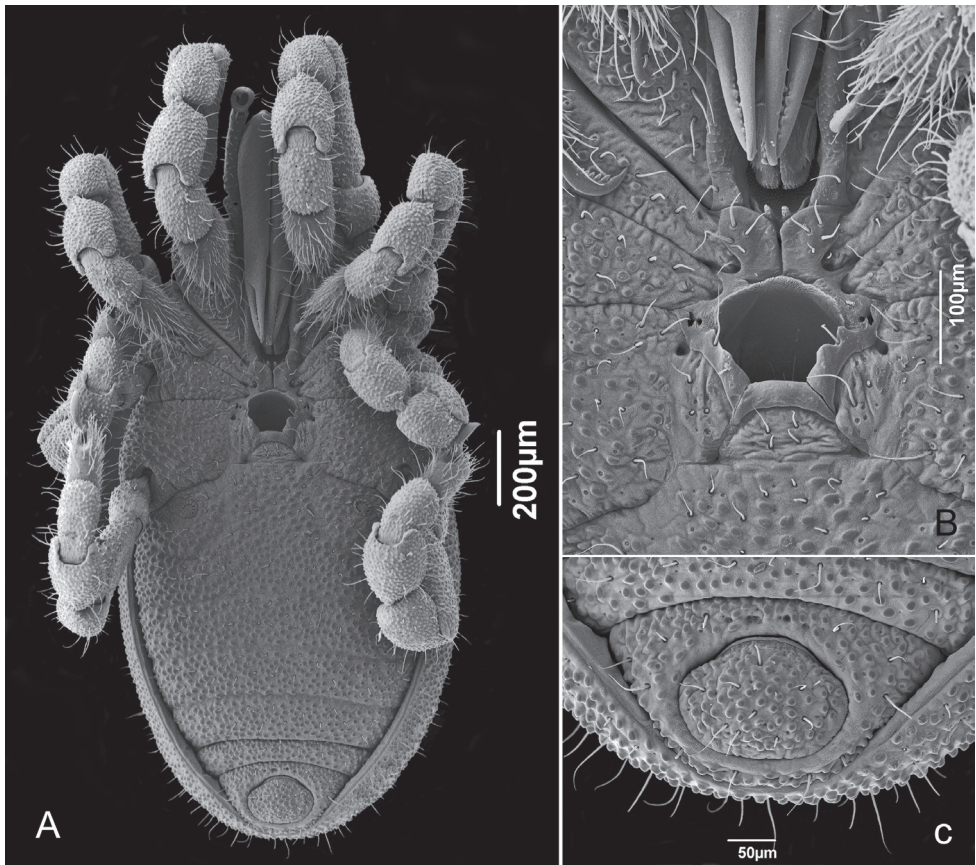


Figure 7. *Metagovea ligiae* sp. n., female paratype (MNRJ 8434). **A** Habitus, ventral view **B** Ventral prosomatic complex **C** Anal region.

and other “rubbish” left on the ground of sometimes compacted, sometimes loose clay, and with virtually no vegetation (Fig. 10B). The area, being in a space of 30 cm to 1 meter retreated under construction, was protected from direct sunlight, but it was indirectly lit, having no aphotic parts. The humidity was high and the animals were found in groups of 2 to 5 specimens.

Discussion

Genital morphology of *Metagovea*

Comparing the score or so of published genital illustrations of Neotropical neogoveids, a few connecting traits can be advanced. Unfortunately male genitalia of *M. disparunguis* are hitherto unknown.

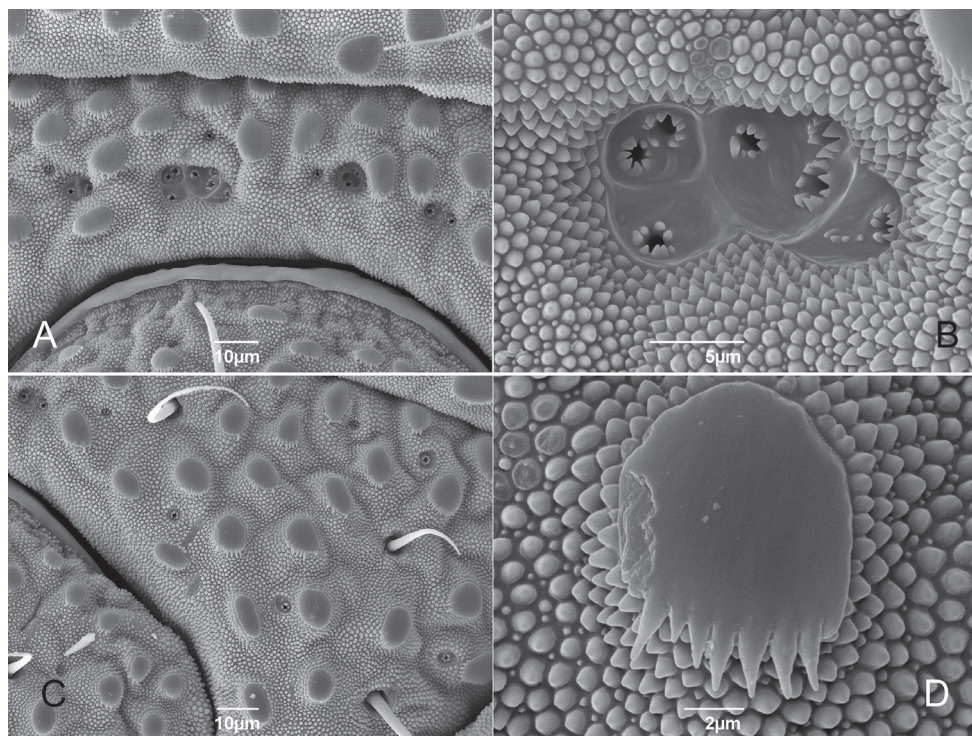


Figure 8. *Metagovea ligiae* sp. n., female paratype (MNRJ 8434). **A** Corona analis, antero-median region with clustered anal glands **B** Same, detail of the anal glands **C** Corona analis, left antero-lateral region with isolated anal glands **D** Same, detail of the pectinate tubercle.

Microtrichiae C may be either apical (short as in *Canga* and *Huitaca* or long as in *Metagovea* and *Tucanogovea*) or subdistal, shifted to dorsal as in *Brasiliogovea* and *Neogovea*. The apical pair of horns with associated shifting of microtrichiae C to dorso subdistal seem to be exclusive of *Neogovea* where they are long and well-developed and of *Brasiliogovea*, where they are much shorter and rounded. The apical margin of the spermatopositor in *Huitaca* is projected as a lobe with an augmented number of very short rod-like microtrichiae C placed in a tight row. *Canga* has only a convex apex, not nearly as projected as *Huitaca*, but with microtrichiae C equally reduced, although they do not form a row as in *Huitaca*.

Microtrichiae A are elongate and slender in most Neogoveidae, with the apparent exception of *M. ligiae* and *M. philipi*, where they are much shorter and thick. Curiously *M. oviformis* does not match the pattern of *Metagovea*. The dma appear to be exclusive of *M. ligiae* and *M. philipi*, again absent in *M. oviformis*. The paired dmm, which seem to be universal in neogoveids, appear to be fused to each other only in *Neogovea*.

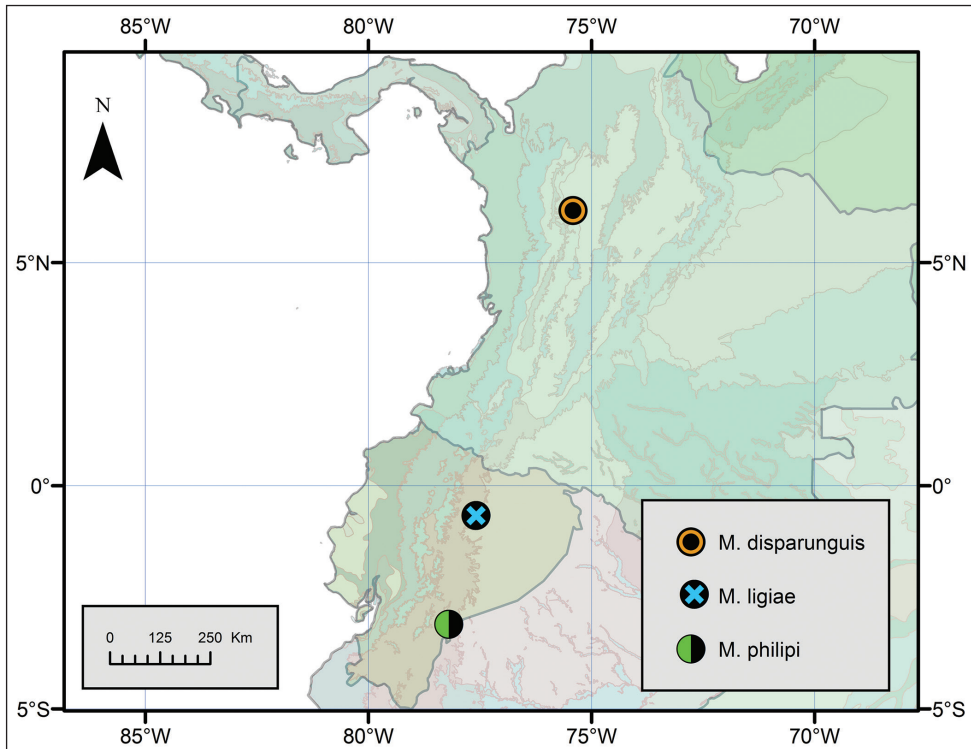


Figure 9. NW South America, showing the three *Metagovea* species occurring in the Andean Range. Shaded areas in the background are WWF ecoregions.

Diversity

Metagovea, now with four described species, displays a formal diversity far smaller than the real one, as shown by Benavides and Giribet (2007), who detected 17 undescribed species. This undersampling may be due to the small size of these animals, non-selective collecting and non-cyphophthalmid-focused collectors.

Distribution

The distribution of the four species of *Metagovea* is disjunct. *Metagovea oviformis* occurs in the lowland forest in Amazon Basin (altitude 100 m), while the other three occur in the Central Andean Range (WWF NT0121 and NT 0136) in Ecuador and Colombia, at altitudes between 1150 and 2150 m. It is possible that *M. oviformis* does not belong in *Metagovea*. This speculation is more tempting since a closely related genus has been described from Amazon basin. Benavides and Giribet (2007) already illustrated the distribution of a large number of undescribed species of Neogoveidae in NW South America. Here only the Andean species of *Metagovea* are represented in a Map (Fig. 9).



Figure 10. Ecuador, Pacto Sumaco, showing the collecting site. **A** General view. **B** Site where the type specimens were found. Photographs by A. B. Kury.

Authors' contributions

APLG located the ideal spot of the type series, conceived of the study and participated in its design and coordination, dissected and prepared specimens, conducted all SEM and optical microscopy imaging sessions, criticized map and plates, and drafted the manuscript outline, species diagnosis and discussion.

ABK managed collecting permissions in Ecuador, drove the vehicle through meandering anoxic Andean roads, edited SEM and optical microscopy images, selected illustrations, set up plates, created the map, drafted the species description, edited the final text and saw the MS through press.

Both authors organized an expedition to Ecuador in which they collected the type series. Also both authors read and approved the final manuscript.

Acknowledgments

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New records of ant species from Yunnan, China

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Abstract

As with many other regions of the world, significant collecting, curation, and taxonomic efforts will be needed to complete the inventory of China's ant fauna. This is especially true for the highly diverse tropical regions in the south of the country, where moist tropical forests harbor high species richness typical of the Southeast Asian region. We inventoried ants in the Xingshuangbanna prefecture, Yunnan, in June 2013, using a variety of methods including Winkler extraction and hand collection to sample ant diversity. We identified 213 species/morphospecies of ants from 10 subfamilies and 61 genera. After identification of 148 valid species of the 213 total species collected, 40 species represent new records for Yunnan province and 17 species are newly recorded for China. This increases the total number of named ant species in Yunnan and China to 447 and 951 respectively. The most common species collected were *Brachyponera luteipes* and *Vollenhovia emeryi*. Only one confirmed exotic species *Strumigenys membranifera*, was collected, although several others were potentially introduced by humans. These results highlight the high biodiversity value of the region, but also underscore how much work remains to fully document the native myrmecofauna.

Keywords

China, Formicidae, new records, Xishuangbanna, Yunnan

Introduction

The understanding of regional and global patterns of insect diversity is limited by our incomplete accounting of Earth's species, especially for tropical regions where species richness peaks in most taxonomic groups. This is also true for Formicidae, an ecologically dominant insect family comprising at least 15,000 described species (Bolton 2014). Despite the ubiquity and ecological importance of ants (Hölldobler and Wilson 1990), many tropical regions remain undersampled even at the generic level (Guénard and Dunn 2012). Compiling and curating complete and accurate species checklists for all regions of the world should be a priority in biodiversity research, especially for diverse insect groups.

Towards that end, here we present the results of an ant survey conducted during the summer of 2013 in the area of Xishuangbanna, Yunnan Province, in the south of China. In particular, our goal here is to document new records of ant species detected in Yunnan, and some new records for China as a whole. The geographic location of Yunnan (ranging from 21.15°N to 29.20°N of latitude) and its topography (elevation range from < 100m to 6740m) render it the most diverse province of China in terms of ant diversity (406 species) (Guénard and Dunn 2012). The same is true for other taxa, such as plants (Li and Walker 1986, Mutke and Barthlott 2005), tiger beetles (Wu and Shook 2007), butterflies (Xie et al. 2009), or amphibians (Chen and Bi 2007). Xishuangbanna prefecture is located in the tropical southwestern region of Yunnan province, bordering Laos and Myanmar, and has been identified as the most diverse region of Yunnan (Long 1995). The ant fauna of Xishuangbanna has been the subject of three studies (Xu 1998, 1999, 2002) and new species are regularly described from this prefecture (e.g. Guénard et al. 2013, Xu et al. 2014a, b). According to Xu's survey (2002), the myrmecofauna of Xishuangbanna consists of approximately 262 species, which constitute about 65% of the total number of species recorded for Yunnan province.

While elements of China's ant fauna may be undocumented due to a lack of sampling in certain geographic regions, there are many taxa likely hidden in areas that have been sampled historically. In particular, methods targeting specifically subterranean or leaf litter ants have been rarely used in China, which as a result might bias our detection of ant species from specific strata. One of the most successful sampling techniques for collecting leaf litter ants, Winkler extraction, which is now commonly used for ant fauna surveys all over the world (Olson 1991, Fisher 1999, Agosti et al. 2000, Martelli et al. 2004, Vasconcelos and Lopes 2008, Ivanov and Keiper 2009), has only been used once in China (Hong Kong in Fellowes 1996) to the best of our knowledge. In this study we used Winkler extraction as a standardized collection technique for the first time in order to survey the leaf litter ant fauna of Xishuangbanna. Based predominantly on this highly successful sampling technique, our diversity survey revealed 40 new species records for Yunnan including 17 new records for China. Here we present those new records, as well as their known global distributions by using data information aggregated by the Global Ant BioInformatics project (GABI, Guénard et al. in prep).

Material and methods

Ant specimens were collected from primary forest, secondary forest and rubber plantation habitats near Menglun town, Xishuangbanna Prefecture, Yunnan Province, China during a survey in June 2013. Ants from leaf litter of multiple sites were collected and extracted by mini Winkler extractors for 72 hours using the shuffling method as described in Guénard and Lucky (2011). Ants were also collected by hand on the ground, lower vegetation, and tree trunks.

Samples were first sorted to morphospecies in alcohol, and up to three representatives of each morphospecies per sample were point-mounted. Each mounted specimen was assigned a unique specimen code, in this case a CASENT number, and traditional locality and collection labels. All mounted and alcohol-preserved ant specimens are currently located in EPE's lab at the Okinawa Institute of Science and Technology Graduate University. Extended depth of field specimen images were taken with an incorporated Leica DFC400 digital camera mounted on a Leica M205C stereomicroscope through the Leica Application Suite V4 software. All specimens were identified to genus using Bolton's key (Bolton 1994), and then identified to species using available keys (see results section) as well as the digital resources on AntWeb (<http://www.antweb.org>). All the specimen data are freely available on AntWeb.

Species distributions presented in the following maps are based on records reported here at the country level, or for the larger countries (China, India, Japan), at the first administration level. For large islands (e.g. Borneo, Sumatra, New Guinea) that form natural biogeographic units, we used the island boundary instead of political boundaries similar to a previous study (Guénard and Dunn 2012).

Results

Over 20000 specimens from 61 genera and 213 valid species and morphospecies were collected during this ant diversity survey (Table 1). A total of 40 new species records are presented for Yunnan province. Seventeen of these are recorded for the first time from China. The newly detected species belong to 15 genera from eight subfamilies. It is beyond the scope of the current paper to perform a comprehensive review/revision of the ant fauna of Yunnan Province, which would require much more geographically comprehensive sampling. Here, we present species accounts for the described ant species found during our survey that were previously unknown to Yunnan, supplementing other recently published checklists of the myrmecofauna of the region (Guénard and Dunn 2012).

Table 1. Ant species (Formicidae) collected from Xishuangbanna, Yunnan in 2013.

Species	Collection record ¹
Aenictinae	
<i>Aenictus artipus</i> Wilson, 1964	N*
<i>Aenictus hodgsoni</i> Forel, 1901	N
<i>Aenictus maneerati</i> Jaitrong & Yamane, 2013	N*
<i>Aenictus paracentatus</i> Jaitrong, Yamane & Tasen, 2012	N*
<i>Aenictus thailandianus</i> Terayama & Kubota, 1993	N
<i>Aenictus</i> clm01	
<i>Aenictus</i> clm04	
Amblyoponinae	
<i>Bannapone scrobiceps</i> Guénard, Blanchard, Liu, Yang & Economo, 2013	N*
<i>Mystrium camillae</i> Emery, 1889	
Cerapachyinae	
<i>Cerapachys</i> clm01	
<i>Cerapachys sulcinodis</i> Emery, 1889	
<i>Cerapachys typhlus</i> (Roger, 1861)	
Dolichoderinae	
<i>Chronoxenus wroughtonii</i> (Forel, 1985)	
<i>Dolichoderus affinis</i> Emery, 1889	
<i>Dolichoderus laotius</i> Santschi, 1920	N*
<i>Dolichoderus squamanodus</i> Xu, 2001	
<i>Dolichoderus thoracicus</i> (Smith, 1860)	
<i>Iridomyrmex anceps</i> (Roger, 1863)	
<i>Tapinoma indicum</i> Forel, 1895	
<i>Tapinoma melanocephalum</i> (Fabricius, 1793)	
<i>Tapinoma</i> clm04	
<i>Technomyrmex albipes</i> (Smith, 1861)	
<i>Technomyrmex horni</i> Forel, 1912	
<i>Technomyrmex pratensis</i> (Smith, 1860)	N
Ectatomminae	
<i>Gnamptogenys costata</i> (Emery, 1989)	N*
<i>Gnamptogenys bicolor</i> (Emery, 1989)	
<i>Gnamptogenys treta</i> Lattke, 2004	N*
Formicinae	
<i>Acropyga nipponensis</i> Terayama, 1985	
<i>Anoplolepis gracilipes</i> (Smith, 1857)	
<i>Camponotus lasiselene</i> Wang & Wu, 1994	
<i>Camponotus mitis</i> (Smith, 1858)	
<i>Camponotus parius</i> Emery, 1889	
<i>Camponotus singularis</i> Smith, 1858	
<i>Camponotus</i> clm02	
<i>Camponotus</i> clm03	
<i>Camponotus</i> clm04	
<i>Camponotus</i> clm07	
<i>Camponotus</i> clm08	

Species	Collection record ¹
<i>Camponotus</i> clm09	
<i>Echinopla cherapunjiensis</i> Bharti & Gul, 2012	N
<i>Gesomyrmex kalshoveni</i> Wheeler, W.M. 1929	N*
<i>Lepisiota opaca</i> (Forel, 1892)	
<i>Lepisiota rothmey</i> (Forel, 1894)	
<i>Myrmoteras binghamii</i> Forel, 1893	
<i>Myrmoteras cuneonodum</i> Xu, 1998	
<i>Nylanderia</i> clm01	
<i>Nylanderia</i> clm02	
<i>Nylanderia</i> clm03	
<i>Nylanderia</i> clm04	
<i>Nylanderia</i> clm05	
<i>Nylanderia</i> clm06	
<i>Oecophylla smaragdina</i> (Fabricius, 1775)	
<i>Paraparatrechina</i> clm01	
<i>Paraparatrechina</i> clm02	
<i>Paraparatrechina</i> clm03	
<i>Paraparatrechina</i> clm04	
<i>Plagiolepis</i> clm01	
<i>Polyrhachis armata</i> (Le Guillou, 1842)	
<i>Polyrhachis bicolor</i> Mayr, 1862	
<i>Polyrhachis bihamata</i> (Drury, 1773)	
<i>Polyrhachis furcata</i> Emery, 1889	
<i>Polyrhachis halidayi</i> Emery, 1889	
<i>Polyrhachis hippomanes</i> Smith, 1861	
<i>Polyrhachis illaudata</i> Walker, 1859	
<i>Polyrhachis illaudata pauperata</i> Emery, 1889	
<i>Prenolepis naoroji</i> Forel, 1902	
<i>Prenolepis sphingthoraxa</i> Zhou & Zheng, 1998	N
<i>Pseudolasius cibdelus</i> Wu & Wang, 1992	
<i>Pseudolasius emeryi</i> Forel, 1915	
<i>Pseudolasius silvestrii</i> Wheeler, 1927	
Myrmicinae	
<i>Acanthomyrmex lucirolae</i> Emery, 1893	
<i>Aphaenogaster beccarii</i> Emery, 1887	
<i>Aphaenogaster feae</i> Emery, 1889	
<i>Aphaenogaster</i> clm05	
<i>Cardiocondyla wroughtonii</i> (Forel, 1890)	
<i>Carebara affinis</i> (Jerdon, 1851)	
<i>Carebara altinoda</i> (Xu, 2003)	
<i>Carebara bruni</i> (Forel, 1913)	
<i>Carebara diversa</i> (Jerdon, 1851)	
<i>Carebara melasolena</i> (Zhou & Zheng, 1997)	N
<i>Carebara</i> clm01	
<i>Carebara</i> clm05	

Species	Collection record ¹
<i>Carebara</i> clm06	
<i>Carebara</i> clm07	
<i>Carebara</i> clm08	
<i>Carebara</i> clm09	
<i>Carebara</i> clm10	
<i>Carebara</i> clm11	
<i>Carebara</i> clm12	
<i>Carebara</i> clm13	
<i>Cataulacus granulatus</i> (Latreille, 1802)	
<i>Crematogaster dohrni</i> Mayr, 1879	
<i>Crematogaster ferrarii</i> Emery, 1888	
<i>Crematogaster millardi</i> Forel, 1902	
<i>Crematogaster osakensis</i> Forel, 1900	
<i>Crematogaster politula</i> Forel, 1902	
<i>Crematogaster rothneyi</i> Mayr, 1879	
<i>Crematogaster</i> clm05	
<i>Crematogaster</i> clm09	
<i>Crematogaster</i> clm10	
<i>Crematogaster</i> clm11	
<i>Dilobocondyla fouqueti</i> Santschi, 1910	
<i>Kartidris ashima</i> Xu & Zheng, 1995	
<i>Lophomyrmex quadrispinosus</i> (Jerdon, 1851)	
<i>Lordomyrma idianale</i> Taylor, 2012	
<i>Meranoplus laeviventris</i> Emery, 1889	
<i>Monomorium chinense</i> Santschi, 1925	
<i>Monomorium pharaonis</i> (Linnaeus, 1758)	
<i>Monomorium</i> clm01	
<i>Monomorium</i> clm02	
<i>Monomorium</i> clm05	
<i>Monomorium</i> clm06	
<i>Myrmecina curvispina</i> Zhou, Huang & Ma L., 2008	N
<i>Myrmecina guangxiensis</i> Zhou, 2001	N
<i>Pheidole hongkongensis</i> Wheeler, 1928	N
<i>Pheidole noda</i> Smith, 1874	
<i>Pheidoleieli</i> Santschi, 1925	
<i>Pheidole plagiaria</i> Smith, 1860	N
<i>Pheidole planifrons</i> Santschi, 1920	N
<i>Pheidole roberti</i> Forel, 1902	
<i>Pheidole rugithorax</i> Eguchi, 2008	N
<i>Pheidole sagei</i> Forel, 1902	
<i>Pheidole smythiesii</i> Forel, 1902	N
<i>Pheidole tumida</i> Eguchi, 2008	N
<i>Pheidole vietii</i> Eguchi, 2008	N*
<i>Pheidole zoceana</i> Santschi, 1925	N
<i>Pheidole</i> clm03	

Species	Collection record ¹
<i>Pheidole</i> clm04	
<i>Pheidole</i> clm07	
<i>Pheidole</i> clm12	
<i>Pheidole</i> clm13	
<i>Pheidole</i> clm16	
<i>Pheidole</i> clm18	
<i>Pheidole</i> clm22	
<i>Pheidole</i> clm13	
<i>Pristomyrmex brevispinosus</i> Emery, 1887	
<i>Pristomyrmex hamatus</i> Xu & Zhang, 2002	
<i>Pristomyrmex punctatus</i> (Smith, 1860)	
<i>Recurvidris recurvispinosa</i> (Forel, 1890)	
<i>Recurvidris kemneri</i> (Wheeler & Wheeler, 1954)	N*
<i>Solenopsis jacoti</i> Wheeler, 1923	
<i>Strumigenys ailaoshana</i> (Xu & Zhou, 2004)	
<i>Strumigenys dyschima</i> (Bolton, 2000)	N*
<i>Strumigenys exilirhina</i> Bolton, 2000	
<i>Strumigenys feae</i> Emery, 1895	
<i>Strumigenys kichijo</i> (Terayama, Lin & Wu, 1996)	N
<i>Strumigenys lyroessa</i> (Roger, 1862)	
<i>Strumigenys membranifera</i> Emery, 1869	
<i>Strumigenys mitis</i> (Brown, 2000)	N
<i>Strumigenys mutica</i> (Brown, 1949)	
<i>Strumigenys nanzanensis</i> Lin & Wu, 1996	
<i>Strumigenys nepalensis</i> Baroni Urbani & De Andrade, 1994	N*
<i>Strumigenys rallarhina</i> Bolton, 2000	N
<i>Strumigenys sauteri</i> (Forel, 1912)	N
<i>Tetramorium aptum</i> Bolton, 1977	
<i>Tetramorium ciliatum</i> Bolton, 1977	
<i>Tetramorium difficile</i> Bolton, 1977	N*
<i>Tetramorium flavipes</i> Emery, 1893	N*
<i>Tetramorium kheperna</i> (Bolton, 1976)	
<i>Tetramorium kraepelini</i> Forel, 1905	
<i>Tetramorium nipponense</i> Wheeler, 1928	
<i>Tetramorium parvispinum</i> (Emery, 1893)	N
<i>Tetramorium polymorphum</i> Yamane & Jaitrong, 2011	N*
<i>Tetramorium tonganum</i> Mayr, 1870	N
<i>Tetramorium</i> clm03	
<i>Tetramorium</i> clm10	
<i>Tetramorium</i> clm18	
<i>Tetramorium</i> clm19	
<i>Vollenhovia emeryi</i> Wheeler, 1906	
Ponerinae	
<i>Anochetus graeffei</i> Mayr, 1870	
<i>Anochetus mixtus</i> Radchenko, 1993	

Species	Collection record ¹
<i>Anochetus myops</i> Emery, 1893	
<i>Anochetus</i> clm04	
<i>Brachyponera luteipes</i> (Mayr, 1862)	
<i>Diacamma</i> clm01	
<i>Ectomomyrmex astutus</i> (Smith, 1858)	
<i>Ectomomyrmex leeuwenhoekii</i> (Forel, 1886)	
<i>Ectomomyrmex lobocarenum</i> (Xu, 1995)	
<i>Ectomomyrmex</i> clm01	
<i>Ectomomyrmex</i> clm02	
<i>Ectomomyrmex</i> clm03	
<i>Ectomomyrmex</i> clm04	
<i>Emeryopone melaina</i> Xu, 1998	
<i>Hypoponera</i> clm01	
<i>Hypoponera</i> clm02	
<i>Hypoponera</i> clm03	
<i>Hypoponera</i> clm04	
<i>Hypoponera</i> clm05	
<i>Hypoponera</i> clm06	
<i>Hypoponera</i> clm07	
<i>Leptogenys birmana</i> Forel, 1900	
<i>Leptogenys chinensis</i> (Mayr, 1870)	
<i>Leptogenys crassicornis</i> Emery, 1895	
<i>Leptogenys diminuta</i> (Smith, 1857)	
<i>Leptogenys lucidula</i> Emery, 1895	
<i>Leptogenys mengzii</i> Xu, 2000	
<i>Leptogenys</i> clm01	
<i>Leptogenys</i> clm02	
<i>Leptogenys</i> clm09	
<i>Myopias hania</i> Xu & Liu, 2011	
<i>Odontomachus</i> clm01	
<i>Odontoponera denticulata</i> (Smith, 1858)	N
<i>Platythyrea parallela</i> (Smith, 1859)	
<i>Pseudoneoponera rufipes</i> (Forel, 1911)	
Proceratinae	
<i>Discothyrea clavicornis</i> Emery, 1897	N*
<i>Discothyrea kamiteta</i> Kubota & Terayama, 1999	N
<i>Probolomyrmex longiscapus</i> Xu & Zeng, 2000	
<i>Proceratium deeleani</i> Perrault, 1981	N*
Pseudomyrmecinae	
<i>Tetraponera amargina</i> Xu & Chai, 2004	
<i>Tetraponera allaborans</i> (Walker, 1859)	
<i>Tetraponera attenuata</i> Smith, 1877	
<i>Tetraponera concava</i> Xu & Chai, 2004	

¹ N = New to Yunnan province; N* = New to China.

Species accounts

Aenictus artipus Wilson, 1964

Figure 1

Material examined. CHINA, Yunnan, Xishuangbanna: Man Sai village (21.858°N, 101.277°E), Rubber plantation, 12.vi.2013, 5 workers, 705m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.860°N, 101.278°E), Secondary forest, 12.vi.2013, 18 workers, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Yunnan (new record), Vietnam and Thailand (Figure 1C). This collection represents the northern-most record of *Aenictus artipus*.

Taxonomic note. *Aenictus artipus* belongs to the *Aenictus wroughtonii* species group and can be easily identified with the identification key provided by Jaitrong et al. (2010).

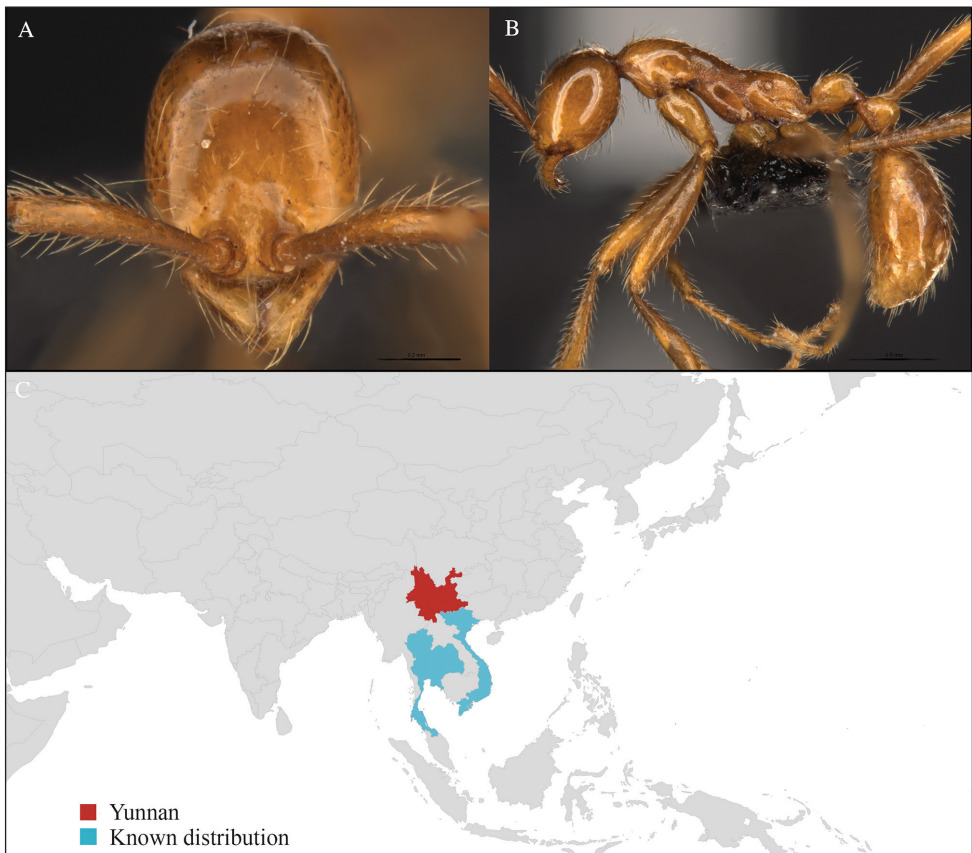


Figure 1. *Aenictus artipus* worker, CASENT0717199. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Natural history. *Aenictus artipus* has been collected from leaf litter in various habitats such as secondary forest and rubber plantation located near natural secondary forest. In addition, *A. artipus* has also been found in different habitats such as montane evergreen forest, savanna forest, evergreen forest and disturbed forest (Jaitrong et al. 2010).

***Aenictus hodgsoni* Forel, 1901**

Figure 2

Material examined. CHINA, Yunnan, Xishuangbanna: Xishuangbanna Tropical Botanical Garden (known as ‘XTBG’) (21.919°N, 101.270°E), Secondary forest, 08.vi.2013, 12 workers, 610m, Hand collection, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Secondary forest, 13.vi.2013, 40 workers, 825m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

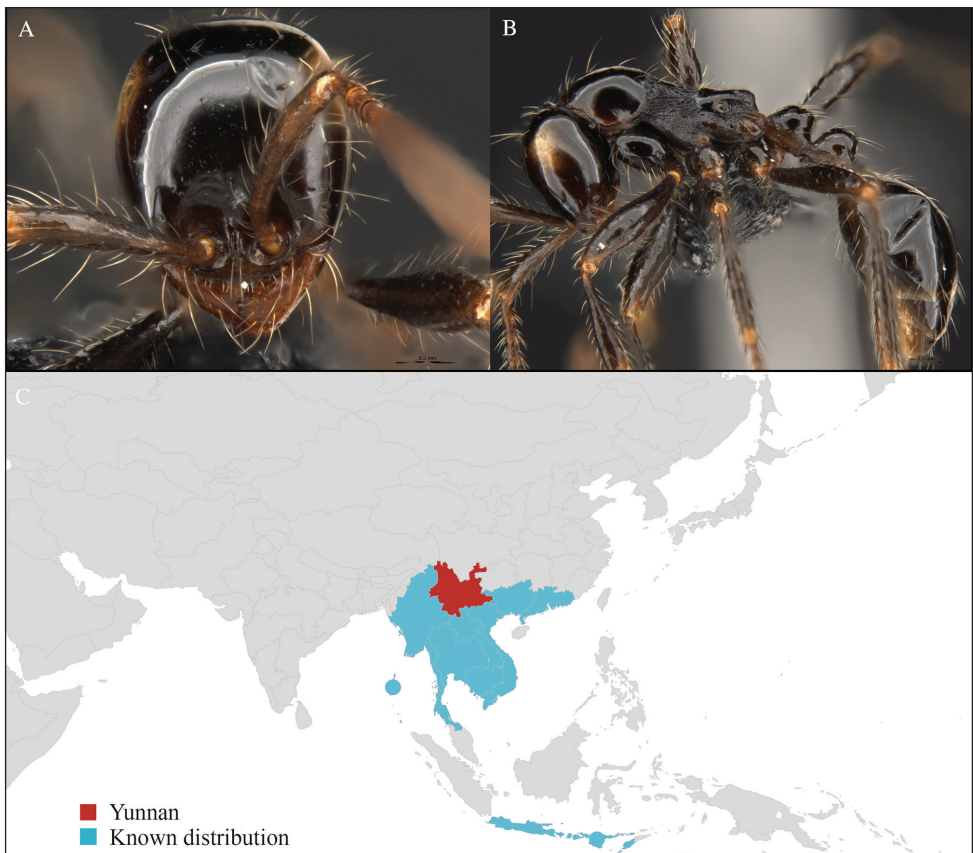


Figure 2. *Aenictus hodgsoni* worker, CASENT0716190. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Distribution. Widely distributed in the Indo-Malayan subregions (Figure 2C).

Taxonomic note. *Aenictus hodgsoni* belongs to the *Aenictus laeviceps* species group and can be easily identified with the identification key provided by Jaitrong and Yamane (2011).

Natural history. *Aenictus hodgsoni* has been collected from leaf litter and foraging columns on the forest ground in secondary forest. This species has also been found from lowland to highland in varied forest types (hill evergreen forest, dry evergreen forest, evergreen rain forest, mixed deciduous forest, and savanna) (Jaitrong and Yamane 2011).

Aenictus maneerati Jaitrong & Yamane, 2013

Figure 3

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.916°N, 101.274°E), Secondary forest, 08.vi.2013, 1 worker, 615m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

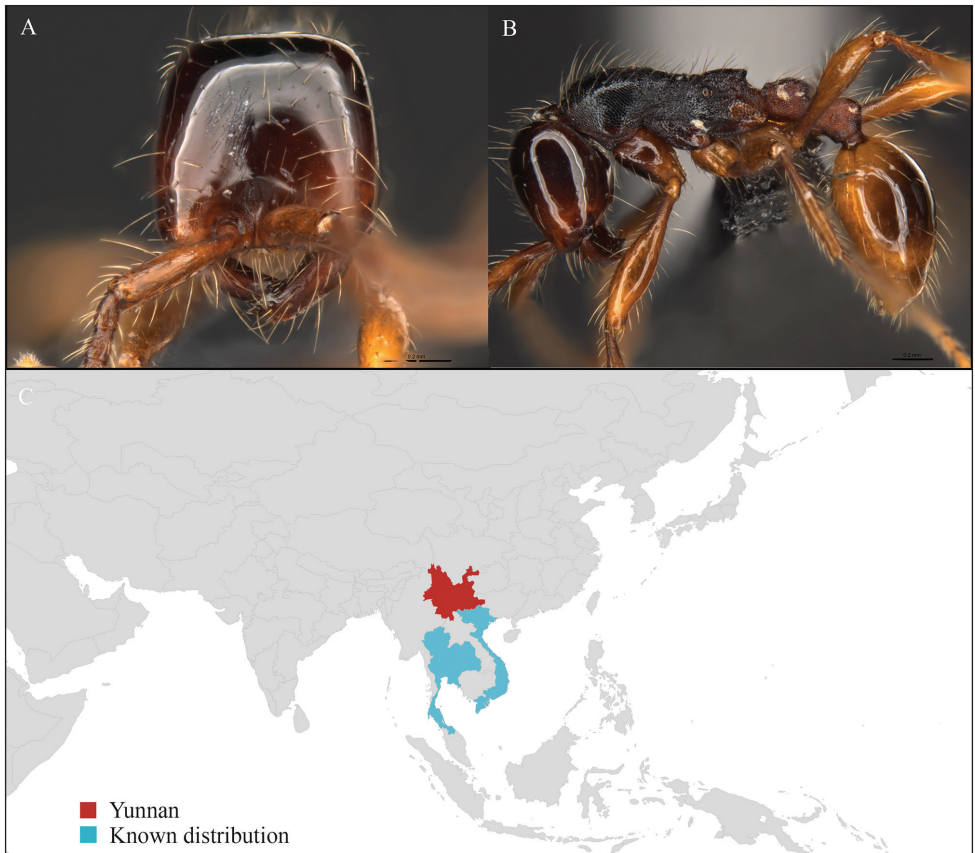


Figure 3. *Aenictus maneerati* worker, CASENT0717211. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Distribution. Yunnan (new record), Vietnam and Thailand (Figure 3C). Our material represents the northern-most record of *Aenictus hodgsoni*.

Taxonomic note. *Aenictus hodgsoni* belongs to the *Aenictus ceylonicus* species group and can be easily identified with the identification key provided by Jaitrong and Yamane (2013).

Natural history. Little is known about the bionomics of *Aenictus hodgsoni*. Before our survey, it has been only collected from primary forest (Jaitrong and Yamane 2013). We collected it from leaf litter in secondary forest.

Aenictus paracentatus Jaitrong, Yamane & Tasen, 2012

Figure 4

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.911°N, 101.281°E), Limestone forest, 06.vi.2013, 46 workers, 655m, Hand collection, B. Guénard, B. Blanchard and C. Liu.

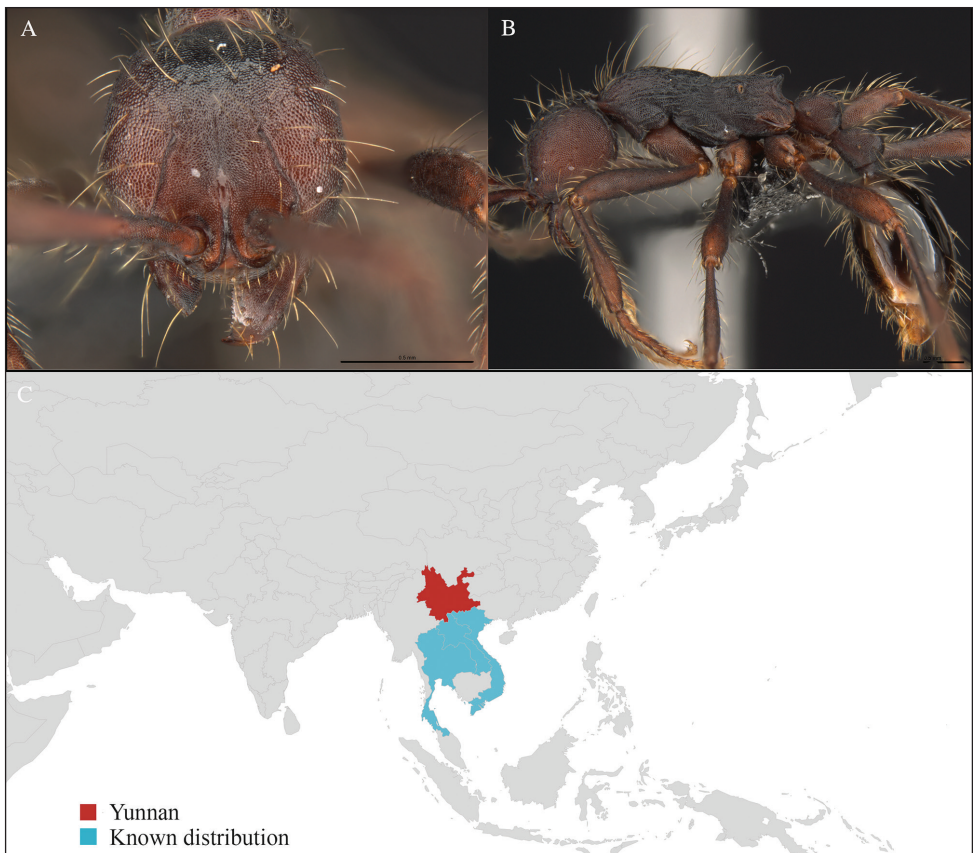


Figure 4. *Aenictus paracentatus* worker, CASENT0716195. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Distribution. Yunnan (new record), Vietnam, Laos, and Thailand (Figure 4C). This collection represents the northern-most record of *Aenictus paradenatus*.

Taxonomic note. *Aenictus paradenatus* is very similar to *Aenictus dentatus* Forel, 1911, and can be easily identified with the key of Jaitrong et al. (2012).

Natural history. *Aenictus paradenatus* has been collected from foraging columns on the ground in limestone forest, but was also reported to be found in other forest habitats, ranging from primary forest to disturbed forest (Jaitrong et al. 2012).

Aenictus thailandianus Terayama & Kubota, 1993

Figure 5

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.919°N, 101.274°E), Secondary forest, 11.vi.2013, 19 workers, 590m, Hand collection, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.857°N, 101.277°E), Rubber

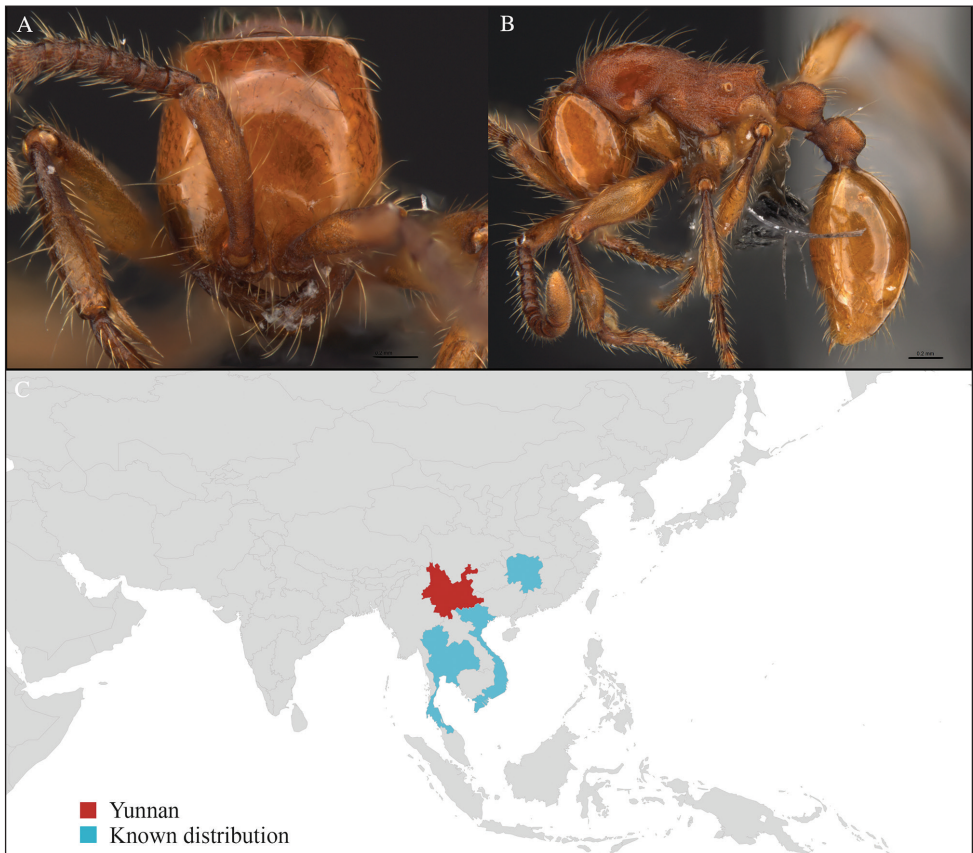


Figure 5. *Aenictus thailandianus* worker, CASENT0717202. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

plantation, 12.vi.2013, 19 workers, 680m, Hand collection, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.857°N, 101.277°E), Rubber plantation, 12.vi.2013, 254 workers, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Yunnan (new record), Hunan, Vietnam and Thailand (Figure 5C).

Taxonomic note. *Aenictus thailandianus* belongs to the *Aenictus ceylonicus* species group and can be easily identified with the identification key presented by Jaitrong and Yamane (2013).

Natural history. *Aenictus thailandianus* has only been found at higher elevations (1000–1500m) in primary and secondary forest (Jaitrong and Yamane 2013). We collected it from leaf litter and foraging columns on the ground in secondary forest and rubber plantations at lower elevations (under 1000m).

***Bannapone scrobiceps* Guénard, Blanchard, Liu, Yang & Economo, 2013**

Figure 6

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 2 workers, 550m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Yunnan (new record) (Figure 6C).

Taxonomic note. *Bannapone scrobiceps* was described recently (Guénard et al. 2013).

Natural history. Little is known about the bionomics of *Bannapone scrobiceps*. The species was collected from leaf litter in secondary forest located at 550 meters elevation (Guénard et al. 2013).

***Carebara melasolena* (Zhou & Zheng, 1997)**

Figure 7

Material examined. CHINA, Yunnan, Xishuangbanna: Kilometer 55 station (21.960°N, 101.199°E), Rain forest, 10.vi.2013, 23 workers, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Widely distributed in Middle and South China (Figure 7C).

Taxonomic note. *Carebara melasolena* can be identified with the key provided by Zhou and Zheng (1997; treated as *Pheidologeton melasolenus*)

Natural history. *Carebara melasolena* has been collected from leaf litter in primary forest.

***Discothyrea clavicornis* Emery, 1897**

Figure 8

Material examined. CHINA, Yunnan, Xishuangbanna: Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 10.vi.2013, 1 worker, 830m, Winkler sifting, B. Guénard,

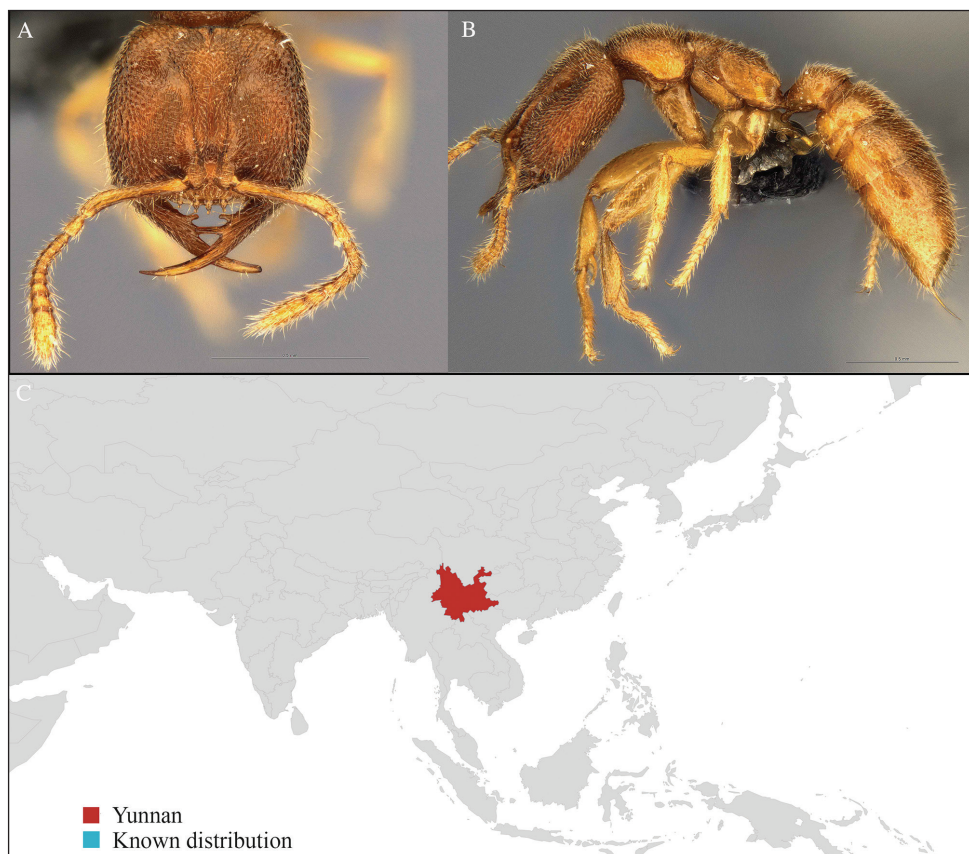


Figure 6. *Bannapone scrobiceps* worker, CASENT0339957. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 13.vi.2013, 8 workers, 805m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.201°E), Rain forest, 13.vi.2013, 1 worker, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.964°N, 101.202°E), Rain forest, 13.vi.2013, 3 workers, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.270°E), Rubber plantation, 09.vi.2013, 12 workers, 645m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 6 worker, 550m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.912°N, 101.285°E), Limestone forest, 06.vi.2013, 3 workers, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.274°E), Limestone forest, 05.vi.2013, 15 workers, 552m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.284°E), Limestone forest, 06.vi.2013, 1 worker, 690m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.918°N, 101.271°E), Rain forest, 05.vi.2013, 3 workers, 581m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.281°E),

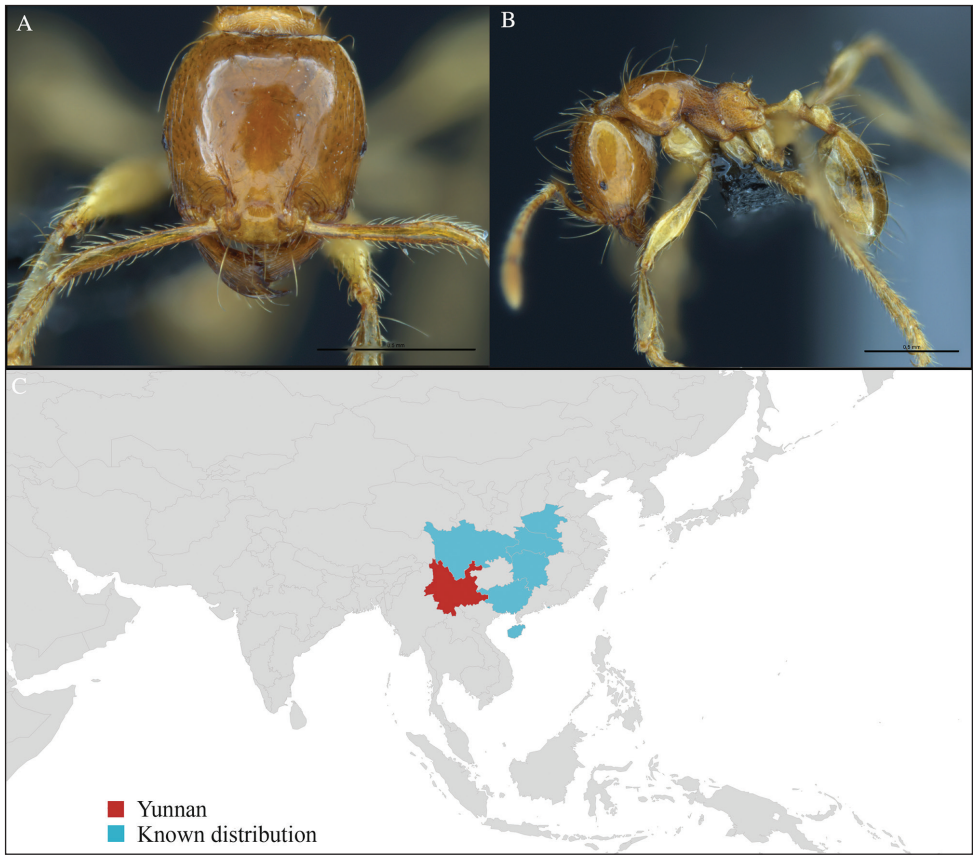


Figure 7. *Carebara melasolena* worker, CASENT0714818. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Limestone forest, 05.vi.2013, 1 worker, 650m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.916°N, 101.274°E), Rain forest, 08.vi.2013, 3 workers, 615m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.917°N, 101.274°E), Rain forest, 08.vi.2013, 2 workers, 625m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.922°N, 101.268°E), Rubber plantation, 14.vi.2013, 3 workers, 620m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. *Discothyrea clavicornis* is a very widespread and common species encountered throughout most of the Austral-Asian and Indo-Malayan subregions (Figure 8C). This new record represents an important extension of the northern range in the distribution of this species.

Taxonomic note. There is no available key for *Discothyrea clavicornis*. Our identification is based on the original description (Emery 1897), comparison with reference material, and montage images of the holotype provided by AntWeb.

Natural history. *Discothyrea clavicornis* has been collected from leaf litter in various habitats such as primary forest, limestone forest and rubber plantation.

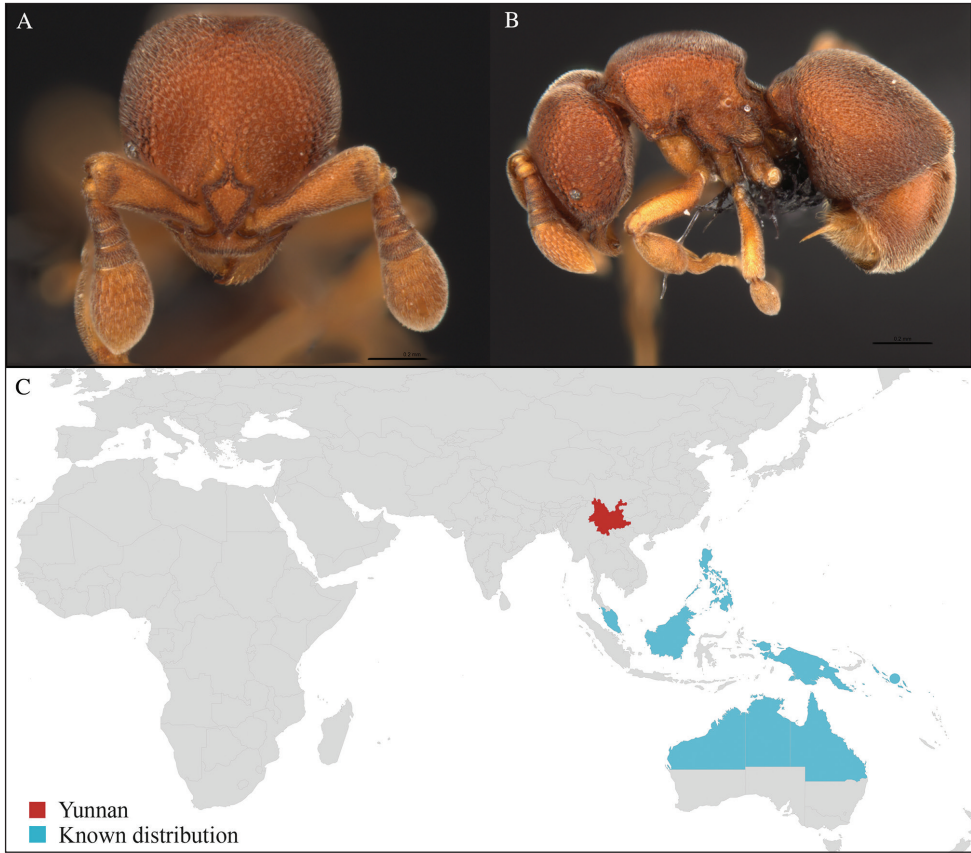


Figure 8. *Discothyrea clavicornis* worker, CASENT0735814. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Discothyrea kamiteta Kubota & Terayama, 1999

Figure 9

Material examined. CHINA, Yunnan, Xishuangbanna: Kilometer 55 station (21.963°N, 101.201°E), Rain forest, 13.vi.2013, 1 worker, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.283°E), Limestone forest, 06.vi.2013, 1 worker, 675m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.917°N, 101.274°E), Secondary forest, 08.vi.2013, 1 worker, 625m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 1 worker, 690m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Yunnan (new record), Hunan, Okinawa (Figure 9C). This new record represents an important western-most extension in the known distribution of this species.

Taxonomic note. *Discothyrea kamiteta* is very similar to the recently described *Discothyrea banna* Xu, Burwell & Nakamura, 2014. Both species seem to be very close

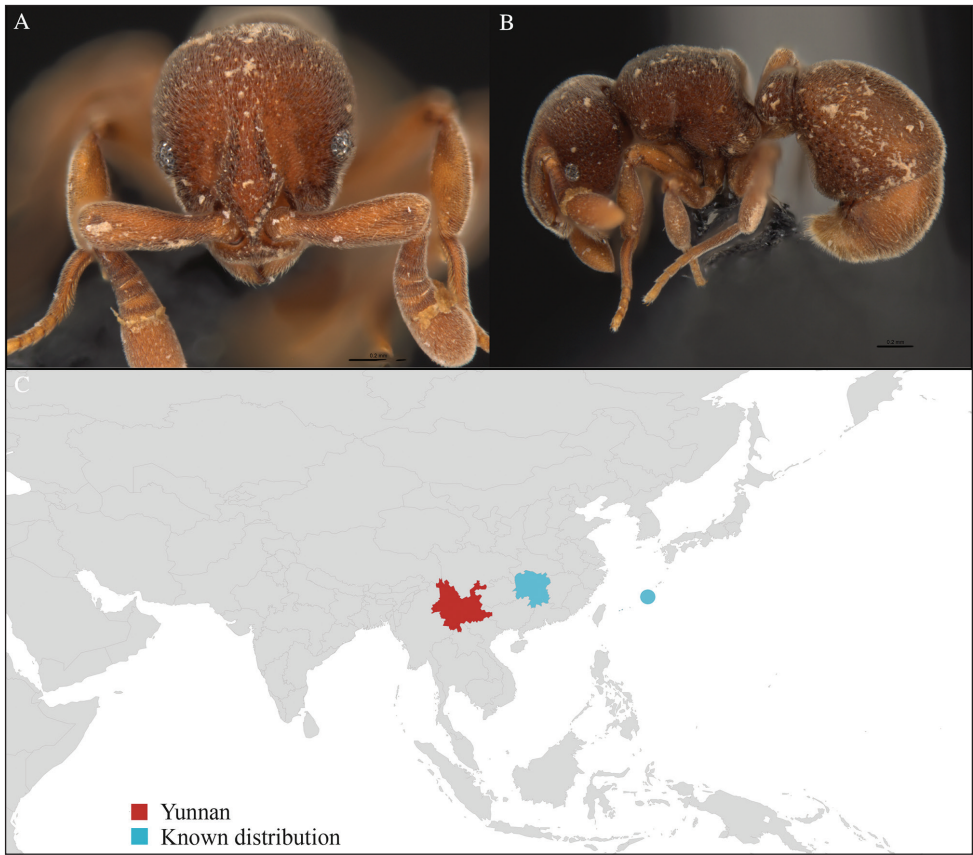


Figure 9. *Discothyrea kamiteta* worker, CASENT0717828. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

morphologically, and their separation is based on minor differences, which could also be attributed to intraspecific variation. The identification is based on the original description of *D. kamiteta*, comparison with *D. kamiteta* material from the type locality (Okinawa), and Xu's key (Xu et al. 2014)

Natural history. *Discothyrea kamiteta* has been collected from leaf litter in various habitats, such as primary forest, limestone forest and secondary forest.

Dolichoderus laotius Santschi, 1920

Figure 10

Material examined. CHINA, Yunnan, Xishuangbanna: Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 5 worker, 690m, Hand collection, B. Guénard, B. Blanchard and C. Liu.

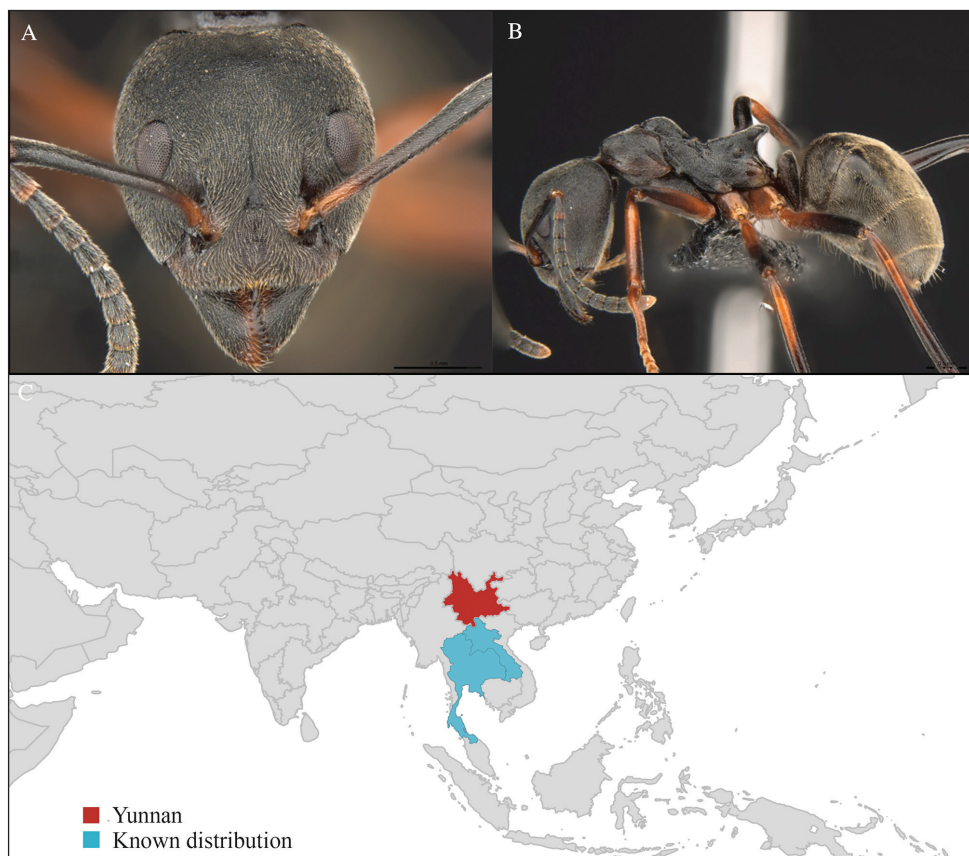


Figure 10. *Dolichoderus laotius* worker, CASENT0716164. **A** Head in front view **B** Alitrunk in profile view **C** Global distribution map.

Distribution. Yunnan (new record), Laos, Thailand (Figure 10C). This collection represents the northern-most record of *Dolichoderus laotius*.

Taxonomic note. There is no available key for the genus in the region. Our identification is based on the description provided by Dill et al. (2002).

Natural history. Little is known about the bionomics of *Dolichoderus laotius*. This species has been collected on a tree trunk in secondary forest.

Echinopla cherapunjiensis Bharti & Gul, 2012

Figure 11

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.919°N, 101.273°E), Secondary forest, 08.vi.2013, 1 worker, 615m, Hand collection, B. Guénard, B. Blanchard and C. Liu.

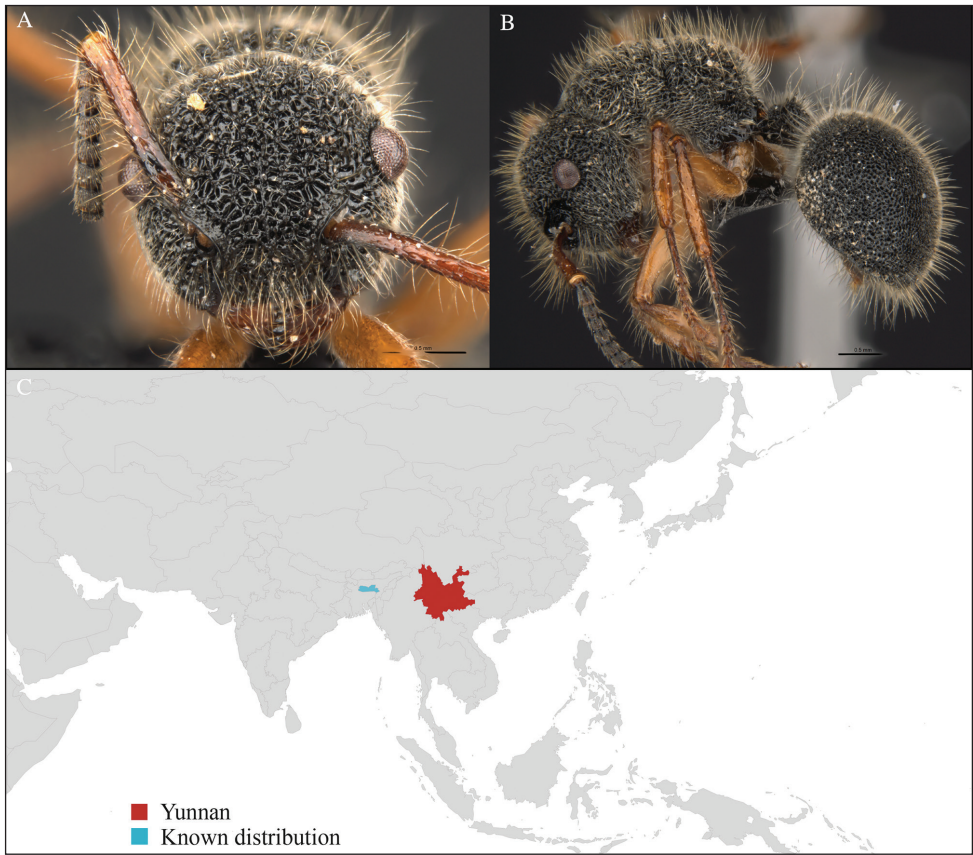


Figure 11. *Echinopla cherapunjiensis* worker, CASENT0716524. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Distribution. Yunnan (new record) and Meghalaya (Figure 11C). This new record represents an important northern and western extension in the distribution of *Echinopla cherapunjiensis*.

Taxonomic note. There is no available key for this genus. Identification is based on the original description (Bharti and Gul 2012).

Natural history. Little is known about the bionomics of *Echinopla cherapunjiensis*. This species has been collected on a tree trunk in secondary forest.

Gesomyrmex kalshoveni Wheeler, 1929

Figure 12

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.925°N, 101.270°E), Forest fragment, 08.vi.2013, 1 worker, 615m, Hand collection, B. Guénard, B. Blanchard and C. Liu.

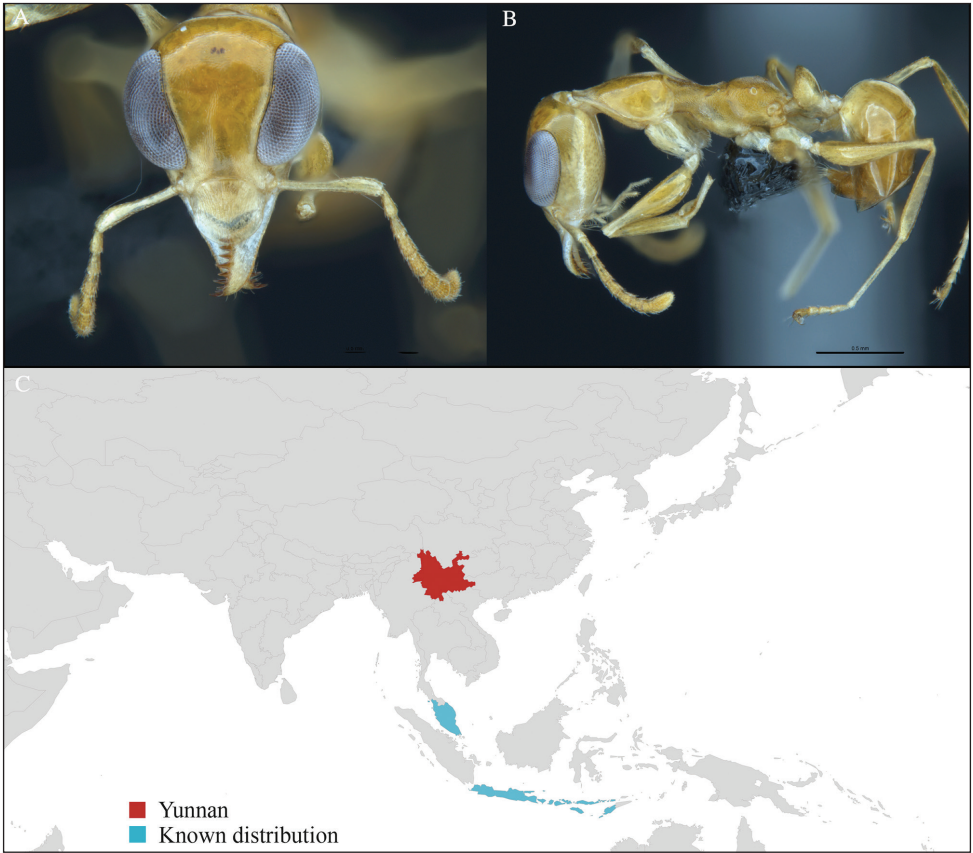


Figure 12. *Gesomyrmex kalshoveni* worker, CASENT0716525. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Distribution. Yunnan (new record), Malaysia and Indonesia (Figure 12C). This new record represents an important extension in the northern range of the distribution of this species and the first occurrence of the genus *Gesomyrmex* from Yunnan province.

Taxonomic note. There is no available key for this genus. The identification is based on the original description (Wheeler 1929) and comparison with reference material from Borneo. Identification in *Gesomyrmex* is generally very difficult due to the high degree of worker polymorphism. However, our single specimen is a minor worker and fits the minor workers of *G. kalshoveni* very well.

Natural history. Little is known about the bionomics of *Gesomyrmex kalshoveni*. It has been collected from a small branch of a tree on the side of road.

***Gnamptogenys costata* (Emery, 1889)**

Figure 13

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.911°N, 101.281°E), Limestone forest, 06.vi.2013, 1 worker, 655m, Hand collection, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.274°E), Rain forest, 08.vi.2013, 2 workers, 615m, Hand collection, B. Guénard, B. Blanchard and C. Liu

Distribution. Widely distributed in the Austral-Asian and Indo-Malayan subregions (Figure 13C).

Taxonomic note. The identification is based on the key provided by Lattke (2004). The material from Yunnan shows some minor variation in the development of gastral sculpture, which we consider as geographic, intraspecific variation.

Natural history. *Gnamptogenys costata* has been collected from foraging columns on the ground in rain forest and limestone forest.

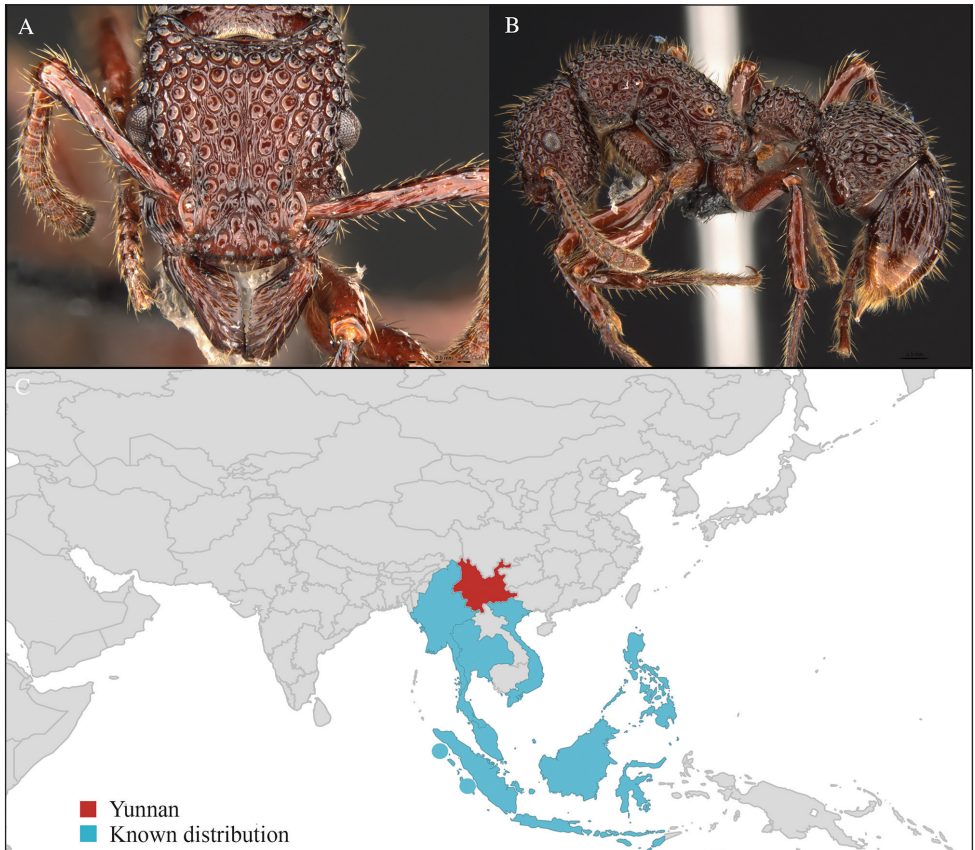


Figure 13. *Gnamptogenys costata* worker, CASENT0715692. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

***Gnamptogenys treta* Latke, 2004**

Figure 14

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.912°N, 101.285°E), Limestone forest, 06.vi.2013, 1 worker, 655m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; “Holy Hills” (21.920°N, 101.240°E), Rain forest, 07.vi.2013, 1 worker, 665m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.271°E), Rubber plantation, 09.vi.2013, 7 workers, 645m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.277°E), Secondary forest, 12.vi.2013, 2 workers, 690m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 13.vi.2013, 10 workers, 865m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu

Distribution. Known from Yunnan (new record) and Borneo (Figure 14C). This collection represents the northern-most record in the distribution of *Gnamptogenys treta*.

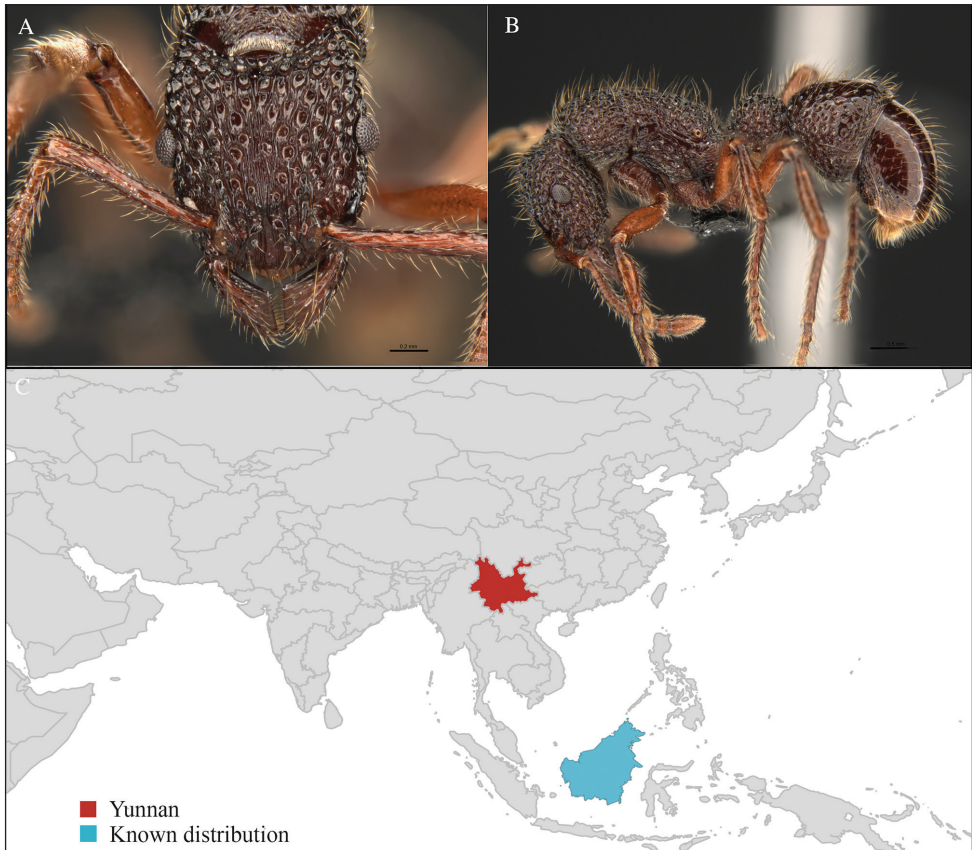


Figure 14. *Gnamptogenys treta* worker, CASENT0715166. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Taxonomic note. The identification is based on the key provided by Lattke (2004). Our material fits the holotype very well, except for the shape of the ventral process of the petiole, which is more rectangular in the material from Yunnan, whereas in the material from Borneo it is more triangular. Since this is the only difference we were able to observe, we treat it as intraspecific variation.

Natural history. *Gnamptogenys treta* has been collected from the leaf litter in rain forest, secondary forest and limestone forest and rubber plantation.

Myrmecina curvispina Zhou, Huang & Ma L., 2008

Figure 15

Material examined. CHINA, Yunnan, Xishuangbanna: “Holy Hills” (21.920°N, 101.240°E), Rain forest, 07.vi.2013, 1 worker, 655m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; “Holy Hills” (21.919°N, 101.239°E), Rain forest, 07.vi.2013, 1 worker, 670m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.961°N, 101.200°E), Rain forest, 10.vi.2013, 1 worker, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Secondary forest, 13.vi.2013, 12 workers, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.963°N, 101.201°E), Rain forest, 13.vi.2013, 14 workers, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.277°E), Rubber plantation, 12.vi.2013, 1 worker, 705m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; : Man Sai village (21.907°N, 101.273°E), Rubber plantation, 12.vi.2013, 2 workers, 635m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; : Man Sai village (21.858°N, 101.277°E), Secondary forest, 12.vi.2013, 2 workers, 685m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 3 workers, 690m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.860°N, 101.278°E), Secondary forest, 12.vi.2013, 2 workers, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.271°E), Rubber plantation, 09.vi.2013, 3 workers, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 1 worker, 550m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.912°N, 101.182°E), Limestone forest, 06.vi.2013, 9 workers, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.888°N, 101.266°E), Rubber Plantation, 14.vi.2013, 7 workers, 600m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.889°N, 101.267°E), Rubber Plantation, 14.vi.2013, 3 workers, 630m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.890°N, 101.267°E), Rubber Plantation, 14.vi.2013, 2 workers, 620m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Yunnan (new record) and Guangxi (Figure 15C). This new record represents the western-most occurrence in the distribution of *Myrmecina curvispina*.

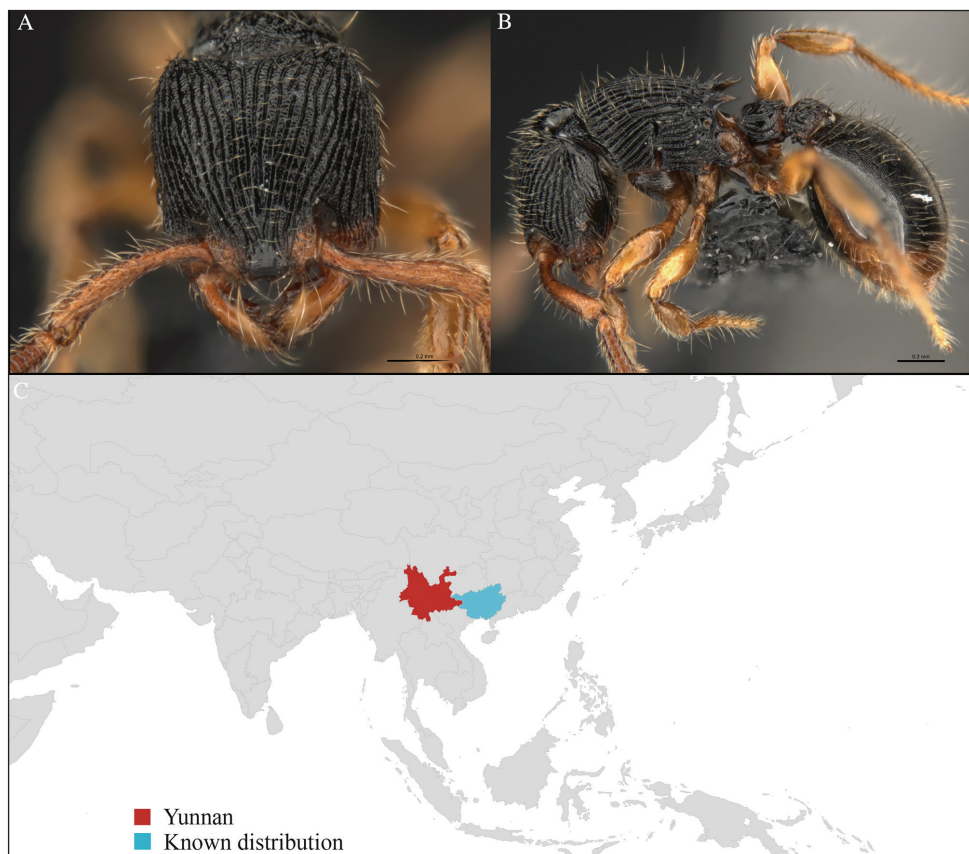


Figure 15. *Myrmecina curvispina* worker, CASENT0713308. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Taxonomic note. The identification is based on the original description and the identification key given by Zhou et al. (2008).

Natural history. *Myrmecina curvispina* has been collected from the leaf litter of various habitats such as rain forest, secondary forest and rubber plantation.

Myrmecina guangxiensis Zhou, 2001

Figure 16

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.912°N, 101.285°E), Secondary forest, 05.vi.2013, 4 workers, 552m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.274°E), Limestone forest, 06.vi.2013, 1 worker, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.281°E), Limestone forest, 06.vi.2013, 2 workers, 650m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.960°N,

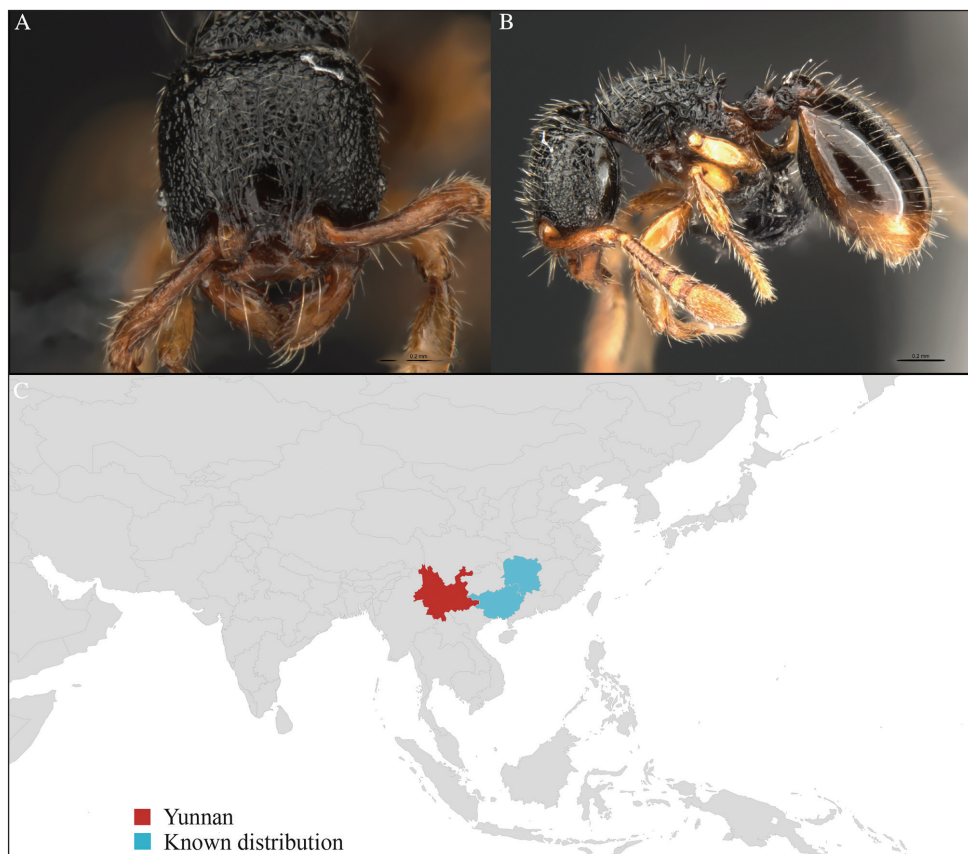


Figure 16. *Myrmecina guangxiensis* worker, CASENT0713314. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

101.199°E), Rain forest, 10.vi.2013, 1 worker, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.963°N, 101.201°E), Rain forest, 13.vi.2013, 9 workers, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Yunnan (new record), Guangxi and Hunan (Figure 16C). This new record represents the western-most occurrence in the distribution of *Myrmecina guangxiensis*.

Taxonomic note. Identification is based on the key provided by Zhou et al. (2008).

Natural history. *Myrmecina guangxiensis* has been collected from leaf litter in rain forest, secondary forest and limestone forest.

Odontoponera denticulata (Smith, 1858)

Figure 17

Material examined. CHINA, Yunnan, Xishuangbanna: “Holy Hills” (21.920°N, 101.240°E), Secondary forest, 07.vi.2013, 1 worker, 655m, Winkler sifting, B.

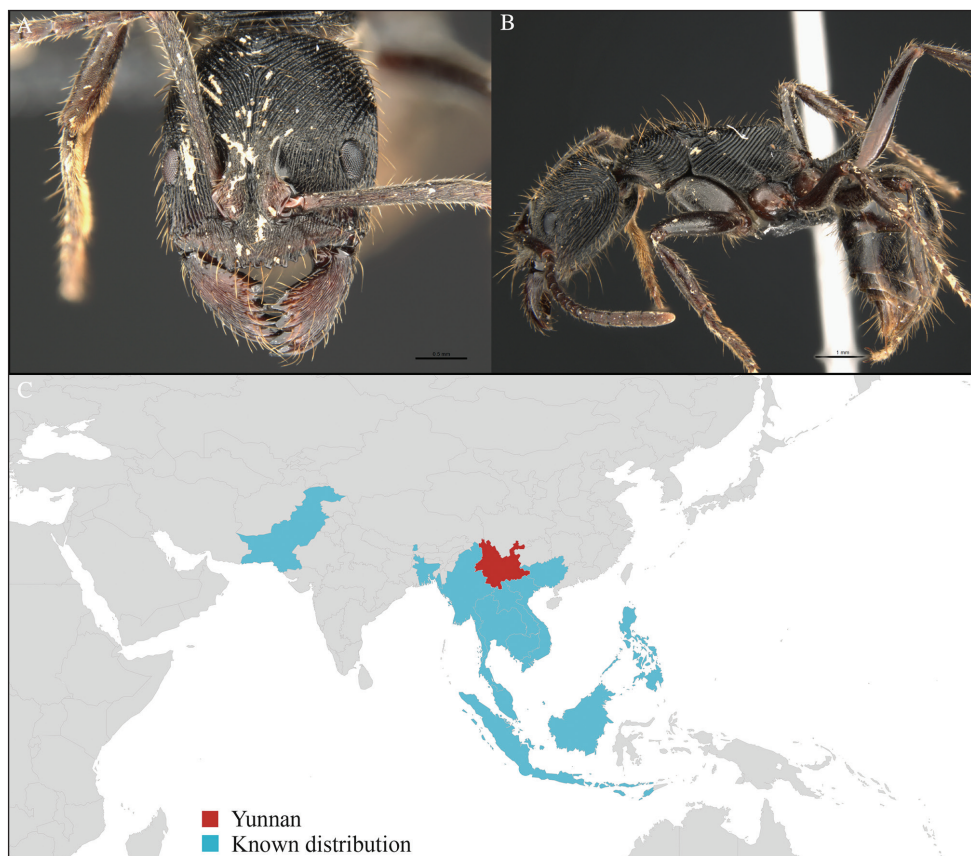


Figure 17. *Odontoponera denticulata* worker, CASENT0717236. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Guénard, B. Blanchard and C. Liu; “Holy Hills” (21.920°N, 101.239°E), Secondary forest, 07.vi.2013, 2 workers, 665m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Secondary forest, 13.vi.2013, 1 worker, 825m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Secondary forest, 13.vi.2013, 1 worker, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 13.vi.2013, 3 workers, 805m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.963°N, 101.201°E), Rain forest, 13.vi.2013, 2 workers, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.964°N, 101.202°E), Rain forest, 13.vi.2013, 1 worker, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.907°N, 101.273°E), Rubber plantation, 12.vi.2013, 1 worker, 635m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.860°N, 101.278°E), Rubber plantation, 12.vi.2013, 1 worker, 710m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest,

12.vi.2013, 1 worker, 685m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.860°N, 101.278°E), Secondary forest, 12.vi.2013, 1 worker, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.933°N, 101.269°E), Rubber plantation, 09.vi.2013, 1 worker, 655m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.271°E), Rubber plantation, 09.vi.2013, 5 workers, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.270°E), Rubber plantation, 09.vi.2013, 2 workers, 645m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.269°E), Rubber plantation, 09.vi.2013, 1 worker, 645m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.924°N, 101.268°E), Rubber plantation, 06.vi.2013, 3 workers, 571m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 1 worker, 550m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.284°E), Limestone forest, 06.vi.2013, 3 workers, 690m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.912°N, 101.282°E), Limestone forest, 05.vi.2013, 1 worker, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.917°N, 101.274°E), Secondary forest, 08.vi.2013, 1 worker, 625m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.889°N, 101.267°E), Rubber Plantation, 14.vi.2013, 4 workers, 630m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.888°N, 101.266°E), Rubber Plantation, 14.vi.2013, 2 workers, 600m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.888°N, 101.266°E), Rubber Plantation, 14.vi.2013, 3 workers, 620m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.889°N, 101.267°E), Rubber Plantation, 14.vi.2013, 3 workers, 630m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.922°N, 101.268°E), Rubber Plantation, 14.vi.2013, 4 workers, 620m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.890°N, 101.267°E), Rubber Plantation, 14.vi.2013, 2 workers, 620m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Widely distributed in the Indo-Malayan subregion (Figure 17C).

Taxonomic note. The identification of our material is based on Yamane's (2009) redescription of *O. denticulata*.

Natural history. *Odontoponera denticulata* has been collected from the leaf litter in various habitats such as rain forest, secondary forest, limestone forest and rubber plantation.

Pheidole hongkongensis Wheeler, 1928

Figure 18

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 1 worker, 550m, Winkler sifting, B.

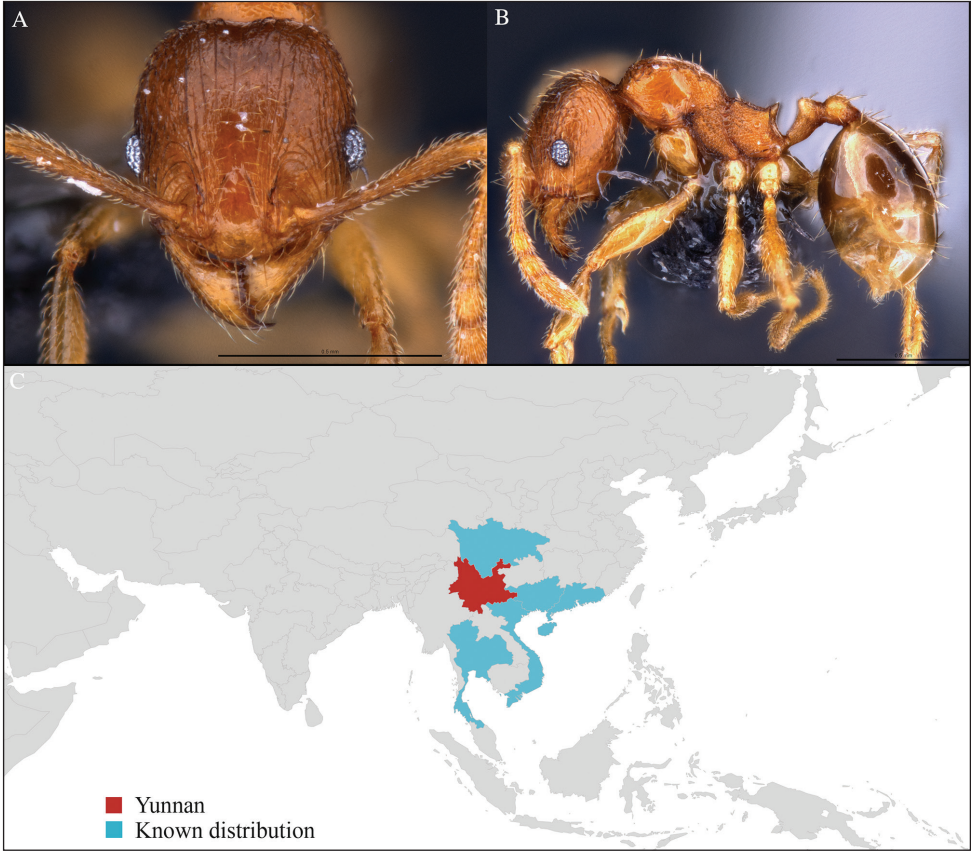


Figure 18. *Pheidole hongkongensis* worker, CASENT0714788. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.274°E), Secondary forest, 05.vi.2013, 3 workers, 1 Soldier, 552m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.924°N, 101.268°E), Secondary forest, 05.vi.2013, 2 workers, 571m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.918°N, 101.271°E), Secondary forest, 05.vi.2013, 1 worker, 581m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.912°N, 101.285°E), Limestone forest, 06.vi.2013, 49 workers, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.912°N, 101.282°E), Limestone forest, 06.vi.2013, 6 workers, 1 Soldier, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.933°N, 101.269°E), Rubber plantation, 09.vi.2013, 3 workers, 655m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 20 workers, 685m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.860°N, 101.278°E), Secondary forest, 12.vi.2013, 1 worker, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.907°N, 101.273°E), Rubber plantation, 12.vi.2013, 3 workers,

635m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 13.vi.2013, 5 workers, 1 Soldier, 805m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.922°N, 101.268°E), Rubber Plantation, 14.vi.2013, 1 worker, 629m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. South China, Vietnam and Thailand (Figure 18C).

Taxonomic note. *Pheidole hongkongensis* can be identified with the identification key to northern Vietnamese *Pheidole* published by Eguchi (2008).

Natural history. *Pheidole hongkongensis* has been collected from leaf litter in secondary forest, limestone forest and rubber plantations. It has also been reported inhabiting the soil of woody gardens, forest edges and open areas (Eguchi 2008).

Pheidole plagiararia Smith, 1860

Figure 19

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.912°N, 101.282°E), Limestone forest, 06.vi.2013, 2 workers, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.933°N, 101.269°E), Rubber Plantation, 09.vi.2013, 1 worker, 655m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.960°N, 101.199°E), Rain forest, 10.vi.2013, 13 workers, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 10.vi.2013, 2 workers, 830m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Widely distributed in the Australasian and Indo-Malayan subregions (Figure 19C).

Taxonomic note. *Pheidole plagiararia* can be identified with the identification key to Northern Vietnamese *Pheidole* provided by Eguchi (2008).

Natural history. *Pheidole plagiararia* has been collected from leaf litter from rain forest, limestone forest and rubber plantation. It has also been reported inhabiting in the soil of forest edge and open land (Eguchi 2008).

Pheidole planifrons Santschi, 1920

Figure 20

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.919°N, 101.274°E), Secondary forest, 05.vi.2013, 2 workers, 552m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.924°N, 101.268°E), Rubber plantation, 05.vi.2013, 3 workers, 571m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.283°E), Limestone forest, 06.vi.2013, 2 workers, 675m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.912°N, 101.282°E), Limestone forest, 06.vi.2013, 4 workers, 640m, Winkler sifting, B.

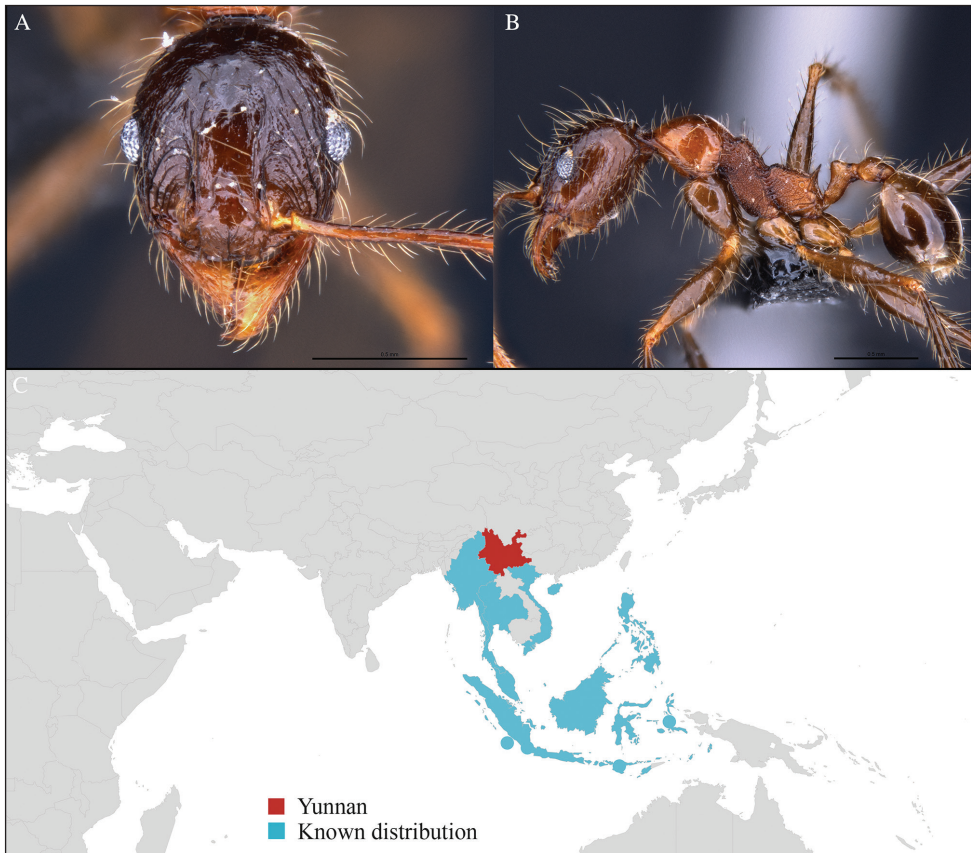


Figure 19. *Pheidole plagiaria* worker, CASENT0713421. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.281°E), Limestone forest, 06.vi.2013, 2 workers, 650m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.916°N, 101.274°E), Limestone forest, 08.vi.2013, 2 workers, 615m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.271°E), Rubber plantation, 09.vi.2013, 1 worker, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.277°E), Rubber plantation, 12.vi.2013, 4 workers, 705m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.857°N, 101.277°E), Rubber plantation, 12.vi.2013, 1 worker, 710m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.907°N, 101.273°E), Rubber plantation, 12.vi.2013, 2 workers, 635m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.277°E), Secondary forest, 12.vi.2013, 2 workers, 685m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 9 workers, 690m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.860°N, 101.273°E), Secondary forest, 12.vi.2013, 1 work-

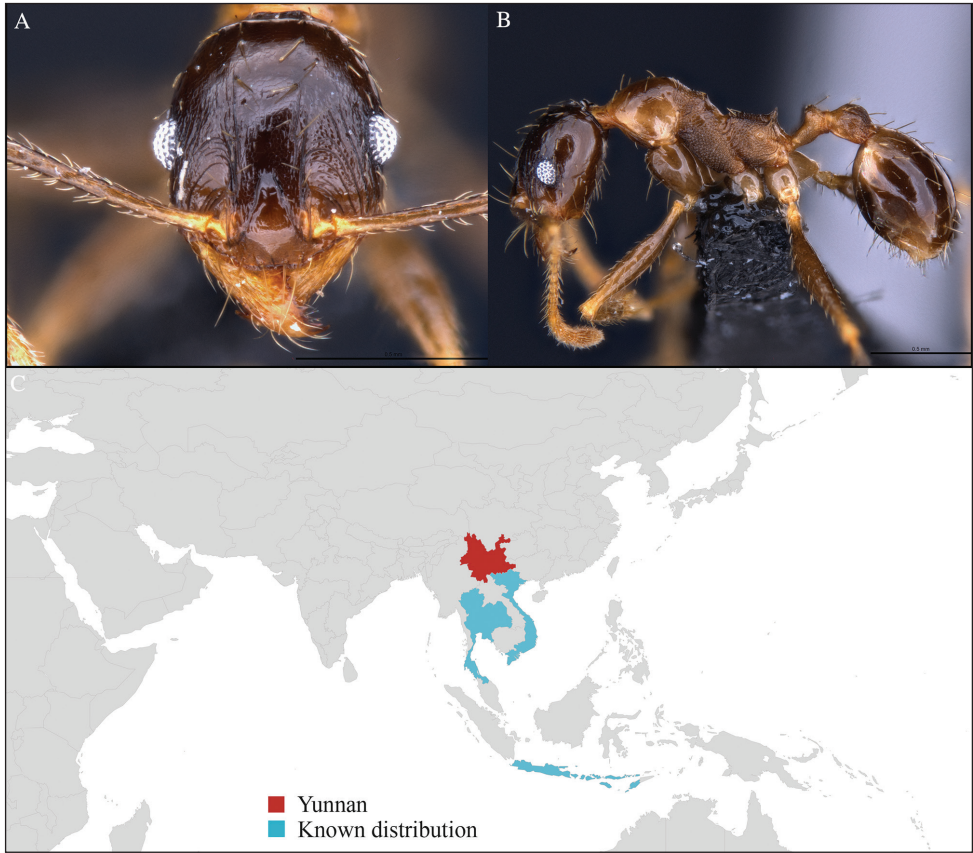


Figure 20. *Pheidole planifrons* worker, CASENT0713099. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

er, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Rain forest, 13.vi.2013, 3 workers, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.889°N, 101.267°E), Rubber Plantation, 14.vi.2013, 33 workers, 630m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.922°N, 101.268°E), Rubber Plantation, 14.vi.2013, 2 workers, 620m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Yunnan (new record), Vietnam, Thailand and Java (Figure 20C). This new record represents the northern-most occurrence in the known distribution of *Pheidole planifrons*.

Taxonomic note. *Pheidole planifrons* can be identified with the identification key to Northern Vietnamese *Pheidole* provided by Eguchi (2008).

Natural history. *Pheidole planifrons* has been collected from leaf litter in rain forest, limestone forest and rubber plantations. It has also been reported inhabiting in the soil of forest edge and woody habitats (Eguchi 2008).

***Pheidole rugithorax* Eguchi, 2008**

Figure 21

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 3 workers, 1 Soldier, 550m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.283°E), Limestone forest, 06.vi.2013, 1 worker, 675m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.281°E), Limestone forest, 06.vi.2013, 3 workers, 650m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; “Holy Hills” (21.920°N, 101.239°E), Rain forest, 07.vi.2013, 2 workers, 665m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Yunnan (new record), Vietnam, Myanmar and Thailand (Figure 21C).

Taxonomic note. *Pheidole rugithorax* can be identified with the identification key to Northern Vietnamese *Pheidole* provided by Eguchi (2008).

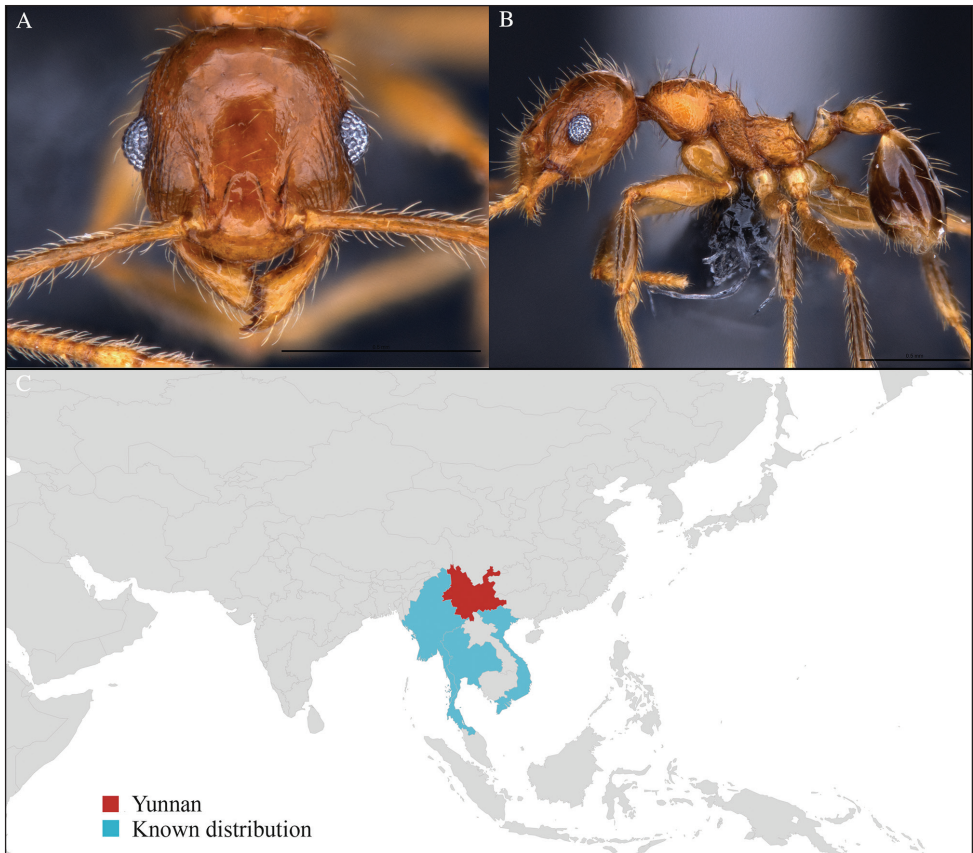


Figure 21. *Pheidole rugithorax* worker, CASENT0717083. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Natural history. *Pheidole rugithorax* has been collected from leaf litter in rain forest, secondary forest and limestone forest. Otherwise there is no available information on its biology.

***Pheidole smythiesii* Forel, 1902**

Figure 22

Material examined. China, Yunnan, Xishuangbanna: XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 9 workers, 550m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.918°N, 101.271°E), Secondary forest, 05.vi.2013, 2 workers, 581m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.283°E), Limestone forest, 05.vi.2013, 1 worker, 675m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 5 workers, 675m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Widely distributed in South China, Vietnam, Thailand and India (Figure 22C).

Taxonomic note. *Pheidole smythiesii* can be identified with the identification key to Northern Vietnamese *Pheidole* provided by Eguchi (2008).

Natural history. *Pheidole smythiesii* has been collected from leaf litter from secondary forest. Eguchi (2008) reported the species to usually inhabit woody habitats and sometimes open areas where it nests in the soil. *Pheidole smythiesii* is also known to tend aphid colonies (Alfred and Agarwal 1990).

***Pheidole tumida* Eguchi, 2008**

Figure 23

Material examined. CHINA, Yunnan, Xishuangbanna: “Holy Hills” (21.920°N, 101.239°E), Rain forest, 07.vi.2013, 2 workers, 665m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Rain forest, 13.vi.2013, 2 workers, 825m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Rain forest, 13.vi.2013, 3 workers, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.277°E), Rubber plantation, 12.vi.2013, 4 workers, 705m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.907°N, 101.273°E), Rubber plantation, 12.vi.2013, 2 workers, 635m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.857°N, 101.277°E), Rubber plantation, 12.vi.2013, 3 workers, 710m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.277°E), Secondary forest, 12.vi.2013, 15 workers, 685m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 2 workers, 690m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.860°N, 101.278°E), Secondary forest, 12.vi.2013, 2 workers, 680m,

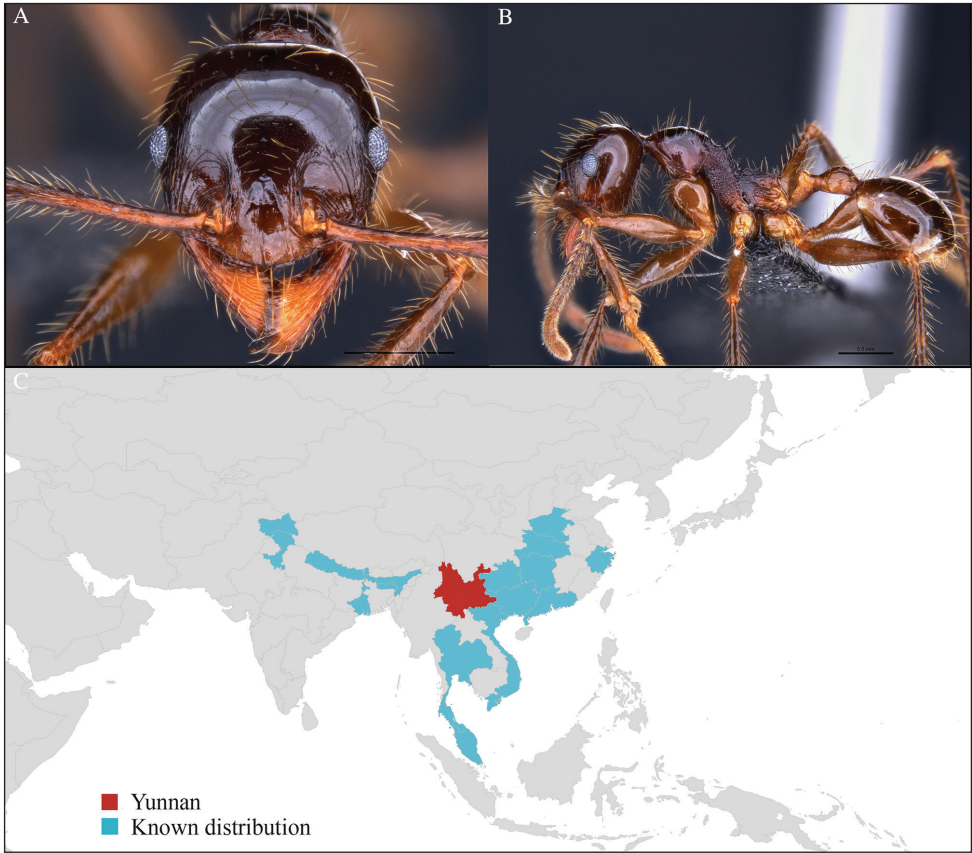


Figure 22. *Pheidole smythiesii* worker, CASENT0713851. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 4 workers, 2 Soldiers, 675m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.934°N, 101.269°E), Rubber plantation, 09.vi.2013, 5 workers, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.933°N, 101.269°E), Rubber plantation, 09.vi.2013, 34 workers, 655m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.270°E), Rubber plantation, 09.vi.2013, 2 workers, 645m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.271°E), Rubber plantation, 09.vi.2013, 3 workers, 645m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.931°N, 101.269°E), Rubber plantation, 09.vi.2013, 1 worker, 645m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.933°N, 101.269°E), Rubber plantation, 09.vi.2013, 2 workers, 655m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.274°E), Secondary forest, 05.vi.2013, 1 worker, 552m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.283°E), Secondary forest, 06.vi.2013, 1 worker, 675m,

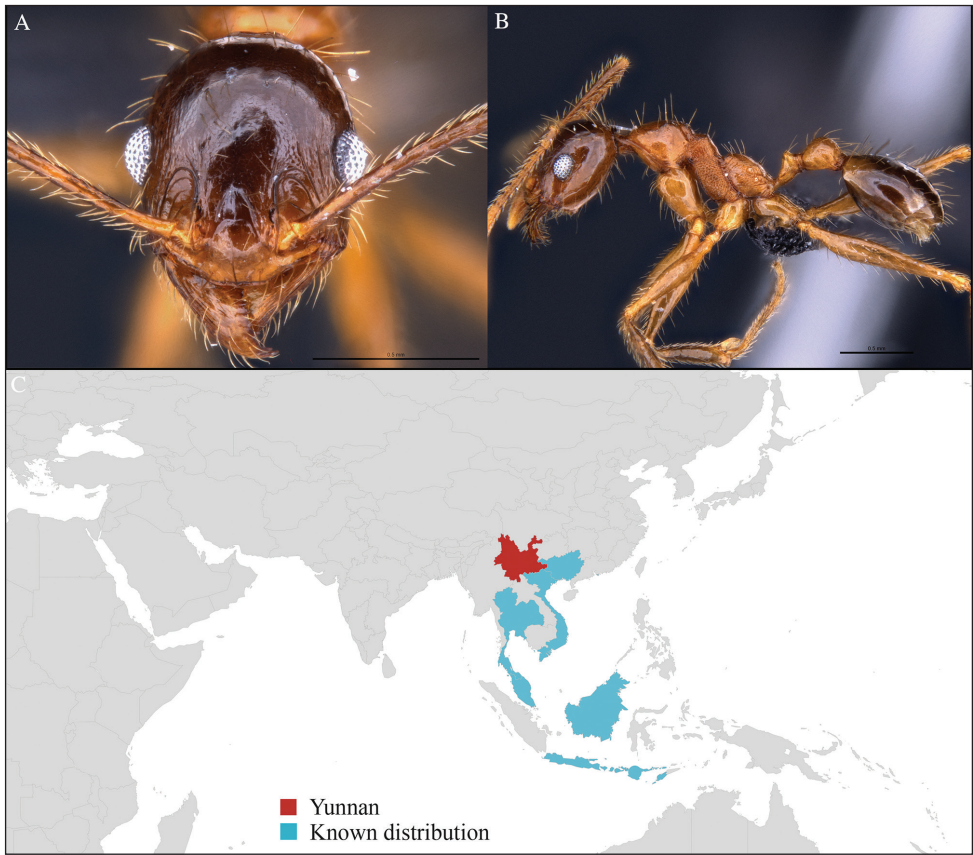


Figure 23. *Pheidole tumida* worker, CASENT0713125. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.924°N, 101.268°E), Secondary forest, 05.vi.2013, 1 worker, 571m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.888°N, 101.266°E), Rubber Plantation, 14.vi.2013, 1 worker, 600m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.888°N, 101.266°E), Rubber Plantation, 14.vi.2013, 1 worker, 620m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.922°N, 101.268°E), Rubber Plantation, 14.vi.2013, 6 workers, 620m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Widely distributed in the Australasian and Indo-Malayan subregions (Figure 23C).

Taxonomic note. *Pheidole tumida* can be identified with the identification key to Northern Vietnamese *Pheidole* provided by Eguchi (2008).

Natural history. *Pheidole tumida* has been collected from leaf litter in rain forest, secondary forest and rubber plantation. It has also been reported nesting in the soil and rotting logs of forest edges (Eguchi 2008).

***Pheidole vieti* Eguchi, 2008**

Figure 24

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.912°N, 101.285°E), Limestone forest, 06.vi.2013, 3 workers, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.917°N, 101.274°E), Secondary forest, 06.vi.2013, 3 workers, 625m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.961°N, 101.200°E), Rain forest, 10.vi.2013, 3 workers, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Known from Yunnan (new record) and Vietnam (Figure 24C). This new record represents the northern-most occurrence in the distribution of *Pheidole vieti*.

Taxonomic note. *Pheidole vieti* can be identified with the key given provided by Eguchi (2008).

Natural history. *Pheidole vieti* has been collected from leaf litter from rain forest, secondary forest and limestone forest.

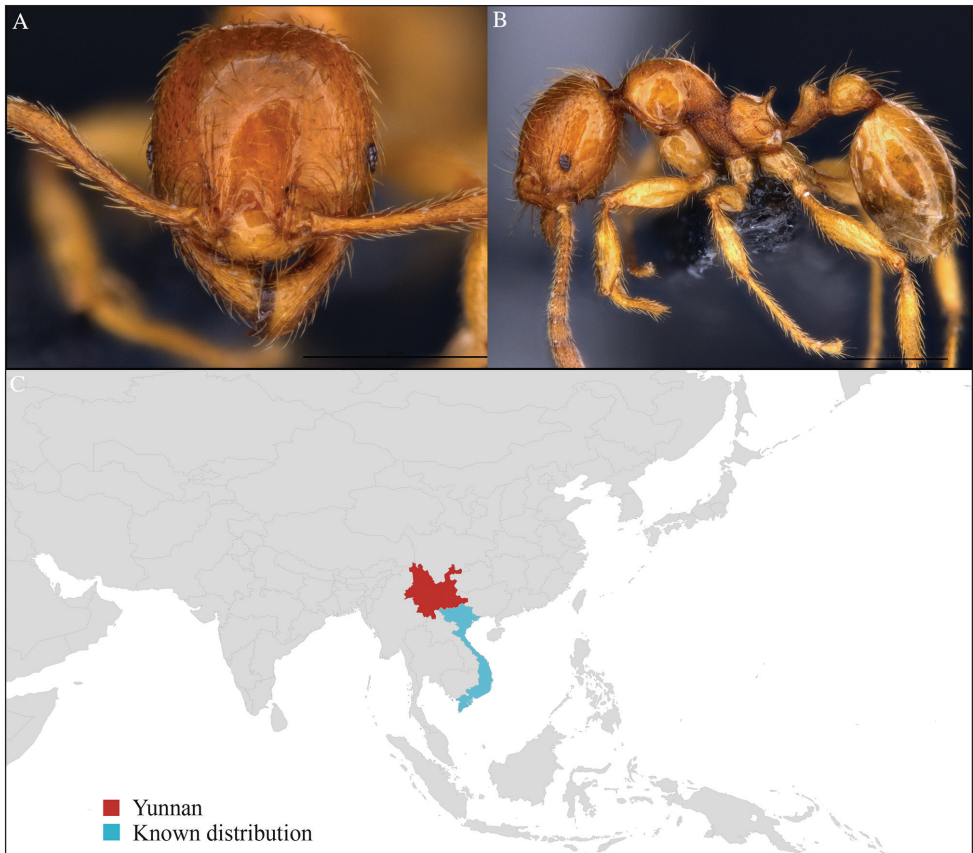


Figure 24. *Pheidole vieti* worker, CASENT0713428. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

***Pheidole zoceana* Santschi, 1925**

Figure 25

Material examined. CHINA, Yunnan, Xishuangbanna: “Holy Hills” (21.920°N, 101.240°E), Secondary forest, 07.vi.2013, 44 workers, 644m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; “Holy Hills” (21.920°N, 101.239°E), Secondary forest, 07.vi.2013, 5 workers, 665m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; “Holy Hills” (21.919°N, 101.239°E), Secondary forest, 07.vi.2013, 11 workers, 670m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Secondary forest, 13.vi.2013, 15 workers, 825m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Secondary forest, 13.vi.2013, 1 worker, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 13.vi.2013, 7 workers, 3 Soldiers, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.960°N, 101.199°E), Rain forest, 13.vi.2013, 25 workers, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 13.vi.2013, 5 workers, 805m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.963°N, 101.201°E), Rain forest, 13.vi.2013, 14 workers, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.964°N, 101.202°E), Rain forest, 13.vi.2013, 2 workers, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 2 workers, 690m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 1 worker, 675m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.271°E), Rubber Plantation, 09.vi.2013, 1 worker, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 77 workers, 550m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.912°N, 101.285°E), Limestone forest, 05.vi.2013, 22 workers, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.274°E), Secondary forest, 06.vi.2013, 2 workers, 552m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.924°N, 101.268°E), Rubber plantation, 05.vi.2013, 3 workers, 571m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.918°N, 101.271°E), Secondary forest, 05.vi.2013, 1 worker, 581m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.916°N, 101.274°E), Secondary forest, 05.vi.2013, 12 workers, 615m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Known from a few localities in China, Vietnam and Thailand (Figure 25C).

Taxonomic note. *Pheidole zoceana* can be identified with the identification key to Northern Vietnamese *Pheidole* provided by Eguchi (2008).

Natural history. *Pheidole zoceana* has been collected from leaf litter in rain forest, secondary forest and rubber plantations. It has also been reported nesting in the soil of forest edges and mountainous area (Eguchi 2008).

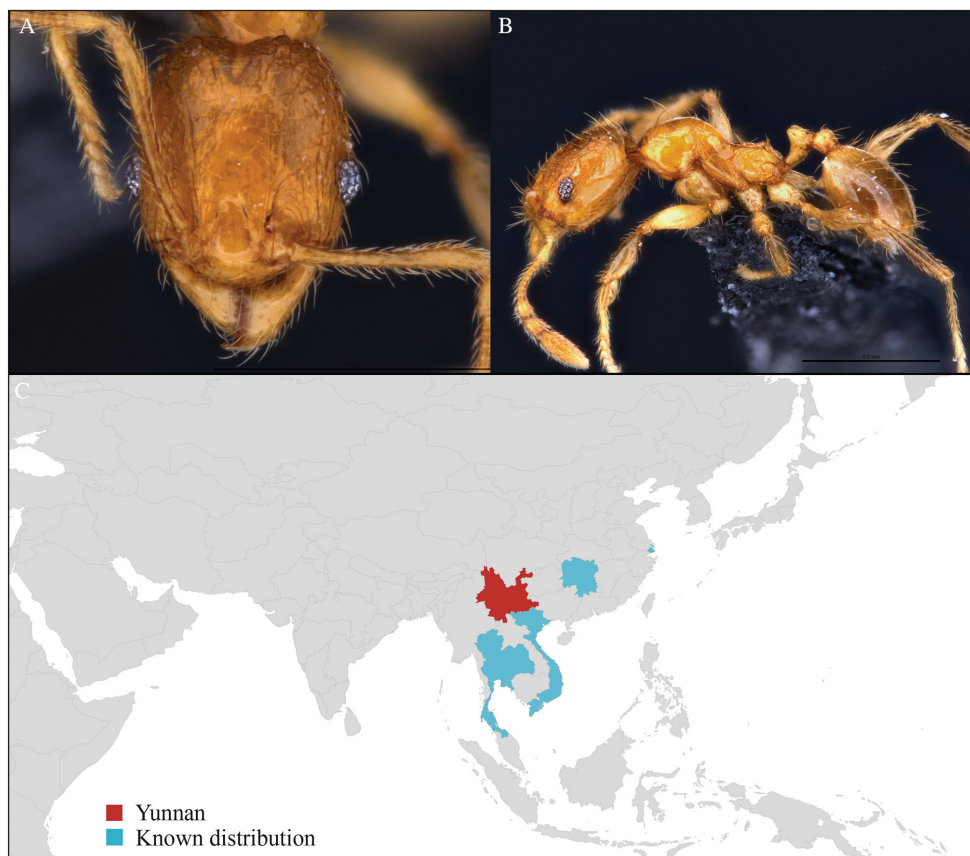


Figure 25. *Pheidole zoceana* worker, CASENT0714742. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Prenolepis sphingthorax Zhou & Zheng, 1998

Figure 26

Material examined. CHINA, Yunnan, Xishuangbanna: Kilometer 55 station (21.960°N, 101.199°E), Rain forest, 10.vi.2013, 1 worker, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Known from Middle and South China (Figure 26C). This new record represents the western-most record in the distribution of *Prenolepis sphingthorax*.

Taxonomic note. The identification is based on the original description (Zhou and Zheng 1998).

Natural history. *Prenolepis sphingthorax* has been collected from leaf litter in rain forest and little is known about its bionomics.

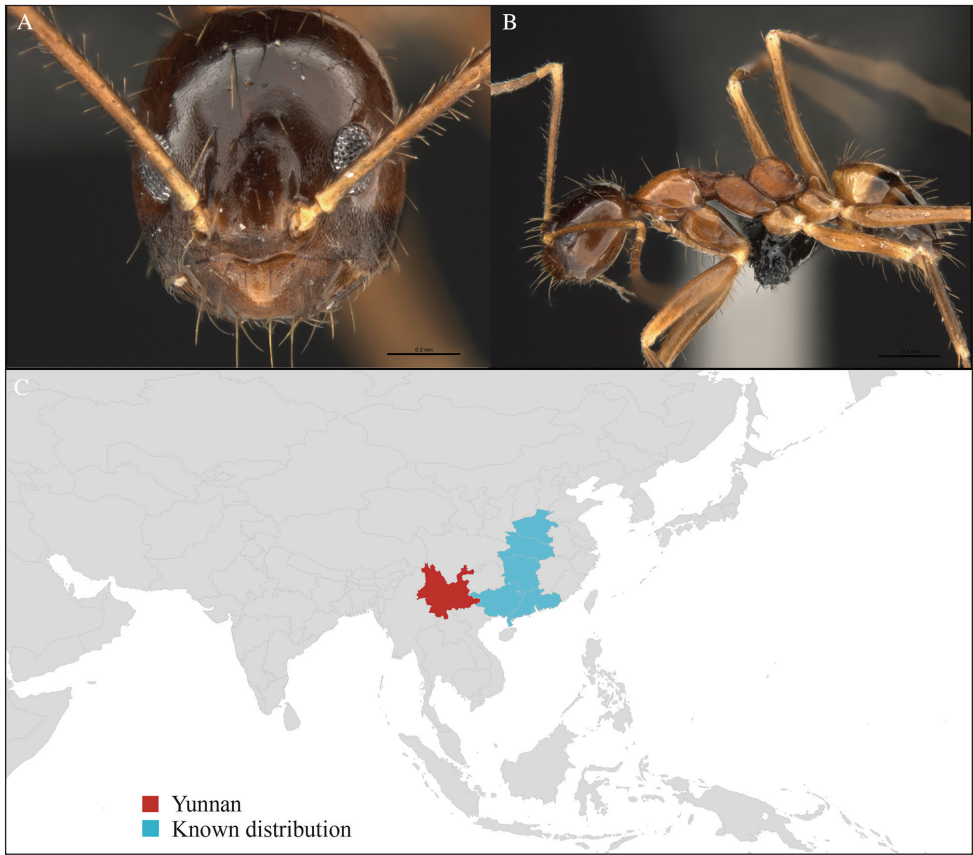


Figure 26. *Prenolepis sphingthoraxa* worker, CASENT0715549. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Proceratium deelemani Perrault, 1981

Figure 27

Material examined. CHINA, Yunnan, Xishuangbanna: Kilometer 55 station (21.964°N, 101.202°E), Rain forest, 13.vi.2013, 1 worker, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Known from Yunnan (new record), Singapore, Thailand and Borneo (Figure 27C). This new record represents the northern-most record in the distribution of *Proceratium deelemani*.

Taxonomic note. The identification of *Proceratium deelemani* is relatively straightforward with the key provided by Baroni Urbani and De Andrade (2003).

Natural history. *Proceratium deelemani* has been collected from leaf litter in rain forest, and little is known about its bionomics.

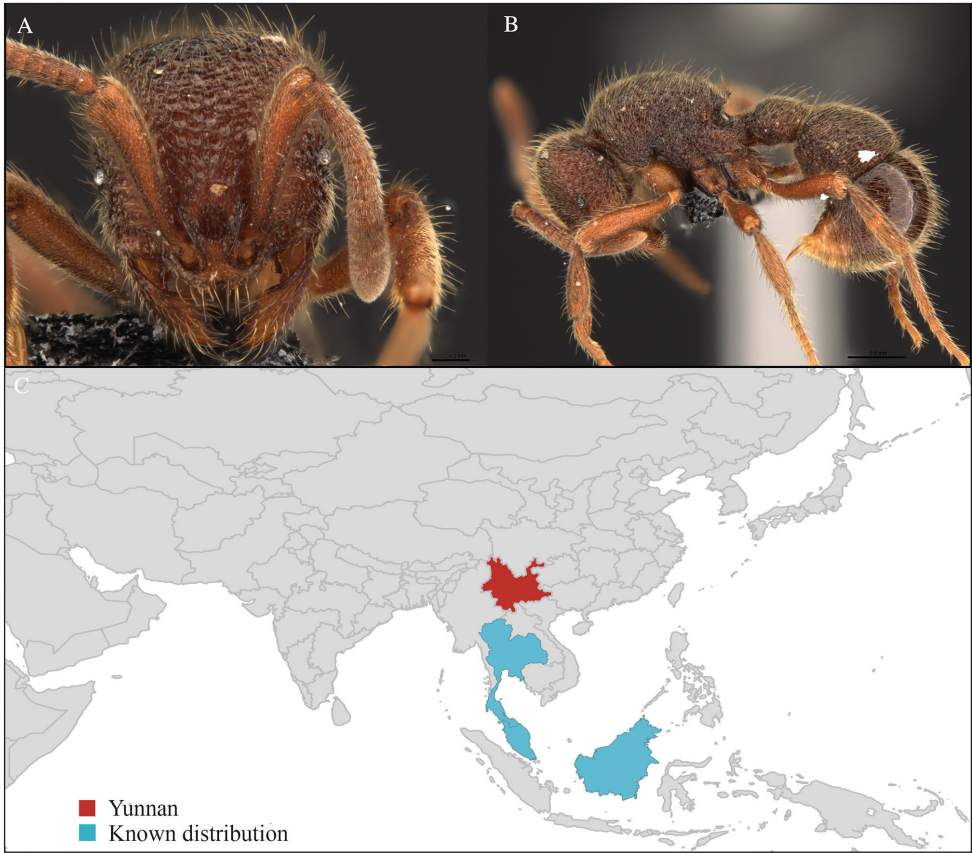


Figure 27. *Proceratium deelemani* worker, CASENT0717686. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

***Recurvidris kemneri* (Wheeler & Wheeler, 1954)**

Figure 28

Material examined. CHINA, Yunnan, Xishuangbanna: “Holy Hills” (21.919°N, 101.239°E), Secondary forest, 07.vi.2013, 1 worker, 670m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.857°N, 101.277°E), Rubber plantation, 12.vi.2013, 3 workers, 710m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 1 worker, 685m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.860°N, 101.278°E), Secondary forest, 12.vi.2013, 1 worker, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.963°N, 101.201°E), Rain forest, 10.vi.2013, 7 workers, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Widely distributed in the Austral-Asian and Indo-Malayan subregions (Figure 28C). This new northern-most record represents an important extension in the distribution of *Recurvidris kemneri*.

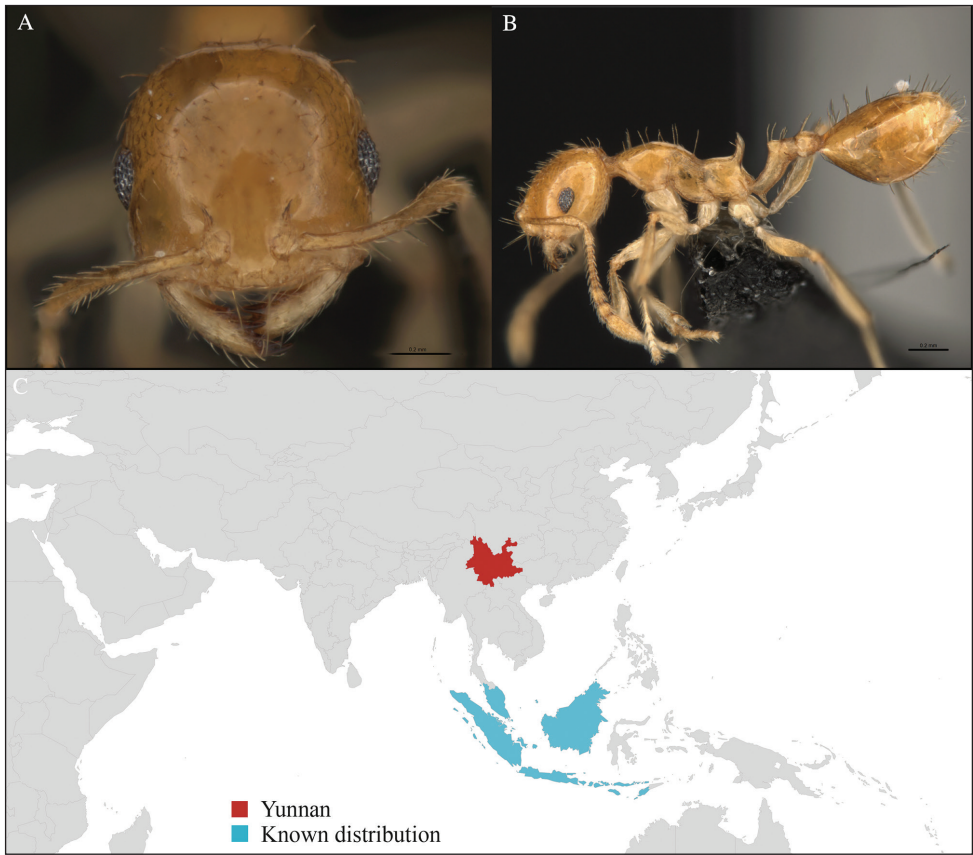


Figure 28. *Recurvidris kemneri* worker, CASENT0715218. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Taxonomic note. The identification is based on Bolton's (1992) key. Our material from Yunnan fits the re-description in the latter publication very well, even though the propodeal spines seem somewhat longer than in the material from Borneo. However, we consider this as a minor geographic variation.

Natural history. *Recurvidris kemneri* has been collected from leaf litter from rain forest, secondary forest and rubber plantation, and little is known about its bionomics.

Strumigenys dyschima (Bolton, 2000)

Figure 29

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.911°N, 101.283°E), Limestone forest, 06.vi.2013, 2 workers, 675m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

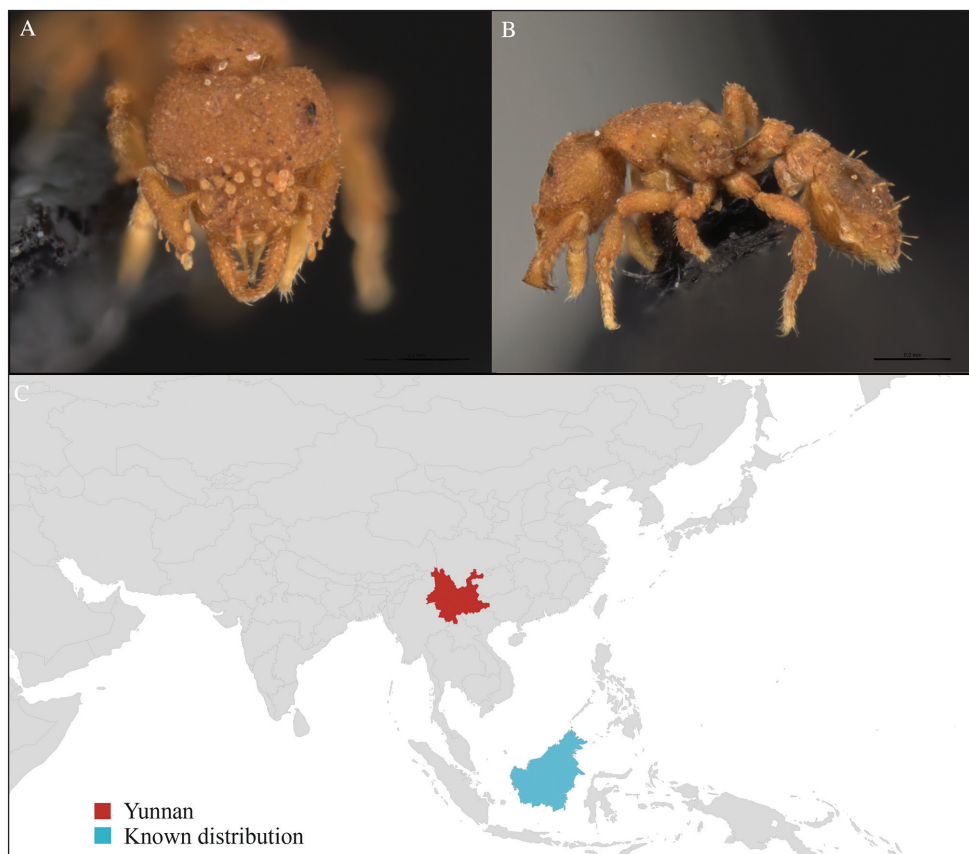


Figure 29. *Strumigenys dyschima* worker, CASENT0717009. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Distribution. Known from Yunnan (new record) and Borneo (Figure 29C). This new record represents an important extension in the northern range of the distribution of *Strumigenys dyschima*.

Taxonomic note. *Strumigenys dyschima* can be identified with the identification key given by Bolton (2000; treated as *Pyramica dyschima*).

Natural history. *Strumigenys dyschima* has been collected from leaf litter in limestone forest, and little is known about its bionomics.

Strumigenys kichijo (Terayama, Lin & Wu, 1996)

Figure 30

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.924°N, 101.268°E), Rubber Plantation, 05.vi.2013, 1 worker, 571m, Winkler sifting, B.

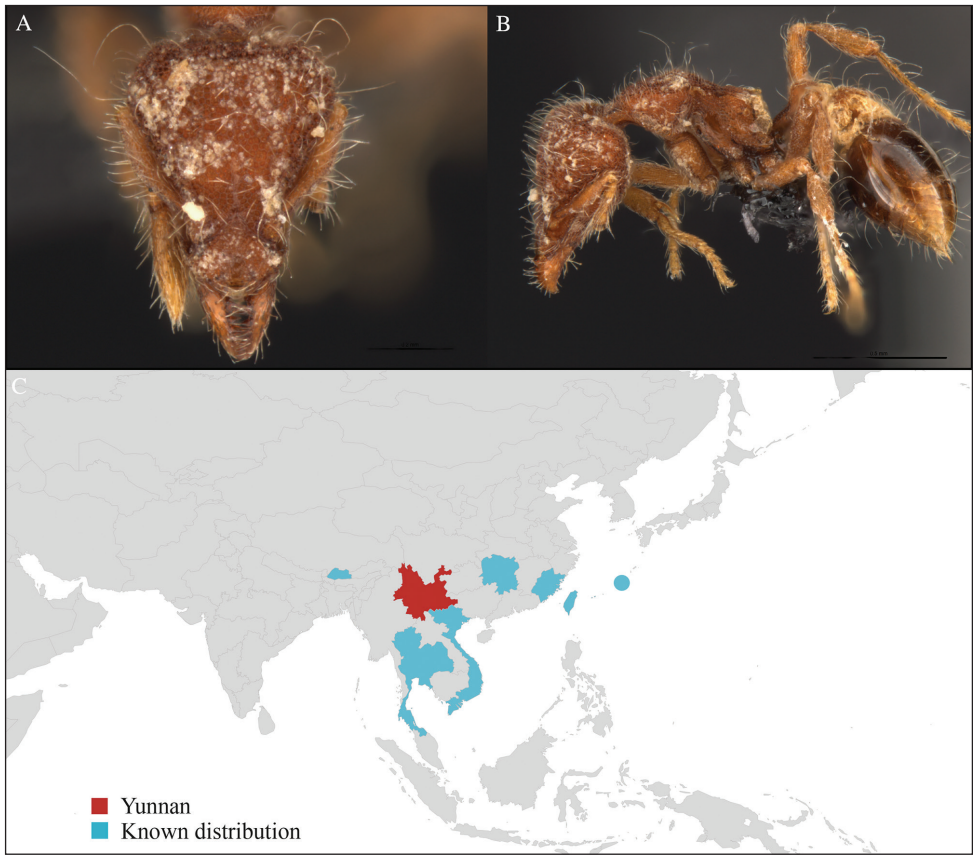


Figure 30. *Strumigenys kichijo* worker, CASENT0713674. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Guénard, B. Blanchard and C. Liu; Menglun town (21.934°N, 101.269°E), Rubber Plantation, 09.vi.2013, 1 worker, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Widely distributed in Indo-Malayan subregions (Figure 30C).

Taxonomic note. *Strumigenys kichijo* can be identified with the identification key given by Bolton (2000; treated as *Pyramica kichijo*).

Natural history. *Strumigenys kichijo* has been collected from leaf litter in rubber plantations, and little is known about its bionomics.

Strumigenys mitis (Brown, 2000)

Figure 31

Material examined. CHINA, Yunnan, Xishuangbanna: “Holy Hills” (21.920°N, 101.239°E), Secondary forest, 07.vi.2013, 9 workers, 655m, Winkler sifting, B.

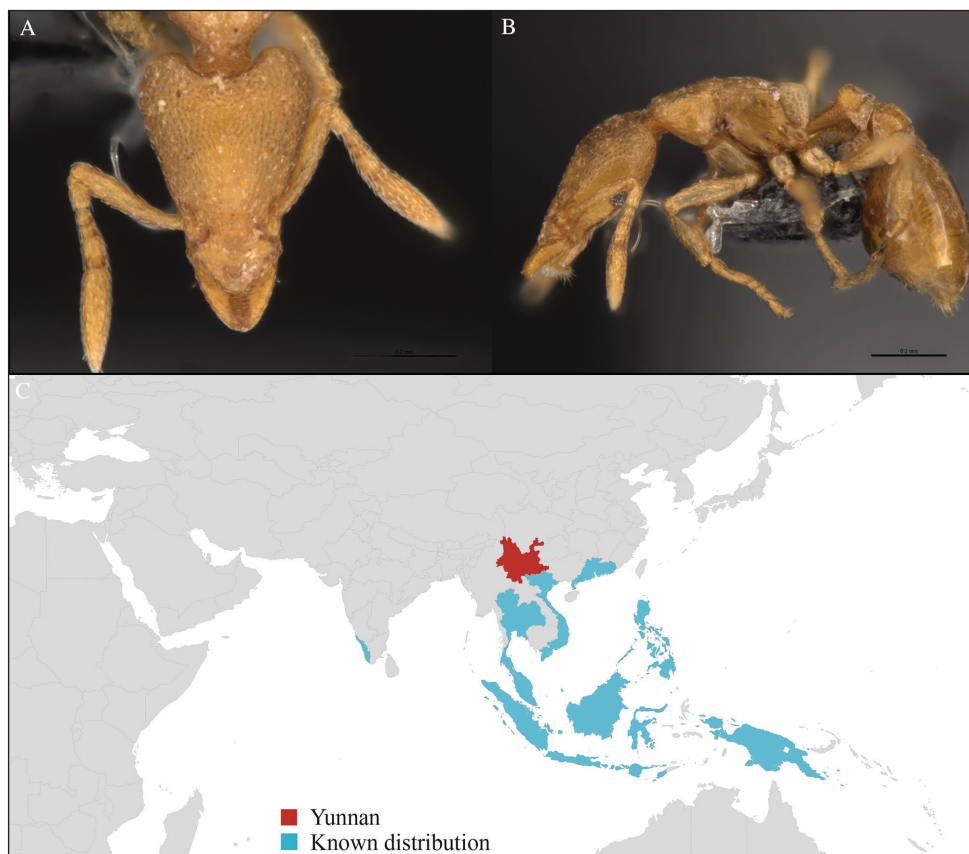


Figure 31. *Strumigenys mitis* worker, CASENT0713676. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Guénard, B. Blanchard and C. Liu; “Holy Hills” (21.919°N, 101.239°E), Rain forest, 07.vi.2013, 7 workers, 670m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Secondary forest, 13.vi.2013, 40 workers, 825m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.966°N, 101.203°E), Secondary forest, 13.vi.2013, 1 worker, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 10.vi.2013, 19 workers, 830m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.961°N, 101.200°E), Rain forest, 10.vi.2013, 8 workers, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.960°N, 101.199°E), Rain forest, 13.vi.2013, 1 worker, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 13.vi.2013, 111 worker, 805m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.963°N, 101.201°E), Rain forest, 13.vi.2013, 122 workers, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.964°N, 101.202°E), Rain forest, 13.vi.2013,

50 workers, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.277°E), Secondary forest, 12.vi.2013, 1 worker, 685m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 12 workers, 690m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.271°E), Rubber plantation, 09.vi.2013, 8 workers, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.932°N, 101.270°E), Rubber plantation, 09.vi.2013, 1 worker, 645m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.931°N, 101.269°E), Rubber plantation, 09.vi.2013, 1 worker, 645m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.924°N, 101.268°E), Rubber Plantation, 05.vi.2013, 1 worker, 571m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 82 workers, 550m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.274°E), Secondary forest, 05.vi.2013, 48 workers, 552m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.918°N, 101.271°E), Secondary forest, 05.vi.2013, 71 workers, 581m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.916°N, 101.274°E), Secondary forest, 08.vi.2013, 2 workers, 615m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.917°N, 101.274°E), Secondary forest, 08.vi.2013, 25 workers, 625m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Widely distributed in Austral-Asian and Indo-Malayan subregions (Figure 31C). This new record represents the northern-most known occurrence in the distribution of *Strumigenys mitis*.

Taxonomic note. *Strumigenys mitis* can be identified with the identification key given by Bolton (2000; treated as *Pyramica mitis*) and Bharti (2013, treated as *Pyramica mitis*).

Natural history. *Strumigenys mitis* has been collected from leaf litter in rain forest, secondary forest and rubber plantations, and little is known about its bionomics.

Strumigenys nepalensis Baroni Urbani & De Andrade, 1994

Figure 32

Material examined. CHINA, Yunnan, Xishuangbanna: “Holy Hills” (21.920°N, 101.240°E), Secondary forest, 07.vi.2013, 5 workers, 655m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; “Holy Hills” (21.920°N, 101.239°E), Secondary forest, 07.vi.2013, 12 workers, 665m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; “Holy Hills” (21.919°N, 101.239°E), Rain forest, 07.vi.2013, 1 worker, 670m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.963°N, 101.201°E), Rain forest, 13.vi.2013, 2 workers, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.277°E), Rubber Plantation, 12.vi.2013, 2 workers, 705m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.857°N, 101.277°E), Rubber Plantation,

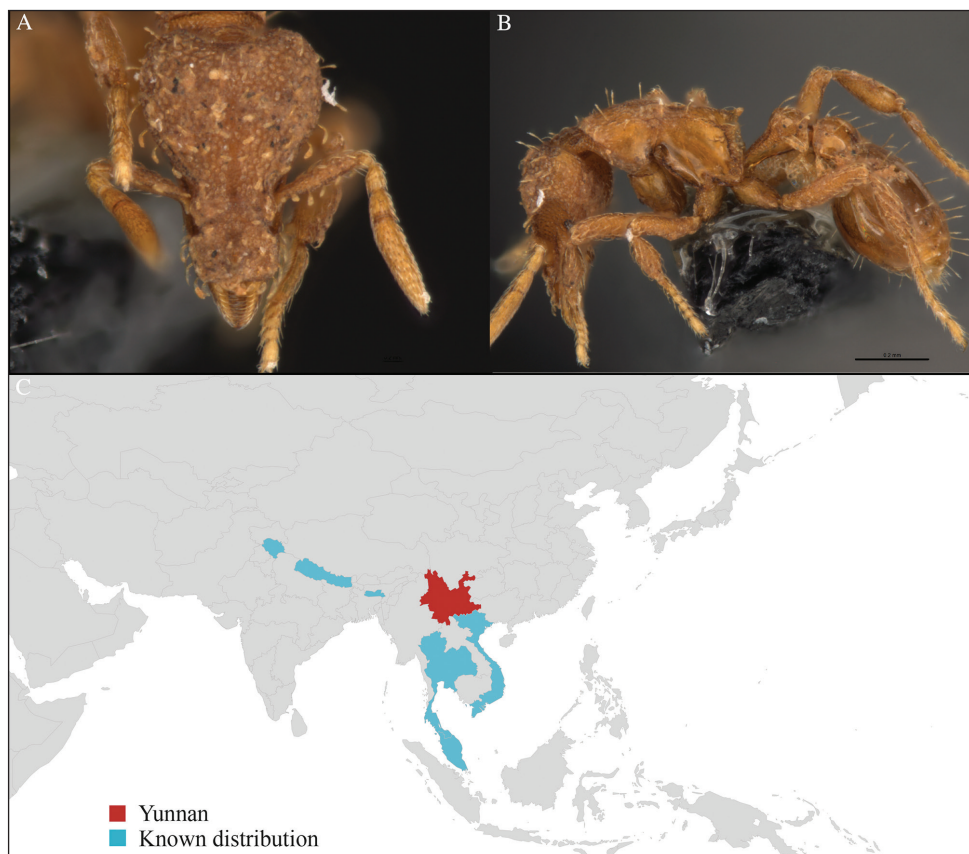


Figure 32. *Strumigenys nepalensis* worker, CASENT0715046. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

12.vi.2013, 2 workers, 710m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.277°E), Secondary forest, 12.vi.2013, 2 workers, 685m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 3 workers, 690m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 4 workers, 685m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.860°N, 101.278°E), Secondary forest, 12.vi.2013, 6 workers, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.858°N, 101.276°E), Secondary forest, 12.vi.2013, 1 worker, 675m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 57 workers, 550m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.912°N, 101.285°E), Limestone forest, 06.vi.2013, 1 worker, 680m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.274°E), Secondary forest, 05.vi.2013, 13 workers, 552m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.283°E),

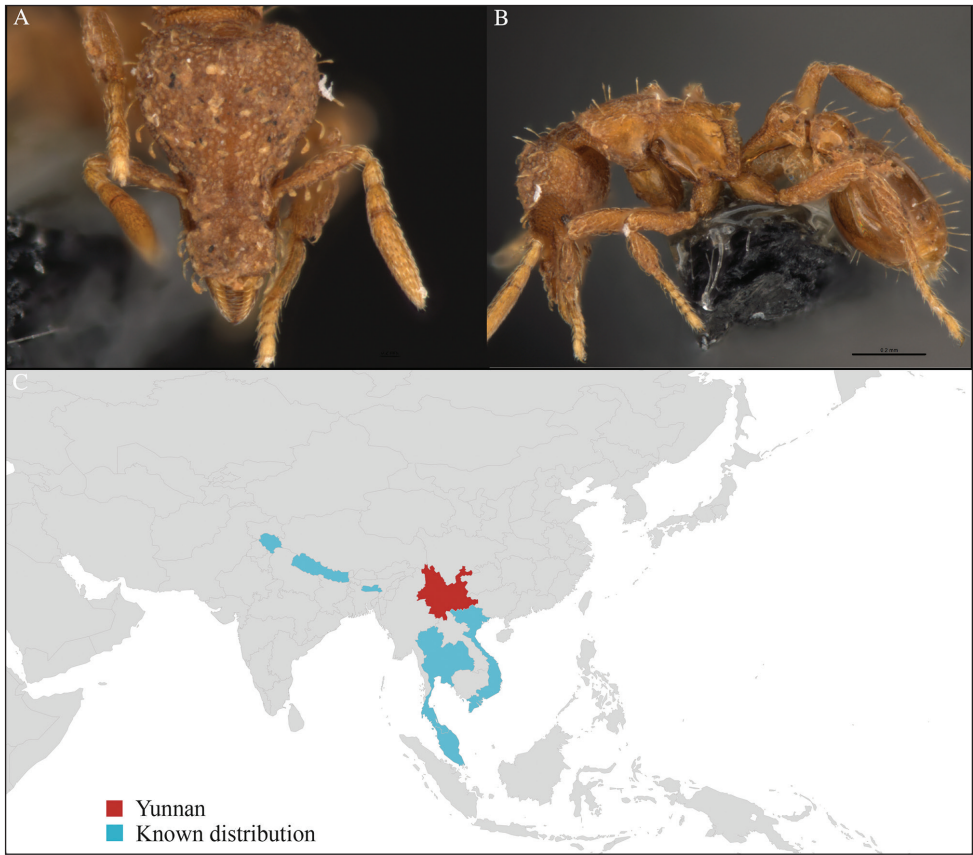


Figure 33. *Strumigenys rallarhina* worker, CASENT0715395. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Limestone forest, 06.vi.2013, 7 workers, 675m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.912°N, 101.282°E), Limestone forest, 06.vi.2013, 21 workers, 640m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.281°E), Limestone forest, 06.vi.2013, 21 workers, 650m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.888°N, 101.266°E), Rubber plantation, 14.vi.2013, 3 workers, 600m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.888°N, 101.266°E), Rubber plantation, 14.vi.2013, 6 workers, 620m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Banna University construction site (21.922°N, 101.268°E), Rubber plantation, 14.vi.2013, 1 worker, 620m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Known from Yunnan (new record), North Indian, Vietnam and Thailand (Figure 32C).

Taxonomic note. *Strumigenys nepalensis* can be identified with the identification key given by Bolton (2000; treated as *Pyramica nepalensis*).

Natural history. *Strumigenys nepalensis* has been collected from leaf litter in rain forest, secondary forest, limestone forest and rubber plantations, and little is known about its bionomics.

***Strumigenys rallarhina* Bolton, 2000**

Figure 33

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.919°N, 101.272°E), Secondary forest, 05.vi.2013, 121 workers, 550m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.274°E), Secondary forest, 05.vi.2013, 34 workers, 552m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.918°N, 101.271°E), Secondary forest, 05.vi.2013, 35 workers, 581m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.916°N, 101.274°E), Secondary forest, 08.vi.2013, 7 workers, 615m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.917°N, 101.274°E), Secondary forest, 08.vi.2013, 44 workers, 625m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 10.vi.2013, 22 workers, 830m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.961°N, 101.200°E), Rain forest, 10.vi.2013, 15 workers, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.960°N, 101.199°E), Rain forest, 10.vi.2013, 26 workers, 840m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 13.vi.2013, 9 workers, 805m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.964°N, 101.202°E), Rain forest, 13.vi.2013, 16 workers, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Known from Yunnan (new record), Guangxi and Vietnam (Figure 33C).

Taxonomic note. *Strumigenys rallarhina* can be identified with the identification key provided by Bolton (2000).

Natural history. *Strumigenys rallarhina* has been collected from leaf litter in rain forest and secondary forest, and little is known about its bionomics.

***Strumigenys sauteri* (Forel, 1912)**

Figure 34

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.918°N, 101.271°E), Secondary forest, 05.vi.2013, 10 workers, 581m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.917°N, 101.274°E), Secondary forest, 08.vi.2013, 3 workers, 625m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.962°N, 101.200°E), Rain forest, 13.vi.2013, 9 workers, 805m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.963°N, 101.201°E), Rain forest, 13.vi.2013, 3 workers, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

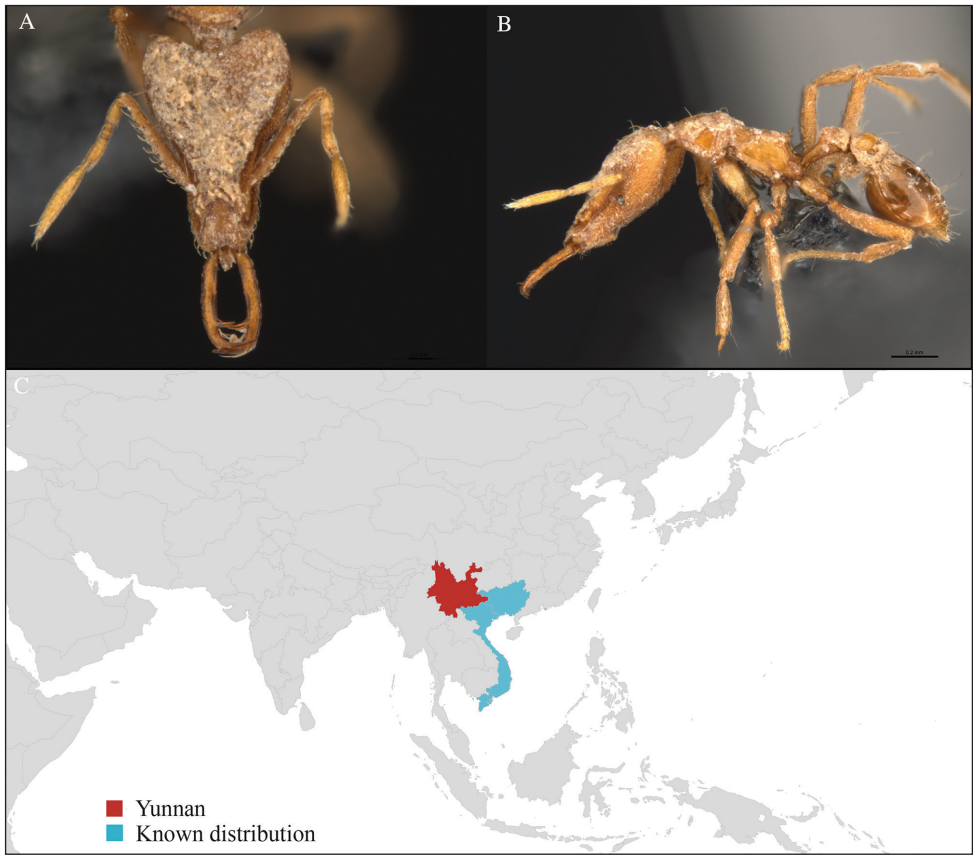


Figure 34. *Strumigenys sauteri* worker, CASENT0717023. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Distribution. Widely distributed in Indo-Malayan subregions (Figure 34C).

Taxonomic note. *Strumigenys sauteri* can be identified with the identification key given by Bolton (2000; treated as *Pyramica sauteri*).

Natural history. *Strumigenys sauteri* has been collected from leaf litter in rain forest and secondary forest, and little is known about its bionomics.

Technomyrmex pratensis (Smith, 1860)

Figure 35

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.918°N, 101.271°E), Secondary forest, 05.vi.2013, 4 workers, 581 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.274°E), Secondary forest, 11.vi.2013, 4 workers, 590 m, Hand collection, B. Guénard, B. Blanchard and C. Liu.

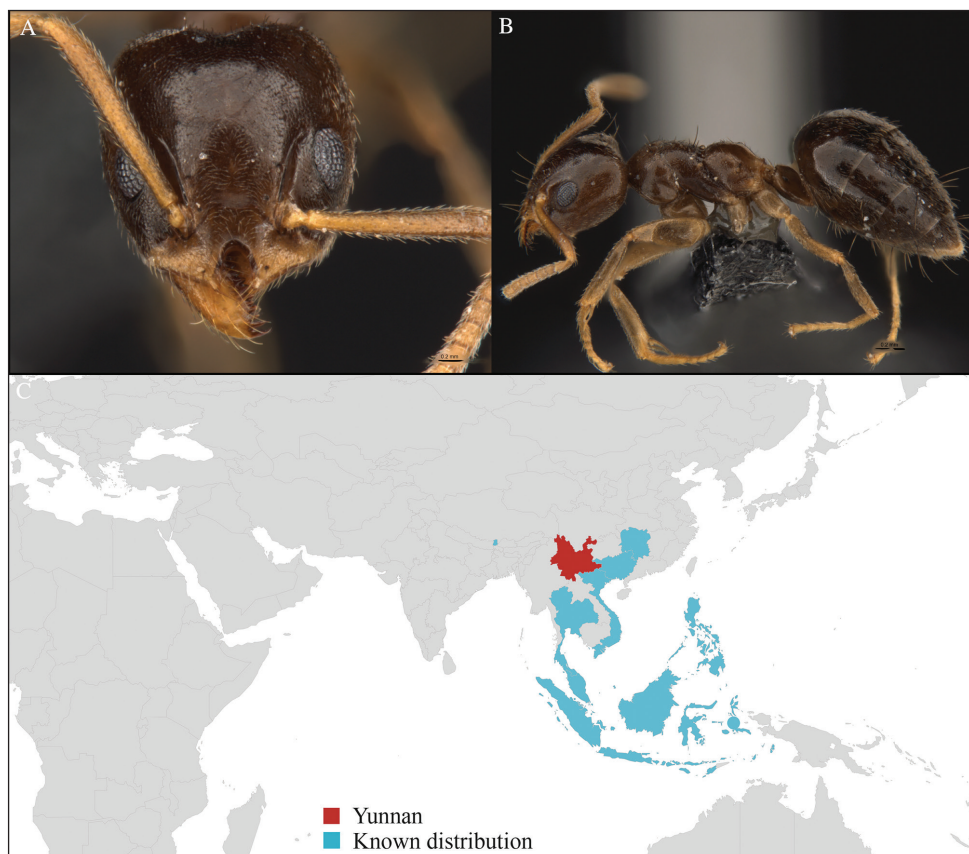


Figure 35. *Technomyrmex pratensis* worker, CASENT0715863. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Distribution. Widely distributed in the Austral-Asian and Indo-Malayan subregions (Figure 35C).

Taxonomic note. *Technomyrmex pratensis* is the only member of the *Technomyrmex pratensis* species group. It is a very conspicuous species within the genus, and its identification is very easy with the key provided by Bolton (2007).

Natural history. *Technomyrmex pratensis* has been collected from leaf litter in secondary forest, and little is known about its bionomics.

Tetramorium difficile Bolton, 1977

Figure 36

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.918°N, 101.271°E), Secondary forest, 05.vi.2013, 2 workers, 552 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

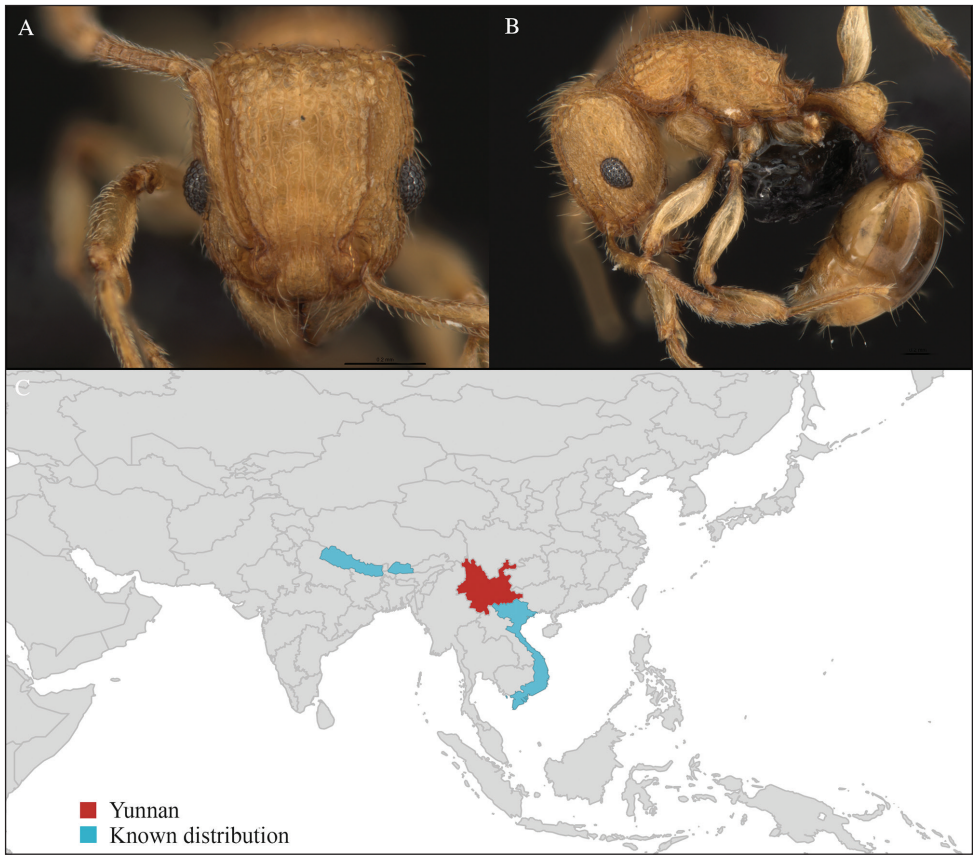


Figure 36. *Tetramorium difficile* worker, CASENT0713193. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Distribution. Known from Yunnan (new record), northern India, and Vietnam (Figure 36C).

Taxonomic note. *Tetramorium difficile* is a member of the *Tetramorium tonganum* group and can be identified with the key provided by Bolton (1977). However, *T. difficile* under its current definition is morphologically very close to *T. tonganum*. It is likely that both are conspecific and the material listed as *T. difficile* represents intraspecific forms of the very widespread *T. tonganum*.

Natural history. *Tetramorium difficile* has been collected from leaf litter in secondary forest, and little is known about its bionomics.

Tetramorium flavipes Emery, 1893

Figure 37

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.918°N, 101.271°E), Secondary forest, 05.vi.2013, 35 workers, 552 m, Winkler sifting, B.

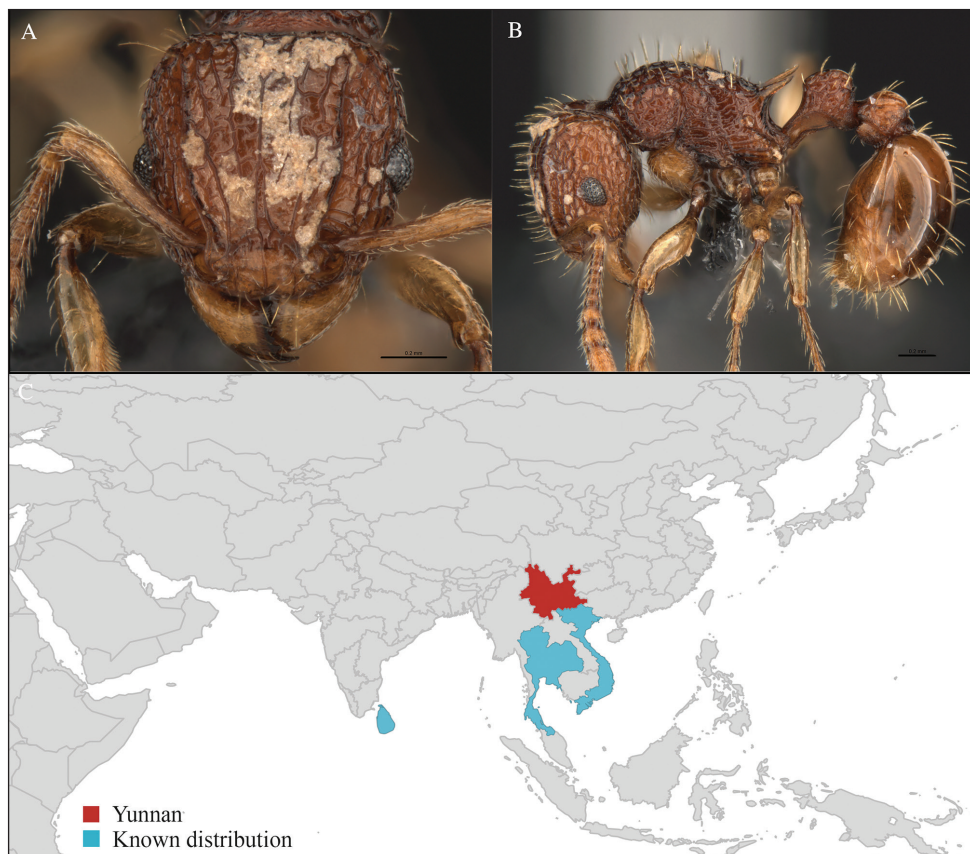


Figure 37. *Tetramorium flavipes* worker, CASENT0713761. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Guénard, B. Blanchard and C. Liu; XTBG (21.917°N, 101.274°E), Secondary forest, 08.vi.2013, 33 workers, 625 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.961°N, 101.201°E), Rain forest, 10.vi.2013, 8 workers, 820m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Kilometer 55 station (21.963°N, 101.200°E), Rain forest, 13.vi.2013, 5 workers, 815m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Known from Yunnan (new record), Vietnam, Thailand and Sri Lanka (Figure 37C). This new record represents the northern-most record in the distribution of this species.

Taxonomic note. *Tetramorium flavipes* is a member of the *Tetramorium tortuosum* group. Its identification is relatively straightforward with the key given by Bolton (1977). However, *T. flavipes*, originally described from Thailand, is very close to *T. eleates* Forel, 1913 from Borneo and the Philippines, and as already pointed out by Bolton (1977), both could represent geographic variants of the same species.

Natural history. *Tetramorium flavipes* has been collected from leaf litter in secondary forest, and very little is known about its bionomics.

***Tetramorium parvispinum* (Emery, 1893)**

Figure 38

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.919°N, 101.274°E), Secondary forest, 05.vi.2013, 155 workers, 550 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.924°N, 101.268°E), Rubber plantation, 05.vi.2013, 6 workers, 571 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.917°N, 101.270°E), Secondary forest, 05.vi.2013, 7 workers, 580 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.911°N, 101.281°E), Limestone rain forest, 06.vi.2013, 155 workers, 650 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.916°N, 101.274°E), Secondary forest, 08.vi.2013, 58 workers, 615 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.930°N, 101.269°E), Rubber plantation, 09.vi.2013, 2 workers, 640 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.890°N, 101.267°E), Rubber plantation, 14.vi.2013, 9 workers, 620 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

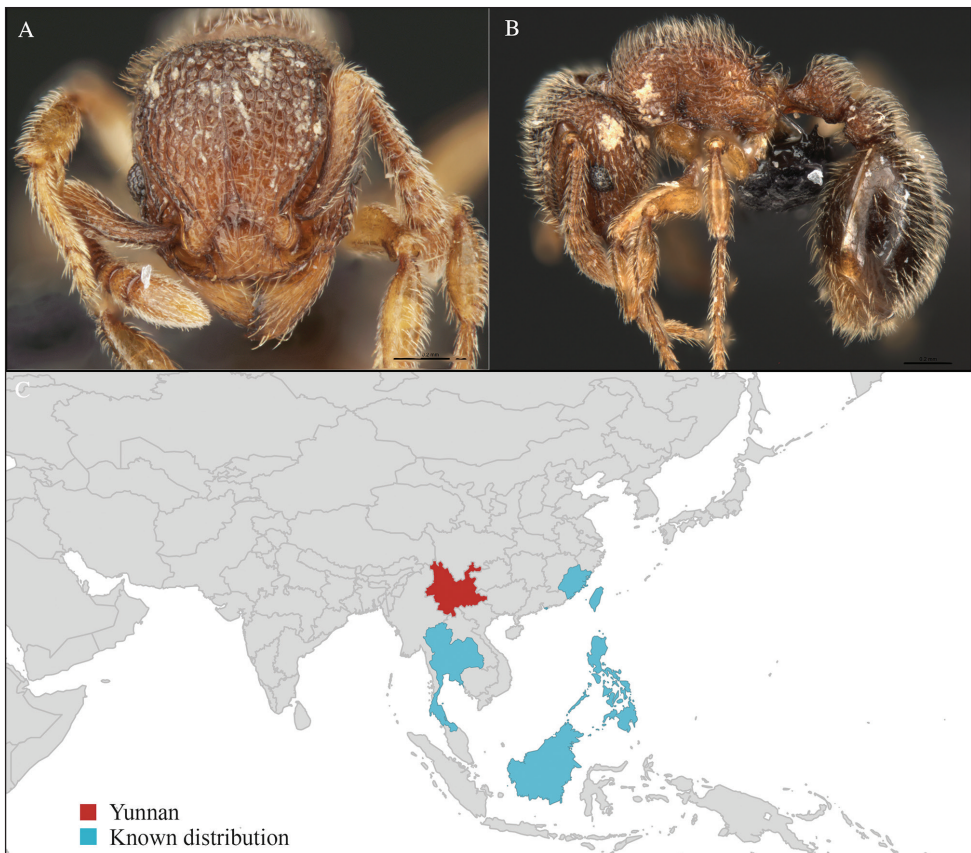


Figure 38. *Tetramorium parvispinum* worker, CASENT0735806. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

Distribution. Widely distributed in the Indo-Malayan subregion (Figure 38C).

Taxonomic note. *Tetramorium parvispinum* is a member of the *Tetramorium walshi* species group. It can be identified with the key presented by Bolton (1976; as *Triglyphothrix parvispina*)

Natural history. *Tetramorium parvispinum* has been collected from leaf litter in secondary forest, limestone forest and rubber plantations, and little is known about its bionomics.

***Tetramorium polymorphum* Yamane & Jaitrong, 2011**

Figure 39

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.917°N, 101.274°E), Rain forest, 05.vi.2013, 1 major worker, 552 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.918°N, 101.270°E), Rain forest,

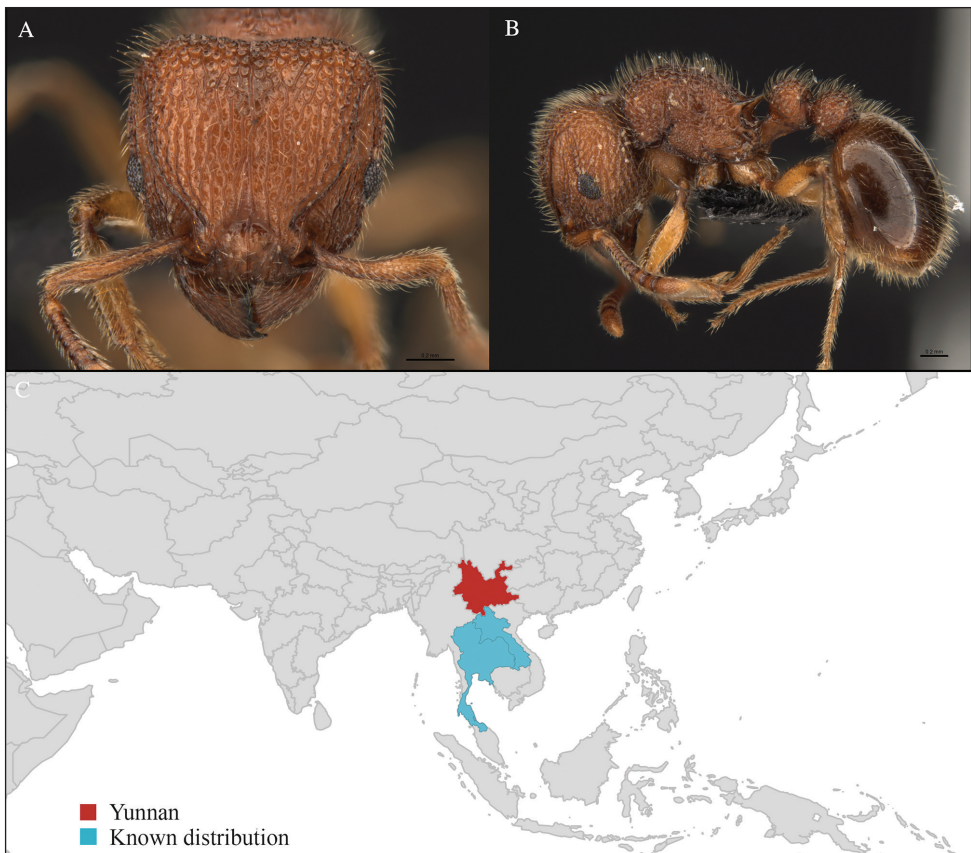


Figure 39. *Tetramorium polymorphum* worker, CASENT0713055. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

05.vi.2013, 3 workers, 581 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.919°N, 101.272°E), Rain forest, 05.vi.2013, 10 workers, 550 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; “Holy Hills” (21.920°N, 101.239°E), Rain forest, 07.vi.2013, 10 worker, 665m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; XTBG (21.928°N, 101.256°E), Rain forest, 07.vi.2013, 10 workers, 565 m, Hand collection, B. Guénard, B. Blanchard and C. Liu; Man Sai village (21.860°N, 101.278°E), Rain forest, 12.vi.2013, 1 worker, 680 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. Known from Yunnan (new record), Laos and Thailand (Figure 39C). This new record represents the northern-most record in the distribution of *Tetramorium polymorphum*.

Taxonomic note. *Tetramorium polymorphum* is a member of the *T. walshi* species group. Its identification is not easy since the species was not known when Bolton (1976) published his revision of the genus *Triglyphothrix* (now *Tetramorium*), in which he provided keys to the Indo-Malayan and Austral-Asian *T. walshi* and *T. obesum* species groups. However, by combining Bolton’s (1976) work with the recent species description of Yamane and Jaitrong (2011) the identification is relatively straightforward. It is very similar to the closely related and sympatric *T. kheperra* Bolton, 1976, and the identification key of Bolton (1976) will lead the user to that species. The recent addition to Bolton’s key provided by Yamane and Jaitrong (2011) clearly separates both species.

Natural history. *Tetramorium polymorphum* is a very special member of the genus *Tetramorium* since it is the only known species that possesses a polymorphic worker caste divisible into distinctive minor, media and major workers (Yamane and Jaitrong 2011). Yamane and Jaitrong (2011) also report that this species is comparatively aggressive and hypothesize that the major worker could have a defensive function. In addition, they emphasize that *T. polymorphum* is only found in undisturbed rain forest habitats in Thailand and Laos. Our data from Yunnan supports this since it was predominantly sampled from rain forest.

***Tetramorium tonganum* Mayr, 1870**

Figure 40

Material examined. CHINA, Yunnan, Xishuangbanna: XTBG (21.919°N, 101.274°E), Secondary forest, 05.vi.2013, 9 workers, 552 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu; Menglun town (21.934°N, 101.269°E), Secondary forest, 09.vi.2013, 2 workers, 640 m, Winkler sifting, B. Guénard, B. Blanchard and C. Liu.

Distribution. *Tetramorium tonganum* is widely distributed in the Austral-Asian and Indo-Malayan subregions where it ranges from western Oceania to South East Asia (Figure 40C). Bolton (1977) has noted already that the species is widespread

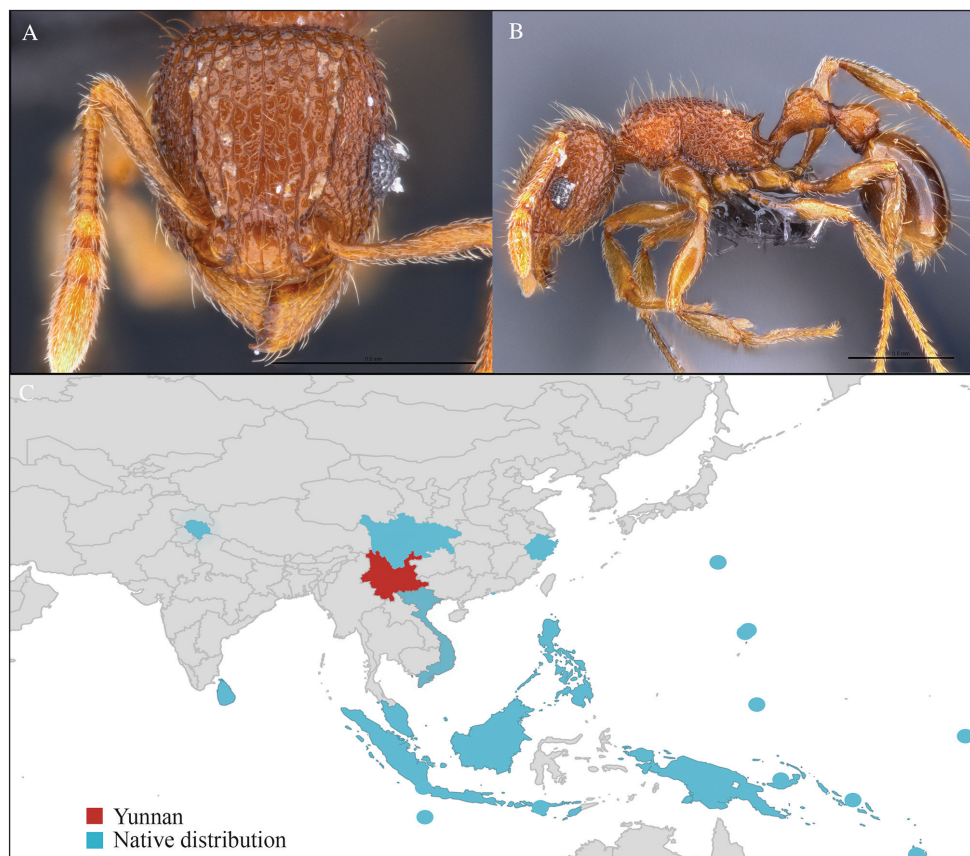


Figure 40. *Tetramorium tonganum* worker, CASENT0713454. **A** Head in front view **B** Mesosoma in profile view **C** Global distribution map.

in its native range and has the characteristics of tramp species. It is very likely that future collections will reveal its presence in more Chinese provinces Southeast Asian countries.

Taxonomic note. *Tetramorium polymorphum* belongs to the *Tetramorium tonganum* group and can be easily identified with the key provided by Bolton (1977).

Natural history. *Tetramorium polymorphum* has been collected from leaf litter in secondary forest, and is known to be an exotic species in China (Guenard and Dunn 2012). Despite its wide distribution and tramping ability, there is very little information about its biology. In addition to Bolton (1977), Sarnat and Economo (2012) also confirm that *T. tonganum* is able to establish populations outside its native range without damaging or significantly altering ecological or agricultural systems in its introduced habitats. They also report that *T. tonganum* is mostly found on vegetation in disturbed or edge habitats.

Discussion

The total number of named ant species in China is 939, but the true species richness is expected to be significantly higher, perhaps as high as 1200 to 1600 species (Guénard and Dunn 2012). The collection of these 40 new ant records for Yunnan and 17 for China through Winkler extraction, combined with the discovery of the extremely rare ant species *Bannapone scrobiceps* (Guenard et al. 2013), should encourage myrmecologists to consider leaf litter extraction as one of the primary methods to collect leaf litter ants, especially for places where this method has not previously been used. Nevertheless, further sampling methods that specifically target different strata will very likely yield additional species, which is especially true for hypogaeic and arboreal ant communities.

Based on our collections, many newly recorded species, such as *Discothyrea clavicornis*, *Myrmecina curvispina*, and *Odontoponera denticulata* are relatively common. The reason why those species were never reported from Yunnan before may be due to different collection techniques and/or misidentifications. For example, *Odontoponera denticulata* has long been misidentified as *Odontoponera transversa* (Yamane 2009). Another reason may be that some of the newly recorded species have been described only recently outside of Yunnan and/or China, such as *Myrmecina curvispina* and *Pheidole tumida* (Zhou et al. 2008, Eguchi 2008).

Many new species records in our collection such as *Aenictus artipus*, *A. maneerati*, *A. paradentatus*, *Discothyrea clavicornis*, *Dolichoderus laotius*, *Gesomyrmex kalshoveni*, *Gnamptogenys treta*, *Pheidole plagiaria*, *P. planifrons*, *P. rugithorax*, *P. tumida*, *P. vietii*, *Recurvidris kemneri*, *Strumigenys dyschima*, *S. mitis*, *Tetramorium difficile*, *T. flavipes*, *T. parvispinum*, and *T. tonganum*, are at the northern limit of their known distribution in Yunnan. Interestingly, the occurrence of several species in Yunnan, such as *Discothyrea clavicornis*, *Gesomyrmex kalshoveni*, *Gnamptogenys treta*, *Recurvidris kemneri*, and *Strumigenys dyschima* constitutes a disjunction from the rest of their known distribution in the Malay Peninsula. At present, it is unclear if these represent sampling artifacts and the ranges are actually continuous in the region, if these species ranges represent true biogeographic disjunctions, or if they are actually different species. Only future diversity inventories and taxonomic treatments, of which this paper represents one modest contribution, can answer these questions and further resolve the biodiversity map for ants and other organisms.

Despite the comparatively short collecting time we invested in the inventory of the myrmecofauna, we were able to identify 145 species, of which over 30% represent new records. This increases the list of known species for Yunnan by 10%, and there are still more than 60 species that we tentatively consider undescribed. This shows how little was previously known about the ant fauna of the region, and we are convinced that more intensive sampling in different habitats and microhabitats will likely reveal the presence of even more species or help improve the current taxonomic resolution. In this context, we think that Yunnan should be considered an area of high biodiversity value and deserving of attention of both biologists and conservationists. Regrettably, this interesting biota is being degraded at an alarming speed, particularly due to the rapid expansion of rubber plantations in the area (Li et al. 2007).

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Taxonomic revision of genus *Ablattaria* Reitter (Coleoptera, Silphidae) using geometric morphometrics

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Abstract

The genus *Ablattaria* Reitter, 1884 (Coleoptera: Silphidae: Silphinae) is revised. Four taxa are recognized as valid species: *Ablattaria arenaria* (Kraatz, 1876), *A. cribrata* (Ménétries, 1832), *A. laevigata* (Fabricius, 1775) and *A. subtriangula* Reitter, 1905. *Ablattaria laevigata* var. *meridionalis* Ganglbauer, 1899 is newly treated as a junior subjective synonym of *A. laevigata*. Lectotypes are designated for *Phosphuga arenaria* Kraatz, 1876, *Ablattaria arenaria* var. *punctigera* Reitter, 1884, *Ablattaria arenaria* var. *alleoni* Portevin, 1926, *Silpha cribrata* Ménétries, 1832, *Silpha laevigata* Fabricius, 1775, *Silpha gibba* Brullé, 1832, *Ablattaria gibba* var. *costulata* Portevin, 1926, *Ablattaria gibba* var. *distinguenda* Portevin, 1926, *Ablattaria gibba* var. *punctata* Portevin, 1926 and *Ablattaria subtriangula* Reitter, 1905. The distribution of all taxa is mapped, based on material examined. Geometric morphometric methods were used to evaluate shape variability in *Ablattaria*. Results indicated sexual dimorphism in all species. Shape inconsistency was found between the sexes of all taxa when tested independently. The first two relative warp axes indicated 65.17% shape variation in males and 65.72% in females. Canonical variate analysis separated the taxa studied. There was minimal overlap between some groups in both sexes. Differences in body shape between populations of *A. laevigata* from Central Europe, Italy and Greece + Turkey were also examined. Relative warps implied 58.01% shape variability on both axes in males and 64.78% in females. CVA revealed noticeable overlaps between the groups, although the Italian population demonstrated a higher separation in both sexes.

Keywords

Taxonomy, new synonymy, lectotype designation, distribution, Western Palearctic Region

Introduction

The genus *Ablattaria* Reitter, 1884 (Silphidae: Silphinae) is a specialized group of gas-tropod predators. Distributed in the Western Palearctic Region, these beetles inhabit forests, gardens, scrubland and generally damp localities (Portevin 1926, Heymons and Lengerken 1932).

Reitter (1884) erected *Ablattaria* as a separate genus to accommodate five taxa of carrion beetles: the widely distributed European *Silpha laevigata* Fabricius, 1775; *Silpha gibba* Brullé, 1832 from Greece: Arcadia (originally described as separate species, but treated by Reitter as a variety of *A. laevigata*); *Silpha cribrata* Ménétries, 1832 from southern Russia; *Phosphuga arenaria* Kraatz, 1876 from Asia Minor; as well as the newly described *A. arenaria* var. *punctigera* Reitter, 1884 from Haifa. Later, Ganglbauer (1899) described *A. laevigata* var. *meridionalis* (merely as a geographic variety occurring in a large area ranging from southern Hungary to Greece) and Reitter (1905) added *A. subtriangula* from Spain. Portevin (1926) in his world revision of carrion beetles treated *A. gibba* once more as a separate species, and added several new varieties: *Ablattaria arenaria* var. *alleoni* (no distribution provided, but the type specimen is labelled as coming from Turkey: Adana), *A. gibba* var. *costulata* (type specimen from Turkey: Istanbul), *A. gibba* var. *distinguenda* and *A. gibba* var. *punctata* (type locality not specified for either taxon). *Silpha laevigata* Fabricius, 1775 is the type species of *Ablattaria* by subsequent designation by Hatch (1928), who treated *Ablattaria* as a subgenus of *Silpha* Linnaeus, 1758. Probably the broadest review of this genus was published by Schawaller (1979), who distinguished four species: *A. arenaria*, *A. cribrata*, *A. laevigata*, and *A. subtriangula*, and formally ranked two additional taxa as subspecies of *A. laevigata*: *A. laevigata gibba* (Brullé, 1832), and *A. laevigata meridionalis* Ganglbauer, 1899. Schawaller provided re-descriptions of all taxa, a key to adults and a brief summary of their distributions. Recently, Nikolaev and Kozminykh (2002) treated only two taxa as full species. They regarded *A. cribrata* as a subspecies of *A. laevigata*, conditionally stated that *A. arenaria* should be considered also as a subspecies of *A. laevigata*, and formally treated *A. gibba* as a junior subjective synonym of *A. laevigata*. Most of these changes were followed in the Palearctic catalogue by Růžička and Schneider (2004). The main morphological characters used to delimit separate species are differences in shape and surface punctuation of pronotum and elytra. No consistent differences were found in the shape of male genitalia (Schawaller 1979).

Historically, most controversies have concerned the delimitations and distributions of *A. laevigata*, *A. gibba* and *A. laevigata* var. *meridionalis* (also treated at different ranks, see above). *A. laevigata* is a widely distributed European species (e.g., Portevin 1926, Schawaller 1979). Its distribution in Central Europe was given in detail by Horion (1949) for Germany and Austria and mentioned by Mroczkowski (1955) from southern Poland. *A. gibba* was originally described from southern Greece (Peloponnese Peninsula: Arcadia region) (Brullé 1832), and *A. laevigata* var. *meridionalis* was delimited as coming from “Illiria, Dalmatia, southern Hungary and Greece” (Ganglbauer 1899). However, later authors confused the distributions of the two taxa: Porta

(1926) treated *A. l.* var. *gibba* from “Lombardia, Veneto, Toscana, Lazio, southern Italy” and *A. l.* var. *meridionalis* from “Corsica”. Portevin (1926) reported *A. gibba* from Romania, Greece and Anatolia and *A. l.* var. *meridionalis* from “southern Europe”. Hatch (1928) repeated Portevin’s distribution data for *A. gibba* as “Rumania [sic], Greece, Anatolia” and added a record for *A. l.* var. *meridionalis* from “Eastern Europe”. Schawaller (1979) reported *A. laevigata laevigata* from the south of Central Europe and from France and Spain, *A. l. gibba* from the Balkan Peninsula to central Anatolia, and *A. l. meridionalis* from Italy, including the surrounding islands.

The genus *Ablattaria* was further reported from many regions: Iberian Peninsula (Caminero Bago 1981, Piloña et al. 2002), France (Debreuil 2004), Central Europe (Růžička 2005), Bulgaria (Guéorguiev and Růžička 2002), Iran and Turkey (Růžička 1996, Háva et al. 1998, Růžička and Schneider 2002), Russia, Ukraine and the Caucasus (Nikolaev and Kozminykh 2002).

The ecology and detailed adult and larval morphology of *A. laevigata* were described in detail by Heymons and Lengerken (1932). Colkesen and Sekeroglu (1989) examined the development and biology of *A. arenaria* adults and larvae. Further, Sekeroglu and Colkesen (1989) studied the feeding and prey preferences of *A. arenaria* larvae.

In this study, we revise the taxonomy of the genus. We provide new lectotype designations and synonymies based on morphological characters and using the valuable technique of geometric morphometrics on the adult beetle’s body shape. These methods helped us to distinguish taxa and understand variation within and between populations. Based on the material examined, we further summarize information about the precise distribution of the taxa.

Materials and methods

Overall, 2729 specimens were examined from various European museums and collections with acronyms as follow:

BMNH	Natural History Museum, London, United Kingdom (M.V.L. Barclay)
EHOC	Private collection of Erwin Holzer, Anger, Austria
HNHM	Magyar Természettudományi Museum, Budapest, Hungary (O. Merkl)
JCOC	Private collection of Jonathan Cooter, Hereford, United Kingdom
JRUC	Private collection of Jan Růžička, Prague, Czech Republic
KORC	Private collection of Kamil Orszulik, Frýdek-Místek, Czech Republic
MHNG	Museum d’histoire naturelle, Genève, Switzerland (G. Cuccodoro)
MNHN	Muséum national d’Histoire naturelle, Paris, France (Azadeh Taghavian)
MNCN	Museo Nacional de Ciencias Naturales, Madrid, Spain (J.F. Gómez)
MZMB	Moravské zemské muzeum, Brno, Czech Republic (I. Malenovský)
NHMW	Naturhistorisches Museum, Vienna, Austria (H. Schillhammer)
NJAC	Private collection of Nicklas Jansson, Linköping, Sweden
NMPC	Národní muzeum, Prague, Czech Republic (J. Hájek)

SDEI	Senckenberg Deutsche Entomologische Institut, Müncheberg, Germany (L. Zerche, L. Behne)
SMFD	Forschungsinstitut Senckenberg, Frankfurt am Main, Germany (D. Kovac)
SMNS	Staatliches Museum für Naturkunde, Stuttgart, Germany (W. Schawaller)
SMTD	Staatliches Museum für Tierkunde, Dresden, Germany (O. Jäger)
TAUM	Department of Zoology, Tel Aviv University, Tel Aviv, Israel (V. Chikatunov)
TSIC	Private collection of Tomáš Sitek, Ostrava, Czech Republic
ZFMK	Forschungsmuseum Alexander Koenig, Bonn, Germany (D. Ahrens)
ZMAN	Zoölogisch Museum Amsterdam, Amsterdam, the Netherlands (S.A. Ulenberg)
ZMAS	Zoological Museum, Academy of Sciences, St. Petersburg, Russia (M.G. Volkovich);
ZMHB	Museum für Naturkunde – Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Berlin, Germany (J. Frisch);
ZMUC	Zoological Museum, University of Copenhagen, Copenhagen, Denmark (A. Solodovnikov)
ZMUM	Zoological Museum of Moscow Lomonosov State University, Moscow, Russia (N. Nikitsky)
ZSM	Zoologische Staatssammlung, Munich, Germany (M. Balke)

Types of most taxa were located and examined. Lectotypes for most taxa are designated below to fix the concept of the taxon in question and to ensure its universal and consistent application and interpretation.

Morphological analyses

Photographs of habitus and morphological details were taken using a Canon MP-E 65 mm or EF-S 60 mm macro photo lens on a Canon 550D, and several layers of focus combined in Zerene Stacker 1.04 software (Zerene Systems 2014; <http://www.zerenesystems.com/cms/stacker>). Exact label data of primary types were cited verbatim. Separate lines on labels are indicated by a slash “/”, separate labels by double slash “//”. Author’s remarks and comments are enclosed in square brackets. The following abbreviations are used: p – preceding data are printed; hw – preceding data are hand-written. Interpreted label data of non-type material examined is summarized in Appendix 1. Data are available from the Dryad Digital Repository (<http://doi.org/10.5061/dryad.7dn7m>). To determine the coordinates of the localities, Google Earth (2014; <http://earth.google.com>) was used along with maplandia (<http://www.maplandia.com>). Distributional maps were created in ESRI ArcMap 10.2 of ArcGIS Desktop 10.2 suite. For map layers, free level 0 data from Global Administrative Areas (<http://www.gadm.org>) and World Shaded Relief (<http://www.arcgis.com/home/item.html?id=9c5370d0b54f4de1b48a3792d7377ff2>) were used.

Geometric morphometrics

Four species of the genus *Ablattaria* were examined: *A. laevigata* (145 males, 174 females), *A. arenaria* (85 males, 87 females), *A. cribrata* (49 males, 33 females) and *A. subtriangula* (5 males, 8 females). Moreover, three groups representing populations of *A. laevigata* were tested: one population from Greece and Turkey (26 males, 37 females), a population from Italy (39 males, 33 females), and one from Central Europe (Austria, Hungary and one specimen from the Czech Republic) (35 males, 33 females). Images were captured using an Olympus digital reflex camera (model E-330) connected to an Olympus stereoscopic microscope (model SZX7) and combined body length of pronotum and elytra was measured.

The geometric morphometric analysis was performed using the thin-plate spline (TPS) package; available free at <http://life.bio.sunysb.edu/morph/index.html> (Rohlf 2014). This technique utilizes coordinates of specific locations called landmarks that are precise points on each specimen describing the overall shape and representing the specimen's morphology (Bookstein 1982, 1986, 1989 and 1991).

In TpsDig 2.10 (Rohlf 2006) the "draw background curves" tool was employed to digitize a curve that outlined only the left half of the pronotum and the left elytron formed from 55 points. The homology of these points on all samples and their reliability in demonstrating the highest shape variability was considered (Bookstein 1991, Slice 2007). The curve points were converted into landmarks using TpsUtil 1.44 (Rohlf 2009) for further analysis.

Landmarks were then superimposed by generalized Procrustes analysis, which allows calculating variability between the taxa after aligning their landmark configurations in a specific process that ensures homology (Rohlf 1990, Rohlf and Slice 1990, Rohlf and Marcus 1993, Zelditch et al. 1995). This was conducted in TpsRelw 1.53 (Rohlf 2013). Relative warp analysis was also performed, wherein the relative warps (RWs) are transformations that express the patterns of shape variation among the specimens and visualize it using D'Arcy Thompson's transformation grids. The deformations in the grids represent the shape changes (Rohlf 1993, Richtsmeier et al. 2002, Adams et al. 2004, Zelditch et al. 2012).

Multivariate analysis of variance (MANOVA) and discriminant analysis (DA) were applied on the relative warp scores matrix to test the significance of the variations between groups (taxa/sexes), and canonical variate analysis (CVA) was performed to illustrate these differences (Zelditch et al. 2004, 2012). Graphical visualization of the CVA results was also made. All of the preceding analyses were executed in PAST ver. 2.11; freeware available for download at <http://folk.uio.no/ohammer/past/> (Hammer et al. 2001).

Geometric morphometrics employs centroid size rather than linear size in calculations associated with allometry (which is the influence size has on shape) (Bookstein 1991; Klingenberg 2010, Zelditch et al. 2004, 2012). The natural logarithm of centroid size was used here, as it increases the statistical power (Viscoci

and Cardini 2011). The taxon groups were first tested independently. Furthermore, multivariate analysis of covariance (MANCOVA) was used in the size correction when comparing groups to test its effect on body shape. In this analysis, the log of centroid size was used as the covariate. TpsRegr 1.38 (Rohlf 2011) was applied to calculate this influence and run permutation tests (Rohlf 1998, Viscoci and Cardini 2011, Zelditch et al. 2012).

Taxonomy

Ablattaria Reitter, 1884

Ablattaria Reitter 1884: 75.

Type species. *Silpha laevigata* Fabricius, 1775 (subsequently designated by Hatch (1928: 120)).

Diagnostic description. Body, in general, dull-black (brown to dark brown in subterrenal specimens), total body length 9–19 mm.

Head flattened with dense but fine puncturing, extra prolonged (used for the invasion of snail shells during feeding; Fig. 20). Eyes large, prominent, emerge to the sides. Antennae clavate, club formed by the antennomeres 9–11 (Fig. 22). Antennomere 1 longer than antennomeres 2 and 3 combined. Antennomere 2 slightly longer than antennomere 3. Frons broad, mandibles large and sickle-shaped, typical to snail eaters, maxilla densely haired outwards (Fig. 20).

Pronotum with continuous margins, semi-elliptical (Figs 12, 13, 15) (conical in *A. subtriangula*, Fig. 14), with distinct punctures covering its dorsal surface (Figs 13–15) (only very superficial medially in *A. arenaria*, Fig. 12), rarely with a fine line in the middle.

Scutellar shield small in size, cordiform in shape and with distinct punctation.

Elytra regularly vaulted, densely and regularly punctured (Figs 16–19), without vestigial ribs, rarely with two very fine, longitudinal lines that are occasionally more visible (Fig. 21). Elytral epipleural ridge is incomplete; extends along the elytron but not to its subapical part (Figs 9–11). Punctures homogenously distributed, of similar size (Figs 18, 19) or varying in size, fine punctures intermixed with larger ones, predominantly in medial part (Figs 16, 17).

Legs strong with fine spines, femur of hind legs broad, tibia ends with an apical spine stretching out (Figs 5, 6). Tarsi with robust tarsal claws. Males with laterally expanding tarsomeres, females with cylindrical and more slender tarsomeres (e.g., as show in Figs. 4 and 5).

Phylogenetic position. *Ablattaria* is classified preliminarily as a sister lineage to *Phosphuga* Leach, 1817 and *Silpha* Linnaeus, 1758, based on 2.1 kB sequence of cytochrome oxidase subunits I and II (Dobler and Müller 2000, Sikes et al. 2005), sometimes treated also as a subgenus of *Silpha* (Sikes et al. 2005).

Key to the *Ablattaria* species

- 1 Elytra with medium-sized, distinct punctures of similar size (Figs 18, 19)...**2**
- Elytra with fine punctures, intermixed with larger ones (Figs 16, 17).....**3**
- 2 Pronotum semi-elliptical, margin regularly rounded anteriorly (Fig. 15), surface matt (Fig. 4). Widely distributed from western and southern Europe (incl. Spain) to southern Russia, western and northern part of Asia Minor and western Transcaucasia***A. laevigata***
- Pronotum almost conical in shape, margins anterolaterally constricted (Fig. 14, arrow), surface glossy (Fig. 3). Endemic to Spain.....***A. subtriangula***
- 3 Pronotum with only very superficial, very fine punctures medially on disc (which looks impunctate under lower magnification), much larger punctures more peripherally (Fig. 12). Elytra with few larger punctures (usually slightly finer than in *A. cribrata*), dispersed mostly toward the inner elytral margin (Fig. 16). Eastern part of Greece, Asia Minor, Middle East..... ***A. arenaria***
- Pronotum with evenly distributed, homogenous, distinct punctures on whole dorsal surface (Fig. 13). Elytra with middle-sized, more densely arranged larger punctures, very dense toward the inner elytral margin and here sometimes subquadrate in shape (Fig. 17). Caucasus, Transcaucasia, Iran, south-western Turkmenistan ***A. cribrata***

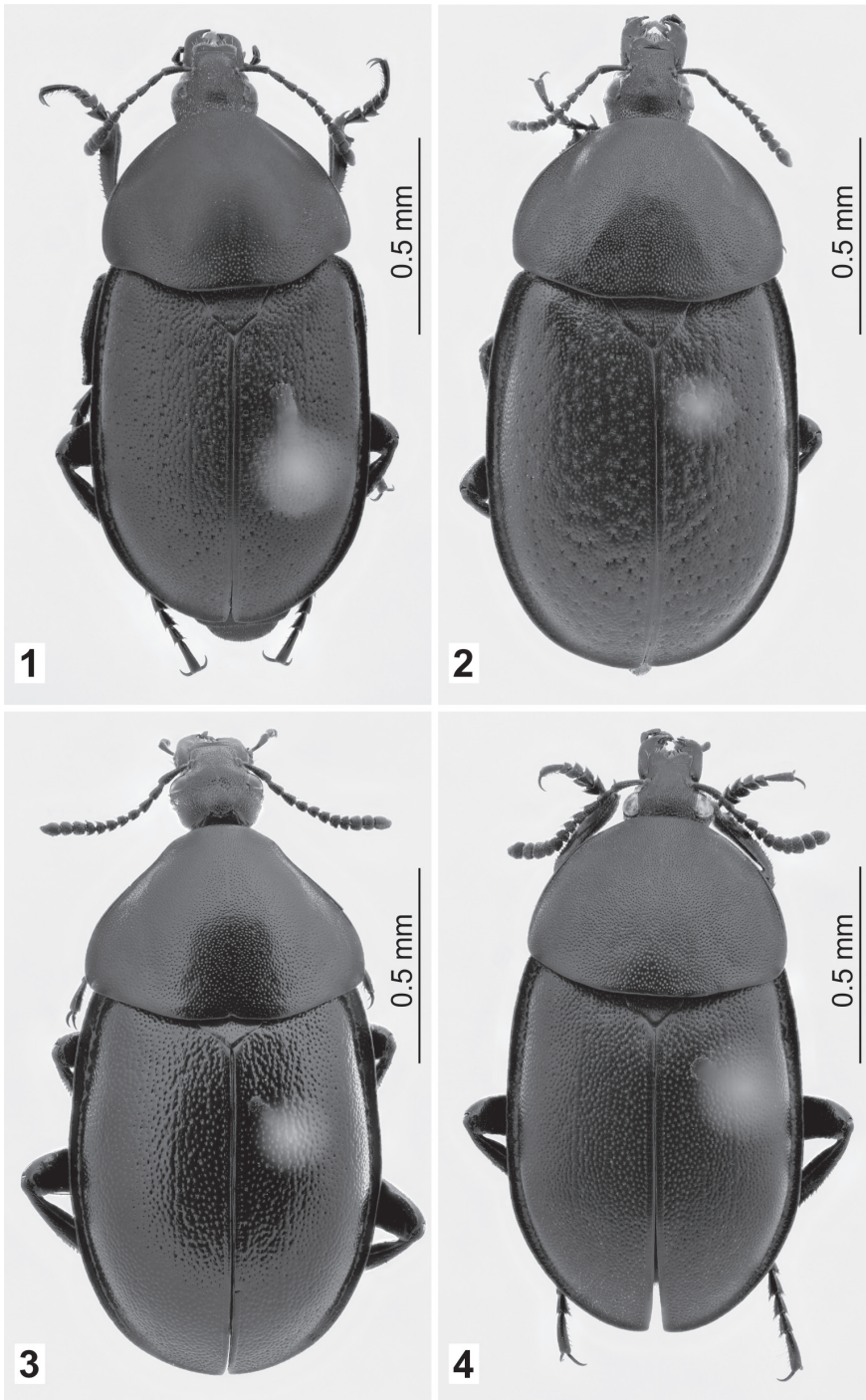
***Ablattaria arenaria* (Kraatz, 1876)**

Figs 1, 12, 16, 23, 24

Phosphuga arenaria Kraatz 1876: 368 (type locality: “Creta, Anatolien” [= Crete, Anatolia]).*Ablattaria arenaria* var. *punctigera* Reitter 1884: 75 (type locality: “Haifa” [ca. 32°49'N 34°59'E]) (as junior synonym of *A. arenaria* by Schawaller 1979: 6).*Ablattaria arenaria* var. *Alleoni* Portevin 1926: 24 (type locality not stated) (as junior synonym of *A. arenaria* by Schawaller 1979: 6).

Type material examined. Lectotype male of *Phosphuga arenaria* (here designated) (SDEI, general collection) (Fig. 23), pinned, labelled: “866 [hw, black frame] // coll. Kraatz [p] // Typus [p, red label] // arenaria / Kraatz Küst. XXX / Asia minor [hw, Kraatz’s handwriting, light yellow label with black frame] // coll. SDEI / (Müncheberg) / general coll. [p, light green label] // Lectotype / *Phosphuga arenaria* / Kraatz, 1876 / J. Qubaiová & J. Růžicka / des. 2014 [p, red label] // *Ablattaria* / arenaria (Kraatz, 1876) / J. Qubaiová & J. Růžicka / det. 2014 [p]”.

Lectotype male of *Ablattaria arenaria* var. *alleoni* (here designated) (MNHN, coll. Pic), pinned, labelled: “Adana [hw] // var. Alleoni / m. [hw, Portevin’s handwriting] // Type [p, red label with black frame] // Muséum Paris / Coll. M. Pic [p] // Lectotype / *Ablattaria arenaria* / var. *alleoni* Portevin, 1926 / J. Qubaiová & J.



Figures 1–4. Habitus in dorsal view: **1** *Ablattaria arenaria* (male, Israel: Mount Carmel) **2** *A. cribrata* (female, Azerbaijan: Zagulba Baglari) **3** *A. subtriangula* (female, Spain: Cameros) **4** *A. laevigata* (male, Hungary: Budapest).

Růžička / des. 2014 [p, red label] // *Ablattaria* / *arenaria* (Kraatz, 1876) / J. Qubaiová & J. Růžička / det. 2014 [p]”.

Lectotype male of *Ablattaria arenaria* var. *punctigera* (here designated) (HNHM) (Fig. 24), pinned, labelled: “Syrien / Haifa / Reitter [p, black frame] // coll. Reitter [p] // Holotypus [p, red letters] 1884 / *Ablattaria arenaria* / v. *punctigera* / Reitter [hw, thick red frame; subsequent label added probably by Z. Kaszab or V. Székessy (O. Merkl, pers. comm.)] // Lectotype / *Ablattaria arenaria* / var. *punctigera* / Reitter, 1884 / J. Qubaiová & J. Růžička / des. 2014 [p, red label] // *Ablattaria* / *arenaria* (Kraatz, 1876) / J. Qubaiová & J. Růžička det. 2014 [p]”. Paralectotypes: 1 male, 2 females (HNHM), pinned, with identical labels as lectotype except for “Paratypus [p, red letters] 1884 / *Ablattaria arenaria* / v. *punctigera* / Reitter [hw, thick red frame] // Paralectotype / *Ablattaria arenaria* / var. *punctigera* / Reitter, 1884 / J. Qubaiová & J. Růžička / des. 2014 [p, red label]”; 1 male (SMTD), pinned, with identical labels as previous paralectotypes except for “Staatl. Museum für / Tierkunde Dresden [p]”; 1 male (SDEI, coll. Heyden), pinned, labelled: “Haifa Syriae [p] // Simon. [p] // Syntypus [p, red label] // *arenaria* / v. *puncti-* / *gera m.* [hw, Reitter’s handwriting] // coll. SDEI / (Müncheberg) / coll. HEYDEN [p, modern light green label] // Paralectotype / *Ablattaria arenaria* / var. *punctigera* / Reitter, 1884 / J. Qubaiová & J. Růžička / des. 2014 [p, red label] // *Ablattaria* / *arenaria* (Kraatz, 1876) / J. Qubaiová & J. Růžička / det. 2014 [p]”; 1 female (MNHN, general collection), pinned, labelled: “Syrien / Haifa / Reitter [p] // *arenaria* / Kratz [hw] // *arenaria* / v. *punctigera* [hw, Reitter’s handwriting; yellow label] // 249 // MUSEUM PARIS / Coll. A. GROUVELLE 1917 [p] // Paralectotype / *Ablattaria arenaria* / var. *punctigera* / Reitter, 1884 / J. Qubaiová & J. Růžička / des. 2014 [p, red label] // *Ablattaria* / *arenaria* (Kraatz, 1876) / J. Qubaiová & J. Růžička / det. 2014 [p]”.

Additional material examined. 391 specimens, see Appendix 1.

Diagnostic description. Total body length 11–15 mm, body matt. Pronotum semi-elliptical, with only very superficial, very fine punctures medially on disc (which looks impunctate under lower magnification), much larger punctures more peripherally (Fig. 12). Elytra with fine punctures that are finer in size and less close together than in *A. cribrata* and *A. laevigata*, with few intermixed larger punctures dispersed mostly toward the inner elytral margin (Fig. 16).

Remarks. Subtle differences in punctuation of the scutellar shield and elytra, which differentiate the two varieties described by Reitter (1884) and Portevin (1926), fall within the intraspecific variability of *A. arenaria*. We confirm their status as junior subjective synonyms, as already proposed by Schawaller (1979).

Table 1. Seasonal activity of *Ablattaria* spp. (based on number of examined specimens per month). *A. subtriangula* is excluded, due to lack of material with precise seasonality data.

Species / month	1	2	3	4	5	6	7	8	9	10	11	12
<i>A. arenaria</i>	1	11	24	68	31	19	5	1	1	6	0	2
<i>A. cribrata</i>	0	0	1	6	13	13	7	5	4	0	0	2
<i>A. laevigata</i>	1	7	50	222	235	154	88	71	33	33	1	1

Biology. Seasonal activity of adults with a peak in March–May (Table 1).

Distribution. Greece (only Crete and Rhodes), Cyprus, Turkey, to the south of Iraq, Israel, Jordan, Lebanon, Syria and the south-west of Iran (Fig. 32).

Ablattaria cribrata (Ménétries, 1832)

Figs 2, 13, 17

Silpha cribrata Ménétries 1832: 168 (attributed to Faldermann) (type locality: “Derbent” [ca. 42°03'N, 48°18'E]).

Silpha cribrata Faldermann 1835: 221 (type locality: “Rossia” [= Russia]; preoccupied, not Ménétries 1832: 168 (junior primary homonym)).

Type material examined. Lectotype female of *Silpha cribrata* Ménétries (here designated) (MNHN, general collection) (Fig. 25), pinned, subteneral, labelled: “[female sign, hw] // Ménétr. [hw] // TYPE [p, modern red label] // Cribrata / Faldermann / Caucase [hw, probably Ménétries’s handwriting, yellow label with partial black frame] // MUSEUM PARIS / Coll. A. GROUVELLE 1915 [p] // Lectotype / *Silpha cribrata* / Ménétries, 1832 / J. Qubaiová & J. Růžicka / des. 2014 [p, red label] // *Ablattaria / cribrata* (Ménétries, 1832) / J. Qubaiová & J. Růžicka / det. 2014 [p]”. Paralectotypes: 1 male (ZMAS), pinned, labelled: “[golden-black quadrate label] // Caucasus [p, pink label] // *cribrata* / Fald. Russ. mer. [hw, double black frame] // Paralectotype / *Silpha cribrata* / Ménétries, 1832 / J. Qubaiová & J. Růžicka / des. 2014 [p, red label] // *Ablattaria / cribrata* (Ménétries, 1832) / J. Qubaiová & J. Růžicka / det. 2014 [p]”; 1 specimen (sex not identified) (ZMHB), pinned, badly damaged (only part of meso- and metathorax with right elytron and left meso- and metaleg present), labelled: “Type. [p] // *Elliposilpha / cribrata* / Caucas Ménétr [hw, Motschulsky’s handwriting] // Museum für Naturkunde / Humboldt-Univ. Berlin / (MNHUB) [p, modern label] // [large red label] // Paralectotype / *Silpha cribrata* / Ménétries, 1832 / J. Qubaiová & J. Růžicka / des. 2014 [p, red label] // *Ablattaria / cribrata* (Ménétries, 1832) / J. Qubaiová & J. Růžicka / det. 2014 [p]”.

Additional material examined. 95 specimens, see Appendix 1.

Diagnostic description. Total body length 11–16 mm, body matt. Pronotum semi-elliptical, with evenly distributed, homogenous, distinct punctures on whole dorsal surface (Fig. 13). Elytra more flattened; with middle-sized, more densely arranged larger punctures, very dense toward the inner elytral margin and here sometimes subquadrate in shape (Fig. 17).

Elytra more flattened. Large punctures are dispersed over the entire elytra with a higher concentration towards the inner elytral margin, which makes the elytra appear coarse. Smaller punctures are also present on both elytra, scutellum and pronotum, although they appear to be larger than those of *A. laevigata* but less frequent.

Biology. Seasonal activity of adults with a peak in May and June (Table 1).

Distribution. From the south of Russia (Dagestan, Chechnya), Georgia, Azerbaijan, Armenia, Iran to south-western Turkmenistan (Fig. 32).

***Ablattaria laevigata* (Fabricius, 1775)**

Figs 4–11, 15, 18, 21, 22, 26, 28–31

Silpha laevigata Fabricius 1775: 74 (with reference to Geoffroy (1762)) (type locality: Europe [“Habitat in sylvis Europae”]).

Silpha polita Sulzer 1776: 28 (with reference to Geoffroy (1762)) (type locality: “Schweiz” [Switzerland]; preoccupied, not Fueßli 1775: 6 (junior primary homonym)) (as junior synonym of *A. laevigata laevigata* by Reitter 1884: 75, confirmed by Schawaller 1979: 5).

Silpha gibba Brullé 1832: 162 (type locality: “Arcadie” [= Greece: Peloponnese Peninsula, Arcadia region]) (as junior synonym of *A. laevigata* by Nikolaev and Kozminykh 2002: 70).

Ablattaria laevigata gibba: Schawaller 1979: 5.

Ablattaria gibba var. *costulata* Portevin 1926: 25 (type locality: Istanbul [ca. 41°01'N, 28°57'E]) (as junior synonym of *A. laevigata gibba* by Schawaller 1979: 5).

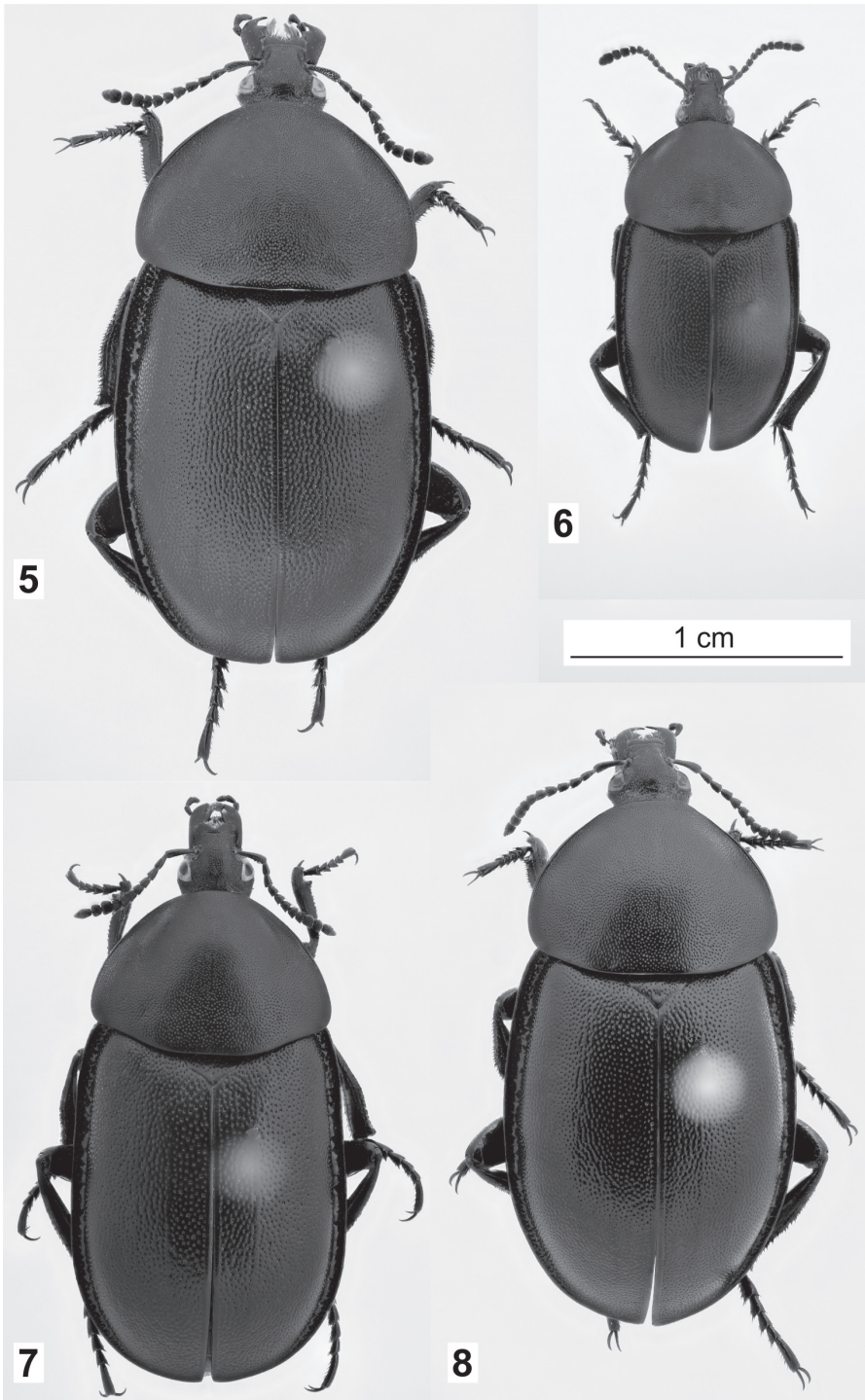
Ablattaria gibba var. *distinguenda* Portevin 1926: 25 (type locality not stated) (as junior synonym of *A. laevigata gibba* by Schawaller 1979: 5).

Ablattaria gibba var. *punctata* Portevin 1926: 26 (type locality not stated) (as junior synonym of *A. laevigata gibba* by Schawaller 1979: 5).

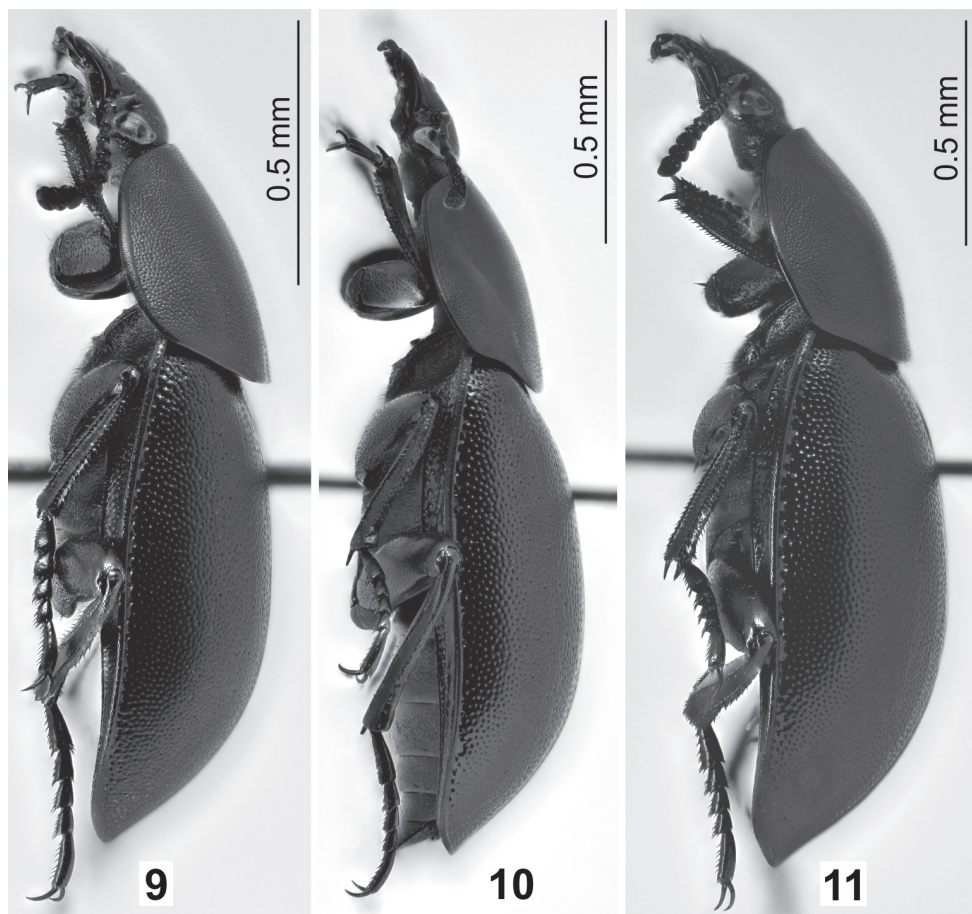
Ablattaria laevigata var. *meridionalis* Ganglbauer 1899: 191 (type locality: “Illirien, Dalmatien, Südungarn und Griechenland” [= Illiria, Dalmatia, southern Hungary and Greece], **syn. n.**

Ablattaria laevigata meridionalis: Schawaller 1979: 5.

Type material examined. Lectotype female of *Silpha laevigata* (here designated) (ZMUC, Collection of Ove Ramel Sehested and Niels Tønder Lund, the “Copenhagen collection” [= coll. S & TL]) (Figs 28–29), pinned, labelled: “Lectotype / *Silpha* / *laevigata* / Fabricius, 1775 / Jan Růžička des. 2012 [p, red label] // *Ablattaria* / *laevigata* / (Fabricius, 1775) / Jan Růžička det. 20 [p] 12 [hw] // zmuc / 00021148 [p, this and subsequent numbers below are associated with photodocumentation]”. Paralectotypes: 1 male (ZMUC, coll. S & TL), pinned, labelled “Paralectotype / *Silpha* / *laevigata* / Fabricius, 1775 / Jan Růžička des. 2012 [p, red label] // *Ablattaria* / *laevigata* / (Fabricius, 1775) / Jan Růžička det. 20 [p] 12 [hw] // zmuc / 00021149 [p]”; 1 male and 1 female (ZMUC, Fabricius personal collection, the “Kiel collection”), pinned, identical labels as previous except for “*laevigata* / *ta* [hw, Fabricius’s handwriting, label pinned in box left to the first specimen]” and “zmuc00021468 [p]” or “zmuc00021469 [p]”; 1 female of *Silpha tyrolensis* Laicharting, 1781 (ZMUC, “Kiel collection”) (Figs 30–31), pinned, labelled “Paralectotype / *Silpha* / *laevigata* / Fabricius, 1775 / Jan Růžička des. 2012 [p, red label] // *Silpha* / *tyrolensis* / Laicharting, 1781 / Jan Růžička det. 20 [p] 12 [hw] // zmuc00021467 [p]”; 1 male (BMNH, coll. Banks), pinned, labelled: “HOLO- / TYPE [p, modern round label with thick red margin] // *Silpha laevigata* [hw] / Fab. Entom. p. [p] 74. n / 10 [hw, double black frame] // Paralectotype / *Silpha* / *laevigata* / Fabricius, 1775 / Jan Růžička des. 2012 [p, red label] // *Ablattaria* / *laevigata* / (Fabricius, 1775) / Jan Růžička det. 20 [p] 12 [hw]”.



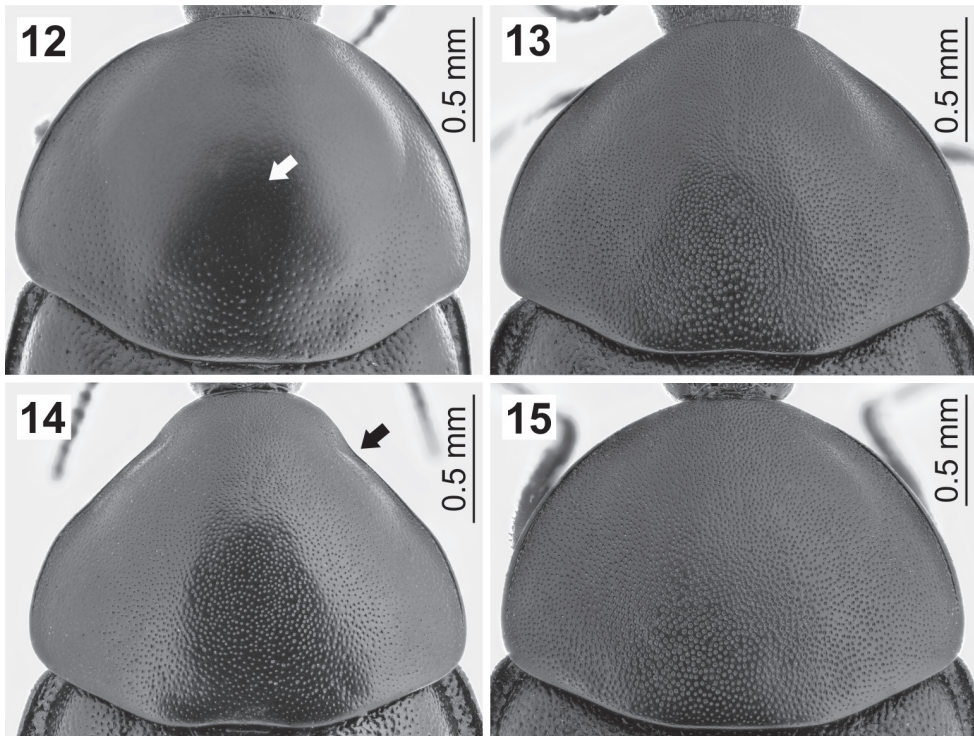
Figures 5–8. Habitus of *Ablattaria laevigata* in dorsal view: **5** female (Croatia: Pula) **6** male (Austria: Elenderwald) **7** female (Greece: Loutraki) **8** female (Italy: Pioppi).



Figures 9–11. Habitus of *Ablattaria laevigata* in dorsal view: **9** male (Hungary: Budapest) **10** female (Greece: Loutraki) **11** female (Italy: Pioppi).

Lectotype female of *Silpha gibba* (here designated) (MNHN, coll. generale), labelled: “Type / de Brullé [hw] // TYPE [p, red label] // MUSEUM PARIS / MORÉE / BRULLÉ 4187-33 [p] // Lectotype / *Silpha gibba* / Brullé, 1832 / J. Qubaiová & J. Růžička / des. 2014 [p, red label] // *Ablattaria* / *laevigata* (Fabricius, 1775) / J. Qubaiová & J. Růžička det. 2014 [p]”. Paralectotype: 1 male (MNHN, coll. generale), labelled: “*gibba* Br. [hw] // TYPE [p, red label] // MUSEUM PARIS / MORÉE / BRULLÉ 4187-33 [p] // Paralectotype *Silpha gibba* / Brullé, 1832 / J. Qubaiová & J. Růžička des. 2014 [p, red label] // *Ablattaria* / *laevigata* (Fabricius, 1775) / J. Qubaiová & J. Růžička det. 2014 [p]”.

Lectotype female of *Ablattaria gibba* var. *costulata* (here designated) (MNHN, coll. Pic), labelled “TURQUIE / Constantinople [= Istanbul] [p] // var. *costatula* [sic] / m. [hw, Portevin’s handwriting] // TYPE [p, red label] // Muséum Paris / Coll. M. Pic [p] // Lectotype / *Ablattaria gibba* / var. *costulata* / Portevin, 1926 / J. Qubaiová

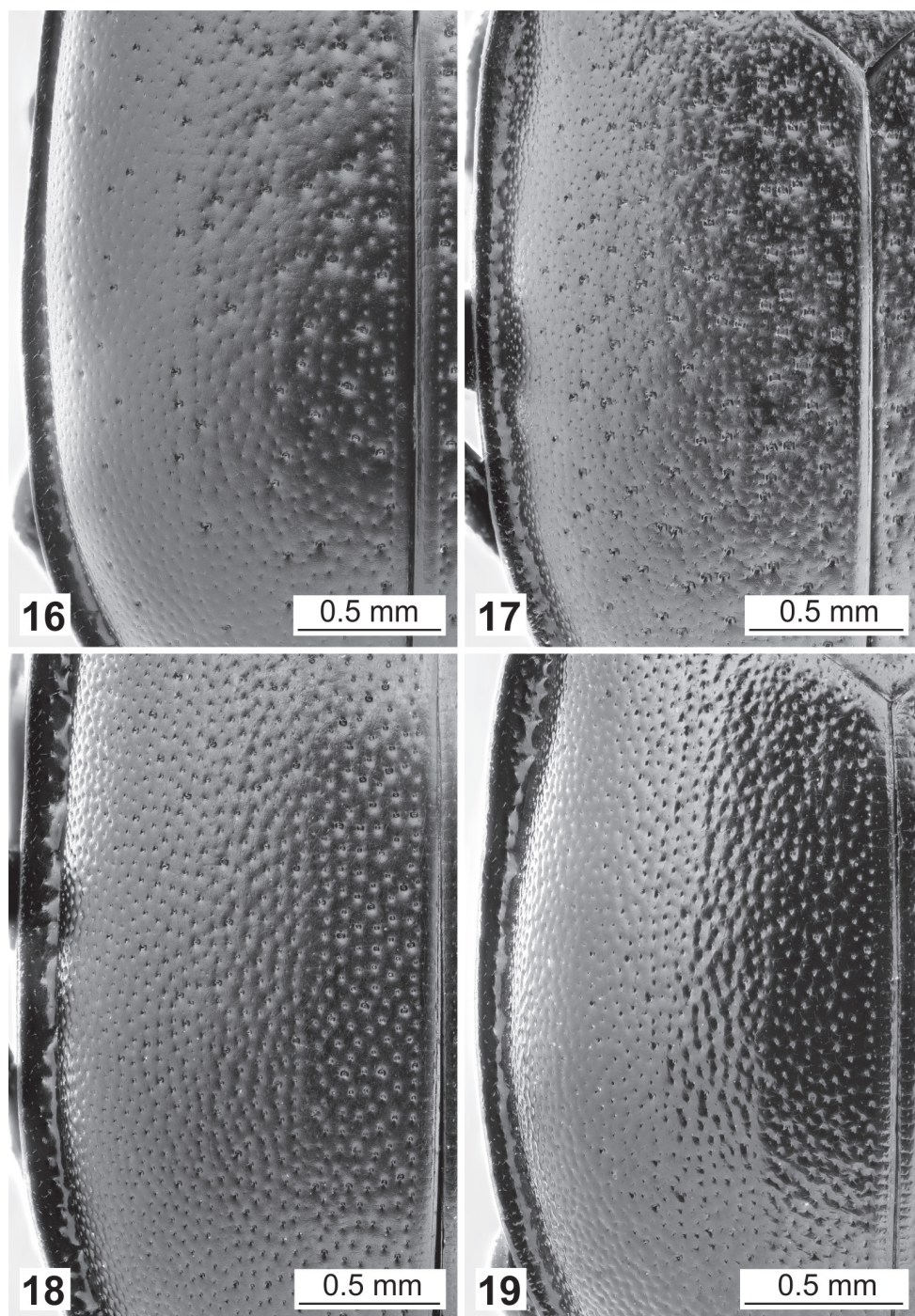


Figures 12–15. Pronotum in dorsal view: **12** *A. arenaria* (female, Iraq: Khanaqin) **13** *A. cribrata* (male, Russia: Dagestan) **14** *A. subtriangula* (male, Spain: Soto) **15** *A. laevigata* (female, Austria: Bisamberg).

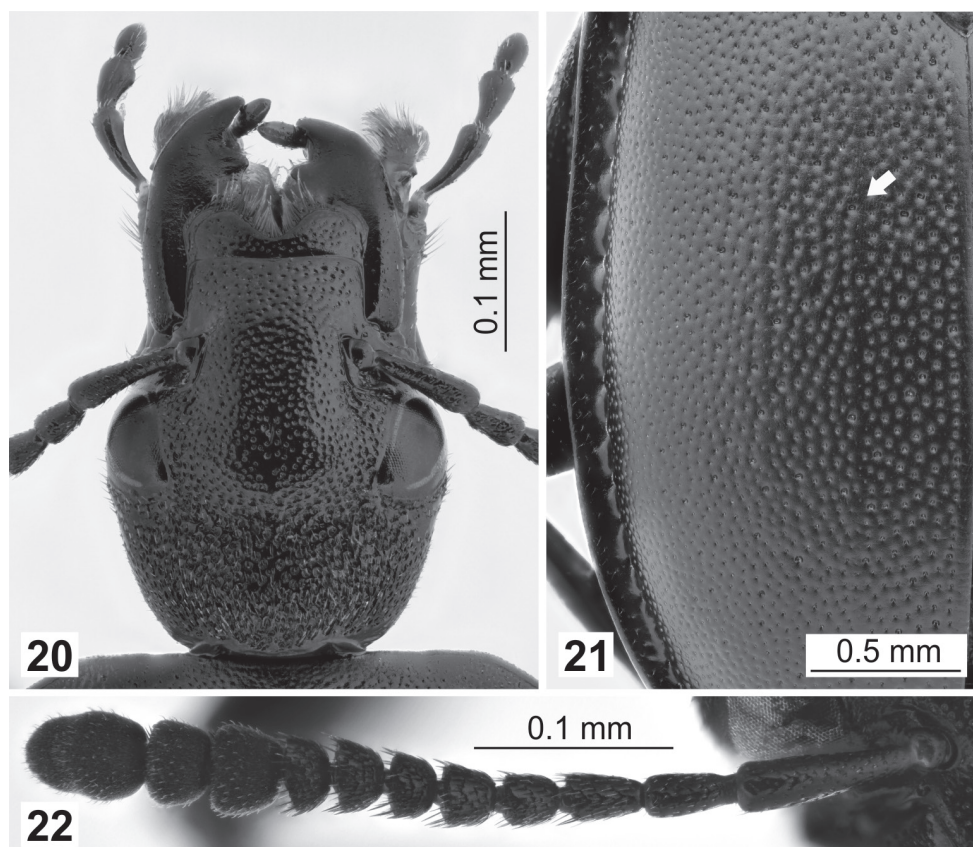
& J. Růžička / des. 2014 [p, red label] // *Ablattaria* / *laevigata* (Fabricius, 1775) / J. Qubaiová & J. Růžička / det. 2014 [p]”.

Lectotype male of *Ablattaria gibba* var. *distinguenda* (here designated) (MNHN, coll. Pic), pinned, labelled: “*laevigata* / var. [hw] // var. *distinguenda* / m. [hw, Portevin’s handwriting] // TYPE [p, red modern label] // Muséum Paris / Coll. M. Pic [p] // Lectotype / *Ablattaria gibba* / var. *distinguenda* / Portevin, 1926 / J. Qubaiová & J. Růžička / des. 2014 [p, red label] // *Ablattaria* / *laevigata* (Fabricius, 1775) / J. Qubaiová & J. Růžička det. 2014 [p]”.

Lectotype male of *Ablattaria gibba* var. *punctata* (here designated) (MNHN, coll. Marmottan) (Fig. 26), pinned, labelled: “Turquie [hw] // TYPE [p, red modern label] // var. *punctata* / m. [hw, probably Portevin’s handwriting] // Muséum Paris / 1914 / Coll. H. Marmottan [p, modern label] // Lectotype / *Ablattaria gibba* / var. *punctata* / Portevin, 1926 / J. Qubaiová & J. Růžička / des. 2014 [p, red label] // *Ablattaria* / *laevigata* (Fabricius, 1775) / J. Qubaiová & J. Růžička / det. 2014 [p]”. Paralectotype: 1 male, labelled: “MUSEUM PARIS [p] / Turquie / Jejeune 1881 [hw] // TYPE [p, red label] // Paralectotype / *Ablattaria gibba* var. *punctata* / Portevin, 1926 / J. Qubaiová & J. Růžička des. 2014 [p, red label] // *Ablattaria* / *laevigata* (Fabricius, 1775) / J. Qubaiová & J. Růžička det. 2014 [p]”.



Figures 16–19. Left elytron in dorsal view: **16** *A. arenaria* (female, Iraq: Khanaqin) **17** *A. cribrata* (male, Russia: Dagestan) **18** *A. laevigata* (female, Austria: Bisamberg) **19** *A. subtriangula* (male, Spain: Soto).

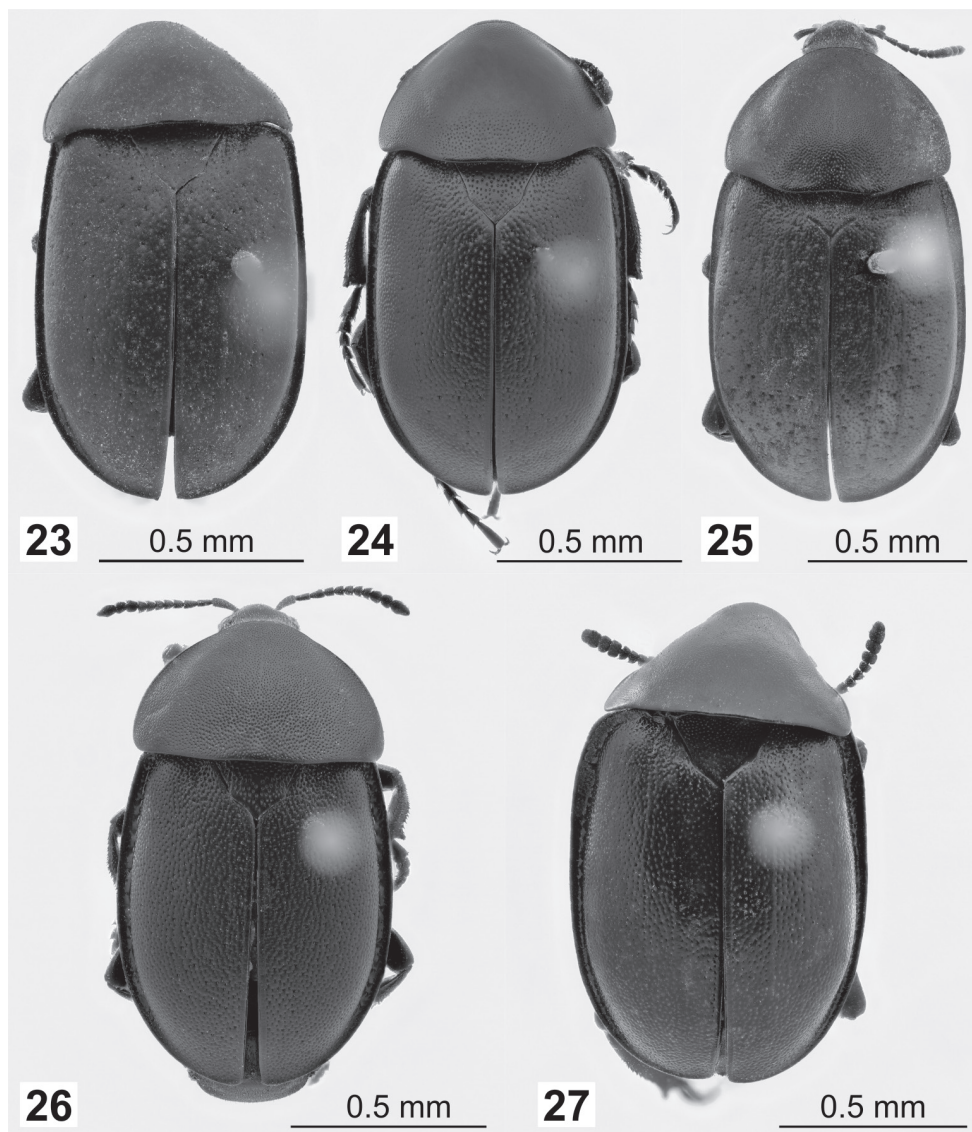


Figures 20–22. Morphological details in dorsal view: **20** *A. subtriangula*, elongated head (female, Spain: Cameros) **21** *A. laevigata*, variable left elytron with traces of two lines (male, Greece: Alistrati) **22** *A. laevigata*, right antenna (female, Hungary: Budapest).

Additional material examined. 2206 specimens, see Appendix 1.

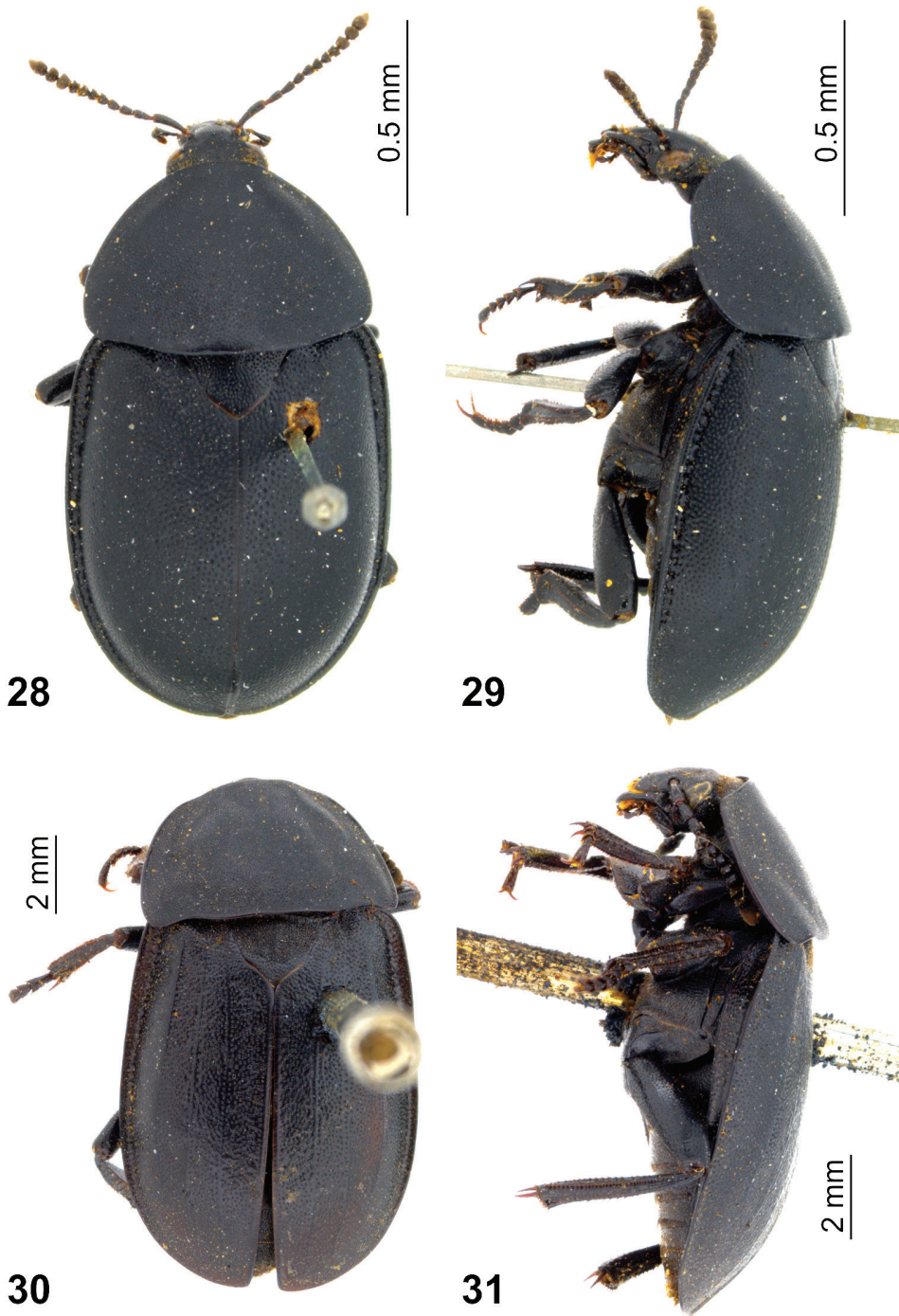
Diagnostic description. Total body length 9–19 mm, body matt. Pronotum semi-elliptical, with evenly distributed, homogenous, distinct punctures on whole dorsal surface (Fig. 15). Elytra regularly rounded (more in larger specimens – compare Figs 9–11); with densely and evenly distributed medium-sized, distinct punctures of similar size (Fig. 18), rarely with two very fine, longitudinal lines that are occasionally more visible (Fig. 21). Rarely, individual larger punctures are intermixed, but never in such regular pattern as in *A. arenaria* and *A. cribrata*.

Remarks. Both Fabricius (1775) and Sulzer (1776) refer in their descriptions of *S. laevigata* and *S. polita* to Geoffroy (1762: 122, species #8). However, the book of Geoffroy is not consistently binominal and Opinion 1754 (ICZN 1994) placed it on the Official List of Works in Zoological Nomenclature with only some generic names available. Accordingly, the author of *S. laevigata* is Fabricius and the author of *S. polita* is Sulzer.



Figures 23–27. 23–26 Lectotypes of *Ablattaria* spp. in dorsal view: **23** *Phosphuga arenaria* Kraatz **24** *Ablattaria arenaria* var. *punctigera* Reitter **25** *Silpha cribrata* Ménétries **26** *Ablattaria gibba* var. *punctata* Portevin **27** *Ablattaria subtriangula* Reitter, paralectotype.

In the syntype series of *Silpha laevigata* from ZMUC and BMNH, consistent with current understanding of *Ablattaria laevigata*, we also found intermixed a single specimen of *Silpha tyrolensis* Laicharting, 1781 (in ZMUC, “Kiel collection”; see above for details). This syntype specimen is here considered a paralectotype. We have designated a female from ZMUC, the “Copenhagen collection”, as the lectotype to fix this name as currently used.



Figures 28–31. Lectotype and paralectotype of *Silpha laevigata* Fabricius: **28, 29** lectotype (female) **30, 31** paralectotype (female, *Silpha tyrolensis*; see text) **28, 30** dorsal view **29, 31** lateral view. (Photo K.P. Puliafico).

Ablattaria laevigata is a widely distributed species with regional variation in size and shape between populations (see Geometric morphometrics section below), and also with some variability in punctuation of elytra, sometimes with intermixed larger punctures or an impunctate pair of longitudinal lines present on elytra.

There are no distinct differences in the description of *Silpha polita* to separate it from *A. laevigata*, and we believe that this taxon is correctly considered as a junior subjective synonym of *A. laevigata* by Reitter (1884) and Schawaller (1979). In our opinion, the variation in body size, proportions and surface sculpturation which led to the description of *Silpha gibba* and several varieties of Ganglbauer (1899) and Portevin (1926) fall within the infrasubspecific variation of *A. laevigata*. We agree with Schawaller (1979), who considered *Ablattaria gibba* var. *costulata*, *Ablattaria gibba* var. *distinguenda* and *Ablattaria gibba* var. *punctata* as junior subjective synonyms of *A. laevigata*. Further, we consider *Ablattaria laevigata* var. *meridionalis* of Ganglbauer (1899) as a junior subjective synonym of *A. laevigata*.

Biology. Seasonal activity of adults with a peak in April–June (Table 1).

Distribution. Most of Europe; from the west (Spain to United Kingdom), through all of central and southern Europe, reaching to the east and north of Turkey; Ukraine, southern Russia, Georgia to Armenia (Fig. 32).

Ablattaria subtriangula Reitter, 1905

Figs 3, 14, 19, 20, 27

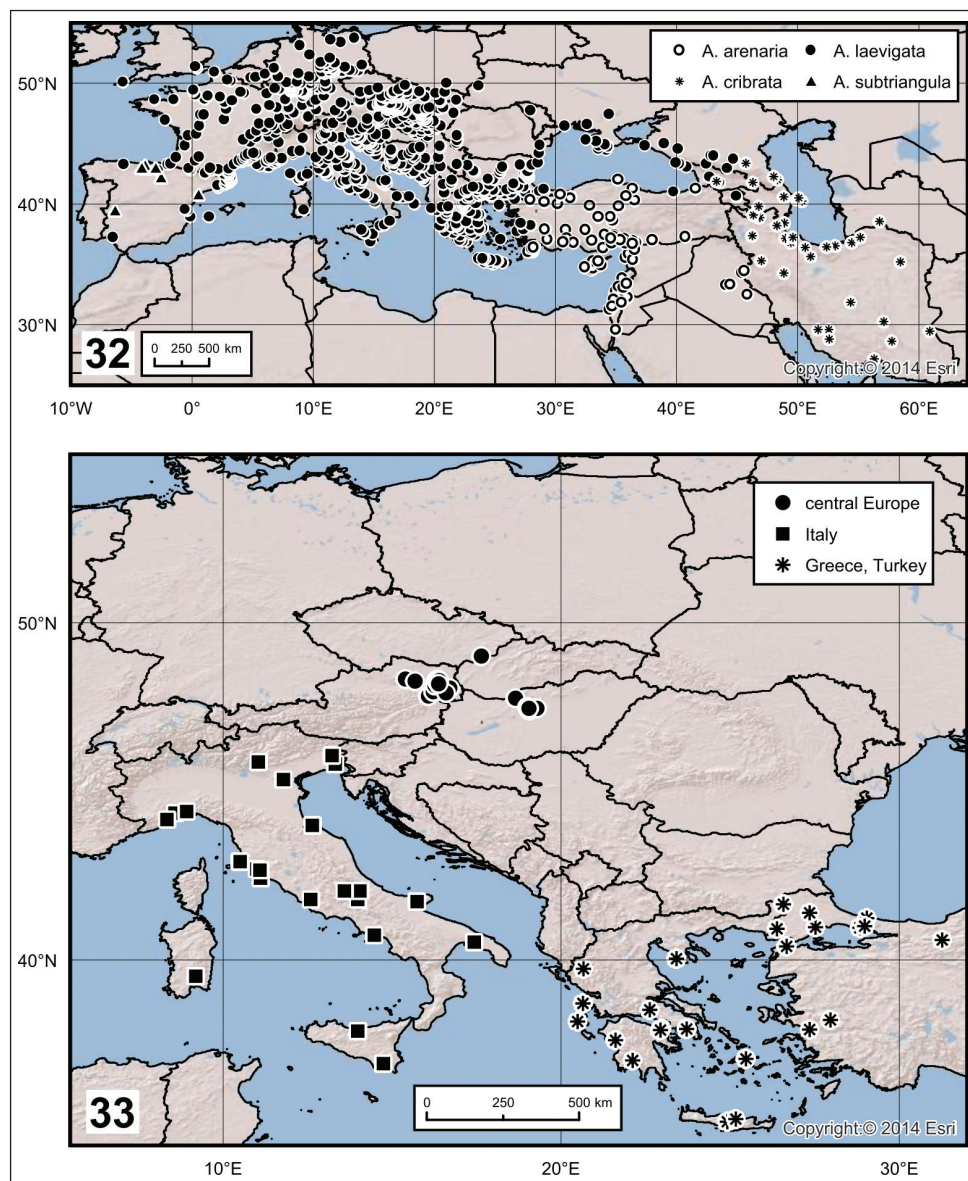
Ablattaria subtriangula Reitter 1905: 90 (type locality: “Spanien, Sierra de Guadeloupe [= Sierra de Villuercas mountain range], Cáceres [ca. 39°29'N, 06°22'W]).

Type material examined. Lectotype male (here designated) (MNHN, coll. Pic), pinned, labelled: “SIERRA DE GUADALUPE / (CÁCERES) / MAI 1904 / G. SCHRAMM [p] // 71 [hw] // type [hw] // Ablattaria / laevigata / v. subtriangula Rtt. / (Reitt. vid.) [hw, probably Portevin’s handwriting] // A. subtriangula / Reitt. [hw, Pic’s handwriting] // Lectotype / Ablattaria subtriangula / Reitter, 1905 / J. Qubaiová & J. Růžicka / des. 2014 [p, red label]. Paralectotype male (MNHN, coll. Marmottan) (Fig. 27), pinned, labelled: “SIERRA DE GUADALUPE / (CÁCERES) / MAI 1904 / G. SCHRAMM [p] // TYPE [p, red modern label] // Subtriangula / Reitt. / (Reynosa) [hw] // Muséum Paris / 1914 / Coll. H. Marmottan [p, modern label] // Paralectotype / Ablattaria subtriangula / Reitter, 1905 / J. Qubaiová & J. Růžicka des. 2014 [p, red label]”.

Additional material examined. 18 specimens, see Appendix 1.

Diagnostic description. Total body length 12–16 mm, body glossy, black (Figs 3, 14, 19). Pronotum almost conical in shape, margins anterolaterally constricted (Fig. 14); with evenly distributed, homogenous, distinct punctures on whole dorsal surface (Fig. 14). Elytra regularly rounded; with densely and evenly distributed medium-sized, distinct punctures of similar size (Fig. 19).

Remarks. Additional male specimen (MNHN, coll. Marmottan), pinned, labelled: “Soto [hw] // TYPE [p, red modern label] // S. subtriangula / Reitt. / Co-type



Figures 32–33. 32 Distribution of *Ablattaria* spp. in Western Palearctic region 33 Delimitation and distribution of samples of *Ablattaria laevigata* used in geometric morphometrics.

[hw, same handwriting as on identification label of lectotype specimen]” is not considered here as paralectotype, because its locality is not consistent with precise information provided in the original description by Reitter (1905). “Soto” is vague, as there seem to be more than 10 localities with this name across Spain (<http://en.wikipedia.org/wiki/Soto>), none of which are in either Cáceres Province or elsewhere in the Extremadura autonomous community.

Biology. Regarding the seasonal activity of *A. subtriangula*, in the limited adult material examined, most specimens were collected between April and June.

Distribution. Endemic to continental Spain (Fig. 32).

Geometric morphometrics

Relative warps (RWs) of both males and females of the four *Ablattaria* taxa were calculated and plotted on an axis system. The first RW (RW1) axis represented 44.25% of shape variability and the second axis (RW2) accounted for 20.22%. Subsequently, discriminant analysis (DA) was applied between the sexes on the first 30 axes representing 99.94% of variability. The results indicated shape sexual dimorphism (Hotelling's test: 444.2, F : 14.071, $p < 0.0001$). Specimens correctly classified to their means showed a percentage of 82.59.

Male groups of the four taxa were tested independently and RW1 accounted for 44.74% of the total variance whereas RW2 accounted for 20.43%. A higher 46.98% of variability was explained by the RW1 axis in females and 18.73% by RW2. Both scatter plots of the two first RWs for male and female *Ablattaria* displayed a high overlap between the groups of the different taxa. The thin-plate spline (TPS) transformation grids (not included in the article) indicated some shape differences between the taxa especially in *A. arenaria*; less rounded or curved pronotal margins posteriorly and more parallel elytra. In *A. laevigata* the posterior pronotal margins appeared more rounded (semi-elliptical) and the elytra were more robust than the other taxa particularly in the females, whereas the pronotal shape of *A. subtriangula* was more narrowed to the front (conical).

Multivariate analysis of variance (MANOVA) was performed on the four groups. The results indicated significant shape variations, but the separations between the groups were weak, given that the number of *A. subtriangula* specimens was very low compared to those of other groups. Hence, the analysis was repeated without the *A. subtriangula* samples to obtain a clearer separation.

Shape diversity of both pronotum and elytra between the three taxa was indicated by MANOVA. Male groups revealed significant shape differences ($F = 32.93$; Wilk's lambda = 0.0784; $DF = 40/512$; $p < 0.00001$). Female groups demonstrated higher body shape variability ($F = 24.93$; Wilk's lambda = 0.1252; $DF = 40/546$; $p < 0.00001$).

Two individual canonical variate analyses (CVA) for males and females (separately) were performed to obtain separation of the four groups on the first 20 axes of the RW scores matrix. These axes covered 99.81% of the shape variation between male groups and 99.82% between female groups. Results indicated no overlap between *A. arenaria* and either *A. laevigata* or *A. cribrata* in males and only with one specimen in females (Fig. 34). The overlap between *A. laevigata* and *A. cribrata* was minimal and more evident in males than in females.

The jackknifed (or leave-one-out) values of the confusion matrix in *A. laevigata* males illustrated a correct mean classification of 131 from 144 specimens (13

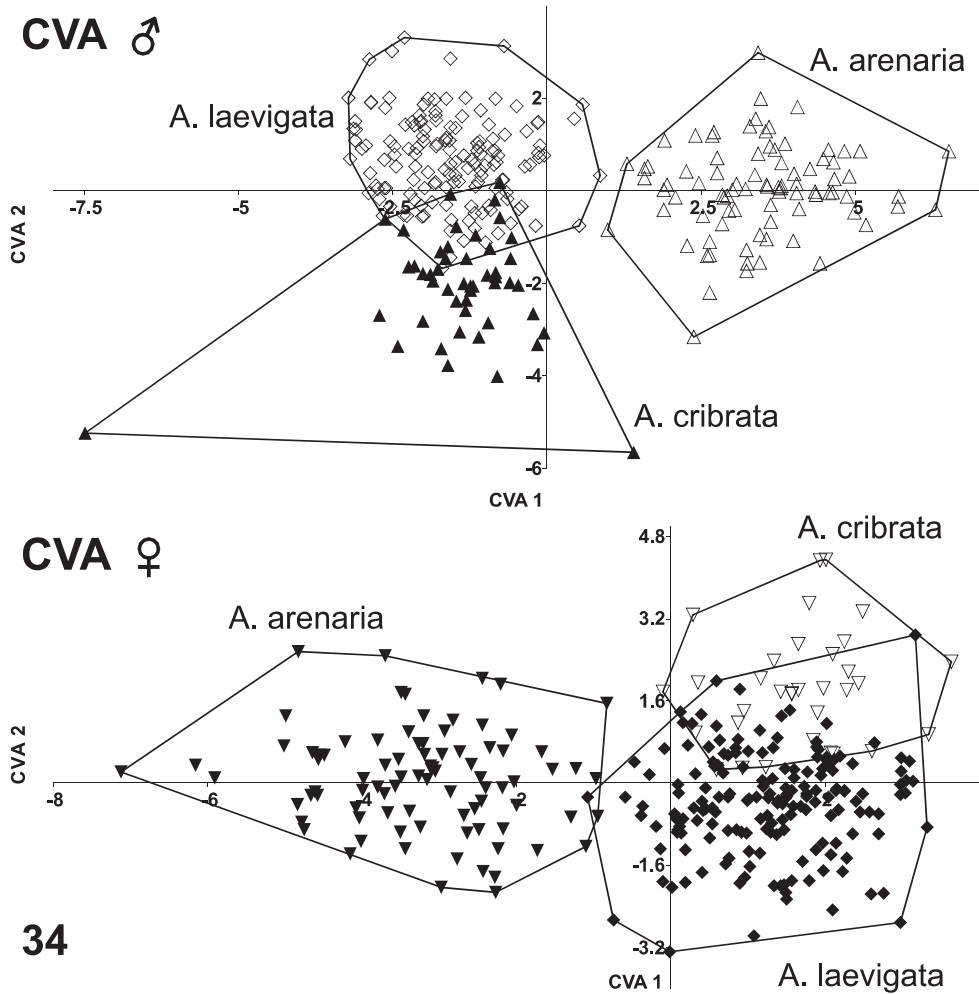


Figure 34. Canonical variate analysis (CVA) of male (above) and female (below) body shape changes in *Ablattaria*.

showed means closer to that of *A. cribrata*). In *A. arenaria*, this was the case for 84 of 85 (1 was closer in its mean value to that of *A. cribrata*). *A. cribrata* had 42 accurate classifications of 49 in total (7 specimens were closer to *A. laevigata*). In the females, 150 specimens of 175 in *A. laevigata* were correctly classified (24 were closer to *A. cribrata* and 1 to *A. arenaria*). In *A. arenaria*, 82 of 87 were correctly classified (4 were closer to *A. laevigata* and 1 to *A. cribrata*). In *A. cribrata*, 25 of 33 were clearly classified (8 were closer to *A. laevigata*). These findings strongly indicate the shape variations of these taxa, and thus support the hypothesis that all three taxa constitute separate species.

Table 2. Multivariate regressions of shape onto size for each *Ablattaria* species and sex separately.

Species	<i>A. laevigata</i>			<i>A. arenaria</i>		
Sex	Explained variance	Goodall's <i>F</i> -test		Explained variance	Goodall's <i>F</i> -test	
		<i>F</i> -value	<i>p</i> -value		<i>F</i> -value	<i>p</i> -value
Males	1.61%	2.33	$p < 0.0001$	1.70%	1.45	$p < 0.01$
Females	0.91%	1.59	$p < 0.0001$	1.60%	1.34	$p < 0.1$
Species	<i>A. cribrata</i>			<i>A. subtriangula</i>		
Sex	Explained variance	Goodall's <i>F</i> -test		Explained variance	Goodall's <i>F</i> -test	
		<i>F</i> -value	<i>p</i> -value		<i>F</i> -value	<i>p</i> -value
Males	1.30%	0.61	$p = 0.9994$	51.03%	3.13	$p < 0.0001$
Females	7.60%	2.55	$p < 0.0001$	4.79%	0.3	$p = 1.00$

Nevertheless, both males and females (independently) of *A. subtriangula* were tested and compared with one group formed by the three other taxa to ensure its independence by discriminant analysis (DA). Results indicated significant shape variability in males (Hotelling's test: 20.598, F : 5.0946, $p < 0.001$) with 86.93% correct classification of specimens to their means. For females (Hotelling's test: 40.282, F : 10.465, $p < 0.0001$), specimens correctly classified were 85.48%. As a result, *A. subtriangula* indicates its division from the other taxa and therefore may also be considered as a separate species.

To examine allometry effects, the influence of size on body shape was tested first on the four taxa by separating them into groups based on taxon and sex. The multivariate regressions of shape onto size were performed one group at a time. Results showed significant relationship in both sexes of *A. laevigata*, males of *A. arenaria* and *A. subtriangula*, and females of *A. cribrata*. The results were insignificant for female *A. arenaria*, *A. subtriangula* and male *A. cribrata* (Table 2).

Since allometry was significant in most taxa groups, size correction was provided by multivariate analysis of covariance (MANCOVA). This tool indicates if variation in shape is a result of size difference alone. MANCOVA was applied on male and female groups of the four taxa. Results suggested a significant interaction between body shape and body size (Table 3). Permutation tests with 1000 random permutations demonstrated a p -value of 0.00021 in males and 0.00087 in females. Considering that the percentage explained by size was 16.09% in males and 11.14% in females, some effect on the body shape variability between the taxa can be observed.

Given that *A. laevigata* has such a wide ranging geographical distribution, it was interesting to examine the species' body changes in various populations. Three different populations were studied: one from Greece and Turkey (Gr. & Tr.), a population from Italy (It.), and a population from Central Europe (CE) (geographic origins of examined specimens are summarized in Fig. 33). Relative warps were calculated in male and female populations separately and plotted on an axis system. The RW1 axis of males corresponded to 39.02% and RW2 to 18.99% of shape variability. In females, RW1 indicated 43.87% of shape variation and RW2 indicated 20.91%. TPS transformation

Table 3. Multivariate analysis of covariance (MANCOVA) for the four *Ablattaria* taxa.

Sex	Explained variance	Goodall's <i>F</i> -test	
		<i>F</i> -value	<i>p</i> -value
Males	16.09%	6.57	$p < 0.00001$
Females	11.14%	4.61	$p < 0.00001$

Table 4. Canonical variate analysis confusion matrix of male *A. laevigata* populations demonstrating the classification of specimens to the groups depending on their proximity to the various means.

<i>A. laevigata</i> populations, males	Pop. (Gr. & Tr.)	Pop. (It.)	Pop. (CE)	Total
Pop. (Gr. & Tr.)	15	4	7	26
Pop. (It.)	3	35	1	39
Pop. (CE)	7	0	28	35

Table 5. Canonical variate analysis confusion matrix of female *A. laevigata* populations.

<i>A. laevigata</i> populations, females	Pop. (Gr. & Tr.)	Pop. (It.)	Pop. (CE)	Total
Pop. (Gr. & Tr.)	27	1	9	37
Pop. (It.)	0	30	3	33
Pop. (CE)	10	2	21	33

grids (not included in the article) showed little shape variability; the elytra appeared, in general, more parallel in the Greek and Turkish populations. Populations from Italy had a more arched elytra and the pronotum was slightly broader (Figs 7 and 8).

MANOVA was performed subsequently. Male populations revealed significant shape dissimilarity ($F = 10.35$; Wilk's lambda = 0.121; $DF = 30/166$; $p < 0.00001$). Shape variability was found to be also significant in the female populations ($F = 8.337$; Wilk's lambda = 0.166; $DF = 30/172$; $p < 0.00001$). Canonical variate analysis on the first 15 axes was performed and represented 99.54% of the shape variation in males and 99.68% in females. Results indicated overlap between all groups (Fig. 35). The jackknifed values of the confusion matrix for both sexes are presented in Tables 4 and 5. The most obvious separation was seen in the Italian population, which showed incorrect classification of only 7 specimens in the two sexes taken together of a total 72 specimens. The Central European population showed higher variation in the male than was that in the female populations from Greece and Turkey.

In order to determine whether allometry played a role in this categorization, and even though the sample was too small, regression results indicated significant relationship between size and shape in both sexes (Table 6). Despite the fact that size explained a low percentage of the body shape (11.49% in males and 9.91% in females), its effect cannot be denied and the influence of allometry can be noted.

The linear size (body length of pronotum and elytra) of both sexes was measured and plotted in a simple boxplot (Fig. 36). In general, females were larger than males. Even though body length differences did not appear to be very marked, the smallest

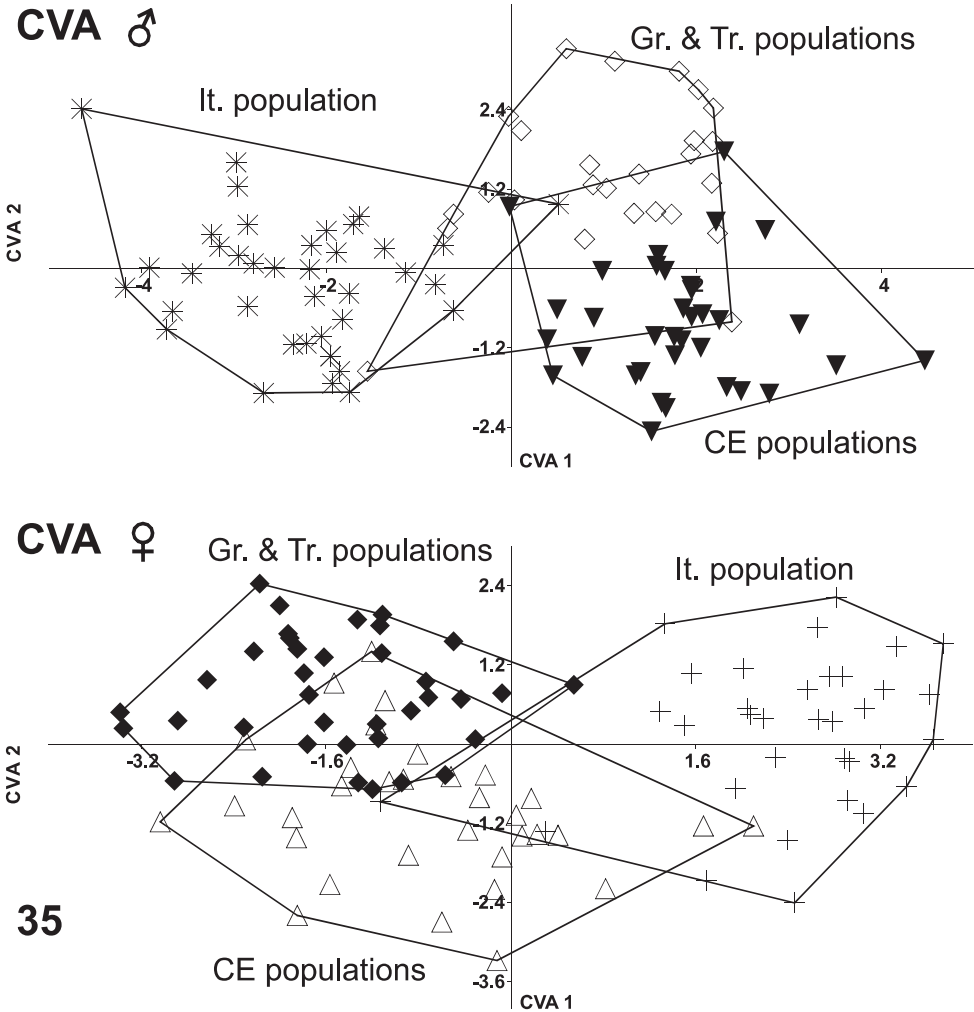


Figure 35. Canonical variate analysis (CVA) of male (above) and female (below) body shape changes in selected populations of *Ablattaria laevigata*; Gr. & Tr. (Greece & Turkey), It. (Italy), CE (Central Europe).

Table 6. Multivariate regression of log centroid size on shape for both sexes of the three populations.

Sex	Explained variance	Goodall's <i>F</i> -test		
		<i>F</i> -value	DF	<i>p</i> -value
Males	11.49%	4.16	318/10176	<i>p</i> < 0.00001
Females	9.91%	3.63	318/10494	<i>p</i> < 0.00001

of the three groups was the population from Central Europe, particularly the males, whereas the females were only slightly smaller than the Greek and Turkish females. The largest specimens measured here were those from Italy.

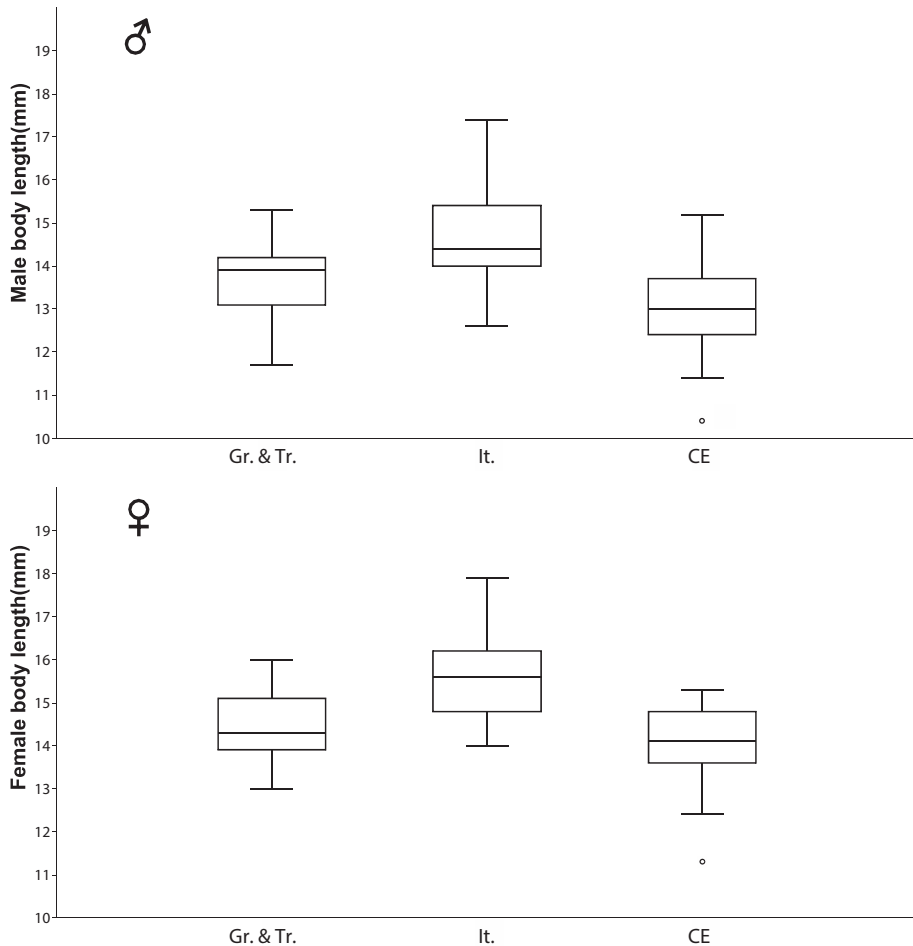


Figure 36. Boxplots of male (above) and female (below) body length in selected populations of *Ablattaria laevigata*; Gr. & Tr. (Greece & Turkey), It. (Italy), CE (Central Europe).

Discussion

Geometric morphometric techniques were applied to this genus for the first time. Based on the results we obtained and the observed morphological traits, *A. cribrata* can be considered a separate species. This agrees with Schawaller (1979) but not with Nikolaev and Kozminykh (2002), who treated *A. cribrata* as a subspecies of *A. laevigata*.

A. laevigata has a vast distribution over the Western Palearctic region. Hence, both its shape and size vary greatly across its range. Applying the geometric morphometric techniques to various populations indeed confirmed these shape variations (see above). These results, together with further morphological examination of other populations, revealed that beetles from the Mediterranean region (specimens from

Croatia, Italy, Greece and Turkey) tend to be larger in body size than those from Central Europe.

The geographical separation of the identified species can be observed most particularly in *A. subtriangula*, which is endemic to Spain and is syntopic only with *A. laevigata*. *A. subtriangula* is absent from the Balearic Islands, where only *A. laevigata* is found. This is in agreement with Piloña et al. (2002). *A. cribrata* is widespread throughout Iran (in contrast to data in Portevin (1926) and Schawaller (1979)) and is separated from *A. arenaria* at the eastern Iraqi – western Iranian borders, where only one specimen of *A. arenaria* has been noted (although two specimens of *A. arenaria* were recorded from Iran: Huzestan prov. by Růžicka and Schneider (2002)). *A. laevigata* overlaps in its occurrence with *A. arenaria* mainly in eastern and more sparsely in northern Turkey. *A. arenaria* does not appear to cross into continental Europe. *A. laevigata* and *A. cribrata* partially overlap in Georgia, Armenia and southern Russia (specifically in Chechnya). The genus does not seem to extend beyond southern Russia and Iran to Kazakhstan or Afghanistan. It is rather scarce in Turkmenistan, where it is known only in the southwestern part (as also mentioned by Nikolaev and Kozminykh (2002)). Moreover, there are no known records of *Ablattaria* from northern Africa or from the Arabian Peninsula.

Schawaller (1979) stated that the genus only rarely occurs at higher elevations. We examined about 52 specimens from localities above 2000 m (140 specimens from localities above 1000 m). Some of the records of *A. laevigata* from high elevations were from Italy: Molise Reg., Majella Mt. at 2793 m. Also, *A. arenaria* was cited from Syria: Nur Mts. (Amanus) at 2240 m, and Israel: Mount Hermon at 2000 m. Schawaller (1979) also speculated whether the genus could be found in the higher Pyrenees and Alps. Two specimens of *A. laevigata* were recorded from the French side of the Pyrenees (Languedoc-Roussillon Reg.: Lac d'Estom and Arles sur Tech), and two specimens from the Spanish side (Catalonia: La Jonquera and Espot). Six specimens of *A. laevigata* were recorded from localities higher than 1000 m in the Alps, the highest being from Provence-Alpes-Côte d'Azur Reg.: Vaucluse Dept., Mont Ventoux, at an altitude of ca. 1900 m.

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Appendix I

List of non-type material of *Ablattaria* spp.

Ablattaria arenaria

Cyprus: Akrotiri forest, 16.iii.1936, G. A. Mavromoustakis leg., 1 ♂ (BMNH); **Dhekelia** (British Overseas Territory): at light, 7.x.1957, M. Connelly, 1 ♀ (BMNH); same locality, 21.iv.1958, M. Connelly leg., 1 ♀ (BMNH); same locality, iii.1986, G. Sama leg., 1 ♂ (SMNS); **Kyrenia Dist.:** Asomatos, 21.x.1943, G. A. Mavromoustakis leg., 1 ♂, 1 ♀ (BMNH); Karavas, 1.-4.v.[19]69, J. Kohousek leg., 1 ♂, 1 ♀ (JRUC); same locality, without date, A. Pfeffer leg., 1 ♂ (NMPC); Kyrenia (Mts.), without date, E. Hanzlikova leg., 2 ♂ (NMPC); **Larnaca Dist.:** Larnaca, 6.iv.[19]81, Cl. Besuchet leg., 1 ♂, 1 ♀ (MHNG); same locality, 1896, Hesse leg., 1 ♂, 2 ♀ (SMNS); **Limassol Dist.:** Limassol, 15.v.1918, G. A. Mavromoustakis leg., 1 ♂ (BMNH); same locality, 24.x.1929, G. A. Mavromoustakis leg., 1 ♂ (BMNH); same locality, 1930, Mavromoustakis leg., general coll., 1 ♀ (SDEI); same locality, ii.1933, G. A. Mavromoustakis leg., 2 ♂ (BMNH); same locality, 24.iv.-15.v.1977, R. Köstlin leg., 1 ♂ (SMNS); same locality, coll. W. H. Muche, 1 ♂ (SMTD); Yermasoyia Hills, 15.ii.1952, G. A. Mavromoustakis leg., 1 ♀ (BMNH); Yermasoyia river, 10.ii.1947, G. A. Mavromoustakis leg., 1 ♀ (BMNH); **Paphos Dist.:** Kanaviou, 14.iv.1992, D. & T. Osten leg., 1 ♀ (SMNS); Paphos, 21.v.1988, Konigagraber & T. Osten leg., 1 ♀ (SMNS); same locality, Limentiotissa ruins, 20.ii.2002, M. V. L. Barclay leg., 1 ♀ (BMNH); same locality, Tombs of the Kings, 23.ii.2002, M. V. L. Barclay leg., 1 ♂ (BMNH); **Cyprus without specific locality:** 5.xii.1988, Grimm & Rachinsky leg., Coral bay, 1 ♀ (SMNS); iv.1986, Bilek & Kritscher leg., 1 ♀ (NHMW); without date and collector, coll. Reitter, 1 ♀ (HNHM);

Greece: Central Macedonia Reg., Sithonia, 20.vi.-4.vii.1992, P. Průdek leg., 1 ♀ (JRUC); **Crete Island:** without date and collector's name, coll. E. Frivaldszky, 1 ♂, 1 ♀ (HNHM); Miramare (Resort area), 25.iv.1962, W. H. Tams leg., 1 ♂ (BMNH); same locality, 15.iv.1962, W. H. Tams leg., 1 ♂ (BMNH); same locality, 22.iv.1962, W. H. Tams leg., 1 ♂ (BMNH); **South Aegean Reg., Rhodes Island:** Apolakia, 26.iv.1990, D. Lange & T. Osten leg., 1 ♂ (SMNS); Arhangelos, 8.iv.1980, Schawaller leg., 1 ♂, 1 spec. (SMNS); Epano Kalamon, 4.iv.1996, R. Grimm leg., 1 ♂ (SMNS); Filerimos (village hotel), 6.iv.1996, R. Grimm leg., 2 ♂ (SMNS); Kattavia, 10 m, 9.v.1985, Wienser and Worn leg., 2 ♂ (SMNS); Koskinou, 20 m, 6.v.1985, Wiesner & Worm leg., 1 ♂, 1 ♀ (SMNS); Lardos, Laerma, 28.vi.2007, K. Orszulik leg., 1 ♂ (KORC); Lindos, 27.iv.1964, Helversen leg., 2 ♂ (SMNS); same locality, 4.iv.1980, Schawaller leg., 1 ♂, 2 ♀ (SMNS); same locality, 16.-30. iv.1981, Köstlin leg., coll. R. Köstlin, SMNS 1987, 1 ♀ (SMNS); Rhodes (city): 50 m, 17.v.1985, Wiesner & Worm leg., 1 ♂, 1 ♀ (SMNS); same locality, without date, Oertzen leg., 4 ♂, 1 ♀ (ZMHB); **Rhodes Island (without specific locality):** without

date, B. Schwarzer leg., 1 ♂ (SMFD); without date, Reitter leg., coll. V. Zoufal, 2 ♂, 2 ♀ (MZMB); without date, Lichtenckert leg., 1 ♂ (HNHM); without date and collector's name, coll. W. H. Muche, 21 ♂, 13 ♀ (SMTD); without date and collector's name, coll. Dr. E. Jagemann, 2 ♂, 2 ♀ (MZMB); without date and collector's name, coll. Prof. Noesske, 3 ♂, 7 ♀ (SMTD); without date and collector's name, coll. Reitter, 1 ♂ (HNHM); without date and collector's name, 2 ♂, 1 spec. (HNHM); without date and collector's name, 1 ♂, 1 ♀ (ZMHB); without date and collector's name, 1 ♂, 2 ♀ (NMPC); Katta [not located], 12.iv.1977, Cl. Besuchet leg., 1 ♂ (MHNG); 6.iv.1996, R. Grimm leg., 1 ♂ (SMNS);

Iran: Kermanshah Prov., Qasr-e-Shirin, 2.v.1914, Nesterov leg., 1 ♀ (ZMAS);

Iraq: Abu-Ghraib, iii.[19]84, I. Smatana leg., 1 ♂, 1 ♀, 1 spec. (JRUC); Al-Kut, iv.1914, A.R. D'Abreu leg., coll. Andrewes Bequest, 1 ♂ (BMNH); Baghdad, 8.iii.1920, Y. R. Roscoll leg., 1 ♂ (BMNH); same locality, summer 1928, leg. R. W. G. Hingston, 1 ♂ (BMNH); same locality, 8.iii.1946, without collector's name, 1 ♀ (BMNH); same locality, without date, Kalalova leg., 1 ♂ (NMPC); same locality, without date and collector's name, coll. Sharp 1905, 1 ♀ (BMNH); Khanaqin, 26.-29. iv.1914, Nesterov leg., 1 ♀ (ZMAS);

Israel: Central Dist., Ramla, 9.iv.1992, H. Mienis leg., 1 ♂ (SMNS); **Coastal plain Reg.,** Nahsholim (20 km South Haifa Nat. Res., Hof Dor-Ha Bonim) [32.37° N 34.54° E], 28.ii.1996, U. Göllner leg., 1 ♂ (ZMHB); **Golan Heights:** Al-Mahjar, 200 m, 27.iv.1982, Besuchet & Löbl leg., 1 ♀ (MHNG); Mount Hermon, 2000 m, 3.viii.1995, V. Chikatunov leg., 1 ♂ (TAUM); Nimrod Fortress (Qalaat Nimrod), 300-600 m, 7.iv.1985, Heinz leg., 1 ♀ (SMNS); **Haifa Dist.:** Beit Oren, 24.ii.1998, V. Chikatunov & T. Pavlíček leg., 1 ♀ (TAUM); Haifa, 1884, coll. Reitter, 1 ♂, 2 ♀ (HNHM); same locality, 1884, coll. Reitter, 1 ♂, (SMTD); same locality, iv.1927, without collector's name, 1 ♀ (SMTD), same locality, without date, B. Schwarzer leg., 1 ♂ (SMFD); same locality, without date, Schonfeldt leg., 2 ♀ (SMFD); same locality, without date and collector's name, coll. Reitter, 1 ♂ (HNHM); Mount Carmel (South-East), Eliakim (South-West), 300 m, 11.ii.1987, Schawaller & Schmalfuss leg., 1 ♂ (SMNS); **Jerusalem Dist.:** Jerusalem, 12.ii.1956, J. Klapperich leg., 1 ♂ (HNHM); same locality, Simon leg., 1 ♂ (ZSM); same locality, without date and collector's name, 2 ♀ (NMPC); same locality, without date and collector's name, coll. W. H. Muche, 1 ♀ (SMTD); Tzora, 5.iv.1996, V. Chikatunov leg., coll. V. Chikatunov, 1 ♀ (TAUM); **Northern Dist.:** Ahihud, 9.-20. iv. (without a year), Heinz leg., 1 ♀ (SMNS); Nahariya, 2.-8.iv.1978, T. Osten leg., 1 ♂ (SMNS); Nazareth, 10.iii.1910, P. J. Barraud leg., 1 spec. (BMNH); same locality, 20.iii.1987, C. Blumenthal leg., 1 ♀ (SMNS); same locality, 15.iii.-3.iv.1987, C. Blumenthal leg., 2 ♀ (SMNS); upper Galilee (open stony grazing land, dolomite), South Zivon [33°01.189'N, 35°24.914'E], 750 m, 8.iii.2008, D. W. Wrase leg., 3 ♂, 2 ♀ (SMNS); upper Galilee, Hula Valley, Ma'agar Einan reservoir (toe of dam in moist loamy soil) [33°05.137'N, 35°34.730'E], 73 m, 1.-2.v.2006, D. W. Wrase leg., 1 ♀ (JCOC); same locality, 73 m, 1.-3.v.2006, D. W. Wrase leg., 1 ♀ (JCOC); same locality, 73 m, 1.-4.v.2006, D. W. Wrase leg., 1 ♀ (JCOC); **North-western**

Negev Reg., Ein HaBesor, 30.iii.1987, Heinz leg., 1 ♀ (SMNS); **Shephelah Reg.**, Netzer Sereni, 17.iv.1992, H. Mienis leg., 1 ♂ (SMNS); **Southern Dist.**, Bitronot Ruhama, Nachal Zedim [31°32'45"N, 34°41'43"E], 5.iv.2005, L. Friedman leg., 1 ♀ (TAUM); **Tel Aviv Dist.**: Herzliya, hill [32°11'N, 34°49'E], 30.i.2009, A. Freidberg leg., 1 ♀ (TAUM); Herzliya, sandy area, Schweiger leg., 1 ♂, 1 ♀ (SMFD); Tel Aviv, 4.xii.1969, Prys leg., 1 spec. (TAUM); **The West Bank**, Jericho, 23.ii.1941, Bytinski-Solz leg., 1 ♂ (TAUM); Without specific locality, 20.iii.1934, F. S. Bodenheimer leg., 1 ♀ (TAUM);

Jordan: Jarash (50 km North Amman), 13.iii.1977, Scheuern leg., 1 ♀ (SMNS); same locality, 30.iv.2004, Lillig & Pavlicek leg., 1 ♂, 1 ♀ (SMNS); Wadi Araba, 1.iii.1983, Ikabo Yamen leg., 1 ♂ (BMNH); Zerkatal near Romana, 3.iii.1957, J. Klapperich leg., 1 ♀ (HNHM);

Lebanon: Beirut, without date and collector's name, coll. L.W. Schaufuss, 1 ♂ (ZMHB); same locality, without date, Plason leg., 3 ♂ (ZMHB); same locality, without date, Plason leg., coll. Pinker, 1 ♂, 1 ♀ (NHMW); Majdal Zun, 7.v.1981, F. Kervink leg., 1 ♂ (ZMAN); Lebanon without specific locality, date and collector's name, 1 ♂, 1 ♀ (ZMHB);

Syria: Aleppo Governorate: Maydan Ikbis (Al Midan Akbes), without date, A. Buchta leg., 1 ♀ (ZMHB); same locality, without date, ex coll. Em. Reitter, coll. V. Zoufal, 1 ♂ (MZMB); **Hama Governorate**: Afamia (Apamea) ruins (North-West Hama), 25.iii.1980, Klapperich leg., 1 ♂ (SMNS); Apamea, Qalaat al-Mudiq (North-West Hama), 23.iii.1979, Kinzelbach leg., 1 ♀ (SMNS); **Latakia Governorate**: Latakia, ruins of Ugarit, 4.iii.1979, Kinzelbach leg., 1 ♂, 1 ♀ (SMNS); same locality, 200 m, 9.iv.1978, Heinz leg., coll. Haffe, 1 ♀ (SMNS); Nur (Amanus) Mts., v.1902, Escalera leg., 1 ♂ (MNCN); **Syria without specific locality**: without date, Rosenbach leg., 1 ♂ (SMFD); without date and collector's name, coll. Sharp, 1905–313, 1 ♂ (BMNH); without date and collector's name, 2 ♀ (BMNH); without date and collector's name, 2 ♂ (MHNG);

Turkey: Aegean Reg.: Bozdağ, without date, Bodemeyer leg., 1 ♂, 2 ♀ (ZMHB); Çameli (6 km South-West), 22.iv.1984, Krätschmer leg., 1 ♂, 2 ♀ (SMNS); Denizli prov., 2.vi.1967, E. Baudisch leg., 1 ♂ (SMNS); same locality, Pamukkale, 28.iv.1992, Kapler leg., 1 ♀ (JRUC); same locality, Hierapolis, 21.iv.1973, Bremer leg., 1 ♂ (SMNS); same locality, 25.–27.vi.2004, V. Hula leg., 4 ♂, 5 ♀ (JRUC); **Anatolia Reg.**: without date, Bodemeyer & Weistriz leg., 2 ♂, 1 ♀ (NMPC); same locality, without date, Obenberger leg., 1 ♂ (JRUC), same locality, without date, Obenberger leg., 1 ♂ (NMPC); Cilician Gates or Gülek Pass, v. (without year), Muche leg., coll. W. H. Muche, 1 ♂, 4 ♀ (SMTD); Yen Chehir, 1900, J. Fodor leg., coll. J. Fodor, 1 ♀ (HNHM); **Black Sea Reg.**: Amasya, 20.vi.1966, Ressler leg., 1 ♂ (SMNS); same locality, 1888, B. Schwarzer leg., 1 ♂ (SMFD); same locality, without date, J. Fodor leg., 1 ♂ (HNHM); same locality, without date, K. Neumann leg., 1 ♀ (SMFD); same locality, without date, Korb leg., 1 ♂ (NMPC); same locality, without date, O. Leonhard leg., general coll., 1 ♂, 1 ♀ (SDEI); same locality, without date and collector, coll. W. H. Muche, 1 ♂, 1 ♀ (SMTD); same locality, without date and collector, coll.

J. Fodor, 1 ♀ (HNHM); same locality, without date and collector, 1 ♀ (HNHM); Merzifon, Samsun, 27.vi.1971, Bettou leg., 1 ♂ (MHNG); Mudurnu, 20.v.1996, I. Smatana leg., 2 ♂ (JRUC); Murgul-yayla, forest zone, 6.-7.vii.1983, Heinz leg., 1 ♀ (SMNS); Sinop, 1888, Retowski leg., 1 ♀ (SMFD); Tokat, 700 m, 17.iv.1986, A. Korell leg., 1 ♀ (SMNS); **Central Anatolia Reg.:** Ankara, vii.1926, R. Vogel leg., 1 ♀ (SMNS); same locality, 12.vii.1939, F. S. Bodenheimer leg., 1 ♀ (BMNH); same locality, 3.iv.1963, Ressler leg., 1 ♂ (SMNS); same locality, 900 m, in a park, singled from ground, 27.vi.1980, O. Merkl leg., 1 ♀ (HNHM); Ereğli, 1000-1200 m, 1.iv.1978, Heinz leg., 1 ♀ (SMNS); Hacibektaş, Gümüşkent, 21.iv.1992, M. Kocian leg., 1 ♂ (JRUC); Konya, 1899, O. Leonhard leg., general coll., 1 ♀ (SDEI); same locality, without date, Bodemeyer leg., coll. Prof. Noesske, 2 ♀ (SMTD); Nevşehir-Göre, 21.iv.1992, M. Kocian leg., 1 ♂ (JRUC); Şereflikoçhisar (15 km South), 24.iv.1973, Heinz leg., 1 ♂ (SMNS); Taurus (Mts.): 1895, Holtz leg., 1 ♀, 1 spec. (ZMHB); without date, A. Kricheldorf leg., coll. Prof. Noesske, 1 ♀ (SMTD); without date, Klein leg., 1 ♂ (JRUC); without date, Klein leg., coll. V. Zoufal, 1 ♂ (MZMB); without date and collector's name, 5 ♂, 2 ♀ (NMPC); Bulghar Maaden [Bolkar Mountains], Bodemeyer leg., 1 ♂ (ZMUC); Pozantı, 1.v.1969, Klapperich leg., 1 ♀ (SMNS); Yozgat prov., Sorgun (5 km East), vii.1974, Pretzmann & Kasy leg., 1 ♀ (NHMW); **Marmara Reg.:** Adapazarı, iv.-v. (without year), Muche leg., coll. W. H. Muche, 1 ♀ (SMTD); Bandırma, 1973, Heinz leg., 1 ♂ (SMNS); Bursa, 1870, Pavel leg., 2 ♀ (HNHM); same locality (25 km East), 600 m, 9.iv.1986, Krätschmer leg., 1 ♂ (SMNS); Gölpazarı, Beşevler, 450 m, 28.-30.v.1996, I. Smatana leg., 1 ♂ (JRUC); **Mediterranean Reg.:** Adana prov.: Tumlu, Kalesi castle, rocky stepe on limestone [37°09'00"N, 35°42'25"E], 44 m, P. Kment leg., 1 ♂, 1 ♀ (NMPC); Yılankale, rocks opposite to Yılankale castle [37°0'52"N, 35°44'52"E], 78 m, shrubs+herbs, P. Kment leg., 1 ♀ (NMPC); Adana, 1905, without collector's name, 1 ♂ (JRUC); same locality, 1937, without collector's name, ex coll. G. Paganetti Hummler, coll. P.v.d. Wiel, 1 ♂, 1 ♀ (ZMAN); same locality, without date, H. Holle leg., 1 ♀ (ZMHB); same locality, without date, Kouřil leg., 1 ♂, 2 ♀ (NMPC); same locality, without date, Štěrbá leg., 5 ♂, 2 ♀ (NMPC); same locality, without date and collector's name, 2 ♀ (NMPC); same locality, Çukurova University, 10.x.2006, N. Jansson leg., 1 ♂, 1 ♀ (NJAC); same locality, Yumurtalık, 25.v.1993, P. Průdek leg., 1 ♂ (JRUC); Adana-Bakalı, 19.vi.1980, F. Ozgur leg., 1 ♂, 1 ♀ (SMNS); same locality, 31.v.1986, F. Ozgur leg., 1 ♀ (SMNS); Alma Dağ (Mt.), without date, Bodemeyer leg., coll. Prof. Noesske, 1 ♂, 2 ♀ (SMTD); Altınözü, 22.iv.1992, Kapler leg., 1 ♂ (JRUC); Antalya, Konyaalti city park, 10.iv.2012, Jan Vitner leg., 3 ♂, 1 ♀ (JRUC); Belen Pass (Belen Geçidi), 9.iv.1992, Z. Švec leg., 1 ♀ (JRUC); Çamlıyayla, 1300 m, 1.vii.1998, G. Sama leg., 1 ♂ (SMNS); Ceyhan, vi.1937, Vasvari leg., 1 ♀ (HNHM); same locality, without date, Vasvari leg., 1 ♀ (HNHM); Gelemen (Noeth Samsun), 4.v.1959, K. M. Guichard leg., 1 ♂ (BMNH); İskenderun (Alexandrette), without date, A. Kricheldorf leg., coll. R. Formánek, 1 ♀ (MZMB); Isparta prov., Eğirdir-çadır, 7.v.1975, Besuchet & Löbl leg., 1 ♀ (MHNG); Issus, 100 m, 18.iv.1973, Heinz leg., 1 ♀ (SMNS); Kargıcak, 200 m, 11.iv.1981, Heinz leg., 1 ♀ (SMNS); Mersin,

1906, Ariamia leg., 1 ♂ (ZMHB); same locality, 1906, without collector's name, 1 ♀ (ZMHB); same locality, without date, A. Kricheldorf leg., coll. J. Fodor, 1 ♀ (HNHM); Namrun, v.1967, I. Dr. Schurmann leg., 1 ♂, 1 ♀ (SMNS), same locality, without date, Petrovitz-Ressl leg., 1 ♂ (NHMW); Silifke, on plant, 5.iv.1972, Bremer leg., 1 ♂ (SMNS); Sülek, without date, Schutz leg., 1 ♂, 1 ♀ (NMPC); same locality, without date and collector's name, 1 ♂ (NMPC); Yakacık (North Iskenderun), 23.iv.1984, Krätschmer leg., 1 ♀ (SMNS); Yayladağı, 600-900 m, 13.iv.1981, Heinz leg., 1 ♂ (SMNS); Yumurtalık, v.1986, H. Donner leg., 1 ♀ (ZMAN); **Southeastern Anatolia Reg.:** Bireçik, without date, Bodemeyer leg., 1 ♂ (ZMHB); Mardin, without date and collector's name, coll. W. H. Muche, 1 ♂ (SMTD); **Turkey without specific locality:** without date and collector's name, coll. Piesbergen, 1 ♀ (SMNS); without date, E. Witt leg., 1 ♀ (SMFD).

Ablattaria cribrata

Armenia: Armen Mt. [not located], without date, A. Weis leg., coll. A. Weis, 1 ♂ (SMNS); Khustup, 27.vi.1982, M. Danilevsky leg., 1 ♂ (ZMUM);

Azerbaijan: Absheron, Baku Dist.: Absheron National Park, without date, Kryzhanovskiy leg., 2 ♂, 1 ♀ (ZMAS), Baku city, 14.v.2007, K. Orszulik leg., 2 ♀ (KORC); same locality, without date, Schonfeldt leg., 1 ♀ (SMFD); Zağulba Bağları, 24.v.1970, Kryzhanovskiy leg., 2 ♂ (ZMAS); same locality, 30.v.1970, Kryzhanovskiy leg., 1 ♂ (ZMAS); same locality, 31.v.1970, Kryzhanovskiy leg., 1 ♀ (ZMAS); **Lankaran Reg.,** Astara, 28.v.2007, K. Orszulik leg., 1 ♀ (KORC); **Shirvan Reg.,** Sündü, Şamaxı, vi.2007, K. Orszulik leg., 1 ♂ (KORC); **Nagorno-Karabakh Rep.,** Stepanakert, 28.viii.1984, Tupavkin leg., 1 ♀ (ZMUM);

Georgia: Sioni (Livnetskiy Reg.), 14.vi.1974, Dzambazishich leg., 1 ♂ (ZMUM); Sioni (Planetsk. Reg.), 10.vi.1975, Mlokos'vic leg., 1 ♂ (ZMAS); **Kakheti Reg.,** Lagodekhi, 1896, Mlokos'vic leg., 1 ♂ (ZMAS); **Samtskhe-Javakheti Reg.:** Borjomi Dist., Borjomi-Kharagauli, dry slope, 2 km East Quabiskhevi, 29.vii.2006, D. Bartsch leg., 1 ♀ (SMNS); same locality, 17.vii.1896, without collector's name, coll. G. Sivers, 1 ♂ (ZMAS);

Iran: Arasbaran wildlife refuge, between Makidi and Mahmudabad, 2000-2300 m, 10.vi.[19]78, Martens and Pieper leg., 1 ♂ (SMNS); **Ardabil prov.,** Ardabil, ix.1999, H. Ghahari leg., 1 ♂ (JRUC); **East Azerbaijan prov.:** Arasbaran, ix.2001, without collector's name, 1 ♀ (JRUC); same locality, viii.2003; without collector's name, 1 ♀ (JRUC); Maragheh, xii.2004, N. Samin leg., 1 ♂ (JRUC); **Fars prov.:** Kazerun, vii.1998, H. Ostovan leg., 1 ♂ (JRUC); Piruz Apad, vi.2003, S. Hesami leg., 1 ♂ (JRUC); without specific locality, vi.2000, Kazon leg., 1 ♂ (JRUC); **Ghazvin prov.,** Alamut to Qazvin, viii.2002, H. Ghahari leg., 1 ♀ (JRUC); **Gilan prov.:** Masule (55 km South-West Rasht), 15.-17.iv.1999, J. Rejsek leg., 3 ♂ (SMNS); Rasht, vi.-vii.1980, Saver leg., 1 ♂ (SMFD); Rudbar, 1.vi.2001, Orszulik leg., 1 ♂, 1 ♀ (JRUC); **Golestan prov.:** Gorgan (Astrabad), iv.-vi.1908, O. Leonhard leg., general coll., 2

♂, 1 ♀ (SDEI); same locality, iv.-vi.1908, O. Leonhard leg., coll. Prof. Noesske coll. 1947, 1 ♂ (SMTD); same locality, 15.iv.1958, Vinert leg., 1 ♂ (ZMAS); same locality, 15.iii.1904, Filinnovich leg., 1 ♂ (ZMAS); same locality, 16.vi.1905, Filinnovich leg., 1 ♀ (ZMAS); same locality, without date and collector's name, coll. Prof. Noesske, 1 ♀ (SMTD); same locality, without date and collector's name, 1 ♀ (ZMHB); Gonbad-e Qabus, ix.2003, Z. Karimian leg., 1 ♂ (JRUC); Golestan forest, vi.1998, H. Sakenin leg., 1 ♂ (JRUC); **Hamadan prov.**, Malayer, viii.2004, H. Ghahari leg., 1 ♂ (JRUC); **Hormozgan prov.**, xii.2005, Bandar-Abbas leg., 1 ♀ (JRUC); **Kerman prov.**: Jiroft, vii.2005, H. Ghahari leg., 1 ♀ (JRUC); Kerman, vi.2004, H. Ostovan leg., 1 ♂ (JRUC); **Kurdistan prov.**, vii.2001, Sanandaj leg., 1 ♂ (JRUC); **Māzandarān prov.:** Amol (35 km South) [36°22'01"N, 52°20'25"E], 500 m, 3.v.1998, Gy. Fabian & K. Szekely leg., 1 ♀ (HNHM); Māzandarān prov. or Gilan prov., 25.v.2001, Orszulik leg., 1 ♀ (JRUC); **Razavi Khorasan prov.**, Kashmar, viii.2003, H. Ghahari leg., 1 ♀ (JRUC); **Sistan and Baluchestan prov.**, vii.2004, H. Rakhshanii leg., 1 ♀ (JRUC); **Tehran prov.**, Shahreyar, ix.2003, H. Ghahari leg., 1 ♂ (JRUC); **Not identified:** Shachnisan shachrub [not located], 30.v.1942, E. Lavlovskiy leg., 1 ♂ (ZMAS);

Russia: North Caucasian Federal Dist., Chechnya, Gudermes, vi.1954, Ivanov leg., 2 ♂ (ZMAS); Dagestan, without date, A. Weis leg., 1 ♀ (SMFD); same locality, without date, B. Schwarzer leg., 1 ♂ (SMFD); same locality, without date, coll. Reitter, 1 ♂ (HNHM); Derbent, without date, Desbroch leg., 1 ♂ (ZSM); same locality, without date, E. Witt leg., 1 ♀ (SMFD); same locality, without date, Schonfeldt leg., 1 ♂ (SMFD); same locality, without date and collector's name, coll. Letzner, general coll., 1 ♂ (SDEI); same locality, without date and collector's name, 1 ♀ (ZMAS); same locality, without date and collector, 2 ♂, 1 ♀ (HNHM); Novyye Vikri, 25.v.1985, Abgurakhm leg., 1 ♂, 1 ♀ (ZMAS);

Turkmenistan: Kopet Dag (Mts.), Kara-Kala, 29.iv.1970, L. Zimina leg., 1 ♂ (ZMUM);

Not located: Eldar, El'arougikaz. u. (village), El. g., 21.iv.1910, Milkosev leg., 1 ♀ (ZMAS).

Ablattaria laevigata

Albania: Vermosh, 1914, Penther leg., 1 ♂, 1 ♀ (NHMW); without detailed locality, without date and collector's name, coll. Prof. F. Werner, 1 ♂, 1 ♀ (NHMW); without detailed locality, without date and collector's name, 1 ♀ (SMFD);

Armenia: Sevan, Covagyukh [Gegharkunik prov.], 1988, Strejček leg., mountain steppe, under stone, 1 ♂ (JRUC); Semyonovka (Diliyan), 4.vi.1989, S. Bečvář leg., 1 ♀ (JRUC);

Austria: Burgenland: Bruckneudorf, without date, J. Obenberger leg., 1 ♀ (NMPC); Illmitz, v.1922, Baderle leg., 1 ♀ (NHMW); same locality, 22.v.1981, H. Schaefflein leg., coll. R. Schrepfer, 1 ♂ (SMNS); Jois, 30.vii.1955, without collector's name, 1 ♂ (ZMHB); Lake Neusiedl (Neusiedler See), vi.1927, W. Prock leg.,

1 ♂ (NHMW); same locality, 1941, R. Zimmermann leg., coll. Herb. Schmidt, 1 ♂ (SMTD); same locality, 17.vii.1955, without collector's name, 1 ♂ (ZMHB); same locality, 30.vi.1956, without collector's name, 1 ♂ (ZMHB); same locality, 1962, Karl Kusdas leg., 1 ♀ (NHMW); same locality, 17.v.1965, Folwaczny leg., 1 ♀ (SMNS); same locality, 22.iv.1967, Baderle leg., 1 ♂ (NHMW); same locality, 20.iv.1976, Scheidl leg., 1 ♂ (NHMW); same locality, 26.v.1978, Probst leg., 1 ♀ (NHMW); Podersdorf am See, 1.v.1932, without collector's name, 1 ♂ (NHMW); same locality, 19.-31.vii.1956, R. Papperitz leg., coll. R. Papperitz, 1 ♂ (SMNS); same locality, 1.v.1974, Kirschenhofer leg., 1 ♀ (NHMW); Rosalia, 19.vii.1960, Dr. Hermann Vogt leg., coll. Hessen Sammlung, 1 ♂ (SMFD); Zurndorf, without date, H. Franz leg., 1 ♀ (NHMW); **Carinthia**: Pischeldorf, without date, Moosbrugger leg., 1 ♀ (NHMW); Steinteld, without date and collector's name, coll. R. Köstlin 1987, 1 ♀ (SMNS); same locality, without date and without collector's name, 1 ♀ (NHMW); without locality without date and collector's name, 1 ♀ (ZMHB); **Lower Austria**: Achau, without collector's name, 3.vii.1926, 1 ♂ (NHMW); Amstetten, without date, Moosbrugger leg., 1 ♂ (NHMW); Anninger (Mt.), 16.vi.1997, 1 ♀ (NHMW); Bad Vöslau, Danube, without date and collector's name, 2 ♀ (NHMW); same locality, without date and collector's name, 1 ♂ (NHMW); Wien-Umgebung [env.]; without date, Th. V. Wänka leg., 2 ♀ (NHMW); same locality, without date and collector's name, coll. W. H. Mucho, 1 ♂ (SMTD); same locality, without date and collector's name, coll. V. Zoufal, 1 ♀ (MZMB); same locality, without date and collector's name, ex coll. Winkler, 1 ♂ (MHNG); Bisamberg, without date, Dr. Minarz leg., 1 ♂ (NHMW); same locality, 1925, Zigeuner leg., ex coll. Winkler, 1 ♀ (MHNG); same locality, 14.v.1950, Dr. H. Lechner leg., 1 ♀ (NHMW); Ellender Wald, v.1928, Zigeuner leg., ex coll. Winkler, 1 ♂ (MHNG); Felixdorf, 21.v.1974, Ulbrich leg., 1 ♂ (SMNS); Gramatneusiedl, without date, Baderle leg., 1 ♂ (NHMW); same locality, without date, Pachole leg., 1 ♀ (NHMW); Guntramsdorf, 1989, without collector's name, 1 ♀ (NHMW); same locality, 10.iv.1989, without collector's name, sand pit (Sandgrube), 1 ♂, 1 ♀ (NHMW); Hadersdorf am Kamp, without date and collector's name, 1 ♀ (NMPC); Hainburg an der Donau, without date, Mader leg., 1 ♂ (NHMW); Herzogenburg, Nied (river), without date and collector's name, 3 ♂, 4 ♀ (NHMW); Hohe Wond, without date and collector's name, coll. Wingelmüller, 1 ♀ (NHMW); Kamptal (wine area), Dr. Minarz leg., coll. Dr. Minarz, 1 ♂, 1 ♀ (NHMW); Kampiche, 1.vii.1969, Wechelg leg., 1 ♀ (NHMW); Krems an der Donau, 11.vi.1924, I. Bachinger leg., 1 ♂ (NHMW); same locality, without date, I. Bachinger leg., 1 ♀ (NHMW); Kampichel, vii.[19]69, Wechelg leg., 1 ♀ (NHMW); Langenzersdorf, v.1965, without collector's name, 1 ♀ (NHMW); Leithagebirge, without date, Mader leg., 1 ♀ (ZMHB); same locality, without date and collector's name, coll. Kaufmann, 1 ♂, 1 ♀ (NHMW); Marchfeld, without date and collector's name, 1 ♀ (SMNS); Melk, viii.1917, without collector's name, 1 ♂ (NHMW); Mödling, Dr. H. Lechner leg., 1 ♂ (NHMW); Neu'enkbach [not located], 19.v.1924, Ajtai Kovach leg., 1 ♂ (HNHM); Fische (river), without date and collector's name, 1 ♀ (NHMW); Oberweiden (Weiden an der March), without date, Hammer leg., 1 ♂ (NHMW); Perchtoldsdorf, Czerny leg., 1 ♀

(NMPC); Retzbach, 4.viii.[19]32, Hedicke leg., coll. P.v.d. Wiel, 1 ♂ (ZMAN); Sankt Pölten, without date, Dr. H. Lechner leg., 1 ♂ (NHMW); Stiefern, without date, Dr. Minarz leg., coll. Dr. Minarz, 1 ♂ (NHMW); Traiskirchen, 1 ♂ (NHMW); Wachau, Dürnstein village, without date, I. Bachinger leg., 1 ♂ (NHMW); Wachau, without date, J. Moosbrugger leg., 1 ♀ (NHMW); Weidling (Klosterneuburg), without date, Walter leg., 2 ♂, 2 ♀ (NHMW); Weyersdorf near Dunkelsteinerwald, without date and collector's name, 1 ♂ (NHMW); **Salzburg**: Pinzgau west, Habachtal (valley), 15.vii.1982, R. Belert leg., 1 ♂ (SMNS); **Styria**: Kulm am Zirbitz, without date and collector's name, 1 ♂ (ZMHB); Graz, 5.v.1925, coll. Praxmarer, 1 ♀ (NHMW); Lannach, V. Konschegg leg., coll. Konschegg, 1 ♂, 1 ♀ (NHMW); Marburg, without date and collector's name, coll. Konschegg, 1 ♂ (NHMW); Neudorf bei Passail, without date and collector's name, coll. Konschegg, 1 ♂ (NHMW); Purgstall, 14.vi.1973, Ressel leg., pitfall trap, 1 ♂ (NHMW); Stainztal, without date and collector's name, coll. Konschegg, 1 ♂ (NHMW); **Vienna**: viii.1933, Prock leg., 1 ♀ (NHMW), same locality, 1937, without collector's name, coll. G. Paganetti Hummler, 1 ♂, 1 ♀ (ZMAN); same locality, without collector's name, viii.[19]62, coll. Schneider-Kelch., general coll., 1 ♀ (SDEI); same locality, without collector's name, same locality, 16.viii.1988, without collector's name, 1 ♀ (NHMW); same locality, without date, Carl Mandl leg., 1 ♀ (NMPC); same locality, without date, G. Reineck leg., coll. Bosch, 1 ♂ (SMFD); same locality, without date, Kelfer leg., 1 ♀ (NMPC); same locality, without date, Klees leg., 1 ♂ (ZSM); same locality, without date, Kracik leg., 1 ♂ (NMPC); same locality, without date, O. Leonhard leg., general coll., 1 ♂ (SDEI); same locality, without date, coll. Reitter, 1 ♂ (NMPC); same locality, without date, Schlereth leg., 2 ♂, 1 ♀ (NHMW); same locality, without date, Türkensch leg., coll. Wingelmüller, 1 ♂ (NHMW); same locality, without date, Walter leg., 1 ♀ (NHMW); same locality, without date and collector's name, coll. Prof. Noesske, on bird, 1 ♂ (SMTD); same locality, without date and collector's name, ex coll. Winkler, 1 ♀ (MHNG); same locality, without date and collector's name, coll. Bachofen, ex coll. Winkler, 1 ♂ (MHNG); same locality, without date and collector's name, coll. Helter, 1 ♂ (SMTD); same locality, without date and collector's name, 2 ♂ (ZMHB); Dornbach, without date and collector's name, coll. Kaufmann, 1 ♀ (NHMW); same locality, without date and collector's name, 1 ♀ (NHMW); Gartenhotel Altmannsdorf, 12.vii.1958, Scheidl leg., 1 ♂ (NHMW); Kahlerberg (Mt.), 12.v.1926, without collector's name, 1 ♂ (NHMW); Kuchelau harbour, without date and collector's name, coll. Muhr, 1 ♀ (NHMW); Oberlaa, v.1974, 1 ♀ (NHMW); Prater (public park), without date, Carl Mandl leg., 1 ♂ (NMPC); Stammersdorf, v.1965, 2 ♂, 1 ♀ (NHMW); same locality, without date, Dr. H. Lechner leg., 1 ♂ (NHMW); same locality, without date, Mader leg., 1 ♀ (NHMW); same locality, without date, Käufel leg., 1 ♂, 1 ♀ (NHMW); Wienerwald highlands, without date, K. Klein leg., 1 ♂ (NMPC); same locality, without date and collector's name, 1 ♂ (ZMHB), same locality, Peilstein, without date and collector's name, 2 ♂, 2 ♀ (NHMW); **Vorarlberg**, Feidkirch, without date, Moosbrugger leg., 1 ♀ (NHMW); **Austria without specific locality**: without date and collector's name, coll. Heller, 1 ♂, 1 ♀ (SMTD); without date and collector's name, coll. Milch, 1 ♀

(NHMW); without date and collector's name, coll. Wustnei, 1 ♂ (ZMUC); North Austria, without date and collector's name, ex coll. Grabowski, 1 ♂ (HNHM);

Belgium: Huy, 1906, without collector's name, coll. Pfaft, 1 ♀ (SMFD); Namur, without date, Muche leg., 1 ♂ (SMTD); without locality, 1906, without collector's name, coll. Pfaft, 1 ♂ (SMFD); Von Halfern Park (South-West Aachen), v.1876, coll. Rhine, 1 ♀ (ZMHB);

Bosnia and Herzegovina: Federation of Bosnia and Herzegovina: Bosansko-Grahovo, 800 m, vii.1998, Krätschmer leg., 1 ♂ (SMNS); Breza, without date, Hlisnikowski leg., 1 ♀ (NMPC); Čelić, without date, Zoufal leg., 1 ♀ (NMPC); Klekovača (Mt.), 1892, Beck leg., 1 ♂, 1 ♀ (NHMW); Makljen-Pass, 7.v.1902, O. Leonhard leg., general coll., 1 ♀ (SDEI); Majevisa (Mt.), without date and collector's name, 1 ♀ (NHMW); same locality, without date and collector's name, 1 ♂, 1 ♀ (NHMW); Mostar, without date, Brydl leg., 1 ♂ (NMPC); same locality, without date, Jak. Schmülzer, V.H. Konschegg leg., coll. Konschegg, 1 ♀ (NHMW); same locality, without date, Scheibel leg., coll. Pinker, 1 ♂ (NHMW); same locality, without date, Stepanek leg., 1 ♂ (NMPC); same locality, without date, Zoufal leg., 1 ♂ (NMPC); same locality, without date and collector's name, coll. V. Zoufal, 1 ♂ (MZMB); Petrovac, without date, Schmidl leg., 1 ♀ (NHMW); Popovo polje [Popovo field] valley, Kotezi, 25.-26.v.1991, V. Zieris leg., 1 ♀ (JRUC); Sarajevo, without date and collector's name, coll. Winglemüller, 1 ♂, 1 ♀ (NHMW); same locality, without date and collector's name, 3 ♂, 1 ♀ (NMPC); Treskavica (Mt.), without date and collector's name, coll. W. H. Muche, 1 ♂ (SMTD); Zavidovići, 11.v.1907, Kendi leg., 1 ♀ (HNHM); same locality, vi.1907, Kendi leg., 1 ♂ (HNHM); Zenica (Zennrico), without date, A. Schatzmayr leg., coll. O. Leonhard, 1 ♀ (SDEI); **Republika Srpska:** Bileća, without date, Grabowski leg., 1 ♀ (HNHM); Bjelašnica (Mt.), 17.vii.1988, Beck leg., 1 ♂ (NHMW); same locality, 17.vii.1988, without collector's name, 1 ♀ (NHMW); same locality, 2000 m, vi.1984, Krätschmer leg., 1 ♂ (SMNS); same locality, without date, Diener leg., coll. J. Fodor, 1 ♀ (HNHM); same locality, without date, J. Fodor leg., 1 ♂ (HNHM); same locality, without date, O. Leonhard leg., general coll., 4 ♂, 4 ♀ (SDEI); same locality, without date, Zeithammer leg., 1 ♀ (NHMW); same locality, without date and collector's name, 1 ♂ (NHMW); same locality, without date, O. Leonhard leg., coll. Prof. Noeske, 1 ♂ (SMTD); Trebinje, 12.vi.1931, Dr. J. Fodor leg., coll. M. Nattan, 1 ♂, 2 ♀ (HNHM); same locality, without date, Vašíček leg., coll. K. Mazura, 1 ♀ (MZMB); same locality, without date and collector's name, coll. Burghauser, Mahler, Waka, Fleischer, Absolon, 1 ♂ (MZMB); same locality, without date and collector's name, coll. M. Nattan, 1 ♀ (HNHM); same locality, without date and collector's name, coll. Reitter, 1 ♂ (HNHM); Višegrad, without date, Zoufal leg., 1 ♀ (NMPC); Volujak (Mt.), 1902, O. Leonhard leg., general coll., 5 ♂, 1 ♀ (SDEI); same locality, without date, O. Leonhard leg., coll. Prof. Noeske, 1 ♂, 1 ♀ (SMTD); same locality, without date and collector's name, coll. W. H. Muche, 1 ♀ (SMTD); same locality, without date and collector's name, 1 ♀ (SMTD); Zelengora, 1400 m, v.1977, D. Bare, Krätschmer leg., 1 ♀ (SMNS); **Bosnia without specific locality:** without date, Derodt leg., 1 ♀ (NMPC); without date and collector's name, 1 ♂

(NMPC); without date and collector's name, 1 ♀ (HNHM); Dalmatia, without date and collector's name, 1 ♂ (ZMHB); Bgman [not located], without date, O. Leonhard leg., general coll., 1 ♂ (SDEI); Ksicna [not located], without date, O. Leonhard leg., general coll., 1 ♀ (SDEI); **Hercegovina without specific locality:** 1993, Hawelka leg., 1 ♂, 2 ♀ (NHMW); without date, Reitter leg., coll. R. Formanek, 1 ♂ (MZMB); Domanovič [probably Domanovići], 22.-24.vii.1930, O. Holik leg., 1 ♂ (SMTD);

Bulgaria: Blagoevgrad prov.: Alí Botúsh or Alibotush (Mt.), 20.vii.1936, E. Csi-ki leg., 1 ♀ (HNHM); same locality, without date, Hlisnikowski leg., 1 ♂ (NMPC); same locality, without date, Mařan & Táborský leg., 1 ♂ (NMPC); Petrich, without date, Pfeffer leg., 1 ♂ (NMPC); **Burgas prov.:** Kiten, 10.vii.1973, E. Kismarja leg., 1 ♀ (HNHM); same locality, without date, J. Mička leg., 1 ♂ (JRUC); Lozenets, 19.vii.1971, J. Boháč leg., 1 ♂ (JRUC); same locality, 29.vi.1997, M. Šárovec leg., 1 ♂ (JRUC); Nesebar, 12.vi.1962, K. Ermisch leg., 1 ♀ (ZMHB); same locality, 4.vi.1964, K. Ermisch leg., 1 ♀ (ZMHB); same locality, 7.vi.1964, K. Pospíšil leg., 1 ♂ (MZMB); same locality, 9.vi.1964, K. Pospíšil leg., 1 ♀ (MZMB); same locality, 20.vi.-6.vii.1965, K. Ermisch leg., 1 ♂ (ZMHB); same locality, 3.vi.1967, K. Ermisch leg., 1 ♂ (ZMHB); same locality, 10.vi.1967, K. Ermisch leg., 1 ♀ (ZMHB); Nesebar (on the Black Sea coast), below the mill, 18., 25.v.1975, H. Schindler leg., 2 ♂ (SMNS); Pomorie, 3.-5.vi.1982, H. Wendet leg., 1 ♂ (ZMHB); Pomoje dintouni, 26.iv.1973, F. Battoni leg., 1 ♀ (MHNG); Primorsko, 20.ix.1975, P. Pecina leg., 1 ♀ (JRUC); Sozopol, viii.1965, Josef Král leg., 1 ♂, 1 ♀ (JRUC); same locality, 1971, J. Král leg., 1 ♀ (JRUC); same locality, without date, J. Jelínek leg., 2 ♀ (NMPC); same locality, without date, Hlisnikowski leg., 1 ♀ (NMPC); Slančev Brjag, 25.viii.1976, K. Pospíšil leg., tons of rubble, 1 ♀ (MZMB); same locality, without date, Dr. A. Svozil leg., 1 ♂ (SMNS); **Dobrich prov.,** Kamen Brjag, 11.vii.1984, J. Růžicka leg., 1 ♀ (JRUC); **Gabrovo prov.,** Tryavna, v.-vi.1912, M. Hilf leg., coll. O. Leonhard, 1 ♀ (SDEI); **Pazardzhik prov.,** Isparihovo village, 17.v.2009, V. Zieris leg., 1 ♀ (JRUC); **Plovdiv prov.,** Asenovgrad, without date, Balog leg., 1 ♂ (HNHM); **Varna prov.:** 22.vii.1936, without collector, 1 ♂ (NHMW); same locality, 1994, Peez leg., 2 ♂, 2 ♀ (NHMW); same locality, without date and collector's name, 1 ♀ (NHMW); Galata beach, without date, J. Balogh leg., 1 ♂ (HNHM); Golden Sands, 3.ix.1965, P. Sedina leg., in dry grass at noon, 1 ♀ (JRUC); Varna beach, without date, Balogh leg., 1 ♀ (HNHM); **Shumen prov.,** Mandra, Fuss leg., 1 ♂, 1 ♀ (NMPC); **Sofia:** v.1902, without collector's name, 1 ♀ (ZMHB); Lyulin (residential complex in Sofia), without date, Hanuš leg., 1 ♂ (NMPC); **Stara Zagora prov.,** Kazanlak, 11.-12.ix.1977, Hieke & Ublig leg., 1 ♀ (ZMHB); **Veliko Tarnovo prov.,** Veliko Tarnovo, 18.vii.1965, Palle Jorum leg., 1 ♀ (ZMUC); **Southern Bulgaria:** Rhodope (Mts.), Bachkovo Monastery, 15.iii.1977, D. W. Wrase leg., 1 ♂ (ZMHB); Zvezdec village near Strandzha (Mts.), without date, I. Smatana leg., 1 ♂, 2 ♀ (JRUC); **Bulgaria without a specific locality:** Madaia [not located], 1928, Biro leg., 1 ♂ (HNHM); vii.1975, without collector's name, 1 ♂ (ZMHB); iv.1989, S. Bečvář leg., 3 ♂, 2 ♀ (JRUC); without date and without collector's name, 1 ♂ (JRUC); without date and collector's name, 2 ♂

(NMPC); Dabovec env., Arda challet [not located], without date, steppe, Hůrka leg., 1 ♂ (NMPC);

Croatia: Dalmatia: “Dalmatia”, without date, Al. Smolka leg., 1 ♀ (NMPC); same locality, without date, J. Vaca leg., 1 ♂ (NMPC); same locality, without date, Kust leg., 1 ♂ (SDEI); same locality, without date, Všetečka leg., 2 ♂ (NMPC); same locality, without date and collector’s name, coll. Fry, 1 ♂, 1 ♀ (BMNH); same locality, without date and collector’s name, coll. Fry, 1 ♀ (BMNH); same locality, without date and collector’s name, coll. K. Hanel, 1 ♂ (SMTD); same locality, without date and collector’s name, coll. Pinker, 1 ♀ (NHMW); same locality, without date and collector’s name, 2 ♀ (MHNG); same locality, without date and collector’s name, 1 ♂, 2 ♀ (NMPC); same locality, without date and collector’s name, 1 ♂ (ZMUC); Brač island, without date, Ad. Hoffmann leg., coll. Prof. Noesske, 1 ♂ (SMTD); Kaštela, without date and collector’s name, 1 ♂ (NHMW); Zennrico [not located], without date, A. Schatzmayr leg., coll. O. Leonhard, 1 ♀ (SDEI); **Dubrovnik-Neretva County:** Dubrovnik (South Dalmatia), 3.v.1981, M. Boneš leg., 1 ♂ (SMNS); same locality, without date and collector’s name, 1 ♀ (NMPC); Opuzen, 29.iv.1975, G. J. Slob leg., 1 ♂, 1 ♀ (ZMAN); Trpanj, without date, Fleischer leg., 1 ♀ (NMPC); Korčula island, v.1902, Gabriel leg., coll. Bosch, 1 ♀ (SMFD); Metković, without date, Fleischer leg., 1 ♂ (NMPC); Hvar island: without date, Kouřil leg., 1 ♂ (NMPC); without date, Hirst leg., 2 ♀ (NMPC); Starigrad, Verbosca (settlement), 13.iv.1929, P. Shulze leg., 1 spec. (ZMHB); Sućuraj, without date and collector’s name, 2 ♀ (NHMW); Zadar, without date, Bocagnazzo leg., 1 ♀ (NMPC); same locality, without date and collector’s name, coll. E. Grundmann, 1 ♀ (NHMW); **Istria County:** without date, without date and collector’s name, coll. Reitter, 1 ♂ (JRUC); same locality, without date and collector’s name, coll. W. H. Muche, 1 ♀ (SMTD); same locality, without date and collector’s name, coll. Reitter, 1 ♀ (HNHM); same locality, without date and collector’s name, 1 ♂ (SMTD); Fuskulin (10 km South Prec), 22.vi.2003, O. Merkl leg., swept and singled, 1 ♂ (HNHM); Isola, 23.vii.1969, S. Horvatovich leg., 1 ♂ (HNHM); Poreč, 29.vi.1920, Devring leg., coll. D. Liebegott, 1 ♀ (SMFD); Pula, 20.viii.1981, T. Klement leg., 1 ♂, 1 ♀ (JRUC); same locality, 21.vii.1982, T. Klement leg., 1 ♀ (JRUC); same locality, 11.xi.1877, Krauss leg., 1 ♀ (NHMW); same locality, without date, Heyrovský leg., 1 ♀ (NMPC); same locality, without date, Kouřil leg., 1 ♀ (NMPC); same locality, without date, Lichtenkert leg., 1 ♂ (HNHM); same locality, without date, Schlettau leg., 1 spec. (NHMW); same locality, without date, Schuster leg., 1 ♀ (NMPC), same locality, without date and collector’s name, 1 ♂ (JRUC); same locality, without date and collector’s name, coll. Kaufmann, 2 ♂, 1 ♀ (NHMW); same locality, without date and collector’s name, 2 ♀ (NHMW); same locality, without date and collector’s name, 2 ♂, 1 ♀ (NMPC); Noriaem [not located], without date and collector’s name, 1 ♀ (NHMW); Rovinj, 4.vi.1960, M. A. Ertel leg., 1 ♀ (SMNS); Vodnjan (Dignano), without date and collector’s name, 1 ♀ (JRUC); **Karlovac County:** Karlovac, without date, Victor Stiller leg., coll. Stiller, 1 ♀ (HNHM); **Lika-Senj County:** Otočac, without date, Jan Obenberger leg., 2 ♀ (NMPC); Senj, 30.vi.1905, Biro leg., 1 ♂ (HNHM); **Lika-Senj County/ Zadar**

County, Pag island, without date and collector's name, 1 ♂ (NMPC); **Primorje-Gorski Kotar County**: Bakar (Buccari), 16.v.1911, without collector's name, coll. Schaltz, 1 ♂ (ZMUC); Crikvenica, without date and collector's name, coll. Mihók, 1 ♂ (HNHM); Fužine, without date and collector's name, coll. Mihók, 1 ♂ (HNHM); Fužine, coastland, 1906, M. Hilf leg., coll. O. Leonhard, general coll., 1 ♂ (SDEI); Krk island, without date and collector's name, 3 ♀ (NHMW); same locality, 1977, Mader leg., 1 ♀ (ZMHB); Krk city, viii.1968, without collector's name, coll. J. Dezort, 1 ♂ (MZMB); Krk city (surrounding area), 20.ix.2007, Erwin Holzer leg., 1 ♀ (EHOC); Mali Lošinj (Lussinpiccolo), without date, Majersky leg., 1 ♀ (NHMW); Novi Vinodolski, without date and collector's name, coll. Mihók, 1 ♂ (HNHM); Punat, viii.1968, without collector's name, coll. I. Grulich, 2 ♂ (MZMB); Rijeka (or Fiume), without date, Victor Stiller leg., coll. Stiller, 1 ♀ (HNHM); same locality, without date and collector's name, 1 ♂ (NMPC); Rab island, without date, Fleischer leg., 1 ♂ (NMPC); **Split-Dalmatia County**: Dugopolje, 1.-3.v.2009, L. & V. Zieris leg., 1 ♂ (JRUC); Kaštel Sućurac, without date, Novak, Kouřil leg., 1 ♂ (NMPC); Klis Fortress near Split, 1.iv.1973, R. Grimm leg., 1 ♂ (SMNS); Omiš (Almissa), without date, Horvath leg., 1 ♂ (HNHM); Salona near Solin, without date, Hoffmann leg., 1 ♂ (NMPC); Sinj, without date, Klimesch leg., 1 ♀ (SMNS); Split (Spalato), iv.[19]28, D. Heberdey leg., coll. Praxmarer, 1 ♂ (NHMW); same locality, 6.v.1938, Dr. Feige leg., 1 ♀ (ZMHB); same locality, 22.v.1975, G. J. Slob leg., 1 ♀ (ZMAN); same locality, without date, Karaman leg., coll. Hauser, 4 ♂ (NHMW); Grenzgebiet, Kralu [not located], 1886, Gerlach leg., 1 ♀ (ZMHB); Vis island (Lissa), 1890, Steind leg., 1 ♀ (NHMW); **Velebit mountain range**, 1500 m, vi.1967, without collector's name, coll. Stegmann, 1 ♂ (SMNS); same locality, vi.1968, W. Back leg., 1 ♂, 1 ♀ (NHMW); **Zagreb (historic name Agram)**, without date, O. Leonhard leg., general coll., 1 ♂ (SDEI);

Czech Republic: Moravian-Silesian Reg., Herčivald or Herzogwald [locality no longer exists], 1900, without collector's name, coll. K. Mazura, 2 ♀ (MZMB); **Olomouc Reg.**: Prostějov, without date, Kouřil leg., 1 ♂ (NMPC); Weisskirchen [Hranice na Moravě], without date and collector's name, 1 ♀ (NHMW); **South Bohemian Reg.**: Strakonice, without date, Šípek leg., 1 ♂ (NMPC); **South Moravian Reg.**: Adamov, without date, J. Fleischer leg., 1 ♂ (NMPC); Brno, 8.v.1921, without collector's name, 1 ♂ (MZMB); same locality, v.1942, Rouscher leg., 1 ♂ (MZMB); same locality, without date, J. Fiala leg., 1 ♀ (MZMB); same locality, without date, Kafka leg., 1 ♀ (JRUC); same locality, without date, Fleischer leg., 2 ♀ (NMPC); same locality, without date and collector's name, 1 ♂ (NMPC); Brno-Ivanovice, without date and collector's name, 1 ♂ (NMPC); same locality, without date, Kouřil leg., 1 ♀ (NMPC); Brno-Řečkovice, without date, Formánek leg., coll. R. Formánek, 3 ♀ (MZMB); Bučovice, without date and collector's name, 1 ♂ (NHMW); Čejč village (in Hodonín Dist.), v.1943, Rouscher leg., 1 ♀ (MZMB); same locality, without date, J. Bechyně leg., 1 ♀ (JRUC); same locality, without date, V. Zavadil leg., 2 ♀ (NMPC); same locality, without date, O. Kodým leg., 1 ♂ and 3 ♀ (NMPC); same locality, without date, Pfeffer leg., 2 ♂ (NMPC); Hodonín, without date, J. Baumert

leg., 2 ♀ (NMPC); same locality, without date, Hliseníkovský leg., 1 ♂ (NMPC); same locality, without date and collector's name, 1 ♂, 1 ♀ (NMPC); Hustopeče, without date, J. Fleischer leg., 2 ♀ (NMPC); Ivančice, without date and collector's name, coll. Fleischer, 1 ♂ (NMPC); Mutěnice, 13.viii.1963, J. Bechyně leg., 1 ♀ (JRUC); same locality, without date, J. Bechyně leg., 1 ♂ (JRUC); Pálava, without date, J. Fleischer leg., 1 ♂ (NMPC); Sokolnice, without date, J. Fiala leg., coll. J. Fiala, 1 ♀ (MZMB); Stará hora, Novosedly, without date, A. Fleischer leg., 1 ♂ (NMPC); same locality, without date and collector's name, 1 ♂, 1 ♀ (NMPC); Tábor, without date and collector's name, coll. Burghauser, Mahler, Waka, Fleischer, Absolon, 1 ♀ (MZMB); Uherčice, 1941, without collector's name, coll. J. Matoušek, 1 ♀ (MZMB); Znojmo, 1935, without collector's name, coll. J. Matoušek, 1 ♂ (MZMB); Židlochovice, 19.viii.1914, coll. J. Dezort, 1 ♂ (MZMB); **Vysočina Reg.**, Červená Řečice, without date, Stiburek leg., 1 ♂ (NMPC); **Zlín Reg.**, Bílovice, without date, M. Chvojka leg., 1 ♂ (NMPC); Chvalčov village (in Kroměříž Dist.), 2.vii. [year not provided], L. Cap leg., 1 ♂ (SMNS); Koryčany, without date, O. Kodym leg., 1 ♂ (NMPC); Luhačovice, without date and collector's name, 1 ♂, 1 ♀ (NMPC); Uherský Brod, vii.1927, W. Prock leg., 1 ♀ (NHMW); same locality, without date, W. Prock leg., 1 ♂ (NHMW);

France: Alsace Reg. Souffelweyersheim, vi.[19]53, Stras Bou leg., 1 ♀ (MHNG); Teghllo [not located], without date, coll. Heyden, 1 ♂ (ZSM); without specific locality, without date and collector's name, coll. W. H. Muche, 1 ♂ (SMTD); **Aquitaine Reg.** Bordeaux, iv.1943, F. Ermisch leg., 1 ♂, 1 ♀ (ZMHB); same locality, v.1943, F. Ermisch leg., 1 ♂ (ZMHB); Col du Soulor mountain pass, 1892, D. Nodis leg., coll. Bertin, 1 ♀ (MHNG); same locality, without date, D. Nodis leg., 1 ♀ (MHNG); Hendaye, viii.1889, P. de Borre leg., 1 ♀ (MHNG); Léon, without date and collector's name, coll. W. H. Muche, 1 ♂ (SMTD); **Auvergne Reg.** Saint-Ferréol-d'Auroure, without date and collector, coll. Achard, 1 ♂ (NMPC); **Basse-Normandie Reg.** Trouville-sur-Mer, without date and collector's name, coll. Kraatz, general coll., 1 ♂ (SDEI); **Bigorre Reg.** Callian, without date, coll. Sharp, 2 ♂ (BMNH); **Brittany Reg.** Morbihan Dep., without date, Pora Louss leg., 1 ♀ (MHNG); Noirmoutier island, iv.1961, Dr. Breuning leg., ex coll. Breuning, 1 ♂, 1 ♀ (SMTD); same locality, without date and collector's name, ex coll. Breuning, 18 ♂, 6 ♀ (SMTD); Saint-Gilles-les-Bois, 27.iii.1978, Kiener leg., coll. S. Kiener, 1 ♂ (MHNG); **Centre Reg.** Amboise, 28.v.1925, without collector's name, coll. Rosenberg, 1 ♀ (ZMUC); Brezoles, without date, Achard leg., 2 ♀ (NMPC); Cher Dep., Avord, 18.vi.1941, Folwaczny leg., 1 ♀ (SMNS); Tours, without date, D. Ludy leg., 1 ♀ (HNHM); **Champagne-Ardenne Reg.** Langres plateau, without date and collector's name, 1 ♀ (NMPC); Preifs [not located], without date and collector's name, coll. W. H. Muche, 5 ♂, 3 ♀ (SMTD); Prosnes, Martin Heyne, without date, J. Fleischer leg., 1 ♂ (NMPC); Reims, without date and collector's name, coll. Johannes Werner Schmidt, 1 ♀ (SMTD); same locality, without date and collector's name, 1 ♂, 1 ♀ (NMPC); without specific locality, 1917, without collector's name, coll. Detzner, 2 ♀ (SMTD); **Corsica island:** Arro, without date, G. Reineck leg., coll. Bosch, 1 ♂ (SMFD); Corte,

28.v.1912, E. Christeller leg., 1 ♂ (ZMHB); Folelli, 1905, O. Leonhard leg., general coll., 1 ♂ (SDEI); Monte Rotondo, without date and collector's name, coll. Hanser, 1 ♀ (NHMW); without specific locality, 23.v.1912, E. Christeller leg., 1 ♂ (ZMHB); **Franche-Comté Reg.:** Jura Dep., Staffelberg (Mt.), 22.v.1952, Eckerlein leg., 1 ♂, 1 ♀ (NHMW); Jura Dep., 18.v.1952, coll. Bertin, 1 ♀ (MHNG); Vosges Mts. (South), v.1916, Muller leg., coll. Prof. Noesske, 1 ♂ (SMTD); **Île-de-France Reg.:** Fontainebleau, without date, J. Achard leg., coll. Achard, 1 ♂ (NMPC); Paris, without date and collector's name, 1 ♀ (MNCN); Provins, 31.iii.1948, P. Bureau leg., coll. P. Bureau, 1 ♀ (SMNS); same locality, without date and collector's name, coll. Andrewes, 1 ♂ (BMNH); Seine (river), without date and collector's name, coll. K. Mazura, 1 ♂ (MZMB); Thoiry, 10.ix.1929, K. Ponov leg., 1 ♂ (ZMUM); same locality, 10.vi.1931, K. Ponov leg., 1 ♂ (ZMUM); **Languedoc-Roussillon Reg.:** Agde, 4.-15.iv.1982, Rieger leg., 1 ♂ (SMNS); Aigues-Mortes, 14.i.1930, J. Therond leg., coll. E. Jagemann, 1 ♀ (MZMB); Aimargues, 15.v.1903, Cheviny, 3 ♂ (MHNG); Aude Dep.: Leucate, 1968, J. Hamon leg., 1 ♂ (MHNG); same locality, 1.viii.1970, J. Hamon leg., 1 ♂ (MHNG); same locality, 15.-16.vi.1973, C. v. Nidek leg., 1 ♀ (ZMAN); same locality, 10.vii.1984, J. Hamon leg., 1 ♀ (MHNG); Quillan, 5.v.1955, J. Th. Skovgaard leg., 1 ♀ (ZMUC); Bagnols-sur-Cèze, 18.iv.1981, Döser leg., 1 ♂, 1 ♀ (SMNS); Canet-en-Roussillon (or Canet Plage), 15.-16.v.1973, G. J. Slob leg., 2 ♂, 1 ♀ (ZMAN); Gard Dep.: Aigues-Mortes, 1.-8.iv.1972, P. Poot leg., 1 ♀ (ZMAN); Gallician, without date, H. Perrot leg., 1 ♂ (MHNG); Le Grau-du-Roi, 1.-8.iv.1972, P. Poot leg., 1 ♀ (ZMAN); Uzès, 29.ix.1949, M. Curti leg., 1 ♀ (MHNG); Aude Dep.: Marsa, 25.-26.v.1972, Schawaller leg., 1 ♀ (SMNS); Montpellier, without date, K. Neumann leg., 1 ♂, 1 ♀ (SMFD); Nîmes, 28.vi.1925, J. Therond leg., 1 ♂ (NHMW); same locality, without date, J. Therond leg., 1 ♂ (NHMW); Palavas-les-Flots, 27.iv.1949, Eyndboven leg., coll. P. v. d. Wiel, 1 ♂ (ZMAN); Perpignan, 10.vi.1976, G. J. Slob leg., 1 ♀ (ZMAN); Pont du Gard, 20.vii.1924, J. Therond leg., 1 ♂ (ZMHB); same locality, without date, J. Therond leg., coll. E. Jagemann, 1 ♂ (MZMB); Port-Vendres, vii.1975, Kiener leg., coll. S. Kiener, 1 ♀ (MHNG); same locality, viii.1975, Kiener leg., coll. S. Kiener, 1 ♀ (MHNG); Pyrénées (Mts), Lac d'Estom, 1989, 1 ♀ (NHMW); Pyrénées-Orientales Dep., Arles sur Tech, 270 m, 14.-20.vi.1962, P.C. Jerrard leg., 1 ♀ (BMNH); **Lorraine Reg.:** Metz, viii.1957, Lenczy leg., 1 ♀ (HNHM); Vosges Dep., without date, coll. Andrewes, 1 ♂ (BMNH); **Lower Normandy Reg.:** Calvados, without date, Dubourgais leg., coll. Pinker, 1 ♀ (NHMW); same locality, without date, Dubourgais leg., 1 spec. (NMPC); same locality, without date and collector's name, 2 ♂ (NMPC); Mont Saint-Michel, without date, coll. Reitter, 1 ♀ (SMNS); Luberon (Mts.), Maubec, 30.iv.2003, H. & I. van Oorschot leg., 1 ♀ (ZMAN); **Midi-Pyrénées Reg.:** Ariège, v.1965, Delestelas, Puig de l'Estela [not located], without collector's name, 1 ♀ (MHNG); Gers, Terraube, without date, 1 ♀ (NMPC); Ornlac-Ussat-les-Bains, without date, Laznicka leg., 1 ♂ (NMPC); **Nord-Pas-de-Calais Reg.:** Calais, without date and collector's name, 1 ♀ (BMNH); Cambrai, v.1917, without collector's name, coll. Dr. Jhssen, 2 ♂ (ZMHB); same locality, x.1917, without collector's name, coll. Dr. Jhssen, 1 ♀ (ZMHB); Mon-

chy-le-Preux, without date, Achard leg., 1 ♂ (NMPC); **Picardy Reg.:** Chaumont-en-Vexin, vii.1927, without collector's name, coll. Dr. R. Streda, 1 ♀ (HNHM); **Plateau de Langres (Langres plate),** without date, Riedel leg., 1 ♀ (NMPC); **Poitou-Charentes Reg.:** Charente, 1946, without collector's name, coll. Fuchs, 2 ♂, 1 ♀ (SMTD); same locality, without date and collector's name, coll. Fuchs, 1 ♂ (SMTD); Cognac, without date and collector's name, coll. Achard, 1 ♂ (NMPC); Vienne Dep., Morthemmer, without date, L. Mesmin leg., 1 ♂ (NMPC); **Provence Reg.:** Verdon Gorge (Grand canyon du Verdon), 15.v.1985, U. Döser leg., 1 ♂ (SMNS); **Provence-Alpes-Côte d'Azur Reg.:** Alpes-Maritimes Dep., 900 m, 16.vii.1950, Berthemont & P. Bureau leg., coll. R. Kostlin, 1 ♀ (SMNS); same locality, Mandelieu-la-Napoule, 20.x.1962, C. v. Nidek leg., 2 ♂, 2 ♀ (ZMAN); Arles, Pont-de-Crau, 3.ix.1967, coll. R. Ertel Remseck, 1 ♂ (SMNS); Cannes, without date, Homeyer leg., 1 ♂ (SDEI); Castellane, vi.1911, D. Novak leg., coll. V. Zoufal, 1 ♀ (MZMB); Cotignac (3 km North of Barjols), 43°31'47"N, 6°09'00"E, 414 m, 20.iv.2006, J. Skuhrovec leg., 1 ♀ (JRUC); Étangs de Villepey (ponds), 2.iv.1913, W. Liebmann leg., general coll., 1 ♂ (SDEI), same locality, 10.iv.1913, W. Liebmann leg., general coll., 1 ♂, 1 ♀ (SDEI); French riviera, Saint-Raphael, 23.iii.1913, W. Liebmann leg., general coll., 2 ♂ (SDEI); Hyères Dep., 7.-12.v.1921, K. G. Blair leg., 1 ♂ (BMNH); same locality, D. Nodis leg., 1 ♀ (MHNG); same locality, without date, Gallmer leg., 1 ♀ (SMFD); Hyères Dep., Lattes, 26.x.1964, without collector's name, 1 ♂ (MHNG); same locality, without date, H. Perrot leg., 1 ♂ (MHNG); Hyères Dep., Montpellier, without date and collector's name, 1 ♂ (MHNG); La Ciotat, 30.vii.1940, G. Condriillier leg., 1 ♀ (MHNG); same locality, 28.viii.1948, without collector's name, 1 ♂ (MHNG); La Turbie, 1927, Klynstra leg., 1 ♀ (ZMAN); same locality, without date and collector's name, 1 ♂ (NMPC); Marseille, viii.-ix.1958, Lenczy leg., 1 ♂ (HNHM); same locality, without date, Kobelt leg., 1 ♂ (SDEI); Nice, 2.v.1891, without collector's name, 1 ♀ (MHNG); same locality, 1883, without collector's name, 1 ♀ (SMFD); same locality, without date, Al. Smolka leg., 1 ♀ (NMPC); same locality, without date, coll. Toumayeff, 1 ♂, 3 ♀ (MHNG); same locality, without date and collector's name, 3 ♂ (BMNH); Peille, 17.x.1954, without collector, 1 ♂, 1 ♀ (MHNG); Saint-Laurent-du-Var, iv.1936, without collector, 3 ♀ (MHNG); same locality, 15.iii.1938, without collector's name, 1 ♀ (MHNG); same locality, 8.iv.1939, without collector's name, 3 ♂ (MHNG); same locality, 10.iv.1939, without collector's name, 2 ♂, 1 ♀ (MHNG); Tarascon, 23.-25.v.1949, Roland Skovgaard leg., coll. Th. Skovgaard, 1 ♂ (ZMUC); Thorenc, viii.1965, without collector's name, 1 ♀ (MHNG); Var Dep.: Canjuers, vii.1964, 1 ♀ (MHNG); Le Lavandou, without date, Obenberger leg., 1 ♀ (NMPC); same locality, without date and collector's name, 1 ♀ (NMPC); Vaucluse Dep., iii.1937, without collector's name, coll. H. Coiffait, 1 ♀ (MHNG); same locality, without date and collector's name, 1 ♂ (MHNG); Mont Ventoux, 18.vi.1959, M. Curti leg., 1 ♂ (MHNG); same locality, 27.-31.v.1973, G. J. Slob leg., 1 ♂ (ZMAN); Vaison-la-Romaine, 19.v.1970, P. Poot leg., 1 ♂ (ZMAN); same locality, 21.v.1985, E. Ulbrich leg., coll. R. Schrepfer, 1 ♂ (SMNS); **Rhône-Alpes Reg.:** Chamonix, without date and collector's name, coll. Leitzner, general coll., 1 ♀ (SDEI); Gex, 16.v.1901,

P. de Borre leg., 1 ♂ (MHNG); Lyon, without date and collector's name, coll. Perez Arcas, 1 ♂ (MNCN); Miribel Ain Dep., 1947, without collector's name, 2 ♂ (MHNG); Saint-Vallier, vi.[19]66, Toumayeff leg., 1 ♀ (MHNG); same locality, viii.[19]69, Toumayeff leg., 1 ♀ (MHNG); same locality, viii.[19]76, Toumayeff leg., 1 ♂, 1 ♀ (MHNG); same locality, viii.[19]80, Toumayeff leg., 1 ♀ (MHNG); same locality, v.[19]85, Toumayeff leg., 1 ♂ (MHNG); Salève (Mt.), 7.v.1950, without collector's name, coll. van de Gumster, 1 ♂, 1 ♀ (MHNG); same locality, 3.vi.1952, without collector's name, coll. van de Gumster, 1 ♀ (MHNG); Savoie Dep., without date and collector's name, 1 ♀ (MHNG); **Savoy Reg.:** without date and collector's name, coll. Sharp, 1 ♂ (BMNH); without specific locality, without date and collector's name, 2 ♂, 2 ♀ (BMNH); **Upper Normandy Reg.:** Fresney, Dubourgias [not located], without date, J. Fleischer leg., 1 ♂ (NMPC); **France without specific locality:** 14.vii.1927, without collector's name, 1 ♀ (NHMW); without date and collector's name, 2 ♀ (NMPC); Galia, without date and collector's name, 1 ♀ (SMTD); South France: Senazaire, Solsales [not located], 14.vi.1948, 2 ♀ (MHNG); without specific locality, 25.iv.1962, Hermann Vogt leg., Hessen collection, 1 ♂ (SMFD); without specific locality, 24.vi.1962, Hermann Vogt leg., Hessen collection, 1 ♀ (SMFD);

Georgia: Abkhazia: Gagra, sea coast, 2.-3.ix.1977, Belov leg., 1 ♀ (ZMUM); New Athos, 24. x.1932, B. Rodendorf leg., 1 ♀ (ZMUM); **Samtskhe-Javakheti Reg.:** Bakuriani, without date, J. Mařan leg., 1 ♂ (NMPC); same locality, 15.vi.1910, Mlokos'vich leg., 1 ♀ (ZMAS); Kutaisi, 26.vi. 1898, Deryugin leg., 1 ♀ (ZMAS); **South Ossetia,** Cey, along Ceydon river [not located], 16.vi.1981, S. Alekseev leg., 1 ♀ (ZMUM);

Germany: Baden-Württemberg state: Bad Wimpfen, Scriba, without date, K. Neumann leg., 1 ♂, 1 ♀ (SMFD); Baden (Historical State), 1902, Dr. Stolz leg., 1 ♀ (NHMW); same locality, 1903, Dr. Stolz leg., 1 ♂ (NHMW); Breisgau, 5.v.1973, without collector's name, ♂ (SMNS); Giengen, 8.ix.1992, without collector's name, coll. Piesbergen, 1 ♂ (SMNS); Herrlingen, 27.vi.1954, R. Schrepfer leg., coll. R. Schrepfer, 1 ♀ (SMNS); Ludwigsburg Dist., Gerlingen, 1.vi.1971, A. Greb leg., 1 ♀ (SMNS); Kaiserstuhl (Mts.), v.-vi.1949, without collector's name, 1 ♂ (ZMHB); same locality, without date, Bischoff leg., 1 ♀ (ZMHB); Mosbach baths, v.1941, Schaaff leg., coll. Bosch, 1 ♂ (SMFD); Schwarzwald (Black Forest), v.1999, Stock leg., 1 ♀ (SMFD); same locality, without date, Schonfeldt leg., 2 ♀ (SMFD); River Danube, Ulm, 1955, G. Scheel leg., 1 ♀ (SMNS); Winterlingen, Rauhe Alb [not located], without date, Dr. Burkart leg., 1 ♂ (SMNS); same locality, Alb. Wurt. [not located], without date, Dr. Burkart leg., 1 ♂ (SMNS); **Bavaria state:** Burghauser, without date, Mahler, Waka, Fleischer & Absolon leg., 1 ♂ (MZMB); Forchheim, 29.v.1955, Dr. Eeerlein leg., 1 ♂ (NHMW); Hackelsberg, 23.iv.1964, Weinten leg., 1 ♂ (SMFD); Höchberg, v.1978, without collector's name, coll. Schwarzer, 1 ♀ (SMFD), Karlstadt, fir forest, 1.vi.1952, Eckerlein leg., 1 ♀ (NHMW); same locality, 6.v.1956, Eckerlein leg., 1 ♂ (NHMW); Rohrbach Dist., Neuburg an der Donau, without date, Karl Ruile leg., coll. Dr. Jhssen, 1 ♀ (ZMHB); Sugenheim, without date, W. Sattler leg., 1 ♀ (SMFD); Treuchtlingen, without date and collector's name, general coll., 1 ♂ (SDEI);

Wegscheid, 8.vii.1920, Dr. Priesner leg., 1 ♀ (NHMW); Weisendorf, 25.vi.1965, Marchied leg., 1 ♀ (ZMHB); Wechselberg, without date, S. Breuning leg., ex coll. S. Breuning, coll. P. v. d. Wiel, 1 ♀ (ZMAN); Würzburg, 6.vi.1955, Siegm Hardorfer leg., coll. Stegmann, 1 ♀ (SMNS); **Bavaria/ Hesse and Thuringia states border:** Rhön (Mts.), without date and collector's name, 1 ♀ (SMTD); **Brandenburg state:** Senftenberg, without date and collector's name, 1 ♀ (NHMW); **Hesse state:** Bickenbach, 1.vi.1916, without collector's name, 1 ♂ (SMFD); Darmstadt, 1.v.1951, Hermann Vogt leg., Hessen collection, 1 ♀ (SMFD); same locality, 11.v.1952, Hermann Vogt leg., 1 ♂ (SMFD); Eberstadt, 1959, Rebmann leg., 1 ♂ (SMFD); Flörsheim am Main, 30.iv.1905, H. Bucking leg., 1 ♀ (SMFD); same locality, 10.iv.1914, Axel Krogh leg., 1 ♂ (SMFD); Frankfurt (forest), 12.v.1901, coll. C. le Dous, 1 ♂ (ZMUC); same locality, Frankfurt, Hyd. leg., 1 ♀ (ZSM); same locality, without date, D. J. Stiebel leg., 1 ♂, 1 ♀ (SMFD); same locality, without date, A. Weis leg., 1 ♂ (SMFD); same locality, without date and collector's name, 1 ♂ (SMFD); Fulda, 1.vi.1957, P. S. Wagner leg., 1 ♀ (ZMAN); same locality, 6.iv.1983, J. Frisch leg., 1 ♀ (ZMHB); same locality, 30.iv.1984, J. Frisch leg., 1 ♂ (ZMHB); same locality, 14.v.1983, J. Frisch leg., 1 ♂ (ZMHB); Kühkopf (Rhein), 19.v.1951, Dr. Hermann Vogt leg., Hessen collection, 1 ♀ (SMFD); same locality, 9.vi.1951, Wagner leg., 1 ♂ (ZMAN); same locality, 8.v.1960, N. Schurmann leg., Hessen collection, 1 ♂ (SMFD); same locality, 18.v.1899, A. Weis leg., 1 ♂ (SMFD); Lorch am Rhein, 21.vi.1958, Schurmann leg., Hessen collection, 1 ♂ (SMFD); same locality, 28.iv.1961, Schurmann leg., Hessen collection, 1 ♀ (SMFD); same locality, 29.iv.1966, Liebegott leg., coll. D. Liebegott, 1 ♀ (SMFD); same locality, Nollig Castle, 9.v.1968, Nollig leg., 1 ♂ (SMNS); Oestrich-Winkel, without date and collector's name, 1 spec. (ZMHB); Rhönnebirge-Römershag, 21.v. [year not provided], G. Ochs leg., 1 ♀ (SMFD); Sachsenberg, 23.v.1924, Dr. Feige leg., 1 ♀ (SMNS); Seligenstadt, without date, K. Neumann leg., 1 ♂, 1 ♀ (SMFD); **Lower Saxony state:** Hannover, without date, G. Reineck leg., coll. Bosch, 1 ♀ (SMFD); same locality, without date and collector's name, coll. W. H. Muche, 1 ♀ (SMTD); Lilienthal- Kaiserstuhl, 24.iv.1937, Bischoff leg., 2 ♂ (ZMHB); Wendeburg, 2.vii.1920, K. Benner leg., coll. F. C. Drescher, 1 ♂ (ZMAN); **Mecklenburg-Western Pomerania state,** without date, Redeberg leg., 4 ♂ (ZMHB); **North Rhine-Westphalia state,** Düsseldorf, without date, K. Ermisch leg., 1 ♀ (ZMHB); **Rhineland-Palatinate state:** Ahrweiler Dist., Scriba, without date, K. Neumann leg., 1 ♀ (SMFD); Alzey, Dintheshein [not located], 15.iv.1973, Fell Rathmacher leg., 1 ♀ (SMNS); Asselheim, without date, O. Rebmann leg., 1 ♀ (SMFD); Bad Dürkheim, without date, Eppelsheim leg., coll. Eppelsheim, 1 ♀ (NHMW); Breisgau, 5.v.1973, without collector's name, 1 ♂ (SMNS); Budenheim, 7.vi.1926, H. Muller leg., Hessen collection, 1 ♂ (SMFD); Frankenthal, 21.ix.1917, Dr. Feige leg., 1 ♀ (ZMHB); same locality, 16.v.1918, Dr. Feige leg., ♀ (ZMHB); same locality, 20.v.1924, Dr. Feige leg., 1 ♂ (ZMHB); Gau-Algesheim, 25.v.1925, H. Bucking leg., 1 ♀ (SMFD); same locality, 28.iv.1895, W. Sattler leg., 1 ♂ (SMFD); Mainz, 6.v.1984, Schonfeldt leg., 1 ♀ (SMFD); same locality, Mainz Sand Dunes (Botanical Reg.), 8.v.1960, Liebegott leg., coll. D. Liebegott, 1 ♂ (SMFD); same locality, 6.v.1984,

Schonfeldt leg., 1 ♀ (SMFD); Mainz, Mombach, 12.v.1901, Stock leg., 1 ♀ (SMFD); same locality, 27.iv.1918, Karl Stock leg., 1 ♂ (SMFD); same locality, 20.iv.1961, without collector's name, 1 ♀ (SMFD); Neustadt an der Weinstraße (formerly Neustadt an der Haardt), 4.vi.1931, Schaaff leg., 1 ♂ (SMFD), same locality, 6.vi.1931, Schaaff leg., 1 ♀ (SMFD); Ockenheim, 29.iv.1913, Karl Stock leg., 1 ♂ (SMFD); Rheinhessen or Rhenish Hesse [wine region], 1921, Buchka & Axel Krogh leg., 1 ♀ (SMFD); same locality, 24.iv.1898, without collector's name, 1 ♂ (SMFD); Rhein-Pfalz-Kreis Dist., without date and collector's name, 1 ♀ (NMPC); **Saarland state**, Weiselberg, 8.ix.1965, A. Kirch leg., 1 ♀ (SMFD); **Saxony state**: Dresden, 7.ix.1890, without collector's name, coll. Prof. Noesske, 1 ♀ (SMTD); Nossen, without date and collector's name, coll. Fuchs, 1 ♀ (SMTD); Seewiesen (Noth of Breitenbrunn), v.1977, R. Papperitz leg., coll. R. Papperitz, 1 ♂ (SMNS); Waldheim, without date and collector's name, coll. Fuchs, 1 ♂ (SMTD); **Saxony-Anhalt state**: Eisleben, without date, M. Naumann leg., 1 ♀ (SMTD); same locality, Susser See lake, 1.vi.1938, Dr. Feige leg., 1 ♀ (ZMHB); Freyburg (toboggan), 2.ix.1956, K. Ermisch leg., 1 ♀ (ZMHB); Harz Dist., without date and collector's name, general coll., 1 ♂ (SDEI); same locality, without date and collector's name, coll. W. H. Muche, 1 ♂ (SMTD); Harz Dist., Thale, Kärrlingsberg [not located], 17.vii.1951, Dorn leg., 1 ♂ (ZMHB); same locality, 22.v.1952, Dorn leg., 1 ♀ (ZMHB); same locality, 4.vi.1953, Dorn leg., 1 ♂, 1 ♀ (ZMHB); same locality, 12.viii.1954, Dorn leg., 1 ♀ (ZMHB); same locality, 27.viii.1954, Dorn leg., 1 ♂ (ZMHB); Könnern, vii.1962, without collector's name, 1 ♀ (ZMHB); Laucha an der Unstrut, without date and collector's name, coll. C. Schenkling, general coll., 3 ♀ (SDEI); Naumburg, sledding area, 25.ix.1936, Maertens leg., 1 ♂ (SMTD); **Thuringia state**: without date and collector's name, 1 ♀ (HNHM); Altenburg, Hundsheimer Berg [not located], 1.-3.vii.1941, Biscnott leg., 1 ♂ (ZMHB), Altenburg, Auenwald [not located], 29.v.1942, Biscnott leg., 1 ♂ (ZMHB); Arnstadt, 23.v.1920, W. Liebmann leg., general coll., 2 ♂ (SDEI); Bad Frankenhausen, viii.1950, Karl Ermisch leg., 1 ♂, 1 ♀ (ZMHB); same locality, viii.1951, Karl Ermisch leg., 1 ♂ (ZMHB); same locality, 23., 25.v.1953, Karl Ermisch leg., 1 ♂ (ZMHB); same locality, 21.v.1956, Karl Ermisch leg., 1 ♂ (ZMHB); Bleicherode, P. Eigen leg., coll. W. H. Muche, 1 ♂ (SMTD); Bretleben, 14.v.1905, A. Petry leg., 1 ♀ (ZMHB); Frankenhausen, without date, Moosbrugger leg., 1 ♂ (NHMW); Gotha, Veretpsgarten Galberg [not located], v.1907, coll. K. Hanel, 1 ♀ (SMTD); Jonastal [Jonas Valley], 4.vi.1954, Dorn leg., ♀ (ZMHB); Kyffhäuser Gebirge [Kyffhäuser hills], 1.ix.1953, 1 ♂ (ZMHB), same locality, vi.[19]54, without collector's name, 1 ♀ (ZMHB); Kyffhäuser Gebirge [Kyffhäuser hills], Galgenberg, 18.iv.1959, without collector's name, 1 ♀ (SMNS); Kyffhäuser Gebirge [Kyffhäuser hills], Kosakenberg, 21.ix.1958, Dorn leg., 2 ♂, 2 ♀ (ZMHB); Naumburg, 12. iv.1925, Dr. Maertens leg., 1 ♂ (ZMHB); same locality, 24.v.1925, Dr. Maertens leg., 1 ♀ (ZMHB); same locality; 2.vi.1925, Dr. Maertens leg., 1 ♂ (ZMHB); same locality, 25.vii.1925, Dr. Maertens leg., 1 ♂ (ZMHB); same locality, 5.vi.1927, Dr. Maertens leg., 1 ♂ (ZMHB); same locality, 29.iv.1928, Dr. Maertens leg., 1 ♂, 3 ♀ (ZMHB); same locality, 14.v.1929, Dr. Maertens leg., 1 ♀ (ZMHB); Naumburg,

Totintal, 21.v.1903, Stockhausen leg., 1 ♀ (ZMHB); Naumburg, Großwilsdorf, 13.v.1951, Dorn leg., 1 ♀ (ZMHB); Naumburg, Roßbach, 13.v.1951, Dorn leg., 1 ♂ (ZMHB); Waldeck, Sachsenhausen, without date and collector's name, coll. Rosenberg, 1 ♂ (ZMUC); Tautenburg, v.-vi.19[60], without collector's name, 2 ♂ (SMTD); Weimarer Dist., Buchfart, 1895, G. Reineck leg., 1 ♂ (SMFD); same locality, 1897, Reineck leg., 1 ♀ (SMFD); Saihsengurge [not located], 12.v.1912, A. Petry leg., ♀ (ZMHB); Futher l. juga [not located], 25.v.1921, A. Petry leg., ♂ (ZMHB); Blaic Ze..berga [not located], 27.iv.1915, leg. A. Petry, ♂ (ZMHB); Frau [not located], 20.v.1905, leg. A. Petry, ♀ (ZMHB); Seit..burg [not located], 14.v.1911, leg. A. Petry, ♀ (ZMHB); **Upper Bavaria state**, Miesbach, without date, Tratzl leg., 2 ♀ (NMPC);

Greece: Acarnania Reg., without date and collector's name, 1 ♀ (NMPC); **Attica Reg.:** Athens, Glyfada, 29.iv.1973, coll. D. Liebegott, 1 ♂ (SMFD); Athens, Kaisariani, without date, Bartoň leg., 1 ♂ (NMPC); Athens, Nea Ionia, Pefkakia station, 2.vi.1980, Epping leg., 1 ♂ (SMNS); Athens, 1960, without collector's name, coll. C. & O. Vogt, 1 ♀ (ZMAN); same locality, without date, Berinek leg., 1 ♀ (ZMHB); same locality, without date, Fankrati leg., 1 ♀ (NHMW); same locality, without date, Zebe leg., 1 ♀ (ZMUC); same locality, without date and collector's name, coll. W. H. Muche, 1 ♂ (SMTD); same locality, without date and collector's name, 1 ♀ (NMPC); (Cape) Sounion, 13.v.1964, Eckerlein leg., 2 ♂ (SMTD); Faliro, without date, Oertzen leg., 1 ♂ (ZMHB); Piraeus, without date, 2 ♂ (BMNH); Rafina, 15.iv.1960, W. Kühnelt leg., 1 ♀ (NHMW); Attica, without specific locality, without date and collector's name, 3 ♂, 2 ♀ (NMPC); Attica, without specific locality, 1882, Oertzen leg., 1 ♂, 1 ♀ (NHMW); Attica, 1907, Leonis leg., 1 ♀ (NHMW); Attica, 14.iv.1922, without collector's name, coll. W. Liebmann, general coll., 1 ♂, 4 ♀ (SDEI); Attica, 27.iv.1967, E. Witt leg., 1 ♂ (SMFD); Attica, 9.v.1869, without collector's name, coll. Kraatz, general coll., 1 ♂ (SDEI); Attica, without date, Leonis leg., 1 ♂ (NMPC); Attica, without date and collector's name, coll. W. H. Muche, 2 ♂, 1 ♀ (SMTD); Attica, without date and collector's name, coll. Noesske, 3 ♂, 2 ♀ (SMTD); Attica, without date and collector's name, coll. Reitter, 1 ♀ (HNHM); Attica, without date and collector's name, coll. Thieme, 1 ♂, 1 ♀ (ZMHB); Attica, without date and collector's name, 1 ♂ (HNHM); Attica, without date and collector's name, 3 ♂, 1 ♀ (NHMW); Attica, without date and collector's name, 1 spec. (NHMW); Attica, without date and collector's name, 3 ♀ (NMPC); **Central Greece Reg.:** Euboea, Chalcis, 26.v. [without year], Holtz leg., 1 ♀ (ZMHB); Boeotia, Chaliá, without date, Holtz leg., 1 ♂ (NMPC); Mount Parnassus, without date and collector's name, coll. Hauser, 1 ♂ (NHMW); same locality, without date and collector's name, coll. Thieme, 1 ♀ (ZMHB); same locality, without date and collector's name, coll. W. H. Muche, 1 ♂ (SMTD); same locality, without date and collector's name, 1 ♂ (HNHM); same locality, without date and collector's name, 1 ♀ (NHMW); Phocis, Nafpaktos, 14.iv.1979, S. Vit leg., 1 ♂ (MHNG); **Central Macedonia Reg.:** Aistrati, 29.iv.1984, H. Schonmann leg., 1 ♂, 1 ♀ (NHMW); Amfipoli, 28.v.2007, Tomáš Sitek leg., 2 ♂, 1 ♀ (TSIC); Asprovalta, 17.vi.1976, Marggi leg., 1 ♀ (SMNS); same locality, 24.vi.1984,

Epping leg., 1 ♂, 1 ♀ (SMNS); Edessa (West), 17.iv.1980, Krätschmer leg., 1 ♀ (SMNS); Evzoni, 10.v.1991, G. Guevare leg., 1 ♀ (JRUC); Chalkidiki Peninsula, Kassandra, viii.2002, Olejníček leg., ex coll. Olejníček, 4 ♂, 11 ♀ (NMPC); Katerini, 4.iv.1987, J. Frisch leg., 1 ♀ (ZMHB); Litochoro, without date, Bartoň leg., 2 ♂ (NMPC); Mount Olympus, without date, Bartoň leg., 1 ♀ (NMPC); Serres, Simvoli, 30.iv.1983, H. Schonmann leg., 1 ♂, 1 ♀ (NHMW); Serres, (3 km North), 41°07'4"N, 23°33'5"E, field, pasture-steppe, 250 m, 26.iv.2007, Jiří Hájek, 2 ♂, 1 ♀ (JRUC); same data, 1 ♂, 2 ♀ (NMPC); Stavros, 20-300 m, 1.-12.vi.1997, Jan Farkač leg., 1 ♀ (JRUC); Thessaloniki (Salonica), 13.v.1968, A. Senglet leg., 1 ♂, 1 ♀ (MHNG); Thessaloniki, 3 km South of Tagarades, 40°28'1"N, 23°00'8"E, olive orchard, field, 170 m, 27.iv.2007, Jiří Hájek leg., 1 ♂, 1 ♀ (JRUC); same data, 2 ♂ (NMPC); Vafiochorion, Castro, 4.iv.1982, Korell leg., 1 ♂ (SMNS); **Crete Island:** without specific locality, v.1904, without collector's name, 1 ♀ (NHMW); same locality, without date, Holtz leg., 1 ♀ (ZMHB); same locality, without date, Paganetti leg., 1 ♂, 1 ♀ (HNHM); same locality, without date, Paganetti leg., 2 ♀ (NHMW); same locality, without date, Paganetti leg., 2 ♂, 4 ♀ (NMPC); same locality, without date, Paganetti leg., 4 ♂, 2 ♀ (ZMHB); same locality, without date, Paganetti leg., coll. J. Fleischer, 1 ♀ (NMPC); same locality, without date and collector's name, coll. Kamberský, 1 ♂ (NMPC); same locality, without date and collector's name, 1 ♂, 1 ♀ (BMNH); same locality, without date and collector, 1 ♀ (NHMW); same locality, without date and collector's name, 1 ♀ (ZMHB); Amnisos, 20.x.1972, A. C. & W. N. Ellis leg., 2 ♂, 2 ♀ (ZMAN); Chania, ii.1906, Biro leg., 3 ♂, 3 ♀ (HNHM); same locality, iv.1906, Biro leg., 1 ♀ (HNHM); same locality, 5.iii.1925, A. Schulz leg., 1 ♂ (ZMHB); same locality, 31.iii.1925, A. Schulz leg., 1 ♀ (ZMHB); same locality, iv.1926, Holtz leg., 1 ♀ (ZMHB); same locality, 26.iv. (without year), Holtz leg., 1 ♂ (ZMHB); same locality, without date, Maltzan leg., 1 ♂, 1 ♀ (ZSM); same locality, without date and collector's name, 1 ♂ (HNHM); Georgioupoli, 10.x.1925, A. Schulz leg., 1 ♀ (ZMHB); Heraklion, iv.1906, Biro leg., 3 ♂, 3 ♀ (HNHM); same locality, 18.vi.1925, A. Schulz leg., 1 ♂ (ZMHB); same locality, 14.v.1963, K. Kusdas leg., 1 ♂ (NHMW); same locality, 22.v.1963, K. Kusdas leg., 1 ♀ (NHMW); same locality, 26.v.1963, K. Kusdas leg., 1 ♀ (NHMW); same locality, 23.-27.iv.1986, Z. Meszaros leg., 1 ♀ (HNHM); same locality (6 km West), 10.iv.1975, J. A. W. Lucas leg., 1 ♂ (ZMAN); Chora Sfakion, 26.iii.1992, Motol leg., 2 ♂ (JRUC); Kalyves, 27.iii.1925, A. Schulz leg., 1 ♀ (ZMHB); Kandia, without date, Mařan, Štěpánek & Bartoň leg., 1 ♂, 2 ♀ (NMPC); Knossos, 1983, without collector's name, coll. Stegmann, 1 ♀ (SMNS); same locality, iv.1988, without collector's name, 1 ♂ (NHMW); same locality, without date, Mařan, Štěpánek & Bartoň leg., 1 ♂ (NMPC); Kritsa (North) between Dramia and Kalami, 25.-26.iii.1925, A. Schulz leg., 1 ♀ (ZMHB); Malia, 17.iv.1971, W. Wittmer leg., 1 ♂ (SMNS); same locality, v.1972, Messutat leg., 1 ♂ (SMNS); Meradhes (in the South-West), Kastelli Kissamu, 7.iii.1925, A. Schulz leg., 1 ♂, 1 ♀ (ZMHB); Mires, iii.1982, G. Sama leg., 1 ♀ (SMNS); Mitass, Epar. Kanurgion [not located], 16.v.1925, A. Schulz leg., 1 ♀ (ZMHB); Crete, 1884, Oertzen leg., 1 ♀ (NHMW), same locality, Viano [Viannos], without date, Oertzen leg., 1 ♀ (ZMHB); Phaistos, iii.1981, Schur-

mann leg., 1 ♀ (SMNS); Rethimnon, 14.iv.1980, Korell leg., 1 ♂, 2 ♀ (JRUC); same locality, Melambes (15 km South-East Spili), 35°08'N 24°39'E, 200 m, 7.v.1995, C. Lange & J. Ziegler leg., general coll., 1 ♂, 1 ♀ (SDEI); Rethymno, 8.-29.v.1979, R. Köstlin leg., coll. R. Köstlin, 1 ♀ (SMNS); Rethymno, Amari Valley, 100-300 m, 5.-11.iv.1991, P.M. Hammond leg., 1 ♂ (BMNH); Rethymno, Episkopi (8 km West of Perama), 35°22'N 24°37'E, 100 m, 28.iv.1995, C. Lange & J. Ziegler leg., general coll., 1 ♂, 1 ♀ (SDEI), Rethymno, 12.x.1925, A. Schulz leg., 1 ♂ (ZMHB); Yoryinpoli [not located], 16.v.2001, H. Schmalfuss leg., 1 ♀ (SMNS); **East Macedonia and Thrace Reg.:** Aristino valley (8 km North of Xanthi), Alexandroupoli, v.1979, Krätschmer leg., 2 ♂, 1 ♀ (SMNS); Alexandroupoli, v.1979, Krätschmer leg., 1 ♂ (SMNS); same locality, without date, Bartoň leg., 1 ♂ (NMPC); Drama, without date, Weirather leg., 1 ♂, 3 ♀ (MHNG); Evros (10 km North-West Didymoteicho), Quercus, cultural-land, 50 m, 22.iv.1994, Bense leg., 1 ♀ (SMNS); Galipsos, 1983, Krätschmer leg., 1 ♂ (SMNS); Chalkero (8 km East of Kavala), 40°58'03"N, 24°28'02"E, pasture, 70 m, 25.iv.2007, Jiří Hájek leg., 1 ♀ (JRUC); same locality, without date, Jiří Hájek leg., 1 ♀ (NMPC); Kavala, vi.1973, without collector, 1 ♂, 2 ♀, 1 spec. (MHNG); same locality, v.1979, O. Krätschmer leg., 1 ♀ (SMNS); same locality, 550 m, 3.v.1984, Krätschmer leg., 1 ♂ (SMNS); same locality, 17.vi.1993, M. Jäch leg., 1 ♂ (NHMW); same locality, Pangeo sopra, Akrovounion, 1500 m, 7.vii.1983, 1 ♂ (MHNG); Komotini, 22.iv.1965, 1 ♂ (SMNS); Thasos Island, 11.vi.1967, Epping leg., 1 ♂ (SMNS); Thasos Island, Crisso Akroyiali [probably App. Akrogiali] near Potamia, 9.viii.1972, M. I. Russell leg., 1 ♂ (BMNH); Thasos Island, Panagia, 27.v.1999, H. Schmalfuss leg., 1 ♂ (SMNS); Xanthi, v.1979, Krätschmer leg., 1 ♂ (SMNS); same locality, without date, Bartoň leg., 1 ♂, 1 spec. (NMPC); same locality, valley, 16.iv.1982, Krätschmer leg., 1 ♂ (SMNS); **Epirus Reg.:** Arta, 5.iv.1973, Krätschmer leg., 1 ♂, 1 ♀ (SMNS); Ioannina, vii.1968, W. Kühnelt leg., 1 ♀ (NHMW); Megalo Peristeri, 23.v.1969, without collector's name, 1 ♀ (MHNG); Pindus (Mt.), Metsovo, 20.iv.1973, Krätschmer leg., 2 ♂ (SMNS); Thesprotia, Igoumenitsa, 5.iv.1973, Krätschmer leg., 1 ♂ (SMNS); same locality, Karteri, 12.vi.2008, K. Orszulik leg., 3 ♂, 3 ♀ (KORC); **Eastern Evrytania / Western Phthiotis Reg. border:** Tymfristos (Mt.), without date and collector's name, 1 ♀ (NMPC); **Ionian Islands:** Cephalonia Island: 1905, O. Leonhard leg., general coll., 2 ♂ (SDEI); Argostoli, 1908, M. Hilf leg., ex coll. O. Leonhard, coll. Noesske, 1 ♂ (SMTD); same locality, 2.-8.v.1929, Beier leg., 1 ♀ (NHMW); same locality, 12.-18.x.1972, G. Benick leg., 1 ♂ (ZMHB); same locality, 10.-15.v.1980, W. H. Gravestein leg., 1 ♂ (ZMAN); Charakti, 1908, M. Hilf leg., coll. O. Leonhard, general coll., 1 ♂ (SDEI); Corfu island, 1903, Paganetti leg., coll. W. H. Mucche, 1 ♀ (SMTD); same locality, 9.v.1913, A. Kramer leg., 1 ♀ (ZMHB); same locality, without date, Paganetti leg., coll. J. Fleischer, 1 ♀ (NMPC); same locality, without date and collector's name, 1 ♂, 2 ♀ (SMTD); Lefkada island, 8.-30.iv.1929, Beier leg., 1 ♂, 1 ♀ (NHMW); same locality, Kallighoni, 26.iii.1971, I. Löbl leg., 1 ♀ (MHNG); Zakynthos Island, 22.iii.1936, Eigelt leg., 1 ♀ (NHMW); same locality, Kalamaki, 1909, M. Hilf leg., coll. O. Leonhard, general coll., 3 ♀ (SDEI); Ionian Islands without specific locality, without date,

Gabriel leg., coll. Bosch, 1 ♂ (SMFD); **North Aegean Reg.:** Lemnos Island (2 km South of Kalliopi), 39°54'03"N, 25°20'06"E, marsh-saline: sand-dunes, 5 m, Jiří Hájek leg., 1 ♂ (NMPC); Samos Island, 26.v.-6.vi.1987, Bilek, Kritscher leg., 1 ♀ (NHMW); **Peloponnese Reg.:** Achaia county, Panahaiko (Mts.), 29.iv.1998, Behne leg., general coll., 2 ♀ (SDEI); Arkadia, Megalopolis, 12.iv.1973, Krätschmer leg., 1 ♀ (SMNS); Corinth, without date and collector's name, 2 ♂, 1 ♀ (NHMW); Dymi (Kato Achaia), Patras, v.1972, Messutat leg., 1 ♀ (SMNS); Epidaurus, 20.v.1937, F. Warner leg., 1 ♀ (NHMW); Galatas, 7.-28.vi.1976, Köstlin leg., 1 ♂ (SMNS); Laconia (South West of Skala), 30.ix.1962, without collector's name, 1 ♀ (ZMAN); Lout-raki, 50 m, v.1974, Weisz leg., 1 ♀ (NHMW); Taygetus (Mts.), without date, Brenske leg., coll. Schwarzer, 1 ♂ (SMFD); same locality, without date, Dr. Kinper leg., coll. Hauser, 1 ♂ (NHMW); Taygetus, Kalamata, 4.ix.1977, L. Toth leg., 1 ♀ (HNHM); Taygetus, without date and collector's name, 1 ♀ (NHMW); Tripotama, Erymanthos valley, 21.iv.1980, Krätschmer leg., 1 ♂ (SMNS); **South Aegean Reg.:** Naxos Island, without date, Dr. Kinper leg., coll. Hauser, 2 ♂, 1 spec. (NHMW); Rhodes Island, without date and collector's name, 1 ♀ (NMPC); same locality, without date and collector's name, coll. Reitter, 1 ♀ (NMPC); **Thessaly Reg.:** Karya, iv.1980, Krätschmer leg., 1 ♂ (SMNS); Larissa (7 km South of Elasson), v.1980, Krätschmer leg., 1 ♀ (SMNS); Mount Ossa, Oros, 1000 m, 18.iv.1980; Krätschmer leg., 1 ♂ (SMNS); Sulopulon [not located], 26.iii.1978, S. Vit leg., 1 ♀ (MHNG); Skopelos Island, vi.1985, Bilek & Kritscher leg., 1 ♀ (NHMW); Sporades, Skiathos Island, 17.iii.1976, Liebegott leg., coll. D. Liebegott, 1 ♂ (SMFD); same locality, 20.iv.1976, Liebegott leg., 1 ♀ (SMNS); same locality, 2.vi.1979; Liebegott leg., 1 ♂ (SMFD); same locality, 15.ix.1991, Liebegott leg., 1 ♀ (SMFD); Tyrnavos, 18.iv.1973, Krätschmer leg., 1 ♀ (SMNS); Volos, without date, Stussiner leg., coll. Fry, 1 ♀ (BMNH); same locality, without date, Stussiner leg., 1 ♂, 1 ♀ (NMPC); **West Greece Reg.:** Achaea, Kalogria, 20.-21.v.2004, Angelini leg., 2 ♂, 1 ♀ (JRUC); Kalavryta, without date, Bartoň leg., 1 ♂ (NMPC); Olympia, without date and collector, 1 ♀ (NHMW); same locality, without date and collector, 1 ♀ (NMPC); **Greece without specific locality:** 7.vii. (without year), without collector's name, 1 ♂ (MHNG); vii.1907, without collector's name, 1 ♂ (MHNG); without date, L. Salvador leg., 1 ♂ (NMPC); without date, Roth & Dohrn leg., 1 ♀ (ZSM); without date, Walff leg., 1 ♂ (ZMHB); without date and collector's name, coll. Merlin, 1 ♀ (BMNH); without date and collector's name, coll. Thieme, 1 ♀ (ZMHB); without date and collector's name, 1 ♀ (BMNH); without date and collector's name, 1 ♂ (MNCN); without date and collector's name, 2 ♀ (NMPC); without date and collector's name, 1 ♀ (ZMHB);

Hungary: Bács-Kiskun County: Kunpeszér, 22.iv.1979, Adam leg., 1 ♂ (HNHM); Szalkszentmarton, 14.vii.1995, O. Merkl leg., 1 ♀ (HNHM); Ficser, Pusztá (grassland biome), 19.vi.1995, J. Probst leg., 2 ♂ (JRUC); Kalocsa, without date, Speiser leg., coll. F. Speiser, 2 ♀ (HNHM); Karapáncsa, without date and collector's name, coll. Peregi, 1 ♂, 1 ♀ (HNHM); Kiskunfélegyháza, without date, Motzar leg., 1 ♂ (HNHM); same locality, without date and collector's name, 1 ♀ (HNHM); Kiskunság National Park, Fülöpháza, 19.v.1982, K. Kiss leg., 1 ♂ (HNHM); Kiskun-

ság National Park, Lakitelek, Tóserdő, 21.ii.1979, Migaly Adam leg., 1 ♂ (HNHM); Kiskunság, Dabas, 12.–17.vi.1979, Adam & Hamori leg., 1 ♀ (HNHM); Kiskunság, Tabdi, 25.x.1977, Adam leg., 1 ♂ (HNHM); Lake Vadkert, 5.v.1936, Erdos leg., coll. J. Erdos, 1 ♂ (HNHM); Tompa, 11.vii.1956, Z. Kaszab leg., 1 ♂ (HNHM); **Baranya County:** Mecsek (Mts.), Zobakpuszta, Hidasi-völgy, without date, Z. Kaszab leg., 1 ♂ (HNHM); Nagyarsány, Harsány, 23.vi.1954, Kaszab & Szekessy leg., 1 ♀ (HNHM); Pécs, 1906, Bokor leg., 1 ♂ (HNHM); same locality, 1906, without collector's name, ex coll. Bokor, 1 ♀ (HNHM); same locality, 1907, without collector's name, ex coll. Bokor, 1 ♂ (HNHM); Villány, 18.viii.1954, Gy. Tópál leg., 2 ♀ (HNHM); Zamárdi, 17.viii.1972, Fzong leg., 1 ♂ (HNHM); **Borsod-Abaúj-Zemplén County,** Aggtelek, 26.v.1972, G. Szocs leg., 1 ♂ (HNHM); **Csongrád County,** Algyő, 27.iv. (without year), without collector's name, 1 spec. (HNHM); Szeged, without date, Victor Stiller leg., coll. Stiller, 2 ♂ (HNHM); **Fejér County:** Besnyő, without date and collector's name, 1 ♂ (NHMW); Csókakő, without date, Lichtenckert leg., 1 ♀ (HNHM); Ercsi, without date, Victor Stiller leg., coll. Stiller, 1 ♀ (HNHM); Martonvásár, Homokgödör, 27.iv.1955, Z. Kaszab leg., 1 ♂ (HNHM); Mezőfalva, without date and collector's name, coll. R. Streda, 1 ♀ (HNHM); Székesfehérvár, 17.vi.1904, without collector's name, 1 ♂ (HNHM); same locality, 1920, without collector's name, coll. W. H. Muche, 2 ♂ (SMTD); same locality, without date, Lichtenckert leg., 1 ♂ (HNHM); **Győr-Moson-Sopron County:** Győr, 14.iv.1936, Révy leg., coll. D. Révy, 1 ♀ (HNHM); same locality, without date, E. Bokor leg., ex coll. E. Bokor, 1 ♂, 1 ♀ (HNHM); same locality, without date, E. Bokor leg., 1 ♂ (HNHM); Győr, pasture, 15.ix.1975, J. Strejček leg., 1 ♀ (JRUC); Dunakiliti, 29.vi.–19.viii.1996, O. Merkl leg., 1 spec. (HNHM); Mosonmagyaróvár, 27.iv.1944, Révy leg., coll. D. Révy, 1 ♂ (HNHM); Lake Neusiedl (Fertő-tó), without date and collector's name, coll. R. Streda, 2 ♀ (HNHM); Sopron, viii.1918, without collector's name, coll. R. Streda, 1 ♀ (HNHM); same locality, without date and collector's name, coll. R. Streda, 1 ♀ (HNHM); **Hajdú-Bihar County:** Debrecen, without date and collector's name, coll. D. Kanabé, 1 ♀ (HNHM); **Heves County:** Eger, 16.iv.1952, N. Vamos leg., 1 ♂ (HNHM); same locality, viii.1984, without collector's name, 1 ♂ (ZMHB); **Komárom-Esztergom County:** Esztergom, 13.v.1916, E. Dudich leg., 1 ♀ (HNHM); same locality, 1919, without collector's name, ex coll. Bokor, 1 ♂ (HNHM); same locality, 9.v.1925, Veghelyi leg., 1 ♂ (HNHM); same locality, 16.vi.1925, Veghelyi leg., 1 ♀ (HNHM); same locality, without date, Bokor leg., ex coll. Bokor, 1 ♀ (HNHM); same locality, without date and collector's name, ex coll. Bokor, 1 ♀ (HNHM); **Nógrád County:** 10.–16.viii.1953, Gy. Tópál leg., 1 ♂ (HNHM); Legénd, without date, Tunkl leg., 1 ♀ (HNHM); **Pest County:** Budapest 1879, J. Langert leg., 1 ♀ (HNHM); same locality, 1883, Pavel leg., 1 ♀ (HNHM); same locality, 1931, Z. Kaszab leg., 1 ♂ (HNHM); same locality, iv.1935, Hory leg., 1 ♀ (HNHM); same locality, v.1954, without collector's name, coll. Dr. Lenci, 1 ♂ (HNHM); same locality, without date, Csillebeh leg., 1 ♀ (HNHM); same locality, without date, E. Dudich leg., 1 ♂ (HNHM); same locality, without date, Kuthy leg., 1 ♂ (HNHM); same locality, without date and collector's name, coll. H. Di-

ener, 2 ♀, 1 ♂ (HNHM); same locality, without date and collector's name, 5 ♂, 3 ♀ (NHMW); Budapest, Albertfalva, without date and collector's name, coll. H. Diener, 1 ♂, 1 ♀ (HNHM); Budapest, Budafok, without date and collector's name, ex. coll. Guranyi, 1 ♂ (HNHM); Budapest, Cinkota, Naplas-to, 22.iv.1992, without collector's name, 1 ♀ (HNHM); same locality, 1.vii.1992, L. Nadai leg., coll. E. Csiki, 1 ♂ (HNHM); Budapest, Csepel, 31.vii.1994, O. Merkl leg., 1 ♀ (HNHM); Budapest, Káposztásmegyer, 100 m, 22.iv.1984, O. Merkl leg., 1 ♀ (HNHM); same locality, 25.v.1986, O. Merkl leg., 1 ♀ (HNHM); same locality, 12.v.-30.vi.1996, O. Merkl leg., 1 ♂ (HNHM); Budapest, Lágymányosi Bridge, 24.viii.1953, Révy leg., coll. D. Révy, 1 ♂ (HNHM); same locality, without date and collector's name, coll. H. Diener, 1 ♀ (HNHM); Budapest, Rákoscscaba, 20.v.1966, L. Haraszthy leg., 1 ♂ (HNHM); same locality, 7.viii.1978, I. Kismarjai leg., 1 ♂ (HNHM); Budapest, Sashegy, without date and collector's name, coll. H. Diener, 1 ♂ (HNHM); Budapest, Törökvész, 27.viii.1940, Csiki leg., coll. E. Csiki, 1 ♂ (HNHM); Budapest, Újpest, without date and collector's name, coll. Noesske, 1 ♂ (SMTD); Budapest, Varosi erdo, 1.v.1966, L. Haraszthy leg., 1 ♂ (HNHM); Budaörs, 6.vii.1988, Korsos & Szel leg., 1 ♀ (HNHM); Érd, without date, Csiki leg., coll. E. Csiki, 1 ♀ (HNHM); same locality, without date and collector's name, coll. E. Csiki, 1 ♂ (HNHM); Felsőgod, 12.vi.1916, R. Streda leg., coll. R. Streda, 1 ♂ (HNHM); Gödöllő, 20.v.1896, without collector's name, coll. E. Csiki, 1 ♀ (HNHM); Haraszt, 27.iv.1926, without collector's name, 1 ♂ (HNHM); Leányfalu, without date and collector's name, coll. R. Streda, 1 ♂ (HNHM); Lórév, 2.iv.2006, O. Merkl leg., 1 ♂ (HNHM); Nagykovácsi, Nagyszenas, without date, Kaszab leg., 1 ♀ (HNHM); Ócsa, 1953, Z. Kaszab leg., 1 ♀ (HNHM); Ócsa, Oreg turjan [not located], 24.iv.1952, Kakassne leg., 2 ♀ (HNHM); Szigetbecse, 100 m, 27.v.1987, O. Merkl leg., 1 ♀ (HNHM); Solymár, 26.iv.1953, Kovacsne leg., 1 ♀ (HNHM); same locality, 26.vi.1982, Racz leg., 1 ♂ (HNHM); Torokugrato hill, Budaörs, 1.vii.2005, Gyöző Szel leg., 1 ♂ (HNHM); Visegrád (castle town), 1905, Penther leg., 1 ♂ (NHMW); **Somogy County:** Kaposvár, 15.-16.iv.1960, M. Nattan leg., coll. M. Nattan, 1 ♂, 1 ♀ (HNHM); same locality, 29.iv.1961, M. Nattan leg., coll. M. Nattan, 1 ♀ (HNHM); same locality, 30.iv.1962, M. Nattan leg., 1 ♂ (HNHM); **Tolna County:** Simontornya, 1910, without collector, ex coll. Bokor, 1 ♂ (HNHM); same locality, iv.1911, without collector's name, coll. Pillich, 1 ♀ (HNHM); same locality, 26.iv.1913, without collector's name, coll. Pillich, 1 ♂ (HNHM); same locality, 27.iv.1927, without collector's name, coll. Pillich, 1 ♂ (HNHM); Udvari, Alsopelpuszt, 22.v.1996, O. Merkl leg., 1 ♀ (HNHM); **Torontal County:** Újszeged, 22.iv.1932, Erdos leg., coll. J. Erdos, 1 ♂ (HNHM); **Veszprém County:** Balatonederics, without date and collector's name, 1 ♂, 1 ♀ (HNHM); Berhida, iv.1954, Lenci leg., 1 ♀ (HNHM); same locality, vii.1954, without collector's name, coll. Lenci, 1 ♀ (HNHM); same locality, without date, Szekessy leg., 1 ♂ (HNHM); Pápa, without date, E. Horvath leg., 1 ♂ (BMNH); Pilis Mts., Köhegy, 24.iii.1966, L. Haraszthy leg., 1 ♂ (HNHM); Tihany, 12.iv.1934, Mihalyi leg., 1 ♀ (HNHM); same locality, v.1941, Kaszab & Szekessy leg., 2 ♂, 1 ♀ (HNHM); Zirc, without date and collector's name, 1 spec. (HNHM);

Zala County: Keszthely, 1869, Dyeney leg., 1 ♂ (HNHM); Nova, without date and collector's name, coll. R. Streda, 3 ♂, 1 ♀ (HNHM); **Hungary without specific locality:** 12.ix.1914, without collector's name, 1 ♀, 1 spec. (ZMUC); without date and collector's name, coll. E. Frivaldszky, 1 ♀ (HNHM); without date and collector, coll. Markel, 1 ♂ (SMTD); without date and collector's name, coll. Noesske, 1 ♀ (SMTD); without date and collector's name, 1 ♀ (BMNH); without date and collector's name, 1 ♀ (ZMUC); without date and collector's name, 1 ♀ (ZSM);

Italy: Abruzzo Reg.: Avezzano, vi.1899, B. Schwarzer leg., 1 ♂ (SMFD); L'Aquila prov., Cerchio, 1908, D'Amore leg., 3 ♂, 1 ♀ (NHMW); Monte Greco, without date, Paganetti leg., 1 ♀ (NHMW); same locality, without date, Paganetti leg., coll. Franklin Muller, general coll., 3 ♀ (SDEI); same locality, without date, Paganetti leg., coll. Rebmann, 1 ♀ (SMFD); without specific locality, without date, Paganetti leg., 1 ♀ (JRUC); **Apulia Reg.:** Brindisi, 3.iv.1973, Krätschmer leg., 2 ♂, 1 ♀ (SMNS); same locality, iv. (without year), Muche leg., coll. W. H. Muche, 1 ♂, 1 ♀ (SMTD); Castellaneta, 20.iv.1979, Duschurmann leg., 1 ♀ (NHMW); Foce di Capota, 1.v.1977, F. Angelini leg., coll. R. Kostlin, 1 ♀ (SMNS); Gargano, 7.v.1995, Mattinaio leg., 1 ♀ (JRUC); same locality, without date, L. S. Giovanni leg., 2 ♂, 3 ♀ (NHMW); Gargano, Mattinata, 5.v.1997, J. Vilimova leg., 1 ♀ (JRUC); Monte Gargano, 24.iv.1979, Schurmann leg., 1 ♂ (NHMW); same locality, 1907, M. Hilf leg., ex coll. O. Leonhard, coll. Noesske, 1 ♀ (SMTD); same locality, 1907, M. Hilf leg., coll. O. Leonhard, general coll., 1 ♂, 3 ♀ (SDEI); same locality, Peschici, 23.iii.1975, M. Niehuis leg., 2 ♂ (SMNS); Ginosa, Salinelle (are three fields of mud volcanoes), 17.xii.1978, F. Angelini leg., coll. R. Kostlin, 1 ♀ (SMNS); Grottaglie, iv.1974, 1979, Dr. Schurmann leg., 1 ♂, 1 ♀ (NHMW); same locality, without date, Paganetti leg., general coll., 1 ♀ (SDEI); same locality, without date, Paganetti leg., 1 ♀ (HNHM); same locality, without date, Paganetti leg., 1 ♂ (NHMW); same locality, without date, Paganetti leg., 1 ♀ (SMFD); same locality, without date, Paganetti leg., 1 ♂ (SMNS); same locality, without date and collector's name, coll. Dr. J. Fodor, 1 ♀ (HNHM); Lecce prov., 25.-31.v.1930, Dannenberg leg., 1 ♀ (ZMHB); Lecce prov., Spongano, 21.vi.1930, Dannenberg leg., 1 ♀ (ZMHB); same locality, 16.-31.iii.1933, Loudon leg., 3 ♂, 2 ♀ (ZMHB); same locality, 5.-10.iv.1933, Loudon leg., 1 ♂ (ZMHB); same locality, 27.iv.1933, Loudon leg., 1 ♂, 2 ♀ (ZMHB); Manfredonia, without date, Hermann Vogt leg., Hessen collection, 1 ♀ (SMFD); same locality, without date, J. Fleischer leg., 1 ♀ (NMPC); Monte Sant'Angelo (Souther slope of Monte Gargano), without date, Stolz leg., 2 ♂ (NHMW); same locality, without date and collector's name, 1 ♂ (NHMW); Taranto, iii.1919, without collector's name, 2 ♂ (BMNH); **Calabria Reg.:** Sant'Eufemia d'Aspromonte, 1905, O. Leonhard leg., general coll., 1 ♀, 1 spec. (SDEI); Serra San Bruno, vi.1875, without collector's name, 1 ♀ (MHNG); same locality, without date and collector's name, coll. K. Mazura, 2 ♂ (MZMB); **Campania Reg.:** Naples, without date, B. Schwarzer leg., 1 ♀ (SMFD); same locality, without date, Muche leg., coll. W. H. Muche, 1 ♂ (SMTD); same locality, without date, Zimmermann leg., 3 ♂ (NHMW); same locality, without date and collector, coll. R. Streda, 2 ♀ (HNHM); Pioppi, 16.vi.1965, W. Liebmann leg.,

coll. E. Ulbrich, 1 ♀ (SMNS); Pompeii (in Napoli prov.); 15.iv.2003, P. Kment & M. Horsák leg., 1 ♂, 1 ♀ (JRUC); San Giorgio, without date, Sterba leg., 2 ♂, 1 ♀ (NMPC); Sturno, 1891, Zara Vecch leg., 1 ♂ (NHMW); **Emilia-Romagna and Tuscany Reg.**, Apennine (Mts.), Passo Dei Mandrioli, 6.vi.1963, R. H. Lechner leg., 1 ♂ (NHMW); **Emilia-Romagna Reg.:** Cattolica, iv.1952, H. Schmielt leg., 1 ♀ (SMFD); same locality, x.1962, Schirners leg., 1 ♂ (SMFD); Cesenatico, 29.iv.-8.v.1991, P. Průdek leg., 1 ♂, 2 ♀ (JRUC); Ravenna, without date, I. Kovář leg., 1 ♂, 1 ♀ (NMPC); Riccione, vi.1958, K. Ulbrich leg., coll. E. Ulbrich, 1 ♂ (SMNS); same locality, vii.1970, without collector's name, coll. S. Kiener, 1 ♀ (MHNG); same locality, without date, Hájek leg., 7 ♂, 4 ♀ (NMPC); same locality, without date, Hájek leg., 1 ♂ (NMPC); Serramazzoni, 22.vii.1963, Lamholdt leg., 1 ♂ (ZMUC); **Friuli-Venezia Giulia Reg.:** Cervignano del Friuli, 20.vi.1910, Pinker leg., 1 ♀ (NHMW); Gorizia, viii.1908, Krekich leg., 1 ♂ (NHMW); Görz (Gorizia), without date, Gabriele leg., 4 ♀ (NHMW); Latisana, without date, Weiser leg., 1 ♂ (NMPC); Martignacco, 15.iv.1963, without collector's name, 1 ♂ (MHNG); same locality, 3.vii.1963, without collector's name, 1 ♂ (MHNG); Monfalcone, 16.vii.1910, Pinker leg., 1 ♂ (NHMW); Noghera, 17.iv.1904, without collector's name, 1 ♀ (NHMW); Tagliamento river, Latisana, without date, I. B. Weises leg., 1 ♂, 1 ♀ (NMPC); Trieste, 2.v.1984, H. Noack leg., 1 ♀ (SMFD); same locality, without date, Dr. Will leg., 1 ♀ (ZMHB); same locality, without date, Schiodte leg., 1 ♀ (ZMUC); same locality, without date, Ullrich leg., 1 ♀ (ZMUC); same locality, without date and collector's name, coll. Bosch, 1 ♀ (SMFD); same locality, without date and collector's name, coll. Schneider-Kelch., general coll., 1 ♀ (SDEI); same locality, without date and collector's name, coll. Krekich, 1 ♀ (NHMW); same locality, without date and collector's name, 1 ♀ (NHMW); same locality, without date and collector's name, 1 ♂ (NMPC); same locality, without date and collector's name, 1 ♂ (SMTD); same locality, without date and collector's name, 2 ♂, 3 ♀ (ZMHB); Udine prov., Martignacco, 15.iv.1963, without collector's name, 1 ♂, 1 ♀ (MHNG); same locality, vi.1964, without collector's name, 1 ♂, 1 ♀ (MHNG); same locality, 20.viii.1966, Cassutti-Morandini leg., 1 ♀ (MHNG); **Lazio Reg.:** Ausonia, 7.v.1965, without collector, coll. J. Erdos, 1 ♀ (HNHM); Latina prov., Parco Nazionale del Circeo, Sabaudia (environs of brackish laquna), 9.iv.2003, Horsák & Kment leg., 1 ♂ (JRUC); Rome, v.1896, without collector's name, coll. W. H. Mucho, 1 ♀ (SMTD); same locality, iv.1972, without collector's name, coll. S. Kiener, 1 ♂ (MHNG); same locality, without date, Brenske & Schonfeldt leg., 1 ♀ (SMFD); same locality, without date, Dolm leg., 1 ♂ (NMPC); same locality, without date, O. Leonhard leg., general coll., 1 ♀ (SDEIC); same locality, without date, P. de Borre leg., 1 ♂ (MHNG); same locality, without date, Schiodte leg., 1 ♂ (ZMUC); same locality, without date, Šulc leg., 1 ♂ (NMPC); same locality, without date and collector's name, coll. D. v. d. Hoop, 1 ♂ (ZMAN); same locality, without date and collector's name, coll. Heyden, general coll., 1 ♂, 2 ♀ (SDEI); same locality, without date and collector's name, coll. Schneider-Kelch., general coll., 1 ♀ (SDEI); same locality, without date and collector's name, 1 ♂ (HNHM); same locality, without

date and collector's name, 2 ♂ (NHMW); same locality, without date and collector's name, 2 ♂ (NMPC); same locality, without date and collector's name, 1 ♀ (ZSM); Rome, Ciampino, 11.ix.1984, Miloš Fassati leg., 1 ♂ (JRUC); Rome, Ostia, without date, Privora leg., 1 ♂ (NMPC); Rome, Palatine Hill, without date, W. Sattler leg., 1 ♂ (SMFD); Rome, Tusculum, without date and collector's name, 1 ♀ (NMPC); Tivoli (North-East Rome), without date and collector's name, 1 ♀ (NMPC); without specific locality, without date, Bellagra leg., 1 ♂ (MHNG); **Liguria Reg.:** Finale Ligure, 5.v.1964, without collector's name, 1 ♂ (MHNG); Genoa, without date, Natterer leg., 1 ♀ (NHMW); same locality, without date, Natterer leg., 1 ♀ (SMNS); Varazze, 1964, without collector's name, coll. S. Kiener, 1 ♀ (MHNG); **Lombardy Reg.:** Grigna (Mts.), without date and collector's name, 1 ♂ (ZSM); Mantua, Guidizzolo, ix.2002, P. M. Giachino leg., 1 ♀ (SMNS); Milan, without date, L. Franzel leg., coll. W. H. Muche, 1 ♂, 1 ♀ (SMTD); **Lombardy Reg. / Veneto Reg. and Trentino Alto-Adige Reg. border:** Lake Garda, viii.-ix.1912, without collector's name, coll. Dr. Jhssen, 1 ♂ (ZMHB); same locality, without date, J. Fleischer leg., 1 ♀ (NMPC); same locality, without date, Mlynář leg., 1 ♂ (NMPC); **Magna Graecia Reg.,** Paestum, iv.1883, without collector's name, 1 ♂ (ZMHB); **Marche Reg.:** Albacina, 24.iv.1960, J. Th. Skovgaard leg., 1 ♂ (ZMUC); Fano, Pesaro, without date, I. Kovář leg., 1 ♂ (NMPC); Macerata, v.1955, S. Battoni leg., 1 ♀ (MHNG); same locality, Gualdo, 4.vi.1979, Cola & Freude leg., coll. R. Kostlin, 1 ♀ (SMNS); Martinsicuro, 1970, Liebegott leg., coll. D. Liebegott, 1 ♂ (SMFD); Pontile, vi.1936, Cerruti leg., 1 ♂ (MHNG); **Molise Reg.:** Maiella (Mts.), 22.vi.1976, M. Curti leg., 5 ♂, 1 ♀ (MHNG); Ovada, without date and collector's name, 1 ♀ (MHNG); Teramo prov., Prati di Tivo, 22.vi.1976, M. Curti leg., 1 ♀ (MHNG); **Piedmont Reg.:** Bussoleno, without date, Della Beffa leg., 1 ♀ (JRUC); Carcare, vi.1910, Luigi Bigliani leg., 1 ♀ (ZMHB); **Sardinia Island:** San Basilio, without date, Paganetti leg., coll. O. Leonhard, general coll., 3 ♂, 1 ♀ (SDEI); same locality, without date, Paganetti leg., coll. Franklin Muller, general coll., 2 ♂, 2 ♀ (SDEI); same locality, without date, Paganetti leg., general coll., 3 ♀ (SDEI); same locality, without date, Paganetti leg., 1 ♂, 1 ♀ (NHMW); same locality, without date, Paganetti leg., coll. J. Fodor, 1 ♂ (HNHM); same locality, without date, Paganetti leg., 2 ♀ (NMPC); **Sicily Island:** Messina, 11.x.1942, without collector, 1 ♂ (SMNS); Piano Zucchi, 16.iv.1979, Schurmann leg., 2 ♂, 1 ♀ (NHMW); Ragusa, 1808, Mann leg., 1 ♀ (NHMW); same locality, without date and collector's name, coll. W. H. Muche, 1 ♂ (SMTD); same locality, without date and collector's name, coll. K. Hanel, 1 ♀ (SMTD); same locality, without date and collector's name, 1 ♂, 1 ♀ (NHMW); Sicily Island without specific locality: without date, Zeller leg., 1 ♀ (SDEI); without date, P. de Borre leg., 1 ♀ (MHNG); without date and collector's name, 1 ♀ (MHNG); **Trentino-Alto Adige/Südtirol Reg.:** Bolzano, 1867, Mann leg., 1 ♀ (NHMW); Brixen, without date, Moosbrugger leg., 1 ♂ (NHMW); Eisacktal (South of Tyrol), Ritten, 6.vii.1983, J. Frisch leg., 1 ♂ (ZMHB); Nago-Torbole, without date and collector's name, coll. Herb-Schmidt, 1 ♂, 1 ♀ (SMTD); Rovereto, without date, Troll leg., 1 ♂, 3 ♀ (NHMW); same locality, without date and collector's name,

1 ♀ (NMPC); South Tyrol, 10.vi.1965, G. Scheel leg., 1 ♀ (SMNS); same locality, without date, Sarcatal & Schaaff leg., coll. Bosch, 1 ♂ (SMFD); Tirol, without date, Jureček leg., 1 ♂ (NMPC); same locality, without date and collector's name, coll. C. Schenkling, general coll., 2 ♀ (SDEI); Trentino prov., without date, J. Waka leg., coll. Burghauser, Mahler, Waka, Fleischer & Absolon, 1 ♂, 1 ♀ (MZMB); Trentino, without date, Sarcatal & Schaaff leg., coll. Bosch, 1 ♀ (SMFD); **Trentino-Alto Adige/Südtirol Reg./ Veneto Reg. border:** Monte Baldo, without date, Nickerl leg., 1 ♂ (NMPC); same locality, without date and collector's name, coll. K. Hanel, 3 ♂, 2 ♀ (SMTD); **Tuscany Reg.:** Florence, without date, B. Schwarzer leg., 1 ♂ (SMFD); Gaville (Gaville 3 km West Figline Valdarno), 26.iv.2003, B. Brugge leg., 1 spec. (ZMAN); Grosseto prov.: Parco Regionale della Maremma, San Rabano env., pasture, 7.iv.2003, Kment leg., 1 ♂ (JRUC); Principina a Mare (sand dune on beach), 7. iv.2003, P. Kment & M. Horsák leg., 1 ♀ (JRUC); Livorno, without date and collector's name, coll. G. Schneider, 1 ♂ (SMNS); Monte Argentario, without date and collector's name, 3 ♂, 3 ♀ (NHMW); Monte Pisano, without date and collector's name, 1 ♀ (NMPC); Orbetello, v. (without year), Miyer leg., coll. W. H. Muche, 1 ♂, 1 ♀ (SMTD); Passo della Futa, without date, Klynar leg., 1 ♀ (NMPC); Piombino, iii.-iv.1908, A. Kniz leg., 4 ♂, 1 ♀ (NHMW); same locality, iii.-iv. (without year), Molitor leg., 2 ♂ (NHMW); same locality, without date and collector's name, 1 ♂, 1 ♀ (NHMW); Pisa, 7.ix.1976, Miloš Fassati leg., 1 ♂ (JRUC); Vallombrosa, without date, O. Schneider leg., 1 ♀ (HNHM); Viareggio, without date, Hanuš leg., 1 ♂, 1 ♀ (NMPC); Volterra, iv.1976, T. Osten leg., 1 ♂, 1 ♀ (SMNS); Tuscany Reg., Firenze, 1924, Lombardi leg., ex coll. Reitter, coll. P.v.d. Wiel, 1 ♀ (ZMAN); Tuscany Reg., without specific locality: without date, Bellier leg., 2 ♂, 2 ♀ (ZSM); without date, M. Argentario leg., 4 ♀ (NHMW); Stierlin leg., general coll., 1 ♀ (SDEI); without date and collector's name, general coll. 1 ♀ (SDEI); **Umbria Reg.:** Lake Trasimeno, without date, Klynar leg., 3 ♂, 1 ♀ (NMPC); Monte Martano, 11.-20. ix.2002, P. M. Hammond leg., coll. P. M. Hammond, 1 ♂ (BMNH); Perugia, 1050 m, 31.v.1962, Battoni leg., 1 ♂ (MHNG); **Veneto Reg.:** Ca' Noghera, without date and collector's name, coll. W. H. Muche, 1 ♀ (SMTD); Lido di Venezia, without date, G. Waldo leg., 1 ♀ (BMNH); Limena, without date and collector's name, 1 ♂ (ZMHB); Padua, Abano Terme, 24.iii.1975, E. Ulbrich leg., 1 ♂ (NHMW); Verona, without date, K. Neumann leg., 1 ♀ (SMFD); Vicenza, without date, Minozzi leg., coll. W. H. Muche, 1 ♂ (SMTD); **Italy without specific locality:** 1878, Ollerich leg., coll. W. H. Muche, 1 ♂ (SMTD); without date, Bötzelmann leg., ex coll. G. Reineck, coll. Bosch, 1 ♂ (SMFD); without date, Reitter leg., 1 ♂ (NMPC); without date, Sprenger leg., 1 ♂ (NMPC); without date and collector's name, 3 ♂, 2 ♀ (NMPC); Monte Falcone [not located], without date, J. Fleischer leg., 1 ♀ (NMPC);

Liechtenstein: Vaduz, without date, Dr. Feige leg., 1 ♂ (ZMHB);

Macedonia: Dojran Lake, 140-350 m, 1.vi.1985, Vilyer et Sruta leg., 1 ♀ (JRUC); Galičica (Mt. and National Park), 5.vi.1973, R. Grimm leg., 1 ♀ (SMNS); Jakupica (Mts.), without date, A. Matejka leg., 1 ♀ (NMPC); same locality, without date, O. Kodym leg., 3 ♂, 4 ♀ (NMPC); same locality, without date, Purkyne leg., 1 ♀

(NMPC); **Skopje Region:** Skopje, 21.iv.1961, J. Th. Skovgaard leg., 1 ♀ (ZMUC); same locality, 21.vi.1973, Blumenthal leg., 2 ♂ (SMNS); same locality, vi.1980, R. de Vos leg., 1 ♂ (ZMAN); same locality, 1985, Zeller leg., coll. W. H. Muche, 1 ♀ (SMTD); Vardar river shore in Skopje, 1.vi.1980, F. Heike leg., 2 ♂, 3 ♀ (ZMHB); **Mavrovo Reg.:** South of Mavrovo, ix.1976, Schurmann leg., 1 ♂ (NHMW); **Vardar Reg.:** Veles, without date, Smetana leg., 1 ♀ (NMPC); **Macedonia without specific locality:** without date and collector's name, 1 ♂ (HNHM);

Moldavia: Bălți, 19.vi.1973, L. Zimina leg., 1 ♀ (ZMUM);

Monaco: without specific locality, beginning of May, W. Sattler leg., 1 ♂ (SMFD);

Montenegro: Bar: Rikavac, 1800 m, 25.vi.-2.vii.1914, Grenze Penther leg., 1 ♂ (NHMW); same locality, 1800-2000 m, 1914, Grenze Penther leg., 1 ♀ (NHMW); Sutomore Mont, 22.v.1978, G. J. Slob leg., 1 ♂ (ZMAN); **Berane:** 6.vii.1917, Akad. Balk. Exped., E. Csiki leg., 1 ♀ (HNHM); **Budva:** 5.-20.v.1954, Kuntzen leg., 1 ♂ (ZMHB); same locality, 30.iv.1975, J. Strejček leg., 1 ♀ (JRUC); same locality, without date, Hummer leg., coll. Franklin Muller, general coll., 1 ♂ (SDEI); **Podgorica:** 1900, Führer leg., 2 ♂, 1 ♀ (ZMAS); same locality, 14.vii.1910, Führer leg., 1 ♂, 1 ♀ (ZMAS); same locality, 1914, Grenze Penther leg., 1 ♀ (NHMW); same locality, without date, Führer leg., 3 ♂, 4 ♀ (ZMAS); Prokletije or Albanian Alps: Gusinje, without date, Purkyne leg., 3 ♂, 2 ♀ (NMPC); **Ulcinj:** v.1976, Marggi leg., 1 ♀ (MHNG); same locality, 8.vi.1984, J. Strejček leg., 1 ♂ (JRUC); Grenzgeb. [not located], without date, F. Gerlach leg., 1 ♂ (ZMHB); **Žabljak:** 1907 m, 15.vi.2006, L. Blažej leg., 1 ♂ (JRUC); 9.viii.1971, Drovenik leg., 1 ♀ (SMNS); Durmitor (Mt.): vii.1970, W. Sach leg., 4 ♂, 1 ♀ (NHMW); Dobri Dol, 1900 m, vii.1980, Krätschmer leg., 1 ♂ (SMNS); Jaksica Katuni [not located], 1800 m, without date, Kaszab & Szekessy leg., 1 ♀ (HNHM); Todorov Dol, without date, J. Mařan leg., 1 ♀ (NMPC); same locality, 1800 m, 2.vii.1958, Kaszab & Szekessy leg., 1 ♂ (SMNS); Štuoc, 1850 m, vii.2001, Ivan Marvan leg., traps, 2 ♂ (JRUC);

Poland: Tarnow forest, without date and collector's name, 1 ♂, 1 ♀ (NHMW);

Romania: Banat Reg.: Anina, 29.iv.1986, R. Fendl leg., 2 ♀ (JRUC); Banat, without date, Reitter leg., coll. Reitter, 1 spec. (HNHM); **Black sea** (without specific location), viii.1968, Niehuis leg., 1 ♂ (SMNS); **Danube Delta river**, Babadag, 27.v.2002, P. Schule leg., 1 ♀ (SMNS); **Transsylvania Reg.:** Krassó-Szörény county, Mehádia, 22.iv.1915, J. Fodor leg., 1 ♂ (HNHM); same locality, 26.iv.1915, J. Fodor leg., 1 ♀ (HNHM); Aiud, Irk leg., 1 ♀ (NHMW); **Wallachia Reg.,** without specific locality, without date and collector's name, coll. K. Fuss, 1 ♀ (HNHM); Mamaia, without date, Hlisnikowski leg., 1 ♂ (NMPC); Reșița, without date, D. Kanabe leg., coll. Kanabe, 2 ♂ (HNHM); Paraipanii [not located], 1.iv.1917, W. Liebmann leg., general coll., 1 ♀ (SDEI); same locality, 11.iv.1917, W. Liebmann leg., general coll., 1 ♂ (SDEI); Paraipanii, 29.iv.1917, W. Liebmann leg., general coll., 1 ♂ (SDEI); without specific locality, without date and collector, coll. K. Hanel, 2 ♂ (SMTD);

Russia: North Caucasian Federal Dist., Mount Elbrus, without date and collector's name, 3 ♀ (JRUC); same locality, without date and collector's name, coll. E. Jagemann, 1 ♂ (MZMB); North of Mount Elbrus, Malka River, without date, Ryssel

leg., 1 ♀ (ZMHB); North Ossetia (Alania), Mozdok, 14.iv.1929, coll. O. N. Kabakov, 1 ♂ (ZMAS); North of Ossetia, Skalisty Mt., drainage basin of Ardon river, 1000 m, 2.viii.1997, A. G. Koval leg., 1 ♂ (JRUC); Stavropol Kray: Pyatigorsk, vii.1904, O. Liur leg., 1 ♀ (ZMHB); Yessentuki, 26.-30.viii.1982, Gordunov & Kholina leg., 1 ♂, 2 ♀ (ZMUM); **Southern Federal Dist.**, Krasnodar Kray: Adler, 1909, G. Sumakov leg., 1 ♀ (ZMAS); Anapa, 24.vii.1982, Korotiaev leg., 1 ♂ (ZMAS); Kuban Reg., Bajalaja [not located], without date, Jüthner leg., 1 ♂, 1 ♀ (NHMW); Gelendzhik, without date, N. Vorob'ev leg., 1 ♂ (ZMAS); Maykop, 8.vi.1903, Filinchenko leg., 1 ♂ (ZMAS);

Serbia: Belgrade, without date and collector's name, coll. W. H. Muche, 1 ♀ (SMTD); Belgrade, Resnik, 13.iv.1936, K. Martino leg., 1 ♀ (BMNH); Crvenka (West Bačka Dist. in Vojvodina prov.), 1981, Kouřil leg., 1 ♂ (NMPC); Dojkinci (in Pirot Dist.), 1.v.2002, T. Lackner leg., 1 ♂ (ZMAN); Niš (in Nišava Dist.), iv.1957, Lenczy leg., 2 ♀ (HNHM); Novi Pazar (in Raška Dist.), 1907, Carl Stock leg., 1 ♂ (SMFD); Subotica (North Bačka Dist. in Vojvodina prov.), 1909, Soos leg., 1 ♂ (HNHM);

Slovakia: Banská Bystrica Reg.: Donovaly, without date, Smetana leg., 1 ♂ (NMPC); same locality, S. Bílý leg., 1 ♂ (NMPC); **Košice Reg.**, Zádiel, 23.vi.1939, Balogh & Kaszab leg., 1 ♀ (HNHM); **Nitra Reg.:** Kamenný Most (in Nové Zámky Dist.), without date, Smetana leg., 1 ♂ (NMPC); Obid (in Nové Zámky Dist.), on terrace, 21.iv.2000, Mantič leg., 1 ♀ (JRUC); Parkán [Štúrovo], without date, Baumert leg., 1 ♀ (NMPC); Štúrovo, 5.vii.1954, J. Strejček leg., 2 ♂ (JRUC); same locality, 23.v.1959, J. Strejček leg., 2 ♀ (JRUC); same locality, vii.1961, J. Strejček leg., 1 ♀ (JRUC); same locality, 17.v.1965, A. Svozil leg., 2 ♂ (SMNS); same locality, 9.v.1984, Klouček leg., 1 ♀ (JRUC); same locality, iv.1992, Krásenský leg., 1 ♀ (JRUC); same locality, without date, I. Kovář leg., 1 ♀ (NMPC); same locality, without date, Kouřil leg., 1 ♂ (NMPC); Štúrovo, Hegyfárok, 1955, Brejcha leg., 1 ♂ (MZMB); Štúrovo, Kamenica nad Hronem, 23.v.1994, Krásenský leg., 1 ♀ (JRUC); Obid (in Nové Zámky Dist.), terrace, 21.iv.2000, Mantič leg., 1 ♀ (JRUC); **Prešov Reg.**, Plaveč, Sv. Mikuláš street, without date, O. Kodym leg., 2 ♂, 1 ♀ (NMPC); **Trenčín Reg.:** Beluša, without date, V. Zoufal leg., 1 ♂ (NMPC); Trenčín, without date and collector's name, 1 ♂ (NMPC); same locality, without date and collector's name, 1 ♂ (NMPC); Štvrtok, without date, O. Kavan leg., 1 ♂ (NMPC); **Žilina Reg.:** Radola (in Kysucké Nové Mesto Dist.), without date and collector's name, 1 ♂ (NMPC); Bratislava, without date, A. Hoffer leg., 1 ♀ (NMPC); same locality, without date, O. Kavan leg., 2 ♂ (NMPC); same locality, without date and collector's name, 1 ♀ (NMPC); Gombasek Cave, without date, J. Macek leg., 1 ♀ (NMPC); Tatra Mts., 1973, J. Strejček leg., 1 ♂ (JRUC);

Slovenia: Carniola Reg.: without date and collector's name, coll. K. Hanel, 1 ♂ (SMTD); without date, Schiodte leg., 1 ♀ (ZMUC); **Littoral Reg.:** Kozina, Petrinje, 29.iv.-1.v.2003, J. Vávra leg., 1 ♀ (JRUC); Podgorski kras, Petrinje, 1.vii.2002, Z. Malinka leg., 1 ♀ (JRUC); Strunjan, vi.1881, Zigeuner leg., ex coll. Winkler, 1 ♀ (MHNG); Tolmin, without date, coll. V. Zoufal, 1 ♂ (MZMB); same locality, Wagner leg., 1 ♀ (NHMW);

Wippach [Vipava], without date and collector's name, coll. Kaufmann, 2 ♂ (NHMW); **Lower Carniola Reg.:** Novegomesto or Novo Mesto, without date, Adoha leg., 1 ♀ (NMPC); **Slovenian Littoral Reg.:** Izola, 4.vi.1968, M. Hubes leg., 1 ♂ (SMNS); Piran (bay), 22.viii.1989, U. Göllner leg., 1 ♀ (ZMHB); **Upper Carniola Reg.:** Bled, vi.1911, V. Zoufal leg., coll. K. Mazura, 1 ♂ (MZMB); same locality, without date, Prochazka leg., coll. Prochazka, 1 ♂ (NMPC); Velika Planina, v.-vii.1912, Ramme leg., 1 ♂, 1 ♀ (ZMHB); same locality, without date, Ramme leg., 1 ♂ (ZMHB);

Spain: Andalusia: Huelva prov., Almonte, v.1969, C. König leg., 1 ♀ (SMNS); without more specific locality, without date, Witt leg., 1 ♀ (SDEI); **Aragon,** Turia River, without date and collector's name, coll. F. Speiser, 1 ♀ (HNHM); **Asturias,** Tuilla, 22.v.1973, K. W. Harde leg., 1 ♀ (SMNS); **Basque Country,** San Sebastián, without date, J. Ardois leg., 1 ♂, 2 ♀ (MNCN); **Catalonia:** Barcelona, Sabadell, iv.1974, Krätschmer leg., 1 ♀ (SMNS); same locality, 15.vi.1977, without collector's name, coll. Poul Kry Poulsen leg., 1 ♀ (ZSM); Bagur, 15.-28.vi.1957, R. Schrepfer leg., coll. R. Schrepfer, 1 ♀ (SMNS); Costa Brava: Castell-Platja, d'Aro, 16.v.1981, K. W. Harde leg., 1 ♂ (SMNS); Empúries, 22.v.1973, K. W. Harde leg., 1 ♀ (SMNS); same locality, 18.x.1974, K. W. Harde leg., 4 ♂, 8 ♀ (SMNS); same locality, 22.v.1973, R. Köstlin leg., coll. R. Köstlin, 1 ♀ (SMNS); same locality, iv.1982, W. G. Ullrich leg., 2 ♀ (MHNG); same locality, without date and collector's name, 1 ♂, 1 ♀ (MNCN); L'Escala, 14.v.1975, Heikel leg., 1 ♀ (SMNS); L'Estartit, 9.v.1973, K. W. Harde leg., 1 ♂ (SMNS); same locality, 16.v.1973, K. W. Harde leg., 1 ♀ (SMNS); same locality, 16.v.1973, R. Köstlin leg., coll. R. Köstlin, 1 ♀ (SMNS); same locality, 11.iv.1977, K. W. Harde leg., 1 ♀ (SMNS); same locality, 14.v.1980, E. Ulbrich leg., 1 ♂ (NHMW); Lloret de Mar, 24.-25.iii.1985, J. Frisch leg., 2 ♂ (ZMHB); Palamós, 12.vi.1957, without collector, 1 ♀ (ZMHB); same locality, 17.v.1957, without collector, 1 ♂ (ZMHB); same locality, 20.vi.1957, without collector, 1 ♀ (ZMHB); same locality, 7., 19.ix.1959, without collector, 2 ♂ (ZMHB); same locality, Girona prov., 7.-13. ix.1974, Ulbrich leg., coll. Ulbrich, 1 ♂ (SMNS); Palamós, La Fosca, 4., 20.v.1975, C. v. Nidek leg., 1 ♂ (ZMAN); Pyrénées (Mts.), Espot, 2200 m, vi.-vii. (without year), Umlauf leg., 1 ♂ (SMNS); Pyrénées (Mts.), La Jonquera, 26.v.1980, E. Ulbrich leg., 1 ♀ (SMNS); Roses, 16.vi.1869, R. V. Budberg leg., 1 ♂ (NHMW); same locality, vi.1966, Budberg leg., 1 ♀ (NHMW); same locality, vi.1967, Budberg leg., 1 ♂ (NHMW); same locality, v., vi.1968, R. V. Budberg leg., 2 ♀ (NHMW); same locality, 1.vii.1970, R.V. Budberg leg., 1 ♀ (NHMW); same locality, 20.vi.1971, R. V. Budberg leg., 1 ♂ (NHMW); same locality, 2.iv.1974, W. Ziegler leg., coll. W. G. Ullrich, 1 ♀ (MHNG); Toroella de Montgri, 7.viii.1972, C. Koenig leg., 1 ♀ (SMNS); **Galicia,** without date, Lauffer leg., 1 ♀ (MNCN); **Ibiza island,** San Rafael, without date, M. Escalera leg., 1 ♂ (MNCN); **Valencia:** without date, G. Reineck leg., coll. Bosch, 1 ♂ (SMFD); same locality, 2.iv.[19]74, W. Ziegler leg., coll. W. G. Ullrich, 1 ♂ (MHNG); Oliva prov., 3.iv.1974, W. Ziegler leg., coll. W. G. Ullrich, 1 ♀ (MHNG);

Switzerland: Aargau Canton: Bözen, vi.1898, A. Weis leg., 1 ♀ (SMFD); Kaiserstuhl, vi.1952, R. Papperitz leg., 1 ♂ (SMNS); **Bern Canton:** Biel (Bienne), Hartmann leg., 1 ♀ (NMPC); Kandersteg, 16.vii.(without year), Stock leg., 1 ♀ (SMFD);

Isenfluh, Bernese Oberland (Bernese Highlands), 2.viii.1963, R. Köstlin leg., 1 ♀ (SMNS); **Vaud Canton:** Bex, 27.vi.1904, without collector's name, 1 ♀ (BMNH); same locality, 3.v.1904, without collector's name, 1 ♀ (BMNH); same locality, 1904, without collector's name, 1 ♀ (BMNH); Lausanne, 3.viii.1985, Hoop leg., 1 ♂ (ZMAN); Vallorbe, without date, J. Fleischer leg., 1 ♀ (NMPC); **Switzerland without specific locality:** without specific locality, without date, Kirsch leg., 2 ♂, 1 ♀ (SMTD); without specific locality, without date and collector's name, 2 ♂ (SMFD); Waldhaus [not located], 8.vi.1919, without collector's name, 2 ♂, 1 spec. (ZMHB);

Turkey: Aegean Reg.: Izmir, Gümüldür, without date and collector's name, 1 ♂ (NMPC); same locality, 18.-31.iii.1917, La Baume leg., 3 ♂, 1 ♀ (ZMHB); Ödemiş (40 km North Kastamonu), 1000 m, 11.vii.1986, A. Korell leg., 1 ♂ (SMNS); **Black Sea Reg.:** Abant lake, vi.1983, G. Sama leg., 1 ♀ (SMNS); Trabzon, without date, Beyrolle leg., coll. Sharp, 1 ♀ (BMNH); **Bosphorus strait,** Dopot Garten [not located], without date, Dr. J. Jaus leg., 1 ♀ (NHMW); **Ionia Reg.:** Ephesus, v.1904, Dr. Werner leg., 1 ♂ (NHMW); **Marmara Reg.:** Çanakkale prov., Gelibolu, 10 m, 3.v.1982, without collector's name, 1 ♂, 1 ♀ (MHNG); Edirne, Necatiye, 1.iv.1990, A. Podlussany leg., 1 ♂ (HNHM); Edirne, v.1894, Flach leg., 1 ♂ (SMFD); same locality, 16.v.1993, P. Průdek leg., 1 ♂ (JRUC); same locality, 3.vii.1993, Kantner leg., 1 ♀ (JRUC); same locality, 16.v.1993, P. Průdek leg., 1 ♂ (JRUC); İpsala, 2.iv.1980, without collector's name, 1 ♂ (SMNS); Istanbul, Ispartakule, 7.iv.1908, Bodemeyer leg., 1 ♀ (ZMHB); Istanbul, Kilyos (in Sarıyer Dist.), beach zone, 1964, Schweiger leg., 1 ♀ (SMFD); Istanbul, Yeşilköy, 1964, Schweiger leg., 2 ♀ (SMFD); Istanbul, Küçükçekmece, 1965, Schweiger leg., 1 ♀ (SMFD); Istanbul, 1900, J. Fodor leg., 1 ♂ (HNHM); same locality, 1900, without collector's name, coll. J. Fodor, 1 ♀ (HNHM); same locality, 7.iv.1908, Bodemeyer leg., coll. Piesbergen, 1 ♂ (SMNS); same locality, 10.-11.v.1937, without collector's name, 1 ♂ (HNHM); same locality, 31.iii.1977, Scheuern leg., 2 ♀ (SMNS); same locality, 2. iv.1999, Orszulik leg., 1 ♂, 1 ♀ (JRUC); same locality, 22.v.2001, Orszulik leg., 1 ♂ (JRUC); same locality, without date, S. Stelano, Wimmer leg., 1 ♂, 1 ♀ (NHMW); Lüleburgaz (in East Thrace), 21.iii.1972, Bremer leg., 1 ♂ (SMNS); Tekirdağ (Rodosto, hist. name), 24.vii.1939, Vasvati leg., 1 ♀ (HNHM); Üsküdar, without date and collector's name, coll. Winkler, 2 ♂ (NHMW); **Southeastern Anatolia Reg.:** without date and collector's name, 1 ♂, 1 ♀ (BMNH); Edessa (West) in Şanlıurfa, 17.iv.1980, Krätschmer leg., 1 ♀ (SMNS); Kodi, without date and collector's name, 1 ♀ (ZMHB);

United Kingdom: Binea [not located], without date and collector's name, 1 ♀ (BMNH); Cornwall, Whitesand Bay, Land's End, 1935, G. C. Champion & H. C. Champion leg., coll. G. C. Champion, 1 ♀ (BMNH); Darneth, without collector's name, 1.v.1870, R. O. S. Clarke leg., in chalk pit, 1 ♂, 1 ♀ (BMNH); Rochester, 18.iv.1894, without collector's name, 1 ♂ (ZMUC);

Ukraine: Crimea: Alma River, without date, Rivakov leg., 2 ♂, 4 ♀ (ZMAS); same locality, 25.iv.1954, Kasheev leg., coll. O. N. Kabakov, 2 ♂ (ZMAS); Foros, vi.1930, without collector's name, 1 ♀ (ZMUM); Kherson, 6.-16.iv.1903, Ewert leg., 1 ♀ (ZMHB); Kyzyl-Tash (Krasnokamyanka), 15.vii.1911, Pliginski leg., 1 ♀

(ZMAS); Mama-Chakrak, Kertch, 26.iv.1911, A. Dirin leg., 1 ♂ (ZMAS); Odessa, without date and collector's name, coll. Schwarzer, 1 ♂ (SMFD); same locality, Limanskaya, 11.v.1979, Kabakov leg., coll. O. N. Kabakov, 1 ♀ (ZMAS); Sevastopol, 4.-8.iv.1899, Birulia leg., 2 ♀ (ZMAS); same locality, 10.iv.1911, V. Kizeritskiy leg., 1 ♂ (ZMAS); same locality, 26.iii.1912, N. L. Pastukhov leg., 1 ♀ (ZMAS); same locality, 6.vi.1941, L. Arnol'di leg., 1 ♀ (ZMUM); same locality, without date, coll. W. H. Muche, 2 ♂ (SMTD); Simferopol, 6.iv.1908, O. G. & K. Khristoforovy leg., 1 ♂ (ZMAS); same locality, 20.iv.1908, O. G. & K. Khristoforovy leg., 1 ♀ (ZMAS); Tarkhankut, 9.v.1980, Mimonov leg., 1 ♂ (ZMUM); Taushan-bazar, 29.vi.1907, B. Grigoriev leg., 1 ♀ (ZMAS); same locality, Jaltinsk [Zaliv Yaltinskiy], 26.vi.1907, W. Pliginskiy leg., 1 spec. (ZMAS); Simferopol, without date and collector's name, 1 ♂, 1 ♀ (NHMW); without specific locality, without date and collector's name, 1 ♂, 1 ♀ (HNHM); Yalta, 21.v.1925, without collector's name, 1 ♂ (ZMAS); Yarlygachs [not located], 13.v.1913, Aleksandov leg., 1 ♂ (ZMAS); Yevpatoria (Eupatoria); viii.1972, S. Alekseev leg., 1 ♂ (ZMUM); **Lviv Oblast**, Galicia, Gródek Jag.[ielloński] (Horodok), without date, D. Grabowski leg., coll. Grabowski, 1 ♀ (HNHM); **Zaporizhia Oblast**, Kamianka-Dniprovska, 5.vii.1973, Koval leg., coll. O. N. Kabakov, 1 ♂ (ZMAS).

Not located: Obercugalin, without date and collector's name, coll. Piesbergen, 1 ♀ (SMNS); Waldhann, 1978, without collector's name, coll. Piesbergen, 2 ♂ (SMNS);

Ablattaria subtriangula

Spain: **Álava prov.**, Nanclares, vi.1966, J. Vives leg., 1 ♂, 1 ♀ (MNHN); **Biscay prov.:** Orduña, iv.1881, Kobelt leg., 1 ♀ (SMNS); same locality, without date, Simon leg., 1 ♂ (MNHN); **Burgos prov.:** Puerto de Orduña, 10.v.1992, J. Alcorta leg., 1 ♀ (MNCN); Soncillo (Valle de Valdebezana), 22.iv.-20.v.1964, I. & E. Yarrow leg., 1 ♂ (BMNH); **Cantabria prov.:** Reinosá, vi.1902, G. Schramm leg., 1 ♀ (MNCN); same locality, without date and collector's name, 1 ♂ (MNCN); Soto, Mr. Martin leg., 3 ♂, 1 ♀ (ZFMK); Tortosa, without date and collector's name, 1 ♀ (MNCN); **La Rioja prov.**, Cameros (La comarca de Tierra de Cameros), without date, C. Bolívar leg., 1 ♀ (MNCN).

A new species of bromeliad-feeding *Cephaloleia* Chevrolat (Coleoptera, Chrysomelidae, Cassidinae) from Costa Rica: evidence from DNA barcodes, larval and adult morphology and insect diets

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Abstract

The Neotropical genus *Cephaloleia* Chevrolat (Coleoptera: Chrysomelidae: Cassidinae) includes 214 species distributed from the south of Mexico to Argentina. *Cephaloleia* beetles feed mostly on plants from the order Zingiberales. The interactions between *Cephaloleia* beetles and their Zingiberales host plants is proposed as one of the oldest and most conservative associations. Here we describe a new species of *Cephaloleia* (*C. kuprewiczae* sp. n.) that feeds on two species of bromeliads (*Pitcairnia arcuata* and *P. brittoniana*, Bromeliaceae: Pitcairnioideae). *Cephaloleia kuprewiczae* was previously described as *Cephaloleia histrionica*. This study includes evidence from DNA barcodes (COI), larval and adult morphology and insect diets that separates *C. kuprewiczae* from *C. histrionica* as a new species.

Keywords

Braulio Carrillo National Park, Bromeliaceae, *Cephaloleia kuprewiczae*, COI DNA barcode, *Pitcairnia arcuata*, *Pitcairnia brittoniana*

Introduction

The Neotropical genus *Cephaloleia* Chevrolat (Coleoptera: Chrysomelidae: Cassidinae) includes 214 species distributed from the south of Mexico to Argentina (Staines and García-Robledo 2014). *Cephaloleia* beetles are also known as the “rolled-leaf beetles” because larvae and adults of the majority of *Cephaloleia* species feed on the scroll formed by the young leaves of their hosts. *Cephaloleia* beetles feed mostly on plants from the order Zingiberales. The interactions between *Cephaloleia* beetles and their Zingiberales host plants is one of the oldest and most conservative insect-host plant associations (García-Robledo and Staines 2008).

Two species of *Cephaloleia* are known to complete their life cycle on plants in the families Arecaceae and Orchidaceae (Urueta-Sandino 1972, Sekerka et al. 2013). Here we describe *Cephaloleia kuprewiczae* sp. n., a new species of *Cephaloleia* from a tropical montane forests in Costa Rica that feeds on plants from the family Bromeliaceae.

Individuals of this species were previously treated as *Cephaloleia histrionica* Baly (García-Robledo et al. 2013a). Combining DNA barcodes, records on host use and larval and adult morphologies, the objective of this study is to describe this new species and clarify the species delimitations between *C. histrionica* and *Cephaloleia kuprewiczae* sp. n.

Materials and methods

Study site and species of interest

This research was conducted at two localities in Costa Rica, Central America. Larvae and adults of *Cephaloleia kuprewiczae* sp. n. were collected in Costa Rica, Heredia Province at the Braulio Carrillo National Park and the Selva Tica and Rara Avis hotels, two private properties that abut this National Park. Additional material was collected at 1500 m elevation in the Braulio Carrillo National Park (Selva Tica: 10°18'10"N, 84°02'02"W Rara Avis: 10°16'54"N, 84°02'41"W, Braulio Carrillo 1500 m elevation shelter: 10°14'32"N, 84°02'58"W). The life zones in this study area include tropical premontane and montane forests (García-Robledo et al. 2013a). Larvae were collected from rolled leaves of *Pitcairnia arcuata* (André) André and *Pitcairnia brittoniana* Mez (Bromeliaceae) (Figure 1).

In addition, we collected larvae and adults of *Cephaloleia histrionica* at two localities in the Talamanca Cordillera in Costa Rica, near the border with Panama. We selected these localities because they are the closest forests in Costa Rica to the type locality of *C. histrionica* (Syntype examined: Panama, Province of Chiriquí, District of Bugaba, 652 m. elevation Champion [printed label]/ Paratipo [handwritten red label]/ F. Monros Collection 1959) (Staines and García-Robledo 2014). The first locality in the Talamanca Cordillera was a tropical rain forest at 60 m.a.s.l. in the Pacific slope, at 27 km from the locality where the type specimen was collected (Costa Rica, Puntarenas Province, Ciudad Neilly, 8°38'56"N, 82°56'43"). Additional surveys were performed

at Las Cruces Biological Station, a Tropical Premontane Forest at 1200–1500 m.a.s.l. The distance of Las Cruces Biological Station to the locality where the type specimen of *C. histrionica* was collected is ca. 38 km (Costa Rica, Puntarenas Province, Cotobrus region 8°47'07"N, 82°57'31"). All individuals were collected from *Costus laevis* Ruiz & Pav., *Costus guanaiensis* Rusby and *Dimerocostus strobilaceus* O. Kuntze (Costaceae).

Individuals were collected in ET-OH 95% for further morphological descriptions and DNA analyses. For adults, measurements were taken with an ocular micrometer. Pronotal length and width were taken along the midlines. Elytral width was measured at the humerus. Elytral length was measured from the base to the apex. Total length was measured from the base of the antennae to the apex of the elytra. For larva descriptions, measurements were taken with an ocular micrometer or from scanning electron microscope images. Total larval length was measured from the anterior to the posterior margins. Total width was measured at the widest point.

DNA sequencing and differences in COI sequences between *C. kuprewiczae* and *C. histrionica*

Legs of each adult and larval tissue were placed in 96-well plates. DNA extractions were performed following the protocols described in García-Robledo et al. (2013b). Amplification of the mitochondrial gene cytochrome oxidase COI was conducted in 96-well plate formats using the COI Folmer primer (García-Robledo et al. 2013b). PCR was followed by ExoSap purification. Amplified products were subjected to standard sequencing using BigDye Di-Deoxy terminator sequencing. Sequences were aligned using multiple sequence alignment with high accuracy and high throughput.

To estimate the similarity of COI sequences among individuals of *C. kuprewiczae* sp. n. and *C. histrionica*, we generated a neighbor-joining tree, estimating bootstrap support after 100 replicates. Analyses were performed using Geneious Pro V 5.6.5 (Biomatters-development-team 2012). Differences among COI sequences were estimated as the percentage of bases/residuals that are identical (DNA sequences: GenBank, accession No. KC794541–KC794652 and Suppl. material 1).

Results

Host plants of *Cephaloleia kuprewiczae* sp. n. and *C. histrionica*

We recorded two host plant species for *Cephaloleia kuprewiczae* sp. n. At 700 m.a.s.l., larvae and adults of this species feed inside the scroll formed by the young rolled leaves of *Pitcairnia arcuata* (Figure 1A–C). At 1500 m.a.s.l., *C. kuprewiczae* sp. n. feeds on *Pitcairnia brittoniana* (Figure 1D). The damage produced by this herbivore differs from the typical longitudinal strip mining damage described for other *Cephaloleia* beetles (García-Robledo and Staines 2008) (Figure 1E).

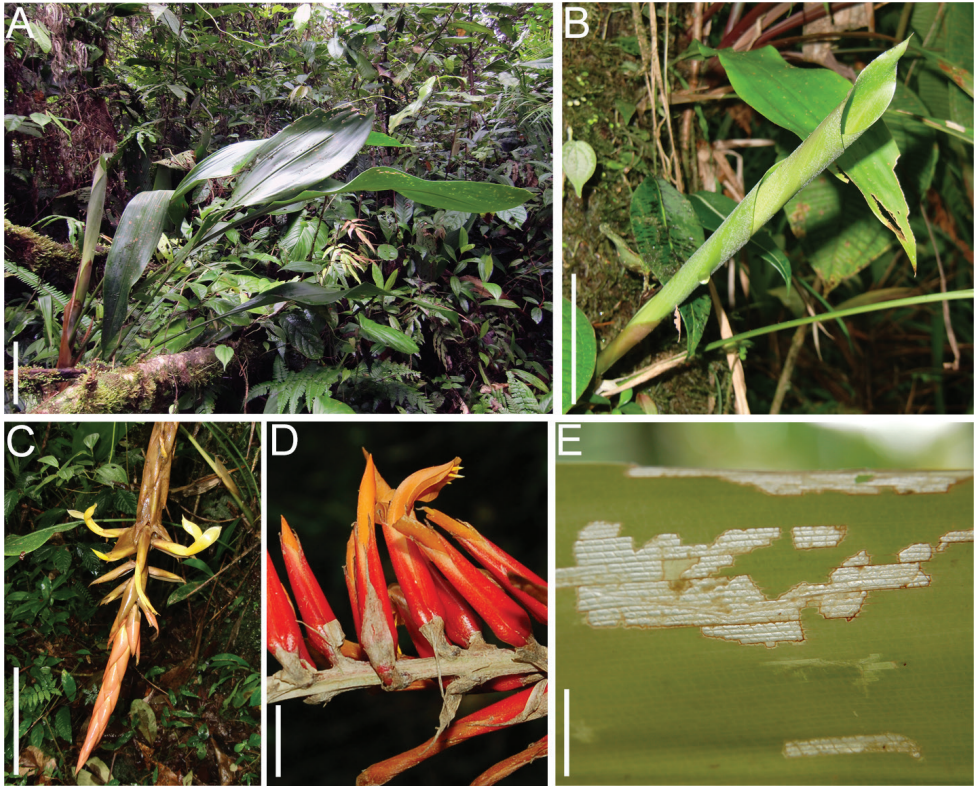


Figure 1. *Pitcairnia arcuata* and *P. brittoniana* (Bromeliaceae), host plants of *C. kuprewiczae*. **A** *Pitcairnia arcuata*, habit **B** Detail of a rolled leaf used as a larval and adult food source and adult oviposition site **C** *Pitcairnia arcuata* Inflorescence **D** *Pitcairnia brittoniana* inflorescence **E** Leaf damage produced by a feeding adult *C. histrionica*. Scale bars: **A–C** = 10 cm; **D, E** = 1 cm. Modified from García-Robledo et al. 2013a.

Cephaloleia histrionica was recorded feeding only on plants from the family Costaceae. In the tropical rain forest at Talamanca (60 m.a.s.l.), this species was collected from *Costus guanaiensis*. In the tropical premontane forest (1200 m.a.s.l.) this species was recorded feeding on *Costus laevis* and *Dimerocostus strobilaceus*.

Species description

***Cephaloleia kuprewiczae* García-Robledo & Staines, sp. n.**

<http://zoobank.org/14DE2AAF-3973-4279-8E09-41E7024C51D3>

Material. Holotype (male), ♂, 'COSTA RICA: Heredia, Braulio Carrillo Nat. Park, near Rara Avis Hotel | 700 m | 9°17'N, 84°03'W | 25 November 2011 | Carlos García-Robledo | K1163_EK-25-nov-2011-12 | *Pitcairnia arcuata* (André) André' (USNM). Paratypes (9 males): with same label data as holotype (USNM, INBIO).

Differential diagnosis. *Cephaloleia kuprewiczae* sp. n. is most similar to *C. histrionica* and in some degree to *C. semivittata* Baly. It can be easily distinguished from *C. semivittata* by its larger size, the elytral declivity beginning at puncture row 7, by antennomere 2 being $\frac{3}{4}$ the length of 1, by the depressed vertex of the head, and by the medial longitudinal impunctate area on the pronotum. It can be distinguished from *C. histrionica* by its rectangular shape and black pronotum (Figure 2). The suture between abdominal sterna 1 and 2 being obsolete medially, by elytral puncture row 10 being near lateral margin, by antennomere 2 being cylindrical, by the humerus not being reddish, and by the sinuate lateral margins of the pronotum.

Description. Elongate; parallel-sided; subdepressed; head, antennae, and scutellum brownish-black; pronotum brownish-black with yellow lateral margins; elytra yellow with brownish-black sutural and subhumeral vittae; venter brownish-black with lateral margins of abdominal sterna paler; legs yellowish with tibio-femoral joint and tarsi brownish (Figure 2A). **Head:** vertex densely punctate, depressed between eyes; medial sulcus absent; keel present between antennal bases; clypeus punctate, with fringe of setae on anterior margin. **Antenna:** reaches beyond humerus; filiform; antennomere 1 subincrassate; 2 cylindrical, $\frac{3}{4}$ length of 1; 3 cylindrical, subequal in length to 1; 4 to 10 cylindrical, decreasing in length; 11 $1\frac{1}{2}\times$ length of 10, pointed at apex; 1 to 4 punctate; 5 to 10 setose. **Pronotum:** longer than wide; lateral margin sinuate, canaliculate; anterior angle rounded, not produced; anterior margin curved forward; posterior angle acute; posterior margin bisinuate; surface irregularly punctate except impunctate medial longitudinal line from base to apex. **Scutellum:** pentagonal; alutaceous (Figure 2A). **Elytron:** lateral margin straight, smooth; exterior apical angle rounded, smooth; apical margin rounded, smooth; sutural angle without tooth; humerus rounded, not produced, impunctate; with 10 regular rows of punctures plus scutellar row; with declivity beginning behind humerus at puncture row 7 (Figure 2A). **Venter:** pro-, meso-, and metasterna impunctate medially, punctate laterally; abdominal sterna finely punctate, each puncture with pale seta; suture between abdominal sterna 1 and 2 obsolete medially; apical margin of last sternite notched in male (Figure 2B). **Leg:** long, slender; punctate; tibia with fringe of setae on inner apical margin. **Total length:** 5.0 to 5.7 mm.

Host plants. *Pitcairnia arcuata* (André) André and *Pitcairnia brittoniana* Mez (Bromeliaceae) (Figure 1).

Etymology. Named for Erin K. Kuprewicz, who discovered this species and its interaction with *Pitcairnia* (Bromeliaceae) host plants. The name is feminine.

Description of *C. kuprewiczae* sp. n. and *C. histrionica* immature stages

Cephaloleia kuprewiczae sp. n.

Cephaloleia kuprewiczae immature stages were previously described as *C. histrionica* (García-Robledo et al. 2013a). *Cephaloleia kuprewiczae* eggs are pale yellow (Figures 3A).

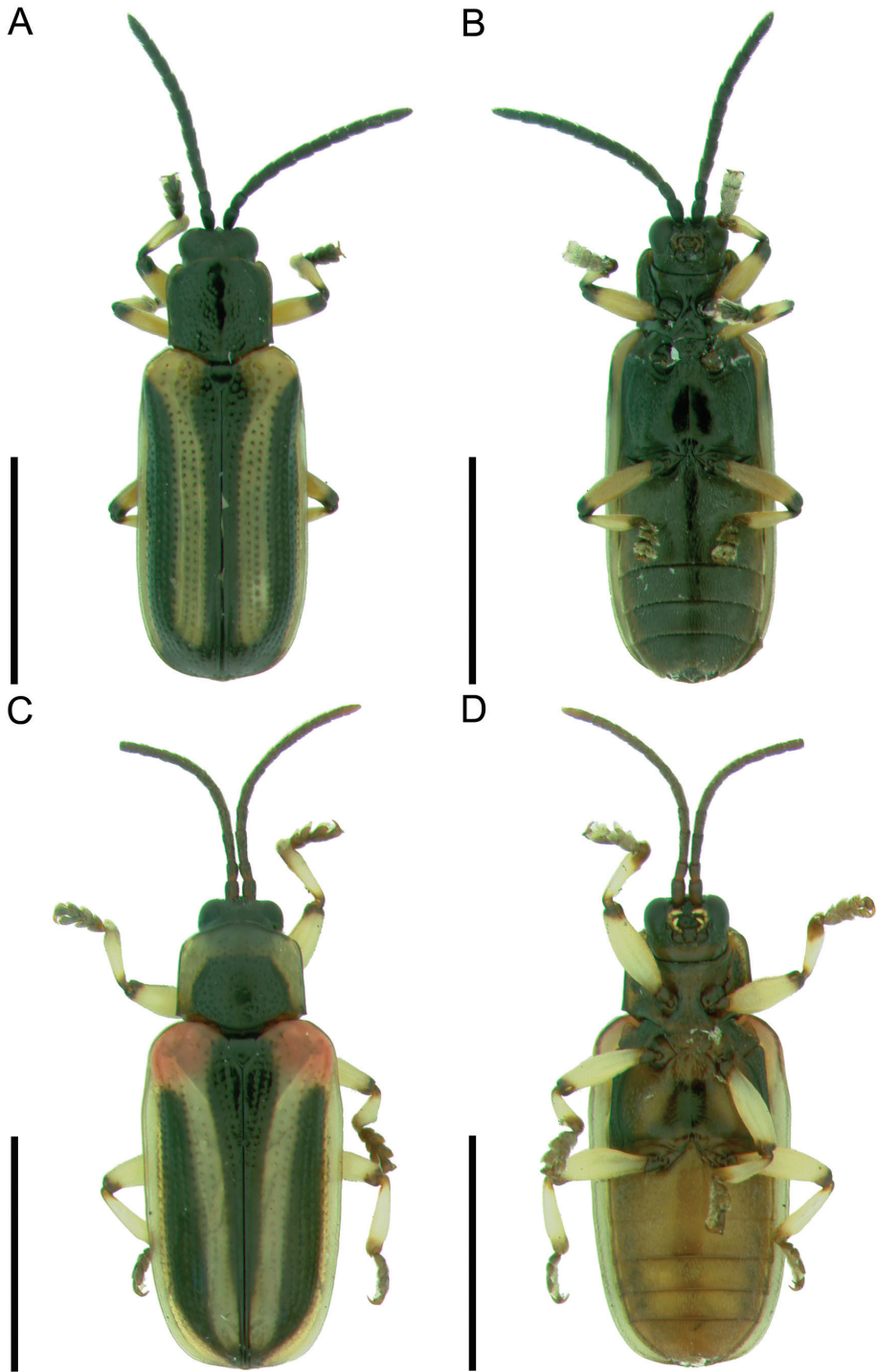


Figure 2. A–B *Cephaloleia kuprewiczae* A dorsal view B ventral view C–D *Cephaloleia histrionica* C Dorsal view D Ventral view. Scale bars = 3 mm.

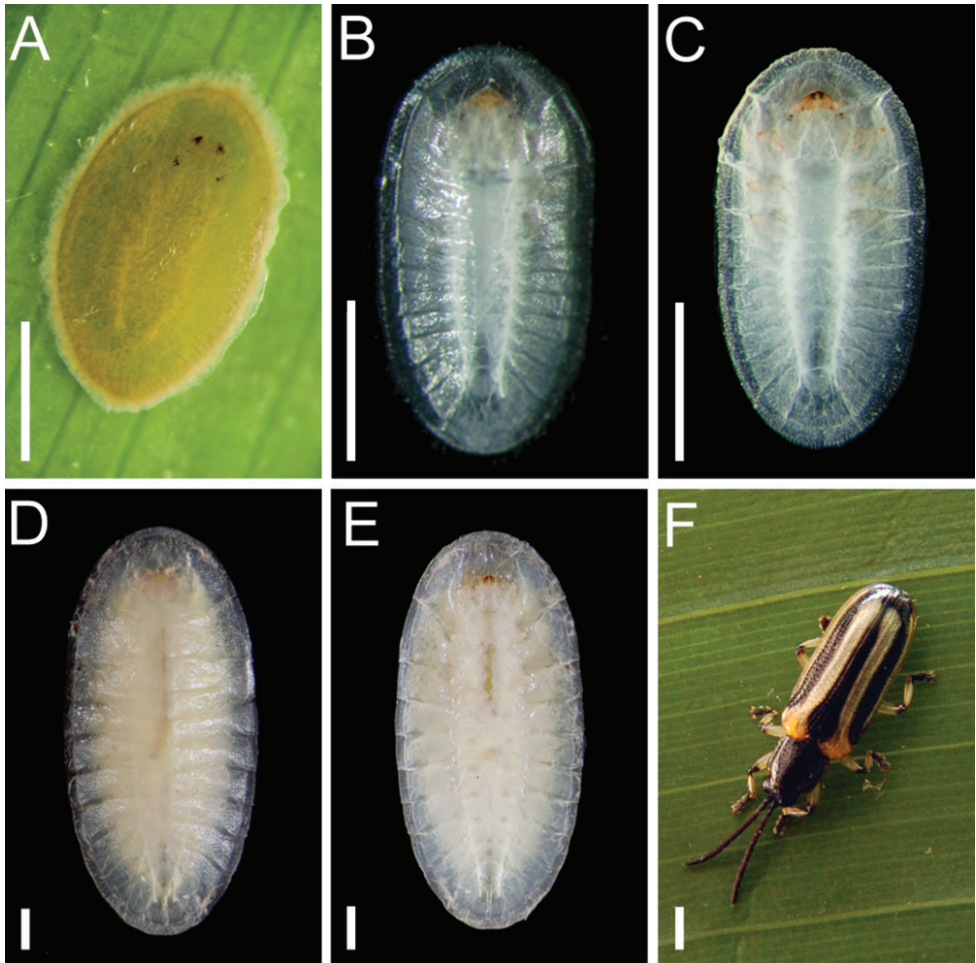


Figure 3. **A** Egg **B–C** First instar larva (dorsal and ventral views) **D–E** Second instar larva (dorsal and ventral views). **F** Adult *C. histrionica*. Scale bars in all panels = 1 mm. From García-Robledo et al. 2013a.

The attachment tissue of the egg to the substrate is pale cream colored. Eggs were found attached to the inner surfaces of rolled leaves of *P. arcuata* and *P. brittoniana*. Mean egg length $\pm$ SD = 2.55 ± 0.09 mm, mean width $\pm$ SD = 1.59 ± 0.10 mm, $n = 6$. Larva color when alive is creamy-white becoming translucent laterally and apically, with some yellowish areas medially (Figures 3B–E, 4A). Color when fixed in EtOH is yellowish-brown. Dorsum without medial setose ridge. Total length: 8.6–9.3 mm; width 4.6–4.9 mm ($n = 4$).

Dorsum. Pronotum without raised central area; micropustulate (Figure 5C); with pale setae along lateral and apical margins; lateral and apical margins with numerous shallow sulci (Figure 5C). Mesonotum without raised central area or carina or sulcus; micropustulate; laterally with numerous shallow sulci on expansion. Metanotum with central portion micropustulate; without carina or sulcus. Abdominal tergites 1–6



Figure 4. Larvae of *Cephaloleia kuprewiczae* (A) and *Cephaloleia histrionica* (B) feeding on their host plants. Scale bars = 3 mm.

slightly narrowed in middle; without carina laterally; spiracle near basal margin; each spiracle appears as spot with darker margin, orifice (Figure 5E). Abdominal tergites 7–10 without surface plicae or carinae.

Venter. Surface of expansions smooth, sulcate laterally. Head with surface sparsely punctate, without setae; clypeus smooth, without setae; labrum with 6 long and 6 short setae on apical margin, with four large punctures each with a single seta; mandibles tridentate (Figure 5A); maxillary palps with 2 palpomeres, each palpomere with 3 setae and 8 sensilla setae at apex; mala robust, clavate, with fringe of long setae at apex; labium smooth (Figure 5A). Antenna with 3 antennomeres; antennomere 1 short, robust, $\frac{1}{2}$ length of 2; 2 cylindrical, longer than 1 and 3 combined; 3 shortest, with ring of 19 setae at apex (Figure 5A). Prosternum longer than others, wider than long, slightly depressed in middle; surface rugose-striate. Meso- and metasterna wider than long, slightly depressed in middle; surface rugose-striate. Abdominal sternites 1–8 wider than long, decreasing in width; with transverse sulcus just beyond middle and second transverse sulcus near apex; sterna 9–10 fused, rounded at apex. Leg stout; coxa with 10 setae; femur wider and longer than tibiotarsus; tibiotarsus subconical, with a robust claw and 6 setae at apex (Figure 5G).

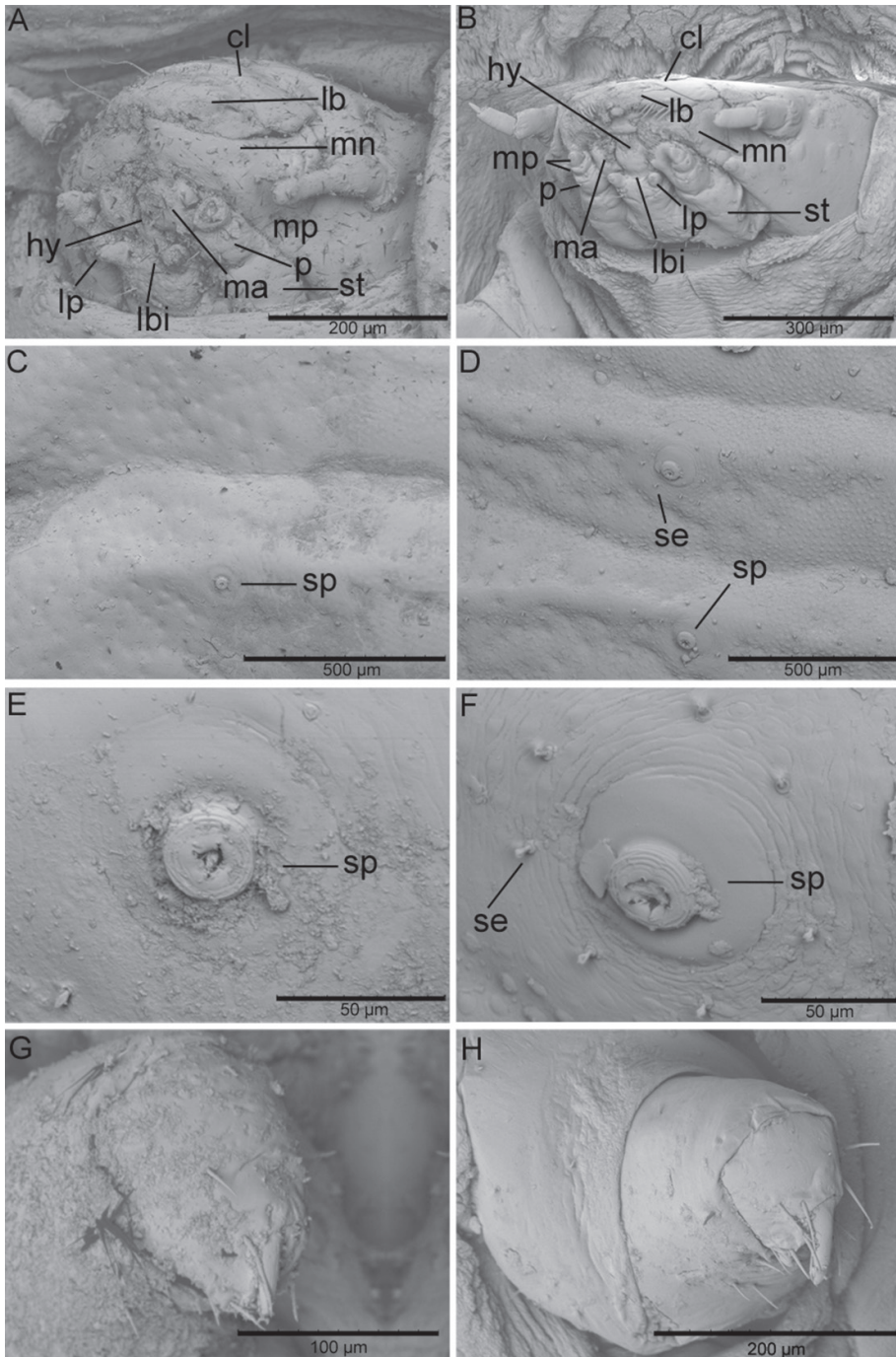


Figure 5. Differences in microstructures between larvae of *Cephaloleia kuprewiczae* (left column) and *C. histrionica* (right column). **A–B** Head **C–D** Details of dorsal papillae and spiracles **E–F** Detail of spiracle and surrounding setae **G–H** Front leg. cl: clypeus, hy: hypopharynx, lb: labrum, lbi: labium, lp: labial palp, ma: malum, mn: mandibula, mp: maxillary palp, p: palpi, se: seta, sp: spiracle, st: stipe.

Cephaloleia histrionica

Color when alive yellow-white becoming translucent laterally and apically, with some yellowish areas medially (Figure 4B). Color when dead yellowish-brown. Dorsum without medial setose ridge. Total length: 8.6–9.3 mm (n=4); width 4.6–4.9 mm.

Dorsum. Pronotum without raised central area; micropustulate; with pale setae along lateral and apical margins; lateral and apical margins with numerous shallow sulci (Figure 5D). Mesonotum without raised central area or carina or sulcus; micropustulate; laterally with numerous shallow sulci on expansion. Metanotum with central portion micropustulate; without carina or sulcus. Abdominal tergites 1–6 slightly narrowed in middle; without carina laterally; spiracle near basal margin; spiracles appear as spot with darker margin, orifice surrounded by five setae as in Figure 5F. Abdominal tergites 7–10 without surface plicae or carinae.

Venter. Surface of expansions smooth, sulcate laterally. Head with surface sparsely punctate, without setae; clypeus smooth, without setae; labrum with 10 long and 6 short setae along apical margin, with four large punctures each with a single seta; mandibles tridentate (Figure 5B); maxillary palps with 2 palpomeres, each palpomere with 3 setae and 8 sensilla at apex; mala robust, clavate, with fringe of long setae at apex; labium smooth (Figure 5B). Antenna with 3 antennomeres; antennomere 1 short, robust, $\frac{1}{2}$ length of 2; 2 cylindrical, longer than 1 and 3 combined; 3 shortest, with ring of 19 setae at apex (Figure 5B). Prosteronum longer than others, wider than long, slightly depressed in middle; surface rugose-striate. Meso- and metasterna wider than long, slightly depressed in middle; surface rugose-striate. Abdominal sternites 1–8 wider than long, decreasing in width; with transverse sulcus just beyond middle and second transverse sulcus near apex; sterna 9–10 fused, rounded at apex. Leg stout; coxa with 4 rows of 2 setae each; femur wider and longer than tibiotarsus, with 8 setae; tibiotarsus subconical, with a strong claw and 6 setae at apex (Figure 5H).

Differential diagnosis for larval stages

Larvae of *C. kuprewiczae* sp. n. and *C. histrionica* display obvious differences in shape and color (Figures 4 and 5). Larvae of *C. kuprewiczae* sp. n. are elongated and white (Figure 4A), while *C. histrionica* larvae are more rounded and yellow (Figure 4B). The head of *C. kuprewiczae* sp. n. is rounded (Figure 5A), the head of *C. histrionica* larvae are flattened (Figure 5B). The setae along dorsal ridges are absent in *C. kuprewiczae* sp. n. larvae (Figure 5C) but present in *C. histrionica*. Larvae of these species are also easily differentiated by a series of five setae surrounding each spiracle only present in *C. histrionica* (Figure 5E–F).

DNA barcode divergence between *Cephaloleia kuprewiczae* sp. n. and *C. histrionica*

Within-species similarities of COI sequences ranged between 91–100% (Figure 6A). Similarities of COI sequences between species ranged between 77–82% (Figure 6A).

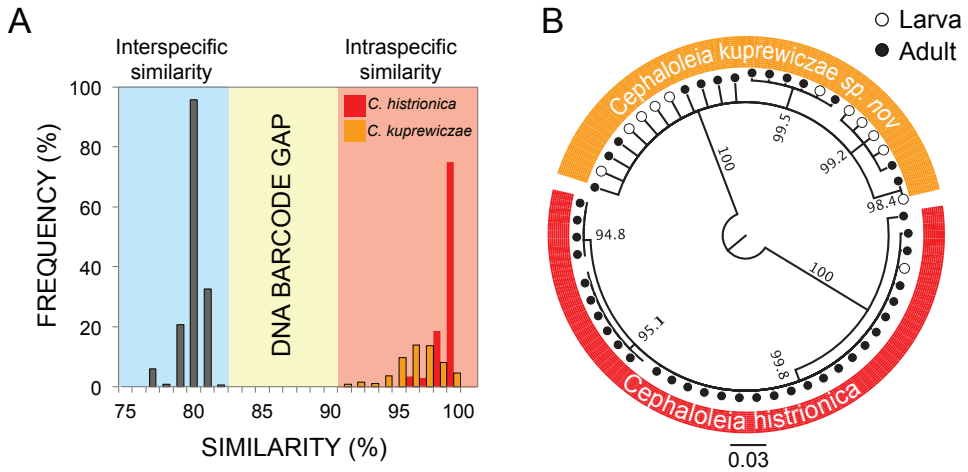


Figure 6. **A** Frequency distributions of inter and intraspecific similarities for beetle COI sequences (paired comparisons, percentage of bases/residuals that are identical for each comparison for cytochrome oxidase I (COI) sequences included in Figure 6B). **B** Identification of *Cephaloleia kuprewiczae* sp. n. and *C. histrionica* using cytochrome oxidase I (COI) sequences. Neighbor-joining tree includes bootstrap values (%) supporting species identifications. Filled circles represent DNA sequences obtained from adults. Empty circles represent DNA sequences obtained from larvae.

These two species can be unambiguously identified as they display a DNA barcode gap between 83–90% (Figure 6A).

Using the DNA barcode COI, we correctly identified the species of all larvae included in this study (Figure 6B). The neighbor-joining tree assigned all *Cephaloleia kuprewiczae* sp. n. individuals to one group. COI sequences of *C. histrionica* from the population in the tropical rain forest (60 m.a.s.l.) and premontane forest (1200 m.a.s.l.) in the Talamanca Cordillera are similar and were assigned to one group (Figure 6B).

Discussion

This study combined morphological, ecological and molecular evidence to discover a new species. Larval morphology and differences in host plant orders are strong evidence that these are two different species. Molecular analyses confirmed that this complex includes at least two different species. It is important to note that with this information, we were able to reassess adult morphologies of *C. kuprewiczae* sp. n. and *C. histrionica* adults, finding obvious morphological differences between these two species (Figure 2).

Previous studies reported two species of *Cephaloleia* completing their life cycles on palms and orchids. *Cephaloleia vagelineata* Pic larvae and adults were recorded on *Elaeis guineensis* Jacq., *Corozo oleifera* (H.B.K.) Bailey, *Cocos nucifera* L. (Urueta-Sandino 1972) and *Astrocaryum chonta* Matrius (Couturier and Kahn 1992) (Arecaceae).

Cephaloleia orchideivora Sekerka et al. larvae and adults feed on *Elleanthus* cf. *robustus* (Rchb. f.) Rchb. f., *Elleanthus* sp., *Epidendrum werklei* Schltr., *Oerstedella exasperata* (Rchb. f.) Hágsater, and *Oerstedella wallisii* (Rchb. f.) Hágsater (Orchideaceae) (Sekerka et al. 2013).

Cephaloleia kuprewiczae sp. n. is a third example of diet expansion beyond the order Zingiberales in rolled-leaf beetles. Further studies are required to determine if other *Cephaloleia* species are also adapted to other non-Zingiberales host plants.

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Supplementary material I

DNA barcodes (COI) for specimens of *Cephaloleia histrionica* and *C. kuprewiczae* included in this study.

Authors: Carlos Garcia-Robledo, Charles L. Staines, W. John Kress

Data type: Fasta file.

Explanation note: Single-line descriptions for each sequence include: Collection number, *Cephaloleia* species, host plant species, elevation and locality. DNA sequences from type specimens include the tag genseq-1 in the description line.

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One new species of the subgenus *Hexatoma* (*Eriocera*) Macquart (Diptera, Limoniidae) from China with a key to Chinese species

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Abstract

One new species of the subgenus *Eriocera* Macquart, 1838, *Hexatoma* (*Eriocera*) *cleopatroides* Men, **sp. n.** (Southern China: Anhui) is described and illustrated. A key to all of 78 known species from China in the subgenus is provided, which was solely based on literatures. The new species is similar to *H. (E.) cleopatra* Alexander, 1933, but distinguishes from the latter by the prescutum entirely black with two ill-defined gray stripes, by the legs with fore and middle femora brown in basal half, black in apical half, with hind femora brown in basal one-fourth, and by the wings with cells c and sc more yellowish brown than the ground color.

Keywords

Nematocera, Crane flies, Tipuloidea, taxonomy

Introduction

Eriocera Macquart, 1838 was originally established as a genus with a single species *Limnobia nigra* Wiedemann. Currently, *Eriocera* is considered a subgenus of the genus *Hexatoma* Latreille, 1809, in which five other subgenera are also included, *Hexatoma* Latreille, 1809, *Cladolipes* Loew, 1865, *Coreozella* Enderlein, 1936, *Euhexatoma* Alexander, 1936 and *Parahexatoma* Alexander, 1951. It is characterized by the following

characters: medium to large size; palpus with segments equilateral; rostrum protruded obliquely from the vertex to the end; anterior vertex often with a greatly enlarged or variously modified tubercle; antenna filiform, with six to eight segments in male, eight to eleven in female, scape quite thick, slightly elongated, cylindrical, pedicel very short, first flagellomere slightly longer than the length of scape and pedicel together; legs with spur formula 2:2:2; wings uniformly tinged with black, gray or brown, sometimes with a conspicuous brown or yellow cross band before cord, rarely subhyaline or hyaline, Rs very long, M with at least three branches, cell m_1 present in Palaearctic, Nearctic and oriental species, and absent in Neotropical species; male hypopygium with two gonostyli, the outer gonostylus with a sharp hook apically, inner gonostylus fluted; ovipositor elongated (Alexander 1948, Savchenko 1986). The subgenus *Eriocera* comprises 565 species (Oosterbroek 2014) and is very well represented in Oriental, Palaearctic, Nearctic and Neotropical regions, and rarely occurs in Australian and Afrotropical regions. The Chinese fauna of subgenus *Eriocera* is extremely rich with 77 members recorded (Alexander 1920, 1923a, 1923b, 1925, 1927, 1930, 1931, 1932, 1933a, 1933b, 1934, 1936, 1937a, 1937b, 1938a, 1938b, 1938c, 1940, 1941, 1942, 1943, 1945, 1949a, 1949b, 1949c, Edwards 1916, 1921, Enderlein 1912, Osten-Sacken 1881, Riedel 1913, Yang 1999, Walker 1848, Westwood 1836, Wiedemann 1828). The Chinese species of the subgenus are mainly distributed in southern China, rarely reported from northern China (Yang 1999). There is little published research on immature stages of subgenus *Eriocera*, for which only five species were reported (Alexander 1915a, Alexander and Lloyd 1914).

While sorting and identifying crane flies collected from Yaoluoping National Nature Reserve, Anhui Province, China, we found one new species of the subgenus *Eriocera*. In the present paper, we describe and illustrate the new species. In addition, a key for separating the known species from China is provided.

Material and methods

The specimens examined in this study were collected during scientific exploration in Yaoluoping National Nature Reserve, Anhui Province, undertaken by undergraduates and author. The genital segments of the specimens were removed and soaked in 10% NaOH overnight and observed or drawn in glycerin jelly using a Leica MZ125 (Leica, Germany) stereomicroscope. The measurements were made with the aid of a digital caliper. All measurements are in millimeters (mm). The terminology and methods of description and illustration follow that of Alexander and Byers (1981), and Ribeiro (2006).

In the present study, no specimens of the other known species were available for examination. However, there is no doubt concerning the identity of those species because the descriptions and illustrations were very clear and detailed. The examined specimens of the new species are deposited in the animal specimen room, School of Life Sciences, Anqing Normal University, Anqing, Anhui Province, China. The key was constructed from the literatures.

Taxonomy

Subgenus *Eriocera* Macquart, 1838

Eriocera Macquart 1838: 74; Brunetti 1912: 530; Edwards 1921: 67; Alexander 1933a: 148; Alexander 1948: 529; Alexander 1966: 415.

Caloptera Guérin-Ménéville 1831: 20.

Evanioptera Guérin-Ménéville 1838: 287.

Allartmia Loew 1850: 36.

Oligomera Doleschall 1857: 387.

Arrhenica Osten-Sacken 1860: 243.

Physecrania Bigot 1859: 123.

Penthoptera Schiner 1863: 220.

Androclosma Enderlein 1912: 34.

Globericera Matsumura 1916: 171.

Coreozelia Enderlein 1936: 22.

Key to species of the subgenus *Eriocera* from China

- | | | |
|---|--|----|
| 1 | Wings unicolor, without marks | 6 |
| – | Wings not unicolor, cells sc and c darker than ground color, or with marks | 3 |
| 2 | Prescutum with three stripes | 8 |
| – | Prescutum with four stripes (see Alexander 1933a: 155) | |
| | <i>omeiana</i> Alexander (China: Sichuan) | |
| 3 | Abdomen, not including hypopygium, unicolor | 15 |
| – | Abdomen, not including hypopygium, bicolor | 16 |
| 4 | Prescutum with stripes | 2 |
| – | Prescutum without stripes | 13 |
| 5 | Prescutum black | 7 |
| – | Prescutum gray (see Alexander 1949c: 448) | |
| | <i>fracida</i> Alexander (China: Fujian) | |
| 6 | Abdomen, not including hypopygium, unicolor | 4 |
| – | Abdomen, not including hypopygium, bicolor | 5 |
| 7 | Head black | 9 |
| – | Head not black | 10 |
| 8 | Antenna brown throughout | 12 |
| – | Antenna with scape, pedicel and first flagellomeres black, the remainder missing (see Alexander 1933a: 158) | |
| | <i>nudivena</i> Alexander (China: Sichuan-Xizang border) | |
| 9 | The extreme cephalic and caudal portions of the prescutum with a capillary reddish brown median vitta (see Alexander 1923a: 298) | |
| | <i>abdominalis</i> (Alexander) (China: Jiangxi) | |
| – | Prescutum without such vitta | 11 |

- 10 Head brownish gray; prescutum without stripe (see Osten-Sacken 1881: 406).....***moresa* (Osten-Sacken)** (China: Taiwan; Indonesia, Malaysia)
- Head dull red; prescutum with four stripes (see Edwards 1916: 253).....
.....***rubriceps* (Edwards)** (China: Taiwan)
- 11 Abdomen with segments two to five entirely orange (see Edwards 1921: 84) ...
.....***shirakii* (Edwards)** (China: Taiwan)
- Abdominal tergites two to five apically with orange bands, the caudal margins remaining narrowly black (see Alexander 1938b: 350).....
.....***scalator* Alexander** (China: Guangdong)
- 12 Cell m_1 present; wings dark brown; head dark brown (see Alexander 1949c: 444).....***suberecta* Alexander** (China: Fujian)
- Cell m_1 absent; wings pale grayish; head gray (see Alexander 1933a: 159, Pl. 1, fig. 20).....***subpusilla* Alexander** (China: Sichuan)
- 13 Head yellow.....**14**
- Head black (see Riedel 1913: 273).....***nigrina* (Riedel)** (China: Taiwan)
- 14 Antenna distinctly shorter than body (see Alexander 1942: 183); basal deflection of CuA_1 nearly its own length beyond base of discal cell (see Alexander 1942: 178, fig. 5).....***licens* Alexander** (China: Yunnan)
- Antenna more than three times longer than body (see Wiedemann 1828: 56; Wulp 1895: 39, Pl. 2, fig. 6); basal deflection of CuA_1 slightly beyond base of discal cell (see Alexander 1915b: Pl. 44, fig. 25).....***verticalis* (Wiedemann)** (China: Taiwan; Japan, Indonesia, Malaysia, Philippines)
- 15 Prescutum with stripes.....**17**
- Prescutum without stripes.....**18**
- 16 Abdomen with tergites two to four yellow or orange.....**31**
- Abdomen with coloration not as above.....**32**
- 17 Rostrum short, greatly reduced (see Alexander 1934: 330).....
.....***diploneura* Alexander** (China: Sichuan)
- Rostrum long, not reduced.....**19**
- 18 Abdomen, not including hypopygium, black.....**29**
- Abdomen, not including hypopygium, dark brown or plumbeous.....**30**
- 19 Prescutum with four stripes (see Alexander 1938a: 125).....
.....***cantonensis* Alexander** (China: Jiangxi, Zhejiang, Guangdong)
- Prescutum with less than four stripes.....**20**
- 20 Prescutum with one middle stripe (see Alexander 1933a: 149).....
.....***lanigrea* Alexander** (China: Sichuan-Xizang border)
- Prescutum with three stripes.....**21**
- 21 Abdomen, not including hypopygium, uniformly black.....**23**
- Abdomen, not including hypopygium, not black.....**22**
- 22 Abdominal segments brownish gray; ovipositor with short hypovalva (see Alexander 1933a: 157).....***luteicostalis* Alexander** (China: Sichuan)
- Abdominal segments brown; ovipositor with long hypovalva (see Alexander 1949a: 538).....***absona* Alexander** (China: Guangdong)

23	Head gray to brownish gray	24
–	Head black	25
24	Cell m_1 lacking	26
–	Cell m_1 present	27
25	Cell m_1 a little shorter than its petiole; prescutum dark brown (see Alexander 1923a: 297)	<i>morula</i> (Alexander) (China: Sichuan)
–	Cell m_1 nearly twice its petiole; prescutum dull black (see Alexander 1927: 6, fig. 3)	<i>arrogans</i> (Alexander) (China: Sichuan)
26	Mesonotum and pleura gray	28
–	Mesonotum dark brown; pleura black (see Alexander 1943: 179)	<i>gressittiana</i> Alexander (China: Guangdong)
27	Wings with strong rufous tinge; m-cu not far beyond the fork of M; mesonotum blackish (see Alexander 1927: 4)	<i>fumidipennis</i> Alexander (China: Sichuan)
–	Wings with strong black tinge; m-cu a little more than one-half its length beyond the fork of M; mesonotum gray (see Alexander 1925: 87, 88, fig. 1)	<i>rufipennis</i> Alexander (China: Guangdong)
28	Prescutum with stripes black; wings tinged with brown (see Alexander 1938b: 347)	<i>toi</i> Alexander (China: Hainan)
–	Prescutum with stripes dark gray; wings tinged with yellow (see Alexander 1949b: 202)	<i>canescens</i> Alexander (China: Guangdong)
29	Cell r_4 with a longitudinal or oblique vein, connecting R_5 with M_{1+2} ; head black (see Alexander 1937a: 82, fig. 12)	<i>pieli</i> Alexander (China: Zhejiang)
–	Cell r_4 without such vein; head orange (see Alexander 1940: 26, 27, fig. 14)	<i>pterotricha</i> Alexander (China: Jiangxi)
30	Cell m_1 absent, m-cu at near two-thirds the length of cell first m_2 (see Alexander 1945: 28, fig. 5)	<i>elevata</i> Alexander (China: Guangdong)
–	Cell m_1 present, m-cu at or just before midlength of cell first m_2 (see Alexander 1937b: 388, Pl. 1, fig. 15)	<i>quadriatrata</i> Alexander (China: Jiangxi)
31	Prescutum with stripes	33
–	Prescutum without stripe	34
32	Abdominal tergites two to seven brilliant purplish blue, the caudal margins of segments dull black (see Alexander 1936: 131)	<i>tuberculata</i> Alexander (China: Hainan)
–	Abdominal tergites with coloration not as above	38
33	Prescutum with four stripes (see Alexander 1931: 359)	<i>caesarea</i> (Alexander) (China: Sichuan)
–	Prescutum with less than four stripes	36
34	Cell m_1 present (see Alexander 1927: 3, fig. 2)	<i>grahami</i> (Alexander) (China: Sichuan)
–	Cell m_1 absent	35
35	Ovipositor with genital shield orange; wings with a large, pale area in cells cu at near middle (see Alexander 1941: 414)	<i>regina kiuhuana</i> Alexander (China: Anhui)

- Ovipositor with genital shield black; wings without pale area in cells cu (see Alexander 1930: 73) ***platysoma* (Alexander)** (China: Sichuan)
- 36 The extreme cephalic portion of prescutum variegated by reddish on either side of median vitta; legs with femora entirely dark brown (see Alexander 1933a: 164) ***cleopatra* Alexander** (China: Sichuan)
- Prescutum without such reddish portions; legs with femora yellow or brownish yellow basally, blackened apically **37**
- 37 Hypopygium reddish yellow; prescutum with three stripes (see Alexander 1933a: 163) ***pyrrhopyga* Alexander** (China: Anhui, Fujian)
- Hypopygium black; prescutum with two stripes .. ***cleopatroides* Men, sp. n.**
- 38 Prescutum with stripes **39**
- Prescutum without stripes **40**
- 39 Prescutum with only one middle stripe **41**
- Prescutum with more than one stripe **42**
- 40 Head black **58**
- Head not black **59**
- 41 Wings strongly blackened; head deep reddish; abdominal sternites orange (see Alexander 1949c: 446, 447) ***eos* Alexander** (China: Fujian)
- Wings with strong fulvous-brown tinge; head brown; abdominal sternites obscure yellow (see Alexander 1933a: 151)
..... ***mediofila* Alexander** (China: Sichuan-Xizang border)
- 42 Prescutum with three stripes **43**
- Prescutum with four stripes **44**
- 43 Abdominal segments reddish brown with caudal borders narrowly gray (see Alexander 1949c: 449) ***carinivertex* Alexander** (China: Fujian)
- Abdominal segments with coloration not as above **45**
- 44 Head black **54**
- Head brown or brownish gray **55**
- 45 Cell m_1 present **46**
- Cell m_1 absent **47**
- 46 Antenna entirely dark brown; wings brown, wing-apex broadly darker brown (see Alexander 1923b: 255) ***muiri* (Alexander)** (China: Guangdong)
- Antenna entirely black; wing-apex without darker tinge **48**
- 47 Legs brownish black or black throughout **49**
- Legs with each segment in different colors or bicolor in same segment **50**
- 48 Halteres entirely dark brown; head brownish gray; abdominal sternites yellow (see Alexander 1933a: 150, 151)
..... ***tibetana* Alexander** (China: Sichuan-Xizang border)
- Halteres with stem brownish black, knob black; head blackish; abdominal sternites fulvous (see Alexander 1933b: 150, 151)
..... ***hemicera* (Alexander)** (China: Sichuan)
- 49 Wings with two yellow blotches in cells r (see Alexander 1923b: 256)
..... ***terryi* (Alexander)** (China: Guangdong)

–	Wings without yellow blotches in cells r	51
50	Head black	52
–	Head yellow	53
51	Antenna 10-segmented in female; Rs about one-half longer than R (see Alexander 1938b: 351, fig. 11)	<i>tinkhami</i> Alexander (China: Guangdong)
–	Antenna 11-segmented in female; Rs about one-third longer than R (see Alexander 1938b: 352, fig. 12)	<i>hoffmanni</i> Alexander (China: Guangdong)
52	Abdominal tergites with basal rings plumbeous (see Alexander 1938a: 124) ...	<i>ambrosia</i> Alexander (China: Guangdong)
–	Abdominal tergites with basal rings iridescent (see Alexander 1949a: 536)	<i>ambrosia angustinigra</i> Alexander (China: Fujian)
53	Wings strongly tinged with yellow brown, cells c and sc light brown (see Alexander 1934: 330)	<i>minensis</i> Alexander (China: Sichuan)
–	Wings nearly hyaline, cells c and sc yellowish (see Yang 1999: 41)	<i>flavimarginata</i> (Yang) (China: Henan)
54	Antenna with each segment in different colors	56
–	Antenna entirely dark brown (see Alexander 1920: 259)	<i>lygropis</i> (Alexander) (China: Taiwan)
55	Abdomen reddish-brown; cell m_1 not present (see Alexander 1938b: 354, fig. 13)	<i>monoleuca</i> Alexander (China: Hainan)
–	Abdomen yellow; cell m_1 present (see Alexander 1940: 24, fig. 13)	<i>pieliana</i> Alexander (China: Zhejiang)
56	Cell m_1 present (see Alexander 1938b: 354, fig. 14)	<i>bifenestrata</i> Alexander (China: Hainan)
–	Cell m_1 not present (see Alexander 1932: 123, fig. 15; Alexander 1937a: 85, fig. 14)	57
57	Antenna with scape and pedicel dark brown, flagellum yellowish brown, the outer segments again darkened; legs with femora brownish black (see Alexander 1932: 123)	<i>kelloggi</i> (Alexander) (China: Fujian, Guangdong)
–	Antenna with scape and pedicel black, the latter more reddish at apex, basal three flagellomeres yellow, the remainder passing into black; legs with femora yellow, the apex narrowly and abruptly blackened (see Alexander 1937a: 85) ...	<i>posticata</i> Alexander (China: Zhejiang)
58	The lateral margins of abdomen with marks	60
–	The lateral margins of abdomen without marks	61
59	Wings with a cross band before cord	74
–	Wings without cross band (see Alexander 1938a: 120)	<i>insidiosa</i> Alexander (China: Guangdong)
60	Wings with a cross band before cord (see Alexander 1938c: 3)	<i>kiangsuana</i> Alexander (China: Jiangxi)
–	Wings without cross band	62
61	Legs with femora entirely black	63
–	Legs with femora not entirely black	64

- 62 Head deep orange; legs with different colors in different segments; wings with a strong brownish yellow suffusion (see Alexander 1937a: 79) *sycophanta* **Alexander** (China: Jiangxi)
- Head bright yellow; legs black throughout; wings with a strong blackish suffusion (see Alexander 1937a: 80) *kolthoffi* **Alexander** (China: Jiangsu)
- 63 Abdomen black, tergites two, four and five with leaden basal bands (see Edwards 1921: 87) *sinensis* (**Edwards**) (China: Sichuan)
- Abdomen with coloration not as above **65**
- 64 Antenna entirely black **70**
- Antenna not uniformly colored **71**
- 65 Antenna entirely dark brown **66**
- Antenna entirely black **67**
- 66 Wings gray (see Alexander 1949c: 445) *celestissima* **Alexander** (China: Guangdong)
- Wings dark brown **68**
- 67 Abdominal tergite three uniformly black (see Alexander 1927: 4) *cybele* (**Alexander**) (China: Sichuan)
- Abdominal tergite three bicolor **69**
- 68 Sc_1 equal to the deflection of CuA_1 , basal deflection of R_{4+5} about 2.5 times longer than r-m (see Alexander 1923a: 295) *davidi* (**Alexander**) (China: Sichuan, Fujian, Jiangxi, Zhejiang, Guangdong)
- Sc_1 shorter than the deflection of CuA_1 , basal deflection of R_{4+5} more than three times longer than r-m (see Alexander 1923a: 296) *hilpoides* (**Alexander**) (China: Sichuan)
- 69 Hypopygium orange; cell m_1 present (see Edwards 1921: 88) *chrysomela* (**Edwards**) (China: Fujian, Jiangxi, Guangdong)
- Hypopygium black; cell m_1 not present (see Alexander 1937a: 83, fig. 13) ... *regina* **Alexander** (China: Anhui, Jiangxi)
- 70 Abdominal segments with silvery luster on anterior borders (see Walker 1848: 79) *hilpa* (**Walker**) (China: Anhui, Zhejiang, Guangdong)
- Abdominal segments without silvery luster **72**
- 71 Legs with coxae and trochanters black, remainder of legs dark brown; cell m_1 present; hypopygium orange (see Alexander 1942: 183, fig. 4) *sincera* **Alexander** (China: Yunnan)
- Legs brownish black throughout; cell m_1 absent; hypopygium black (see Alexander 1923b: 256) *submorosa* (**Alexander**) (China: Guangdong)
- 72 Wings with an oblique whitish hyaline cross band before cord **73**
- Wings without cross band (see Enderlein 1912: 42) *sauteriana* (**Enderlein**) (China: Taiwan)
- 73 Legs with femora entirely yellow (see Alexander 1938a: 122) *celestia* **Alexander** (China: Guangdong)
- Legs with femora yellow basally, the tip gradually and much more broadly blackened (see Alexander 1949a: 536) *celestia maligna* **Alexander** (China: Guangdong)

74	Antenna uniformly colored.....	75
–	Antenna with different colors in different segments	76
75	Head blackish gray; antenna entirely black.....	77
–	Head plumbeous; antenna entirely brown (see Alexander 1949c: 450)	
	 <i>urania</i> Alexander (China: Guangdong)	
76	Abdomen reddish brown; prescutum reddish brown (see Alexander 1923b: 254).....	<i>praelata</i> (Alexander) (China: Guangdong)
–	Abdomen black; prescutum black (see Alexander 1936: 131).....	
	 <i>hirtithorax</i> Alexander (China: Hainan)	
77	Wings bright orange-yellow at the base (see Westwood 1836: 681)	<i>nepalensis</i> (Westwood) (China: Sichuan, Guangdong; India, Malaysia, Nepal)
–	Wings with the base not brightened (see Alexander 1923b: 255)	
	 <i>obliqua</i> (Alexander) (China: Jiangxi, Guangdong)	

***Hexatoma* (*Eriocera*) *cleopatroides* Men, sp. n.**

<http://zoobank.org/773B8999-ACE1-4AD4-A223-C1855120DBE1>

Figs 1–6

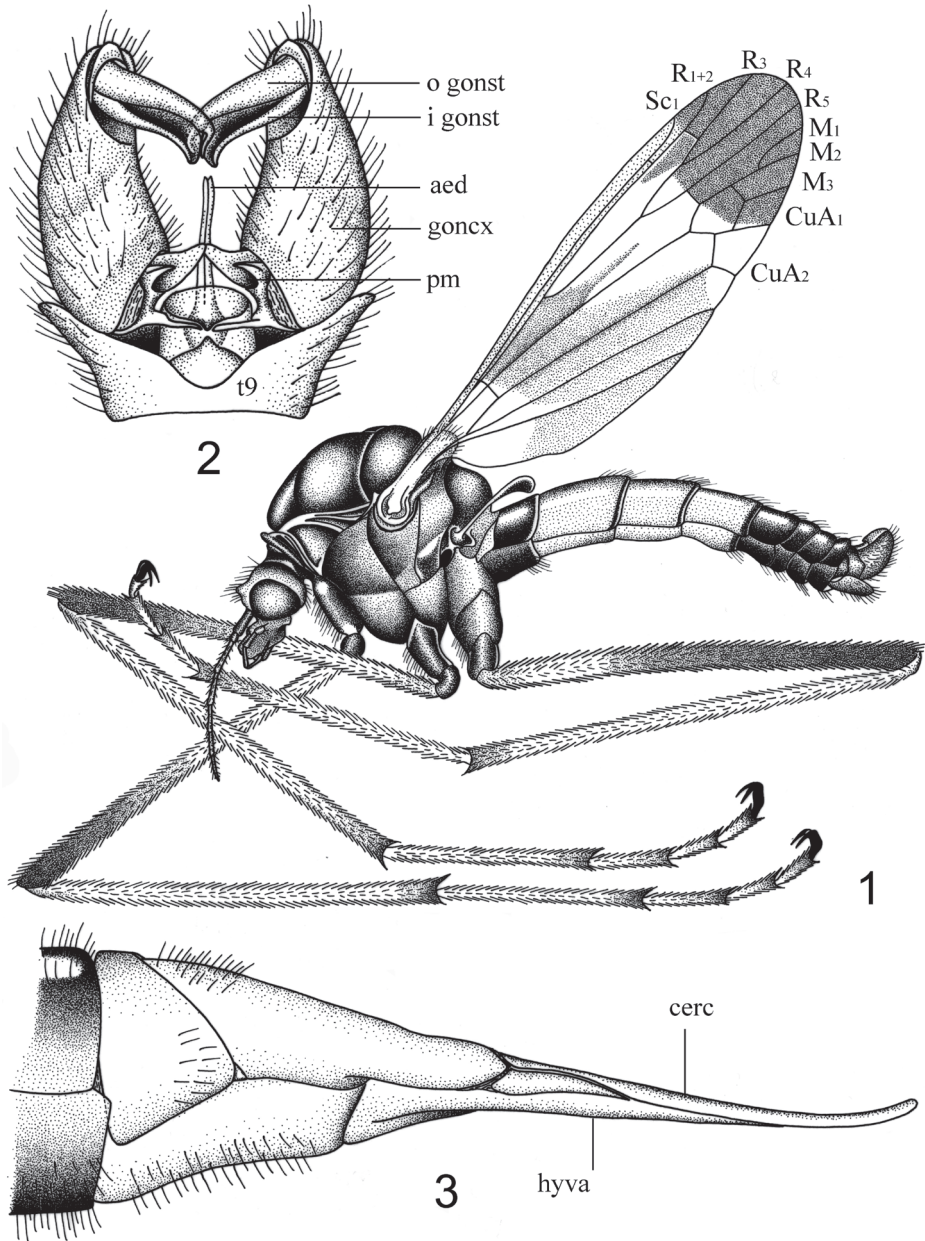
Diagnosis. Antennal flagellum yellow. Head and thorax black, prescutum with two ill-defined grayish stripes. Wings tinged with light brown, cells c and sc more yellowish brown than ground color, wing-apex blackish, the basal half except extreme base also blackish. Abdominal segments two to four orange.

Description. Body length: male 15.5–16.5 mm (n=2), female 18.3 mm (n=1). Wing: male 15.5–17.5 mm (n=2), female 15.2 mm (n=1). Antenna: male 4.5 mm, female 4.2 mm.

Head. Rostrum dark brown with dark brown nasus. Vertex and occiput blackish. Setae on head black. Antenna 7-segmented in both sexes, relatively short, if bent backward not extending to the root of halteres (Fig. 1); scape black, elongated; pedicel black, very short; flagellum yellow, the first flagellomere longest, the remainder progressively shortened (Fig. 1). Verticils black, shorter than flagellomeres. Palpi black, the setae on palpi black. Tubercle enlarged (Fig. 1).

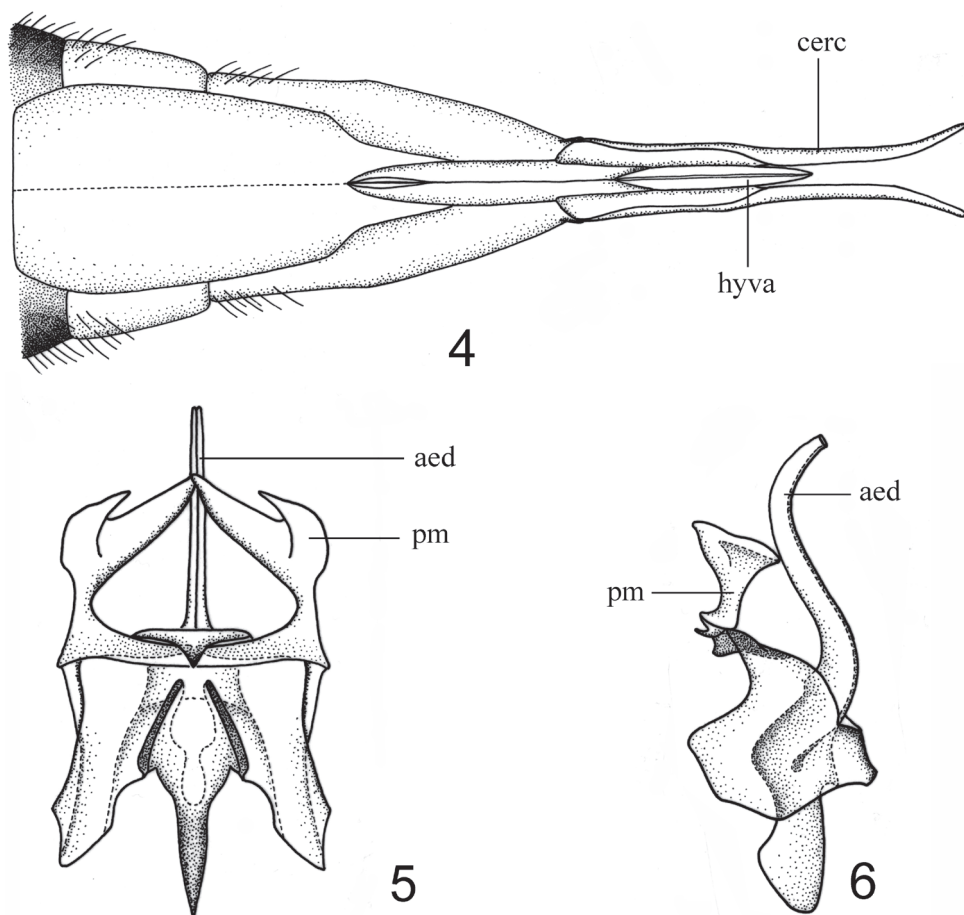
Thorax. Pronotum black. Prescutum black with two ill-defined grayish stripes. Scutum and scutellum black. Pleura deep brown. Setae on thorax mainly distributed on the lateral side of the prescutum. Coxae black; trochanters black; fore and middle femora brown in basal half, black in apical half (Fig. 1); hind femora brown in basal one-fourth, the remainder black (Fig. 1); tibiae dark brown, black at apex; tarsi black. Tibia spurs black with 2-2-2 in number. Setae on coxae and trochanters long, black, the remainder relatively short. Wings with ground color light brown, more yellowish brown in cells c and sc; stigma inconspicuous; wing with apex blackish, the basal half of wing except the extreme base also blackish (Fig. 1). Sc ending beyond the fork of R_{2+3+4} ; R_{2+3} distinctly shorter than R_3 ; cell m_1 present, asymmetrical, slightly longer than its petiole (Fig. 1). Halteres entirely black.

Abdomen. The first tergite black, narrowly ringed with orange at the caudal margin, the first sternite black also with orange stripe apically; tergites two to four orange, narrowly



Figures 1–3. *Hexatoma (Eriocera) cleopatroides* Men, sp. n. **1** habitus of male adult, lateral view **2** hypopygium, dorsal view **3** ovipositor, lateral view. Abbreviations: aed=aedeagus, cerc=cercus, goncx=gonocoxite, hyva=hypovalva, i gonst=inner gonostylus, o gonst=outer gonostylus, pm=paramere, t=tergite.

ringed with black apically, sternites uniformly orange; the remainder including hypopygium black in male (Fig. 1); the eighth to tenth tergites orange in female, ovipositor with cercus long and straight, basally brown and gradually passing into orange apically, hypovalva



Figures 4–6. *Hexatoma* (*Eriocera*) *cleopatroides* Men, sp. n. **4** ovipositor, ventral view **5** aedeagal complex, dorsal view **6** aedeagal complex, lateral view. Abbreviations: aed=aedeagus, cerc=cercus, hyva=hypoalva, pm=paramere.

relatively long, orange (Figs 3, 4). Hypopygium with outer gonostylus slender, dark brown, the terminal spine decurved (Fig. 2); inner gonostylus dark brown, thick, fluted (Fig. 2); paramere bifid, curved inwardly, forming two triangular lobes, the ventral one larger than the dorsal one (Figs 2, 5, 6); aedeagus tubular, S-shaped in lateral view (Fig. 6).

Type material. **Holotype** male. Pinned specimen. China: Anhui Province, Yuexi County, Yaoluoping National Nature Reserve, 31°2.123'N, 116°6.290'E, 1000m, 16 Aug. 2013, Z. K. Liu. **Paratype.** Pinned specimen. China: 1 male 1 female, Anhui Province, Yuexi County, Yaoluoping National Nature Reserve, 31°2.122'N, 116°6.209'E, 1000m, 17 Aug. 2013, Q. L. Men.

Distribution. China (Anhui).

Remarks. This new species is similar to another Chinese species *Hexatoma* (*Eriocera*) *cleopatra* from Sichuan by the color pattern of abdomen and wings. It can be eas-

ily distinguished from the latter by the prescutum entirely black with two ill-defined gray stripes (prescutum not entirely black, the extreme cephalic portion of prescutum variegated by reddish, with only one black median vitta in *H. (E.) cleopatra* as described in Alexander 1933a); legs with fore and middle femora brown in basal half, black in apical half, with hind femora brown in basal one-fourth, the remainder black as shown in Fig. 1 (entirely dark brown in *H. (E.) cleopatra* as described in Alexander 1933a); wings with cells c and sc more yellowish brown than the ground color as illustrated in Fig. 1 (cells c and sc not darker than the ground color in *H. (E.) cleopatra* as described in Alexander 1933a).

Etymology. The specific epithet is an adjective based on a name of a morphologically similar species, *H. (E.) cleopatra*.

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