ZooKeys 112: 1–19 (2011)
doi: 10.3897/zookeys.112.947
www.zookeys.org

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Taxonomic review of the *postica*-group of *Fannia* Robineau-Desvoidy (Diptera, Fanniidae) from China, with the description of one new species

Ming-fu Wang[1,†], Kai Li[2,‡], Dong Zhang[1,2,§]

1 *Institute of Entomology, Shenyang Normal University, Shenyang 110034, Liaoning, P. R. China* **2** *College of Biological Sciences and Biotechnology, Beijing Forestry University, Beijing 100083, P. R. China*

† *urn:lsid:zoobank.org:author:6A204B2F-51D5-4476-A32B-47898ADAC8CC*
‡ *urn:lsid:zoobank.org:author:12117AA6-F556-4395-BB74-2344E20E9BBC*
§ *urn:lsid:zoobank.org:author:EFF289EA-68B9-4E40-9AA6-8F4167C7E78E*

Corresponding author: Ming-fu Wang (wangmingfu403@163.com), *Dong Zhang* (ernest8445@163.com)

Academic editor: *Torsten Dikow* | Received 25 January 2011 | Accepted 18 May 2011 | Published 24 June 2011

urn:lsid:zoobank.org:pub:466F28DE-A876-44D5-9D9A-18D366E98B60

Citation: Wang M, Li K, Zhang D (2011) Taxonomic review of the *postica*-group of *Fannia* Robineau-Desvoidy (Diptera, Fanniidae) from China, with the description of one new species. ZooKeys 112: 1–19. doi: 10.3897/zookeys.112.947

Abstract

The Chinese fauna of the *Fannia postica*-group Chillcott (1961) is reviewed, the diagnostic features of this group are redefined, one new species, *Fannia nudifemorata* **sp. n.**, is described, and a key to the males of nine known species is given. One new junior synonym, *F. tigripeda* Xue, Wang & Li, **syn. n.** for *F. stigi* Rognes is established. To facilitate comparisons of the species, *Fannia aethiops* Malloch, *F. ardua* Nishida, *F. discoculea* Xue, *F. ringdahlana* Collin, *F. postica* (Stein), *F. spathiophora* Malloch, and *F. stigi* Rognes are redescribed and illustrated. The geographic distribution of the known Chinese species is updated.

Keywords

Diptera, Fanniidae, *Fannia*, *Fannia postica*-group, new species

Introduction

The *Fannia postica*-group was originally established in the genus *Fannia* Robineau-Desvoidy by Chillcott (1961), consisting of two subgroups, the *F. postica*-subgroup and the *F. spathiophora*-subgroup. Fifteen species were included from the Holarctic Region (Chillcott 1961). Since then, Nishida (1975, 1976), Rognes (1982), and Xue et al. (2001) have studied the *F. postica*-group from Japan, Europe, and China, respectively, forming a sound basis for further research on this group. Rozkošný et al. (1997) listed nine European species of the *F. postica*-group and transferred *F. ringdahlana* Collin from the *F. spathiophora*-subgroup to the *F. postica*-subgroup. Gregor and Rozkošný (2005) described an additional new species of the *F. postica*-group from Slovakia. So far, twenty-two species of the *F. postica*-group are known worldwide, of which eight species belong to the *F. postica*-subgroup and the others to the *F. spathiophora*-subgroup.

Before the present contribution, eight species of the *F. postica*-group were known in China (Nishida 1975, Fan 1992, Xue and Wang 1998, Xue et al. 2001, Wang and Xue 2002, Wu and Wang 2002, Su and Wang 2004, Wang et al. 2006). In recent years we have been engaged in faunal studies of this group of flies in China, and have found one further undescribed species from the Tibetan Plateau. The purpose of this paper is to review the *F. postica*-group, describe one new species, and provide a key to the known Chinese species. Based upon the morphological characters, we also discuss the diagnostic characters of this group.

Materials and methods

The morphological terminology follows McAlpine (1981), except that we follow Stuckenberg (1999) in using "postpedicel" for first antennal flagellomere. Absolute measurements are used for body length in millimetres (mm). Abbreviations used for characters include: *a* = anterior seta, *acr* = acrostichal seta, *ad* = anterodorsal seta, *av* = anteroventral seta, *d* = dorsal seta, *dc* = dorsocentral seta, *ia* = intra-alar seta, *p* = posterior seta, *pd* = posterodorsal seta, *pra* = prealar seta, and *pv* = posteroventral seta.

Our study of the *F. postica*-group was based on an examination of specimens of *Fannia postica*, *F. ringdahlana*, *F. aethiops*, *F. ardua*, and *F. spathiophora*, and the holotypes of *F. discoculea*, *F. nudifemorata* sp. n., and *F. stigi*. Data on *F. coculea* Nishida was taken from Nishida (1975). All specimens studied in this paper, including the types of new species, are deposited in the Institute of Entomology, Shenyang Normal University, Shenyang.

Taxonomic account

Fannia postica-group

Fannia postica-group: Chillcott, 1961: 101, 222; Rozkošný et al., 1997: 48.

Diagnosis. Each tibia with at most one seta on each surface; mid first tarsomere usually with basal tooth-like spines or clustered hairs on ventral surface; hind femur usually with one or numerous *av*; hind coxa bare on posterior surface (except *Fannia discoculea* and *F. coculea*); lower calypter at least leaf-like, otherwise lower calypter projecting beyond upper one; *pra* usually 2; presutural *acr* usually biserial; katepisternum without ventral spines; male cercal plate longish, the median part distinctly swollen in ventral view, the median part curving anteriorly and the apex curving posteriorly in lateral view. For detailed descriptions of the adults, see Chillcott (1961: 124).

Included species: *Fannia postica*-subgroup: *F. brevicauda* Chillcott, *F. discoculea*, *F. enigmata* Chillcott, *F. flavibasis* (Stein), *F. multisetosa* Chillcott, *F. postica*, *F. ringdahlana*, *F. sequoiae* Chillcott; *F. spathiophora*-subgroup: *F. aethiops*, *F. ardua*, *F. bigelowi* Chillcott, *F. brooksi* Chillcott, *F. coculea*, *F. gotlandica* Ringdahl, *F. nudifemorata* sp. n., *F. scyphocerca* Chillcott, *F. slovaca* Gregor & Rozkošný, *F. spathiophora*, *F. stigi*, *F. tundrarum* Chillcott, *F. umbratica* Collin, *F. umbrosa* (Stein).

Key to males of the known Chinese species of the *Fannia postica*-group

1	Hind femur at least with 2 *av* in distal half (*postica*-subgroup)	**2**
–	Hind femur only with 1 *av* in distal half (*spathiophora*-subgroup)	**4**
2	*Pra* 2; hind coxa bare on posterior surface	**3**
–	*Pra* 1; hind coxa with hairs on posterior surface	***F. discoculea***
3	Mid first tarsomere with basal tooth-like spines on ventral surface; hind femur only with 2 *av* in distal half; calypters blackish	***F. ringdahlana***
–	Mid first tarsomere without basal tooth-like spines on ventral surface; hind femur with 4–6 *av* in distal half; calypters yellow	***F. postica***
4	Hind coxa bare on posterior surface	**5**
–	Hind coxa with hairs on posterior surface; *pra* 2 (rarely 3); frontal setae 7–9; mid first tarsomere with basal tooth-like spines on ventral surface	***F. coculea***
5	Fore tibia with 7–9 long and fine *pv* hairs	***F. spathiophora***
–	Fore tibia without such hairs	**6**
6	Hind femur with *pv* in distal 1/3	**7**
–	Hind femur without distinct *pv* in distal 1/3; haltere dark brown	***F. nudifemorata***
7	Hind femur with 4 or 5 *pv* in distal half	**8**
–	Hind femur only with 2 or 3 *pv* in distal half; abdominal tergites 2–4 each with a median black stripe	***F. aethiops***

8 The median part of frons about as wide as anterior ocellus; frontal setae 6; each abdominal tergite with a triangular mark .... ***F. ardua***

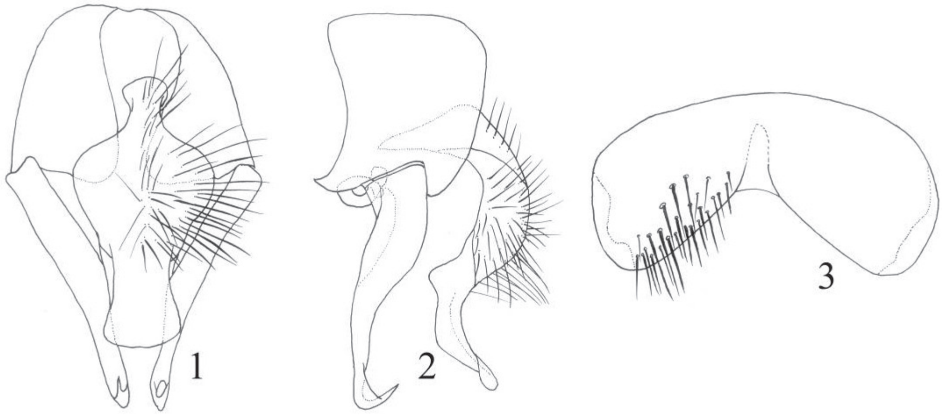
– The median part of frons about 2.5 times as wide as anterior ocellus; frontal setae 8 or 9; each abdominal tergite with a median black stripe.......... ***F. stigi***

Catalogue of known Chinese species of the *F. postica*-group and description of one new taxon

Fannia discoculea **Xue in Xue & Wang, 1998**
http://species-id.net/wiki/Fannia_discoculea
Figs 1–3

Fannia discoculea Xue in Xue and Wang 1998: 822–824; Wang and Xue 2002: 56; Su and Wang 2004: 111.

Description. MALE. Body length 3.5 mm. Eye bare; fronto-orbital plate and parafacial with greyish-white pruinosity; the median part of frons about 1.5 times as wide as anterior ocellus, fronto-orbital plate adjoined in upper half, frontal setae 5, situated in the lower 2/3 of frons, orbital setae absent; parafacial bare and narrow, about half as wide as postpedicel width at middle part; antenna black, postpedicel 1.5 times as long as wide, arista black, distinctly swollen in basal 1/4, haired, the longest hair about equal to aristal base; epistoma not projecting beyond vibrissal angle, vibrissal angle behind frontal angle in profile; gena and genal dilation with black hairs, upper margin of gena without upcurved setae; proboscis short, prementum slightly shining, with greyish-brown pruinosity, palpus black, slightly longer than prementum. Thorax ground-colour black, with thin greyish-brown pruinosity, scutum without stripes; presutural *acr* biserial, only prescutellar pairs slightly stout, *dc* 2+3, *ia* 0+2, *pra* 1, notopleuron without setulae; basisternum, proepisternum, anepimeron, meron and katepimeron bare; katepisternal setae 1:1, katepisternum without ventral spines; calypters yellowish, lower one slightly projecting beyond upper one. Wing brownish; costal spine inconspicuous; vein Sc curved bow-like; node of Rs bare on ventral and dorsal surfaces; crossveins without obvious cloud; haltere yellow. Legs entirely black; fore tibia without *ad* and median *p*; mid coxa without any hooked spines or spine-like setae on lower and outer margins, mid femur with 15 *av*, becoming gradually shorter towards apex, *pv* row distinct in basal 2/3, *p* row stout in distal part, mid tibia slightly swollen in distal part, with 1 *ad*, 1 *pd* and numerous hairs on ventral surface, the longest one about equal to mid tibia width, mid first tarsomere without basal tooth-like spines on ventral surface, only with a cluster of hairs; hind coxa with hairs on posterior surface, hind femur with 5 *av* and 2 *ad* in distal half, 2 long *pv* in distal 1/4, the longer one slightly longer than hind femoral width, hind tibia with 1 *av*, 1 *ad* and 1 *d*. Abdomen oval, depressed and flattened, ground-colour black, with thin greyish-brown pollinosity; syntergite 1+2 to tergite 4 each with a black triangular mark at middle; sternite 1 with hairs, sternite



Figures 1–3. *Fannia discoculea* Xue, 1998 (male) **1** terminalia, ventral view **2** terminalia, lateral view 3 sternite 5.

5 broad; cercal plate straight in apex, bare on ventral surface, median part distinctly broad; bacilloform process U-shaped in ventral view, ring-like in lateral view.

Material examined. Holotype ♂: China: Xinjiang: Jakesi, 43°49'12"N, 81°07'12"E, 6.VIII.1957, Coll. G. Wang.

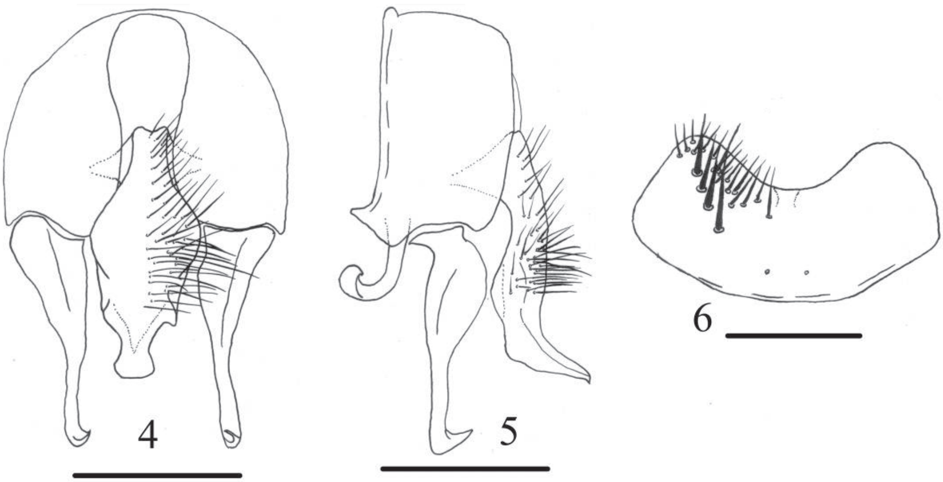
Distribution. China (Xinjiang).

Fannia postica (Stein, 1895)

http://species-id.net/wiki/Fannia_postica
Figs 4–6

Homalomyia postica Stein, 1895: 89.
Fannia postica (Stein): Hennig 1955: 72; Chillcott 1961: 103; Pont 1986: 53; Xue and Wang 1998: 819; Wang and Xue 2002: 57; Su and Wang 2004: 111; Wang et al. 2006: 555.

Description. MALE. Body length 4.0 mm. Eye bare, facets slightly enlarged on anterior margin in upper part; fronto-orbital plate, parafacial and gena with densely grey pruinosity; the median part of frons about 1.5 times as wide as anterior ocellus, as wide as 2/3 of postpedicel, frontal vitta black, linear at middle, frontal setae 6 or 7, situated in the lower 3/4 of frons, orbital setae absent; postocular setulae short, in one row, regularly placed; parafacial bare, about half as wide as postpedicel width at middle; antenna black, postpedicel 2.0 times as long as wide, arista black, distinctly swollen in basal part, ciliated, the longest hair about equal to aristal base; epistoma not projecting beyond vibrissal angle, vibrissal angle behind frontal angle in profile; gena and genal dilation with black hairs; genal height about 1/10 of eye height, upper margin of gena without upcurved se-



Figures 4–6. *Fannia postica* (Stein,1895) (male) **4** terminalia, ventral view **5** terminalia, lateral view 6 sternite 5, scale bar = 0.25mm.

tae; proboscis short, prementum with thin greyish-yellow pruinosity, its length 1.8–2.0 times as long as its width, palpus black, claviform, about as long as prementum. Thorax ground-colour black, with dark brown pruinosity, scutum without stripes; presutural *acr* biserial, only prescutellar pairs slightly stout, the distance between two *acr* rows slightly narrower than the distance between *acr* row and *dc* row, *dc* 2+3, *ia* 0+2, *pra* 2, the anterior one about 1/2 length of posterior notopleural seta, notopleuron without setulae; basisternum, proepisternum, anepimeron, meron and katepimeron bare; katepisternal setae 1:1, katepisternum without ventral spines; anterior spiracles yellowish, the posterior ones brownish-yellow; calypters yellow, lower one slightly projecting beyond upper one. Wing brownish; veins brown, tegula dark brown, basicosta brownish-yellow, costal spine inconspicuous; vein Sc curved bow-like; node of Rs bare on ventral and dorsal surfaces; veins R_{4+5} and M parallel to each other distally; crossveins without obvious cloud; haltere brownish-yellow. Legs entirely black; fore tibia without median *p*, fore first tarsomere with 2 or 3 longish basal setae on ventral surface; mid coxa without any hooked spines or spine-like setae on lower and outer margins, mid femur with sparse and long *av* row in basal half, becoming gradually shorter towards apex, comb-like in basal 1/3, *pv* row complete, becoming gradually shorter towards apex, *p* row complete, mid tibia swollen in distal half, with 1 *ad* and 1 *pd* in distal half, with numerous hairs on ventral surface, the longest ones about 3/4 of mid tibia width, mid first tarsomere without basal tooth-like spines on ventral surface; hind coxa bare on posterior surface, hind femur with short *av* row in basal half, becoming gradually longer towards apex, 4–6 long and stout *av* in distal half, *pv* row inconspicuous in basal half, 4 or 5 stout *pv* in distal half, hind tibia with 1 median *av*, 1 *ad* and 1 *d*. Abdomen oval, depressed and flattened, ground-colour black, with greyish-brown pollinosity; syntergite 1+2 to tergite 4 each with dark triangular mark at middle, tergite 5 only with narrow stripe at middle; sternite 1 bare.

Material examined. China: Heilongjiang: 2 ♂, Xilinji, 53°28'48"N, 122°22'12"E, 19.VI.1986, Coll. C.Y. Cui.

Distribution. China (Heilongjiang), Europe, North America.

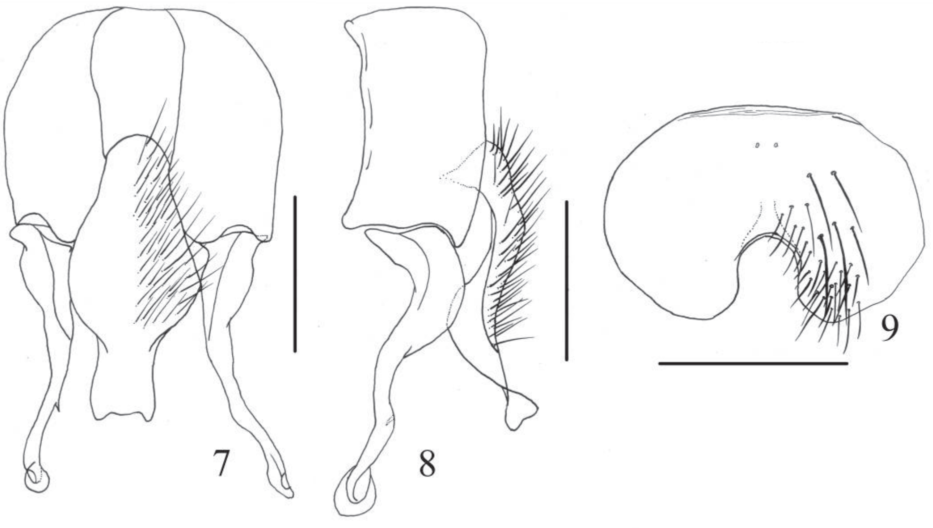
Fannia ringdahlana Collin, 1939

http://species-id.net/wiki/Fannia_ringdahlana

Figs 7–9

Fannia.ringdahlana Collin 1939:14; Nishida 1975: 378; Fan 1992: 216; Xue and Wang 1998: 815; Wang and Xue 2002: 57; Su and Wang 2004: 112; Wu and Wang 2002: 563; Wang et al. 2004: 34; Wang et al. 2006: 555.

Description. MALE. Body length 4.0–4.8 mm. Eye with short and brownish hairs, facets slightly enlarged on anterior margin in upper part; fronto-orbital plate with brownish-grey pruinosity in upper half, lower half of fronto-orbital plate and parafacial with densely silvery-grey pruinosity; the median part of frons about 1.5 times as wide as anterior ocellus, 2/3 as wide as postpedicel, frontal vitta black, linear at middle part, frontal setae 11 or 12, nearly reaching ocellar triangle, orbital setae absent; postocular setulae in one row, 4 or 5 ones long and fine in vertex, anteriorly curved, others short, regularly placed; parafacial bare, about1/2 as wide as postpedicel width at middle part; antenna black, postpedicel about 1.5 times as long as wide, arista black, distinctly swollen in basal 1/3, ciliated, the longest hairs slightly shorter than aristal base; epistoma not projecting beyond vibrissal angle, vibrissal angle behind frontal angle in profile; gena and genal dilation with black hairs; genal height about 1/10 of eye height, upper margin of gena without upcurved setae; proboscis short, prementum slightly shining, with thin greyish-yellow pruinosity, its length 1.5 times as long as its width, palpus black, claviform, slightly longer than prementum. Thorax ground-colour black, with dark brown pruinosity, scutum without stripes; presutural *acr* biserial, only prescutellar pairs slightly stout, the distance between two *acr* rows slightly narrower than the distance between *acr* row and *dc* row, *dc* 2+3, *ia* 0+2, *pra* 2, the anterior one about 3/5 of the length of posterior notopleural seta, notopleuron without setulae; basisternum, proepisternum, anepimeron, meron and katepimeron bare; katepisternal setae 1:1, katepisternum without ventral spines; spiracles dark brown; calypters dark brown, blackish-brown on the margin, lower one slightly projecting beyond upper one. Wing dark brown; veins dark brown, tegula black, basicosta dark brown, costal spine inconspicuous; vein Sc curved bow-like; node of Rs bare on ventral and dorsal surfaces; veins R_{4+5} and M conspicuously close to each other distally; crossveins without obvious cloud; haltere blackish-brown in base and apex, median part brown. Legs entirely black; fore tibia without *ad* and median *p*, fore first tarsomere with 2 or 3 longish basal setae on ventral surface; mid coxa without any hooked spines or spine-like setae on lower and outer margins, mid femur with sparse and long *av* row in basal half, becoming gradually shorter and denser towards apex, comb-like in basal 1/3, *pv* row complete, long and stout, slightly biserial at middle part, mid tibia distinctly swollen



Figures 7–9. *Fannia ringdahlana* Collin, 1939 (male) **7** terminalia, ventral view, scale bar = 0.25mm **8** terminalia, lateral view, scale bar = 0.25mm **9** sternite 5, scale bar = 0.40mm.

in distal half, with 1 *ad* and 1 *pd* in distal half, with numerous hairs on ventral surface, the longest one about 4/5 of mid tibia width, mid first tarsomere with basal tooth-like spines on ventral surface; hind coxa bare on posterior surface, hind femur with 2 *av* in subapical, 5 *ad* and 2 *d* in distal 1/3, *p* row seta-like in basal half, becoming gradually longer towards apex, 7 or 8 *pv* in distal 1/3, hind tibia with 1 *av*, 1 *ad*, 1 submedian *d* and 1 apical *d*, with numerous erect median setae on posterior surface. Abdomen long, depressed and flattened, ground-colour black, with densely brownish-grey pollinosity; syntergite 1+2 to tergite 4 each with a large triangular mark at middle, tergite 5 with a dark median stripe in basal half, the setae long and stout on the lateral margin of each tergite; sternite 1 with 1–3 fine and long setae on each lateral margin.

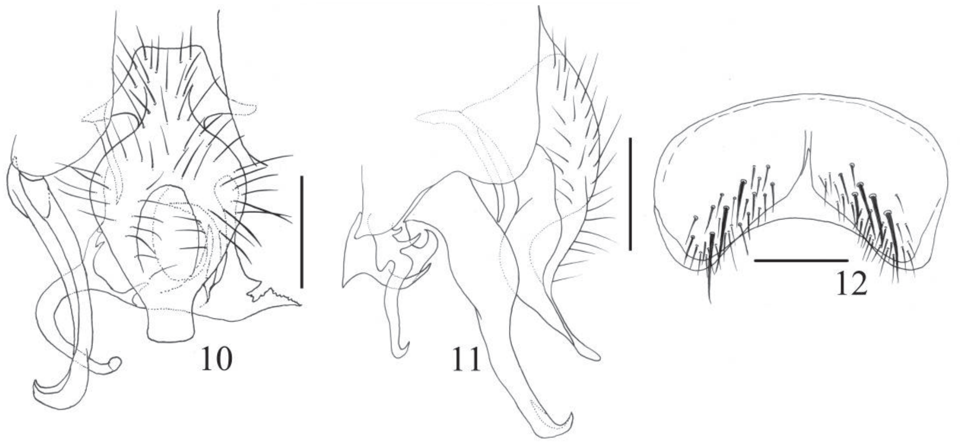
Material examined. China: Yunnan: 5 ♂, Xianggelila, Bitahai, 27°48'00"N, 99°54'00"E, 3700m, 2.VII.2006, Coll. M.F. Wang; 1 ♂, same locality and time, Coll. B.F. Wang; 5 ♂, same locality and time, Coll. L. Chang; 1 ♂, Deqin, Mt. Meili, 28°29'24"N, 98°55'48"E, 4000–4200m, 2.VII.2006, Coll. Y. Wang. Shanxi: 1 ♂, Ningwu, Mt. Luya, 38°43'48"N, 111°55'48"E, 12.VI.1987, Coll. M.F. Wang. Jilin: 2 ♂, Mt. Changbai, 42°19'48"N, 127°16'12"E, 18.VII.1988; 2 ♂, Mt. Changbai, Xiaotianchi, 42°34'48"N, 128°18'00"E, 25.VII.1982, Coll. L.Y. Gao. Sichuan: 1 ♂, Daocheng, Kasi, 29°2'24"N, 100°18'36"E, 2750–3000m, 12.VII.2006, Coll. C.T. Zhang; 9 ♂, Jiuzaigou, 33°15'36"N, 103°54'36"E, 2800m, 3.VI.2006, Coll. D. Wang; 3 ♂, same locality, 2.VI.2006, Coll. D. Jing; 2 ♂, same locality, 1.VI.2006, Coll. Y. Zhu.

Distribution. China (Shanxi, Jilin, Sichuan, Yunnan, Taiwan), Japan, Europe.

***Fannia aethiops* Malloch, 1913**
http://species-id.net/wiki/Fannia_aethiops
Figs 10–12

Fannia aethiops Malloch 1913: 628; Wang and Xue 1993: 458; Xue and Wang 1998: 818; Wang and Xue 2002: 55.

Description. MALE. Body length 4.5 mm. Eye bare, facets slightly enlarged on anterior margin in upper part; fronto-orbital plate with golden-brown pruinosity in upper half, lower half of fronto-orbital plate and parafacial with densely grey pruinosity; the median part of frons about 1.5 times as wide as anterior ocellus, 3/5 as wide as postpedicel, frontal vitta black, linear in narrowest part, frontal setae 9, nearly reaching ocellar triangle, orbital setae absent; postocular setulae in one row, short, regularly placed; parafacial bare, about as wide as 2/5 of postpedicel width at middle; antenna black, postpedicel broad, about 1.5 times as long as wide, arista black, distinctly swollen in basal part, ciliated, the longest hairs slightly shorter than aristal base; epistoma not projecting beyond vibrissal angle, vibrissal angle behind frontal angle in profile; gena with thin greyish-brown pruinosity, gena and genal dilation with black hairs; genal height about 1/11 of eye height, upper margin of gena without upcurved setae; prementum slightly shining, without distinct pruinosity, its length 1.5 times as long as its width, palpus black, slightly swollen and depressed in apex, about as long as prementum. Thorax ground-colour black, scutum and scutellum with densely brown pruinosity, pleura with thin greyish-brown pruinosity, scutum without distinct stripe; presutural *acr* biserial, only prescutellar pairs slightly stout, the distance between two *acr* rows slightly narrower than the distance between *acr* row and *dc* row, *dc* 2+3, *ia* 0+2, *pra* 2, the anterior one about 1/2 of the length of posterior notopleural seta, notopleuron without setuaae; basisternum, proepisternum, anepimeron, meron and katepimeron bare; katepisternal setae 1:1, katepisternum without ventral spines; spiracles brown; calypters brownish-yellow, lower one slightly projecting beyond upper one. Wing brownish; veins brown, tegula dark brown, basicosta brownish-yellow, costal spine conspicuous, about as long as 2/3 of crossvein r-m; vein Sc curved bow-like; node of Rs bare on ventral and dorsal surfaces; vein R_{4+5} straight, veins R_{4+5} and M conspicuously close to each other distally; crossveins without obvious cloud; haltere yellowish-brown. Legs black; fore tibia without median *p*, fore first tarsomere with few longish basal setae on ventral surface; mid coxa without any hooked spines or spine-like setae on lower and outer margins, mid femur with sparse and long *av* row in basal half, becoming gradually shorter and denser towards apex, bare in subapical part, 3 or 4 short setae in apical part, *pv* row complete, long and stout, slightly biserial on middle part, *p* row fine and long, mid tibia distinctly swollen in distal half, with 1 *ad* and 1 *pd* in distal half, with numerous hairs on ventral surface, the longest one about 3/4 of mid tibia width, mid first tarsomere with clustered basal hairs on ventral surface; hind coxa bare on posterior surface, hind femur with 1 stout *av* and 2 or 3 *pv* in subapical part, hind tibia with 1 median *av*, 1 *ad* and 1 *d*. Abdomen long, depressed and flattened,



Figures 10–12. *Fannia aethiops* Malloch, 1913 (male) **10** terminalia, ventral view **11** terminalia, lateral view **12** sternite 5, scale bar = 0.20mm.

ground-colour black, with densely greyish-brown pollinosity; syntergite 1+2 with broad black stripe on middle, tergites 3 and 4 with narrow black stripe on middle, tergite 5 without stripe; sternite 1 with 1or 2 long setae on each lateral margin.

Material examined. China: Shanxi: 1 ♂, Ningwu, Mt. Luya, 38°43'48"N, 111°55'48"E, 12.VI.1987, Coll. M.F. Wang. Jilin: 1 ♂, Mt. Changbai, 42°19'48"N, 127°16'12"E, 22.VI.1980, Coll. Z.Y. Ma.

Distribution. China (Shanxi, Jilin), North America, Europe.

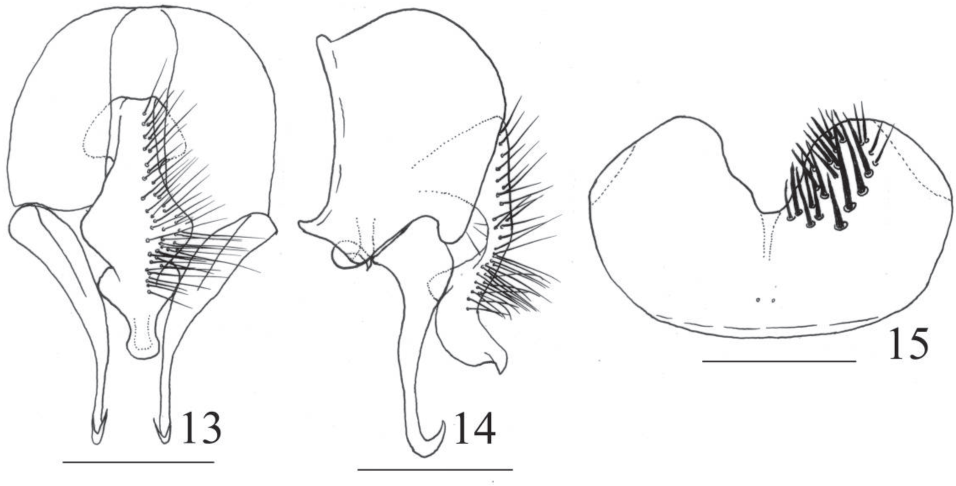
Fannia ardua Nishida, 1976

http://species-id.net/wiki/Fannia_ardua

Figs 13–15

Fannia ardua Nishida 1976: 135–137; Wang and Xue 2002: 55; Su and Wang 2004: 110; Wang et al. 2006: 555.

Description. MALE. Body length 4.0 mm. Eye bare, facets slightly enlarged on anterior margin in upper part; fronto-orbital plate with greyish-brown pruinosity in upper half, lower half of fronto-orbital plate and parafacial with silvery-grey pruinosity; the median part of frons about as wide as anterior ocellus, frontal vitta linear at middle, frontal setae 7 or 8, situated in the lower 2/3 of frons, orbital setae absent; postocular setulae in one row, regularly placed; parafacial bare, about 1/3 as wide as postpedicel width at middle; antenna black, postpedicel about 1.2 times as long as wide, arista black, distinctly swollen in basal 1/5, ciliated, the longest hairs about as long as aristal base; epistoma not projecting beyond vibrissal angle, vibrissal angle behind frontal angle in profile; gena and genal dilation with black hairs; genal height about 1/10 of eye height, upper margin of gena without upcurved setae; prementum shining, with thin



Figures 13–15. *Fannia ardua* Nishida, 1976 (male) **13** terminalia, ventral view **14** terminalia, lateral view **15** sternite 5, scale bar = 0.25mm.

grey pruinosity, its length 2.0 times as long as its width, palpus black, claviform, slightly longer than prementum. Thorax ground-colour black, with thin greyish-brown pruinosity, scutum without distinct stripe; presutural *acr* biserial, only prescutellar pairs slightly stout, the distance between two *acr* rows slightly narrower than the distance between *acr* row and *dc* row, *dc* 2+3, *ia* 0+2, *pra* 2, the anterior one about 1/2 as long as posterior notopleural seta, notopleuron without setulae; basisternum, proepisternum, anepimeron, meron and katepimeron bare; katepisternal setae 1:1, katepisternum without ventral spines; spiracles brown; calypters brown, lower one slightly projecting beyond upper one. Wing brownish; veins brown, tegula black, basicosta brown, costal spine inconspicuous; vein Sc curved bow-like; node of Rs bare on ventral and dorsal surfaces; vein R_{4+5} straight, veins R_{4+5} and M conspicuously close to each other distally; crossveins without obvious cloud; haltere yellowish-brown. Legs entirely black; fore tibia without *ad* and median *p*; mid coxa without any hooked spines or spine-like setae on lower and outer margins, mid femur narrowed and bare in subapical part, with 6 or 7 sparse and long *av* in basal 2/5, becoming gradually shorter and denser towards apex, *pv* row complete, biserial at middle, *p* row stout, mid tibia distinctly swollen in distal part, with 1 *ad* and 1 *pd* in distal half, with numerous hairs on ventral surface, the longest ones shorter than mid tibia width, mid first tarsomere with 1 tooth-like basal process on ventral surface; hind coxa bare on posterior surface, hind femur with 1 subapical *av*, 1 apical *d*, 1 apical *pd*, 3 *ad* in distal 1/3 and 5 *pv* in distal half, hind tibia with 1 *av*, 1 *ad*, 1 median *d* and 1 apical *d*. Abdomen long, depressed and flattened, ground-colour black, with densely greyish-brown pollinosity; syntergite 1+2 to tergite 4 each with dark triangular mark at middle, tergite 5 only with a dark stripe at middle; sternite 1 with 4 or 5 long setae on each lateral margin.

Material examined. China: Jilin: 1 ♂, Mt. Changbai, 42°19’48”N, 127°16’12”E, 10.VII.1998.

Distribution. China (Jilin), Japan.

Fannia coculea Nishida, 1975

http://species-id.net/wiki/Fannia_coculea

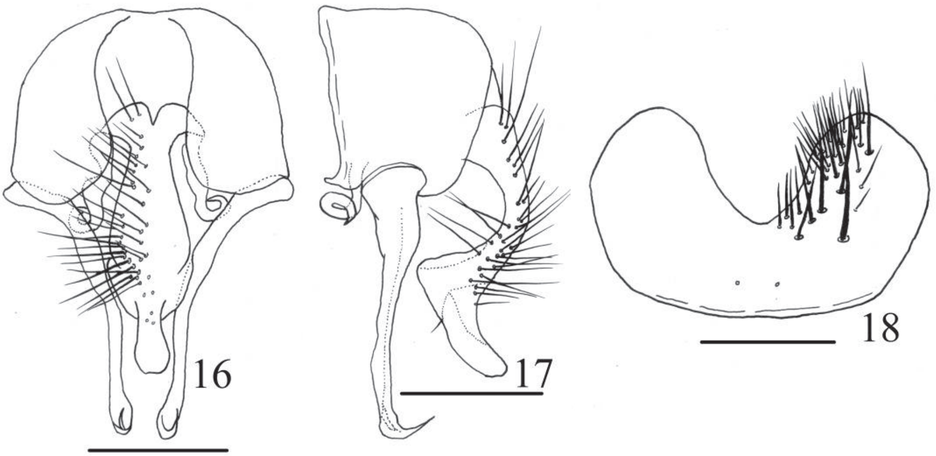
Fannia coculea Nishida, 1975: 368–370; Xue and Wang, 1998: 815; Wang and Xue, 2002: 56; Su and Wang, 2004: 110.

Distribution. China (Taiwan).

Fannia nudifemorata Wang and Zhang, sp. n.

urn:lsid:zoobank.org:act:49E9C8CB-DF77-4B77-AC17-4B3589494995
http://species-id.net/wiki/Fannia_nudifemorata
Figs 16–18

Description. MALE. Body length 4.5–5.0 mm. Eye bare, facets slightly enlarged on anterior margin in upper part; fronto-orbital plate, parafacial and gena with silvery-grey pruinosity; the median part of frons about 2.0 times as wide as anterior ocellus, about 4/5 of postpedicel, slightly narrower than the distance between two posterior ocelli, frontal vitta black, about as wide as fronto-orbital plate, frontal setae 11–13, situated in the lower 4/5 of frons, the gaps filled with numerous fine setae, orbital setae absent; postocular setulae long and curved anteriorly; parafacial bare, about 2/5 as wide as postpedicel width at middle; antenna black, postpedicel about 1.5 times as long as wide, arista black, distinctly swollen in basal part, ciliated, the longest hairs shorter than aristal base; epistoma not projecting beyond vibrissal angle, vibrissal angle behind frontal angle in profile; gena and genal dilation with black hairs; genal height about 1/9 of eye height, upper margin of gena with 1 or 2 upcurved setae; prementum shining, with thin greyish-yellow pruinosity, its length 2.0 times as long as its width, palpus black, claviform, slightly longer than prementum. Thorax ground-colour black, with brownish-grey pruinosity, scutum without distinct stripe; presutural *acr* biserial, only prescutellar pairs slightly stout, the distance between two *acr* rows about 1/2 of the distance between *acr* row and *dc* row, *dc* 2+3, *ia* 0+2, *pra* 2, the anterior one about 1/2 of the length of posterior notopleural seta, notopleuron without setulae; basisternum, proepisternum, anepimeron, meron and katepimeron bare; katepisternal setae 1:1, katepisternum without ventral spines; spiracles brown; calypters brown, lower one not projecting beyond upper one. Wing brownish; tegula black, basicosta brown, costal spine inconspicuous; vein Sc curved bow-like; node of Rs bare on ventral and dorsal surfaces; vein R_{4+5} straight, veins R_{4+5} and M conspicuously close to each other distally; crossveins without obvious cloud; haltere dark brown at apex. Legs entirely black; fore



Figures 16–18. *Fannia nudifemorata* Wang and Zhang, sp. n. (male) **16** terminalia, ventral view **17** terminalia, lateral view **18** sternite 5, scale bar = 0.25mm.

tibia without median *p*, fore first tarsomere with several longish setae on ventral surface; mid coxa without any hooked spines or spine-like setae on lower and outer margins, mid femur with a long and sparse *av* row in basal half, becoming gradually shorter and denser towards apex, *pv* row long and stout, biserial at middle, *p* row complete and long, mid tibia distinctly swollen in distal half, with 1 *ad* and 1 *pd*, with numerous hairs on ventral surface, the longest one slightly shorter than mid tibia width, mid first tarsomere with basal cluster of hairs on ventral surface; hind coxa bare on posterior surface, hind femur with 1 long subapical *av*, 4 or 5 long *ad* in distal 1/3, and 2 or 3 *p* rows in basal 2/3, *pv* row in distal 2/3, hair-like, hind tibia with 1 median *av*, 1 *ad*, 1 *d* and several erect short setae on posterior surface. Abdomen long, depressed and flattened, ground-colour black, with densely bluish-grey pollinosity; syntergite 1+2 to tergite 4 each with a dark triangular mark at middle, tergite 5 only with a dark stripe at middle, each tergite with long setae on lateral part; sternite 1 with 10–12 setae.

Female: Unknown.

Material examined. Holotype, ♂: China: Yunnan: Yulongxueshan, 27°5'24N, 100°15'00"E, 3200m, 24.V.2007, Coll. W.X. Dong. Paratype, 1 ♂, same locality and time, Coll. S.C. Bai.

Remarks. This new species belongs to the *F. spathiophora*-subgroup of *F. postica*-group. It can easily be separated from its allies by hind femur without stout *pv* and bare from *p* to *pv* surface in distal 1/3. It resembles *F. ardua* but differs from the latter in having the median part of frons about 2.0 times as wide as anterior ocellus, frontal setae 11–13, lower calypter not projecting beyond upper one, haltere dark brown at apex. The new species is also similar to *F. umbrosa* (Stein, 1895), but differs from it in having hind femur without distinct *pv* row in distal 1/3.

Distribution. China (Yunnan).

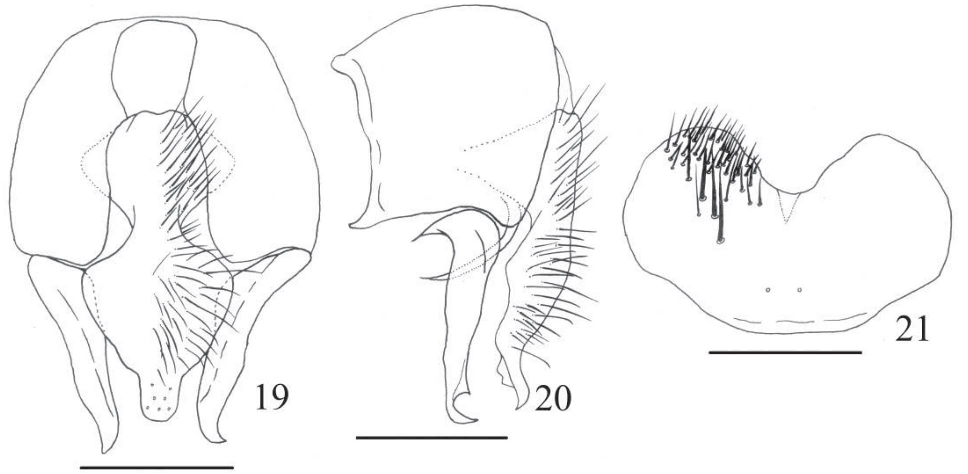
Fannia spathiophora **Malloch, 1918**

http://species-id.net/wiki/Fannia_spathiophora

Figs 19–21

Fannia spathiophora Malloch 1918: 294; Pont 1986: 56; Fan 1992: 217; Xue and Wang 1998: 815; Wang and Xue 2002: 57; Wu and Wang 2002: 563; Su and Wang 2004: 112; Wang et al. 2004: 34;Wang et al. 2006: 556.

Description. MALE. Body length 4.5–5.0 mm. Eye bare, facets slightly enlarged on anterior margin in upper part; fronto-orbital plate with brownish-grey pruinosity in upper half, lower half of fronto-orbital plate and parafacial with silvery-grey pruinosity; the median part of frons about 1.5 times as wide as anterior ocellus, about 2/3 of pedicel, frontal vitta linear in upper half, frontal setae 7 or 8, situated in the lower 3/4 of frons, orbital setae absent; postocular setulae short, regularly placed; parafacial bare, about 1/3 as wide as postpedicel width at middle; antenna black, postpedicel about 2.0 times as long as wide, arista black, distinctly swollen in basal 1/4, ciliated, the longest hairs slightly shorter than aristal base; epistoma not projecting beyond vibrissal angle, vibrissal angle behind frontal angle in profile; gena and genal dilation with black hairs; genal height about 1/11 of eye height, upper margin of gena without upcurved setae; prementum shining, with thin grey pruinosity, its length 1.5–2.0 times as long as its width, palpus black, claviform, slightly longer than prementum. Thorax ground-colour black, with dense brown pruinosity, scutum without distinct stripe; presutural *acr* biserial, only prescutellar pairs slightly stout, the distance between two *acr* rows slightly narrower than the distance between *acr* row and *dc* row, *dc* 2+3, *ia* 0+2, *pra* 2, the anterior one about 1/2 of the length of posterior notopleural seta, notopleuron without setulae; basisternum, proepisternum, anepimeron, meron and katepimeron bare; katepisternal setae 1:1, katepisternum without ventral spines; spiracles brown; calypters dark brown, lower one projecting beyond upper one. Wing brownish; veins brown, tegula black, basicosta brown, costal spine inconspicuous; vein Sc curved bow-like; node of Rs bare on ventral and dorsal surfaces; vein R_{4+5} straight, veins R_{4+5} and M conspicuously close to each other distally; crossveins without obvious cloud; haltere dark brown. Legs black, except knees yellow; fore tibia with 7–9 *pv*; mid femur with long and sparse *av* row in basal half, becoming gradually shorter and denser towards apex, bare in subapical part, 4 or 5 short setae in apical part, *pv* row biserial at middle, *p* row complete, mid tibia distinctly swollen towards apex, with 1 *ad* and 1 *pd* in distal half, 2 long and curved apical hairs on ventral surface, with numerous hairs on ventral surface, the longest ones slightly shorter than mid tibia width, mid first tarsomere with tooth-like basal process on ventral surface; hind coxa bare on posterior surface, hind femur with 1 subapical *av*, *pv* row hair-like in basal half, becoming gradually longer towards apex, 6 or 7 stout and long *pv* in basal 1/3, hind tibia with 1 *av*, 1 *ad* and 1 median *d*. Abdomen long, depressed and flattened, ground-colour black, with dense brownish-grey pollinosity; syntergite 1+2 to tergite 4 each with a dark triangular mark at middle, tergite 5 only with a dark stripe at middle; sternite 1 with 1–3 long setae on each lateral margin.



Figures 19–21. *Fannia spathiophora* Malloch, 1918 (male) **19** terminalia, ventral view **20** terminalia, lateral view **21** sternite 5, scale bar = 0.25mm.

Material examined. China: Shanxi: 1 ♂, Hunyuan, 39°42'00"N, 113°40'48"E, 12.VII.1985, Coll. M.F. Wang. Liaoning: 2 ♂, Xinbin, Gangshan, 41°43'12"N, 125°01'12"E, -.VI.1981, Coll. Z.Y. Ma; 1 ♂, same locality, 08.IX. 1990; 2 ♂, Benxi, Yanghugou, 41°18'00"N, 123°43'48"E, 01.VII.1993, Coll. Y.S. Cui; 1 ♂, same locality, 01.VII.1993, Coll. C.T. Zhang; 1 ♂, Huanren, 41°16'12"N, 125°21'00"E, 09.VI.1994, Coll. D. Wei; 3 ♂, Qianshan, 41°01'48"N, 123°07'48"E, 25.VI.2007, Coll. M.F. Wang. Jilin: 1 ♂, Baihe, 42°34'48"N, 128°02'24"E, 20.VI.1980, Coll. Z.Y. Ma; 1 ♂, Mt. Changbai, 42°19'48"N, 127°16'12"E, 19.VII.1986; 1 ♂, Mt. Changbai, 42°19'48"N, 127°16'12"E, 15.VII.1990. Heilongjiang: 1 ♂, Guyuan, 50°34'48"N, 123°42'00"E, 26.VI.1980, Coll. C.Y. Cui; 1 ♂, Wuying, 48°06'36"N, 129°14'24"E, 16.VII.1977, Coll. C.Y. Cui; 1 ♂, Bizhou, 51°56'24"N, 124°36'00"E, 13.VII.1980.

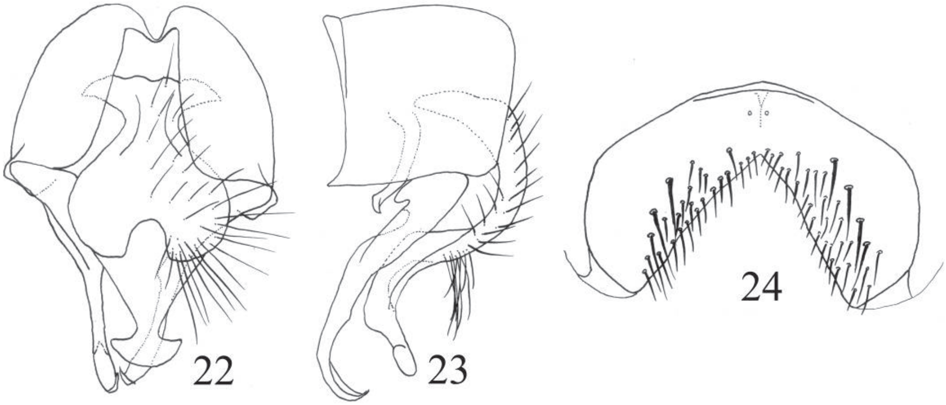
Distribution. China (Shanxi, Liaoning, Heilongjiang, Jilin), Japan, Europe, North America.

Fannia stigi **Rognes, 1982**

http://species-id.net/wiki/Fannia_stigi
Figs 22–24

Fannia stigi Rognes, 1982: 325–329.
Fannia tigripeda Xue, Wang and Li 2001: 225–226; Wang and Xue 2002: 57; Su and Wang 2004: 112. syn. nov.

Description. MALE. Body length 4.5–5.0 mm. Eye bare, facets slightly enlarged on anterior margin in upper part; fronto-orbital plate with dark cupreous pruinosity; the



Figures 22–24. *Fannia stigi* Rognes, 1982 (Holotype of *Fannia tigripeda* Xue, Wang & Li, 2001) (male) **22** terminalia, ventral view **23** terminalia, lateral view **24** sternite 5.

median part of frons about 2.5 as wide as anterior ocellus, slightly narrower than postpedicel, frontal vitta black, linear at middle, frontal setae 8 or 9, nearly reaching ocellar triangle; parafacial with silvery-grey pruinosity, slightly narrower than 1/3 of postpedicel width at middle; antenna black, postpedicel about 2.5 times as long as wide, arista distinctly swollen at base, the longest hairs slightly shorter than aristal base; gena and genal dilation with black hairs; genal height about 1/10 of eye height; proboscis short, labella large, the length of prementum 2.5 times as long as its width, palpus black, slightly longer than prementum. Thorax ground-colour black, with thin grey pruinosity, slightly shining, scutum without distinct stripe; presutural *acr* biserial, only prescutellar pairs slightly stout, the distance between two *acr* rows slightly narrower than the distance between *acr* row and *dc* row, *dc* 2+3, *ia* 0+2, *pra* 2, the anterior one about 1/2 the length of posterior notopleural seta, notopleuron without setulae; basisternum, proepisternum, anepimeron, meron and katepimeron bare; katepisternal setae 1:1; spiracles brownish; calypters brownish, lower one not projecting beyond upper one. Wing brownish; tegula black, basicosta brown, costal spine inconspicuous; vein Sc curved bow-like; node of Rs bare on ventral and dorsal surfaces; vein R_{4+5} straight, veins R_{4+5} and M parallel to each other distally; crossveins without obvious cloud; haltere dark brown. Legs entirely black; fore tibia without median *p*; mid femur concave at apex on ventral surface, with comb-like *av* row, becoming shorter towards apex, *pv* row distinct in basal 2/3, 1 short and erect *pv* row in subapical part, with 1 complete *p* row, among which subapical 2 stout, mid tibia distinctly swollen in distal half, with 1 *ad* and 1 *pd* in submedian part, with numerous hairs on ventral surface, the longest ones slightly longer than mid tibia width, mid first tarsomere with tooth-like basal process on ventral surface; hind coxa bare on posterior surface, hind femur with 1 short subapical *av*, 4 or 5 long *pv* in distal 1/3, hind tibia with 1 *av*, 1 *ad* and 1 *d* in submedian part. Abdomen long, depressed and flattened, ground-colour black, with brownish-grey pollinosity; syntergite 1+2 to tergite 5 each with a black stripe on middle; sternite 1 with short setae on each lateral margin.

Remarks. Rognes (1982) described *F. stigi* as new to science from Norway and Sweden, and also provided detailed description and high-quality illustrations. When re-examined the holotype of *F. tigripeda*, we found its morphological characters, especially the male terminalia, is similar with *F. stigi*. Whereas, we have not studied the types of *F. stigi*, but it is clear from Rognes's notes and figures on *stigi* that our *tigripeda* is actually his *stigi*. An anonymous reviewer also pointed out the possible synonymy of *F. stigi* and *F. tigripeda*. We confident that *F. tigripeda* is a new junior synonym for *F. stigi*.

Material examined. 1 ♂: China: Jilin, Mt. Changbai, 42°19'48"N, 127°16'12"E, 1700m, 28.VI.1997, Coll. W.Q. Xue (holotype of *F. tigripeda*). Shanxi: 1 ♂, Ningwu, 38°43'48"N, 111°55'48"E, 07.VI.1982, Coll. M.F. Wang.

Distribution. China (Shanxi, Jilin), Norway, Sweden.

Discussion

Chillcott (1961) revised the Nearctic species of the genus and assigned the 148 Holarctic species to 11 species groups and 15 subgroups, including the *Fannia postica*-group. He recognized that the relationship between the *F. postica*-group, *F. hirticeps*-group and *F. lugubrina*-group was very close (Chillcott 1961). Since Chillcott (1961), Domínguez and Roig-Juñent (2008) proposed a phylogenetic hypothesis of the family Fanniidae, using 151 characters from adult external morphology and female and male terminalia for 78 fanniid species. The analysis, including the *F. postica*-subgroup and *F. spathiophora*-subgroup, also recovered the paraphyletic of the *F. postica*-group, which nested within the *F. carbonaria*-group, *F. hirticeps*-group and *F. lugubrina*-group (Domínguez and Roig-Juñent, 2008). A phylogenetic revision of the genus *Fannia*, from molecular data and more characters of immature stages or adult morphology, at the species-group level is required to establish a more reasonable species-group classification.

After a systematic study of these species and related species, we found that the *F. postica*-group can be distinguished from other *Fannia* in having the median part of the male cercal plate distinctly swollen in ventral view, the median part curving anteriorly and the apex curving posteriorly in lateral view. In the course of this study, we also found that a number of characters, including the number of distal *av* on hind femur and the shape of male cercal plate (Chillcott 1961: 101), which have previously been described as being diagnostic characters for the *F. postica*-subgroup and *F. spathiophora*-subgroup, are variable and unreliable.

Acknowledgements

We are very grateful to Dr. Adrian C. Pont (*Oxford University Museum of Natural History*, *Oxford*, *U.K.*) and one anonymous reviewer, who have given us invaluable suggestions for this manuscript. We are grateful to Prof. Chuntian Zhang and Mr. You Wang (*Institute of Entomology, Shenyang Normal University, Shenyang, China*), who provided the specimens for this study. This study was supported by the Fundamental Research Funds for the Central Universities (YX2010-15, TD2010-4), the National Nature Science Foundation of China (No.30770252, No.31071957 and No.30870463), Science Foundation of Doctor Subjects, State Education Ministry of China (No.20090014120015) and Chinese Postdoctoral Science Foundation (No. 20100470009).

References

Chillcott JG (1961) A revision of the Nearctic species of Fanniinae (Diptera: Muscidae). Canadian Entomologist Supplement 14 (1960): 1–295.

Collin JE (1939) On various new or little known British Diptera, including several species bred from the nests of birds and mammals (Part.). Entomologist's Monthly Magazine 75: 134–144.

Domínguez MC, Roig-Juñent SA (2008) A phylogeny of the family Fanniidae Schnabl (Insecta: Diptera : Calyptratae) based on adult morphological characters, with special reference to the Austral species of the genus *Fannia*. Invertebrate Systematics 22: 563–587. doi:10.1071/IS08003

Fan ZD (1992) Key to the common flies of China, second edition. Science Press, Beijing, 992 pp.

Gregor F, Rozkošný R (2005) A new species of *Fannia* (Diprera: Fanniidae) from central Europe. Biologia Bratislava 60(5): 519–522.

Hennig W (1955) Muscidae. In: Lindner E (Ed) Die Fliegen der Palaearktischen Region, 63b (part). Schweizerbart, Stuttgart, 1–99.

McAlpine JF (1981) Morphology and terminology–adults. In: McAlpine JF, Peterson BV, Shewell GE, Teskey HJ, Vockeroth JR, Wood DM (Eds) Manual of Nearctic Diptera, Vol. 1. Research Branch, Agriculture Canada Monograph, 27, Ottawa, 9–63.

Malloch JR (1913) Notes on some American Diptera of the genus *Fannia*, with descriptions of new species. Proceedings of the United States National Museum 44: 621–631.

Malloch JR (1918) Diptera from the Southwestern United States, Paper IV, Anthomyiidae. Transactions of the American Entomological Society 44: 263–319.

Nishida K (1975) Six new and one newly recorded species of the genus *Fannia* (Diptera: Muscidae) from Taiwan, with a key to species. Kontyû 43(3): 364–380.

Nishida K (1976) Studies on the species of Fanniinae (Diptera: Muscidae) from Japan. IV. Five new and two newly recorded species of genus *Fannia* from Japan. Japanese Journal of Sanitary Zoology 27(2): 133–143.

Pont AC (1986) Family Fanniidae. In: Soós Á, Papp L (Eds) Catalogue of Palaearctic Diptera. Volume 11. Scathophagidae–Hypodermatidae. Akadémiai Kiadó, Budapest, 41–57.

Rognes K (1982) *Fannia stigi* n. sp. from Scandinavia (Diprera: Fanniidae). Entomologica Scandinavica 13: 325–330.

Rozkošný R, Gregor F, Pont AC (1997) The European Fanniidae (Diptera). Acta Scientiarum naturalium Academiae scientiarum Bohemicae-Brno 31: 1–80.

Stein P (1895) Die Anthomyidengruppe *Homalomyia* nebst ihren Gattungen und Arten. Berliner entomologische Zeitschrift 40: 89.

Stuckenberg BR (1999) Antennal evolution in the Brachycera (Diptera), with a reassessment of terminology relating to the flagellum. Studia dipterologica 6: 33–48.

Su LX, Wang MF (2004) Studies on classification of the genus *Fannia* in China (Diptera: Fanniidae). Chinese Journal of Vector Biology and Control 15(2): 110–112.

Wang BF, Wang MF, Xue WQ (2006), Studies on fauna of Fanniidae in Dongbei region of China. Chinese Journal of Pest Control 22(8): 554–557.

Wang MF, Wu YX (1996) Taxonomic study of Fannidae in Shanxi (Diptera). Shanxi Journal of Preventive Medicine 5(2): 65–67.

Wang MF, Xue WQ (1993) Three newly recorded species of Fanniinae from China. Acta Zootaxonomica Sinica 18(4): 458.

Wang MF, Xue WQ (2002) Taxonomic study on Fanniidae of China (Diptera: Cyclorrhapha). In: Li DM, Kang L, Wu JW (Eds) Innovation and Development in Entomology. Science and Technology Press of China, Beijing, 54–59.

Wang MF, Xue WQ, Cao XF (2004) Studies on the Family Fanniidae from the Subregion Loess Plateau of China (Diptera:Fanniidae). Chinese Journal of Vector Biology and Control 15(1): 33–35.

Wu YX, Wang MF (2002) Studies on the family Fanniidae from Shanxi (Diptera: Cyclorrhapha). In: Li DM, Kang L, Wu JW (Eds) Innovation and Development in Entomology. Science and Technology Press of China, Beijing, 562–564.

Xue WQ, Wang MF (1998) Fanniidae. In: Xue WQ, Chao CM (Eds) Flies of China. Volume1. Liaoning Science and Technology Press, Shenyang, 809–835.

Xue WQ, Wang MF, Li FH (2001) The descriptions of two new species of the genus *Fannia* R.-D. from China. Acta Zootaxonomica Sinica 26(2): 225–228.

ZooKeys 112: 21–38 (2011)
doi: 10.3897/zookeys.112.1735
www.zookeys.org

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

A new species of *Megalommum* Szépligeti (Hymenoptera, Braconidae, Braconinae); a parasitoid of the pistachio longhorn beetle (*Calchaenesthes pistacivora* Holzschuh; Coleoptera, Cerambycidae) in Iran

C. van Achterberg[1,†], M.R. Mehrnejad[2,‡]

1 *Dept. Terrestrial Zoology, NCB Naturalis, Postbus 9517, 2300 RA Leiden, The Netherlands* **2** *Pistachio Research Institute, P.O. Box 77175.435, Rafsanjan, Iran*

† *urn:lsid:zoobank.org:author:D6374CF4–8F07–4FA8–8C55–9335FD19CECD*
‡ *urn:lsid:zoobank.org:author:6D72952F-DE3C-44CA-9F59-4E7209259BAB*

Corresponding author: *C. van Achterberg* (Kees.vanAchterberg@ncbnaturalis.nl)

Academic editor: *Michael Sharkey* | Received 12 November 2010 | Accepted 31 March 2011 | Published 24 June 2011

urn:lsid:zoobank.org:pub:5D08A285-4DF2-4ACA-A09F-FF25F9271F5E

Citation: Achterberg C van, Mehrnejad MR (2011) A new species of *Megalommum* Szépligeti (Hymenoptera, Braconidae, Braconinae); a parasitoid of the pistachio longhorn beetle (*Calchaenesthes pistacivora* Holzschuh; Coleoptera, Cerambycidae) in Iran. ZooKeys 112: 21–38. doi: 10.3897/zookeys.112.1735

Abstract

A new species of the genus *Megalommum* Szépligeti (Hymenoptera: Braconidae: Braconinae), reared from the pistachio longhorn beetle (*Calchaenesthes pistacivora* Holzschuh; Coleoptera: Cerambycidae), is described and illustrated. The genera *Curreia* Ashmead, 1900 and *Endovipio* Turner, 1922 are new synonyms of *Megalommum* Szépligeti, 1900. Notes on the biology of *M. pistacivorae* **sp. n.** and a key to the West Palaearctic and Oriental species are added. The following new combinations are given: *M. xanthoceps* (Fahringer, 1928), **comb. n.,** *M. jacobsoni* (Tobias, 1968), **comb. n.,** *M. ayyari* (Watanabe, 1950), **comb. n.,** *M. philippinense* (Baker, 1917), **comb. n.,** *M. dodecanesi* (Ferrière, 1922), **comb. n.,** *M. ceresense* (Turner, 1922), **comb. n**., *M. inareatum* (Granger, 1949), **comb. n.,** *M. antefurcale* (Szépligeti, 1915) **comb. n.** and *M. tibiale* (Ashmead, 1906), **comb. n.**

Keywords

Braconidae, Braconinae, *Megalommum*, *Curreia*; *Endovipio*, pistachio longhorn beetle, new species, Coleoptera, Cerambycidae; *Calchaenesthes pistacivora*, Cerambycidae, Palaearctic, Iran

Introduction

In 1999 a conspicuous longhorn beetle (Coleoptera: Cerambycidae), was collected from pistachio trees, *Pistacia vera* Linnaeus and *P. atlantica* subsp. *mutica* (Fischer & C.A. Meyer) at Sirjan (South Iran) for the first time. The beetle (Figs 7, 8, 10) proved to be undescribed and was named as *Calchaenesthes pistacivora* by Dr C. Holzschuh (Holzschuh 2003). According to Hashemi-Rad (2005) the pistachio longhorn beetle caused very severe damage to weakened pistachio trees. During April, 2007 the second author managed to rear a parasitoid from the longhorn beetle, which may play a role in the biological control of the pest. It proved to be a new species of the genus *Megalommum* Szépligeti near *jacobsoni* (Hymenoptera: Braconidae: Braconinae). The new species, *M. pistacivorae*, is described below. It is the first record of a cerambycid host for the genus, and is the first record of the genus *Megalommum* from Iran.

Material and methods

The material was partially reared from the larvae of the pistachio longhorn beetle boring in pistachio trees and partially collected at light in the wild pistachio growing areas of Sirjan (South Iran). The material is deposited in the Netherlands Centre for Biodiversity Naturalis at Leiden (RMNH).

For the recognition of the subfamily Braconinae, see van Achterberg (1990, 1993, 1997), for a key to the genera of Braconinae, see Quicke (1987), and for the terminology used in this paper, see van Achterberg (1988).

No taxonomic history is presented in this paper; for information, we refer to the Taxapad interactive catalogue (Yu et al. 2007 and later updates).

Key to the genera *Aphrastobracon* Ashmead and *Megalommum* Szépligeti

1 Scapus hardly or not protruding apico-ventrally (Fig. 71) and inner aspect of scapus normal apically, without double margin (Fig. 71); marginal cell of hind wing moderately wide subbasally (Fig. 65); first subdiscal cell of fore wing without dark patch; vein CU1b of fore wing subvertical and widened (Fig. 69), obsolescent or moderately inclivous and slender; [medio-basal area of second tergite semi-circular (Fig. 68) or triangular; dorso-lateral carinae of first metasomal tergite complete (Fig. 68)]; Oriental and Southeast Palaearctic; parasitoids of Noctuidae (living on Coccoidea: Kerridae) and Curculionidae .... ***Aphrastobracon* Ashmead, 1896**

– Scapus distinctly protruding apico-ventrally (Figs 33, 46, 59) and inner aspect of scapus with minute double margin apically (Figs 34, 48, but may be less developed in Afrotropical and West Palaearctic spp.); marginal cell of hind wing narrow subbasally (Figs 26, 38, 52), if intermediate then first subdiscal cell with dark patch and vein CU1b of fore wing strongly reclivous and more or less widened, triangular (Figs 45, 36) or parallel-sided (Fig. 60) or nearly so; [medio-basal area of second tergite triangular or rhombic, and often comparatively narrow (Figs 27, 39, 53), or area absent (*M. inareatum* (Granger, 1949) comb. n.); vein 1-SR 0.5–0.7 times vein 1-M; specimens from New Guinea (= *Megalommum* s.s.) have no dorso-lateral carinae of the first tergite (Fig. 50), upper valve of ovipositor wider than lower valve (and distinctly flattened; Fig. 51), have often a rather short ovipositor, if rather long then ovipositor valves normal and lower valve slightly narrower; m-cu of fore wing more or less widened]; New Guinea, Oriental, Afrotropical and South Palaearctic; parasitoids of tunneling larvae of Cerambycidae and Xyloryctidae (*Pansepta* spp.) .... ***Megalommum* Szépligeti, (Febr.) 1900 s.l.**

Notes. *Curreia* Ashmead, [Oct.] 1900 (Figs 26–37) and *Endovipio* Turner, 1922 (Figs 52–64) are new junior synonyms. *Endovipio* was synonymized with *Curreia* by Falco and Quicke (1997) and *Curreia* is here synonymized with *Megalommum* (syn. n.). The differences between the genera *Megalommum* Szépligeti s.s. (species from Australasia), *Endovipio* Turner (Afrotropical) and *Curreia* Ashmead (remainder of Palaeotropical area and South Palaearctic) are gradual and, therefore, they are considered congeneric here. The only small difference that seems to be valid is the development of the dorso-lateral carinae of the first tergite posteriorly; absent in *Megalommum* s.s. and present (but often only weakly developed) in *Curreia* and *Endovipio*. The shape of the ovipositor valves is variable in both groups as is the relative length of veins 1-CU1 and 1-M of the fore wing.

Key to West Palaearctic and Oriental species of the genus *Megalommum* Szépligeti

1 Vein CU1b of fore wing triangular, strongly widened basally (Figs 1, 2, 21, 45).. **2**

– Vein CU1b of fore wing parallel-sided or slightly narrowed apically and more or less evenly widened (Fig. 36) **4**

2 Medio-basal area of second metasomal tergite smooth and slightly longer than half length of tergite (Figs 2, 18, 19, 23, 24); vein CU1b of fore wing weakly reclivous (Figs 2, 22); vein 3-CU1 of fore wing 2–3 times as long as vein CU1b (Figs 2, 22); body yellowish-, orange- or dark reddish-brown; pterostigma partly dark brown (Figs 1, 2); veins more extensively dark brown (Figs 2, 21); first-fourth metasomal tergites of male largely rugulose to largely smooth (Figs 19, 24).. **3**

– Medio-basal area of second metasomal tergite longitudinally rugulose and distinctly longer than half as long as tergite (Fig. 19 in Quicke et al. 2000); vein CU1b of fore wing strongly reclivous; vein 3-CU1 of fore wing about 1.2 times as long as vein CU1b; body pale yellowish; pterostigma completely yellow; veins (except dark veins below blackish parastigma) yellowish; first-fourth metasomal tergites of male largely rugose; Afrotropical but reported from Yemen (Quicke et al. 2000) ....***M. xanthoceps* (Fahringer, 1928), comb. n.**

3 Vein 1-M of fore wing 0.7–1.1 times as long as vein 1-CU1 (Figs 21, 77, 78); hind femur more robust (Fig. 25); hind femur dorsally and coxa yellowish-brown or brown (Fig. 25), at most hind femur dark brown dorsally; pterostigma (near vein r) dark brown (Figs 21, 77, 78); OOL of ♀ short (Fig. 22); [vein 3-SR of fore wing 1.4–1.7 times vein 2-SR; body completely dark reddish-, orange or yellowish-brown; pterostigma baso-posteriorly (and apex narrowly) yellow and remainder dark brown]; Central Asia to Cape Verde Isles, including Spain, France, Croatia, Egypt, Yemen (RMNH) and Morocco..***M. jacobsoni* (Tobias, 1968), comb. n.**

Notes. *Curreia antefurcalis* Szépligeti, 1915 sensu Papp (1972) from Croatia belongs to *M. jacobsoni* according to Falco and Quicke (1997); *M. antefurcale* (Szépligeti, 1915) comb. n. is an Afrotropical species. *M. jacobsoni* is closely related to *M. tibiale* (Ashmead, 1906) comb. n. from China and Japan.

– Vein 1-M of fore wing 1.4–2.2 times as long as vein 1-CU1 (Figs 2, 74, 75); hind femur less robust (Fig. 20); hind femur dorsally and coxa dark brown (Figs 1, 20), at most hind coxa largely brown; pterostigma medially (near vein r) nearly always partly yellow (Figs 2, 74, 75); OOL of ♀ slightly longer (Fig. 16); Iran ....***M. pistacivorae* sp. n.**

4 Vein 2-SC+R of hind wing vertical; first subdiscal cell of fore wing with distinct dark spot and area below parastigma darkened; pterostigma largely yellow; marginal cell of hind wing parallel-sided submedially; vein 2–1A of fore wing nearly straight or slightly curved; Oriental..**5**

– Vein 2-SC+R of hind wing longitudinal; first subdiscal cell of fore wing without distinct dark spot and area below parastigma hardly or not darkened; pterostigma partly dark brown (except of *M. fasciatipenne*); marginal cell of hind wing more or less narrowed submedially; vein 2–1A of fore wing distinctly curved; [vein m-cu of fore wing narrow; scapus black]; Afrotropical and West Palaearctic **6**

5 Vein 2-SR of fore wing about as long as vein r-m; vein m-cu of fore wing widened; scapus yellow with a black streak; vein CU1b of fore wing about 0.7 times as long as vein 3-CU1; = *Aphrastobracon maculipennis* Ramakrishna Ayyar, 1926, not *Megalommum maculipenne* Cameron, 1914)]; India........... ....***M. ayyari* (Watanabe, 1950), comb. n.**

– Vein 2-SR of fore wing about twice as long as vein r-m; vein m-cu of fore wing slender; scapus black; vein CU1b of fore wing about as long as vein 3-CU1; Philippines....................***M. philippinense* (Baker, 1917), comb. n.**

6 Vein cu-a of fore wing subinterstitial and subvertical (Figs 26, 36); vein CU1b of fore wing about as long as vein 3-CU1 and subhorizontal (Fig. 36); eyes

deeply incised (Fig. 28); maximum width of the subdiscal cell of fore wing about equal to width of discal cell (Fig. 26); apical half of pterostigma largely yellow; vein m-cu of fore wing subinterstitial (Fig. 26); [second metasomal suture crenulate; surroundings of medio-basal area of second tergite rugulose]; Afrotropical but reported from Egypt (Quicke et al. 2000) ....***M. fasciatipenne* (Ashmead, 1900), comb. n.**

– Vein cu-a of fore wing far antefurcal and reclivous (Fig. 60); vein CU1b of fore wing about half as long as vein 3-CU1 and oblique (Fig. 60); eyes shallowly incised (Fig. 54); maximum width of the subdiscal cell of fore wing about 1.4–1.7 times width of discal cell (Fig. 52); apical half of pterostigma dark brown; vein m-cu of fore wing distinctly antefurcal (Fig. 52); [second metasomal suture and surroundings of medio-basal area of second tergite smooth; only males known]; Greece and Israel.. ....***M. dodecanesi* (Ferrière, 1922), comb. n.**

Note. Very close to *M. ceresense* (Turner, 1922) comb. n. from South Africa and Namibia; seems to differ mainly by having the maximum width of the subdiscal cell of fore wing about 1.4 times width of discal cell (Fig. 60); about 1.6 times in *M. dodecanesi*).

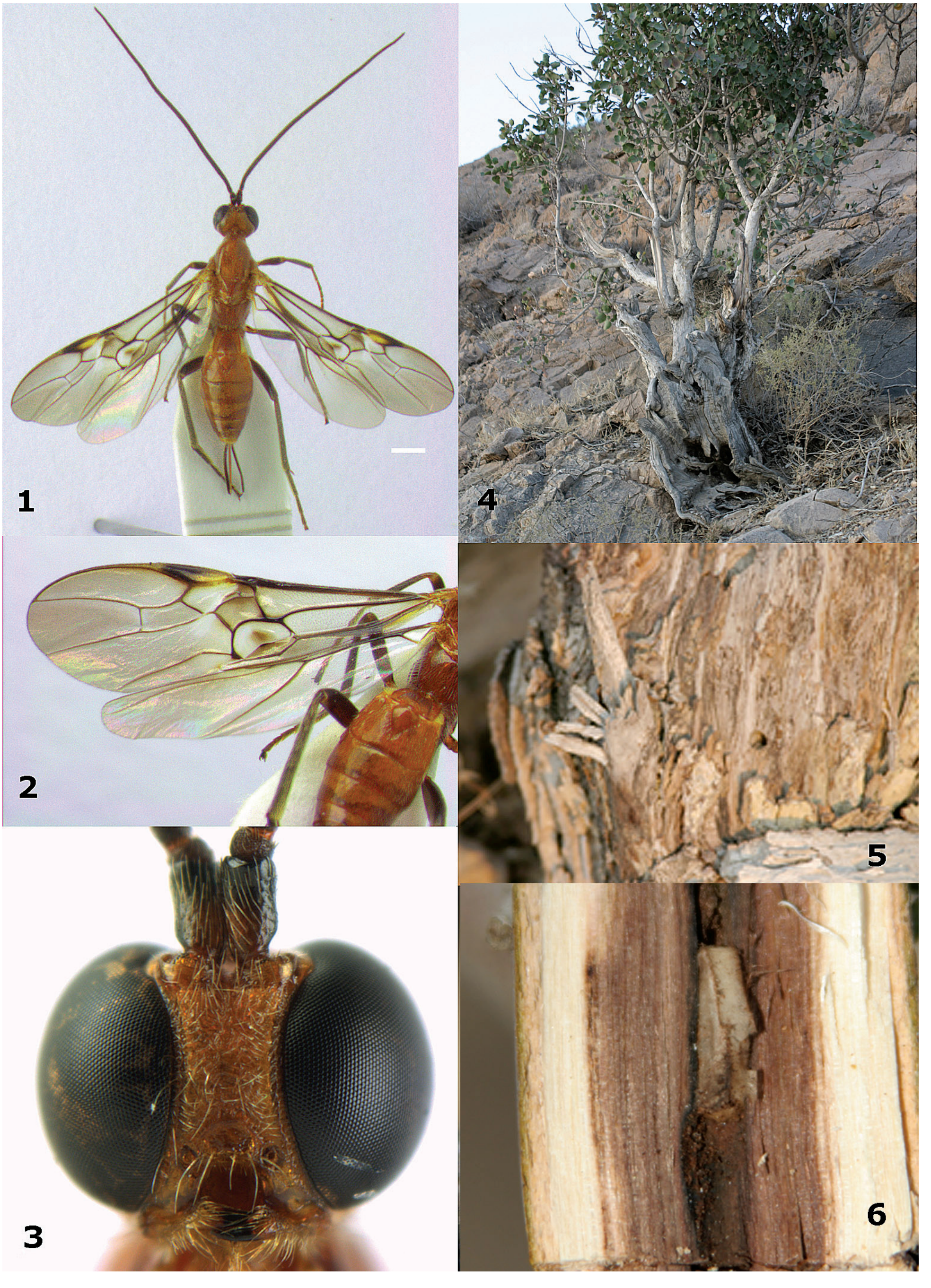
Taxonomy

***Megalommum pistacivorae* sp. n.**
urn:lsid:zoobank.org:act:16F7B146-34DD-40BB-A3CF-CA5D7806C8A4
http://species-id.net/wiki/Megalommum_pistacivorae
Figs 1–3, 16–20, 74–76

Type material. Holotype, ♀ (RMNH), "Iran, Sirjan, ex *Calchaenesthes pistacivora* (Ceramb.) on *Pistacia vera*, em. 14.iv.2007, M.R. Mehrnejad, RMNH'08". Paratypes (3 ♀ + 4 ♂; RMNH): 1 ♂ topotypical and from same host, but emerged 12.xi.2007; 2 ♀ "Iran, Sirjan, 14.v.2009, at light, M.R. Mehrnejad, RMNH'09"; 1 ♀ + 1 ♂, id., but 17.v.2009; 2 ♂, id., but 30.iv.2009.

Diagnosis. Body yellowish- or orange-brown; hind femur and coxa dark brown (Figs 1, 20); pterostigma medially (near vein r) partly yellow (Figs 2, 74, 75); OOL of ♀ slightly longer (Fig. 16); vein CU1b of fore wing triangular, strongly widened basally and weakly reclivous (Figs 2, 74, 75); vein 3-CU1 of fore wing 2–3 times as long as vein CU1b; vein 1-M of fore wing 1.4–2.2 times as long as vein 1-CU1 (Figs 2, 74, 75); vein 2–1A distinctly bent (Fig. 2); hind femur rather slender (Fig. 20); medio-basal area of second metasomal tergite smooth and slightly longer than half length of tergite (Figs 2, 18, 19); ovipositor sheath 0.25 times as long as fore wing and half as long as metasoma.

Description. Holotype, ♀, length of body 7.6 mm, of fore wing 7.3 mm.



Figures 1–6. 1–3: *Megalommum pistacivorae* sp. n., holotype female. **1** habitus dorsal (scale line = 1 mm) **2** wings and metasoma dorsal **3** head anterior. **4–6:** Old *Pistacia khinjuk* tree. **4** infested tree **5** old emergence holes of *Calchaenesthes pistacivora* **6** tunnel of *Calchaenesthes pistacivora* with closed cocoon of *Megalommum pistacivorae*.

Head. Antenna about as long as fore wing, with 61 segments; apical antennal segment with distinct spine and slender, scapus robust and distinctly protruding apically, its inner aspect with minute double margin apically; third, fourth and penultimate segments 1.2, 0.9 and 1.6 times their maximum width, respectively; length of maxillary palp 0.9 times height of head; eye distinctly emarginate (Fig. 3); face narrow and irregularly rugulose; clypeus flat, partly smooth and with some microsculpture, dorsally with angled carina and ventral margin thin and lamelliform, with 5 long setae ventrally; hypoclypeal depression 0.7 times as wide as minimum width of face (Fig. 3); frons moderately concave behind antennal sockets, smooth, without median carina (Fig. 16); vertex slightly convex, smooth, sparsely setose and stemmaticum protruding and surrounded by a groove; OOL:diameter of posterior ocellus:POL = 5:10:4; in dorsal view length of eye 5.2 times temple; temples directly narrowed behind eyes and smooth (Fig 16); malar suture absent, eye almost touching base of mandible; mandible strongly twisted and unidentate.

Mesosoma. Length of mesosoma 1.6 times its height; side of pronotum and propleuron smooth, except for some indistinct fine crenulae anteriorly and some punctulation posteriorly; pronotum vertical anteriorly and with a shallow groove and no antescutal depression; mesopleuron smooth, setose, except for a medial glabrous area; mesosternal sulcus smooth and narrow; metapleuron punctulate, convex; mesoscutum nearly completely sparsely punctulate and setose; notauli only present anteriorly and shallowly impressed; scutellar sulcus present and with distinct fine crenulae; scutellum weakly convex and sparsely punctulate; side of scutellum smooth; metanotum medio-anteriorly with carina, posteriorly evenly convex and smooth; propodeum smooth, setose and evenly convex.

Wings. Fore wing (Figs 1, 2): 1-M 1.8 times as long as 1-CU1; m-cu widened and 1.1 times as long as 1-M; first subdiscal cell with narrow and glabrous sclerome; 3-SR and SR1 weakly curved; r:3-SR:SR1 = 2:5:13; 2-SR:3-SR:r-m = 18:25:19; r-m largely unsclerotised; wide ring around dark patch of first subdiscal cell glabrous, but posteriorly setose; CU1b triangular and strongly widened basally. Hind wing: SR sinuate and marginal cell somewhat widened apically; subbasal cell setose; 1r-m weakly curved; M+CU:1-M:1r-m = 6:18:5.

Legs. Tarsal claws simple and with bristly setae ventrally; hind femur slender (Fig. 20) compared to *M. jacobsoni*; length of femur, tibia and basitarsus of hind leg 3.9, 10.0 and 4.7 times their maximum width, respectively; hind tibia with dense adpressed setae; hind tibial spurs 0.5 and 0.6 times as long as hind basitarsus; inner side of hind tibia and tarsus with dense long whitish setae.

Metasoma. Length of first tergite 1.1 times its apical width, parallel-sided, dorso-lateral carinae strong behind spiracles and medial area longitudinally rugose; second tergite smooth except for crenulae near distinct triangular medio-basal area, area surrounded by crenulate groove and tergite antero-laterally with small triangular smooth areas (Fig. 18); second suture distinct and weakly sinuate and finely crenulate; medial length of second tergite 1.2 times median length of third tergite; third and following tergites smooth; ovipositor depressed, without notch or nodus dorsally and without ventral teeth, apically narrowed (Fig. 76); ovipositor straight, its sheath 0.25 times as long as fore wing.

Colour. Yellowish-brown; antenna, hind femur dorsally, hind tibia and tarsus and ovipositor sheath, black; fore and middle femora, tibiae and tarsi, and remainder of hind leg more or less dark brown; most veins of basal half of wing, sclerome of first subdiscal cell and apical 0.6 of pterostigma largely dark brown (Fig. 2), vein 1-R1 of fore wing yellowish and remainder of veins brown; wing membrane moderately infuscate, below parastigma and patch in first subdiscal cell dark brown.

Variation. Length of body of ♀ 6.7–8.7 mm (of ♂ 5.2–7.3 mm), and of fore wing of ♀ 6.7–8.1 mm (of ♂ 4.3–6.4 mm); antenna of ♀ with 54 (1), 61 (1) or 65 (1) segments, of ♂ with 44 (1), 47 (1), 51 (1) or 52 (1) segments; vein 1-M of fore wing 1.4–2.2 times as long as vein 1-CU1; vein 3-SR of fore wing 1.4–1.7 times vein 2-SR; body completely reddish-, orange or yellowish-brown; basal 0.4 of pterostigma largely yellowish or darkened and only with yellowish basal patch; hind coxa and femur largely dark brown to largely brown; length of first tergite 1.1–1.3 times its apical width; second metasomal suture weakly to strongly crenulate; second, third and base of fourth metasomal tergites of ♂ finely rugulose, but sometimes only superficially so and partly smooth; length of ovipositor sheath 0.25–0.26 times fore wing.

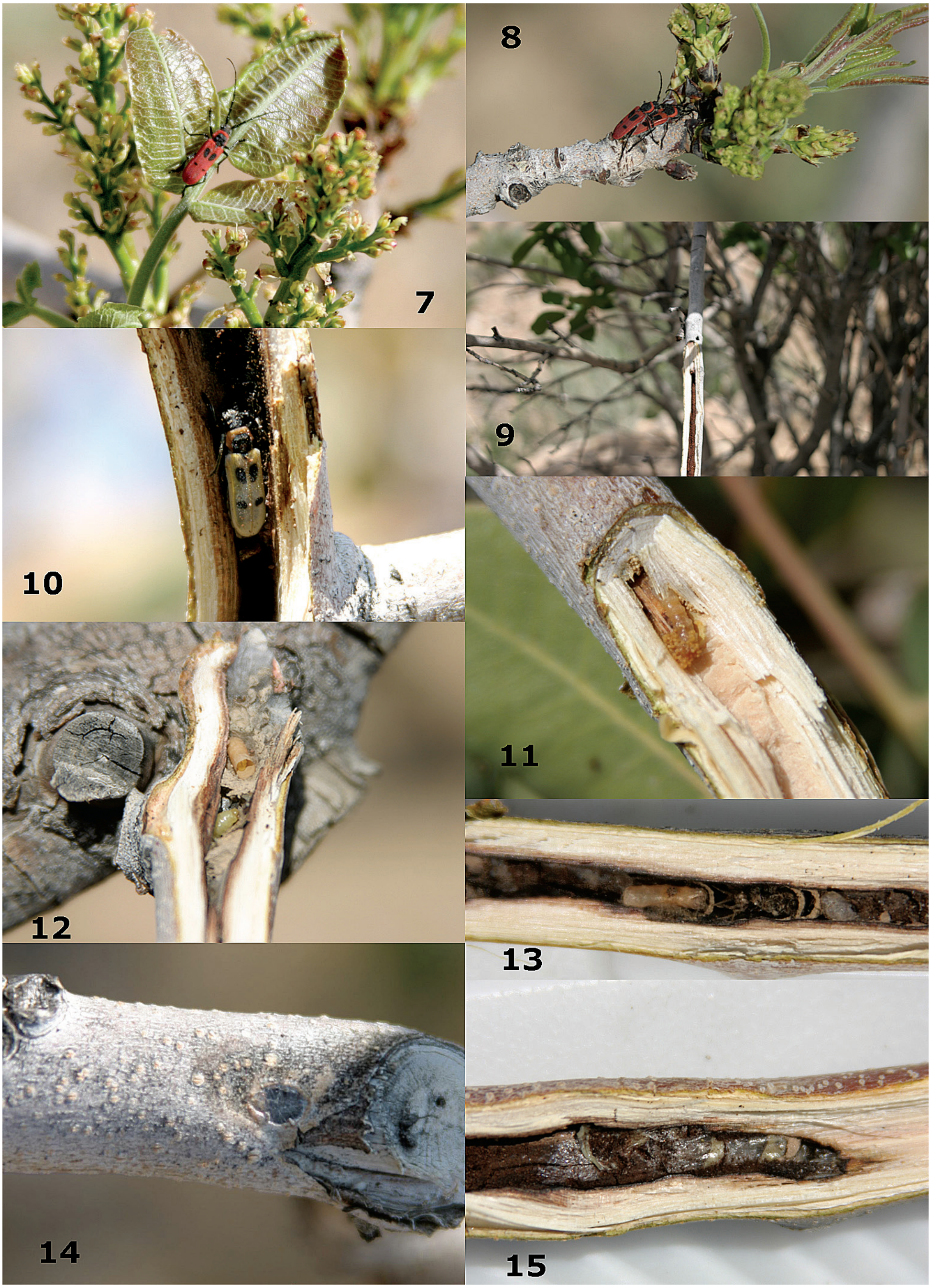
Distribution. South Palaearctic (Iran).

Biology. Solitary and possibly endoparasitoid of *Calchaenesthes pistacivora* Holzschuh (Coleoptera: Cerambycidae) on *Pistacia vera* Linnaeus, *P. atlantica* subsp. *mutica* (Fischer & C.A. Meyer) and *P. khinjuk* Stocks.

Etymology. Named after the specific name of its host.

Biology

The development of the cerambycid host *Calchaenesthes pistacivora* Holzschuh lasts two years; the first winter it survives as a larva and during the second autumn it usually develops into an adult (Hashemi-Rad 2005). The adult beetle stays inside the feeding canal (Fig. 10) for about five months, from mid October to late March. In early April, the adult beetles appear on the pistachio trees and usually feed on the fresh pistachio leaves (Fig. 7); the resulting damage is considered to be minimal. The beetles lay their eggs on twigs, branches or stems of weakened pistachio trees, preferably on the pruned sites where the tiny larvae promptly penetrate into the twigs or branches. Changes in the environmental conditions of pistachio growing areas in the collection site are thought to be drought, an increase of salinity in irrigation water, which in turn is caused by a decrease of water resources and mismanagement by pistachio producers. These appear to be the major reasons for the establishment and development of this pest on cultivated pistachio trees (Hashemi-Rad 2005). It is predicted that the contaminated areas will expand as more pistachio trees lose vigor. Our survey in wild pistachio growing areas of Sirjan clearly showed that *C. pistacivora* had already been living in the wild pistachio trees for a long time, because the beetle canals are clearly visible on both dead and living trunks of very old trees of *Pistacia khinjuk* Stocks (Figs 4, 5) and *P. atlantica mutica*. It is assumed that the beetle has been a minor phytophagous



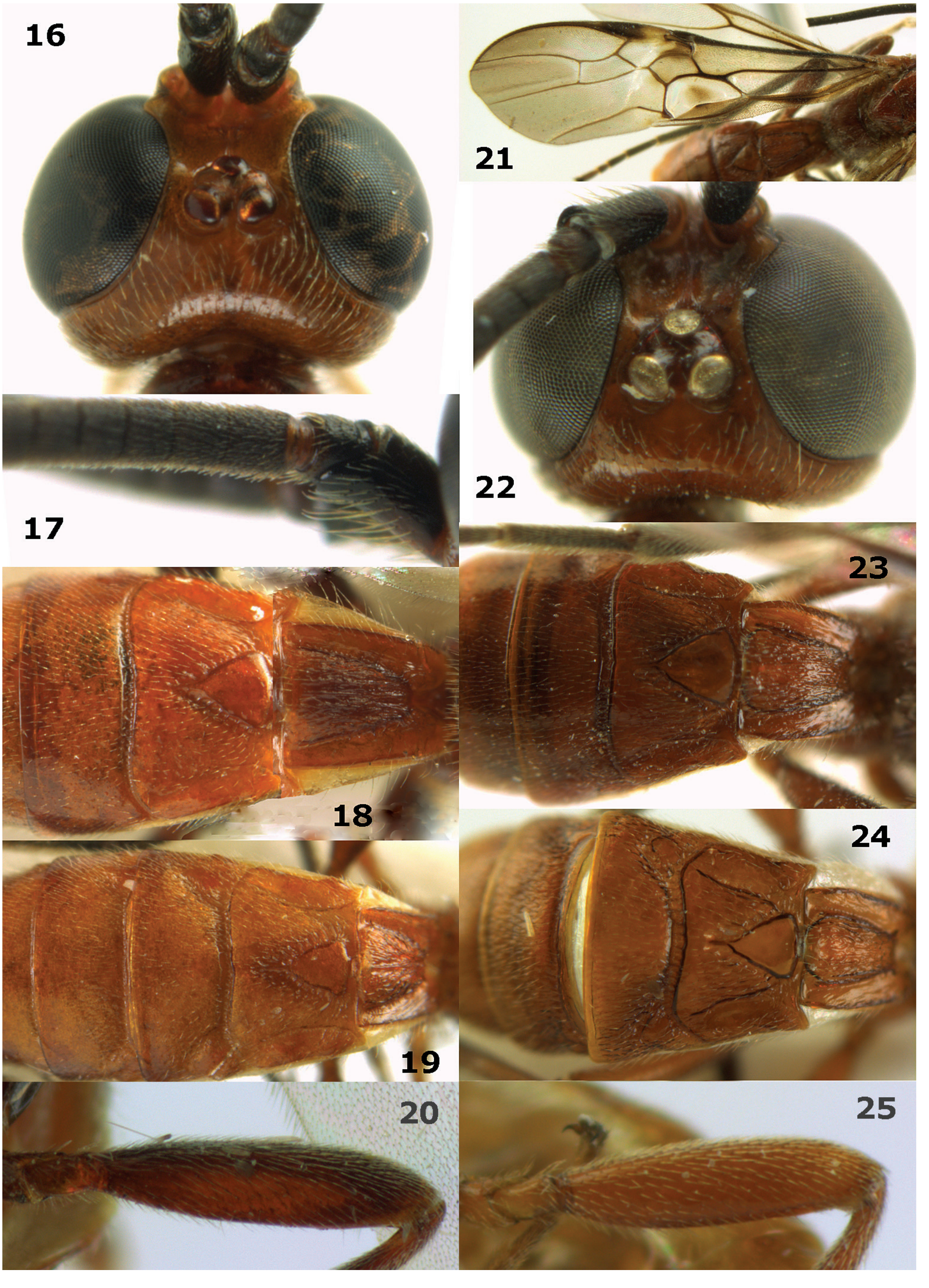
Figures 7–15. 7–11: *Calchaenesthes pistacivora* Holzschuh. **7** adult on pistachio tree **8** copula on pistachio tree **9** tunnel and emergence hole **10** freshly emerged adult **11** larva in tunnel in spring. **12–15:** Tunnels and emergence holes in pistachio trees. **12** opened cocoon of crabronid wasp and larvae of *Hylaeus* sp. **13** cocoon of crabronid wasp **14** grey coverage of emergence hole by *Hylaeus* sp. **15** *Hylaeus* cells.

pest on wild pistachio trees for hundreds of years, however, populations increased due to weakening of these trees. The wild pistachio species have been suffering from the effects of erosion caused by human activities, particularly overgrazing and harvesting for use as firewood or charcoal as well as from severe drought periods for several years. In addition, the cultivated pistachio regions at Sirjan are not far from areas with wild pistachio trees. Therefore, emigration of *C. pistacivora* to pistachio orchards is likely. At present the pistachio growers experience many serious problems caused by pests and diseases (Mehrnejad 2001) and the longhorn beetle is one of those that can cause considerable tree damage and reduction of yields.

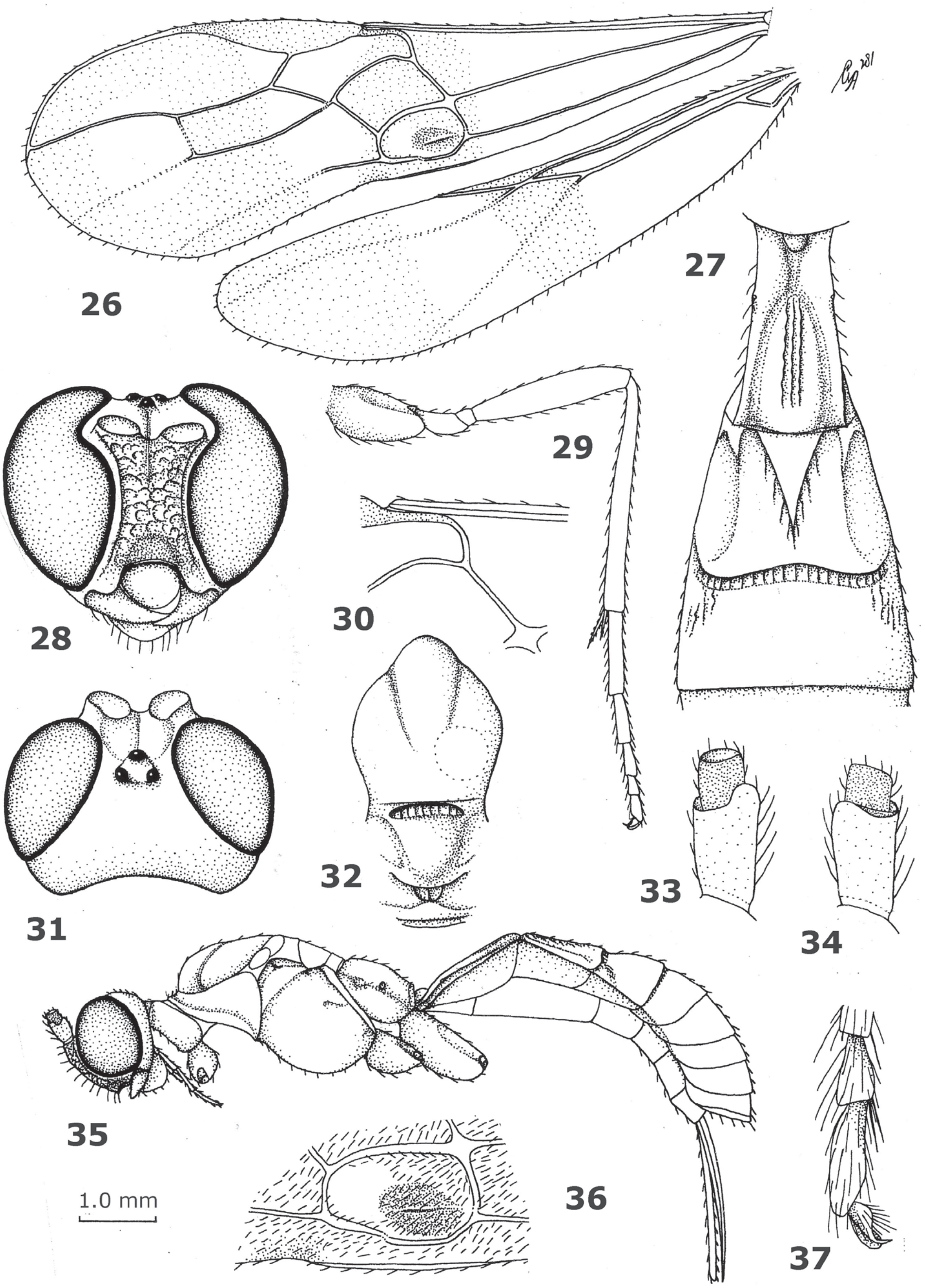
The cocoons of the parasitoid were collected inside the tunnels of the beetle (Fig. 6). The cocoons are 12–15 mm long, brownish and consist of thin paper-like silk. The beetle usually pupates inside the tunnel about 2–3 cm from the emergence hole, where the cocoons of *M. pistacivorae* are also found. Field studies showed that the parasitoid enters the tunnel of the beetle through the hole made by the last instar beetle larva before pupation. The parasitoid attacks the last instar beetle larva in September and October and the parasitoid larva is solitary. Members of Braconinae are all thought to be ectoparasitoids. Surprisingly, the second author did not see any parasitoid larva or egg when he collected a fully developed beetle larva from the feeding tunnel. The beetle larva (still in the tunnel) was transferred to the laboratory where it was kept under controlled conditions. After a week a naked pupa of the wasp (that did not construct the usual cocoon) was present and the pupa developed into an adult *M. pistacivorae*. Further investigations are necessary to rule out the possibility that a minute wasp larva was present on the non-exposed side of the beetle larva.

M. pistacivorae overwinters in the prepupal stage and it has an obligatory diapause to pass the winter. The parasitoid cocoons containing the prepupa were kept under controlled conditions (27.5°C, 16L:8D photoperiod and 55±5 RH), but they did not pupate until early March. In the field, pupation takes place from mid to late March and the adults of *M. pistacivorae* appear in the orchards from early April onwards. The rate of parasitism was estimated to be about 23% (n = 110) in experimental orchards. Alternative hosts for this parasitoid remain undetermined, also it is not clear if the adult wasps attack another host after emergence in early April or they pass the hot summer period and attack the larvae of *C. pistacivora* the following September.

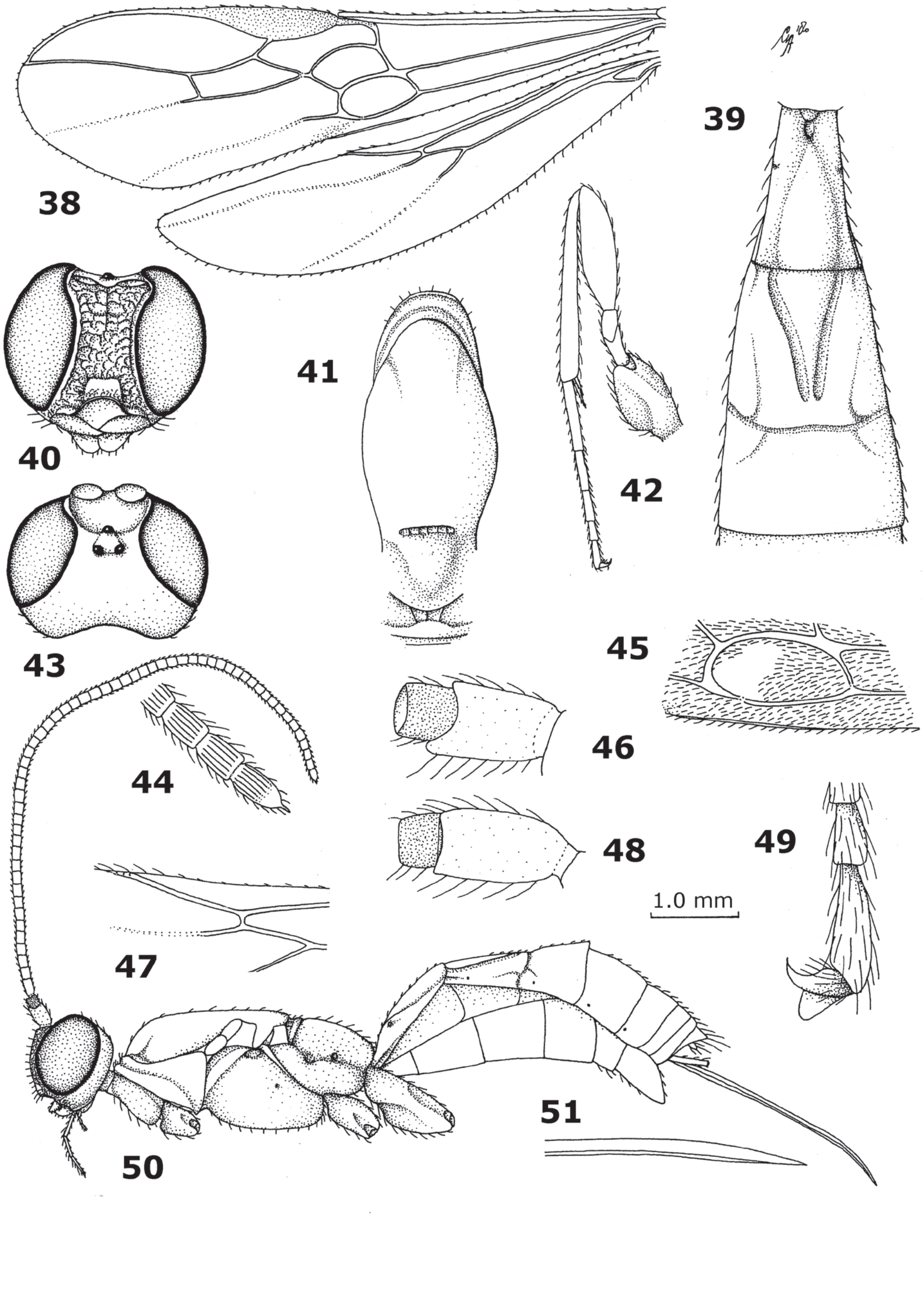
In the same tunnels several other insects were found; the most common was a bee belonging to the genus *Hylaeus*. It uses the tunnels as shelter for its brood cells. Several small cells of bees are usually found at the same site where *M. pistacivorae* makes its cocoons (Fig. 15). From late September till late October the female bee makes 3–5 small cells (4 mm length and 3 mm diameter each) in each tunnel, and fills them with a yellowish jelly mixed with pollen. In each cell an egg or a young larva was found (Fig. 12). The female bees cover the emergence hole (tunnel cup) with a very thin and delicate grayish waxy layer (Fig. 14). The cover protects the offspring of the bee as well as that of the wasp, *M. pistacivorae,* against predation or parasitism during the overwintering period. The bee larvae overwinter in these cells at the prepupal stage and pupate from late March on. The tunnels are also used as a nest site (Fig. 13) by a Crabronid wasp.



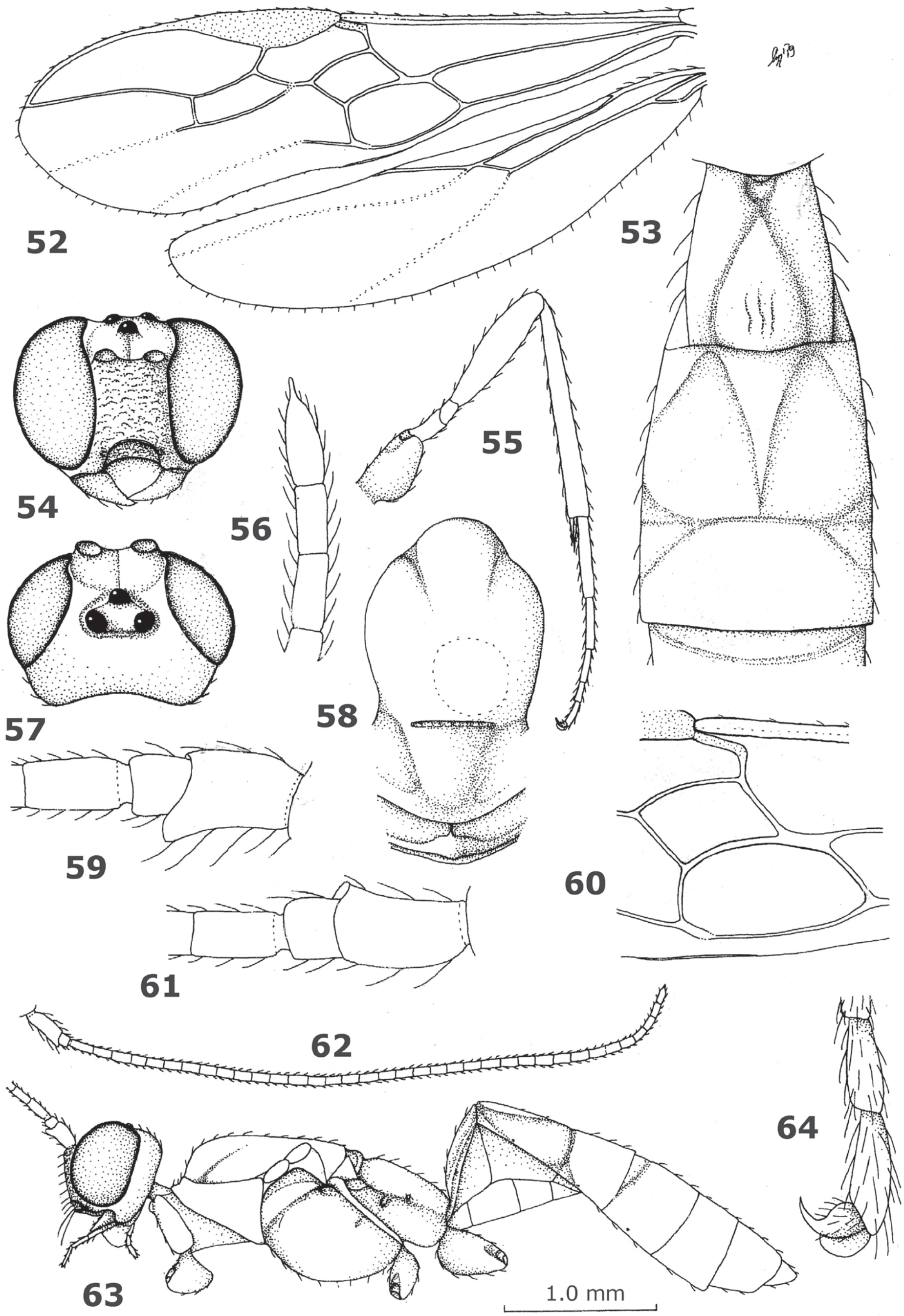
Figures 16–25. 16–20: *Megalommum pistacivorae* sp. n., holotype female, but 19 of paratype male. **16** head dorsal **17** basal part of antenna **18, 19** basal metasomal tergites, dorsal **20** hind femur lateral. **21–25:** *Megalommum jacobsoni* (Tobias), Yemen, Al Kowd, female, but 24 of male. **21** fore wing **22** head dorsal **23, 24** basal metasomal tergites, dorsal **25** hind femur lateral.



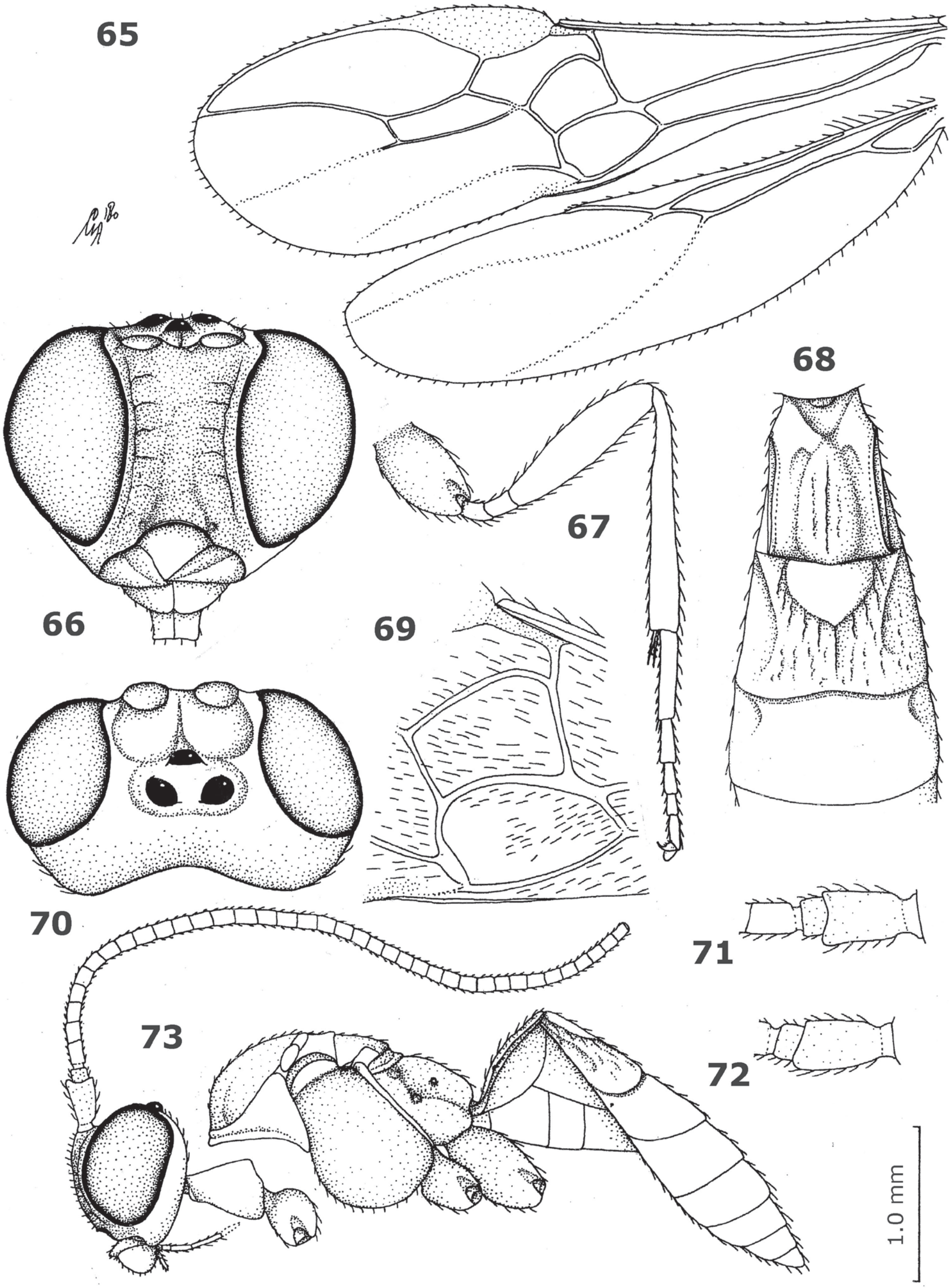
Figures 26–37. *Curreia fasciatipennis* Ashmead, holotype female. **26** wings **27** first-third metasomal tergites dorsal **28** head, anterior **29** hind leg **30** veins 1-SR and 1-M of fore wing **31** head dorsal **32** mesonotum dorsal **33** scapus and pedicellus outer side **34** scapus and pedicellus inner side **35** habitus, lateral **36** first discal and first subdiscal cells of fore wing **37** inner hind claw.



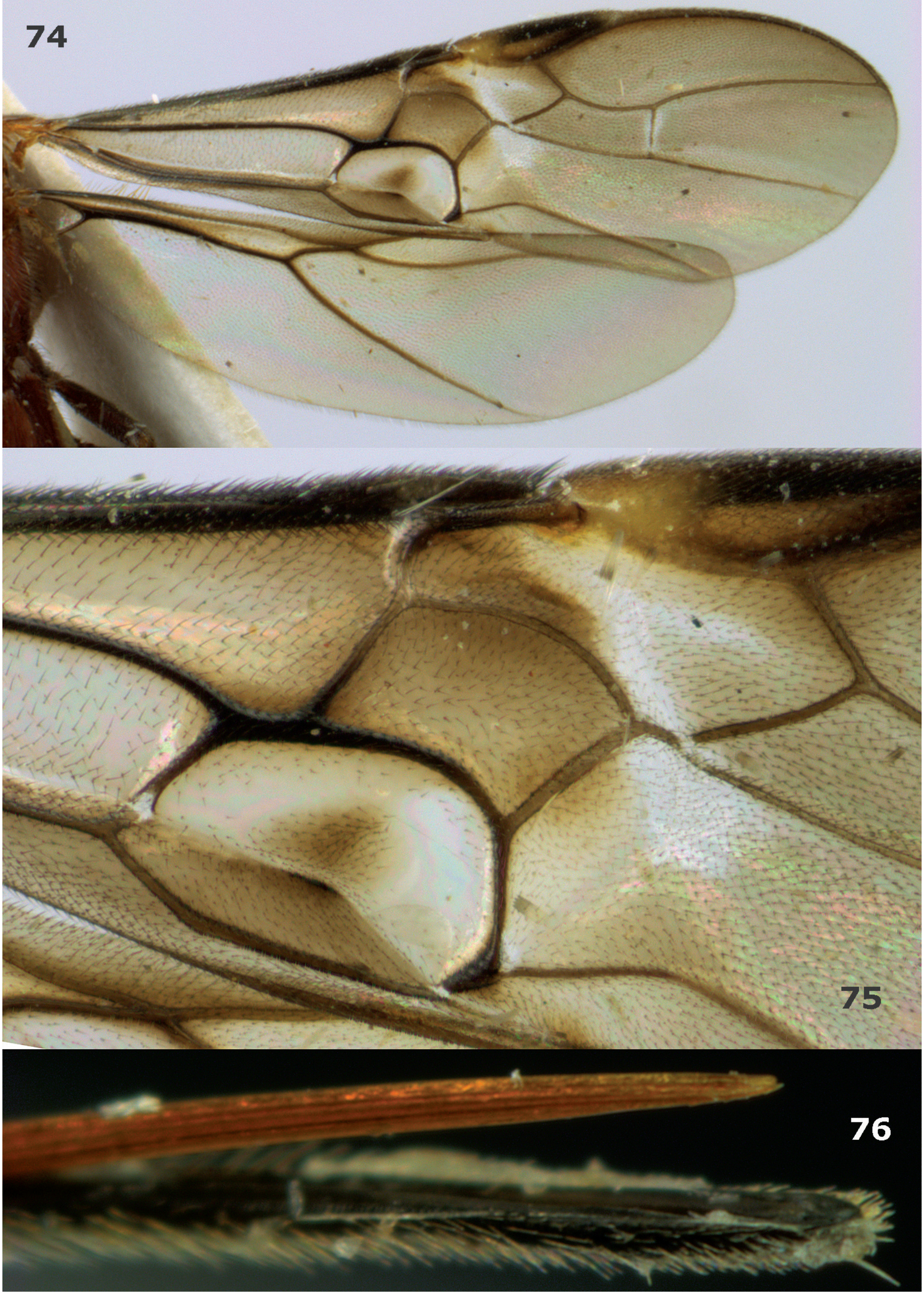
Figures 38–51. *Megalommum oculatum* Szépligeti, holotype female. **38** wings **39** first-third metasomal tergites dorsal **40** head anterior **41** mesonotum dorsal **42** hind leg **43** head dorsal **44** apex of antenna **45** first subdiscal cell of fore wing **46** scapus and pedicellus outer side **47** veins SC+R1, 2-SC+R and 1r-m of hind wing **48** scapus and pedicellus inner side **49** inner middle claw **50** habitus, lateral **51** apex of ovipositor.



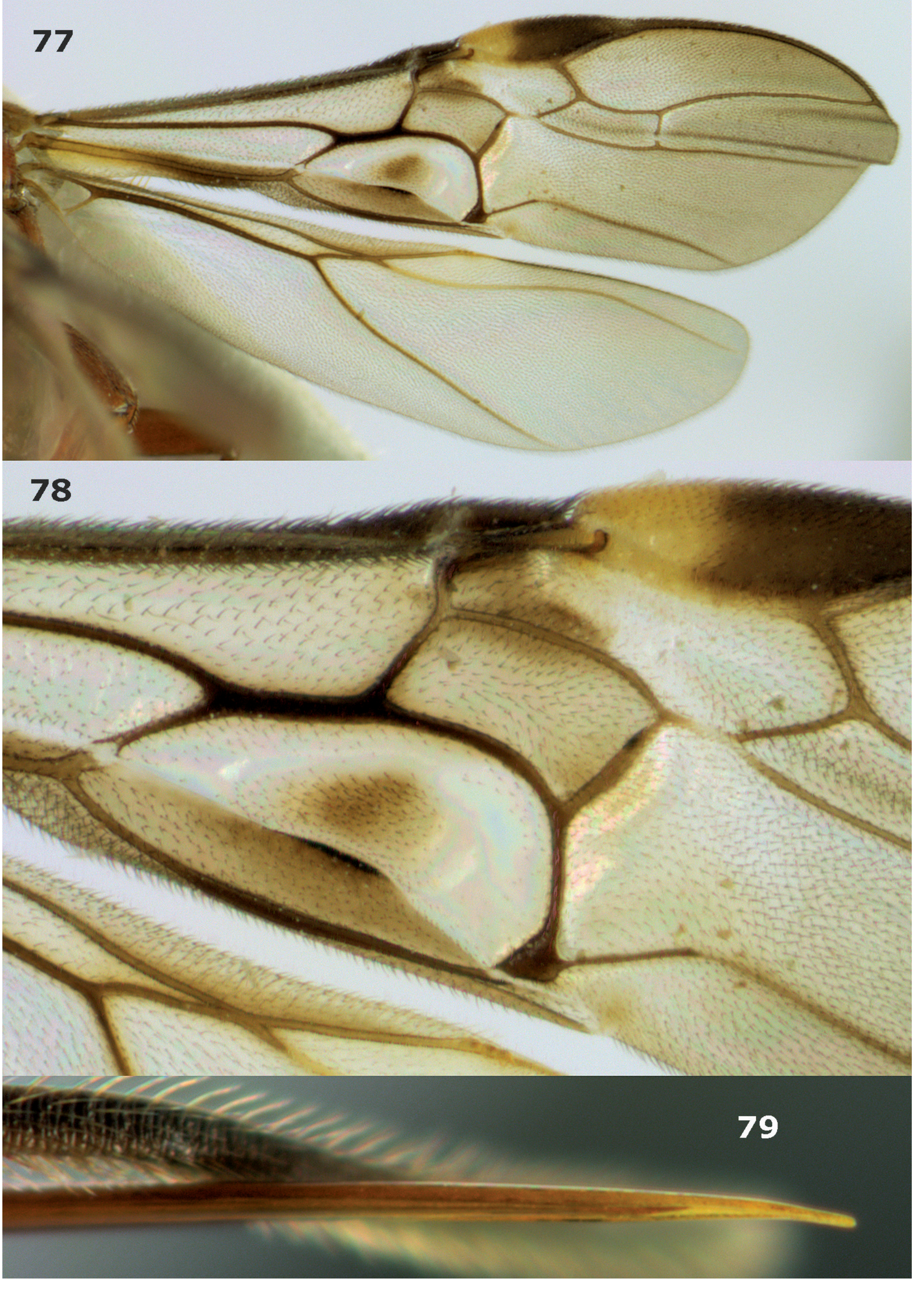
Figures 52–64. *Endovipio ceresensis* Turner, holotype male. **52** wings **53** first-third metasomal tergites dorsal **54** head anterior **55** hind leg **56** apex of antenna **57** head dorsal **58** mesonotum dorsal **59** scapus and pedicellus outer side **60** first discal and first subdiscal cells of fore wing **61** scapus and pedicellus inner side **63** habitus, lateral **64** inner hind claw.



Figures 65–73. *Aphrastobracon flavipennis* Ashmead, holotype male. **65** wings **66** head anterior **67** hind leg **68** first-third metasomal tergites dorsal **69** first discal and first subdiscal cells of fore wing **70** head dorsal **71** scapus and pedicellus, outer side **72** scapus and pedicellus inner side **73** habitus lateral.



Figures 74–76. *Megalommum pistacivorae* sp. n., paratype female. **74** wings **75** detail of fore wing **76** apex of ovipositor.



Figures 77–79. *Megalommum jacobsoni* (Tobias), Yemen, Al Kowd, female. **77** wings **78** detail of fore wing **79** apex of ovipositor.

Acknowledgements

We wish to thank Ing. Tony van Harten (Sharjah) for the specimens from the Arabian Peninsula (Yemen) which allowed an analysis of the variation of *M. jacobsoni* and R. Mirzaei for assistance during the field survey. The field survey was supported by the Pistachio Research Institute of Iran.

References

Achterberg C van (1988) Revision of the subfamily Blacinae Foerster (Hymenoptera, Braconidae). Zoologische Verhandelingen Leiden 249: 1–324.

Achterberg C van (1990) Illustrated key to the subfamilies of the Holarctic Braconidae (Hymenoptera: Ichneumonoidea). Zoologische Mededelingen Leiden 64: 1–20.

Achterberg C van (1993) Illustrated key to the subfamilies of the Braconidae (Hymenoptera: Ichneumonoidea). Zoologische Verhandelingen Leiden 283: 1–189.

Achterberg C van (1997) Braconidae. An illustrated key to all subfamilies. ETI World Biodiversity Database CD-ROM Series, Amsterdam.

Falco JV, Quicke DLJ (1997) The genus *Curriea* in Europe and the Canary Islands (Hymenoptera: Braconidae: Braconinae). European Journal of Entomology 94(4): 547–552.

Hashemi-Rad H (2005) Study on the biology and distribution of the Long-horned beetle *Calchaenesthes pistacivora* a new cultivated and wild pistachio pest in Kerman province. Final project report of the Pistachio Research Institute of Iran, 23.

Holzschuh C (2003) Beschreibung von 72 neuen Bockkäfern aus Asien, vorwiegend aus China, Indien, Laos und Thailand (Coleoptera, Cerambycidae). Entomologica Basiliensia 25: 147–241.

Mehrnejad MR (2001) The current status of pistachio pests in Iran. Cahiers Options Méditerranéennes 56: 315–322.

Papp J (1972) *Aphrastobracon antefurcalis* (Szépl.), an Ethiopian braconid species caught near Rijeka, Yugoslavia (Hym., Braconidae). Folia Entomologica Hungarica 25: 307–311.

Quicke DLJ (1987) The Old World genera of braconine wasps (Hymenoptera: Braconidae). Journal of Natural History 21: 43–157. doi:10.1080/00222938700770031

Quicke DLJ, Brandt AP, Falco JV (2000) Revision of the Afrotropical species of *Curriea* Ashmead (Hymenoptera: Braconidae: Braconinae): a genus with diverse ovipositor morphology. African Entomology 8(1): 109–139.

Yu DS, Achterberg K van, Horstmann K (2007) Biological and taxonomical information: Ichneumonoidea 2006. Taxapad Interactive Catalogue, Lexington.

ZooKeys 112: 39–52 (2011)
doi: 10.3897/zookeys.112.1110
www.zookeys.org

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Review of the genus *Plistobunus* Pocock, 1903, with description of a new species from Hainan Island, China (Opiliones, Laniatores, Epedanidae)

Wei-Guang Lian[1,†], Chao Zhang[2,‡], Feng Zhang[2,§]

1 *Department of Laboratory Animal Science, Hebei Medical University; Key Lab of Laboratory Animal Science of Hebei Province, Shijiazhuang, 050017, China* **2** *College of Life Sciences, Hebei University, Baoding, Hebei 071002, China*

† *urn:lsid:zoobank.org:author:E2EFBC5F-448D-490F-8326-6CD2648FF317*
‡ *urn:lsid:zoobank.org:author:7BF197AF-0B03-4F35-81C7-1E4AD1DE77EE*
§ *urn:lsid:zoobank.org:author:904C4445-AAEA-40BC-B418-502053EF39B8*

Corresponding author: *Feng Zhang* (dudu06042001@163.com)

Academic editor: *Christine Rollard* | Received 9 February 2011 | Accepted 7 June 2011 | Published 24 June 2011

urn:lsid:zoobank.org:pub:D1D92EF4-1997-4C0D-BE8B-567186C1F145

Citation: Lian W-G, Zhang C, Feng Zhang F (2011) Review of the genus *Plistobunus* Pocock, 1903, with description of a new species from Hainan Island, China (Opiliones, Laniatores, Epedanidae). ZooKeys 112: 39–52. doi: 10.3897/zookeys.112.1110

Abstract
The genus *Plistobunus* Pocock, 1903 and its type species *Plistobunus rapax* Pocock, 1903 are redescribed based on the type material deposited in the British Museum of Natural History (BMNH), London. In addition, a new *Plistobunus* species from Hainan Island is described and illustrated of *Plistobunus columnarius* **sp. n.** The new species is diagnosed by having a row of 12 setiferous tubercles on anterior margin of carapace, and the femur of pedipalpus ventrally with 13 setiferous tubercles in male.

Keywords
taxonomy, Arachnida, harvestmen, *Plistobunus*, China

Introduction

The Epedanidae Sørensen, 1886 includes 73 genera and 188 species, and they are endemic to Asia (Kury 1993). According to Pinto-da-Rocha and Giribet (2007) and Kury (2007), no systematic research to this family in the later decades, although four new species are occasionally being proposed (Kury 2008; Zhu and Lian 2006; Lian et al., 2008; Zhang and Zhang 2010).

This family was removed from the Phalangodidae Simon, 1879 by Kury (1993), based mainly on the presence of a well developed immovable sac (which he called 'follis') and the absence of complex introverting structures in the penis (Lian et al. 2008). Kury (2003) recognized the following four subfamilies under Epedanidae: Acrobuninae Roewer, 1912; Sarasinicinae Roewer, 1923; Epedaninae Sørensen, 1886 and Dibuninae Roewer, 1912.

The genus *Plistobunus* of Epedaninae was erected by Pocock in 1903 based on a single male, the type species *P. rapax* Pocock, 1903. The original description provided by Pocock (1903) was brief and the figure was very schematic. Although Roewer (1912) failed to examine the type species *P. rapax*, he redescribed the genus characters in detail with the helps of Hirst who was an arachnologist in London. Moreover, the description was mentioned again in Roewer's voluminous book, as well as the only figure which is from Pocock (Roewer 1923). In 1937, Roewer finally examined, redescribed and illustrated the type specimen. So far, there is no further report for this genus and species.

In 2009, we explored Hainan Island, China, and collected some laniatorid harvestmen specimens by sieving the leaf in the forest. Among the collected specimens, we recognized a species new to science, and describe it under the name *Plistobunus columnarius* sp. n. here. Additionally, we loaned the type specimen of *P. rapax* from the British Museum of Natural History (BMNH), London, examined, redescribed and illustrated it, and revised the generic characters based on the two species above.

Materials and methods

Taxonomic methods follow outline proposed by Acosta et al. (2007). The type materials of *Plistobunus* was loaned from the British Museum of Natural History, London, British (BMNH) and was preserved in 75% Industrial Methylated Spirit (IMS), also was examined, drawn and measured under a Tech XTL-II stereomicroscope equipped with an Abbe drawing device. Type specimens of the new species were preserved in 75% ethanol (deposited in the Museum of Hebei University, Baoding, China (MHBU)) and were examined and drawn under a Leica M165c stereomicroscope equipped with drawing tube. The male genitalia were placed firstly in hot lactic acid, followed by distilled water to expand those parts for observation (Schwendinger and Martens 2002). The terminology of the setae on penis follow Ubick and Briggs (2004), except for basal setae of glans, which is presented by current authors. All measurements are given in mm.

The following abbreviations are used in the text: BS, basal sac; DP, dorsal plate; DS, dorsal setae; DSL, dorsal stylar lobe; G, glans; GBS, basal setae of glans; LP, lateral plate; LS, lateral setae; S, stylus; SL, stylar lobe; VP, ventral plate; VS, ventral setae; VSL, ventral stylar lobe.

Taxonomy

***Plistobunus* Pocock, 1903**
http://species-id.net/wiki/Plistobunus

Plistobunus Pocock, 1903: 447; Roewer, 1912: 232; 1923: 207; 1938: 124.

Type species: *Plistobunus rapax* Pocock, 1903, by original designation.

Diagnosis. Medium-sized epedanines (3.03–3.57) with a long median spine on the ocularium. Carapace with a row of 4–6 setiferous tubercles on each side of the frontal margin. Area II with a pair of spines. Area IV with a median spine. Area IV and all free tergites with a transverse row of hair-tipped tubercles. The proximal segment of chelicera elongated and armed above with numerous tubercles, of which distal one enlarged the largest on the dorsal surface. Pedipalpus elongated; femur of male with 9–13 setiferous tubercles ventrally, a longitudinal row of 7–9 setiferous tubercles dorsally, and with two tubercles on medial side distally; patella of male with two setiferous tubercle disto-medially and three setiferous tubercles ectally. Distitarsus of leg I with two segments. Shaft of penis widened distally. DP conspicuous, VP complex. G protrude sideways beyond the distal penis and near the DP. S is surrounded and protected by SL. BS globular, immovable and entire hidden into truncus.

Distribution: China (Hongkong, Hainan).

Remarks. The male genitalia of *P. rapax* remains unknown, because the penis was lost (see remarks below). According to study of *P. columnarius* sp. n., we tentatively supplemented the male genital structure to the generic characters.

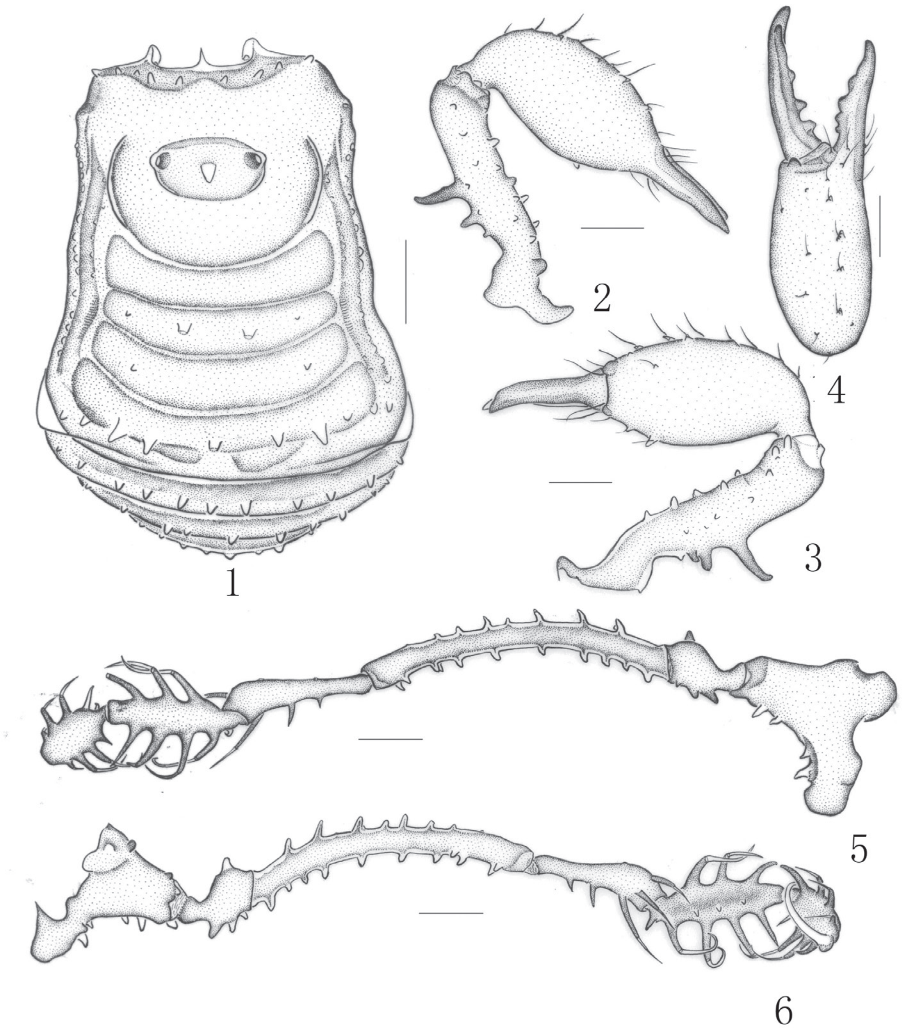
***Plistobunus rapax* Pocock, 1903**
http://species-id.net/wiki/Plistobunus_rapax
Figs 1–6

Plistobunus rapax Pocock 1903: 447, fig. 2; Roewer 1912: 232; 1923: 207, fig. 236; 1938: 124, fig. 43.

Type material examined. Holotype ♂, in 75% Industrial Methylated Spirit (IMS), labelled as follows: "56. 113, *Plistobunus rapax* Pocock, Hong Kong" (BMNH 56. 113).

Redescription. Male holotype (habitus see Fig. 1): Coloration. Body yellowish brown and appendages yellow. Lateral margins and free tergites banded with dark brown. Chelicerae dorsally reticulated with dark brown.

Dorsum. Dorsal scutum nearly trapezoid in shape; widest portion at fourth scutal area; anterior margin of carapace armed with a transverse row of four to five setiferous tubercles. Ocularium long oval, armed with a short median spine. Opisthosomal region of scutum with four areas, first area completely smooth, without a median furrow or line; second area has four hair-tipped tubercles, of which two median ones are



Figures 1–6. *Plistobunus rapax* Pocock, 1903, male (holotype) **1** Body, dorsal view **2** Left chelicera, medial view **3** Same, ectal view **4** Distal segment of the left chelicera, frontal view **5** Left pedipalpus, ectal view **6** Same, medial view. Scale bars: 0.5 mm (1–6).

longer than others; third area covered with two relatively tubercles; fourth area with a transverse row of seven tubercles, of which the median one is longest. Free tergites with hair-tipped granules arraged in a transverse; each lateral margin of the scutum with a longitudinal row of granules.

Venter. Coxae I–III armed with a row of hair-tipped tubercles, additionally coxa I covered with a row of relatively small hair-tipped tubercles. Coxa III with a row of low humps along front and hind margins. Coxa IV with a row of small hair-tipped granules. Some small hair-tipped granules scttered over surfaces of coxae I–IV. Tracheal stigma clearly visible.

Chelicera (Figs 2–4). Proximal segment fairly strong, distinctly armed with two prominent spines dorsally, numerous hair-tipped tubercles scattered over ventral and lateral surface. Second segment distinctly expanded, armed with a row of four strong hair-tipped bifid tubercles on the prodorsal surface. A few hair-tipped granules scattered over the prodorsal surface. Fingers relatively strong, cutting edges dentate (Fig. 4).

Pedipalpus (Figs 5–6). Relatively long and slender. Trochanter with a single setiferous tubercle dorsally, three ventrally. Femur dorsally with a longitudinal row of seven setiferous tubercles; ventrally with a longitudinal row of nine setiferous tubercles; distally with two setiferous tubercles medially. Patella ectally with three setiferous tubercles, disto-medially with two ones. Tibia with three medial and five ectal setiferous tubercles. Tarsus with four setiferous tubercles on both sides of ventral surface. Tibia with a longitudinal row of three granules ventrally. Tarsal claw long, strongly curved.

Legs. All of legs were destroyed and missing but their trochanters ventrally with two hair-tipped tubercles, their femora armed with a row of setiferous tubercles.

Penis. Lost.

Measurements. Body 3.03 long, scutum 2.64 long, 2.25 with at the widest portion; ocularium 0.65 long, 0.35 wide.

Distribution. China: Hong Kong.

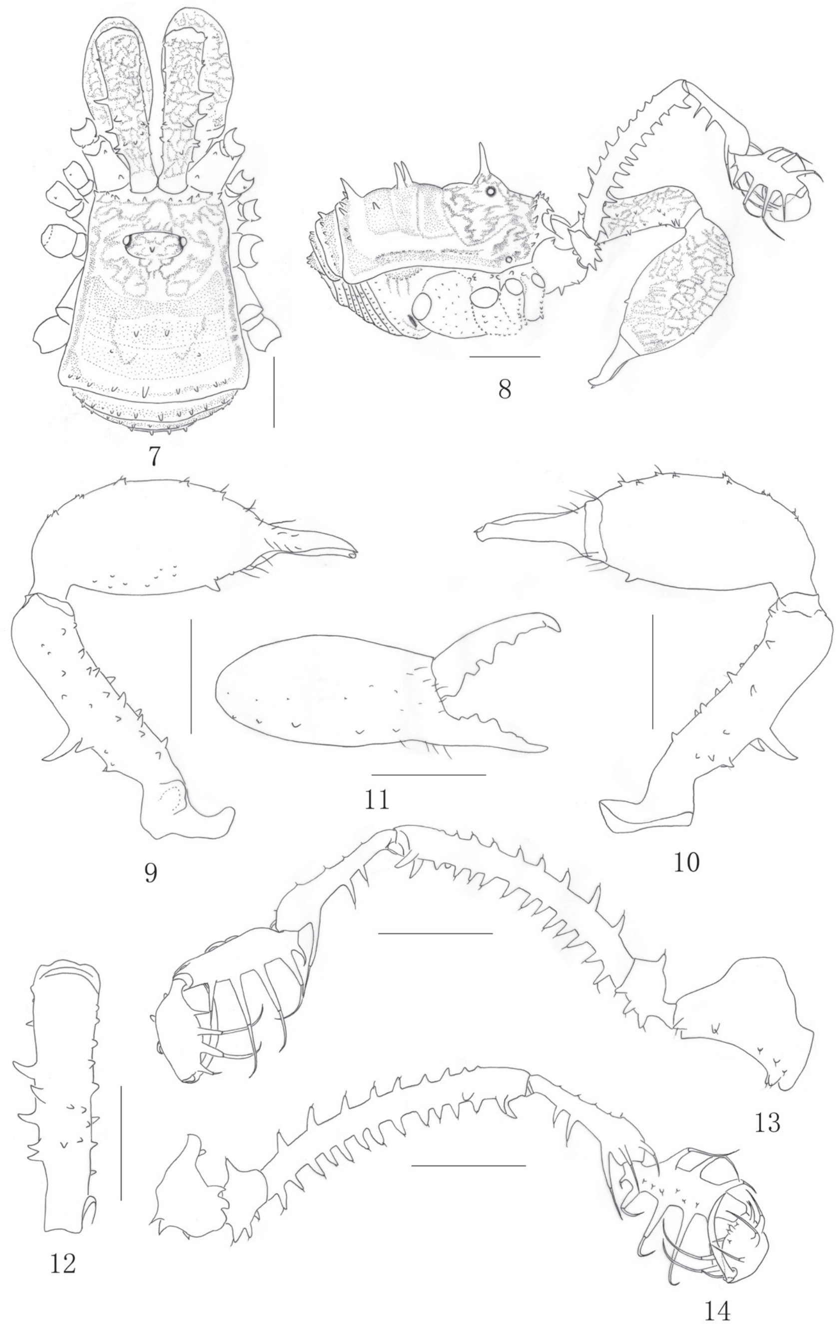
Remarks. *P. rapax* is only known from the type specimen. To make matters worse, the type specimen is in an incomplete state. All legs were missing and the penis is lost. Roewer at first (1912, 1923) did not examine the holotype by himself, and learned from Hirst that all the tarsi of legs in type specimen were missing. According to the description of Pocock, he assumed that the species should be placed in the subfamily Epedaninae, family Phalangodidae. Later Roewer (1937) examined the type specimen, he found that all legs were lost, then he (1938) listed it also in the family Epedanidae, merely based on the original description and Hirst's information. We can not confirm when the penis was lost, as Roewer did not usually describe and illustrate the structure of penis, because he was unaware of the importance of genital diagnostic characters.

Plistobunus columnarius sp. n.

urn:lsid:zoobank.org:act:1E2AB18D-7941-495F-A8C5-1406864D6F79
http://species-id.net/wiki/Plistobunus_columnarius
Figs 7–23

Type material. Holotype male (Opi.11061601), CHINA: Hainan Province, Tunchang County, Xichang Town [N19°26′, E 110°02′], June 16, 2009, C. Zhang leg. (MHBU), paratype 1♀(Opi.11061602), same data as holotype.

Diagnosis. The new species is similar to the type species *P. rapax* Pocock, 1903, but can be easily distinguished from the latter by: 1) anterior margin of carapace with a row of six setiferous tubercles on either side; 2) the femur of pedipalpus ventrally with 13 setiferous tubercles in male and seven setiferous tubercles in female; 3) the medial surface of cheliceral proximal segment with a huge protuberance at base.



Figures 7–14. *Plistobunus columnarius* sp. n. male **7** Body, dorsal view **8** Same, lateral view **9** Left chelicera, medial view **10** Same, ectal view **11** Distal segment of the left chelicera, frontal view **12** Proximal cheliceral segment, dorsal view **13** Left pedipalpus, ectal view **14** Same, medial view. Scale bars: 1 mm (7–14).

Etymology. The specific name is derived from the Latin adjectives "columnaris" meaning columnar, refers to shape of the stylus in male penis.

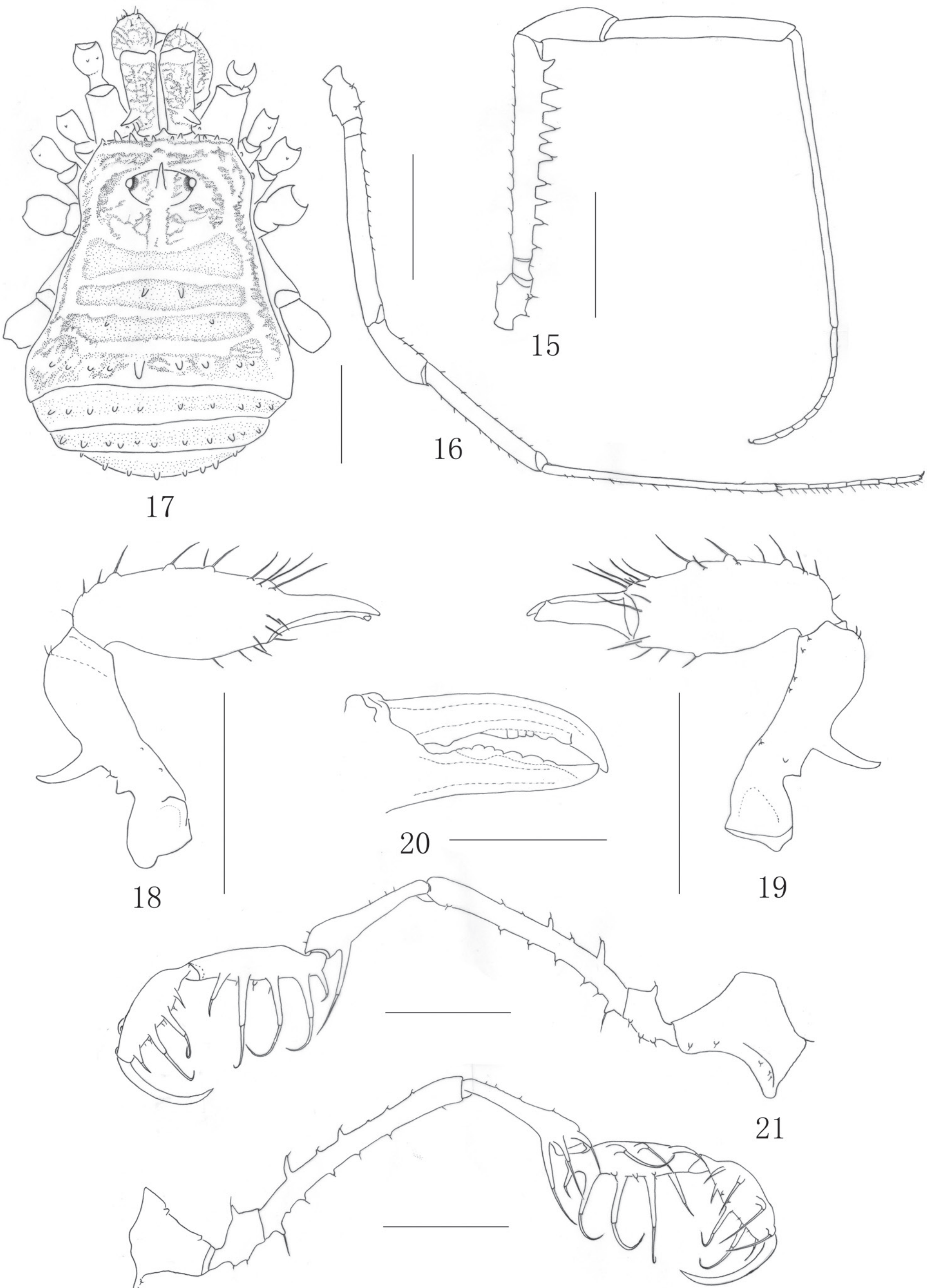
Description. Male (holotype) habitus as in Figs 7–8. Coloration: entire body rusty yellow, with somewhat dark brown to blackish brown patches on the dorsum; median area of carapace with blackish brown reticulations; each side of carapace dark brown; lateral ridges of the scute margined with blackish brown; venter concolorous with dorsum; coxae with dark brown reticulations; free sternites with transverse band of blackish brown; chelicerae rusty yellow, with blackish brown reticulate markings above; pedipalpus dark brown, tibia and tarsus paler, tarsus with dark brown reticulations dorsally; legs brown, trochanters yellow, femur, patella and tibia with blackish brown reticulations, metatarsus and tarsus lighter.

Dorsum. Dorsal scutum trapezoid in shape; widest portion of body at forth scutal area. Carapace with a row of six small setiferous tubercles on each side of front margin. Surface of dorsum almost smooth. Ocularium wide oval, remote from anterior border of scutum, armed with a long erect median spine. Opisthosomal region of scutum with four areas, first area well defined, entire. Second area with two long median spines. Third with a pair of hair-tipped tubercles removed from each other. Fourth with a transverse row of nine tubercles, median tubercle enlarged into a spine. Each lateral margin of the scutum with a longitudinal row of minute hair-tipped granules. Free tergites each with a transverse row of hair-tipped granules spread over its entire width.

Venter. All coxae and genital operculum granulate. Coxae I–III disto-dorsally with two coarse tubercles on anterior and posterior sides respectively. Coxa IV with a reduced one on medio-prolaterally. Coxa I medio-ventrally and prolaterally with transverse rows of hair-tipped tubercles. Coxae II–III medio-ventrally with a transverse row of same tubercles. Coxa III with prolateral and retrolateral rows of small humps. Coxa IV widened, with hair-tipped granules. Free sternites each with a transverse of hair-tipped granules. Tracheal stigma clearly visible.

Chelicera (Figs 9–12). Fairly strong. Proximal segment elongated and with numerous hair-tipped tubercles above; the dorsal surface centrally with six hair-tipped tubercles, of which distal one the largest, three medium-sized tubercles posterior to it, and two smaller ones toward the medial side; the ventral surface and the medial surface with rows of eight hair-tipped tubercles respectively, the medial surface with a huge protuberance at base; the ectal surface with a row of seven tubercles. Second segment considerably widened, medially with five enlarged hair-tipped bifid tubercles and ectally with five reduced ones on prodorsal surface, medially with many small hair-tipped granules on ventral surface, the largest one towards the base of fingers. Fingers relatively strong, inner edges toothed as illustrated (Fig. 11): moveable finger with four teeth, the proximal one square, the middle with two crest teeth, the distal one rectangular; fixed finger with five teeth, the proximal two formed one bifid tooth, the middle with one conical tooth, the distal with two lower than the middle one.

Pedipalpus (Figs 13–14). Coxa dorsally with one proximal and one strong distal bifurcate setiferous tubercles, ventrally with a row of five setiferous tubercles, two enlarged ones additionally at base. Trochanter ventrally with three setiferous tubercles, dorsally



Figures 15–22. *Plistobunus columnarius* sp. n. **15** Right first leg, male, retrolateral view **16** Left first leg, female, retrolateral view **17** Female body, dorsal view **18** Left chelicera, female, medial view **19** Same, ectal view **20** left cheliceral fingers, female, frontal view **21** Left pedipalpus, ectal view **22** Same, medial view. Scale bars: 1 mm (15–19, 21–22); 0.5 mm (20).

with one. Femur elongate, ventrally with 13 setiferous tubercles, dorsally with nine ones of which the distal two inconspicuous, distally on medial side with two setiferous tubercles of which the distal one tipped and the other one conical. Patella very long, widening abruptly distally, with two setiferous tubercle disto-medially and three setiferous tubercles ectally, dorsally with five inconspicuous granules. Tibia with three medial and five ectal setiferous tubercles, with a row of six hair-tipped granules in the ventral surface. Tarsus with four setiferous tubercles on both sides of ventral surface, with three granules in the ventral surface. Tarsal claw nearly as long as tarsus, strongly curved.

Legs. Legs I–II slender and legs III–IV strong. Trochanters I–II each with one hair-tipped tubercles arising distally on the dorsal surface, the ventral surface with three hair-tipped tubercles. Trochanters III-IV smooth dorsally, with inconspicuous granules ventrally. Femur I–II ventrally with a row of 10 or 17 setiferous tubercles respectively (Fig. 15). Femur III ventrally with two rows of 12 and 14 setiferous tubercles respectively. Femur IV ventrally with two rows of many granules. The remaining leg-segments unarmed, smooth, with hairs. Tarsi III–IV with bare double claws, without scopulae. Tarsal formula: 8/17/7/8. Distitarsus of the first and second tarsi with two segments.

Penis (Figs 25–31) slender, its shaft widened distally. The apical structure is divided by lateral incisions into both DP and VP. The VP with complex structures, is separated again by a median cleft, consists of two LPs and the membrane between both sides. The DP simple, distal margin corrugate. G protruding beyond the anterior margin of the dorsal surface. SL somewhat as the shape of tulip ventrally and dorsally, consists of VSL and DSL. The VSL slightly curved toward ventral surface and with a labiate protrusion distally. The DSL petaloid. S smooth, columnar and arising straight from the glans, SL almost entire surrounding the S. BS globular, well developed, immovable and entire sunken into truncus. Setae arranged as follow: 11 VS, four DS, four LS, four GBS.

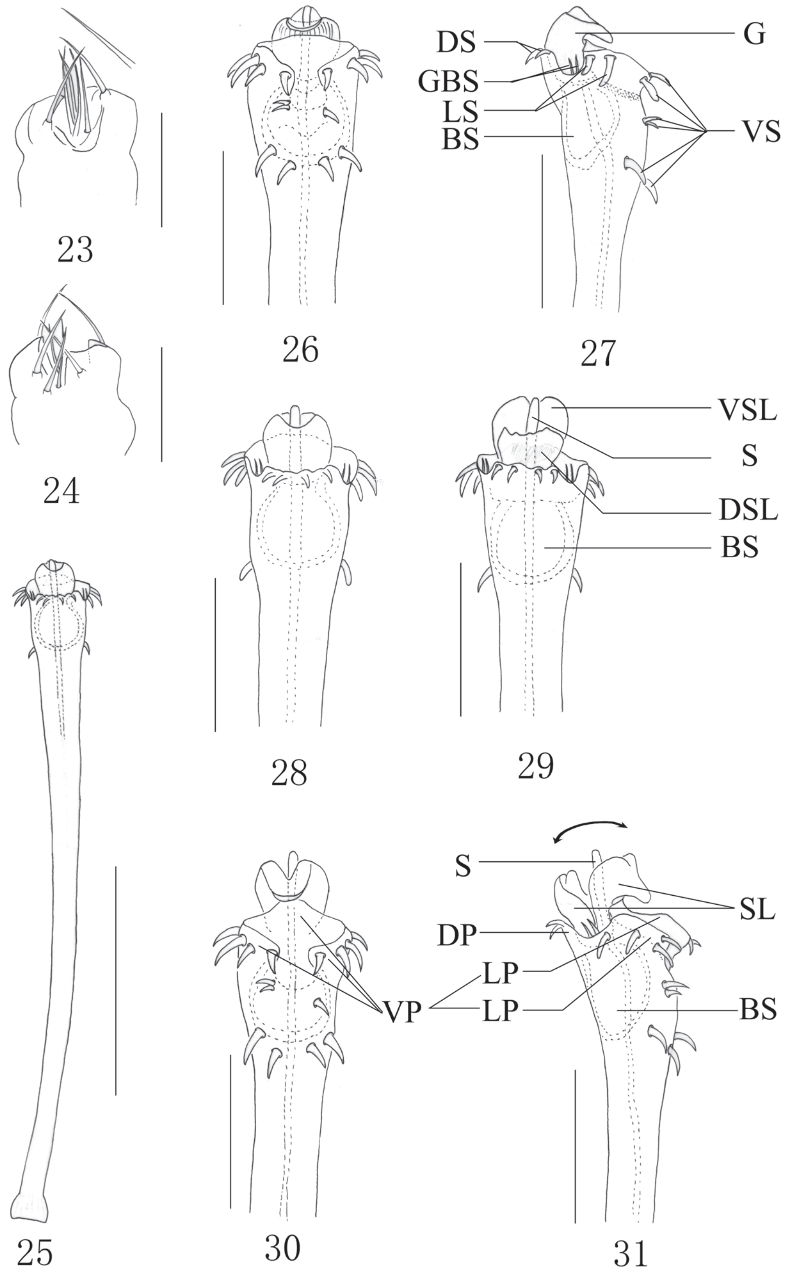
Female (Figs 16–24). In general appearance similar to the male but smaller and with abdomen more rounded posteriorly (Fig. 17). Chelicera (Figs 18–20) smaller and with reduced tubercles, the proximal segment shorter than those of the male, the second segment is not so greatly enlarged as in the male, inner edges of finger toothed as illustrated (Fig. 20). The pedipalpus (Figs 21–22) femur with seven reduced setiferous tubercles ventrally and two conspicuous setiferous tubercles dorsally, distally on medial side without any setiferous tubercle; Patella with two setiferous tubercle disto-medially and one setiferous tubercles disto-ectally. Setiferous tubercles of leg I (Fig. 16), as well as leg II–IV inconspicuous. Tarsal formula: 7/17/7/8. Distitarsus of the first and second tarsi with two segments.

Ovipositor (Figs 23–24). Ventral surface with five setae and dorsal surface with six setae. Tip of each seta pinpoint (Fig. 23).

Measurements. Male holotype (female paratype): body 3.57 (3.37) long, 2.70 (2.65) wide at the widest portion, scutum 3.21 (2.75) long. Ocularium 0.38 (0.33) long, 0.90 (0.68) wide. Pedipalpus claw 0.90 (0.83) long. Penis 1.55 long. Measurements of left pedipalpus and legs as in Table 1.

Habitat. Collected by leaf litter sieving in the rubber forest.

Distribution. China: Hainan (Tunchang County).



Figures 23–31. *Plistobunus columnarius* sp. n. **23** Ovipositor, dorsal view **24** Ditto, ventral view **25** Entire penis, dorsal view **26** Penis tip, ventral view **27** Ditto, lateral view **28** Ditto, dorsal view **29** Expanded penis, dorsal view **30** Ditto, ventral view **31** Ditto, lateral view. Abbreviations: **BS** basal sac **DP** dorsal plate **DS** dorsal setae **DSL** dorsal stylar lobe **G** glans **GBS** basal setae of glans **LP** lateral plate **LS** lateral setae **S** stylus **SL** stylar lobe **VP** ventral plate **VS** ventral setae **VSL** ventral stylar lobe. Scale bars: 0.5 mm (25); 0.20 mm (26–31); 0.25 (23–24).

Table 1. Pedipalpus and leg measurements of the male holotype (female paratype).

	Trochanter	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
Pedipalpus	0.63(0.50)	2.63(2.00)	1.35(1.13)	1.18(1.00)		0.95(0.88)	6.74(5.51)
Leg I	0.50(0.45)	2.10(1.68)	0.80(0.58)	1.50(1.25)	2.48(1.88)	1.38(1.20)	8.76(7.04)
Leg II	0.50(0.45)	2.98(2.45)	0.83(0.75)	2.35(1.88)	3.13(2.43)	2.60(2.38)	12.39(10.34)
Leg III	0.50(0.45)	2.38(2.00)	0.85(0.63)	1.63(1.38)	2.95(2.45)	1.43(1.25)	9.74(8.16)
Leg IV	0.50(0.45)	3.00(2.70)	0.95(0.75)	2.00(1.75)	3.95(3.25)	1.75(1.45)	12.15(10.35)

Remarks. A certain similarity in ornamentation of the new species may be noted with that of *P. rapax* as figured and described by Roewer (1912, 1923, 1938) and Pocock (1903), e. g., the high erect spine on ocularium, fused scutal areas I–II, a pair of spines on the second opisthosomal area, a spine on the fourth opisthosomal area of the dorsal scutum, the greatly elongate pedipalpus and almost identical chelicera. The style of the ornament of the new species is typical of *Plistobunus*. Based on above we believe it should be a new species.

Martens (1988) suggested that "an intensive search, not only for diverse morphological structures in laniatorid penes, but even more for the function of their movable parts under hemolymph pressure will reveal a wealth of structures up to now largely undiscovered". Many families (e. g., Assamiidae Sørensen, 1884; Biantidae Thorell, 1889; Fissiphalliidae Martens, 1988; Oncopodidae Thorell, 1876; Phalangodidae and Podoctidae Roewer, 1912) were studied in genital morphology and function. At the meantime, some laniatorid structure cannot be homologized completely. Epedanidae is restricted in Asia, among of these known species, Suzuki porvided drawings of genital morphology, however, he failed to give the expanded the structures of the penis.

In this paper, we tentatively explain the movement of the penis in the new species briefly. The S is mainly exposed by the movement of VSL and DSL in the opposite direction, DSL tends to move dorsally wider than that of VSL. DSL and VSL like the petal, S is similar to the stamen. The expansion of G resembles the blooming flower (Fig. 31).

Discussion

Kury (1993) detached the family Epedanidae which included four subfamilies (i. e., Epedaninae, Acrobuninae, Dibuninae and Sarasinicinae) from the Phalangodidae for the first time. Most genera and species were created by Roewer, based on external morphological characters. Suzuki finely described and redescribed some species of Epedanidae, especially for the male penis. However, internal relationships of the four subfamilies have not been investigated (Kury 2007).

It is obvious to assign *Plistobunus* to the Epedanidae because its penis possesses immovable sac, and protruding glans which only consists of stylus and stylar lobe. Furthermore, according to Kury (2007), the genus should belong to the subfamily

Epedaninae based on morphological characters such as eyes placed laterally at the base of a well-marked common ocularium, tarsi III–IV without scopula and distitarsus I with two tarsomeres.

The external morphology of *Plistobunus* is similar to the genera *Euepedanus* Roewer, 1915 and *Pseudoepedanus* Suzuki, 1969. *Plistobunus* is distinct from *Euepedanus* and *Pseuduoepedanus* by the number of tubercles on the femur of pedipalpus ventrally and dorsally. The most significant difference concerns the male genitalia. *Euepedanus* has conspicuous ventral plate which is absent in *Plistobunus*; and glans in *Euepedanus* protrude from the center at the top of penis, while glans in *Plistobunus* protrude sideways beyond the distal penis and near the dorsal plate; dorsal plate of penis has incision in *Pseudonepedanus*, while absent incision in *Plistobunus*; and the shape of glans are different in both *Pseudonepedanus* and *Plistobunus*.

The male genitalia of *P. columnarius* sp. n. is very similar to some other species of Epedaninae, Acrobuninae, Sarasinicinae and even *incertae sedis* of Epedanidae, respectively *Alloepedanus robustus* Suzuki, 1985 (Epedaninae), *Zepedanulus ishikawai* Suzuki, 1971 (Epedaninae), *Zepedanulus watanabei* Suzuki, 1981 (Epedaninae), *Toccolus chibai* Suzuki, 1976 (Epedaninae), *Toccolus globitarsis* Suzuki, 1969 (Epedaninae), *Paracrobunus bimaculatus* Suzuki, 1977 (Acrobuninae), *Opelytus spinichelis* Roewer, 1938 (Sarasinicinae), *Pasohnus bispinosus* Suzuki, 1976 (Sarasinicinae), *Tokunosia tenuipes tenuipes* Suzuki, 1964 (*incertae sedis*), *Tokunosia tenuipes taiwana* Suzuki, 1977 (*incertae sedis*).

Moreover, *A. robustus* (Suzuki, 1985: 87–89, fig. 10) which is distributed in the Doi Sutep (Thailand, Chieng Mai Province) has similar external morphology with *P. columnarius* sp. n. (e.g., ocularium with a long median spine, spination of chelicerae, pedipalpus femur with a row of more than 10 setiferous tubercles dorsally and ventrally, tarsi I–IV with more than six segments, distitarsus I–II with two segments, tarsi III–IV with bare double claws). *A. robustus* differs from *P. columnarius* sp. n. by penis without dorsal plate and the scutal area II without two long median spines.

Similar concerns apply to *Toccolus globitarsis* (Suzuki, 1969: 91–96, figs 9–11), *T. chibai* (Suzuki, 1976: 15–18, fig. 5), *O. spinichelis* (Suzuki, 1976: 18–20, fig. 6) and *Pasohnus bispinosus* (Suzuki, 1976: 21–23, fig. 8), *T. globitarsis* is distributed in the Paktong Chai (Thailand) and others in the Pasoh Forest Reserve (Malaysia). However, *P. bispinosus* can be easily distinguished from *P. columnarius* sp. n. by two long median spines on the scutal area III instead of the scutal area II.

The external morphology of other four species (i. e., *Z. watanabei*, *Z. ishikawai*, *Tokunosia tenuipes tenuipes*, *T. tenuipes taiwana* and *Paracrobunus bimaculatus*) is distinct from *P. columnarius* sp. n. except *A. robustus*, *Toccolus globitarsis*, *T. chibai* and *Pasohnus bispinosus*. They are all absent a long median spine on ocularium and without conspicuous enlarged tubercles on proximal segment of chelicera. They are distributed mainly in the Thailand (e. g., *Z. watanabei* (Suzuki, 1981: 268–269, fig. 1)), Ryukyus (e. g., *Z. ishikawai* (Suzuki, 1971: 196–200, figs 22–30), *Tokunosia tenuipes tenuipes* (Suzuki, 1971: 193–196, figs 12–21)), Taiwan Island (e. g., *T. tenuipes taiwana* (Suzuki, 1977b: 124–125, fig. 1)), Philippines (e. g., *Paracrobunus bimaculatus* (Suzuki, 1977a: 17–20, figs 5–6)).

Based on the references cited above, these species are distributed mainly in Southeast Asia. Furthermore, the male genital morphology of most species also shows great similarity to *P. columnarius* sp. n., although they belong to different subfamilies presently. For these reasons, we presume they may have a relatively close phylogenetic relationship, not depend only on the external morphological characters which currently support the subfamilies.

Acknowledgements

We are grateful to Mrs. Janet Beccaloni for the loan of the valuable type specimen. This work was supported by the Ministry of Science and Technology of the People's Republic of China (MOST Grant No. 2006FY110500), and in part by the Open Project Program of Key Laboratory of Hebei University (09265631D–10) and the Program of Science & Technology Bureau of Baoding City (11ZF071) to Chao Zhang.

References

Acosta LE, González AP, Tourinho AL (2007) Methods for taxonomic study. In: Pinto-da-Rocha R, Machado G, Giribet G (Eds) Harvestmen: The Biology of Opiliones. Harvard University Press, Cambridge, Massachusetts and London, 494–510.

Hirst S (1911) On some new Opiliones from Japan and the Loo-Choo Islands. Annals and Magazine of Natural History 8(47): 625–636.

Kury AB (1993) Análise filogenética de Gonyleptoidea (Arachnida, Opiliones, Laniatores). Unpublished Ph. D. Thesis, Instituto de Biociências, Universidade de São Paulo, São Paulo, 73 pp.

Kury AB (2003) Annotated catalogue of the Laniatores of the New World (Arachnida, Opiliones). Revista Ibérica de Aracnologìa, vol. especial monográfico, n° 1: 1–337.

Kury AB (2007) Epedanidae Sørensen, 1886. In: Pinto-da-Rocha R, Machado G, Giribet G (Eds) Harvestmen: The Biology of Opiliones. Harvard University Press, Cambridge, Massachusetts and London, 188–191.

Kury AB (2008) On the systematic position of *Dino* Loman and *Toccolus* Roewer (Opiliones, Laniatores, Epedanidae), with the description of a new species from western Java, Indonesia. Zootaxa 1932: 61–68.

Lian WG, Zhu MS, Kury AB (2008) A new species of the genus *Tithaeus* from China (Arachnida: Laniatores: Epedanidae). Zootaxa 1841: 53–60.

Martens J (1988) Fissiphalliidae, a new family of South American laniatorean harvestmen (Arachnida: Opiliones). Zeitschrift für zoologische Systematik und Evolutionsforschung, Hamburg 26(2): 114–127.

Pinto-Da-Rocha R, Giribet G (2007) Taxonomy. In: Pinto-da-Rocha R, Machado G, Giribet G (Eds) Harvestmen: The Biology of Opiliones. Harvard University Press, Cambridge, Massachusetts and London, 88–92.

Pocock RI (1903) Fifteen new species and two new genera of tropical southern Opiliones. The Annals and Magazine of Natural History, London, Series 7, 11(65): 433-450, pl. 11-12.

Roewer CF (1912) Die Familien der Assamiiden und Phalangodiden der Opiliones-Laniatores. (= Assamiden, Dampetriden, Phalangodiden, Epedaniden, Biantiden, Zalmoxiden, Samoiden, Palpipediden anderer Autoren). Archiv für Naturgeschichte, Berlin, Abt. A, Original-Arbeiten 78(3): 1–242.

Roewer CF (1923) Die Weberknechte der Erde. Systematische Bearbeitung der bisher bekannten Opiliones. Gustav Fischer, Jena, 1116 pp.

Roewer CF (1938) Über Acrobuninae, Epedaninae und Sarasinicinae. Weitere Weberknechte IX. (9. Erganzung der "Weberknechte der Erde" 1923). Veröffentlichungen aus dem Deutschen Kolonial- und Übersee-Museum in Bremen, Bremen, 2(2), 81–169, plates 1–10.

Schwendinger PJ, Martens J (2002) A taxonomic revision of the family Oncopodidae III: Further new species of *Gnomulus* Thorell (Opiliones, Laniatores). Rev. Suisse Zool 109: 47–113.

Suzuki S (1969) Some phalangids from Thailand. Journal of Science of the Hiroshima University, Series B, Division 1 (Zoology), 22(3): 79–101 + pl. I.

Suzuki S (1971) Opiliones of the Ryukyus. Journal of Science of the Hiroshima University, Series B, Division 1 (Zoology) 23(2): 187–213.

Suzuki S (1976) Report on a collection of opilionids from Pasoh Forest Reserve, West Malaysia. Nature and Life in Southeast Asia 7: 9–38, 13 Figs

Suzuki S (1977a) Report on a collection of opilionids from the Philippines. Journal of Science of the Hiroshima University, Series B, Division 1 (Zoology), Hiroshima 27(1): 1–120, figs 1–56, map 1.

Suzuki S (1977b) Opiliones from Taiwan (Arachnida). Journal of Science of the Hiroshima University, Series B, Division 1 (Zoology) 27(1): 121–157, figs 1–4.

Suzuki S (1981) Three opilionids from Thailand. Annotationes Zoologicae Japonenses 54(4): 267–272.

Suzuki S (1985) A synopsis of the Opiliones of Thailand (Arachnida) I. Cyphophthalmi and Laniatores. Steenstrupia 11(3): 69–110.

Zhang C, Zhang F (2010) A new *Tithaeus* species from Hainan Island, China (Arachnida, Opiliones, Laniatores, Epedanidae), with a key to the Chinese species. ZooKeys 67: 65–72. doi: 10.3897/zookeys.67.705

Zhu MS, Lian WG (2006) First record of the genus *Euepedanus* from China, with the description of a new species (Opiliones: Laniatores: Epedanidae). Zootaxa 1367: 63–68.

Ubick D, Briggs TS (2004) The harvestman family Phalangodidae. 5. New records and species of *Texella* Goodnight and Goodnight (Opiliones: Laniatores). Texas Memorial Museum, Speleological Monographs 6: 101–141.

ZooKeys 112: 53–87 (2011)
doi: 10.3897/zookeys.112.1138
www.zookeys.org

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Taxonomy of the genus *Metolinus* Cameron (Coleoptera, Staphylinidae, Staphylininae, Xantholinini) from China with description of three new species

Yu-Lingzi Zhou[1,2,†], Hong-Zhang Zhou[1,‡]

1 *Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, 1 Beichen West Rd., Chaoyang District, Beijing, 100101, P. R. China* **2** *Graduate University of the Chinese Academy of Sciences, 19A Yuquan Rd., Shijingshan District, Beijing, 100049, P. R. China*

† *urn:lsid:zoobank.org:author:156D3774-1C0E-4B43-B5C4-F4BFF836D4CB*
‡ *urn:lsid:zoobank.org:author:0CCACC79-9829-44FE-8069-6FBCD1EA269F*

Corresponding author: *Hong-Zhang Zhou* (zhouhz@ioz.ac.cn)

Academic editor: *Volker Assing* | Received 16 February 2011 | Accepted 25 May 2011 | Published 24 June 2011

rn:lsid:zoobank.org:pub:B5B9712D-AA01-4966-865E-0D94F3248606

Citation: Zhou YL, Zhou HZ (2011) Taxonomy of the genus *Metolinus* Cameron (Coleoptera, Staphylinidae, Staphylininae, Xantholinini) from China with description of three new species. ZooKeys 112: 53–87. doi: 10.3897/zookeys.112.1138

Abstract

This paper studies the taxonomy of the genus *Metolinus* Cameron, 1920 (Coleoptera: Staphylinidae, Staphylininae, Xantholinini) from China and describes three new species: *Metolinus xizangensis* **sp. n.** from Xizang (Tibet), *M. emarginatus* **sp. n.** from Sichuan, and *M. binarius* **sp. n.** from Yunnan. The Chinese fauna of the genus is thus increased to 8 species in total. A key to eight Chinese species is provided. Female genital segments and other important morphological characters are illustrated in line drawings for the new species as well as *M. shanicus* Bordoni, 2002 and *M. gardneri* (Cameron, 1945). The text also provides color plates with habitus photographs and a map to show the species' geographical distribution pattern. The type specimens of the new species are deposited in Institute of Zoology, the Chinese Academy of Sciences (IZ-CAS).

Keywords

Coleoptera, Staphylinidae, Xantholinini, *Metolinus*, China, new species, identification key

Introduction

The tribe Xantholinini is a large rove beetle group of more than 75 genera and was considered currently by most taxonomists as one of the six tribe level taxa in the subfamily Staphylininae (Coleoptera: Staphylinidae) (Newton et al 2000, Assing 2000, Herman 2001, Zhou 2005). The genus *Metolinus* is one of those genus-level taxa belonging to the tribe Xantholinini. It was erected by Cameron (1920) and included originally two species: *Metolinus basalis* Cameron, 1920 and *Metoponcus leucocnemis* Kraatz, 1859. Subsequently, Blackwelder (1952) designated *Metoponcus leucocnemis* as the type species of the genus. According to Herman (2001), the genus included totally 14 species which were described by Kraatz (1859), Bernhauer (1915), Cameron (1920, 1932, 1933, 1936, 1937, 1950), Scheerpeltz (1957), Coiffait (1977) and Last (1980). In the last decade, Bordoni (2002, 2003b, 2003c, 2004, 2005a, 2005b, 2006, 2009b, 2009c, 2010a, 2010b) made enormous contributions to the knowledge of the genus and published 89 additional species so that the total number of species was increased to 116 for the world fauna.

Individuals of the genus *Metolinus* occur mostly in rotting wood under bark and thus are assumed saproxylobionts (Fig. 1). Available label data, our own collecting experience, and the morphology of the genus (i. e. compressed body shape, expanded protarsi) support this observation and confirmed that most *Metolinus* species were saproxylic. These biological characteristics might explain their rarity in collections; obtaining specimens was difficult and mainly achieved by methods targeting microhabitats on or near the ground.

Before this study, five species of the genus *Metolinus* were recorded to occur in the territory of China: *M. planulatus* (Sharp, 1889), *M. gardneri* (Cameron, 1945), *M. hayashii* Bordoni, 2002, *M. shanicus* Bordoni, 2002, and *M. yunnanus* Bordoni, 2002. These Chinese species were all detected by Bordoni (2002). He described three species from China and transferred the other two from *Leptacinus* Erichson, 1839 to *Metolinus* till then. Assing (2009) published one additional Chinese species, *Metolinus parvioculatus* Assing, 2009, which was synonymized by Bordoni (2009a) and is now a synonym of *Mahavana watanabei* Bordoni, 2009.

This paper studies the taxonomy of the genus *Metolinus* Cameron, 1920 from China and describes three new species: *Metolinus xizangensis* sp. n. from Xizang (Tibet), *M. emarginatus* sp. n. from Sichuan, and *M. binarius* sp. n. from Yunnan. The number of Chinese species is thus increased to eight species in total. A key to these Chinese species is provided. Female genital segments and other important morphological characters are illustrated in line drawing for the species including the new ones and *M. shanicus* Bordoni 2002 and *M. gardneri* (Cameron 1945). The text provides also color plates to show beetle habitus and a map to show the geographical pattern of species distribution (Fig. 15).

Figure 1. Habitat and feeding photo of *Metolinus shanicus* Bordoni, 2002 (photos by Xinlei Huang).

Materials and methods

Specimens were relaxed in warm water (60 °C) for about 5–8 hours, then cleared in 10% KOH for 5 minutes, and transferred in 75% alcohol. Cleared specimens were dissected to observe morphological details of mouthparts, abdominal segments VIII and sexual genital segments and the aedeagus. After examination, the body parts were stored permanently in glycerin for future studies. Observations and drawings were done under a compound microscope (ZEISS Stemi 2000-C). The specimens used in this study, including the types of the new species, are deposited in the Institute of Zoology, the Chinese Academy of Sciences (IZ-CAS).

In describing morphological features, we followed Smetana (1982), Naomi (1990), Smetana and Davies (2000), Bordoni (2002), Gusarov (2002) and Solodovnikov and Newton (2005). In addition, schematic line drawings were employed to avoid confusions in describing and measuring of some important body parts and diagnosing important taxonomic characters (Figs 2–9). Measurements were done with the aid of an eyepiece micrometer under the compound microscope ZEISS Stemi 2000-C (Germany) and were given in millimeter (mm) in the text. The following abbreviations were used throughout the paper:

HL head length (from apex of epistoma to neck constriction);
HW head width (maximal, including eyes);
PL pronotum length (along mid line);

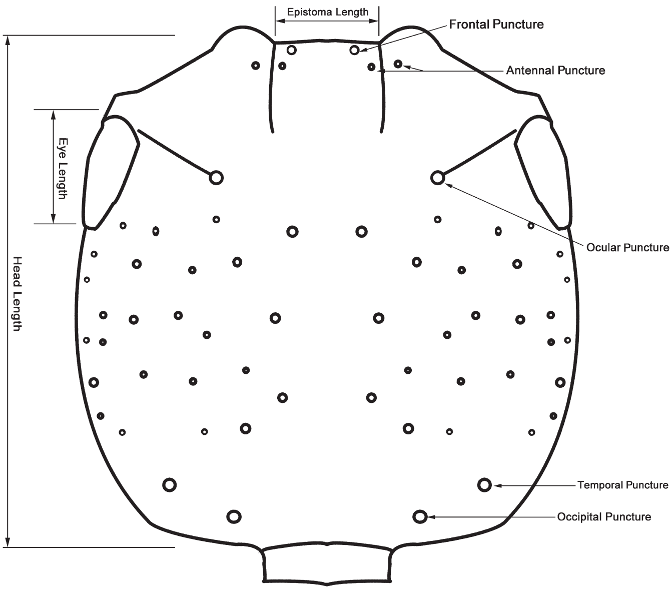


Figure 2. Chaetotaxy of head and measuring scheme of head (*M. emarginatus* sp. n.) in dorsal view.

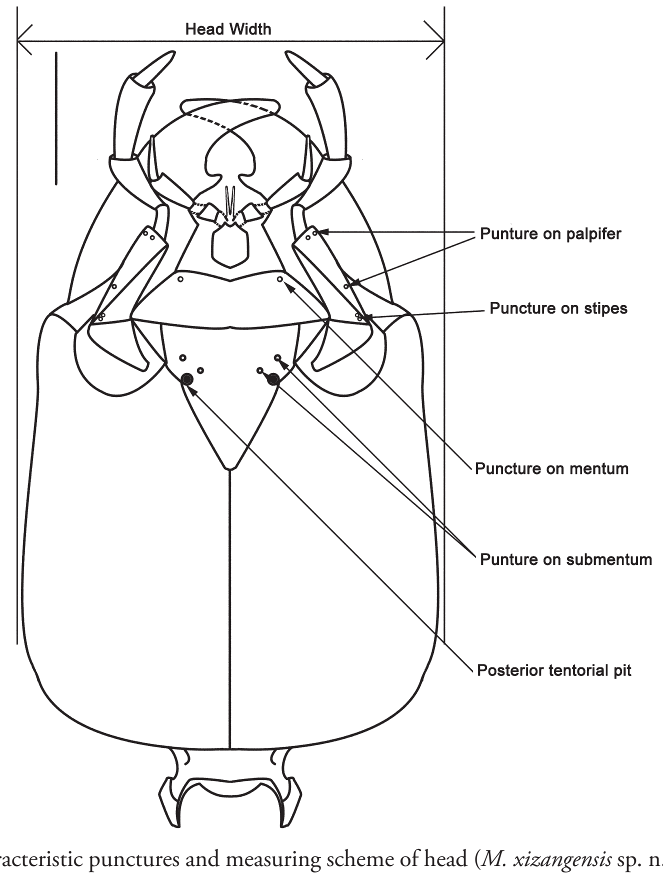


Figure 3. Characteristic punctures and measuring scheme of head (*M. xizangensis* sp. n.) in ventral view.

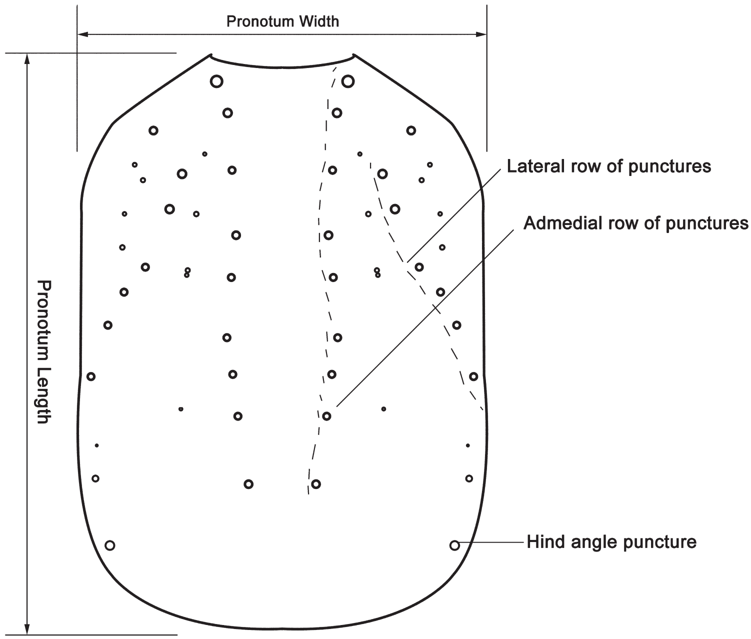


Figure 4. Puncture pattern and measuring scheme of pronotum (*M. emarginatus* sp. n.) in dorsal view.

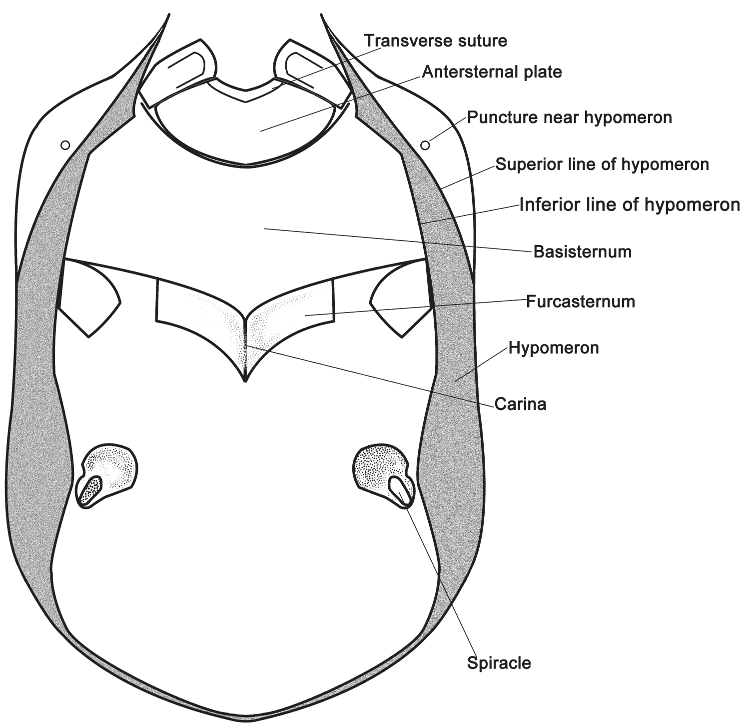


Figure 5. Schematic ventral view of prosternum (*M. xizangensis* sp. n.).

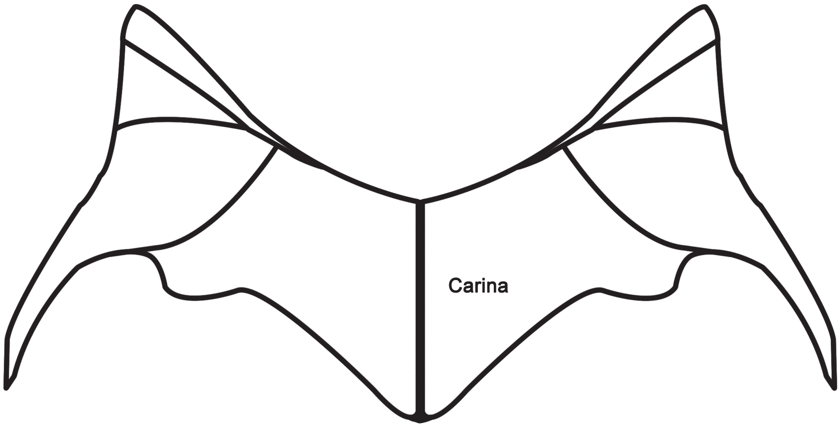


Figure 6. Schematic ventral view of mesoventrite (*M. xizangensis* sp. n.).

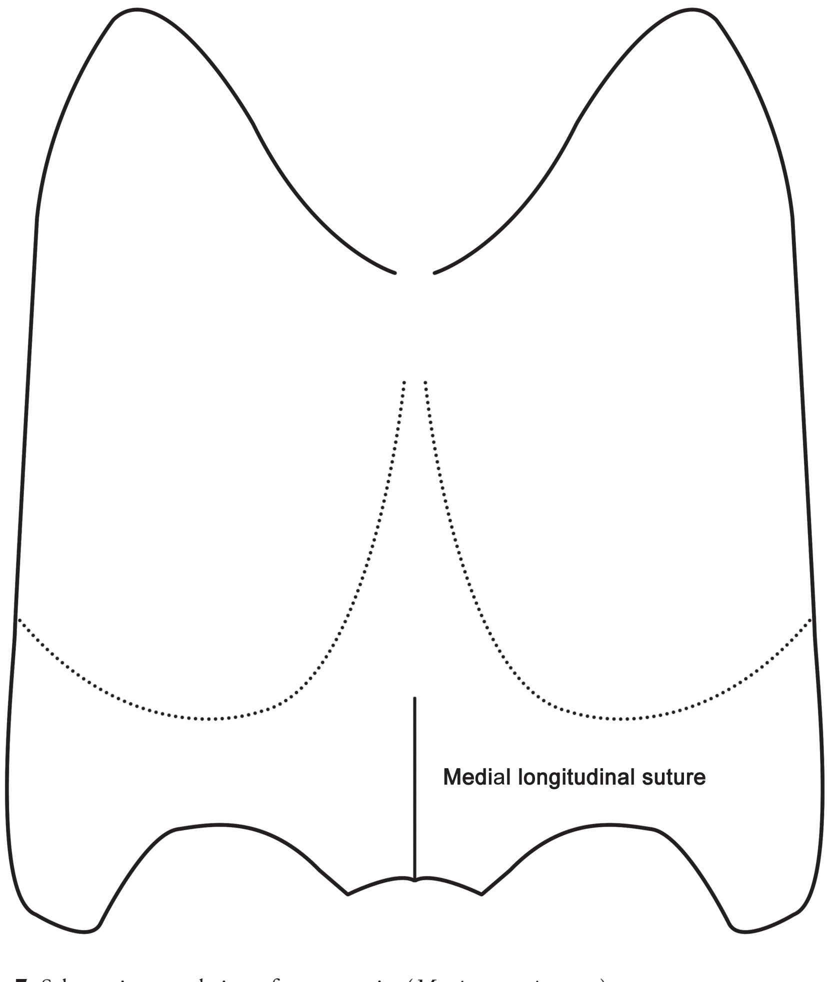


Figure 7. Schematic ventral view of metaventrite (*M. xizangensis* sp. n.).

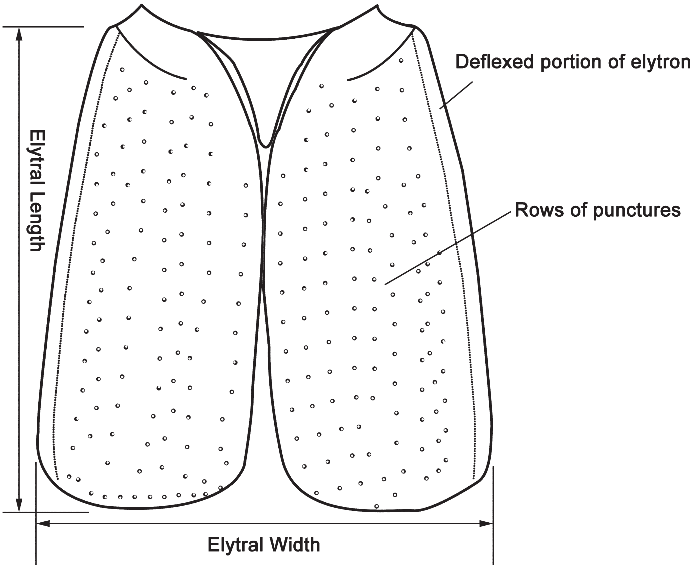


Figure 8. Puncture pattern and measuring scheme of elytra (*M. emarginatus* sp. n.) in dorsal view.

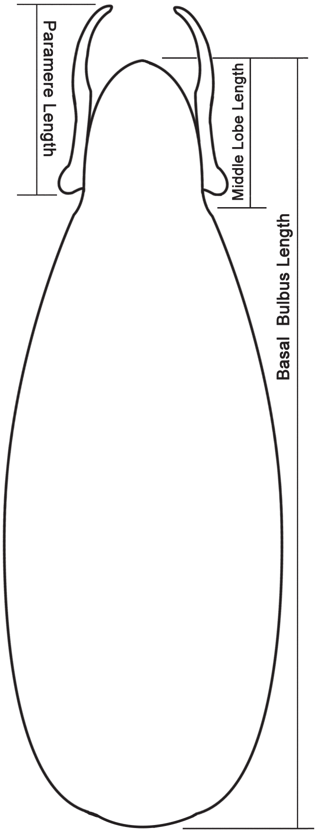


Figure 9. Measuring scheme of aedeagus (*M. binarius* sp. n.) in dorsal view.

PW pronotum width (maximal);
EL elytral length (from acute humerus to most distal apical margin; best taken from lateral view of the elytron);
EW combined width of both elytra (maximal, when elytra closed along suture).

Color photographs were captured with a Nikon D300 and the final deep focus images were created with the stacking software Helicon Focus 3.10. The species distribution database was compiled with Microsoft Excel and is based on the data of published records as well as label data of available specimens. The distribution map was produced with the aid of ArcGIS 8.3.

Taxonomy

Genus *Metolinus* Cameron, 1920
http://species-id.net/wiki/Metolinus

Metolinus Cameron 1920: 147; Cameron 1932: 4 (characters; key to species of British India); Scheerpeltz 1933: 1298 (world catalog supplement); Shibata 1983: 68 (checklist of species of Japan); Herman 2001: 3703 (world catalog); Bordoni 2002: 337 (revision of oriental region; characters; key to species); Smetana 2004: 691 (Palearctic catalog); Bordoni 2005b: 539 (revision of Australia; characters; key to species); Bordoni 2007: 71 (catalog).

Type species. *Metoponcus leucocnemis* Kraatz, fixed by subsequent designation by Blackwelder, 1952: 241.

Diagnosis. The genus *Metolinus* Cameron can be distinguished from all other genus level taxa within the tribe Xantholinini by the following characters: a) body nearly compressed, small to medium sized (3–8 mm), rarely larger (8–10 mm); b) head subquadrate or subrectangular (Fig. 2), often with microsculpture of microstriae (rarely of polygonal reticulum) and sparse medium punctures; c) frontal furrow often short or not obvious, ocular grooves distinct; d) penultimate segment of maxillary palpi and labial palpi distinctly longest, ultimate one slender and subaciculate (Fig. 3); e) pronotum with admedian and lateral row of punctures (Fig. 4); f) antesternal plate integrated (Fig. 5); g) superior line of hypomeron bending towards the prosternum before anterior angle of pronotum, but not joining with inferior line; h) tibiae with apical ctenidium, only protibiae with 2–3 rows of subapical ctenidia; i) aedeagus subelliptical, or lenticular, with symmetrical and thin parameres (Fig. 9); j) female genital segment with large sternite, devoid of supplementary sclerites (Fig. 10H).

Key to species of the genus *Metolinus* Cameron from China (cf. Bordoni 2002).

1 Elytra bicolorous, anterior 1/3 ochre, posterior 2/3 dark brown .... ***M. shanicus* Bordoni**

– Elytra entirely dark brown, posterior margin sometimes narrowly yellowish ... **2**
2 Dorsal integument with microsculpture of polygonal reticulum.................. **3**
– Dorsal integument with distinct transverse microstriae **4**
3 Lateral punctural row of pronotum with 3 punctures ...***M. hayashii*** **Bordoni**
– Lateral punctural row of pronotum with 6–8 punctures ....
.... ***M. xizangensis*** **sp. n.**
4 Distance between punctures on dorsal surface of head ca. 5–6 puncture diameters ....***M. binarius*** **sp. n.**
– Distance between punctures on dorsal surface of head ca. 2–3 puncture diameters **5**
5 Body rather small, shorter than 4.5 mm......... ***M. planulatus*** **(Sharp, 1889)**
– Body medium sized, longer than 5 mm **6**
6 Pronotum as long as head, abdominal terga III-VI entirely black ....
.... ***M. gardneri*** **(Cameron, 1945)**
– Pronotum longer than head, posterior margins of all abdominal terga broadly reddish... 7
7 Sides of pronotum almost straight, slightly narrowed towards base ....
....***M. yunnanus*** **Bordoni, 2002**
– Sides of pronotum shallowly concave, at posterior angles about as wide as at anterior angles .... ***M. emarginatus*** **sp. n.**

1. *Metolinus xizangensis* Zhou & Zhou, sp. n.
urn:lsid:zoobank.org:act:7F979EE2-CBE3-4A82-874E-284C70120AB8
http://species-id.net/wiki/Metolinus_xizangensis
Fig. 10A–H; Fig. 10-1A–E

Type material. Holotype: male, **CHINA: Xizang:** Cayu co.: Shangcayu (E 97.0994, N 28.7131), 1960 m, 21.VIII.2005, Wu Jie & Wang Xuejian collected (IZ-CAS); Paratypes: **CHINA: Xizang:** 6 males, 6 females, same data as holotype; 2 males, 1 female, same locality as holotype, 2000 m, 7.VIII.2005, Wu Jie collected (IZ-CAS).

Description. *Measurement*. BL=7.9 mm, FL=3.8 mm, HL=1.2 mm, HW=0.93 mm, PL=1.3 mm, PW=0.90 mm, EL=1.3 mm, EW=1.1 mm.

Body nearly compressed and medium sized. Head, pronotum, mesoscutellum and elytra entirely dark brown. Abdomen dark brown, segment II and genital segments paler. Legs brown except femora obviously darker. Antennae entirely brown. Maxillary palpi and labial palpi light brown.

Head (Fig. 10-1A). Subrectangular (HL to HW ratio 1.3), tempora (behind eyes) slightly widened posteriorly, posterior angles rounded. Dorsal integument shiny, with extensive microsculpture composed of a mixture of transverse microstriae and polygonal reticulum, and with sparse, scattered with setiferous punctures of medium size, distance between punctures ca. 2 puncture diameters. With pair of frontal puncture on epistoma, 2 antennal punctures near antennal insertion, ocular puncture near medial

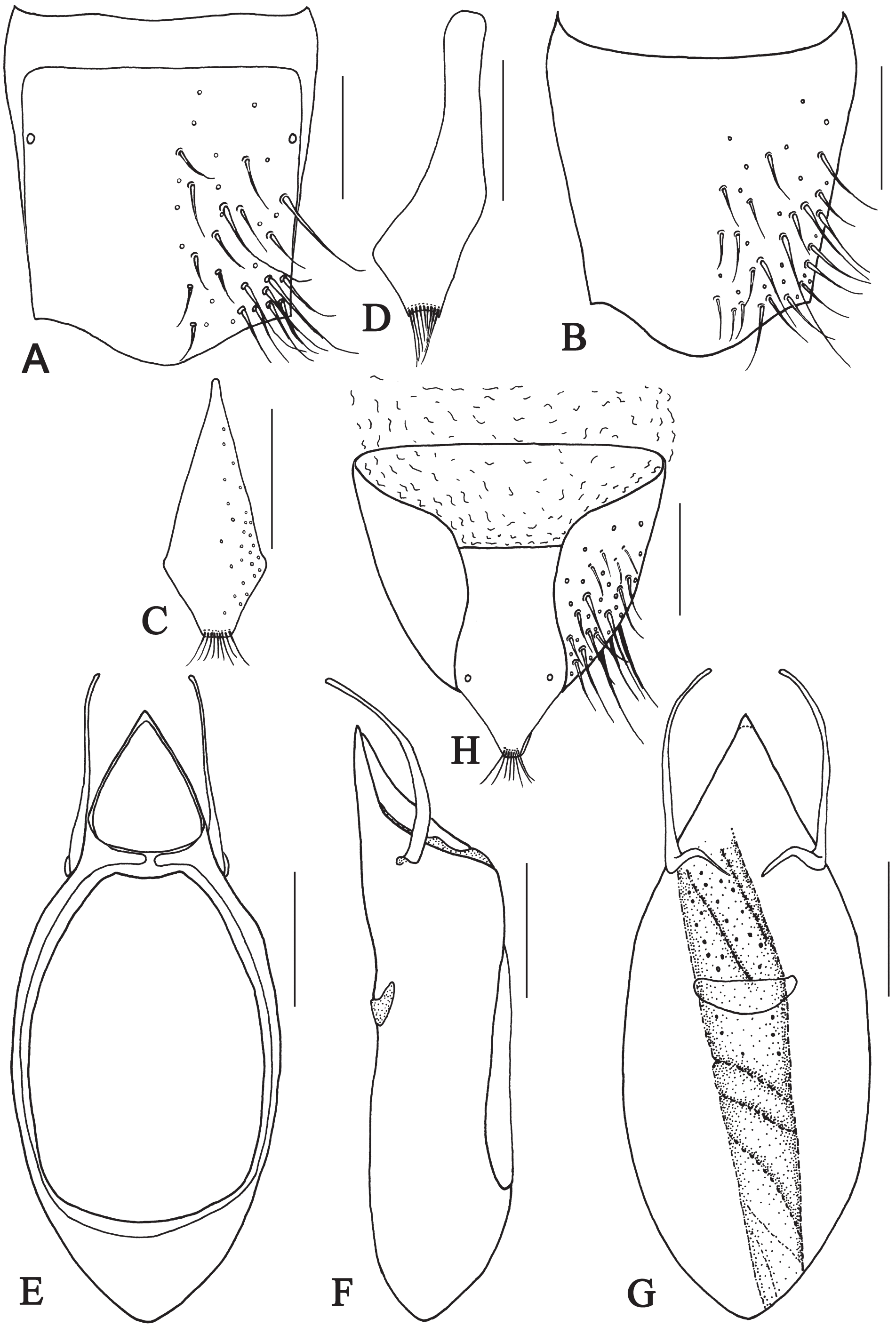


Figure 10. *Metolinus xizangensis* sp. n. **A** male tergite VIII **B** male sternite VIII **C** tergite of male genital segment **D** sternite of male genital segment **E** aedeagus, dorsal view **F** aedeagus, lateral view **G** aedeagus, ventral view **H** female genital segment, ventral view. Scale bars 0.15 mm.

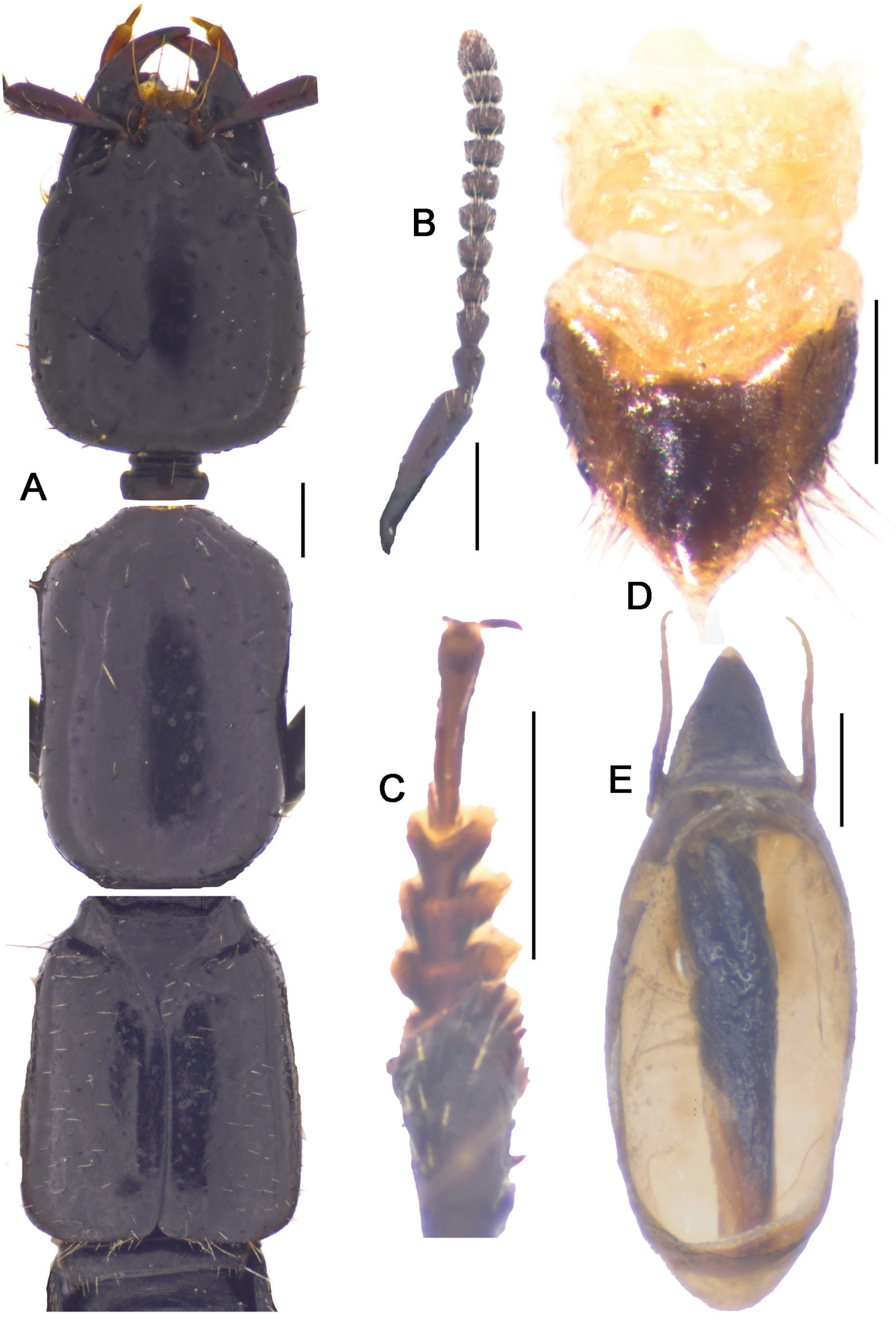


Figure 10-1. *Metolinus xizangensis* sp. n. **A** habitus of forebody **B** antennae **C** male protarsi; D. female genital segments, ventral view **E** aedeagus devoid of oval sclerite, ventral view. Scale bars 0.3 mm.

margin of eye (ca. 3–4 puncture diameters to eye), temporal puncture at posterior 1/5 and occipital puncture at lateral 1/3; deflexed portion of tempora with same setiferous punctures and microstriae as on dorsal integument. Frontal furrows superficial and short, not longer than 1/2 of eye length. Ocular furrows of medium length, equal to eye length. Eye of medium size, nearly 1/3 of temple length (eye: temple = 0.23:0.68 mm), slightly protruding laterad. Epistoma protruding forwards, anterior margin subtruncated, dorsally flat and broad, as wide as 1/2 of eye length. Distance between antennal insertions ca. 0.32 mm, obviously wider than that from antenna to eye (ca. 0.26 mm). Ventral integument shiny, with polygonal reticulum, and with setiferous punctures as on dorsal integument, but obviously denser laterad. Mentum with a pair of setae inserted at anterior angle in addition to other irregularly scattered setae, submentum with 2 pairs of setae. Gular sutures fused at middle, and not separated at base of occiput. Gular plate devoid of punctures, with distinct transverse microstriae.

Antennae (Fig. 10-1B). Scape stout, thickened apically, longer than three subsequent antennomeres combined, ca. 0.45 mm; 2nd elongate, ca. 0.14 mm, distinctly longer than 3rd; 3rd globular, ca. 0.090 mm; 4th and 5th subequal, ca. 0.080 mm; last antennomere of medium length, ca. 0.15 mm, subequal to preceding 2 antennomeres combined.

Mouthparts. Labrum transverse and V-shaped bilobed, two lateral teeth subtruncated on anterior margin. Mandibles falciform, left one with two teeth on medial edge. Maxillary palpus elongate, with 3rd segment longest, last slender and aciculate. Labial palpus distinctly slender, with 2nd longest, last slender and aciculate.

Neck. Rather narrow (ca. 0.24 mm), approximately of 1/4 of head width.

Pronotum (Fig. 10-1A). Subrectangular, distinctly elongate (PL to PW ratio 1.4), of same length and width as head. Slightly widened anteriad, lateral margins concavely sinuate, anterior angles well defined, posterior angles broadly rounded. Integument shiny, extensively covered with oblique microstriae; with two rows of setiferous punctures on each side, admedian row consisting of 7–9 punctures and lateral row of 6–8 punctures obliquely arranged; hind angle puncture ca. 1–2 puncture diameters distant from lateral margin. Antesternal plate integrated and symmetrically shallowly concave medially; medial longitudinal suture missing, transverse suture at anterior 1/5 fine but visible. Prosternum with demarcated medial longitudinal carina on furcasternum, prosternal process (between anterior legs) triangularly projecting upwards. Mesoventrite extensively covered with transverse microstriae, medial longitudinal carina demarcated, process of mesoventrite triangularly protruding backwards. Metaventrite rather long, medial longitudinal keel sharp and obvious, without a fine furrow on posterior 1/3 of keel top; process of metaventrite subtruncated.

Elytra (Fig. 10-1A). Subrectangular, distinctly elongate (EL to EW ratio 1.2), of same length as pronotum, but obviously wider. Humeri well developed, lateral margins subparallel or slightly widened posteriorly, hind margin subtruncated. Integument shiny and flattened, without microsculpture, and with setiferous punctures arranged in several rows (more than 3 rows) on each elytron; deflexed portion of each elytron with 2–3 rows of sparse setiferous punctures.

Legs (Fig. 10-1C). First four segments of protarsi obviously dilated, heart shaped, bearing extremely dense clothing of white fine hairs ventrally, last tarsomere as long as III–IV combined. Last segment of both meso- and metatarsi longer than that of protarsi and about equal to length of II–IV combined. Tibiae with apical ctenidium, only protibia with 2–3 rows of subapical ctenidia.

Abdomen. Cylindrical, broadest at segment VI. Terga III–VII shiny, entire surface covered with distinct transverse microstriae, sparsely scattered with dot-like setiferous punctures, but denser laterobasally; each tergite with impunctate basal impression bearing more obvious transverse microstriae. All abdominal sterna shiny, with microstriae and setiferous punctures as those on terga.

Male. Tergite VIII entirely covered with setiferous punctures, except a narrow medial longitudinal impunctate band; posterior margins of tergite VIII and sternite VIII both arcuately protruding backwards (Fig. 10A, B). Tergite of genital segment symmetrical and small, with sharp base and subtruncated apex (Fig. 10C), *in situ* broadly exposed between pleurites. Pleurites of genital segment symmetrical, connected mediobasally. Sternite asymmetrical, with rounded base and more angular left side (Fig. 10D). Aedeagus pear-shaped and medium sized (Fig. 10-1E; Fig. 10E–G), basal bulbus ca. 1.50 mm long; median lobe triangular and long, ca. 1/3 of basal bulbus length. Parameres symmetrical and thin, ca. 1/3 of basal bulbus length. Internal sac with a cylindrical and spiral solid structure, of black color but base paler.

Female. Posterior margin of tergite VIII and sternite VIII broadly arcuate backwards. Genital segment medium sized (Fig. 10-1D; Fig. 10H), ca. 0.86 mm long. Sternite with subtruncated base. No additional sclerites attached on base of genital segment, except some membranous structures.

Distribution. China (Xizang).

Etymology. The specific epithet is the Chinese name (Pin-Yin) of the type locality.

Remarks. This species could be distinguished from its congeners by microsculpture on head, the shape of the male genital segment (Fig. 10C, D) and the internal sac of the aedeagus (Fig. 10G).

2. *Metolinus emarginatus* Zhou & Zhou, sp. n.

urn:lsid:zoobank.org:act:3E4A7417-F19A-413C-A2E3-CFF0C59AC052
http://species-id.net/wiki/Metolinus_emarginatus
Fig. 11A–H; Fig. 11-1A–E

Type material. Holotype: **CHINA: Sichuan:** male, Baoxing co. (E 102.8146, N30.3681), Pujigou, 2450 m, 11.VIII.2003, Wu Jie collected (IZ-CAS); Paratypes: **CHINA: Sichuan:** 2 males, 4 females, same data as holotype.

Description. *Measurement*. BL=5.8 mm, FL=2.9 mm, HL =0.84 mm, HW=0.78 mm, PL= 1.00 mm, PW=0.69 mm, EL=1.00 mm, EW=1.00 mm.

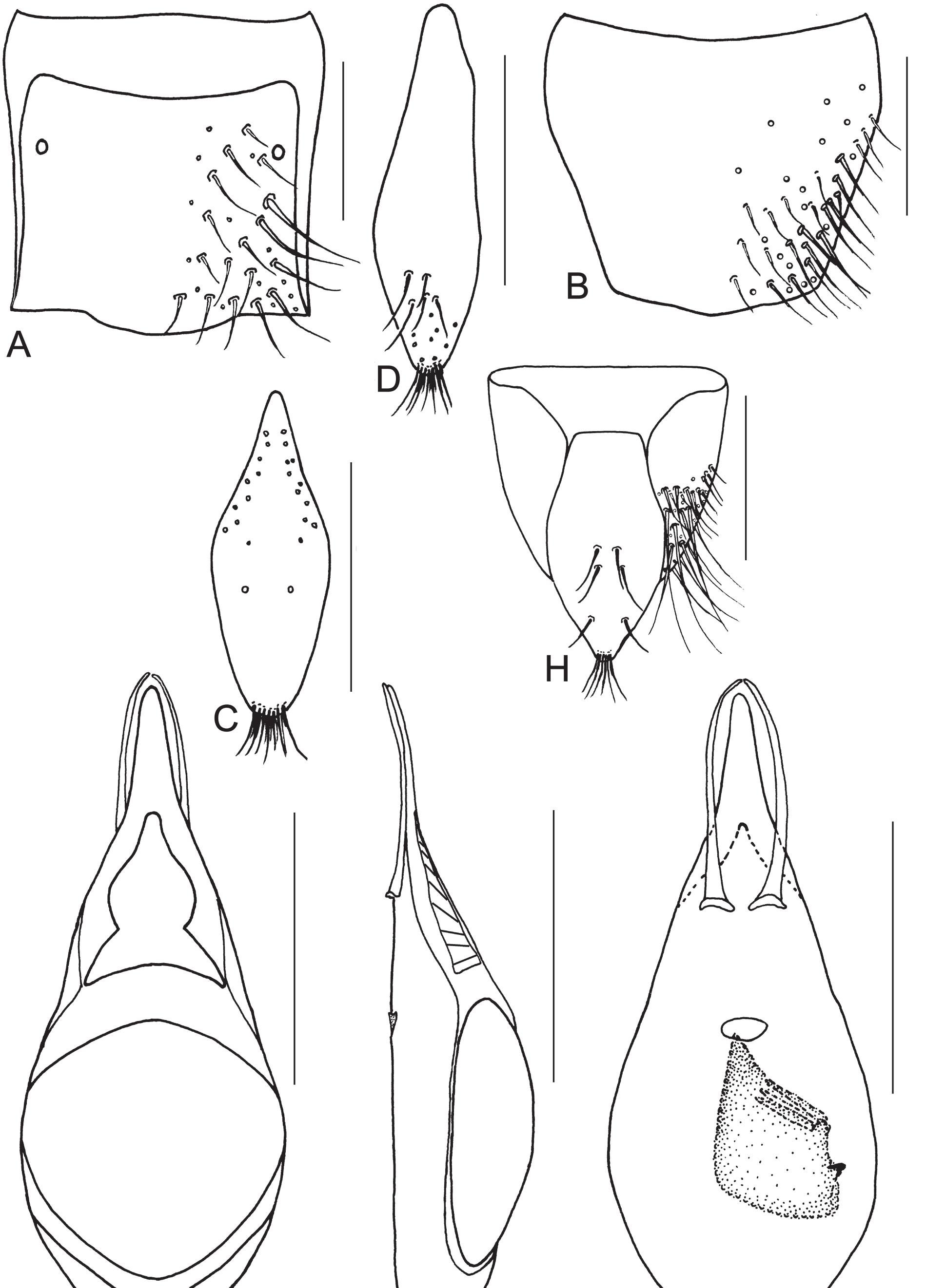


Figure 11. *Metolinus emarginatus* sp. n. **A** male tergite VIII **B** male sternite VIII **C** tergite of male genital segment **D** sternite of male genital segment **E** aedeagus, dorsal view **F** aedeagus, lateral view **G** aedeagus, ventral view **H** female genital segment, ventral view. Scale bars 0.15 mm.

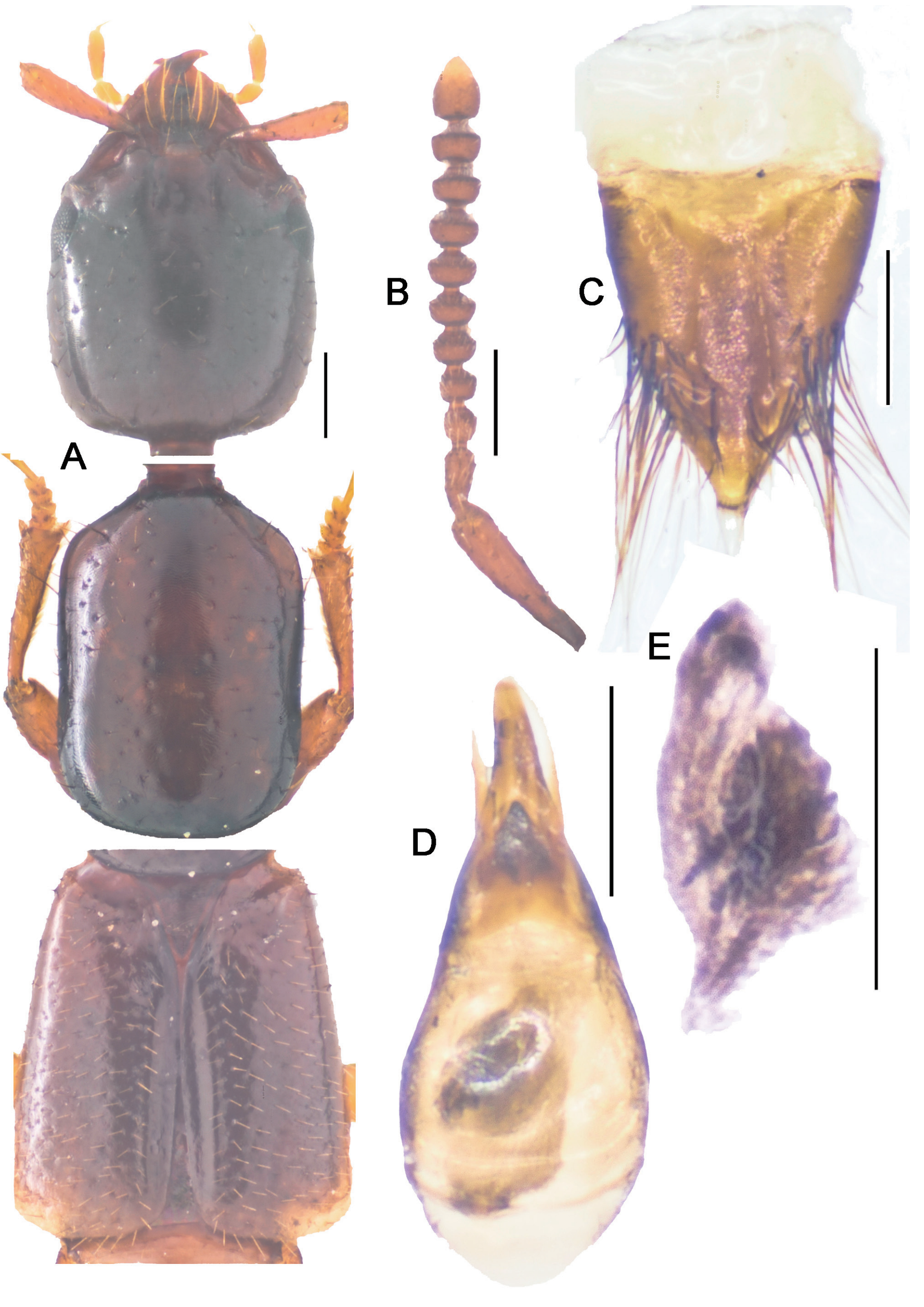


Figure 11-1. *Metolinus emarginatus* sp. n. **A** habitus of forebody **B** antennae **C** female genital segments, ventral view **D** aedeagus, dorsal view **E** inner sac. Scale bars 0.3 mm.

Body medium sized and nearly compressed. Body entirely dark brown, except each apical 1/3 of abdominal segment lighter. Legs dark brown, tarsi lighter. Antennae, maxillary palpi and labial palpi light brown.

Head (Fig. 11-1A). Subquadrate (HL to HW ratio 1.1), tempora (behind eyes) widened posteriorly, posterior angles rounded. Dorsal integument shiny, extensively covered with distinct transverse microstriae, and with sparse, scattered setiferous punctures of medium size, distance between punctures ca. 3 puncture diameters. With pair of frontal puncture on epistoma, 2 antennal punctures near antennal insertion, ocular puncture near medial margin of eye (ca. 3–4 puncture diameters from eye), temporal puncture at posterior 1/5 and occipital puncture at lateral 1/3; deflexed portion of tempora with same setiferous punctures and microstriae as on dorsal integument. Frontal furrows parallel and of medium length, longer than 1/2 of eye length. Ocular furrows deep and long, over eye length. Eye medium sized, nearly 1/3 of temple length (eye: temple =0.18:0.53 mm), slightly protruding laterad. Epistoma not protruding, anterior margin subtruncated, dorsally flat and broad, over 1/2 of eye length. Distance between antennal insertions ca. 0.23 mm, subequal to that from antenna to eyes (ca. 0.26mm). Ventral integument shiny, with same microstriae and setiferous punctures as on dorsal integument. Mentum with three pairs of setae inserted at each anterior angle in addition to other irregularly scattered setae, submentum with four pairs of setae. Gular sutures fused at middle, but separated at base of occiput. Gular plate devoid of punctures, but with distinct transverse microstriae.

Antennae (Fig. 11-1B). Scape stout, thickened apically, longer than three subsequent antennomeres combined, ca. 0.45 mm; 2^{nd} elongate, ca. 0.15 mm, distinctly longer than 3^{rd}; 3^{rd} globular, ca. 0.075 mm; 4^{th} and 5^{th} subequal, ca. 0.06 mm; last antennomere moderately long, ca. 0.15 mm, subequal to preceding 2 antennomeres combined.

Mouthparts. Labrum short and U-shaped bilobed, two subtruncated teeth on anterior margin. Mandibles falciform, left one with two teeth on medial edge. Maxillary palpus elongate, with 3^{rd} segment longest, last slender and aciculate. Labial palpus distinctly slender, with 2^{nd} longest, last slender and aciculate.

Neck. Rather narrow (ca. 0.24 mm), slightly wider than 1/4 of head width.

Pronotum (Fig. 11-1A). Subrectangular, distinctly elongate (PL to PW ratio 1.4), obviously longer than head, but of same width. Widened anteriad, lateral margins concavely sinuate; anterior angles well defined, posterior angles broadly rounded. Integument shiny, extensively with oblique microstriae; with two rows of setiferous punctures on each side, admedian row consisting of 7–9 punctures, lateral row of 6–8 punctures obliquely arranged; hind angle puncture ca. 1–2 puncture diameters distant from lateral margin. Antesternal plate integrated and not shallowly concave; medial longitudinal suture missing, transverse suture at anterior 1/5 fine but visible. Prosternum with demarcated medial longitudinal carina on posterior 1/5 of basisternum, anteriorly fused with prosternal process (between anterior legs). Mesoventrite extensively covered with transverse microstriae, medial longitudinal carina demarcated, process of mesoventrite arcuately protruding backwards. Metaventrite rather long, medial longitudinal keel sharp and obvious, with a fine furrow on posterior 1/2 of keel top; process of metaventrite subtruncated.

Elytra (Fig. 11-1A). Subquadrate, distinctly elongate (EL to EW ratio 1.0), of same length as pronotum, but distinctly wider. Humeri well developed, lateral margins widened posteriorly, hind margin convex. Integument shiny and flattened, without microsculpture, with setiferous punctures arranged in several rows (more than 3) on each side; deflexed portion of each elytron with 3–5 rows of punctures.

Legs. First four segments of protarsi obviously dilated, heart shaped, bearing extremely dense clothing of white fine hairs ventrally, last tarsomere as long as III–IV combined. Last segment of both meso- and metatarsi longer than that of protarsi and about equal to length of II–IV combined. Tibiae with apical ctenidium, only protibia with 2–3 rows of subapical ctenidia.

Abdomen. Cylindrical, broadest at segment VI. Terga III–VII shiny, entire surface covered with distinct transverse microstriae, with sparse, scattered, tiny setiferous punctures; each tergite with impunctate basal impression bearing more obvious transverse microstriae. All abdominal sterna shiny, with microstriae and setiferous punctures as those on terga.

Male. Tergite VIII entirely covered with setiferous punctures, except a narrow medial longitudinal impunctate band; posterior margin of tergite VIII (Fig. 11A) and sternite VIII (Fig. 11B) broadly arcuately protruding backwards,. Tergite of genital segment (Fig. 11C) symmetrical and medium sized, widest at midlength, with sharp base and rounded apex, in situ broadly exposed between pleurites. Pleurites of genital segment symmetrical, connected mediobasally. Sternite (Fig. 11D) asymmetrical, with rounded base and subtruncated right side. Aedeagus (Fig. 11-1D; Fig. 11E–G) pear-shaped and small sized, basal bulbus ca. 0.75 mm long; median lobe medium sized and sharply narrowed towards apex, ca. 1/3 of basal bulbus length. Parameres symmetrical and thin, ca. 1/3 of basal bulbus length. Internal sac (Fig. 11-1E; Fig. 11H) with brown and slightly sclerotized structure, composed of soft scales and 2–3 darker and transverse tubular-shaped structures medially.

Female. Posterior margin of tergite VIII and sternite VIII distinctly arcuate backwards. Genital segment (Fig. 11-1C) small, ca. 0.50 mm long. Sternite with subtruncated base. In addition, with some membranous structures attached to base of genital segment.

Distribution. China (Sichuan).

Etymology. The specific epithet is the Latin word *emarginatus* (emarginate) and refers to the shape of anterior margin of the epistoma.

Remarks. Although the shape of the median lobe of the aedeagus seems similar to that of *M. yunnanus* Bordoni 2002 and *M. loebli* Bordoni 2002, the species may be distinguished by the longer parameres (Fig. 11E), different shape and composition of the internal sac (Fig. 11G), and by the tergite and sternite of the genital segment (Fig 11A, B).

3. ***Metolinus binarius*** **Zhou & Zhou, sp. n.**

urn:lsid:zoobank.org:act:EE6F836A-0CF1-48B6-B60E-C3A3DB7FEC94
http://species-id.net/wiki/Metolinus_binarius
Fig. 12A–H; Fig. 12-1A–E

Type material. Holotype: **CHINA: Yunnan:** male, **Xishuangbanna Dai Autonomous Prefecture**, Menglun town (E 100.9876, N 22.1711), 860 m, 11.II.2004, Wu Jie collected (IZ-CAS); Paratypes: **CHINA: Yunnan: Xishuangbanna Dai Autonomous**, 5 males, 1 female, same data as holotype (IZ-CAS); 1ex., same data as holotype, except Wu Jie & Bai Dayuan collected (IZ-CAS); 2 males, 1 female, same locality as holotype, 560 m, 09.II.2004, Wu Jie collected (IZ-CAS); 1 male, 4 females, same locality as holotype, 550 m, 08.II.2004, Wu Jie & Bai Dayuan collected (IZ-CAS); 1ex., same locality as holotype, 730 m, 13.II.2004, Wu Jie collected (IZ-CAS); 1 female, same locality as holotype, 760 m, 10.II.2004, Wu Jie collected (IZ-CAS); Mengyang town: 1 female, Kungenaban 2nd village, 910 m, 08.X.2010, Zhou Yulingzi collected; 1 female, Mengla co., Nanman river, 857 m, 07.X.2010, Zhou Yulingzi collected (IZ-CAS).

Description. *Measurement*. BL=5.0 mm, FL=2.3 mm, HL=0.62 mm, HW=0.53 mm, PL=0.75 mm, PW=0.51 mm, EL=0.83 mm, EW=0.72 mm.

Body medium sized and nearly compressed. Body entirely dark brown. Legs dark brown, tarsi lighter. Antennae, maxillary palpi and labial palpi light brown.

Head (Fig. 12-1A). Subrectangular (HL to HW ratio 1.2), tempora (behind eyes) obviously widened posteriorly, posterior angles rounded. Dorsal integument shiny, extensively covered with distinct transverse microstriae, and sparse, scattered setiferous punctures of medium size, distance between punctures ca. 5–6 puncture diameters. With pair of frontal puncture on epistoma, 2 antennal punctures near antennal insertion, ocular puncture near medial margin of eye (ca. 3–4 puncture diameters from eye), temporal puncture at posterior 1/5 and occipital puncture at lateral 1/3; deflexed portion of tempora with same setiferous punctures and microstriae as on dorsal integument. Frontal furrows superficial and short, slightly shorter than 1/2 of eye length. Ocular furrows of medium length, subequal to 1/2 of eye length. Eye of relatively large size, longer than 1/2 temporal length (eye: temple =0.18:0.29 mm), distinctly protruding laterad. Epistoma protruding forwards, anterior margin subtruncated, dorsally flat and broad, as wide as 1/2 of eye length. Distance between antennal insertions ca. 0.20 mm, obviously wider than distance from antenna to eyes (ca. 0.09 mm). Ventral integument shiny, with same microstriae and setiferous punctures as on dorsal integument. Mentum with a pair of setae inserted at each anterior angle in addition to other irregularly scattered setae, submentum with 2 pairs of setae. Gular sutures fused at middle, and not separated at base of occiput. Gular plate devoid of punctures, but with distinct transverse microstriae.

Antennae (Fig. 12-1B). Scape stout, thickened apically, longer than three subsequent antennomeres combined, ca. 0.23 mm; 2nd elongate, ca. 0.075 mm, distinctly longer than 3rd; 3rd globular, ca. 0.045 mm; 4th and 5th subequal, ca. 0.045 mm; last antennomere relatively long, ca. 0.11 mm, subequal to preceding 3 antennomeres combined.

Mouthparts. Labrum transverse and U-shaped bilobed, two lateral teeth subtruncated on anterior margin. Mandibles falciform, left medial edge bearing two teeth. Maxillary palpus elongate, with 3rd segment longest, last slender and aciculate. Labial palpus distinctly slender, with 2nd longest, last slender and aciculate.

Neck. Rather narrow (ca. 0.12 mm), approximately of 1/4 of head width.

Pronotum (Fig. 12-1A). Subrectangular, distinctly elongate (PL to PW ratio 1.5), obviously longer than head, but of same width. Slightly dilated anteriad, sides slightly concavely sinuate; anterior angles well defined, posterior angles broadly rounded. Integument shiny, extensively covered with oblique microstriae; with two rows of setiferous punctures on each side, admedian row consisting of 4–5 punctures, lateral row with 3–4 punctures obliquely arranged; hind angle puncture ca. 1–2 puncture diameters distant from lateral margin. Antesternal plate integrated, not concave; medial longitudinal and anterior transverse sutures both missing. Prosternum with demarcated medial longitudinal carina on furcasternum, prosternal process (between anterior legs) triangularly projecting upwards. Mesoventrite extensively covered with transverse microstriae, medial longitudinal carina missing, process of mesoventrite triangularly protruding backwards. Metaventrite rather long, medial longitudinal keel sharp and obvious, a fine furrow on posterior 1/3 of keel top; process of metaventrite subtruncated.

Elytra (Fig. 12-1A). Subrectangular, distinctly elongate (EL to EW ratio 1.2), obviously longer and wider than pronotum. Humeri well developed, lateral margins widened posteriorly, hind margin curved backwards. Integument shiny and flattened, without microsculpture. Each elytron with three rows of setiferous punctures, along suture, in middle and near lateral margin, with additional punctures irregularly scattered between them; deflexed portion of each elytron with 2–3 rows of sparse setiferous punctures.

Legs. First four segments of protarsi obviously dilated, heart shaped, bearing extremely dense clothing of white fine hairs ventrally, last tarsomere as long as III–IV combined. Last segment of both meso- and metatarsi longer than that of protarsi and about equal to length of II–IV combined. Tibiae with apical ctenidium, only protibia with 2–3 rows of subapical ctenidia.

Abdomen. Cylindrical, broadest at segment VI. Terga III–VII shiny, entire surface covered with distinct transverse microstriae, with sparse, scattered, tiny setiferous punctures, but denser laterobasally; each tergite with impunctate basal impression bearing more obvious transverse microstriae. All abdominal sterna shiny, with microstriae and setiferous punctures as those on terga.

Male. Tergite VIII entirely covered with setiferous punctures, except a narrow medial longitudinal impunctate band; posterior margin of tergite VIII and sternite VIII both broadly arcuate backwards (Fig. 12A, B). Tergite of genital segment (Fig. 12C) symmetrical and small, with sharp base and rounded apex, in situ broadly exposed between pleurites. Pleurites of genital segment symmetrical, connected mediobasally. Sternite (Fig. 12D) asymmetrical, with subtruncated base and more angular left side.

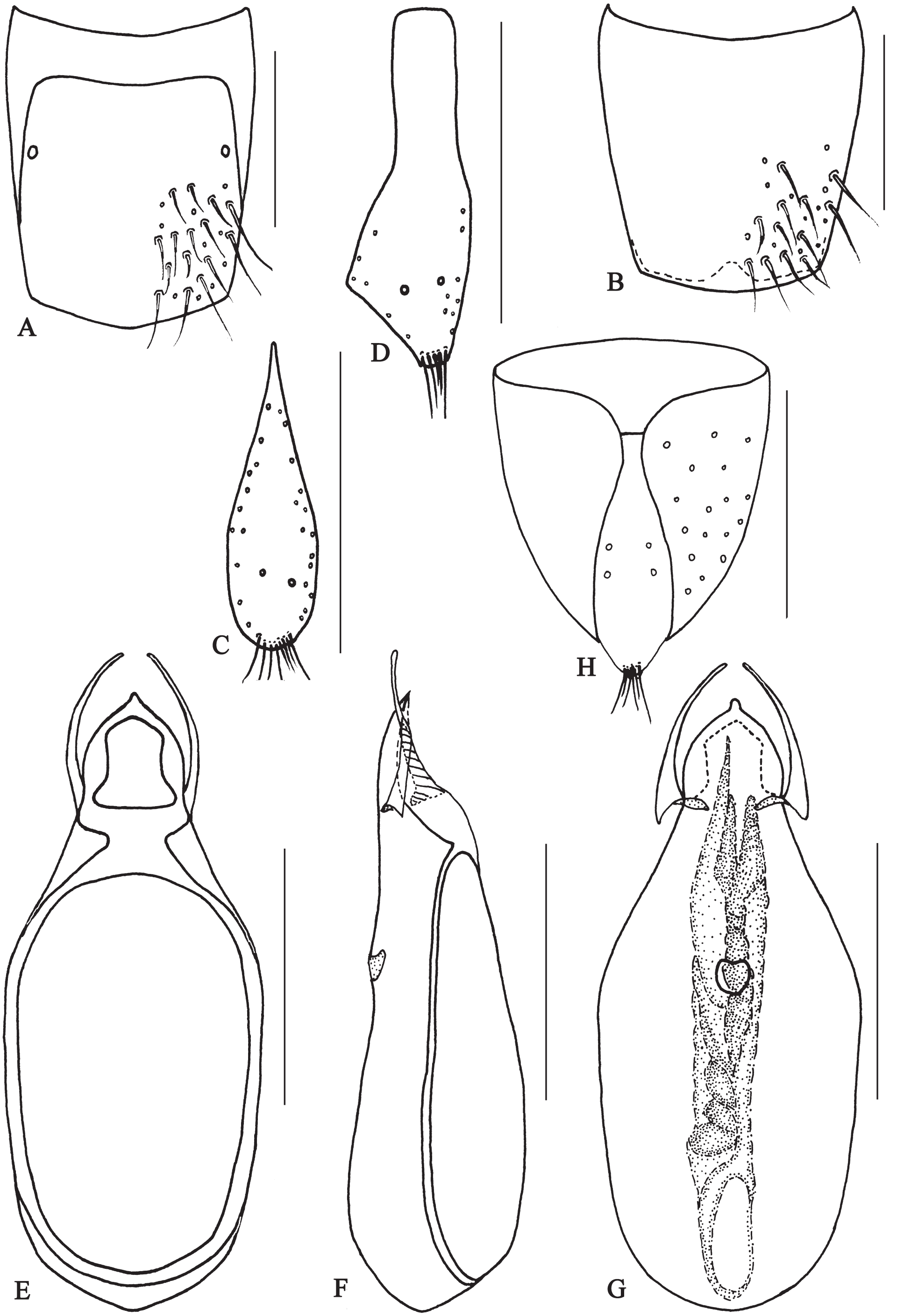


Figure 12. *Metolinus binarius* sp. n. **A** male tergite VIII **B** male sternite VIII **C** tergite of male genital segment **D** sternite of male genital segment **E** aedeagus, dorsal view **F** aedeagus, lateral view **G** aedeagus, ventral view **H** female genital segment, ventral view. Scale bars 0.15 mm.

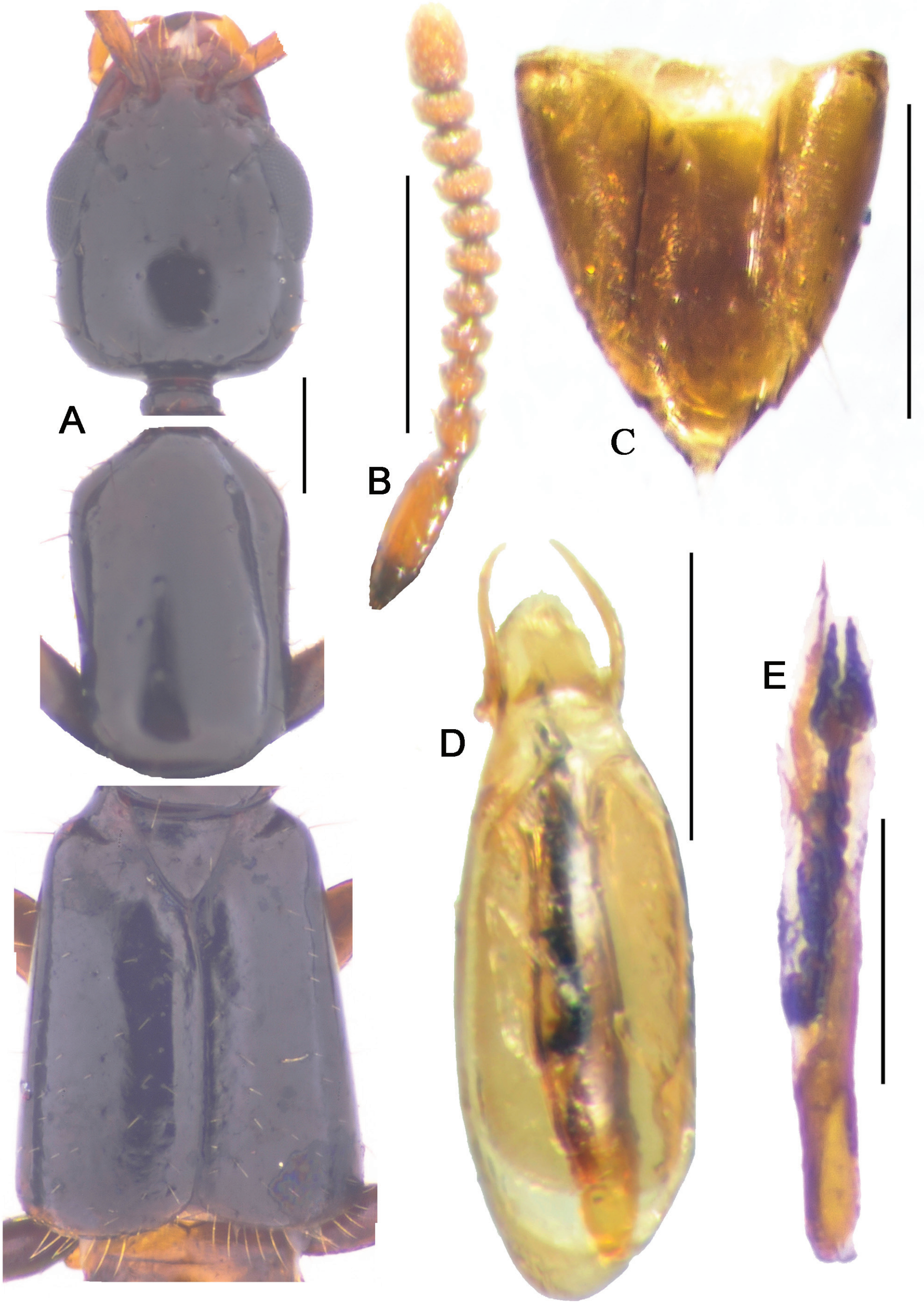


Figure 12-1. *Metolinus binarius* sp. n. **A** habitus of forebody **B** antennae **C** female genital segments, ventral view **D** aedeagus, dorsal view **E** inner sac. Scale bars 0.3 mm.

Aedeagus (Fig. 12-1D; Fig. 12E–G) elliptical and small sized, basal bulbus ca. 0.80 mm long; median lobe distinctly shorter than 1/3 of basal bulbus length. Parameres symmetrical and thin, distinctly shorter than 1/3 of basal bulbus length. Internal sac (Fig. 12-1E; Fig. 12H) with well sclerotized structure, spines composed of larger tubular-shaped spines and dark brown complex spines, apical portion with a pair of spines and a lighter spine.

Female. Posterior margin of tergite VIII subtruncated, but sternite VIII broadly arcuate. Genital segment (Fig. 12-1C) small, ca. 0.45 mm long. Sternite with subtruncated base. Additional brown and transverse sclerite attached at base of genital segment.

Distribution. China (Yunnan).

Etymology. The specific epithet is derived from the Latin word *binarius* and refers to the pair of spines on the apical portion of the internal sac.

Remarks. Although the large eyes and the number of punctures on the pronotum are similar to *M. schulzvocki* Bordoni, 2003 and *M. heuresilogus* Bordoni, 2002, it may be distinguished by the combined characters of the male genital segment (Fig. 12C, D) and the aedeagus (Fig. 12-1D; Fig. 12E–G).

4. *Metolinus shanicus* Bordoni, 2002

http://species-id.net/wiki/Metolinus_shanicus
Fig. 13A–H; Fig. 13-1A–E

Bordoni 2002: 375 (Type locality: Yunnan, Gaoligongshan Mts., 90 km W of Baoshan); Bordoni 2007: 71 (*Metolinus*; catalog)

Material examined. 2 males, 4 females, **CHINA: Yunnan:** Jingdong co.: Ailaoshan Field Station (E 98.2974, N 25.1119), 2486 m, 20.IX.2010, Zhou Yulingzi collected (IZ-CAS); 1 female, same locality as above, 21.IX.2010, Zhang Xi collected (IZ-CAS).

Description. *Measurement*. BL=4.7 mm, FL=2.7 mm, HL= 0.74 mm, HW=0.66 mm, PL=0.87 mm, PW=0.60 mm, EL=0.99 mm, EW=0.78 mm.

Body small and nearly compressed. Head dark brown; pronotum, mesoscutellum, elytra and abdomen brown, except humeral portion (anterior 1/3 of elytra), posterior half of abdominal segment VII and entire VIII ochre. Legs entirely testaceous. Antennae, maxillary palpi and labial palpi castaneous.

Head (Fig. 13-1A). Subquadrate (HL to HW ratio 1.1), tempora (behind eyes) subparallel or slightly widened posteriorly, posterior angles rounded. Dorsal integument shiny, extensively covered with distinct transverse microstriae, and sparse, scattered setiferous punctures of medium size, distance between punctures ca. 4–5 puncture diameters. On each side symmetrically with frontal puncture on the epistoma, 2 antennal punctures near antennal insertion, ocular puncture near inner side of eye (ca. 3–4 puncture diameters from eye), temporal puncture at posterior 1/4 and occipital puncture at lateral 1/3; deflexed portion of tempora with same setiferous punctures and microstriae as on dorsal integument. Frontal furrows of medium length, ca. 2/3 of eye length, slightly curved and extending backward to same level of eye midlength. Ocular furrows of medium length, as long as eye length. Eye of medium size, nearly 1/3 of temple length (eye: temple =0.15:0.45 mm), and slightly protruding laterad. Epistoma protruding forwards, anterior margin subtruncated, dorsally flat and broad, as wide as 1/2 of eye length. Distance between antennal insertions ca. 0.23 mm, obviously wider than that from antenna to eyes (ca. 0.15 mm). Ventral integument shiny, with same microstriae and setiferous punctures as dorsal integument, except punctures deeper. Mentum with two pairs of setae inserted at anterior angles in addition to other irregularly scattered setae, submentum with 2 pairs of setae. Gular sutures fused at middle, not separated at base of occiput. Gular plate devoid of punctures, but with distinct transverse microstriae.

Antennae (Fig. 13-1B). Scape stout, thickened apically, longer than three subsequent antennomeres combined, ca. 0.33 mm; 2nd elongate, ca. 0.12 mm, distinctly longer than 3rd; 3rd globular, ca. 0.075 mm; 4th and 5th subequal, ca. 0.06 mm; last antennomere proportionately long, ca. 0.12 mm, subequal to preceding 3 antennomeres combined.

Mouthparts. Labrum transverse and V-shaped bilobed, with two subtruncated teeth on anterior margin. Mandibles falciform, left one with two teeth on medial edge. Maxillary palpus elongate, with 3rd segment longest, last slender and aciculate. Labial palpus distinctly slender, with 2nd longest, last slender and aciculate.

Neck. Rather narrow (ca. 0.17 mm), approximately of 1/4 of head width.

Pronotum (Fig. 13-1A). Subrectangular, distinctly elongate (PL to PW ratio 1.5), obviously longer than head but of same width as head. Slightly widened anteriad, lateral margins substraight; anterior angles well defined, posterior angles broadly rounded. Integument shiny, extensively covered with obliquely microstriae; with two rows of setiferous punctures on each side, admedian row consisting of 5–7 punctures, lateral row of 4–5 punctures obliquely arranged; hind angle puncture ca. 1–2 puncture diameters distant from lateral margin. Antesternal plate integrated and symmetrically shallowly concave medially; medial longitudinal suture missing, transverse suture at anterior 1/5 fine but observable. Prosternum with demarcated medial longitudinal carina on furcasternum, prosternal process (between anterior legs) triangularly projecting upwards. Mesoventrite extensively covered with transverse microstriae, medial longitudinal carina demarcated, process of mesoventrite triangularly protruding backwards. Metaventrite rather long, medial longitudinal keel sharp and obvious, without a fine furrow on keel top; process of metaventrite subtruncated.

Elytra (Fig. 13-1A). Subrectangular, distinctly elongate (EL to EW ratio 1.3), obviously longer and wider than pronotum. Humeri well developed, lateral margins subparallel, slightly widened posteriorly, hind margin subtruncated. Integument shiny and flattened, without microsculpture. Each elytron with three rows of setiferous punctures, along suture, in middle and near lateral margin, additional punctures scattered irregularly between them; deflexed portion of each elytron with 2–3 rows of sparse setiferous punctures.

Legs. First four segments of protarsi obviously dilated, heart shaped, bearing extremely dense clothing of white fine hairs ventrally, last tarsomere as long as III–IV

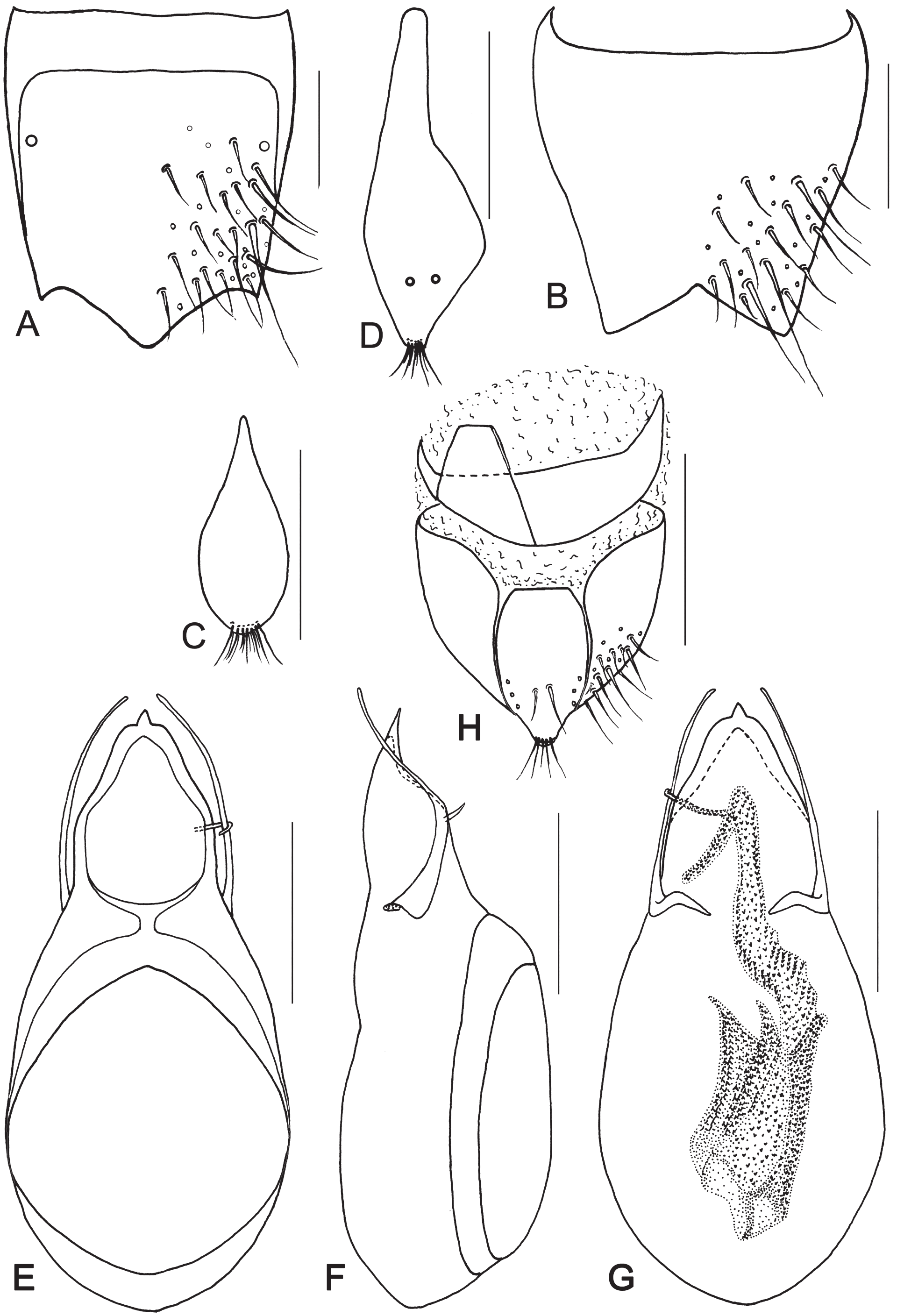


Figure 13. *Metolinus shanicus* Bordoni, 2002 **A** male tergite VIII **B** male sternite VIII **C** tergite of male genital segment **D** sternite of male genital segment **E** aedeagus, dorsal view **F** aedeagus, lateral view **G** aedeagus, ventral view **H** female genital segment, ventral view. Scale bars 0.15 mm.

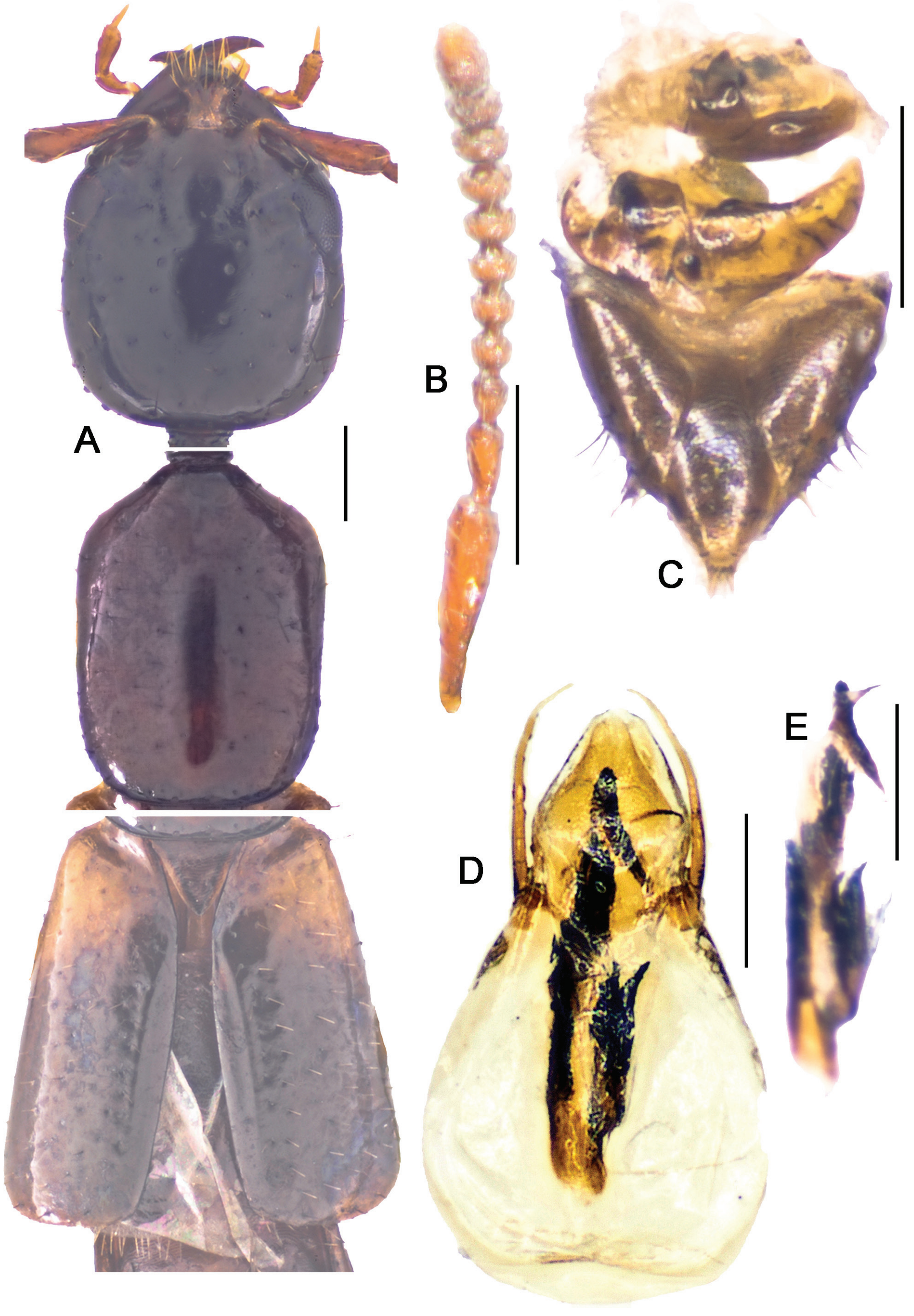


Figure 13-1. *Metolinus shanicus* Bordoni, 2002 **A** habitus of forebody **B** antennae **C** female genital segments, ventral view **D** aedeagus, dorsal view **E** inner sac. Scale bars 0.3 mm.

combined. Last segment of meso- and metatarsi longer than that of protarsi and about equal to length of II–IV combined. Tibia with apical ctenidium, only protibia with 2–3 rows of subapical ctenidia.

Abdomen. Cylindrical, broadest at segment VI. Terga III–VII shiny, entire surface covered with distinct transverse microstriae, with sparse, scattered, round setiferous punctures, but denser laterobasally; each tergite with impunctate basal impression bearing more obvious transverse microstriae. All abdominal sterna shiny, with microstriae and setiferous punctures as those on terga.

Male. Tergite VIII entirely covered with setiferous punctures, except a narrow medial longitudinal impunctate band; posterior margin of tergite VIII triangularly extended (Fig. 13A), that of sternite VIII triangularly emarginated (Fig. 13B). Tergite of genital segment (Fig. 13C) symmetrical, with sharp base and round apex, in situ broadly exposed between pleurites. Pleurites of genital segment symmetrical, connected mediobasally. Sternite (Fig. 13D) asymmetrical, with subtruncated base and more angular right side. Aedeagus (Fig. 13-1D; Fig. 13E–G) elliptical and medium sized, basal bulbus ca. 1.04 mm long; median lobe distinctly elongate, ca. 1/3 of basal bulbus length. Parameres symmetrical and of medium length, ca. 1/3 of basal bulbus length, thin and curved. Internal sac (Fig. 13-1E) with well sclerotized structure, some large spines on base, some small spines spirally arranged in middle, a long and thin flagellum extending out and intertwining right paramere in dorsal view.

Female. Posterior margin of tergite VIII and sternite VIII broadly arcuate backwards. Genital segment (Fig. 13-1C; Fig. 13H) small, ca. 0.40 mm long. Sternite with subtruncated base. Additional triangular-shaped sclerite attached to base of genital segment and folded by itself (Fig. 13-1C).

Distribution. China (Yunnan).

Remarks. This species may be distinguished from its congeners by the bicolorous elytra, the unique internal sac of aedeagus (Fig. 13G) and genital segment (Fig. 13C, D). However, the shape of the male tergite VIII of the specimens reported here slightly differs from the illustration given by Bordoni (2002: 374) which might reflect some degree of intraspecific variation.

5. *Metolinus gardneri* (Cameron, 1945)

http://species-id.net/wiki/Metolinus_gardneri
Fig. 14A–H; Fig. 14-1A–E

Cameron 1945: 68 (*Leptacinus*; Type locality: United Provinces: Dehra Dun, New Forest); Herman 2001: 3674 (*Leptacinus*; catalog); Bordoni 2002: 412 (*Metolinus*; characters; China, Thailand, Myanmar, Malaysia, Laos, Vietnam); Bordoni 2003a: 50 (*Metolinus*; Malaysia, W-Perak, 30 km SE Ipoh; Smetana 2004: 691 (*Metolinus*; catalog; Yunnan, India); Bordoni 2007: 71 (*Metolinus*; catalog).

Material examined. CHINA: Yunnan: Xishuangbanna Dai Autonomous Prefecture, 1 female, 860 m, 11.II.2004, Wu Jie & Bai Dayuan collected (IZ-CAS); Yaoqu (E 101.6659, N 21.7007), 1 male, 1 female, 940 m, 19.II.2004, Wu Jie collected (IZ-CAS); Menglun town (E 100.9876, N 22.1711), 1ex., 620 m, 21.II.2004, Wu Jie & Zhang Jiaolin collected (IZ-CAS); Menglun town, 1 male, 730 m, 13.II.2004, Wu Jie collected (IZ-CAS); **Mengla co.**, Longmen village, Xiaoniupeng (E 101.3252, N 21.3095), 1 female, 1035 m, 07.X.2010, Zhou Yulingzi collected (IZ-CAS); Mengyang town, 1 male, Kungenaban 2nd village (E 100.9876, N 22.1711), 910 m, 09.X.2010, collected by Lvliang (IZ-CAS).

Description. *Measurement*. BL=4.9 mm, FL=2.7 mm, HL=0.80 mm, HW=0.63 mm, PL=0.90 mm, PW=0.63 mm, EL=0.89 mm, EW=0.69 mm.

Body small sized and nearly compressed. Head, pronotum, mesoscutellum and elytra entirely black. Abdomen dark brown, posterior margin of segment VII and VIII paler. Legs dark brown, tarsi lighter. Antennae brown except apical 1/2 of 11th segment yellowish. Maxillary palpi and labial palpi light brown.

Head (Fig. 14-1A). Subrectangular (HL to HW ratio 1.3), tempora slightly widened posteriorly, posterior angles rounded. Dorsal integument shiny, extensively covered with distinct transverse microstriae, and sparse, scattered setiferous punctures of medium size, distance between punctures ca. 3 puncture diameters. On each side symmetrically with frontal puncture on the epistoma, 2 antennal punctures near antennal insertion, ocular puncture near medial margin of eye (ca. 3–4 puncture diameters from eye), temporal puncture at posterior 1/5 and occipital puncture at lateral 1/3; deflexed portion of tempora with smaller setiferous punctures, and microstriae same as on dorsal integument. Frontal furrows superficial and short, shorter than 1/2 of eye length. Ocular furrows of medium length, subequal to eye length. Eye of medium size, slightly longer than 1/3 of temple length (eye: temple=0.18:0.42 mm), and slightly protruding laterad. Epistoma protruding forwards, anterior margin subtruncated, dorsally flat and broad, as wide as 1/2 of eye length. Distance between antennal insertions ca. 0.23 mm, obviously wider than distance from antenna to eyes (ca. 0.15 mm). Ventral integument shiny, with same microstriae and setiferous punctures as on dorsal integument. Mentum with two pairs of setae inserted at anterior angles in addition to other irregularly scattered setae, submentum with 3 pairs of setae. Gular sutures fused at middle, and separated at base of occiput. Gular plate devoid of punctures, but spread with distinct transverse microstriae.

Antennae (Fig. 14-1B). Scape stout, thickened apically, longer than three subsequent antennomeres combined, ca. 0.30 mm; 2nd elongate, ca. 0.075 mm, distinctly longer than 3rd; 3rd globular, ca. 0.060 mm; 4th and 5th subequal, ca. 0.053 mm; last antennomere medium long, ca. 0.11 mm, as long as preceding 2 antennomeres combined.

Mouthparts. Labrum short and V-shaped bilobed, with two subtruncated teeth on anterior margin. Mandibles falciform, left with two teeth on medial edge. Maxillary palpus elongate, with 3rd segment longest, last slender and aciculate. Labial palpus distinctly slender, with 2nd longest, last slender and aciculate.

Neck. Rather narrow (ca. 0.17 mm), approximately of 1/4 of head width.

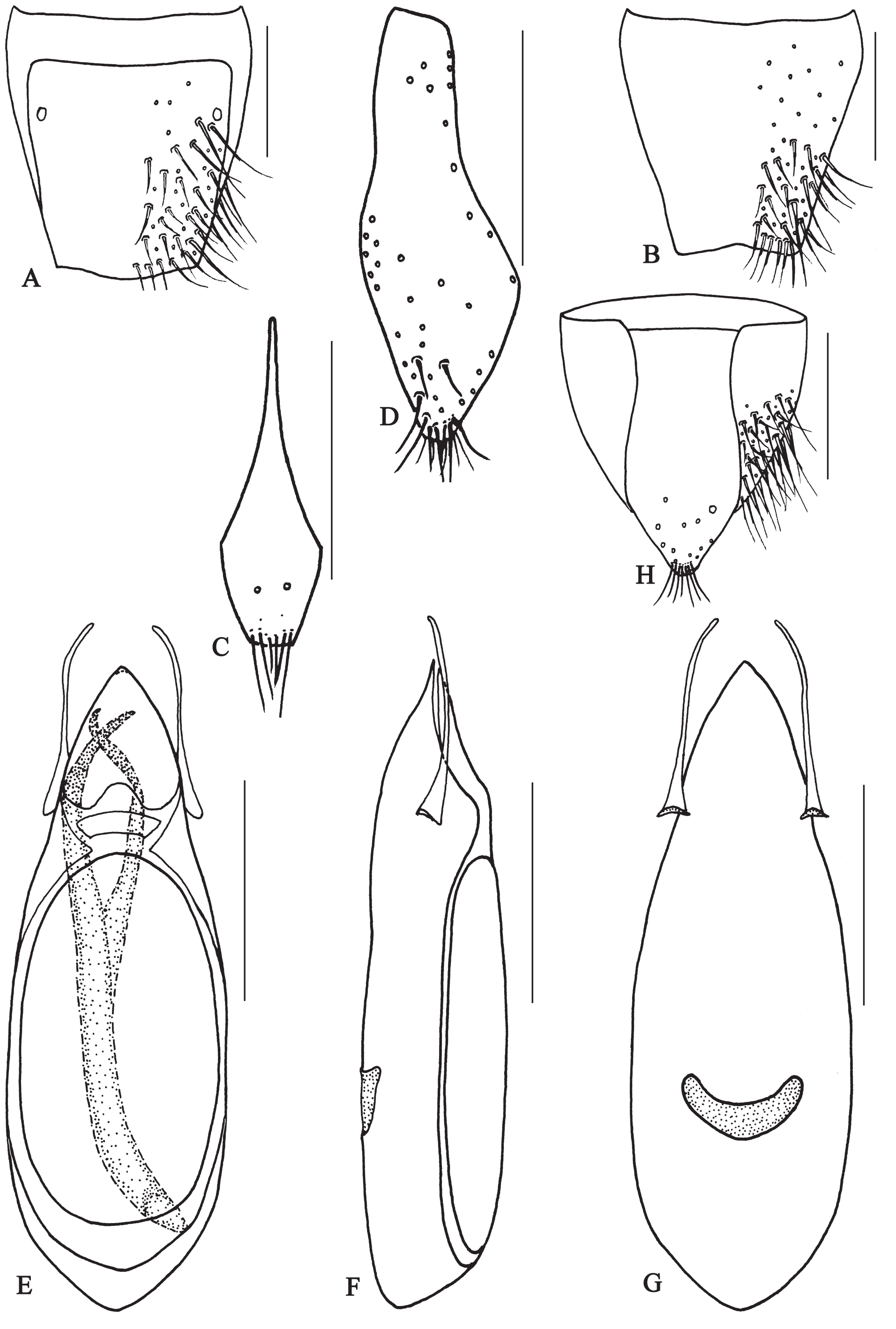


Figure 14. *Metolinus gardneri* (Cameron, 1945) **A** male tergite VIII **B** male sternite VIII **C** tergite of male genital segment **D** sternite of male genital segment **E** aedeagus, dorsal view **F** aedeagus, lateral view **G** aedeagus, ventral view **H** female genital segment, ventral view. Scale bars 0.15 mm.

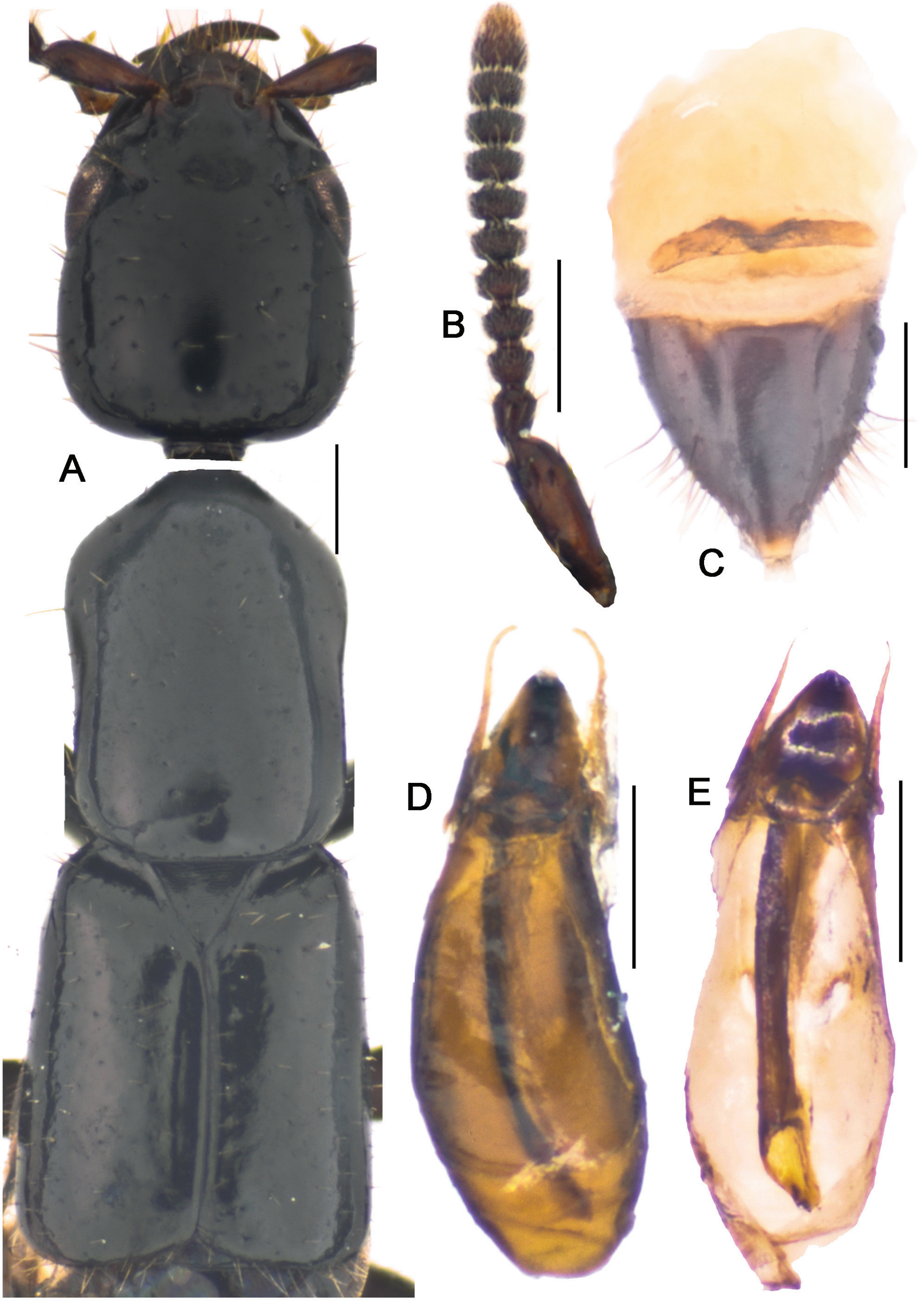


Figure 14-1. *Metolinus gardneri* (Cameron, 1945) **A** habitus of forebody **B** antennae **C** female genital segments, ventral view **D** aedeagus, dorsal view **E** inner sac. Scale bars 0.3 mm.

Pronotum (Fig. 14-1A). Subrectangular, distinctly elongate (PL to PW ratio 1.4), of same length and width as head. Slightly dilated anteriad, sides sinuate; anterior angles well defined, posterior angles broadly rounded. Integument shiny, extensively covered with oblique microstriae; with two rows of setiferous punctures on each side, admedian row consisting of 4–5 punctures, lateral row with 3–4 punctures straightly arranged; hind angle puncture ca. 1–2 puncture diameters distant from lateral margin. Antesternal plate integrated, not concave; medial longitudinal suture missing, transverse suture on anterior 1/5 fine but visible. Prosternum with demarcated medial longitudinal carina on furcasternum, prosternal process (between anterior legs) triangularly projecting upwards. Mesoventrite extensively covered with transverse microstriae, medial longitudinal carina missing, process of mesoventrite triangularly protruding backwards. Metaventrite rather long, medial longitudinal keel sharp and obvious, with a fine furrow on posterior 1/3 of keel top; process of metaventrite subtruncated.

Elytra (Fig. 14-1A). Subrectangular, distinctly elongate (EL to EW ratio 1.3), of same length and width as pronotum. Humeri well developed, lateral margins widened posteriorly, hind margin convex. Integument shiny and flattened, without microsculpture. Each elytron with three rows of setiferous punctures, along suture, in middle and near lateral margin, other punctures scattered irregularly between them; deflexed portion of each elytron with 2–3 rows of sparse setiferous punctures.

Legs. First four segments of protarsi obviously dilated, heart shaped, bearing extremely dense clothing of white fine hairs ventrally, last tarsomere as long as III–IV combined. Last segment of both meso- and metatarsi longer than that of protarsi and about equal to length of II–IV combined. Tibiae with apical ctenidium, only protibia with 2–3 of subapical ctenidia.

Abdomen. Cylindrical, broadest at segment VI. Terga III–VII shiny, entire surface covered with distinct transverse microstriae, with sparse, scattered, tiny setiferous punctures, but denser laterobasally; each tergite with impunctate basal impression bearing more obvious transverse microstriae. All abdominal sterna shiny, with microstriae and setiferous punctures as those on terga.

Male. Tergite VIII entirely covered with setiferous punctures, except for a narrow medial longitudinal impunctate band; tergite VIII with posterior margin broadly arcuate backwards (Fig. 14A), sternite VIII emarginated (Fig. 14B). Tergite of genital segment (Fig. 14C) symmetrical, with sharply pointed base and subtruncated apex, in situ broadly exposed between pleurites. Pleurites of genital segment symmetrical, connected mediobasally. Sternite (Fig. 14D) asymmetrical, with subtruncated base and more angular right side. Aedeagus (Fig. 14-1D; Fig. 14E–G) tubular-shaped and small sized, ca. 0.90 mm long; median lobe distinctly elongate, ca. 1/3 of basal bulbus length. Parameres symmetrical and thin, shorter than 1/3 of basal bulbus length. Internal sac (Fig. 14-1E) with well sclerotized structure, tubular-shaped, apical portion with two black and large spines.

Female. Posterior margin of tergite VIII subtruncated, that of sternite VIII subtruncated, and slightly transparent. Genital segment (Fig. 14-1C; Fig. 14H) small, ca. 0.58 mm long. Sternite with subtruncated base. Additional brown transverse sclerite attached to base of genital segment.

Distribution. China (Yunnan); India, Thailand, Myanmar, Malaysia, Laos, Vietnam.

Remarks. This species may be distinguished from its congeners by the few number of admedian punctural row of pronotum, the unique internal sac of the aedeagus (Fig. 14G) and genital segment (Fig. 14C, D).

6. *Metolinus hayashii* Bordoni, 2002

http://species-id.net/wiki/Metolinus_hayashii

Bordoni, 2002: 359 (Type locality: S-China, Jizushan Mts, 40 km N of Binchuan; 25 51N, 100 34E, 2600 m; 19–21.VI.1995).

Material examined. None.

Distribution. China (Yunnan).

7. *Metolinus planulatus* (Sharp, 1889)

http://species-id.net/wiki/Metolinus_planulatus

Sharp 1889: 252 (*Leptacinus*; Type locality: Hitoyoshi; Kuma Kuni); Bernhauer and Schubert 1914: 294 (*Leptacinus*; catalog); Shibata 1983: 73 (*Leptacinus*; check list of the family Staphylinidae of Japan. III); Herman 2001: 3681 (*Leptacinus*; Japan); Bordoni 2002: 426 (*Metolinus*; characters; China, Fujian, Shaowu, Tachuland; 24.IV.1942); Smetana 2004: 691 (catalog; Fujian, Sichuan, Japan); Bordoni 2007: 71 (*Metolinus*; catalog).

Material examined. None.

Distribution. China (Fujian); Japan.

8. *Metolinus yunnanus* Bordoni, 2002

http://species-id.net/wiki/Metolinus_yunnanus

Bordoni 2002: 405 (Type locality: S-China, Yunnan, Heishui, 35 km N Lijiang; 27 13N, 100 19E; 1–19.VII.1992); Bordoni 2007: 71 (*Metolinus*; catalog)

Material examined. None.

Distribution. China (Yunnan).

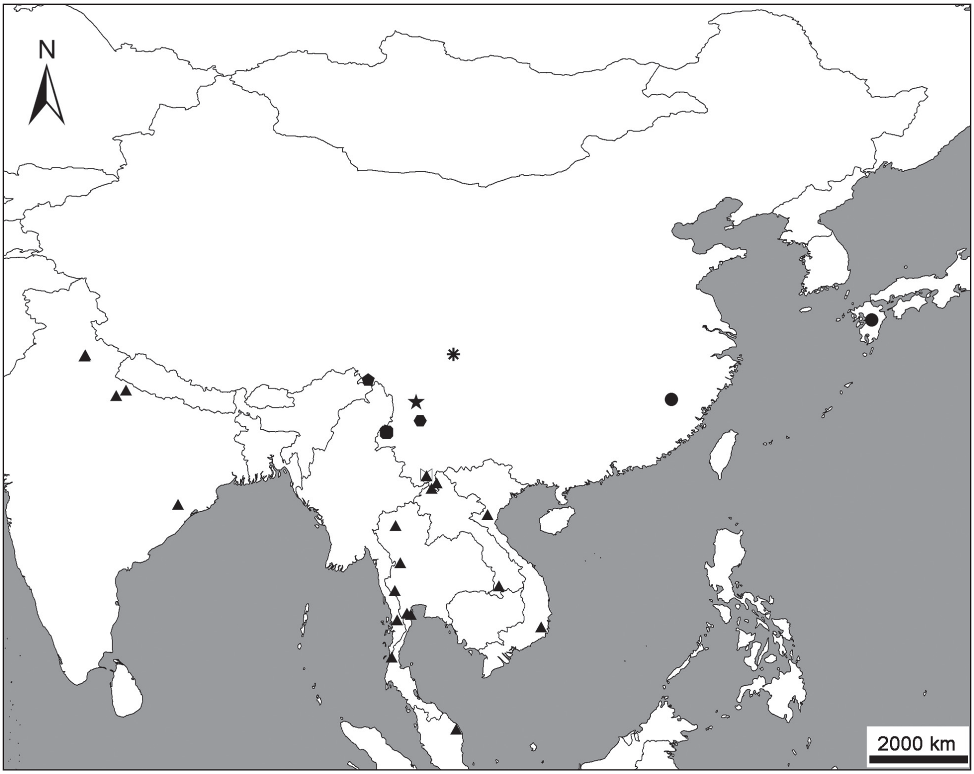


Figure 15. Geographical distribution of species of the genus *Metolinus* Cameron in China. ▲ *M. gardneri* (Cameron, 1945); ● *M. planulatus* (Sharp, 1889); *M. binarus* sp. n.; ✱ *M. emarginatus* sp. n.; ⬢ *M. hayashii* Bordoni, 2002; ⬣ *M. shanicus* Bordoni, 2002; ⬟ *M. xizangensis* sp. n.; ★ *M. yunnanus* Bordoni, 2002.

Acknowledgements

Our sincere thanks are due to Dr. Harald Schillhammer (Naturhistorisches Museum Wien, Wien, Austria) for many valuable suggestions to improve the manuscript and thank the other anonymous reviewer for providing helpful suggestions. We are also indebted to Mr. Arnaldo Bordoni and Dr. Volker Assing for sending important literature during study. We are grateful to Mr. Yuhong Liu (Vice director, Ailaoshan Forest Ecosystem Research Station) and Dr. Yong Tang (Xishuangbanna Tropical Botanical Garden, CAS) for help during the field collections in Yunnan. This study was supported by the National Natural Science Foundation of China (NSFC-31071909, NSFC-J0930004), the National Key Technology R&D Program (2008BAC39B02), CAS Innovation Program (KSCX2-YW-Z-0910), and a grant from the Key Laboratory of the Zoological Systematics and Evolution of CAS (No. O529YX5105).

References

Assing V (2000) A taxonomic and phylogenetic revision of Maorothiini trib. n. from the New Zealand subregion (Coleoptera: Staphylinidae, Staphylininae). Beiträge zur Entomologie 50: 3–64.

Assing V (2009) A new species of *Metolinus* from Yunnan, China (Coleoptera: Staphylinidae: Staphylininae: Xantholinini). Linzer Biologische Beitraege 41: 481–484.

Bernhauer M (1915) Neue Staphyliniden des südlichen Ostindiens. Entomologische Blätter 11: 251–258.

Bernhauer M, Schubert K (1914) Staphylinidae IV. In: Schenkling S (Ed) Coleopterorum Catalogus. Berlin: Junk, 289–408.

Blackwelder RE (1952) The generic names of the beetle family Staphylinidae, with an essay on genotypy. United States National Museum Bulletin: i–iv, 1–483.

Bordoni A (1982) Coleoptera. Staphylinidae. Generalita - Xantholininae. Fauna d'Italia IXI: 1–434.

Bordoni A (2002) Xantholinini of the Oriental Region (Coleoptera: Staphylinidae). Classification, phylogeny and taxonomic revision. Museo Regionale di Scienze Naturali Monografie (Turin) 33: 1–998.

Bordoni A (2003a) New data for the knowledge of the Xantholinini of the Oriental Region. III. New species of the Naturhistorisches Museum of Vienna (Coleoptera Staphylinidae). Quaderno di Studi e Notizie di Storia Naturale della Romagna 17: 43–54.

Bordoni A (2003b) New data on the knowledge of Xantholinini of the Orient. 1. *Metolinus schulzvocki* sp. n. from Thailand (Coleoptera Staphylinidae). 130th contribution to the knowledge on Staphylinidae. Animmax 2: 7–10.

Bordoni A (2003c) New data on the knowledge of Xantholinini of the Oriental region. IV. New species of the Tateo Ito di Kyoto collection (Coleoptera: Staphylinidae). 141st contribution to the knowledge on Staphylinidae. Animmax 3: 1–14.

Bordoni A (2004) New data on the Xantholinini of the Oriental Region. VIII. Species from Mount Kinabalu (Sabah) collected by Ales Smetana (Coleoptera Staphylinidae). Redia 87: 27–38.

Bordoni A (2005a) New data on the knowledge of the Xantholinini of the oriental region. XIII. Species from south India collected by H. Frane and preserved in the naturhistorisches museum of Wien (Coleoptera, Staphylinidae). Entomologica (Bari) 39: 89–97.

Bordoni A (2005b) Revision of the Xantholinini of Australia (Coleoptera: Staphylinidae): 152nd contribution to the knowledge of the Staphylinidae. Museo Regionale di Scienze Naturali Monografie 42: 435–613.

Bordoni A (2006) New data to the knowledge of the Xantholinini of the Oriental Region. XII. Species of the Jiri Janak collection (Coleoptera Staphylinidae). Bollettino della Societa Entomologica Italiana 138: 197–206.

Bordoni A (2007) Xantholinini (Coleoptera staphylinidae). Supplement to the catalogue Palaearctic coleoptera, volume 2. Bollettino della Societa Entomologica Italiana 139: 67–78.

Bordoni A (2009a) *Metolinus parvioculatus* Assing, 2009 synonym of *Mahavana watanabei* Bordoni, 2009 and general considerations. (Insecta Coleoptera Staphylinidae). Quaderno di Studi e Notizie di Storia Naturale della Romagna 29: 133–135.

Bordoni A (2009b) New data on species of the Xantholinini from the Oriental Region. XX. Species collected by RIEDEL in Sumatra, Java and Bali in 2005-2007 (Coleoptera, Staphylinidae). Carolinea 67: 109–115.

Bordoni A (2009c) Review of Xantholinini of New Guinea and Austromalaysian islands (Coleoptera: Staphylinidae) 165 degree contribution to the knowledge of Staphylinidae. Museo Regionale di Scienze Naturali Bollettino (Turin) 27: 253–635.

Bordoni A (2010a) New data on the Xantholinini from the Oriental Region. XXII. New species from Laos (Coleoptera, Staphylinidae) 203 degree contribution to the knowledge of the Staphylinidae. Linzer Biologische Beiträge 42: 523–528.

Bordoni A (2010b) Xantholinini from the Australian and Oriental Regions. New genus, new species and new records (Coleoptera, Staphylinidae). 208 degree contribution to the knowledge of the Staphylinidae. Zootaxa 2538: 38–46.

Cameron M (1920) New species of Staphylinidae from India (1). The entomologist's Monthly Magazine, London 56: 141–148.

Cameron M (1932) The Fauna of British India including Ceylon and Burma. Coleoptera. Staphylinidae.-Vol. III. Taylor & Francis, xiv + 443 pp.

Cameron M (1933) Fauna Sumatrensis. Staphylinidae. Tijdschrift voor Entomologie 76: 383–395.

Cameron M (1936) New species of Staphylinidae (Col.) from the Malay Peninsula. Journal of the Federated Malay States Museums 18: 40–53.

Cameron M (1937) Fauna Javanica. The Staphylinidae collected by Mr. F. C. Drescher. Part II. Tijdschrift voor Entomologie 80: 1–37.

Cameron M (1945) Descriptions of new Staphylinidae (Coleoptera). Proceedings of the Royal Entomological Society of London 14: 63–69.

Cameron M (1950) New species of Staphylinidae (Col.) from the Malay Peninsula. The Annals and Magazine of Natural History of the National Parks of Hungary 12: 1–40, 89–131.

Coiffait H (1977) Ergebnisse der Bhutan Expedition 1972 des Naturhistorischen Museums in Basel. Coleoptera: Fam. Staphylinidae Subfam. Xantholininae et Staphylinidae. Entomologica Basiliensia 2: 205–242.

Gusarov VI (2002) *Xantholinus dvoraki* Coiffait, 1956, the only valid species of the subgenus *Meneidophallus* Bordoni, 1999, with remarkably variable internal sac of aedeagus (Coleoptera, Staphylinidae). Zootaxa 21: 1–11.

Herman LH (2001) Catalog of the Staphylinidae (Insecta: Coleoptera). 1758 to the end of the second millennium. VI. Staphylinine group (part 3) Staphylininae: Staphylinini (Quediina, Staphylinina, Tanygnathinina, Xanthopygina), Xantholinini. Staphylinidae incertae sedis. Fossils, Protactinae. Bulletin of the American Museum of Natural History 265: i–v, 3021–3839.

Kraatz G (1859) Die Staphylinen-Fauna von Ostindien, insbesondere der Insel Ceylan. Archiv für Naturgeschichte 25: 1–196.

Last HR (1980) Records of New Guinea Staphylinidae (Coleoptera) in the Hungarian Natural History Museum. Annales Historico-Naturales Musei Nationalis Hungarici 72: 139–161.

Naomi SI (1990) Comparative morphology of the Staphylinidae and the allied groups (Coleoptera, Staphylinoidea). 11. Abdominal glands, male genitalia and female spermatheca. Japanese Journal of Entomology 58: 16–23.

Newton AF, Thayer MK, Ashe JS, Chandler DS (2000) Staphylinidae Latreille, 1802. In: Arnett RH, Thomas MC (Eds) American Beetles. Vol.1 Archostemata, Myxophaga, Adephaga, Polyphaga: Staphyliniformia CRC Press, Boca Raton, 272–418.

Scheerpeltz O (1933) Staphylinidae VII. In: Schenkling S (Ed) Coleopterorum Catalogus. Junk, Berlin, 1501–1881.

Scheerpeltz O (1957) Wissenschaftliche Ergebnisse der Sumba-Expedition des Museums für Völkerkunde und des Naturhistorischen Museums in Basel, 1949. Staphylinidae (Col.) von Sumba und Flores. Verhandlungen der Naturforschenden Gesellschaft in Basel 68: 217–357.

Sharp DS (1889) The Staphylinidae of Japan. The Annals and Magazine of Natural History 6: 249–267.

Shibata Y (1983) Provisional checklist of the family Staphylinidae of Japan. III. Annual Bulletin of Nichidai Sanko 21: 67–140.

Smetana A (1982) Revision of the subfamily Xantholininae of America north of Mexico (Coleoptera: Staphylinidae). Memoirs of the Entomological Society of Canada 120: 1–384.

Smetana A (2004) Staphylinidae, tribe Xantholinini. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera. 687–698.

Smetana A, Davies A (2000) Reclassification of the north temperate taxa associated with Staphylinus sensu lato, including comments on relevant subtribes of Staphylinini (Coleoptera: Staphylinidae). American Museum Novitates 3287: 1–88.

Solodovnikov AY, Newton AF (2005) Phylogenetic placement of Arrowinini trib.n. within the subfamily Staphylininae (Coleoptera: Staphylinidae), with revision of the relict South African genus *Arrowinus* and description of its larva. Systematic Entomology 30: 398–441.

Zhou H-Z (2005) Challenging the monophyly of the subtribe Anisolinina (Coleoptera, Staphylinidae) based on taxonomic changes and morphology. Acta Zootaxonomica Sinica 30: 676–683.

ZooKeys 112: 89–96 (2011)
doi: 10.3897/zookeys.112.1205
www.zookeys.org

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Notes on the genus *Harmonicon* F.O.P.-Cambridge, 1896 (Araneae, Dipluridae) with description of a new species from French Guyana

Bastian Drolshagen[1,†], Christian M. Bäckstam[2,‡]

1 *Institute of Environmental Sciences, University of Koblenz-Landau, Fortstrasse 7, 76829 Landau, Germany*
2 *Olshammarsgatan 36, S-12475 Bandhagen, Sweden*

† *urn:lsid:zoobank.org:author:4B37AE80-1180-4FDD-ADE8-1C5463B1FA89*
‡ *urn:lsid:zoobank.org:author:360B7D57-2829-4AB1-B3E1-E6AB9B82F34E*

Corresponding author: *Bastian Drolshagen* (drolshagen@dipluridae.de)

Academic editor: *Rudy Jocqué* | Received 7 March 2011 | Accepted 6 May 2011 | Published 24 June 2011

urn:lsid:zoobank.org:pub:A48F1812-4FA4-4E66-AD03-57F4D4463928

Citation: Drolshagen B, Bäckstam CM (2011) Notes on the genus *Harmonicon* F.O.P.-Cambridge, 1896 (Araneae, Dipluridae) with description of a new species from French Guyana. ZooKeys 112: 89–96. doi: 10.3897/zookeys.112.1205

Abstract

Information on the genus *Harmonicon* F.O.P.-Cambridge, 1896, a key to the species and a new diagnosis differing from the one in Maréchal and Marty (1998) are provided. A new species is described: *Harmonicon oiapoqueae* differing from other species of the genus by the morphology of the posterior sternal sigilla, the more recurved, inverted U–shaped fovea, the amount and arrangement of maxillary cuspules, a single row of teeth on the claws of the palpal tarsus, longer and more slender legs III and IV in females, longer embolus, thinner bulb, and longer, more slender legs in males. The status of the putative junior synonyms of *Harmonicon*, *Pseudohermachura* Mello-Leitão, 1927 and *Prosharmonicon* Mello-Leitão, as well as the two species formerly assigned to *Harmonicon*, *Harmonicon nigridorsi* Mello-Leitão, 1924 and *Harmonicon riveti* Simon, 1903, is discussed.

Keywords

spider taxonomy; diplurinae; new species; typus rediscovery

Introduction

The genus *Harmonicon* F.O.P.-Cambridge, 1896 was established on the basis of a single juvenile specimen with the type species *Harmonicon rufescens* F.O.P.-Cambridge, 1896 from Santarem, Brazil. Raven (1985) considered *Harmonicon* a junior synonym of *Diplura* C.L. Koch, 1850 because both genera possess a lyra consisting of few modified bristles on the prolateral side of the maxillae. Maréchal and Marty (1998) rejected this synonymy on the basis of the shape of the lyra bristles that differ between the two genera and a different leg formula, and they described an additional species: *Harmonicon audeae* Maréchal & Marty, 1998.

Material and methods

Material and methods follow Drolshagen and Bäckstam (2009). Abbreviations and measurement of male palpal organ follow Coyle (1995): PL = length of male palpal organ, BD = bulbus width. Measurements and leg proportion (diameter of femur/length of leg × 100) follow Maréchal and Marty (1998). The term megaspine is used according to Raven (1984). Additional abbreviations: imm = immature, Co = coxa, Fe = femur, Pa = patella, Ti = tibia, Mt = metatarsus, Ta = tarsus, STC = superior tarsal claw, ITC = inferior tarsal claw, PMS = posterior median spinnerets, PLS = posterior lateral spinnerets.

Acronyms of institutes, museums and collections:

IBSP: Instituto Butantã, São Paulo; SMNK: Staatliches Museum für Naturkunde Karlsruhe; MNHN: Muséum National d'Histoire Naturelle, Paris; MPSP: Universidade de São Paulo, Museu Paulista; NHM: The Natural History Museum, London (formerly British Museum, Natural History); NHMW: Naturhistorisches Museum, Wien; SMF: Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main; PCD = Drolshagen private collection.

Examined (type-) material: *Diplura nigra* (F. O. P.-Cambridge, 1896), female holotype, NHM (BMNH1896.12.13.49), Santarem, lower Amazonas, Brazil. *Diplura sanguinea* (F. O. P.-Cambridge, 1896), female holotype, NHM (BMNH1896.12.13.41), Santarem, lower Amazonas, Brazil. *Harmonicon rufescens* F. O. P.-Cambridge, 1896, imm male holotype, NHM (no collection number), Santarem, lower Amazonas, Brazil. *Harmonicon oiapoqueae* sp. n. male holotype and paratype female, SMNK, Saint Georges, French Guiana. *Harmonicon oiapoqueae* sp. n. juvenile, PCD, Saint Georges, French Guiana. *Trechona rogenhoferi* (Ausserer, 1871), female holotype, NHMW (N.I.: 62), Brazil. *Trechona rufa* (Ausserer, 1871), female SMF (Nr. 38604), Miracatu, São Paulo, Brazil. *Trechona zebrata* (Walkenaer, 1835) (currently in synonymy of *Trechona venosa* (Latreille, 1832)), female holotype, NHM (no collection number), Brazil.

Taxonomy

Harmonicon F.O.P.-Cambridge, 1896

http://species-id.net/wiki/Harmonicon

Harmonicon F.O.P.-Cambridge 1896: 755; Maréchal and Marty 1998: 500.

Diagnosis: *Harmonicon* is one of the genera of the subfamily Diplurinae with a lyra prolaterally on the maxillae. It differs from *Diplura* by the shape of the lyra bristles (claviform in *Diplura* rather than hookshaped in *Harmonicon*), a more dense scopula on Ta I and II, the presence of a dense scopula in more than the apical third of pedipalpal tarsus, the presence of a scopula in the apical third of most leg metatarsi, and by the leg tarsi being pseudosegmented instead of showing only a few cracks. *Harmonicon* can be distinguished from *Trechona* by a less dense scopula on Ta III and IV, and by fewer lyra bristles arranged in a single row.

Remarks: Cambridge (1896) and Maréchal and Marty (1998) regarded the presence of five lyra bristles a key feature for the genus. Research on the development on the new species described here showed that younger specimens have fewer lyra bristles than fully grown ones. Therefore the number of lyra bristles should no longer be considered diagnostic for *Harmonicon*. Maréchal and Marty (1998) stated that the leg formula of 1423 (rather than 4123 as in *Diplura* and *Trechona* C.L. Koch, 1850), is also a key feature of the genus *Harmonicon*, but show a leg formula of 4123 for the female holotype of *H. audeae*. Cambridge (1896) was incorrect in stating that the holotype of *Harmonicon rufescens* is a female; it is in fact a juvenile male. Maréchal and Marty (1998) did not comment on the putative synonyms of *Harmonicon, Pseudohermachura* Mello-Leitão, 1927 and *Prosharmonicon* Mello-Leitão, 1938, as well as those species formerly assigned to *Harmonicon*: *Harmonicon nigridorsi* Mello-Leitão, 1924 and *Harmonicon riveti* Simon, 1903. Mello-Leitão (1927) described the monotypical genus *Pseudohermachura* from a single female specimen of the type species *Pseudohermachura catharinensis* Mello-Leitão, 1927 (holotype deposited in MPSP) and did not mention the presence of a lyra at all. Bücherl (1962) redescribed *P. catharinensis* and mentioned a lyra consisting of 7–10 claviform bristles. Mello-Leitão (1938) described the monotypical genus *Prosharmonicon* from a single female specimen of the type species *Prosharmonicon maculatum* Mello-Leitão, 1938 (holotype deposited in IBSP and destroyed in the fire of 2010) and explicitly mentioned claviform lyra bristles. We therefore consider *Pseudohermachura* and *Prosharmonicon* junior synonyms of *Diplura* and reject the synonymies with *Harmonicon* established by Bücherl (1962). Simon (1903) described *H. riveti* from a single male specimen, of which the palpal organ, distal part of Ti I and basal part of Mt I were later illustrated in Berland (1913): pl. 7, fig. 5–6. The illustrations show a palpal organ with a strongly curved apex of the embolus and a highly elevated tubercle laterally in the basal third of Mt I. The morphology of the palpal organ and the tubercle in the basal third of Mt I in (known) males is different in those species currently assigned to *Harmonicon*. Mello-Leitão (1924) described *H. nigridorsi* from a single female specimen, he explicitly mentioned claviform lyra bristles, which is also supported by the illustration in Mello-Leitão (1926): fig. 4. We therefore support the transfer of those two species to *Diplura* by Raven (1985).

Key to the species of *Harmonicon*

1	Female or juvenile	**2**
–	Male	**4**
2	Tarsal claw of pedipalps with one row of teeth	**3**
–	Tarsal claw of pedipalps with a double row of teeth	***H. audeae***
3	Fovea slightly recurved, not inverted U–shaped; approximately 30–40 maxillary cuspules; posterior pair of sternal sigilla circular	***H. rufescens***
–	Fovea strongly recurved, inverted U–shaped; approximately 40–50 maxillary cuspules; posterior pair of sternal sigilla oval	***H. oiapoqueae* sp. n.**
4	Palpal organ long, bulbus narrow [PL(100)/BD = 251]; tubercle in basal third of metatarsus I absent	***H. audeae***
–	Palpal organ short, bulbus wide [PL(100)/BD = 147]; tubercle in basal third of metatarsus I present	***H. oiapoqueae* sp. n.**

***Harmonicon oiapoqueae* sp. n.**
urn:lsid:zoobank.org:act:AAE8BAB3-42C4-4A88-B2F6-ADCA489482B4
http://species-id.net/wiki/Harmonicon_oiapoqueae

Type material: Male holotype and 1 female paratype (SMNK) from Saint Georges, French Guiana, 3°56'56.12"N, 51°47'39.90"W (leg. T. Vinmann).

Other material examined: PCD–33–306–03 1 imm of *Harmonicon oiapoqueae*, same data as for holotype and paratype.

Etymology: The specific epithet, a feminine genitive singular, refers to the Oiapoque river, which is close to the type locality.

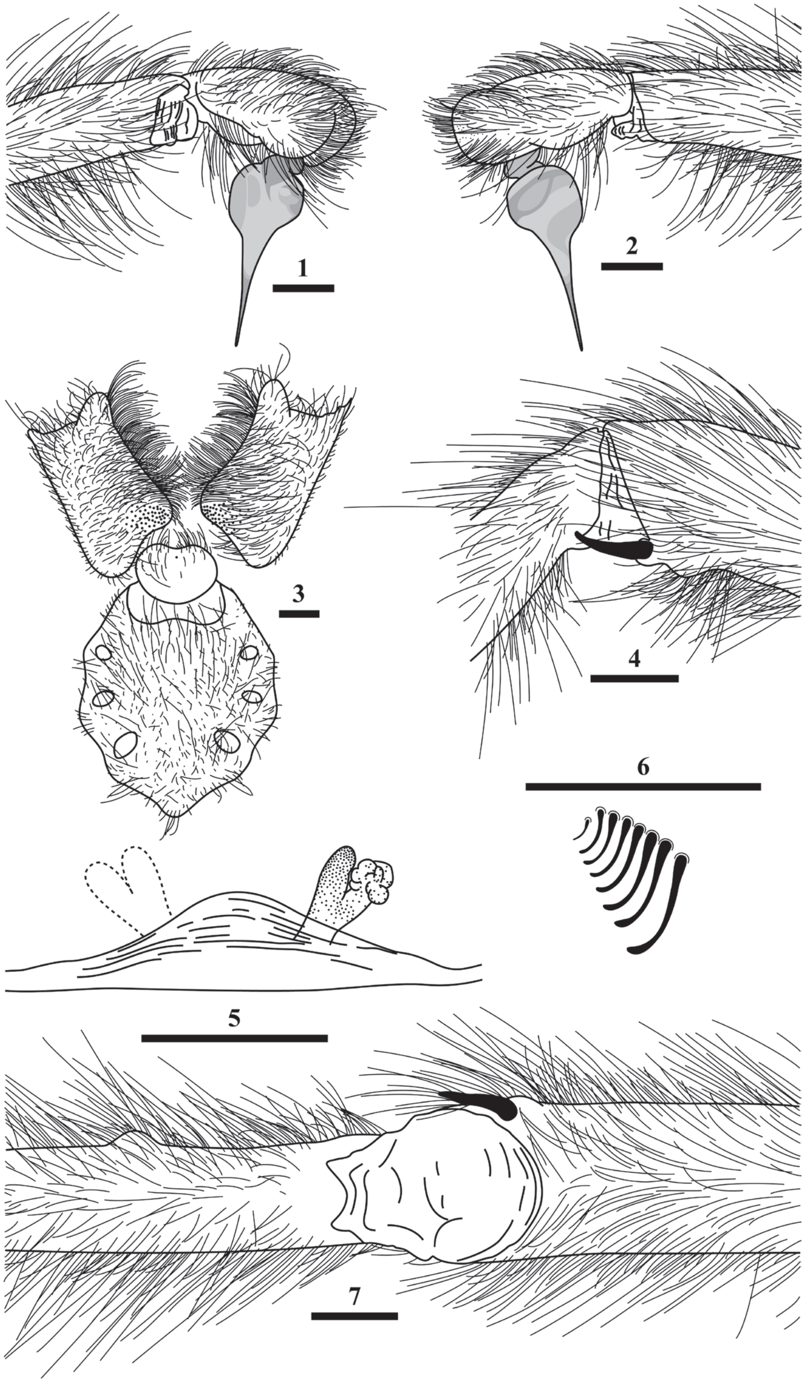
Diagnosis: *Harmonicon oiapoqueae* sp. n. can be distinguished from the other species of the genus by the posterior pair of sternal sigilla being oval instead of circular. It furthermore differs from *Harmonicon audeae* by only one row of teeth on the tarsal claws of the pedipalp and from *H. rufescens* by a more stronly recurved, inverted U–shaped fovea and position and arrangement of cuspules on the basal inner corner of the maxillae. *Harmonicon oiapoqueae* sp. n. differs from *Harmonicon audeae* and *Harmonicon rufescens* by more slender legs III and IV in females and juveniles and legs I-IV in males. Furthermore, males can be distinguished from those of *H. audeae* by a shorter embolus and a wider bulbus [PL(100)/BD = 147] and the presence of a tubercle in the basal third of the lateral metatarsus I.

Description: Male holotype: Colour in alcohol: carapace, legs and pedipalps mahagony brown, chelicerae red, opisthosoma grey. Carapace (length: 11.67; width: 10.38) covered with soft grey setae and longer, black setae in posterior thoracic area; margin with long, black setae and soft, silver setae; clypeus present, narrow; fovea slit-like, recurved, inverted U–shaped; striae marked. Chelicerae with two retrolateral bands of plumose setae and one dorsal band, broadening to full width of chelicerae distally; ventrally with one row of 9 teeth (1–1–1–1–5) on promargin; cheliceral furrow with a field of small basomesal teeth; retroventral base with isolated bristles. Maxillae with prolateral lyra consisting of 7 hookshaped bristles (as in the female paratype - viz. Fig. 6); ventrally with few cuspules on basal inner corner, number and arrangement different in both sides. Labium trapezoidal, without cuspules; labiosternal suture short and divided. Sternum with 3 pairs of sigilla: anterior pair at height of Co I, circular, medial pair at Co II, circular, posterior pair between Co III and IV, oval, largest; anterior and medial pairs almost equal in size. Legs long and slender (measurements and proportions in table 1), with all tarsi pseudosegmented (Ta IV missing). All present tarsi with dense and entire scopula; metatarsi also scopulated in apical third, but less dense. STC at Ta I and II truncated (maybe worn off), not curved; normal at Ta III, curved and long; all with few teeth; ITC short, without teeth. Ti I retroventrally at apex with megaspine (Fig. 4, 7); Mt I with a low, domed tubercle retroventrally in basal third (Fig. 7). Number and position of spines on legs different on both sides. Opisthosoma (length: 12.34; width: 7.15) with two pairs of spinnerets: PMS small, consisting of one segment (length: 3.96), widely separated from each other. PLS elongated, consisting of three segments: basal (length: 5.62), medial (length: 6.18), apical (length: 10.68) longest. Palpal bulb pyriform with relatively long, almost straight embolus (Figs 1, 2).

Female paratype: Colour in alcohol: resembles male holotype, but legs darker. Carapace (length: 13.26; width: 12.54) and opisthosoma (length: 17.37; width: 7.58) larger than that of holotype. Different from male holotype by the presence of one more labial cuspule and several more cuspules on basal inner corner of maxillae (Fig. 3). Chelicerae with more teeth on promargin (1–1–1–1–1–1–1–1–3). Lyra as in Fig. 6. Legs not as long and slender (measurements and proportions in table 1 in parenthesis). Pedipalpal tarsus with slight scopula, divided by two parallel rows of spiniform setae in apical third, becoming more irregular beyond apical third. Slight scopula on Ta I and II; divided by two parallel rows of spiniform setae. Mt I and II with scopula less dense only covering apical third, divided by two parallel rows of spiniform setae, becoming more irregular basally. Ta III like Ta I and II; Mt III without scopula, only with hairlike setae. Ta IV with only thin scopula and more setae, Mt IV like Mt III. Leg spination as in male holotype. Opisthosoma resembles male holotype, but with PMS (length: 3.27) more widely (by length of segment) seperated and basal segment of PLS (length: 5.12), medial (length: 4.44), apical (length: 8.55) slightly shorter. Vulva as in Fig. 5.

Remarks: Although the number of lyra bristles varies during the development of this species, the paratype of *H. oiapoqueae* sp.nov. has more such bristles than the female holotype of *H. audeae*; both specimens are of almost the same size.

Ecology: According to Thomas Vinmann (pers. comm.), who collected the specimens examined, females build large sheetwebs of *ca*. 2 m^2 which are attached to branches of trees and bushes. The sheetweb runs into a funnel which leads to a ca. 20 cm deep tube–shaped retreat. The burrow leads about 5 cm vertically into the ground and continues for *ca*. 10 cm at an angle of about 45°. At dusk the spiders come to the entrance of the funnel and wait for prey.



Figures 1–7. *Harmonicon oiapoqueae* sp. n. **1, 2, 4, 7** male holotype; **3, 5, 6** female paratype. **1** right palp, retrolateral view **2** right palp, prolateral view **3** sternum, labium and maxillae, ventral view **4** distal part of Ti and basal part of Mt I, retrolateral view **5** vulva (with left receptaculum seminis lost), dorsal view **6** lyra **7** distal part of Ti and basal part of Mt I, ventral view. Scale bars = 1 mm each.

Table 1. Measurements of male holotype and female paratype (in parenthesis) of *Harmonicon oiapoqueae* sp. n. legs, pedipalps and proportions

	Leg I	**Leg II**	**Leg III**	**Leg IV**	**Pedipalp**
Fe	17.96 (13.34)	15.05 (12.54)	13.34 (11.18)	15.77 (13.47)	8.05 (7.95)
Pa	6.75 (6.58)	5.52 (6.06)	3.70 (5.19)	5.05 (6.05)	3.31 (4.13)
Ti	15.38 (10.50)	12.79 (10.08)	13.54 (8.38)	13.77 (10.89)	6.28 (6.23)
Mt	17.65 (10.27)	15.59 (10.05)	15.11 10.48)	17.69 (14.27)	-
Ta	10.63 (7.03)	8.91 (6.89)	8.19 (6.44)	- (7.24)	3.12 (6.58)
Total	68.37 (47.72)	57.86 (45.62)	53.88 (41.67)	52.28 (51.92)	20.76 (24.89)
Diameter of Fe	2.61 (2.97)	2.51 (2.91)	2.38 (2.58)	2.47 (2.83)	-
Proportion	3.82 (6.22)	4.34 (6.38)	4.42 (6.84)	- (5.45)	-

Acknowledgements

We want to thank Janet Beccaloni (NHM), Christine Rollard (MNHN), Christoph Hörweg (MNHW), Peter Jäger (SMF) and Hubert Höfer (SMNK), who granted us access to their collections. Furthermore we want to thank Thomas Vinmann and Gordon Telford for information regarding the ecology of *H. oiapoqueae* sp.nov. and for donating specimens. We also wish to thank Steve Nunn for reviewing the manuscript.

References

Berland L (1913) Araignées. In Mission du Service géographique de l'armée pour la mesure d'un arc du méridien équatorial en Amérique du Sud (1899–1906). Paris, 78–119.

Bücherl W (1962) Estudos sistemáticos sôbre aranhas caranguejeiras. I. Revisão dos gêneros Pseudohermachura Mello-Leitão 1927 (Ctenizidae, Ctenizinae, Nemesieae) e Prosharmonicon Mello-Leitão 1937 (Dipluridae, Diplurinae, Diplureae, Trechonini). Arquivos da Faculdade de Higiene e Saúde Pública da Universidade de São Paulo 27: 259–261.

Cambridge FOP (1896) On the Theraphosidae of the lower Amazons: being an account of the new genera and species of this group of spiders discovered during the expedition of the steamship Faraday up the river Amazons. Proceedings of the Zoological Society of London 1896: 716–766.

Coyle FA (1995) A revision of the funnelweb mygalomorph spider subfamily Ischnothelinae (Araneae, Dipluridae). Bulletin of the American Museum of natural History 226: 1–133.

Drolshagen B, Bäckstam CM (2009) A new genus and species of the subfamily Diplurinae (Araneae, Dipluridae). Bulletin of the British Arachnological Society 14: 365–367.

Maréchal P, Marty C (1998) Réhabilitation du genre Harmonicon (Pickard-Cambridge, 1896) et description d'une nouvelle espèce de Guyane française (Araneae, Mygalomorphae, Dipluridae). Zoosystema 20: 499–504.

Mello-Leitão CFd (1924) Quelques arachnides nouveaux du Bresil. Annales de la Société Entomologique de France 93: 179–187.

Mello-Leitão CFd (1926) Algumas Theraphosoideas novas do Brasil. Revista do Museu Paulista 14: 307–324.

Mello-Leitão CFd (1927) Arachnideos de Santa Catharina (Brasil). Revista do Museu Paulista 15: 393–418.

Mello-Leitão CFd (1938) Um genero e sete especies novas de aranhas. Memorias do Instituto Butantan 11: 311–317.

Raven RJ (1984) Systematics of the Australian curtain-web spiders (Ischnothelinae: Dipluridae: Chelicerata). Australian Journal of Zoology (Supplementary series) 93: 1–102.

Raven RJ (1985) The spider infraorder Mygalomorphae (Araneae): cladistics and systematics. Bulletin of the American Museum of natural History 182: 1–180.

Simon E (1903) Etudes arachnologiques. 34e Mémoire. LVI. Descriptions de deux espèces nouvelles de la famille des Aviculariides recueillis dans l'Ecuador par M. le Dr Rivet et faisant partie des collections du Muséum de Paris. Annales de la Société Entomologique de France 72: 314.