RESEARCH ARTICLE



Microgloma Sanders & Allen, 1973 (Nuculanidae) and Pristigloma Dall, 1900 (Pristiglomidae) (Pelecypoda) in the Campos Basin of Brazil

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Abstract

As a secondary result of oil prospecting in Brazil, samples from the Campos Basin continental slope became available. In these samples, specimens of the genera *Microgloma* Sanders & Allen, 1973 and *Pristigloma* Dall, 1900 were found. This contribution provides the southernmost record of the genus *Microgloma*, the first record of *M. mirmidina* (Dautzenberg & Fischer 1897) from the western Atlantic, the descriptions of *M. macaron* **sp. n.** and *M. nhanduti* **sp. n.** as new species, and the shallowest record of *Pristigloma alba* Sanders & Allen 1973.

Keywords

Pristiglomidae, Nuculanidae, Pelecypoda, deep-sea, biodiversity, Campos Basin slope, Rio de Janeiro

Introduction

Knowledge of the deep-sea mollusks from the Campos Basin has increased in the last ten years, and several new species have been described (Absalão et al. 2001, 2003; Absalão and Pimenta 2003, 2005; Caetano et al. 2006; Zelaya et al. 2006; Pimenta et al.

2008; Oliveira and Absalão 2007, 2008, 2009, 2010a, 2010b; Absalão 2009; Benaim and Absalão 2011). However, the genera *Microgloma* Sanders & Allen, 1973 and *Pristigloma* Dall, 1900 have not been recorded until the present report.

Microgloma and *Pristigloma* comprise a few species that appear represented only in the Atlantic Ocean, each genus being represented by no more than five species. Their systematic affinities have been the subject of debate for almost 30 years (Sanders and Allen 1973, Allen and Hannah 1986, Ockelmann and Warén 1998, La Perna 2003, 2008), reflecting the usual confusion in protobranch taxonomy. Both *Pristigloma* and *Microgloma* were considered as members of the Pristiglomidae by Sanders and Allen (1973) and subsequent authors, until Ockelmann and Warén (1998) revised the systematic affinities of the genus *Microgloma*. This genus is characterized by miniaturization, and was considered by Sanders and Allen (1973) to be among the smallest pelecypods known. Synapomorphies include the enlarged innermost teeth of the left valve and the radially wrinkled surface of the prodissoconch. Members of this genus may comprise progenetic representatives of the family Nuculanidae, and may represent a polyphyletic group (Ockelmann and Warén 1998, La Perna 2008).

The five species of *Microgloma* described until now [*M. tumidula* (Monterossato, 1880), *Microgloma mirmidina* (Dautzenberg & Fischer, 1897), *Microgloma yongei* Sanders & Allen, 1973, *M. pusilla* Jeffreys, 1979, and *M. guilornadi* Hoeksema, 1993] were recorded from Western Europe (Iberian Peninsula, Mediterranean Sea, Azores and Canaries), West Africa (Cape Verde and Angola), Surinam, and North America. Prior to the report of Ockelmann and Warén (1998), there was no record of the genus *Microgloma* for the western Atlantic; these authors suggested the possibility of the presence of some specimens of *Microgloma* in Surinam, but made no formal record. Allen (2008) presented a checklist of the pelecypods of the Atlantic and made reference to the presence of *M. pusilla*, *M. tumidula* (as *M. turnerae*), *M. yongei*, and *Microgloma* sp. in North America and Surinam.

Pristigloma is a genus widespread in the entire Atlantic Ocean and is characterized by smooth, fragile shells, lamellar hinge teeth with an unequal number of teeth on both plates, and a large, internally elongated ligament which is opisthodetic (Sanders and Allen 1973).

Here, we present the first records of the genus *Microgloma* from the southwestern Atlantic, as well as descriptions of two new species belonging to this genus. We also present new points in the geographical distribution of *Pristigloma alba* Sanders & Allen 1973.

Material and methods

The samples used in the present study were collected by means of a box corer in the Campos Basin, off Rio de Janeiro State (22°S, 41°W), Brazil, from the research vessel *Astro–Garoupa*, as part of the programs "Environmental Characterization of Campos Basin, RJ, Brazil" during the years 2002 and 2003, and "Habitats Project – Campos

Basin Environmental Heterogeneity" in 2008 and 2009. Both programs were sponsored by the Brazilian oil company Petrobras S.A. Of the material obtained we observed 260 samples taken between the isobaths of 400 and 2500 m. The list of localities with *Microgloma* and/or *Pristigloma* specimens is given in Tables 1 and 2. Most of the shells were found in a good state of preservation, with valves attached, ligaments intact, and often with the mass of the animal body inside the shell. Unfortunately, there were no preserved organs in these cases. Each specimen was examined under stereoscopic microscope (Nikon SMZ 800), and selected specimens were photographed with a scanning electron microscope (ZEISS EVO 40), at the Gerência de Bioestratigrafia e Paleoecologia Aplicada (BPA), of the Petrobras Research Center (Centro de Pesquisas da Petrobras, CENPES).

Taxonomic identifications were made through comparison with the figures of type specimens [*Microgloma pusilla* (Jeffreys, 1879)] and descriptions available in the literature (Sanders and Allen 1973, Salas 1996, Ockelmann and Warén 1998, La Perna 2008, Oliver et al. 2009). The species were characterized considering traditional criteria used in pelecypod orientation and terminology (Figs 1–2) (Fischer 1886, Sanders and Allen 1973, Mikkelsen and Bieler 2008, Baylei 2009). In view of the importance of the features of the hinge plate for the discrimination of other protobranch species (Benaim and Absalão 2011, Benaim et al. 2011), and also some subjective concepts in taxonomy (e.g., 'thin' or 'thick'), we described the species using certain quantitative criteria such as the ratios of the hinge teeth (wht) and hinge plate (whp) measurements (Figs 1–2), which are described as follows: 'thin' for width of hinge plate/total height ratio < 0.1; 'thick' for width of hinge plate/total height ratio ≥ 0.1 . The width of the big-

Station	Depth (m)	Latitude Longitude		Date
10	1700	21°58'36.06"S	39°46'30.28"W	08/10/2001
28	1930	22°06'52.98"S	39°44'13.90"W	08/05/2002
32	900	22°38'01.14"S	40°17'26.55"W	18/05/2002
33	900	22°35'47.22"S	40°15'00.33"W	18/05/2002
34	900	22°33'31.21"S	40°12'05.38"W	18/05/2002
36	1000	22°37'54.17"S	40°13'36.46"W	19/05/2002
37	1000	22°39'44.28"S	40°15'44.41"W	19/05/2002
38	1100	22°41'18.79"S	40°14'05.93"W	15/05/2002
42	1200	22°41'39.45"S	40°10'24.84"W	15/05/2002
47	1650	22°11'04.40"S	39°47'04.60"W	25/11/2002
48	1950	22°11'16.63"S	39°43'44.70"W	25/11/2002
51	1350	22°04'43.44"S	39°49'08.29"W	24/11/2002
52	1650	22°04'44.26"S	39°46'31.55"W	24/11/2002
53	1950	22°04'46.20"S	39°43'02.02"W	24/11/2002
54	750	21°57'17.50"S	39°56'01.10"W	12/12/2002

Table 1. Table of the localities sampled as part of the project Environmental Characterization of Campos

 Basin.

Station	Depth (m)	Latitude	Longitude	Date	
57	1650	21°57'15.55"S	5 39°47'43.80"W 14/12/2002		
58	1950	21°57'26.87"S	39°40'33.80"W 11/12/2002		
59	750	21°52'59.60"S	39°55'30.60"W	12/12/2002	
61	1350	21°52'51.90"S	39°48'11.68"W	12/12/2002	
62	1650	21°52'41.91"S	39°46'17.52"W	11/12/2002	
63	1950	21°52'44.10"S	39°40'45.60"W	11/12/2002	
64	750	22°36'03.00"S	40°21'45.36"W	22/11/2002	
65	1050	22°40'57.81"S	40°16'30.35"W	22/11/2002	
68	1950	22°48'05.28"S	40°06'38.64"W	15/11/2002	
69	750	22°31'12.47"S	40°15'11.08"W	22/11/2002	
73	1950	22°41'35.24"S	40°00'45.24"W	22/11/2002	
74	750	22°27'31.62"S	40°09'23.19"W	21/11/2002	
75	1050	22°31'28.28"S	40°03'50.40"W	19/11/2002	
77	1650	22°36'03.37"S	39°57'54.68"W	16/11/2002	
78	1950	22°37'02.47"S	39°56'20.52"W	23/11/2002	
81	1350	22°27'18.98"S	39°54'50.48"W	17/11/2002	
83	1950	22°30'35.35"S	39°51'45.42"W	23/11/2002	
85	1350	22°29'33.89"S	39°56'17.64"W	19/11/2002	
86	1650	22°31'36.00"S	39°55'15.00"W	16/11/2002	
87	1950	22°33'10.00"S	39°54'22.00"W	23/11/2002	
45	1050	22°10'53.40"S	39°52'18.30"W	01/07/2003	
46	1336	22°10'54.60"S	39°48'59.50"W	25/06/2003	
48	1968	22°11'16.50"S	39°43'44.60"W	22/06/2003	
49	722	22°04'32.80"S	39°54'11.40"W	30/06/2003	
52	1643	22°04'45.20"S	39°46'31.70"W	27/6/2003	
53	1910	22°04'45.40"S	39°41'58.50"W	27/6/2003	
54	698	21°57'11.80"S	39°56'04.20"W	29/06/2003	
56	1357	21°57'15.60"S	39°49'37.50"W	25/06/2003	
58	1942	21°57'26.80"S	39°40'34.00"W	27/06/2003	
59	750	21°52'59.20"S	39°55'32.20"W	29/06/2003	
61	1350	21°52'51.80"S	39°48'12.50"W	26/06/2003	
63	1941	21°52'43.10"S	39°40'41.60"W	26/06/2003	
64	750	22°36'01.30"S	40°21'43.70"W	11/06/2003	
65	1050	22°40'57.70"S	40°16'31.10"W	11/06/2003	
67	1596	22°46'58.30"S	40°07'49.30"W	12/06/2003	
68	1972	22°48'05.90"S	40°06'38.60"W	12/06/2003	
69	743	22°31'11.80"S	40°15'12.10"W	18/06/2003	
71	1350	22°38'52.90"S	40°04'16.30"W	14/06/2003	
75	1050	22°31'28.30"S	40°03'49.30"W	18/06/2003	
77	1650	22°36'12.20"S	39°58'22.90"W	13/06/2003	
78	1945	22°37'02.90"S	39°56'20.10"W	13/06/2003	
82	1650	22°28'46.50"S	39°53'27.90"W	17/06/2003	
84	1050	22°26'28.80"S	39°58'53.30"W	20/06/2003	
86	1630	22°31'37.20"S	39°55'14.50"W	16/06/2003	
87	1934	22°33'08.00"S	39°54'21.50"W	15/06/2003	

Cruise	Station (#)	Depth (m)	Latitude	Longitude	Date
HAB 4	D11	R1	2449	22°52'15.30"S	40°05'10.40"W	22/5/2008
HAB 4	G12	R1	3236	22°12'19.50"S	38°35'52.00"W	25/5/2008
HAB 6	D07	R1	698	22°36'27.10"S	40°22'29.60"W	25/6/2008
HAB 6	D07	R2	700	22°36'27.30"S	40°22'29.30"W	25/6/2008
HAB 6	D07	R2	700	22°36'27.30"S	40°22'29.30"W	25/6/2008
HAB 6	A7	R1	694	23°39'20.10"S	41°18'30.30"W	23/6/2008
HAB 6	A7	R2	692	23°39'19.80"S	41°18'30.20"W	23/6/2008
HAB 6	A7	R2	692	23°39'19.80"S	41°18'30.20"W	23/6/2008
HAB 6	A7	R3	733	23°39'19.90"S	41°18'30.50"W	24/6/2008
HAB 6	CANAC7	R1	758	21°47'26.70"S	40°02'13.30"W	28/6/2008
HAB 6	CANAC7	R2	753	21°47'26.60"S	40°02'13.70"W	28/6/2008
HAB 6	I07	R1	694	21°11'12.20"S	40°12'52.00"W	29/6/2008
HAB 6	D07	R2	700	22°36'27.30"S	40°22'29.00"W	25/6/2008
HAB 6	D07	R2	700	22°36'27.30"S	40°22'29.30"W	25/6/2008
HAB 6	D07	R1	698	22°36'27.10"S	40°22'29.60"W	25/6/2008
HAB 6	D07	R2	700	22°36'27.30"S	40°22'29.30"W	25/6/2008
HAB 7	D06	R1	396	22°33'35.70"S	40°26'38.90"W	08/7/2008
HAB 7	D06	R3	393	22°33'33.80"S	40°26'40.30"W	11/7/2008
HAB 7	H7	R1	700	21°41'12.30"S	40°02'20.20"W	07/7/2008
HAB 7	H7	R2	699	21°41'11.70"S	40°02'20.70"W	07/7/2008
HAB 7	H7	R3	700	21°41'11.80"S	40°02'20.40"W	07/7/2008
HAB 7	I07	R3	792	21°11'02.60"S	40°12'18.20"W	05/7/2008
HAB 8	D06	R2	401	22°33'35.10"S	40°26'37.50"W	31/1/2009
HAB 8	D07	R2	696	22°36'25.30"S	40°22'30.60"W	29/1/2009
HAB 8	C10	R3	1953	23°08'23.80"S	40°36'37.90"W	27/1/2009
HAB 8	A07	R2	701	23°39'20.60"S	41°18'28.20"W	28/1/2009
HAB 8	A07	R3	693	23°39'21.90"S	41°18'33.10"W	28/1/2009
HAB 9	CANAC7	R2	780	21°47'26.60"S	40°01'55.30"W	06/2/2009
HAB 9	CANAC7	R3	775	21°47'26.70"S	40°01'55.50"W	06/2/2009
HAB 9	CANG-7	R2	720	21°56'11.90"S	39°57'45.30"W	07/2/2009
HAB 9	H07	R2	702	21°41'12.60"S	40°01'56.10"W	06/2/2009

Table 2. Table of the localities sampled as part of the Habitats Project – Campos Basin Environmental Heterogeneity.

ger teeth. The width of the hinge plate was measured in the thicker part with a straight line (Figs 1–2).

The material analyzed in this study is deposited in the Mollusca collections of the following institutions: Departamento de Zoologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro (IBUFRJ); Museu Nacional do Rio de Janeiro (MNRJ); Museu de Zoologia da Universidade de São Paulo (MZUSP); Museu Oceanográfico da Fundação Universitária de Rio Grande (MOFURG); National Museum of Natural History, Smithsonian Institute (USNM); and Muséum National d'Histoire Naturelle, Paris (MNHN). The following abbreviations are used: # – station; IBUFRJ – Instituto



Figures 1–2. Scheme of the measurements and abbreviations used in the descriptions of the species **A** *Microgloma* **B** *Pristigloma* **H** height **L** length, wht – width of hinge teeth, whp – width of hinge plate.

de Biologia da Universidade Federal do Rio de Janeiro; MNRJ – Museu Nacional do Rio de Janeiro; MZUSP – Museu de Zoologia da Universidade de São Paulo; MO-FURG – Museu Oceanográfico da Fundação Universitária de Rio Grande; MNHN – Muséum National d'Histoire Naturelle, Paris; USNM – National Museum of Natural History, Smithsonian Institute; MCZ – Museum of Comparative Zoology, Harvard University, Cambridge, U.S.A.

Systematics

Pristigloma alba Sanders & Allen, 1973

http://species-id.net/wiki/Pristigloma_alba Figs 3–8

Pristigloma alba Sanders & Allen, 1973: 245, fig 5; Allen 2008: 67, 87, 95, 97–101, 103, 111, 113, 119, 141, 146, 152, 153, 157, 167, 168, 173. Oliver et al. 2009: figs. MO11691-11697 (available online).

Type specimen. MCZ 271976. We tried to find this lot in the MCZ with the help of Mr. Cleo Oliveira, but the curators could not find it. We made contact with Dr John A. Allen who sent us live specimens from Surinam Basin #293 (08°58'N54°04'W, 1518 m) to compare with Campos Basin specimens. Furthermore, using the good description in Sanders and Allen (1973) and figures of the specimens of Rockall Trough and Biscay Bay available in Oliver et al. (2009) we could properly identify our specimens.

Geographical distribution. Angola, 3739–4597 m; Canaries, 6709–6711 m; North America, 2178–4892 m; Brazil, 3459 m; Argentina, 4382–4405 m (all from Sanders and Allen 1973); Cape Verde, 3495 m; Angola, 3797 m; Canaries, 2351–3000 m; West Europe, 2897–4660 m; Newfoundland, 4400 m; North America, 2178–4833 m; Surinam, 5100 m; Brazil, 3495 m; Argentine, 4402 m (all from Allen 2008); Rock-



Figure 3–8. *Pristigloma alba* Sanders & Allen, 1973 IBUFRJ 16161. Left valve: internal view **3** external view **4** detail of the hinge plate **5** Right valve: detail of the hinge plate **6** internal view **7** external view **8** Scale bars 3–4, 7–8 = 500 µm, 5–6= 250 µm

all Trough and Biscay Bay mostly in depths over 2000 m (Oliver et al. 2009); Brazil–Campos Basin, 1200–1972 m (present study).

Material examined. MNRJ 19114 (# 68, 2003), 4 valves; MZUSP 99977 (# 68, 2003), 4 valves; IBUFRJ 16161 (# 68, 2002), 3 valves; IBUFRJ 19001 (# 10, 2002), 5 valves; IBUFRJ 19002 (# 42, 2002), 3 valves; IBUFRJ 19003 (# 47, 2002), 1 valves; IBUFRJ 19004 (# 48, 2002), 7 valves; IBUFRJ 19005 (# 52, 2002), 1 valve; IBUFRJ 19006 (# 58, 2002), 6 valves; IBUFRJ 19007 (# 62, 2002), 3 valves; IBUFRJ 19008 (# 63, 2002), 6 valves; IBUFRJ 19009 (# 73, 2002), 14 valves; IBUFRJ 19010 (# 77, 2002), 2 valves; IBUFRJ 19011 (# 78, 2002), 4 valves; IBUFRJ 19012 (# 83, 2002), 2 valves; IBUFRJ 19013 (# 87, 2002), 6 valves; IBUFRJ 19014 (# 46, 2003), 1 valve; IBUFRJ 19015 (# 48, 2003), 15 valves; IBUFRJ 19016 (# 52, 2003), 1 valve; IBUFRJ 19017 (# 53, 2003), 16 valves; IBUFRJ 19018 (# 58, 2003), 3 valves; IBUFRJ 19019 (# 61, 2003), 2 valves; IBUFRJ 19020 (# 63, 2003), 16 valves; IBUFRJ 19023 (# 73, 2003), 8 valves; IBUFRJ 19024

(# 78, 2003), 14 valves; IBUFRJ 19025 (# 82, 2003), 1 valve; IBUFRJ 19026 (# 86, 2003), 4 valves.

Characterization. Shell H/L ratio about 1.04. W/H ratio approximately 0.86. Muscle scars rarely visible; anterior adductor scar 2/3 of posterior scar. Anterior and posterior parts of the hinge plate usually of same length. Width of posterior row of teeth occupies about 65% of width of hinge plate, which is thin for its size (whp/H approximately 0.07). Posterior part of the hinge plate longer than anterior one. Prodissoconch smooth, with length approximately 120 μ m.

Remarks. This species was recently well described and for this reason we add only new information on the proportions of the shell (H/L and width) and hinge plate characteristics. Sanders and Allen (1973) noted no evident muscle scars or pallial line. In the Campos Basin specimens, no pallial line is discernible on the valves, but faint muscle scars are apparent in some specimens. It is a common species in the Atlantic, and its occurrence in the Campos Basin was expected, since it was previously recorded from the northern Brazilian coast (Pernambuco) and from Argentina. The present study provides new points to the geographical distribution of *P. alba*, and is also the shallowest (1200 m) record for the species, which was previously known only from abyssal depths (2100–4898 m).

Microgloma mirmidina (Dautzenberg & Fischer, 1897)

http://species-id.net/wiki/Microgloma_mirmidina Figs 9–13

Leda mirmidina Dautzenberg and Fischer, 1897: 208, pl. 6, figs 11–14; Dautzenberg 1927: 292, pl. 8, figs 27–30.

Nuculana mirmidina: Clarke, 1962: 53. Microgloma mirmidina: La Perna, 2008: 154, 155, fig 6.

Geographical distribution. Southeast of Flores, Azores, 1846 m (La Perna, 2008). Campos Basin 1050–1950 m (present study).

Material examined. MNRJ 19115 (#68, 2003), 6 valves; MZSP 99978 (#71, 2003), 7 valves; IBUFRJ 15889 (#67, 2003), 5 valves; IBUFRJ 17501 (#87, 2003), 4 valves; IBUFRJ 19084 (# 10, 2001), 4 valves; IBUFRJ 19085 (# 28, 2001), 1 valve; IBUFRJ 19086 (# 42, 2002), 1 valve; IBUFRJ 19087 (# 48, 2002), 6 valves and 2 specimens; IBUFRJ 19088 (# 51, 2002), 1 valve; IBUFRJ 19089 (# 53, 2002), 6 valves and 1 specimen; IBUFRJ 19090 (# 57, 2002), 1 valve IBUFRJ 19091 (# 62, 2002), 4 valves; IBUFRJ 19092 (# 63, 2002), 10 valves; IBUFRJ 19093 (# 68, 2002), 1 valve; IBUFRJ 19094 (# 73, 2002), 6 valves and 1 specimen; IBUFRJ 19096 (# 77, 2002), 12 valves and 1 specimen; IBUFRJ 19096 (# 77, 2002), 12 valves and 1 specimen; IBUFRJ 19096 (# 81, 2002), 2 valves; IBUFRJ 19099 (# 83, 2002), 4 valves



Figures 9–13. *Microgloma mirmidina* (Dautzenberg & Fischer, 1897). External view, left valve **9** internal view, right valve **10** Detail of the hinge plate **11** External view, right valve **12** internal view, left valve **13** All from the lot IBUFRJ 15889. Scale bars A= 200 μ m; B, E = 300 μ m; C = 100 μ m; D = 250 μ m.

and 1 specimen; IBUFRJ 19100 (# 85, 2002), 1 valve; IBUFRJ 19101 (# 86, 2002), 6 valves; IBUFRJ 19102 (# 87, 2002), 5 valves; IBUFRJ 19103 (# 50A, 2003), 1 valve; IBUFRJ 19105 (# 61, 2003), 3 valves; IBUFRJ 19106 (# 63, 2003), 2 valves; IBUFRJ 19107 (# 72, 2003), 2 valves and 1 specimen; IBUFRJ 19108 (# 73, 2003), 4 valves; IBUFRJ 19109 (# 77, 2003), 5 valves and 3 specimens; IBUFRJ 19110 (# 78, 2003), 4 valves; IBUFRJ 19111 (# 82, 2003), 2 valves; IBUFRJ 19112 (# 84, 2003), 2 valves; IBUFRJ 19113 (# 86, 2003), 2 valves; IBUFRJ 19114 (# C10, 2008), 1 valve.

Characterization. Shell H/L approximately 0.79 (n 10, min 0.75, max 0.83), W/H approx. 0.59(n 10, min 0.53, max 0.63). Posterior part of the hinge plate shorter than anterior one. Width of both the anterior and posterior rows of teeth occupies nearly half of the width of the hinge plate, which is moderately thick for its size (whp/H about 0.11). Prodissoconch smooth, length approximately 176 µm.

Remarks. The radial sculpture on the prodissoconch surface is absent in *M. mirmidina*, but admittedly it is not always clearly developed in the other species of *Microgloma* (La Perna 2008). *Microgloma mirmidina* differs from other species of the genus in the elongated outline, more inflated shells and small hinge plate. In relation to the type material of *M. mirmidina* figured by La Perna (2008) the Campos Basin material presents a smaller hinge plate. The figured specimens presents H/L ratio of 0.72, 0.76 and 0.83 (La Perna 2008 fig 6 B, E, I, respectively). Despite geographical distance between the two records of the present species, these conchological differences are not pronounced enough to affirm they belong to distinct species.

Microgloma macaron sp. n.

urn:lsid:zoobank.org:act:31275EB9-546D-414B-82B0-C59CA55F8C93 http://species-id.net/wiki/Microgloma_macaron Figs 14–22

Holotype. MNRJ 19.112 (Figs 14, 16, 18).

Type locality. Campos Basin, #54, 12/12/2002, 750m, 21°57'17,5"S, 39°56' 01,1"W.

Paratypes. IBUFRJ 15297, 8 valves and 2 specimens; MZUSP 99979, 4 valves; USNM 1156943, 6 valves; MNHN 24596, 6 valves; all from the type locality.

Etymology. The species epithet refers to the French macaroon cookie ("macaron" in the French language), which has a similar appearance to the articulated valves. The species epithet is proposed as a noun in apposition.

Material examined. IBUFRJ 19145 (# 32, 2002), 3 valves; IBUFRJ 19146 (# 33, 2002), 1 valve; IBUFRJ 19147 (# 34, 2002), 1 valve; IBUFRJ 19148 (# 36, 2002), 1 valve; IBUFRJ 15482 (# 54, 2002), 6 valves; IBUFRJ 17033 (# 59, 2002), 1 specimen; IBUFRJ 19150 (# 61, 2002), 3 specimens; IBUFRJ 16074 (# 64, 2002), 14 valves and 1 specimen; IBUFRJ 15141 (# 69, 2002), 7 valves; IBUFRJ 15285 (# 74, 2002), 2 valves; IBUFRJ 15635 (# 54, 2003), 32 valves and 5 specimens; IBUFRJ 19152 (# 59, 2003), 6 valves and 1 specimen; IBUFRJ 19153 (# 61, 2003), 1 valve; IBUFRJ 19153 (# 61, 2003), 1 valve; IBUFRJ 19154 (# 64, 2003), 18 valves and 4 specimens; IBU-FRJ 19155 (# 69, 2003), 4 valves; IBUFRJ 19156 (# D11, 2008), 1 specimen; IBU-FRJ 19157 (# G12, 2008), 1 specimen; IBUFRJ 19158 (# A7, 2008), 10 specimens; IBUFRJ 19159 (# A7, 2008), 1 specimen; IBUFRJ 19160 (# A7, 2008), 2 valves and 5 specimens; IBUFRJ 19161 (# D7, 2008), 1 specimen; IBUFRJ 19162 (# D7, 2008), 6 specimens; IBUFRJ 19163 (# CANAC7, 2008), 1 specimen; IBUFRJ 19164 (# H7, 2008), 1 specimen; IBUFRJ 19165 (# H7, 2008), 1 specimen; IBUFRJ 19166 (# H7, 2008), 5 specimens; IBUFRJ 19167 (# I7, 2008), 2 specimens; IBUFRJ 19168 (# A7, 2009), 3 specimens; IBUFRJ 19169 (# A7, 2009), 5 specimens; IBUFRJ 19170 (# D6, 2009), 1 specimen; IBUFRJ 19171 (# D7, 2009), 1 specimen; IBUFRJ 19172 (# H7, 2009), 12 specimens; IBUFRJ 19173 (# CANAC7, 2009), 1 specimen; IBUFRJ 19174 (# CANAC7, 2009), 1 specimen; IBUFRJ 19175 (# CANG7, 2009), 3 specimens; IBUFRJ 19177 (# 64, 2003), 4 specimens.

Diagnosis. Shell minute, ovate. Entire shell margin thickened and covered by an extension of the periostracum. Prodissoconch surface with one subtle radial striae.

Description. Shell minute, ovate, H/L ratio about 0.81 (n 38, min 0.75, max 0.92), W/H ratio about 0.84 (n 14, min 0.77, max 0.87), glossy, translucent, robust for its size, equilateral; umbones prominent, large, posterior to midline, orthogyrous. Antero–dorsal margin straight, oblique; anterior margin rounded, extended. Antero–ventral margin, postero–ventral margin shorter and rising up to the short posterior end; posterior margin slightly truncated, forming a small shoulder. Entire shell margin thickened and covered by an extension of the periostracum, resembling a macaroon in ventral view (Figs 21–22). Surface with commarginal growth lines. Hinge plate with 5–7 anterior and 4–5 posterior teeth, interrupted by a large, rectangular and shallow resilifer. Width of both anterior and posterior row of teeth occupies about 70% of width of hinge plate, which is thick for its size (whp/H approximately Campos Basin, #54, 12/12/2002 0.14). Posterior part of the hinge plate shorter than anterior one. Prodissoconch surface nacreous, with one subtle radial striae (Fig. 20), and length approximately 244 µm. Maximum adult shell length 1.20 mm.

Remarks. In some other species of *Microgloma*, the shell is expanded ventrally, around the valve, which enlarges the internal volume of the animal and counterbal-

	M. macaron s	p. n.	
	Length	Height	Width*
MNRJ 19.112	1.20	1.00	0.36
IBUFRJ 15.297	1.11	0.87	0,31
IBUFRJ 15.297	1.11	0.89	0.36
IBUFRJ 15.297	1.11	0.91	0.36
IBUFRJ 15.297	1.11	0.84	0.33
IBUFRJ 15.297	1.11	0.89	0.36
IBUFRJ 15.297	1.11	0.89	0.36
IBUFRJ 15.297	1.16	0.93	0.38
IBUFRJ 15.297	1.11	0.91	0.33
IBUFRJ 15.297	1.13	0.82	0.31
IBUFRJ 15.297	1.13	0.89	0.33
MZSP 99.979	1.11	0.87	0.33
MZSP 99.979	1.13	1.04	0.36
MZSP 99.979	1.16	0.93	0.38
MZSP 99.979	1.11	0.91	0.31
USNM 1156943	1.11	0.89	0.36
USNM 1156943	1.11	0.89	0.36
USNM 1156943	1.13	0.91	0.36
USNM 1156943	1.13	0.89	0.38
USNM 1156943	1.13	0.91	0.33

Table 3. Measurements of the type material. * Width = width of a single valve.

M. macaron sp. n.				
	Length	Height	Width*	
USNM 1156943	1.11	0.89	0.36	
MNHN 24596	1.11	0.91	0.33	
MNHN 24596	1.18	0.93	0.38	
MNHN 24596	1.11	0.91	0.36	
MNHN 24596	1.11	0.89	0.38	
MNHN 24596	1.11	0.91	0.36	
MNHN 24596	1.04	0.87	0.38	



Figures 14–18. *Microgloma macaron* sp. n. Internal view, right valve **14** left valve **15** detail of the hinge plate and ligament **16** External view, right valve **17** left valve **18** Holotype MNRJ 19112 (14,16,18). Paratype IBUFRJ 15297 **15, 17** Scale bars: 14, 16= 200 μm; 15, 18 = 300 μm; 17 = 250 μm.

ances the effects of miniaturization (Ockelmann and Warén 1998, La Perna 2008). However, in *M. macaron* this expansion is thicker, and the periostracum surrounds the entire margin (Fig 22). This characteristic of the periostracum deserves special attention since it not only covers the shell to the margins in the usual way, but is more conspicuous in this area, giving the impression that valves do not articulate. We are



Figures 19–22. *Microgloma macaron* sp. n. Dorsal view **19** prodissoconch **20** (IBUFRJ 15297). Ventral margin view, extended margin **21** periostracum of the ventral margin **22** (IBUFRJ 19177). Scale bars: **19, 21** = 200 μm; **20, 22** = 100 μm.

not sure how this system works, and how the animal, in spite of having these fibers surrounding the valve apertures, can have water flux in the mantle cavity.

Compared to *M. pusilla* and *M. mirmidina*, *M. macaron* is distinguished by the ovate outline, umbones at midline and much more projecting, and a thicker hinge plate. *Microgloma macaron* is similar to *M. yongei* in outline, but compared with the paratypes figured by Ockelmann and Warén (1998, page 14, fig 6–D), the former has more prominent umbones, a thicker hinge plate, as well as a larger resilifer. *Microgloma macaron* can be distinguished from *M. tumidula* by the shape of the teeth, which are not as inclined as in this latter species. The anterior and posterior areas of the hinge plate form a less obtuse angle compared to those of *M. tumidula*.

Except for two, probably worn, valves found at two stations at approx. 3000 m depth, and one at 1970 m, this species is concentrated at depths between 400–750 m. Untill now this species is reccorded solely in Campos Basin.

Microgloma nhanduti sp. n.

urn:lsid:zoobank.org:act:511F7840-3490-4EA1-A48F-CB56C60329FC http://species-id.net/wiki/Microgloma_nhanduti Figs 23–31

Holotype. MNRJ 19.113 (Figs 26, 28).

Type locality. Campos Basin, #54, 12/12/2002, 750m, 21°57'17,5"S, 39°56'01,1"W.

M. nhanduti sp. n.			
	Length	Height	Width*
MNRJ 19.113	1.12	0.90	0.29
IBUFRJ 14.991	1.11	0.84	0.24
IBUFRJ 14.991	1.04	0.82	0.29
IBUFRJ 14.991	1.09	0.89	0.29
IBUFRJ 19.176	1.13	0.89	0.29
MZSP 99.980	1.09	0.82	0.29
MZSP 99.980	1.09	0.82	0.27
MZSP 99.980	0.98	0.76	0.24
MZSP 99.980	1.09	0.82	0.27
MZSP 99.980	1.11	0.82	0.27
MZSP 99.980	1.11	0.84	0.22
USNM 1156944	1.11	0.87	0.27
USNM 1156944	1.11	0.87	0.29
USNM 1156944	0.96	0.78	0.27
USNM 1156944	1.07	0.80	0.24
USNM 1156944	1.11	0.89	0.27
MNHN 24596	1.07	0.87	0.22
MNHN 24596	1.07	0.87	0.22
MNHN 24596	1.09	0.80	0.22

Table 4. Measurements of the type material. * Width = width of a single valve.

Paratypes. IBUFRJ 14991 (# 54, 2002), 2 valves and 1 specimen; IBUFRJ 19176 (# 64, 2003), 1 specimen; MZSP 99980 (# 54, 2002), 5 valves; USNM 1156944 (# 54, 2002), 5 valves; MNHN 24597 (# 54, 2002), 2 valves 1 specimen.

Etymology. Nhanduti is a Tupi–Guarani term (the language spoken by the largest groups of native people living in Brazil prior to the European colonization) for a spider web–like structure, similar to those present on the prodissoconch of this species. The species epithet is proposed as a noun in apposition.

Material examined. IBUFRJ 15140 (# 69, 2002), 17 valves and 2 specimens; IBUFRJ 15283 (# 69, 2002), 6 valves; IBUFRJ 19115 (# 33, 2002), 1 valve; IBUFRJ 19116 (# 64, 2002), 16 valves and 1 specimen; IBUFRJ 19117, (# 49, 2003), 7 valves; IBUFRJ 19118, (# 54, 2003), 1 valve; IBUFRJ 19119, (# 59, 2003), 10 valves and 2 specimens; IBUFRJ 19121, (# 34, 2002), 1 valve; IBUFRJ 19122, (# 37, 2002), 1 valve; IBUFRJ 19123, (# 38, 2002), 1 valve; IBUFRJ 19124, (# 64, 2003), 12 valves and 1 specimen; IBUFRJ 19125, (# 75, 2003), 2 valves; IBUFRJ 19126, (# A7, 2008), 4 specimens; IBUFRJ 19127, (# A7, 2008), 1 valve; IBUFRJ 19128, (# A7, 2008), 1 valve and 3 specimens; IBUFRJ 19129, (# D7, 2008), 1 specimen; IBUFRJ 19130 (# H7, 2008), 2 specimens; IBUFRJ 19131 (# D6, 2008), 3 specimens; IBUFRJ 19134 (# D6, 2008), 1 specimen; IBUFRJ 19135 (# I7, 2008), 1 specimen; IBUFRJ 19136 (# A7, 2009), 2 specimens; IBUFRJ 19137 (# A7, 2009), 6 specimens; IBUFRJ 19138 (# D6, 2009), 4 specimens; IBUFRJ 19139 (# H7, 2009), 10 specimens; IBUFRJ 19134 (#



Figures 23–28. *Microgloma pusilla* (Jeffreys, 1879) USNM 199712 **23** *Microgloma nhanduti* sp. n. External view, leftt valve **24** IBUFRJ 15283, right valve **25** IBUFRJ 14991. Internal view holotype MNRJ 19.113, detail of the reslifer and umbo **26** right valve **27** left valve **28** Scale bars: $23 = 500 \mu m$; $26 = 100 \mu m$; 24-25, $27-28 = 200 \mu m$.

(# CANAC7, 2009), 5 specimens and 2 valves; IBUFRJ 19141(# CANAC7, 2008), 1 specimen; IBUFRJ 19142 (# I7, 2008), 2 specimens; IBUFRJ 19143 (# CANAC7, 2008), 6 specimens; IBUFRJ 19144 (# D7, 2008), 1 specimen.

Diagnosis. Shell minute, ovate. Entire margin slightly thickened. Hinge plate moderately thick. Prodissoconch with web–like striae.

Description. Shell minute, ovate, H/L ratio about 0.78 (n 29, min 0.74, max 0.81), Width of both valves/H ratio about 0.7 (n 11, min 0.67, max 0.77), inequilateral, translucent, glossy; umbones moderately prominent, large, posterior to midline, orthogyrous. Antero–dorsal margin convex and oblique; anterior margin rounded and projected. Antero–ventral margin convex, postero–ventral margin shorter and rising up to short and rounded posterior end; postero–dorsal margin convex, but forming a small shoulder. Entire shell margin slightly thickened. Surface with subtle commargin-



Figures 29–31. *Microgloma nhanduti* sp. n. Dorsal view IBUFRJ 19131 **29** prodissoconch surface **30** ventral margin IBUFRJ 19176 **31** Scale bars: 29, 30 = 200 μm, 31 = 80 μm.

al growth lines. Hinge plate with 5–7 anterior and 4–5 posterior teeth, interrupted by a shallow rectangular hinge plate. Width of both anterior and posterior row of teeth occupies about 70% of width of hinge plate, which is thick for its size (whp/H approximately 0.14). Posterior part of the hinge plate shorter than anterior one. Prodissoconch surface nacreous, with several radial striae, resembling a spider's web. Prodissoconch length approximately 246 µm.Maximum adult shell length 1.16 mm.

Remarks. *Microgloma nhanduti* sp. n. is similar to *M. pusilla* and *M. tumidula* in the oval outline. but has more prominent umbones (Figs 26–28). Compared to *M. macaron* sp. n. and *M. yongei, M. nhanduti* sp. n. has a more elongated outline, a longer anterior area, and a more evident prodissoconch sculpture, with a web–like pattern (Figs 29–30). In *M. nhanduti* sp. n. the umbo is not as prominent and the shell margin not as thick as in *M. macaron sp. n*. Untill now this species is reccorded solely in Campos Basin.

Discussion

Ockelmann and Warén (1998) carefully evaluated the systematic position of the Nuculoidea and Nuculanoidea, and placed *Microgloma* within the Nuculanidae (a position with which we agree). However, these authors did not use the subfamily rank introduced by Allen and Hannah (1986). Considering differences such as prominence of the rostral area, presence of carena and keels, foot grooves, and the characteristics of the ligament among some groups within the Nuculanidae such as in *Ledella* Verrill and Bush, 1897, *Propeleda* Iredale, 1924, and *Nuculana* Link, 1807, we believe that the proposed subfamilies should be used for taxonomic purposes. Whether they represent a natural division or not is a matter to be discussed later in a phylogenetic study.

The genus *Microgloma* is still in need of review since, as stated by Ockelmann and Warén (1998), "similarity in hinge structure to juvenile specimens of *Yoldiella* and other nuculanids directly suggests progenesis. We assume that the species of *Microgloma* simply are species derived from *Yoldiella* or *Ledella*, which mature at a much smaller size than normal in these taxa. (...) Possibly the genus *Microgloma* is polyphyletic,

since progeneses may have taken place more than once. This will be difficult to prove or disprove." The similarities with some species of the genera cited above may confuse many researches in the identification of *Microgloma* species and the validity or status of the genus must be revisited. We believe this is an issue to be resolved with molecular analysis. At present we can only assume the genus to be valid.

The sculpture pattern on the prodissoconch surface is not a character commonly used in taxonomy of the protobranchs and, considering the confused taxonomy of the protobranchs (as seen by the genus *Microgloma*), we believe it might be useful to better determine the genera. This character has been recorded recently in the literature, and some species, from different families, show particular patterns. The reticulated sculpture on the prodissoconch surface seems to be a common character for the Nuculanidae, and has been recorded for the genera Nuculana, Sacella Woodring 1925 (Allen 1993, Ockelmann and Warén 1998, La Perna 2007), Propeleda (seen by Natalia Benaim; unpublished data), and the Bathyspinulidae, in *Tindariopsis agathida* Dall, 1889 (seen by the present authors; unpublished data). Some members of Nuculidae have ridges or knobs on the prodissoconch surface (Gofas and Salas 1996, Zardus 2002). The genus *Yoldiella* presents a smooth prodissoconch surface, but the species Yoldiella philippiana (Nyst, 1845) presents a radial prodissoconch sculpture with a web-like pattern (Ockelmann and Warén 1998, Salas 1996) as seen here in M. nhanduti sp. n. Salas (1996) also illustrated radial ridges on the prodissoconch of M. pusilla and *M. tumidula* from the Iberian Peninsula. The radial ridges present in *M. macaron* sp. n. and *M. nhanduti* sp. n. are distinctive characters that should be considered in future descriptions of species of *Microgloma* to aid in resolving the status of the genus.

Conclusion

The apparent absence of species of the genus *Microgloma* along the Brazilian coast wais an artifact, reflecting the logistical difficulties in obtaining material from these depths. Once this material became available, additions to the fauna was brought to light. The description of two new species of *Microgloma* and the new information on the conchology, and bathymetric and geographical distributions of *M. mirmidina* and *P. alba* contribute to knowledge of the biodiversity of deep–sea mollusks of the Campos Basin and Brazil.

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RESEARCH ARTICLE



New species of *Homidia* (Collembola, Entomobryidae) from eastern China with description of the first instar larvae

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Abstract

Morphology of the first instar larvae of Collembola has considerably taxonomical and phylogenetic significance. We describe the first instar larvae for the first time in *Homidia*. External morphology of first instar larvae and adults of *Homidia jordanai* sp. n. is described based on observations under light and scanning electron microscopes. Most organs of adults bear considerably more setae than the first instar larvae; in addition, first instar larval *Homidia* lack labial seta R, seta on tenaculum, mucronal spine, and dental spines. The new species is characterized by weakly pigmented body, long antennae subequal to body in length, 1+1 inner macrochaetae on Abd. III, few inner macrochaetae on posterior Abd. IV, and spiny and short seta pi on dental base. Differences between new species and other two similar ones, taxonomical significance of the first instar larvae and the position of *Homidia* are also discussed.

Keywords

new species, first instar, scanning electron microscope, chaetotaxy, China

Introduction

In epimetabolic Collembola, the number of setae and pigmentation often change after moult (Christiansen 1992). Morphology of the first instar larvae has considerably taxonomical and phylogenetic significance (Szeptycki 1979), but it has been rarely studied. *Homidia* is the most widespread entomobryid genus in East Asia, particularly Japan, Korea and China. The genus is characterized by presence of spines on inner edge of dens, "eyebrow" macrochaetae on anterior part of Abd. IV of adults, ommatidia 8+8, mucro bidentate with subapical tooth much larger than the apical one, and absence of body scales. The chaetotaxy of first instar larvae (primary chaetotaxy) in *Homidia* has never been described.

In the present paper, the primary chaetotaxy of *Homidia* was studied for the first time based on *H. jordanai* sp. n., from East China. Many other morphological details are showed under scanning electron microscope.

Material and methods

Alcohol preserved young and adult specimens, were cleared in lactic acid, mounted on microscope slides in Marc André II solution, and studied using Leica DM2500 and Nikon 80i microscopes. Few specimens, coated with platimum under vacuum conditions, were observed under scanning electron microscope. Photographs were taken with Leica AL2 and Nikon SMZ1000 microscopes using a mounted Nikon DS-Fi1 camera and Hitachi S4800 scanning electron microscope, numbers and letters added with photoshop CS2 (Adobe Inc.), all length data measured with Nikon NIS-Elements Documentation 3.1. First instar larvae were determined by the stability of primary chaetotaxy (e.g. 19/18 common setae on meso-/metathorax, Szeptycki 1979). Cephalic dorsal chaetotaxy is designated after Jordana and Baquero (2005) and Soto-Adames (2008), interocular setae after Mari-Mutt (1979, 1986), labial palp setae after Fjellberg (1998), labial setae after Gisin (1964), dorsal chaetotaxy after Szeptycki (1979).

Abbreviations. Th. –thoracic segment, Abd. –abdominal segment, Ant. –antennal segment, ms –microsensillum/a, s –common sensillum/a, mac –macrochaeta(e), mic –microchaeta(e), SEM –scanning electron microscope, LM –light microscope, Tita I–III –tibiotarsus of fore, mid, and hind legs.

Results

Homidia jordanai sp. n.

urn:lsid:zoobank.org:act:7A40BC6A-99BB-4A02-AE92-0899F6556BD8 http://species-id.net/wiki/Homidia_jordanai Figs 1–80, Tables 1–3

Holotype. δ on slide, Shaoxin City, Zhuji Country, Dongbaihu, Zhejiang Province, CHINA, 29°34.48'N, 120°24.32'E, 3.X.2009, collection number S4014, collected by Zhi-Xiang Pan and Chen-Chong Si, deposited in Taizhou University.

Paratypes. 2 \Diamond , 11 \bigcirc and 5 larvae on slide, numerous in alcohol, same data as holotype. 5 paratypes (1 \Diamond , 1 \bigcirc on slide, 1 larva and 2 adults in alcohol) deposited in School of Life Sciences, Nanjing University and others in Taizhou University, China.

Etymology. Named after the famous Spanish entomologist Jordana Rafael (University of Navarra).

Description. Adult. Size. Maximum body length up to 2.3 mm.

Habitus. Ground colour pale yellow in alcohol. Body dorsally without pigment. Coxa and trochanter of all legs with weak blue pigment. Eye patches dark. Antennae gradually darker from Ant. III to Ant. IV (Figs 1, 2).

Head. Ommatidia 8+8, G and H smaller than others, and sometimes invisible under LM, interocular setae as p, r, t (Figs 5, 44). Antenna 3.9-4.6 times as long as cephalic diagonal, subequal to body in length, antennal segment ratio as I : II : III : IV = 1 : 1.3 - 1.5 : 1.3 - 1.4 : 2.4 - 3.1. Basal Ant. I with 2 dorsal and 4 ventral spiny setae (Figs 5, 45, 46). Basal Ant. II with 5 smooth setae (Figs 47, 48); distal Ant. II with 4 s (2-3 longer, 1-2 shorter) (Figs 52, 53). Ant. III organ with 2 rod-like s and 3 small s (Figs 54-56); those s also with obvious ridges on surface under SEM. Distal Ant. IV with several types of s (Figs 57–62); apical bulb bilobed (Fig. 6). Dorsal cephalic chaetotaxy with 4An and 7S mac. Clypeus with many ciliate setae (Fig. 5). Labral papillae absent. Prelabral and labral setae as 4/5, 5, 4, all smooth, labium intrusion U-shaped (Fig. 7). Maxillary outer lobe with 1 apical seta, 1 subapical seta and 3 sublobal hairs on sublobal plate; subapical seta slightly longer than apical one (Fig. 49). Labial palp with five papillae A–E, with 0, 5, 0, 4, 4 guard setae, respectively, and 5 smooth proximal smooth setae; lateral process differentiated with blunt tip reaching apex of papilla E (Figs 8, 50, 51). Hyaline plate with 1 main (H) and 2 accessorial (h_1, h_2) setae. Setal formula of labial base as MREL, L₂, seta E smooth, others ciliate (Fig. 9).

Thorax. Complete s-chaetae of dorsal body as 32/223(>47)3 (examined specimens mostly with 47 s-chaetae on Abd. IV, but some lost during preparation), ms as 10/10100. Th. II with 3 medio-medial (m1, m2, m2i), 3 medio-sublateral (m4, m4i, m4p), 17–18 posterior mac and 3 s-chaetae (ms antero-internal to s); seta p1i2 rarely present, seta p6 as mic. Th. III with 29–32 mac and 2 s-chaetae; setae p1i2 and p4 absent (Fig. 10). Numerous setae on hind leg (Figs 15–19); pseudopores on coxa shown in Fig. 63, but their number unclearly seen. Coxal macrochaetal formula as 3/4+1, 2+1/4+2 (Fig. 11). Trochanteral organ with 36–64 smooth spiny setae (Fig. 16). Inner



Figures 1-4. Habitus of *H. jordanai* sp. n. 1-2 adults, lateral view 3-4 the first instar larvae 3 dorsal view 4 lateral view.

differentiated tibiotarsal setae slightly ciliate, most distal smooth seta present on hind leg (Figs 18, 19, 65). Tenent hair clavate and subequal to inner edge of unguis in length (Figs 19, 66). Unguis with 4 inner, 2 lateral and 1 outer teeth, all tiny. Unguiculus lanceolate with outer edge slightly serrate (Fig. 65). Pretarsus with 1 pair of small spines (Figs 19, 67).



Figures 5–9. *H. jordanai* sp. n. 5 dorsal cephalic chaetotaxy 6 apical bulb of Ant. IV 7 labrum 8 labial palp 9 labial base.

Abdomen. Abd. I with 9 (a2, a3, m2–4, m2i, m4i, m4p, a5) mac and 2 s-chaetae (ms anterio-external to s) (Figs 68, 69). Abd. II with 6 (a2, a3, m3, m3e, m3ea, m3ep) inner, 1 (m5) lateral mac, and 2 s-chaetae. Abd. III with 1 (m3) inner and 4 (am6, pm6, m7a, p6) lateral mac, and 3 s-chaetae (Fig. 12). Abd. IV with more than 47 s-chaetae (2 of normal length and others elongated), 6–9 mac on anterior part and irregularly arranged in a transverse row; posterior part with 2 (3) (B5 and A6, A6 rarely as mic, B4 sometimes present) mac and 1 (B6) mic (Fig. 13). Abd. V with 3 s-chaetae; m3a absent, a5i sometimes absent (Fig. 14). Anterior face of ventral tube with many ciliate setae, including 4+4 mac, line connecting proximal (Pr) and external-distal (Ed) (Chnd and Li 1997) mac oblique to median furrow (Fig. 20); posterior face with 5 or 6 (median with 1 or 2 small) smooth and numerous ciliate setae (Fig. 21); lateral



Figures 10–14. *H. jordanai* sp. n. 10 dorsal chaetotaxy of Th. II–III 11 coxal chaetotaxy formula (A fore leg B mid leg C hind leg) 12–14 dorsal chaetotax 12 Abd. I–III 13 Abd. IV 14 Abd. V.



Figures 15–19. Hind leg of *H. jordanai* sp. n. 15 coxa, trochanter and femur 16 trochanteral organ 17 basal Tita 18 apical Tita 19 apical Tita and claw.



Figures 20–24. *H. jordanai* sp. n. 20–22 ventral tube 20 anterior face 21 posterior face 22 lateral flap 23 tenaculum 24 genital plate and spermary.

flap with 6–7 smooth and 10–22 ciliate setae (Figs 22, 74, 75). Furcula shown in Figs 25–28. Manubrial plaque with 3 pseudopores, 2 inner and 5–6 outer ciliate setae (Fig. 26). Dens with 20–40 spines (Figs 26, 27, 77); basal sete (Szeptycki 1973) bs₁ and bs₂ spiny and multilaterally ciliate, bs₁ shorter than bs₂; proximal-inner seta (pi) spiny, shorter and thicker than bs₁ and bs₂ (Figs 26, 27). Mucro bidentate with subapical tooth obviously larger than apical one; basal spine short, with tip only reaching apex of subapical tooth (Figs 28, 76). Tenaculum with 4+4 teeth and 1 large, multilaterally ciliate basal seta (Fig. 23). Genital plate papillate (Fig. 24).

The first instar larva. Size. Body length up to 0.7 mm.

Habitus. Ground colour pale white in alcohol. Eye patches dark. Distal antennae slightly pigmented (Figs 3, 4).

Head. Antenna 1.3–1.8 times as long as cephalic diagonal, antennal segment ratio as I : II : III : IV = 1 : 1.4–2.2 : 1.5–2.5 : 3.3–4.3. Ant. I with 11 ciliate and 1 basal spiny setae. Ant. II with 25 ciliate setae. Ant. III with 38 ciliate setae and 5 s-chaetae of Ant. III organ (Figs 30, 78). Ant. IV with numerous ciliate setae and some s-chaetae (Figs 31, 79). Dorsal cephalic chaetotaxy as 3An and 5S mac (Fig. 29). Labium with 3 smooth proximal setae. Setal formula of labial base as MEL_1L_2 , seta E smooth, all others ciliate (Fig. 32). Ommatidia, Ant. IV apical bulb, interocular setae, labral papillae, labrum, maxillary outer lobe, labial palp, hyaline plate same as adults.

Chaetotaxy. Complete s-chaetae of body as 32/223(50–53)3, ms as 10/10100. Th. II with 13 (a1–6, m1, m4, m6, p1–3, p5) mac, 6 (a7, m2, m5, m7, p4, p6) mic and



Figures 25–28. Furcula of *H. jordanai* sp. n. **25** manubrium **26** manubrial plaque and base of dens **27** inner side of dens (triangles representing spines) **28** apical dens and mucro.



Figures 29–32. The first instar larval *H. jordanai* sp. n. 29 dorsal cephalic chaetotaxy 30 Ant. I–III 31 Ant. IV 32 labal base

3 s-chaetae (ms anterior to s), m1 rarely as mic. Th. III with 9 (a2–6, m6, p1–3) mac, 9 (a1, a7, m1, m4, m5, m7, p4, p6) mic and 2 s-chaetae. Abd. I with 3 (m2–4) mac, 9 (a1–3, a5, a6, m5, m6, p5, p6) mic and 2 s-chaetae (ms antero-external to s). Abd. II with 2 (m3, m5) mac, 13 (a1–3, a6, a7, m4, m6, m7, p4, p7, el) mic, 1 additional mic on lateral and 2 s-chaetae. Abd. III with 1 (m3) mac central, 13 (a1–3, a6, a7, m4, am6, pm6, m7, p4) mic, 3 s-chaetae and 5 lateral additional mic (Fig. 33). Abd. IV with 2 (B5, E3) mac, 27 (A1–4, A6, B1–4, B6, C1–4, T1, T3, T5, D1–3, E1, E4, F1–3) mic and 50–53 s-chaetae (48–51 elongated and 2 of normal length); setae A5 and E2 absent (Fig. 34). Abd. V with total 14 setae and 3 s-chaetae. Abd. VI with 21+21 setae; 3 on middle line (Fig. 35).



Figures 33–37. The first instar larval *H. jordanai* sp. n. 33–35 dorsal chaetotaxy 33 Th. II–Abd. III 34 Abd. IV 35 Abd. V–VI 36 ventral tube 37 tenaculum.

Leg. Coxa I–III with 2, 3, 5 ciliate setae. Trochanter I–III with 4, 5, 4 ciliate and 2, 1, 0 smooth setae, 1 spine on trochanter III. Femur I–III with 10, 16, 14 ciliate and 3, 1, 3 smooth setae. Tita I–III with 38, 41, 46 ciliate setae and 1 tenent hair respectively, 1 supraempodial seta on Tita III (Figs 38–41). Unguis with 4 minute inner and 2 lateral teeth. Unguiculus lanceolate with outer edge slightly serrate (Fig. 80).

Ventral tube. Anterior face without seta; posterior face with 2 apical smooth setae; lateral flap with 2 smooth setae (Fig. 36).

Furcula. Manubrum with 24+24 ciliate setae. Manubrial plaque not seen. Dorsal dens with 14–15 (8 in outer 6–7 in inner row) setae, ventral side with about 55 ciliate setae, inner of dens without dental spine, basal setae (b_{s_1} and b_{s_2}) absent (Figs 42, 43).



Figures 38–43. The first instar larval *H. jordanai* sp. n. 38 hind leg 39 Tita I 40 Tita II 41 Tita III 42 manubrium and dorsal dens 43 ventral dens.



Figures 44–51. SEM photos of adult *H. jordanai* sp. n. 44 eye patches 45 base of Ant. I, dorsal side 46 spiny setae on base of Ant. I, dorsal side 47 joint of Ant. I and Ant. II 48 spiny seta on base of Ant. II
49 maxillary outer lobe 50 labial palp 51 micro-architecture of proximal setae.



Figures 52–59. SEM photos of adult *H. jordanai* sp. n. 52 distal part of Ant. II 53 s on distal part of Ant. II 54 Ant. III organ 55 internal two s of Ant. III organ 56 external s of Ant. III organ 57 Ant. IV 58–59 s on Ant. IV.



Figures 60–67. SEM photos of adult *H. jordanai* sp. n. **60–62** s of Ant. IV **63** pseudopores of coxa **64** Tita and claw of hind leg **65** supraempodial seta and outer edge of unguiculus **66** distal part of tenent hair **67** spiny seta on pretarsus.



Figures 68–75. SEM photos of adult *H. jordanai* sp. n. 68 lateral s-chaetae on Abd. I 69 lateral ms on Abd. I 70 three types of setae on Abd. IV 71 bothriotrichum on Abd. IV 72 elongate s-chaetae on Abd. IV 73 ciliate seta on Abd. IV 74 distal part of ventral tube 75 two types of setae on lateral flap of ventral tube.


Figures 76–80. SEM photos of *H. jordanai* sp. n. 76–77 adult 76 partial mucro 77 dental spines 78–80 the first instar larva 78 Ant. III organ 79 distal part of Ant. IV 80 distal part of hind leg.

Mucro bidentate with subapical tooth obviously larger than apical one; basal spine absent. Tenaculum with 4+4 teeth but without setae on corpus (Fig. 37).

Ecology. In the leaf litter of *Cunninghamia lanceolata* (Lambert) and *Dicranopteris dichotoma* (Thunberg).

Remarks. The new species is characterized by weak pigment on dorsal body, long antennae subequal to body in length, labial basal seta L_1 ciliate, absence of setae m2i2 on Th. II, a1 on Abd. I, a2 on Abd. III, A4–5 on Abd. IV, and dental basal seta pi spiny and shorter than bs. It is similar to *Homidia unichaeta* Pan, Shi & Zhang, 2010

Characters	Н. ј	Н. и	H. t
Pigment on dorsal tergite	-	-	slight
Antenna length as long as cephalic diagonal	3.9-4.6	1.5-2.5	about 3.5 times
Seta L ₁ on labial base	ciliate	smooth	smooth
Lateral prosess of labial papilla E	reach apex	not reach	?
Seta m2i2 on Th. II	-	+	-
Seta a1 on Abd. I	-	+	+
Seta a2 on Abd. III	-	+	+
Mac on posterior Abd. IV	2 (rarely 3)	1	2
"Eyebrow" setae on anterior Abd. IV	6–9	3-8 (usually 5-7)	10-12
Dental spines	20-40	19–23	39–54
Comparison of dental basal seta in length	bs > pi	pi > bs	bs > pi
Type locality (China)	Zhejiang	Zhejiang	Tibet

Table 1. Main differences between H. jordanai sp. n. and two similar species.

H. j: H. jordanai sp. n.; H. u: H. unichaeta; H. t: H. tibetensis; -: absent; +: present;?: the character unclear.

Table 2. Differences between the first instar larvae and adults (apart from chaetotaxy of body tergites).

Characters	First instar larvae	Adults
Ground colour	pale white	pale yellow
Cephalic chaetotaxy	3An, 5S	4An, 7S
Spiny setae on basal Ant. I	1	2 dorsal, 4 ventral
S on distal Ant. II	-	4
Proximal setae of labium	3	5
Seta R on labial base	-	+
Coxal macrochaetal formula	2/3/5	3/4+1, 3/4+2
Setae on trochanteral organ of hind leg	1	36–64
Inner tibiotarsal setae	strongly ciliate	thicker and slightly serrate
Setae on anterior face of ventral tube	-	4+4 mac and numerous mic
Setae on lateral flap of ventral tube	2 smooth	6–7 smooth and 10–24 ciliate
Setae on posterior face of ventral tube	2 smooth	5 or 6 smooth and numerous ciliate
Seta on tenaculum	-	1
"Eyebrow" setae on Abd. IV	-	6–9
Setae on manubrium	24+24	more than 24+24
Pseudopores on manubrial plaque	-	3
Ciliate setae on manubrial plaque	-	7–8
Basal setae (bs_1 and bs_2) on dens	-	+
The shape of proximal-inner seta (pi)	normal	spiny
Dental spines	-	20-40
Basal spine of mucro	-	+
Genital plate	-	papillate

-: absent; +: present.

and *Homidia tibetensis* Chen & Zhong, 1998 in colour pattern, cephalic chaetotaxy, labrum, coxal formula, chaetotaxy of Abd. II and claw. However, it can be distinguished from them by the length of antennae, labial setal formula, chaetotaxy on Th. II, Abd. I, Abd. III–IV and seta pi on basal dens. Additional differences are listed in Table 1.

Differences between the first instar larvae and adults. Some characters are principally same in the first instar larvae and adults: ommatidia, interocular setae, Ant. III organ, apical bulb on Ant. IV, labrum and labral papillae, labial palp, maxillary outer lobe, claw, bothriotricha and s-chaetoxic pattern on terga.

Characters that develop after the first instar: s on distal part of Ant. II, smooth setae on base of Ant. II, labial seta R, smooth spiny setae on trochanteral organ, mac on anterior face of ventral tube, seta on corpus of tenaculum, pseudopores on manubral plaque, basal spine on mucro and genital plate.

Chaetotaxy become more complicated during postembryonal development, detailed differences between the first instar larvae and adults (apart from chaetotaxy of body tergites) are listed in Table 2. Tergal chaetotaxy of adults becomes much more complicated than that of primary chaetotaxy. In addition to numerous secondary common mic and mac on terga, some primary mic are transformed into mac: m2, m5 and p4 on Th. II, a1, m5, p5 and p6 on Th. III, a2, a3 and a5 on Abd. I, a2 and a3 on Abd. II, am6 and p6 on Abd. III, A6 and B4 on Abd. IV (homology of lateral setae difficult to determine).

Discussion

Taxonomical significance of the first instar larvae and the position of the genus *Homidia*

The adult chaetotaxy of Entomobryidae exhibits marked differences among genera or species. Szeptycki (1972) found that the primary chaetotaxy of Entomobryomorpha was almost identical in number and position. Later, he (1979) studied the ontogeny of tergal chaetotaxy of the representative Entomobryidae genera and its preliminary phylogenetic significance at higher level of hierarchy with four subfamilies included in Entomobryidae. Subsequent authors (Rusek 2002; Deharveng 2004) emphasized again the systematic significance of the first instar larval chaetotaxy at higher level.

We compare the primary dorsal chaetotaxy of the body among *H. jordanai* sp. n. and another five species of family Entomobryidae. The morphology of some primary homologous setae under Szeptycki's nomenclature exhibits stable differentiation (mac, mic or absent) at the first instar (Table 3), though number and position of them are apparently similar. Among six species, the primary tergal chaetotaxy of *H. jordanai* sp. n. is closest to *Entomobryoides myrmecophila*, almost identical in number and arrangement except s-chaetae on Abd. IV. Integrating its adult features, such as

tergite	seta	Н. ј	O.f	Н. п	<i>E. m</i>	<i>P. a</i>	<i>S. d</i>
Th. II	m1	mac	mac	mic	mac	mac	mac
	m2	mic	mac	mic	mic	scale	mac
	p5	mac	mac	mic	mic	mac	mac
Th. III	a2	mac	mic	mic	mic	mic	mac
	a3	mac	mic	mic	mic	mic	mic
	a4	mac	mac	mic	mic	mac	mac
	m1	mic	mic	mic	mic	-	mic
	m2	-	-	-	-	mac	-
Abd. I	m2	mac	mac	mac	mic	mac	mac
	m4	mac	mac	mic	mac	mac	mac
	m6	mic	mic	mic	mic	mic	mic
Abd. II	a2	mic	mac	mic	mic	mac	mac
	m5	mac	mac	mic	mac	mac	mac
Abd. III	pm6	mac	mac	mac	mac	mac	mac
	p6	mic	mic	mic	mac	mic	mac
Abd. IV	A4	mic	-	-	mic	-	-
	A5	-	-	-	-	mic	mic
	B4	mic	-	-	mic	mic	mac
	B5	mac	mic	mic	mac	mac	mac
	B6	mic	mic	-	mic	mic	mic
	E2	-	mac	mic	-	mic	mic
	E3	mac	-	-	mac	mic	mac

Table 3. Morphological differences of the first instar larvae among six Entomobyridae species.

H. j: Homidia jordanai sp. n.; *O. f. Orchesella flavescens* (Bourlet, 1839); *H. n: Heteromurus nitidus* (Templeton, R in Templeton, R & Westwood, J. O, 1836); *E. m: Entomobryoides myrmecophila* (Reuter, 1884); *P. a: Pseudosinella alba* (Packard, 1873); *S. d: Seira dowlingi* (Wray, 1953); -: absent.

elongated Abd. IV, four antennal segments and absence of scales, the genus *Homidia* apparently belongs Entomobryini sensu (Soto-Adames et al. 2008). It differs from Orchesellinae in 4 antennal segments (5–6 in the latter), elongated Abd. IV, as well as more primary setae on Abd. IV. It also can be distinguished from *Seira* and Lepidocyrid species by presence of p4 and absence of p3 (reverse in the latter) on Abd. III, and absence of E2 on Abd. IV. Among genera of Entomobryini (*Entomobrya, Drepanura, Sinella, Coecobrya*), adults of *Homidia* is easily separated from others in presence of dental spines, "eyebrow" on Abd. IV, and larger subapical mucronal tooth; as for first instar larvae (no dental spines), we also separate it from others by below characters: smooth labial seta E, abundant elongated s-chaetae on Abd. IV (much more than primary setae), and longer distance between area aM and pM on Abd. IV. The origin of peculiar "eyebrow" on anterior part of Abd. IV of adults couldn't be traced by primary chaetotaxy; postembryonic development may provide key evidences to homology of enigmatic "eyebrow".

It is still a long way to achieve the correct homology of setae in Entomobryidae. Further exploration at species level could be studied by thorough survey of more species and more characters of first instar, although first instar larvae are usually more difficult to collect than adults and subadults.

Morphology of the "smooth" setae under SEM

Spiny setae on antennae are smooth under LM and SEM. S and ms on dorsal body smooth under LM, but not smooth under SEM (Figs 53–62, 68, 69, 72). Guard setae on labial palp, proximal setae, "smooth" setae on ventral tube, tenent hair and supraempodial seta on Tita III are also smooth under LM, but weakly ciliate under SEM (Figs 50, 51, 64–66, 74, 75). We have to carefully describe "smooth" setae in future (Chen and Christiansen 1993). Descriptions of some details (e. g. setal surface) based on LM are incomplete, and may bring confusion. SEM observation could provide fine details as a better supplementary tool for species diagnosis.

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RESEARCH ARTICLE



A taxonomic study on semifumata species-group of Fissocantharis Pic, with description of six new species from China and Myanmar (Coleoptera, Cantharidae)

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Abstract

The cantharid *Fissocantharis semifumata* species-group is reviewed. *F. semifumata* (Fairmaire, 1889) is redescribed and illustrated. The type series of *F. fissa* (Wittmer, 1997) is shown to consist of 3 species and clarified, except the holotype, the two paratypes become invalid. *F. grahami* (Wittmer, 1997) is attributed to this species group. Six new species are described and illustrated, *Fissocanthais yui* **sp. n.** (CHINA: Yunnan), *F. semimetallica* **sp. n.** (CHINA: Yunnan; MYANMAR: Kachin), *F. bicolorata* **sp. n.** (CHINA: Sichuan), *F. maculiceps* **sp. n.** (CHINA: Gansu), *F. bimaculata* **sp. n.** (CHINA: Sichuan) and *F. flava* **sp. n.** (CHINA: Sichuan, Guizhou). The number of species in the *F. semifumata* species-group is increased from 4 to 11, and a key to all species is provided.

Keywords

Coleoptera, Cantharidae, Fissocantharis, new species, China, Myanmar

Introduction

The genus *Fissocantharis* Pic, 1921 was synonymized with *Micropodabrus* Pic, 1920 by Wittmer (1997). It was reinstated to be valid and redefined by Yang et al. (2009). Until now, this genus has about 180 species (Yang and Yang 2009), which are widely distributed in the Oriental and East Palaearctic Regions (Kazantsev and Brancucci 2007).

The semifumata species-group of Fissocantharis was proposed by Švihla (2005) based on 4 species, F. semifumata (Fairmaire, 1889), F. fissa (Wittmer, 1997), F. semifumatoides (Švihla, 2005) and F. fissiformis (Švihla, 2005).

During our recent study on this species group, we discover that the aedeagus of *F. semifumata* (Fairmaire) illustrated by Wittmer (1997) is different from that of the type specimen. Also, the type series of *F. fissa* (Wittmer) is shown to consist of 3 species, except the holotype, the two male paratypes belong to different species respectively. Besides, *F. grahami* (Wittmer, 1997) should be attributed to this species group because of its similarity to *F. fissa* in both appearance and aedeagus. Except the above 5 species, 6 new species of this species group are described here under the names of *Fissoantharis yui* sp. n., *F. semimetallica* sp. n., *F. bicolorata* sp. n., *F. maculiceps* sp. n., *F. bimaculata* sp. n. Now the *F. semifumata* species-group has 11 species, which are all distributed in SW China, except one species spreads to NE Myanmar.

Material and methods

The material of this study is deposited in the following collections:

Hebei University Museum, Baoding, China
Institute of Zoology, Chinese Academy of Sciences, Beijing, China
Muséum National d'Histoire Naturelle, Paris, France
Naturhistorisches Museum Basel, Switzerland

Labels of the type material are cited verbatim, some old names of localities are updated in square brackets []. Names of localities of the additional material are written in standard English style, if in Chinese, annotated with transliterations in square brackets []. The depositories of all material are noted at the end of their localities in round brackets ().

The aedeagi are detached from the body under a stereoscopic microscope and kept in 10% KOH solution for several minutes, then cleared in 75% alcohol and observed under a compound light microscope. Line illustrations are drawn with the aid of a camera lucida mounted on a Nikon SMZ 800 stereomicroscope. The scanning electronic micrographs are edited in CORELDRAW 12 and ADOBE PHOTOSHOP 8.0.1. The habitus photos are taken by Canon 450D digital camera with a Canon EF 100mm f/2.8 USM Macro Lens. The body length is measured from the anterior margin of clypeus to apex of elytron, and width is at the humeri of the conjoint elytra. Absolute measurements are used in millimetres (mm).

Taxonomy

Key to the species of *Fissocantharis semifumata* species-group (males)

1	Elytra metallic blue or green or mixed with light yellow2
_	Elytra yellow or light yellow, or mixed with black, never metallic
2	Elytra at most light yellow at bases of outer margins; pronotum with lateral
	margins slightly diverging posteriorly
_	Elytra at least light yellow at lateral margins and humeri; pronotum with
	lateral margins distinctly diverging posteriorly
3	Aedeagus: conjoint dorsal plate of parameres with lateral emarginations of
	apical margin shallow, protuberances between median and lateral emargina-
	tions slightly wide and nearly truncated at apices
_	Aedeagus: conjoint dorsal plate of parameres with lateral emarginations of api-
	cal margin slightly deep, protuberances between median and lateral emargina-
	tions slightly narrow and rounded at apices <i>F. grahami</i> (Wittmer, 1997)
4	Femora entirely vellow; aedeagus; ventral process of each paramere slightly
	turned outwards at apex in lateral view, median lobe with a sclerotized projec-
	tion in middle of dorsum
_	Femora black along apical two-thirds of upper sides; aedeagus; ventral process
	of each paramere distinctly turned outwards at apex in lateral view, median
	lobe without any sclerotized projection in dorsum <i>F. semimetallica</i> sp. n.
5	Aedeagus: ventral process of each paramere wide
_	Aedeagus: ventral process of each paramere narrow9
6	Head with a black marking on vertex; aedeagus: conjoint dorsal plate of para-
	meres with median emargination of apical margin as deep as lateral ones
	<i>F. maculiceps</i> sp. n.
_	Head without any black marking; aedeagus: conjoint dorsal plate of parameres
	with median emargination of apical margin deeper than lateral ones
7	Aedeagus: conjoint dorsal plate of parameres with median emargination of
	apical margin inverse-trapeziform, protuberances between median and lateral
	emarginations truncated at apices
_	Aedeagus: conjoint dorsal plate of parameres with median emargination of
	apical margin not like above, protuberances between median and lateral
	emarginations rounded at apices
8	Elytra entirely light yellow, without black markings, lateral margins nearly
	parallel
_	Elytra yellow, each with a large rounded black marking at apex, lateral mar-
	gins distinctly diverging posteriorly
9	Head behind eyes black; pronotum with black markings; aedeagus: conjoint
	dorsal plate of parameres with median emargination of apical margin shal-
	lower than lateral ones

Fissocantharis semifumata (Fairmaire, 1889)

http://species-id.net/wiki/Fissocantharis_semifumata Figs 1–3, 11–13

Podabrus semifumatus Fairmaire, 1889: 39. Podabrus bicoloricornis Pic, 1926a: 356. –Wittmer, 1989: 219 (syn.). Rhagonycha nigrosubapicalis Pic, 1926b: 5. –Wittmer, 1989: 219 (syn.). Rhagonycha semifumata: Wittmer, 1989: 219. Micropodabrus semifumatus: Wittmer, 1997: 312. Fissocantharis semifumata: Yang et al. 2009: 49.

Type material examined. Holotype ♂ of *Podabrus semifumatus* Fairmaire, 1889, "Moupin [Sichuan: Baoxing], 1870, A. David" (MNHN). Holotype ♂ of *Podabrus bicoloricornis* Pic, 1926, "Moupin [Sichuan: Baoxing], 1870, A. David" (MNHN). Holotype ♂ of *Rhagonycha nigrosubapicalis* Pic, 1926, "Szetschwan [Sichuan], Gunpanting [Songpan], Stöner" (MNHN).

Additional material examined. $2\sqrt[3]{3}$, CHINA, Sichuan, Mt. Emei, 500–1200m, 29.30°N, 103.20°E, 4–18.v.1989, leg. S.J. Kolibáč (NHMB); $1\sqrt[3]{3}$, same locality, 1000m, 4–20.v.1989, leg. Vit Kubáň (NHMB); $1\sqrt[3]{3}$, same locality, 600–1050m, 5–19.v.1989, lgt. Lad. Bocák (NHMB); $1\sqrt[3]{3}$, $1\bigcirc$, Sichuan, Mt. Emei, 580–960m, 21.vi.1955, leg. Xingchi Yang [transliterated from Chinese label, the followings as the same] (IZAS); $1\bigcirc$, same locality, 580–1150m, 27.vi.1955, leg. Zhonglin Ge (IZAS); $1\bigcirc$, same locality, 1800–2100m, 24.vi.1955, leg. Zhonglin Ge (IZAS); $1\bigcirc$, same locality, 2100–3100m, 25.vi.1955, leg. Le Wu (IZAS); $1\bigcirc$, Sichuan, Chudian, 1783m, 23.vi.1957, leg. Fuxing Zhu (IZAS).

Distribution. China (Gansu, Sichuan).

Redescription. Male (Figs 1–3). Head yellow, apices of mandibles, terminal labial and maxillary palpomeres dark brown, antennae black, antennomeres I yellow, slightly darkened at apices, prothorax and scutellum yellow, elytra mostly black, light yellow at bases and lateral margins, of which inner margins slightly wider on anterior than



Figures 1–4. Male habitus, dorsal view **1–3** *Fissocantharis semifumata* (Fairmaire, 1889) **1** Holotype of *Podabrus semifumatus* Fairmaire, 1889 **2** Holotype of *Podabrus bicoloricornis* Pic, 1926 **3** Holotype of *Rhagonycha nigrosubapicalis* Pic, 1926 **4** Holotype of *Micropodabrus fissus* Wittmer, 1997

posterior part and distinctly wider than outer margins, legs yellow, femora darkened at apices, tibiae black along upper sides, tarsi black, meso- and metasterna and abdomen black, last 2 abdominal ventrites yellow.

Head subquadrate, evenly narrowed behind eyes, densely and finely punctate, eyes moderately protruding, breadth across eyes slightly wider than anterior margin of pronotum, terminal maxillary palpomeres long-triangular, widest near apices, antennae filiform and simple, extending to apical one-third of elytra, antennomeres II slightly widened apically, about 1.5 times as long as wide at apices, III about twice as long as II, V longest, XI slightly longer than X.

Pronotum subquadrate, slightly wider than long, widest at base, anterior margin arcuate, lateral margins diverging posteriorly, posterior margin almost straight, anterior angles rounded, posterior angles nearly vertical, disc densely and finely punctate as that on head, distinctly convex on posterolateral parts.

Elytra about 4 times longer than pronotum, 3 times longer than humeral width, lateral margins distinctly diverging posteriorly, disc slightly sparsely and largely punctate than that on pronotum.

Legs: all tarsal claws bifid, with lower claws slightly shorter than upper ones.

Aedeagus (Figs 11–13): conjoint dorsal plate of parameres with median emargination of apical margin wide and distinctly deeper than lateral ones, protuberances between median and lateral emarginations narrow and almost half length of ventral process of each paramere in dorsal view; ventral process of each paramere narrow, slightly turned outwards at apex in lateral view; median lobe without any sclerotized projection in dorsum.

Female. Body larger, eyes less protruding and antennae shorter than that of males, pronotum distinctly wider than long, disc slightly convex, tarsal claws with lower claws distinctly shorter than upper ones.

Variation within species. Sometimes elytra entirely light yellow, or slightly darkened at apices, legs with tibiae entirely black. Body length: 8.0–11.0 mm; width: 1.5– 2.5 mm.

Remarks. In this study, the holotype male of this species is examined, however, its male genitalia is different from the illustration provided by Wittmer (1997) who based on the specimen located in "Chasseurs Thibetains, Ta-Tsien-Lu, 1896" (NHMB). After a careful examination, the latter is shown to be a new species described below, *Fissocantharis bicolorata* sp. n. In this case, it is necessary to redescribe and illustrate this species here.

Fissocantharis fissa (Wittmer, 1997)

http://species-id.net/wiki/Fissocantharis_fissa Fig. 4

Micropodabrus fissus Wittmer, 1997: 313, Abb. 183. *Fissocantharis fissa*: Yang et al. 2009: 49.

Type material examined. Holotype ♂, "CHINA SE, Shaanxi, Danfeng NE env., 900–1500m, 33°45–52'N, 110°22–37'E, 28–29.v.1995, lgt. L.R. Businský" (NHMB).

Additional material examined. 1endown i, CHINA, Hubei, Xingshan, Longmenhe, 1350m, 18.vi.1993, leg. Jian Yao; 1endown i, same locality, 1280m, 23.vi.1993, leg. Wenzhu Li; 1endown i, same locality, 1400m, 16.vi.1993, leg. Runzhi Huang; 1endown i, same locality, 1260m, 14.vi.1993, leg. Hongxing Li; 1endown i, same locality, 1280m, 14.vi.1993, leg. Jian Yao; 1endown i, same locality, 1350m, 16.vi.1993, leg. Jian Yao; 1olimits, same locality, 1280, leg. Jian Yao; 1olimits,

Distribution. China (Shaanxi, Hubei).

Supplementary description. Male (Fig. 4). Elytra metallic blue, light yellow at bases and lateral margins, of which inner margins slightly wider on anterior than posterior part and distinctly wider than outer margins. Aedeagus: conjoint dorsal plate of parameres with median emargination of apical margin wide and deeper than lateral ones, protuberances between median and lateral emarginations narrowed apically and rounded at apices, about one-fourth length of ventral process of each paramere in dorsal view; ventral process of each paramere slender; median lobe presenting with a sclerotized projection in middle of dorsum, which tapered apically and bent dorsally at apex.

Female. Body larger, eyes less protruding, antennae shorter and narrower than that of males, pronotum with disc slightly convex, elytra metallic blue, light yellow at bases of outer margins, all tarsal claws each with a triangular appendiculate.

Body length: 7.0–9.0 mm; width: 1.5–2.3 mm.

Remarks. In the original manuscript by Wittmer (1997), the elytra of the type male was described as being partly black, which actually is metallic blue based on the examination of a series of additional specimens at our disposal. Also, it is the first time to describe the female for this species here.

Besides, the type series of this species is shown to be plural and composed of 3 species. Except the holotype, one male paratype labeled with "CHINA NW, Sichuan, Min Shan, 2500–4500m, 33°10'N, 103°50'E, 14–16.vii.1990, leg. Jiří Kolibáč" actually belongs to *F. fissiformis* (Švihla, 2005), the other one "CHINA, Sichuan pr., Kangding distr., Hailougou Glacier Park, 21–24.vii.1992, lgt. R. Dunda" is a new species described here, *F. bicolorata* sp. n. Thus, the two paratypes of this species designated by Wittmer (1997) become invalid. In this case, this species is excluded from Sichuan province at the moment.

Fissocantharis yui sp. n.

urn:lsid:zoobank.org:act:57C148E2-C9E5-476C-A8EA-81AC65B20EC0 http://species-id.net/wiki/Fissocantharis_yui Figs 5, 14–16

Type material. Holotype \mathcal{O} , CHINA, Yunnan, Lanping, 13.vi.2010, leg. Guoyue Yu [transliterated from Chinese label] (IZAS). Paratypes: $2\mathcal{O}\mathcal{O}$, same data to the holotype (IZAS).

Distribution. China (Yunnan).





Figures 5–10. Male habitus, dorsal view 5 *Fissocantharis yui* sp. n. 6 *F. semimetallica* sp. n. 7 *F. bicolorata* sp. n. 8 *F. maculiceps* sp. n. 9 *F. bimaculata* sp. n. 10 *F. flava* sp. n.

Diagnosis. This species is similar to *F. grahami* (Wittmer, 1997), but distinguishable by the aedeagus: conjoint dorsal plate of parameres with lateral emarginations of apical margin shallow, protuberances between median and lateral emarginations slightly wide and nearly truncated at apices.

Description. Male (Fig. 5). Head yellow, dorsum behind eyes black, apices of mandibles brown, terminal labial and maxillary palpomeres black, antennae black,

antennomeres I–V yellow, darkened at apices, pronotum yellow, with a large black marking in middle, which extending from anterior to posterior margin and wider on posterior than anterior part, scutellum yellow, elytra metallic blue, light yellow at bases of outer margins, legs yellow, femora and tibiae darkened at apices, tarsi black, ventral parts of thorax and abdomen black, last 3 abdominal ventrites yellow.

Head subquadrate, evenly narrowed behind eyes, slightly depressed on vertex, dorsum densely and finely punctate, eyes slightly protruding, breadth across eyes wider than anterior margin of pronotum, terminal maxillary palpomeres slender, slightly widened near apices, antennae filiform and simple, extending to middle of elytra, antennomeres II about twice as long as wide, III one-third longer than II, XI slightly longer than X.

Pronotum subquadrate, almost as long as wide, widest at base, anterior margin arcuate, lateral margins slightly diverging posteriorly, posterior margin almost straight, anterior angles rounded, posterior angles nearly vertical, disc densely and finely punctate as that on head, convex on posterolateral parts.

Elytra about 5 times longer than pronotum, 4 times longer than humeral width, lateral margins parallel, disc densely and slightly largely punctate than that on pronotum.

Legs: all tarsal claws bifid, with lower claws slightly shorter than upper ones.

Aedeagus (Figs 14–16): conjoint dorsal plate of parameres with median emargination of apical margin slightly wide and distinctly deeper than lateral ones, protuberances between median and lateral emarginations slightly wide and nearly truncated at apices, about one-fourth length of ventral process of each paramere in dorsal view; ventral process of each paramere slender, slightly turned outwards in lateral view; median lobe presenting with a sclerotized lingulate projection in middle of dorsum.

Female. Unknown.

Type series variation. Sometimes head black, slightly brown at clypeus, antennae entirely black, pronotum black, slightly brown at anterior and lateral margins, scutellum black, legs mostly dark brown. Body length: 6.0–7.0 mm; width: 1.1–1.3 mm.

Etymology. Patronymic, dedicated to its collector, Dr. Guoyue Yu (Beijing, China).

Fissocantharis semimetallica sp. n.

urn:lsid:zoobank.org:act:B47A68A1-3F09-4879-B0D2-DCC04EB351AB http://species-id.net/wiki/Fissocantharis_semimetallica Figs 6, 17–19

Type material. Holotype 3° , MYANMAR, Kachin prov., Mt. Emaw Bum, road of Kanphant, 2358m, 26°09'N, 98°31'E, 28.v.2006, M. Langer (NHMB). Paratypes: 13° , 29° , same data as holotype (19° in NHMB; 13° , 19° in IZAS); 13° , CHINA, Yunnan Prov., Tengchong, Houqiao, Danzha, Zhaobitang, 2510m, 25.55627°N, 98.20941°E, 29.v.2006, H.B. Liang collector, California Academy & IOZ, Chinese Acad. Sci. (IZAS).

Distribution. China (Yunnan), Myanmar (Kachin).

Diagnosis. This new species is similar to *F. fissa* (Wittmer, 1997), but can be distinguished by the femora black along apical two-thirds of upper sides, aedeagus: ventral process of each paramere distinctly turned outwards in lateral view, median lobe without any sclerotized projection in dorsum.

Description. Male (Fig. 6). Head light yellow, dorsum behind eyes black, apices of mandibles dark brown, labial and maxillary palpomeres darkened, gula black, antennae black, pronotum black, light yellow at anterior and lateral margins, of which wider on anterior than posterior part, scutellum black, with very narrow light yellow lateral and apical margins, elytra metallic blue, light yellow at humeri and lateral margins, of which inner margins slightly wider than outer ones, legs black, coxae, trochanters and femora light yellow, femora black along apical two-thirds of upper sides, ventral parts of thorax and abdomen black, last abdominal ventrite light yellow.

Head subquadrate, evenly narrowed behind eyes, dorsum densely and finely punctate, eyes strongly protruding, breadth across eyes distinctly wider than anterior margin of pronotum, terminal maxillary palpomeres long-triangular, widest near apices, antennae filiform and simple, extending to apical one-third of elytra, antennomeres II slightly widened apically, about 3 times as long as wide at apices, III one-third longer than II, V longest, XI slightly shorter than X.

Pronotum subquadrate, almost as long as wide, widest at base, anterior margin arcuate, lateral margins distinctly diverging posteriorly, posterior margin almost straight, anterior angles rounded, posterior angles nearly vertical, disc densely and finely punctate as that on head, distinctly convex on posterolateral parts.

Elytra about 5 times longer than pronotum, 4 times longer than humeral width, lateral margins parallel, disc slightly sparsely and largely punctate than that on pronotum.

Legs: all tarsal claws bifid, with lower claws slightly shorter than upper ones.

Aedeagus (Figs 17–19): conjoint dorsal plate of parameres with median emargination of apical margin wide and distinctly deeper than lateral ones, protuberances between emarginations slightly narrow, about one-fourth length of ventral process of each paramere in dorsal view; ventral process of each paramere slender, distinctly turned outwards in lateral view; median lobe without any sclerotized projection in dorsum.

Female. Body larger, eyes less protruding, antennae shorter and narrower, pronotum wider than that of males, head mostly black, elytra with lateral margins diverging posteriorly, legs with coxae and femora black, light yellow at bases of ventral sides of femora, all tarsal claws each with a triangular appendiculate.

Type series variation. Sometimes head and pronotum entirely light yellow, elytra light yellow almost at basal half part. Body length: 8.5–12.0 mm; width: 1.5–2.5 mm.

Etymology. This new specific name is derived from Latin *semi* (half) and Greek *metall* (metallic), referring its elytra partly metallic blue.

Remarks. One male paratype (CHINA, Yunnan) with left antennomeres VIII–XI, right protarsomeres II–V, right mesoleg, left mesotarsomeres II–V, right metatarsi and left metatarsomeres III–V and one female paratype with left antennomeres VII–XI, right VIII–XI and right metatarsus are missing.

Fissocantharis bicolorata sp. n.

urn:lsid:zoobank.org:act:A1A55A22-BBA6-498D-AC18-34A5C42A4849 http://species-id.net/wiki/Fissocantharis_bicolorata Figs 7, 20–22

Micropodabrus semifumatus: Wittmer, 1997: 312, Abb. 184 [misidentification, nec. Fairmaire, 1889].

Type material. Holotype 3, CHINA, Sichuan, Kangding, Zheduoshanya, 4300m, 21.vi.1990, leg. Fusheng Huang [transliterated from Chinese label] (IZAS). Paratypes: 13, Sichuan pr., Kangding distr., Hailuogou Glacier Park, 21–24.vii.1992, lgt. R. Dunda (NHMB); 233, 19, Tat-sien-lu [Sichuan: Dajianlu], 1896 (NHMB); 13, Tatsien-Loû [Sichuan: Dajianlu], Chasseurs Thibetains, 1896 (NHMB); 233, Sichuan, Kangding, 2700m, 29.v.1983, leg. Xuezhong Zhang [transliterated from Chinese label, the followings as the same] (IZAS); 13, same locality, 2100m, leg. 22.vi.1983, leg. Shuyong Wang (IZAS); 233, same locality, 2500m, leg. 26.vi.1983, leg. Shuyong Wang (IZAS); 13, 19, same locality, 2600m, leg. 30.vi.1983, leg. Yuanqing Chen (IZAS); 23300, 30.vi.1983, leg. Yuanqing Chen (IZAS); 399, Sichuan, Kangding, 3.vi.2004, leg. Yibin Ba & Aimin Shi (HBUM).

Distribution. China (Sichuan).

Diagnosis. This new species is similar to *F. semifumata* (Fairmaire, 1889), but differs in the following characters: elytra with different coloration in both sexes, mixed black with light yellow in male, while entirely lightly yellow in female, lateral margins nearly parallel in male; aedeagus: conjoint dorsal plate of parameres with median emargination of apical margin slightly narrow, protuberances between median and lateral emarginations slightly wide.

Description. Male (Fig. 7). Head reddish brown, clypeus light yellow, mouthparts dark brown, antennae black, pronotum and scutellum reddish brown, elytra black, light yellow at bases and lateral margins, of which inner margins wider than outer ones, legs black, femora light brown at inner sides, ventral parts of thorax and abdomen black, last 2 abdominal ventrites light yellow.

Head subquadrate, evenly narrowed behind eyes, dorsum densely and finely punctate, eyes moderately protruding, breadth across eyes slightly wider than anterior margin of pronotum, terminal maxillary palpomeres long-triangular, widest near apices, antennae filiform and simple, extending to apical one-third of elytra, antennomeres II about 1.5 times as long as wide at apices, III one-third longer than II, V longest, XI slightly shorter than X.

Pronotum subquadrate, slightly wider than long, widest at base, anterior margin arcuate, lateral margins diverging posteriorly, posterior margin almost straight, anterior angles rounded, posterior angles nearly vertical, disc densely and finely punctate as that on head, distinctly convex on posterolateral parts. Elytra about 5 times longer than pronotum, 4 times longer than humeral width, lateral margins nearly parallel, disc slightly sparsely and largely punctate than that on pronotum.

Legs: all tarsal claws bifid, with upper claws almost as long as lower ones.

Aedeagus (Figs 20–22): conjoint dorsal plate of parameres with median emargination of apical margin slightly narrow and deeper than lateral ones, protuberances between median and lateral emarginations slightly wide and rounded at apices, about half length of ventral process of each paramere in dorsal view; ventral process of each paramere narrow, slightly turned outwards at apex in lateral view; median lobe without any sclerotized projection in dorsum.

Female. Body larger, eyes less protruding, antennae narrower and shorter than that of males, pronotum distinctly wider than long, elytra entirely light yellow, with lateral margins diverging posteriorly, tarsal claws with lower claws distinctly shorter than upper ones.

Body length: 8.0–11.0 mm; width: 1.5–2.5 mm.

Etymology. This new specific name is derived from Latin *bi*- (two) and *color* (coloration), referring to it being sexually dimorphic in coloration of elytra.

Fissocantharis maculiceps sp. n.

urn:lsid:zoobank.org:act:64BAA203-6045-448D-9978-05EF2FB85AC2 http://species-id.net/wiki/Fissocantharis_maculiceps Figs 8, 23–25

Type material. Holotype 3, CHINA, Gansu, Wenxian, Huangtuling, 2350m, 9.vii.2003, leg. Yibin Ba &Yang Yu (HBUM). Paratypes: 233, 299, same data to the holotype (13, 19) in HBUM; 13, 19 in NHMB); 13, Gansu, Wenxian, Qiujiaba, 2350–2650m, 30.vi.1998, leg. Xingke Yang (IZAS); 13, same locality, 2000–2100m, 1.vii.1998, leg. Shuyong Wang (IZAS); 19, same locality, 2200–2350m, 29.vi.1998, leg. Decheng Yuan (IZAS); 19, same locality, 2350–2650m, 30.vi.1998, leg. Decheng Yuan (IZAS); 299, same locality, 2350–2650m, 30.vi.1998, leg. Decheng Yuan (IZAS); 299, same locality, 2350–2650m, 30.vi.1998, leg. Wenyi Zhou (IZAS); 3999, Gansu, Zhouqu, Shatan Forestry, 2400m, 6.vii.1999, leg. Jian Yao (IZAS) [all transliterated from Chinese labels].

Distribution. China (Gansu).

Diagnosis. This new species is similar to *F. fissiformis* (Švihla, 2005), but can be distinguished by the aedeagus: conjoint dorsal plate of parameres with median emargination of apical margin narrow and almost as deep as lateral ones, protuberances between median and lateral emarginations wide and nearly parallel-sided; ventral process of each paramere wide.

Description. Male (Fig. 8). Head yellow, with a inverse-trapeziform black marking on vertex, clypeus and mouthparts light yellow, apices of mandibles, terminal labial and maxillary palpomeres dark brown, antennae black, pronotum yellow, scutellun light yellow, elytra light yellow, slightly darkened at apices, legs yellow, femora slightly darkened at api-

ces, tibiae black along upper sides, tarsi black, ventral parts of thorax and abdomen black, posterior and lateral margins of each abdominal ventrite and the whole last ventrite yellow.

Head subquadrate, evenly narrowed behind eyes, dorsum densely and finely punctate, eyes slightly protruding, breadth across eyes wider than anterior margin of pronotum, terminal maxillary palpomeres long-triangular, widest near apices, antennae filiform and simple, extending to middle of elytra, antennomeres II about twice as long as wide, III about twice as long as II, V longest, XI slightly longer than X.

Pronotum subquadrate, slightly wider than long, widest at base, anterior margin arcuate, lateral margins diverging posteriorly, posterior margin almost straight, anterior angles rounded, posterior angles nearly vertical, disc densely and finely punctate as that on head, slightly convex on posterolateral parts.

Elytra about 5 times longer than pronotum, 4 times longer than humeral width, lateral margins slightly diverging posteriorly, disc slightly sparsely and largely punctate than that on pronotum.

Legs: all tarsal claws bifid, with lower claws slightly shorter than upper ones.

Aedeagus (Figs 23–25): conjoint dorsal plate of parameres with median emargination of apical margin narrow and almost as deep as lateral ones, protuberances between median and lateral emarginations wide and nearly parallel-sided and rounded at apices, about half length of ventral process of each paramere in dorsal view; ventral process of each paramere wide, slightly turned outwards at apex in lateral view; median lobe without any sclerotized projection in dorsum.

Female. Body larger, eyes less protruding, antennae shorter and narrower than that of males, pronotum with disc slightly convex, elytra with lateral margins slightly diverging posteriorly, tarsal claws with lower claws distinctly shorter than upper ones.

Variation in type series. Sometimes head with a small rounded black marking on vertex, elytra entirely light yellow, legs with femora and tibiae entirely yellow. Body length: 7.0–9.0 mm; width: 1.6–2.0 mm.

Etymology. This new specific name is derived from Latin *macula* (marking) and *ceps* (head), referring to its head with a black marking on vertex.

Fissocantharis bimaculata sp. n.

urn:lsid:zoobank.org:act:23308F99-71D6-40D9-BB4B-3B3F126A8DD8 http://species-id.net/wiki/Fissocantharis_bimaculata Figs 9, 26–28

Type material. Holotype ♂, CHINA, Sichuan, Mt. Emei, 1600m, 31.v.1979, leg. Jinwen Shang (IZAS). Paratype: 1♂, same locality, 1600–2100m, 24.vi.1955, leg. Le Wu (IZAS) [both transliterated from Chinese labels].

Distribution. China (Sichuan).

Diagnosis. This new species is related to *F. semifumatoides* (Svihla, 2005), but distinguishable by the pronotum distinctly wider than long; elytra each with a black marking at apex, lateral margins distinctly diverging posteriorly.

Description. Male (Fig. 9). Body yellow, mouthparts dark brown, antennae black, elytra each with a large rounded black marking at apex, femora slightly darkened at apices, tibiae black along upper sides, tarsi black, meso- and metasterna and abdomen black, posterior and lateral margins of each abdominal ventrite and the whole last ventrite yellow.

Head subquadrate, evenly narrowed behind eyes, dorsum densely and finely punctate, eyes moderately protruding, breadth across eyes slightly narrower than anterior margin of pronotum, terminal maxillary palpomeres long-triangular, widest near apices, antennae filiform and simple, extending to apical one-fifth of elytra, antennomeres II slightly widened apically, about twice as long as wide at apices, III about twice as long as II, V longest, XI slightly shorter than X.

Pronotum subquadrate, distinctly wider than long, widest at base, anterior margin arcuate, lateral margins diverging posteriorly, posterior margin almost straight, anterior angles rounded, posterior angles nearly vertical, disc densely and finely punctate as that on head, distinctly convex on posterolateral parts.

Elytra about 5 times longer than pronotum, 2.5 times longer than humeral width, lateral margins distinctly diverging posteriorly, disc slightly sparsely and largely punctate than that on pronotum.

Legs: pro- and mesotarsal claws bifid, with lower claws slightly shorter than upper ones.

Aedeagus (Figs 26–28): conjoint dorsal plate of parameres with median emargination of apical margin narrow and distinctly deeper than lateral ones, protuberances between median and lateral emarginations wide and rounded at apices, almost as long as ventral process of each paramere in dorsal view; ventral process of each paramere wide, slightly turned outwards at apex in lateral view; median lobe without any sclerotized projection in dorsum.

Body length: 9.0–11.0 mm; width: 2.5–3.0 mm.

Female. Unknown.

Etymology. This new specific name is derived from Latin *bi*- (two) and *macula* (marking), referring to its elytra each with a black marking at apex.

Remarks. The metalegs of both holotype and paratype and antennomeres III–XI of paratype are missing. Besides, the left basal piece of holotype and basal pieces of aedeagus of paratype are damaged.

Fissocantharis flava sp. n.

urn:lsid:zoobank.org:act:CC97E9B5-717A-4CF1-A403-3DFA3F2CFED5 http://species-id.net/wiki/Fissocantharis_flava Figs 10, 29–31

Type material. Holotype \Diamond , CHINA, Sichuan, Wanxian, Wangerbao, 1200m, 28.v.1994, leg. Wenzhu Li [transliterated from Chinese label] (IZAS). Paratypes: 1 \bigcirc , same locality, 27.v.1994, leg. Xingke Yang (IZAS); 1 \Diamond , W. Guizhou prov., Leigongshan, Xijiang, 1200–1900m, 29.v–2.vi.1997, lgt. Bolm (IZAS).



Figures 11–13. Aedeagus of *Fissocantharis semifumata* (Fairmaire, 1889) 11 dorsal view 12 ventral view 13 lateral view. Scale bar: 1 mm.

Distribution. China (Sichuan, Guizhou).

Diagnosis. This new species is similar to *F. bimaculata* sp. n., but differs in the following characters: pronotum slightly wider than long in male; elytra entirely yellow; aedeagus: conjoint dorsal plate of parameres with median emargination of apical margin slightly wide and inverse-trapeziform, protuberances between median and lateral emarginations truncated at apices.

Description. Male (Fig. 10). Body yellow, apices of mandibles dark brown, antennae black, antennomeres I yellow, slightly darkened at apices, femora black at apices, tibiae black along upper sides, tarsi black, metasternum and abdomen black, posterior and lateral margins of each abdominal ventrite and the whole last 2 ventrites yellow.

Head subquadrate, evenly narrowed behind eyes, dorsum densely and finely punctate, eyes moderately protruding, breadth across eyes slightly wider than anterior margin of pronotum, terminal maxillary palpomeres long-triangular, widest near apices, antennae filiform and simple, extending to apical one-fourth of elytra, antennomeres II slightly widened apically, about twice as long as wide at apices, III about twice as long as II, V longest, XI slightly longer than X.

Pronotum subquadrate, slightly wider than long, widest at base, anterior margin arcuate, lateral margins diverging posteriorly, posterior margin almost straight, anterior angles rounded, posterior angles nearly vertical, disc densely and finely punctate as that on head, distinctly convex on posterolateral parts.

Elytra about 5 times longer than pronotum, 2.5 times longer than humeral width, lateral margins distinctly diverging posteriorly, disc slightly sparsely and largely punctate than that on pronotum.



Figures 14–22. Aedeagi 14–16 Fissocantharis yui sp. n. 17–19 F. semimetallica sp. n. 20–22 F. bicolorata sp. n. 14, 17, 20 dorsal view 15, 18, 21 ventral view 16, 19, 22 lateral view. Scale bars: 1 mm.



Figures 23–31. Aedeagi 23–25 *Fissocantharis maculiceps* sp. n. 26–28 *F. bimaculata* sp. n. 29–31 *F. flava* sp. n. 23, 26, 29 dorsal view 24, 27, 30 ventral view 25, 28, 31 lateral view. Scale bars: 1 mm.

Legs: all tarsal claws bifid, with lower claws slightly shorter than upper ones.

Aedeagus (Figs 29–31): conjoint dorsal plate of parameres with median emargination of apical margin slightly wide and inverse-trapeziform, distinctly deeper than lateral ones, protuberances between median and lateral emarginations wide and truncated at apices, almost as long as ventral process of each paramere in dorsal view; ventral process of each paramere wide, slightly turned outwards at apex in lateral view; median lobe without any sclerotized projection in dorsum.

Female. Body larger, eyes less protruding than that of males, pronotum distinctly wider than long, disc slightly convex, tarsal claws with lower claws distinctly shorter than upper ones.

Body length: 10.0–14.0 mm; width: 2.0–3.5 mm.

Etymology. This new specific name is derived from Latin *flavus* (yellow), referring to its yellow elytra.

Remarks. The female paratype with right antenna, left antennomeres III–XI, left metatarsomere V and right metatarsomeres III–V are missing.

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RESEARCH ARTICLE



A new species of Urophora Robineau-Desvoidiy, 1830 (Diptera, Tephritidae) from Iran

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Abstract

Urophora merzi **sp. n.** reared from flower heads of *Centaurea behen* Linnaeus is described from Iran. It is similar to *U. campestris*, *U. sachalinensis*, *U. stylata*, *U. tsoii* and *U. vera* in wing pattern with 3 well developed crossbands and indistinct subbasal crossband, differing in aculeus tip with two pairs of diminished preapical steps and different host plants.

Keywords

Tephritidae, Urophora, new species, Iran

Introduction

The genus *Urophora* Robineau-Desvoidiy, 1830 with about 60 species is one of the largest genera of the family Tephritidae in the Palaearctic Region (Norrbom et al. 1999). All species of known biology are associated with asteraceous plants and induce galls in their flower heads and, rarely, stems (White and Korneyev 1989). Some *Urophora* species are agents for biological control of astraceous weeds; *U. affinis* (Frauenfeld), *U.* *cardui* (Linnaeus), *U. quadrifasciata* (Meigen), *U. sirunaseva* (Hering), *U. solstitialis* (Linnaeus) and *U. stylata* (Fabricius) successfully introduced to the Nearctic Region for biocontrol of weeds (Peschken and Harris 1975; Turner et al. 1994; Turner 1996 a, b; Wheeler and Stoops 1996).

While studying the tephritid flies fauna in Iran in 2008–2011 seasons, we collected and reared a previously undescribed species that infests the flower heads of *Centaurea behen* L. (Asteraceae). The new species is described and figured below.

Material and methods

Materials were collected by standard sweeping net and rearing from flower heads of *Centaurea behen*. Morphological terminology follows White et al. (1999). The material examined minuten-pinned on side and deposited in collections of the following institutions:

JAZM	Jalal Afashar Zoological Museum, College of Agriculture, University of Teh-
	ran, Karaj, Iran.
MHNG	Museum d'histoire naturelle, Genève, Switzerland.
SIZK	I. I. Schmalhausen Institute of Zoology, National Academy of Sciences of
	Ukraine, Kiev, Ukraine.
ZISP	Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

The following morphometric characters with their abbreviations are used: Body length (BL); wing length (WL); aculeus length (AL).

Results

Key to Western Palaearctic species of *Urophora* with the *stylata*-like wing pattern (3 distinct crossbands, of them, apical and subapical fused)

(Corresponding to the couplet 94 in Korneyev and White 1999)

1	Apex of aculeus with two pairs of indistinct steps (Fig. 6); associated with
	Centaurea behen U. merzi sp. n.
-	Apex of aculeus with 1–2 pairs of prominent primary steps2
2	Apex of aculeus with 1 pair of prominent primary steps
-	Apex of aculeus with 2 pairs of prominent, sharp steps
	(see couplet 97 in Korneyev and White 1999)
3	Apex of first flagellomere slightly pointed. Aculeus width between primary
	steps almost equal to distance from primary steps to apex (see Korneyev and
	White 1996: Fig. 21). Larvae in <i>Serratula</i> flower head galls. Armenia

First flagellomere apically rounded. Aculeus apex between primary steps almost twice as wide as its length from primary steps level to tip (see Korneyev and White 1996: Fig. 17). Larvae in *Cirsium* flower head galls. Whole Europe and Western Asia to West Siberia and western China.... U. stylata Fabricius

Urophora merzi Mohamadzade Namin, sp. n. urn:lsid:zoobank.org:act:2A468C69-CE7C-4C69-BE53-06168D739915 http://species-id.net/wiki/Urophora_merzi Figs 1–15

Type material. Holotype (female): **Iran:** Mazandaran Province, Haraz road, 10 km north east Abali, 35°50'N; 51°58'E, h 2360m, swept from flower heads of *Centaurea behen*, 20 May, 2011, S. Mohamadzade Namin leg. (JAZM).

Paratypes: 1 \bigcirc , same collection data as in holotype, reared from flower heads of *Centaurea behen* Linnaeus, collected 13 September, 2008 & emerged 22 September 2008; 1 \bigcirc , 1 \bigcirc , Alburz Province, Chaloos road, Nesa, 36°04'N; 51°19'E, h 2200m, 22 June 2009, swept from *Centaurea behen*; 15 \bigcirc , 18 \bigcirc , same collection data as in holotype, 20 May, 2011, S. Mohamadzade Namin leg. (JAZM; some paratypes are deposited also in MHNG, SIZK, ZISP and first author's personal collection).

Description. Head: Yellow, except ocellar triangle, occiput and slender part of arista black. Length: height: width ratio = 1: 1: 1.25. Frons brown; face whitish yellow; Antenna yellow, scape with blackish setulae at dorso-apical margin; first flagellomere light yellow, 1.6 times as long as wide and distinctly rounded antro-ventrally; arista bare. Compound eye about as high as long. Gena 1.1 times as high as length of first flagellomere. Proboscis capitate with black setae. Two frontal and one orbital setae present. Postocellar, postocular, vertical and genal setae black and acuminate. Frons with black setulae around frontal setae (Fig. 4).

Thorax: General color black; mesonotal scutum densely covered with gray microtrichia and black setulae. Notopleura shining black. Pleuron black; only stripe in anterior half of anepisternum and postpronotal lobe yellow. Scutellum yellow; slightly convex, corners of scutellum black. Subscutellum and mediotergite black. All setae on thorax black and acuminate. Scutellum with 4 equal black setae; basal setae placed in yellow area. Halter yellow.

Wing: Hyaline with 3 well developed dark brown crossbands. Subbasal band reduced and only present as darkening near apex of cell bm and rarely bcu. Discal crossband complete, crossing wing from pterostigma through R-M crossvein into posterior margin. Preapical crossband complete, reaching posterior margin. Apical band well developed. In females, preapical and apical crossbands in 56.2% of type material fused in cell r_1 (Fig. 2), in 31.2% fused in r_1 and r_{2+3} (Figs 1, 11) and in 12.5% fused in r_1 , r_{2+3} and anterior half of r_{4+5} cells (Fig. 3). In males, preapical and apical crossbands in



Figures 1–3. *Urophora merzi* sp. n., 1 wing pattern of the holotype 2–3 variation of wing pattern in paratypes.

33.3% of specimens fused in cell r_1 , in 50% fused in r_1 and r_{2+3} and in 16.6% fused in r_1 , r_{2+3} and anterior half of r_{4+5} cells. In one male of type series discal and preapical crossbands narrowly joined in r_1 cell and in one female and one male discal and preapical crossbands narrowly connected at posterior margin of wing. Pterostigma yellowish.



Figures 4–8. Urophora merzi sp. n., 4 head in profile 5 aculeus 6 aculeus tip 7 male terminalia 8 epandrium.

Distance between crossveins about 1.4 as long as dm-cu crossvein. R_{4+5} with 1 setula ventrally at node.

Legs: Completely yellow; fore femur in 60% of females and 55% of males with black stripe in dorsal side. All setae and setulae blackish (Figs 9, 10). Fore femur with two dorsal and one ventral rows of setae.

Abdomen: General color black, sparsely microtrichose, subshining with black setulae. Posterior margin of abdominal tergites, especially tergites 5–6 with long black setae. Oviscape 1.25 times as long as preabdomen, shining black with black hairs. Aculeus narrow, 11 times as long as wide, apically rounded, apex with two pairs of indistinct steps, as in Figs 5, 6, 13, 14. Tergite 5 of males as long as two preceding tergites with long setae in posterior margin. Epandrium as in Figs 8, 12 and glans as in Figs 7, 15.

Measurements: Male: BL= 3.5–4 mm (average 3.8), WL = 3.5–4.5 mm (average 3.9); female: BL= 4.5–6 mm (average 5.3), WL= 4–4.9 mm (average 4.3), AL = 1.5–2 mm (average 1.9) (n = 5).

Etymology. The species is named in honour of Dr Bernhard Merz, an outstanding Swiss dipterist, in recognition of his invaluable contribution into study of the order Diptera, especially family Tephritidae.



Figures 9–15. *Urophora merzi* sp. n., 9 ♂, total view, left 10 ♀ (Holotype), total view, left 11 wing pattern (Holotype) 12 aculeus 13 aculeus tip 14 epandrium 15 male terminalia.

Discussion. The new species is similar to *U. campestris* Ito (Japan), *U. sachalinen-sis* (Shiraki) (Russia and Japan), *U. stylata* Fabricius (Worldwide), *U. tsoii* Korneyev and White (Russia) and *U. vera* Korneyev and White (Armenia), sharing similar wing pattern (3 well developed crossbands and indistinct subbasal crossband, with apical and preapical crossbands fused along anterior margin of wing), yellow femora and antenna and black

notopleura, differing in the shape of aculeus apex. Apex of aculeus in *U. sachalinensis*, *U. stylata* and *U. vera* has one pair of steps. *U. campestris* and *U. tsoii* (both occurring in the Far East of the Palaearctic Region) possess two pairs of distinct steps, whereas the aculeus tip in *U. merzi* sp. n. has two pairs of smoothed, almost indistinct steps. Also the new species is similar to *U. jaculata* Rondani (Italy and Greece), sharing similar aculeus apex and host plants of the genus *Centaurea*, differing in the subbasal crossband strongly reduced to a darkening near bm cell (distinct and reaching R₁ in *U. jaculata*).

All the compared species are associated with different host plants: *U. campestris, U. sachalinensis* and *U. stylata* are associated with *Cirsium* spp., *Carduus* spp. and *Galactites tomentosa*; *U. tsoii* and *U. vera* with *Serratula* spp. and *U. jaculata* with *Centaurea solstitialis* (Korneyev and White 1999, 2000) whereas *U. merzi* sp. n. is associated with *Centaurea behen*.

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RESEARCH ARTICLE



First report of the genus *Kisaura* Ross (Trichoptera, Philopotamidae) from India with the description of six new species

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Abstract

The genus *Kisaura* Ross, 1956 (Trichoptera, Philopotamidae, Philopotaminae) is reported from India the first time. Six new species are described and illustrated: *K. elongata* **sp. n.**, *K. eloct* **sp. n.**, *K. clavata* **sp. n.**, *K. gangtokensis* **sp. n.**, *K. truncata* **sp. n.**, all from Gangtok (Sikkim) and *K. himachalica* **sp. n.** from Barot (Himachal Pradesh). Male genitalia of this genus are distinguishable from those of other genera of the family by the pair of long lateral processes of tergum X, the well-developed mesoventral plates between two segments of the inferior appendages, and by the brush-like row of dark setae on the inner surfaces of the terminal segments (harpago) of the inferior appendages.

Keywords

Trichoptera, Philopotamidae, Philopotaminae, systematic, *Kisaura, Sortosa*, new species, Oriental Region, India, male genitalia

Introduction

Kisaura was established by Ross (1956) as a subgenus of *Sortosa* Navás (1918), based on *Sortosa obrussa* Ross (1956) as its type species. It was considered a subgenus of

Dolophilodes Ulmer (1909) by Kuhara (1999), based on the precedence of the generic name *Dolophilodes* over that of *Sortosa* as pointed out by Ulmer (1957). *Sortosa* Navás (1918) is not a synonym of *Dolophilodes* Ulmer (1909) as indicated by Schmid (1964) by writing "*Dolophilodes* (*Sortosa*)." *Kisaura* was subsequently raised to the status of an independent genus by Sun and Malicky (2002), based on the typical and distinct male genitalic structures. *Kisaura* is thought to have originated in the Oriental Region where the greatest number and most primitive of its species occur (Ross 1956).

This genus is currently represented by 42 species, mostly confined to the Oriental and Palaearctic Regions (Morse 2011). Twenty-seven species (more than ½) in the genus occur in the Oriental Region, many of which were transferred from *Dolophilodes* Ulmer. Most of the recent additions to *Kisaura* were made by Malicky and co-workers (Malicky 1993a, 1993b, Malicky and Chantaramongkol 1993a, 1993b, Malicky1995, Sun and Malicky 2002, Malicky 2007, Malicky 2009), who added 17 new species to this genus from Thailand, Bhutan, China, and Vietnam. The genus *Kisaura* is reported from India for the first time here, with the description of six new species.

Ross 1956 divided the species of *Kisaura* into two major groups, a primitive one from Myanmar with species in which the basal segment (coxopodite) of inferior appendage is longer than the apical segment (harpago), and another more specialized group from Southeast China, Japan, and Russian Far East in which the basal segment of the inferior appendage is shorter than the apical segment. Based on current diversity, there is inconsistency in the species groups originally defined by Ross (1956), presumably because they were based on very few known species. In addition to the characters specified by Ross (1956), species can be distinguished also by the variation in the shape and length of lateral spiniform processes of tergum X and the black comb-like setae on apical segment of inferior appendage. The biology of the species in the genus is poorly known (Hur and Morse 2006). A more thorough study and complete diagnosis of all previously known and newly described species will be required, along with a study of the larval stages and a well supported phylogenetic analysis, to understand the origin and dispersal of *Kisaura* to other parts of Eastern Asia.

Materials and methods

Adults were collected by light traps (mercury vapour bulb and UV) placed near the edge of high altitude streams of the Himalayan belt of India. The species described here were mainly collected from Gangtok (Sikkim) in very dense humid forests at altitudes ranging from 1800 m to 2100 m. One species was collected from Himachal Pradesh. The specimens were preserved in 70% ethyl alcohol with a drop of glycerol added. Pertinent collection and locality data were recorded.

For species level identification it is essential to observe the lateral processes of the Xth tergite which are hidden below the preanal appendages in lateral view and are also not clearly visible even in dorsal view. For accomplishing this, the male genitalia
were removed from the specimens and put in 10% KOH solution overnight. After this treatment the genitalia were put in 80% ethyl alcohol with a drop of glycerol and observed for morphological characters. The drawings of various aspects were done with the aid of zoom stereoscopic binocular microscope (with maximum magnification of 120×) fitted with an ocular grid in one eye piece. The final drawings were rendered in black ink. The illustrations were scanned at 600 dpi grayscale, and mounted onto plates in Adobe© Photoshop© 7.0. The genitalic terminology corresponds to Ross (1956) and Hur and Morse (2006). Type specimens are deposited in the Punjabi University Patiala Museum (PUPM), Department of Zoology and Environmental Sciences, Punjabi University, Patiala. Additional material examined in also listed, but these specimens were damaged and considered of poor quality to include as paratypes.

Systematics

Genus Kisaura Ross, 1956 http://species-id.net/wiki/Kisaura

Type species. Sortosa obrussa Ross 1956: 57 (original designation).

Description. Spurs: 2, 4, 4; wings with primitive venation except fork I variable: it may be near or considerably beyond sectorial cross vein s, or R_2 may be atrophied and 2A of forewing incomplete (Ross 1956). Male genitalia with pair of lateral processes between Xth tergite and preanal appendages; inferior appendages simple, with mesoventral plate developed between two segments; apical segment of inferior appendage with diagnostic longitudinal row of spine-like setae on its inside mesal surface.

Distribution. Oriental and Palaearctic Regions.

Diagnosis. The genus *Kisaura* can be easily separated from *Dolophilodes* Ulmer by a pair of elongate and sclerotized lateral processes of segment X and by the brush-like row of dark setae on the inner surface of apical segment of the inferior appendages which are lacking in *Dolophilodes*.

Species descriptions

Kisaura clavata Pandher & Saini, sp. n. urn:lsid:zoobank.org:act:CA276C7B-013B-4C7C-A428-961110C17518 http://species-id.net/wiki/Kisaura_clavata Figs 1–5

Description. In superficial comparison, this species seems somewhat allied to *K. mo-selyi* Kimmins, 1955 from North East Myanmar, but the combination of characters, including segment VIII with a deep median V-shaped indentation, clavate preanal ap-



Figures 1–5. *Kisaura clavata* sp. n. **I** Male genitalia, lateral **2** Inferior appendage, dorsal **3** Tergite VIII, dorsal **4** Preanal appendage, dorsal **5** Male genitalia, dorsal. Abbreviations: VIII, IX, X = abdominal segments VIII, IX, and X, respectively

pendages, and basal part of the apical segment of the inferior appendage with a stout spine like setae, sets *K. clavata* sp. n. apart from *K. moselyi*.

Adult. Color in alcohol entirely fulvous except mesoscutellum flavid; maxillary palp with pale annulations at the joints; head with golden and fulvous pubescence; antenna moderately long, scape:pedicel ratio = 1.66: 1; maxillary palp segments ratios 1: 2: 3: 4: 5 = 1: 2.4: 2.6 : 2.6: 5.3; labial palp segments ratios 1: 2: 3 = 1: 1.75: 3.1. Length of forewing 7 mm, sprinkled with white patches along the posterior margin and covered with moderate, sparse and brownish setae, pterostigma not prominent in both wings; discoidal cell very small in forewing; fork I absent in both wing.

Male Genitalia (Figs 1–5). Sternum VIII without ventral process; tergum VIII with deep median V-shaped zone of spines. Segment IX rather short, sclerotized, quadrate with median prominence on anterolateral side, posterolaterally with shallow, rounded excision, apically setose. Inferior appendages two-segmented; basal segment (coxopodite) little longer and stouter than apical segment (harpago), narrow at its base, broad and rounded towards apex, in lateral view, with two lobes, inferior lobe with tuft of long setae; apical segment with curved row of dark brush-like setae and stout spine-like setae at base on mesal surface in dorsal view. Tergum X membranous, extending beyond apex of segment IX, at base on each side arises blade-like, lateral spiniform process, with articulated spinelet at apex, recurved cephalad and then caudoventrad, reaching up to apex of segment IX. Preanal appendage as long as spiniform process of tergum X and clavate at apex. Phallus membranous, intimately surrounded by tergum X.

Holotype male: INDIA: Sikkim: Gangtok: 27°36'0"N, 88°37'0"E, 1700 m, 25.v.1999, M. Saini, (PUPM).

Paratypes. same data as holotype, 2 males (PUPM).

Additional material. INDIA: Sikkim: Gangtok: 27°36'0"N, 88°37'0"E, 1,700m, 15.v.2011, Parey, 1 male (PUPM).

Distribution. India: Sikkim.

Etymology. Because of the club-like, (i.e., clavate) apex of preanal appendage, this species has been named *clavata*.

Kisaura elongata Pandher & Saini, sp. n.

urn:lsid:zoobank.org:act:B6A4576F-56E1-4811-A60F-031FF8F3535C http://species-id.net/wiki/Kisaura_elongata Figs 6–10

Description. This species is allied to *Kisaura sura* Malicky & Chantaramongkol, 1993 and *K. consagia* Malicky & Chantaramongkol, 1993, both reported from Thailand, because of the presence of bilobed preanal appendages. However, *K. elongata* is sufficiently distinct from these two species as the two lobes are unequal, i.e., one lobe of the preanal appendage is long while the second is very small, and also in having elongate



Figures 6–10. *Kisaura elongata* sp. n. 6 Male genitalia, lateral 7 Inferior appendage, dorsal 8 Tergite VIII, dorsal 9 Preanal appendages, dorsal 10 Male genitalia, dorsal

and inwardly recurved lateral spiniform process of tergum X. In *K. sura* and *K. consagia* the two lobes of preanal appendage are almost equal and the lateral spiniform process of tergum X is not inwardly recurved.

Adult. Color in alcohol entirely fulvous excepting antenna with dark brown annulation at joints; body covered with moderate, sparse and fuscous setae excepting head with nigrescent pubescence. Antenna almost equal to length of forewing; scape:pedicel ratio = 1: 0.58; maxillary palp segments ratios 1: 2: 3: 4: 5 = 1: 2: 2.6: 1.6: 4.3 and labial palps segments ratios 1: 2: 3 = 1: 0.8: 1.8. Length of forewing 6 mm, sprinkled with yellow patches, in both wings pterostigma not prominent; discoidal cell almost triangular; apical fork I present in both wings, in forewing positioned considerably beyond sectorial cross-vein s.

Male Genitalia (Figs 6–10). Sternum VIII without ventral process, tergum VIII not indented, posterior margin widely excised with V-shaped mark dorsally. Segment IX sclerotized, short, anterolaterally much produced, posterodorsal corner rounded. Inferior appendages long and stout, basal segment (coxopodite) as long as apical segment (harpago), basal segment with small lobe on proximal end of superior side in lateral view, and distally bilobed with inferior lobe bearing long tuft of setae; apical segment curved upright and pointed apically in lateral view, with curved row of black comb-like setae on inner surface in dorsal view. Tergum X membranous, with long inwardly recurved or bent backward, broad ribbon-like lateral spiniform processes which are pointed apically. Preanal appendages long, with two lobes of unequal size, larger lobe thumb-like while smaller wart-like in lateral view. Phallus membranous, surrounded by tergum X.

Holotype male: INDIA: Sikkim: Gangtok: 27°36'0"N, 88°37'0"E, 1700 m, 25.v.1999, M. Saini (PUPM).

Additional material. India: Sikkim: Rongli: 27°13'0"N, 88°42'0"E, 900 m, 1.v.2009, Pandher and Parey, 2 males (PUPM).

Distribution. India: Sikkim.

Etymology. This species name pertains to excessively long lateral spiniform process of segment X of male genitalia.

Kisaura eloct Pandher & Saini, sp. n.

urn:lsid:zoobank.org:act:BE5FE988-64E4-4098-836F-34A49EAB5550 http://species-id.net/wiki/Kisaura_eloct Figs 11–15

Description. This species is close to *Kisaura longispina* Kimmins 1955 in having a very long lateral spiniform process of tergum X. It also resembles *K. intermedia* Kimmins 1955 in the shape of the preanal appendages. In *K. eloct* sp.n. segment IX is much shorter, but wider and the basal segment (coxopodite) of the inferior appendage is long, narrow basally, and broad and truncate apically in lateral view.



Figures 11–15. *Kisaura eloct* sp. n. 11 Male genitalia, lateral 12 Inferior appendage, dorsal 13 Tergite VIII, dorsal 14 Preanal appendage, dorsal 15 Male genitalia, dorsal

In *K. longispina* segment X is long and somewhat quadrate posterodorsally, and the basal segment of the inferior appendage is small, but uniformly wide in lateral view. *Kisaura intermedia* differs in having the lateral spiniform process of tergum X narrow basally, broad towards its apex, and pointed apically, and also in having the superior side of the basal segment of the inferior appendage convex in lateral view whereas in *Kisaura eloct* sp. n. the lateral spiniform process of tergum X is almost uniformly wide except with a pointed apex and the basal segment is without any convexity on its superior side in lateral view.

Adult. Color in alcohol entirely fulvous, except mesoscutellum flavid; maxillary palps with pale annulations at their joints. Body covered with dense and fuscous setae except head with fulvous pubescence. Antenna long, scape:pedicel ratio= 1: 0.6; maxillary palp segments ratios 1: 2: 3: 4: 5 = 1: 1.5: 2: 1.2: 2.5 and labial palp segments ratios 1: 2: 3 = 1: 0.75: 1.75. Length of forewing 7 mm; forewing with long discoidal cell; apical fork I absent in both fore- and hind wings.

Male Genitalia (Figs 11–15). Ventral process absent on sternum VIII, tergum VIII with diamond-shaped lobe medially on dorsal surface, with two small incurved depressions on posterior margin. Segment IX sclerotized, long, trapezoidal, stout in lateral view, with posterodorsal margin slightly setose and postventrally produced apically; anterior margin covered partially by sternum VIII. Inferior appendage with basal segment (coxopodite) stout, about as long as apical, narrow at base, broad and bilobed apically in lateral view, inferior lobe with long tuft of setae; apical segment (harpago) curved upwards, with curved row of strong black brush-like setae on inner surface in dorsal view, pointed apically. Tergum X short, narrow, membranous, with pair of long lateral spiniform processes placed medially, extending almost to middle of apical segment of inferior appendage in dorsal view. Preanal appendages narrow, finger-like, scarcely dilated apically, slightly longer than segment IX in lateral view. Phallus tubular, membranous, apparently fused dorsally with membranous tergum X.

Holotype male: INDIA: Sikkim: Gangtok: 27°36'0"N, 88°37'0"E, 1700 m, 25.v.1999, M. Saini, (PUPM).

Paratypes. same data as holotype, 2 males (PUPM).

Distribution. India: Sikkim.

Etymology. This species name is based on an arbitrary combination of letters (i.e., Entomology Laboratory of Caddisfly Taxonomy - "*eloct*").

Kisaura gangtokensis Pandher & Saini, sp. n. urn:lsid:zoobank.org:act:38468B63-43EF-4FB9-B32C-072DF504A657 http://species-id.net/wiki/Kisaura_gangtokensis Figs 16–9

Description. This species is close to *Kisaura rossi* Kimmins, 1955 from North East Myanmar, based on similarities in the shape of the preanal appendages in dorsal view. In *K. rossi* segment IX is very short, quadrate in lateral view and the preanal appendages are



Figures 16–19. *Kisaura gangtokensis* sp. n. 16 Male genitalia, lateral 17 Tergite VIII, dorsal 18 Preanal appendage, dorsal 19 Male genitalia, dorsal.

not twisted at mid- length, but preapically twisted. In *K. gangtokensis* sp. n. segment IX is long, trapezoidal in lateral view, and the preanal appendages are twisted at mid length.

Adult. Color in alcohol entirely fulvous and covered with moderate, fuscous setae excepting head with golden and fulvous pubescence. Antenna long, scape: pedicel ratio = 1: 0.5; maxillary palp segments ratios 1: 2: 3: 4: 5 = 1: 1.3: 2.6: 2.1: 5; labial palp segments ratios 1: 2: 3= 1: 1.5: 2. Length of forewing 7.5 mm; discoidal cell small, apical fork I lacking in both wings.

Male genitalia (Figs 16–19). Sternum VIII without ventral process; tergum VIII roundly produced dorsomesally. Segment IX sclerotized, long, trapezoidal in lateral view, anterodorsally pointed at apex, posteroventrally much produced. Inferior appendages short, stout and two-segmented, both segments subequal in length, basal segment narrow basally, with convex superior and inferior margins, apically bilobed, inferior lobe with long tuft of setae; apical segment vertically upright, its superior margin almost straight, inferior margin convex, rounded apically, mesally with black brush-like setae. Tergum X membranous, intimately surrounding phallus, lateral spiniform process blade-like, long, almost reaching posterodorsal margin of IX in lateral view, with spinelet at apex. Preanal appendagesas long as lateral spiniform process in dorsal view twisted at mid-length, broad and rounded apically. Phallus membranous, fused dorsally with tergum X.

Holotype male: INDIA: Sikkim: Gangtok: 27°36'0"N, 88°37'0"E, 1700 m, 25.v.1999, M. Saini, (PUPM).

Paratype. same data as holotype, 1 male (PUPM). **Distribution.** India: Sikkim.

Etymology. This species is named after the type locality, Gangtok.

Kisaura himachalica Pandher & Saini, sp. n.

urn:lsid:zoobank.org:act:995FA64D-0F65-43D9-BF2F-A679AF9649D7 http://species-id.net/wiki/Kisaura_himachalica Figs 20–24

Description. In superficial comparison *Kisaura himachalica* sp. n. is allied to *K. rossi* Kimmins and *K. cina* Malicky & Chantaramongkol, 1993. However *K. himachalica* is distinct as segment IX is long, the basal segment of the inferior appendage is almost oval in shape, and the preanal appendage is knob-like in dorsal view. In *K. rossi* segment IX is small, the basal segment of the inferior appendage is quadrate, and thr preanal appendage is twisted preapically and not knob-shaped. The new species also differs in the shape of segment IX, which is broader, and the preanal appendages, which are bilobed and clavate in dorsal view in *K. cina*.

Adult. Color in alcohol uniformly fulvous and body covered with inconspicuous, sparse and fulvous setae excepting mesoscutellum where is golden. Antenna long, scape:pedicel ratio = 1: 0.7; maxillary palp segments ratios 1: 2: 3: 4: 5 = 1: 1.5: 2.5: 2: 5; labial palp segments ratios 1: 2: 3= 1:1.2: 1.75. Forewing with golden



Figures 20–24. *Kisaura himachalica* sp. n. 20 Male genitalia, lateral 21 Inferior appendage, dorsal 22 Tergite VIII, dorsal 23 Preanal appendage, dorsal 24 Male genitalia, dorsal

irrorations; length of forewing 7 mm, dicoidal cell small, apical fork I lacking in both wings.

Male genitalia (Figs 20–24). Ventral process absent on sternum VIII; tergum VIII with apical margin produced into two small triangular extensions, separated by shallow excision, area between the two lobes slightly elevated. Segment IX roughly quadrate, anterodorsally pointed, anteromedially with excision, posterodorsally rounded. Inferior appendage with basal segment equal in length to apical segment but stouter than the later, roughly oval in shape, superior and inferior sides convex, divided into two lobes, inferior one with path of long setae, apical segment slender, incurved, with curved row of stout black comb-like setae on inner surface in dorsal view. Tergum X membranous with pair of sword-like lateral spiniform process, about as long as segment IX. Preanal appendage as long as segment IX, clavate in lateral view, apically bulbous and setose in dorsal view. Phallus tubular, membranous, apparently surrounded by Tergum X.

Holotype male: Himachal Pradesh: Barot: 32°17′0″N, 75°77′0″E, 2300 m, 22.v.1998, M. Saini, (PUPM).

Distribution. India, Himachal Pradesh.

Etymology. This species is named after the state in which the holotype was found, Himachal Pradesh.

Kisaura truncata Pandher & Saini, sp. n.

urn:lsid:zoobank.org:act:35D84A5D-ADFC-4BD4-AE82-865821D1DC42 http://species-id.net/wiki/Kisaura_truncata Figs 25–29

Description. This species resembles *K. gangtokensis* sp. n., based on the ratio of the lengths of the lateral spiniform process and preanal appendages, but differs in several aspects: the preanal appendages are long and slender, segment IX is broad anterolaterally and without rounded lobes at the posterolateral end, and the basal segment of the inferior appendage is long and the apical segment is directed upright and truncate apically.

Adult. Color in alcohol entirely fulvous excepting fuscous mesoscutellum. Antenna almost $1.2 \times longer$ than forewing, scape:pedicel ratio = 1: 0.46; maxillary palp segments ratios 1: 2: 3: 4: 5= 1: 2.6: 3.3: 2.6: 5.6; labial palp segments ratios 1: 2: 3= 1: 1: 2. Forewing with white spots and covered with moderate and short setae; length of forewing 9 mm; discoidal cell small, triangular; apical fork I absent in both wings.

Male genitalia (Figs 25–29). Sternite VIII without ventral process, tergite VIII indented dorsomesally, with rounded median lobe. Segment IX long and broad, roughly pentagonal, anterodorsally with pointed median prominence in lateral view. Inferior appendage two-segmented, basal segment convex on lateral margin, broader, bilobed at apex with short inferior lobe and bearing tuft of long setae; apical segment nearly as long as basal segment, narrower, with curved row of spines, rounded at apex in dorsal



Figures 25–29. *Kisaura truncata* sp. n. 25 Male genitalia, lateral 26 Inferior appendage, dorsal 27 Tergite VIII, dorsal 28 Preanal appendage, dorsal 29 Male genitalia, dorsal.

view. Tergite X membranous, almost reaching apex of basal segment of inferior appendage, with lateral spiniform processes extending beyond apical margin of segment IX, with spinelet at apex. Preanal appendage almost equal to lateral spiniform process, rounded apically in lateral view. Phallus membranous and fused with tergite X.

Holotype male: INDIA: Sikkim: Gangtok: 27°36'0"N, 88°37'0"E, 1700 m, 25.v.1999, M.Saini, (PUPM).

Additional material. INDIA: Sikkim: Singhik: 27°31'0"N, 88°34'0"E, 1900 m, 14.ix.2009, Pandher, 2 males (PUPM).

Distribution. India: Sikkim.

Etymology. This species is named for the truncate posterolateral margin of segment IX.

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DATA PAPER



Project Description: DNA Barcodes of Bird Species in the National Museum of Natural History, Smithsonian Institution, USA

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Abstract

The Division of Birds, National Museum of Natural History, Smithsonian Institution in Washington, DC, has obtained and released DNA barcodes for 2,808 frozen tissue samples. Of the 1,403 species represented by these samples, 1,147 species have not been barcoded previously. This data release increases the number of bird species with standard barcodes by 91%. These records meet the data standard of the Consortium for the Barcode of Life and they have the reserved keyword BARCODE in GenBank. The data are now available on GenBank and the Barcode of Life Data Systems.

Keywords

DNA barcoding, GenBank, BOLD, genomics

Introduction

The Division of Birds, National Museum of Natural History of the Smithsonian Institution (USNM), has released approximately 2800 DNA barcode data records into the public domain through GenBank and the Barcode of Life Data Systems (BOLD). These records were derived from the Division's extensive collection of frozen tissues that are linked to voucher specimens in the Museum. The data adhere to the DNA barcode data standard (Consortium for the Barcode of Life 2005) and accordingly they have been labeled by GenBank with the reserved keyword 'BARCODE'. This new public dataset adds 1,147 newly barcoded species to the 1,259 species in GenBank that meet the BARCODE data standard. This increase of 91% in the DNA reference library for birds serves as a model for how frozen tissue collections in major biorepositories can be digitized through barcoding and made more accessible to the research community.

This 'Project Description' has been submitted as part of a policy of rapid data release for genomic data known as the Fort Lauderdale Principles (Wellcome Trust 2003). These principles described a system of shared responsibility that would be needed to create incentives to construct, publish and use large public genome datasets such as that of the Human Genome Project. The Principles have not been implemented or even discussed to any extent in the taxonomic community. Stated briefly, the Principles:

- Urge funding agencies to require the early and rapid release of large genomic datasets that represent research infrastructure with significant potential for use by the research community beyond the data producers;
- Encourage data producers to publish Project Descriptions such as this one to state their intended use of a newly released dataset within a stated, reasonable period of time;
- Propose that researchers should be expected to refrain from using the data for purposes and interval stated in the Project Description, but should be free to use the data for other applications with proper citation of the Project Description or other references to the dataset.

A full description of the dataset is in preparation with the goal of publication as a 'data release paper' in ZooKeys before June 2012, in accordance with guidelines issued by ZooKeys (Penev et al. 2011) and CBOL (Consortium for the Barcode of Life 2008). The data release paper will present summary statistics on the variability within and among species of the DNA barcode region (648 nucleotides representing approximately the 5' half of the mitochondrial cytochrome c oxidase I gene). The paper will describe the geographic range covered by samples, numbers of samples analyzed per species, and the methods used in the cryo-collection, laboratory, and post-sequencing data processing. The impact of barcoding on collection management and curation will also be addressed in the data release paper.

The data release paper will also discuss the relationship between clusters based on barcode data variability and taxonomic names attached to the voucher specimens from which the DNA barcodes were derived. The taxonomic identifications in the GenBank records have undergone screening relative to each other and there are some uncertainties associated with some species-level determinations. These will be investigated more carefully by re-examining voucher specimens and analysis of the barcode sequences relative to other public barcode records. All species determinations will be resolved by the time of publication of the full data release paper.

Data resources

Data are deposited in GenBank under accession numbers JQ173884-JQ176686 (http://www.ncbi.nlm.nih.gov/nuccore?term=JQ173884:JQ176686[accn]). The full dataset is also available on BOLD at http://www.barcodinglife.org as project name 'USNMY' under 'Published Projects'.

Contents of the dataset

The dataset represents samples from 27 countries (Argentina, Australia, Botswana, Brazil, Gabon, Greece, Guyana, Iceland, Johnston Atoll, Mariana Islands, Mexico, Mongolia, Myanmar, Pakistan, Panama, Papua New Guinea, Philippines, Puerto Rico, Russia, South Korea, St. Vincent, Swaziland, Sweden, United Kingdom, United States, Uruguay, and the former Soviet Union).

Each GenBank record in the dataset carries the BARCODE keyword that indicates compliance with CBOL's barcode data standard. Accordingly, each record includes the following data elements required by the standard:

- The name of the approved BARCODE region (COI in this case).
- A species level identification. All names can be found in the Integrated Taxonomic Information System (ITIS 2011) or Clements (2007).
- A structured identifier of the voucher specimen using the Darwin Core triplet consisting of institutional acronym, collection code, and specimen ID number.
- Country of origin.
- Forward and reverse primer sequences.
- A DNA sequence based on forward and reverse sequencing reactions with at least 75% coverage of the standard barcode region as specified in

In addition, many records include the following data fields that are strongly recommended by the standard:

- Latitude and longitude of collecting locality
- Date of collection
- Name of collector
- Name of identifier

Use of early release data

The authors invite the research community to examine and analyze the data in their current form with the following understandings:

- As with all data released on GenBank, the National Center for Biotechnology Information places no restriction on their use or distribution.
- The authors intend to publish a descriptive paper summarizing the dataset and its implications for bird barcoding and any taxonomic issues arising from the data. Publication of this data release paper is anticipated by 1 June 2012. In accordance with the Fort Lauderdale Principles (Welcome Trust 2011), the authors ask the community to respect our intent to publish on these topics and not to submit manuscripts for this purpose based on this dataset.
- Use of this dataset for purposes other than those described above are welcome and encouraged, contingent on proper citation of this publication.
- The authors invite members of the community to examine the data and test their accuracy relative to other datasets. We welcome your comments, suggestions and corrections. BOLD 3.0 includes the capability to submit annotations to data submitters and we encourage readers to use this new system to submit observations on this dataset.
- The species determinations are not yet final. Some of the species identification may be change by the time of publication of the data release paper (anticipated by 1 June 2012).

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