

A new genus of soft coral of the family Alcyoniidae (Cnidaria, Octocorallia) with re-description of a new combination and description of a new species

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Academic editor: *Leen van Ofwegen* | Received 5 December 2010 | Accepted 17 February 2011 | Published 1 March 2011

[urn:lsid:zoobank.org:pub:219749FF-65B6-4A02-A884-D8D8CBE4C1C1](https://doi.org/urn:lsid:zoobank.org:pub:219749FF-65B6-4A02-A884-D8D8CBE4C1C1)

Citation: Benayahu Y, McFadden CS (2011) A new genus of soft coral of the family Alcyoniidae (Cnidaria, Octocorallia) with re-description of a new combination and description of a new species. ZooKeys 84: 1–11. doi: 10.3897/zookeys.84.781

Abstract

A new genus, *Aldersladum* (family Alcyoniidae), is established to accommodate a previously described species, *Efflatounaria sodwanae* Benayahu, 1993 (family Xeniiidae) from Sodwana Bay, South Africa that was wrongly assigned to the latter genus. This species is redescribed and a second new species, *A. jengi* from Penghu Is., Taiwan, is described. The diagnostic features of the new genus include the presence of only figure-eight shaped platelets in all parts of the colony, thus differentiating it from all known genera of the Alcyoniidae. Based on examination of additional material from other localities, the zoogeographical distribution of the genus is confirmed to include the coral reefs of South Africa, Kenya, Gulf of Oman, Taiwan and Japan. Phylogenetic analyses of two mitochondrial genes strongly support its placement in the family Alcyoniidae.

Keywords

Alcyonacea, South Africa, Kenya, Gulf of Oman, Taiwan, Japan, coral reefs

Introduction

In a study of Alcyonacea from Sodwana Bay, South Africa, the new species, *Efflatounaria sodwanae* Benayahu, 1993, (family Xeniidae) was described. This species features a low crust and has platelet-like sclerites with a distinct waist and either single or double pits on their flat surface, thus resembling a figure-eight. During an octocoral survey conducted in 2006 on the reefs of Penghu Is., Taiwan, a colony with finger-like, flabby lobes was collected and found to have a similar type of sclerite to those of *E. sodwanae*. While comparing the colonies of South Africa and Taiwan, we were intrigued by their figure-eight sclerites, which resembled those found in polyps of the genera *Cladiella* Gray, 1869, *Klyxum* Alderslade, 2000 and *Rhytisma* Alderslade, 2000 of the family Alcyoniidae (see Fabricius and Alderslade 2001), yet had never been recorded among genera of the family Xeniidae (e.g., Alderslade 2001; Benayahu in press). These findings led us to thoroughly re-examine the type material of *E. sodwanae*, also in relation to the colony from Penghu Is. and other related material kept at the Zoological Museum of Tel Aviv University (ZMTAU) and at the Netherlands Center for Biodiversity, Naturalis, formerly Rijksmuseum van Natuurlijke Historie, Leiden (RMNH). The findings resulted in establishing *Aldersladum* gen. n. (family Alcyoniidae) for placement of the above-mentioned material, which includes *A. sodwanum* comb. n., which is also re-described; and *A. jengi* sp. n. which is depicted and described. Based also on molecular analyses, the phylogenetic position of the new genus is discussed.

Materials and methods

The material examined in this study was obtained during several octocoral surveys conducted in north-east Taiwan (1998); Yoron Is. and Okinoerbu Is., Ryukyu Archipelago, Japan (2000); Kenya (2001, 2002 and 2003); Penghu Is., Taiwan (2006) and the Gulf of Oman (2009). The 1998 and 2000 material was initially fixed in 4% formalin in seawater, rinsed in fresh water after 24 hours, and then stored in 70% alcohol. The later collections, from 2001 onwards, were fixed in 70% alcohol and subsamples were removed and preserved in absolute alcohol or DMSO for molecular studies. Sclerites from different parts of the colony (polyps, polypary, base-surface and interior) were obtained by dissolving the tissues in 10% sodium hypochlorite, followed by careful rinsing in fresh water. They were then prepared for scanning electron microscopy as follows: the sclerites were carefully rinsed with double-distilled water, dried at room temperature, coated with gold and examined with a Jeol 840A electron microscope, operated at 15 kV. The identified specimens are deposited at ZMTAU and at RMNH as indicated below.

Taxonomy

Aldersladum, gen. n.

urn:lsid:zoobank.org:act:43D3F04F-EE2D-44AD-9D0B-4EC510F0B1A6

Type species. *Efflatounaria sodwanae* Benayahu, 1993: 11–14, here designated.

Etymology. The genus name (gender-neutral) honors Dr. Phil Alderslade, a prominent octocoral taxonomist and a friend, in recognition of his immense contribution to the study of octocorals.

Diagnosis and description. Colonies have a low encrusting base, holdfast-like, from which lobes arise. The lobes vary in size from short, knob-like to longer, finger-like. The non-retractile monomorphic polyps are densely arranged on the lobes. The same type of sclerite is found in all parts of the colony, as confirmed by both light microscopy and SEM examination. It comprises platelets that are narrower across their mid-lateral line. A longitudinal slit, sometimes narrower in its middle part, is commonly found on the platelet's flat surface, located at the center and occupying about half its length, thus giving the sclerite a typical figure-eight form. The surface of the platelets is characterized by the appearance of an uneven crystal deposition that gives it a porous texture. Colonies are zooxanthellate.

Aldersladum sodwanum (Benayahu, 1993), comb. n.

Figs 1–2, 6a

Efflatounaria sodwanae Benayahu 1993: 11–14.

Holotype and 2 microscopic slides: ZMTAU Co 27902, South Africa, Sodwana Bay, Nine-mile Reef, 23 July 1992, 16 m 1992, leg. Y. Benayahu. Paratypes: ZMTAU Co 27933 and 27935 details as above; ZMTAU Co 27934, South

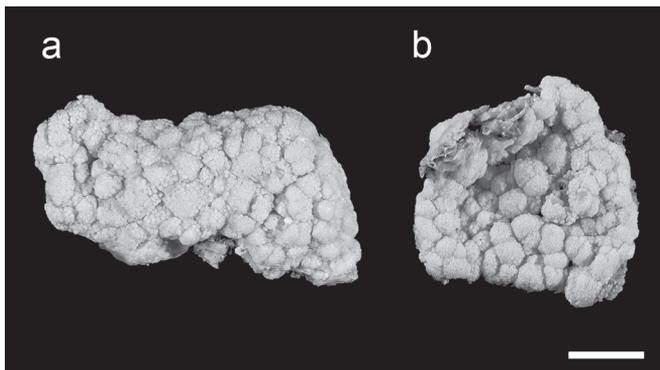


Figure 1. Fixed specimens of *Aldersladum sodwanum* comb. n.; **a** holotype ZMTAU Co 27902 **b** 27934 paratype. Scale = 10 mm.

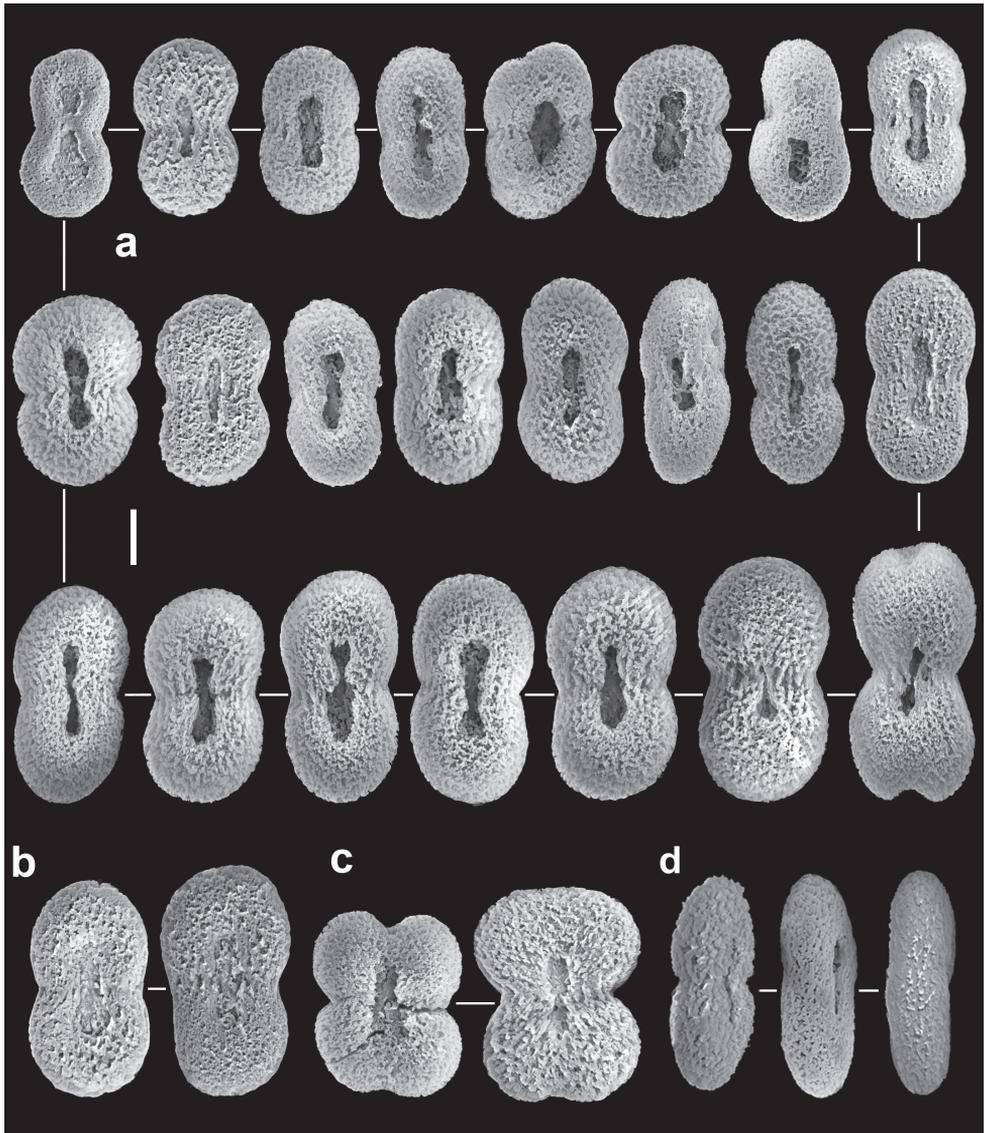


Figure 2. *Alderladum sodwanum* comb. n., holotype ZMTAU Co 27902; figure-eight sclerites; **a** with median slit **b** with poorly developed median slit **c** wide sclerites **d** lateral view. Scale = 0.010 mm, that at **a** also applies to **b–d**.

Africa, Sodwana Bay, Nine-mile Reef, 5 May 1992, 10 m, leg. M.H. Schleyer. Other material: ZMTAU Co 30465, Kenya, Mombassa, off Likoni (Wall reef), 04°06'S, 39°41'E, 20–22 m, 27 January 2000; ZMTAU Co 31165, Kenya, Mombassa, off Likoni, Shelly Beach, 04°07'S, 39°40'E, 20–26 m, 20 February, 2001; ZMTAU Co 31520, Kenya, Mombassa, off Likoni, Shelly Beach (Turning Buoy), 04°05'S, 39°41'E, 15–28 m, 27 February 2002; ZMTAU Co 31598, Kenya, Wasini Is., Shimoni Channel, 04°00'S, 39°22'E 8m, 7 March

2002; ZMTAU Co 32579, Kenya, Kilifi (Mooring), 03°58'S, 39°46'E. All other material listed above was collected by Y. Benayahu and S. Perkol-Finkel. ZMTAU Co 31092, Aoti, north-east coast of Taiwan, 7 July 1998, Coll. M.-S. Jeng; RMNH Coel. 39925, Gulf of Oman, Iran, Chabahar, 25°16'29.251"N, 60°40'32.189"E, 3 m depth, exposed rocky substrate, leg. K. Samimi-Namin, 27 January 2009. Each ZMTAU Co and RMNH Coel number represents one colony.

Diagnosis and description. For the sake of convenience the revised description also contains the relevant information that appeared in the original description of *E. sodwanae*. The holotype has a firm, low, crust-like base, 3–5 mm high, attached to a calcareous fragment. The maximum cross-section of the colony is 6 × 3 cm, and its total height (base and polypary) is up to 8 mm (Fig. 1a). The polypary consists of numerous knob-like lobes, some of which bud off into one to three smaller side lobules. Obscure material, composed of slime and debris, is found between adjacent lobes. The polyps are confined only to the lobes and are absent from their basal part. The anthocodial wall of some polyps is partially contracted and, very rarely, the tentacles are withdrawn into the mouth.

The sclerites are platelets of porous texture, narrower across the lateral middle-line, 0.032–0.048 mm long (Fig. 2). They are found in the polyps and in all parts of the colony. A longitudinal median slit on the flat surface of the sclerite occupies about half of its length. The slit can be narrower in its middle and occasionally widens at its ends, forming aperture-like structures (Fig. 2a). Some of the sclerites have a poorly developed slit (Fig. 2b) while in others this is wider (Fig. 2c), but both possess similar common features. The architectural features of the sclerites confer upon them a figure-eight shape. Under a light microscope the slit and apertures are observed on the surface of the sclerite as bright median areas. Although some sclerites appear as cigar-shaped, these are actually platelets viewed from their narrow lateral surface, as also confirmed by scanning electron microscopy (Fig. 2d). The alcohol preserved colony is cream-beige. The preserved paratypes differ in size (e.g., Fig. 1b).

When alive the polyps are light brown and the base of the colony is brighter (Fig. 6a). The colonies are quite small, commonly no larger than 30–40 mm in diameter.

***Aldersladum jengi* sp. n.**

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Figs 3–6b

Holotype: ZMTAU Co 33607 and 2 microscope slides, Taiwan, Penghu Is. Gupo Reef, 23°42'859"N, 119°33'488'E; 2–8 m, 29 July 2006. **Paratypes:** ZMTAU Co 31687, Japan, Ryukyu Archipelago, Yoron Is., 27°03'28"N, 128°23'59"E, 9 m, 1 July 2000; RMNH Coel. 39926, Japan, Ryukyu Archipelago, Okinoerabu Is. 27°23'38"N, 128°31'32"E, 11 m, 30 June 2000. Each ZMTAU Co number represents one colony. Material was collected by Y. Benayahu.

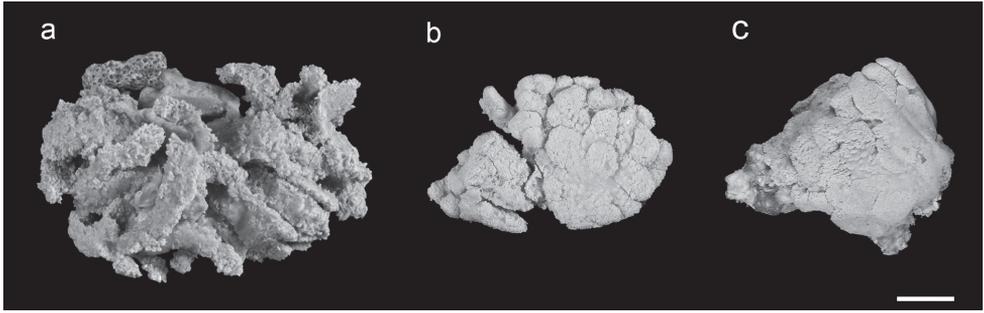


Figure 3. Fixed specimens of *Aldersladum jengi* gen. n. and sp. n.; **a** holotype ZMTAU Co 33607 **b** paratype ZMTAU Co 31687 **c** paratype ZMTAU Co 31688. Scale = 10 mm.

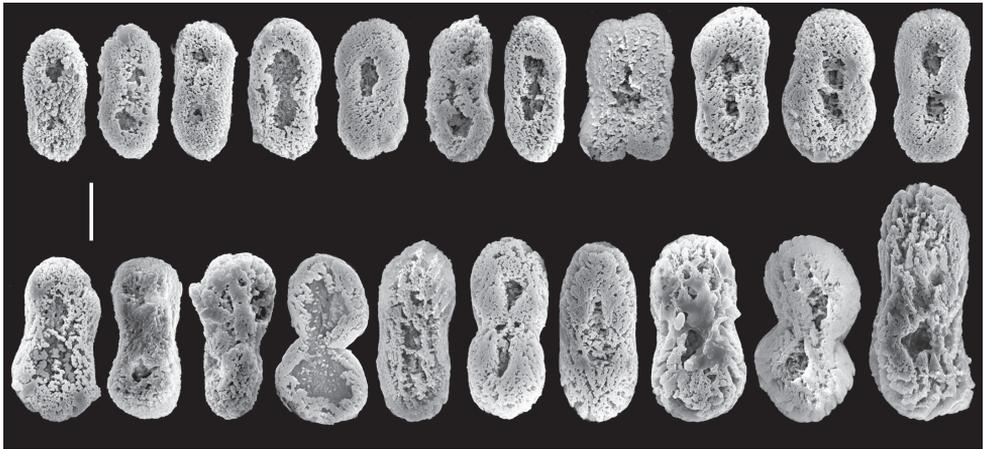


Figure 4. *Aldersladum jengi* gen. n. and sp. n., holotype ZMTAU Co 33607; figure-eight sclerites of the polyps and the lobules. Scale = 0.010 mm.



Figure 5. *Aldersladum jengi* gen. n. and sp. n., holotype ZMTAU Co 33607; rods with median constriction from colony base. Scale = 0.010 mm.

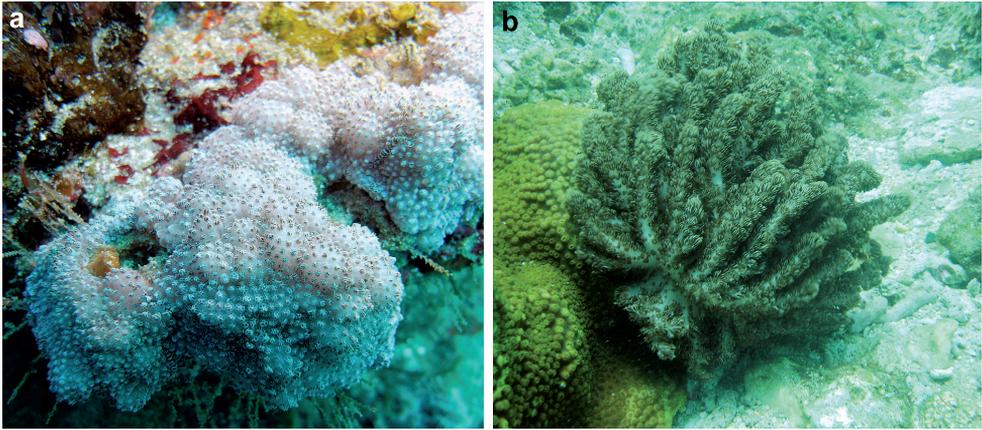


Figure 6. Underwater photographs of **a** *Aldersladum sodwanum* comb. n. * **b** holotype of *A. jengi* gen. n. and sp. n. ZMTAU Co 33607. *Courtesy of M.H. Schleyer.

Etymology. The species is named after Prof. M.-S. Jeng, Institute of Zoology, Academia Sinica, Taipei, Taiwan, in appreciation of his continuous support of octocoral studies in Taiwan.

Diagnosis and description. The holotype is a flabby colony with a maximum cross-section of 6×5 cm (Fig. 3a). It has a low base, holdfast-like, 3–5 mm high, attached to a fragment of calcareous substrate. The base gives rise to primary finger-like lobes that occasionally branch once or twice into short lobules. The polyps feature densely on the lobes, with their density markedly decreasing on the basal part. The polyps are expanded and in only a few of them the anthocodial wall is partially contracted. Very rarely, the tentacles are withdrawn into the mouth.

The sclerites are platelets, mostly narrower across their lateral middle-line, 0.023–0.042 mm long (Fig. 4). These sclerites are found in all parts of the colony, including the polyps. The vast majority of sclerites have a longitudinal median slit on their flat surface. The slit is often calcified along most of its length, thus leaving two, or rarely one, aperture-like structures at its ends. The base of the colony has fewer sclerites compared to the lobes; these reach up to 0.060 mm long, mostly with no median slit (Fig. 5). These latter sclerites may have a circumferential waist, rather than being narrow across their lateral middle-line. The architectural features of these sclerites give them the appearance of rods with a median constriction (Fig. 5), which is more pronounced compared to the sclerites of the lobes (Fig. 4). All sclerites feature a “spongy” texture that seems to result from the uneven alignment of the crystal-nodules that construct them. The colony is zooxanthellate. The alcohol-preserved colony is cream-beige.

The preserved paratypes differ in size (Fig. 3b, c) and are more rigid than the holotype. The few sclerites in the base of both paratypes are up to 0.080 mm long, and thus larger compared to those found in the holotype.

When alive the polyps of the holotype were dark brown and the surface of the lobes was brighter (Fig. 6b). The flabby lobes tend to undulate with the water surge and in this sense resemble certain *Klyxum* colonies (pers. obs.)

Discussion

The generic diagnosis of *Efflatounaria* is based on *E. tottoni* Gohar, 1939, a species that lacks sclerites and is characterized by retractile polyps. Fabricius and Alderslade (2001: 144–145) noted that in this genus “They [polyps] are so highly contractile that they can deflate until flush with the colony surface and appear to be retracted”. To the best of our knowledge, except for the original description, the literature has since only once mentioned the occurrence of *E. tottoni* (Okinawa: Benayahu 1995: 108, 124). The latter colony has the suite of diagnostic features noted by Gohar (1939), including the typical colony shape, retractile polyps and absence of sclerites. Interestingly, Gohar (1939) assigned *Cespitularia mantoni* Hickson, 1931 to *Efflatounaria* and as a result included a species with sclerites in this genus. The lack of sclerites is therefore not an obligate feature of the genus. Both genera feature the corpuscle-like platelets or spheroids that are typical of other members of the Xenidiidae. It should also be noted that at present there is some ambiguity concerning the morphological distinction between the two xeniid genera, *Efflatounaria* and *Cespitularia* Milne-Edwards & Haime, 1850 (see Fabricius and Alderslade 2001), which further complicates the placement of species in these two genera.

Re-examination of the holotype of *E. sodwanae* (see also below) revealed no real sign of either contractile or retractile polyps. Indeed, in some of the polyps the anthocodial wall is contracted (Benayahu 1993: 11) to a limited degree. The sclerite-architecture of *E. sodwanae* (Benayahu 1993: 13) markedly differs from the corpuscle-like platelets or spheroids attributed to xeniids (see Fabricius and Alderslade 2001). Based on these features it is evident that *E. sodwanae* can not retain its original generic placement.

The following genera of the family Alcyoniidae – *Cladiella* Gray, 1869; *Klyxum* Alderslade, 2000 and *Rhytisma* Alderslade, 2000 – have figure-eight sclerites resembling those of *Aldersladum* gen. n. However, in these genera they are confined only to the polyps, while other parts of the colony feature different diagnostic sclerites (*Cladiella*: dumbbells, *Klyxum*: spindles and granular rods, *Rhytisma*: spindles; i.e., Fabricius and Alderslade 2001). We suggest, therefore, that the presence of figure-eight sclerites in all parts of the colony justifies the establishment of *Aldersladum* gen. n. for placement of *E. sodwanae*. Since this type of sclerite occurs only in the family Alcyoniidae, the new genus is assigned to that family. Preliminary molecular data based on mitochondrial *msh1* and *COI* gene sequences strongly support the placement of *Aldersladum* in a clade with the alcyoniid genera *Klyxum* and *Cladiella* (McFadden unpub. data).

The current study expands the zoogeographical distribution of *A. sodwanum* from the type locality (Sodwana Bay, South Africa) to several sites along the Kenyan coast, from Likoni, off Mombassa in the north, to Wasini Is. in the south. This species has

also been recorded from the Gulf of Oman and north-east Taiwan (see above). It is therefore evident that *A. sodwanum* features a wide zoogeographical distribution ranging from the East-African coast to the Pacific reefs. We suggest that the infrequent appearance of the species on the reefs may have hindered its record in reef surveys.

A. jengi fits the diagnosis of *Aldersladum* gen. n. by having lobes arising from a narrow base, non-retractile polyps and figure-eight sclerites found in all parts of the colony. Its lobes are much longer compared to *A. sodwanum*. The porous sclerite texture of *A. jengi* is coarser compared to that of its congener (Fig. 2 *vs.* Fig. 4, 5). The sclerites of the colony base are longer, with some featuring a circumferential waist. We consider these differences sufficient to justify the separation between the two species and to establish *A. jengi* as a second species within the genus. Analysis of molecular data (mitochondrial *msh1* and *COI* genes) also supports the genetic distinction between these two species; the pair-wise genetic distance (uncorrected p) between *A. sodwanum* and *A. jengi* is 0.4%, comparable to or greater than that observed among some morphospecies in the closely related genera *Klyxum* and *Cladiella* (McFadden et al. 2011; unpub. data).

Conclusions

Among the genera of the family Alcyoniidae the genus *Aldersladum* seems to be the only one to possess figure-eight sclerites in all parts of the colony. In the alcyoniids *Cladiella*, *Klyxum* and *Rhytisma* this type of sclerite is found only in the polyps, and different, diagnostic sclerite-forms characterize other parts of the colony. Indeed, no other genus of Alcyoniidae has only a single sclerite form in all regions of the colony; for example, *Sinularia* May, 1898 has clubs on the surface of the lobes and base but spindles in its interior (see Fabricius and Alderslade, 2001). Although some species of the genera *Xenia* and *Ovabunda* (family Xeniidae) also have uniform sclerites in all parts of the colony (Benayahu, in press), they are not figure-eights. The xeniid genera *Ingotia*, *Ixion* and *Bayerxenia* have platelet-like sclerites that are narrow across the lateral middle-line like those of *Aldersladum*, but they lack the median slit that gives the figure-eight appearance; moreover, they are not the only sclerite-form found throughout the colony (Alderslade 2001). Sclerites of *Moolabalia* (family Clavulariidae) also lack the median slit, and the stoloniferous growth form of this genus is distinctive (Alderslade 2001). Placement of the newly-assigned genus *Aldersladum* in the family Alcyoniidae on the basis of sclerite-form is supported by molecular results that clearly show that *Aldersladum* is a close relative of *Cladiella* and *Klyxum*.

In the original description of *E. sodwanae* the resemblance between the fine structure of its sclerites and those of *Cladiella daphnae* Ofwegen & Benayahu, 1992 was noted, indications that its significance in the systematics of Alcyoniidae needed to be studied (Benayahu 1993). There is a certain similarity between *A. jengi* and *C. daphnae* as reflected in their flabby lobes, figure-eight sclerites and the resemblance between the base sclerites of the former (Fig. 5) and the surface stalk sclerites of the latter (Ofwe-

gen and Benayahu 1992: Fig. 2 i-n). Despite this similarity, it should be noted that *C. daphnae* features different sclerites in the lobes to those in the base (Ofwegen and Benayahu 1992: Figs 2, 3: figure-eights *vs.* dumbbells) and hence it differs from both *A. sodwanae* and *A. jengi*.

Acknowledgements

Our sincere thanks to L.P. van Ofwegen for advice and fruitful discussions during the preparation of this manuscript. We are grateful to the Assistant Director of Fisheries (M&C), Ministry of Livestock and Fisheries Development, Fisheries Department, Republic of Kenya for issuing a collection-permit along the Kenya coast. PharmaMar Spain is acknowledged for providing financial support to Y.B. for surveys there. We thank S. Perkol-Finkel and M.H. Schleyer for advice and help during the field work. M.H. Schleyer is acknowledged for the underwater photograph of *Aldersladum sodwanum*. The late A. Zverdling provided the logistic support for the collection trips to Kenya. We are grateful to J. Tanaka, University of the Ryukyus, Okinawa, Japan for his valuable assistance during the octocoral surveys conducted along the Ryukyu Archipelago. The survey of Penghu reefs was made possible due to a grant to Y.B. from the National Science Council of Taiwan in order to conduct octocoral research. We thank Mr. W.-S. Tsai, the director of Penghu Marine Biology Research Center, Fisheries Research Institute Penghu for providing facilities during the field work. We would like to express our gratitude for the enthusiastic assistance and friendship of H.J. Hsieh. Thanks are due to A.C. Chen, C.-F. Dai, M.-S. Jeng and K Soong for help and advice. We wish to thank M. Alexandroni for photography, Y. Delarea for electron microscopy, V. Wexler for digital editing, M. Weis for technical assistance, S. Abdalla for assistance with molecular work, A. Shlagman for curatorial skills and N. Paz for skillful editorial assistance. This research was in part supported by The Israel Cohen Chair in Environmental Zoology to Y.B., by grant 2008186 from the United States-Israel Binational Science-Foundation (BSF), Jerusalem Israel to Y.B., C.S.M and R. Toonen and by the Assembling the Cnidarian Tree of Life project, NSF grants EF-0531570 to C.S.M. and EF-0531779 to P. Cartwright.

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Notes on the *Nazeris* fauna of Yunnan Province, China (Coleoptera, Staphylinidae, Paederinae)

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Academic editor: Volker Assing | Received 9 March 2010 | Accepted 12 January 2011 | Published 1 March 2011

urn:lsid:zoobank.org:pub:E27D8AB1-223C-4246-B208-400014DDDF7E

Citation: Hu J-Y, Li L-Z, Zhao Y-L (2011) Notes on the *Nazeris* fauna of Yunnan Province, China (Coleoptera, Staphylinidae, Paederinae). ZooKeys 84: 13–21. doi: 10.3897/zookeys.84.1189

Abstract

Two new species of the genus *Nazeris* Fauvel collected from Nabanhe Nature Reserve, Yunnan Province, are described under the names of *N. nabanhensis* **sp. n.** and *N. caoi* **sp. n.** The male sexual characters are described and illustrated. A key to the *Nazeris* species of Yunnan is provided. A map of the collecting sites is given.

Keywords

Coleoptera, Staphylinidae, Paederinae, *Nazeris*, key, Yunnan, China, new species

Introduction

The genus *Nazeris* Fauvel (1873: 298) can be readily distinguished from other Paederinae by the labrum having four teeth at the front margin and the bi-lobed 4th tarsal segments. Up to the present, 51 species and subspecies of *Nazeris* have been recorded from China. Yunnan is a mountainous province located in Southwest China, from

which nine species of *Nazeris* have been described: *N. zhangii* Watanabe & Xiao (1993: 130) from “Yu’an-shan near Kunming City”, *N. giganteus* Watanabe & Xiao (1997:2) and *N. daliensis* Watanabe & Xiao (1997: 7) from “Diancang shan Mts., Dali shi”, *N. alpinus* Watanabe & Xiao (1997: 5) from “Mt. Yulongxue shan, Lijiang County”, *N. jizushanensis* Watanabe & Xiao (1997: 9) from “Mt. Jizu Shan, Binchuan County”, *N. baihuaensis* Watanabe & Xiao (2000: 312), *N. ishiiianus* Watanabe & Xiao (2000: 319) and *N. nomurai* Watanabe & Xiao (2000: 316) from “Gaoligong Shan Mts., Baoshan area”, *N. huanxipoensis* Watanabe & Xiao (2000: 318) from “Huanxipo, Tengchong Xian”. Only two species have become known from the three countries adjacent to Yunnan (Myanmar, Laos and Vietnam): *Nazeris coomani* Jarrige (1948: 40) (redescribed by Rougemont 1988: 775) from “du mont Bavi, Tonkin” (Vietnam) and *Nazeris odzisan* Watanabe (1996: 1) from “Mt. Tam Dao, Vinh Phu Prov.” (Vietnam).

The specimens from Yunnan Province contained another two undescribed species, *N. nabanhensis* sp. n. and *N. caoi* sp. n. The male sexual characters of the two new species are described and illustrated. A map (fig. 13) of the collecting sites of *Nazeris* species in Yunnan and a key to the Yunnan species are provided.

The types are deposited in the Insect Collections of Department of Biology, Shanghai Normal University, Shanghai, P. R. China (SHNUC).

Methods

The specimens were collected from decaying leaf litter of forest floors by hand sifting. They were killed with ethyl acetate and dried. To examine the male genitalia, the last four abdominal segments were detached from the body after softening in hot water. The aedeagi and sternites were mounted in Euparal on plastic slides. Drawings were made using an Olympus SZ61 microscope. Photos were taken with an Olympus E420 camera mounted on an Olympus SZX12 stereoscope. Material of other Yunnanese *Nazeris* species was not examined. The characters used in comparative remarks and keys are according to descriptions of Watanabe and Xiao (1993, 1997, 2000), Watanabe (1996), Jarrige (1948) and Rougemont (1988).

Measurements

Body length: measured from anterior margin of labrum to end of abdomen;
Forebody length: measured from anterior margin of labrum to elytral apices;
Eye length: longitudinal length of eye in dorsal view;
Postocular length: length of postocular portion in dorsal view;
Head width: width of head across eyes;
Pronotum width: width of pronotum across the widest part;
Elytra width: width of elytra across the widest part;
Head length: measured from front margin of head to its posterior margin;

Pronotum length: measured from front margin of pronotum to its posterior margin;
Elytra length: measured from humeral angle to apicolateral angle.

Descriptions

Nazeris nabanbensis sp. n.

urn:lsid:zoobank.org:act:7B0F8A68-2EEE-412E-9090-9F1CE8EBA8ED

Figs 1, 3–7

Type material. CHINA: Holotype: Yunnan Prov.: male, Jinghong City, Nabanhe Nature Reserve, Benggangxinzhai, 1,750m, 16. XI. 2008, Hu Jia-Yao & Tang Liang leg. Paratypes: 2 females, Jinghong City, Nabanhe Nature Reserve, Bengganghani, Nanmugahe, 1,700m, 11. XI. 2008, Hu Jia-Yao & Tang Liang leg.; 1 female, Jinghong City, Nabanhe Nature Reserve, Bengganghani, 1,800m, 14. XI. 2008, Hu Jia-Yao & Tang Liang leg.; 5 males, 8 females, same locality as holotype, 3. V. 2009, Hu Jia-Yao & Yin Zi-Wei leg.; 1 female, Jinghong City, Nabanhe Nature Reserve, Bengganghani, Nanmugahe, 1,700m, 27. IV. 2009, Hu Jia-Yao & Yin Zi-Wei leg.; 3 females, Jinghong City, Nabanhe Nature Reserve, Bengganghani, Chuguohe, 1,700m, 28. IV. 2009, Hu Jia-Yao & Yin Zi-Wei leg.; 1 male, 1 female, Jinghong City, Nabanhe Nature Reserve, Bengganghani, 1,650m, 29. IV. 2009, Hu Jia-Yao & Yin Zi-Wei leg.; 1 male, Jinghong City, Nabanhe Nature Reserve, Bengganghani, Nanmugahe, 1700m, 30. IV. 2009, Hu Jia-Yao & Yin Zi-Wei leg.; 4 females, Jinghong City, Nabanhe Nature Reserve, Bengganghani, 1,650m, 30. IV. 2009, Hu Jia-Yao & Yin Zi-Wei leg. SHNUC.

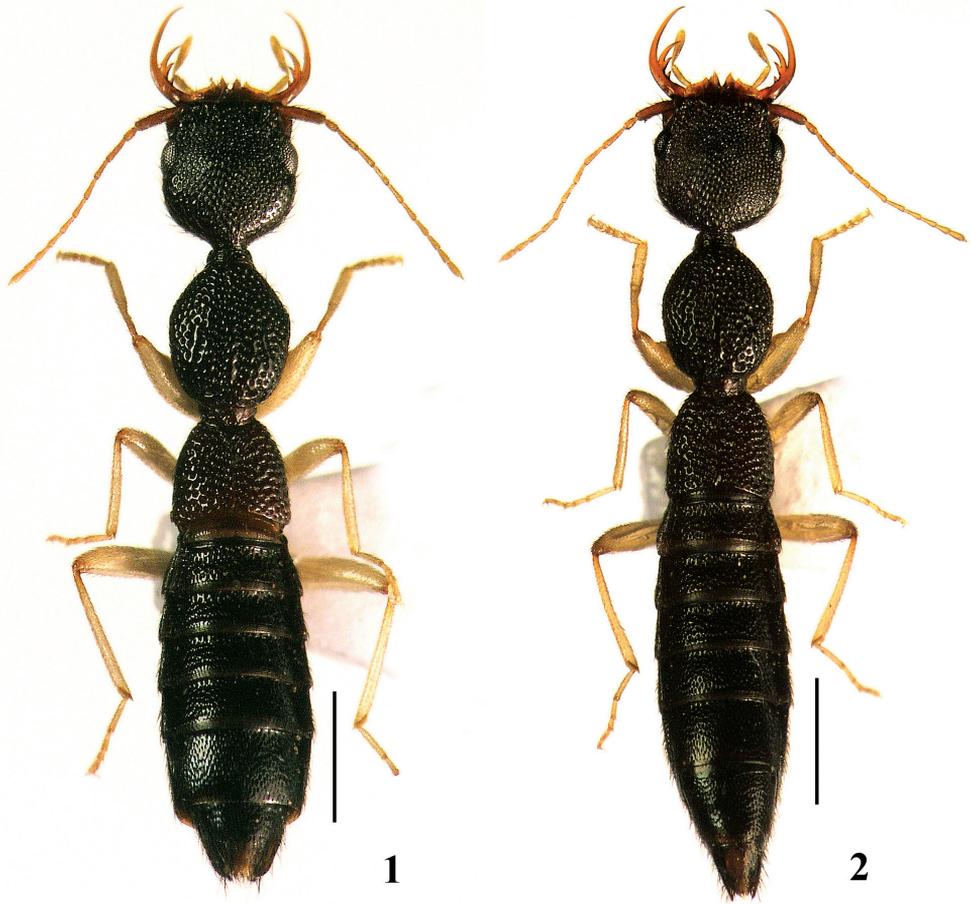
Description. Body length: 5.8–6.4 mm; forebody length: 3.3–3.5 mm.

Male. Body (Fig. 1) elongate, dark brown, with labrum, coxae, and basal antennomeres reddish yellow, the remaining antennomeres, maxillary palpi and legs yellow, with exception for coxae.

Head suborbicular, longer than wide (length/width = 1.18); postocular portion 1.96 times as long as eye length; punctation coarse, dense, and umbilicate; interstices reduced to narrow ridges. Antennae slender; relative length of each segment from 1 to 11: 42.0 : 15.0 : 29.0 : 23.0 : 22.5 : 22.0 : 19.0 : 17.0 : 15.5 : 14.0 : 20.0; relative width of each segment from 1 to 11: 12.0 : 7.5 : 6.0 : 6.0 : 6.0 : 6.0 : 6.0 : 6.0 : 6.0 : 7.5 : 7.5.

Pronotum convex, oval, longer than wide (length/width = 1.20), narrower (pronotum/head = 0.93) and shorter (pronotum/head = 0.94) than head; prosternum with strong longitudinal median carina, which disappears behind anterior margin. Elytra shorter than wide (length/width = 0.91), distinctly shorter (elytra/pronotum = 0.74) and slightly narrower (elytra/pronotum = 0.97) than pronotum.

Abdomen elongate, tergites without any microsculpture. Seventh sternite (Fig. 3) trapezoidally emarginated in middle of posterior margin and distinctly depressed in front of emargination; 8th sternite (Fig. 4) V-shaped deeply excised in middle of posterior margin. Aedeagus (Figs 5, 6 and 7) well sclerotized; apical part of me-

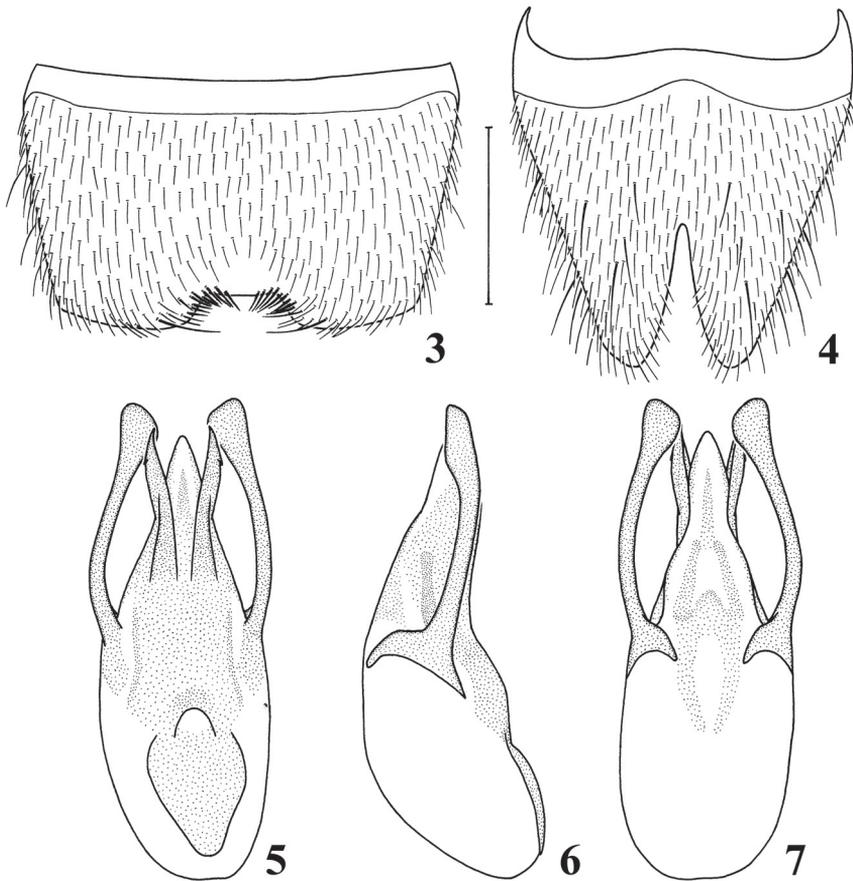


Figures 1–2. Habitus of *Nazeris*. **1** *N. nabanhensis* sp. n. **2** *N. caoi* sp. n. Scale bars 1 mm.

dian lobe in dorsal view tri-lobed, median part cone-shaped, two outer parts acute at apices, with little agnail in each outer side near apex; dorso-lateral apophyses slightly curved inward, distinctly widened near apex, extending beyond apices of median lobe.

Female. Seventh and 8th sternites simple. The other characters are similar to those of male.

Remarks. The new species is similar to *N. daliensis* Watanabe (1997: 7) from Yunnan Province in appearance, but it can be distinguished from the latter by the following characters: elytra slightly narrower than pronotum (in *N. daliensis* nearly as wide as, or slightly broader than pronotum); depth of excision of male 8th sternite nearly half of middle length of sternite (in *N. daliensis* much shallower, nearly 1/3 of middle length of 8th sternite); apical part of median lobe of aedeagus in dorsal view tri-lobed (in *N. daliensis* not lobed). The new species can be distinguished from *N. coomani* Jarrige (1948: 40) from Vietnam by head with umbilicate punctation (in *N.*



Figures 3–7. Details of *Nazeris nabanhensis* sp. n. **3** male 7th sternite **4** male 8th sternite **5** aedeagus, in dorsal view **6** aedeagus, in lateral view **7** aedeagus, in ventral view. Scale bar: 0.5 mm.

coomani punctation of head simple) and distinguished from *N. odzisan* Watanabe (1996: 1) from Vietnam by elytra shorter than wide (in *N. odzisan* elytra longer than wide); dorso-lateral apophyses of aedeagus extending beyond apices of median lobe (in *N. odzisan* not extending to apices of median lobe).

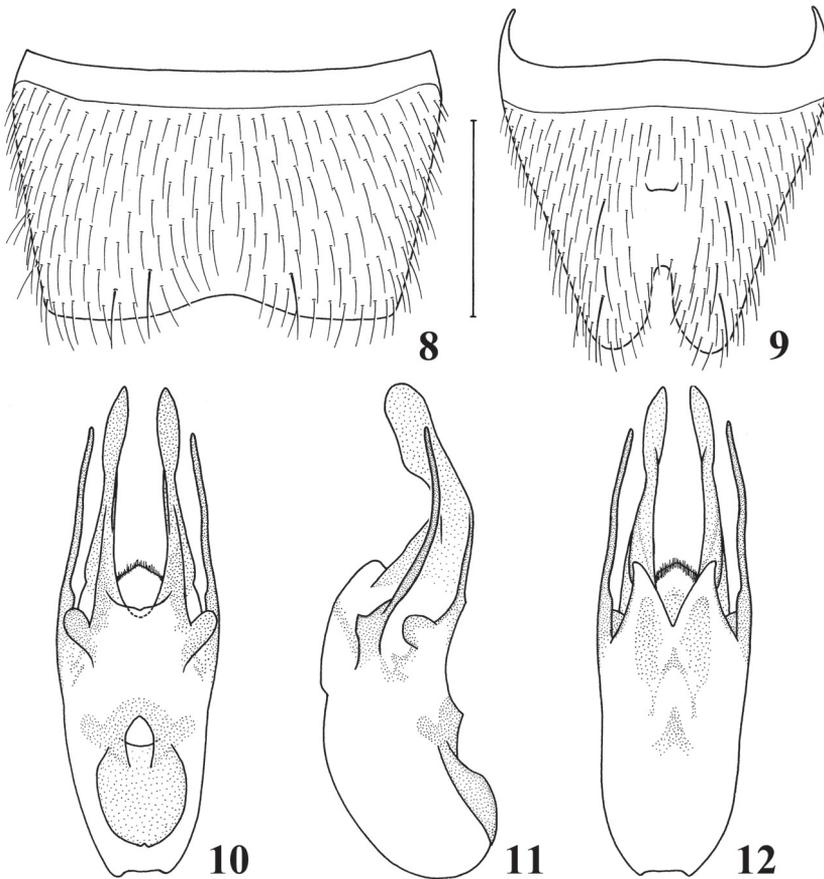
Etymology. The specific name is derived from the name of the type locality: Nabanhe Nature Reserve.

***Nazeris caoi* sp. n.**

urn:lsid:zoobank.org:act:3B251645-1B6B-4388-ACEC-4E5B42C4A858

Figs 2, 8–12

Type material. CHINA: Holotype: Yunnan Prov.: male, Jinghong City, Nabanhe Nature Reserve, Bengganhani, 1,930m, 14. XI. 2008, Hu Jia-Yao & Tang Liang leg.



Figures 8–12. Details of *Nazeris caoi* sp. n. **8** male 7th sternite **9** male 8th sternite **10** aedeagus, in dorsal view **11** aedeagus, in lateral view **12** aedeagus, in ventral view. Scale bar: 0.5 mm.

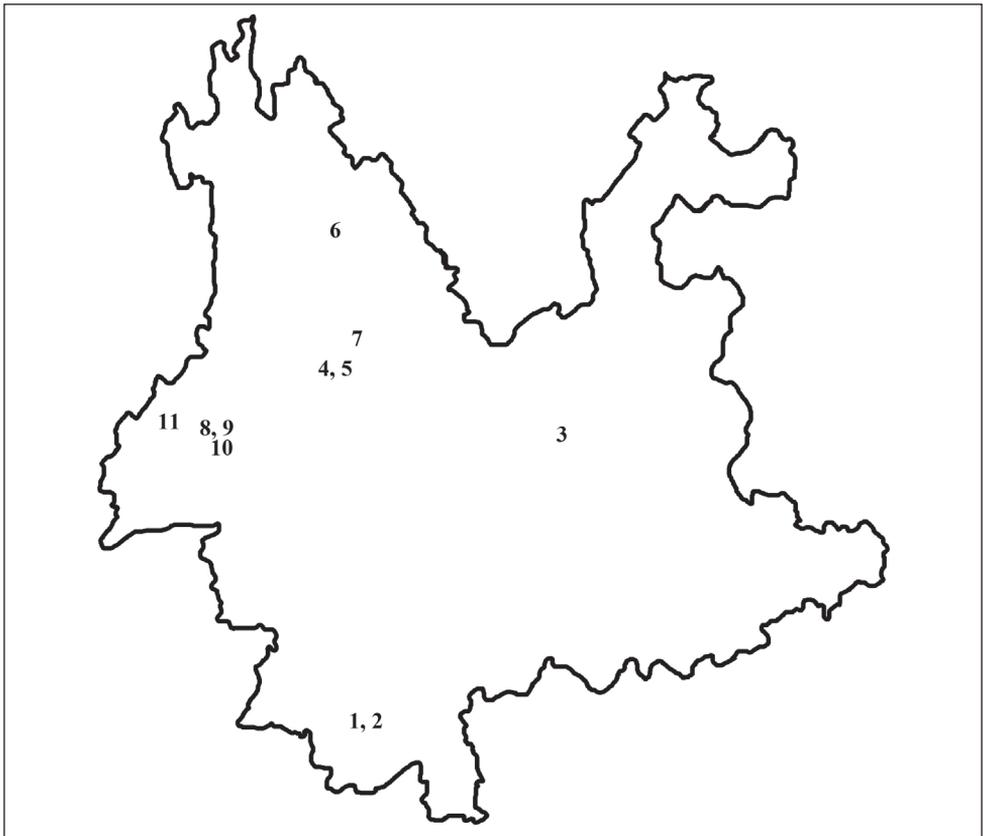
Paratypes 1 male, same data as holotype; 1 female, Jinghong City, Nabanhe Nature Reserve, Bengganghani, 1,900m, 1. V. 2009, Hu Jia-Yao & Yin Zi-Wei leg. SHNUC.

Description. Body length: 6.1–6.4 mm; forebody length: 3.3–3.6 mm.

Male. Body (Fig. 2) elongate, dark brown, with labrum, coxae, and basal two antennomeres reddish yellow, the remaining antennomeres, maxillary palpi and legs yellow, with exception for coxae.

Head suborbicular, slightly longer than wide (length/width = 1.07); postocular portion 2.14 times as long as eye length; punctation coarse, dense, and umbilicate; interstices reduced to narrow ridges. Antennae slender; relative length of each segment from 1 to 11: 42.0 : 13.5 : 30.0 : 23.0 : 21.0 : 21.0 : 19.0 : 18.0 : 18.0 : 16.0 : 22.0; relative width of each segment from 1 to 11: 10.5 : 7.0 : 6.5 : 6.0 : 5.5 : 6.0 : 5.5 : 5.5 : 6.0 : 6.5 : 7.0.

Pronotum convex, oval, longer than wide (length/width = 1.19), narrower (pronotum/head = 0.88) and shorter (pronotum/head = 0.98) than head; prosternum with



Figures 13. Map showing the collecting sites of the *Nazeris* in Yunnan Prov.; **1** *N. nabanhensis* sp. n. **2** *N. caoi* sp. n. **3** *N. zhangi* Watanabe & Xiao **4** *N. giganteus* Watanabe & Xiao **5** *N. daliensis* Watanabe & Xiao **6** *N. alpinus* Watanabe & Xiao **7** *N. jizushanensis* Watanabe & Xiao **8** *N. baihuaensis* Watanabe & Xiao **9** *N. isbitianus* Watanabe & Xiao **10** *N. nomurai* Watanabe & Xiao **11** *N. huanxipoensis* Watanabe & Xiao.

strong longitudinal median carina, which disappears behind anterior margin. Elytra slightly shorter than wide (length/width = 0.97), distinctly shorter (elytra/pronotum = 0.80) and slightly narrower (elytra/pronotum = 0.97) than pronotum.

Abdomen elongate, tergites without any microsculpture; densely and coarsely punctate. Seventh sternite (Fig. 8) distinctly emarginated in middle of posterior margin; 8th sternite (Fig. 9) with little short protrusion in middle, deeply excised in middle of posterior margin. Aedeagus (Figs 10, 11 and 12) well sclerotized; median lobe bi-lobed in dorsal view, curved ventrad in apical 1/3 in lateral view; dorso-lateral apophyses very thin, slightly curved ventrad, not extending to apices of median lobe.

Female. Seventh and 8th sternites simple. The other characters are similar to those of male.

Remarks. The present new species is similar in appearance to *N. nabanhensis* sp. n. from the same locality, but can be distinguished from the latter by the following

characters: postocular part more than twice as long as longitudinal diameter of each eye (in *N. nabanhensis* less than twice as long as longitudinal diameter of each eye); median lobe of aedeagus in dorsal view bi-lobed (in *N. nabanhensis* tri-lobed); dorso-lateral apophyses of aedeagus not extending to apices of median lobe (in *N. nabanhensis* extending beyond apices of median lobe). The new species can be distinguished from *N. coomani* Jarrige (1948: 40) from Vietnam by head with umbilicate punctation (in *N. coomani* punctation of head simple), and distinguished from *N. odzisan* Watanabe (1996: 1) from Vietnam by elytra shorter than wide (in *N. odzisan* elytra longer than wide); median lobe of aedeagus in dorsal view bi-lobed (in *N. odzisan* not lobed).

Etymology. The species is named in honor of Mr. Guanghong Cao of Nabanhe Nature Reserve, who helped us a lot during field work.

Key to species of *Nazeris* from Yunnan Province, China

- 1 Body length less than 4.5 mm; posterior margin of male 7th sternite not emarginate ***N. zhangi* Watanabe & Xiao**
- Body length at least 5.0 mm; posterior margin of male 7th sternite emarginate..... **2**
- 2 Male 8th sternite with short protrusion in middle, median lobe of aedeagus bi-lobed in dorsal view.....***N. caoi* sp. n.**
- Male 8th sternite without protrusion in middle, median lobe of aedeagus not bi-lobed in dorsal view..... **3**
- 3 Median lobe of aedeagus tri-lobed in dorsal view ***N. nabanhensis* sp. n.**
- Median lobe of aedeagus not tri-lobed in dorsal view..... **4**
- 4 Dorso-lateral apophyses of aedeagus extending beyond apex of median lobe.... **5**
- Dorso-lateral apophyses of aedeagus not extending to apex of median lobe **9**
- 5 Dorso-lateral apophyses of aedeagus dilated in apical part and markedly curved ventrad in apical half..... ***N. nomurai* Watanabe & Xiao**
- Dorso-lateral apophyses of aedeagus not dilated in apical part and not markedly curved ventrad in apical half..... **6**
- 6 Median lobe of aedeagus subtriangular in apical third and curved dorsad near apex in lateral view, dorso-lateral apophyses curved ventrad near apex in lateral view..... ***N. huanxipoensis* Watanabe & Xiao**
- Median lobe of aedeagus not subtriangular in posterior third, not curved dorsad near apex in lateral view, dorso-lateral apophyses nearly straight in lateral view **7**
- 7 Dorso-lateral apophyses of aedeagus dilated at middle; median lobe of aedeagus without wing-shaped process ***N. baihuaensis* Watanabe & Xiao**
- Dorso-lateral apophyses of aedeagus not dilated at middle; median lobe of aedeagus with a wing-shaped process on each side near middle..... **8**
- 8 Postocular part less than twice as long as eye length; depth of excision of posterior margin of male 8th sternite more than twice its width.....
.....***N. jizushanensis* Watanabe & Xiao**

- Postocular part more than twice as long as eye length; depth of excision of posterior margin of male 8th sternite nearly the same its width.....
..... ***N. daliensis* Watanabe & Xiao**
- 9 Median lobe of aedeagus semicircularly emarginate at apex.....
..... ***N. ishiiianus* Watanabe & Xiao**
- Median lobe of aedeagus not emarginate at apex..... **10**
- 10 Median lobe of aedeagus tongue-shaped; dorso-lateral apophyses of aedeagus very narrow and near straight in dorsal view....***N. alpinus* Watanabe & Xiao**
- Median lobe of aedeagus not tongue-shaped, distinctly narrowed in apical 1/4 in dorsal view; dorso-lateral apophyses of aedeagus markedly curved inward in dorsal view ***N. giganteus* Watanabe & Xiao**

Acknowledgements

We thank Mr. Guanghong Cao and Mr. Maoxing Tian (Nabanhe Nature Reserve) for their help during field work. We thank Dr. Liang Tang and Mr. Ziwei Yin (Shanghai Normal University) for their collecting the specimens and continuous help in many ways. We thank Dr. Ales Smetana (Agriculture and Agri-Food Canada) for revision our paper. This study is supported by the National Natural Science Foundation of China (No. 30870323) and by Shanghai Normal University (No. SK200833 and SK200834).

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Taxonomic redescription and biological notes on *Diaugia angusta* (Diptera, Tachinidae): parasitoid of the palm boring weevils *Metamasius ensirostris* and *M. hemipterus* (Coleoptera, Dryophthoridae)

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Academic editor: Martin Hauser | Received 20 November 2010 | Accepted 13 February 2011 | Published 1 March 2011

Citation: Nihei SS, Pavarini P (2011) Taxonomic redescription and biological notes on *Diaugia angusta* (Diptera, Tachinidae): parasitoid of the palm boring weevils *Metamasius ensirostris* and *M. hemipterus* (Coleoptera, Dryophthoridae). ZooKeys 84: 23–38. doi: 10.3897/zookeys.84.756

Abstract

Diaugia angusta Perty, 1833 is a Neotropical species of Tachinidae (Diptera) reported here as a parasitoid of *Metamasius ensirostris* (Germar, 1824) and *M. hemipterus* (Linnaeus, 1758) (Coleoptera: Dryophthoridae) in Brazil. Several species of Dryophthoridae and Curculionidae cause damage to bromeliad and palm species, and most are regarded as pests. In the present study, the male and female of *D. angusta* are morphologically characterized and illustrated to provide a means for the identification of this parasitoid. Data obtained from preliminary field research show that natural parasitism of *Metamasius* pupae by *D. angusta* varies by year but can reach nearly 30%. A network of parasitoid-host interactions among tachinid parasitoids and coleopteran hosts reported as bromeliad and palm pests (Dryophthoridae and Curculionidae) in the Americas indicates that the species of the tribe Dexiini *sensu lato* (including *D. angusta*) might be promising as biological control agents of these pests.

Keywords

Dexiinae, taxonomy, host record, biological control, palm, bromeliad, Brazil, Neotropical Region

Introduction

The Neotropical genus *Diaugia* (Tachinidae: Dexiinae: Dexiini) was described by Perty (1833) to include a single new species, *D. angusta*. This species was described based on material collected from state of Minas Gerais in the southeastern Brazil. Since the description, the genus and the species appeared in the literature only through brief citations and catalogues, without any detailed study (Townsend 1939, Guimarães 1971, Tschorsnig 1985). The most relevant studies were made by Charles H. Townsend, including *Diaugia* in a key to Zeliini genera (Townsend 1936) and providing a morphological diagnosis of the genus (Townsend 1939). In the end of his diagnosis, Townsend (1939: 78) wrote: “Ranges in two species from Minas Geraes [sic] to Rio de Janeiro”. Apart from the type-species (*D. angusta*), from Minas Gerais, Townsend (1939) had therefore regarded the existence of a second undescribed species, from Rio de Janeiro. The material examined by Townsend was found deposited at the Museu Nacional (Rio de Janeiro) and a detailed examination confirmed it to be conspecific with *D. angusta*.

Metamasius Horn (Coleoptera: Dryophthoridae) is a Neotropical weevil genus comprising about 110 species, mostly associated damaging bromeliads, sugarcane, bananas and palms (Vaurie 1966, Frank 1999). Several species are considered important crop pests. *Metamasius ensirostris* (Germar) is known to cause damages to bananas, sugarcane and palms (Vaurie 1966, Silva 1968). Furthermore, within the attacked palms, there are reports to several species explored for “palmito” (heart-of-palm) extraction in Brazil, as *Euterpe edulis* Mart. (“juçara”), *Euterpe oleracea* Mart. (“açai”) and *Bactris gasipaes* Kunth (“pupunha”, peach-palm) (Zorzenon et al. 2000). *Metamasius hemipterus* (Linnaeus) is an important stem-borer of sugarcane, banana, bromeliads and palms in Central and South Americas, but also introduced to other regions of the world (Vaurie 1966). *Metamasius callizona* (Chevrolat) is associated with bromeliads and bananas in Central America but, after introduction, it has damaged severely the native bromeliad species in tropical areas of North America (Frank and Cave 2005).

Recently, great efforts have been applied in order to find ways to control the bromeliad and palm weevils, such as the field exploration for parasitoids (Cave et al. 2003), experiments evaluating efficiency of parasitoids (Moura et al. 2006), use of pheromone-based traps (Oehlschlager et al. 1993), among others.

In the present study, comprehensive material of *Diaugia* from several museums was studied in detail. Within the material, there was one specimen reared on *Metamasius ensirostris* from the state of Santa Catarina (southern Brazil), and several specimens reared on *M. hemipterus* from the state of São Paulo (southeastern Brazil). Additionally, there were some specimens from São Paulo reared from an undetermined *Metamasius*.

This paper aims to provide taxonomic support for the identification of this parasitoid and for its potential use as a biological control agent of *Metamasius* species. We provide a detailed morphological characterization of *Diaugia angusta* Perty. Both male and female specimens are characterized, the male terminalia are described and illustrated for the first time, and photographs and distribution map are presented. In addition, based on preliminary field research performed in the state of São Paulo (Brazil),

some biological data on the interaction between *Diaugia* and *Metamasius* is presented. Finally, a parasitoid-host network is elaborated showing the interactions between these parasitoid flies (Tachinidae) and coleopteran hosts reported as bromeliad and palm pests (Dryophthoridae and Curculionidae) in the Americas.

Material and methods

The examined material is deposited at the following institutions: Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (MNRJ); and Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil (MZSP). The morphological terminology follows mainly McAlpine (1981), Wood (1987) and Stuckenberg (1999).

The subfamily and tribal classification of Tachinidae followed here is that used in the latest Nearctic Catalogue by O'Hara and Wood (2004), which basically followed the classification scheme of Herting (1984) and Tschorsnig (1985). One example is Dexiini, into which some tribes were included under its name (*e.g.*, Zeliini, Prosenini, Theresiini as junior synonyms). Even though, the earlier classification of Neotropical Tachinidae (*sensu* Guimarães 1971) was eventually mentioned during the discussion. In this case, the old names were cited in the following way: "Zeliini", "Theresiini".

To elaborate the network of parasitoid-host interactions, we included all the species of Tachinidae recorded as parasitoids of species of Dryophthoridae and Curculionidae which are reported in the literature as pests of bromeliads and palms in the Americas. However, the network is complete only in that all the hosts of "Zeliini" and all the parasitoids of Dryophthoridae and Curculionidae are presented. For the other taxa in the network, neither all parasitoids nor all hosts are presented. For complementary information about them, please refer to Guimarães (1977, South America) and Arnaud (1978, North and Central Americas). Although out-of-date, these host-parasitoid catalogues still remain as comprehensive and reliable references for the Tachinidae of the Americas for the time coverage.

Systematics

Diaugia Perty, 1833

Diaugia Perty 1833: 187, type species: *Diaugia angusta* Perty, 1833 (by monotypy).

Diaugia; Townsend 1936: 30 (key to genera of Zeliini), Townsend 1939: 77 (diagnosis), Guimarães 1971: 101 (as '*Diaughia*', catalogue, in Zeliini), Tschorsnig 1985: 100 (as '*Diaughia*', citation, male terminalia characterization, in Dexiini).

Diaughia, error.

Diagnosis. *Diaugia* differs from other South American Dexiini by the following combination of characters: eye bare; arista densely long plumose; no facial carina; parafacial bare; proepisternum bare; intrapostalar seta absent; 2 katepisternal setae; katepimeron

(barette) setulose anteriorly; costal spine undeveloped; R_1 without setulae; base of R_{4+5} setulose dorsally and ventrally; abdominal syntergite 1+2 and tergite 3 without median marginal setae (but females have a pair of median marginal setae on tergite 3) and all tergites without discal setae (but some ground setulae rather developed middorsally); male abdomen conspicuously elongate (although not caudate as in *Uramya* Robineau-Desvoidy and *Trichodura* Macquart).

Among Dexiini, *Diaugia* undoubtedly resembles the other genera formerly included in the extinct tribe Zeliini (sensu Guimarães 1971, 1975). If valid today, this tribe would include 11 genera, all them monotypic except for *Zelia* Robineau-Desvoidy with nine species. Although *Diaugia* may be distinguished from other “Zeliini” and Dexiini (former paragraph), as well as each of the former “Zeliini” genera may bear a set of diagnostic characters, a discussion about the validity of each of these 10 monotypic genera is extremely necessary. On the other hand, to achieve a reliable treatment of these generic names (if valid or not), a detailed and comprehensive revision including types and non-types of all the 11 genera is much required.

Diaugia angusta Perty, 1833

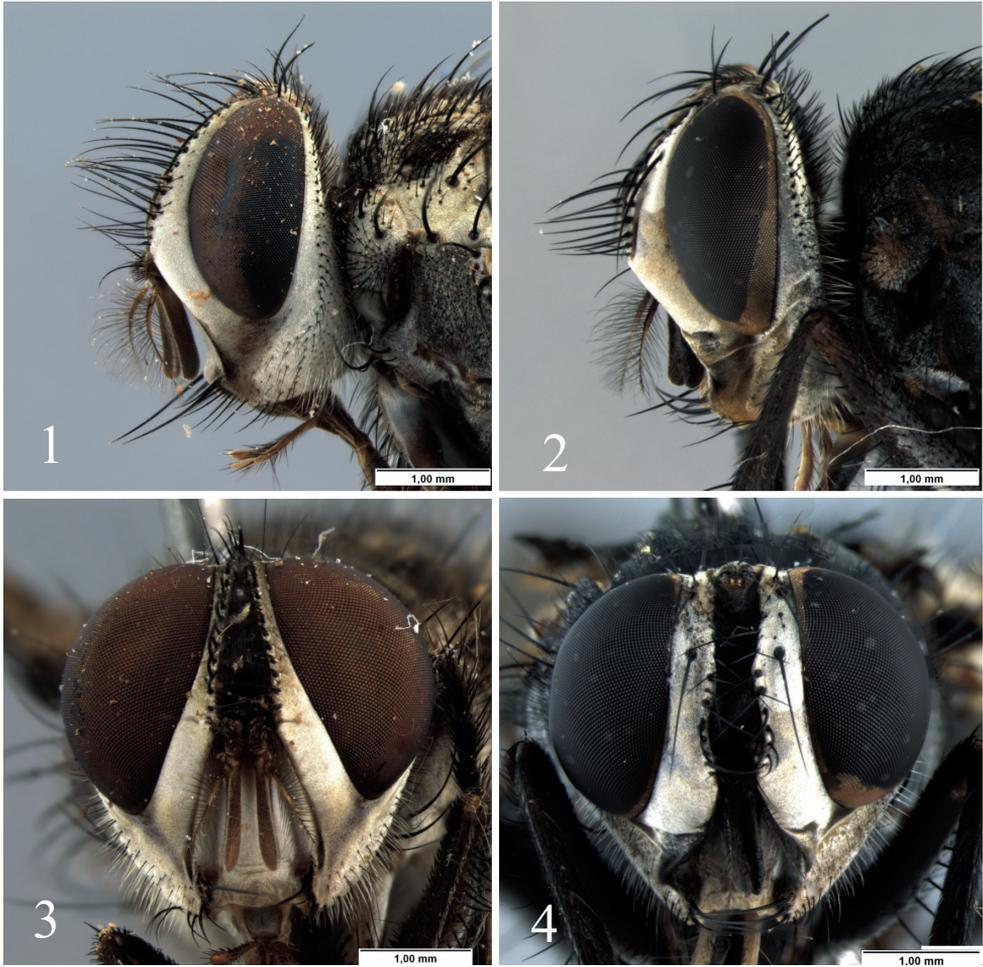
Figures 1–11

Diaugia angusta Perty 1833: 187, plate 37, fig. 9, type locality: Brazil, Minas Gerais, syntype male (lost *sec* Reiss and Schacht 1983: 308, formerly at the Zoologischen Staatssammlung München), syntype male (USNM, #A16608, also from Minas Gerais, not examined)

Redescription. Male: Body length: 13.5 mm (11.5–15.0), wing length: 11.0 mm (10.0–12.0) (n=20).

Colouration (Figures 1–7): Frontal vitta dark-brown to black (Figure 3); head silver or light-golden pruinose but gena with reddish dark brown area from the eye lower margin to vibrissal angle (Figures 1). Antenna dark-brown. Palpus yellowish brown; proboscis dark-brown. Thorax dark-brown to black with silver or light-golden pruinosity (Figure 6); the scutum with 4 dark stripes not reaching the scutellum, and the remaining scutum silver pruinose. Wing hyaline, the membrane tinged with light-brown or at least along the veins (Figure 5); calypteres and halter brown. Legs dark brown with silver pruinosity on coxae and femora. Abdomen (Figures 5 and 7) dark brown to black with silver pruinosity on anterior margin of tergites 3 to 5, and with extensive yellow areas on sides of syntergite 1+2 and tergites 3 and 4, both dorsally and ventrally.

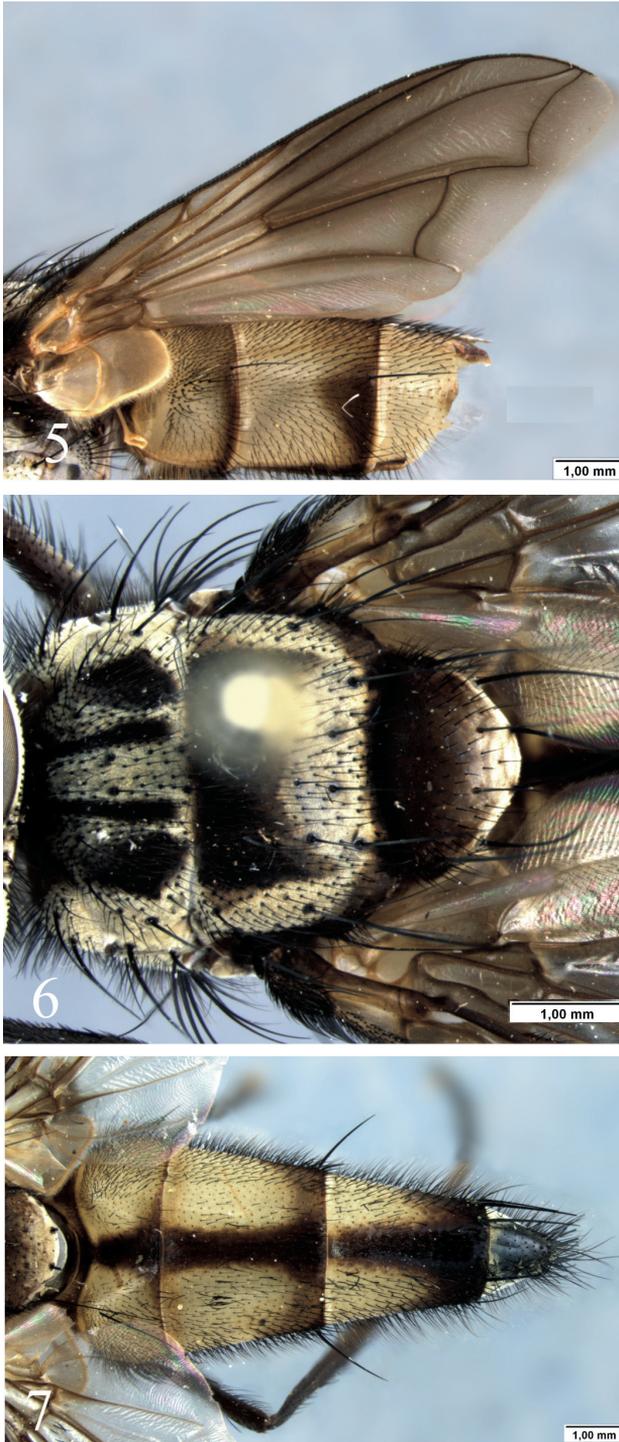
Head (Figures 1, 3): Eye apparently bare, with very short and sparse setulae. About 14 pairs of frontal setae. Two minute proclinate fronto-orbital setulae; fronto-orbital plate bare and narrower than frontal vitta and parafacial. Parafacial bare. Facial ridge with few weak setulae near vibrissa. Postpedicel slender, 4x the length of pedicel; arista long plumose, with 2–3 dorsal and 2 ventral rows (but one single ventral row on basal half), with about same length of postpedicel, and the length of longest cilia about 5x



Figures 1–4. *Diaugia angusta*: **1** male head, lateral view **2** female head, lateral view (head partially collapsed) **3** male head, frontal view **4** female head, frontal view. (Scale bar: 1 mm)

the basal width of arista. Vibrissa fine and long, inserted at level of lower facial margin. Genal dilation covered by fine pale setulae. Palpus filiform; labella developed, slightly shorter than prementum, which is as long as palpus.

Thorax (Figure 6): Acrostichals 3+1, but a weak pair before the postsutural pair. Dorsocentrals 3+4, but seems 3+3 as the second postsutural is weakly developed or indistinct from ground setulae in some specimens. Posthumeral 2, aligned with the intralar row, the posterior seta stronger and the anterior located lateral to the postpronotum. Presuturals 2, the posterior stronger. Postpronotals 3. Notopleurals 2. Postutural intra-alars 2, the anterior weak; intra-postalar absent. Postsutural supra-alars 3, the anteriormost (prealar) weakly developed, about 1/3 the length of the strongest supra-alar and shorter than the first postsutural intra-alar and dorsocentral. Prosternum and proepisternum bare. Six strong anepisternal setae. Katepisternals 2,



Figures 5–7. *Diaugia angusta*: **5** male wing, lateral view **6** male thorax, dorsal view **7** male abdomen, dorsal view. (Scale bar: 1 mm)

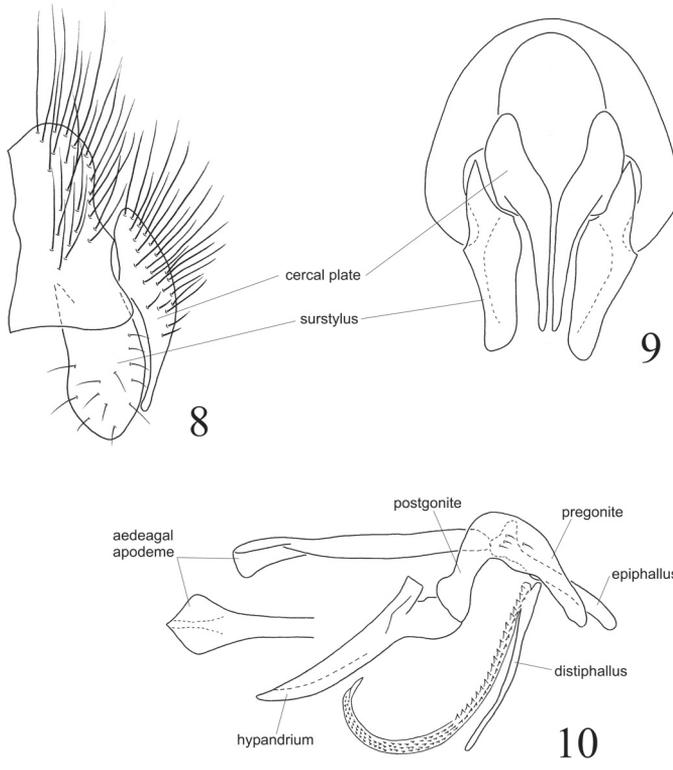
but some specimens with a reduced lower anterior seta is present. Katepimeron (barrette) setulose anteriorly. Scutellum with one basal, one lateral, one apical and one discal pairs of setae.

Wing (Figure 5): costal spine undeveloped; base of R_{4+5} setulose dorsally and ventrally; M vein bent forward to R_{4+5} , and convex after bend.

Legs: Fore tibia with 2 posterior setae. Mid femur with 2 anterior setae on median third, 2 dorsal preapical setae, and one posterodorsal preapical setae. Mid tibia with 1 submedian anterodorsal seta, 2 posterior setae on apical and basal third (the basal seta weak), and one ventral seta on apical third. Hind tibia with an anterodorsal row of irregularly sized and spaced setae but one strong submedian seta; with one submedian anteroventral and two posterodorsal seta (the submedian stronger).

Abdomen (Figure 7): Abdomen elongate and tapering to apex in dorsal view. Syntergite 1+2 and tergite 3 each with one lateral marginal seta. Tergite 4 with a marginal row of setae, the ventral setae reduced. Tergite 5 with marginal row of setae, with the ventral setae reduced; no discal setae but the ground setulae rather developed dorsally.

Terminalia (Figures 8–10): Cercal plate enlarged at base and tapering to the apex in posterior view (Figure 9), with long setulae mostly on base, the tip long and narrow and slightly curved inwards, ending before apex of surstylus (Figure 8). Surstylus broad and



Figures 8–10. *Diaugia angusta*: **8** male terminalia, lateral view **9** male terminalia, posterior view **10** aedeagus in lateral view and the detail showing the tip of aedeagal apodeme in dorsal view. (Scale bar: 0.5 mm)

the apex rounded, with subparallel margins in lateral view (Figure 9), while in posterior view tapering slightly to the subtruncate apex, the inner surface of surstylus concave. Pregonite and postgonite widely fused as a single piece on each side and firmly connected to the hypandrium (Figure 10); pregonite+postgonite somewhat stout at basal 2/3, strongly curved downwards at middle and tapering to the apex. Aedeagal apodeme straight, with subparallel margins, and elongate, longer than hypandrium (Figure 10). Epiphallus enlarged at base but uniformly narrow until a subtruncate apex, a little longer than half length of aedeagal apodeme. Distiphallus composed of a dorsal sclerite, long, straight and quite narrow, and anteriorly to it, a ventral membrane narrow and extremely elongate. The latter curved at apical half and bearing spinulae all along, these spinulae with their points upwardly oriented and becoming tinier towards the apex (Figure 10).

Female: Body length: 11.0 mm (11.5–15.0), wing length: 9.0 mm (7.5–10.5) (n=12). Differs from male in the following: two strong proclinate fronto-orbital setae (Figures 2, 4); fronto-orbital plate as wide as both frontal vitta and parafacial; fore tibia with 1 posterior seta; abdomen oblong in dorsal view, not elongate as in males, with the yellow areas on sides of syntergite 1+2 and tergites 3 and 4 less extensive than in male; tergite 3 with a median marginal pair; and tergite 5 with the ground setulae weakly developed.

Intraspecific variation. Within the examined material, the specimens showed some significant intraspecific variation in colouration: body colouration varied from dark brown to black (compare Figures 3 and 4); head and thorax with silver to light-golden pruinosity (compare Figures 1 and 2, and 3 and 4); wing always hyaline but the membrane tinged throughout with light-brown (Figure 5) or infuscated at least along the veins, and in some specimens with no noticeable infuscation.

Examined material. BRAZIL: *Goiás*: Anápolis, 1 male, 3.iii.1937, 1 male, vii.1934, Serviço Febre Amarela M.E.S. leg. (MZSP); *Rio de Janeiro*: Itatiaia, 700m, 1 male, 28.iv.1941, J. F. Zikán leg. (MZSP); Rio de Janeiro, Corcovado (Paineiras), 2 males (MZSP), 1 male (MNRJ), iii.1934, L.T. [Travassos] leg. (MZSP); idem, 1 male, xi.1935, L. Travassos leg. (MNRJ); idem, 1 male, 19.i.1938, Oiticica leg. (MZSP); Rio de Janeiro, Jardim Botânico, 1 male, vi.1935[? year hardly readable], H. S. Lopes leg. (MZSP); *São Paulo*: Barueri, 1 male, 3.iv.1957, 1 male, 20.iv.1957, 1 male, 20.vi.1957, 1male, 28.xii.1965, 2 males, 15.i.1966, 1 male, vii.1966, K. Lenko leg. (MZSP); Juquiá, 3 males and 3 females, i.2006, R. Pavarini leg. (ex. *Metamasius* sp. in “pupunha” crop [*Bactris gasipaes* Kunth]) (MZSP); Pariquera-Açu, 8 males and 11 females, iv–xii.2007, P.H. Silva & R. Pavarini leg. (ex. *Metamasius hemipterus* in “pupunha” crop – *Bactris gasipaes*) (MZSP); Araçatuba, Sítio Santo Amaro, 1 male, 6.i.1963, Rabello leg. (MZSP); Salesópolis, Boracéia, 1 male, 10–14.xi.1947, L. Trav. F., G. Ramalho & E. Rabello leg. (MZSP); idem, 2 males, 14.viii.1947, E. Rabello, Trav. F. & J. Lane leg. (MZSP); São Paulo, Ipiranga, 1 male, i.1932, R. Spitz leg. (MZSP); *Paraná*, Rio Negro, 1 male, 7.i.1929, no collector (MZSP); *Santa Catarina*: Blumenau, 1 male, xii.1924, Luederwaldt leg. (ex. *Metamasius ensirostris*) (MZSP); Nova Teutônia, 1 male, iv.1964, 1 male, viii.1967, F. Plaumann leg. (MZSP).

On the type material. Perty (1833: 187) described *D. angusta* without mentioning the composition of the type-series and with no reference to a holotype. Townsend

(1939: 77) provided a diagnosis of *Diaugia* in his “Manual of Myiology” and deliberately referred to a ‘holotype’ and a ‘paratype’ (deposited at “Munich” and “Washington” respectively). Quite possibly he had not examined the supposed ‘holotype’ (perhaps only the ‘paratype’ at the USNM), as there is no clear statement in the brief pages about *Diaugia*. The male syntype deposited at the Zoologischen Staatssammlung München is lost (Reiss and Schacht 1983: 308), and the only type-material remaining is the male syntype at USNM.

Distribution. BRAZIL (states of Goiás, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina) (Figure 11).

Habitat characterization. Based on geographical data of the examined material, *D. angusta* has been recorded in areas covered by Atlantic Forest (Figure 11). Most areas are characterized by dense evergreen ombrophilous tropical forests, whereas there is a single record in semi-deciduous forest (Brazil: São Paulo: Araçatuba). Outside the Atlantic Forest, this species also occurs in drier biomes such as Cerrado (Brazil: Goiás: Anápolis), however, it is very likely that it actually inhabits the gallery forests (humid forests accompanying riverine systems). Additionally, based on the known records, the altitude ranges from sea-level to 900 meters.



Figure 11. Distribution map of *Diaugia angusta* (black dots).

Hosts:

- i) *Metamasius ensirostris* (Germar, 1824) (Coleoptera: Dryophthoridae) (new record) from Blumenau, state of Santa Catarina;
- ii) *Metamasius hemipterus* (Linnaeus, 1758) (new record) from Pariquera-Açu, state of São Paulo;
- iii) *Metamasius* sp. (new record) from Juquiá, state of São Paulo.

Preliminary field research

The junior author is developing a long-term research project searching for natural enemies of boring weevils attacking peach-palm crops (“pupunha”, *B. gasipaes*). In a non-commercial crop of peach-palms in the municipality of Pariquera-Açu (southernmost of state of São Paulo), larvae of *Metamasius* sp. (undetermined species) were observed attacking the stems. Population peaks of the weevil were recorded during the months with higher temperatures and higher levels of precipitation.

Between April and December 2007, a survey was conducted to identify parasitoids of *Metamasius* sp. in that area. A total of 235 pupae were collected in the field and taken to the laboratory (UNESP, Registro-SP), where they were stored individually in small glass vials covered with a polyester-netting cloth. They were maintained under ambient-temperature until the emergence of the host or parasitoid.

Within the 235 field-collected pupae, 23 were parasitized by the tachinid *D. angusta*. This parasitism varied along the time (Figure 12), ranging from 28.57% in September to 0.00% in May and December (Figure 13). Although the samples were higher in May (20 pupae) and December (14 pupae) than in September (9 pupae), there was no tachinid emergence in May and December. The largest sample was obtained in November with 68 pupae, but only 7 parasitized pupae (10.28%).

We do not have data available for January, February and March, which are usually the months with the highest levels of precipitation and temperature in the study area. Furthermore, additional field studies are required to obtain reliable and statistically significant data on this interaction. Nevertheless, this preliminary field research indicates that *D. angusta* has a great potential for use in the biological control of *Metamasius* species in peach-palm crops and, perhaps, in other crops.

Discussion**Parasitoidism of tachinid flies on Dryophthoridae and Curculionidae bromeliad and palm pests**

The present study reveals important reports of *D. angusta* parasitizing *M. ensirostris* and *M. hemipterus*. These are the first host records for this tachinid species, and absolutely nothing is known about a potential host specialization over *M. ensirostris* and/or *M.*

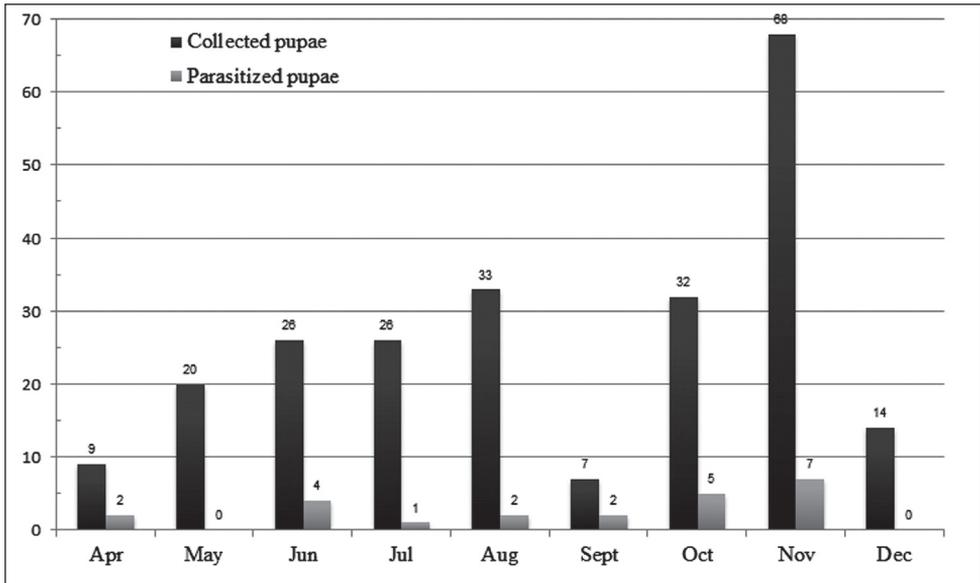


Figure 12. Monthly parasitism of *Metamasius* sp. by *Diaugia angusta* (total number of collected pupae and total number of parasitized pupae) from April to December 2007 in Pariquera-Açú (Brazil).

hemipterus. The geographical distribution known for *D. angusta* ranges from central to southeastern and southern Brazil (Figure 11), while the host *M. ensirostris* occurs from northern South America (Colombia, Venezuela) southwards to Paraguay, southern Brazil and northern Argentina (Vaurie 1966). And the host *M. hemipterus* is the most widespread among all the species of *Metamasius* (Vaurie 1966), occurring in Central and South America (from Mexico to Argentina), with recent introductions reported to other regions (e.g., western Africa, UK, USA, Australia, Philippines) (Vaurie 1966, CABI 2007).

The host-parasitoid network presented in Figure 14 is focused on the interaction between Tachinidae parasitoids and Dryophthoridae and Curculionidae species reported as pest of bromeliads and palms in the Americas. The network is not complete for every species included, as only “Zeliini” has all its hosts and only Dryophthoridae and Curculionidae have all their parasitoids depicted (see Material and Methods for details).

The network (Figure 14) shows that the parasitoid-host relationship is not very well established in terms of species-specific associations. Dryophthoridae species are parasitized by a great variety of tachinids, and these tachinid species develop on several hosts, not only Dryophthoridae. There are only 10 tachinid species connected to 11 dryophthorid species, on the other hand, these 10 tachinids have several other connections (most not shown) to species of Coleoptera and Lepidoptera (Guimarães 1977, Arnaud 1978). The species of “Zeliini” in the network connect to Cerambycidae, Passalidae, Scarabaeidae and Tenebrionidae (Coleoptera); “Theresiini” connects

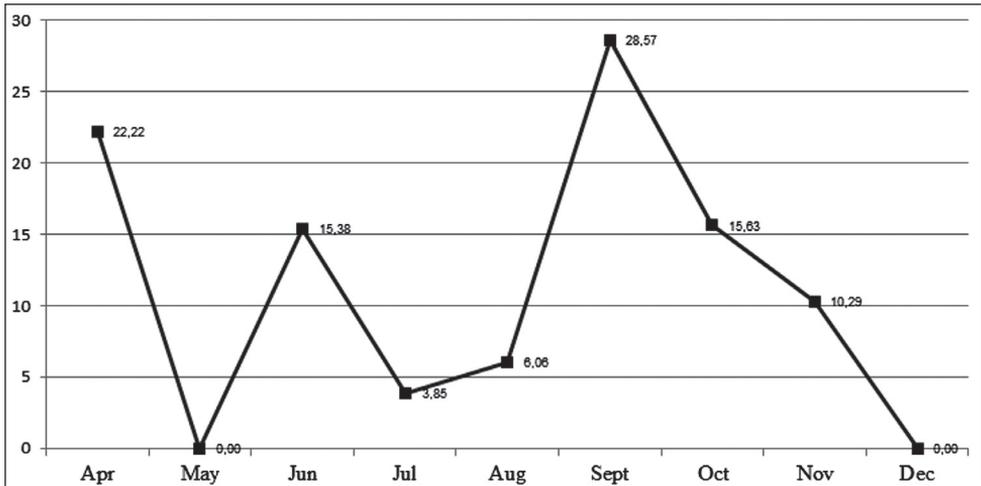


Figure 13. Monthly percentages of parasitism of *Diaugia angusta* on pupae of *Metamasius* sp. from April to December 2007 in Pariquera-Açu (Brazil).

to Curculionidae (Coleoptera) and Pyralidae (Lepidoptera); Blondeliini connects to Dryophthoridae, Curculionidae, Cerambycidae, Bostrichidae (Coleoptera), Pyralidae, Arctiidae, Hesperidae, Noctuidae, Olethreutidae, Gelechiidae, Limacodidae, Tortricidae and Noctuidae (Lepidoptera); while Myiophasiini connects to Scarabaeidae and Curculionidae (Coleoptera).

The present study records *D. angusta* to *M. ensirostris* and *M. hemipterus* in southeastern and southern Brazil. Before that, the only host record for a South American “Zeliini” was the one reporting *Neozelia alini* Guimarães, 1975 on a cerambycid species in southeastern Brazil (Guimarães 1975). Additionally, in North America, *Zelia tricolor* (Coquillett) parasitizes *Rhabdoscelus obscurus* (Boisduval) (Dryophthoridae). And, contrary to the apparent specificity observed in “Zeliini”, *Z. vertebrata* (Say) has host species within Passalidae, Scarabaeidae, Tenebrionidae and Cerambycidae (Arnaud 1978) (Figure 14).

Members of “Zeliini” has been recorded on several different and not closely related branches of Coleoptera. On this sense, the Dryophthoridae species are also parasitized by a disparity of tachinid species, belonging to three different subfamilies: Exoristinae (Blondeliini), Tachininae (Myiophasiini) and Dexiinae (Dexiini, “Zeliini”, “Theresiini”) (Guimarães 1977, Moura et al. 2006) (Figure 14).

Although the interactions between Dryophthoridae species and the tachinids *Lixophaga* Townsend, *Ceromasia* Rondani and *Gnadochaeta* Macquart seem to be specific, this is an artefact as the network does not show all the host associations recorded to these tachinid genera. North American species of *Gnadochaeta* parasitize *Sphenophorus* spp. (Dryophthoridae), but there are also records to several other host species among Curculionidae (Coleoptera), and among lepidopterans Arctiidae, Pyralidae and Noctuidae (Arnaud 1978). Moreover, other Myiophasiini parasitize members of Scarabaei-

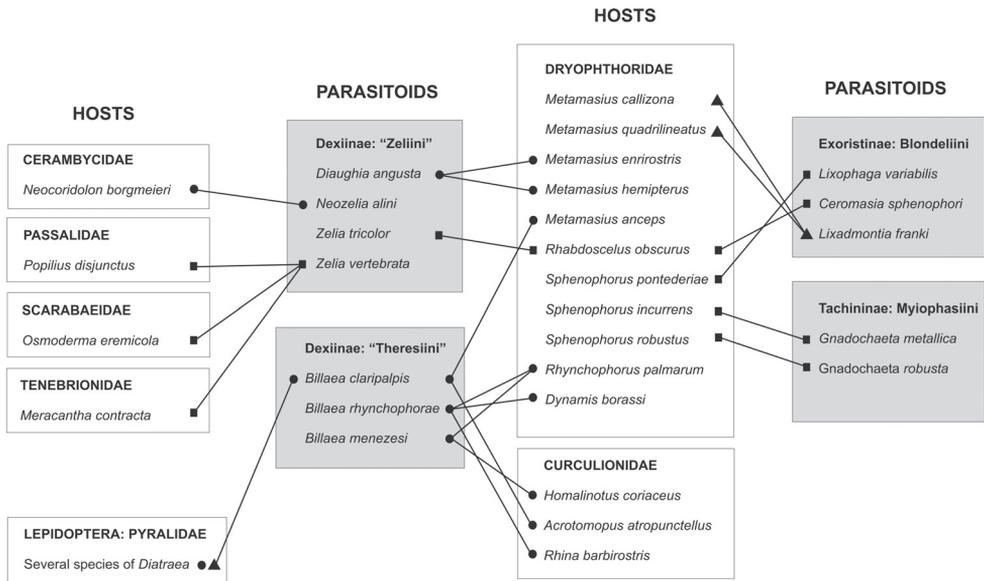


Figure 14. Host-Parasitoid network for Tachinidae, Dryophthoridae and other taxa. Legends: grey boxes = parasitoid taxa; white boxes = host taxa; circles = records in South America; squares = records in North America; triangles = records in Central America. (Sources: Alvarez-Del-Hierro and Cave 1999, Arnaud 1978, Cave 1997, Couturier et al. 1998, Guimarães 1975, 1977, Moura et al. 1993, 2006, Suazo et al. 2006, Wood and Cave 2006).

dae and Curculionidae (Coleoptera) (Guimarães 1977). On its turn, *Lixophaga* is one of the most diverse genus of Blondeliini in the Americas, with 16 Nearctic and 34 Neotropical species, and the host diversity is also high: Dryophthoridae, Curculionidae, Cerambycidae and Bostrichidae (Coleoptera), and Pyralidae, Arctiidae, Hesperidae, Noctuidae, Olethreutidae, Gelechiidae, Limacodidae and Tortricidae (Lepidoptera).

However, unlike other Blondeliini, *Lixadmontia franki* Wood and Cave, 2006 (Tachinidae: Exoristinae: Blondeliini) has some specificity in attacking only species of *Metamasius*. This tachinid has been considered a potential biological control agent of two species of meristem-boring weevils of bromeliads: *M. callizona* (Cave 1997, Wood and Cave 2006) and *M. quadrilineatus* Champion (Alvarez-Del-Hierro and Cave 1999). The later species was reported as being parasitized by *L. franki* only during the larval instars IV, V and VI (Alvarez-Del-Hierro and Cave 1999). As far, the available biological information indicates that there is some specificity in the association between *L. franki* and *M. callizona* and *M. quadrilineatus*.

Conclusion

Great efforts have been done recently in order to find parasitoids of bromeliad and palm weevils, by searching for parasitoids for the biological control of *M. callizona* in

Florida (Cave et al. 2003), or by testing the efficiency of parasitoids for the control of *R. palmarum* in tropical America (Moura et al. 2006).

Although still premature, the use of the tachinid *D. angusta* as an alternative for the biological control of *Metamasius* species may be promising, either in its native geographical range or in Central America and tropical North America. On this respect, further studies are needed to test the efficiency of this species under laboratory and natural conditions (through mass hearing and field release). We encourage the community to focus their research on “Zeliini” and “Theresiini” flies while aiming to search for parasitoids of Dryophthoridae and Curculionidae bromeliad and palm pests. Unfortunately, the host records and present knowledge for these tachinids are scattered in the literature. The neotropical “Zeliini” comprises about eleven genera and 18 species, but only four species have some knowledge about their host associations. As for the neotropical “Theresiini”, there are about 14 genera and 23 species, but host records are available to only three species. At present, both “Zeliini” and “Theresiini” are included into the large tribe Dexiini.

Acknowledgements

Thanks to Fábio Gaiger and Sérgio Vanin (IB-USP) for the identification of *Metamasius* specimens, to Marcia Couri (MNRJ) and Carlos Lamas (MZSP) for the loan of material. James O’Hara and Pierfilippo Cerretti provided suggestions and comments which improved the manuscript. Financial support from FAPESP (proc. n. 2004/13663-9 and 2007/50836-7) and fellowship from CNPq (proc. n. 303897/2008-2).

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Revision of the South American window fly genus *Heteromphrale* Kröber, 1937 (Diptera, Scenopinidae)

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Academic editor: *Martin Hauser* | Received 2 December 2010 | Accepted 26 January 2011 | Published 1 March 2011

[urn:lsid:zoobank.org:pub:9DB541F9-3F5B-4B95-B6A8-803E3E2A0B14](https://doi.org/urn:lsid:zoobank.org:pub:9DB541F9-3F5B-4B95-B6A8-803E3E2A0B14)

Citation: Winterton SL, Gaimari SD (2011) Revision of the South American window fly genus *Heteromphrale* Kröber, 1937 (Diptera, Scenopinidae). ZooKeys 84: 39–57. doi: 10.3897/zookeys.84.774

Abstract

The Neotropical window fly genus *Heteromphrale* Kröber, 1937 is revised. Two previously described species (*H. chilensis* (Kröber, 1937) and *H. cyanops* (Edwards, 1932)) are redescribed while a new species (*H. blanca* **sp. n.**) is described from Argentina. The male of *H. chilensis* and female of *H. cyanops* are described and figured for the first time, and a key to species is presented.

Keywords

Heteromphrale, Therevoid clade, Asiloidea, Scenopinidae

Introduction

Window flies (Diptera: Scenopinidae) are a small family (*ca.* 420 species in 24 extant genera) of cosmopolitan asiloid flies with an adult body size rarely exceeding 5.0 mm. Scenopinids are distributed throughout all major biogeographical regions, but with significant continental endemism at the genus level (Kelsey 1973).

Heteromphrale Kröber, 1937 is one of several genera of Scenopinidae found in the Neotropics, a region also including *Brevitrichia* Hardy, 1944 (also Nearctic), *Irwiniana* Kelsey, 1971, *Jackhallia* Nagatomi & Liu, in Nagatomi et al. 1994, *Pseudotrichia* Osten Sacken, 1877 (also Nearctic), *Metatrichia* Coquillett, 1900 (cosmopolitan), and *Scenopinus* Latreille, 1802 (cosmopolitan). *Heteromphrale* was erected by Kröber (1937) to accommodate his previously described species *Pseudotrichia chilensis* Kröber, 1928 from Chile, with *Pseudotrichia* being a highly distinctive genus to which this species clearly does not belong. In his monographic revision of world Scenopinidae, Kelsey (1969) subsequently transferred *Pseudomphrale cyanops* Edwards, 1932 to *Heteromphrale* as the second species in the genus. These two previously described species of *Heteromphrale* were each known only from a single sex (i.e. the female of *H. chilensis* and male of *H. cyanops*). As a result of extensive collecting by Dr Michael Irwin in Chile and Argentina, the opposing sexes of both species are now available, along with males and females of a new species (*H. blanca* sp. n.) described herein. *Heteromphrale* is revised with all species diagnosed and figured, and a dichotomous key to species presented. The key to genera in Woodley (2009) can be used to identify specimens to this genus, although the female of one species has a weakly emarginate posterior edge of sternite 8 (but not forming distinct posterolateral lobes as in *Brevitrichia*), and only one species has bulbous male epandrial lobes. As in recent papers using cybertaxonomic methods such as hypertext mark-up links to internet resources (e.g. online image databases, name registration in Zoobank, etc.) (Pyle et al. 2008; Winterton 2009), we have also extensively used such resources throughout the text.

Materials and methods

Genitalia were macerated in 10% KOH at room temperature for one day to remove soft tissue, then rinsed in distilled water and dilute acetic acid, and dissected in 80% ethanol. Preparations were then placed into glycerine, with images made with the aid of a digital camera mounted on a stereomicroscope. Genitalia preparations were placed in glycerine in a genitalia vial mounted on the pin beneath the specimen. Terminology follows Winterton (2005) and Winterton and Woodley (2009). In contrast to the scenopinid subfamilies Proratinae and Caenotinae, the male terminalia of Scenopininae are rotated 180°. To avoid confusion with terminology and comparative homology, structures are described and labeled as they are in related flies with terminalia not rotated; therefore the ventral apodeme of the aedeagus described herein is physically located dorsally. The following collection acronyms are cited in the text: California Academy of Sciences, San Francisco, California, USA (CAS), Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany (DEI), California State Collection of Arthropods, Sacramento, California, USA (CSCA), Bohart Museum of Entomology, University of California, Davis, California, USA (UCDC), the National Museum of Natural History, Smithsonian Institution, Washington, DC, USA (NMNH), and the Natural History Museum, London, United

Kingdom (BMNH). Numbers quoted with individual specimens as MEI000000 are unique identifiers in the therevid database MANDALA and are attached to each specimen as a yellow or white label (Kampmeier et al. 2004). Specimen images at different focal points were taken using a digital camera and subsequently combined into a serial montage image using CombineZP. Higher-resolution digital images were also archived in Morphbank with embedded URL links between figure captions and Morphbank images. All new nomenclatural acts and literature are registered in Zoobank as per the recent proposed amendment to the *International Code of Zoological Nomenclature* for a universal register for animal names (Polaszek et al. 2005a,b; Pyle et al. 2008; ICZN 2008).

Taxonomy

Heteromphrale Kröber

Heteromphrale Kröber 1937: 221. – Hardy 1966: 1; Kelsey 1969: 286; 1971: 284; 1973: 332; Woodley 2009: 651. Type species (by original designation): *Pseudatrichia chilensis* Kröber 1928: 31.

Diagnosis. *Body length:* 2.5–4.0 mm [male], 2.7–5.0 mm [female]. Cream-white with yellowish-brown suffusion; eyes contiguous in male, frons broader than ocellar tubercle in female; antennal flagellum approximately twice length of scape and pedicel combined, attenuate and pyriform, notched apically; scutum light brown to dark grey, with cream-white to yellow patches marginally (pale area often more extensive in female); entire thorax overlain with glaucous pubescence; wing vein M_1 meeting vein R_5 , forming closed petiolate cell r_5 ; R_4 branching from R_5 along basal half of cell r_5 ; abdomen with tergites either dark brown-grey with pale white to yellow band posteriorly, or vivid white with orange-brown suffusion laterally (and medially in female); tergite 2 sensory setae well defined (Fig. 1); male epandrium split medially as two sclerites, halves sub-quadrangular with posterior margins flared or tapered laterally, or large and globose; epandrium not completely covering gonocoxite ventrally; gonocoxite and aedeagus extended anteriorly from anterior margin of epandrium a relatively short distance; gonocoxite irregular, largely reduced, with strongly sclerotized dorsal process; gonocoxal apodeme relatively thickened; hypandrium as paired lobes, size and shape variable, with margin of setae, but no large setal brushes; lateral aedeagal bulb present; distiphallus bifid, recurved dorsally at base or straight, slender or slightly thickened, arms parallel or divergent. Female sternite 8 longer than tergite 8, almost level with cerci, broadly rounded or weakly emarginate (not forming distinct lobes posterolaterally); 6–7 acanthophorite spines present on lobes of well defined tergite 9+10; furca ring-like, dark-sclerotized; spermathecae paired, sclerotized and irregular-shaped; spermathecal sac simple, minute, elongate.

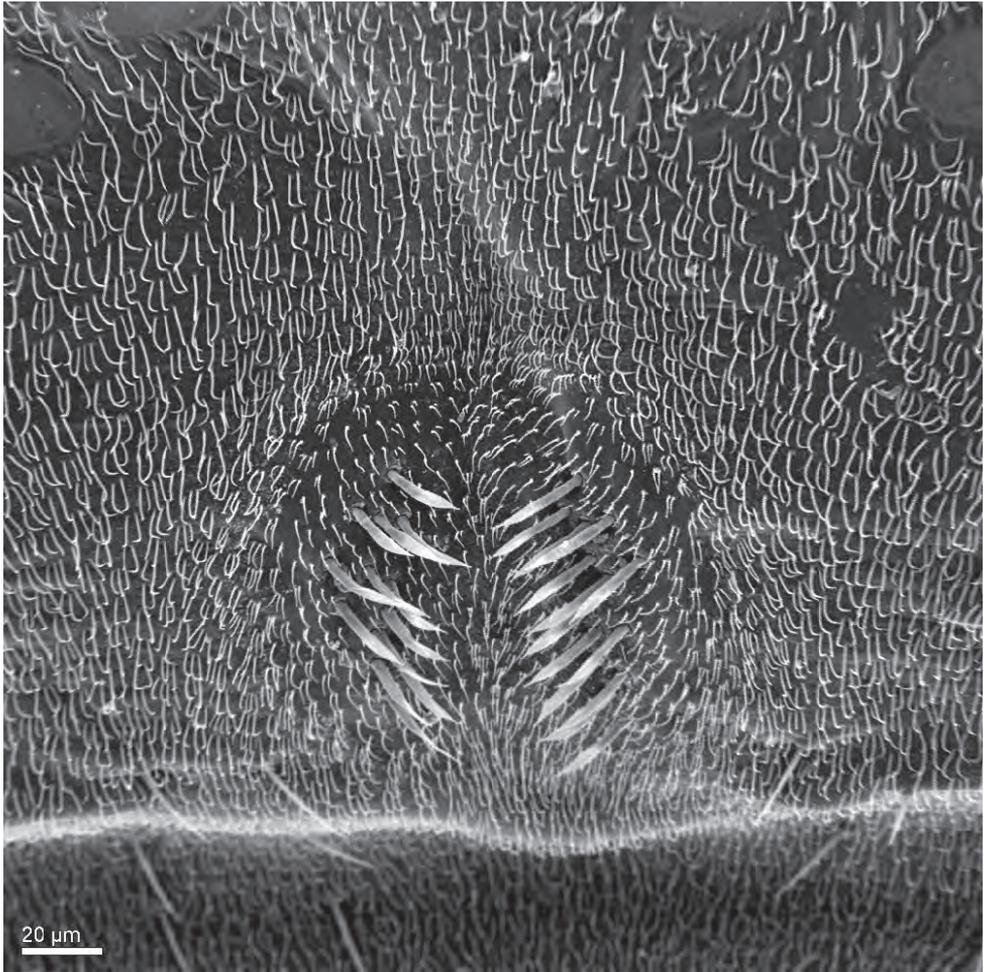


Figure 1. *Heteromphrale chilensis* (Kröber): Scanning electron micrograph of tergite 2 sensory setal patch.

Comments. *Heteromphrale* is closely related to *Brevitrichia*, a genus found primarily in western North America and throughout Central America (Kelsey 1969; Woodley 2009). *Heteromphrale* can be differentiated from *Brevitrichia* by the shape of sternite 8 in the female (apically emarginate with rounded posterolateral lobes in *Brevitrichia*), male distiphallus short and thick (relatively long and thread-like in *Brevitrichia*) and the distiphallus straight (highly reflexed basally in *Brevitrichia*). The distiphallus of *Brevitrichia* can be greatly elongated, with the basiphallus reflexed upon itself up to 180° as found in the proratine genus *Cyrtosathe* Winterton & Metz, 2005 (Winterton and Metz 2005). This complex arrangement of the distiphallus in *Brevitrichia* often projects anteriorly into the abdominal cavity and is supported by aedeagal guides formed by paired, blade-like extensions of the hypoproct; the aedeagus is largely contained within the genitalic capsule in *Heteromphrale*, with hypoproct extensions absent. The distinct dorsal processes (physically ventral) on the gonocoxites of *Heteromphrale*

(Figs 2–3) are similar to those found in some species of *Propebrevitrichia* Kelsey, 1969 (see Winterton 2005) and indicate a likely close relationship between these genera.

Distribution. Southern South America; recorded from Uruguay, Chile and Argentina.

Included species. *Heteromphrale blanca* sp. n., *H. chilensis* (Kröber) and *H. cyanops* (Edwards).

Key to *Heteromphrale* species

- 1 Scutum with glabrous, glossy dorsocentral area (circular in male, linear in female) (Fig. 5C, D); basal antennal flagellomere abruptly pear-shaped; mouthparts tiny, much smaller than oral cavity; female frons with extensive pile (Fig. 4C); abdomen distinctly matte white with brown suffusion laterally and ventrally (Fig. 7A, B), transverse brown line anterior to dark brown spot encompassing tergite 2 sensory patch *H. chilensis* (Kröber)
- Scutum with uniform covering of pubescence, lacking a glabrous or glossy mark (Fig. 5A, B, E, F); basal antennal flagellomere more conical-shaped, tapering evenly; mouthparts usually normal-sized, nearly filling oral cavity; female frons with less extensive pile; abdomen in both sexes more extensively dark brown, with white only on posterior margins of tergites (Figs 6A–B, 8A–B)..... **2**
- 2 Wing with vein R_4 diverging from vein R_5 at point in basal quarter of cell r_5 (Fig. 8B); tergite 2 sensory patch as relatively small single patch, slightly narrowed; male epandrium enlarged, bulbous, without distal fringe of long, white setae on posterior edge (Figs 3A–B, 8A, 10C); female sternite 8 shallowly emarginate posteriorly and without a fringe of long setae; acanthophorite spines stout (Fig. 9G–H) *H. cyanops* (Edwards)
- Wing with vein R_4 diverging from vein R_5 at point between one-quarter and one-half of cell r_5 (Figs 6A, B); tergite 2 sensory patch large and distinct, divided into two small patches with setae directed medially; male epandrium not bulbous, size subequal to preceding abdominal segment, with distal fringe of long white setae on posterior edge (Fig. 2A, B, 10A); female sternite 8 distally rounded with dense long thin setae apicolaterally and distally; acanthophorite spines thin and wispy (Fig. 9A–C)..... *H. blanca* sp. n.

Heteromphrale blanca sp. n.

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Figures 2A–B, 4A–B, 5A–B, 6, 9A–C, 10A

Type material. Holotype male, “ARGENTINA. La Rioja Prov., Departamento Famatina, 12 km N Pituil, 4,135 ft; 20-X-1997, M.E. Irwin, F.D. Parker, S. Roig, malaise, 28.5151°S, 67.3389°W” / “Schlinger Foundation Argentina Expedition, November

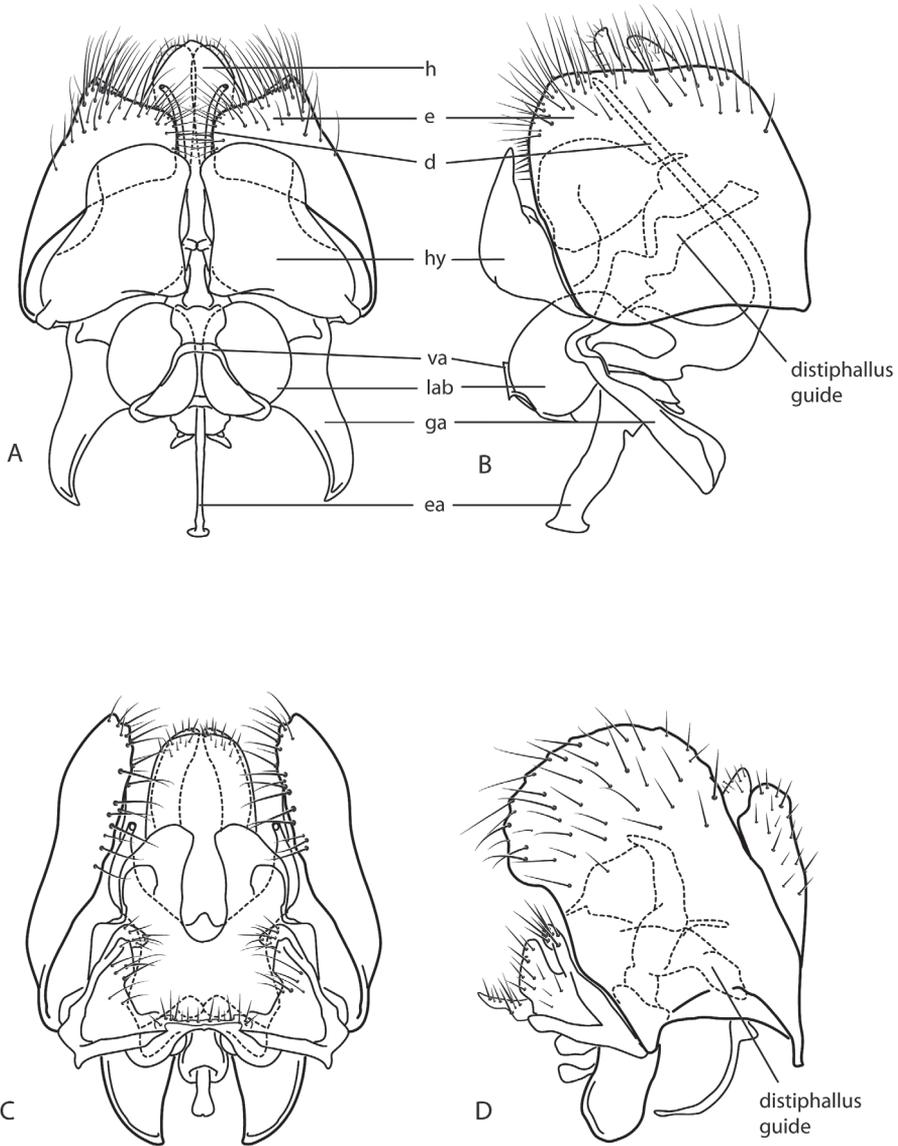


Figure 2. *Heteromphrale* spp. Male genitalia: **A** *H. blanca* sp. n.: dorsal view **B** same, lateral view **C** *H. chilensis* (Kröber): dorsal view **D** same, lateral view. Scale line = 0.2 mm. Abbreviations: **d** distiphallus **e** epandrium **g** gonocoxite **ga** gonocoxal apodeme **gs** gonostylus **h** hypandrium **hy** hypoproct **lab** lateral aedeagal bulb **va** ventral apodeme of parameral sheath.

1997, ME Irwin, F.D. Parker & S. Roig" / "HOLOTYPE ♂ *Heteromphrale blanca* Winterton & Gaimari" [red label]. (MEI165196) (CASC, point mounted, excellent condition).

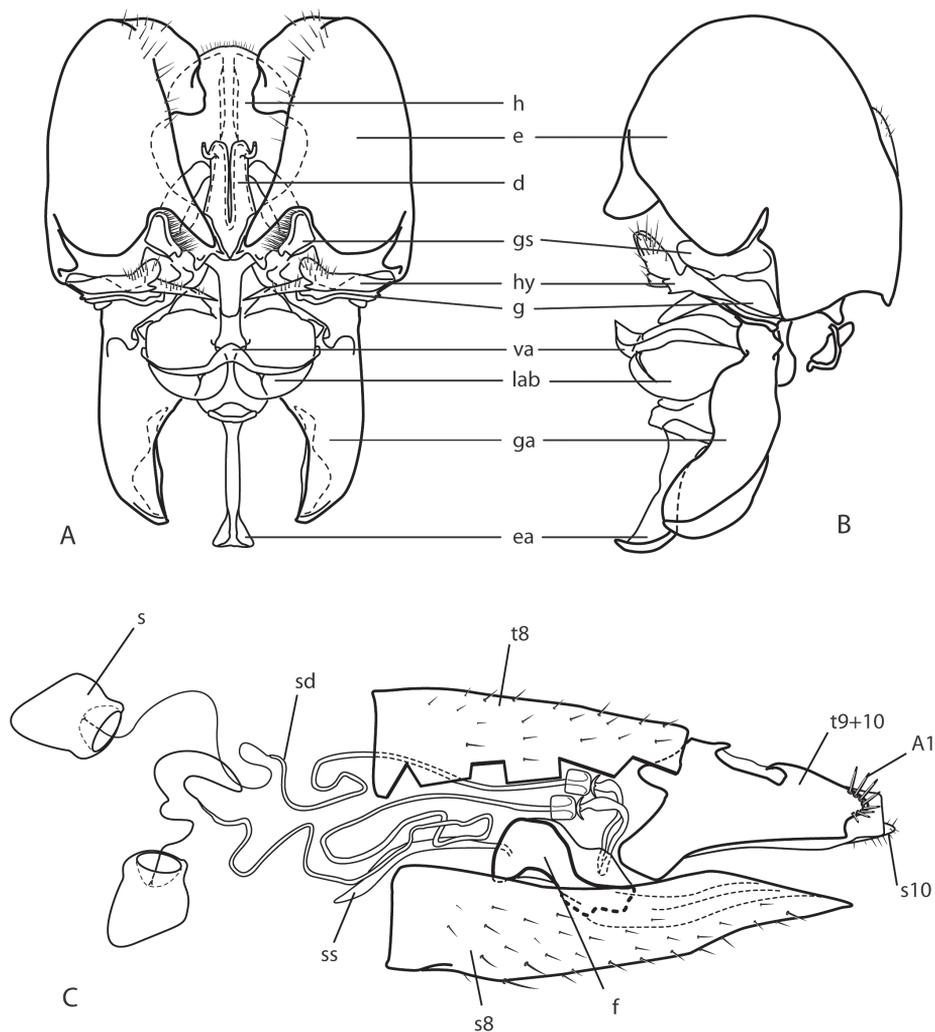


Figure 3. *Heteromphrale cyanops* (Edwards). Male genitalia: **A** dorsal view **B** same lateral view. Female genitalia: **C** lateral view, with tergite 8 cut away. Scale line = 0.2 mm. Abbreviations: **d** distiphallus **e** epandrium **g** gonocoxite **ga** gonocoxal apodeme **gs** gonostylus **h** hypandrium **hy** hypoproct **lab** lateral aedeagal bulb **va** ventral apodeme of parameral sheath **A1** acanthophorite spines **f** furca **s** spermatheca **sd** spermathecal duct **ss** spermathecal sac **s8** sternite 8 **s10** sternite 10 **t8** tergite 8 **t9+10** tergites 9 and 10.

Paratypes. ARGENTINA: **La Rioja Province:** Departamento Famatina, 12 km N Pituil, 4135 ft. [1260 m], -28.5151° -67.3389°, 15.X.1997, M.E. Irwin, F.D. Parker & S. Roig, ex. Malaise trap [1 male (CASC)] (MEI165195); 2 females (CASC) (MEI165197, 165198)]; on leaves of *Prosopis* tree [1 male (CSCA)]; 53 km from Villa Unión, Route 40, Pedregosa River, 27.XI.1976, ex. sweeping *Prosopis chilensis* [1 female (USNM)]; Departamento Famatina, 12 km N Pituil, 4135 ft. [1260 m], -28.5151°S -67.3389°, 15.X.1997, M.E. Irwin, F.D. Parker & S. Roig, ex. Malaise

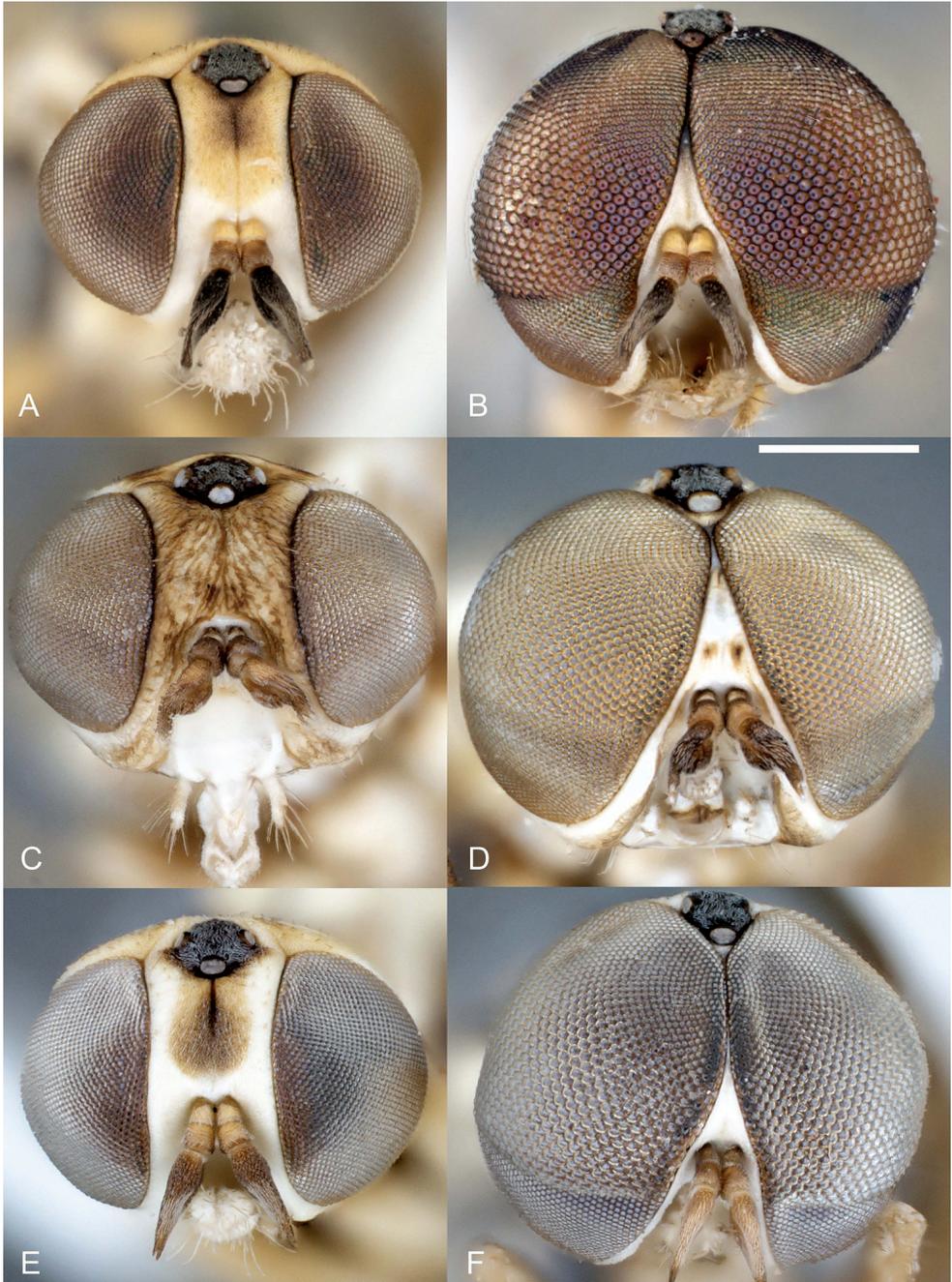


Figure 4. *Heteromphrale* spp.: *H. blanca* sp. n.: **A** female head, anterior view [Morphbank entry= 579914] **B** male head, anterior view [579921]; *H. chilensis* (Kröber): **C** female head, anterior view [579925] **D** male head, anterior view [579932]; *H. cyanops* (Edwards): **E** female head, anterior view [579935] **F** male head, anterior view [579942]. Scale line = 0.25 mm.

trap [1 male (DEI)] (MEI165199); **Tucuman Province:** 8 km NW Amaichá del Valle, 1847 m, -26°32.35' -65°58.37', 22–25.X.2003, M.E. Irwin & F.D. Parker, ex. Malaise trap in ravine [1 male (CSCA); 1 male (USNM)]. **Salta Province:** 10 km S Cafayete, 26.X–13.XI.2003, M.E. Irwin, F.D. Parker, -26.1514° -65.9586°, 1644 m, Malaise in *Prosopis* covered dunes [1 female (CSCA)] (MEI165204).

Diagnosis. Antennal flagellum dark brown to black, conical and evenly tapered distally; mouthparts normal, nearly filling oral cavity; scutum without glabrous dorso-central patches; wing with vein R_4 diverging from vein R_5 at point between one-quarter and one-half of cell r_5 ; abdomen dark with pale posterior band on tergites 2–5; tergite 2 sensory patch distinct as two small patches; male epandrium not bulbous, dense fringe of white setae along posterior margin; hypandrium lobes relatively large and sub-triangular; distiphallus with arms parallel; lateral aedeagal bulbs relatively large; female sternite 8 posterior edge rounded; acanthophorite spines elongate and finely tapered, wispy.

Description. Body length: 2.5–4.0 mm [male], 2.7–4.2 mm [female]. *Head* (Figs 4A–B, 5A–B). Frons, parafacial, face and gena cream-white to yellow; female frons with tan suffusion dorsomedially and surface slightly furrowed medially, sparsely distributed with small, pale setae; male frons with whitish pubescence and dark where eyes are proximate; occiput with yellow suffusion marginally, black medially; face white; flagellum brown to black; scape pale yellow; pedicel yellowish-tan with a few minute pale setae; mouthparts normal-sized, nearly filling oral cavity; pale yellow, including prementum, labellum, labellar setae, and small cylindrical palpus. *Thorax* (Figs 5A–B, 6). Scutum black to grey, small pale yellow areas marginally (postpronotal lobe, notopleuron and supra-alar area), more extensive in female and additionally with yellow on anterior part of scutum adjacent to postpronotum, on postalar callus, and medially on posterior part of scutum; entire thorax overlain with dense glaucous pubescence; scutellum dark medially, yellow marginally (yellow area more extensive in female); scutum without pale setae, some present on postpronotal lobe, anepisternum and katepisternum; prosternum yellow; proepisternum and proepimeron yellow, sometimes with brown on posterior part; anepisternum grey pubescent, yellow in upper part; katepisternum grey pubescent, yellow in posterodorsal corner (in female, along most of dorsal margin); anepimeron grey pubescent anteriorly, yellow posteriorly; meron grey pubescent, except yellow dorsally; coxae light brown to orange; legs tan to dark yellow-orange; distal tarsomeres darker than rest of leg; haltere stem brown, knob white with brown suffusion dorsally; wing venation pale yellow; vein R_4 diverging from R_5 at point between one-quarter and one-half of cell r_5 . *Abdomen* (Fig. 6). Segments dark brown-grey with pale white-yellow band posteriorly; sternites dark brown-grey; sparse pale setae on most segments; tergite 2 sensory patch large and distinct, divided medially into two small patches, patch concolorous with rest of tergite. *Male genitalia* (Figs 2A–B, 10A). Epandrium sub-quadrangular, outer margins tapered, dark brown in basal half and pale yellow in distal half, white setal fringe along margin; hypandrium lobes relatively large, triangular; gonocoxite with darkly sclerotized, narrowly acuminate, dorsal process; gonostylus complex, apparently fused to gonocoxites,

with posteriorly directed margin fringed with setae, and hook-like process dorsally, inner lobe triangular and fused medially; gonocoxal apodeme broadly flattened, curved medially; ejaculatory apodeme relatively elongate, directed anteriorly; lateral aedeagal bulbs large, round; distiphallus elongate, arms proximate and parallel, broadly curved ventrally at base then straight along distal length. *Female genitalia* (Fig. 9A–C). Sternite 8 with posterior edge rounded, with posterolateral part fringed with long wispy setae; acanthophorite spines elongate and curved, becoming wispy and hair-like.

Comments. *Heteromphrale blanca* sp. n. is very similar to *H. cyanops* in overall body color, but differs considerably in male genitalic morphology and in the shape of the female sternite 8. As in *H. chilensis*, the tergite 2 sensory patch is large and distinct, and is divided into two small patches with the setae directed medially. In males, the non-bulbous epandrium distinguishes this species and *H. chilensis* from *H. cyanops*, but the dense fringe of white setae along the posterior margin, distinguishes *H. blanca* sp. n. from *H. chilensis*. In females, the rounded sternite 8 distinguishes *H. blanca* sp. n. from *H. cyanops*, and the fringe of long wispy setae and elongate wispy acanthophorite spines distinguishes this species from *H. cyanops* and *H. chilensis*.

Distribution. Known only from Argentina (La Rioja, Salta and Tucuman Provinces).

Etymology. The specific epithet is a Latin adjective – *blanca* – meaning white, referring to the dense fringe of white setae along the posterior margin of the epandrium.

Heteromphrale chilensis (Kröber)

Figures 1, 2C–D, 4C–D, 5C–D, 7, 9C–E, 10B

Pseudatrichia chilensis Kröber 1928: 31.

Heteromphrale chilensis (Kröber). – Kröber 1937: 221; Hardy 1966: 2; Kelsey 1969: 286; 1971: 284.

Type material. Holotype female, label data: “CHILE Concepción, P. Herbst” / “coll. Lichtwardt” / “*Pseudatrichia chilensis* det. Kröber” / “HOLOTYPUS”. (DEI) (micro-pin mounted, reasonable condition except abdomen greasy and antennae missing).

Other material examined. CHILE: **Elqui Province:** 10 km N La Serena, 10 m, -29°49.27' -71°16.20', 8.X.2003, M.E. Irwin, ex. hand net in coastal dunes [3 males (CASC) (MEI165208, 165209, 165210), 1 female (CASC) (MEI165211), 3 males (CSCA) (MEI165206, 165207 165212)].

Diagnosis. Antennal flagellum orange brown, abruptly pear-shaped; female frons with extensive pile; mouthparts much smaller than oral cavity; scutum with glabrous, glossy dorsocentral spot (linear in female); wing with vein R_4 diverging from R_5 at point in basal quarter of cell r_5 ; abdomen vivid matte-white with brown suffusion laterally (also medially in female), and with dark brown spot encompassing tergite 2 sensory patch; tergite 2 sensory patch distinct as two small patches; male epandrium not bulbous, without dense fringe of setae; hypandrium lobes sub-triangular with scler-

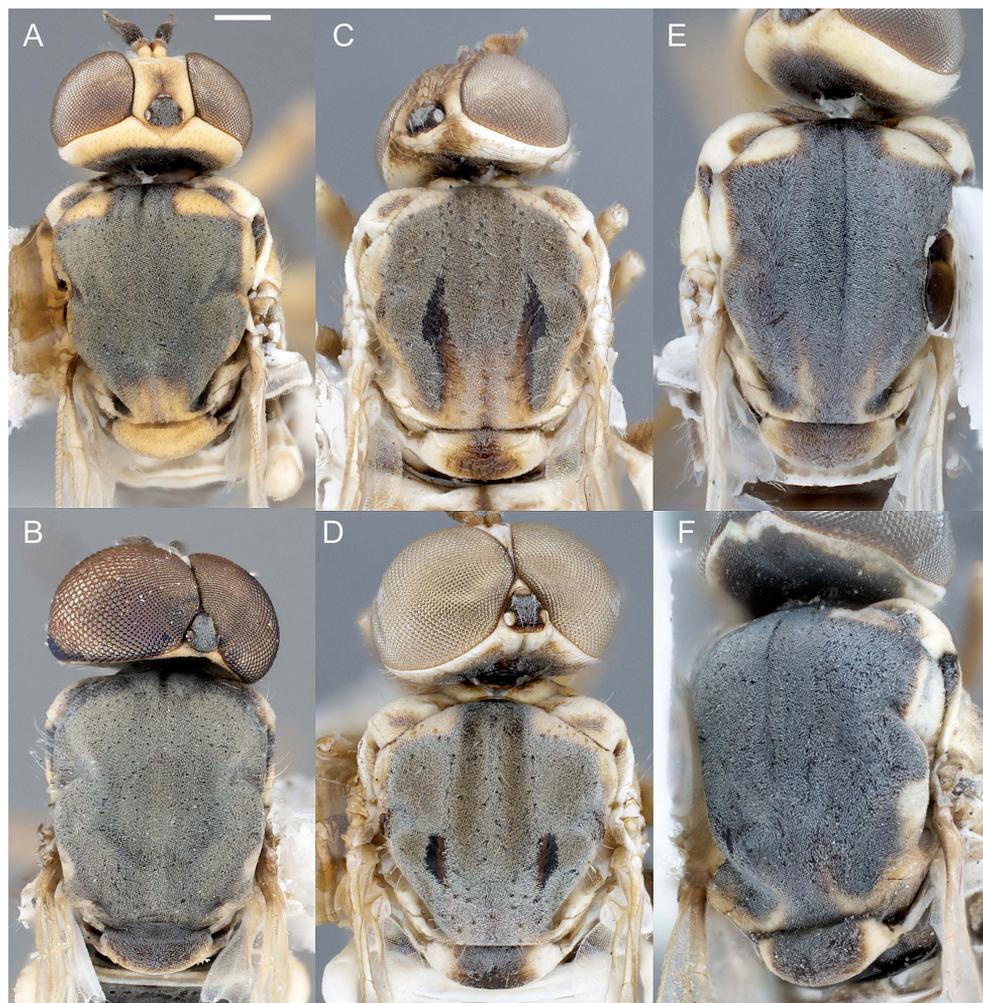


Figure 5. *Heteromphrale* spp.: *H. blanca* sp. n.: **A** female thorax, dorsal view [579911] **B** male thorax, dorsal view [579919]; *H. chilensis* (Kröber): **C** female thorax, dorsal view [579923] **D** male thorax, dorsal view [579929]; *H. cyanops* (Edwards): **E** female thorax, dorsal view [579933] **F** male thorax, dorsal view [579939]. Scale line = 0.25 mm.

rotized lateral margins; distiphallus arms divergent; lateral aedeagal bulbs relatively small; female sternite 8 rounded posteriorly, without fringing elongate setae; acanthophorite spines robust and stout.

Redescription. Body length: 2.6–3.2 mm [male], 4.8 mm [female]. *Head* (Figs 4C–D, 5C–D). Frons cream-white, female frons with yellow to light brown patch dorsomedially, sometimes more extensive brown-orange suffusion, surface wrinkled, sparsely distributed with small, pale setae; parafacial in male dark orange medially, white along eye margin (in female entirely yellow); ocellar triangle grey pubescent, raised, with anterior ocellus slightly larger than posterior ocellus; occiput and postgena

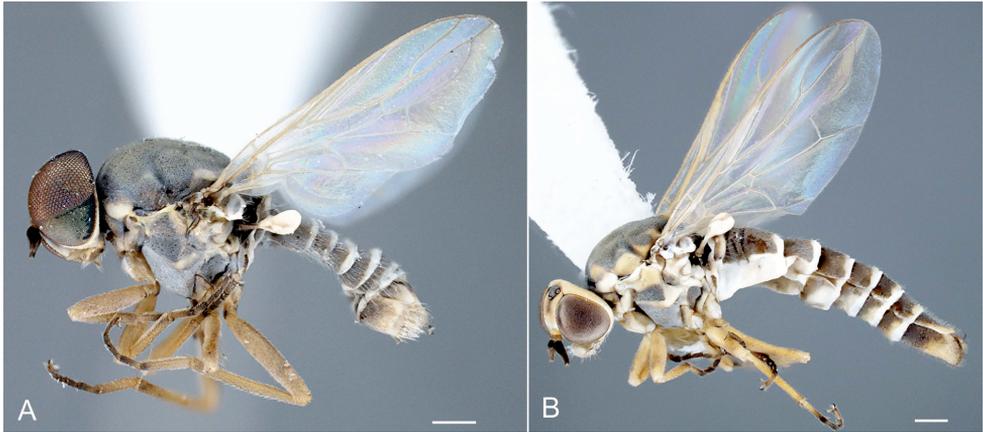


Figure 6. *Heteromphrale blanca* sp. n.: **A** male, lateral view [579920] **B** female, lateral view [579913]. Scale line = 0.25 mm.

dark with pale yellow with orange-brown suffusion marginally; face white with brown suffusion; mouthparts pale, relatively small in size, much smaller than oral cavity; pale yellow, including labellum, labellar setae, and small cylindrical palpus; prementum in male dark orange (in female pale yellow); flagellum orange-brown, abruptly pyriform, tapered distally; scape and pedicel brown with a few minute pale setae. *Thorax* (Figs 5C–D, 7). Scutum light brown to grey, yellow on postpronotal lobe, anterior part of scutum adjacent to postpronotum, notopleuron, supra-alar area and postalar callus (in female, with yellow more extensive in these areas); entire thorax overlain with dense glaucous pubescence; glossy black dorsocentral patches present at point posterior third of scutum, patches round in male, elongate in female, paired median brown vittae in anterior half; scutellum dark medially, pale marginally; prosternum yellow, bare; proepisternum and proepimeron orange (in female yellow); anepisternum orange in dorsal half and along posterior margin (in female yellow), except white along dorsal margin and grey to brown pubescent anteroventrally; katepisternum grey to brown pubescent, except orange in upper part (in female yellow); anepimeron white to yellow, darkened anteriorly; meron shining glossy brown, except white pubescent dorsally; legs pale cream with uniform or mottled brown suffusion, tibiae orange, with dorsal surface pale; hind tibia becoming darker distally; tarsi dark. *Wing*. Venation pale brown; vein R_4 diverging from R_5 at point in basal quarter of cell r_5 ; aberrant specimens with either spurious vein present between distal part of R_5 and C (Fig. 7B) or R_4 incomplete basally; haltere mostly cream-white. *Abdomen* (Fig. 7). Vivid matte-white to cream with brown suffusion laterally; dark brown band posteriorly (more obvious in female), tergite 2 with dark brown band level with and encompassing sensory setal patch; sternites white with brown suffusion laterally; sparse elongate setae on most segments. *Male genitalia* (Figs 2C–D, 10B). Epandrium brown basally and pale yellow

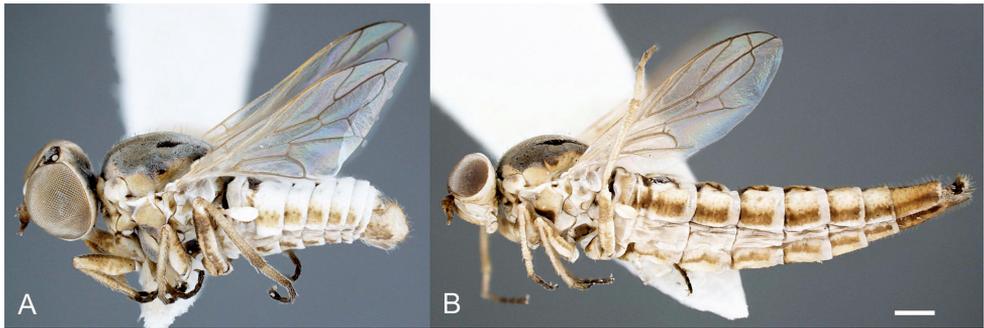


Figure 7. *Heteromphrale chilensis* (Kröber): **A** male, lateral view [579931] **B** female, lateral view [579924]. Scale line = 0.25 mm.

marginally; sub-quadrangular with posterior margins tapered, fine setae along margin; hypandrium halves small, sub-triangular with multiple lobes directed posteromedially, dark sclerotized along anterior and lateral margins; gonocoxite with darkly sclerotized, acuminate, dorsal process; gonostylus large, posteriorly directed and united medially, apparently fused to gonocoxites; gonocoxal apodeme broadly flattened, outer margin curved, inner margin straight; ejaculatory apodeme minute, directed ventrally; lateral aedeagal bulbs small; ventral apodeme dark sclerotized; distiphallus divergent laterally around gonostylus, medially directed process from between distiphallus projecting towards hypoproct, curved anteriorly, apex spatulate. *Female genitalia* (Figs 9C–E). Sternite 8 with posterior edge rounded, with longish setae around fringe; acanthophorite spines long and robust.

Comments. Originally described in *Pseudatrachia*, Kröber (1937) later erected *Heteromphrale* to accommodate this species. Although the female holotype is faded, encrusted with naphthalene and dust, and the abdomen is greasy, the distinctive bone-white color of the abdomen is still observable, along with the brown coloration around the tergite 2 sensory patch. In the original description, Kröber (1928) described the flagellum as red-yellowish color, but the antennae are now lost from the type specimen.

Heteromphrale chilensis is easily distinguished from other species of *Heteromphrale* by the glabrous dorsocentral patches on the scutum (elongate in females), mostly bone-white coloured abdomen, basally bulbous antennal first flagellomere, and the relatively tiny mouthparts. As in *H. blanca* sp. n., the tergite 2 sensory patch is large and distinct, and is divided into two small patches with the setae directed medially, and the epandrium is not bulbous as in *H. cyanops*, but in *H. chilensis* there is no dense fringe of long white setae. Also like *H. blanca* sp. n., the female sternite 8 is rounded, but in *H. chilensis*, the edge is not fringed with long wispy setae, and the acanthophorite spines are robust.

Distribution. Known from Chile (Biobío Region (Concepción Province) and Coquimbo Region (Elqui Province)).

***Heteromphrale cyanops* (Edwards)**

Figures 3, 4E–F, 5E–F, 8, 9G–I, 10C

Pseudomphrale cyanops Edwards 1932: 259. – Kröber 1937: 212; Hardy 1966: 2.
Heteromphrale cyanops (Edwards) – Kelsey 1969: 286.

Type material. Holotype male, URUGUAY: Montevideo, 21.i.1927, F. & M. Edwards (MEI165200). (BMNH) (excellent condition).

Other material examined. ARGENTINA: **Catamarca Province:** 50 km W Andalgalá, 31.X.1972, G.E. Bohart [1 male (UCDC)]; Andalgalá, 4.XI.1972, G.E. Bohart, *Prosopis alba* [1 male (UCDC)]; 28 km SE Tinogasta, 1100 m, -28.2450° -67.4557°, 17.X.1997, M.E. Irwin, F.D. Parker & S. Roig, ex. inland dunes [4 males (CSCA)]. **La Rioja Province:** Departamento Famatina, 12 km N Pituil, 4135 ft. [1260 m], -28.5151° -67.3389°, 15.X.1997, M.E. Irwin, F.D. Parker & S. Roig, ex. Malaise trap [1 female (CASC), 1 female (CSCA)], ex. leaves of *Prosopis* tree [1 male (CASC)], 20.X.1997, ex. leaves of *Prosopis* tree [1 female (CASC)]. 16 km NE Pagancillo, Route 18, 28.XI.1976, ex. sweeping *Prosopis chilensis* [2 males (USNM)]. **Mendoza Province:** Departamento de Levalle, 20 km N Parque Telteca, -32.2916° -67.3878°, 10.x.1997, M.E. Irwin, F.D. Parker, S. Roig, ex. *Cercidium* blooms in sandy area [1 male (CASC)]. **Salta Province:** 10 km S Cafayete, 1644 m, -26°09.05' -65°57.31', 22–26.X.2003, M.E. Irwin & F.D. Parker, ex. Malaise trap in *Prosopis*-covered dunes [1 female (CASC), 1 female (CSCA)]. **Tucuman Province:** 8 km NW Amaichá del Valle, 1847 m, -26°32.35' -65°58.37', 22–25.X.2003, M.E. Irwin & F.D. Parker, ex. Malaise trap in ravine [1 female (CASC)].

Diagnosis. Antennal flagellum brown, conical and evenly tapered distally; mouthparts normal, nearly filling oral cavity; scutum without glabrous dorsocentral patches; wing with vein R_4 diverging from vein R_5 at point in basal quarter of cell r_5 ; abdomen

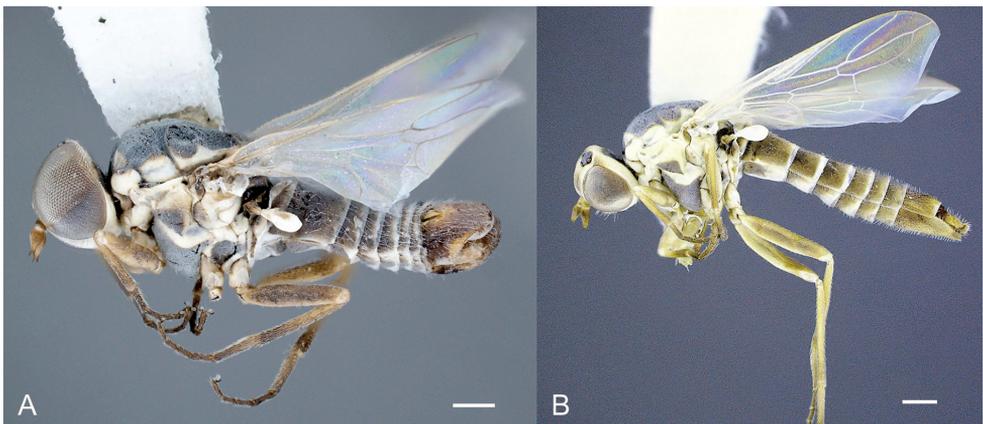


Figure 8. *Heteromphrale cyanops* (Edwards): **A** male, lateral view [579941] **B** female, lateral view [579934]. Scale line = 0.25 mm.



Figure 9. *Heteromphrale* spp., female terminalia: *H. blanca* sp. n.: **A** dorsal view [579915] **B** lateral view [579916] **C** ventral view [579917]; *H. chilensis* (Kröber): **D** dorsal view [579926] **E** lateral view [579927] **F** ventral view [579928]; *H. cyanops* (Edwards): **G** dorsal view [579936] **H** lateral view [579937] **I** ventral view [579938]. Scale line = 0.25 mm.

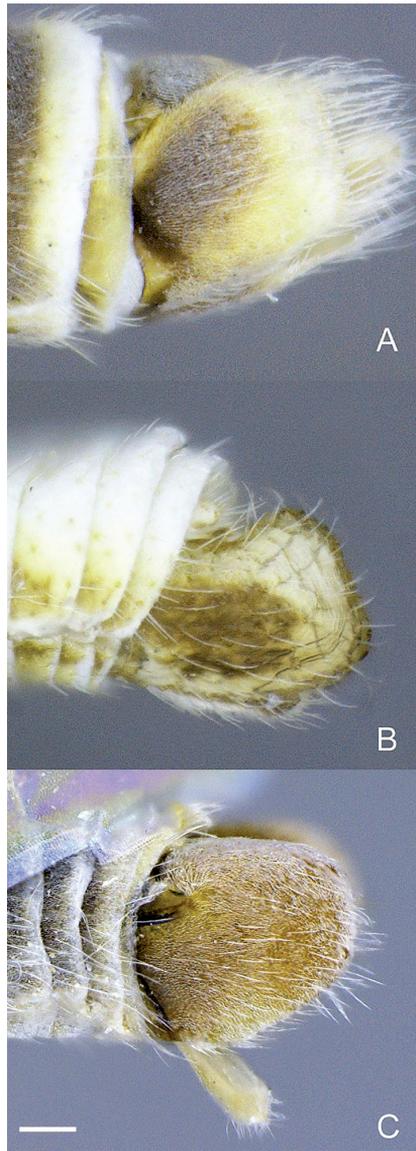


Figure 10. *Heteromphrale* spp., male terminalia: **A** *H. blanca* sp. n., lateral view [579922] **B** *H. chilensis* (Kröber), lateral view [579930] **C** *H. cyanops* (Edwards), lateral view [579940]. Scale line = 0.25 mm.

dark with pale posterior band on tergites 2–5; tergite 2 sensory patch relatively small, as single narrowed patch; male epandrium relatively large and bulbous, without distinctive white setal fringe along posterior margin; hypandrium small, lobes irregular; distiphallus arms parallel; lateral aedeagal bulb relatively large; female sternite 8 shallowly emarginate posteriorly, without fringing elongate setae; acanthophorite spines short and stout.

Redescription. Body length: 2.5–3.5 mm [male], 3.0–4.0 mm [female]. *Head* (Figs 4E–F, 5E–F). Frons, parafacial, face and gena cream-white to yellow (in female, with tan suffusion on frons, with median furrow), sparsely distributed with small, pale setae; ocellar triangle grey pubescent, slightly raised, with anterior ocellus slightly larger than posterior ocellus occiput and postgena dark, pale marginally with yellow suffusion; face white; mouthparts pale yellow, including labellum, labellar setae, and small cylindrical palpus; prementum pale yellow to slightly darker yellow; antennae with flagellum brown, evenly tapered; scape and pedicel pale brown-orange with a few minute pale setae. *Thorax* (Figs 5E–F, 8). Scutum black to grey, cream-white to yellow areas on postpronotal lobe, anterior part of scutum adjacent to postpronotum, notopleuron, supra-alar area and postalar callus with slightly darker, thin, median stripe (more extensive in female in these areas, and additionally with yellow medially on posterior part of scutum, and a slight medial brownish mark extending from scutellum); thorax mostly overlain with dense glaucous pubescence; scutum largely without setae, some present on postpronotal lobe, anepisternum and katepisternum; scutellum dark medially, pale marginally; prosternum yellow, bare; proepisternum and proepimeron yellow, sometimes slightly darker on posterior part; anepisternum yellow in dorsal half and along posterior margin, grey pubescent anteroventrally; katepisternum grey pubescent, except yellow along entire dorsal margin; anepimeron yellow, usually with some grey pubescence anteriorly; meron grey pubescent, except yellow dorsally; coxae light brown; legs pale cream with uniform brown suffusion; basitarsi orange with slightly darker distal tip, and remaining tarsomeres dark orange. *Wing*. Venation pale yellow; vein R_4 diverging from R_5 at point in basal quarter of r_5 ; haltere with stem mostly brown, distal part of stem and entire knob white. *Abdomen* (Fig. 8). Tergites dark brown pubescence with pale white band posteriorly; with pale setae, longer laterally; tergite 2 sensory patch small and inconspicuous, as single small, brown narrow patch, completely encompassed within dark brown pubescence; sternites white posteriorly, dark brown anteriorly and laterally; with sparse short pale setae. *Male genitalia* (Figs 3, 10C). Epandrium robust, globose, dark orange, with sparse, small white setae; hypandrium lobes small, membranous, sub-triangular, each with two lobes directed posteromedially; gonocoxite with large, darkly sclerotized, anvil-like dorsal process; gonostylus complex, apparently fused to gonocoxites, outer lobe L-shaped with posteriorly directed margin fringed with setae, inner lobe triangular and fused medially; gonocoxal apodeme broadly flattened, and curved medially; ejaculatory apodeme relatively elongate, directed anteriorly; lateral aedeagal bulbs large; ventral apodeme dark sclerotized; distiphallus parallel, ventrally directed towards apex. *Female genitalia* (Fig. 9G–I). Sternite 8 with posterior edge weakly emarginate, margin thin; acanthophorite spines stout.

Comments. *Heteromphrale cyanops* was originally described in the genus *Pseudomphrale* by Edwards (1932) based on a single male specimen from Uruguay. Edwards (1932) noted that the specimen was taken in a sandy spot near the shore, and also noted that the eye in life was deep blue in color; this eye color is retained in some specimens. Kelsey (1969) subsequently transferred the species to *Heteromphrale*. *Heteromphrale cyanops* is very similar to *H. blanca* sp. n. in overall body coloration, but is

easily distinguished from both other species of *Heteromphrale* by the greatly enlarged, bulbous epandrium in the male, the shallowly emarginate posterior edge of sternite 8 in the female, and by the tergite 2 sensory patch being a relatively small, singular, narrowed patch.

Distribution. Known from Argentina (Catamarca, La Rioja, Mendoza, Salta and Tucuman Provinces) and Uruguay (Montevideo Department).

Acknowledgements

Thanks are extended to Frank Menzel (DEI) and Erica McAllister (BMNH), for their assistance with examining types, and to Mike Irwin (Illinois Natural History Survey, Urbana, Illinois, USA), Lynn Kimsey (UCDC) and Norman Woodley (USNM) for loans and access to specimens. This paper is based upon work supported by the National Science Foundation under DEB Award Number 0614213. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of NSF.

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Review of the Palaearctic members of the *Lispe tentaculata* species-group (Diptera, Muscidae): revised key, synonymy and notes on ecology

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Academic editor: Martin Hauser | Received 20 December 2010 | Accepted 23 February 2011 | Published 1 March 2011

Citation: Vikhrev N (2011) Review of the Palaearctic members of the *Lispe tentaculata* species-group (Diptera, Muscidae): revised key, synonymy and notes on ecology. ZooKeys 84: 59–70. doi: 10.3897/zookeys.84.819

Abstract

The taxonomic reasons for regarding *L. draperi* Séguéy, 1933, **sp. rev.**, as a valid species instead of a synonym of *L. tentaculata* (De Geer, 1776) and for treating *L. quaerens* Villeneuve, 1936, **syn. n.**, as a junior synonym of *L. sericipalpis* Stein, 1904 are given. A revised key for the Palaearctic members of the *Lispe tentaculata* species-group is given. Data on ecology, distribution and feeding preferences are provided.

Keywords

Lispe tentaculata, *Lispe consanguinea*, *Lispe draperi*, *Lispe sericipalpis*, *Lispe orientalis*, *Lispe quaerens*, Muscidae, Diptera, key, Palaearctica, new synonym

Introduction

The *Lispe tentaculata* species-group was proposed by Hennig (1960) and is characterized by the meron setulose above hind coxa and the following leg chaetotaxy: *t1* without setae; *t2* only with *p*-seta, without *ad* or *av*, *t3* with 1 *ad* and 1 weak *pd*, without *av*.

Currently eight species are placed in the *Lispe tentaculata* species-group, six of which are present in the Palaearctic region. The taxonomic status of *Lispe alpinicola* Zhong, Wu & Fan, 1981 has not yet been settled (see below). *Lispe sericipalpis* Stein, 1904 and *L. orientalis* Wiedemann, 1824 are also distributed in the Oriental region. *Lispe tentaculata* (De Geer, 1776) is recorded from the very north of the Oriental

region and widespread in Nearctic. Two more species of this group are found in the Nearctic region.

Material and methods

The majority of the specimens studied are in the Zoological Museum of Moscow University (not indicated in text). Other material is in Natural History Museum, London (BMNH), Zoological Institute, St Petersburg (ZIN), Zoologisch Museum, Universiteit van Amsterdam (ZMAN).

The following abbreviations for morphological structures are used: *f1*, *t1*, *f2*, *t2*, *f3*, *t3* = fore-, mid-, hind- femur or tibia; *ac* = acrostichal setae; *dc* = dorsocentral setae; *a*, *p*, *d*, *v* = anterior, posterior, dorsal, ventral seta(e); *prst* – presutural, *post* - postsutural.

Here I suggest a new abbreviation for the tarsi as *tar* followed by a pair of digits separated by a hyphen: the first digit (1 to 3) gives the leg number and the second digit (1 to 5) the number of the tarsal segment. For example, *tar1-4* = 4-th segment of fore tarsus; *tar3-1* = hind basitarsus.

Identification key for Palearctic species of the *Lispe tentaculata* species-group

- | | | |
|---|--|---|
| 1 | Males..... | 2 |
| – | Females..... | 6 |
| 2 | Fore tarsus modified: <i>tar1-1</i> yellow to dark, <i>tar1-2</i> to <i>tar1-4</i> yellow, <i>tar1-5</i> black; <i>tar1-1</i> half as long as <i>tar1-2</i> , with a dense row of brush-like <i>av</i> setulae and on posterior side with a finger-like yellow process with black apex, this process reaching middle of <i>tar1-2</i> ; <i>tar1-2</i> projecting ventrally. Male cercal plate as Fig. 1..... | 3 |
| – | Fore tarsus unmodified. Male cercal plate as Fig. 3..... | 5 |
| 3 | Median third of <i>f3</i> with 2–5 <i>av</i> setae 1.5–2 times longer than femoral width. <i>tar3-1</i> shortened (slightly more than one third as long as <i>t3</i>); ventral median part of <i>tar3-1</i> concave; basal 1/3 of <i>tar3-1</i> with a brush of ventral hairs contrasting with shorter hairs in apical 2/3. Scutellum with some fine hairs below at apex (these hairs may be invisible in old specimens). Cercal plate with 2 pairs of projections apically, distinctly longer than wide (Fig. 1.2). 3 strong <i>post dc</i> setae..... | 4 |
| – | Median 1/3 of <i>f3</i> without long <i>av</i> setae (though in basal 1/3 of <i>f3</i> with 3–4 <i>av</i> subequal to femoral width). <i>tar3-1</i> straight, not curved or concave, <i>tar3-1</i> longer (slightly less than half as long as <i>t3</i>); ventral hairs on <i>tar3-1</i> of uniform length. Scutellum bare below at apex and bare at apex laterally below apical scutellar bristles. Cercal plate with only 1 pair of projections apically, almost as wide as long (Fig. 1.1). Usually 4 <i>post dc</i> setae, anterior 2 <i>post</i> pairs short | |

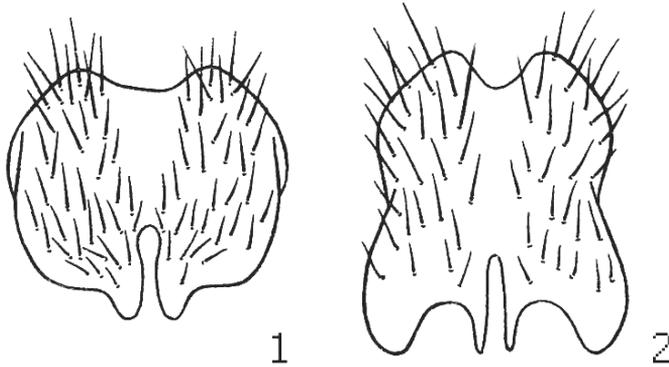


Figure 1. Male cercal plates. **1** *L. consanguinea* Loew **2** *L. tentaculata* (De Geer) (from Hennig, 1960).

- and fine (but sometimes 3 strong *post dc* as in *tentaculata*!). Palearctic, temperate zone..... ***consanguinea* Loew**
- 4 Male sternite 5 as in Fig. 2.1. Tibiae dark, yellow only at basal fifth. Median 1/3 of *fβ* with 3–5 *av* setae. Basal 1/3 of *fβ* with 3–4 *av* setae subequal to femoral width. Holarctic..... ***tentaculata* (De Geer)**
- Male sternite 5 as in Fig. 2.2. At least *t2* yellow in ground colour, more or less grey dusted, usually both *t2* and *t3* entirely yellow. Median 1/3 of *fβ* with 2–3 *av* setae. Basal 1/3 of *fβ* with 0–2 *av* setae subequal to femoral width. North Africa..... ***draperi* Séguy**
- 5 Palpi black. *f2* with 2–7 fine *pv* setae in basal 1/3. *fβ* with a long *v-pv* seta at base, 1–4 *av* setae in apical 2/5 and at most with a sparse row of 7–8 *pv*. *tar1-2* and *tar1-3* ventrally dark like the rest of fore tarsus. Presutural *ac* in 4–5 irregular rows. Dusting greyish. Length 5–6mm. Male terminalia – Figs 3.3, 4. Southern Palearctic and Oriental ***sericipalpis* Stein**
- Palpi yellow to brownish. *f2* with a full and dense row of 20–30 *pv* setae and full row of about 20 *av* (in both rows, setae long in basal half and short in apical half). *fβ* with full rows of about 15 *av* and *pv* setae, the longest setae beyond middle twice as long as femoral width (long *v-pv* seta at base of *fβ* also present, but not as conspicuous among other setae). *tar1-2* and *tar1-3* yellow ventrally. Presutural *ac* in 6–7 irregular rows. Dusting brownish. Length 6.5–7.5mm. Male terminalia – Figs 3.1, 2. Southern Palearctic and Oriental ***orientalis* Wiedemann**
- 6 Only posterior pair of *prst dc* present. Presutural *ac* hairs weak and short, arranged in 5–7 irregular rows **7**
- Both pairs of *prst dc* present. Presutural *ac* hairs stronger, arranged in 3–4 rows **8**
- 7 Palpi black (blackish brown in specimens collected 50–100 years ago). Presutural *ac* hairs in 5 rows. *fβ* without *av* setae in basal 3/5. Length 5–6mm..... ***sericipalpis* Stein**

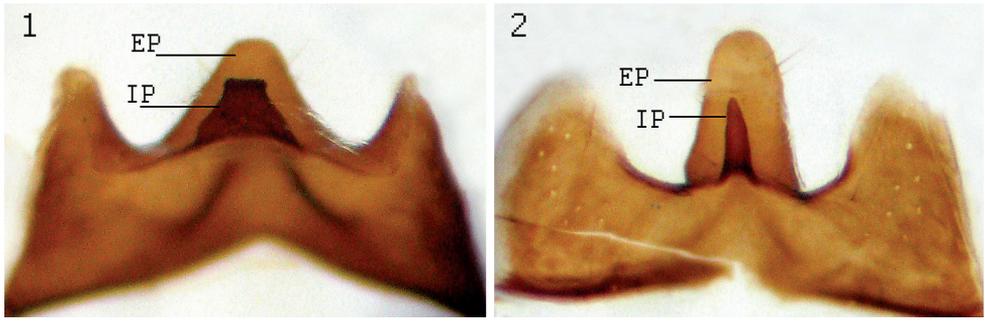


Figure 2. Male sternite 5, view from inner side. **1** *L. tentaculata* (De Geer) **2** *L. draperi* Séguay; **EP** external median process **IP** internal median process.

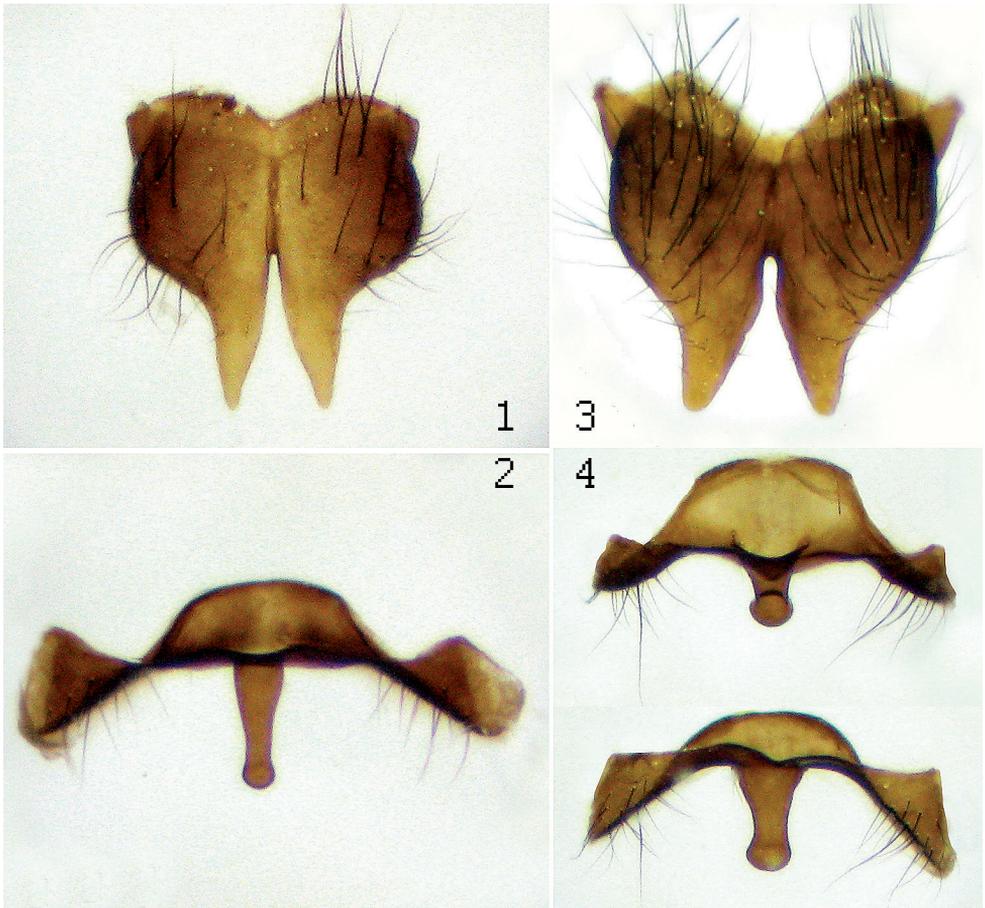


Figure 3. Male terminalia. **1, 2** *L. sericipalpis* Stein, **1** cercal plate **2** sternite 5; **3, 4** *L. orientalis* Wiedemann, **3** cercal plate **4** sternite 5 (from two points of view).

In *L. sericipalpis* the cercal plate is more pointed, sternite 5 has the median process thinner and longer.

- Palpi yellow to light brown. Presutural *ac* hairs in 6–7 rows. $f\beta$ with a row of 7–9 *av* in basal 3/5. Length 6–7mm ***orientalis* Wiedemann**
- 8 Scutum with a median pruinose patch between 2-nd and 3-rd *post dc* setae; 4 strong *post dc* setae, 2nd and 3rd *post dc* closely approximated. (Scutellum with some fine hairs below at apex) **9**
- Scutum without median pruinose patch between 2-nd and 3-rd *post dc* setae; 3 strong *post dc* setae or only 2 strong *post dc* (and 1–2 weak anterior *post dc*), closely approximated strong *post dc* absent **10**
- 9 Tibiae dark, only knees yellow. $f\beta$ usually with 2–3 long submedian *av*; basal 1/3 of $f\beta$ with 1–4 *av* subequal to $f\beta$ width ***tentaculata* (De Geer)**
- *t2* at least in basal half yellow in ground colour, more or less dusted, usually both *t2* and *t3* entirely yellow. $f\beta$ usually with only 1 long submedian *av*; basal 1/3 of $f\beta$ with 0–3 *av* hardly longer than half $f\beta$ width ***draperi* Séguéy**
- 10 Scutellum bare below at apex. *t2* and *t3* yellow, more or less dusted. 2+4 *dc*, but the anterior 2 *post* pairs short and fine. $f\beta$ in median 1/3 without *av* 1.5–2 times longer than femoral width (but 1–3 *av* setae subequal to $f\beta$ width present at basal 1/3 of $f\beta$) ***consanguinea* Loew**
- Scutellum with some fine hairs below at apex (these hairs often invisible on old specimens). 2+3 *dc*, all strong. $f\beta$ in median 1/3 with 1–3 *av* 1.5–2 times longer than $f\beta$ width (females with male chaetotaxy of scutum) ***tentaculata* (De Geer)**

Taxonomic notes

Lispe alpinicola Zhong, Wu & Fan, 1981

Remarks. Described from Lhasa (China, 3500–4000 m asl.). Male fore and hind basitarsus modified as in *L. tentaculata*, female scutum with a pruinose patch as in *L. tentaculata* (Xue & Dong, 2005), male cercal plate similar to *L. tentaculata* (Xue & Chao, 1998). According to Xue and Dong (2005), males of *L. alpinicola* may be separated by the presence of a *p*-seta on *t1* and 3 *pd* setae on *t2*. It is difficult to give any opinion on this species without making a personal examination of specimens, but I have some doubts about the validity of this species. Among the rich *tentaculata* material examined, there were no specimens with both *p*-seta on *t1* and 3 *pd* setae on *t2*, but separately the presence of these setae was recorded. Several specimens from the north of Russia have a *p*-seta on *t1*. The male from Mongolia (about 2000 m asl.) has 2 *pd* setae on each mid tibia, and what is more these setae are placed differently on the left and right tibiae. See also remarks on *L. tentaculata*. For these reasons I have not included *L. alpinicola* in the identification key.

***Lispe consanguinea* Loew, 1858**

Material examined. Over 130 specimens. **Moldova; Russia (European):** Arkhangelsk reg., Chuvashia, Krasnodar reg., Moscow reg., Tver reg., Nizhnyi Novgorod reg., Vologda reg., Ulyanovsk reg.; **Mongolia; Russia (Asian):** Amur reg., Khanty-Mansi reg., Krasnoyarsk reg., Kurgan reg., Novosibirsk reg., Primorsky Kray; **Tajikistan:** Dushanbe; **Turkey:** Sakarya prov., Zonguldak prov.

***Lispe draperi* Séguy, 1933, sp. rev.**

Lispe draperi Séguy 1933: 122. Fig. 11–13.

Lispe tentaculata ssp. *draperi* Canzoneri and Meneghini 1966: 115.

Material examined. Morocco: east of Marrakech, 1400m, stones on river bank, 22.III.2009, N.Vikhrev, 1♀; west of Marrakech, Oued Nfiss, stones on river bank, 23.III.2009, N.Vikhrev, 2♂♂, 5♀♀; near Essaouira, stones on river bank and pond/pool silt, 24–29.III.2009, N.Vikhrev, 11♂♂, 4♀♀.

Remarks. The conspecificity of the material listed above with type of *L. draperi* Séguy was kindly confirmed by A.C. Pont (pers. comm.) who examined the holotype of *L. draperi* in the Muséum national d'Histoire naturelle, Paris. Hennig (1960: 430) examined the type of this species and provisionally maintained it as a good species although he considered that the type might be an aberrant specimen of *L. tentaculata*. Canzoneri and Meneghini (1966) suggested that *L. draperi* is North African yellowish-legged subspecies of *L. tentaculata* but the species was sunk as a synonym of *L. tentaculata* by Pont (1986). This decision could be supported by the fact that the male cercal plate is similar to that of *L. tentaculata*. However, more careful examination shows that the structure of male terminalia differs and it is especially obvious in the structure of sternite 5 (Fig. 2). *L. draperi* should therefore be restored as a valid species, although closely related to *L. tentaculata*. I examined the sternite 5 of *L. tentaculata* collected in the Netherlands, Moscow region, Krasnodarsky Kray, Primorsky Kray (Russian Far East) and high in the Pamir mountains (Tajikistan, Gorno-Badakhshan, 3800 m asl.) and found it to be identical in all cases but different from that in Moroccan *L. draperi*.

***Lispe orientalis* Wiedemann, 1824**

Material examined. Azerbaijan: Lenkoran env., 38.66°N 48.79°E, 22–25.X.2008, N.Vikhrev, 16♂♂, 6♀♀.

India: Rajasthan, Jaipur, 21.II. 2011, N.Vikhrev, 1♂, 1♀.

Russia: Krasnodarsky Kray, Sochi env., 43.547°N 39.811°E, 29.IX–24.X.2010, D.Gavryushin, 4♂♂; Primorsky Kray, 42.86°N 133.62°E, 18.IX.1987, A.Ozerov, 1♂.

Tajikistan: Khatlon div., Farkhor (=Parkhar) env., 37.420°N 69.352°E, 07.VI.2010, K.Tomkovich, 7♂♂, 5♀♀; Khatlon div., Kulob, 37.909°N 69.784°E, 07.VI.2010, K.Tomkovich, 19♂♂, 22♀♀.

Thailand: Mae Hong Son prov., 19.57N 98.28E, 650m asl., 21.XI.2010, N.Vikhrev, 1♂.

Turkey: Izmir prov., Dilek Milli Park, 37.68°N 27.10°E, 20.XII.2006, N.Vikhrev, 1♀; Antalia prov., Sillion ruins, 36.989°N 30.985°E, goat drinking bowl, 25.V.2008, N.Vikhrev, 1♂, 1♀; Hatay prov., Arzus env., 36.407°N 35.886°E, 14.IV.2010, N.Vikhrev, 8♂♂, 2♀♀; Hatay prov., Samandag env., Çivlek, 17.IV.2010, N.Vikhrev, 6♂♂.

S. Korea: Seoul env., 31.VII.1938, Zhenzhurist, 5♀♀.

Lispe sericipalpis Stein, 1904

Fig. 4

Lispe sericipalpis Stein 1904: 110

Lispe quaerens Villeneuve 1936: 157, syn. n.

Material examined. Lectotype male of *sericipalpis* – male (Fig. 4), paralectotypes 1♂, 4♀♀ (ZMAN).

Azerbaijan: Lenkoran reg., 38.65°N 48.80°E, 25.V.2009, K.Tomkovich, 1♀.

Myanmar: Shan state, Inle Lake env., 20.664°N 96.966°E, 26–30.XI.2009, N.Vikhrev, 4♂♂, 2♀♀; Kakaw env., 20.64°N 96.59°E, 03.XII.2009, N.Vikhrev, 45♂♂, 3♀♀.

Nepal: Solukhumbu distr., Janbesi env., 27.581°N 86.548°E, 2660m asl., 19.III.2010, A.Reshchikov, 2♂♂, 2♀♀.

Tajikistan: Dushanbe division, Ramit env. (38.72N 69.32E), river bank, 15–16.VI.2010, K.Tomkovich, 17♂♂, 30♀♀; Dushanbe env., 13.V.1943, A.Stackelberg, 1♂ (with handwritten label by W.Hennig “*L. quaerens*”) (ZIN); Varzob Canyon, 28–29.VII.1939, L.Zimin, 4♀♀ (ZIN); Varzob Canyon, 04.VII.1937, A.Gussakovsky, 1♂ (ZIN).

Turkey: Antalia prov., Köprü River, 37.075°N 31.232°E, 06–10.IX.2009, N.Vikhrev, 40♂♂, 29♀♀ (3♂♂, 2♀♀ deposited in BMNH); Mersin prov., 37.194°N 34.810°E, forest stream, 23.IV.2010, N.Vikhrev, 1♀; Bolu prov., 40.498°N 31.890°E, forest stream, 1800m asl., 31.VIII.2009, N.Vikhrev, 1♂; Sarakya prov., Karasu env., 41.03°N 30.79°E, forest stream, 15.VI.2010, N.Vikhrev, 1♀, 28.VIII.2009, N.Vikhrev, 1♂, 1♀; Zonguldak prov., Alaply env., 41.14°N 31.36°E, forest stream, 21.VI.2010, N.Vikhrev, 3♂♂, 2♀♀.

Remarks. Male. Ground colour black. Pollinosity grey, but may be yellowish-grey. Palpus black(ish), but becoming brown in old specimens. Fronto-orbital plate and parafacial whitish, rarely yellowish. Scutum with 3 brown vittae along *ac* and *dc* rows, submedian (*dc*) vittae sometimes almost indistinct. *dc* 2(1) + 4 (rarely 3), as: presutural:



Figure 4. *L. sericipalpis* Stein, male lectotype (designated by Pont, 1970). Photo by Joke van Erkelens.

weak to hardly distinct, medium; postsutural: weak, weak, strong, strong. Presutural *ac* in 4–5 irregular rows. Legs dark. *f2* with several (2–7) fine *pv*-setae in basal 1/3, the longest one (1.5 times as long as femoral width) at base. *f3* at base with long (1.5–2 times as long as femoral width) and fine characteristic seta in *v-pv* position. Other setae on *f3* variable: several *av*-setae present in apical third or slightly more, 1–3 among them longer, from as long as femoral width to twice as long; *pv* row may consist of 7–8 setae of which 2–3 are as long as femoral width, or may be reduced to 1–2 hardly distinct *pv* at base; sometimes chaetotaxy of *f3* differs on right and left legs of the same specimen. Abdomen whitish-grey to yellowish-grey dusted, with paired L-shaped, more or less extensive dark spots on tergites 3 to 5, divided by dusted median vitta. Female differs from male as follows: parafacial more often yellowish; *dc* 1+4(3), anterior *prst dc* always absent; *v-pv* seta at base of *f3* shorter to reduced; other ventral setae on *f2* and *f3* shorter or reduced.

The type locality of *L. sericipalpis* is Indonesia, Java. The species has also been recorded from other Indonesian islands (Bali, Sumatra), Taiwan, Vietnam, Thailand, Myanmar, Sri Lanka, India, Pakistan, Nepal. The type locality of *L. quaerens* is Turkey, Akshehir prov. This species, as interpreted by Hennig (1960: 453) who studied the holotype, has also been recorded from Spain, Italy, Croatia, several provinces of Turkey, Azerbaijan, Tajikistan and China. Thus, there appears to be no geographic gap between the natural habitats of *L. sericipalpis* and *L. quaerens*, but the former, known as an Oriental species, has never been compared with the latter, regarded as a Palearctic species. The examined series from Turkey and Tajikistan (some specimens were identified by Hennig, 1960: 453) had been assigned to *L. quaerens*, whereas the series from the

Oriental region (Myanmar) had been assigned to *L. sericipalpis*. I came to conclusion that all the material listed above (Azerbaijan, Myanmar, Nepal, Tajikistan and Turkey) is conspecific with type series of *L. sericipalpis*. The terminalia of males from Turkey, Tajikistan, Nepal and Myanmar are similar. Oriental specimens have the dark abdominal patterns more extensive, especially so on tergite 3. Stein's type series has the *av* setae on *f*₃ longer and more numerous in males, but all these characters may be found in some Palearctic specimens too.

Hennig (1960: 409) mentioned the possibility that *L. quaerens* could be a subspecies of *L. orientalis*. I am sure it is not - *L. sericipalpis* (= *L. quaerens*) is closely related to *L. orientalis*, but the two can be reliably separated, even as females (see key). In addition to morphological characters, there is a clear difference in ecology between these species (see below).

***Lispe tentaculata* (De Geer, 1776)**

Material examined. Over 350 specimens from a vast territory from the Iberian to Kamchatka Peninsulas.

Europe: Greece; Latvia; Portugal; Russia (European): Arkhangelsk, Chuvashia, Komi, Krasnodar, Kursk, Moscow, Murmansk, N. Ossetia, Nizhnyi Novgorod, Tula, Vladimir, Ulyanovsk; **the Netherlands; Ukraine.**

Asia: Abkhazia; Armenia; Azerbaijan; Kazakhstan: Almaty; **Mongolia:** Uvs prov.; **Russia (Asian):** Altai, Amur reg., Kamchatka, Khanty-Mansi reg., Krasnoyarsk reg., Magadan reg., Omsk reg., Primorsky Krai, Sakha (Yakutia) reg., Tyumen reg., Yamalo-Nenets reg.; **Tajikistan:** Dushanbe div., Khatlon div., Gorno-Badakhshan div.; **Turkmenistan:** Ahal, Mary; **Turkey (Asian):** Adana prov., Ankara prov., Antalya prov., Bolu prov., Duzce prov., Hatay prov., Isparta prov., Izmir prov., Kayseri prov., Konya prov., Mersin prov., Sakarya prov., Zonguldak prov.; **Uzbekistan:** Tashkent.

Remarks. *L. tentaculata* has a variable *t*₃ chaetotaxy: besides the normal strong *ad* and short *pd* setae, an additional seta just below the strong *ad* but in a more *a*-position is often present and sometimes a second strong *ad* and a short *pd* may also be present. About 5% of females have a male-like scutum: with only 3 strong *post dc* and without a pruinose patch on the scutum.

Distribution and ecology

L. tentaculata is a very common species across its natural habitat. The northernmost specimens were collected near Murmansk (forest-tundra at 69°N) and Vorkuta (tundra at 67.5°N), where this species was found on boulders on river banks and was the only *Lispe* species recorded at these places. In southern Turkey at 36°N *L. tentaculata* was common again on boulders in streams and, in springtime, at various muddy places such as temporary pools. In temperate conditions of the East European Plain *L. ten-*

tentaculata is absent from small forest streams and is infrequent on the sandy banks of big rivers but is common on the mud ponds and small lakes. Both in temperate and southern habitats *L. tentaculata* distinctly avoids a salty mud where it is replaced by species from the *Lispe caesia*-group and the *Lispe palposa*-group. *L. tentaculata* is common in high mountain areas where it prefers boulders along the shores of mountain lakes; the series from Gorno-Badakhshan in Tajikistan was collected at 3800 m asl.

L. draperi was observed in Morocco in late March and seems to have an ecology similar to *L. tentaculata*.

L. consanguinea clearly prefers narrow sandy bands along the banks of big rivers. In this habitat *L. consanguinea* is the dominant species in the temperate zone, whereas *L. tentaculata* is uncommon. I had never collected *L. consanguinea* in localities north of the Arctic Circle, but on sandy banks of the Vychegda River at 61.3°N 46.9°E this species was very common. The most southern records are Tajikistan (Dushanbe env., 1 specimen) and N. Turkey (2 specimens among numerous *L. tentaculata*).

L. sericipalpis (Fig. 5.1) may be found on boulders on the banks of rapid streams together with *L. tentaculata*. In N. Turkey this species is uncommon, whilst in S. Turkey *L. sericipalpis* is absent in spring time (late April), but becomes about as common as *L. tentaculata* in September. In Myanmar *L. sericipalpis* was absent in tree-shaded parts of streams, but was found in sunny sites at altitudes of 1100–1300 m asl.

The ecology of *L. orientalis* (Fig. 5.2) is rather unusual: it is a species of dirty, organically-polluted water. *L. orientalis* was collected in Krasnodarsky Kray (Russia) and Antalya prov. (Turkey) around drinking bowls at pools polluted by cattle dung, in Tajikistan (Farkhor) at a very dirty irrigation ditch inside the town and at pools around this ditch polluted by refuse and even carrion, and in Hatay prov. (Turkey) at a strongly dung-polluted pool under a cattle shed.

In Azerbaijan, in late October, I observed *L. orientalis* during cold and bad weather, when it rained every day and usually all day long. In such conditions most flies appeared only after several hours without rain, while during the rain the only active dipteran was *L. orientalis* which hunted Diptera larvae on a wet chicken dunghill. It seems that *L. orientalis* has adapted to endure the rain and to keep on hunting because the larvae have to move up to the surface of the chicken manure and thus the prey becomes more accessible to the predator. In contrast to the related *L. sericipalpis*, *L. orientalis* prefers stagnant water. Only once near Çivlek (Turkey, Hatay prov.), I found *L. orientalis* by a rapid stream but shortly afterwards found a cattle shed in 50 metres upstream, which explained the presence of this species.

L. orientalis was regarded as an Oriental species, but the records listed above show that it is widespread in the South Palearctic and rather uncommon in the Oriental region where, for example, my dedicated *Lispe* collecting in Thailand made over several years has yielded only a single specimen of *L. orientalis*. The record from European Russia (Krasnodarsky Kray, vicinity of Sochi) is the northernmost one (43.4°N) and the first record for Europe, but I suspect that *L. orientalis* may be found in other European countries, being overlooked due to its omission from the keys for European *Lispe*.

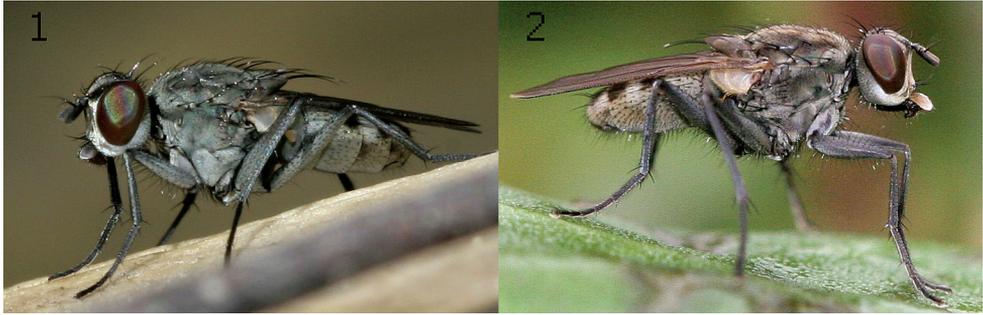


Figure 5. 1 *L. sericipalpis* Stein, male (Turkey, Antalya) 2 *L. orientalis* Wiedemann, male (Azerbaijan).

Feeding

It is well known that all *Lispe* are predators (e.g. Werner and Pont 2006). Actually there are two poles of this behaviour. Some species are skilful hunters of active Diptera, like Dolichopodidae, Ephydriidae, Muscidae or Scathophagidae. Such a hunting style is typical for the *Lispe caesia* species-group (note that the characteristic ventral spines on *f1* and *f2* serve to grip the prey), another example is the Oriental *Lispe geniseta* Stein, 1909 which usually hunts on *Musca* on the cattle dung in pastures. The other type is feeding on invertebrate carrion, and a typical example is the Oriental *Lispe binotata* Becker, 1914 which sucks dead Arthropoda from forest streams, usually ants and spiders. Species of the *Lispe tentaculata* group represent an intermediate type as they feed either on dead insects (Fig. 6) or on living prey, but in the later case the prey is usually an insect larvae and less often slow moving imago of a group such as Chironomidae.



Figure 6. *L. draperi* Séguy, male feeding on a dead Corixidae bug (Morocco, Essaouira).

Acknowledgements

I thank Adrian Pont (Oxford) for his invaluable help. Due to the kind help of Dutch colleagues Ben Brugge, Joke van Erkelens and Gerard Pennards (Amsterdam) I was able to examine type material of *L. sericipalpis*. I thank Oleg Kosterin (Novosibirsk) and Paul Beuk (Maastricht) who suggested several useful corrections.

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