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Honorary Membership to Prof. S. C. Stearns

One of the rewarding things about life is the chance to meet someone who makes a difference – who is ready to share knowledge, experience, ideas, advice, and constructive criticism. It is in this spirit of gratefulness, felt not only individually by many of its members, but also as a representative of the scientific community in our country, that the **Swiss Zoological Society awards a honorary membership to Stephen C. Stearns**, Professor at the Department of Ecology and Evolutionary Biology in the Faculty of Arts and Sciences at Yale University.

Stephen C. Stearns was professor of zoology at the University of Basel from 1983 to 2000, when he moved to Yale University, the *alma mater* where he had graduated in 1967, before earning a M.Sc. from the University of Wisconsin and a Ph.D. from the University of British Columbia.

The focus of Prof. Stearns' research interests is life history evolution, which connects ecology and evolutionary biology. His work in the area of life history evolution has substantially contributed to raise scientific awareness for this field ("The Evolution of Life Histories", Oxford 1992). He has most likely been the first organismic biologist in Switzerland to appreciate the importance of the upcoming genomics techniques for evolutionary biology, and to start to use them in his work. His research interests also cover evolutionary medicine ("Evolution in health and disease", Oxford 1998).

During his nearly two decades in Switzerland, Prof. Stearns enormously enriched research and teaching in zoology, well beyond the walls of the atheneum on the Rhine shores. His successful research, his dedication to expose students to the international scientific community - resulting in innovative forms of teaching such as the Guarda seminars, as well as in memorable wine tastings organized by Steve and his wife Beverly at their house in Arlesheim -, and his commitment to promote organismic biology and evolutionary ecology at the national and international level have been exemplary. He founded and has served as the president of the European Society for Evolutionary Biology and the Tropical Biology Association, was founding editor of the Journal of Evolutionary Biology, and has been a vice president of the Society for the Study of Evolution. In Switzerland, Steve has been the driving force in strengthening evolutionary biology. In this spirit the annual meeting of Swiss organismic biologists, now called BIOLOGY, has been invigorated, rejuvenated, becoming thriving and of high academic standards in recent years. He and his students (Jacqui Shykoff in particular) first established Darwin's birthday party in Basel in 1992, an event that has become an essential highlight of the BIOLOGY conferences. Above all, the success of his efforts is reflected by the brilliant academic careers of many of his former collaborators and students, to whom he has been a wise advisor and a source of inspiration. Steve's impact is further witnessed by the fact that his view of teaching and education continues – the Guarda seminars, where Steve always attracted brilliant faculties, have now become an international tool for student education, and this formula has spread from the peaks of Graubünden to those of Valais, where similar workshops are held in the framework of the “3ème cycle romand”. Steve's and his assistants' courses in ecology, evolution and behaviour (EOV) finally changed the life of many young biologists.

Steve's contribution to zoology and evolutionary biology in our country, to our scientific standards and academic performance, to our views and values, has been and continues to be very substantial and a point of reference, and is the gift of a very committed and generous scientist.

Those who attended Darwin's birthday party held during the meeting of the Swiss Zoological Society in 1992 in a castle near Basel will never forget that in those days Darwin himself seemed to have paid us a visit.

Basel, February 2005, The board and general assembly of the Swiss Zoological Society.

REVUE SUISSE DE ZOOLOGIE 112 (2): 313-327; juin 2005

Gammarus species from River Jumahe, China (Crustacea, Amphipoda, Gammaridae)

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Gammarus species from River Jumahe, China (Crustacea, Amphipoda, Gammaridae). - Three *Gammarus* species are reported from River Jumahe. *Gammarus madidus* sp. n. is characterized by antenna 2 with groups of long setae along the anterior and posterior margins, inner ramus of uropod 3 reaching about 40% of length of outer ramus and both rami fringed with long simple setae. *G. lacustris* Sars, 1863 is distinguished by epimeral plates 2 and 3 with sharp posterodistal corners, inner ramus of uropod 3 reaching about 75% of length of outer ramus and both rami armed with plumose setae. *G. nekkensis* Uchida, 1935 differs from congeneric species by pereopod 3 with long curled setae on the posterior margin and inner ramus of uropod 3 reaching 50% of outer ramus. Distribution data of these gammarids are presented.

Keywords: Amphipoda - *Gammarus* - new species - taxonomy - China.

INTRODUCTION

On December 27, 2002, China started its gigantic South-to-North Water Transfer Project, which is expected to take 50 years to complete and will cost 58 billion US dollars. The project involves three canals running 1,300 kilometers across the eastern, middle and western parts of China, linking four major rivers, the Yangtze, Yellow, Huaihe and Haihe River (Anonymous, 2002). This project is thought to be an important infrastructural work for the optimal allocation of water resources in China.

Beijing is one of the target cities of the Middle Line Project within the South-to-North Water Transfer Project. To better understand the ecological effects of this gigantic project, we have investigated the current *Gammarus*-fauna in most water systems around Beijing. In this paper we present a *Gammarus* inventory of the River Jumahe.

River Jumahe, 254 km long, is one of five water systems running through Beijing City. Its source is located in Laiyuan County of Hebei Province and its mid-upper stretch runs through Fangshan District of Beijing, about 100 km away from urban Beijing. In Zhangfang Town it divides into the Rivers South-Jumahe and North-Jumahe, and then runs into the River Daqinghe and further into Bohai Sea.

Manuscript accepted 13.10.2004

Gammarus is among the most species-rich groups of epigean freshwater amphipods (Hou & Li, 2002a, b, 2003a; Hou, Li & Morino, 2002). Our intensive investigation of the *Gammarus* fauna of the River Jumahe began in May 2000, although previous collection is also used in the current study. Collecting was done at possible locality on both sides of the river where we could stop our car. Although most samples taken in 2001-2004 contained no *Gammarus*, we continued our search all along the river. This yielded three amphipod species: *Gammarus lacustris*, *G. nekkensis* and *G. madidus* sp. n., the latter of which is new to science. A detailed description of this new species, as well as the localities of all three species (Map 1) is given.

MATERIAL AND METHODS

Specimens were collected by a net and then preserved in 75% alcohol. For each species three to five specimens of each sex were dissected and appendages were mounted on slides according to the methods described by Holsinger (1967). The drawings were made with the aid of a drawing tube mounted on an Olympus BX-41 compound microscope.

Holotype of the new species is deposited at the Institute of Zoology, Chinese Academy of Sciences (IZCAS), Beijing, China. Additional specimens, including paratypes of the new species are deposited at the same institute and at the Muséum d'histoire naturelle, Geneva (MHNG), Switzerland.

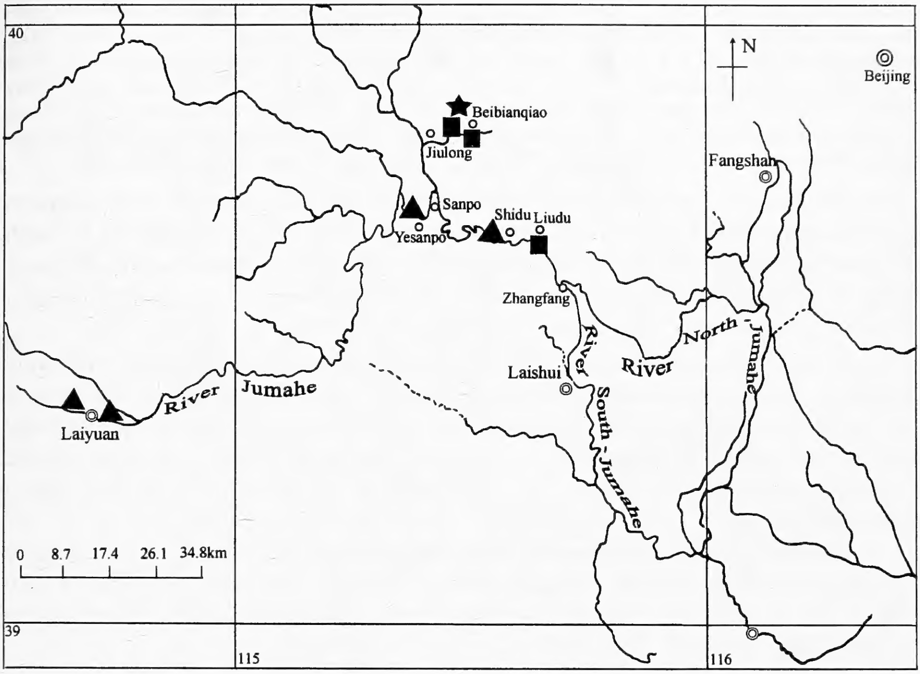
DESCRIPTIONS

Gammarus lacustris Sars, 1863

Gammarus lacustris Sars, 1863: 207; Pinkster, 1972: 166-169, Figs 1-2; Karaman & Pinkster, 1977: 32-34, Fig.12; Barnard & Dai, 1988: 92-94, Figs 1-5.
Gammarus pulex Dahl, 1915: 1-32, Fig. 1.
Gammarus scandinavicus S. Karaman, 1931: 101, Fig. 6a.
Gammarus bolkayi S. Karaman, 1934: 325, Fig.1.
Gammarus (Rivulogammarus) lacustris Schellenberg, 1937: 490, Figs 2-6.
Rivulogammarus lacustris Dussart, 1948: 101-102; Straskraba, 1967: 208.
Gammarus lacustris lacustris Bousfield, 1958: 80.
Gammarus wigrensis Micherdzinski, 1959: 598-599, Fig. 81.

Material examined: 97 ♂♂, 163 ♀♀ and 29 juv. (No. 1), a spring near Shidu (39°38.521′N, 115°38.273′E), Fangshan District, Beijing, altitude 160-190 m, water temperature 6°C, 12 May 2000, collected by Shuqiang Li; 38 ♂♂, 40 ♀♀ and 7 juv. (MHNG, No. 2), same data as No. 1; 46 ♂♂, 87 ♀♀ and 10 juv. (No. 3), same data as No. 1 except for the collecting day 13 May 2000; 75 ♂♂, 108 ♀♀ and 16 juv. (No. 4), same data as No. 3; 23 ♂♂, 28 ♀♀ and 10 juv. (No. 5), spring near Cave Yugudong (39°45.434′N, 115°24.312′ E), Yesanpo Scenic Area, Laishui County, Hebei Province, altitude 340 m, 13 May 2000, collected by Shuqiang Li; 8 ♂♂, 7 ♀♀ and 2 juv. (No. 6), same data as No. 5; 55 ♂♂ and 50 ♀♀, a fishery without name, Laiyuan County (39°18′ N, 114°42′E), Hebei Province, 8 August 1988, collected by Shuqiang Li; 32 ♂♂ and 32 ♀♀, headwaters of River Jumahe, Laiyuan County, Hebei Province, 5 September 2004, collected by Zhong-E Hou and Yucheng Lin.

Diagnosis: Body large and stout; peduncle of antenna 2 with few short setae, calceoli present in male, pereopods 3 and 4 with long straight setae on posterior margins, epimeral plates 2 and 3 with sharp posterodistal corners, inner ramus of uropod 3 reaching about 75% of length of outer ramus, both rami set with plumose setae.



MAP 1

Localities of freshwater amphipods along the River Jumahe. Triangle = *Gammarus lacustris* Sars, 1863; square = *G. nekkensis* Uchida, 1935; pentangle = *G. madidus* sp. n..

Remarks: *G. lacustris* was redescribed by Karaman & Pinkster (1977) based on samples from all over the distribution area, while Barnarad & Dai (1988) redescribed it in detail with material from Yunnan, China. The specimens examined accord well with the figures and description of *G. lacustris* given by Barnard & Dai (1988), except that the bases of pereopods 5-7 is a little more elongate, epimeral plates 2 and 3 without very sharp posterodistal corners and telson with 1 basolateral spine.

Distribution: Karaman & Pinkster (1977) recorded the known distribution of the species as follows: Afghanistan, Austria, Balkan region, Canada, Czech Republic, Denmark, Finland, France, Germany, India, Ireland, Italy, Norway, north Poland, Scotland, Slovakia, Sweden, Switzerland, Spain, Turkey, northern parts of U.S.A. According to the material deposited in IZCAS, *G. lacustris* also occurs in Nepal (Parbat Distr.) and China (Yunnan Province, Hebei Province and Xinjiang Uygur Autonomous Region).

Gammarus nekkensis Uchida, 1935

Gammarus nekkensis Uchida, 1935: 1-6, pls 1-4; Barnard & Barnard, 1983: 463; Karaman, 1984: 147-148; Karaman, 1989: 19-35, Figs 1-5.

Gammarus (Rivulogammarus) nekkensis Barnard & Dai, 1988: 90.

Material examined: 20 ♂♂, 21 ♀♀ and 5 juv., Mt. Baicaopan, Beibianqiao Village, Jiulong Town, Yesanpo Scenic Area, Laishui County, Hebei Province, 13 May 2000, collected by Shuqiang Li; 2 ♂♂ and 2 ♀♀, a sump under Baicaopan Glacier, Yesanpo Scenic Area, glacier water temperature 5.5°C, glacier surface temperature -1.5°C, altitude 1180 m, 13 May 2000, collected by Shuqiang Li; 1 ♂, 2 ♀♀ and 5 juv., a brook on the left hand of the glacier, 13 May 2000, collected by Shuqiang Li; 13 ♂♂, a sump in the middle hill of Mt. Baicaopan, 13 May 2000, collected by Shuqiang Li; 8 ♂♂, 10 ♀♀ and 5 juv. (MHNG), a drinkable water spring near Wanglaopu Village, Liudu Town, Fangshan District, Beijing City, opening about 0.5 square meter, 24 November 2003, collected by Shuqiang Li, Lihong Tu and Kaibaryer Meng.

Diagnosis: Antennae 1 and 2 with few setae, calceoli present in male, merus to propodus of pereopod 3 with long curled setae on posterior margin, pereopods 5-7 with few setae on anterior margin, epimeral plates 1-3 with blunt posterodistal corners, inner ramus of uropod 3 reaching about 50% of length of outer ramus, outer margin of outer ramus in uropod 3 with long simple setae only.

Remarks: *G. nekkensis* was first described on the basis of material from Wuling Mountain, Hebei, then it was reviewed in detail by Karaman (1989) on the basis of specimens from Beijing. The present material accords well with the figures and description given by Karaman (1989), except for a little shorter inner ramus of uropod 3 and long setae on the dorsal surface of the telson. These features may be variable within the species.

Distribution: Known from the River Jumahe and Mt. Wuling. River Jumahe runs along Mts. Taihangshan, which is the west boundary of North China Plain (33.0-40.5°N, 113.0-119.5°E), while Mt. Wuling is the highest peak in Mts. Yanshan, the north boundary of North China Plain.

Gammarus madidus sp. n. Figs 1-6

Material examined: Holotype (IZCAS-I-A0111), ♂, a sump on the middle hill of Mt. Baicaopan, Yesanpo Scenic Area, Laishui County, Hebei Province, 13 May 2000, collected by Shuqiang Li; paratypes, 195 ♂♂, 172 ♀♀ and 13 juv. (IZCAS), 20 ♂♂ and 20 ♀♀ (MHNG), same data as holotype.

Etymology: The latin epithet "madidus" (= wet, moist) refers to the habitat of the species.

Diagnosis: Peduncular articles 4 and 5 with groups of long setae along anterior and posterior margins, calceoli present in male; gnathopods 1 and 2 with straight setae; pereopod 3 with long, weakly curled setae on posterior margin; inner ramus of uropod 3 reaching about 40% of length of outer ramus, both rami fringed with long simple setae.

Description of male holotype: Body length 14.0 mm.

Head (Fig. 1A): Inferior antennal sinus deep, eyes medium in size.

Antenna 1 (Fig. 5A): Peduncular articles 1-3 with length ratio 1: 0.7 : 0.5, bearing some distal setae; flagellum with 30 articles, most articles with aesthestascs, accessory flagellum with 5 articles.

Antenna 2 (Figs 5B, F, G): Peduncular article 4 about as long as article 5, both with 5-7 groups of long setae on inner margin, 6-7 groups of long setae on inner surface and 3-5 groups of long setae on outer margin; flagellum with 15 articles, calceoli present.

Upper lip (Fig. 1C): Convex, with minute setae.

Lower lip (Fig. 1J): Inner lobe absent.

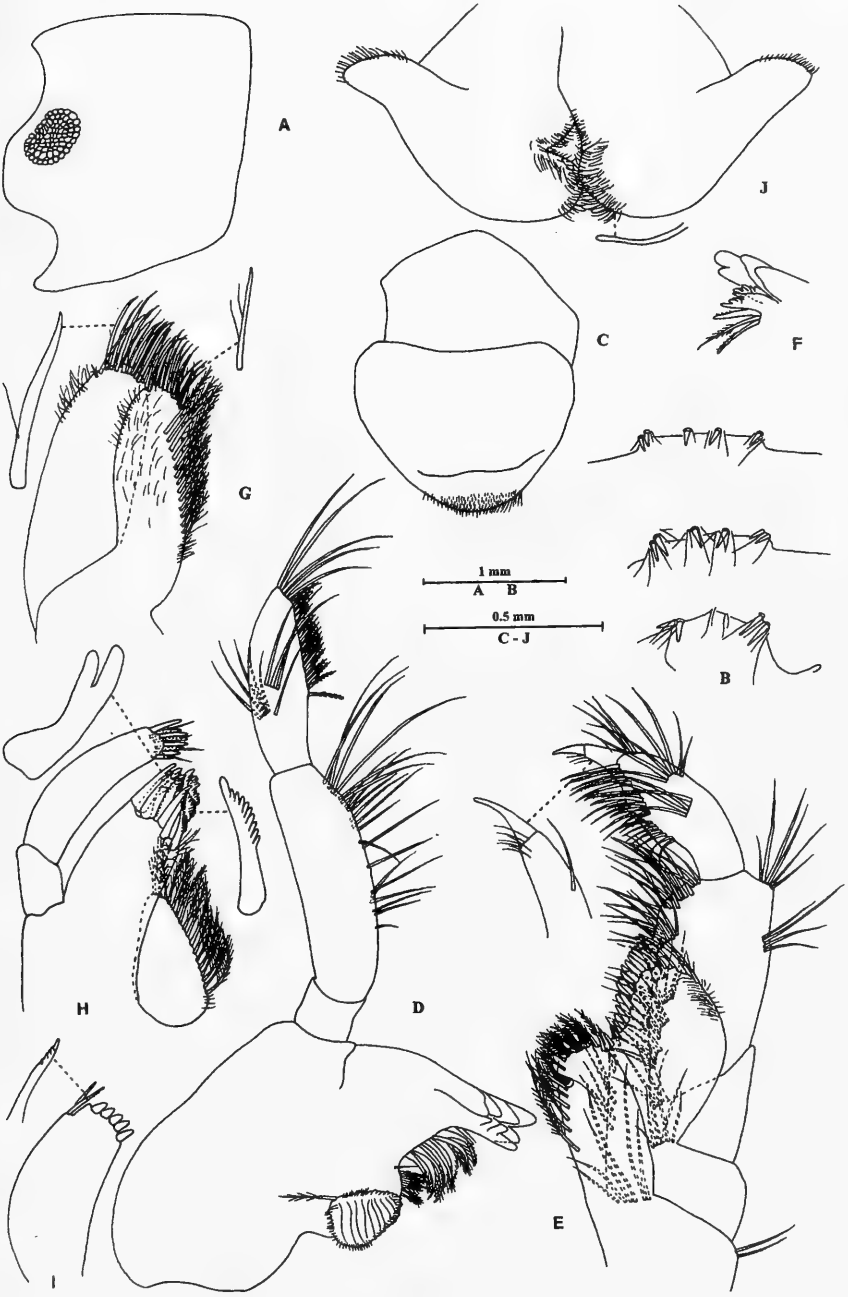


FIG. 1

Gammarus madidus sp. n., holotype, male. A, head; B, urosomites 1-3 (dorsal view); C, upper lip; D, left mandible; E, maxilliped; F, incisor and lacinia mobilis of right mandible; G, maxilla 2; H, left maxilla 1; I, palp of right maxilla 1; J, lower lip.

Mandibles (Figs 1D, F): Left incisor with 5 teeth; lacinia mobilis with 4 dentitions; spine row with 9 plumose setae; molar bearing 1 plumose seta; article 2 of palp bearing 21 stiff setae, article 3 about 75% of length of article 2, bearing a group of 5 A-setae on outer surface, 4 B-setae on inner surface, a row of plumose D-setae and 5 long E-setae. Right incisor with 4 teeth, lacinia mobilis bifurcate, each with crenulations at edge.

Maxilla 1 (Figs 1H, I): Asymmetrical, inner margin of inner plate bearing several setules basally and 17 plumose setae evenly distributed between base and apex; outer plate bearing 11 serrated spines; palp with 2 articles, left second article falcate, bearing 8 slender spines apically accompanied by 4 apico-facial setae; right second article bearing 5 blunt spines associated with 2 stiff setae.

Maxilla 2 (Fig. 1G): Inner plate bearing a diagonal row of 15 plumose setae on inner margin, some pubescent setae on outer margin and many stiff setae apically; outer plate with long stiff setae apically and some setules on outer margin.

Maxilliped (Fig. 1E): Inner plate bearing 1 subapical spine and 3 apical blunt spines; outer plate with row of 16 blade spines and 4 pectinate setae; palp with 4 articles.

Coxal plates: Coxal plate 1 (Fig. 2A) weakly dilated distally, bearing 3 setules on anteroventral corner and 2 setules on posteroventral corner; coxal plates 2 and 3 subrectangular (Figs 2B, 3B), bearing 2 setules on anteroventral corner and 1 setule on posteroventral corner; coxal plate 4 excavated on posterior margin (Fig. 3A), bearing 2 setules on anteroventral corner and 5 setules on posterior margin; coxal plates 5 and 6 with small anterior lobe (Figs 4A, B), bearing 2 setules on posterior margins; coxal plate 7 shallow (Fig. 4C), bearing 4 setules on posterior margin.

Coxal gills present on gnathopod 2 and pereopods 3-7 (Figs 2B, 3A, B, 4A-C).

Gnathopod 1 (Figs 2A, C): Basis bearing long setae on antero-proximal and posterior margin; carpus about 75% of length of propodus, densely setose, with long setae on posterior margin; propodus ovate, palm oblique, bearing 1 palmar medial spine, 4 pairs of spines and 1 spine on posterior margin and 6 spines on inner surface, these associated with groups of long, naked setae on posterior margin; dactylus with 1 seta on outer margin and 2 setules at hinge of nail.

Gnathopod 2 (Figs 2B, D): Basis similar to that of gnathopod 1; carpus reaching about 75% of length of propodus; propodus subrectangular, palm weakly oblique, bearing 1 medial palmar spine, 4 spines on inner posterodistal corner and 2 spines on outer posterodistal corner, these associated with groups of setae on posterior margin; dactylus bearing 1 seta on outer margin and 2 setules at hinge of nail.

Pereopod 3 (Figs 3B, C): Basis with groups of long setae on posterior margin; merus to propodus densely set with long, weakly curled setae on posterior margins, carpus and propodus accompanied by 4-5 spines; dactylus bearing 1 plumose seta on outer margin and 2 setae at hinge of nail.

Pereopod 4 (Figs 3A, D) shorter than pereopod 3; basis with long setae on posterior margin; merus with 5 groups of long setae on posterior margin; carpus bearing 2-3-2-1 spines accompanied by long setae on posterior margin; propodus bearing 2-1-1-1 spines accompanied by some long setae on posterior margin; dactylus bearing 1 plumose seta on outer margin and 2 setae at hinge of nail.

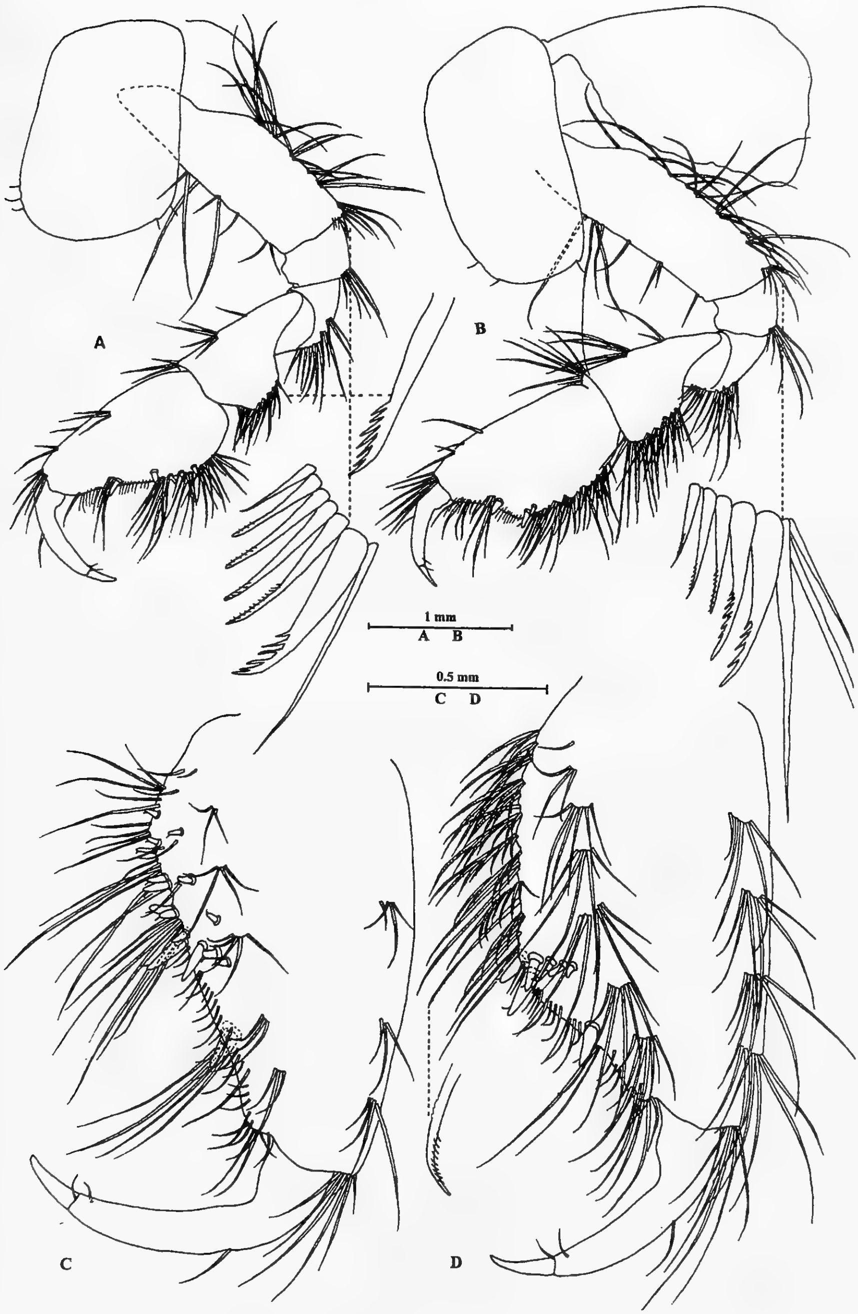


FIG. 2

Gammarus madidus sp. n., holotype, male. A, gnathopod 1; B, gnathopod 2; C, propodus of gnathopod 1; D, propodus of gnathopod 2.

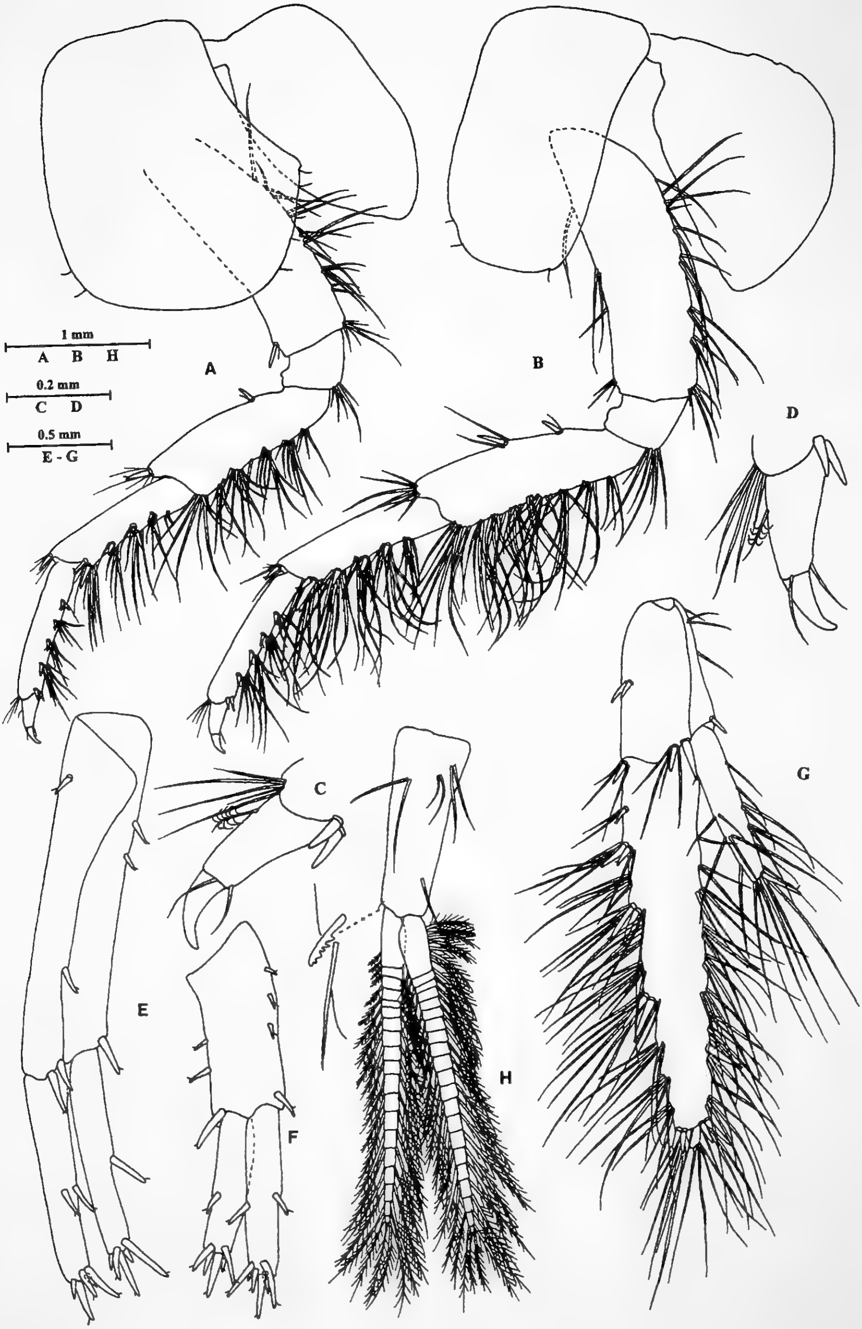


FIG. 3

Gammarus madidus sp. n., holotype, male. A, pereopod 4; B, pereopod 3; C, dactylus of pereopod 3; D, dactylus of pereopod 4; E, uropod 1; F, uropod 2; G, uropod 3; H, pleopod 1.

Pereopod 5 (Figs 4A, D): Basis with almost straight posterior margin, bearing 5 long setae and 5 single short spines on anterior margin, a row of 7 setules on posterior margin; merus bearing 3 groups of spines accompanied by short setae on anterior margin and 3 spines on posterior margin; carpus bearing 4 groups of spines associated with short setae on anterior margin and 3 pairs of spines on posterior margin; propodus bearing 5 groups of spines on medial surface, some setae and 1 spine on posterior margin; dactylus bearing 1 plumose seta on outer margin and 2 stiff setae at hinge of nail.

Pereopod 6 (Figs 4B, E) longer than pereopod 5, basis elongate, attenuated distally, bearing a group of 4 long setae and 5 single spines on anterior margin and a row of 11 setules on posterior margin; merus and carpus bearing 3-4 groups of spines accompanied by a few short setae on anterior margin and 2-3 groups of spines on posterior margin; propodus bearing 4 groups of spines on medial surface, 1 spine on posterior margin; dactylus similar to that of pereopod 5.

Pereopod 7 (Figs 4C, F) similar to pereopod 6, basis weakly rounded on proximal posterior margin, inner surface bearing 1 spine accompanied by 3 setae on posterodistal corner.

Epimeral plates: Plates 1-3 progressively acute on posterodistal corners, bearing 3-5 setules on posterior margins; plate 1 (Fig. 5C) bearing 11 long setae on anteroventral corner associated with 1 spine; plate 2 (Fig. 5D) with nearly straight posterior margin, bearing 1 setule and a pair of spines on ventral margin; plate 3 (Fig. 5E) bearing 2 setae on anterior margin and 3 spines on ventral margin.

Pleopods (Fig. 3H): Pleopods 1-3 subequal, peduncle bearing 1-2 retinacula on anterodistal corner and some long setae on dorsal surface; outer ramus a little shorter than inner ramus, both rami armed with plumose setae.

Urosomites 1-3 dorsally flat (Fig. 1B), urosomite 1 bearing 2-1-1-1 spines accompanied by some setae on posterodorsal margin from left to right; urosomite 2 bearing 2-1-1-2 spines accompanied by setae, setae longer than spines; urosomite 3 bearing 2 pairs of spines on both sides and 2 pairs of setae on medial dorsal margin.

Uropod 1 (Fig. 3E): Peduncle bearing 1 basofacial spine, 1 spine on outer margin, 2 single spines on inner margin, 2 spines on anterodistal corner and 1 spine on posterodistal corner; outer ramus reaching 57% of length of peduncle, bearing 1 spine on each side; inner ramus a little shorter than outer ramus, bearing 1 spine on inner margin; both rami bearing 5 distal spines.

Uropod 2 (Fig. 3F): Peduncle bearing 2 spines on outer margin, 3 spines on inner margin, 1 spine on anterodistal corner and 1 spine on posterodistal corner; outer ramus reaching 90% of length of peduncle, bearing 1 spine on outer margin; inner ramus a little longer than outer ramus, bearing 1 spine on inner margin and 1 spine on outer margin.

Uropod 3 (Fig. 3G): Peduncle bearing 2 spines on outer margin, a few setae on inner margin, 2 spines on mid-ventrodistal margin, 1 spine apico-laterally and 1 spine apico-medially; inner ramus reaching 40% of length of outer ramus, bearing 1 long distal spine; article 1 of outer ramus bearing 1-2-2-2 spines on outer margin and 2 pairs of distal spines; article 2 shorter than adjacent spines; both rami densely fringed with long simple setae.

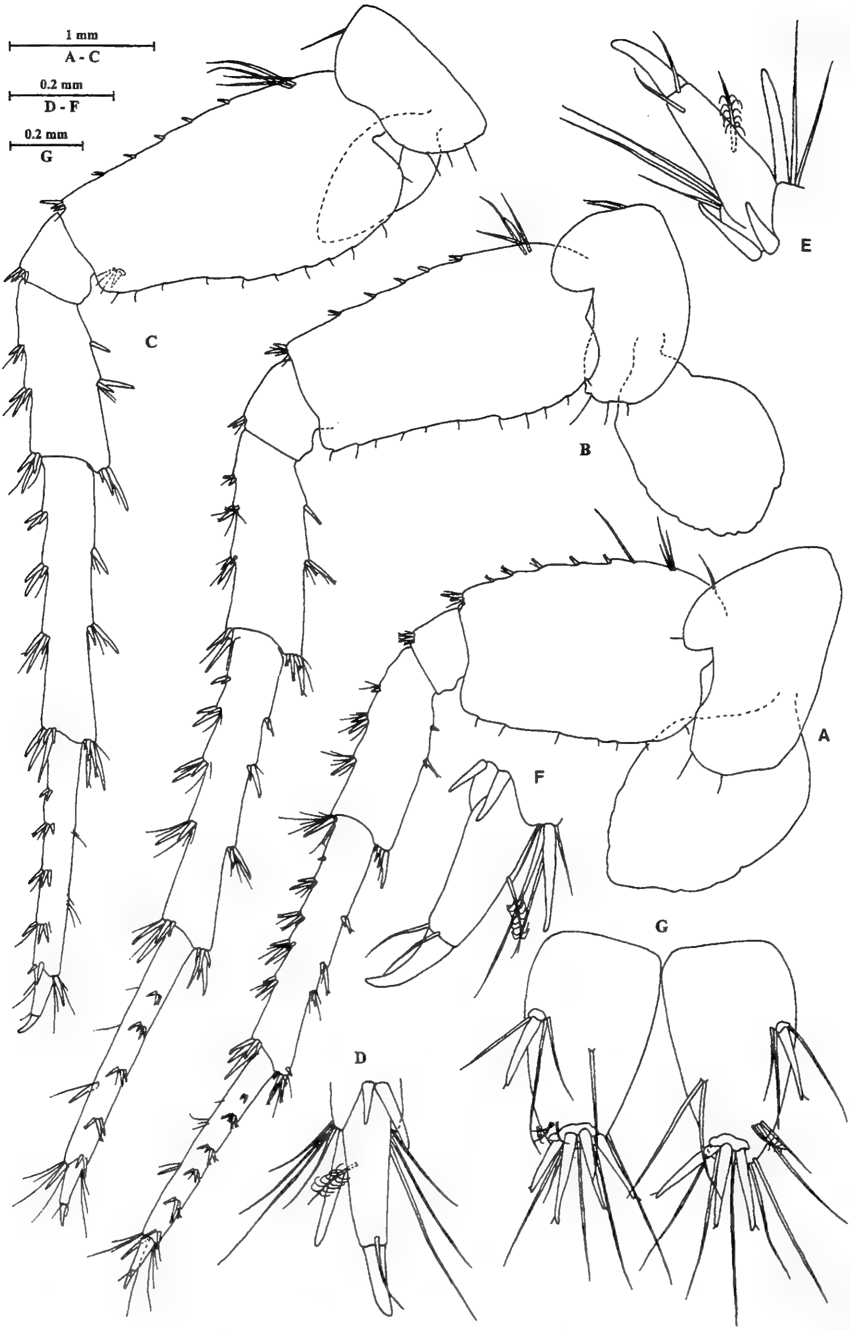


FIG. 4

Gammarus madidus sp. n., holotype, male. A, pereopod 5; B, pereopod 6; C, pereopod 7; D, dactylus of pereopod 5; E, dactylus of pereopod 6; F, dactylus of pereopod 7; G, telson.

Telson deeply cleft (Fig. 4G), each lobe bearing 1 lateral spine accompanied by long setae, 3-4 distal spines accompanied by long setae and some facial setae.

Description of female: Body length 13.5 mm.

Antenna 2 (Fig. 5H): Peduncular articles 4 and 5 bearing groups of long setae along anterior and posterior margins; flagellum with 12 articles, calceoli absent.

Gnathopod 1 (Fig. 6A): Propodus ovate, palm not as oblique as that of male, bearing 8 spines on posterodistal corner; dactylus bearing 1 seta on outer margin and 2 setules at hinge of nail.

Gnathopod 2 (Fig. 6B): Propodus subrectangular, palm truncate, bearing 5 spines on posterodistal corner; dactylus bearing 1 seta on outer margin and 2 setules at hinge of nail.

Pereopods 5-7: Bases shorter than those of male (Figs 6C-E).

Uropod 3 (Fig. 6F): Inner ramus reaching 44% of length of outer ramus, bearing 1 lateral and 1 distal spines; outer ramus with 1-2-2 spines on outer margin and 1 spine on inner margin, both rami fringed with simple setae.

Oostegites (Fig. 5I) present on gnathopod 2 and pereopods 3-5.

Remarks: *Gammarus madidus* sp. n. is similar to *G. electrus* Hou & Li (see Hou & Li, 2003c), which is distributed in and around Beijing City and to *G. curvativus* Hou & Li (see Hou & Li, 2003b), which occurs in Yunnan and Sichuan Province. All three species possess (1) antenna 2 with calceoli, (2) inner ramus of uropod 3 reaching about 40% of length of outer ramus and both rami armed with long simple setae, (3) urosomites 1-3 flat, with 4 groups of spines and setae. *G. madidus* sp. n. differs from *G. electrus* (character states of *G. electrus* in parentheses) in (1) peduncular articles 4 and 5 of antenna 2 bearing groups of long setae along anterior and posterior margins (short setae), (2) gnathopods 1 and 2 with long straight setae (gnathopod 1 with long curled setae on posterior margin of propodus, gnathopod 2 with long curled setae on dorsal margins of carpus and propodus), (3) pereopod 3 with long straight setae on posterior margin (long curled setae). *G. madidus* sp. n. differs from *G. curvativus* (character states of *G. curvativus* in parentheses) by (1) accessory flagellum of antenna 1 with 4 or 5 articles (2 articles); (2) gnathopod 2 with straight setae (gnathopod 2 with long curled setae on dorsal margin of carpus and weakly curled setae on dorsal margin of propodus); (3) telson with 1 lateral spine (no spines).

Gammarus madidus sp. n. is also similar to *G. nekkensis* in (1) antenna 2 with calceoli, (2) epimeral plates 1-3 progressively acute, (3) inner ramus not more than half of outer ramus. The new species can be distinguished from *G. nekkensis* (character states of *G. nekkensis* in parentheses) by (1) antenna 2 with long setae on peduncular articles 4 and 5 (short setae), (2) pereopod 3 with long straight setae (curled setae), (3) both rami of uropod 3 bearing long simple setae (outer margin of outer ramus bearing long simple setae, but inner margin of outer ramus and both margin of inner ramus bearing plumose setae).

Gammarus madidus sp. n. coexists with *G. nekkensis* at Mt. Baicaopan.

Distribution: Known only from Mt. Baicaopan, Hebei Province.

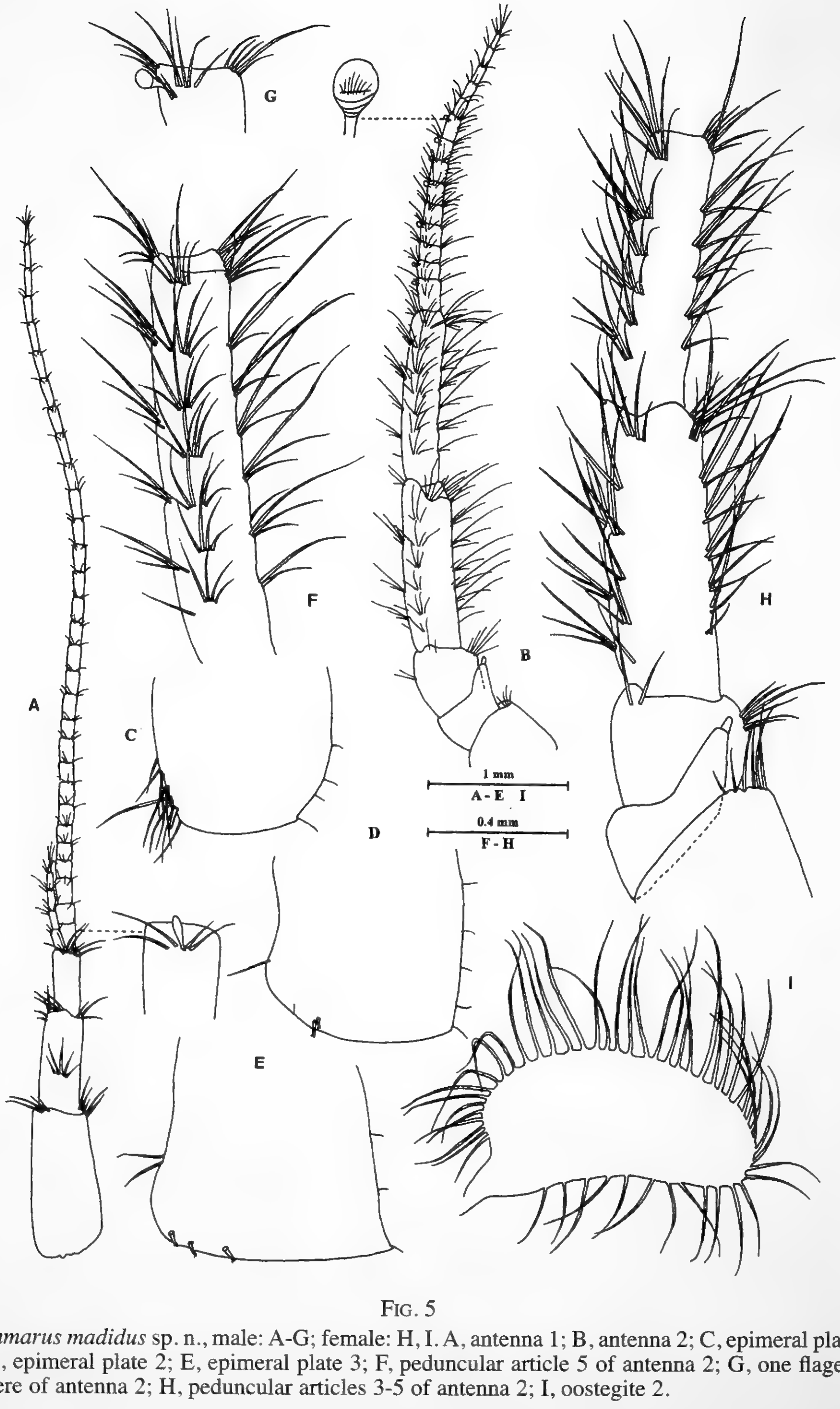


FIG. 5

Gammarus madidus sp. n., male: A-G; female: H, I. A, antenna 1; B, antenna 2; C, epimeral plate 1; D, epimeral plate 2; E, epimeral plate 3; F, peduncular article 5 of antenna 2; G, one flagellomere of antenna 2; H, peduncular articles 3-5 of antenna 2; I, oostegite 2.

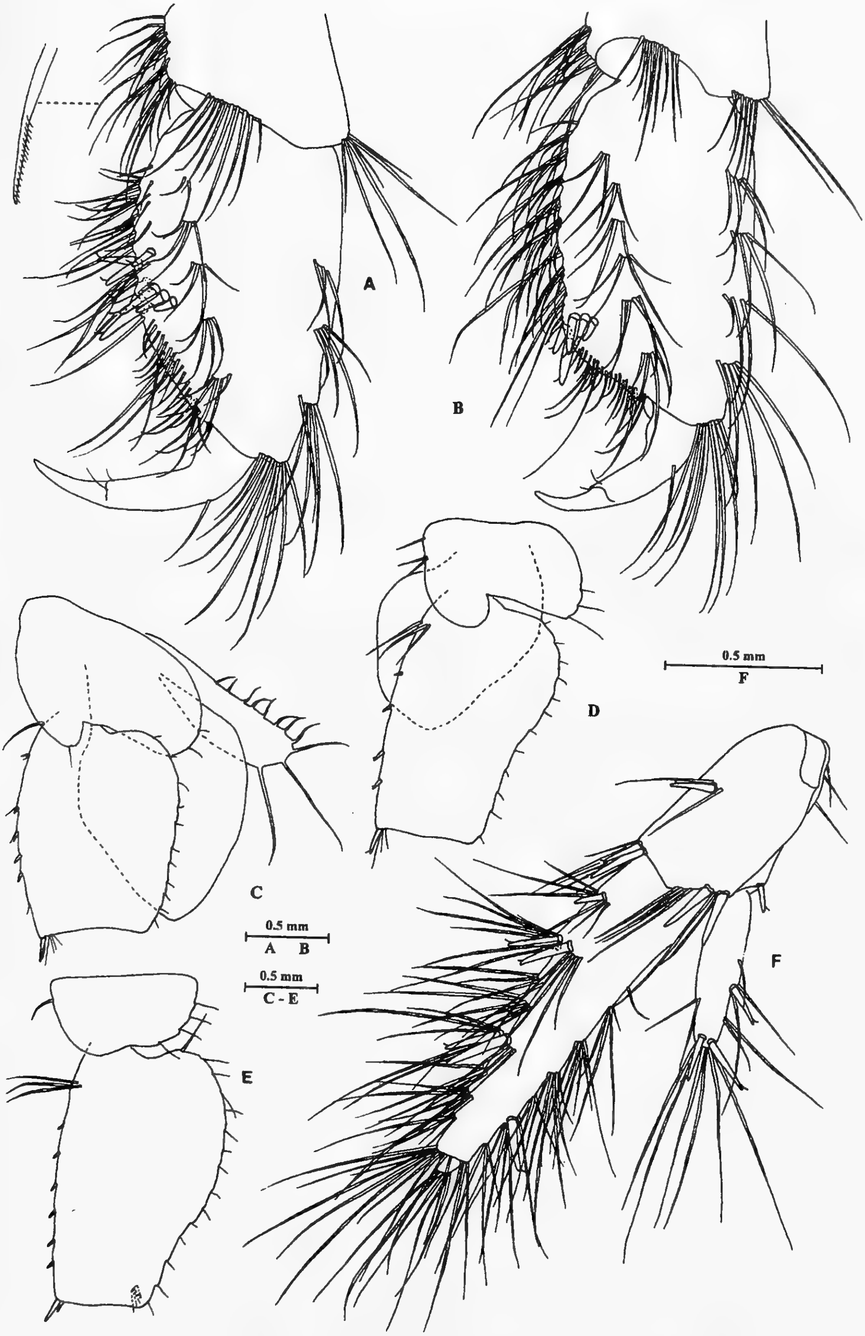


FIG. 6

Gammarus madidus sp. n., female. A, propodus of gnathopod 1; B, propodus of gnathopod 2; C, basis of pereopod 5; D, basis of pereopod 6; E, basis of pereopod 7; F, uropod 3.

DISCUSSION

Gammarus lacustris and *G. nekkensis* are very common species in China. They occur at several places in upper reaches of River Jumahe. They live specially in riverside springs, but we could also find them in the main rivers in wintertime. In the lower reaches of River Jumahe, including Rivers South-Jumahe and North-Jumahe, we did not find any *Gammarus* species. The reason could be that the river often dried. In case that there is enough water, water pollution may be another reason.

Gammarus madidus sp. n. occurs in a small stretch of the River Jumahe, while *G. lacustris* and *G. nekkensis* are widespread. *G. lacustris* and *G. nekkensis* are ecological generalists that have been able to colonize many kinds of new, disturbed and marginal habitats, whereas related species with only a narrow distribution, as *G. madidus*, are ecological specialists that competitively dominate specific kinds of relatively stable biotopes (Glazier & Eckert, 2002).

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REVUE SUISSE DE ZOOLOGIE 112 (2): 329-331; juin 2005

Über eine neue *Octodrilus*-Art aus Frankreich (Oligochaeta: Lumbricidae)

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On a new *Octodrilus* species from France (Oligochaeta: Lumbricidae). - The new earthworm species *Octodrilus juvyi* sp. n. is described and the taxonomic differences among the red, small bodied *Octodrilus* species are emphasized.

Keywords: Earthworms - Oligochaeta - Lumbricidae - taxonomy - new species - France.

EINLEITUNG

Aus Frankreich war bislang als einzige Art der Gattung *Octodrilus complanatus* (Dugès, 1828) gemeldet, die in den südöstlichsten Teilen Frankreichs und in Korsika verbreitet ist (Bouché, 1972).

Octodrilus complanatus ist in den südlichen Teilen Europas, vorwiegend jedoch im mediterranem Gebiet und Nordafrika, weit verbreitet und gehört zu den tiefgrabenden, nie rot pigmentierten Grossformen dieser Gattung. Die kleinen, in der obersten Bodenschicht oder Laubstreu lebenden, rotpigmentierten *Octodrilus*-Arten, die hauptsächlich im Alpengebiet Italiens, der Schweiz, Österreichs und Sloweniens und in den Dinarischen Alpen anzureffen sind, waren bisher aus dem westlichen Alpengebiet Frankreichs nicht gemeldet.

Jetzt liegen 6 Exemplare einer kleinen, rotpigmentierten Art vor, die Herr Bernard Juvy in den Westalpen im Massiv Grande Chartreuse gesammelt hatte und die nachstehend als neue Art beschrieben wird.

BESCHREIBUNG DER ART

Octodrilus Omodeo, 1956

Octolasium (Octodrilus) Omodeo, 1956: 177, part.
Octodrilus; Bouché, 1972: 311.
Octodrilus; Zicsi, 1986: 108.
Octodrilus; Mršíc, 1991, 356.
Octodrilus; Qui & Bouché, 1998: 203.
Octodrilus; Csuzdi & Zicsi, 2003: 206.

Typus-Art: *Lumbricus complanatus* Dugès, 1828

Manuskript angenommen am 13.10.2004

Nach Abtrennung der Gattung *Octodriloides* Zicsi, 1986 verblieben in der Gattung *Octodrilus* 36 Arten (Mršíc, 1991), die über ganz Europa und Nordafrika verbreitet sind. Der Hauptunterschied zwischen den beiden Gattungen besteht in der Lage der männlichen Poren, die bei Vertretern von *Octotrilus* auf dem 15. Segment, bei denen von *Octodriloides* jedoch vor oder auf dem Gürtelsegment liegen. Die Arten beider Gattungen sowie die von *Lumbricus* Linnaeus, 1758 und *Octolasion* Örley, 1885 sind durch die Lage des Gürtels und der Pubertätsstreifen ausschlaggebend gekennzeichnet, die Verschiebung dieser Merkmale um ein einziges Segment reicht zur Trennung der Arten aus.

Octodrilus juvyi sp. n.

Holotypus: HNHM 15201. Frankreich, Massif Grande Chartreuse, Saint Pierre de Chartreuse, Rocher de la Petite Vache, 1195 m, 17.6.2003, leg. B. Juvy.

Paratypen: HNHM 12502 2 Ex., MHNG - INVE 35901 1 Ex. Fundort wie beim Holotypus. HNHM 15203 2 Ex. Bois de Valombré, 1460 m, 20.09.2002, leg. B. Juvy.

Typenmaterial wird im Naturhistorischen Museum Budapest (HNHM) und im Naturhistorischen Museum Genf (MHNG) aufbewahrt.

Etymologie: Die neue Art wird zu Ehren des Sammlers, Herrn Umweltingenieur Bernard Juvy (CEMAGREF - Unité de Recherche E.P.M., Saint Martin d'Heres, Frankreich) benannt.

Diagnose: L. 55-63 mm, B. 3-4 mm, Segmentzahl 76-113. Rotviolett. Kopf epilobisch. Borsten ungepaart. Gürtel vom 29.-35., Pubertätsstreifen vom 29.-35. Segment. Dissepimente 11/12-13/14 schwach verdickt. Letztes Paar Herzen im 11., Kalkdrüsen im 10-12. Segment. Testikelblasen im 10. und 11. Segment. 4 Paar Samensäcke im 9.-12. Segment. Typhlosolis einfach. Nephridialblasen ocarina-förmig. Muskulatur gefiedert. 5 Paar Samentaschen in Segment 6/7-10/11. Die neue Art unterscheidet sich von allen rotpigmentierten, kleinen Arten mit männlichen Poren auf dem 15. Segment durch die Lage des Gürtels in Kombination mit der Lage und Zahl der Samentaschen (vergl. auch Tabelle 1).

Holotypus: Länge 63 mm, Breite 3,5 mm, Segmentzahl 123. Paratypen: Länge 55-63 mm, Breite 3-4 mm, Segmentzahl 76-113.

Farbe dorsal, bis zur Borstenlinie *c* rotviolett, ventral weiss. Kopf epilobisch, halb offen. Segmente nicht geringelt. Borsten ungepaart, hinter dem Gürtel *aa:ab:bc:cd:dd* wie 2,7:1,3:1,3:1:4. Nephridialporen etwas oberhalb der Borstenlinie *b*, regelmässig angeordnet. Erster Rückenporus auf Intersegmentalfurche 14/15. Weibliche Poren winzig kleine Öffnungen auf dem 14. Segment, dicht neben der Borstenlinie *b*. Männliche Poren ebenfalls winzig kleine Öffnungen auf dem 15. Segment, in der Mitte zwischen der Borstenlinie *b* und *c*. 5 Paare kleiner Samentaschenöffnungen auf Intersegmentalfurche 6/7-10/11, zwischen den Borstelinien *b* und *c*.

Gürtel vom 29. - 35. Segment, sattelförmig. Pubertätsstreifen vom 29. - 35. Segment.

Innere Organisation: Dissepimente 6/7-9/10 dünn, 11/12 - 13/14 etwas kräftiger ausgebildet. Schlunddrüsen bis zum 6. Segment reichend. Letztes Paar Herzen im 11. Segment, eine unpaarige Schlinge im 12. Segment. Kalkdrüsen im 10-12. Segment, mit Ausbuchtungen im 10. Segment. Kropf im 15.-16. Segment; Muskelmagen im 17.-18.

Segment; Mitteldarm im 19. Segment beginnend, Typhlosolis vorhanden, sackförmig. Nephridialblase mit einer nach hinten gebogenen, verschmolzenen Schlinge (ocarina-shaped).

Hoden und Samentrichter im 10. und 11. Segment von mächtigen Testikelblasen umgeben. Vier Paar Samensäcke im 9.-12. Segment. Ovarien im 13. Segment. Samentaschen im 6.-11. Segment, die beiden vorderen vor den Dissepimenten, die drei hinteren hinter den Dissepimenten liegend.

TABELLE 1. Wichtige Trennungsmerkmale kleiner, rotpigmentierter *Octodrilus*-Arten.

Art	Gürtel	Pubertätsstreifen	Samentaschen öffnungen	Zahl der Samentaschen	Samensäcke
O. argoviensis (Bretscher, 1899)	28-34	28-34, 35	6/7-11/12	6	9-12
O. croaticus (Rosa, 1895)	28-35	28-35	5/6-10/11	6	9-12
O. lissaensis (Michaelsen, 1891)	29-36	29-36	5/6-10/11	6	9-12
O. bretscheri Zicsi, 1969	29, 30-36	29, 30-36	6/7-10/11	5	9-12
O. hemiander (Cognetti, 1901)	28-36, 37	28-38, 39	6/7-12/13	7	10, 12
O. illyricus Mršíc, 1987	28, 29-36	29-36	6/7-10/11	5	10, 12
O. lissaensioides Zicsi, 1971	29-36	29-37	5/6-10/11	6	9, 10, 12
O. juvyi sp. n.	29-35	29-35	6/7-10/11	5	9-12

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REVUE SUISSE DE ZOOLOGIE 112 (2): 333-349; juin 2005

Description of a new beetle-like psocid (Insecta: Psocoptera: Protroctopsocidae) from Turkey showing an unusual sexual dimorphism

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Description of a new beetle-like psocid (Insecta: Psocoptera: Protroctopsocidae) from Turkey showing an unusual sexual dimorphism. - *Reticulopsocus besucheti* gen. n., sp. n. is described and illustrated from a series of specimens of both sexes collected under stones in southern Turkey. The new genus is closely related to the Mediterranean genera *Chelyopsocus* Lienhard and *Philedaphia* Lienhard. Some illustrations of the type genus of the family, *Protroctopsocus* Mockford, are also provided. Both sexes of the new genus are elytropterous and beetle-like in habitus but the fore wing venation is strongly sexually dimorphic: males have a normal venation, though somewhat simplified, females however, have a highly apomorphic, reticulate venational pattern. A key to the genera of the family Protroctopsocidae is provided.

Keywords: *Reticulopsocus* - *Protroctopsocus* - *Chelyopsocus* - *Philedaphia* - new genus - new species - wing venation - elytroptery - soil fauna - Mexico.

INTRODUCTION

Sometimes spectacular discoveries within a particular insect group are not due to the targeted collecting of a specialist but to the quick-witted reaction of a non-specialist encountering an unusual representative of a group, which he did not really search for. So it is not surprising that litter-dwelling beetle-like psocids are more effectively collected by coleopterists interested in soil-fauna than by psocidologists. This is the case in the Oriental genus *Coleotroctellus* Lienhard, 1988 (Electrentomoidea: Troctopsocidae) where three of the four known species have been discovered by entomologists searching for soil Coleoptera by sifting plant debris in forests. *C. burckhardti* and *C. loebli* were collected by my Swiss colleagues Daniel Burckhardt and Ivan Löbl, *C. venosus* by the Russian coleopterist Sergei Kurbatov.

A similar and very recent collecting success is due to my colleague Claude Besuchet, well known specialist of pselaphine Coleoptera and former curator at the Natural History Museum of Geneva. When turning stones in a pine forest in southern Turkey in May 2004, he immediately recognized some fast-moving dark brown "peculiar beetles" on the undersurfaces of the stones and identified them as unusual

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psocids. Remembering my interest in these insects, he made a special effort to collect a representative series of these intriguing creatures. Back to Geneva he immediately gave them to me, commenting that he had apparently found two kinds (two species?) of very particular psocids, both of them with dark brown elytriform fore wings, one of them with a characteristically reticulate structure, the other with a relatively simple venation.

What he initially thought to be two different species are actually males and females of a new electrentomoid psocid exhibiting one of the most intriguing cases of sexual dimorphism ever observed in the order Psocoptera. This species is here considered as a representative of a new genus of the family Protroctopsocidae Smithers, which is already represented in the Mediterranean region by the genera *Chelyopsocus* Lienhard and *Philedaphia* Lienhard.

Mockford (1967) described the very particular monotypic Mexican genus *Protroctopsocus* in the family Troctopsocidae. Smithers (1972: 338) later placed *Protroctopsocus* Mockford in a subfamily of its own: Protroctopsocinae Smithers. Based on the short phylogenetic discussion presented by Lienhard (1995), two other troctopsocid genera, *Chelyopsocus* Lienhard and *Philedaphia* Lienhard, have been assigned to this subfamily by Lienhard & Mockford (1997). Subsequently elevated to family rank, this taxon has been assigned to the superfamily Electrentomoidea Enderlein (see Enderlein, 1911) (suborder Troctomorpha, infraorder Amphientometae) by Lienhard & Smithers (2002).

The superfamily Electrentomoidea sensu Lienhard & Smithers (2002) contains four relatively small families comprising 20 genera, most of them monotypic (12 genera), the others containing only few species (6 genera with 2-5 spp., 2 with 7-8 spp.) (see Lienhard & Smithers, 2002 and Lienhard, 2003). All genera are characterized by striking autapomorphies but their relationships are still poorly understood (see Lienhard & Mockford, 1997). It is not the purpose of this paper to analyse these relationships but to introduce a new species representing a new genus and to present some morphological characters, which could be of phylogenetic significance for future analyses. A sample of the new species has also been sent to Kazunori Yoshizawa for DNA extraction (see "Material and Methods").

The family Protroctopsocidae is characterized by the following synapomorphies of its genera: presence of larval glandular hairs on thorax and abdomen (at present only confirmed in *Protroctopsocus* and *Philedaphia*, see Lienhard, 1995; nymphs of other genera not known); AP joined to vein *m*; endophallus with a conspicuous eversible pouch, sac-shaped (Figs 10, 11, 29) or tube-shaped (Lienhard, 1995: fig. 24) when everted and characteristically folded in resting position (Fig. 9 and Lienhard, 1995: fig. 23 and Garcia Aldrete, 1982: fig. 10) (this character not confirmed in *Chelyopsocus*, the male of which is not known).

The main diagnostic characters of protroctopsocid genera are mentioned in the key below. At present the following four genera and five species are known:

Protroctopsocus Mockford, 1967: *P. enigmaticus* Mockford, 1967 (Mexico), ♂♀. - See Mockford (1967) and Garcia Aldrete (1982).

Chelyopsocus Lienhard, 1980: *C. garganicus* Lienhard, 1980 (Italy), ♀ (♂ unknown). - See Lienhard (1980, 1998).

Philedaphia Lienhard, 1995: *P. aphrodite* Lienhard, 1995, type species (Cyprus), ♂♀. - *P. hauseri* (Lienhard, 1988) (Greece), ♀ (male unknown, parthenogenetic). - See Lienhard (1988, 1995, 1998).

Reticulopsocus gen. n.: *R. besucheti* sp. n. (Turkey), ♂♀. - See description below.

MATERIAL AND METHODS

The following protroctopsocids have been examined for this study:

Reticulopsocus besucheti gen. n., sp. n.: type material (MHNG), see description below. NOTE. Thorax (except fore wings) and basal half of abdomen of one paratype male (MHNG 7625) were sent to Kazunori Yoshizawa (SEHU) for DNA extraction in June 2004; after their return, the exoskeleton of these parts was mounted on a permanent slide together with the other parts of the specimen.

Chelyopsocus garganicus Lienhard: type material (2 ♀, MHNG), see Lienhard (1980).

Philedaphia aphrodite Lienhard: type material (♂♂ and ♀♀, MHNG), see Lienhard (1995).

Philedaphia hauseri (Lienhard): type material (♀♀, MHNG), see Lienhard (1988).

Protroctopsocus enigmaticus Mockford: 1♂, 1♀ (both slightly brachypterous, with elytriform fore wings) (MHNG), MEXICO: Mexico, K. 87, Toluca - Tejupilco, 1750m, 4.VI.1988, leg. A. Cadena, L. Cervantes.

Habitus photographs were made with the AutoMontage® system using a JVC® video camera mounted on a Leica MZ APO stereomicroscope and slightly reworked with ADOBE Photoshop®.

Abbreviations used in the descriptions: A = antenna length; AP = areola postica (cubital loop in fore wing); BL = body length (in alcohol); f1, f2, f3, f4 = length of basal four antennal flagellomeres; F = hind femur length; FW = fore wing length; IO/D = shortest distance between compound eyes divided by antero-posterior diameter of compound eye in dorsal view of head; P4 = fourth (apical) article of maxillary palpus; PS = pterostigma (fore wing); T = hind tibia length; t1, t2, t3 = tarsomeres of hind tarsus (lengths measured from condyle to condyle). For standard abbreviations concerning wing venation, see Lienhard (1998).

Other abbreviations: BISU = Biological Sciences, Illinois State University, Normal; MHNG = Muséum d'histoire naturelle de la Ville de Genève, Switzerland; SEHU = Systematic Entomology, Hokkaido University, Sapporo; UNAM = Universidad Nacional Autónoma de México.

DESCRIPTION AND DISCUSSION

Reticulopsocus gen. n.

Diagnosis (see also key to the genera of Protroctopsocidae below). Brachypterous and flightless, general habitus somewhat beetle-like (Pl. 1AB) due to blackish brown elytriform fore wings with thickened veins; venation slightly simplified in male, forming a highly apomorphic, reticulate pattern in female. Hind wings strongly

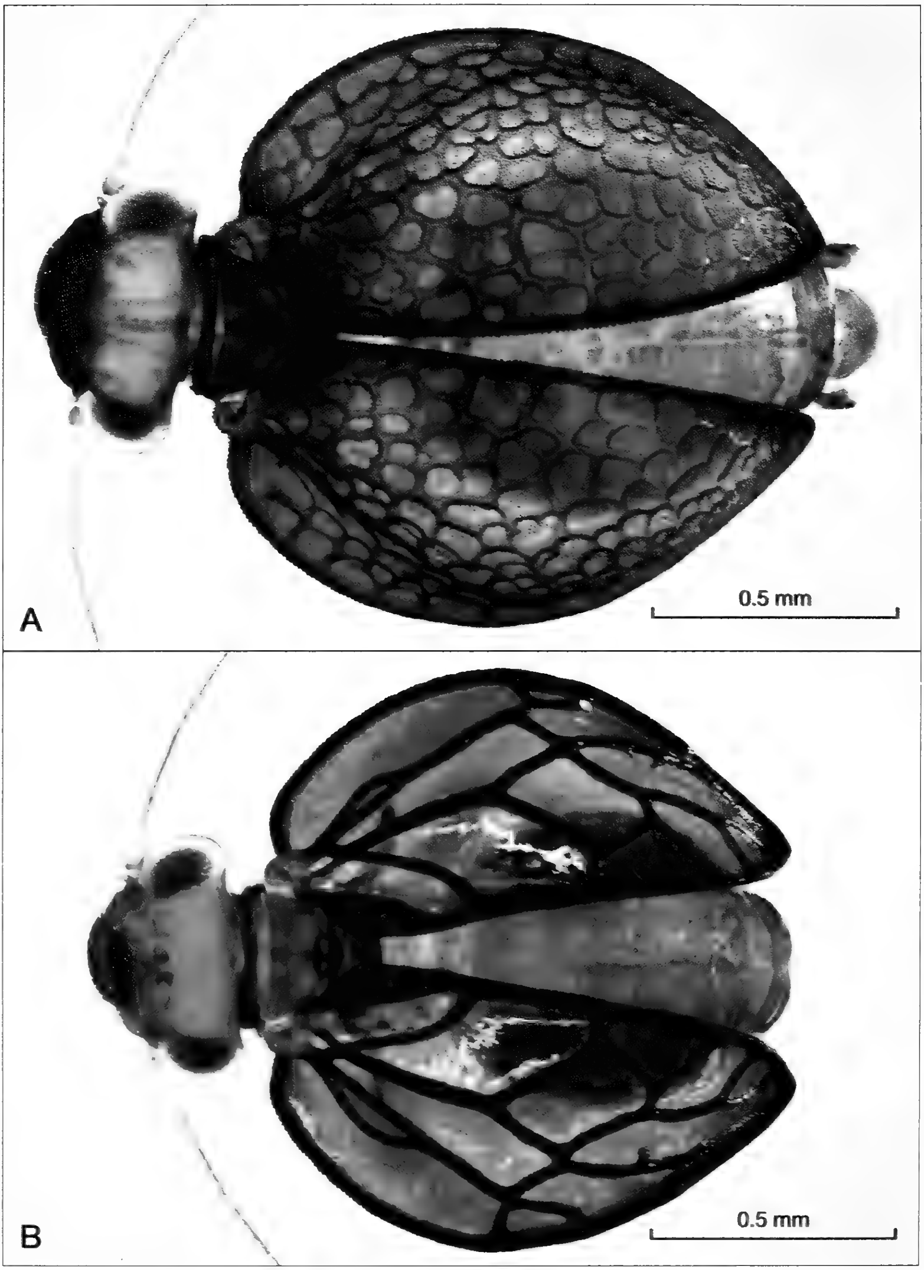


PLATE 1

Reticulopsocus besucheti gen. n., sp. n., habitus in alcohol, dorsal view, legs not visible on photograph. A: female paratype. B: male holotype [epiproct and paraprocts not visible, they were hidden by the extruded phallic structures (cf. Figs 10, 11) that have been deleted from the photograph].

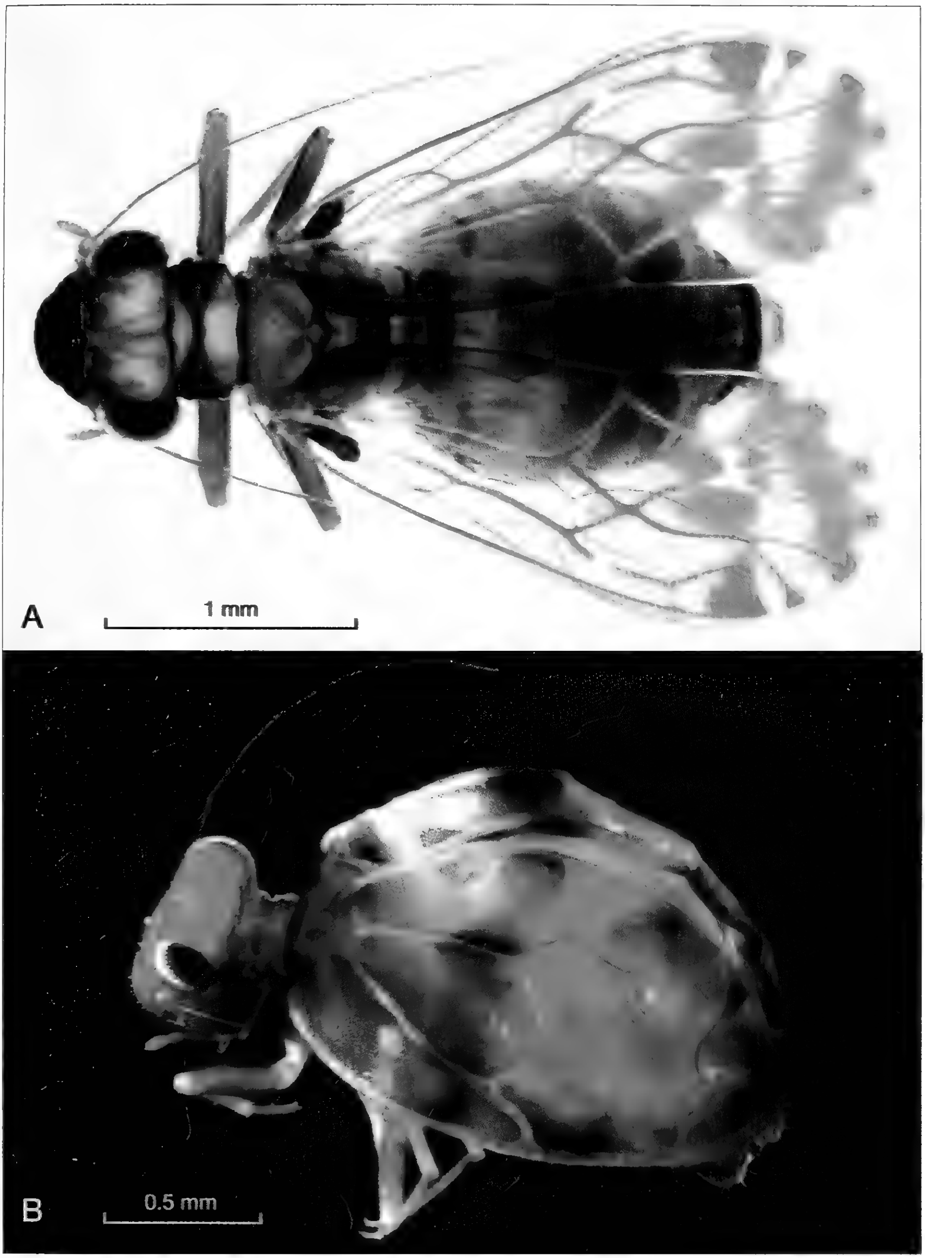


PLATE 2

Habitus, in alcohol. A: *Philedaphia aphrodite* Lienhard, female paratype (dorsal view). B: *Chelyopsocus garganicus* Lienhard, female paratype (dorso-lateral view; with right/left reversal of photograph for publication; left wing of the same specimen illustrated in Lienhard, 1998: pl. 9g).

reduced, veinless (Fig. 3). Antenna 14-segmented. Frons about equal in length to postclypeus in anterior view. Ocelli present in male, close to each other, absent in female. Outer cusp of lacinial tip distinctly bidenticulate (Fig. 19), incisive region of mandibles acute (Fig. 21). Fore femur with a longitudinal ventral row of particularly well-developed sculptural denticles on anterior side (Fig. 22). Pretarsal claw with one preapical denticle and some ventral and lateral microtrichia (Fig. 23). Principal veins of fore wing not clearly recognizable in female (Pl. 1A, Fig. 1). Venation of male fore wing (Pl. 1B, Figs 4-6) similar to that of other genera of the family, but slightly simplified and somewhat variable; membrane of wing cells slightly concave.

Epiproct and paraproct (Figs 8, 14) with some simple stout marginal setae in both sexes, setae on weakly differentiated sense cushion of paraproct without basal rosettes. Lateral hind margin of male clunium simple, roughly right-angled, without densely pilose posterior lobe (Fig. 8). Hypandrium simple (Fig. 7). Phallosome V-shaped (Figs 9, 11), lacking medio-apical sclerite; lateral struts simple but curved to the middle at their apex; latero-apical sclerites elongated, articulated to the apical angle of lateral struts close to a pore-bearing membranous zone. Endophallic pouch sac-shaped in everted position (Fig. 10), centro-ventral pore-bearing lobe of endophallus apically bilobed, its position varying according to the degree of eversion of the endophallic sac (cf. Figs 9, 11). Female subgenital plate (Fig. 12) with 2 stout apical setae and with sclerotized latero-dorsal zones on margin, these joined to T-shaped sclerite by small sclerotized bridges. External valve of gonapophyses (Fig. 13) deeply bilobed. Spermathecal duct (Figs 15, 16) relatively short, straight and of same width throughout its length; spermapore situated on a slightly sclerotized oval zone surrounded by fine wrinkles; spermathecal sac with a distinct basal zone bearing a field of inward-directed papillae near opening of duct; wall of spermathecal sac loosely covered with small pores each bearing a short outward-directed microtubular appendix (Fig. 17).

Type species. *Reticulopsocus besucheti* sp. n.

Etymology. The genus name is of masculine gender and refers to the reticulate venational pattern of female fore wing.

Remarks. See discussion of the type species.

Reticulopsocus besucheti sp. n. Figs 1-23, Pl. 1

MATERIAL

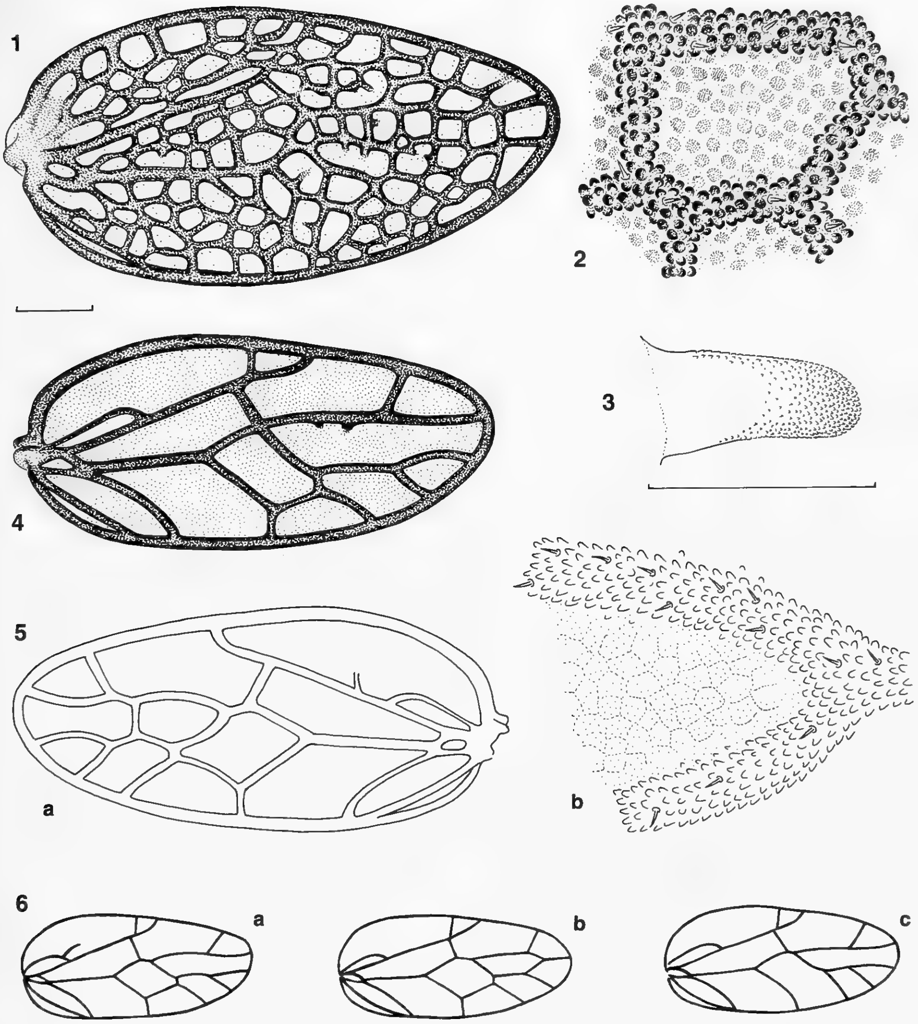
Holotype ♂. TURKEY (Mersin Province): Toros mountains, valley from Mersin town up to village Arslanköy, close to village Aladag, 850 m, forest of *Pinus* sp., under stones, 2.V.2004, leg. C. Besuchet (no. 34); the specimen has been dissected and mounted on two slides (MHNG 7645). Allotype ♀, same data as for holotype; dissected and mounted on two slides (MHNG 7646). Other paratypes: 4♂, 5♀, same data as for holotype.

ETYMOLOGY

The species is dedicated to Dr Claude Besuchet who collected the type material (see also "Introduction").

DESCRIPTION

MALE. *Coloration*. See Pl. 1B. Body generally medium to dark brown, vertex light brown with some darker spots. Compound eye uniformly dark brown (observed after some months in alcohol). Antenna and maxillary palpus light brown; legs light to



FIGS 1-6

Reticulopsocus besucheti gen. n., sp. n.: 1, right fore wing (♀ allotype); 2, idem, detail of wing sculpture (in apical half of wing); 3, hind wing (♀ allotype, coloration not shown); 4, right fore wing (♂ holotype); 5, left fore wing (♂ paratype MHNG 7625), venation (5a) and detail of sculpture (5b) in centre of wing (coloration not shown); 6a-c, schematic presentation of variability of male fore wing venation (see text). Scale bars: 0.2 mm (Figs 1, 4, 5a; 3).

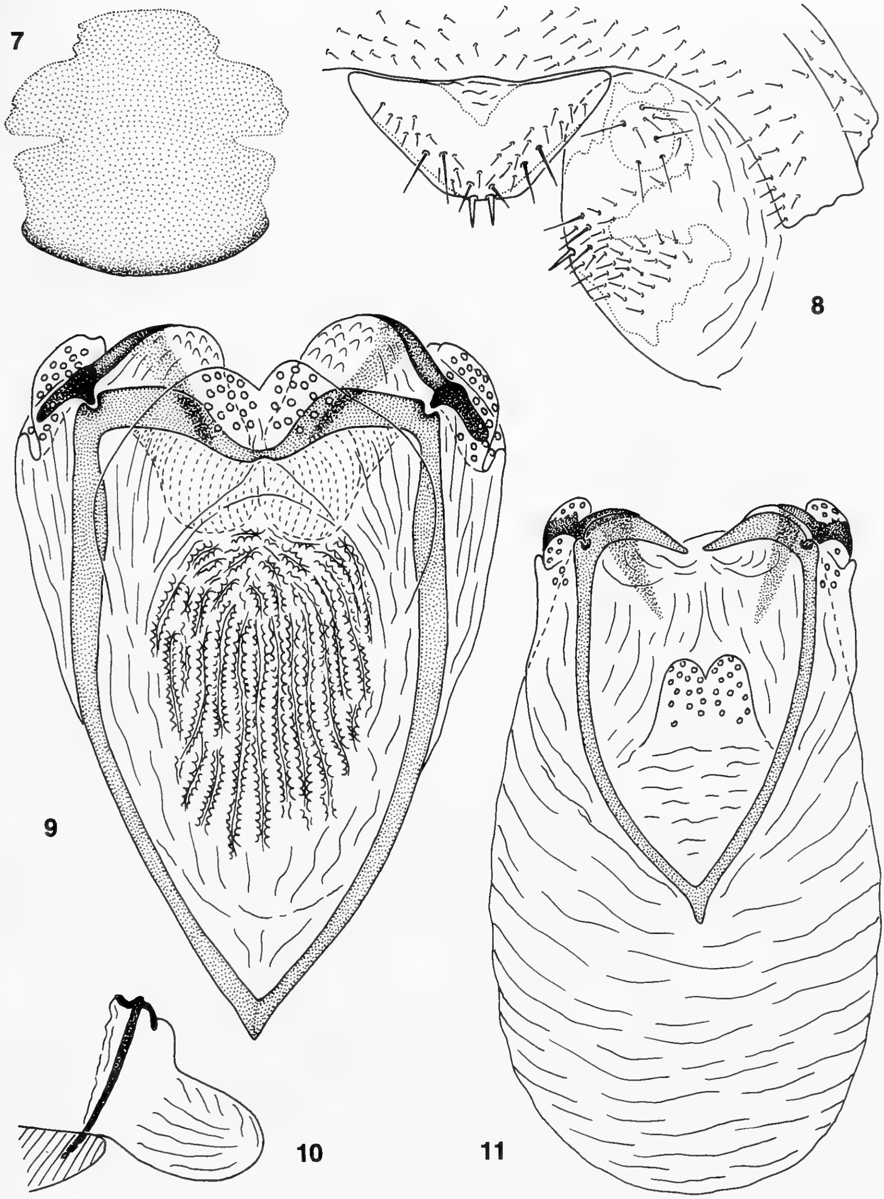
medium brown, with dark brown coxae and femora. Membrane of fore wing uniformly dark brown, glossy, veins blackish brown. Abdomen with dense red-brown hypodermal pigmentation on dorsal and ventral side, terminalia brown.

Morphology. See generic diagnosis, with the following complements. Vertex antero-posteriorly rounded, outline slightly undulated in frontal view (cf. Garcia Aldrete, 1982: fig. 1), due to the presence of a shallow dimple on each side, about half way between compound eye and vertical suture; frontal suture also visible. Vertex with distinct tubercular sculpture, locally forming a more or less scale-like pattern, pilosity very short. Antennal flagellomeres with annulate sculpture and relatively long slightly wavy hairs (length several times the width of flagellomere). Maxillary palpus as in Fig. 20; sensilla on distal margin of labrum as in Fig. 18, the placoid sensilla lacking central cones. Internal microtrichial field of galea (mentioned for *Philedaphia* by Lienhard, 1998: fig. 44b) absent or only weakly developed. Prodorsum short, dorsally covered by prominent and almost sharp-edged anterior margin of mesonotum fitting into the occipital margin of the head-capsule (contracted condition of the body). Sculpture of mesonotum similar to that of vertex. Elytriform fore wings in resting position joined along posterior margin to form a hemispherical sclerotized capsule covering the soft abdomen. Veins of fore wing with distinct rounded tubercles, dorsal membrane glossy, only finely granular and locally with fine reticulate pattern (Fig. 5b). Vein *an*2 absent. Observed variability of wing venation (often asymmetrical on same individual; totally 9 wings of 5 males examined; right wing of paratype male MHNG 7625 lost during capture): PS basally closed (Fig. 4) in 7 wings, open (Fig. 5a) in 2 wings; rudimentary second section of *sc* present in 3 wings, bifurcating from *r* proximally to *r*1-*rs* bifucation (Fig. 5a: 1 wing) or bifurcating from basal section of *sc* near its meeting point with *r* (Fig. 6a: 2 wings); *rs* and *m* basally meeting in a point (Fig. 4) or fused for a short length (Fig. 5a) and in 1 wing distally joined by a crossvein (Fig. 5a: cell R5 subdivided in middle), the latter completely absent (5 wings) or rudimentary (3 wings) (Pl. 1B and Fig. 4); in 1 wing *r*4+5 fused to *m*1 for the portion before the wing margin, resulting in a closed cell R5 (Fig. 6b); *cu*1 (i. e. AP) distally fused to *m*3, resulting in a large AP apparently joined to *m* by a short crossvein and *m* appearing only 2-branched (Figs 4, 5a: 6 wings), or proximal section of *cu*1 completely absent, resulting in an apparently 3-branched *m* and absence of AP due to simple vein *cu* (Fig. 6c: 3 wings). Hind wing strongly reduced (cf. Fig. 3) and almost vertically protruding from thorax (transparent through fore wings in Pl. 1B). Pearman-organ of hind coxa incomplete, only tympanum visible, coxal rasp not differentiated; tibiae with two apical spurs; number and position of microtrichia of pretarsal claws somewhat variable, usually three relatively long seta-like ventral microtrichia at base and on ventral edge (cf. Fig. 23). Phallosome in resting position as in Fig. 9, with everted endophallic sac as in Fig. 11, hook-shaped lateral struts medially separated (Fig. 11) or joined by a small sclerotized bridge (Fig. 9); membrane near apex of latero-apical sclerite on each side with a basally directed, slightly sclerotized longitudinal zone (Figs 9, 11).

Measurements (♂ holotype, in μm). BL = 1450; FW = 1280; A = 1510; f1 = 125; f2 = 150; f3 = 155; f4 = 160; F = 365; T = 570; t1 = 285; t2 = 53; t3 = 78; IO/D = 1.5.

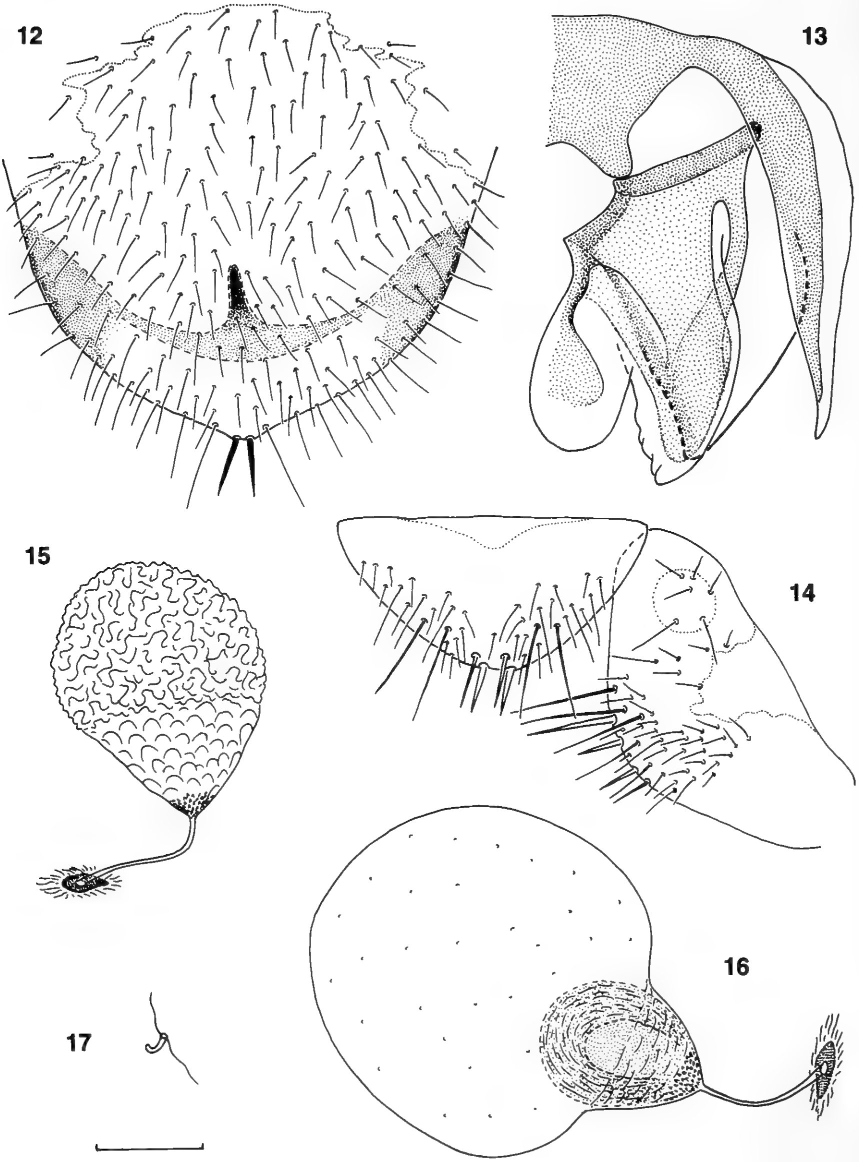
FEMALE. *Coloration*. Same as in male, but membrane of fore wing dull (Pl. 1A).

Morphology. See generic diagnosis and description of male, with the following complements. Sculpture of vertex with large rounded tubercles (their diameter about twice the diameter of the alveoli of the fine hairs on vertex), usually not forming scale-like pattern. Pilosity of antennal flagellum much sparser and shorter than in male.



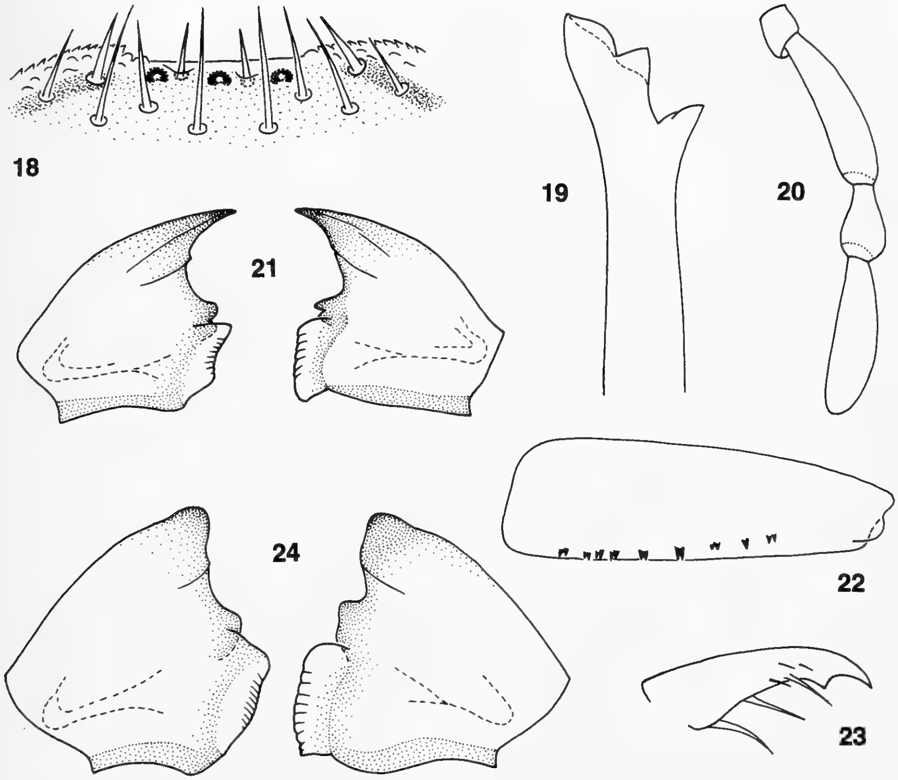
FIGS 7-11

Reticulopsocus besucheti gen. n., sp. n., male (paratype MHNG 7625: Figs 7-9, holotype: Figs 10-11): 7, hypandrium (pilosity not shown); 8, epiproct, right paraproct, right angle and hind margin of clunium (coloration not shown, brown cuticular pigmentation of epiproct and paraproct delimited by dotted lines); 9, phallosome (ventral view, endophallic sac not everted); 10, phallosome with everted endophallic sac, in situ (lateral view, schematic, hypandrium hatched); 11, phallosome with everted endophallic sac, slide-mounted (dorsal view, centro-ventral pore-bearing lobe of endophallus visible by transparency, lower magnification than in Fig. 9).



FIGS 12-17

Reticulopsocus besucheti gen. n., sp. n., female (allotype: Figs 12-15, paratype MHNG 7648: Figs 16-17): 12, subgenital plate (general coloration of ventral side not shown, brown cuticular pigmentation anteriorly delimited by dotted line); 13, gonapophyses; 14, epiproct and right paraproct (coloration not shown, brown cuticular pigmentation delimited by dotted lines); 15, spermatheca (empty spermatheca of virgin female); 16, spermatheca of mated female, with spermatophore (sperm packet) in basal zone of sac; 17, pore with microtubular appendix of spermathecal membrane (scale bar 0.02 mm).



FIGS 18-24

Figs 18-23. *Reticulopsocus besucheti* gen. n., sp. n., female allotype: 18, sensilla on distal margin of labrum; 19, lacinial tip; 20, maxillary palpus (pilosity not shown); 21, mandibles (anterior view); 22, anterior side of fore femur (base left, apex right; general sculpture not shown); 23, pretarsal claw. - Fig. 24. *Chelyopsocus garganicus* Lienhard, female holotype: mandibles (anterior view, same magnification as Fig. 21).

Principal veins of fore wing not clearly recognizable, except vein *an*1 and basal parts of *r* and *m+cu* visible as particularly well-differentiated straight venational structures within the reticulate pattern covering the whole wing (Pl. 1A, Fig. 1) and delimiting small cells of irregular shape, these cells sometimes partially open due to incomplete veins (see Fig. 1). Veins with distinct, rounded tubercles; dorsal membrane slightly rugose and reinforced by sclerotized circular plaques (Fig. 2). Dorsal valve of gonapophyses particularly broad (Fig. 13). The terminalia of two female paratypes have been dissected, one of them (MHNG 7646 allotype) proved to be virgin, its spermatheca being shrivelled and empty (Fig. 15), in the other one (MHNG 7648) a simple spermatophore (sperm packet) could be observed in the basal zone of the spermathecal sac (Fig. 16).

Measurements (♀ allotype, in μm). BL = 1730; FW = 1470; A = 1460; f1 = 120; f2 = 150; f3 = 155; f4 = 170; F = 400; T = 610; t1 = 285; t2 = 55; t3 = 88; IO/D = 1.7.

BIOLOGY

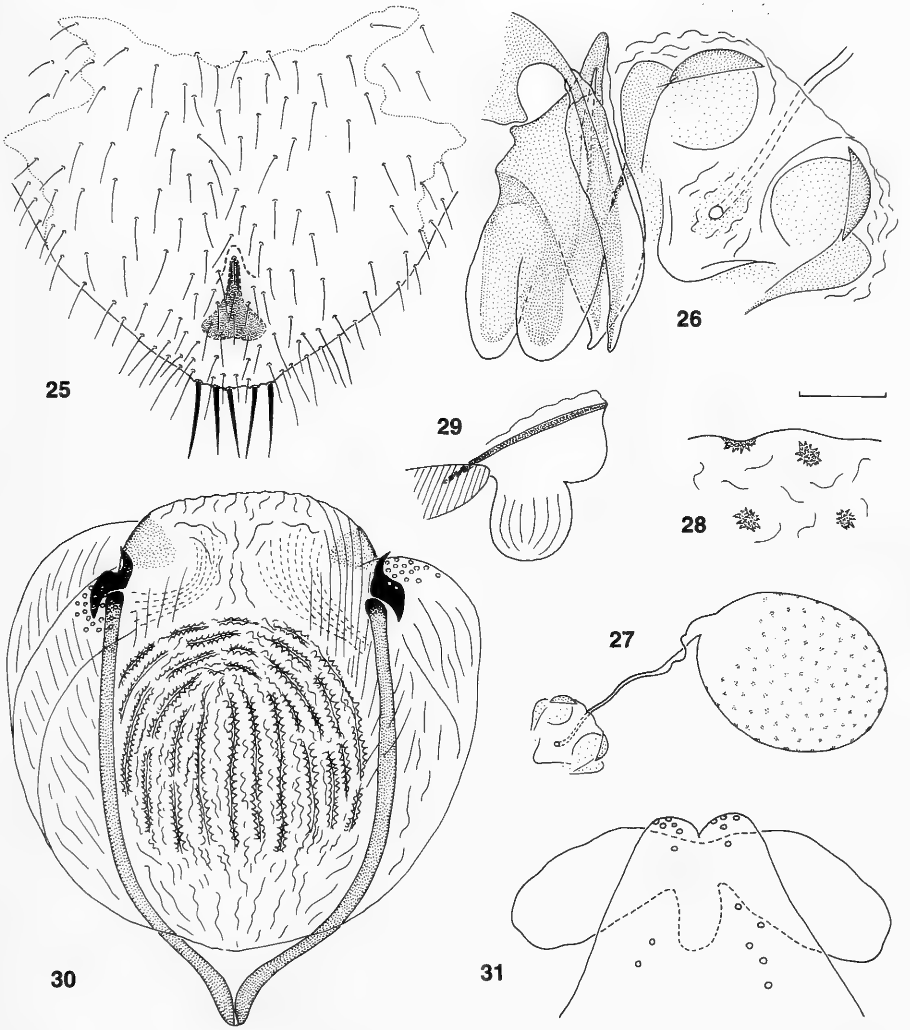
The type series was collected under stones lying on the soil of a relatively open forest of *Pinus* sp., situated in a mountainous region of southern Turkey, about 30 km from the Mediterranean coast. When disturbed, these black, hemispherical, beetle-like insects moved quickly on the underside of the stones (C. Besuchet, pers. comm.).

DISCUSSION

The definition of the family Protroctopsocidae and its generic and specific composition have already been presented in the "Introduction". Within this family the three Mediterranean genera *Philedaphia*, *Chelyopsocus* and *Reticulopsocus* gen. n. undoubtedly form a monophyletic group defined by the following synapomorphies: antenna 14-segmented, female subgenital plate with sclerotized latero-dorsal zones on margin, endophallus with pore-bearing central lobe. Its sister-group is the Mexican genus *Protroctopsocus*, which is characterized by several plesiomorphic features and by the autapomorphic basal enlargement of P4 and the complex sclerotizations around the spermapore (Fig. 26). The three Mediterranean genera can be assigned to two phylogenetic clades, one comprising *Philedaphia*, characterized by the complex phallosome (see key below), and the other comprising *Chelyopsocus* and *Reticulopsocus*. The latter two genera have a very similar spermatheca structure (simple spermapore, membrane of spermathecal sac with pores bearing microtubular appendices; but spermatheca lacking inward-directed basal papillae near opening of duct in *Chelyopsocus*) which can be interpreted as a probable synapomorphy. In both other protroctopsocid genera (i.e. *Protroctopsocus* and *Philedaphia*) the membrane of the spermathecal sac lacks basal papillae and pores with microtubular appendices; however, in *Philedaphia* this membrane bears regularly distributed inward-directed spine-like structures (see Lienhard, 1988: fig. 7 and 1995: fig. 14), which are probably homologous to the inward-directed, small, rugose plates present in *Protroctopsocus* (Figs 27, 28).

Chelyopsocus is characterized by the clearly apomorphic blunt incisive region of the mandibles (Fig. 24; this newly observed character state was confirmed for both specimens known of this genus, holotype and paratype females of *C. garganicus*); in all other protroctopsocid genera this region is acute, corresponding to the plesiomorphic condition within Psocoptera (cf. Fig. 21). The broad and only weakly subdivided outer cusp of the lacinial tip can also be interpreted as an autapomorphy of this genus; all other protroctopsocids show a distinct indentation (cf. Fig. 19).

Occasional brachyptery with a tendency towards elytriform fore wings can be observed in *Protroctopsocus*, but it is without sexual dimorphism. Elytroptery seems to be genetically fixed in the female of *Chelyopsocus* (male not known) and in both sexes of *Reticulopsocus*, where a strong sexual dimorphism occurs. The male exhibits a "moderate elytroptery" (with essentially normal wing venation, similar to that present in the female of *Chelyopsocus* and in the brachypterous morph of *Protroctopsocus*), whereas the female shows a "perfect elytroptery" with densely reticulate fore wings forming a regularly vaulted and uniformly structured, hemispherical covering of the abdomen strongly resembling elytra in Coleoptera.



Figs 25-31

Figs 25-30. *Protroctopsocus enigmaticus* Mockford (female: Figs 25-28; male: Figs 29-30): 25, subgenital plate (general coloration of ventral side not shown, brown cuticular pigmentation anteriorly delimited by dotted line); 26, gonapophyses and sclerotizations around spermapore; 27, spermatheca; 28, rugose areas of spermathecal membrane (scale bar 0.02 mm); 29, phallosome with everted endophallic sac, in situ (lateral view, schematic, hypandrium hatched); 30, phallosome (ventral view). - Fig. 31. *Philedaphia aphrodite* Lienhard, male paratype: medio-apical sclerite of phallosome (coloration not shown) and membranous pore-bearing central lobe of endophallus (ventral view, endophallic sac not everted).

The presence of morphologically so different brachypterous morphs within the same species has never been observed before in Psocoptera. In the other electrentomoid genus with beetle-like females, the litter-dwelling *Coleotroctellus* Lienhard (see "Introduction"), males are always macropterous, with normal venation and fully developed hind wings. In that genus the mobility of the males apparently represents a more important evolutionary advantage than it could be offered by an efficient abdominal protection in both sexes (Lienhard, 2002). In *Reticulopsocus* this is apparently not the case. Males have also become flightless and perhaps they are on the way to evolve towards a "perfect elytroptery" as it has already been genetically fixed in females. The many venational aberrations observed in males (see description) may be interpreted as an indication of a diminishing selection pressure for "normal" venation in these brachypterous and flightless animals.

In *Coleotroctellus* the females show a beetle-like habitus similar to that of the female of *Reticulopsocus*. In both genera shape and length of the dark brown female fore wings are about the same. However, in *Coleotroctellus* the sclerotized vaulted wing membrane is stabilized by a series of thickened longitudinal veins derived from the normal venation of the family Troctopsocidae, which is very similar to the normal venation of Protroctopsocidae. In some species these veins are relatively easy to homologize with the normal venation (*C. burckhardti* and *C. loebli,* see Lienhard, 1988 and Lienhard & Mockford, 1997), but in *C. venosus* the multiplication of longitudinal veins makes this homologization very difficult. *C. venosus* apparently is the most derived form resulting from an evolutionary trend towards "perfect elytroptery", where the vaulted fore wing membrane is mechanically stabilized by numerous parallel longitudinal ribs (see Lienhard & Mockford, 1997: figs 8-10). As we have seen above, another type of "perfect elytroptery" has evolved in *Reticulopsocus,* based on a different constructional principle, which consists of "wire-netting" the vaulted fore wing membrane by a dense reticulate venational pattern (Pl. 1A and Fig. 1).

Reticulate fore wings are very rare in Psocoptera. Some distinct but very fine reticulate sculpture can be observed in the strongly reduced scale-like fore wings of *Lepinotus reticulatus* Enderlein (Trogiidae, suborder Trogiomorpha) and in the parchment-like elytriform fore wings of *Badonnelia titei* Pearman (Sphaeropsocidae, suborder Troctomorpha) (*L. reticulatus*: see Lienhard, 1998: fig. 26d; *B. titei*: see Pearman, 1958: fig. 6, New, 1974: fig. 130, Lienhard, 1982: fig. 3). But in these cases the reticulation is not directly derived from the wing venation. The only family, where extensive venational reticulation in fore wings is currently known are the Calopsocidae (suborder Psocomorpha; see Thornton & Smithers, 1984). In some species the reticulate venation is especially well-developed in the apical half of the wing, but species with almost completely reticulate wings are also known (e. g., *Calopsocus reticuloides* Thornton & Smithers). In Calopsocidae this reticulate condition is usually also combined with some wing shortening and a slight tendency towards elytroptery, but hind wings are always well-developed, with normal venation, and probably these psocids are all able to fly. Sexual dimorphism in wing structure is not known in Calopsocidae (see male and female of *C. reticuloides*, Thornton & Smithers, 1984: figs 116 and 121). Calopsocids usually live on vegetation and with a fore wing length of several millimeters they are all much larger than *Reticulopsocus*. Probably selection pressure leading to reticulate fore wings differs considerably in these phylogenetically very distant groups.

KEY TO GENERA OF PROTROCTOPSOCIDAE

NOTE. Figures of *Protroctopsocus* have been published by Mockford (1967, female) and Garcia Aldrete (1982, male) and additional information is given in Figs 25-30 of the present paper. For *Chelyopsocus* and *Philedaphia* see Figs 24 and 31 and figures in Lienhard (1998). The male of *Chelyopsocus* is not known. All known species of Protroctopsocidae are mentioned in the "Introduction".

1 Antenna 15-segmented. Head capsule clearly elongated in anterior view, frons distinctly longer than postclypeus (Garcia Aldrete, 1982: fig. 1). P4 basally enlarged, its maximal width near base (Mockford, 1967: fig. 46 and Garcia Aldrete, 1982: fig. 8). Fore femur with a longitudinal ventral row of short articulated spines on anterior side (Mockford, 1967: fig. 29; Garcia Aldrete, 1982: fig. 4). Female subgenital plate (Fig. 25) with 2-5 (usually 4)[1] stout apical setae, lacking sclerotized latero-dorsal zones on margin. Phallosome (Fig. 30) V-shaped, without medio-apical sclerite, lateral struts straight, simple; endophallus lacking pore-bearing central lobe. Fore wing not sexually dimorphic, normally shaped in macropterous morph (Mockford, 1967: fig. 26), slightly elytriform with concave wing cells but with normal venation in brachypterous morph (Garcia Aldrete, 1982: fig. 2); this morph known in both sexes . . . . *Protroctopsocus* Mockford

\- Antenna 14-segmented. Head capsule weakly elongated, nearly circular in anterior view, frons not or only slightly longer than postclypeus. P4 nearly spindle-shaped, its maximal width roughly in the middle (Fig. 20). Fore femur with a longitudinal ventral row of particularly well-developed sculptural denticles (not articulated!) on anterior side (Fig. 22). Female subgenital plate (Fig. 12) with 2 (rarely 3) stout apical setae and with sclerotized latero-dorsal zones on margin, these more or less distinctly joined to T-shaped sclerite by small sclerotized bridges. Phallosome relatively complex, with medio-apical sclerite (Lienhard, 1998: fig. 45d) or lateral struts curved inward (Figs 9, 11); endophallus with a pore-bearing central lobe (Figs 9, 11, 31). Fore wing normal (Pl. 2A) or strongly elytriform and with modified venation (Pls 1AB, 2B), sometimes sexually dimorphic 2

2 Incisive region of mandibles blunt (Fig. 24). Apex of outer cusp of lacinial tip broad, only with a slight marginal incision (Lienhard, 1998: fig. 43d). Brachypterous female with elytriform fore wing, venation modified to form concave "honeycombed" cells (Pl. 2B and Lienhard, 1998: fig. 43a, e; pl. 9g) . . . . *Chelyopsocus* Lienhard

\- Incisive region of mandibles acute (Fig. 21). Apex of outer cusp of lacinial tip with distinct indentation (Fig. 19). Brachypterous female

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[1] Mockford (1967: fig. 37) illustrated a subgenital plate with only 2 stout apical setae; the specimen examined has 5 such setae (Fig. 25). In 1979 Mockford (in litt.) stated: "4 stout setae is the usual situation for both forms" [i. e. for macropterous and brachypterous morphs].

with normally shaped fore wing and slightly reduced venation (Lienhard, 1998: fig. 46a, pl. 3a) or with reticulate elytriform fore wing (Fig. 1 and Pl. 1A) 3

3 Fore wing normally shaped in macropterous morph (male and female) (Pl. 2A) and in brachypterous morph (female), venation normal in both morphs but slightly reduced in brachypterous females. Phallosome U-shaped (Lienhard, 1998: fig. 45d), with medio-apical sclerite; lateral struts of phallosome doubled, not curved to the middle at their apex. Angle of lateral hind margin of clunium with a densely pilose posterior lobe (Lienhard, 1998: fig. 45a) .... *Philedaphia* Lienhard

\- Only brachypterous morph known (male and female), fore wing elytriform with somewhat simplified venation in male (Figs 4-6; Pl. 1B) and with reticulate venational pattern in female (Fig. 1; Pl. 1A). Phallosome V-shaped (Figs 9, 11), lacking medio-apical sclerite; lateral struts simple but curved to the middle at their apex. Lateral hind margin of clunium simple, roughly right-angled, without densely pilose posterior lobe (Fig. 8) .... *Reticulopsocus* gen. n.

ACKNOWLEDGEMENTS

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Revision of the Oriental Genus *Loeblites* Franz (Coleoptera, Scydmaenidae)

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Revision of the Oriental genus *Loeblites* Franz (Coleoptera, Scydmaenidae). - The Oriental scydmaenid beetle genus *Loeblites* Franz is revised. *Loeblites mastigicornis* Franz from Thailand and *L. sabahensis* Franz from Borneo are redescribed, and a new species, *L. minor* sp. n. from Borneo is described. The general morphology of the genus is described and illustrated in details, including mouthparts, wings, female and male genitalia, and an identification key to the species of *Loeblites* is given.

Keywords: Coleoptera - Scydmaenidae - *Loeblites* - revision - morphology - new species - Oriental region - taxonomy.

INTRODUCTION

The genus *Loeblites* (Scydmaeninae, Cyrtoscydmini) was established by Franz (1986) for a single species, *L. mastigicornis*, on the basis of four individuals collected in Thailand. A few years later *L. sabahensis* was described by the same author from Borneo (Franz, 1992). These two species were the only members of the genus known so far. As mentioned previously (Jałoszyński, 2004), *Loeblites* shows a high degree of similarity to *Syndicus* Franz and *Horaeomorphus* Schaufuss; the three genera may form a monophyletic group within the Cyrtoscydmini. Details of morphology have been described only in *Syndicus* (Jałoszyński, 2004); therefore, a comprehensive comparison of all three genera will be possible when respective structures have been described in *Horaeomorphus* (Jałoszyński, in preparation). The purpose of the present paper is to provide a clear diagnosis of *Loeblites* and a detailed description of the morphology. Existing descriptions of the two known species lack important details (e.g., spermathecae, mouthparts, thoracic morphology), and during the present study I discovered that the type series of *L. sabahensis* consisted of two different taxa. Therefore, herein *L. mastigicornis* and *L. sabahensis* are redescribed, the detailed morphology of the genus is given (including previously unknown characters), and a new species, *L. minor* sp. n., from Borneo is described.

METHODS

Illustrated anatomical structures were disarticulated, dehydrated in isopropanol, transferred to xylene, and mounted in Canada balsam, or dehydrated in ethanol and mounted in euparal. The measurements are as follows: length of the head is from the

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occipital constriction to the anterior margin of clypeus; width maximum includes eyes; length of pronotum is measured along midline; length of elytra is measured along suture; width of elytra combined, measured at greatest width; elytral index (EI): length/width. Mounted specimens often have head and pronotum bent ventrally to a various extent, and therefore a total length measured in dorsal view might be misleading; for this reason the total length given in descriptions is the sum of individual measurements of the head, pronotum and elytra. The length of spermatheca is the longest measurement of the capsular part. The nomenclature of morphological details follows that used in Jałoszyński, 2004, which was partly adopted from O'Keefe & Monteith (2000), Bordoni & Castellini (1973), and Nomura (1991). Studied specimens are deposited in Muséum d'histoire naturelle, Geneva, Switzerland (MHNG), Natural History Museum, Vienna, Austria (NMW), private collection of the author, Poznań, Poland (PCPJ), and private collection of Peter Hlaváč, Košice, Slovakia (PCPH).

TAXONOMY

Loeblites Franz

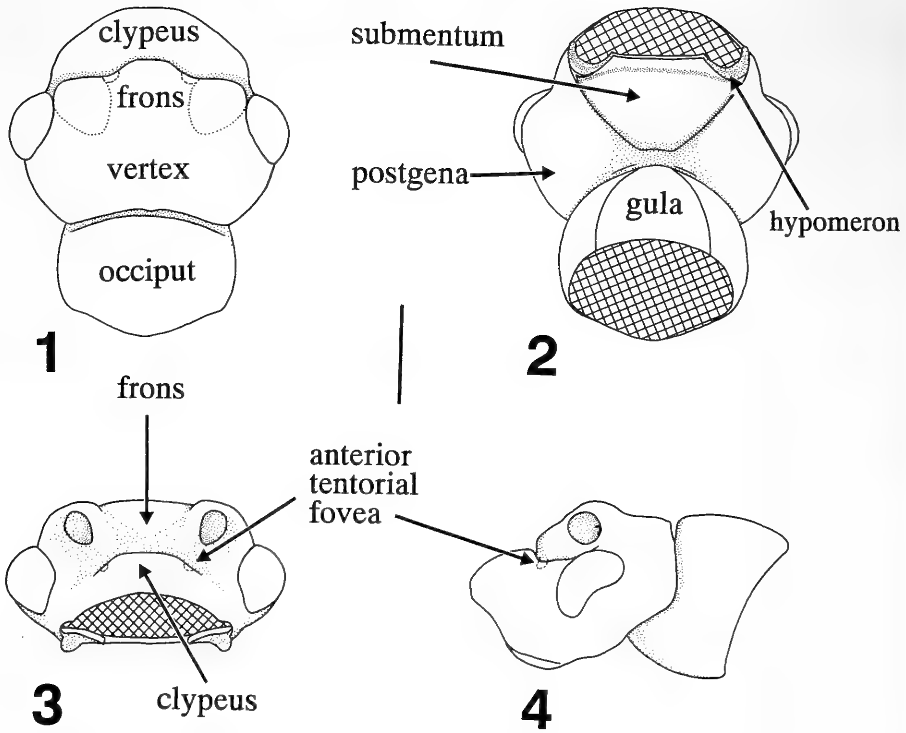
Loeblites Franz, 1986: 965. Type species: *Loeblites mastigicornis* Franz, 1986 (des. orig.); Newton & Franz, 1998: 147.

Diagnosis. Members of *Loeblites* can be identified on the basis of the following characters: body of moderate size (2.31-2.82 mm), relatively slender, very convex, light to dark brown, covered with moderately dense and long setation; head wider than long, widest at eyes; mandibles nearly planar, subtriangular with long prostheca, slender and sharp apical tooth and subapical tooth; maxillary palpi with broadened, elongate palpomere III and fusiform, slender palpomere IV; antenna without club, very long and slender, barely broadened toward apex, antennomere XI not modified, well separated from X; pronotum widest near anterior $^1/_5$-$^1/_3$, with rounded anterior margin and sides, lateral margins distinctly narrowing posteriorly, without lateral carina or sharp edge, with constriction separating short posterior collar, in dorsal view posterior collar demarcated from disc by transverse row of four pits, each side of pronotum bears two additional, shallow and indistinctly delimited pits or impressions; scutellum not visible; elytra entire, oval, each elytron with two basal foveae located very close to elytral insertion, so that pits are partly covered by posterior margin of pronotum, base of elytra usually with shallow internal humeral impressions; all femora with slender basal stalk-like part and strongly clavate distal part with narrow dorsal femoral groove and very small circular or oval pore, presumably a gland opening. Aedeagus symmetrical or with minimally asymmetrical internal armature, elongate, with long, asetose parameres and relatively complicated, darkly sclerotized internal sac; spermatheca well sclerotized, usually dark brown, ovoid with tubular or funnel-like excavation and approximate insertions of very thin ductus spermathecae and thicker duct of accessory gland; bursa copulatrix variously developed, in one case missing, in remaining two known species relatively large and dark, asymmetrical to symmetrical.

Redescription. The following detailed description of the general morphology is based on disarticulated male and female specimens of *Loeblites sabahensis* (remarks on the remaining species are included, if described structures are significantly different). This species was selected because of the abundance of specimens available for dissections.

Head (Figs 1-4, 19). In dorsal view head wider than long, widest at eyes; occiput broad, only slightly narrower than vertex, distinctly separated from vertex by constriction and relatively deep transverse groove, tempora long, rounded; vertex about 2.5 times as wide as long, slightly convex, with small and indistinctly delimited median tubercle adjacent to occipital constriction; supraantennal tubercles relatively large and strongly raised; frons relatively short, gradually lowering anteriorly, demarcated from clypeus by transverse groove. Punctation of vertex and frons relatively fine and sparse; setation sparse and moderately long. Clypeus wider than long, with uneven, granulated surface; anterior tentorial foveae barely visible, located in supraclypeal groove, in anterior margin of head; eyes located near middle of head length, convex, relatively large, in lateral view with emarginate postero-ventral margin, finely faceted; gena and postgena strongly convex, with moderately long setae directed laterally and dorsally. In ventral view gula large, subtriangular with rounded lateral margins; submentum subtriangular, with shallow groove parallel to posterior margin of mentum; posterior tentorial pits not visible; hypomera (sensu Jałoszyński, 2004; hypostomae of O'Keefe, 2000) well developed. Antennal cavities broadly separated, located in latero-anterior part of head, under supraantennal tubercles; antenna (Figs 36-38) without club, very long, antennomeres with well delimited basal rings, covered with long, moderately dense, suberect to erect setae.

Mouthparts (Figs 5-8). Labrum (Fig. 5) wider than long, subtrapezoidal, with straight posterior margin, rounded sides and minimally concave anterior margin; lateral and anterior margins with narrow, lightly sclerotized velum. Dorsal surface of labrum with seven pairs of symmetrically located setae of various lengths. Mandible (Fig. 6) subtriangular, nearly planar, with broad base and curved, sharp apical tooth and single subapical tooth. External margin of mandible near posterior condyle bears group of several setae. Prostheca well developed, relatively broad, composed of short setae nearly from base of mandible to about middle of internal margin, which between prostheca and subapical tooth is sharp and irregularly, very finely serrated. Maxilla (Fig. 7) with subtriangular stipes bearing two basal setae; elongate palpifer with two long subapical setae and three or four short setae on ventral surface; elongate galea with row of long and dense setae along internal apical margin and additionally two shorter and thinner setae on apex and on external margin; and long lacinia with dense and long setae along internal margin and two additional thinner sensory setae near middle of internal margin. Palpus maxillaris relatively large, palpomere I very small, subtrapezoidal, with single subapical seta; II elongate and curved, pipe-like, with slender basal part, gradually broadening toward truncate apex, covered with relatively sparse, suberect setae confined to distal $^2/_3$; palpomere III distinctly enlarged, with narrow base, broadened between middle and distal third, then narrowing toward truncate apex, with moderately dense, suberect setation; palpomere IV small and long, narrowing from base to pointed apex, setation relatively short and dense, recumbent to suberect, apical third to fourth asetose. Labium (Fig. 8) with darkly sclerotized, subrectangular mentum with numerous tiny pores on ventral surface; palpomere I about

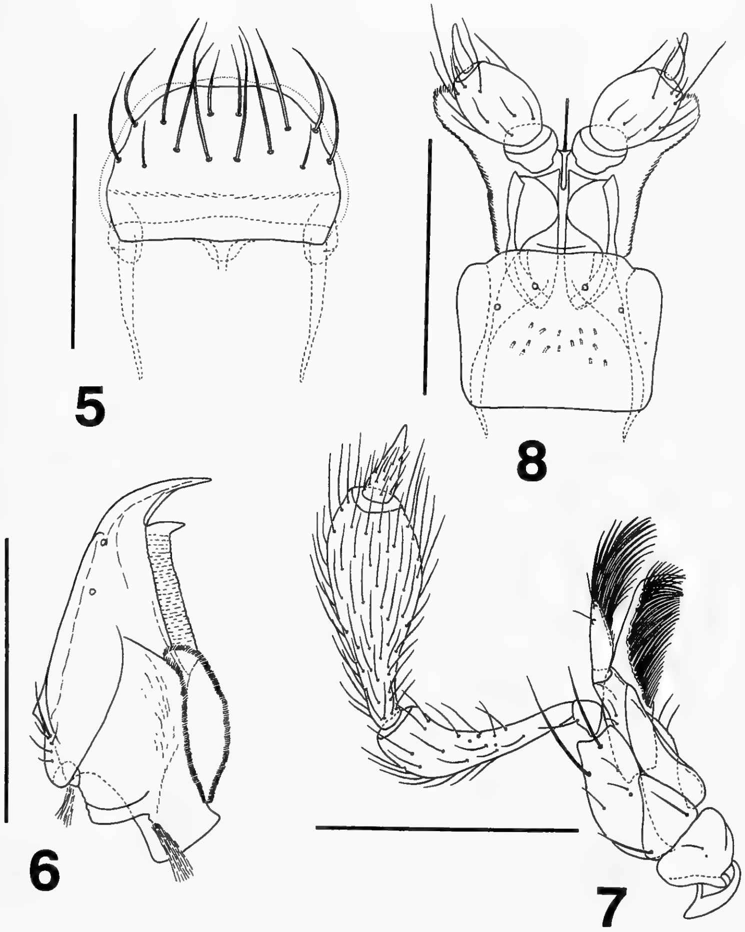


FIGS 1-4

Loeblites sabahensis Franz: 1 – head, dorsal view, 2 – head, ventral view, 3 – head, anterior view, 4 – head, left lateral view. Scale 0.2 mm.

twice as wide as long, broadened in distal half, asetose; palpomere II large, subcylindrical with rounded sides, nearly three times longer than I, with several long setae; palpomere III long and slender, slightly more than half length of II, narrowing toward pointed apex, asetose. Anterior margin of labium between insertions of palpi bears pair of long bristles in middle; hypostom well developed, with short and dense setation.

Prothorax (Figs 9-10, 19). In dorsal view (Fig. 19), pronotum elongate, anterior margin rounded, lateral margins without sharp edges or carinae, rounded, posterior margin arcuate, hind angles indistinct. Pronotum widest near anterior third or fourth; posterior third or less demarcated by transverse row of eight variously developed foveae. In strictly dorsal view, four foveae fully visible and additional pair of lateral foveae partly visible; external, very shallow pits or rather impressions located laterally, visible only in lateral view (Fig. 10). Dorsal surface of pronotum moderately or strongly convex, except for posterior collar, which is flatter than disc. Dorsal surface covered with very dense, round granules (*L. mastigicornis*) or distinct, but relatively small and sparse punctures (*L. sabahensis* and *L. minor*); setation moderately dense, composed of curved, suberect to erect setae. Ventral side of pronotum (Fig. 9) very short, with relatively well developed basisternum; procoxal cavities large, nearly



Figs 5-8
Loeblites sabahensis Franz: 5 – labrum, dorsal view, 6 – left mandible, dorsal view, 7 – right maxilla, ventral view, 8 – labium, ventral view. Scale 0.2 mm.

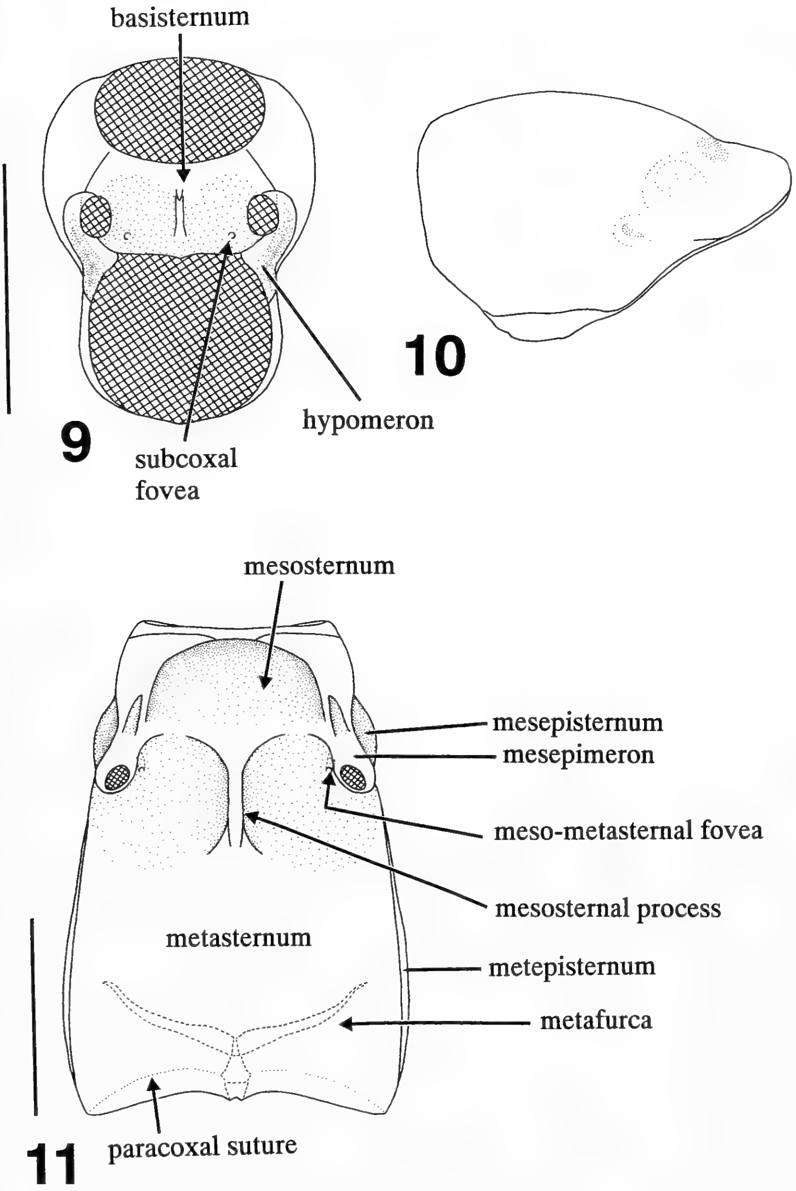
circular, procoxal insertions very widely separated; subcoxal foveae small, located close to posterior margin of prosternum, near coxal insertions, in natural position covered by coxae. Hypomera large and well demarcated, elongate, impressed in middle. Ventral surface of pronotum covered with relatively dense, short suberect setation, except for asetose areas under coxae.

Mesothorax (Figs 11-12). Mesonotum (Fig. 12) elongate; prescutellum relatively short and broad, subtriangular, with slightly concave anterior margin and convex, rounded posterior margin, each lateral margin terminated at short anterior notal wing process; scutellum long and narrow, with rounded apex; postscutellum very short, with deeply emarginate posterior margin; posterior notal wing processes long and slender, extending latero-posteriorly toward latero-anterior margins of metatergal prescutum. Mesosternum (Fig. 11) wider than long, subtrapezoidal; mesepimeron elongate, with shallow subtriangular impression; mesepisternum elongate, distinctly convex, partly visible in dorsal view; basisternal area large, broadly and deeply impressed in middle, posteriorly basisternum expanded in middle into raised, moderately narrow mesosternal process extending to about anterior third of metasternum, gradually raising to posterior $^1/_4$-$^1/_5$, then lowering toward rounded apex. Coxal insertions small, oval, very broadly separated. Surface of basisternal area uneven, densely covered with long setae; convex parts of mesepimera glabrous and asetose, glossy, concave area on each mesepimeron with dense, short setae; mesepisterna covered with short and dense setae.

Metathorax (Figs 11-12). Metanotum (Fig. 12) distinctly wider than long. Prescutum relatively small, transverse, with rounded posterior margin, distinctly demarcated from scutum, laterally connected to wing insertion, postero-laterally to scutum; scutum large, nearly completely divided into two lateral parts by large, triangular scutellum, distinctly separated from scutum and from postnotum by sutures; postnotum relatively small, narrow, with convex, rounded posterior margin. Metasternum (Fig. 11) elongate, basisternal area with biemarginate anterior margin, deeply depressed between mesosternal process and mesocoxal insertions; meso-metasternal foveae (metasternal foveae in Jałoszyński, 2004; the foveae are actually located between meso- and metasternum) small, in natural position covered by mesocoxae; middle part of anterior margin fused to mesosternal process; posterior $^2/_3$ or more of metasternum convex; posterior margin biemarginate, slightly expanded posteriorly in middle, with relatively shallow median notch. Paracoxal sutures indistinct in dry-mounted specimens, well recognizable in transparent mounts; metasternum bordered on each side by narrow episternum. Setation of metasternum relatively long, moderately dense, suberect, except for asetose areas under mesocoxae. Metafurca with short and broad basal stalk and two long, slender, recurved and widely divergent furcal arms.

Elytra (Figs 12, 19) entire, oval, convex, widest anterior to middle, base nearly straight or slightly concave, wider than base of pronotum; humeral callus moderately distinct, internally delimited by relatively short and shallow internal humeral impression; each elytron bears pair of small circular basal foveae connected by U-shaped groove and located in depression between convex discal part and small basal lobe connected to mesonotum; in natural position foveae barely visible, covered by posterior margin of pronotum. Elytral punctation not ordered in rows, punctures relatively fine and sparse; elytral setation composed of moderately long, suberect to erect setae.

Wing insertion and wing (Figs 12-13). Suralare large, subrectangular with rounded margins; axillary sclerites elongate, the uppermost sclerite large and S-shaped, two remaining sclerites smaller, elongate; subalare moderately large, elongate. Wings (Fig. 13) in all species fully developed, about twice as long as elytra. Wing venation highly reduced, limited to basal half of wing or less; costa highly reduced, very short; subcosta and radius short, distally fused together with anterior margin of wing; posterior venation composed of only two nearly parallel veins, which may represent mediana and cubitus (or fused cubitus + postcubitus). Distal half of wing without traces



FIGS 9-11

Loeblites sabahensis Franz: 9 – pronotum, ventral view, 10 – pronotum, left lateral view, 11 – mesosternum and metasternum, ventral view. Scale 0.5 mm.

of veins, posterior margin bears row of long setae, anterior margin with very short setae, entire wing covered with extremely short, very dense setation.

Legs. Procoxae relatively large, subconical, contiguous; mesocoxae slightly larger than procoxae, oval, separated by mesosternal process; metacoxae narrowly separated, transverse, elongate, with well delimited internal posterior part adjacent to trochanters. Trochanters small and longer than wide, protrochanters fully separating procoxae from profemora; meso- and metatrochanters not separating meso- and metafemora from coxae. Femora long, clavate, with very slender proximal part (about half length of femur) and abruptly expanded distal part. Dorsal surface of clavate part of femora bears very narrow but distinct dorsal femoral groove and very small circular or oval pore near the widest place of femur. Tibiae relatively slender and long, straight or minimally recurved, pro- and especially mesotibiae in both sexes bear dense patch of golden setae along distal fourth or fifth of internal margin. Tarsi moderately long, relatively thick, tarsomeres I-IV subequal or only slightly decreasing in length, tarsomere V elongate, nearly as long as II-IV together.

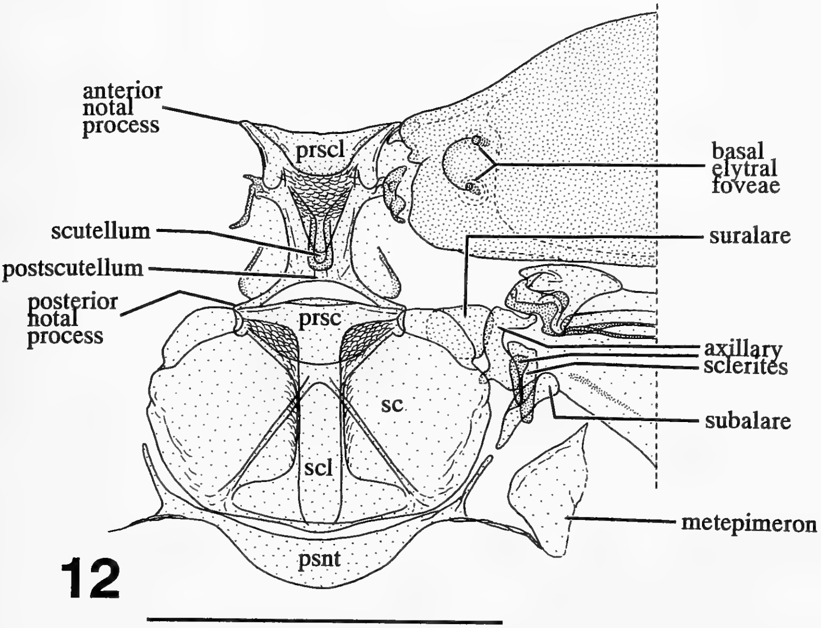
Abdominal sternites. Six abdominal sternites visible (numbered I-VI in the present study), together shorter than metasternum. Sternite I relatively long, but only partly visible from under metacoxae, under coxae concave, with median longitudinal carina not reaching posterior margin of sternite. Sternites II-IV subequal in length, each about as long as half of I; sternite V about as long as 1.5 length of IV, sternite VI subtriangular, with broadly rounded posterior margin, as long as V or slightly longer. Sutures between sternites arcuate or nearly straight; all sternites with variable punctation and moderately dense, short and slightly suberect setation.

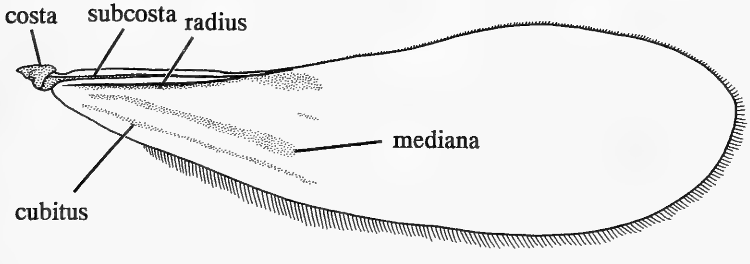
Male genital segment (Figs 14-16) composed of tergite IX, sternite IX and tergite X. Tergite IX (Fig. 14) composed of two elongate lateral parts; sternite IX (Fig. 15) relatively large, subtriangular, with broadly emarginate anterior margin and rounded apex bearing several setae of various lengths, lateral margins convex in proximal part and strongly concave in distal part; tergite X (Fig. 16) small, nearly pentagonal, with anterior margin expanded in middle and posterior margin broadly emarginate.

Aedeagus (Figs 20-22, 25-27, 30-32) with large and elongate median lobe widest near base and narrowing toward rounded apex; base with narrow median emargination; parameres long, symmetrical, without apical setae. Armature of internal sac relatively complicated; symmetrical (*L. mastrigicornis* and *L. minor*) or slightly to distinctly asymmetrical (*L. sabahensis*).

Female genital segment (Figs 17-18) composed of pair of large, fused paraprocts; pair of moderately broad valvifers fused with paraprocts, with dense setation along apical margin; pair of elongate, slender coxites with sparse and relatively long setae; and small proctiger (Fig. 18) with broadly emarginate proximal margin, with long, slender and pointed median projection in distal margin. Bursa copulatrix (Figs 24, 29, 35) highly diversified within the genus; well developed, darkly sclerotized and symmetrical in *L. mastigicornis* (Fig. 24), relatively lightly sclerotized and asymmetrical in *L. sabahensis* (Fig. 29), and *L. minor* lacks visible structures surrounding distal (i.e. genital) end of ductus spermathecae (Fig. 35).

Spermatheca (Figs 23, 28, 34) capsular, well sclerotized, relatively dark, with apical excavation leading into internal tube or funnel; ductus spermathecae very thin, inserted in base of spermatheca, near short and thicker duct of very lightly sclerotized, in most cases barely recognizable accessory gland.





FIGS 12-13

Loeblites sabahensis Franz: 12 – mesonotum, metanotum, base of right elytron and wing, dorsal view, 13 – right wing, dorsal view. Prscl – prescutellum, prsc – prescutum, sc – scutum, scl – scutellum, psnt – postnotum. Scale 0.5 mm.

KEY TO THE SPECIES OF *LOEBLITES* FRANZ

1 Pronotum densely covered with small, round granules . *L. mastigicornis* Franz
- Pronotum without granules 2
2 Elytral index: males 1.49-1.62, females 1.51-1.56 .... *L. sabahensis* Franz
- Elytral index: males 1.39-1.47, females 1.44-1.51 .... *L. minor* sp. n.

Loeblites mastigicornis Franz Figs 20-24, 36

Loeblites mastigicornis Franz, 1986: 966, figs. 1, 2.

Type material. Holotype male, white printed label "THAILAND: Chiang Mai, Doi Suthep, 1050 m, 5. XI. 1985, Burckhardt-Löbl", white handwritten label "Loeblites mastigicornis m." and printed "det H. Franz", red handwritten label "Holotypus" (MHNG). Paratypes: 2 males, 2 females, same data (MHNG).

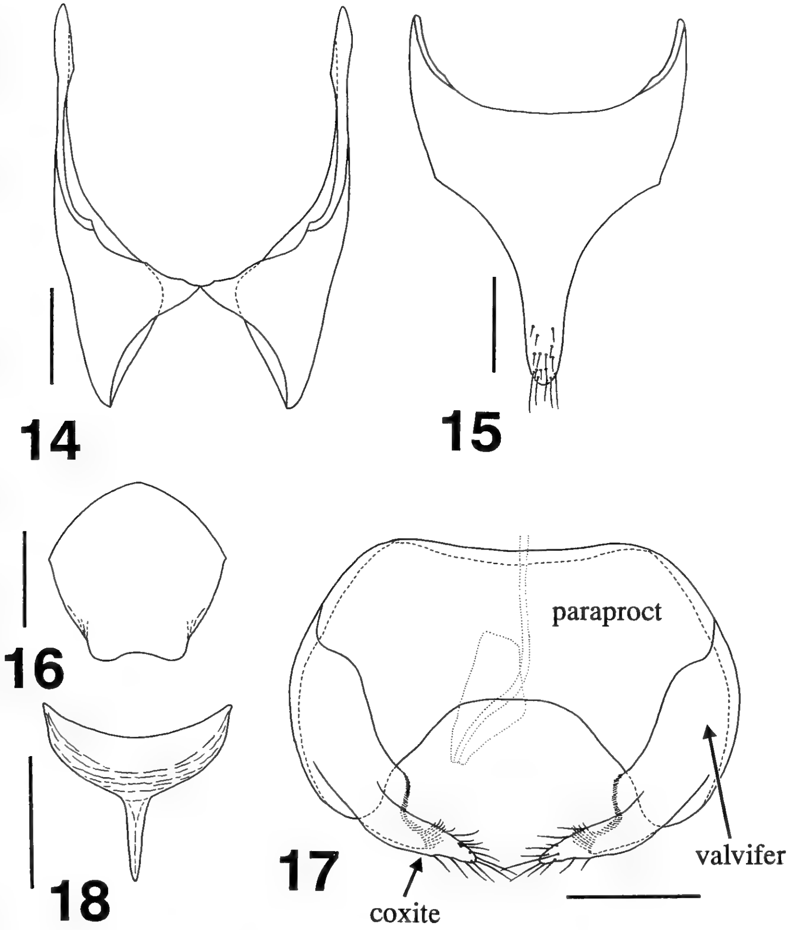
Redescription. Body large, slender, very convex, moderately dark brown, antennae and tibiae slightly lighter, palpi, femora and tarsi distinctly lighter than body; setation relatively sparse, moderately long, suberect, light brown.

Male. Body length 2.77-2.82 mm (mean 2.8 mm). Head broader than long, widest at large, very convex and finely faceted eyes, length 0.45-0.47 mm (mean 0.46 mm), width 0.61-0.62 mm (mean 0.615 mm). Tempora about as long as eye length in dorsal view, rounded, strongly convergent posteriorly; vertex over twice as broad as long, regularly convex, with small and indistinctly delimited median tubercle adjacent to occipital constriction; supraantennal tubercles prominent, distinctly demarcated from frons but indistinctly delimited from vertex; frons relatively small, subtrapezoidal, gradually lowering toward deep clypeal suture; clypeus very large, subtrapezoidal, convex. Vertex posterior to supraantennal tubercles with small, round granules separated by distances about equal to granule diameters; frons with sparse and fine punctures, some with slightly raised margins; clypeus with coarse, small and very dense granules of irregular shape. Setation relatively sparse, setae thin, moderately long, suberect to erect. Antenna (Fig. 36) very slender, length 2.56-2.57 mm (mean 2.565 mm), minimally longer than 0.9 of body length, not thickened toward apex.

Pronotum elongate, widest near anterior fourth, length 0.8-0.81 mm (mean 0.815 mm), maximum width 0.69-0.7 mm (mean 0.695 mm), width at base 0.47-0.5 mm (mean 0.48 mm). Anterior and lateral margins rounded together, sides between middle and posterior third constricted, posterior margin nearly straight, minimally expanded posteriorly in middle; posterior collar demarcated from disc by transverse row of four large but very shallow, elongate pits. Discal part densely covered with small, round, very convex granules about twice as large as those on vertex, distances between granules shorter than their diameters, posterior collar with very coarse and dense granules irregular in shape. Setation moderately sparse, anterior fourth of disc or less with setae as thin as those on head, posteriorly setae increasing in thickness, all setae moderately long, suberect.

Elytra oval, widest at middle or just anterior to middle, length 1.52-1.54 mm (mean 1.53 mm), width 1.0-1.02 mm (mean 1.01 mm), EI 1.51-1.52. Humeral callus on each elytron moderately distinct; internal humeral impression broad and shallow; very narrow adsutural area in anterior $^1/_4$-$^1/_3$ slightly raised and demarcated by sharp edge; apices of elytra separately rounded. Punctation sparse and fine, punctures shallow and relatively indistinct; setation sparse, moderately long, suberect, setae slightly thinner than those on posterior part of pronotum. Hind wings well developed.

Legs long and slender, all femora with stalk-like basal half and clavate distal half, dorsal femoral groove developed nearly from base of femur up to apex, circular pore very small, located in the highest point of dorsal margin of clavate part; tibiae slender, protibiae minimally recurved, meso- and metatibiae nearly straight; tarsi



FIGS 14-18

Loeblites sabahensis Franz: 14 – tergite IX of male, dorsal view, 15 – sternite IX of male, ventral view, 16 – tergite X, dorsal view, 17 – ovipositor, dorsal view, 18 – proctiger, ventral view. Scale 0.1 mm.

slender, tarsomeres I-IV only slightly reducing in length, tarsomere V as long as III-IV together or minimally longer.

Aedeagus (Fig. 20-22) elongate, subtriangular, widest near base, narrowing toward rounded apex, length 0.66 mm. Base with deep median emargination or notch; parameres long, slender, exceeding apex of median lobe, broadened near apex, without visible setae; internal armature symmetrical, complicated, its most noticeable and darkly sclerotized part is basal complex composed of median capsule surrounded by two pairs of elongate structures, other parts of internal sac are relatively lightly sclerotized.

Female externally indistinguishable from male. Body length 2.74-2.82 mm, length of head 0.45-0.47 mm, width of head 0.62 mm, length of antenna 2.55-2.57 mm, length of pronotum 0.79-0.8 mm, maximum width of pronotum 0.67 mm, width of pronotum at base 0.47-0.5 mm, length of elytra 1.5-1.55 mm, width of elytra 1.0-1.02 mm, EI 1.5-1.52.

Spermatheca as in Fig. 23, length 0.075 mm. Bursa copulatrix (Fig. 24) relatively large, length 0.24 mm, darkly sclerotized, symmetrical, in dorso-ventral view elongate and broadly constricted in distal third.

Comments. Loeblites mastigicornis is unique in having pronotum with small, round, very convex granules densely covering disc.

Loeblites sabahensis Franz Figs 1-19, 30-35, 37

Loeblites sabahensis Franz, 1992: 889, fig. 33.

Type material. Holotype male, white printed label "SABAH: Poring Hot Springs, 500 m, 11. V. 1987, Burckhardt-Löbl", white handwritten label "Loeblites sabahensis m." and printed "det. H. Franz", red handwritten label "Holotypus" (MHNG). Paratypes: 2 males, 1 female, same data except for yellow handwritten identification label with printed "PARATYPUS" (2 in MHNG, 1 in NMW); 2 females, white printed label "SABAH: Kibongol V., 7 km N Tambunan, 700 m, 20. V. 1987, Burckhardt-Löbl" and identification label as above (MHNG); 1 female, white printed label "SABAH: Crocker Ra., 1270 m, km 60 rte Kota Kinabalu-Tambunan, 17. V. 87, Burckhardt-Löbl" and standard yellow identification label (MHNG); 1 female, white printed label "BORNEO Sabah Mt Kinabalu N.P. Por. H.S., area Kipungit Crk. 2, 490 m, 14. VIII. 1988, A Smetana (B112)", and standard yellow identification label (NMW).

Additional material studied. 5 males, 6 females, Borneo, Sabah, Batu Punggul resort, 24.-26. vi. 1988, Kodada & Čiampur leg. (PCPH, PCPJ); 1 male, Borneo, Sabah, Crocker Range, Gunung Emas, 1600 m, 31. v. 2001, Kodada & Čiampur leg. (PCPH).

Redescription. Body moderately large, slender, very convex, moderately dark brown, antenna slightly lighter, palpi and legs distinctly lighter than body; overall setation moderately sparse and long, suberect, light brown.

Male (Fig. 19). Body length 2.42-2.59 mm (mean 2.49 mm). Head (Figs. 1-4) very similar to that of *L. mastigicornis*, length 0.42 mm, width 0.55-0.57 mm (mean 0.56 mm), covered with sparse, small punctures with well delimited margins and sparse, moderately long, very thin setae. Antenna slightly less than 0.9 of body length, length 2.1-2.25 mm (mean 2.19 mm), as in Fig. 37.

Pronotum (Figs 9-10) elongate, widest near anterior fourth, length 0.7-0.75 mm (mean 0.72 mm), maximum width 0.57-0.62 mm (mean 0.60 mm), width at base 0.41-0.45 mm (mean 0.43 mm). Lateral and anterior margins rounded and separated by slightly indistinct angle; posterior margin arcuate, minimally expanded posteriorly in middle; sides strongly constricted between middle and posterior half; posterior collar demarcated from disc by transverse row of four large, deep, slightly elongate pits. Punctation sparse, composed of fine punctures with sharply delimited and slightly raised margins, sides of posterior collar with moderately coarse granulation; setation as that in *L. mastigicornis*.

Elytra as in *L. mastigicornis*, length 1.3-1.42 mm (mean 1.35 mm), width 0.8-0.95 mm (mean 0.87 mm), EI 1.49-1.62, punctation fine and sparse; setation moderately long, suberect, setae minimally increasing in thickness from base to middle of each elytron. Hind wings well developed.

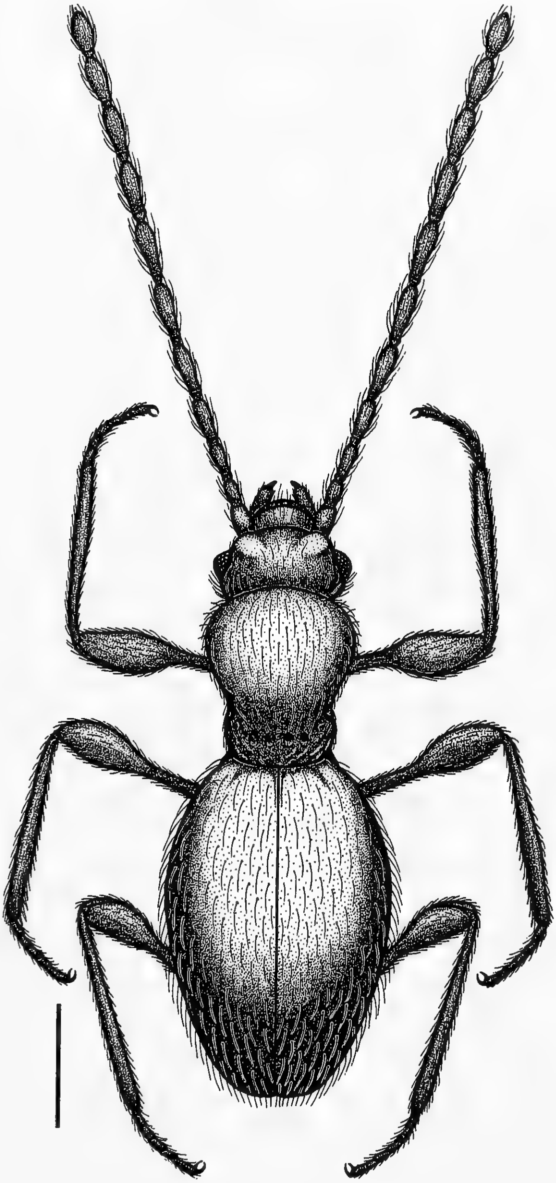
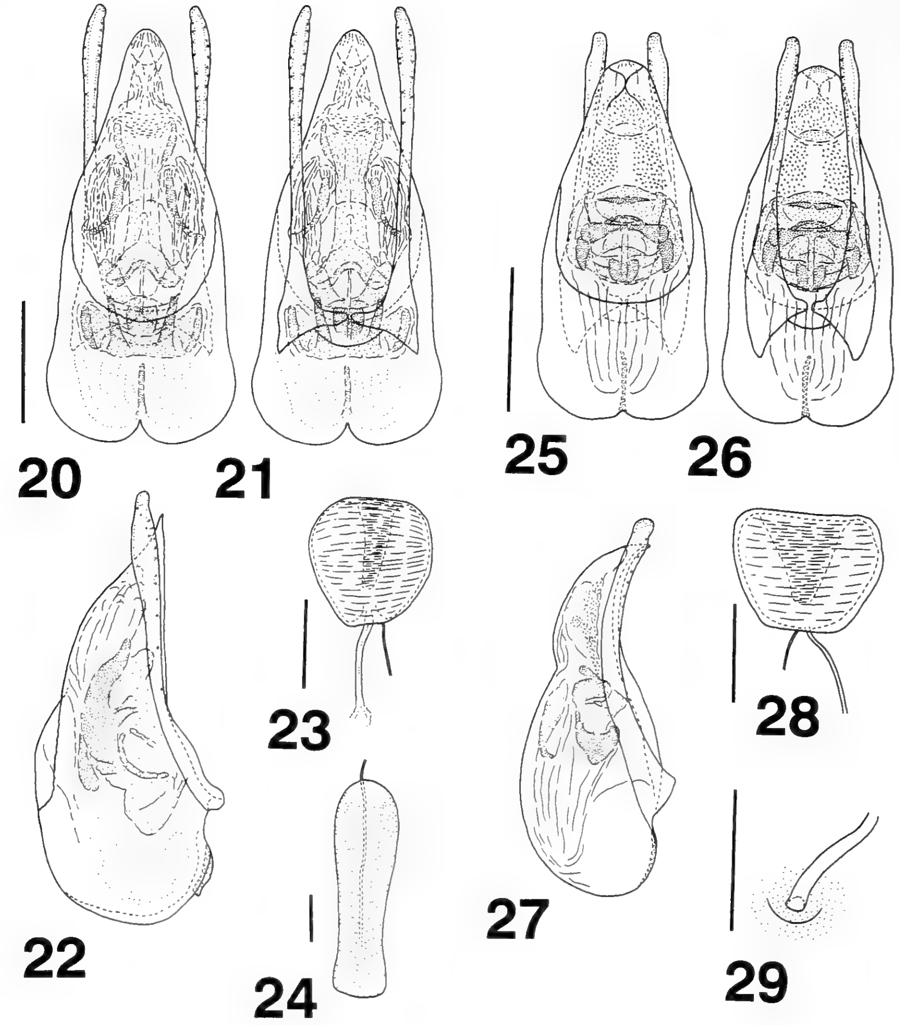


FIG. 19
Loeblites sabahensis Franz, dorsal habitus of male. Scale 0.5 mm.

Legs as in *L. mastigicornis*, except for protibiae, which are nearly straight, not recurved.

Aedeagus (Figs 30-33) elongate, widest near base, narrowing toward rounded apex, length 0.6 mm. Base with moderately deep median emargination; parameres



FIGS 20-29

Loeblites mastigicornis Franz (20-24) and *L. minor* sp. n. (25-29): 20, 25 – aedeagus, dorsal view, 21, 26 – aedeagus, ventral view, 22, 27 – aedeagus, lateral view, 23, 28 – spermatheca, 24, 29 – bursa copulatrix, ventral view. Scale 0.2 mm for 20-22 and 25-27, 0.05 mm for 23-24, 28, 29.

long, slender, exceeding apex of median lobe, broadened near apex, without visible setae; internal armature in most type specimens distinctly asymmetrical, in non-type males inner sac variable, from nearly symmetrical as in Fig. 33 to strongly asymmetrical. The most noticeable part of inner armature is median complex composed of dark central arcuate structure (capsule?) surrounded by relatively lightly pigmented lateral lobes bearing numerous tiny denticles in basal part.

Female very similar to male but slightly longer. Body length 2.59-2.68 mm (mean 2.64 mm), length of head 0.45-0.46 mm (mean 0.455 mm), width of head 0.56-0.59 mm (mean 0.57 mm), length of antenna 2.12-2.25 mm (mean 2.19 mm), length of pronotum 0.72-0.75 mm (mean 0.74 mm), maximum width of pronotum 0.57-0.65 mm (mean 0.61 mm), width of pronotum at base 0.42-0.45 mm (mean 0.43 mm), length of elytra 1.42-1.47 mm (mean 1.45 mm), width of elytra 0.91-0.97 mm (mean 0.94 mm), EI 1.51-1.56.

Spermatheca as in Fig. 34, length 0.08 mm. Bursa copulatrix (Fig. 35) moderately darkly sclerotized, asymmetrical, subconical and slightly curved, length 0.12 mm.

Comments. This species can be identified on the basis of lack of granulation on pronotum and moderately large body. Comparison of the elytral index, the shape of aedeagus or spermatheca and especially the bursa copulatrix is necessary to distinguish *L. sabahensis* from *S. minor*. The latter taxon has not been recognized by Franz and was included into the type series of *L. sabahensis*.

Loeblites minor sp. n. Figs 25-29, 38

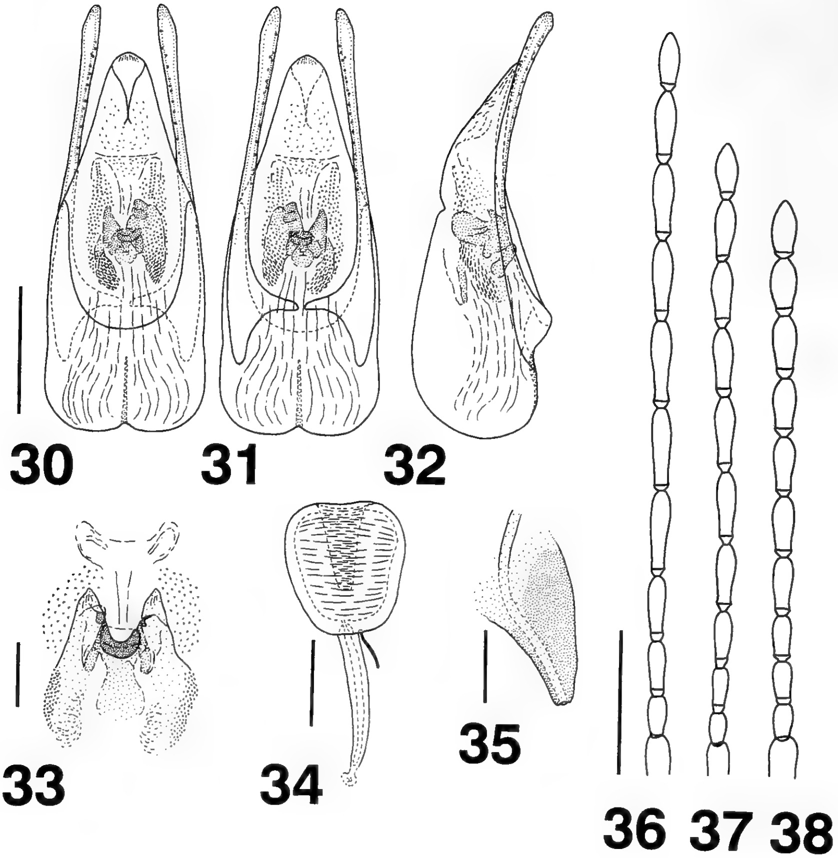
Type material. Holotype male, white printed label "Malaysia, Sabah, Batu Punggul Resort env., 24. VI.-1. VII. 1996, 11c, vegetation debris and forest floor litter accumulated around large trees near river", red printed label "*LOEBLITES minor* m., det. P. Jałoszyński, 2004" (MHNG). Paratypes (all misidentified and bearing yellow identification labels with handwritten "Loeblites sabahensis m." and printed "PARATYPUS", labeled by H. Franz): 1 male, 1 female, white printed label "SABAH: Poring Hot Springs, 500 m, 7. V. 1987, Burckhardt-Löbl" (MHNG); 1 male, 2 females, white printed label "SABAH, # 15a, Poring Hot Springs, 500 m, 7. V. 1987, Burckhardt-Löbl" (2 in NMW, 1 in MHNG); all paratypes have been labeled during the present study with yellow, printed labels "*LOEBLITES minor* m., det. P. Jałoszyński, 2004".

Description. Body small, slender, very convex, moderately dark brown, antennae slightly lighter, palpi and legs distinctly lighter than body; setation moderately long and sparse, suberect.

Male externally nearly identical to *L. sabahensis*, including setation and punctation, it differs only in slightly smaller body, shorter antennae and proportions of elytra. Body length 2.31-2.45 mm (mean 2.38 mm), length of head 0.39-0.41 mm (mean 0.4 mm), width of head 0.55-0.57 mm (mean 0.56 mm), antenna only slightly longer than 0.8 of body length, as in Fig. 38, length 1.95-2.05 mm (mean 1.99 mm); length of pronotum 0.67-0.72 mm (mean 0.69 mm), maximum width of pronotum 0.55-0.57 mm (mean 0.56 mm), width of pronotum at base 0.4-0.42 mm (mean 0.41 mm), length of elytra 1.25-1.32 mm (mean 1.29 mm), width of elytra 0.85-0.95 mm (mean 0.88 mm), EI 1.39-1.47.

Aedeagus (Fig. 25-27) elongate, widest near base, narrowing toward rounded apex, length 0.49 mm. Base with moderately deep median emargination; parameres long, slender, exceeding apex of median lobe, broadened near apex, without setae; internal armature symmetrical, relatively darkly sclerotized, central complex composed of median capsule surrounded by subtriangular lateral structures and pair of elongate, nearly transverse sclerites in distal part of inner sac.

Female externally differs from male only in higher elytral index. Body length 2.33-2.55 mm (mean 2.41 mm), length of head 0.41-0.45 mm (mean 0.43 mm), width of head 0.56-0.57 mm (mean 0.565 mm), length of antenna 1.9-2.0 mm (mean



FIGS 30-38

Loeblites sabahensis Franz (30-35, 37), *L. mastigicornis* Franz (36) and *L. minor* sp. n. (38): 30 – aedeagus of paratype, dorsal view, 31 – aedeagus, ventral view, 32 – aedeagus, lateral view, 33 – structures of inner sac, non-type male (variant), 34 – spermatheca, 35 – bursa copulatrix, ventral view, 36-38 – left antenna, dorsal view. Scale 0.2 mm for 30-32, 0.05 mm for 33-35, 0.5 mm for 36-38.

1.94 mm), length of pronotum 0.67-0.71 mm (mean 0.68 mm), maximum width of pronotum 0.55-0.56 mm (mean 0.55 mm), width of pronotum at base 0.41-0.42 mm (mean 0.41 mm), length of elytra 1.25-1.39 mm (mean 1.30 mm), width of elytra 0.87-0.92 mm (mean 0.89 mm), EI 1.44-1.51.

Spermatheca as in Fig. 28, length 0.062 mm. Bursa copulatrix (Fig. 29) missing or highly reduced to transparent, hymenous structures surrounding end of ductus spermathecae.

Comments. This species is the smallest *Loeblites*, externally extremely similar to *L. sabahensis*. Examination of the aedeagus or spermatheca and bursa copulatrix is necessary for correct identification.

Etymology. The specific Latin epithet "*minor*" refers to the smallest body amongst all species of the genus.

DISCUSSION

Within the Cyrtoscydmini, *Loeblites* shows the highest degree of similarity to *Syndicus* and *Horaeomorphus*. During the present study, the dorsal femoral groove was found in all members of this genus. This interesting character has been discovered very recently in *Syndicus* (Jałoszyński, 2004); all Asiatic species of the Cyrtoscydmini known to the author (including all described species of *Horaeomorphus*, *Borneosabahia* Franz, *Parastenichnus* Franz, *Protoscydmus* Franz, *Parastenichnaphes* Franz, *Siamites* Franz, and many species of *Euconnus* Thomson, *Microscydmus* Saulcy & Croissandeau, *Neuraphes* Stevens, *Scydmoraphes* Reitter, and *Stenichnus* Thomson) have dorsal surface of femora without this structure. The general body shape of species belonging to *Syndicus* s. str. and *Loeblites* is very similar; on the other hand, the body shape (and some other characters) of *Syndicus* (*Semisyndicus*) is more similar to that of *Horaeomorphus*. The very long and thin antenna with well separated antennomere XI in *Loeblites* can be used as an unambiguous key character to distinguish this genus from *Syndicus*, which has the antennomere XI tightly inserted into the apex of the antennomere X, without separating interspace (a unique character within the family). Also, the single subapical tooth instead of two teeth and the sharp, finely and irregularly serrated cutting edge of mandibles found in *Loeblites* is not known among representatives of *Syndicus* and *Horaeomorphus* (however, details of mouthparts of *Horaeomorphus* are known only in *H. sakishimanus* Jałoszyński). An undescribed species of *Horaeomorphus* from Malaysia known to the author has the prostheca significantly shorter than that of *H. sakishimanus*, similar to the prostheca of *L. sabahensis*. Another unique feature of *Loeblites* is the long and slender median projection located in the posterior margin of the proctiger; this part of the female genital segment has broadly rounded posterior margin both in *Syndicus* and *Horaeomorphus*. The bursa copulatrix uniquely shaped in two out of three known species of *Loeblites* seems to be extremely diversified within the genus, and it has not been found in *L. minor*. This character is also variable within *Horaeomorphus* (Jałoszyński, in preparation). Wing venation in *Loeblites*, thought similar to that found in the both subgenera of *Syndicus*, clearly differs in longer subcosta fused distally with radius (very short in *Syndicus*); wings in the remaining genera of the tribe have not been illustrated or described.

Besides the general appearance and the presence of femoral grooves, members of *Loeblites* and *Syndicus* share the following features: the clypeus separated from the frons by a transverse groove; eyes with emarginated posterior or postero-ventral margin; antennal insertions located on latero-anterior margin of the head, widely separated; anterior tentorial foveae (overlooked in Jałoszyński, 2004, examined and confirmed during the present study in *S.* (s. str.) *difficilis* Jałoszyński and *S.* (*Semisyndicus*) *laei ranongianus* Jałoszyński) hidden in supraclypeal groove, hardly visible in dry-mounted specimens; occiput broad; mandible nearly planar, subtriangular; very similar maxilla (however, this structure seems to be little diversified within the tribe, Jałoszyński, unpublished observations); nearly identical design of palpi maxillare and labiale; pronotum widest near anterior third, with narrow posterior collar separated by a row of ante-basal foveae; very similar details of mesosternum, metasternum, metanotum and mesonotum, the latter structure with characteristic long posterior notal processes; each elytron with two basal foveae connected by an U-shaped groove and in natural position partly hidden under the posterior margin of the pronotum; similar wing venation; shape of legs; male and female genital segments; the aedeagus; and the spermatheca. *Loeblites* is more similar to *Syndicus* s. str. in the body shape (in *Semisyndicus* the body shape is stouter and resembles that of *Horaeomorphus*), uniformly concave basisternal area of the mesosternum (in *Semisyndicus* with unique median "isle", as illustrated in Jałoszyński, 2004, fig. 35D) and nearly straight base of elytra (strongly concave in *Semisyndicus*). In turn, *Loeblites* is more similar to *Semisyndicus* than to *Syndicus* s. str. in the shape of the posterior margin of the vertex, which bears a small median tubercle (not found in *Syndicus* s. str.); the aedeagus, which is especially similar between all *Loeblites* and *S.* (*Sem.*) *tenuicornis* Jałoszyński (Jałoszyński, 2004, fig. 42A-C); in turn the copulatory organ of the latter species resembles that of *Horaeomorphus*. *Loeblites* also shares with *Semisyndicus* the shape of the spermatheca, which has approximate insertions of the ductus spermathecae and the accessory gland, which are widely separated in *Syndicus* s. str. Interestingly, in representatives of *Horaeomorphus*, which have aedeagi similar to those of *Loeblites*, the spermatheca is distinctly different; it is also not similar to the spermatheca of *Syndicus* s. str. However, in one species of *Horaeomorphus* (*H. nepalensis* Franz) the posterior margin of the vertex bears a very small median tubercle like that found in *Loeblites* and *Semisyndicus*, and the structures surrounding the opening of the ductus spermathecae inside the female genital segment are darkly sclerotized and relatively complicated (Jałoszyński, unpublished observations). Actual relationships between the three genera will be analyzed when important morphological details of *Horaeomorphus* have been described. The existing data strongly suggest a separate position of *Loeblites*, *Syndicus* and *Horaeomorphus* within the Cyrtoscydmini, a monophyly of this small group seems plausible.

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On *Hadogenes angolensis* Lourenço, 1999 syn. n. (Scorpiones, Liochelidae), with a redescription of *H. taeniurus* (Thorell, 1876)

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On *Hadogenes angolensis* Lourenço, 1999 syn. n. (Scorpiones, Liochelidae), with a redescription of *H. taeniurus* (Thorell, 1876). - The flat rock scorpion, *Hadogenes taeniurus* (Thorell, 1876), is redescribed, based on an examination of approximately 250 specimens from Angola and Namibia. *Hadogenes angolensis* Lourenço, 1999 is demonstrated to be a junior synonym. The distribution of *H. taeniurus* is mapped, and notes on its ecology and conservation status are provided. The synonymy of *Hadogenes bifossulatus* Roewer, 1943 with *Hadogenes tityrus* (Simon, 1888), rather than with *H. taeniurus*, is confirmed.

Keywords: Scorpiones - Liochelidae - *Hadogenes taeniurus* - *Hadogenes tityrus* - synonymy - Angola - Namibia.

INTRODUCTION

Flat rock scorpions of the genus *Hadogenes* Kraepelin, 1894 represent an intriguing group of mostly large, extremely dorsoventrally compressed scorpions, all described species of which are obligate lithophiles, inhabiting the narrow cracks, crevices and spaces beneath exfoliations of weathered rock outcrops from South Africa to Tanzania. Besides dorsoventral compression, other ecomorphological adaptations facilitating existence in this specialized habitat include elongation of the metasoma and pedipalps, perhaps to aid with prey capture in confined spaces; greatly enlarged lateral ocelli relative to the median ocelli, to aid in anterior light perception; pronounced superciliary carinae to protect the median ocelli from abrasion; stout, spiniform setae on the ventral surfaces of the telotarsi and highly curved telotarsal ungues, to provide a vice-like grip on rock surfaces (Newlands, 1972a, 1972b, 1978; Newlands & Prendini, 1997; Prendini, 2001a). The tarsal adaptations of *Hadogenes* facilitate locomotion on rock but hinder locomotion across other substrata. These scorpions are thus restricted to regions of rugged, mountainous topography and subject to allopatric speciation when mountain ranges become separated through erosion (Newlands, 1972a; Prendini, 2001b). With few exceptions, the distributional ranges of *Hadogenes* species are allopatric or parapatric as a result (Newlands, 1980; Prendini, 1995, 2001a).

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The taxonomy and phylogenetic position of *Hadogenes* have been the focus of several investigations in recent years (e.g., Newlands & Prendini, 1997; Lourenço, 1999; Prendini, 2000a, 2001a). The present contribution forms part of an ongoing revision of the taxonomy of the genus, and addresses the status of *Hadogenes taeniurus* (Thorell, 1876), a flat rock scorpion endemic to southern Angola and northern Namibia (Fig. 1).

Hadogenes taeniurus was first described under the name *Ischnurus hahni* Peters, 1862. However, this name was apparently forgotten after its description and not listed in any subsequent revisions or catalogs until its rediscovery by V. Fet. At the time of its rediscovery, the syntypes of *I. hahni* were examined (Prendini in Fet, 2000), determined to be conspecific with *H. taeniurus*, and synonymized accordingly. Although Peters' (1862) name is the senior synonym, it has not been used since its description, whereas *H. taeniurus* has been widely accepted (Fet, 2000).

After its description, *H. taeniurus* was synonymized, first with *Hadogenes trichiurus* (Gervais, 1843) by Kraepelin (1894) and then with *Hadogenes troglodytes* (Peters, 1861) by Kraepelin (1899), but its validity was upheld by all subsequent authors, including Kraepelin (1908, 1914). *Hadogenes taeniurus* remained poorly known – aside from a few citations, mostly providing new locality records or discussing its diagnostic characters (Purcell, 1901; Kraepelin, 1908, 1914; Hewitt, 1918; Lawrence, 1928, 1955, 1959, 1961; Newlands, 1972a; Lamoral & Reynders, 1975) – until its redescription by Lamoral (1979). Lamoral (1979) examined most of the specimens of *H. taeniurus* that were available at the time, described the trichobothria and hemispermatophore of the species for the first time, and restricted its known distribution to southern Angola and northern Namibia. Meanwhile, Newlands (1980), in an unpublished thesis, independently redescribed the species, mapped its known distribution in Angola and Namibia, and refined its diagnosis in a key to the species of *Hadogenes*. Newlands' (1980) redescription and distribution map of *H. taeniurus* were never published. However, Newlands & Cantrell (1985) published Newlands' (1980) key to the species of *Hadogenes*, as well as the chromosome number of *H. taeniurus*.

Several authors previously noted the occurrence of *H. taeniurus* in Angola (Lawrence, 1959; Newlands, 1972a, 1980; Lamoral & Reynders, 1975; Lamoral, 1979). Three of these authors cited the Angolan specimens they examined (Lawrence, 1959; Newlands, 1972a, 1980; Lamoral, 1979). Indeed, the occurrence of *H. taeniurus* in that country was not questioned until a recent paper, in which a new species, *Hadogenes angolensis* Lourenço, 1999, was described. Lourenço (1999) justified this putative new species largely on a mistaken impression that the Angolan records of *H. taeniurus*, attributed solely to Lawrence (1959), were based on misidentifications (implying that the Angolan specimens represented another species, for which the name *H. angolensis* was proposed). Lourenço (1999) neglected to mention that the type locality of *H. taeniurus* is unknown (and could, in fact, be in Angola) and failed to provide any consistent diagnostic differences by means of which this putative new species might be distinguished from *H. taeniurus*. During the present study, the type specimens of *H. angolensis* were compared and found to be conspecific with the type specimens of *H. taeniurus* and *I. hahni*, and also with 247 non-type specimens of *H. taeniurus* from Angola and Namibia, including all the material examined by Lawrence (1959), Newlands

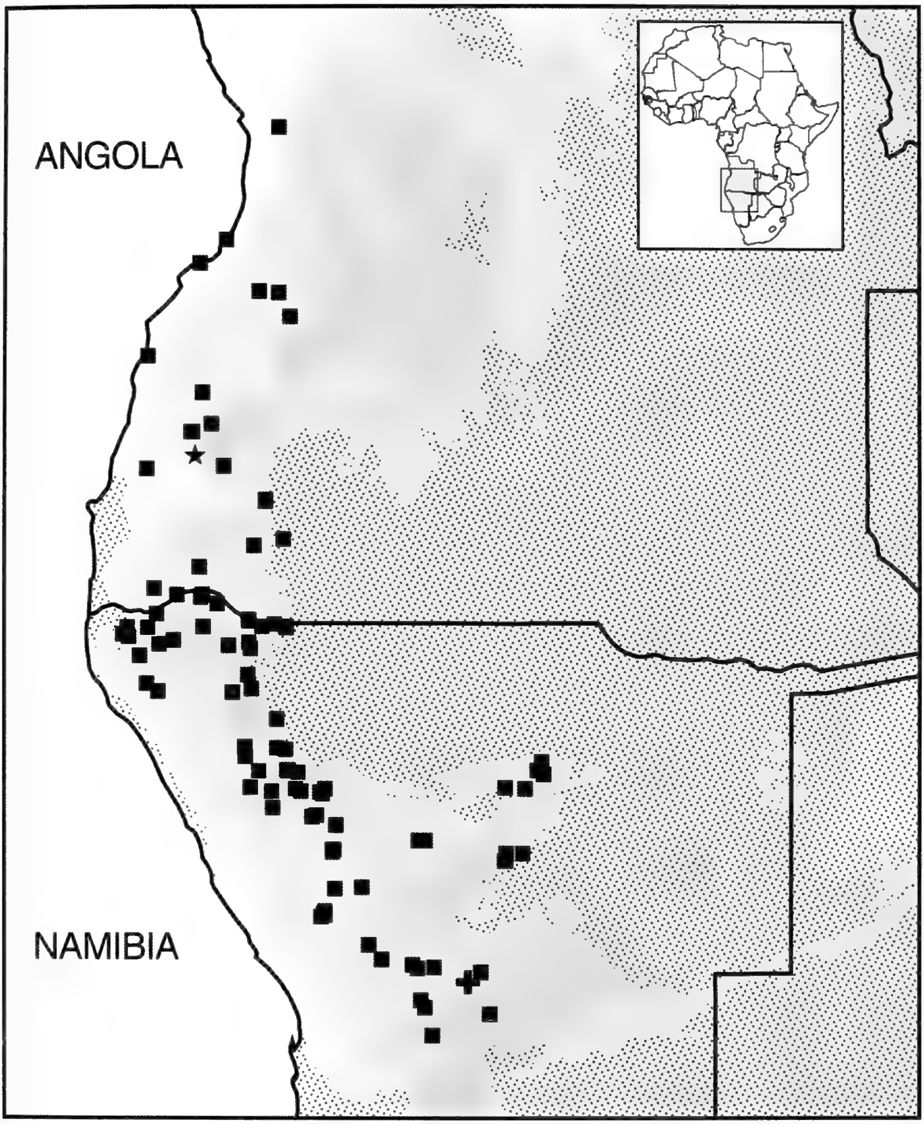


FIG. 1

Map showing the known distribution of *Hadogenes taeniurus* (Thorell, 1876) in Angola and Namibia (■), including the type localities for its synonyms: *Ischnurus hahni* Peters, 1862 (+) and *H. angolensis* Lourenço, 1999 (★).

(1972a, 1980) and Lamoral (1979). On the basis of this evidence, *H. angolensis* is here synonymized with *H. taeniurus*.

The status of *Hadogenes bifossulatus* Roewer, 1943, long regarded as a dubious species (Lawrence, 1955; Newlands, 1972a, 1980; Lamoral & Reynders, 1975; Lamoral, 1979; Fet, 2000) was also investigated. Newlands (1972a) suggested that *H.*

bifossulatus might be synonymous with *H. taeniurus*. However, Newlands (1980) retracted his earlier suggestion, after examining the holotype of *H. bifossulatus*, and instead synonymized *H. bifossulatus* with *Hadogenes tityrus* (Simon, 1888). Newlands' (1980) unpublished synonymy of *H. bifossulatus* was later published (and thereby validated) by Kovařík (1998), without explicit mention of the source, but the synonymy was not accepted by Fet (2000). During the present investigation, the holotype of *H. bifossulatus* was re-examined and confirmed to be conspecific with *H. tityrus*, rather than with *H. taeniurus*.

In light of this new evidence, the diagnosis and description of *H. taeniurus* are revised, its known distribution mapped on the basis of all available material, including a large number of new specimens (many from Angola) that have accumulated since the work of Lamoral (1979), and notes on its ecology and conservation status are provided.

MATERIAL AND METHODS

Many personally collected specimens of *H. taeniurus* were located at night using the ultraviolet (UV) light detection method (Honetschlager, 1965; Stahnke, 1972; Sissom *et al.*, 1990). A portable UV lamp, comprising two mercury-vapour tubes attached to a chromium parabolic reflector and powered by a rechargeable 7 Amp/hr, 12 V battery, was used for this purpose. A few specimens were also found by inspecting rock crevices and exfoliations during the day. A portable Garmin™ GPS II Plus device was used for recording the geographical coordinates of collection localities in the field.

All material examined, including type specimens, is deposited in the following collections: Albany Museum, Grahamstown, South Africa (AMGS); American Museum of Natural History, New York (AMNH), some bearing accession numbers from the Alexis Harington Collection (AH); California Academy of Sciences, San Francisco (CASC); Muséum d'histoire naturelle, Genève, Switzerland (MHNG); Musée Royal de l'Afrique Centrale, Tervuren, Belgium (MRAC); National Collection of Arachnida, Plant Protection Research Institute, Pretoria, South Africa (NCA); Göteborgs Naturhistoriska Museet, Göteborg, Sweden (NMG); Naturhistoriska Riksmuseet, Stockholm, Sweden (NHRM), bearing an accession number from the Julio Ferrer Collection (JF); National Museum of Namibia, Windhoek (NMNW); Natal Museum, Pietermaritzburg, South Africa (NMSA); South African Museum, Cape Town (SAMC), some bearing accession numbers from the John Visser Collection (JV); Natur-Museum Senckenberg, Frankfurt, Germany (SMF); Transvaal Museum, Pretoria, South Africa (TMSA); Zoologisches Museum, Humboldt-Universität, Berlin, Germany (ZMHB); Zoologiska Institutionen, Lunds Universitet, Sweden (ZMLU); Zoologisches Institut und Zoologisches Museum, Universität Hamburg, Germany (ZMUH). Tissue samples of *H. taeniurus* have been stored (in the vapour phase of liquid nitrogen at -150°C) in the Ambrose Monell Collection for Molecular and Microbial Research (AMCC) at the AMNH.

Photographs were taken in visible light as well as under long wave UV light using a Microptics™ ML-1000 digital photomicrography system. Measurements were taken using the ocular micrometer of a Nikon® SMZ-1500 stereomicroscope. Colour designation follows Smithe (1974, 1975, 1981), trichobothrial notation follows Vachon

(1974), sternum terminology follows Soleglad & Fet (2003). Morphological terminology and mensuration follows previous papers (e.g., Newlands & Prendini, 1997; Prendini, 2000a, 2001a).

A distribution map was produced using ArcView GIS Version 3.2 (Environmental Systems Research Institute, Redlands, California), by superimposing point locality records on coverages depicting the political boundaries, topography (500 m contour interval) and major sand systems in Angola and Namibia. A topographic contour coverage was created from the GTOPO30 raster grid coverage, obtained from the website of the U.S. Government Public Information Exchange Resource: http://edcdaac.usgs.gov/gtopo30/gtopo30.html. The coverage of sand systems was created by clipping and merging relevant polygons extracted from a coverage of the geology of Africa provided by the Department of Marine Geoscience, University of Cape Town, South Africa, with polygons extracted from a coverage of Namibian landforms from the Namibian National Biodiversity Task Force (Barnard, 1998), downloaded from their website: http://www.dea.met.gov.na/programmes/biodiversity/countrystudy.htm.

In order to create a point locality geographical dataset for mapping the distributional range of *H. taeniurus*, all records of sufficient accuracy were isolated from the material examined. Only a small proportion of the records were accompanied by geographical coordinates or quarter-degree squares (QDS), usually entered by the collector or subsequently added by the curator or collections manager. These were checked for accuracy and an attempt was made to trace coordinates for as many of the remaining records as possible, by reference to gazetteers, the official 1:250 000, 1:500 000 and 1:1000 000 topo-cadastral maps of Namibia published by the Government Printer, and the GEOnet Names Server (GNS): http://164.214.2.59/gns/html/cntry_files.html. Names of provinces, regions and magisterial districts of countries listed in the material examined follow the most recent systems (post-1994).

Spatial analyses were conducted, using ArcView, in order to ascertain whether the distribution of *H. taeniurus* is related to present environmental variables, to determine the specific ecological correlates of its distributional range, and to calculate statistics that could be used to define its conservation status. Coverages representing the topography, mean annual rainfall, biomes (as defined by Irish, 1994), vegetation types and protected areas in Namibia were used for these analyses. The GTOPO30 raster grid coverage was used for spatial analysis of topography. Polygon coverages representing the mean annual rainfall and vegetation types (as defined by Giess, 1971) of Namibia, were obtained from the website of the Namibian National Biodiversity Task Force (Barnard, 1998).

The conservation status of *H. taeniurus* was assessed using a coverage of the protected area network in Namibia, also obtained from the Namibian National Biodiversity Task Force (Barnard, 1998). This was superimposed on the mapped distributional range of *H. taeniurus* to determine whether any point locality records fall within the boundaries of protected areas. Number of known locality records, extent of the distributional range, occurrence inside and outside of protected areas, and prevailing land uses that might be construed as threats to the future survival of the species were then used as criteria for assigning *H. taeniurus* to one of the IUCN Red List Categories (IUCN, 2001).

SYSTEMATICS

Hadogenes taeniurus (Thorell, 1876)

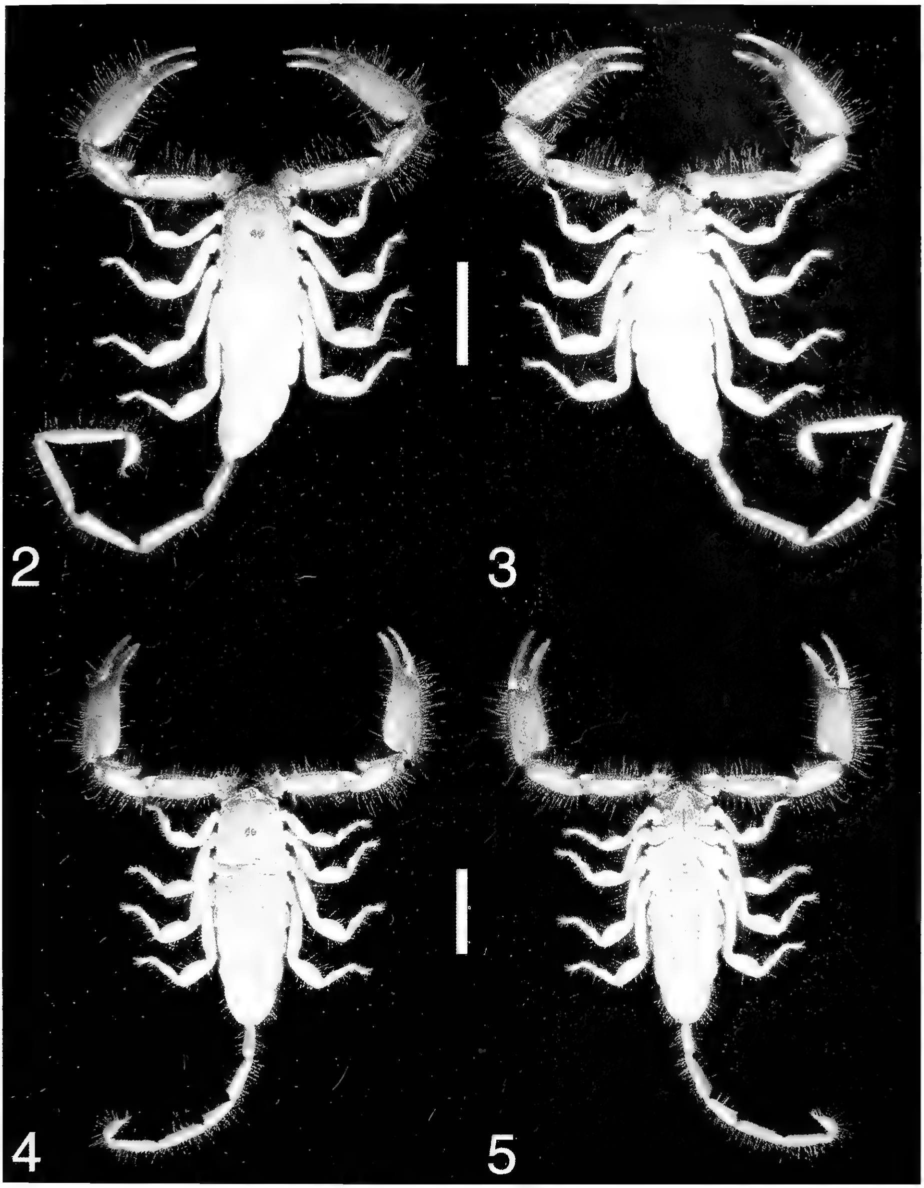
Ischnurus hahni Peters, 1862: 27 (synonymized by Prendini in Fet, 2000: 389); Moritz & Fischer, 1980: 315.
Ischnurus taeniurus Thorell, 1876: 254-258.
Hadogenes trichiurus: Kraepelin, 1894: 115 (part).
Hadogenes troglodytes: Kraepelin, 1899: 145 (part).
Hadogenes taeniurus: Purcell, 1901: 206; Kraepelin, 1908: 267, 268 (part); Kraepelin, 1914: 117 (part); Hewitt, 1918: 163; Lawrence, 1928: 277, 278, tab.; Lawrence, 1955: 223, 252; Lawrence, 1959: 386; Lawrence, 1961: 154; Newlands, 1972a: 135 (part); Lamoral & Reynders, 1975: 540; Lamoral, 1979: 654-656, 657 (part), fig. 304, 305, 307-309; Newlands & Cantrell, 1985: 42, 44, tab. 2; Sissom, 1990: 125, fig. 3.24H; Kovařík, 1998: 133; Lourenço, 1999: 932, 934, 935, fig. 18, 21, 22; Fet, 2000: 389; Prendini, 2001a: 148, tab. 1; Prendini, 2001b: 137.
Hadogenes sp. ?: Lawrence, 1927: 73.
Hadogenes angolensis Lourenço, 1999: 932-936, fig. 1–17, 19, 20, 23, 25, tab. I (**syn. n.**); Kovařík, 2001: 83; Prendini, 2001a: 148, tab. 1; Prendini, 2001b: 136.
Hadogenes taeniurus (?): Lourenço, 1999: 937, fig. 25.

Type material (examined). *Ischnurus taeniurus*: holotype ♀ [two legs broken, opisthosoma damaged] (NMG 121 [type no. 90]), 'S. Africa' [probably northern **Namibia** (Purcell, 1901; Hewitt, 1918)], 28.xi.1864, C.J. Andersson. *Ischnurus hahni*: 1 ♂, 1 ♀ syntypes (ZMHB 2317/18), Neu-Barmen [Gross Barmen, 22°06'S 16°45'E], Otjimbingue [21°21'S 16°08'E], South West Africa [**Namibia: Otjozondjupa Region: Okahandja District**], Hahn. *Hadogenes angolensis*: holotype ♂ [hemispermatophore dissected], paratype ♀, 1 juv. ♂ paratype (MHNG), **Angola: Huíla District:** Fazenda Bumbo, near Capangombe, 15°10'S 13°09'E, 21-26.vi.1954, W. Kisker & H. Barmann.

Diagnosis. *Hadogenes taeniurus* appears most closely related to *H. granulatus* Purcell, 1901 and *H. troglodytes*, based on their large size (113-160 mm in ♂, 108-154 mm in ♀) and similarity in habitus. All three species share the presence of posterolateral oval depressions in sternite VII (Figs 10, 11), although these are most pronounced in *H. taeniurus* (Lawrence, 1928; Newlands, 1972a, 1980; Lamoral, 1979). They also share the presence of granulation on the telson of the adult male, which is more pronounced in *H. granulatus* (Purcell, 1901; Newlands, 1980).

Hadogenes troglodytes differs from *H. granulatus* and *H. taeniurus* in the shape of metasomal segment I, which is higher than wide posteriorly, rather than wider than high posteriorly (Newlands, 1972a, 1980; Lamoral, 1979; Newlands & Cantrell, 1985). *Hadogenes granulatus* differs from *H. taeniurus* and *H. troglodytes* in two secondary sexual characters of the adult male. The lobe on the movable finger and corresponding notch in the fixed finger of the pedipalp chela are weakly developed to absent in *H. granulatus*, whereas the lobe and notch are more pronounced in *H. taeniurus* (Fig. 12) and *H. troglodytes*. The telson of *H. granulatus* is elongated and coarsely granular (Purcell, 1901; Newlands, 1980), compared with that of *H. taeniurus* and *H. troglodytes*, which is oval and finely granular (Fig. 21).

Hadogenes taeniurus is readily separated from *H. granulatus* and *H. troglodytes* by the presence of a deep oval depression in the basal piece, between the pectines (Figs 8, 9), which is absent in the other species. This character has not been noted previously. These species are further separated by the relatively shorter metasoma of the adult male *H. taeniurus* (usually 30-40% greater than the combined length of prosoma and mesosoma, compared with 50% and 45% greater in *H. granulatus* and *H. troglodytes*, respectively).



FIGS 2-5

Hadogenes taeniurus (Thorell, 1876), habitus of ♂ and ♀ (Farm Uisib 427 [AMNH]). 2. Dorsal aspect, ♂. 3. Ventral aspect, ♂. 4. Dorsal aspect, ♀. 5. Ventral aspect, ♀. Scale bars = 10 mm.

Description. The following description is based on the holotype ♀ of *I. taeniurus*, the ♂ and ♀ syntypes of *I. hahni*, the holotype ♂ and paratype ♀ of *H. angolensis*, and another ♂ specimen in the AMNH [AH 4132]. Colour is described from a ♂ and ♀ recently collected at Farm Uisib 427 (AMNH).

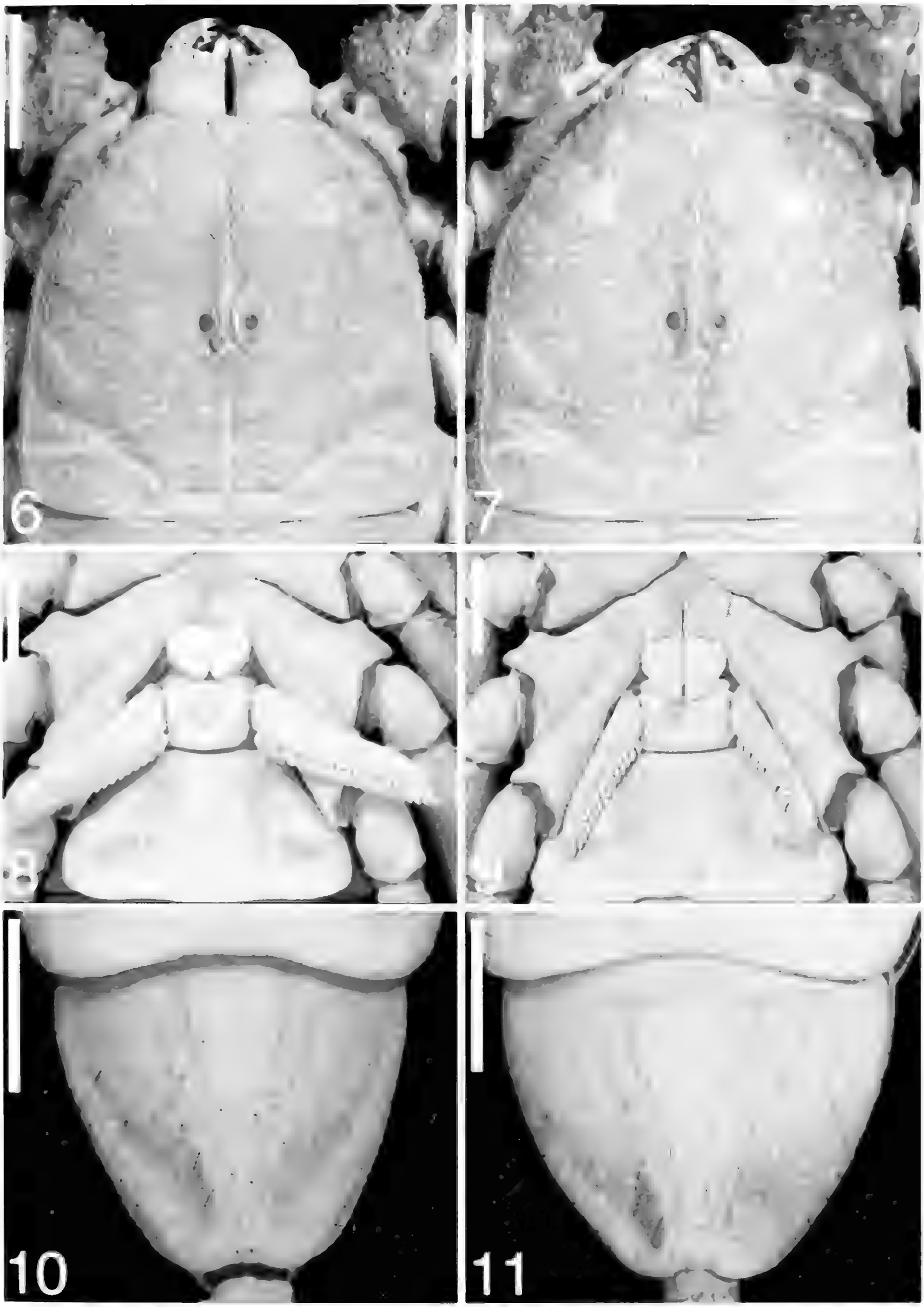
Colour. Pale legs and tergites contrasting with darker chelicerae, carapace, pedipalps, metasoma and telson (Figs 2-5). Posterior third of carapace, tergites, and sternites paler than anterior two-thirds of carapace, pedipalps, metasoma and telson. Telson often slightly paler than metasoma but darker than tergites. Chelicerae, pedipalp carinae, chela fingers, and ventral surfaces of leg femora sepia 119; carapace (anterior two-thirds), pedipalp chela manus, and intercarinal surfaces of patella and femur chestnut 32; carapace (posterior third), tergites and sternites olive-yellow 52; pectines and genital operculum straw yellow 36; legs (except ventral surfaces of femora) cinnamon 123A; metasomal segments I-V dusky brown 19; telson raw umber 123.

Carapace. Three pairs of lateral ocelli, slightly smaller than median ocelli (Figs 6, 7). Median ocular tubercle with superciliary carinae well developed, protruding above ocelli, and interocular sulcus distinct. Anterior margin of carapace with median notch absent, triangular inset protruding slightly anteriorly. Anteromedian sulcus deep, sutuliform, furcating anteriorly around triangular inset. Median longitudinal suture distinct, continuous from anterior furcated sutures through ocular tubercle to posterior furcated sutures, which converge on ocular tubercle from posterior carapace margin. Posterior furcated sutures obsolete, discontinuous. Posteromedian and posteromarginal sulci distinct, but shallow. Paired median lateral and posterolateral sulci also distinct, shallow. Carapace almost entirely granular, except for surfaces behind lateral ocelli, and median lateral, posterolateral and posteromarginal sulci, which are smooth. Granulation almost uniformly fine, becoming coarse on antero-ocular and anterolateral surfaces.

Chelicerae. Movable finger with distal internal tooth slightly smaller than distal external tooth, and opposable. Ventral aspect of fingers and manus with long, dense macrosetae.

Pedipalps. Chela pentacarinate, with three distinct carinae; dorsal secondary and digital carinae obsolete (Figs 12, 13); external secondary carina strongly developed, costate granular (Figs 13, 14); ventroexternal carina strongly developed, crenulate, aligned parallel to longitudinal axis of chela, with distal edge disconnected from external movable finger condyle and directed toward a point between external and internal movable finger condyles, but closer to external condyle (Fig. 15); ventromedian carina obsolete, reduced to a vestigial granule proximally; ventrointernal carina also obsolete; internomedian and dorsointernal carinae weakly developed, each comprising a series of isolated spiniform granules; dorsomedian carina strongly developed, composed of a continous row of spiniform granules; dorsal and ventrointernal intercarinal surfaces smooth, reticulate, becoming granulo-reticulate dorsally; dorsointernal intercarinal surfaces with scattered spiniform granules, becoming finely granular on internal surface of fixed finger; external intercarinal surfaces coarsely granular. Chela with a rounded lobe on movable finger and corresponding notch in fixed finger. Dentate margins of chela fingers with double row of denticles, fused at the lobe/notch. Chela width 49.5% (45-54%) greater than chela height; length along ventroexternal carina 46% (43-49%) greater than width in ♂, and 39.5% (32-47%) greater in ♀; length of movable finger 15.5% (10-21%) less than length along ventroexternal carina in ♂, and 10.5% (3-18%) less in ♀.

Patella with seven carinae, six of them distinct (Figs 16-18); dorsoexternal carina obsolete; dorsointernal and ventrointernal carinae costate to costate granular;



FIGS 6-11

Hadogenes taeniurus (Thorell, 1876), carapace, pectines and sternites of ♂ and ♀ (Farm Uisib 427 [AMNH]). 6. Carapace, ♂. 7. Carapace, ♀. 8. Pectines and basal piece, ♂. 9. Pectines and basal piece, ♀. 10. Sternite VII, ♂. 11. Sternite VII, ♀. Scale bars = 5 mm.

internomedian carina costate granular, composed of very large heavily sclerotized spiniform granules; externomedian and ventroexternal carinae granular; dorsoexternal and ventral intercarinal surfaces finely and uniformly granular, becoming granulo-reticulate on ventral surfaces; internal intercarinal surfaces smooth, except for a few scattered granules; anterior process strongly developed. Patella length 38.5% (32-46%) greater than width.

Femur pentacarinate, with four distinct carinae; ventroexternal carina obsolete, reduced to a weak row of scattered granules; dorsoexternal and externomedian carinae granular, dorsointernal and ventrointernal carinae costate granular, composed of very large heavily sclerotized granules (Fig. 19); dorsoexternal and ventral intercarinal surfaces finely and uniformly granular, becoming granulo-reticulate on ventral surfaces; internal intercarinal surfaces smooth, except for a few scattered spiniform granules. Femur length 62.5% (58-66%) greater than width (Table 1).

Trichobothria. Neobothriotaxic major, type C (Figs 12-19), with the following segment totals (Table 1): femur 3 (1 *d*; 1 *i*; 1 *e*), patella 86–127 (2 *d*; 1 *i*; 28-49 *v*; 55-75 *e*) and chela 90-126 (80-116 manus; 10 fixed finger, including 2 *i*). Total number of trichobothria per pedipalp, 179-256. Only femoral trichobothria, trichobothria in the *d* and *i* series of the patella, and trichobothria in the *D*, *d*, *e* and *i* series of the chela stable in number and distribution. External and ventral trichobothria of the chela and patella numerically and distributionally too variable for diagnostic purposes.

Mesosoma. Tergites each with paired submedian depressions and obsolete median carina. Pre-tergites of ♂ and ♀ smooth and shiny. Post-tergites of ♂ uniformly finely granular, imparting a matt appearance to all surfaces, except for smooth submedian depressions; post-tergites I-VI of ♀ smooth and shiny, but often with very fine and even granulation anteromedially, VII uniformly finely granular. Sternites smooth and shiny, each with paired longitudinal depressions internal to spiracles; VII additionally with a pair of deep posterolateral oval depressions (more prominent in ♂) and a pair of obsolete carinae, converging distally towards a shallow notch in distal apex (Figs 10, 11). Sternite VII 10% (3-17 %) wider than long in ♂, 15% (7-23%) wider than long in ♀ (Table 1).

Pectines. Basal piece between pectines with a deep oval depression (Figs 8, 9). Mesial margin of first proximal median lamella of each pecten angular, with pectinal teeth present along entire posterior margin in ♂; mesial margin of first proximal median lamella shallowly curved, with proximal fifth of posterior margin devoid of teeth in ♀. Pectinal teeth: 18-24 (♂), 14-20 (♀).

Sternum. Subpentagonal, type 2. Median longitudinal furrow deep and narrow along enire length.

Genital operculum. Suboval, completely divided longitudinally, with genital papillae present (♂). Subcordate, partially connected by a membrane in anterior two-thirds, with distinct distal lobes in posterior third, and with genital papillae absent (♀).

Legs. Femora each with paired granular carinae on ventral surface, becoming less developed on posterior legs. Basitarsi each with a few spiniform setae on prolateral and retrolateral margins, decreasing in number from anterior to posterior legs. Telotarsi each with two rows of three ventrosubmedian spiniform setae and a basal row of ventromedian spinules. Telotarsal laterodistal lobes truncated; median dorsal lobes extending to ungues. Telotarsal ungues short, distinctly curved, and equal in length. Retrolateral pedal spurs absent.

Metasoma and telson. Metasomal segment I 13.5% (2-25 %) wider than high posteriorly (Table 1). Metasomal segments I-V progressively increasing in length, and decreasing in width, with segment V 36.5% (27-46%) narrower than segment I in ♂, 40% (32-43%) narrower in ♀. Metasoma slender, width percentage of length for segment I, 34% (29-39%) in ♂, 45.5% (38-53%) in ♀; for II, 15% (12-18%) in ♂, 23.5% (22-25%) in ♀; for III, 17% (15-19%) in ♂, 25% (24-26%) in ♀; for IV, 12.5% (10-15 %) in ♂, 19.5% (14-22%) in ♀; and for V, 12.5% (11-14%) in ♂, 17.5% (16-19%) in ♀. Telson vesicle 16.5% (3-30%) wider than metasomal segment V in ♂, 15% (4-26%) wider in ♀; oval in shape, with flattened dorsal surface and rounded ventral surface (Figs 20, 21), height 36.5% (33-40%) of length. Aculeus short, 20% (14-26%) of vesicle length, and sharply curved. Total length of metasoma 45.5% (31-60%) greater than combined length of prosoma and mesosoma in ♂, but 5% (0-10%) less than combined length of prosoma and mesosoma in ♀.

Eight carinae on segment I, six carinae on segments II-IV, and five carinae on segment V. Dorsosubmedian carinae of segment I becoming obsolete posteriorly, but distinct throughout length of segments II-V. Median lateral carinae fully developed on segment I, but absent from segments II-V. Segments I-IV with closely paired ventrosubmedian carinae, fused into a single ventromedian carina on segment V. Ventrosubmedian and ventrolateral carinae costate on segment I, costate to costate granular on segments II-IV. Ventrolateral and ventromedian carinae of segment V composed of spiniform granules. Median lateral and dorsosubmedian carinae costate on segment I, dorsosubmedian carinae costate to costate granular (♀) or granular (♂) on segments II-V. Dorsosubmedian carinae of metasomal segments II, III and, to a lesser extent IV, each terminating posteriorly with a slightly enlarged, spiniform granule; dorsosubmedian carinae of other metasomal segments without spiniform granules posteriorly. Intercarinal surfaces smooth, except for lateral surfaces of segments II-V, finely granular in ♂. Telson smooth (♀), or finely granular (♂), and covered in long macrosetae.

Hemispermatophore. Double hook near the base of the distal lamella; distal crest truncate (Figs 22, 23).

Geographic variation. Specimens from higher elevations, which receive more rainfall, in the Khomas, Oshikoto and Otjozondjupa Regions of Namibia (e.g., Khomas Hochland, Otavi Highlands and Waterberg) are smaller and darker in colour, than specimens from lower elevations, which receive less rainfall, in Angola and the Erongo and Kunene Regions of Namibia (e.g., Damaraland and Kaokoveld).

Ontogenetic variation. The presence of a lobe on the movable finger of the pedipalp chela and a corresponding notch in the fixed finger (Figs 12, 13) are indicative of sexual maturity in most species of *Hadogenes* (Lawrence, 1966; Newlands & Prendini, 1997; Prendini, 2001a). The lobe and corresponding notch are absent from the fingers of the pedipalp chela in subadults and juveniles, developing in the final instar of species, such as *H. taeniurus*, in which these characters are present in the adults.

In the specimens of *Hadogenes* examined for this study, sexual maturity was assessed by the presence of a lobe and notch in males and females, and by the presence

TABLE 1. Meristic data for adult ♂ and ♀ *Hadogenes taeniurus* (Thorell, 1876), including the holotype, the syntypes of *Ischnurus hahni* Peters, 1862, and the holotype and paratype of *Hadogenes angolensis* Lourenço, 1999. Measurements following Newlands & Prendini (1997) and Prendini (2001a). [1]Measured from base of condyle to tip of fixed finger. [2]Sum of metasomal segments I-V and telson. [3]Metasomal segment I missing. Consult 'Material Examined' for AMNH specimens from which meristic data were collected.

		H. angolensis		*I. hahni*		*H. taeniurus*											
Specimen:	sex	♂	♀	♂	♀	♂	♂	♂	♂	♂	♂	♂	♀	♀	♀	♀	♀
	collection	MHNG	MHNG	ZMHB	ZMHB	TMSA	AMNH	AMNH	AMNH	AMNH	AMNH	AMNH	NMG	TMSA	AMNH	AMNH	AMNH
	number			2317/18	2317/18	9416	AH 4132						121	10424			
	type	holo	para	syn	syn								holo				
Carapace:	anterior width	9.62	10.98	8.57	10.91	9.53	9.82	9.26	9.96	8.51	10.75	8.71	10.45	11.75	11.08	10.14	8.92
	posterior width	16.04	17.53	15.79	19.51	16.41	16.80	14.58	16.39	14.82	17.14	15.50	17.91	20.14	19.12	16.43	14.43
	length	16.60	17.35	15.18	18.78	14.80	16.32	15.01	15.98	14.11	16.57	14.67	16.27	19.40	18.13	16.22	14.01
Chela:	maximum width	9.35	10.78	9.21	10.13	8.42	9.55	8.66	9.06	8.60	10.05	8.78	10.43	13.23	12.37	9.89	8.61
	maximum height	4.47	5.50	4.51	5.54	4.31	5.06	4.38	4.97	4.11	4.91	4.48	5.30	7.04	6.51	4.58	4.29
	length[1]	29.93	33.62	28.38	35.51	28.22	30.90	29.30	30.78	26.00	32.12	28.13	31.16	35.34	33.32	30.55	27.92
	length of ventroexternal carina	17.46	19.16	16.47	18.98	16.64	17.97	16.44	17.14	16.07	18.51	15.45	16.70	21.22	18.15	17.61	16.06
	length of movable finger	13.76	15.83	13.99	17.41	13.82	15.14	14.47	14.46	13.56	15.97	13.90	15.11	17.95	17.67	14.42	13.43
	E trichobothria (left/right)	47/47	49/49	49/54	51/51	47/46	50/50	51/54	57/56	43/44	55/53	44/45	48/48	50/49	51/55	45/44	47/49
	V trichobothria (left/right)	48/48	44/50	47/44	49/49	49/46	48/48	58/52	56/54	44/42	49/44	38/35	48/52	51/49	45/48	42/40	45/40
Patella:	maximum width	8.50	9.50	8.77	9.75	7.72	10.02	7.73	8.38	7.38	9.55	8.10	8.56	10.86	10.60	8.75	8.18
	maximum height	4.53	5.15	4.47	5.19	4.17	4.94	4.21	4.77	4.07	5.10	4.23	4.99	6.23	5.80	4.56	4.11
	length	14.71	15.69	14.27	15.76	12.99	14.65	13.82	14.07	13.70	15.93	13.26	14.42	17.36	15.98	15.26	13.25
	e trichobothria (left/right)	59/55	68/65	68/72	62/66	57/60	71/75	81/78	70/74	62/59	67/67	58/58	61/56	64/70	73/69	65/64	62/58
	v trichobothria (left/right)	34/35	36/36	44/44	36/36	32/36	39/45	47/45	48/49	36/38	42/42	29/28	37/36	44/45	45/46	37/34	32/31
Femur:	maximum width	5.73	6.25	5.65	6.33	5.75	6.24	5.83	5.96	5.25	6.37	5.82	6.50	7.40	7.22	6.06	5.34
	maximum height	3.74	4.26	3.75	4.33	3.34	3.99	3.57	3.80	3.47	4.09	3.82	4.66	5.17	4.67	3.79	3.41
	length	15.92	16.34	15.04	17.16	15.15	16.71	15.54	15.91	15.46	17.10	13.71	15.85	18.53	17.16	16.24	15.06

Pedipalp:	total length (incl. trochanter)	67.38	73.25	64.10	76.86	62.30	68.54	64.73	67.53	59.90	71.60	74.56	67.88	79.96	73.73	67.89	61.63
Mesosoma:	total length (tergites)	44.61	51.40	43.76	53.63	37.18	45.60	40.56	43.20	38.80	50.03	45.24	47.39	57.52	48.10	48.20	44.47
Sternite VII:	width	10.41	12.46	10.74	14.44	11.01	11.41	10.39	10.23	10.20	11.99	11.53	11.68	16.26	11.87	13.03	12.03
	length	9.13	11.63	10.40	11.84	9.09	11.06	9.51	10.01	9.27	11.36	9.93	10.29	12.81	9.53	10.33	9.31
Metasoma I:	maximum width	3.67	3.67	2.96	3.33	–[3]	4.21	3.34	3.89	3.28	3.81	3.78	3.66	4.33	4.12	3.64	3.16
	maximum height	3.00	3.22	2.90	3.25	–	3.40	2.83	2.93	2.72	3.05	2.98	2.96	3.70	3.35	3.00	2.79
	length	9.65	8.69	10.24	8.75	–	10.97	10.29	11.21	11.04	11.67	9.69	8.10	10.02	7.79	7.56	6.55
Metasoma II:	maximum width	2.61	2.66	2.46	2.74	2.22	2.86	2.53	2.51	1.93	2.44	2.32	2.59	2.97	2.87	2.55	2.21
	maximum height	4.31	4.19	4.02	4.19	3.88	4.69	3.89	4.18	3.90	4.36	4.00	4.15	4.68	4.55	3.86	3.27
	length	15.05	11.29	14.51	12.46	14.31	15.78	13.80	15.90	15.90	17.06	14.72	10.96	13.50	11.62	10.01	9.53
Metasoma III:	maximum width	2.51	2.75	2.54	2.65	2.29	2.78	2.49	2.51	2.33	2.62	2.51	2.56	2.92	2.68	2.41	2.09
	maximum height	4.22	4.25	3.98	4.10	3.89	4.59	4.15	4.30	3.89	4.65	3.99	4.10	4.71	4.43	3.80	3.49
	length	13.93	10.85	13.58	10.02	13.40	15.03	12.78	14.71	14.67	17.11	14.04	10.05	11.96	10.93	9.81	8.75
Metasoma IV:	maximum width	2.41	2.31	2.02	2.47	1.75	2.36	1.96	2.30	1.73	2.19	2.26	2.42	2.66	1.82	2.31	2.11
	maximum height	3.78	3.30	3.15	3.35	3.13	3.89	3.45	3.41	3.23	3.25	3.21	3.31	3.22	3.58	3.11	2.67
	length	16.22	12.65	16.20	13.31	15.73	18.69	15.63	17.42	17.33	19.26	16.24	12.20	14.95	12.57	10.66	10.82
Metasoma V:	maximum width	2.27	2.46	2.15	2.24	2.05	2.45	2.07	2.20	1.87	2.07	2.07	2.19	2.59	2.34	2.14	1.93
	maximum height	3.47	3.30	3.05	3.46	3.35	4.02	3.07	3.14	3.04	3.31	3.15	3.27	3.71	3.60	3.12	2.97
	length	15.81	13.37	16.01	13.97	14.61	18.28	15.79	17.09	16.75	18.36	16.47	13.44	15.37	13.53	11.36	10.98
Telson:	maximum width	2.76	2.98	2.21	2.75	2.92	3.02	2.46	2.68	2.53	2.69	2.37	2.48	3.52	3.16	2.24	2.11
	maximum height	3.39	3.73	3.16	3.44	3.04	3.60	3.07	3.43	3.02	3.45	3.30	3.08	4.31	3.78	2.75	2.61
	aculeus length	2.01	2.10	1.96	1.8	1.41	2.45	1.60	1.79	1.44	1.62	1.37	2.13	1.52	1.76	1.45	1.50
	total length	9.32	10.23	8.41	9.68	8.14	9.36	8.40	9.27	8.97	9.79	8.31	8.14	10.81	9.53	8.28	7.42
Metasoma:	total length[2]	79.98	67.08	78.95	68.19	66.19	88.11	76.69	85.60	84.66	93.25	79.47	62.89	76.61	65.97	57.68	54.05
Total length:	prosoma+mesosoma +metasoma	134.21	129.46	131.28	132.73	112.90	143.53	132.26	144.78	137.57	154.03	133.42	120.73	153.53	132.20	122.10	112.53
Pectines:	total length	10.38	7.76	9.69	8.62	12.38	10.89	9.92	10.47	9.27	11.32	9.42	7.94	10.75	8.89	7.17	7.43
	length along dentate margin	8.89	5.89	8.23	6.29	11.33	9.32	9.52	9.34	8.71	10.31	7.89	6.20	7.85	7.59	6.32	6.14
	tooth count (left/right)	23/22	16/15	21/20	14/14	20/21	20/20	24/24	23/23	19/18	22/22	18/20	15/15	20/18	14/16	15/15	14/15

of fully developed paraxial organs in males or the gravid condition in females. The elongated metasoma (longer than the combined length of prosoma and metasoma), a secondary sexual characteristic only acquired in the final instar male (Lamoral, 1979; Newlands, 1980; Prendini, 2001a), is a further indication that male specimens are adult (Fig. 21, cf. female, Fig. 20). In all species of *Hadogenes*, juvenile males and females resemble each other, and adult females, very closely in general morphological features (besides the absence of a lobe and notch on the pedipalp chela fingers) until the final instar. The metasoma of the juvenile male is also shorter than the combined length of the prosoma and mesosoma.

Sexual dimorphism. The characters of primary external sexual dimorphism are the undivided genital operculum of the female, which opens in a single flap (Fig. 9), whereas in the male, the operculum consists of two unconnected sclerites that open independently and cover a pair of genital papillae (Fig. 8). Secondary sexual characters observed in adult males, compared with adult females and juveniles of both sexes, are as follows (Table 1): more slender pedipalp chela, with a less pronounced lobe on the movable finger and a less pronounced notch in the fixed finger (Fig. 12); more slender mesosoma (Fig. 2); metasoma elongated, longer than the combined length of the prosoma and mesosoma (Fig. 21); increased granulation of the carapace (Fig. 6), tergites and metasoma; granular telson; greater number of pectinal teeth (Fig. 8).

Chromosome number. Newlands & Cantrell (1985) recorded a chromosome number of $2n = 100$.

Remarks. Lourenço (1999: 932) prefaced his description of *H. angolensis* with a commentary on the known records of *Hadogenes* from Angola:

> 'Sa présence en Angola est limitée à une seule citation de Lawrence (1959), qui signale *Hadogenes taeniurus* (Thorell) dans ce pays (Vila Arriaga près de Lungo: aujourd'hui Lubango, et Lucira). Newlands (1972), Lamoral (1979) et Lamoral & Reynders (1975) mentionnent à nouveau *Hadogenes taeniurus* pour la partie sud du pays, sans pour autant préciser avoir examiné le matériel en question.
>
> La faune des scorpions d'Angola a été jusqu'à présent très peu connue. Les publications se limitent à celles de Monard (1929, 1937), suivies de Lawrence (1949, 1959, 1961) et Vachon (1950). Seul Lawrence (1959) mentionne le genre *Hadogenes*, mais il m'a été impossible de localiser le matériel en question.
>
> L'étude de trois spécimens collectés dans la région du Plateau de l'Huila, près de Capangombe, permet la description d'une nouvelle espèce, qui présente des similitudes avec *H. taeniurus*. Ceci soulève la question d'une possible erreur d'identification de la part de Lawrence (1959), non vérifiée par Lamoral (1979).'

In this commentary, Lourenço (1999) claimed that Lawrence (1959) was solely responsible for the records of *H. taeniurus* from Angola, that the specimens on which these records were based, were not examined by subsequent authors (i.e., Newlands, 1972a; Lamoral & Reynders, 1975; Lamoral, 1979), and that Lawrence (1959) misidentified these specimens. The implication is that *H. taeniurus* does not occur in Angola and that these, as well as other Angolan *Hadogenes* specimens, represent another species, for which Lourenço (1999) devised the name *H. angolensis*.

Lourenço's (1999) claims are false. Newlands (1972a, 1980) listed the specimens examined by Lawrence (1959), which reside in the TMSA, proving that Newlands examined them and concurred with Lawrence's (1959) identification as *H. taeniurus*. The specimens referred to are: Lucira (TMSA 8941); Lungo near Vila

Arriaga (TMSA 8919-8921). Lamoral (1979) did not examine these particular specimens, but examined others from Angola, which he also identified as *H. taeniurus*. These are: Assuncas [Assunção] (TMSA 10240); Benguela (NMSA 10002); Oncocua (NMNW 1602 [old 165]). All three authors evidently examined *Hadogenes* specimens from Angola and considered these specimens to be conspecific with *H. taeniurus*. Meanwhile, Lourenço (1999) provided no reason as to why *H. taeniurus* should not occur in Angola, neglected to mention that the type locality of *H. taeniurus* is unknown and could, in fact, be in Angola – although, as noted by Purcell (1901) and Hewitt (1918), it is more likely to be in the Damaraland region of Namibia – and failed to provide any consistent diagnostic differences by means of which this putative new species might be distinguished from *H. taeniurus*.

According to the brief diagnosis, *H. angolensis* can be separated from *H. taeniurus* according to three differences (Lourenço, 1999): the 'structure' of sternite VII; the 'structure' of the hemispermatophore, particularly the distal lamella; the number of pectinal teeth (22/23 and 15/16 compared with 17/19 and 13/15 in the males and females of *H. angolensis* and *H. taeniurus*, respectively). The first two alleged differences could not be discerned from the illustrations accompanying Lourenço's (1999) description. Lourenço's (1999) figures 16 and 17, purportedly illustrating the structural difference in hemispermatophores, are not even directly comparable with his figure 18, reproduced from Lamoral (1979), and there is no obvious difference between them, besides a slight curvature in the distal lamella of the hemispermatophore of *H. angolensis*, which could be attributed to intraspecific variation or to an artifact of preservation. Lourenço's (1999) figures 18 and 20 illustrate postero-lateral oval depressions in sternite VII of *H. angolensis*, a diagnostic character for *H. taeniurus* (Lawrence, 1928; Newlands, 1972a, 1980; Lamoral, 1979), as illustrated in Lourenço's (1999) figures 21 and 22, also reproduced from Lamoral (1979). The third putative difference in pectinal tooth count, based on a sample size of two males and one female, must be dismissed on the grounds that pectinal tooth counts are known to vary considerably both among and within populations of *Hadogenes*, as in many other scorpions (Purcell, 1899; Hewitt, 1918; Lamoral, 1979; Prendini, 2001c), and the alleged differences fall well within the range for *H. taeniurus* based on data presented by Lawrence (1928: 278) and new a survey of 23 males and 38 females (Table 2).

No additional diagnostic differences were discerned in the present study, when the type specimens of *H. angolensis* were compared directly with those of *H. taeniurus* and *I. hahni* and also with 247 non-type specimens of *H. taeniurus* from Angola and

TABLE 2. Pectinal tooth counts in a sample of *Hadogenes taeniurus* (Thorell, 1876), including the holotype, the syntypes of *Ischnurus hahni* Peters, 1862, and the holotype and paratype of *Hadogenes angolensis* Lourenço, 1999.

	♂ (*n* = 23)		♀ (*n* = 38)	
	left	right	left	right
Range	18-24	18-24	14-20	14-20
Mean	21	20	16	16
Median	21	20	16	16
Mode	19	20	16	16

Namibia, including all the material examined by Lawrence (1959), Newlands (1972a, 1980), and Lamoral (1979). Instead, the type specimens of *H. angolensis* displayed the diagnostic characters of *H. taeniurus*, including the abovementioned depressions in the basal piece and sternite VII, metasomal segment I width greater than height, and the relatively short metasoma of the adult male (23% greater than the combined length of prosoma and mesosoma). On the basis of this evidence, *H. angolensis* is hereby synonymized with *H. taeniurus*.

Distribution. Hadogenes taeniurus is endemic to rocky and mountainous regions in southern Angola and northern Namibia. Its known distributional range is bordered approximately by the Huíla Plateau to the north, the western limit of the Kalahari sand system to the east, the Namibian Central Highlands to the south, and the Skeleton Coast, Engo-Kunene and Baia dos Tigres-Curoca sand systems to the west (Fig. 1). In Angola, the species has been recorded from the Benguela, Cuanza Sul, Cunene, Huíla and Namibé Districts. In Namibia, it has been recorded from the Erongo Region (Karibib and Omaruru Districts), Khomas Region (Windhoek District), Kunene Region (Khorixas, Opuwo and Outjo Districts), Oshikoto Region (Tsumeb District), and Otjozondjupa Region (Grootfontein, Okahandja and Otjiwarongo Districts). Although Newlands (1980) cited Uis [21°03'S 14°51'E] as the southernmost record, there are many records further south in the Erongo, Khomas and Otjozondjupa Regions, the southernmost being Farm Uitsig [on Uruganus 358, 22°49'S 16°17'E].

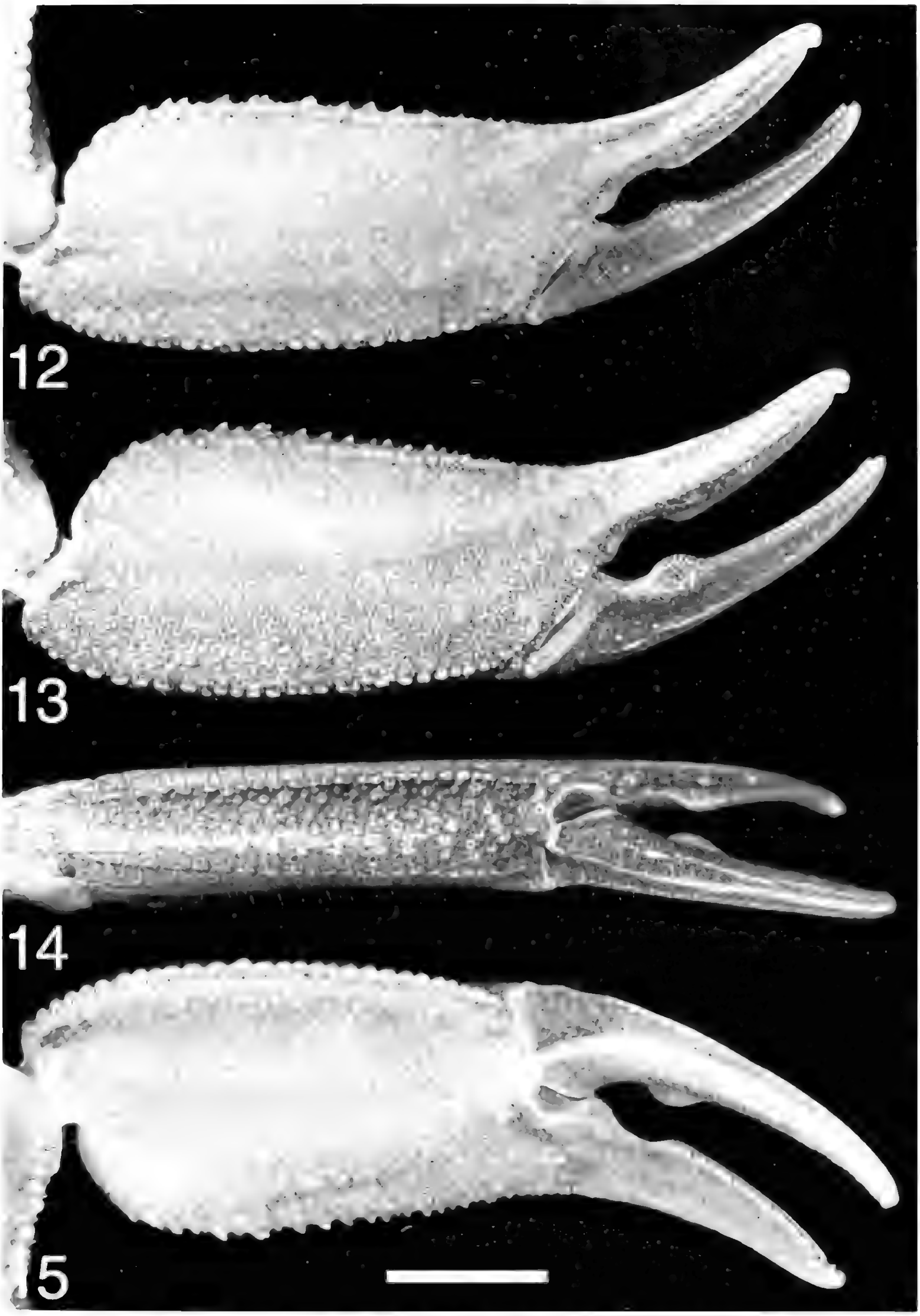
Kraepelin's (1908) records of *H. taeniurus* from Kanya [Kanye] (Southern District, Botswana), Steinkopf and Kamaggas [Komaggas] (Northern Cape Province, South Africa), later listed by Lamoral & Reynders (1975), are erroneous (Kraepelin, 1914; Newlands, 1980). Kraepelin (1908) misidentified the specimens in question and later suggested (Kraepelin, 1914) that the specimens from Kamaggas might represent a new species. These specimens were re-examined during the present investigation, and found to be conspecific with *Hadogenes gunningi* Purcell, 1899 (Kanye, ZMHB 15110) and *Hadogenes phyllodes* Thorell, 1876 (Steinkopf and Komaggas, ZMHB 15111-15113). Kraepelin's (1914) record from 'Ababis, Hereroland' [Farm Abbabis 3] (Hardap Region, Namibia) is also erroneous, although the specimen was examined at the ZMUH and confirmed to be conspecific with *H. taeniurus*.

According to Newlands (1980), records from Kub [Farm Kub 657] (Hardap Region, Namibia) (AMGS), listed in Newlands (1972a), but supplied by Lawrence (*in litt.*, 1969) were also based on misidentifications. This was also confirmed in the present study. The specimens in question (AMGS 8616, 8873, 8914) are conspecific with *Hadogenes zumpti* Newlands in Newlands & Cantrell, 1985.

Lamoral's (1979) records of *H. taeniurus* from the Hoanib River (NMNW 130), Portsmut (NMNW 222) and Gorob Mine (NMNW 517) are also based on misidentifications. These specimens are conspecific with *H. tityrus*.

The known locality records of *H. taeniurus* fall within the following range of altitudes (percentage of locality records indicated in parentheses): 300-600 m (5%), 600-900 m (27%), 900-1200 m (31%), 1200-1500 m (31%), 1500-1800 m (6%).

The distributional range falls mostly within the Savanna biome (Irish, 1994), where locality records occur in the Mopane Savanna (66%), Thornbush Savanna (9%),



FIGS 12-15. *Hadogenes taeniurus* (Thorell, 1876), carinae, trichobothria and macrosetae on the dextral pedipalpal segments of ♂ and ♀ (Farm Uisib 427 [AMNH]) 12. Chela, dorsal aspect, ♂. 13. Chela, dorsal aspect, ♀. 14. Chela, external aspect, ♀. 15. Chela, ventrointernal aspect, ♀. Scale bar = 5 mm.

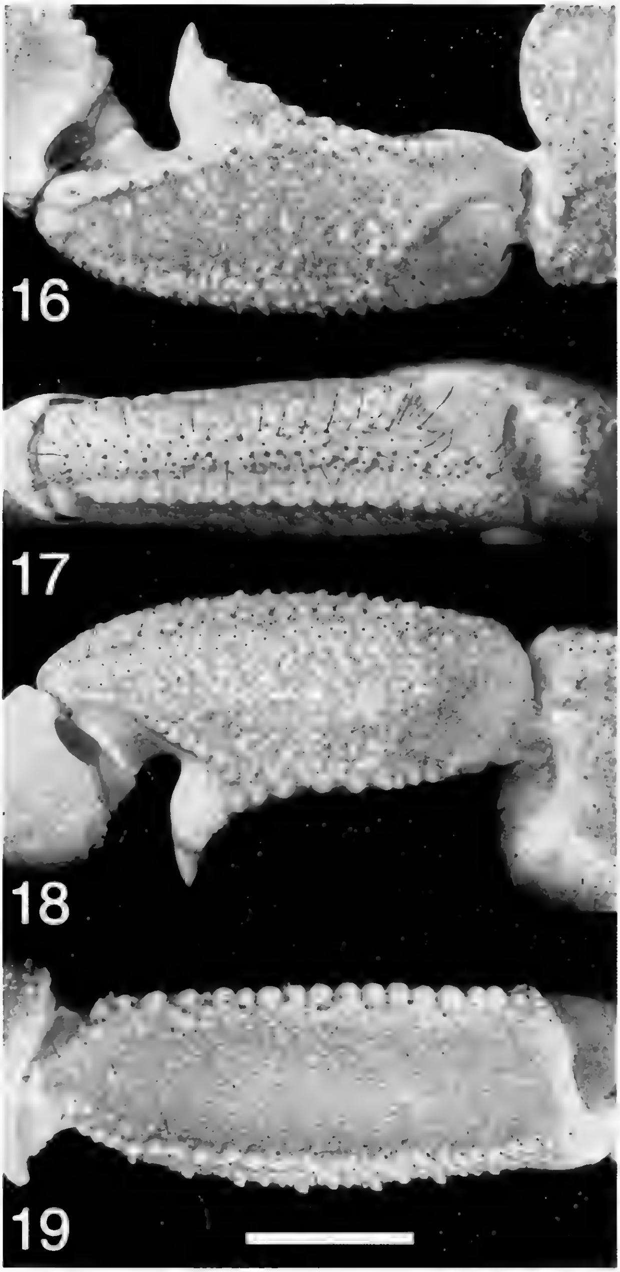
Mountain Savanna and Karstveld (7%), Forest Savanna and Woodland (3%), and Highland Savanna (3%) vegetation zones (Giess, 1971). However, a significant proportion of records fall within the Desert and Nama Karoo biomes (Irish, 1994), in the following vegetation zones (Giess, 1971): Semi-desert and Savanna Transition (10%), Northern Namib (2%).

This species inhabits a moderately to very arid region, receiving less than 650 mm annual rainfall, most of which falls in the summer (December to May). Known locality records fall within the following mean annual rainfall ranges: 0-50 mm (8%), 50-100 mm (4%), 100-150 mm (5%), 150-200 mm (13%), 200-250 mm (13%), 250-300 mm (21%), 300-350 mm (14%), 350-400 mm (13%), 400-450 mm (4%), 500-550 mm (3%), 550-600 mm (2%), 600-650 mm (2%).

Ecology. *Hadogenes taeniurus* is an obligate lithophile, which inhabits the narrow cracks, crevices and spaces beneath exfoliations of weathered granite rocks, but can also be found under large flat rocks resting on bedrock (Prendini, 2001b). The distributional range of *H. taeniurus* is allopatric with that of its closest relatives, *H. granulatus* and *H. troglodytes*, which occur on the eastern side of the Kalahari sand system in Botswana, Malawi, Mozambique, Zambia, Zimbabwe and South Africa, and parapatric with that of *H. tityrus*, which occurs in drier habitats further south and west in Namibia and South Africa (Prendini, 1995, 2001a). *Hadogenes taeniurus* has been collected in sympatry with *H. tityrus*, 5 km SE of Blue Drum, Kaokoveld (AMNH), but the two species were not syntopic. *Hadogenes taeniurus* inhabited large crevices in granite outcrops, whereas the much smaller *H. tityrus* inhabited narrow fissures in schist outcrops.

Hadogenes taeniurus has also been collected in sympatry with other scorpion species, including the bothriurids, *Lisposoma elegans* Lawrence, 1928 and *L. josehermana* Lamoral, 1979; the buthids, *Hottentotta conspersus* (Thorell, 1876), *Parabuthus brevimanus* (Thorell, 1876), *P. granulatus* (Ehrenberg, 1831), *P. kraepelini* Werner, 1902, *P. villosus* (Peters, 1862), *Uroplectes otjimbinguensis* (Karsch, 1879), and *U. planimanus* (Karsch, 1879); the scorpionids, *Opistophthalmus brevicauda* Lawrence, 1928, *O. carinatus* (Peters, 1861), *O. cavimanus* Lawrence, 1928, *O. chrysites* Lawrence, 1967, *O. lamorali* Prendini, 2000, *O. gibbericauda* Lamoral, 1979, and *O. wahlbergii* (Thorell, 1876).

Conservation status. *Hadogenes taeniurus* is largely unaffected by the dual threats of habitat destruction and collection for the exotic pet trade that threaten many other species of *Hadogenes* (Prendini, 2001a). This species is presently known from ca. 100 localities, falling within 80 QDS, in a region of low agricultural potential (Barnard, 1998) where, besides mining, which occurs at sporadic sites across its distributional range (e.g., Uis), there are few other threats to its survival. Furthermore, the species has been recorded from at least two protected areas (Iona Reserve in Angola; Waterberg Plateau Park in Namibia) and may occur in others. For example, records of *H. taeniurus* from localities close to the western boundary of Etosha National Park (e.g., Hobatere, Kowares), suggest that it probably occurs in rocky habitats in the south and west of the park. *Hadogenes taeniurus* is therefore assigned the Least Concern IUCN Red List Category.



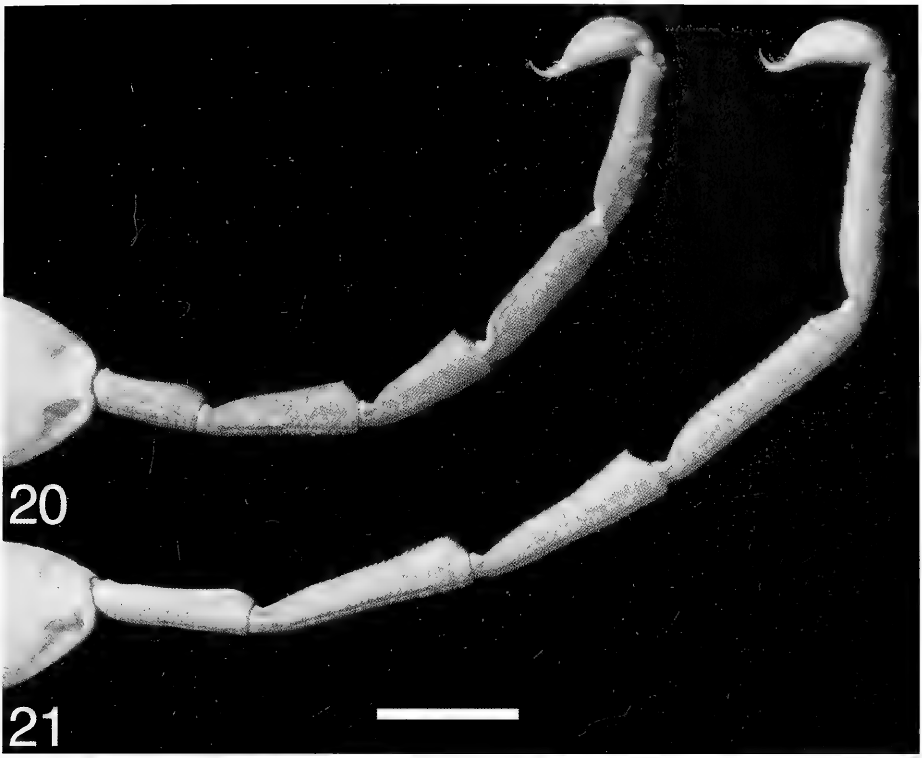
FIGS 16-19

Hadogenes taeniurus (Thorell, 1876), carinae, trichobothria and macrosetae on the dextral pedipalpal segments of ♀ (Farm Uisib 427 [AMNH]). 16. Patella, dorsal aspect. 17. Patella, external aspect. 18. Patella, ventral aspect. 19. Femur, dorsal aspect. Scale bar = 5 mm.

Material examined (type material, see above). No data: J. Visser, 1 ♀ (SAMC C4286 [JV 3284]), 2 juv. ♂ (SAMC C4264 [JV 3119], C4265 [JV 3120]). **Angola: Benguela District:** between Cainbanbo [Caibambo, 13°01'S 14°00'E] and Cubal [13°02'S 14°15'E], 2.iii.1972, J. Visser, 1 juv. ♂ (TMSA 10373), 3.iii.1972, J. Visser, 1 subad. ♂ (TMSA 10374); Hanha [13°21'S 14°24'E], 13–18.v.1925, Lang & Boulton, Vernay Angola Expedition, 1 ♂ 3 ♀ 3 subad. ♂ 2 subad. ♀ 2 juv. ♂ (AMNH [27278]); Lobito Bay [12°20'S 13°34'E], vi.1932, K.H. Barnard, 1 ♂ (SAMC B7343); near Baia Farta, Benguela [12°36'S 13°13'E], 8.ix.1970, J. Visser, 1 juv. ♂ 1 juv. ♀ (NMSA 10002). **Cuanza Sul District:** Gabela, 25 km W [10°51'S 14°15'E], 26.v.1974, W.D. Haacke, 2 subad. ♀ (TMSA 10987, 10988), 1 juv. ♂ (TMSA 10986). **Cunene District:** Cahama, 2 mi NW [16°17'S 14°19'E], 22.iii.1971, W.D. Haacke, 1 juv. ♀ (TMSA 14332); Oncocua, 23 km W [16°39'S 13°13'E], 6.ix.1969, C.G. Coetzee, 1 juv. ♀ (NMNW 1602 [old 165]), 6–7.ix.1969, C.G. Coetzee, 1 ♂ 1 subad. ♂ (NMNW 165); Ruacana [17°24'S 14°12'E], 3.xii.1972, Crawford Cabral, 1 subad. ♂ 1 subad. ♀ 1 juv. ♀ (MRAC 166.889). **Huíla District:** Chibemba, 5 km S [15°46'S 14°45'E], 24.iii.1971, W.D. Haacke, 1 ♂ (TMSA 10234), 1 ♀ (TMSA 10235); Chibemba, 11 km S [15°47'S 14°45'E], 2.v.1974, W.D. Haacke, 1 ♂ (TMSA 10933), 1 juv. ♀ (TMSA 10934); Hungueria [15°19'S 13°32'E], 1970, Crawford Cabral, 1 juv. ♂ (MRAC 207.424); Otchinjau, 15 km W towards Oncocua [16°22'S 13°56'E], 10.iv.1971, W.D. Haacke, 1 ♀ (TMSA 10425). **Namibé District:** Assunção [14°52'S 13°06'E], 24.iii.1971, W.D. Haacke, 1 ♀ (TMSA 10236); Assunção, 5 km E [14°52'S 13°07'E], 26.iii.1971, W.D. Haacke, 1 juv. ♀ (TMSA 10240); Lucira [13°52'S 12°32'E], 13.ix.1956, G. Rudebeck, 1 subad. ♀ (TMSA 8941 [ex NMSA]); Lungo near Vila Arriaga [14°21'S 13°15'E], 10.ix.1957, G. Rudebeck, 1 ♀ (TMSA 8919), 1 subad. ♀ (TMSA 8921), 1 juv. ♂ [not ♀ cf. Lawrence (1959: 386)] (TMSA 8920); Saiona River, 25 km NW Cainde [15°21'S 12°31'E], 16.iv.1971, W.D. Haacke, 1 ♀ (TMSA 10422), 1 juv. ♀ (TMSA 10423); Vila Arriaga, 5 mi E [14°46'S 13°22'E], 21.v.1958, E.S. Ross & R.E. Leech, 1000 m, 1 ♀ (CASC). Iona Reserve: Iona, 7 km towards Oncocua [16°56'S 12°37'E], 8.iv.1971, W.D. Haacke, 1 ♀ (TMSA 10424). **Namibia: Erongo Region: Karibib District:** Farm Ameib 60 [21°49'S 15°37'E], 1–2.ii.1972, C.G. Coetzee & M.-L. Penrith, 2 juv. ♀ (NMNW 333); Dawisaub [Farm Davetsaub 29, 22°27'S 16°11'E], J. Visser, 1 juv. ♂ (SAMC C4179 [JV 3169]), 1–16.iv.1984, J. Visser, 1 juv. ♀ (SAMC C4164 [JV 3102]); Farm Dobbelsberg 99 [21°53'S 16°01'E], 13.i.1981, A. Harington, sympatric with *P. brevimanus*, 1 juv. ♂ (AMNH [AH 1792]); Farm Johann Albrechtshöhe 44 [21°56'S 16°05'E], 9.iii.1970, H. Mittendorf, 1 juv. ♂ (NMNW 160); Farm Springbokfontein 21 [21°37'S 15°27'E], Erongo Mountains, 25.xii.1988, A. Harington, 1 ♀ 2 juv. ♀ (NMNW 2038), in cracks on granite hillside, sympatric with *P. kraepelini* and *O. carinatus*, 1 ♀ (AMNH [AH 3671]); Otjimbingue [21°21'S 16°08'E], Wilhelmstal [21°55'S 16°18'E], 1-16.iv.1984, J. Visser, 2 juv. ♂ (SAMC C4170 [JV 3147], C4187 [JV 3148]), 1 juv. ♀ (SAMC C4171); Otjimbingue to Windhoek [21°55'S 16°18'E], 1-16.iv.1984, J. Visser, 1 juv. ♀ (SAMC C4268 [JV 3150]). **Omaruru District:** 'Damaraland', ix.1911, 1 subad. ♂ (ZMUH); Khorixas, 84 km S [20°53'S 15°00'E], 22.i.1986, J. Visser, 1 ♂ (SAMC C4215 [JV 4155]); Ozondati, 16 km N towards Okonyenye Mountains [20°52'S 15°21'E], 1.iv.1979, W.D. Haacke, 1 ♀ (TMSA 11569); Uis mine, Uis river [21°11'S 14°52'E], 12.ix.1962, B. Grobbelaar, 1 subad. ♂ (NMNW 167); Uis tin mine [21°13'S 14°51'E], Uis, 30.iii.1969, J.J. Nel, 1 ♂ (TMSA 9416); Uis, 5 km W [21°15'S 14°50'E], 15.iv.1980, A. Harington, in rock cracks, syntopic with *U. planimanus*, 1 juv. ♂ (AMNH [AH 1416]); Uis, at Kamanjab turnoff [21°14'S 14°51'E], 18.iv.1980, A. Harington, in rock crack at summit of extremely rocky hill, 1 ♀ (AMNH [AH 1356]). **Khomas Region: Windhoek District:** Farm Uitsig [on Uruganus 358, 22°49'S 16°17'E], Wilhelmstal [21°55'S 16°18'E], 15.iii.1963, C. de Wet, 1 ♂ (NMNW 61); Goreangab Dam [22°32'S 17°02'E], v.1970, H. Strauss, 1 juv. ♀ (NMNW 252). **Kunene Region: Khorixas District:** Farm Engelbrecht 272 [19°56'S 14°42'E], 14.xii.1988, A. Harington, rocky area, sympatric with *H. conspersus*, *P. brevimanus*, *P. villosus*, *O. carinatus* and *O. wahlbergii*, 1 ♂ (AMNH [AH 4132]); Hobatere Lodge, Farm Marenphil 641, 19°19.89'S 14°22.45'E, 20.i.1998, L. Prendini & E. Scott, 1050 m, granitic hills near camp, in crevices of rock outcrops at night, syntopic with *L. elegans*, *P. kraepelini*, *P. villosus*, *O. carinatus*, and *O. gibbericauda*, 3 ♀ (AMNH); Hobatere Lodge [19°19'S 14°22'E], 10.viii.1990, S. Braine, 1 ♀ (NMNW 1475), 11.x.1993, B. Brell, 1 juv. ♂ (NMNW 2037), iii.1997, S. Braine, 1 ♂ (NMNW 2046), 2000, S. Braine, 1 ♂ (NMNW 2048); Hobatere [19°15'S 14°23'E], 12.x.1993, M. Griffin & M.A. de Kock, 1 subad. ♂ (NMNW 1556);

Kamanjab, 68 km W [19°49'S 14°11'E], J. Visser, 1 juv. ♀ (SAMC C4208 [JV 4019]); Khorixas, 2 km E [20°22'S 14°59'E], 19.iv.1980, A. Harington, sympatric with *O. wahlbergii*, 1 subad. ♀ (AMNH [AH 1399]); Khorixas, 5 km S [20°24'S 14°58'E], 13.xii.1988, A. Harington, sympatric with *H. conspersus*, *P. brevimanus*, *P. granulatus*, *P. kraepelini*, *O. carinatus* and *O. wahlbergii*, 1 ♂ (AMNH [AH 4066]); Makukous Spring, 6 km N [19°33'S 13°53'E], 27.iv.1976, W.D. Haacke, 1 juv. ♂ (TMSA 11226); Onguati, 44.3 km N [19°34'S 14°29'E], 18.vi.1993, A. Bauer, 1 ♀ (NMNW 1529); Welwitschia (Khorixas) [20°22'S 14°58'E], i.1963, F. Gaerdes, 1 juv. ♂ (NMSA 9049). **Opuwo District:** Anabib (Orupembe), about 100 mi W Ohopoho (Opuwo) [18°11'S 12°31'E], 6.vi.1951, P. & G. Brinck, G. & I. Rudebeck, on dry hillside, 1 juv. ♂ [not ♀ cf. Lawrence (1955: 223)] (ZMLU L51/4285); base of Vanzyl's Pass, 17°39.827'S 12°40.852'E, 11.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, 635 m, UV detection, in crevices in schist slope in arid savanna, syntopic with *H. conspersus*, *U. otjimbinguensis*, *U. planimanus* and *O. brevicauda*, 1 ♀ (AMNH); Beesvlakte [19°02'S 14°14'E], 15.vi.1992, M. Griffin & M.A. de Kock, 1 ♂ 1 juv. ♀ (NMNW 2036); Blue Drum, 5 km SE on S bank of Ondondujengo River, 17°48.894'S 12°25.626'E, 15.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, 841 m, UV detection, in crevices in granite outcrops near riverbed, arid savanna, syntopic with *H. conspersus*, *P. brevimanus*, *P. granulatus*, *P. villosus*, *U. otjimbinguensis*, *U. planimanus*, *O. brevicauda*, *O. cavimanus* and *O. chrysites*, *H. tityrus* collected on same slopes from crevices in schist, 1 ♂ [measured] 1 ♀ (AMNH), 1 subad. ♂ 1 subad. ♀ (NMNW 2665), 1 subad. ♂ (AMCC 126098); Caimaeis [19°20'S 14°00'E], i–iv.1926, S.A. Museum expedition, 1 juv. ♂ 1 juv. ♀ [rehydrated] (SAMC B6071); Epupu falls on Kunene River [17°01'S 13°15'E], 26.iv.1970, W.D. Haacke, 1 subad. ♀ (TMSA 9799); Epupa falls, Kunene River, 8 km SE [17°03'S 13°14'E], 25.iv.1970, W.D. Haacke, 1 juv. ♂ (TMSA 9798); Farm Kowares 276 [19°03'S 14°21'E], i–iv.1926, S.A. Museum expedition, 1 ♀ [rehydrated] (SAMC B6967), 1 juv. ♂ [rehydrated] (SAMC B6974); Hartmann Valley, S of Angola border [17°34'S 12°17'E], iii.1995, C.R. Owen, 2 ♀ (NHRM [JF 80]); Hartmann's Valley, ca. 39 km N of Orange Drum, 17°26.396'S 12°15.868'E, 14.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, 699 m, UV detection, in crevices on granite inselberg on gravel plain, syntopic with *H. conspersus*, 2 ♂ [measured] (AMNH); Kaoko Otavi [18°18'S 13°39'E], i–iv.1926, S.A. Museum expedition, 2 juv. ♂ [rehydrated] (SAMC B6801); Kaokoland [17°37'S 12°12'E], 15.x.1988, M. Griffin & H. Kleynhans, between stones, rocky hillside, 1 juv. ♀ (NMNW 1069); Kaokoveld, 1.ix.1955, E. van Koen, 1 ♀ 1 juv. ♂ (SMF 39267); Kaokoveld, 17°36.842'S 12°52.107'E, 9.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, 1339 m, arid savanna, found walking on rock in the late afternoon, 1 juv. ♀ (AMNH); Kunene River [17°26'S 14°02'E], iii.1923, R.F. Lawrence, 1 juv. ♂ 1 juv. ♀ (SAMC B5420, damaged), 1 juv. ♀ (SAMC B5428, damaged); Kunene River, 37 km E of Epupa [17°01'S 12°55'E], 10–11.iv.1991, M. Griffin, 2 juv. ♂ (NMNW 2049); Ohopoho [Opuwo], 40 km N [17°43'S 13°53'E], 12.ii.1975, L. Schulze, 1 juv. ♂ (TMSA 10969); Okokatuwo [17°27'S 12°32'E], 10.v.1991, E. Griffin, between rock slabs, 3 juv. ♂ 1 juv. ♀ (NMNW 1449); Ongongo Community Campsite, 6 km N of Warmquelle, 19°08.427'S 13°49.173'E, 20.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, 730 m, UV detection, in crevices in calcrete on rocky slope near freshwater spring, arid savanna, syntopic with *H. conspersus*, *P. brevimanus*, *U. otjimbinguensis*, *U. planimanus*, *O. brevicauda* and *O. cavimanus*, 1 ♀ [measured] (AMNH), 1 juv. ♀ (NMNW 2666); Opura [Opuwa?, 18°04'S 13°51'E], vii–ix.1982, J. Coetzer, 1 ♀ (NCA 84/83); Oruhona [17°41'S 13°36'E], 28.iv.1970, W.D. Haacke, 2 ♀ (TMSA 9807, 9809), 1 subad. ♂ (TMSA 9808); Orumana [18°15'S 13°54'E], iii.1973, Mr Vermaak, 1 juv. ♀ (NMNW 437); Otjihepa Mountains [17°16'S 12°39'E], 11.vi.1992, M. Griffin & M.A. de Kock, 3 ♂ (NMNW 2052); Otjijangasemo [Otjijandjasemo, 17°26'S 13°16'E], 27.iv.1970, W.D. Haacke, 1 juv. ♀ (TMSA 9800); Otjitanda, 5 km E, 17°38.820'S 13°51.814'E, 9.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, 1338 m, UV detection, in crevices in granitic hillside in fairly dense broadleaf savanna, syntopic with *P. brevimanus*, *P. granulatus*, *P. kraepelini*, *P. villosus*, *U. otjimbinguensis*, *U. planimanus* and *O. carinatus*, 1 ♂ [measured] 4 ♀ (AMNH), 1 subad. ♂ 2 subad. ♀ (NMNW 2667), 3 juv. ♂ 1 juv. ♀ (AMCC 126102); Otjitundua [18°39'S 14°14'E], i–iv.1926, S.A. Museum expedition, 1 juv. ♂ (SAMC B6973, damaged, without metasoma); Ruacana [17°26'S 14°21'E], 21.iv.1970, W.D. Haacke, 1 juv. ♂ (TMSA 9839); Ruacana, 2 km NNE, 17°26.709'S 14°21.396'E, 6.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N.

Martins, 1138 m, UV detection, in crevices in calcrete on rocky slope (edge of Kunene River valley), arid savanna, syntopic with *H. conspersus*, *P. brevimanus* and O. *carinatus*, 1 ♀ (AMNH), 1 juv. ♂ (AMCC 126101), 1 juv. ♂ (NMNW 2673); Ruacana, 5 km NNE, 17°25.869'S 14°21.522'E, 6.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, 1109 m, UV detection, in crevices in sandstone at base of rocky slope (edge of Kunene River valley), arid savanna, syntopic with *H. conspersus*, *P. brevimanus*, *U. planimanus* and *O. carinatus*, 1 ♀ (AMNH), 2 subad. ♀ (NMNW 2668), 1 juv. ♂ 1 juv. ♀ (AMCC 126099); Sanitatas [18°17'S 12°40'E], 30.iv.1970, W.D. Haacke, in crack of layered sandstone-slate, 1 subad. ♂ (TMSA 9811); Swartboois Drift, on Kunene River [17°22'S 13°52'E], 23.iv.1970, W.D. Haacke, 1 ♀ (TMSA 9790), 1 juv. ♀ (TMSA 9789), 24.iv.1970, W.D. Haacke, 1 ♀ (TMSA 9793), 1 subad. ♂ (TMSA 9792), 1 subad. ♀ (TMSA 9791), 1 juv. ♂ (TMSA 9794); Swartbooisdrif, 2 km E, 17°20.693'S 13°51.427'E, 7.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, 732 m, UV detection, in crevices in sandstone on S bank of Kunene River, arid savanna, syntopic with *H. conspersus*, *P. brevimanus*, *U. planimanus*, O. *carinatus* and *O. gibbericauda*, 1 ♀ 1 subad. ♂ (AMNH), 1 ad. [pedipalp chela] 1 juv. ♂ 1 juv. ♀ (AMCC 126100), 4 juv. ♀ (NMNW 2669); Warmquelle [19°01'S 13°49'E], J. Visser, 1 juv. ♂ (SAMC C4210 [JV 4092]); Zebra Mountain North [17°08'S 13°27'E], 31.i.1972, G.J. Menge, 1 juv. ♂ 1 juv. [fragment] (TMSA 10442). **Outjo District:** Farm Glücksburg 152 [20°15'S 16°06'E], 23.iv.1980, A. Harington, sympatric with *H. conspersus*, *P. brevimanus*, *U. planimanus*, *O. carinatus* and *O. wahlbergii*, 1 ♀ (AMNH [AH 3578]); Farm Hoas 273 [19°55'S 14°45'E], 1971, J.R. Labuschagne, 1 ♀ (TMSA 10132), 1 juv. [pedipalp] (TMSA 10152), 18.i.1972, J.R. Labuschagne, 1 subad. ♂ (TMSA 10269); Farm Kamanjab 104, ca. 2 km towards Ruacana [19°37'S 14°50'E], 21.iv.1980, A. Harington, in granite rock cracks, 1 ♀ (AMNH [AH 1317]); Farm Kamanjab 190 [19°34'S 14°52'E], 21.iv.1980, A. Harington, in granite rock cracks near town, 1 ♀ (AMNH [AH 1387]), 1 subad. ♀ (AMNH [AH 1386]); Farm Kaross 237 [19°21'S 14°31'E], 7.x.1986, E. Griffin, in rocks, 1 juv. ♂ (NMNW 1209), 10.ii.1987, E. Griffin, between slabs of stone, 1 juv. ♀ (NMNW 1022); Farm Palafontein 158 [20°15'S 16°11'E], iv.1980, A. Harington, 2 subad. ♀ (AMNH [AH 3586, 3587]); Farm Weerlig 11 [20°03'S 15°01'E], 21.iv.1980, A. & L. Harington, in granitic rock cracks, sympatric with *O. carinatus* and *O. wahlbergii*, 2 ♀ (AMNH [AH 1333, 1334]); Kamanjab [19°38'S 14°50'E], J. Visser, 1 juv. ♂ (SAMC C4206 [JV 4007]), 1 juv. ♀ (SAMC C4207 [JV 4006]), i–iv.1926, S.A. Museum expedition, 1 subad. ♀ [rehydrated] (SAMC B6089), 21.iv.1980, A. Harington, 1 juv. ♂ 1 juv. ♀ (AMNH [AH 4260]); Kamanjab, 3 km N [19°37'S 14°48'E], 5.iv.1976, B. Lamoral & L. Ferguson, in vertical crevices of rocky outcrops, at night, 1 juv. ♀ (NMSA 10747); Kamanjab, 30 km W [19°36'S 14°33'E], J. Visser, 1 subad. ♀ (SAMC C4211 [JV 4093]); Kamanjab, 34 km W [19°36'S 14°10'E], J. Visser, 1 juv. ♀ (SAMC C4205 [JV 4002]), 23.i.1986, J. Visser, 1 ♀ (SAMC C4299 [JV 4167]), 1 ♀ (SAMC C4305 [JV 4166]). **Oshikoto Region: Tsumeb District:** Farm Varianto on Elandshoek 771, 19°22.773'S 17°44.456'E, 4.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, 1500 m, UV detection, in crevices in dolomite at base of rocky hill in dense broadleaf savanna, fairly humid with dense litter layer, syntopic with *L. josehermana*, *U. otjimbinguensis*, *U. planimanus* and O. *carinatus*, 1 ♀ (AMNH), 1 subad. ♂ 1 juv. ♂ (NMNW 2670); Farm Uithoek 770, 9 mi S Tsumeb [19°20'S 17°39'E], 6.iv.1970, W.D. Haacke, 1 ♀ (TMSA 9786); Tsumeb [19°13'S 17°43'E], iv.1984, J. Visser, 1 ♀ (SAMC C4282 [JV 3227]). **Otjozondjupa Region: Grootfontein District:** Farm Uisib 427, 15 km NW of Otavi, 19°33.132'S 17°14.124'E, 2.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, 1293 m, UV detection, in crevices in dolomite at base of rocky hill in dense broadleaf savanna, fairly humid with dense litter layer, syntopic with *L. josehermana*, *U. otjimbinguensis*, *U. planimanus* and O. *carinatus*, 7 ♂ [1 measured] 14 ♀ 2 subad. ♂ 5 subad. ♀ (AMNH), 4 subad. ♀ 7 juv. ♂ 5 juv. ♀ (NMNW 2671), 1 juv. ♂ 1 juv. ♀ (AMCC 126103); Tsumeb, 40 km S [19°34'S 17°30'E], J. Visser, 2 juv. ♀ (SAMC C4165 [JV 3116], C4166 [JV 3117]). **Okahandja District:** Gross Barmen [22°06'S 16°45'E], xii.1981, H. Otto, 1 subad. ♀ (AMNH [AH 2234]); Okahandja [21°59'S 16°55'E], 1955, F. Gaerdes, 1 juv. ♂ 1 juv. ♀ (SMF 39323), v.1960, F. Gaerdes, 1 juv. ♂ [not ♀ cf. Lamoral (1979: 657)] (NMSA 7318). **Otjiwarongo District:** Waterberg [20°25'S 17°15'E], 5.iv.1970, P.J. Buys & P.G. Olivier, 1 juv. ♂ (NMNW 168); Waterberg [20°31'S 17°14'E], 5.iv.1970, W.D. Haacke, 1 ♂ [fragmented, dehydrated] 3 juv. ♀ 1 juv. [exuvium] (TMSA 9835). Waterberg Plateau Park: Main camp, 20°30.803'S 17°14.753'E, 1.i.2004, L. Prendini, E. Scott,



FIGS 20-21

Hadogenes taeniurus (Thorell, 1876), metasoma and telson of ♂ and ♀ (Farm Uisib 427 [AMNH]). 20. Lateral aspect, ♀. 21. Lateral aspect, ♂. Scale bar = 10 mm.

Q. & N. Martins, 1440 m, UV detection, in crevices in sandstone on eastern slope of Waterberg, fairly dense mixed savanna, sympatric with *L. josehermana*, *U. otjimbinguensis*, *U. planimanus* and *O. carinatus*, 3 ♀ [2 measured] (AMNH), 1 subad. ♂ 1 subad. ♀ 1 juv. ♀ (NMNW 2672).

Dubious records: NAMIBIA: Erongo Region: Swakopmund District: Hentiesbaai [22°07'S 14°17'E], iv.1970, J. Viljoen, 1 ♀ (NMNW 74). **Hardap Region: Maltahöhe District:** Ababis [Farm Abbabis 3, near Solitaire, 23°57'S 16°03'E], 10.x.1910, G.E. Müller, 1 subad. ♀ (ZMUH). **Karas Region: Bethanie District:** Helmeringhausen, just south [25°55'S 16°50'E], J. Visser, 1 juv. ♀ (SAMC C4209 [JV 4025]).

Hadogenes tityrus (Simon, 1888)

Ischnurus tityrus Simon, 1888: 383–384.

Hadogenes tityrus: Kraepelin, 1894: 118; Kraepelin, 1896: 136; Kraepelin, 1899: 145–146; Kraepelin, 1901: 272; Kraepelin, 1908: 268; Kraepelin, 1914: 117; Hewitt, 1918: 163; Hewitt, 1925: 270; Werner, 1936: 189; Roewer, 1943: 232; Lawrence, 1955: 252; Lawrence, 1961: 154; Lawrence, 1962: 221; Lawrence, 1966: 5-7, fig. 3c; Newlands, 1972a: 135; Vachon, 1974, fig. 95, 109, 125-127; Lamoral & Reynders, 1975: 540; Lamoral, 1979: 657-661, fig. 302, 303, 310-317; Newlands & Cantrell, 1985: 37-43, fig. 1-3, tab. 1, 2; Lourenço, 1989: 166, pl. 4, fig. 9-11; Newlands & Prendini, 1997: 80, 81;

Kovařík, 1998: 133; Fet, 2000: 389, 390; Prendini, 2000b: 110, tab. 1; Prendini, 2001a: 148, tab. 1; Prendini, 2001b: 137.

Hadogenes bifossulatus Roewer, 1943: 222-234, fig. 10, 10a-d, pl. 5 (synonymized by Kovařík, 1998: 133); Lawrence, 1955: 254; Newlands, 1972a: 134, 135; Lamoral & Reynders, 1975: 538; Lamoral, 1979: 661; Fet, 2000: 387.

Hadogenes taeniurus: Lamoral, 1979: 657 (NMNW 130, 222, 517).

Hadogenes tityurus: Bücherl, 1964: 61.

Type material (examined). *Ischnurus tityrus*: holotype ♀ (not ♂) (MNHN RS 0378), 'Kalahari', South West Africa [**NAMIBIA**]. *Hadogenes bifossulatus*: holotype subad. ♂ (not ♀) (SMF 6739/146), Waterberg [**Otjozondjupa Region: Otjiwarongo District**], South West Africa [**NAMIBIA**].

Remarks. *Hadogenes bifossulatus* has long been regarded as a dubious species on account of the inadequate original description (Lawrence, 1955; Newlands, 1972a, 1980; Lamoral & Reynders, 1975; Lamoral, 1979; Fet, 2000). Newlands (1972a) suggested that *H. bifossulatus* might be synonymous with *H. taeniurus*, perhaps because the type locality of *H. bifossulatus* occurs in an area from which *H. taeniurus* had previously been recorded, and different *Hadogenes* species are seldom sympatric. However, after examining the holotype of *H. bifossulatus*, Newlands (1980) synonymized the species with *H. tityrus*. Newlands' (1980) unpublished synonymy of *H. bifossulatus* was later published (and thereby validated) by Kovařík (1998), without explicit mention of the source, but Fet (2000) did not accept the synonymy. During the present investigation, the holotype of *H. bifossulatus* was re-examined and confirmed to be conspecific with *H. tityrus*, rather than with *H. taeniurus*. Although not adult, the holotype presents many of the diagnostic characters of *H. tityrus*: small size; pale colouration; greatly enlarged lateral ocelli; long, slender pedipalp chela with short fingers, and with dorsal and ventral margins of manus subparallel; less than 140 trichobothria per pedipalp; very short metasoma, total length 25% less than combined length of prosoma and mesosoma; distinctive shape of the metasomal segments (e.g., metasomal segment I width greater than height, dorsosubmedian carinae of segment III only terminating posteriorly with enlarged, spiniform granules); lateral margins of sternite VII strongly convex. The type locality of *H. bifossulatus* nevertheless remains questionable, because the nearest records of *H. tityrus* are much further south and west, in habitats considerably drier than the Waterberg, as is typical for this species. It seems unlikely, although perhaps not impossible, that *H. tityrus* occurs in the Waterberg.

Material examined (type material, see above). **NAMIBIA: Erongo Region: Omaruru District:** Brandberg [21°14'S 14°30'E], B.H. Lamoral, 1977, 1 ♀ (TMSA 18350); Brandberg, Basswald Rinne [21°10'S 14°38'E], 17-18.iv.1980, A. Harington, in cracks in red rocks, 2 ♀ 2 subad. ♀ (AMNH [AH 1369-1371]); Brandberg, Goaseb gorge [21°14'S 14°35'E], 20.xii.1988, A. Harington, on foothills, under granite rocks, 1 ♀ (AMNH [AH 4001]); Numas Valley, 21°06'S 14°23'E, 13.viii.1995, M. & E. Griffin, between slabs of stone, 1 ♂ (NMNW 1863); Numaskloof, Brandberg, 21°07.48'S 14°25.54'E, 17.i.1998, L. Prendini & E. Scott, 470 m, rocky granite slopes at base of mountain, UV detection, 1 ♂ (AMNH); Brandberg West mine [21°00'S 14°09'E], 27.iii.1964, F. Motonane, 1 ♀ 1 subad. ♂ (NMNW 90); Brandberg West, 7 km from turnoff towards Uis [21°06'S 14°17'E], 28.i.1981, A. Harington, 1 ♀ 1 juv. ♂ (AMNH [AH 2221]); 5 km SE of Brandberg West-Cape Cross-Uis T-junction [21°05'S 14°16'E], 22.xii.1988, A. Harington, granite exfoliations of low boulders, no hill per se, 1 ♀ (AMNH [AH 3757]). **Swakopmund District:** Namib-Naukluft Park: Gorob Mine [23°33'S 15°25'E], 15.iii.1974, J. Tebje, 1 ♂ (NMNW 517) [misidentified as *H. taeniurus* by Lamoral (1979: 657)]; Rössing, Crusher Dust Area [22°28'S 15°02'E], 28.viii–25.ix.1984, J. Irish &

FIGS 22-23

Hadogenes taeniurus (Thorell, 1876), hemispermatophore (holotype ♂ of *H. angolensis* Lourenço, 1999, MHNG). 22. Ental aspect. 23. Ectal aspect. Scale bar = 1 mm.

H. Rust, preservative pitfall traps, 1 ♀ (NMNW 867). **Khomas Region: Windhoek District:** Farm Portsmut [33 23°06’S 16°26’E], 7.ii.1969, P.G. Olivier, 1 juv. ♂ (NMNW 222) [misidentified as *H. taeniurus* by Lamoral (1979: 657)]. **Kunene Region: Opuwo District:** Skeleton Coast Park: Hoanib River, 8 mi E of dunes [19°23’S 13°06’E], 11.xi.1965, C. Brits, 1 ♀ (NMNW 130) [misidentified as *H. taeniurus* by Lamoral (1979: 657)].

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Note added in proof

While this paper was in press, Acosta & Fet (2005) reinstated *Hadogenes hahni* (Peters, 1862) as the valid name for the species referred to in this paper as *Hadogenes taeniurus* (Thorell, 1876). As noted on p. 372 of the present paper, Prendini (in Fet, 2000: 389) examined the syntypes of *Ischnurus hahni* Peters, 1862, determined them to be conspecific with *H. taeniurus*, and proposed that *I. hahni* and *H. taeniurus* were synonymous. Fet (2000) gave precedence to Thorell's (1876) binomen, *H. taeniurus*, because Peters' (1862) name, *I. hahni*, had not been cited since the original description, and *H. taeniurus* was the only name used for the species since 1876. However, as pointed out by Acosta & Fet (2005), Fet's (2000) action violates the Principle of Priority (ICZN, 1999). The nearest provision is the Reversal of Precedence (Art. 23.9), according to which priority may be reversed when long unused names are involved, but only if two conditions are met. In this particular case, the first condition (Art. 23.9.1.1) is fulfilled. The senior synonym was not used as a valid name for the species after 1899. However, the second condition (Art. 23.9.1.2) is not. In the 50 years immediately preceding Fet's (2000) action, there are only nine works citing *H. taeniurus* as the valid name for the species, although 25 are required. Recognition that *H. hahni* is the valid name for this species implies that *Hadogenes angolensis* Lourenço, 1999 = *Hadogenes hahni* (Peters, 1862), **syn. n.**

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Astyanax pampa (Characiformes, Characidae), a new species from the southernmost boundary of the Brazilian subregion, Argentina

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***Astyanax pampa* (Characiformes, Characidae), a new species from the southernmost boundary of Brazilian subregion, Argentina.** - *Astyanax pampa* sp. n., the new species of characid described herein, is known from arroyo Las Mostazas, an Atlantic Ocean drainage, and the lower río Colorado basin. *Astyanax pampa* sp. n. is distinguished from all other *Astyanax* species by the possession of 17-20 branched anal-fin rays, one maxillary tooth unicuspidate to tricuspidate, short anal-fin base (24.2-30.3% of SL), and long caudal peduncle (10.5-12.7% of SL).

Keywords: Freshwater fishes - characids - Buenos Aires - systematics.

INTRODUCTION

The streams of the Atlantic Ocean drainage and the lower río Colorado represent the southern limit of the Brazilian subregion. In that area, the diversity of freshwater fishes is low, about 15 species (Casciotta *et al.*, 1999) and supossedly, the fish species are well known. Thus, collecting trips in the streams of Atlantic Ocean drainages and río Colorado are not frequent. In the last years, some trips in the area allow us to confirm the presence of several freshwater species including a new species of *Astyanax*. *Astyanax pampa* is included in this genus following Eigenmann (1921, 1927) by the presence of two series of premaxillary teeth, maxilla with few or no teeth, dentary with strong teeth in front and minute conical ones on the sides, lateral line complete, caudal fin naked, shallow body depth, and a complete series of scales in the predorsal area.

The aim of this paper is to describe *Astyanax pampa* sp. n. which has the southernmost distribution of the genus.

MATERIAL AND METHODS

The specimens were cleared and counterstained (C&S) following Taylor & Van Dyke (1985). Measurements were taken as straight line distances in mm, using digital calliper; all measurements are expressed as percentages of SL or indicated length. Standard length is taken from tip of snout to hypural joint; head length includes opercular flap; peduncle length is taken from insertion of last anal-fin ray to hypural

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joint. Measurements of holotype and paratypes (Table 1) include two cleared and stained specimens. Values of holotype are indicated by an asterisk. Vertebrae count includes four vertebrae of Weber apparatus and the CP1+U1 as one element. Scales below lateral line are counted from that line to pelvic-fin origin. Perforated scales of lateral line were counted from first scale posterior to opercle to last scale on caudal peduncle. Institutional abbreviations are as listed in Leviton *et al.* (1985), excluded AI (Asociación Ictiológica, La Plata, Argentina), and CI-FML (Fundación Miguel Lillo, Tucumán, Argentina).

Comparative material examined (SL in mm). *Astyanax abramis* (Jenyns, 1842): MLP 9427, 2 ex., 102.0-113.0, Argentina, Misiones, río Paraná. *Astyanax asuncionensis* Géry, 1972: MLP 8660, 5 ex., 43.6-61.4, Argentina, Santiago del Estero, Bañado de Añatuya. *Astyanax eigenmanniorum* (Cope, 1894): ANSP 21627-28, 2 paratypes, 42.5-49.4, Brazil, Rio Grande do Sul. AI 167, 5 ex., 30.3-54.6, Brazil, Rio Grande do Sul, Rio Jacuí basin, Arroio do Conde. MLP 9160, 6 ex., 36.8-80.2, Argentina, Buenos Aires, man-made ponds in Los Talas. *Astyanax* cf. *fasciatus* (Cuvier, 1819): MLP 8668, 4 ex., 61.0-67.7, Argentina, Santiago del Estero, Bañado de Figueroa. MLP 8798, 17 ex., 28.8-39.6, Argentina, Formosa, highway from Formosa to Clorinda. *Astyanax ita* Almirón *et al.*, 2002: MLP 9599, holotype, 64.0, Argentina, Misiones, río Iguazú basin, arroyo Tateto. *Astyanax latens* Mirande *et al.*, 2004: CI-FML 3400, holotype, male, 44.3, Argentina, Salta, río Bermejo basin, arroyo El Oculto. *Astyanax leonidas* Azpelicueta *et al.*, 2002: MLP 9580, holotype, male, 45.6, Argentina, Misiones, río Paraná basin, headwaters of arroyo Urugua-í. *Astyanax ojiara* Azpelicueta & García, 2000: MLP 9470, holotype, male, 50.5, Argentina, Misiones, río Uruguay basin, arroyo Benítez, headwaters of arroyo Yabotí-Miní. *Astyanax paris* Azpelicueta *et al.*, 2002: MLP 9584, holotype, 75.6, Argentina, Misiones, río Uruguay basin, Arroyo Fortaleza. *Astyanax pynandi* Casciotta *et al.*, 2003: MACN-ict 8543, holotype, 52.0, Argentina, Corrientes, Esteros del Iberá, Laguna Iberá, Lobo-Cuá. *Astyanax saguazu* Casciotta *et al.*, 2003: MLP 9603, holotype, 63.0, Argentina, Misiones, Uruguay basin, arroyo Once Vueltas. *Astyanax stenohalinus* Messner, 1962: AI 132, 2 ex. C&S, 42.6-55.7, Argentina, Buenos Aires, Río de la Plata basin, Punta Indio, unnamed stream. *Astyanax troya* Azpelicueta *et al.*, 2002: MACN-ict 8310, holotype, 73.8, Argentina, Misiones, río Paraná basin, arroyo Cuñapirú Chico. *Astyanax tupi* Azpelicueta *et al.*, 2003: MACN-lct 8646, holotype, 70.1, Argentina, Misiones, arroyo Cuñapirú in Balneario of Aristóbulo del Valle.

RESULTS

Astyanax pampa sp. n. Figs 1-6, Table 1

Holotype. MACN-ict 8651, 63.7 mm SL, female, Argentina, province of Buenos Aires, arroyo Las Mostazas (38°5'S, 61°27'W), coll. J. Casciotta and A. Almirón, October 1997.

Paratypes. AI 134, 8 ex., 38.3-73.0 mm SL, collected with the holotype. MHNG 2644.22, 4 ex., 37.7-65.0 mm SL, collected with the holotype. AI 135, 2 ex. C&S, 43.8-46.0 mm SL, collected with the holotype. AI 166, 2 ex. C&S, 27.5-31 mm SL, Argentina, province of Buenos Aires, río Colorado, coll. M. Azpelicueta, A. Almirón and J. Casciotta, December 1994.

Diagnosis. *Astyanax pampa* sp. n. is distinguished from all other *Astyanax* species by the possession of 17-20 branched anal-fin rays, one maxillary tooth uni-

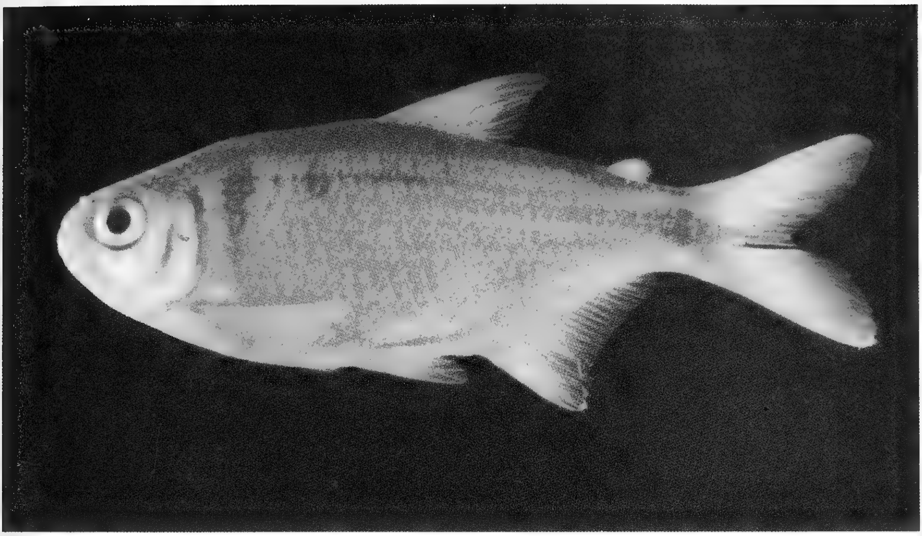


FIG. 1

Astyanax pampa sp. n., holotype, female, MACN-ict 8651, 63.7 mm SL, Argentina, province of Buenos Aires, arroyo Las Mostazas.

cuspidate to tricuspidate, short anal-fin base (24.2-30.3% of SL), and long caudal peduncle (10.5-12.7% of SL).

Description. Morphometrics of holotype and 14 paratypes are presented in Table 1. Maximum body depth located inmediately anterior to dorsal-fin origin (Fig. 1). Dorsal profile of body convex from snout to dorsal-fin origin, with concavity over supraoccipital area; almost straight from dorsal-fin origin to adipose fin, then slanted ventrally to caudal peduncle, concave along caudal peduncle to base of caudal-fin rays. Ventral profile of body similar to dorsal profile, more curved at pelvic-fin origin.

Dorsal-fin origin nearer tip of snout than base of caudal-fin rays. Adipose fin located anterior to vertical through base of posteriormost anal-fin rays. Pelvic-fin origin situated anterior to vertical through dorsal fin-origin. Anal-fin origin placed posterior to vertical through last dorsal-fin ray insertion. Tip of pectoral fin surpassing pelvic-fin origin in males, even in small specimens. Tip of pelvic fin reaching anal-fin origin in males.

Head length moderate, mouth horizontal and terminal; snout smaller than eye. Lower jaw slightly longer than upper jaw. Premaxilla with slender ascending process (Fig. 2); alveolar process bearing two series of teeth. Outer row with 3 (1 ex.), 4 (12* ex.), 5 (2 ex.), tricuspidate or tetracuspidate teeth. Inner series with 5 teeth; symphysial tooth tetracuspidate, remaining teeth tricuspidate to pentacuspidate, with central cusp larger. Maxilla long; laminar process with one small unicuspidate or tricuspidate tooth (Fig. 2). Dentary with 3 (11* ex.) or 4 (4 ex.) large teeth pentacuspidate followed by a median-sized tooth tricuspidate or pentacuspidate, and 3-4 smaller teeth unicuspidate or tricuspidate (Fig. 3).

TABLE 1. Morphometric data of the holotype and 14 paratypes of *Astyanax pampa* sp. n. Standard length expressed in mm.

	Holotype	Range	Mean	SD
Standard length	63.7	37.7-73.0		
% of standard length				
Predorsal distance	52.1	49.5-55.0	53.1	1.29
Prepelvic distance	50.5	46.1-52.8	49.6	1.72
Preanal distance	68.6	65.1-69.5	67.5	1.24
Body depth	39.6	36.9-42.2	38.7	1.37
Dorsal-fin base	13.7	13.2-15.3	14.1	0.61
Anal-fin base	25.7	24.2-30.3	27.8	1.69
Pectoral-fin length	25.0	22.3-26.0	24.5	1.16
Pelvic-fin length	19.3	18.4-21.6	20.0	1.01
Distance between pectoral and pelvic-fin origins	25.1	20.5-25.6	22.9	1.44
Distance between pelvic and anal-fin origins	21.0	18.5-22.2	20.1	1.10
Head length	27.8	26.5-30.3	28.6	1.31
Caudal peduncle depth	13.7	12.8-14.2	13.5	0.46
Caudal peduncle length	12.7	10.5-12.7	11.4	0.80
% of head length				
Snout length	25.4	21.9-26.5	24.0	1.29
Eye	32.2	30.9-42.3	37.1	3.03
Interorbital distance	32.8	31.3-34.8	33.1	1.09
Postorbital length	40.1	40.1-46.9	43.4	1.90
Maxillary length	27.1	25.0-29.9	27.6	1.55

Eye scarcely larger than interorbital. Third infraorbital not contacting laterosensory canal of preopercle.

Dorsal fin with iii,9 rays; first dorsal-fin ray very small, easily visible in some specimens. Distal margin of dorsal fin slightly straight. Anal fin with iii-v, 17 (1* ex.), 18 (4 ex.), 19 (4 ex.), 20 (6 ex.) rays. Males with anal-fin distal margin straight and females with anteriormost rays somewhat lengthened to form a small lobe. Caudal fin with i,17,i principal rays, upper lobe scarcely shorter and narrower than lower lobe. Pectoral-fin with i,11-14 rays; 11 (1 ex.), 12 (8 ex.), 13 (5* ex.), 14 (1 ex.); margin rounded. Pelvic-fin with i,7 rays and margin slightly rounded.

Hooks on anal and pelvic fins of males; one pair on each segment, on posterior branch of ray. Hooks extended on first to eighth branched anal-fin rays, curved anteriorly. Pelvic fin with large hooks on second to seventh branched rays.

Scales cycloid. Lateral series with 35 (7* ex.), 36 (4 ex.), 37 (4 ex.) perforated scales. Scales between dorsal-fin origin and lateral line 6-7, 6 (14* ex.), 7 (1 ex.); scales between lateral line and pelvic-fin origin 5-6, 5 (10 ex.), 6 (5* ex.). Scales around caudal peduncle 16-17. Nine to 13 scales forming an irregular row between tip of supraoccipital spine and dorsal-fin origin. Nine to 12 scales situated along anal-fin base, covering base of all unbranched and first 8 to 12 branched anal-fin rays. Few scales on caudal-fin base.

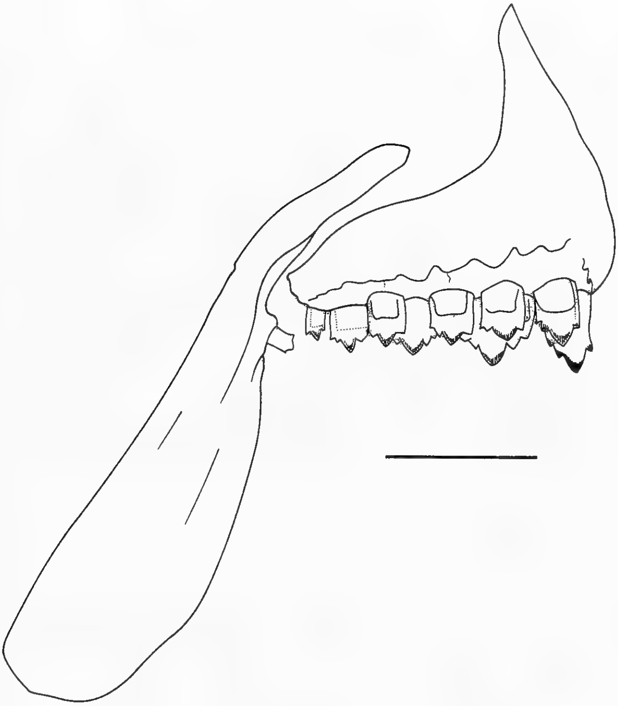


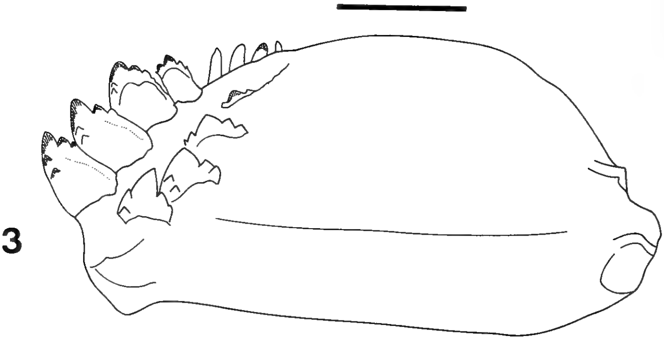
FIG. 2

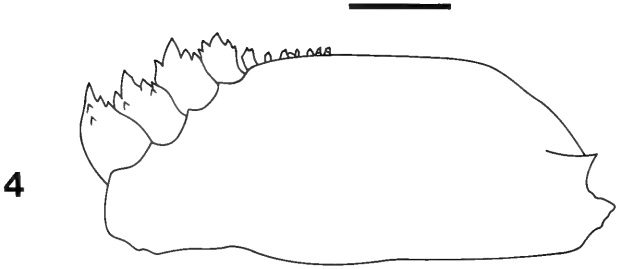
Astyanax pampa sp. n., 46.0 mm SL, right upper jaw in lateral view. Scale bar = 1 mm.

In 4 cleared and stained specimens, first branchial arch with 19 to 21 gill rakers (2 on hypobranchial, 11-12 on ceratobranchial, 1 on cartilage, and 7-8 on epibranchial). Caudal fin with 9-10 dorsal and 8-10 ventral procurrent rays. Thirty three to 35 vertebrae. Ten to eleven dorsal-fin pterygiophores between neural spines of vertebrae 9-10 and 18-19; 19 to 20 anal-fin pterygiophores between hemal spines of vertebrae 18-19 and 27-28. Eleven or twelve pairs of ribs. Five or six supraneurals.

Color in alcohol: Background light yellowish, dorsal region of body and head sligthly darker. Lateral band extended from posterior margin of opercle to caudal peduncle, forming a caudal spot; this band continuing onto middle caudal-fin rays. One vertical triangular humeral spot with its vertex directed ventrally, located posterior to vertical through pectoral-fin insertion. A second humeral spot very faint, posterior to vertical through middle pectoral fin. Dark chromatophores concentrated on scale margins of uppermost portion of body. Small faint chromatophores present on premaxilla and around nares. Mouth surrounded by chromatophores. All fins hyalines. Anal and caudal fins with dark chromatophores concentrated on distal margins (Fig. 2).

Etymology. The specific epithet *pampa*, a noun in apposition, is a Quichua word that named one of the groups of aborigines that lived in the plain regions of Buenos Aires province.





FIGS 3-4
Right lower jaw in medial view. 3, *Astyanax pampa* sp. n., 46.0 mm SL; 4, *Astyanax eigenmanniorum*, 47.8 mm SL. Scale bar = 1 mm.

Distribution. *Astyanax pampa* sp. n. is known from arroyo Las Mostazas and the lower río Colorado basin, both environments running through the south of Buenos Aires province into the Atlantic Ocean.

Habitat. The arroyo Las Mostazas is a short stream with variable depth ranging from 0.60 to 1 m. The water was turbid because of rainfall, with slow current and muddy bottom (Fig. 5). The lower río Colorado basin presently has a net of irrigation cannals, 0.30 to 1 m deep with the caudal varying between 0.20 to 3 m^3 /seg^{-1}; the current velocity can reach 1.5 km/h^{-1} (Almirón *et al*., 1997).

DISCUSSION

Astyanax pampa sp. n. comes from arroyo Las Mostazas and the lower río Colorado basin. Both environments are at the southernmost border of the zoogeographic Brazilian subregion in the cis-Andean basins and they are probably isolated from the remaining Brazilian drainages at least since middle Miocene (Casciotta *et al*., 1999). *Astyanax pampa* (cited as *A. eigenmanniorum* by Almirón *et al*., 1997; Casciotta *et al*., 1999) is the only species of the genus inhabiting the streams and rivers of southern Buenos Aires province. The species *A. abramis, A. asuncionensis, A. eigenmanniorum, A. fasciatus*, and *A. stenohalinus* do not surpass the Río de la Plata

FIG. 5
Habitat of *Astyanax pampa* sp. n., at arroyo Las Mostazas, type locality.

basin, about 37° S. There is only one and old record of *Astyanax fasciatus* (in Eigenmann, 1921 following Günther, 1880) that surpasses the geographical limit of the species mentioned above because it reaches the río Negro basin (about 41° S) but it has never been found again in that river.

Astyanax pampa sp. n., *Cheirodon interruptus* (Jenyns, 1842), *Bryconamericus iheringii* (Boulenger, 1887), *Oligosarcus jenynsii* (Günther, 1864), and *Gymnocharacinus bergii* Steindachner, 1903, are the species of characiforms with the southernmost distribution in South America.

Astyanax pampa sp. n. is similar to *A. eigenmanniorum* in shape, color pattern, and number of perforated scales of lateral line system. *Astyanax pampa* sp. n. and *A. eigenmanniorum* differ in having lower number of branched anal-fin rays (17-20 vs. 22-24), shorter anal-fin base (24.2-30.3 vs. 30.3-32.6 % SL), longer caudal peduncle (10.5-12.7 vs. 8.5-9.4 % SL). Furthermore, *A. pampa* sp. n. is distinguished from *A. eigenmanniorum* by the lower number of smaller dentary teeth (2-5 vs. 6-8), the distal tip of maxilla not reaching vs. surpassing the anterior margin of the eye, and depth of dentary higher vs. lower (see both dentaries in Figs 3, 4).

Astyanax pampa sp. n. has similar number of branched anal-fin rays that *A. brachypterygium* Bertaco & Malabarba, 2001, *A. cremnobates* Bertaco & Malabarba, 2001, *A. intermedius* Eigenmann 1908, *A. ita* Almirón *et al.,* 2002, *A. laticeps* (Cope,1894), *A. leonidas* Azpelicueta *et al.,* 2002, *A. paranae* Eigenmann, 1914, *A. scabripinnis* (Jenyns, 1842), and *A. obscurus* (Hensel, 1870). *Astyanax pampa* sp. n. is distinguished from *A. brachypterygium* and *A. cremnobates* by the longer anal-fin base (24.2-30.3 vs. *A. brachypterygium* 17.0-23.3 and *A. cremnobates* 18.4-24.1% of SL). *Astyanax pampa* sp. n. has 17-20 branched anal-fin rays whereas *A. intermedius* has 21-26 rays. *Astyanax pampa* sp. n. bears one unicuspidate to tricuspidate maxillary tooth and *A. ita* has one heptacuspidate maxillary tooth; in addition, *A. laticeps* has three or four maxillary teeth.

The caudal-fin hooks of males in *A. leonidas* differentiate it from *A. pampa* sp. n. The body depth of *A. paranae* (less than 33% of HL) separates *A. pampa* sp. n. with deeper body (36.9-42.2% of SL). The width of the interorbital (38.5% of HL) and the predorsal length (46.2% of SL) of the holotype of *A. scabripinnis* (following Melo, 2001) distinguish that species from *A. pampa* sp. n. (31.3-34.8% of HL and 49.5-55.0% of SL respectively). The numerous dark dots present on body, opercle, and all fins and the body depth (33.3% SL) of *A. obscurus* differenciatte it from *A. pampa* sp.n. (36.9-42.2% SL).

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Morphology and systematic status of *Coluber karelini mintonorum* Mertens, 1969 (Reptilia: Squamata: Colubrinae)

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Morphology and systematic status of *Coluber karelini mintonorum* Mertens, 1969 (Reptilia: Squamata: Colubrinae). - Mintons' racer is a valid species of the racer genus *Platyceps* Blyth. It is, so far, only reported from southern Afghanistan and Baluchistan (Iran, Pakistan). Morphologically, *P. mintonorum* (Mertens) differs from all potentially sympatric *Platyceps* spp. Baluchi records of *P.* cf. *rhodorachis* (Jan) are in need of further studies.

Keywords: *Platyceps mintonorum* - species status - morphology - Afghanistan - Baluchistan - *Platyceps* spp. - sympatry.

INTRODUCTION

From the systematic point of view, species of the genus *Platyceps* Blyth, 1860 (see Schätti & Utiger, 2001) are among the most difficult and intriguing taxa within Old World racers. This is particularly true for *P. rhodorachis* (Jan, 1863) and the type species, *P. ventromaculatus* (Gray, 1834), reported from northern India to the Near East (e.g., Smith, 1943; Minton, 1966). They are commonly considered to be closely related to *P. karelini* (Brandt, 1838) from the eastern Caspian region to Pakistan (e.g., Terentjev & Chernov, 1949; Khan, 1997).

The taxonomic history of Sindo-Arabian *Platyceps* spp. is tricky, resulting in considerable confusion about species concepts as well as mixed-up morphological and distribution data. Leviton (1959), for instance, noted that the ranges of *P. karelini*, *P. rhodorachis*, and *P. ventromaculatus* "from southwestern Asia [...] overlap most extensively", and "they exhibit the same ranges of morphological variation, the same color pattern variations, and are found in similar environmental situations", concluding that "their recognition is based upon characters of rather nebulous taxonomic value, and their present partition is not entirely satisfactory."

Minton (1966) could not identify various racers from Chagai District in Baluchistan, Pakistan, "with Afghan specimens reported by Leviton and Anderson (1961) or with Iranian specimens of *rhodorachis* reported by Steven C. Anderson (1963)." He considered that these Baluchi snakes "may represent an undescribed form, perhaps related to *rhodorachis*" (Minton, 1966: 172). A few years later, *Coluber karelini mintonorum* Mertens, 1969, described on the basis of 17 specimens from Chagai

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and Kharan District in southwest Pakistan, was named after Sherman A. Minton, Jr., and his wife Madge.

Referring to the status of the "Variegated Sand Racer", Minton (1966) noted that "its relationships to other racers of the Middle East and North Africa will not be clear until monographic treatment of the group is undertaken." Although Khan (1997) started "a new approach" on "the *Coluber karelini-rhodorachis-ventromaculatus* species complex", and despite the description of new obscure taxa (Khan & Khan, 2000), the remarks of Leviton (1959) and Minton (1966) regarding the systematics of Saharo-Sindian *Platyceps* spp. hold, with some reservation, to the present day. *P. rhodorachis* auct., reported from the Himalayas to the western Sahara, is a species complex, and Middle East populations of *P. ventromaculatus* auct. may be conspecific with *P. rogersi* (Anderson, 1893) (Schätti & McCarthy, 2004; Schätti, 2005).

This is the first in a series of papers dedicated to Sindian taxa of the *Platyceps rhodorachis-ventromaculatus* group of species. The objective of this investigation is to analyse the intraspecific variation and distribution of Mintons' racer, assess the systematic status of this taxon, and elaborate its morphological distinction from presumably closely related species.

MATERIAL AND METHODS

The study is based on 33 specimens including 14 of the 16 paratypes and Minton's (1966) "Variegated Sand" racers except SAM 695 and UMMZ 123436. An additional individual, CAS 120543 from "10 km N Darweshan" (Afghanistan), is in very poor condition, and no data were ascertained. The material was borrowed from the American Museum of Natural History, New York (AMNH), California Academy of Sciences, San Francisco (CAS), Field Museum of Natural History, Chicago (FMNH), Muséum d'histoire naturelle, Genève (MHNG), and the Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main (SMF). Further acronyms used in the text are BMNH (The Natural History Museum, London, formerly British Museum of Natural History), NMW (Naturhistorisches Museum, Wien), SAM (collection of Sherman A. Minton), and UMMZ (University of Michigan, Museum of Zoology, Ann Arbor).

Morphological terms and cephalic measurements are explained in Schätti (1988) and Schätti & McCarthy (2004). Numbers in parenthesis indicate intraspecific variation. Cephalic measurements were ascertained with a calliper. The head length is in a straight line from the anterior tip of the rostral to the posterior end of the median suture of the parietals. The head width equals the distance between the lateral edge of the supraoculars at the middle of the eye. The frontal length is along the midline from the anterior tip to the posterior border, and its width equals the maximum distance between the lateral projections. The internasal, prefrontal, and parietal length were measured along their respective median suture. The distance from the nostril to the eye is the shortest span from the posterior border of the external nose opening to the orbit.

Scale formulae give the number of longitudinal dorsal scale rows (dsr) at the 20th ventral, midbody, and five ventrals in front of the vent. The reduction pattern is expressed in terms of ventrals and as a percentage of their total number (%ven), based on the average of the right and left side. Maxillary teeth were examined on the right bone. The length of the hemipenis *in situ* and the insertion of the *Musculus retractor penis magnus* are expressed in absolute numbers of subcaudals and as a percentage thereof (%sub).

Scientific names of the taxa discussed in this paper are usually given in full only at their first appearance in the text. Coordinates are from Mertens (1969) and, in the case of Afghanistan, the GEONET database (http://earth-info.nima.mil).

RESULTS

Platyceps mintonorum (Mertens, 1969) comb. n. – Mintons' racer

Coluber karelini Brandt, 1838 [partim]. - Leviton, 1959: 454, Tb. IV ("Chah-i-Angir", CAS 84630-33); Leviton & Anderson, 1961: 275 (same material [Chah-i-Anjir]) [1].

Coluber sp. - Minton, 1966: 122 [172], Pl. 24.2 [Nushki] (vicinity of Nushki, "2 miles northwest of Ahmad Wal", and "Chagai" [Nushki]: AMNH 87460, 88464, 96222, FMNH 140277-78, SAM 695, and UMMZ 123436 [last two not examined]).

Coluber karelini mintonorum Mertens, 1969: [3, 10] 56, Fig. 17 [holotype], Tb. [unnumbered]. - "Zangi-Nawar" [29°26'N 65°47'E], Chagai District, Baluchistan, Pakistan [SMF 62942, ♂, not examined] (paratypes from Dalbandin, Kharan, Nok Kundi, Nushki, "between Nushki and Dalbandin", and Surdehgari [not located]: SMF 62923, 62931-37, 62939, 62943 [not examined], 62944-48, 62949 [not examined]).

Coluber karelini [partim]. - Gasperetti, 1988: 219, Fig. 29 [dorsal and lateral view of head, dorsal section of body scales: "Chah-i-Angir", Nushki: CAS 84632, 101593] (see Discussion); Clark, 1990: 33 [35], Tb. [unnumbered] (vicinity of Darweshan, "40 Km. SE Kandahar": CAS 120541, 120715-17).

Coluber sp. - Latifi, 1991: [67] 104 [footnote 3] (see Discussion).

Coluber ventromaculatus Gray, 1834 [partim]. - Disi, 1993: 111 ("Pakistan, Belouchistan": "MHNG 1359.12" [MHNG 2443.12]).

Coluber karelini [partim]. - Khan, 1997: 56 (see Discussion).

Coluber rhodorachis (Jan, 1863) [partim]. - Khan, 1997: 56 (see Discussion).

Coluber karelini mintonorum. - Latifi, 2000: 263 ("Sistan and Baluchistan").

Material examined (an asterisk denotes specimens used for the calculation of head indices; see also Material and Methods). AFGHANISTAN: CAS 84630-33 ("Chah-i-Angir" [Chah-i-Anjir], 31°41'N 64°20'E, ♂, 3 ♀♀), 120541 (10 km N Darweshan, ca. 31°00'N 64°10'E, ♀), 120715 ("10-20 km NE Darweshan", ♀), 120716-17 ("40 km SE Kandahar" [31°36'N 65°42'E], ♂♀). PAKISTAN (Baluchistan: Chagai and Kharan districts): *AMNH 87460 ("near Nushki", ca. 29°33'N 66°01'E, ♀), *88464 (2 km NW Ahmadwal, ca. 29°25'N 65°56'E, ♂), 96222 ("2 miles east of Nushki", ♀); *CAS 101498, *101592-93 (Nushki, ♂♂, ♀); *FMNH 140277-78 (Nushki, ♀♀); *MHNG 2443.11-12 and *2629.98 ("Baluchistan", ♂, ♀♀); *SMF 62923 (Dalbandin, 28°53'N 64°26'E, ♀ paratype), *62931-32 ("6 Meilen nördlich Nushki", ♀♀ paratypes), 62933 (Kharan, 28°34'N 65°25'E, ♀ paratype), 62934 (Nushki, ♀ paratype), 62935 ("between Nushki and Dalbandin", ♂ paratype), 62936-37 (Nushki, ♂♀ paratypes), *62939 (Nok Kundi, 28°47'N 62°44'E, ♂ paratype), *62944-48 (Dalbandin, 2 ♂♂, 3 ♀♀ paratypes).

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[1] Leviton & Anderson (1961) discussed seven specimens from Chah-i-Anjir (Dasht-i-Margo Desert) reported earlier as *Coluber karelini* (Leviton, 1959). This material was re-examined by Sergjus A. Chernov (St. Petersburg) who referred CAS 84634-36 (see Appendix) to *Platyceps rhodorachis ladacensis* (Anderson, 1871) and CAS 84630-33 to *P. karelini* (as *Coluber* auct.). However, scale data, the description of the dorsal colour pattern, and accession numbers were mixed up in Leviton & Anderson (1961) as already noted by Mertens (1969: 56).

MORPHOLOGY

Snout in dorsal view comparatively pointed, rostral usually projecting "and strongly concave on under side" (Minton, 1966; "auf der Unterseite stark ausgehöhlt", Mertens, 1969), 1.25-1.56 times broader than high [2]. Internasals shorter than prefrontals, nearly equal length in FMNH 140278, SMF 62923, 62944, and the holotype (fide Mertens, 1969). SMF 62949 (not examined) with two pairs of internasals ("in zwei hinteinanderstehenden Paaren ausgebildet [...], wodurch das Rostrale hinten einen spitzen Fortsatz aufweist", Mertens, 1969; see footnote 2). Frontal 1.23-1.39 times longer than broad, 1.23-1.70 times longer than internasals and prefrontals, 0.87-1.07 times as long as parietals. Posterior border of the latter somewhat indented towards the median suture. Head 1.90-2.25 times longer than broad.

Nostril-eye distance 0.79-0.96 times length of internasals and prefrontals. Loreal rectangular or pentagonal, usually as long as high and situated on second and third supralabial (third in SMF 62931, 62948); coalesced with nasal in SMF 62933. Preocular single, paired or, sometimes, with an incomplete but distinct suture (e.g., in CAS 120541, on right side of CAS 101498, and left in SMF 62945) [3]; in contact with frontal except on left side of SMF 62944. Anterior subocular sometimes quite large (e.g., CAS 84631), slightly larger than posterior subocular in AMNH 87460; 2 anterior suboculars in SMF 62933 (first larger), 62942 (left, holotype), and 62949 (fide Mertens, 1969).

Normally 9 supralabials (last 3 larger), 8 on right side of holotype (Mertens, 1969), 10 in AMNH 87460 (left side); fifth, fifth and sixth, sixth, or none in contact with eye. Posterior subocular usually present and slightly larger than anterior (see above); absent in CAS 84630, FMNH 140277, SMF 62933 as well as on one side in CAS 120715-16, MHNG 2443.11, 2629.98, SMF 62937, and 62939; 2 posterior suboculars on one side in SMF 62935, 62939, and 62948, anterior small. Two postoculars (see footnote 3) and anterior temporals; 2 or 3 (4) scales in second row; anterior temporals comparatively large in SMF 62937, small in CAS 84632, and lower scale generally larger (upper particularly small in SMF 62933).

Usually 10 (9-11) sublabials, the 4 anterior in contact with first inframaxillary, sixth (fifth) largest. Anterior chin shields shorter and usually broader than posterior pair; the latter anteriorly separated by 2 rows of scales and usually 4 to 5 (3) posteriorly. Gulars in 4 (3-5) oblique rows between the posterior inframaxillaries and the first ventral.

Ventrals 221-240 (♂♂ 225-231, ♀♀ 221-240); anal scute divided; 110-127 (♂♂ 110-122, ♀♀ 113-127) paired subcaudals; sum of ventrals and subcaudals 336-360 (336-350 and 337-360, respectively). Up to 242 ventrals and 128 subcaudals according to Clark (1990) and Latifi (1991), respectively [4].

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[2] Mertens (1969: 58) noted that the shape of the rostral is a variable feature ["Andererseits gibt es unter *mintonorum*, vor allem unter den älteren weiblichen Tieren, vereinzelt Individuen, bei denen die Schnauze vorne erheblich abgerundet ist (z. B. bei dem großen ♀ SMF 62949 mit der anomalen Rostralbeschilderung)"].

[3] Minton (1966) and Mertens (1969) included the anterior and posterior subocular(s) in their number of preoculars and postoculars, respectively.

[4] Ventral data in Minton (1966), Mertens (1969), and Clark (1990) include preventrals.

Dorsals with paired apical pits, in 19-19-13 rows except SMF 62944 which has 21 longitudinal dsr from ventrals 47 (right) and 49 (left) to 105 and 101, respectively (increase and decrease involving row 9); this female reduces the number of dsr at ventral 142 (rows 8+9, 61%ven), 147 (3+4, 63%ven), and 187 (6+7, 81%ven). In males, the first and second reduction occur between ventrals 126 and 136 (55-60%ven) and 130-137 (57-60%ven), respectively; the third (last) reduction is situated at the level of ventrals 149-169 (67-74%ven). In females (except SMF 62944), the values are 121-139 (55-59%ven), 127-145 (56-61%ven), and 144-171 (64-72%ven), respectively. The sequence of the first and second reduction is variable but, in most cases, the anterior is paravertebral (rows 7+8 in males except CAS 101593 [8+9, left}, 7-9 in females); rows 3+4 (2+3 on left side in CAS 84632, 4+5 on left in CAS 101593) are involved in the lateral reduction. The third is paravertebral, or vertebral (i.e., rows 7+8) in four females (CAS 84632, 120717, MHNG 2629.98, SMF 62931). Without specification, Minton (1966) indicated an increase to 21 dsr on the anterior trunk in two specimens and a reduction to 11 dsr in front of the vent in one.

Longest specimens 1110 + 360 mm (♂, SMF 62942, holotype) and 1170 mm snout-vent length (incomplete tail 287 mm, ♀, SMF 62949) according to Mertens (1969: Tb.). Smallest individual (AMNH 96222) 295 + 102 mm. Tail/body length ratio in holotype (♂) 0.32, 0.33-0.36 for remaining ♂♂, and 0.32-0.37 in ♀♀. To conclude from these data, the snout-vent length of 1190 mm for the holotype as stated in the original diagnosis (Mertens, 1969) is most probably not correct.

Dorsal ground colour light tan to pale grey, "top of head often dull reddish, with shields narrowly edged with cream" (Minton, 1966). A dark, light-edged spot between the frontal and parietal and along the parietal suture in the holotype. Circumocular scales light (yellowish) except for a dark blotch below the eye. Temporals yellowish, with irregular darker marks. Dorsal scales dark-edged, forming cross-bars or two series of juxtaposed and slightly transverse paravertebral bars. Dark flecks may also occur along the lower flank. SMF 62943 (not examined) with a more distinct pattern on the anterior portion of the trunk (Mertens, 1969). Venter and underside of tail "immaculate pearly gray to white" (Minton, 1966) or yellowish (e.g., CAS 101592-93).

Maxillary with 14-16 teeth, anterior series subisodont, diastema distinct, posterior two teeth enlarged, last offset laterad. Palatine teeth 9. Hemipenis subcylindrical, *sulcus spermaticus* simple; spinose throughout, apical area calyculate, apex (*in situ*) at subcaudals 8-11 (7-10%sub); insertion of *Musculus retractor penis magnus* at subcaudals 26-28 (21-25%sub).

DISTRIBUTION AND ECOLOGY

Given the published records and collecting sites of the examined specimens, Mintons' racer seems to be restricted to southern Afghanistan, southeastern Iran (Sistan-va-Baluchistan), and Baluchistan province (Chagai and Kharan districts) in Pakistan (Fig. 1). "Surdehgari", the collecting site of a paratype (SMF 62943), could not be located.

The specimens reported by Minton (1966) "have all been collected in the desert basin near Nushki." Mertens (1969) recorded the type series of *Coluber karelini mintonorum* from the sandy districts of Chagai and Kharan. Material from southeastern

PLATE 1 - *Platyceps mintonorum* MHNG 2443.12 (♂) from Baluchistan Province, Pakistan.

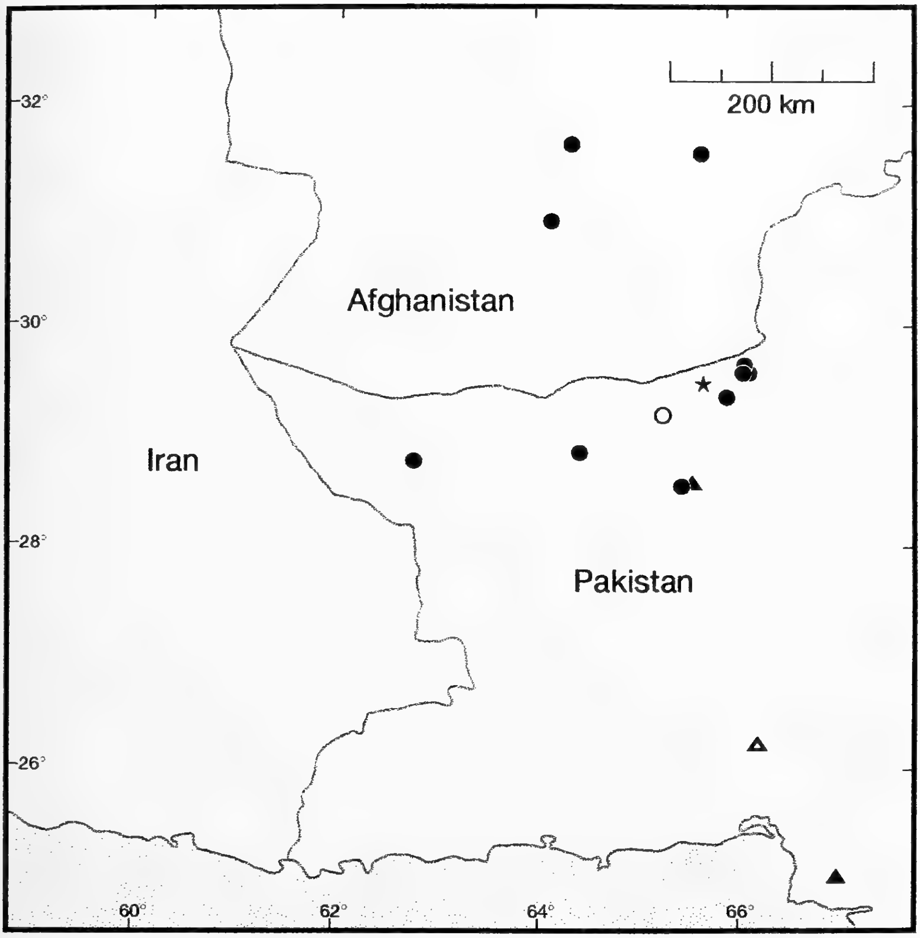

FIG. 1. Known distribution of *Platyceps mintonorum*. The localities (●) are based on the examined material and Zangi Nawar, the type locality (★). Triangles (▲) mark three collecting sites of *P.* cf. *rhodorachis* (see Discussion) from the "Gandrani Caves" (SAM 679), Band Murad Khan (SMF 62928), and Kharan (SMF 62938). Open symbols denote two approximate locations ("between Nushki and Dalbandin" and "Gandrani Caves").

Iran "in the collection of the State Razi Institute near Teheran" (Minton, 1966) is from "Sistan and Baluchistan province (Zabol, Zahedan)" (Latifi, 1991).

Minton's (1966) Nushki series was obtained "in relatively flat sandy country with sparse vegetation. All were in the open, three being taken between sunrise and midmorning and two between sunset and darkness. They are very quick, alert snakes and savage biters. One captive fed on sand lizards (*Acanthodactylus*)." According to Clark (1990), Mintons' racer is "Very common at the Darweshan and Kandahar sites" where it was "found both in non-sandy and sandy biotopes, both firm and loose sands" between 800 and 1'060 m.

One specimen from the vicinity of Kandahar [Qandahar] "was found lying in the open so bloated with a large gecko (*Teratoscincus*) that it had just consumed that it was incapable of movement" (Clark, 1990: 28, 33). Latifi (1991) reported this species to feed on "mice in captivity."

DISCUSSION

Based on head shape, viz., a pointed ("zugespitzt") snout, and the presence of a posterior subocular or, sometimes, a complete row of scales separating the eye from the supralabials, Mertens (1969) considered Mintons' racer a subspecies of *Platyceps karelini* (Brandt). This opinion was reached in spite of considerable ("erhebliche") differences in ventral and subcaudal scale counts as well as a marked fading of the head and dorsal colour pattern vis-à-vis Karelin's racer.

Morphologically, *Platyceps mintonorum* and *P. karelini* are easily separable. Apart from differences in body length (less than 750 mm snout-vent length in the latter), dorsal colour pattern (transverse black blotches in *karelini*), and hemipenis features (length, insertion of retractor muscle; in prep.), these species differ quantitatively in a number of head measurements and scale characters including the dorsal scale reduction pattern of males, and they are most distinct in ventral and subcaudal counts and the sum thereof (Tbs 1-2).

TABLE 1. Head measurements and cephalic scales in *Platyceps mintonorum* and *P. karelini*. Rostral length/height, frontal length/width, length of frontal/internasals and prefrontals, condition of preocular (1: single, 2: paired), number of supralabials in contact with eye, and posterior subocular (0: absent, 1: present). Unusual condition in parenthesis; rare states in brackets. Data for *P. karelini* are based on 19 specimens from Afghanistan, Iran, and Pakistan (see Appendix).

character / taxon	rostral length	frontal length	frontal / inter-nas. + prefr.	preocular	supralabial cont. eye	posterior subocular
P. mintonorum	1.25-1.56	1.23-1.39	1.23-1.70	1 or 2	0-2	1 (0)
P. karelini	1.50-1.76	1.36-1.53	1.18-1.45	1 [2]	1 [0]	1

TABLE 2. Body scale characters in *Platyceps mintonorum* and *P. karelini* (see Tb. 1 and Discussion). Ventrals, subcaudals, and sum of ventrals and subcaudals in ♂♂ and ♀♀, as well as position of second reduction (from 17 to 15 dsr) in ♂♂, expressed in terms of ventrals and as a percentage of their total number (%ven). See Morphology for ventral and subcaudal data of *P. mintonorum* reported by Clark (1990) and Latifi (1990).

character /	ventrals		subcaudals		sum		second
taxon	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	reduction (♂♂)
P. mintonorum	225-231	221-240	110-122	113-127	336-350	337-360	130-137 (57-60)
P. karelini	193-207	202-212	90-105	86-106	290-311	292-314	119-130 (60-64)

Higher body scale counts for *Platyceps karelini* than reported here are given, for instance, for a female from the Kavir Desert in Iran with 216 ventrals (Nilson & Andrén, 1981) and an unsexed specimen from Mastung, Pakistan, with 110 subcaudals (Khan & Ahmed, 1987). Without further evidence ("nach Literatur-Angaben"), Mertens (1969) noted up to 220 ventrals and 117 subcaudals for *P. karelini*. These data exceed by far authentic values ard, therefore, seem highly unlikely. Khan's (1997) total counts (282-317) for this species were probably added up from the extremes of ventrals (192-207) and subcaudals (90-110).

Ultimately, alleged parapatric ranges led Mertens (1969) to refer the new taxon to *Platyceps karelini* ("Die neue Form ist [...] nichts anderes als ein Vikariant von *karelini*, der mit dieser Natter kaum [sic] sympatrisch auftritt") 5). However, sympatry of Mintons' racer and *P. karelini* is documented, for instance, near Darzi Chah, roughly 65 km west of Nushki (SMF 64629, Mertens, 1969), probably in Afghanistan (see Appendix). There, these taxa occur together, among other places, at Chah-i-Anjir (CAS 84634-35, see footnote 1, Appendix, and below).

Mertens (1969) thought that at least some of the specimens reported by Boulenger (1889) as "*Zamenis karelini*" from the border region in Afghanistan ("aus dem afghanischen Grenzgebiet") probably belonged to Mintons' racer. However, three specimens from the "Helmund River" and "between Tirphul and Kilki" (Herat province) collected by the Afghan Boundary Commission and deposited in the BMNH collection with 200-209 ventrals and 86-106 subcaudals (Boulenger, 1893: 402) are not *Platyceps mintonorum* (unpubl. data).

Minton (1966) correctly stated that "Although I originally identified these Nushki snakes as *karelini* on the basis of circumocular lepidosis, the two are quite different in pattern and in ventral and subcaudal counts." That author emphasised that "the regular presence of a third preocular, high ventral count, and body pattern" as well as a "more pointed" snout distinguish the "Variegated Sand Racer" (*Platyceps mintonorum*) from *P. karelini* (Brandt), *P. rhodorachis* (Jan), and *P. ventromaculatus* (Gray) (see footnotes 2-3 and 5). Minton (1966) concluded that the "nearest relative appears to be *rhodorachis*." Latifi (1991), most likely following this quotation, considered Mintons' racer to be "a valid taxon but probably not a subspecies of *karelini*. It may be closer to *rhodorachis*."

Khan (1997) believed that two *Platyceps mintonorum* figured in Gasperetti (1988: Fig. 29), i.e., CAS 84632 from Chah-i-Anjir (Afghanistan, see footnote 1) and CAS 101593 from Nushki, were *P. karelini*, and that "specimens from this region have neither dorsal pattern nor orbito-labial and temporal stripes as vivid as observed in *C.*[*oluber*] *karelini* from Quetta-Peshin, Baluchistan." According to Khan (1997), Mintons' racer was "erected [...] on similar *C. rhodorachis* from the Baluchistan highland." This erroneous conclusion resulted from enormous confusion as to the systematics of certain Sindian *Platyceps* spp.

Minton (1966) and Mertens (1969) stated that, apart from head shape and the presence or absence of the posterior subocular, *Platyceps mintonorum* and *P. rhodorachis* auct. differ in their habitus (*rhodorachis* is more slender). However, the specific allocation of some female Baluchi racers referred to *P. rhodorachis* and their

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5) From a comparison with *Platyceps rhodorachis* and *P. ventromaculatus* (as *Coluber* spp.) "ziehe ich den Schluß, daß *mintonorum*, ein Vikariant von *karelini*, am besten als Subspecies von dieser Natter aufzufassen ist. Die kleine Lücke zwischen der Plusvariante bei *karelini* (220) und der Minusvariante bei *mintonorum* (227) wird zweifellos durch weitere Funde überbrückt werden. Bei der Zahl der Subcaudalia ist das bereits der Fall [...]. Auf den Zeichnungsunterschied ist kein großer Wert zu legen" (Mertens, 1969: 59). "In der äußeren Erscheinungsform herrscht zwischen der neuen Form und *karelini*, abgesehen von der Zeichnung, eine recht große Übereinstimmung. Der spitze Kopf ist bis zu einem gewissen Grade auch *karelini* eigen [...]. Er ist stärker zugespitzt und vor allem die Schnauze stärker vorspringend als bei *rhodorachis, ventrimaculatus* [sic] oder [*Hemorrhois*] *ravergieri*, aber keinesfalls stärker als bei den meisten *karelini*" (Mertens, 1969: 58).

distinction from *P. mintonorum* require some comments [6]. This is the case with SAM 679 from the "Kud River [approx. 26°17'N 66°13'E] near the Las Bela-Kalat border" ("Gandrani Caves"), SMF 62938 from Kharan, and SMF 62928 (subadult) from Band Murad Khan (25°06'N 67°00'E) on the Hab River (Fig. 1).

SAM 679 (not examined) shows "a pattern more suggestive of this form [i.e., *Platyceps mintonorum*] than of coastal *rhodorachis*, and circumocular scales as in *rhodorachis*" (Minton, 1966: 123). The latter feature, i.e., the lack of a posterior subocular, does not allow a positive identification of that species and a distinction from *P. mintonorum* (see Morphology). SMF 62928 (237 ventrals, 124 subcaudals) and 62938 (236 and 115, respectively; see footnote 4) possess, as SAM 679, a single anterior subocular and two supralabials (fifth and sixth) entering the eye (i.e., no posterior subocular).

The dorsal colour pattern of SMF 62938 is surprisingly similar ("Erstaunlich ähnlich") to a female *Platyceps mintonorum* (SMF 62933) obtained at the same locality (Kharan) but the specimen lacks a posterior subocular and the rostral is not projecting ("zeichnet sich [...] außer durch die bezeichnende Subocular-Pholidose durch ein kleines, nicht vorspringendes Rostrale aus", Mertens, 1969: 59). However, that author emphasised that, occasionally, the snout of Mintons' racer is considerably rounded, particularly in large females (see footnote 2). SMF 62938 has the loreal and nasal fused on the left side.

SMF 62928 is remarkable for somewhat elevated head indices vis-à-vis *Platyceps mintonorum* (i.e., frontal 1.73 times longer than internasals and prefrontals, head length/width 2.34, nostril-eye distance 1.0), the shape of the posterior border of the parietals (straight instead of indented), a tail/body ratio of 0.38 (snout-vent and tail length 365 + 140 mm, respectively), and dsr reduction pattern, viz., the second fusion involving the fourth and fifth (instead of third and fourth) rows.

For the time being, it cannot be ruled out that SMF 62928 and/or 62938 belong to *Platyceps mintonorum*, or that this species intergrades with *P. rhodorachis* auct. By all means, their systematic status requires further studies.

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[6] Khan & Khan's (2000) description of three new racer taxa from Pakistan begs a thorough response (in prep.). In any case, *Coluber ventromaculatus bengalensis* Khan & Khan, 2000 and *C. ventromaculatus khanorum* Barabanov, 2002 (*nomen novum*) are objective junior synonyms of *C. ventromaculatus* Gray, 1834. The description of *C. ventromaculatus indusai* Khan & Khan, 2000 violates rules of the code (e.g., Art. 16.4, ICZN, 1999; Hallermann *et al.*, 2001).

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APPENDIX. Comparative sample of *Platyceps karelini*. AFGHANISTAN: BMNH 73.1.7.10 ("Kila-i-Fath, Seistan", juv.), 82.3.20.2 (Kandahar, ♂), 86.9.21.102 (Tirpul, ♀), 86.9.21.103 ("Kilki", ♀); CAS 84634-36 (Chah-i-Anjir, ♀, juv. ♂♂), 103785 (Herat – Islam Qala, ♀), 120540 (vicinity of Tashkurghan, ♂), 120714 (45 km E Herat, ♀); SMF 64629 (Darzi Chah, juv. ♂). IRAN: FMNH 141604 (Pahlavi Dezh, ♀); NMW 25446.3 ("Vor Neh", juv.), 25446.4 ("Zirkuch", ♀), 25446.5 ("Gulu Chakak", ♀), 25446.6 ("Tscha Sam", ♂). PAKISTAN: AMNH 96219 ("near Pishin", ♂); SMF 62924 (Khuzdar, ♂), 62940 (Quetta, ♀).

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Oribatids from Brunei IV (Acari: Oribatida). (*Acarologica Genavensia* CVI)

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Oribatids from Brunei IV (Acari: Oribatida) (*Acarologica Genavensia* CVI). - Fifteen oribatid species are recorded from Brunei; five are new to science and for four of them a new genus (*Nasobelba* gen. n.) is established in the family Suctobelbidae. The following new combinations are proposed: *Nasobelba inenodabilis* (Hammer, 1980) comb. n. (= *Suctobelbella inenodabilis* Hammer, 1980) and *Nasobelba transitoria* (Balogh & Mahunka, 1974) comb. n. (= *Suctobelba transitoria* Balogh & Mahunka, 1974). A list of the hitherto published oribatid species of Brunei is given in addition.

Keywords: Acari - Oribatida - taxonomy - new genus - new species - Brunei.

INTRODUCTION

The oribatid fauna of Brunei is exceptionally rich and therefore its study extremely rewarding. In this part of the island of Borneo some restricted parts of the mountain vegetation are still well preserved and also large patches of the lowland rain forests are intact.

For this reason Dr B. Hauser, then Head of the Arthropoda Department of the Muséum d'histoire naturelle, Geneva, undertook alone a second collecting trip in 1996 to Brunei (with stops in Singapore and Hong Kong) with a focus on soil fauna. I had the opportunity to study a small part of this material and again I found many interesting species.

So far, I have published three papers discussing the oribatids living in Brunei (Mahunka 1995, 1997, 2001). Besides giving new distributional data of some rare and hardly known species (e.g. *Gehypochthonius xarifae* Strenzke, 1963, *Epilohmannoides esulcatus* Ohkubo, 1979, *Notogalumna praetiosa* Sellnick, 1959), I there described 37 new species.

In my last paper it struck me that the suctobelbid fauna of this territory is exceptionally rich. Therefore, in my new investigations, I concentrated upon this family. Five species are again new for science and four also represent a new genus

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(*Nasobelba* gen. n.). The fifth species is a peculiar new species of *Parasuctobelba* Hammer, 1977. I describe the new taxa in this paper, completing them with some known species and add new distributional data. In describing the new species, I use morphological terms applied in earlier work (e.g., Mahunka & Mahunka-Papp, 2001).

A first list of the hitherto published 64 species of beetle mites from Brunei concludes this study.

LIST OF IDENTIFIED SPECIES

For localities see list at the end of this paper (p. 436).

Phthiracaridae Perty, 1841
Notophthiracarus hauseri Mahunka, 1995
Locality: SBH-96/12: 10 specimens.
Distribution: Brunei (hitherto known from the type locality only): second record for Brunei.
Temburongiidae Mahunka, 1990
Temburongia patoi Mahunka, 1990
Localities: SBH-96/11: 3 specimens; SBH-96/12: 4 specimens.
Distribution: Sarawak, Brunei.
Microtegeidae Balogh, 1961
Suctotegeus tumescitus Mahunka, 1987
Locality: SBH-96/12: 5 specimens.
Distribution: Sabah, Brunei: second record for Brunei.
Microzetidae Grandjean, 1936
Teraja sungai Mahunka, 1997
Locality: SBH-96/9: 2 specimens.
Distribution: Brunei.
Damaeolidae Grandjean, 1965
Fosseremus laciniatus (Berlese, 1905)
Locality: SBH-96/11: 2 specimens.
Distribution: Cosmopolitan (?); second record for Brunei.
Carabodidae C. L. Koch, 1837
Hardybodes penicillatus Mahunka, 1995
Locality: SBH-96/12: 3 specimens.
Distribution: Brunei.
Dampfiellidae Balogh, 1961
Dampfiella zellwegeri Mahunka, 1997
Locality: SBH-96/11: 3 specimens.
Distribution: Brunei (hitherto known from two localities only): second record for Brunei.
Rhynchoribatidae Balogh, 1961
Oxyamerus hauserorum Mahunka, 1987
Localities: SBH-96/11: 3 specimens; SBH-96/12: 2 specimens.
Distribution: Sabah, Brunei: first record for Brunei.
Suctoribates foliatus Mahunka, 1997
Localities: SBH-96/11: 2 specimens; SBH-96/12: 5 specimens; SBH-96/15a: 3 specimens.
Distribution: Brunei (hitherto known from two localities only): second record for Brunei.
Suctobelbidae Jacot, 1938
Condylobelba bruneiensis Mahunka, 2001
Locality: SBH-96/12: 3 specimens.
Distribution: Brunei (hitherto known from six localities): second record for Brunei.
Nasobelba agathis gen. n., sp. n.
Locality: SBH-96/12.
Nasobelba coronata gen. n., sp. n.
Localities: SBH-96/11, SBH-96/15a.

Nasobelba hauseri gen. n., sp. n.
Locality: SBH-96/11.
Nasobelba undosa gen. n., sp. n.
Localities: SBH-96/9, SBH-96/11.
Parasuctobelba quinquecostata sp. n.
Locality: SBH-96/15a.

DESCRIPTIONS OF NEW TAXA

Nasobelba gen. n.

Diagnosis: Family Suctobelbidae. Rostral apex nasiform, following a rostral elevation, with large rostral and smaller accessory teeth. Tectopedial field reduced, paratectopedial field absent. Lamellar knob present, prebothridial rib mostly absent, or reduced. Bothridial lobe present, interbothridial field often reduced. Sensillus with a conspicuously long peduncle. Two pairs of notogastral condyles fusing toone pair of large apophyses in the sejugal region. Polygonal pattern on notogaster and ventral plate. Sternal apodemes more or less reduced, epimeral fields not touching medially. Epimeral setal formula: 3 – 1 – 3 – 3. Anogenital setal formula: 6 – 1 – 2 – 3. Setae ad_1 in paraanal position.

Type species: *Nasobelba agathis* sp. n.

Remarks: Hammer (1980) already drew the attention to the difficult generic placement of *Suctobelbella inenodabilis* from Java. She also properly placed *Suctobelba transitoria* Balogh & Mahunka, 1974 in the same species group. I relegate both species to this new genus: *Nasobelba inenodabilis* (Hammer, 1980) **comb. n.** and *Nasobelba transitoria* (Balogh & Mahunka, 1974) **comb. n.**

The new genus is well characterised by the somewhat sclerotised anteromedian part of the prodorsum, the form of the sensillus, the peculiar pattern on the notogaster and ventral plate, and the position of the adanal setae. It seems to be related to the genus *Fenestrobelba* Balogh, 1970, however, the new genus is distinguishable from *Fenestrobelba* by te presence of its tectopedial field and lamellar knob, by the form of sensillus, the pattern on the surfaces and by the large rostral tooth, which is missing in *Fenestrobelba* (Balogh, 1970; Balogh & Balogh, 1992).

Derivatio nominis: Named after the form of the rostral apex.

Nasobelba agathis sp. n. Figs 1-6

Material examined: Brunei: Holotype: SBH-96/12, 2 paratypes from the same sample. Holotype and 1 paratype: MHNG[1], 1 paratype: (1664-PO-02) HNHM[2].

Diagnosis: Rostral apex nasiform, well protruding, rostral tooth large. Anterior part of prodorsum with small tubercles arranged in longitudinal rows. Head of the sensillus symmetric. Notogastral condyles partly separated from each other. Median part of the notogaster and the ventral plate with polygonal pattern. Nine pairs of long and simple notogastral setae, setae h_1 much shorter than h_2.

Measurements: Length of body: 245-267 μm, width of body: 110-114 μm.

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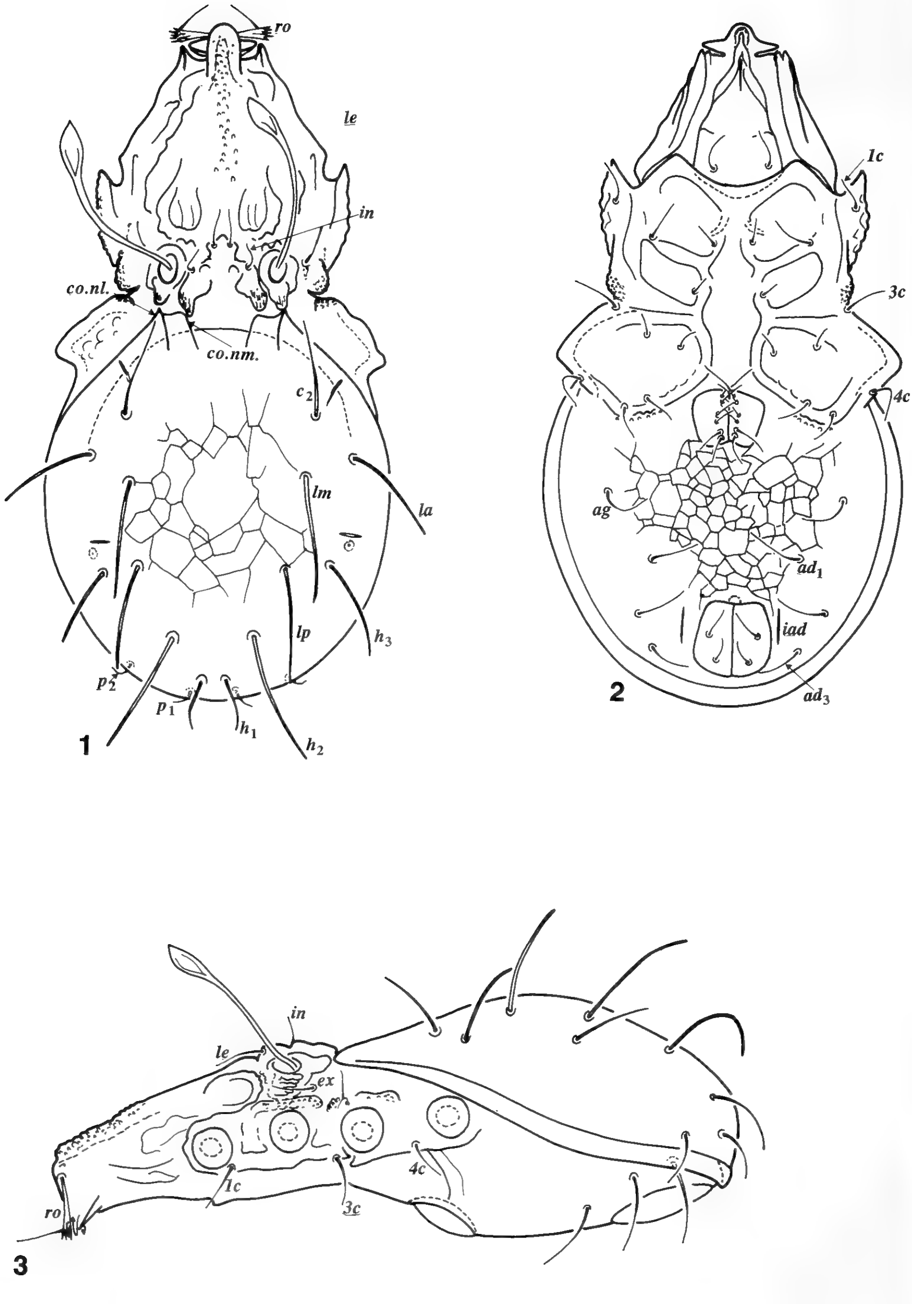
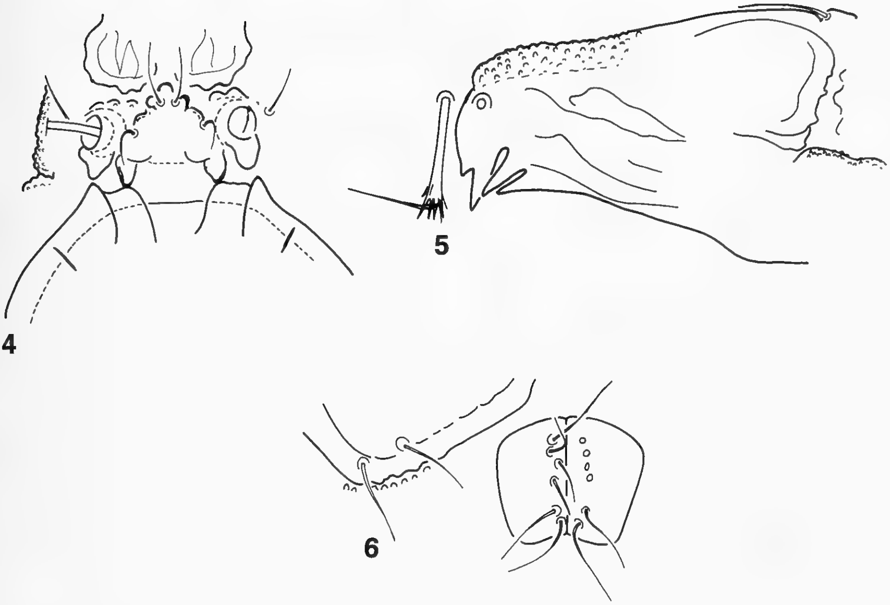
[1] MHNG = deposited in the Muséum d'histoire naturelle, Geneva.

[2] HNHM = deposited in the Hungarian Natural History Museum, Budapest, with the identification number of the specimens in the Collection of Arachnida.



FIGS 1-3
Nasobelba agathis gen. n., sp. n. – 1, body in dorsal view; 2, body in ventral view; 3, body in lateral view.



FIGS 4-6

Nasobelba agathis gen. n., sp. n. – 4, basal part of prodorsum; 5, rostrum in lateral view; 6, genital region.

Prodorsum: Rostral apex strongly protruding, nasiform. Rostral teeth larger than the 2 equally long accessory teeth. Rostral elevation well separated, surface with small tubercles posteriorly, arranged in longitudinal column. Tectopedial fields comparatively small, located posteriorly, near to bothridium (Fig. 1). Paratectopedial field reduced, only a small part visible anteriorly, therefore anterior part of prodorsum nearly smooth. Lamellar knob normally developed, interbothridial field well developed basally, along the bothridial lobe (Fig. 4). Rostral setae geniculate, lamellar and interlamellar setae short, simple. Sensillus very long, its head symmetrical, widely lanceolate.

Lateral part of podosoma: Lateroprodorsal pattern absent. Rostral elevation rising from the prodorsal surface, well tuberculate or granulate (Fig. 5). Exobothridial region (Fig. 3) well sclerotised.

Notogaster: Lateral notogastral condyles fused with the median ones, but their original form observable (Fig. 1). Typical polygonal pattern seen on the middle part of the notogaster. Among the fields observable are also larger ones. Nine pairs of long and simple notogastral setae, c_2 narrower than *la* and *ms*. Setae h_1 much shorter than h_2. Setae p_1 and p_2 minute.

Ventral parts (Fig. 2): Epimeres located far from each other, sternal apodeme absent, there is a wide sternal field in this region. Epimeral setal formula: 3 – 1 – 3 – 3. All setae well developed, comparatively long. Some tubercles present along the posterior epimeral borders. Ventral plate with well developed polygonal pattern reaching over to the anal plates posteriorly, but absent laterally. Anogenital setal formula: 6 – 1 – 2 – 3. Anterior and posterior genital setae are longer than those in the middle part of the genital plates (Fig. 6). Aggenital setae located laterally, much farther from each other than the adanal setae. Setae ad_1 in paraanal position, all setae in this region long. Lyrifissure *iad* conspicuously long.

Legs: Trochanter III and IV and all femora granulate.

Remarks: See *Nasobelba undosa* sp. n.

Derivatio nominis: Named after the *Agathis* (Araucariaceae) forest in Brunei. The name is a noun in apposition.

Nasobelba coronata sp. n. Figs 7-11

Material examined: Brunei: Holotype: SBH-96/11, 11 paratypes from the same sample and 2 paratypes: SBH-96/15a. Holotype and 8 paratypes deposited in MHNG, 2 paratypes in HNHM (1665-PO-02).

Diagnosis: Rostral apex nasiform, fused with a plate bearing small median teeth, these teeth reaching over the apex. Rostral teeth very large. Anterior part of prodorsum with a few small irregularly arranged tubercles. Head of the sensillus asymmetric. Notogastral condyles completely fused. Median part of notogaster and the ventral plate with irregular pattern. Nine pairs of notogastral setae, h_1 and h_2 equal in length. Anal plates granulate medially.

Measurements: Length of body: 198-211 μm, width of body: 104-112 μm.

Prodorsum: Rostral apex seems to be very wide, true nasiform apex hardly observable. The apices of the anteromedian teeth, bearing the rostral plate and the rostral teeth, form a wide, crown-shaped anterior margin (Fig. 11). Rostral elevation weakly developed, only with some, 2-3, small tubercles. Outer margin of the tectopedial field conspicuously long (Fig. 7), a weak paratectopedial field observable anteriorly. Lamellar knob well developed, located basally between the bothridia. Rostral setae geniculate, lamellar setae very long, robust. Interbothridial setae short, directed backwards. Sensillus very long, its head asymmetrical.

Lateral part of podosoma: Lateroprodorsal pattern conspicous, polygonal (Fig. 10). Exobothridial region well sclerotised.

Notogaster: Notogastral condyles fused, seem to be one pair condyles with two apices each. Notogastral pattern small, located medially, formed of irregular lines (Fig. 7). Nine pairs of notogastral setae, their ratio different from the previous species. Setae h_1 slightly shorter than h_2, but longer than h_3. Setae p_1 and p_2 short, but not minute.

Ventral parts: Basically similar to the preceding species but the epimeral setae longer (Fig. 8), setae *1b* particularly long. Setae *4a* and *4b* arising very near to each other. Along the posterior epimeral border a line of small tubercles present, a pile of secretions observable behind them. Ventral plate with a region of interconnecting lines just posterior to genital plates. Anogenital setal formula: 6 – 1 – 2 – 3. The position of setae also similar to that of the preceding species. Surface of anal plates granulate, the granules form an elliptical pattern (Fig. 9).

Legs: Similar to the preceding species.

Remarks: See *Nasobelba undosa* sp. n.

Derivatio nominis: Named after the shape of the structure in the rostral region.

FIGS 7-11

Nasobelba coronata gen. n., sp. n. – 7, body in dorsal view; 8. body in ventral view; 9, anal plates; 10, podosoma in lateral view; 11, rostral part of prodorsum.

Nasobelba hauseri sp. n. Figs 12-16

Material examined: Brunei: Holotype: SBH-96/11. 2 paratypes from the same sample. Holotype and 1 paratype deposited in MHNG, 1 paratype in HNHM (1666-PO-02).

Diagnosis: Rostral apex wide, rostral and 2 pairs of accessory teeth nearly equal. Surface of prodorsum without tubercles. Head of the sensillus symmetric, narrow. Notogastral condyles fused. Whole surface of notogaster and ventral plate with a dense polygonal pattern. Nine pairs of very long notogastral setae, h_1 shorter than h_2. Anal plates smooth.

Measurements: Length of body: 232-237 μm, width of body: 118-122 μm.

Prodorsum: Rostral apex nasiform. Rostral teeth large, accessory teeth of equal length (Fig. 14). Rostral elevation separated, its surface smooth. Tectopedial fields comparatively small, located posteriorly near to the bothridium (Fig. 12). Paratectopedial field reduced, only a small part visible anteriorly. Lamellar knob weakly developed, its anterior border opened or absent and seemingly consisting of two parts. Interbothridial field weakly developed, its posterior margins and the same part of the basal lobe finely granulate. Rostral setae geniculate, lamellar setae long, interlamellar setae short, simple. Sensillus very long, its head symmetrically lanceolate, narrow.

Lateral part of podosoma: Lateroprodorsal pattern absent. Rostral elevation rising from the prodorsal surface, smooth. Exobothridial region well sclerotised (Fig. 16).

Notogaster: Lateral notogastral condyles fused with the median ones, both apices rounded anteriorly. Notogastral pattern covering nearly the entire surface, polygonal, consisting of mostly small fields. Nine pairs of notogastral setae, some of them very long, their distal ends mostly curved (Fig. 12). Setae c_2 much shorter than *la* and *ms*. Setae h_1 not shorter than h_2. Setae p_1 and p_2 comparatively long.

Ventral parts (Figs 13): Similar to the preceding species, epimeres located far from each other, sternal apodeme absent. Epimeral setal formula: 3 – 1 – 3 – 3. All setae well developed, comparatively long. The posterior epimeral borders with some tubercles (Fig. 15). Ventral plate with well developed polygonal pattern reaching to the anal plates. Anogenital setal formula: 6 – 1 – 2 – 3. Anterior and posterior genital setae longer than those in the middle part of the genital plates. Aggenital setae located laterally, much farther from each other than the adanal setae. Setae ad_1 in paraanal position, all setae in this region long. Lyrifissure *iad* long.

Remarks: See *Nasobelba undosa* sp. n.

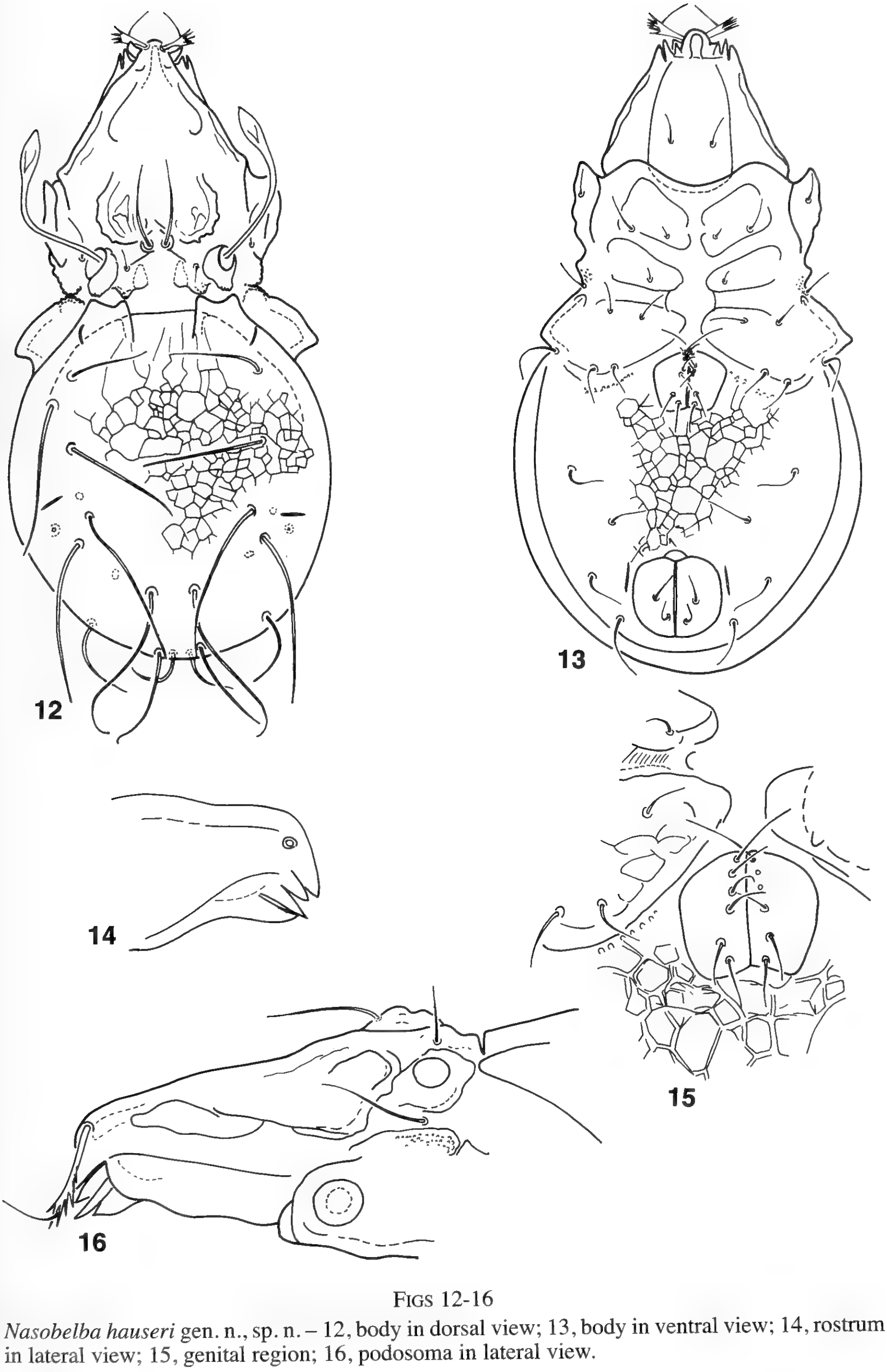
Derivatio nominis: I dedicate the new species to my friend, Dr B. Hauser (Muséum d'histoire naturelle, Geneva), the collector of this very interesting material.

Nasobelba undosa sp. n. Figs 17-20

Material examined: Brunei: Holotype: SBH-96/9, 1 paratype SBH-69/11. Holotype deposited in MHNG, paratype in HNHM (1667-PO-02).

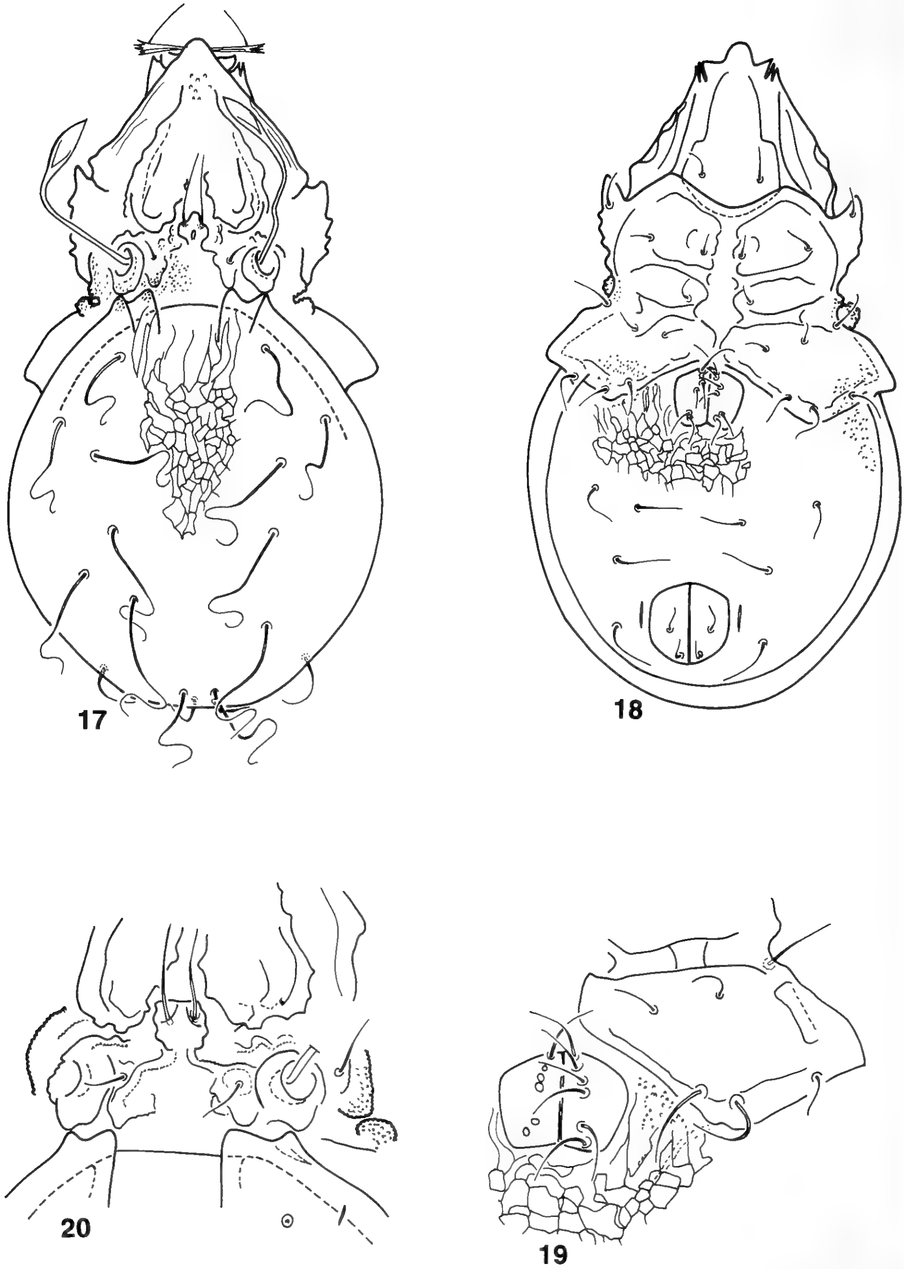
Diagnosis: Rostral apex nasiform, well protruding, rostral tooth large. Anterior part of prodorsum with irregular small tubercles. Peduncle of sensillus very long, curved, head of the sensillus symmetric. Surface of notogaster and the ventral plate with an irregular polygonal pattern. Nine pairs of long and flagellate notogastral setae, p_1 and p_2 short, simple.

Measurements: Length of body: 242-247 μm, width of body: 133-141 μm.



FIGS 12-16

Nasobelba hauseri gen. n., sp. n. – 12, body in dorsal view; 13, body in ventral view; 14, rostrum in lateral view; 15, genital region; 16, podosoma in lateral view.



FIGS 17-20
Nasobelba undosa gen. n., sp. n. – 17, body in dorsal view; 18, body in ventral view; 19, genital region; 20, basal part of prodorsum.

Prodorsum: Rostral apex strongly protruding, nasiform. Rostral teeth large, accessory teeth much narrower. Rostral parts with some irregular small tubercles. Tectopedial fields comparatively large, their inner margin observable (Fg. 17). Paratectopedial field reduced, only a small part visible anteriorly. Basal part of the prodorsum distinctly covered by fine granules. Lamellar knob normally developed, some tubercles or short crests present along it (Fig. 20). Interbothridial field weakly developed basally, along the bothridial lobe. Rostral setae geniculate, lamellar and interlamellar setae normal or short, simple. Sensillus with very long peduncle, its head symmetrically lanceolate, narrow.

Lateral part of podosoma: Lateroprodorsal pattern absent. Rostral elevation rising from the prodorsal surface. Exobothridial region well sclerotised.

Notogaster: Lateral notogastral condyles fused with the median ones, their original form still observable (Fig. 17). Typical polygonal pattern reaching to the sejugal margin anteriorly. There are long small fields medially, their borders mostly curved. Nine pairs of long, flagellate notogastral setae, c_2 shorter than la and ms. Setae h_1 longer than h_2. Setae p_1 and p_2 also short.

Ventral parts (Fig. 18): Similar to the other species. Epimeres located far from each other, sternal apodeme absent. All epimeral setae well developed, comparatively long. Surface of the posterior epimeres covered by fine granules. Along the posterior epimeral borders some small tubercles present, continuing in lines (Fig. 19). Ventral plate with well developed polygonal pattern reaching the anal plates posteriorly. Lateral surface also covered by minute granules. Anogenital setal formula: 6 – 1 – 2 – 3. Anterior and posterior genital setae are longer than those in the middle part of the genital plates. Aggenital setae located much more medially than in the preceding species. Anal setae located in the posterior part of the anal plates. Setae ad_1 in paraanal position, all setae in this region long. Lyrifissure *iad* conspicuously long.

Derivatio nominis: Named after the form of the notogastral setae.

Remarks: The genus *Nasobelba* gen. n. comprises 6 species, all from the Oriental Region. The four new species are well characterizable and distinguished from the previously known species by the form of the sensillus and the notogastral setae of different lengths, and the composition of the notogastral and ventral pattern or the shape of the prodorsal structures.

All six species can be distinguished by using the following key:

1 Rostral apex crown-shaped, with small teeth medially. Notogastral surface with irregular pattern . . . . *coronata* sp. n.
\- Rostral apex nasiform, without small teeth. Notogastral surface with polygonal pattern 2
2 Prodorsal surface with small tubercles medially. Setae h_1 much shorter than c_2 3
\- Prodorsal surface smooth. Setae h_1 and c_2 nearly equal in length 4
3 Prodorsal tubercles arranged in a longitudinal column. Notogastral setae rather shorter, *lp* shorter than the distance between them . . . . *agathis* sp. n.
\- Prodorsal tubercles irregular. Notogastral setae rather longer, *lp* longer than the distance between them
. . . . *transitoria* (Balogh & Mahunka, 1974) comb. n.

4 Lamellar knob opened anteriorly. Posterior part of the interbothridial field and bothridial lobe finely granulated . . . . *hauseri* sp. n.
\- Lamellar knob normal, closed anteriorly. Posterior part of the interbothridial field and bothridial lobe smooth, or the entire basal surface granulated 5
5 Notogastral setae flagellate . . . . *undosa* sp. n.
\- Notogastral setae normal . . . . *inenodabilis* (Hammer, 1980) comb. n.

Parasuctobelba quinquecostata sp. n. Figs 21-23

Material examined: Brunei: Holotype: SBH-96/15a, 6 paratypes from the same sample. Holotype and 4 paratypes deposited in MHNG, 2 paratypes in MHNG, 2 paratypes in HNHM (1668-PO-02).

Diagnosis: Rostrum wide, conical, without teeth or incisures. Lamellar knob long. Sensillus clavate. Bothridium large and wide. Two pairs of sejugal condyles, their median part connected with each other. Five thick, longitudinal crests present, median one longer than the lateral crest. Ten pairs of short notogastral setae. Posterior border of the epimeral region with digitiform extensions and tubercles. Anogenital setal formula: 5 – 1 – 2 – 3.

Measurements: Length of body: 159-170 μm, width of body: 91-100 μm.

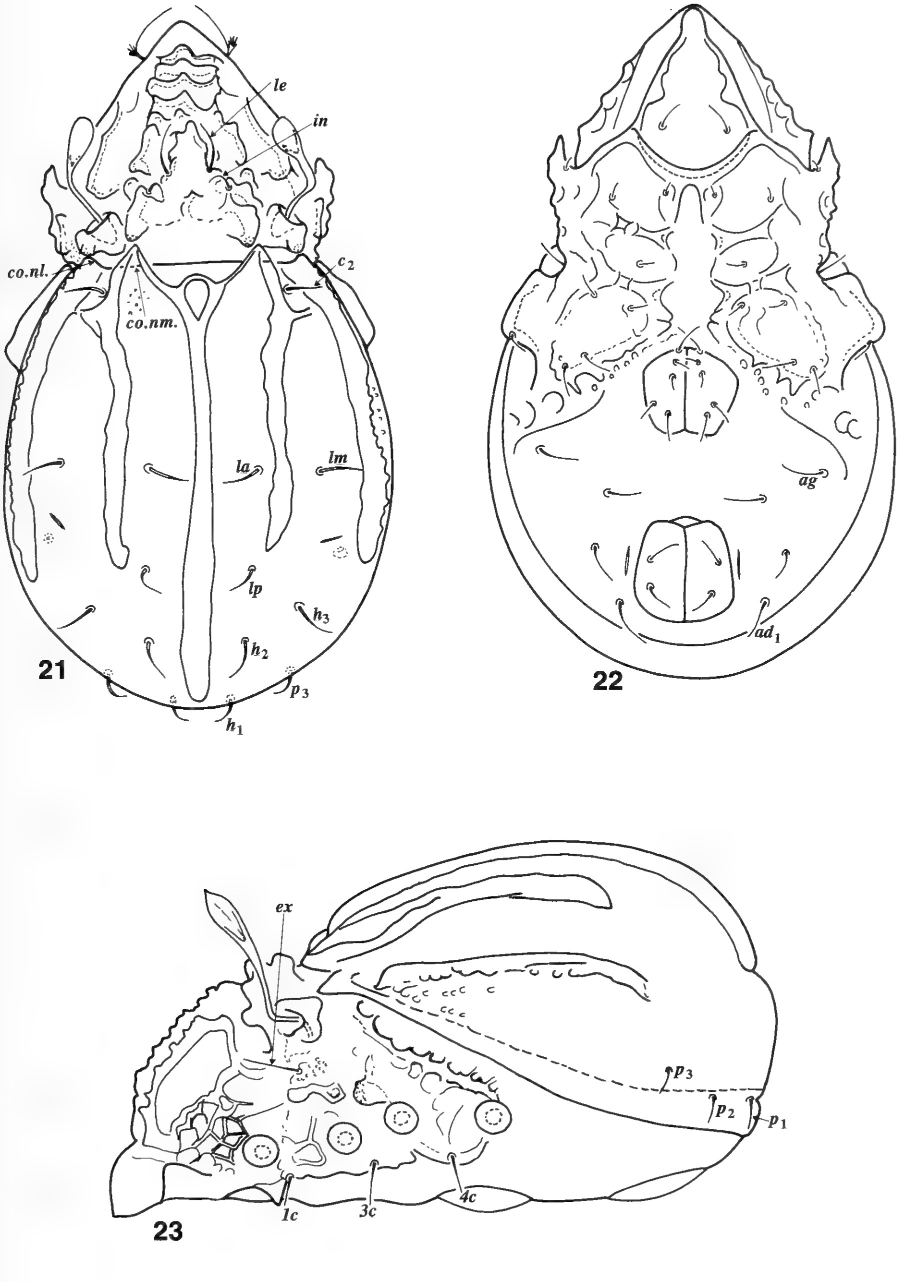
Prodorsum: Rostrum conical, its margin nearly smooth, neither teeth, incisures nor lobes present. There are short transversal crests with 3 sharply pointed tubercles each behind the rostrum (Fig. 22). They are connected laterally, so this border and a longitudinal lateral strong crest form a pair of fields, appearing to be paratectopedial fields. True tectopedial field absent. Lamellar knob elongated. Interbothridial field with a well sclerotised basal part. Rostral setae geniculate, lamellar setae simple, interlamellar ones short, curved. Sensillus club-shaped.

Lateral part of podosoma: Well developed polygonate lateroprodorsal pattern present. Exobothridial region well sclerotised, partly granulated. Above the acetabula a strong lath running anteriorly from acetabula IV (Fig. 23).

Notogaster: Two pairs of sharply pointed, interconnected notogastral condyles present. Two pairs of shorter lateral costulae and one unpaired, long median costula present, they are thick and rise well out from the surface (Fig. 21). The lateral ones with tubercles, some tubercles also existing along the anterolateral margin. Median costula also connected with the lateral ones and bearing a cordyform cavity anteriorly. 10 pairs of short, nearly spiniform notogastral setae present, two posterior ones observable only in lateral view (Fig. 23).

Ventral parts: Sternal apodeme absent, epimeres not touching medially, a wide sternal field exist between them. Posterior border of the epimeral region with a peculiar structure bearing some digitiform expansions and behind them some large tubercles (Fig. 22). Some large alveoli observable laterally. Epimeral setal formula: 3 – 1 – 3 – 3, all epimeral setae simple and short. Anogenital setal formula: 5 – 1 – 2 – 3. Aggenital setae located near to the lateral margin of the ventral plate, far from each other. Adanal setae equal in length, setae ad_1 in paraanal position. Lyrifissures *iad* long.

Remarks: On the basis of the shape of the prodorsum and the peculiar notogastral structure, the new species without doubt belongs to the genus *Parasuctobelba*



FIGS 21-23

Parasuctobelba quinquecostata sp. n. – 21, body in dorsal view; 22, body in ventral view; 23, body in lateral view.

Hammer, 1977. The new species is distinguishable from the known species by the five long costulae, which are absent in the other species.

Derivatio nominis: Named after the structure of the notogaster.

CHECK-LIST OF THE HEREWITH PUBLISHED ORIBATID SPECIES OF BRUNEI, WITH COMPLETE LIST OF LOCALITIES

This check-list contains the bibliographic references and all data concerning the collecting localities. To make it more effective for ecological and biogeographical purposes, the complete locality-list gives the possibility to decode all published localities.

Eniochthoniidae Grandjean, 1947
1. *Eniochthonius sumatranus* (Mahunka, 1989) — Mahunka, 1997: Bru-88/41.

Gehypochthoniidae Strenzke, 1963
2. *Gehypochthonius xarifae* Strenzke, 1963 — Mahunka, 1997: Bru-88/41.

Parhypochthoniidae Grandjean, 1932
3. *Parhypochthonius asiaticus* Mahunka, 1997 — Mahunka, 1997: Bru-88/41.

Brachychthoniidae Thor, 1934
4. *Sellnickochthonius muara* Mahunka, 1995 — Mahunka, 1995: Bru-88/12; Bru-88/24.
5. *Sellnickochthonius planus* (Chinone, 1974) — Mahunka, 1995: Bru-88/24.

Phthiracaridae Perty, 1841
6. *Hoplophthiracarus* (*Plonaphacarus*) *aculeatus* Mahunka, 1995 — Mahunka, 1995: Bru-88/38; Mahunka, 1997: Bru-88/46.
7. *Notophthiracarus hauseri* Mahunka, 1995 — Mahunka, 1995: Bru-88/21; Mahunka, 2005: SBH-96/12.

Synichotritiidae Walker, 1965
8. *Sabahtritia lienhardi* Mahunka, 1995 — Mahunka, 1995: Bru-88/29; Mahunka, 2001: Bru-88/32.

Temburongiidae Mahunka, 1990
9. *Temburongia patoi* Mahunka, 1990 — Mahunka, 1990 and Mahunka, 1995: Bru-88/21, Bru-88/38, Mahunka, 1997: Bru-88/41, Bru-88/46; Mahunka, 2001: Bru-88/29, Bru-88/38; Mahunka, 2005: SBH-96/11, SBH-96/12.

Epilohmanniidae Oudemans, 1923
10. *Epilohmannia nortoni* Mahunka, 1997 — Mahunka, 1997: Bru-88/29, Bru-88/41, Bru-88/46.
11. *Epilohmannoides esulcatus* Ohkubo, 1979 — Mahunka, 1997: Bru-88/29, Bru-88/41, Bru-88/46.

Lohmanniidae Berlese, 1916
12. *Papillacarus lienhardi* Mahunka, 1997 — Mahunka, 1997: Bru-88/29.

Hermanniellidae Grandjean, 1934
13. *Bruneiella sultan* Mahunka, 1997 — Mahunka, 1997: Bru-88/41, Bru-88/46.

Microtegeidae Balogh, 1961
14. *Microtegeus sabahnus* Mahunka, 1987 — Mahunka, 1997: Bru-88/21, Bru-88/41.
15. *Suctotegeus tumescitus* Mahunka, 1987 — Mahunka, 1997: Bru-88/41, Mahunka, 2005: SBH-96/12.

Eremaeozetidae Balogh, 1972
16. *Eremaeozetes maculosus* Mahunka, 1995 — Mahunka, 1995: Bru-88/24.

Microzetidae Grandjean, 1936
17. *Anakingia borneensis* Mahunka, 1997 — Mahunka, 1997: Bru-88/41.
18. *Teraja asymmetrica* Mahunka, 2001 — Mahunka, 2001: Bru-88/38.
19. *Teraja sungai* Mahunka, 1997 — Mahunka, 1997: Bru-88/41, Bru-88/46; Mahunka, 2001: Bru-88/35; Mahunka, 2005: SBH-96/9.
20. *Teraja tuberculata* (Mahunka, 1987) — Mahunka, 2001: Bru-88/35.
21. *Teraja wongi* Mahunka, 1995 — Mahunka, 1995: Bru-88/32; Mahunka, 1997: Bru-88/29; Mahunka, 2001: Bru-88/32.

Damaeolidae Grandjean, 1965

22. *Fosseremus laciniatus* (Berlese, 1905) — Mahunka, 2001: Bru-88/12; Mahunka, 2005: SBH-96/11.

Eremobelbidae Balogh, 1961

23. *Eremobelba porcella* Mahunka, 2001 — Mahunka, 2001: Bru-88/21, Bru-88/24.

Peloppiidae Balogh, 1943

24. *Austroceratoppia serapi* Mahunka, 1996 — Mahunka, 2001: Bru-88/29.

Carabodidae C. L. Koch, 1837

25. *Congocepheus* orientalis Mahunka, 1987 — Mahunka, 1997: Bru-88/41.
26. *Gymnobodes semengok* Mahunka, 1996 — Mahunka, 2001: Bru-88/35.
27. *Hardybodes flabellatus* Mahunka, 1995 — Mahunka, 1995: Bru-88/21, Bru-88/32, Bru-88/38; Mahunka, 1997: Bru-88/41.
28. *Hardybodes penicillatus* Mahunka, 1995 — Mahunka, 1995: Bru-88/35; Mahunka, 2001: Bru-88/24; Mahunka, 2005: SBH-96/12.
29. *Pasocepheus eremaeozetoides* Mahunka, 1995 — Mahunka, 1995: Bru-88/32.

Tectocepheidae Grandjean, 1954

30. *Tegeozetes tunicatus* Berlese, 1913 — Mahunka, 2001: Bru-88/32, Bru-88/38.

Otocepheidae Balogh, 1961

31. *Dolicheremaeus andulauensis* Mahunka, 1997 — Mahunka, 1997: Bru-88/41, Bru-88/46; Mahunka, 2001: Bru-88/24.
32. *Dolicheremaeus bruneiensis* Aoki, 1967 — Aoki, 1967: Brunei City, 21.I.1962.
33. *Dolicheremaeus furcillatus* Mahunka, 1997 — Mahunka, 1997: Bru-88/21, Bru-88/46.
34. *Dolicheremaeus wallacei* Mahunka, 1997 — Mahunka, 1997: Bru-88/29, Bru-88/46.
35. *Otocepheus durian* Mahunka, 1997 — Mahunka, 1997: Bru-88/46.

Dampfiellidae Balogh, 1961

36. *Dampfiella zellwegeri* Mahunka, 1997 — Mahunka, 1997: Bru-88/21, Bru-88/46; Mahunka, 2005: SBH-96/11.

Luxtoniidae Mahunka, 2001

37. *Luxtonia hauseri* Mahunka, 2001 — Mahunka, 2001: Bru-88/35.

Oppiidae Grandjean, 1951

38. *Arcoppia teraja* Mahunka, 2001 — Mahunka, 2001: Bru-88/21, Bru-88/32.
39. *Corynoppia andulau* Mahunka, 2001 — Mahunka, 2001: Bru-88/21.
40. *Graptoppia sundensis* (Hammer, 1980) — Mahunka, 2001: Bru-88/21, Bru-88/35.
41. *Karenella bruneiana* Mahunka, 2001 — Mahunka, 2001: Bru-88/21, Bru-88/46.
42. *Oppiella nova* (Oudemans, 1902) — Mahunka, 2001: Bru-88/24, Bru-88/32, Bru-88/35.
43. *Ptiloppia lienhardi* Mahunka, 2001— Mahunka, 2001: Bru-88/21, Bru-88/32, Bru-88/35.
44. *Pulchroppia burckhardti* Mahunka, 1987 — Mahunka, 2001: Bru-88/35.
45. *Senectoppia kerangas* Mahunka, 2001 — Mahunka, 2001: Bru-88/32.

Rhynchoribatidae Balogh, 1961

46. *Oxyamerus hauserorum* Mahunka, 1987 — Mahunka, 2005: SBH-96/11, SBH-96/12.
47. *Suctoribates foliatus* Mahunka, 1997 — Mahunka, 1997: Bru-88/29, Bru-88/41; Mahunka, 2005: SBH-96/11, SBH-96/12, SBH-96/15a.

Suctobelbidae Jacot, 1938

48. *Bruneibelba separata* Mahunka, 2001 — Mahunka, 2001: Bru-88/21, Bru-88/35.
49. *Bruneibelba tuberosa* Mahunka, 2001 — Mahunka, 2001: Bru-88/35.
50. *Coartobelba pauper* Mahunka, 2001 — Mahunka, 2001: Bru-88/21, Bru-88/29, Bru-88/41, Bru-88/46.
51. *Condylobelba agathis* Mahunka, 2001 — Mahunka, 2001: Bru-88/21, Bru-88/29, Bru-88/35, Bru-88/46.
52. *Condylobelba bruneiensis* Mahunka, 2001 — Mahunka, 2001: Bru-88/21, Bru-88/24, Bru-88/29, Bru-88/35, Bru-88/41, Bru-88/46; Mahunka, 2005: SBH-96/12.

53. *Condylobelba sculpturata* Mahunka, 2001 — Mahunka, 2001: Bru-88/35.
54. *Nasobelba agathis* Mahunka, 2005 — Mahunka, 2005: SBH-96/12.
55. *Nasobelba coronata* Mahunka, 2005 — Mahunka, 2005: SBH-96/11, SBH-96/15a.
56. *Nasobelba hauseri* Mahunka, 2005 — Mahunka, 2005: SBH-96/11.
57. *Nasobelba undosa* Mahunka, 2005 — Mahunka, 2005: SBH-96/9, SBH-96/11.
58. *Parasuctobelba quinquecostata* Mahunka, 2005 — Mahunka, 2005: SBH-96/15a.
59. *Suctobelbella subcomplexa* (Balogh & Mahunka, 1968) — Mahunka, 2001: Bru-88/21, Bru-88/41.
60. *Suctobelbella variosetosa* (Hammer, 1961) — Mahunka, 2001: Bru-88/35, Bru-88/38, Bru-88/46.

Haplozetidae Grandjean, 1936

61. *Bolkiah hauseri* Mahunka, 1997 — Mahunka, 1997: Bru-88/41; Bru-88/46.
62. *Borneozetes lanceolatus* Mahunka, 1997 — Mahunka, 1997: Bru-88/29.

Oribatellidae Jacot, 1925

63. *Lamellobates orientalis* Csiszár, 1961 — Mahunka, 2001: Bru-88/35.

Galumnidae Jacot, 1925

64. *Notogalumna praetiosa* Sellnick, 1959 — Mahunka, 2001: Bru-88/24.

List of localities for all published records (Expeditions of 1988 and 1996)

1988

Bru-88/12: **Brunei** (Brunei-Muara District): près du pont sur le ruisseau "Sungai Lubang Barus" sur la route venant de Tutong, à 33 km de Bandar Seri Begawan, prélèvement de sol dans les angles formés par les contreforts de deux grands arbres proches des habitations, env. 20 m; 16.XI.1988; leg. B. Hauser — (extraction par appareil Berlese à Bandar Seri Begawan, Brunei).

Bru-88/21: **Brunei** (Belait District): "Andulau Forest ("Mixed dipterocarp forest"), K-7 ("Kompartment 7"), prélèvement de sol dans les angles formés par les contreforts de grands arbres, 50 m; 19.XI.1988; leg. B. Hauser — (extraction par appareil Berlese à Bandar Seri Begawan, Brunei).

Bru-88/24: **Brunei** (Brunei-Muara District): "Berakas Forest Reserve" au nord de Bandar Seri Begawan sur la route, à 19,5 km de Muara (= à 102,5 km de Kuala Belait), forêt "Kerangas" (= "Tropical heath forest"), prélèvement de sol au pied de *Casuarina nobilis* Whitmore (Casuarinaceae), 30 m; 20.XI.1988; leg. B. Hauser — (extraction par appareil Berlese à Bandar Seri Begawan, Brunei).

Bru-88/29: **Brunei** (Belait District): Sungai Liang, "Arboretum Forest Reserve", forêt primaire ("Mixed dipterocarp forest"), prélèvement de sol dans les angles formés par les contreforts de deux arbres appelés "Nyatho", 90 m; 21.XI.1988; leg. B. Hauser — (extraction par appareil Berlese à Bandar Seri Begawan, Brunei).

Bru-88/32: **Brunei** (Belait District): "Labi Hills Forest Reserve", "Teraja", à 42 km au sud de Sungai Liang (= 12 km au Sud de Labi), environs de "Rumah Panjang" (= Longhouse du Kampong Teraja), forêt primaire ("Mixed dipterocarp forest"), prélèvement de sol dans les angles formés par les contreforts d'un très grand arbre, 40 m; 22.XI.1988; leg. B. Hauser — (extraction par appareil Berlese à Bandar Seri Begawan, Brunei).

Bru-88/34: **Brunei** (Belait District): "Badas Forest Reserve", à env. 10 km sur la route secondaire qui bifurque, à 32 km de Kuala Belait, vers le sud, forêt "Kerangas" (="Tropical heath forest") formée presque exclusivement par *Agathis dammara* (Lambert) L. G. Rich. (Araucariaceae), sur et sous écorces, 10 m; 23.XI.1988; leg. B. Hauser.

Bru-88/35: **Brunei** (Belait District): "Badas Forest Reserve", à env. 10 km sur la route secondaire qui bifurque, à 32 km de Kuala Belait, vers le sud, forêt "Kerangas" (="Tropical heath forest") formée presque exclusivement par *Agathis dammara* (Lambert) L. G. Rich. (Araucariaceae), prélèvement de sol au pied de *Agathis dammara*, 10 m; 23.XI. 1988; leg. B. Hauser — (extraction par appareil Berlese à Hong Kong).

Bru-88/38: **Brunei** (Temburong District): "Peradayan Forest Reserve" (= "Bukit Patoi"), à 14,5 km de Bangar (= 2,5 km de Labu), forêt primaire ("Mixed dipterocarp forest"), prélèvement de sol dans les angles formés par les contreforts de grands arbres morts, 80 m; 24.XI.1988; leg. B. Hauser — (extraction par appareil Berlese à Hong Kong).

Bru-88/41: **Brunei** (Belait District): Sungai Liang, “Arboretum Forest Reserve”, forêt primaire (“Mixed dipterocarp forest”), prélèvement de sol dans les angles formés par les contreforts d’arbres appelés “Kempas” (= *Koompassia malaccensis* Maing. & Benth. [Fabaceae]), 20 m; 25.XI.1988; leg. B. Hauser — (extraction par appareil Berlese à Hong Kong).

Bru-88/46: **Brunei** (Belait District): “Andulau Forest Reserve”, à 3,5 km au sud de Sungai Liang (= à 39,5 km de Labi), forêt primaire (“Mixed dipterocarp forest”), K-8 (“Kompartment 8”), prélèvement de sol dans les angles formés par les contreforts d’un grand arbre, 70 m; 26.XI.1988; leg. B. Hauser — (extraction par appareil Berlese à Hong Kong).

1996

SBH-96/9: **Brunei** (Belait Dstrict): Sungai Liang, “Arboretum Forest Reserve”, forêt primaire (“Mixed dipterocarp forest”), prélèvement de sol dans les angles formés par les contreforts de *Alstonia angustiloba* Miq. (Symplocaceae), 20 m; 29.XI.1996; leg. B. Hauser — (extraction par appareil Berlese à Bandar Seri Begawan, Brunei).

SBH-96/11: **Brunei** (Belait District): “Badas Forest Reserve”, à env. 10 km sur la route secondaire qui bifurque, à 32 km de Kuala Belait, vers le S; forêt “Kerangas” (= “Tropical heath forest”) formée presque exclusivement par *Agathis dammara* (Lambert) L. G. Rich. (Araucariaceae), “Genetic Resources Protection Area”, prélèvement de sol au pied d’un gros *A. dammara*, 10 m; 30.XI.1996; leg. B. Hauser — (extraction par appareil Berlese à Bandar Seri Begawan, Brunei).

SBH-96/12: **Brunei** (Belait District): “Badas Forest Reserve”, à env. 10 km sur la route secondaire qui bifurque, à 32 km de Kuala Belait, vers le S; forêt “Kerangas” (= “Tropical heath forest”) formée presque exclusivement par *Agathis dammara* (Lambert) L. G. Rich. (Araucariaceae) “Genetic Resources Protection Area”, prélèvement de sol au pied de *A. dammara*, 10 m; 30.XI.1996; leg. B. Hauser — (extraction par appareil Berlese à Bandar Seri Begawan, Brunei).

SBH-96/15a: **Brunei** (Belait District): “Labi Hills Forest Reserve”, “Teraja”, à 42 km au S de Sungai Liang (= 12 km au Sud de Labi), environs de “Rumah Panjang” (= Longhouse du Kampong Teraja), forêt primaire (“Mixed dipterocarp forest”), prélèvement de sol dans les angles formés par les contreforts de deux très grands arbres, 20 m; 2.XII.1996; leg. B. Hauser — (extraction par appareil Berlese à Bandar Seri Begawan, Brunei).

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Trojanella serbica gen. n., sp. n., a remarkable new troglobitic travunioid (Opiliones, Laniatores, Travunioidea)

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***Trojanella serbica* gen. n., sp. n., a remarkable new troglobitic travunioid (Opiliones, Laniatores, Travunioidea). -** A new species of travunioid from Serbia, Mt. Stara Planina, is described and a new genus is established. The new species exhibits some characters and combination of characters not known from any other species. It cannot be placed at this time in any of the described families of the superfamily Travunioidea. Some unknown details of male morphology in *Abasola hofferi* (Travuniidae) are presented.

Keywords: Travunioidea - Mt. Stara Planina - troglobite - Travuniidae - *Abasola hofferi* - penis structure.

INTRODUCTION

Thanks to intensive biospeleological research done by the Belgrade Institute for Protection of Nature team under Dragan Pavicević's leadership, an unusual new species of troglobitic opilionid has been discovered. Specimens of the new species were found in a pothole in Mt. Stara Planina in south-east Serbia, near the Bulgarian border. The specimens were collected from the 60 m deep pothole, between stones of the breakdown covering its bottom.

The new species belongs to the suborder Laniatores and the superfamily Travunioidea which is widespread in temperate zones of both hemispheres. In the southern hemisphere this superfamily has a typical Gondwanan distribution, whereas in the northern hemisphere it is represented by a small number of genera and species found locally in some parts of Europe, North America, Japan, and Korea. In all areas, representatives of this superfamily mostly occur as rare relict elements, often as troglobionts, which indicates the great age of the group.

Characteristics of the new species and the combination of characteristics make the species unique in the group. So it was not difficult to establish that it belongs to a new genus. On the basis of the criteria of significance of certain characters and of the current classification of the Travunioidea into families and subfamilies, the position of this new genus is rather disputable. By its sternum structure, form of spiracle and the type of claws structure, this genus seems closely related to the family Triaenonychidae, which representatives are predominantly distributed in the southern hemisphere (in the

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northern hemisphere, given the current composition, this family is represented by 12 genera and 23 species in North America, Japan and Korea). On the other hand by the ovipositor morphology and midgut anatomy this new genus is closely related to the north hemispheric families Cladonychidae and Travuniidae.

Systematic of the superfamily Travunioidea is somewhat confusing with five families and eight subfamilies, in some cases uncritically erected. A comprehensive revision of the whole superfamily Travunioidea is needed. Recent confusing systematic of the superfamily, the extremely specific penis structure and combination of relevant characters of *Trojanella serbica* gen. sp. n., made me decide to put it in Travunioidea *incertae sedis*.

Male specimens of *Abasola hofferi* Šilhavý, 1936 (family Travuniidae) were first collected in the cave Pokljuka Gornja (type locality) in Montenegro (Šilhavý, 1936). The material was used for comparison and for learning more about the morphology of this little known species. Details of penis structure in *A. hofferi* question the validity of the current composition of the Travuniidae.

RESULTS

TRAVUNIOIDEA *incertae sedis*

Trojanella gen. n.

The genus of small long legged Travunioidea is defined by morphological characters of the genitalia. Penis with elongated truncus and movable articulated, flattened, bifurcate glans. Truncus of the penis terminally widened; musculature settled in the terminally widened part of the truncus and in the glans. Glans wide and flattened, terminally bifurcated, laterally with 2 strong teeth-like protrusions. Ovipositor with 4 lobes terminally; dorsal and ventral one as well as the ovipositor body covered with sparce denticles; lateral lobes smooth, each bearing ventral and dorsal rows of few spines.

Spiracle not concealed, semicircular in shape. Sternum narrow, basally widened with setae; subapically trapezoidally expanded.

Claws III and IV with a pair of elongated, flattened branches parallel to widely flattened medial prong. Shape of these claws similar to peltonychium in Travuniidae. Juveniles with claws III and IV of peltonychium type.

Type species. *Trojanella serbica* sp. n.

Etymology: *Trojan* – in south Slavic mythology the demon or the god of night and darkness. According to legends, most often lives in ruins of towns and fortresses. The name is diminutive of femine gender.

Trojanella serbica sp. n. Figs 1-4, 5A, 6-7

Material examined: From an unnamed pothole, at the locality of Vladikina Ploča in the Visočica River gorge, near the village of Rsovci, on Mt. Stara Planina, Serbia (Serbia & Montenegro), 900 m asl (UTM - FN48), 2.10.2002. leg. I.Karaman: 1 ♂ holotype, 5 ♂ paratypes, 8 ♀ paratypes and 2 juv. (+1 adult specimen used for molecular analyses); *ibid.*, 30.05.2002, leg. S. Ognjenović: 2 juv.; *ibid.*, 2.10.2002-2.06. 2003, from traps, leg. S. Ognjenović: 3 ♂ paratypes and 3 ♀ paratypes.

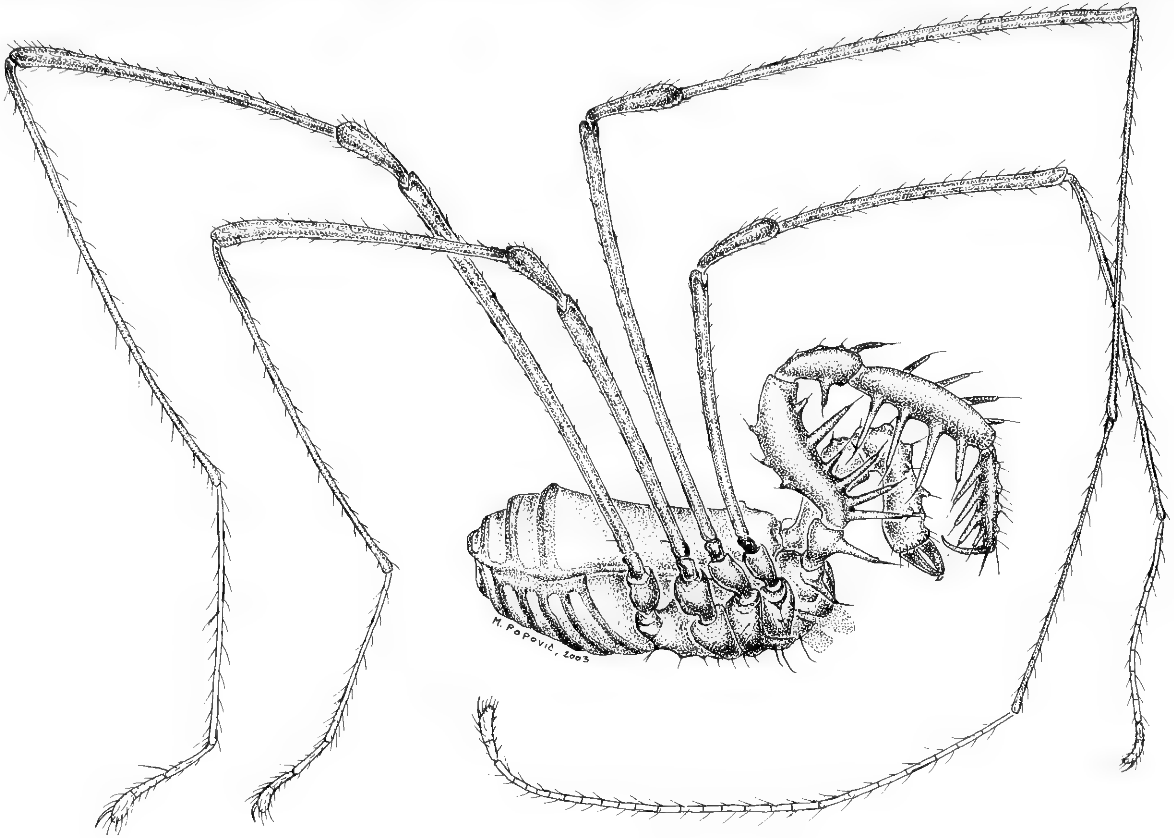

FIG. 1. *Trojanella serbica* gen. n., sp. n. (male paratype, 1.83 mm): Lateral view.

Holotype ♂ (Inv.No 1324), 7 ♂, 10 ♀ paratypes and 4 juv. are deposited in the author's collection at the Department of Biology and Ecology – Novi Sad (Serbia & Montenegro), 1 ♂ and 1 ♀ paratypes in the Muséum d'histoire naturelle, Geneva, Switzerland.

DESCRIPTION

Male: Blind troglobitic species. Male holotype 1.7 mm (male paratypes 1.58-1.83 mm) long, measured from frontal edge of dorsal scutum. Body uniformly yellowish amber in colour. Dorsum densely granular with sparse rows of setae and pronounced lateral grooves in its median area (Figs 2A-B). Grooves starting with two lateral creases on both sides of carapace region on same level as ocular tubercle and above ozopores. Creases joined in a depression at posterior end of dorsal scutum. A pair of grooves anteriolateral, near and parallel to frontal edge of dorsal scutum. Conical ocular tubercle distant from anterior edge of dorsal scutum for almost twice its length.

Coxal lobes II anteriomesally with strong conical apophyses (male secondary sexual character) ventrally directed (Fig. 2C), sparsely setose. Coxal lobes III anteriomesally with a pair of small tubercles (on both sides of the sternal subapical expansion). Sternum as in Fig. 2C, basally widened, with two pairs of setae (short and long ones); sternum slightly trapezoidally expanded at level of junction between coxae II and III.

Chelicerae (Figs 3A-B). Basal segment gradually widened distally, dorsal surface terminally with two tubercles bearing setae, ventrally with few setae; second segment anteromesally with two spinelike tubercles bearing subapical setae, anteriorly with several tubercles bearing apical setae and with concentration of terminal setae.

Pedipalps (Figs 3C-D) in a form of catching basket, armed with strong elongate spinelike tubercles, each bearing a strong elongate seta subapically; coxae ventrally with a low tubercle bearing small setae and a strong spinelike tubercle proximally; trochanter ventrally with 1 strong spinelike tubercle, dorsally with 1 tubercle bearing small setae; femur strong, ventrally with a row of 6 spinelike tubercles (proximal 3 stronger than others), medio-proximally with 2 spinelike tubercles, dorsally with 2 low spinelike tubercles; patella medially with 2 spinelike tubercles, laterally with 1 spinelike tubercle; tarsus with 4 strong spinelike tubercles on both sides (laterally and medially), terminally with 2 strong setae. Claw elongated. All articles bearing sparce hairs and setae, on dorsal sides usually placed on low tubercles. Sparce hairs on tarsal segment in longitudinal rows.

Legs elongated, segments cylindrical; coxae ventrally with a row of tubercles bearing setae subapically; each femur basally with a false articulation (Fig. 7B). Calcanei I-IV elongated. Ratio of calcaneus/astragalus of metatarsi I-IV: 0.78/0.91/1.08/1.56. Tarsal formula: I-11; II-24; III-3; IV-3.

Tarsal claws of first and second legs simple (Fig. 4A), first claw somewhat more sickle-shaped than second one; claws of third and fourth legs (Figs 4C-D) with lateral branches almost parallel to longer median prong, median prong and basal parts of branches dorso-ventrally flattened.

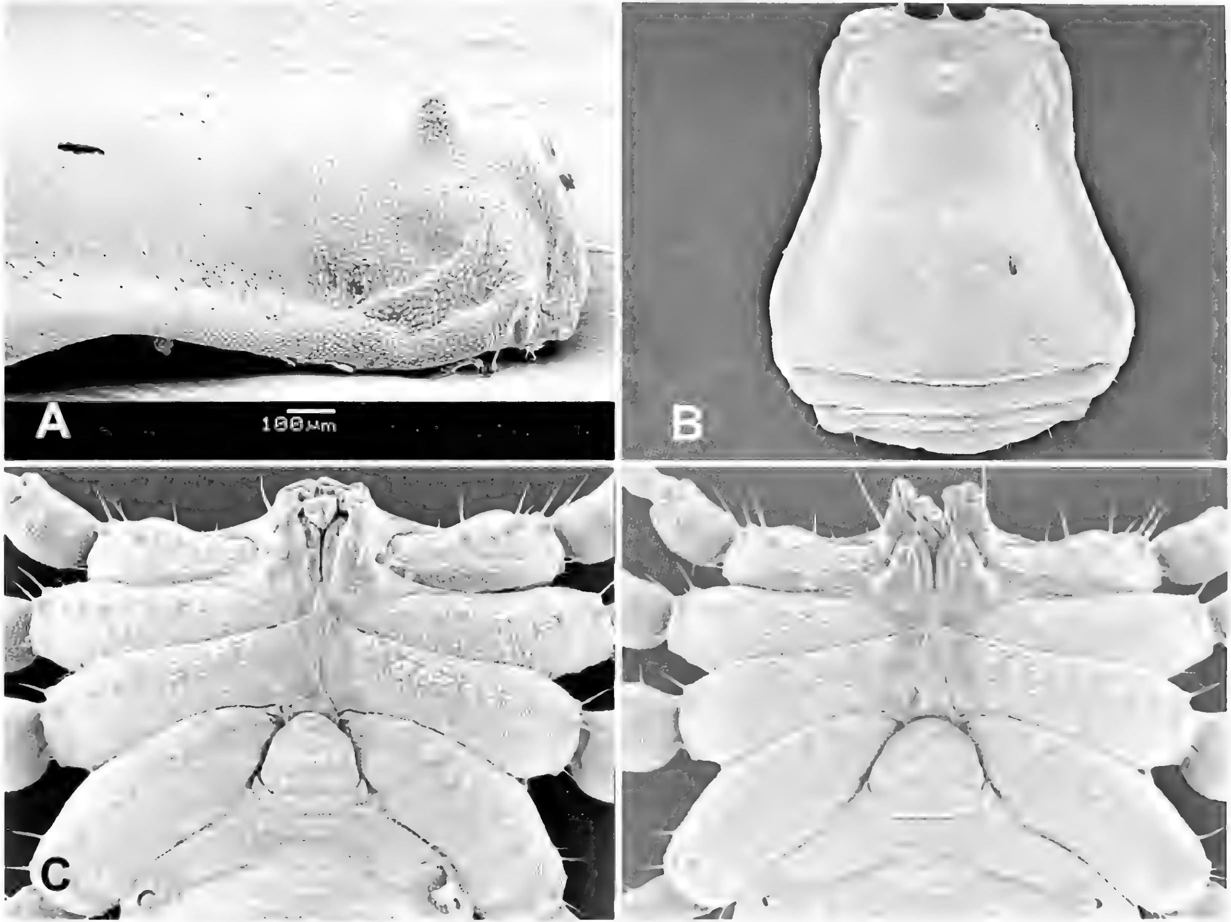

FIG. 2
Trojanella serbica gen. n., sp. n. (male paratype, 1.76 mm): **A**, anterior part of dorsal scutum, lateral view; **B**, dorsum, dorsal view; **C**, anterior part of body, ventral view. *T. serbica* gen. n., sp. n. (female paratype, 1.68 mm): **D**, anterior part of body, ventral view.

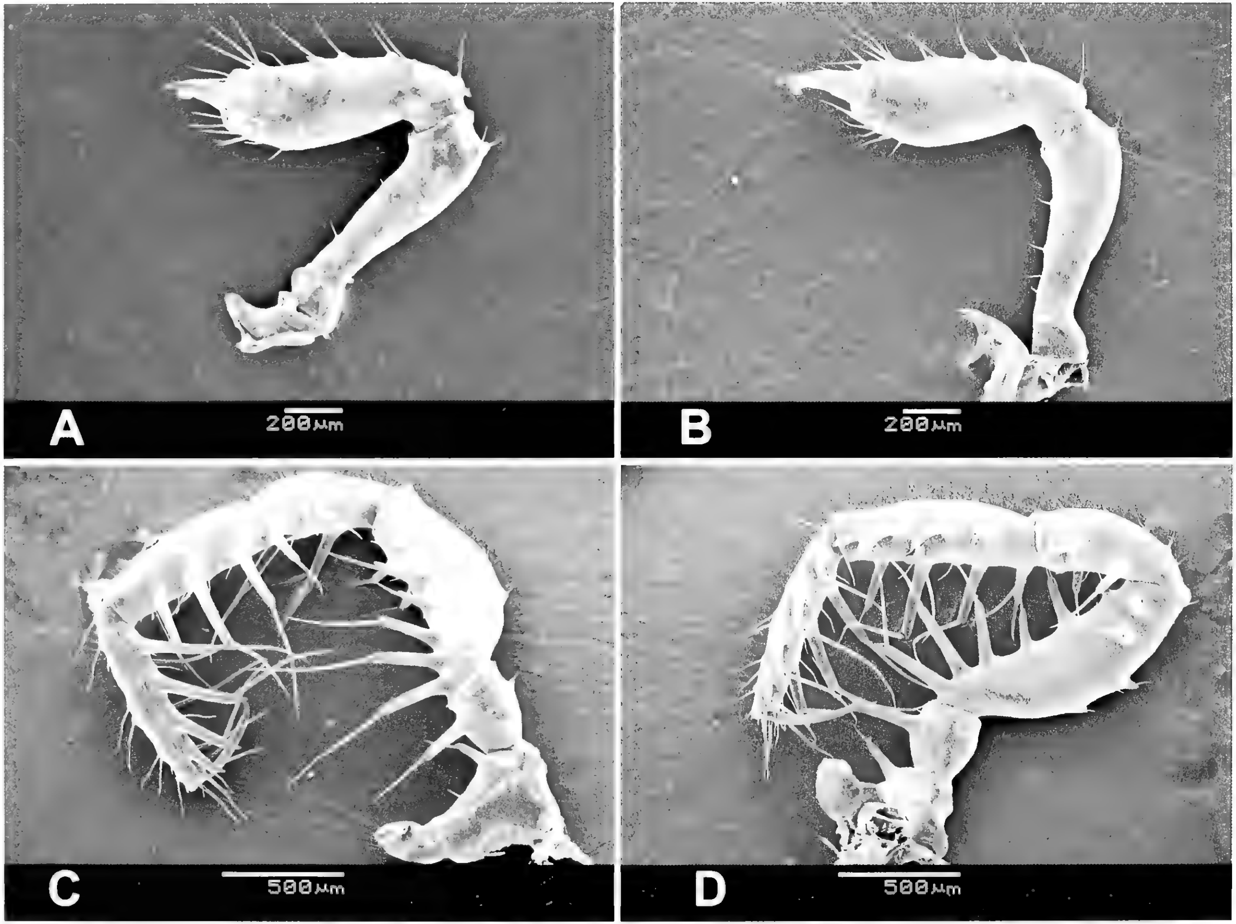

FIG. 3
Trojanella serbica gen. n., sp. n. (male paratype, 1.76 mm): **A**, chelicera, inner view; **B**, chelicera, outer view; **C**, pedipalp, outer view; **D**, pedipalp, inner view.

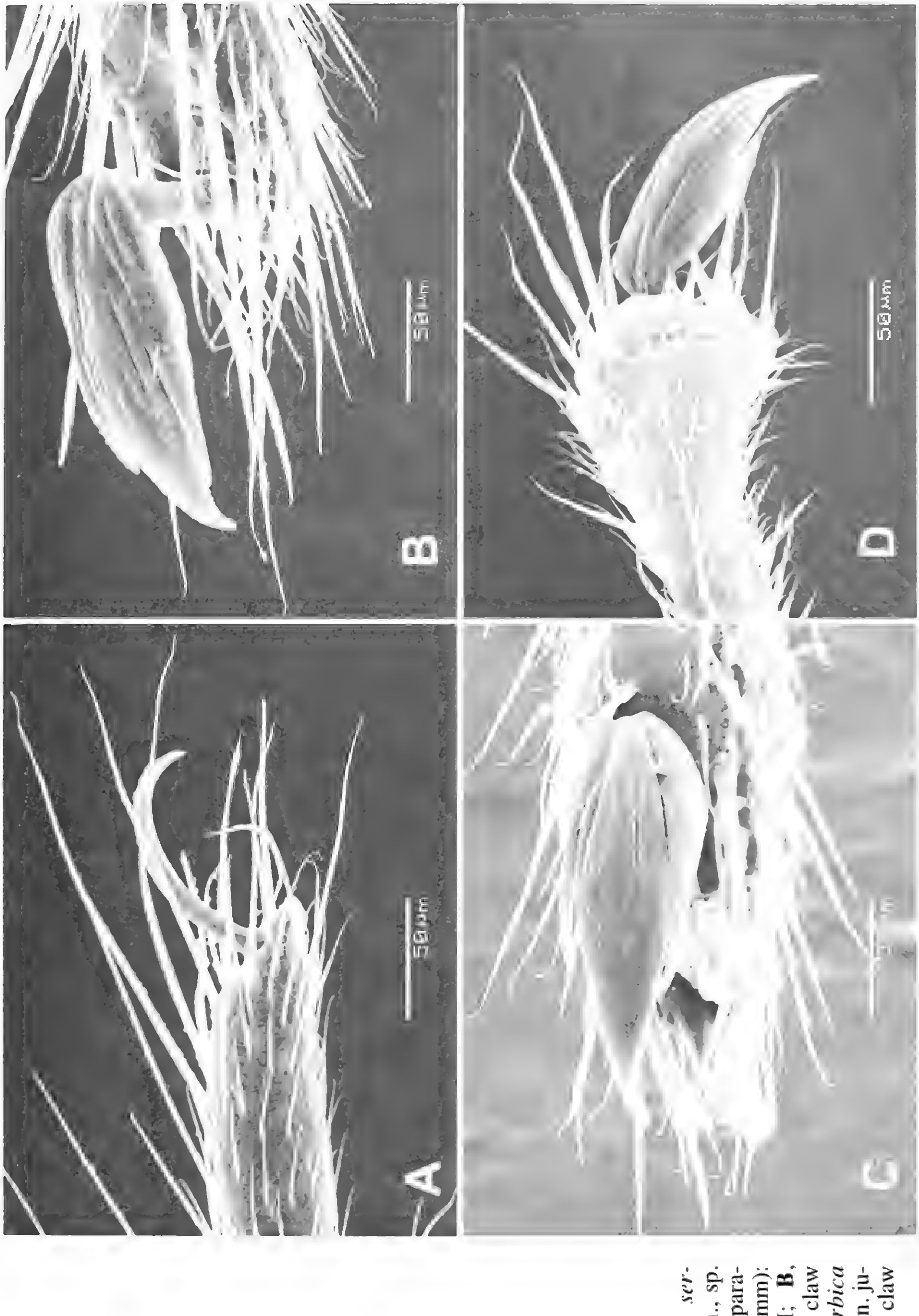

Fig. 4

Trojanella serbica gen. n., sp. n. (male paratype, 1.76 mm): **A**, claw I; **B**, claw III; **C**, claw IV; *T. serbica* gen. n., sp. n. juvenile: **D**, claw IV.

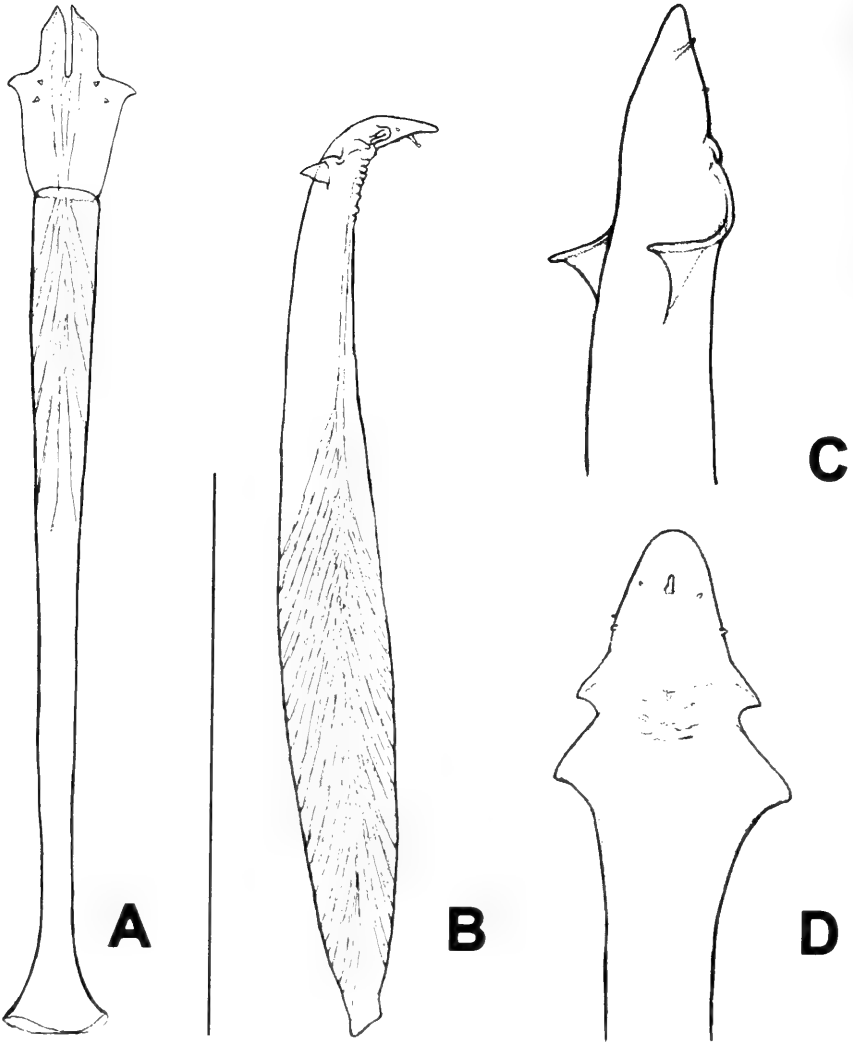

FIG. 5

Trojanella serbica gen. n., sp. n. (holotype): **A**, penis, ventral view. *Abasola hofferi* (male, 1.23 mm): **B**, penis (contracted), lateral view. *A. hofferi* (male, 1.43 mm): **C**, terminal part of penis, lateral view; **D**, penis terminal part, ventral view. Scale line: **A, B** = 500μ; **C, D** = 100μ.

Measurements of legs (in mm):

	Tr	*Fe*	*Pa*	*Ti*	*Mt*	*Ta*	*Σ*
Leg I	0.31	2.16	0.5	1.93	1.82	2.38	9.1
Leg II	0.36	3.44	0.7	3.22	3.19	4.9	15.81
Leg III	0.42	2.58	0.56	1.96	2.66	2.24	10.42
Leg IV	0.39	3.22	0.56	2.4	3.16	3.22	12.95

Penis (Fig. 5A; Figs 6A-D). Truncus elongated with wide basis, from the basal narrowing gradually widened toward the apex; musculature concentrated in distal part of truncus and in glans. Glans wide and flattened, terminally bifurcated, laterally with a pair of divergent tooth-like protrusions, ventrally with 2 pairs of short spines. Seminal opening situated in between branches of glans bifurcation, close to its ventral side (Fig. 6C, see arrow). Glans musculature composed of a median trapezoidal muscle extending through entire length of glans to apical parts of bifurcation (on inner side of each branch), and by smaller muscle bands situated on outer sides of bifurcation branches. Inner structure of glans complex, with 2 groups of cells (possibly glandular structures) lateral to trapezoidal muscle. This group of cells extended from terminal parts of truncus to level of lateral teeth-like protrusions. If these structures really represent glands, their canals could open on the tips of the bifurcation branches. Unfortunately the tiny membranous structures at the tip of the bifurcations as seen at high magnification under LM and SEM (Fig. 6D) does not allow me to reach a conclusion about the presence of glandular openings on them.*

Female: Similar to male in somatic characters but differs in lacking the medial conical apophyses on coxal lobes II. Genital operculum wider than in male (Fig. 2D). Body length (from frontal edge of dorsum) 1.54-1.91 mm. Ovipositor cylindrical, with 4 terminal lobes (Fig. 7A); ovipositor body and outer sides of dorsal and ventral lobes covered with sparse denticles; lateral lobes smooth, on the ventral side bearing 3 small spines, on the dorsal side 4-5 small spines; eight spherical receptacles in radial arrangement.

Intestinal complex. First pair of intestinal diverticula ramified in ramus anterior and ramus coxalis. Second pair of intestinal diverticula ramified in ramus transversalis and ramus longitudinalis. Third pair of intestinal diverticula with two rami - ramus medianus and ramus lateralis. Ramus medianus remarkably shorter than ramus lateralis; ramus lateralis in distal half rectangularly ventrally oriented. First half of the ramus lateralis on the distal end (at the place where it's rectangularly changing orientation to the ventral side) is heavily widened.

TRAVUNIIDAE Absolon & Kratochvíl, 1932

Abasola hofferi Šilhavý, 1936 Figs 5B-D, 8, 9

Material examined: From Pokljuka Gornja Cave (type locality), near the village of Knežlaz, Krivošije, Montenegro (Serbia & Montenegro), 1.07.1997 leg. I. Karaman: 1 ♂, 1 juv.; *ibid*., 9.07.1999, leg. S. Ognjenović: 1 ♂; Jama Duboka pothole, *ibid*., 15.09.2003, leg. S. Ognjenović: 1 juv.

Specimens are deposited in the author's collection at the Department of Biology and Ecology – Novi Sad (Serbia & Montenegro).

Dorsal scutum anteriorly with visible remnants of 2 tubercles (Fig. 8A). The anterior one, more pronounced and coarsely ornamented, is situated on the frontal edge of the dorsal scutum and probably represents the remnant of some larger protrusion. The other one is noticeably smaller and located more posteriorly and thus is presumably the remnant of an ocular tubercle.

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* Histological studies of the inner structure of the glans are undertaken by Prof. J. Martens and will be published in due time.

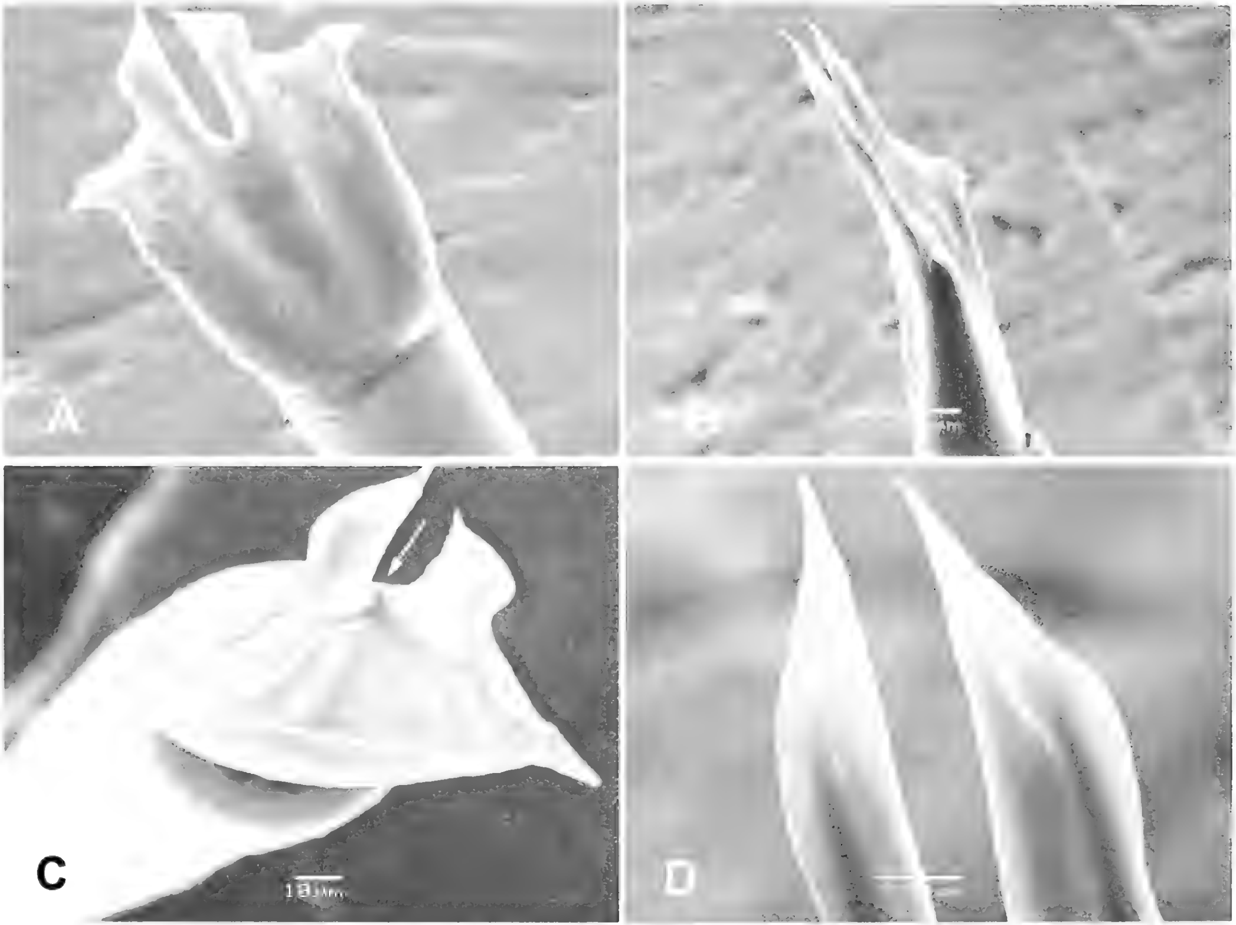

FIG. 6
Trojanella serbica gen. n., sp. n. (male paratype, 1.6 mm), penis: **A**, glans, ventral view; **B**, glans, lateral view; **C**, distal view of glans with seminal opening indicated by arrow; **D**, terminal part of glans bifurcation, dorsal view.

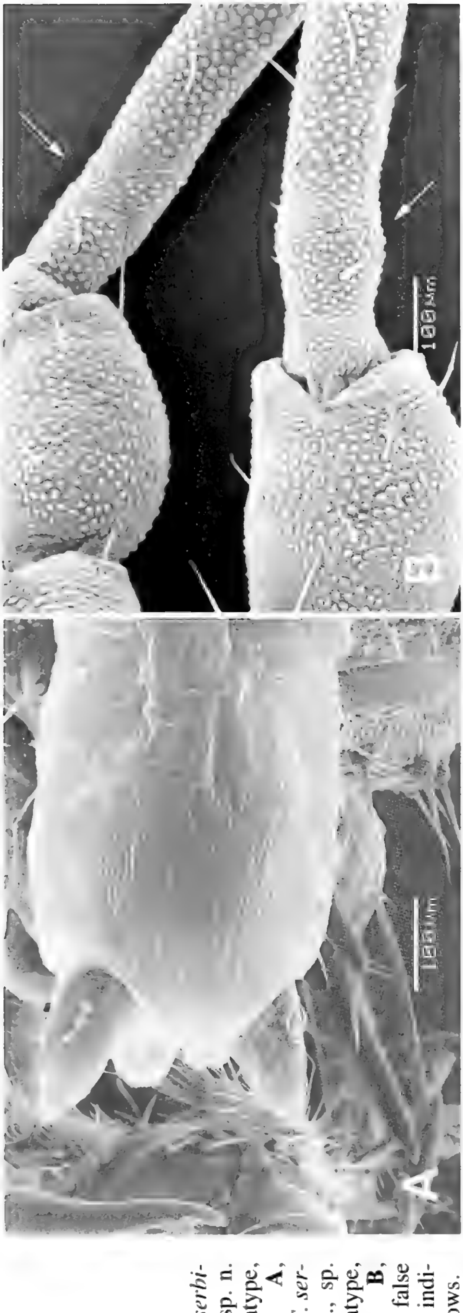

FIG. 7
Trojanella serbica gen. n., sp. n. (female paratype, 1.58 mm): **A**, ovipositor. *T. serbica* gen. n., sp. n. (male paratype, 1.76 mm): **B**, femur with false articulation indicated by arrows.

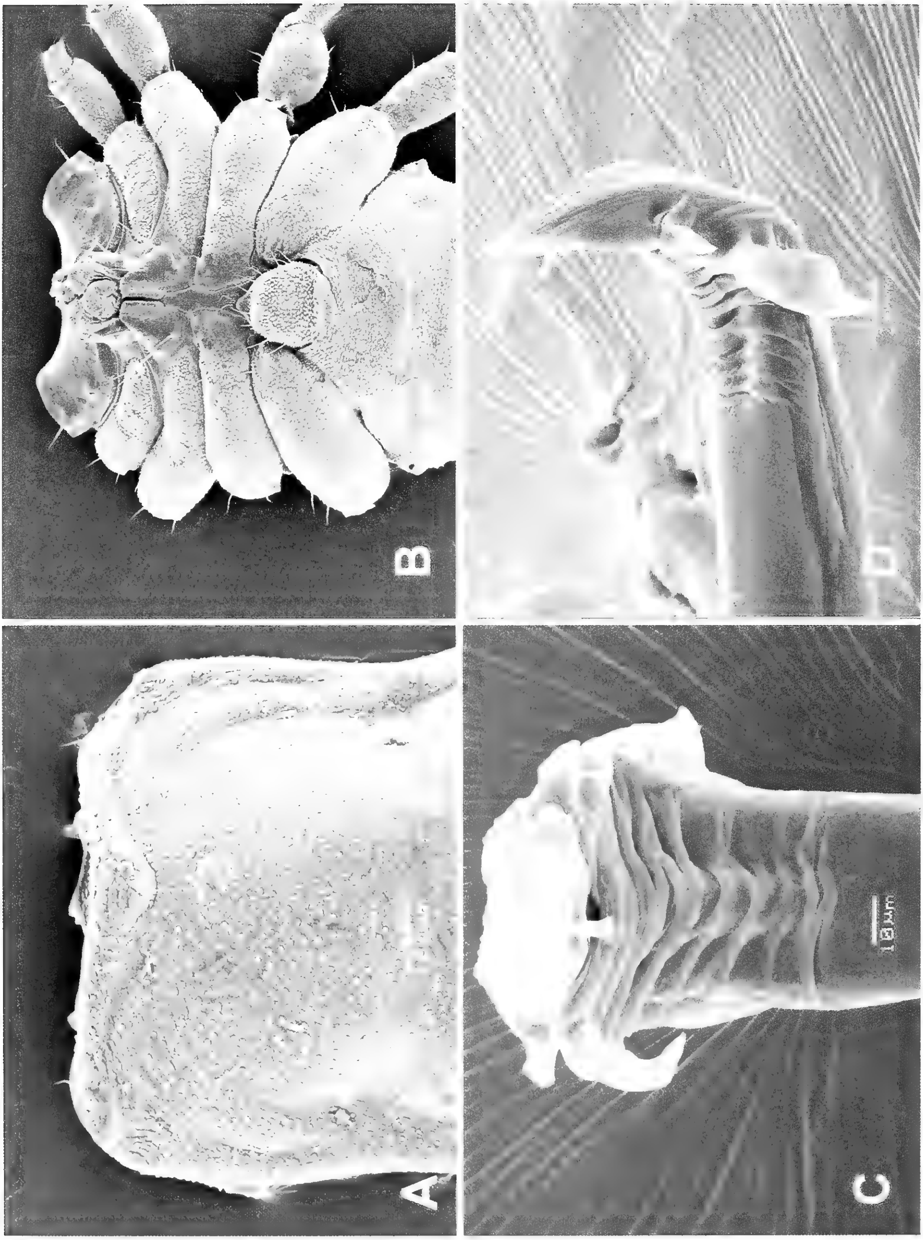

FIG. 8

Abasola hofferi (male, 1.23 mm): **A**, anterior part of dorsal scutum, dorsal view; **B**, anterior part of body, ventral view; **C**, terminal part of penis (contracted), ventral view; **D**, same, lateral view.

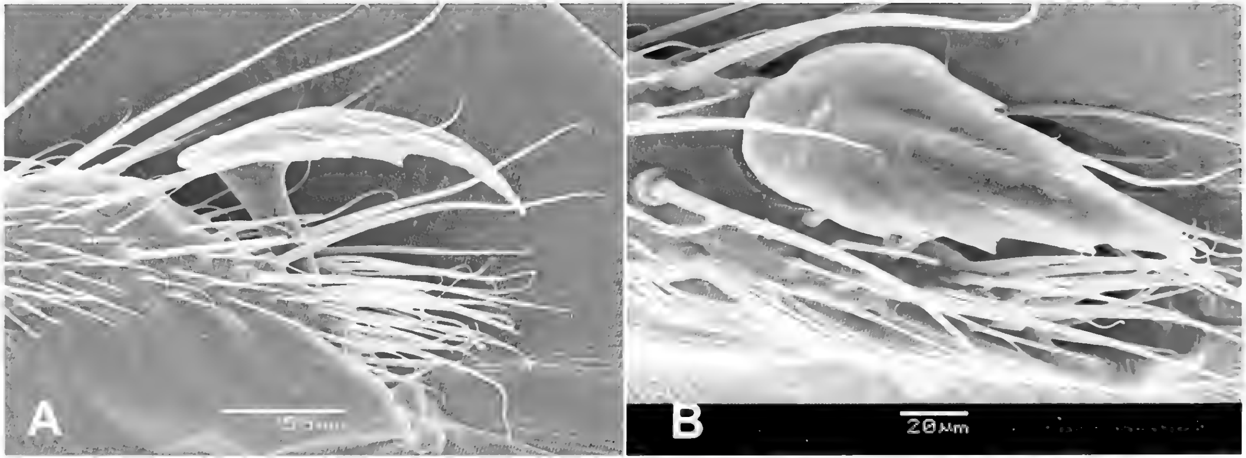

FIG. 9
Abasola hofferi (male, 1.23 mm): **A**, claw IV, lateral view; **B**, claw IV, dorsal view.

Penis structure (Figs 5B-D, 8C-D); truncus stout, basally and terminally narrowed, continuous with glans without clear transition; subterminally with two pairs of lateral membranous wing-like lamina, basal pair bigger and dorsally directed (Fig. 5C); ventral side of glans with a small subterminal stylus; 2 pairs of small spines subterminally, bigger one ventrolaterally above wing-like lamina, smaller one ventrally on both sides of stylus; a muscle in basal 2/3 of truncus.

DISCUSSION

With some details of their structures (primarily of the penis), the species *Trojanella serbica* gen. n., sp. n. and *Abasola hofferi* additionally complicate the already rather confusing classification of Travunioidea. It is difficult to single out any differentiating character used so far that could clearly define a particular family or subfamily of Travunioidea. Claw structure seems not so useful in family and subfamily classification of the Travunioidea, as it was summarised by Hunt & Hickman (1993) for Triaenonychidae. Too much attention was paid to this character and has sometimes caused absurd results. An example are species *Paranonychus brunneus* (Banks, 1911) from the north-west of North America and *Mutsunonychus fuscus* Suzuki, 1976 from the north-east of Japan, which are obviously congeneric. Based solely on claw structure, they were classified into two different subfamilies of the Triaenonychidae: Paranonychinae Briggs, 1971 and Kaolinonychinae Suzuki, 1975, respectively (Briggs, 1971; Suzuki, 1976). Dorsoventrally flattened claws III and IV (with central prong and side branches in the same plane) in *Trojanella serbica* gen. n., sp. n., although of the triaenonychid type, seem closer to the peltonychium type of claws present in *A. hofferi* (i.e. Dinaric travunioids) than to the claws of Triaenonychidae from the southern hemisphere (typical triaenonychid type).

Claw structure cannot be a defining character for the family Travuniidae either, because the obvious great differences in penis structures of Dinaric Travuniidae and the genus *Peltonychia* do not confirm their monophyletic origin. It can be assumed that the closeness by this character is a consequence of independent occurrence of the same, probably convergent neotenic characteristic. The current composition of the Travuniidae is also largely a result of a, in my opinion flawed, perception of Europe as a region with more or less homogeneous fauna. The genus *Trojanella* gen. n., Dinaric travuniids and Balkan Cyphophthalmi (as representatives of the old relictual fauna) suggest that a part of the Balkan fauna must have had a long and significant period of autonomous and independent development, in an isolated region (which surely must have had its own dynamics).

The sternum structure seems still useful in the classification of Travunioidea. Based on this character *Trojanella* gen. n. is close to Triaenonychidae. However, among Dinaric travuniids there are remarkable differences, from a wedge-shaped sternum in *Dinaria vjetrenicae* Hadži, 1932 (Hadži, 1932: fig. 6) to a wider sternum type with subterminal expansion in *A. hofferi,* and an almost Triaenobuninae type sternum in *Abasola borisi* Hadži, 1973 (Hadži, 1973: fig.15c).

The spiracle structure may be a character of importance for classifying Travunioidea. There are significant differences in spiracle structures among species discussed in this paper. *Trojanella serbica* gen. n., sp. n. has unconcealed spiracles, semicircular in shape, which are present also in south hemisphere Triaenonychinae. In *Abasola hofferi* the spiracles are small, rounded, exposed on a tubercle-like protrusion and laterally directed. This type of spiracle (exposed) is also present in some north hemisphere Travunioidea (Dinaric travuniids; Paranonychinae Briggs, 1971; Kaolinonychinae Suzuki, 1975; Nippononychinae Suzuki, 1975 and *Yuria pulcra* Suzuki, 1964). The concealed type of spiracles is present in south hemispheric Triaenobuninae and some north hemispheric Travunioidea, as well.

The penis structure and musculature are no doubt very important in the classification of this group. Yet, it seems that they have not been used consistently when defining certain taxonomic categories. One of the main differentiating characters of the family Cladonychiidae (Martens, 1978, 1986) is the basal position of penis musculature. However, according to Hadži's description and drawings (Hadži, 1935), the type species of the family, *Cladonychium corii* Hadži, 1935 [synonymized by Briggs (1969) with *Erebomaster acanthina* (Crosby & Bishop, 1924)] has the truncus with a fully developed muscle. Despite this significant deviation, the current composition of the family Cladonychidae, based on the penis structure, maybe is not questioned[*]. This discrepancy may be assigned to something which appears as a general tendency within the Travunioidea (and wider, within Opiliones) towards simplification of the terminal part of the penis (both structurally and functionally, causing reduction of the musculature) and prolongation of the truncus, followed by glans reduction (with subsequent displacement i.e. concentration of the remaining musculature in the widest, basal part of the truncus). This tendency (and gradual transition), ranging from the complex penis structure in Australian Triaenonychidae to the simple penis in species belonging to the genus *Peltonychia*, can manifest itself in various stages of reduction and changes in closely related taxa, which is considered to be the case with Cladonychidae, as well. It is also possible that cases of convergent similarity with respect to the penis structure may occur among phylogenetically remote taxa. *Trojanella serbica* gen. sp. n. deviates from this tendency because it is obvious that the terminal part of the penis (glans) is functionally very complex and highly apomorphic. The specific structure of the glans may be derived from the complex structure of the terminal part of the penis in Australian and South African triaenonychid taxa shown by Martens (1986) by complete reduction of the dorsal and dorsolateral plates and by merging the stylus with the ventral plate (i.e. "Sensillenträger"). With respect to the penis structure, this species represents an unique and isolated phylogenetic line in the superfamily.

It is interesting that the great heterogeneity of penis structures in Travunioidea is almost invariably followed by the presence of subterminal, laterally diverging structures (obviously functionally very important) of different structural types, from dorsolateral plates in south hemispheric genera to diverging thorns of the glans in the species of the genus *Peltonichya*. In *Trojanella* gen. n. they are present in the form of diverging teeth on the glans.

Penis structure in *A. hofferi* may also be derived from the complex types of Australian and South African triaenonychids. The basal pair of membranous wing-like lateral lamina may represent dorsolateral plates of the terminal part of the truncus,

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[*] But the ovipositor structure in Cladonychidae also shows remarkable differences. A comprehensive revision of this family is needed.

which most triaenonychids have. The part of the penis distally to these structures may be the glans, i.e. the ventral plate and the stylus that have become a glans. The structure of the penis in *D. vjetrenicae* may be derived from the penis structure of *A. hofferi*, the glans of which is greatly reduced and the dorsolateral plates strongly developed and with ventral orientation.

The structure of the intestinal complex could give useful data for phylogenetic consideration, however there are available data only for a few species (Dumitrescu 1974, 1976). Dumitrescu (1976) noticed differences in midgut anatomy between southern hemispheric and northern hemispheric Travunioidea. After him southern hemispheric Travunioidea posses the ramus exterior of the third pair of intestinal diverticula in comparison with species on the northern hemisphere. In *Trojanella serbica* gen. n., sp. n. absence of the ramus exterior is evident, but a widened median part of ramus lateralis could be interpreted as shortened and reduced "true ramus lateralis". In such interpretation the part distally of that widening could represent ramus exterior. In that case the midgut anatomy of *T. serbica* gen. n., sp. n., could represent a transition form between "southern" and "northern" type of the intestinal complex. To make final conclusions about taxonomic value and usefulness of the intestinal structure in solving problems in Travunioidea, details of this structure in higher number of species are needed.

Unfortunately I was not able to investigate completely the intestinal structure of *A. hofferi*.

Significant differences in the penis structure of *Abasola hofferi* and *Dinaria vjetrenicae* suggest that a diverse travuniid fauna (at least two genera and obviously more than two species) exists in one relatively small Dinaric region (south-eastern Herzegovina, southern Dalmatia and south-western Montenegro). So far six species in three genera – *Travunia*, *Abasola* and *Dinaria* – have been described, at times extremely superficially and uncritically (without any clear differentiating characteristics given for the genera). In at least two cases the descriptions are based on juvenile specimens. The confusing situation is additionally complicated by imprecise location data for some caves where certain species were recorded, and by unknown destiny of some specimens. In order to get a clearer picture of this undoubtedly distinct phyletic line of Travunioidea, it is necessary to obtain detailed information on the morphology of all the species described so far. Unfortunately this will be difficult in some cases. The terrain where the Durović pećina cave [type locality of *Abasola troglodytes* (Roewer,1915)] is situated has been devastated and made part of an airport complex (R. Ozimec in pers. comm.), while the Dejanova pećina cave (type locality of *Abasola borisi* Hadži, 1973) is now submerged in an artificial lake.

Once the Dinaric travuniids have been revised, the species *Dinaria vjetrenicae* and *Abasola hofferi* may no longer be placed in to the genera where they currently are.

Laniatorid *Paralola buresi* Kratochvîl,1951 inhabits the same regions as *T. serbica* gen. n., sp. n.(western part of Mt Stara Planina), and *Lola insularis* Kratochvîl, 1937 (both in the Phalangodoidea-Phalangodidae) is found in the south Dinaric region, like Dinaric travuniids. After comparing characteristics of the species *Trojanella serbica* gen. n., sp. n. and *Abasola hofferi* (as representatives of Dinaric travuniids) it is clear that both are phylogenetically very distant from each other. It would be interesting to research further into interrelations and phylogenetical distance of the genera *Paralola* and *Lola* (Phalangodidae) for the purpose of comparison.

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First records of Pauropoda (Millotauropodidae; Pauropodidae) from Gabon with the description of 16 new species (Pauropoda and Symphyla of the Geneva Museum XIV)

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First records of Pauropoda (Millotauropodidae; Pauropodidae) from Gabon with description of 16 new species (Pauropoda and Symphyla of the Geneva Museum XIV). - Two collections of Pauropoda (Myriapoda) from Gabon were studied. Twenty-three species were identified, 16 of them are new to science and are described here: *Allopauropus gabonicus* sp. n., *A. akonesis* sp. n., *A. barrai* sp. n., *A. ipassaensis* sp. n., *A. singesensis* sp. n., *A. cleofanus* sp. n., *A. cylindricus* sp. n., *A. suppeditatus* sp. n., *A. isodacintrai* sp. n., *A. stenygros* sp. n., *A. phakoides* sp. n., *A. bovistellus* sp. n., *A. lambdoides* sp. n., *Cauvetauropus pistillifer* sp. n., *Hemipauropus elongatus* sp. n., *H. bilobatus* sp. n. A key to the species of the subgenus *Perissopauropus* in *Allopauropus* is presented. Most species found in tropical West Africa have not been collected elsewhere, indicating a high degree of endemism. Species occurring outside West Africa more often have ranges including the islands of the Indian Ocean and/or south Asia rather than North or South Africa. The wide range element is poor in species.

Keywords: Myriapoda - taxonomy - soil fauna - Africa - biogeography.

INTRODUCTION

The Pauropoda of tropical West Africa have been studied by Remy, several papers in 1948-1962, and by Scheller, papers in 1975 and 1995. Their studies were based on material from Senegal, Gambia, Guinea, Sierra Leone, the Ivory Coast, Cameroon, Congo, and Angola but even if many species have been reported, the taxonomic and distributional knowledge of the West African pauropods is still very incomplete. One gap is partly filled by this study of the first collections from Gabon.

Prof. P. A. Remy (†) was one of the participants of the C.N.R.S. expedition to Gabon in 1962. Unfortunately he died right in the midst of the collection work there, but he and his colleagues, Dr G. Bernardi (†), Paris, Prof. B. Condé (†), Nancy, and Prof. P. P. Grassé (†), Paris, had the opportunity to collect in the Ogooué-Ivindo District in north-eastern Gabon, particularly in the neighbourhood of the Biological Station of Makokou. Their material has been studied here together with material collected by Dr J. A. Barra, Strasbourg, who studied the soil fauna SW of Makokou, of the Plateau Forestier d'Ipassa and of the Île aux Singes in the Ivindo River, 10 km

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downstream Makokou. The two collections, 342 specimens in all, included 23 species. Sixteen species are new to science are described below.

The material, preserved in alcohol, is deposited in the collections of the Department of Arthropods and Entomology I, Natural History Museum of Geneva.

ABBREVIATIONS AND MEASUREMENTS

Abbreviations: ad. ..., subad. ... and juv. ... = an adult, a subadult or a juvenile specimen with the number of pairs of legs indicated.

Measurements: length of the body in mm and range of variation in adult paratypes given in brackets. Indication of absolute lengths are always applicated with μm. Otherwise the text refer to relative lengths.

In the section Systematics the names of the collectors are given by surname only.

SYSTEMATICS

Order HEXAMEROCERATA

MILLOTAUROPODIDAE

Genus ***Millotauropus*** Remy, 1950

1. ***Millotauropus angustiramosus*** Remy Figs 1-3

Millotauropus angustiramosus Remy, 1955a: 117-118, figs 1-5.

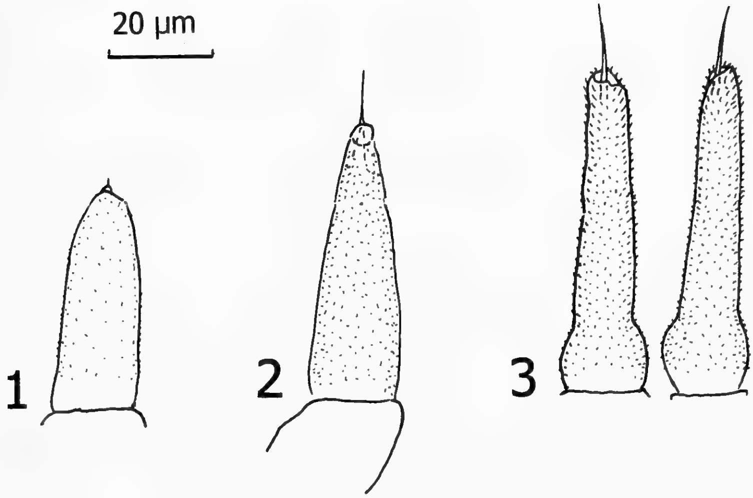
Material examined. Plateau Forestier d'Ipassa, primary forest, soil, 1 ad.(♂), 1 subad. 10(♀), 7.VI.1966 (loc. IPA5/E7); ibidem, 1 juv. 8(sex?), 11.VI.1966 (loc. IPA6/Cl 9); ibidem, at base of plant, 1 ad.(♀), 2 subad. 9(♂), 1 subad. 8(♀), 27.VI.1966 (loc. IPA9/AN2); ibidem, at base of fern, 1 subad.10(♂), 27.VI.1966 (loc. IPA9/AN3); ibidem, at base of fern, 1 subad. 9(♀), 27.VI.1966 (loc. IPA9/AN4); ibidem, at base of fern, 1 ad.(♀), 27.VI.1966 (loc. IPA9/AN5) (all leg. Barra). – Mbeza, secondary forest, near trail at old plantation, 1 ad.(♀), 20.II.1962 (loc. 5, leg. Condé). – Mayiga, left side of road to Booué, at trail near stream, 1 subad. 10(♂), 22.II.1962 (loc. 7, leg. Condé). – Makokou, dell with source, near the water intake, 1 subad. 8(♀), 18.VII.1962 (loc. 48, leg. Condé).

Total number. 13 specimens.

General distribution. The species is known from Angola only and was described by Remy (1955a) from the Lunda District. Later two more Angolan specimens were reported from two other districts, Cuanza-Norte and Cabinda (Scheller, 1975).

Taxonomic remarks. Remy had 3 subad. 10 specimens only when he erected the species and therefore his description is unusually brief. Though the specimens reported above are not in the best condition, it has been possible to emend the description in the following respects.

Antennae. Chaetotaxy of segments 4-6: $7+p$ / $6+R$ / $p+p'+p''+R'+f$. Distal part of flagella tapering, pointed. Their relative lengths (base segments included): $F = 100$, $F' = 256(-259)$. Antennal branch R on 5th segment cylindrical, 1.4 times as long as wide, its flagellum F 3.0 times longer than R. Distal branch R' subcylindrical, 1.3 times as long as its greatest diameter. Relative lengths of setae of segment 6 ($F = 100$): $p = (196\text{-})200(\text{-}207)$, $p' = (75\text{-})78(\text{-}81)$, $p'' = (45\text{-})47(\text{-}50)$. Forked organ f as long as basal



Figs 1-3
Millotauropus angustiramosus Remy, genital papillae. 1, subad. 9, right, anterior view; 2. subad 10, right, lateral view; 3, ad. 11, anterior view.

segment of *F'* and with 3 distally furcate end-branches. Antennal branches almost glabrous, but *R'*, basal segment of *F'* and basal part of *p* with short but distinct oblique pubescence.

Genital papillae (Figs 1-3). Base with convex sides, papilla straight, subcylindrical, somewhat tapering, 3.9 times as long its greatest diameter; seta 0.4 of the length of organ; pubescence usually very short, most distally distinct, dense, oblique. Seta on coxa of leg 2 as other coxal setae of anterior legs.

Papillae in subad. 10 conical, with convex sides, 3.3 times as long as their greatest diameter; seta 0.3 of the length of organ, in subad. 9 subcylindrical, distal part strongly tapering and with a very short distal seta; pubescence minute, dense.

Pygidium. Remy (1955a) said that the *st* were very thin and according to his fig. 1 they were glabrous too. In the material from Gabon, and in the Angolan specimens studied by me, they are proportionately shorter and with a few hairs. A few characters of the pygidial sternum are deviating too. The setae b_1 in the Gabon specimens are tapering, not subcylindrical, and they are longer than their interdistance, not 0.8 of that length. Moreover are the branches of the anal plate tapering in the distal half, not cylindrical. The latter character was found also in the Angolan specimens.

Order TETRAMEROCERATA

PAUROPODIDAE

Genus ***Allopauropus*** Silvestri, 1902
Subgenus ***Allopauropus*** s. str.

2. *Allopauropus (A.) bicornis* Remy

Allopauropus bicornis Remy, 1948a: 568-569, fig. 1.

Material examined. Plateau Forestier d'Ipassa, primary forest, litter, 1ad. 9(♀) 23.VI.1966 (loc. IPA8/IVI5, leg. Barra). – Mbeza, secondary forest, near trail at old plantation, 1 juv. 6, 20.II.1962 (loc. 5, leg. Condé).

Total number. 2 specimens.

General distribution. Known from tropical Africa only: Kenya (Remy, 1948a) and Angola (Scheller, 1975).

3. *Allopauropus (A.) dundoensis* Remy

Allopauropus dundoensis Remy, 1955a: 121-122, fig. 3.

Material examined. Mbeza, secondary forest, near trail at old plantation, 1 subad. 8(♀), 20.II.1962 (loc. 5, leg. Condé).

Total number. 1 specimen.

General distribution. A. (A.) dundoensis has been collected on both sides of the Atlantic, in Amazonia (Scheller, 1994, 1997) and in Angola (Remy, 1955a; Scheller, 1975).

4. *Allopauropus (A.) sphaeruliger* Remy

Allopauropus sphaeruliger Remy, 1948b: 116-117, fig. 1.

Material examined. Plateau Forestier d'Ipassa, primary forest, under piece of wood, 1 ad. 9(♀), 11.VI.1966 (loc. IPA6/C15, leg. Barra); ibidem, soil, 1 juv. 3, 23.VI.1966 (loc. IPA8/AVCT3, leg. Barra).

Total number. 2 specimens.

General distribution. A. (A.) sphaeruliger is widely distributed in tropical Africa and has been collected in south and east Asia as well. Previous African records are from Gambia (Remy, 1958a), the Ivory Coast (Remy, 1948b, 1952a, 1953), Angola (Scheller, 1975), Madagascar (Remy, 1956b; Remy & Rollet, 1960), Réunion (Remy, 1956b), Mauritius (Remy, 1959b).

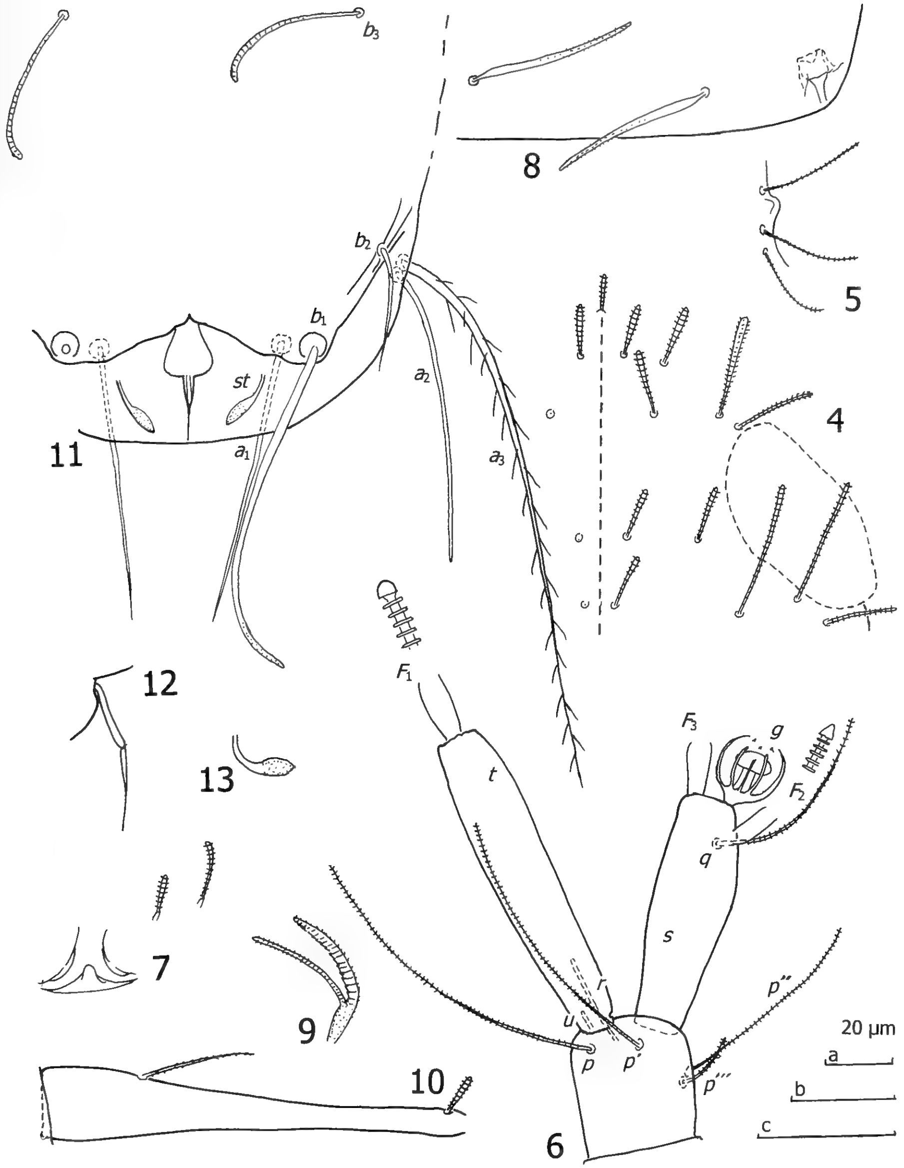
5. *Allopauropus (A.) gabonicus* sp. n. Figs 4-13

Type material. **Holotype**: ad. 9(♀), GABON, Plateau Forestier d'Ipassa, primary forest, soil, 20.V.1966 (loc. I PA3/4, leg. Barra).

Other material. Plateau Forestier d'Ipassa, primary forest, soil, 1 juv. 6 (moulting), 7.VI.1966 (loc. IPA5/E8); ibidem, 1 juv. 3, 23.VI.1966 (loc. IPA8/AMC2); ibidem, at base of plant, 1 juv. 3, 27.VI.1966 (loc. IPA9/AN4, leg. Barra).

Total number. 4 specimens.

Diagnosis. The new species is close to *Allopauropus (A.) aculeatus* Remy and *A. (A.) stilifer* Remy, from Congo (Remy, 1954) and Angola (Remy, 1955a), respectively. These three species together form a homogenous group characterized by great similarities in the shape of the anal plate and in the general chaetotaxy of the pygidial tergum. The anal plate is narrowest anteriorly, linguiform and with a single stiletto-shaped appendage, and the setae of the pygidial tergum are of very similar shape and length. *A. gabonicus* sp. n. is distinguished from both *A. aculeatus* and *A. stilifer* in the pubescence of the pygidial setae a_3 (strong sparse hairs in *A. gabonicus* sp. n., very short or glabrous in *A. aculeatus* and *A. stilifer*) and the shape of the sternal antennal branch (subcylindrical with indistinct anterior truncation in *A.* -



Figs 4-13

Allopauropus (A.) gabonicus sp. n., holotype, ad. 9(♀). 4, head, median and right part, tergal view; 5, lateral group of setae and posterior margin of right temporal organ; 6, left antenna, tergal view; 7, collum segment, median and left part, sternal view; 8, tergite VI, posterior part; 9, seta on trochanter of leg 9; 10, tarsus of leg 9; 11, pygidium, median and left part, sternal view; 12, anal plate, lateral view; 13, stylus, lateral view. Scale a: Figs 4-5, 7-8, 10; b: Figs 9, 11; c: Figs 6, 12-13.

gabonicus sp. n., truncated posteriorly too in *A. stilifer* and proportionately short and wide in *A. aculeatus*). Moreover is the antennal globulus different (large spherical in *A. gabonicus* sp. n., very small in *A. aculeatus* and longish in *A. stilifer*).

Etymology. A latinized adjective of the name Gabon.

DESCRIPTION

Length. 1.02 mm.

Head (Figs 4, 5). Tergal setae blunt, striate, median ones rather long, clavate; some lateral ones long, (sub)cylindrical. Relative lengths of setae, 1st row: $a_1 = 10$, $a_2 = 11$; 2nd row: $a_1 = 13$, $a_2 = 20$, $a_3 = 17$; 3rd row: $a_1 = 10$, $a_2 = 11$; 4th row: $a_1 = 11$, $a_2 = 27$, $a_3 = 25$, $a_4 = 15$; lateral group: $l_1 = 21$, $l_2 = 20$, $l_3 = 15$. Ratio $a_1/a_1 - a_1$ is in 1st, 3rd and 4th rows 1.1, in 2nd row 0.6. No posterior aperture in temporal organs. Other parts of these organs not studied. Head cuticle glabrous.

Antennae (Fig. 6). Segment 4 with 6 setae, these cylindrical, distally tapering, striate. Relative lengths of setae: $p = 100$, $p' = 84$, $p'' = 62$, $p''' = 18$, $r = 32$, $u = 12$. Tergal seta p 1.1 times as long as tergal branch t. The latter somewhat fusiform, 5.1 times as long as its greatest diameter and 1.3 times as long as sternal branch s, the latter 2.9 times as long as its greatest diameter and with its anterodistal corner somewhat truncate. Seta q somewhat thinner than p'', cylindrical, blunt, striate, 0.8 of the length of s. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 8$; $F_2 = 42$, $bs_2 = 7$; $F_3 = 73$, $bs_3 = 8$. F_2 thinnest. F_1 2.5 times as long as t, F_2 and F_3 1.6 and 2.5 times as long as s respectively. Distal calyces of F_1 and F_3 hemispherical, those of F_2 smaller and conical. Globulus g 1.1 times as long as wide; 8-9 bracts of unequal lengths; width of g 1.1 times as wide as greatest diameter of t. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 7) simple, subcylindrical, blunt, striate, sublateral ones 1.7 times as long as submedian ones; sternite process low, blunt, glabrous; appendages short, subhemispherical with flattened caps, glabrous.

Setae on anterior tergites as submedian setae on head; on posterior tergites longer, most posteriorly tapering and shortly pubescent. 4+4 setae on tergite I, 6+6 on II-IV, 6+4 on V and 4+2 on VI. Posterior setae on tergite VI (Fig. 8) 0.7 of their interdistance and 0.9 of the length of pygidial setae a_1.

Bothriotricha. Relative lengths: $T_1 = 100$, $T_2 = 98$, $T_3 = ?$, $T_4 = 136$, $T_5 = 216$. All with very thin axes, those of T_3 thickest; pubescence minute.

Legs. Setae on coxa and trochanter (Fig. 9) of leg 9 furcate, branches curved, subequal in length; primary one thickest, tapering, pointed, striate, secondary one cylindrical, blunt, indistinctly striate. Corresponding setae on more anterior legs not studied.

Tarsus of leg 9 (Fig. 10) tapering, 5.4 times as long as its greatest diameter, very slender, distal part subcylindrical. Proximal seta tapering, pointed, with very short oblique pubescence, 1/4 of the length of tarsus, 2.5 times as long as distal seta, the latter somewhat clavate, striate. Cuticle of tarsus almost glabrous.

Pygidium (Fig. 11). *Tergum.* Posterior margin rounded. Relative lengths of setae: $a_1 = 100$, $a_2 = 104$, $a_3 = 202$, $st = 23$. a_1 and a_2 tapering, glabrous, the former straight, pointed, converging, the latter curved inwards and diverging. a_3 and st

(Fig. 13) curved inwards, the former tapering, pointed, diverging and with sparse, oblique, long pubescence, the latter clavate, converging, almost glabrous. Distance $a_1 - a_1$ 0.6 of the length of a_1, distance $a_1 - a_2$ 4.3 times as long as distance $a_2 - a_3$; distance $st - st$ 2.3 times as long as st and 0.8 of distance $a_1 - a_1$.

Sternum. Posterior margin between b_1 with broadly V-shaped indentation. Relative lengths of setae ($a_1 = 100$): $b_1 = 131$, $b_2 = 45$, $b_3 = 64$. b_1 and b_3 subcylindrical, the former with very faint pubescence most distally, the latter somewhat striate; b_2 tapering, pointed, glabrous. $b_1$1.4 times as long as their interdistance; b_2 about as long as distance b_1 - b_2; b_3 0.5 of distance $b_3 - b_3$.

Anal plate (Fig. 12) directed downwards, about as broad as long, narrowest anteriorly, lateral margins almost straight, posterolateral corners rounded and posterior margin straight; stiletto-shaped appendage, as long as the plate, protruding backwards from middle of posterior margin.

6. *Allopauropus (A.) akonesis* sp. n. Figs 14-22

Type material. **Holotype**: ad. 9(♀), GABON, 11 km W Makokou, at road to Booué, forest near Ntsibelong, 19.II.1962 (loc. 4, leg. Condé). **Paratypes**: same data as for holotype, 7 ad. 9(♀), 3 subad. 8(♀), 1 juv. 6.

Other material. Same data as for holotype, 2 juv. 5, 11 km W Makokou, at road to Booué, forest near Ntsibelong, right bank of the Ivindo River, 2 ad. 9(♀), 19.II.1962 (loc. 3B, leg. Condé). – Mayiga, Endoumé, old plantation near the village, soil, 6 ad. 9(♀), 2 subad. 8(♀), 3 juv. 6, 1 juv. 5, 1 juv. 3, 21.II.1962 (loc. 7, leg. Condé); ibidem, forest near the village, 1 ad. 9(♀), 1 juv. 6, 1 juv. 5, 21.II.1962 (loc. 7, leg. Condé & Remy); Mayiga, forest near road to Booué, at trail, 2 subad. 8(♀), 22.II.1962 (loc. 8, leg. Condé & Remy). – Loualouah, right bank of the Ivindo River, 1 ad. 9(♀), 1 subad. 8(♀), 8.III.1962 (loc. 3bis, leg. Grassé); ibidem, right bank of the Ivindo River, under piece of wood, 4 ad. 9(♀), 1 juv. 6, 1 juv. 5, 1 juv. 3, 10.III.1962 (loc. 3, leg. Grassé); ibidem, 1 ad. 9(♀), under piece of wood, 8-10.III.1962 (loc. 23, leg. Condé & Remy). – Edoungavion, 1 ad. 9(♀), 19.II.1962 (loc. 4, leg. Condé & Remy) and 2 ad. 9(♀), 2.III.1962 (loc. 15bis, leg. Condé); ibidem, at beginning of trail to Alarmintang, near stream, under piece of wood, 1 ad. 9(♀), 2.III.1962 (loc. 15, leg. Condé). – Belinga, at trail along the drinking-water pipe, under piece of wood, 2 ad. 9(♀), 2 subad. 8(♀), 1 juv. 5, 16.III 1962 (loc. 33bis, leg. Condé); Belinga, 1 ad. 9(♀), 3 subad. 8(♀), 4 juv. 6, 4 juv. 5, 17.III.1962 (loc. 35, leg. Condé & Bernardi); Belinga, under small stone, 1 ad. 9(♀), 1 juv. 6, 22.VII.1 962 (loc. 55, leg. Condé). – Mvadhi, end of trail to Dubost forest, under stones in laterite, 2 subad. 8(♀), 9.IX.1962 (loc. 101, leg. Condé); ibidem, miners crossroad, under stones, 2 ad. 9(♀), 24.IX.1962 (loc. 107, leg. Condé).

Total number. 69 specimens.

Diagnosis. The new species is close to *Allopauropus (A.) stilifer* and *A. (A.) aculeatus*, the former described from Angola (Remy, 1955a) and the latter from Belgian Congo (Remy, 1954) later also reported from Angola (Remy, 1955a). Together with the preceding species, *A. (A.) gabonicus* sp. n., these three species form a homogenous group characterised by great similarities in the shape of the anal plate and in the general chaetotaxy of the pygidial tergum. The anal plate is narrowest anteriorly, linguiform and with a single stiletto-shaped posterior appendage, and the setae of the pygidial tergum are of similar shape and length. *A. (A.) akonesis* sp. n. is distinguished from *A. (A.) stilifer* by the shape of the sternal antennal branch [only anterodistal corner truncated in *A. (A.) akonesis* sp. n., both anterior corners truncated in *A. (A.) stilifer*], the *st* [straight and distinctly fusiform in *A. (A.) akonensis* sp. n., thinner, curved inwards and clavate in *A. (A.) stilifer*], the shape of the posterior margin of the pygidial sternum [median indentation deep with steep lateral margins in *A. (A.) akonesis* sp. n., shallow and with rounded inner margins in *A. (A.) stilifer*]. There are dissimilarities in the shape of the anal plate too [appendage with two small knobs at its base and appendage itself probably perforated and with convex margins in *A. (A.) akonesis* sp. n., straight margin and neither knobs nor perforation in *A. (A.) stilifer*]. Many characters separate *A. (A.) akonesis* sp. n. from *A. (A.) aculeatus,* e.g. the shape of the tergal antennal branch [very slender, 6.0-6.5 times as long as its greatest diameter in *A. (A.) akonesis* sp. n., 3 times as long as its greatest diameter in *A. (A.) aculeatus* Remy], the globulus *g* [distinct conical stalk in *A. (A.) akonesis* sp. n., short-stalked in *A. (A.) aculeatus*]. Moreover, the appendage of the anal plate is at least as long as the plate in *A. (A.) akonesis* sp. n., about 0.3 of the length of the plate in *A. (A.) aculeatus*) and the b_3 are proportionately much longer in *A. (A.) akonesis* sp. n. than in *A. (A.) aculeatus*.

Etymology. From Greek akonesis = forming a sharpening (referring to the pointed appendage of the anal plate).

DESCRIPTION

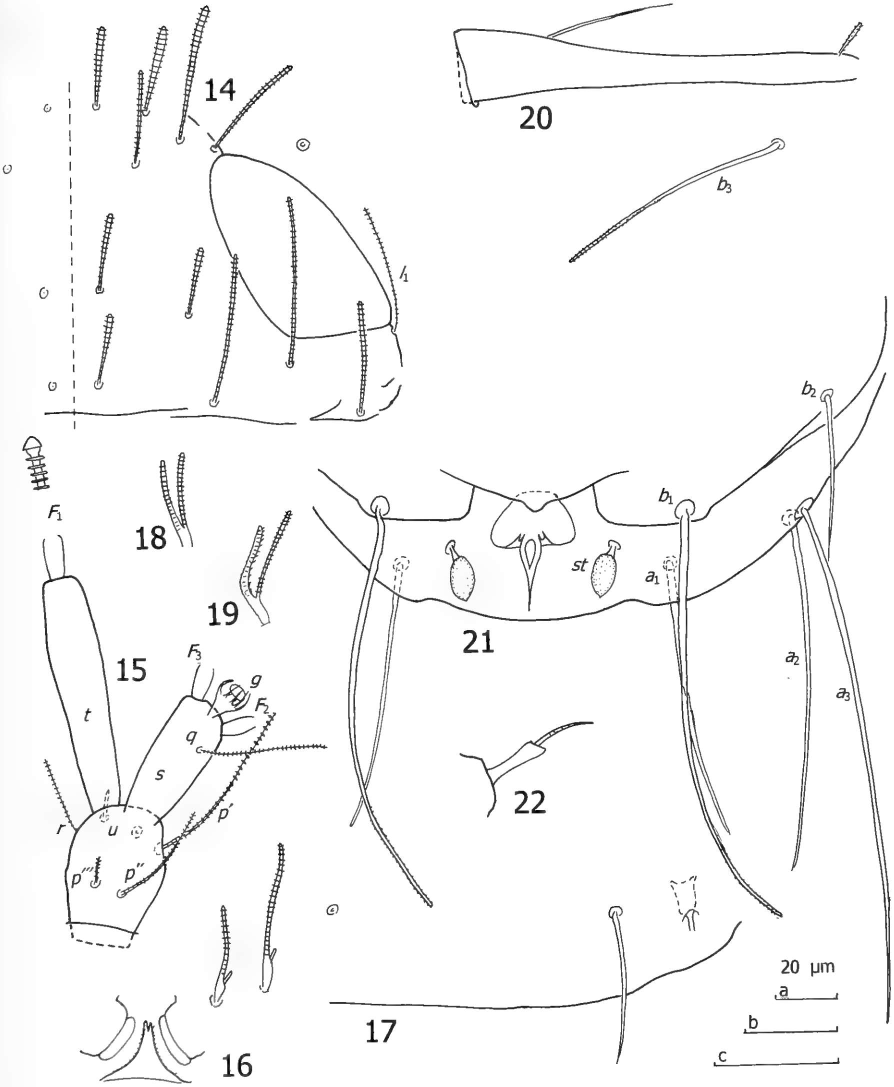
Length. (1.20-)1.39(-1.52) mm.

Head (Fig. 14). Tergal setae blunt, striate, median ones rather long, somewhat clavate; some lateral ones long, (sub)cylindrical. Relative lengths of setae, 1st row: $a_1 = 10$, $a_2 = 12$; 2nd row: $a_1 = 12$, $a_2 = (16\text{-})18$, $a_3 = 15(\text{-}16)$; 3rd row: $a_1 = 9$, $a_2 = 9(\text{-}10)$; 4th row: $a_1 = 9(\text{-}10)$, $a_2 = 19(\text{-}21)$, $a_3 = (19\text{-})22$, $a_4 = 14(\text{-}15)$; lateral group: $l_1 = 18(\text{-}19)$, $l_2 = 15(\text{-}18)$, $l_3 = 22(\text{-}24)$. The ratio $a_1/a_1 - a_1$ is in 1st row (1.4-)1.5, 2nd row 0.7, 3rd row (1.1-)1.3 and 4th row 1.5. Length of temporal organs (0.7-)0.8 of their shortest interdistance; neither pistil nor posterior aperture present. Head cuticle glabrous.

Antennae (Fig. 15). Segment 4 with 6 thin, cylindrical, distally tapering, striate setae. Relative lengths of setae: $p = 100$, $p' = 84(\text{-}88)$, $p'' = (47\text{-})48(\text{-}52)$, $p''' = 10(\text{-}15)$, $r = (31\text{-})32(\text{-}33)$, $u = (10\text{-})12$. Tergal seta p as long as tergal branch t. The latter somewhat fusiform, 6.0(-6.5) times as long as its greatest diameter and (1.3-)1.5 times as long as sternal branch s, the latter (2.3-)2.4(-2.7) times as long as its greatest diameter and with truncate anterodistal corner. Seta q somewhat thinner than p'', cylindrical, blunt, striate, (0.7-)0.8 of the length of s. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 5$; $F_2 = 33(\text{-}47)$, $bs_2 = 4$; $F_3 = 73(\text{-}88)$, $bs_3 = 5(\text{-}6)$. Flagella similar in thickness; F_1 (3.1-)3.5 times as long as t, F_2 and F_3 (1.7-)1.8(-2.3) and (3.6-)3.8(-3.9) times as long as s respectively. Distal calyces conical, with rounded tip. Globulus g (1.3-)1.4 times as long as wide; ≈ 10 thin bracts present; width of g (1.3-)1.4 times as long as wide and 0.9 of greatest diameter of t. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 16) furcate, subcylindrical, somewhat tapering, striate, secondary branch rudimentary, blunt, glabrous. Sublateral setae 1.5 (-1.6) times as long as submedian ones; sternite process with broad base, anterior part narrow, incised distally; appendages short, wide, with flattened caps. Process and appendages with faint pubescence.

Setae on anterior tergites as submedian setae on head; on posterior tergites longer, most posteriorly tapering and almost glabrous. 4+4 setae on tergite I, 6+6 on



Figs 14-22

Allopauropus (A.) akonesis sp. n., holotype, ad. 9(♀). 14, head, median and right part, tergal view; 15, right antenna, sternal view; 16, collum segment, median and left part, sternal view; 17, tergite VI, right posteromedian part; 18, setae on coxa of leg 9; 19, seta on trochanter of leg 9; 20, tarsus of leg 9; 21, pygidium, median and left part, sternal view; 22, anal plate, lateral view. Scale a: Figs 16-20; b: Figs 14-15; c: Figs 21-22.

II-IV, 6+4 on V and 4+2 on VI. Posterior setae on tergite VI (Fig. 17) (0.5-)0.7 of their interdistance and 1.1(-1.2) times as long as pygidial setae a_1.

Bothriotricha. Relative lengths: $T_1 = 100$, $T_2 = (98\text{-})104$, $T_3 = (106\text{-})112(\text{-}114)$, $T_4 = ?(123)$, $T_5 = ?(189\text{-}198)$. All possessing very thin axes with short oblique pubescence.

Legs. Setae on coxa (Fig. 18) and trochanter (Fig. 19) of leg 9 furcate, branches similar, cylindrical, blunt, striate, subequal in length on coxa, secondary branch longest on trochanter. Corresponding setae on more anterior legs with rudimentary secondary branches.

Tarsus of leg 9 (Fig. 20) tapering, (5.6-)5.9(-6.3) times as long as its greatest diameter, in middle and distal parts very slender, distal 2/3 subcylindrical. Proximal seta tapering, pointed, with very short oblique pubescence, (0.3-)0.4 of the length of tarsus, (3.3-)3.6 times as long as distal seta, the latter is somewhat clavate, with short oblique pubescence. Cuticle of tarsus almost glabrous.

Pygidium (Fig. 21). *Tergum*. Posterior margin rounded but with shallow indentations outside *st*. Relative lengths of setae: a_1 = 100, a_2 = (119-)128, a_3 = (204-) 255, *st* = 20(-23). a_1, a_2 and a_3 long, thin, tapering, glabrous, somewhat diverging, a_1 curved outwards, a_2 and a_3 curved inwards; *st* straight, bladder-shaped, tapering distally, converging, faintly pubescent. Distance $a_1 - a_1$ about as long as a_1, distance $a_1 - a_2$ about 6 times longer than distance $a_2 - a_3$; distance *st* – *st* (2.7-)2.9 times as long as *st* and (0.5-)0.6 of distance $a_1 - a_1$.

Sternum. Posterior margin between b_1 with median indentation having steep sides; a median, broadly triangular lobe below anal plate. Relative lengths of setae (a_1 = 100): b_1 = 135(-155), b_2 = (57-)60(-65), b_3 = (74-)89. b_1 and b_3 of similar shape, thin, tapering, blunt, very short pubescence or striate only most distally; b_2 tapering, pointed, glabrous. $b_1$1.4(-1.5) times as long as their interdistance; b_2 (0.8-)0.9 of distance $b_1 - b_2$; b_3 0.5 of distance $b_3 - b_3$.

Anal plate (Figs 21, 22) directed obliquely upwards, narrowest anteriorly, broader than long, lateral margins convex, posterolateral corners rounded and posterior margin straight. A stiletto-shaped appendage protruding backwards from posterior margin. Appendage longer than plate and with two small knobs at base and probably a perforation in the middle of basal part.

7. ***Allopauropus (A.) barrai*** sp. n. Figs 23-31

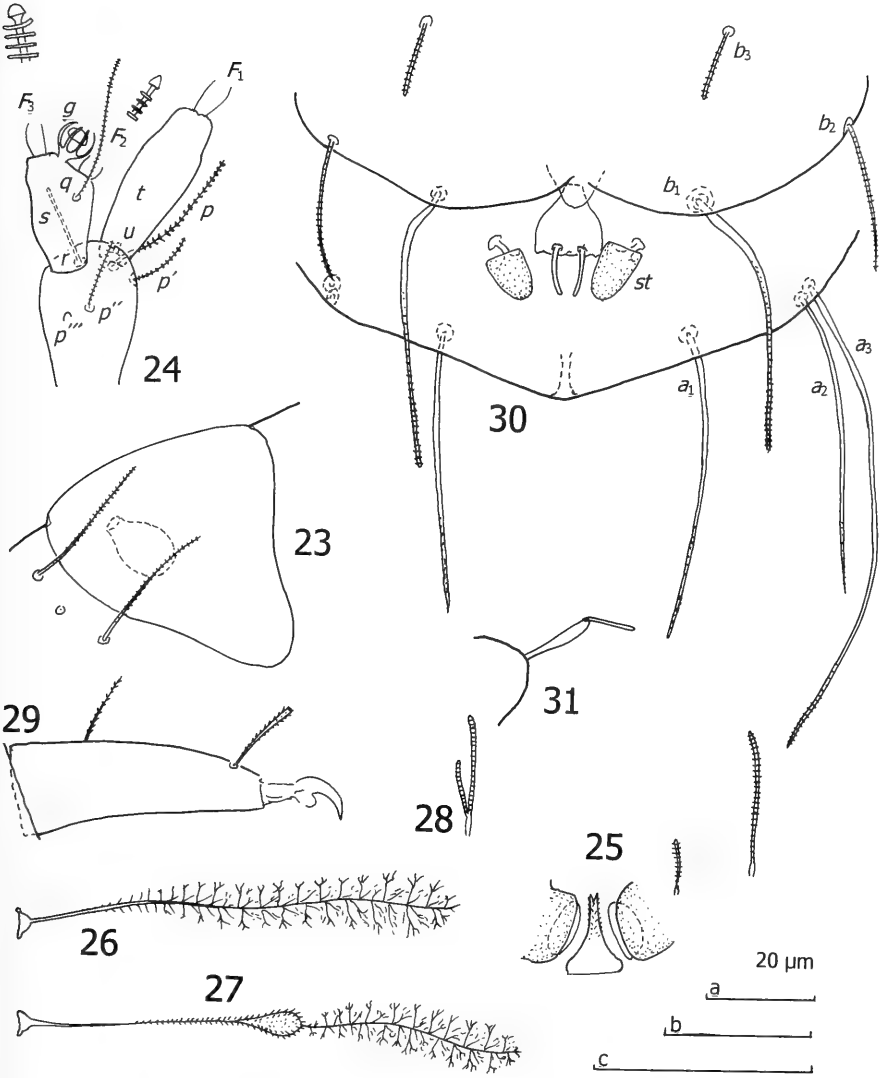
Type material. **Holotype**: subad. 8(♀), GABON, Plateau Forestier d'Ipassa, primary forest, from fruit on soil, 20.V.1966 (loc. IPA3/Fruit B, leg. Barra). **Paratypes**: GABON, Plateau Forestier d'Ipassa, primary forest, 3 subad. 8(1♀, 2 sex?), 27.VI.1966 (IPA9/AN6, leg. Barra).

Other material. Plateau Forestier d'Ipassa, primary forest, in soil, 1 juv. 5, 7.VI.1966 (loc. IPA5/E13, leg. Barra); ibidem, base of fern, 1 juv. 6, 1 juv. 5, 27.VI.1966 (loc. IPA9/AN4, leg. Barra). – Ntsibelong, 1 subad. 8(♀), 19.II.1962 (loc. 3, leg. Condé). – Mayiga, Endoumé, 1 juv. 6, 12.II.1962 (loc. 7, leg. Condé).

Total number. 9 specimens.

Diagnosis. *A. (A.) barrai* sp. n. belongs to a homogenous group of species described from the Ivory Coast by Remy (1948b): *A. (A.) liticen* Remy, *A. (A.) bucinator* Remy and *A. (A.) vouauxi* Remy. These four species have great similarities in the antennae and the bothriotricha, and in the pygidium with its anal plate. The new species is distinguished from Remy's three species by the shape of the T_3 [with swelling in the middle in *A. (A.) barrai* sp. n., axis thin without swelling in the others] and the posterior part of the pygidial tergum [broadly triangular in *A. (A.) barrai* sp. n., rounded with median indentation in the others].

Etymology. Dedicated to the collector, Dr J.A. Barra.



FIGS 23-31

Allopauropus (A.) barrai sp. n., holotype, subad. 8(♀). 23, right temporal organ with interior pistil, lateral view; 24, right antenna, sternal view; 25, collum segment, median and left part, sternal view; 26, T_1; 27, T_3; 28, seta on trochanter of leg 8; 29, tarsus of leg 8; 30, pygidium, sternal view; 31, anal plate, lateral view. Scale a: Figs 26-27; b: Figs 23-25, 28-29; c: Figs 30-31.

DESCRIPTION

Length. (0.95-)0.97 mm.

Head. Tergal setae not available for study. Temporal organs (Fig. 23) short, in lateral view triangular and faintly pubescent. No posterior aperture but an inner ovoid pistil in posterior half.

Antennae (Fig. 24). Segment 4 with 5 setae and rudiment of a 6th one, i. e. *p'''*. Setae cylindrical, blunt, annulate. Relative lengths of setae: $p = 100, p' = p'' = (43\text{-})45$, $r = 50(\text{-}52)$, $u = (6\text{-})7$. Tergal seta *p* 0.9 of length of tergal branch *t*. The latter somewhat fusiform, 2.8(-3.0) times as long as its greatest diameter and 1.4 times as long as sternal branch *s*, this (1.7-)1.9 times as long as its greatest diameter and with distinctly truncate anterodistal corner. Seta *q* somewhat thinner than *p*, cylindrical, blunt, striate, 1.2 times as long as *s*. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 6$; $F_2 = 27(\text{-}28)$, $bs_2 = (2\text{-})3$; $F_3 = (77\text{-})79$, $bs_3 = 5$. F_2 thinnest. F_1 3.5(-3.6) times as long as *t*, F_2 and F_3 1.6 and (4.5-)4.6 times as long as *s*, respectively. Distal calyces of F_1 and F_3 hemispherical, those of F_2 smaller and conical. Flagella axes cylindrical below calyx. Globulus *g* as long as wide, with ≈ 9 thin bracts; width of *g* 0.6(-0.7) of greatest diameter of *t*. Antennae faintly pubescent.

Trunk. Setae of collum segment (Fig. 25) simple, subcylindrical, blunt, striate, sublateral ones 2.9 times as long as submedian ones; sternite process with small base and narrow anterior lengthening with apical incision; appendages low, with wide caps. Appendages faintly pubescent, process distinctly pubescent anteriorly, caps glabrous.

Setae on tergites not available for study.

Bothriotricha (Figs 26, 27). Relative lengths: $T_1 = 100$, $T_2 = 104$, $T_3 = 112$, $T_5 = 178$. All with simple straight axes. T_1 and T_2 possessing thin axes, most proximally glabrous, more outwards with thin pubescence hairs, these at first short and simple, then longer and branched. Proximal half of T_3 thin but at the middle a distinct clavate thickening, axis outside it very thin; pubescence on proximal half and on thickening consisting of short simple oblique hairs, on distal half as on T_1 and T_2. T_5 with minute pubescence of very simple oblique hairs.

Legs. Tibia of legs 2-8 short, annulate. Setae on coxa and trochanter (Fig. 28) of leg 8 furcate, branches thin, cylindrical, striate, primary branch almost twice longer than secondary branch. More anteriorly setae on trochanter similar but those on coxae simple without rudiment of secondary branch.

Tarsus of leg 8 (Fig. 29) 2.8 times as long as its greatest diameter, tapering. Setae with short oblique pubescence, proximal one cylindrical and pointed, distal one somewhat clavate. Proximal seta 0.3 of length of tarsus, about as long as distal seta. Cuticle of tarsus faintly pubescent.

Pygidium (Fig. 30). *Tergum*. Posterior part between setae a_3 obtusely triangular. Relative lengths of setae: $a_1 = 100$, $a_2 = (91\text{-})97$, $a_3 = 153(\text{-}179)$, $st = 20(\text{-}25)$. a_1, a_2 and a_3 long, thin, tapering, glabrous except most distally, curved inwards; *st* bladder-shaped, with faint pubescence, converging. Distance $a_1 - a_1$ 0.8 of length of a_1, distance $a_1 - a_2$ about 4 times as long as distance $a_2 - a_3$; distance $st - st$ 2.1(-2.2) times as long as *st* and 0.5 of distance $a_1 - a_1$.

Sternum. Posterior margin with broadly V-shaped indentation between b_1 and small triangular lobe with rounded tip below anal plate. Relative lengths of setae ($a_1 = 100$): $b_1 = 87(\text{-}97)$, $b_2 = (41\text{-})50$, $b_3 = 22(\text{-}23)$. Setae striate, b_1 and b_2 thin, tapering; b_3 subcylindrical. b_1 1.1 times as long as their interdistance; b_2 1.2(-1.3) times as long as distance $b_1 - b_2$; b_3 0.2 of distance $b_3 - b_3$.

Anal plate (Figs 30, 31) directed obliquely upwards, about as broad as long, narrowest anteriorly, lateral margins convex and posterior margin almost straight, posterolateral corners right-angled. Two submedian appendages projecting backwards from sternal side of posterior margin, these 0.6 of length of plate, cylindrical, blunt, somewhat curved inwards. Plate and appendages glabrous.

8. *Allopauropus (A.) ipassaensis* sp. n. Figs 32-44

Type material. **Holotype**: ad. 9(♀), GABON, Plateau Forestier d'Ipassa, primary forest, soil, 23.VI.1966 (loc. IPA8/AVCT5, leg. Barra).

Total number. 1 specimen.

Diagnosis. Among several similar species in the subgenus the new species can be distinguished by the following combination of characters: the tergal setae of the head are cylindrical, the temporal organs have a distinct inner pistil, the antennal branches *t* and *s* are proportionately long, the distinctly stalked antennal globulus *g* has few bracts, the appendage of the collum segment has a deep anterior incision, and the bothriotricha T_1 and T_2 have long branched hairs on distal half.

Etymology. A latinized adjective of the name Ipassa.

DESCRIPTION

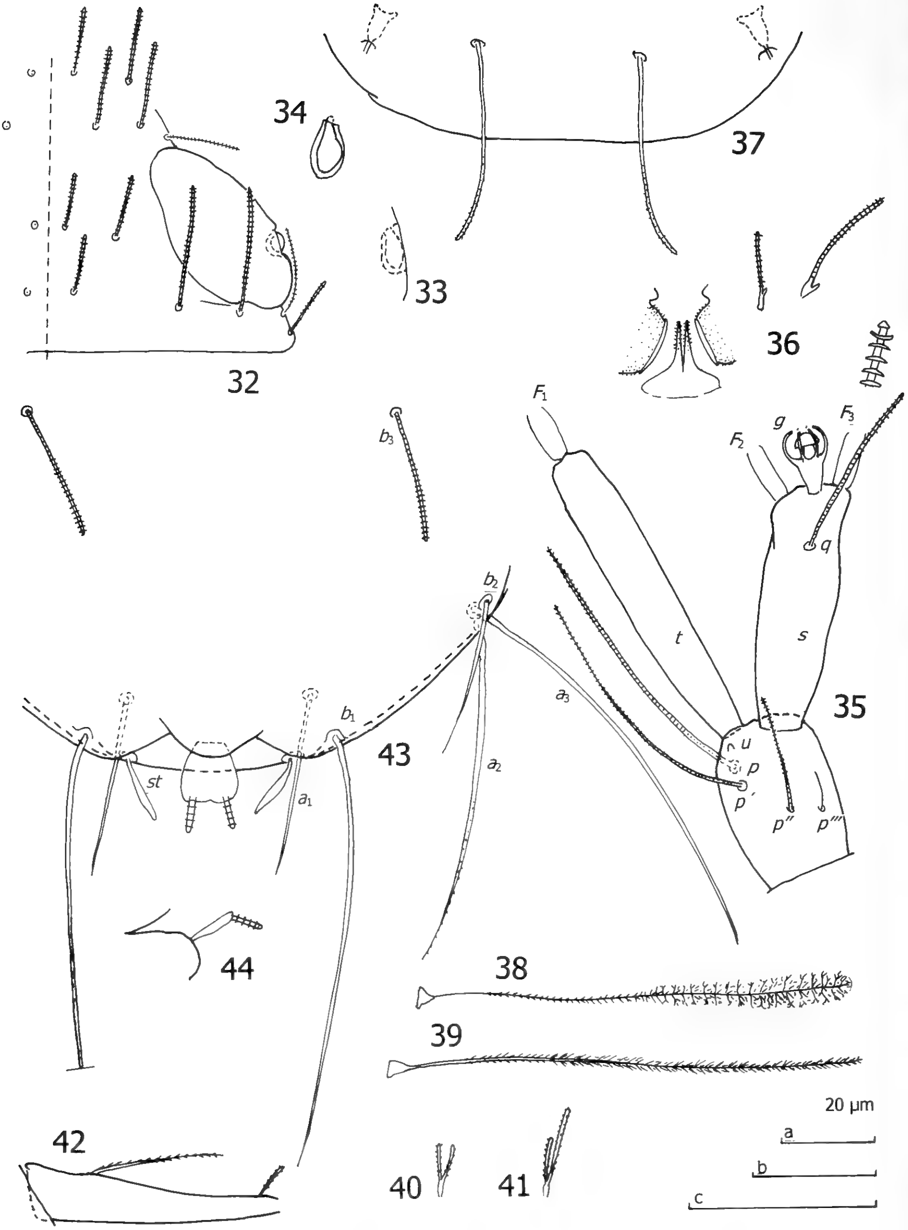
Length. 0.72 mm.

Head (Fig. 32). Tergal setae cylindrical, thin, blunt, striate, of medium lengths or long. Relative lengths of setae, 1st row: $a_1 = 10, a_2 = 11$; 2nd row: $a_1 = 12, a_2 = 13, a_3 = 11$; 3rd row: $a_1 = 8, a_2 = 10$; 4th row: $a_1 = a_4 = 9, a_2 = 17, a_3 = 18$; lateral group: $l_1 = 13, l_2 = l_3 = 10$. Ratio $a_1/a_1 - a_1$ in 1st row 1.5, in 2nd row 0.9, in 3rd row 0.6 and in 4th row 0.8. Temporal organs 1.1 times as long as their shortest interdistance; in posterior half a claviform pistil (Figs 33, 34) in a depression of the cuticle; pistil 3 times longer than its greatest diameter. No small posterior aperture present. Head cuticle glabrous.

Antennae (Fig. 35). Segment 4 with 6 setae, 5 of them cylindrical, distally tapering, striate, one rudimentary. Relative lengths of setae: $p = 100, p' = 86, p'' = 37, p''' = 9, r = 34, u = 1$. Tergal seta *p* as long as tergal branch *t*. The latter very slender, somewhat tapering proximally, 5.8 times as long as its greatest diameter and 1.3 times as long as sternal branch *s*, the latter 2.9 times as long as its greatest diameter and with its anterodistal corner somewhat truncate. Seta *q* cylindrical, blunt, striate, as thick as *p'*, almost 0.8 of length of *s*. Lengths of flagella (basal segments included) and basal segments: $F_1 = ?, bs_1 = 6; F_2 = 48, bs_2 = 6; F_3 = 50, bs_3 = 6\ \mu$m. F_2 thinnest; F_2 and F_3 1.8 and 1.9 times as long as *s* respectively. Distal calyces of F_2 and F_3 proportionately small and conical. Axis of flagella not widened below calyx. Globulus *g* 1.4 times as long as wide; 8-9 bracts; width of *g* 0.8 of greatest diameter of *t*. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 36) furcate, cylindrical, blunt, striate, with rudimentary secondary branch, sublateral setae 1.5 times as long as submedian setae; sternite process narrow anteriorly, with deep anterior incision; appendages low and with flattened caps; appendages and anterior part of process with short but distinct pubescence.

Setae on anterior tergites as submedian setae on head; on posterior tergites longer, and shortly pubescent. 4+4 setae on tergite I, 6+6 on II-IV, 6+4 on V and 4+2



FIGS 32-44

Allopauropus (A.) ipassaensis sp. n., holotype, ad. 9(♀). 32, head, median and right part, tergal view; 33, pistil, sternal view; 34, pistil, lateral view; 35, left antenna, sternal view; 36, collum segment, median and left part, sternal view; 37, tergite VI, right posteromedian part; 38, T_1; 39, T_3; 40, seta on coxa of leg 9; 41, seta on trochanter of leg 9; 42, tarsus of leg 9; 43, pygidium, median and left part, sternal view; 44, anal plate, lateral view. Scale a: Figs 32, 37-42; b: Figs 33-34, 36; c: Figs 35, 43-44.

on VI. Posterior setae on tergite VI (Fig. 37) 1.3 times as long as their interdistance and as long as pygidial setae a_1.

Bothriotricha (Figs 38, 39). Their relative lengths: $T_1 = 100$, $T_2 = 103$, $T_3 = 111$, $T_4 = 145$, $T_5 = 211$. All with very thin axes, those of T_3 thickest. Pubescence hairs short simple, oblique everywhere except on distal half of T_1 and T_2, hairs there increasing in length outwards and becoming branched.

Legs. Setae on coxa (Fig. 40) and trochanter (Fig. 41) of leg 9 furcate, branches cylindrical, blunt, shortly pubescent; branches equal in length on coxal seta, primary branch twice longer than secondary branch on seta of trochanter. More anterior setae with rudimentary secondary branch.

Tarsus of leg 9 (Fig. 42) tapering, 4.6 times as long as its greatest diameter. Proximal seta long, tapering, pointed, with short oblique pubescence; its length 0.5 of length of tarsus and 3.6 times as long as cylindrical, blunt, striate, distal seta. Cuticle of tarsus somewhat pubescent.

Pygidium (Fig. 43). *Tergum*. Posterior margin evenly rounded. Relative lengths of setae: $a_1 = 100$, $a_2 = 93$, $a_3 = 107$, $st = 18$. a_1 and a_2 tapering, glabrous, the former also directed upwards, straight, pointed, the latter curved inwards. a_3 as a_2 but longer and directed obliquely outwards. *st* somewhat fusiform, a little curved inwards, converging. Distance $a_1 - a_1$ 0.4 of length of a_1, distance $a_1 - a_2 \approx 5$ times longer than distance $a_2 - a_3$; distance $st - st$ 2.4 times as long as *st* and as long as distance $a_1 - a_1$.

Sternum. Posterior margin between b_1 with deep, broadly V-shaped indentation and rounded lobe below anal plate. Relative lengths of setae ($a_1 = 100$): $b_1 = 112$, $b_2 = 38$ and 40, $b_3 = 33$. Setae thin, b_1 and b_2 tapering and pointed, the former almost glabrous, the latter glabrous; b_3 cylindrical, blunt, striate. b_1 1.7 times as long as their interdistance; b_2 0.7-0.8 of distance $b_1 - b_2$; b_3 0.4 of distance $b_3 - b_3$.

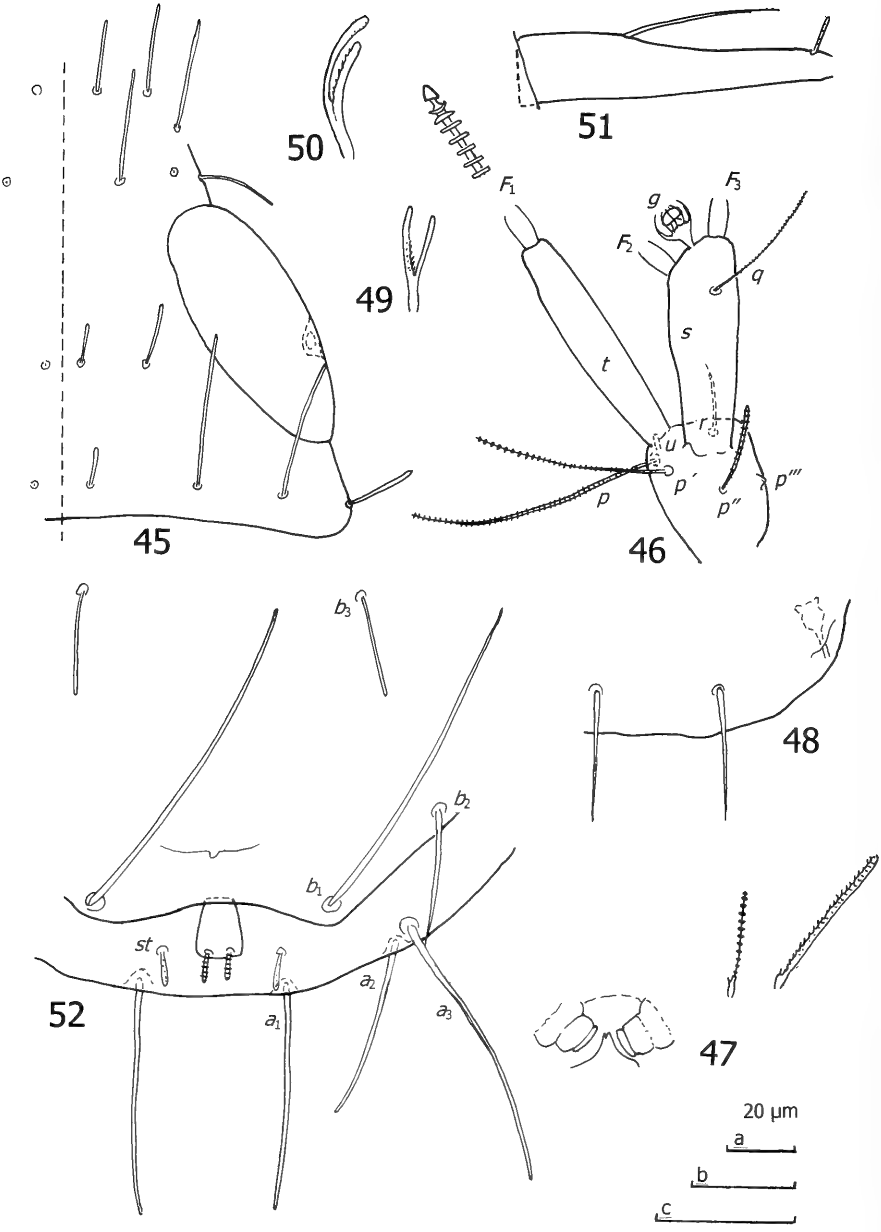
Anal plate (Figs 43, 44) directed obliquely upwards, about as broad as long, narrowest anteriorly, lateral margins convex, posterolateral corners rounded and posterior margin straight with minute median indentation; two cylindrical, blunt, striate, somewhat diverging appendages protruding backwards from sternal side of posterior margin, length of appendages 0.6 of length of plate.

9. ***Allopauropus (A.) singesensis*** sp. n. Figs 45-52

Type material. **Holotype**: ad. 9(♀), GABON, Île aux Singes, in the Ivindo River, 10 km downstream Makokou, primary forest, at base of fern, 11.VII.1966 (loc. IS3/AN4 B, leg. Barra). **Paratype**: same data as for holotype, 1 ad. 9(♀), 4.VII.1966 (loc. IS2/7, leg. Barra).

Total number. 2 specimens.

Diagnosis. *A. (A.) singesensis* sp. n. may be closest to *A. (A.) inornatus* (Hansen) from Paraguay and *A. (A.) siamensis* (Hansen) from Thailand (Hansen, 1902). They have similarities both in antennae and pygidium. Good distinctive characters in relation to *A. (A.) inornatus* (Hansen) are the shape of the tergal setae on the head [thin and cylindrical in *A. (A.) singesensis* sp. n., thicker and clavate in *A. (A.) inornatus*], the shape of the *st* [subcylindrical in *A. (A.) singesensis* sp. n., distinctly clavate in *A. (A.) inornatus*] and the shape of the anal plate [longer than broad, with sharp posterolateral corners and posteriorly directed appendages in *A. (A.) singesensis* sp. n., as long as broad, with rounded posterolateral corners and diverging appendages



FIGS 45-52

Allopauropus (A.) singesensis sp. n., holotype, ad. 9(♀). 45, head, median and right part, tergal view; 46, left antenna, sternal view; 47, collum segment, median and left part, sternal view; 48, tergite VI, right posteromedian part; 49, setae on coxa of leg 9; 50, seta on trochanter of leg 9; 51, tarsus of leg 9; 52, pygidium, sternal view. Scale a: Fig 48; b: Fig 45, 49-51; c: Figs 46-47, 52.

in *A. (A.) inornatus*]. The new species is distinguished from *A. (A.) siamensis* by the length of the distal seta on the tarsus of leg 9 [0.5 of length of tarsus in *A. (A.) singesensis* sp. n., 0.1-0.2 in *A. (A.) siamensis*], the length of the pygidial setae [long in *A. (A.) singesensis* sp. n., short in *A. (A.) siamensis*] and the shape of the *st* [cylindrical in *A. (A.) singesensis* sp. n., thick and clavate in *A. (A.) siamensis*].

Etymology. A latinized adjective of the name Singes.

DESCRIPTION

Length. (0.75-)0.78 mm.

Head (Fig. 45). Tergal setae of medium lengths or long, thin, cylindrical, blunt, glabrous. Relative lengths of setae (holotype only), 1st row: $a_1 = 10, a_2 = 11$; 2nd row: $a_1 = 15, a_2 = ?, a_3 = \approx 11$; 3rd row: $a_1 = 5, a_2 = 8$; 4th row: $a_1 = 5, a_2 = a_3 = 19, a_4 = 9$; lateral group not studied. Ratio $a_1/a_1 - a_1$ in 1st row 0.9, in 2nd row 1.0, in 3rd row 1.2 and in 4th row 0.7. Temporal organs 1.3 times as long as their shortest interdistance; in posterior half a small claviform pistil in a depression of the cuticle. No posterior aperture. Head cuticle glabrous.

Antennae (Fig. 46). Segment 4 with 5 setae and rudiment of a 6th one, i. e. p'''. Setae thin, cylindrical, blunt, striate-annulate. Relative lengths of setae: $p = 100, p' = 68(76), p' = 35(38), r = 27(29), u = 8$. Tergal seta p as long as tergal branch t. The latter somewhat fusiform, 5.1(5.6) times as long as its greatest diameter and 1.1(1.2) times as long as sternal branch s; this 3.1(3.4) times as long as its greatest diameter and with its anterodistal corner distinctly truncate. Seta q thinner than p, cylindrical, striate, 0.6 of length of s. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100, bs_1 = 6; F_2 = (73)74, bs_2 = 5; F_3 = (74)75, bs_3 = 6$. F_2 thinnest. F_1 (2.6)2.9 times as long as t, F_2 and F_3 2.2 and 2.2(2.3) times as long as s respectively. Distal calyces conical. Flagella axes very little widened below calyx. Globulus g 1.3(1.5) times as long as wide with ≈ 9 thin bracts; width of g 0.8 of greatest diameter of t. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 47) furcate, with thin rudiment of secondary branch; main branch cylindrical, on sublateral setae striate, on submedian setae annulate. Sublateral setae 1.4 times as long as submedian ones; sternite process low, anterior lengthening with minute apical incision; appendages with distal half cylindrical and proximal half conical, caps flat. Appendage and processes glabrous.

Setae on anterior tergites glabrous, somewhat thickening distally, on posterior tergites tapering distally. 4+4 setae on tergite I, 6+6 on II-IV, 6+4 on V and 4+2 on VI. Posterior setae on tergite VI (Fig. 48) 1.2 times as long as their interdistance and as long as pygidial setae a_1.

Bothriotricha. Relative lengths: $T_1 = 100, T_2 = (65)67, T_3 = 52(60), T_4 = 61(62), T_5 = (84)93$. All with simple straight axes, T_3 thickest. Anterior bothriotricha glabrous, posterior pairs with faint pubescence only most distally.

Legs. Setae on coxa (Fig. 49) and trochanter (Fig. 50) of leg 9 furcate, branches (sub)cylindrical, with sparse pubescence; branches subequal in length on coxal seta, secondary branch longest on seta of trochanter. Secondary branch rudimentary on more anterior setae.

Tarsus of leg 9 (Fig. 51) tapering, 4.3(5.0) times as long as its greatest diameter. Setae thin, with minute pubescence, proximal seta pointed, distal one cylindrical. Proximal seta 0.5 of length of tarsus and 4.6 times as long as distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 52). *Tergum*. Posterior part between setae a_3 evenly rounded. Relative lengths of setae: $a_1 = 100$, $a_2 = (71)80$, $a_3 = 104(112)$, $st = 16$. a_1, a_2 and a_3 thin, tapering, curved inwards, glabrous, a_2 converging, a_3 diverging, *st* subcylindrical and converging, straight, with minute pubescence. Distance $a_1 - a_1$ (0.5-)0.6 of length of a_1, distance $a_1 - a_2$ 3.5(4.0) times as long as distance $a_2 - a_3$; distance $st - st$ 4.9(5.0) times as long as *st* and 0.8 of distance $a_1 - a_1$. Tergum glabrous.

Sternum. Posterior margin with broad and shallow indentation between b_1. Relative lengths of setae ($a_1 = 100$): $b_1 = (123)141$, $b_2 = (50)54$, $b_3 = (39)43$. Setae thin, b_1 and b_2, tapering, with short oblique pubescence most distally, b_3 cylindrical, glabrous. b_1 (1.4)1.5 times as long interdistance; b_2 as long as distance $b_1 - b_2$; b_3 0.4 of distance $b_3 - b_3$. Sternum glabrous.

Anal plate glabrous, 1.1 times as long as broad, narrowest anteriorly, lateral margins convex and posterior margin somewhat convex, posterolateral corners distinct. Two submedian appendages projecting backwards from sternal side of posterior margin. These 0.5 of length of plate, straight, cylindrical, blunt, striate.

10. ***Allopauropus (A.) cleofanus*** sp. n. Figs 53-60

Type material. **Holotype**: ad. 9(♀), GABON, Mayiga, Endoumé, old plantation near the village, in soil, 21.II.1962 (loc. 7, leg. Condé).

Total number. 1 specimen.

Diagnosis. The subequal length of the flagellae F_2 and F_3 and the pygidial sternum with setae b_3 on distinct diverging lobes are characters which place *A. (A.) cleofanus* sp. n. close to *A. (A.) bicornis* Remy from Kenya (Remy, 1948a) and Angola (Remy, 1955a). There are also similarities in the general shape of the anal plate, but it has good distinctive characters too [narrowest anteriorly and with pointed appendages in *A. (A.) cleofanus* sp. n., broadest anteriorly and with cylindrical appendages in *A. (A.) bicornis*].

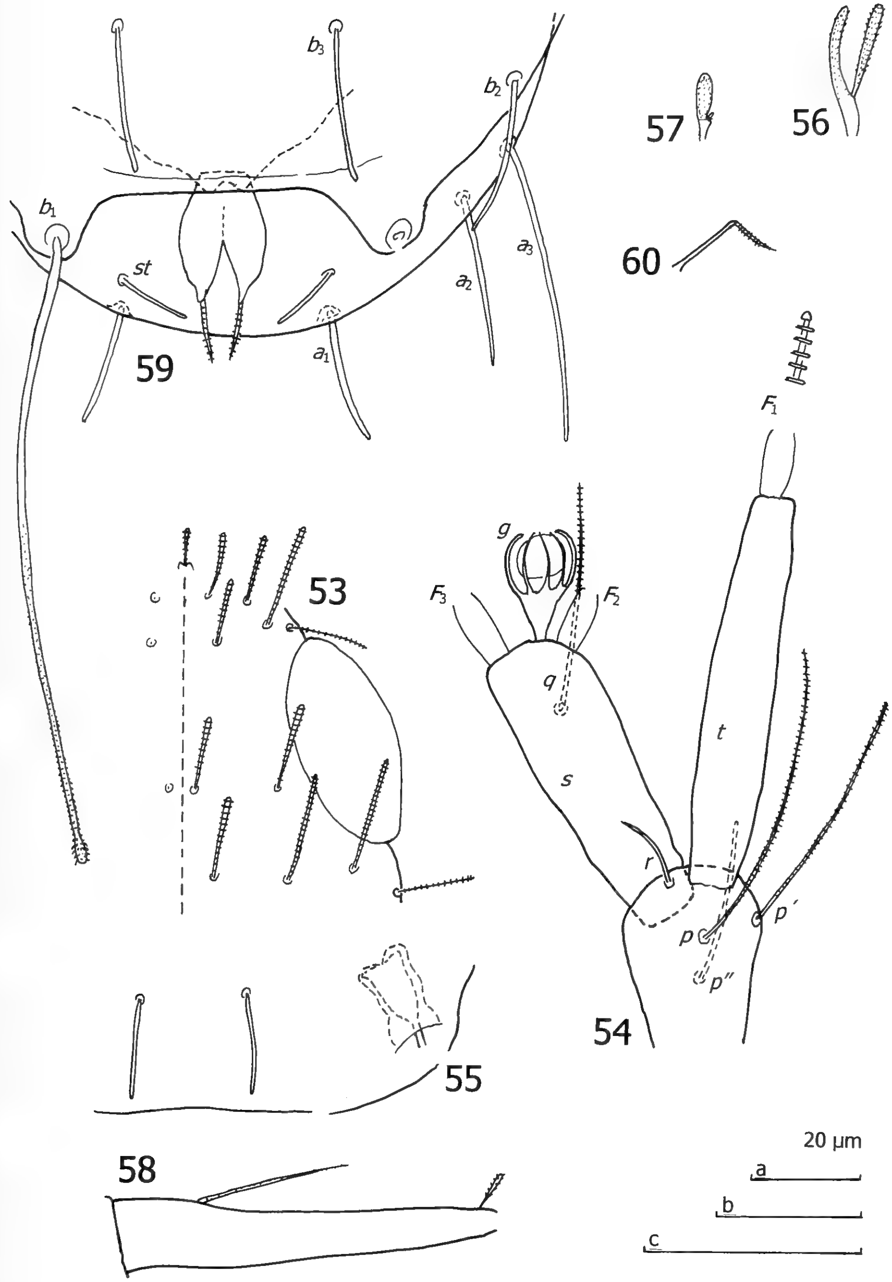
Etymology. From Anglo-Saxon cleofan = cleave, split (posterior half of anal plate).

DESCRIPTION

Length. 0.98 mm.

Head (Fig. 53). Tergal setae subcylindrical, blunt, striate, some sublateral ones long. Relative lengths of setae, 1st row: $a_1 = 10$, $a_2 = 11$; 2nd row: $a_1 = a_3 = 12$, $a_2 = 15$; 3rd row: $a_1 = 10$, $a_2 = 12$; 4th row: $a_1 = 12$, $a_2 = 15$, $a_3 = 16$, $a_4 = 12$; lateral group: $l_1 = l_3 = 15$, $l_2 = 12$. Ratio $a_1/a_1 - a_1$ in 1st row 1.2, 2nd row 1.0, 3rd row 2.6 and 4th row 1.3. Temporal organs 2.4 times as long as their shortest interdistance. Small posterior aperture outside posterior margin at level of l_1. Head cuticle glabrous.

Antennae (Fig. 54). Segment 4 with 4 thin, cylindrical, striate setae. Relative lengths of setae: $p = 100$, $p' = 83$, $p'' = 52$, $r = 24$. Neither p''' nor *u* present. Tergal seta *p* 0.8 of length of tergal branch *t*. The latter somewhat fusiform, 3.6 times as long as its greatest diameter and 1.2 times as long as sternal branch *s*; this 3.2 times as long



Figs 53-60

Allopauropus (A.) cleofanus sp. n., holotype, ad. 9(♀). 53, head, median and right part, tergal view; 54, left antenna, tergal view; 55, tergite VI, right posteromedian part; 56, seta on trochanter of leg 9; 57, seta on coxa of leg 8; 58, tarsus of leg 9; 59, pygidium, median and left part, sternal view; 60, anal plate, lateral view. Scale a: Figs 53, 56-58; b: Fig 55; c: Figs 54, 59-60.

as its greatest diameter and with its anterodistal corner truncate. Seta *q* as *p"*, 0.7 of length of *s*. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 8$; $F_2 = 82$, $bs_2 = 8$; $F_3 = 81$, $bs_3 = 8$. F_1 2.3 times as long as *t*, F_2 and F_3 2.2 times as long as *s*. Distal calyces small, helmet-shaped. Globulus *g* 1.6 times as long as wide, almost 0.4 of length of *s*, ≈ 10 bracts; width of *g* 0.9 of greatest diameter of *t*. Antennae glabrous.

Trunk. Collum segment not studied. Setae on anterior tergites as submedian setae on head; on posterior tergites longer, most posteriorly tapering and glabrous. 4+4 setae on tergite I, 6+6 on II-IV, 6+4 on V and 4+2 on VI. Posterior setae on tergite VI (Fig. 55) as long as their interdistance and 1.2 times as long as pygidial setae a_1.

Bothriotricha. Relative lengths: $T_1 = 100$, $T_2 = 159$, $T_3 = 165$, $T_4 = ?$, $T_5 = 271$. All with very thin axes, those of T_3 thickest; pubescence minute.

Legs. Setae on coxa and trochanter of leg 9 (Fig. 56) furcate, shortly pubescent, branches equal in length, main branch curved, secondary branch straight. Corresponding setae on more anterior legs (Fig. 57) furcate, main branch foliform, with short pubescence, and secondary branch rudimentary, blunt, glabrous.

Tarsus of leg 9 (Fig. 58) tapering, slender, 5.0 times as long as its greatest diameter. Proximal seta tapering, pointed, with minute pubescence, 0.4 of the length of tarsus, 3.7 times as long as clavate, striate, distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 59). *Tergum*. Posterior margin evenly rounded. Relative lengths of setae: $a_1 = 100$, $a_2 = 133$, $a_3 = 247$, $st = 58$. Setae glabrous, a_1, a_2 and a_3 diverging, a_1 also cylindrical, curved outwards, a_2 tapering, somewhat curved inwards, a_3 cylindrical, somewhat curved inwards; *st* cylindrical, somewhat curved inwards and converging. Distance $a_1 - a_1$ 1.6 times as long as a_1, distance $a_1 - a_2$ twice longer than distance $a_2 - a_3$; distance $st - st$ 2.7 times as long as *st* and as long as distance $a_1 - a_1$.

Sternum. Posterior margin between b_1 with deep and broad indentation with flat bottom, setae b_1 protruding from outer part of distinct, somewhat diverging lobes. Relative lengths of setae ($a_1 = 10$): $b_1 = 52$, $b_2 = 13$, $b_3 = 12$. b_1 and b_3 subcylindrical, the former somewhat widened most distally and with short pubescence on distal half, the latter glabrous; b_2 tapering, glabrous. b_1 1.9 times as long as their interdistance; b_2 0.9 of distance $b_1 - b_2$; b_3 0.7 of distance $b_3 - b_3$.

Anal plate (Fig. 60) directed obliquely upwards, appendages obliquely downwards, plate 1.3 times longer than broad, narrowest anteriorly, lateral margins convex, deep posterior incision reaching to middle of plate, posterior corners strongly tapering. One long appendage, 0.5 of length of plate protruding from distal part of each of the two posterior lobes.

Subgenus **Decapauropus** Remy, 1957

11. ***Allopauropus (D.) bouini*** Remy, 1955

Allopauropus Bouini Remy, 1955a: 129-130, fig. 8.

Material. Île aux Singes, in the Ivindo River, 10 km downstream Makokou, primary forest, in soil, depth 0-5 cm, 12 ad. 9(♀), 4.VII.1966 (loc. IS2/6, leg. Barra).

Total number. 12 specimens.

General distribution. Earlier reported from Angola (Remy, 1955a; Scheller, 1975), Borneo (Scheller, 2001), Florida (Remy, 1958b) and Canada (Scheller, 1984). The species is rare and has a very wide but discontinuous distribution.

12. *Allopauropus (D.) proximus* Remy, 1948

Allopauropus proximus 1948a : 572-573, fig. 4.

Material. Île aux Singes, in the Ivindo River, 10 km downstream Makokou, primary forest, in dead wood, 1 ad. 9(♀), 25.V.1966 (loc. IS1/2, leg. Barra). – Ntsibelong, right side of the Ivindo River, under wood, 1 ad. 9(♀), 4.VII.1966 (loc. IS1/2, leg. Barra); ibidem, right bank of the Ivindo River, under bark, 40 ad. 9(♀), 6 juv. 6, 19.II.1962 (loc. 3, leg. Grassé). – Loualouah, right side of the Ivindo River, under bark, 5 ad. 9(♀), 10.III.1962 (loc. 3, leg. Condé); ibidem, under bark on trunk and in litter, 6 ad. 9(♀), 8-10.III.1962 (leg. Remy); ibidem, right bank of the Ivindo River, under bark, 2 ad. 9(♀), 1 juv. 6, 8.III.1962 (loc. 3bis, leg. Grassé). – Mayiga, Endoumé, old plantation near village, in soil, 3 ad. 9(♀), 21.II.1962 (loc. 7, leg. Remy); Mayiga, forest near road to Boué, 2 ad. 9(♀), 22.II.1962 (loc. 8, leg. Remy). – Edoungavion, at road to Boué, near Ntsibelong, 6 ad. 9(♀), 1 juv. 6, 19.II.1962 (loc. 4, leg. Bernardi); ibidem, beginning of trail to Alarmintang, near small stream, under bark on soil, 4 ad. 9(♀), 1 juv. 6, 2.III.1962 (loc. 15, leg. Remy). – Mbeza, secondary forest, near trail at old plantation, 16 ad. 9(♀), 20.II.1962 (loc. 5, leg. Condé & Remy); ibidem, 9 ad. 9(♀), 1 juv. 6, 20.II.1962 (loc. 6, leg. Condé & Remy). – Makokou, small valley, in dell with source, near the water intake, 2 ad. 9(♀), 1 juv. 6, 18.II.1962 (loc. 48, leg. Foulé); ibidem, Loaloa, 11 ad. 9(♀), 1 subad. 8(♀), 18.II.1962 (loc. 2, leg. Condé); ibidem, near the quay of Somifer, under brick and bark, 2 ad. 9(♀), 24.II.1962 (loc. 11, leg. Remy). – Plateau Forestier d'Ipassa, primary forest, soil, 1 juv. 6, 20.V.1966 (loc. IPA3/B1, leg. Barra); ibidem, primary forest, soil, 8 ad. 9(♀), 20.V.1966 (loc. IPA3/4, leg. Barra); ibidem, primary forest, soil, 6 ad. 9(♀), 1.VI.1966 (loc. IPA/4, leg. Barra); ibidem, primary forest, burned soil, 6 ad. 9(♀), 11.VI.1966 (loc. IPA/6Cl1, leg. Barra); ibidem, primary forest, burned soil, 2 ad. 9(♀), 11.VI.1966 (loc. IPA/6Cl3, leg. Barra); ibidem, primary forest, under wood, 1 ad. 9(♀), 1 stad.?, 11.VI.1966 (loc. IPA/6Cl5, leg. Barra); ibidem, primary forest, litter, 1 juv. 6, 11.VII.1966 (loc. IPA/6Cl1, leg. Barra); ibidem, primary forest, at foot of *Palisota,* 1 ad. 9(♀), 11.VI.1966 (loc. IPA/6Cl11, leg. Barra); ibidem, primary forest, base of plant, 3 ad. 9(♀), 27.VI.1966 (loc. IPA/9AN6, leg. Barra); ibidem, primary forest, at foot of fern, 11 ad. 9(♀), 3 juv. 6, 27.VI.1966 (loc. IPA/9AN7, leg. Barra).

Total number. 166 specimens.

General distribution. Earlier reported from Angola (Remy, 1955a; Scheller, 1975). The species is widely and discontinuously distributed in the tropics and subtropics of America, Africa and south Asia.

13. *Allopauropus (D.) cylindricus* sp. n. Figs 61-71

Type material. **Holotype**: ad. 9(♀), GABON, Plateau Forestier d'Ipassa, primary forest, soil, 20.V.1966 (loc. IPA3/4, leg. Barra). **Paratypes**: same data as for holotype, 2 ad. 9(♀).

Other material. Plateau Forestier d'Ipassa, primary forest, soil, 1 juv. 6, 20.V.1966 (loc. IPA3/4, leg. Barra). – Edoungavion, at road to Booué, near Ntsibelong, 1 ad. 9(♀), 19.II.1962 (loc. 4, leg. Bernardi). – Mayiga, left side of road to Booué, at trail near small stream, 1 ad. 9(♀), 22.II.1962 (loc. 7, leg. Condé & Remy). – Makokou, Loaloa, 1 ad. 9(♀), 18.II.1962 (loc. 2, leg. Condé).

Total number. 7 specimens.

Diagnosis. Some species in *Allopauropus* are characterized by a complicated ramification of the bothriotrica combined with a linguiform anal plate with two posterior appendages. Among them the new species is closest to *A. (D.) machadoi* Remy from Angola (Remy, 1955a). The T_3 are almost identical, but the two species are easily distinguished by, e.g. the length of the antennal flagella [F_3 0.7 of F_1 in *A. (D.) cylindricus* sp. n., F_3 only a little shorter than F_1 in *A. (D.) machadoi*], the length of the setae on the tarsus of the last pair of legs [proximal seta 0.3-0.4 of the distal one in *A. (D.) cylindricus* sp. n., 0.75 in *A. (D.) machadoi*], the shape of the styli and the anal plate [styli cylindrical and lateral margins of anal plate concave anteriorly in *A. (D.)*

cylindricus sp. n., somewhat clavate styli and anal plate with convex lateral margins in *A. (D.) machadoi*]. There are also similiraties with *A. (D.) arbusculosus* Remy & Bello from Madagascar (Remy & Bello, 1960) as to the antennae, bothriotricha and pygidium.

Etymology. From Latin cylindrus = roller (referring to the appendages of the collum segment).

DESCRIPTION

Length. (0.51-)0.52(-0.56) mm.

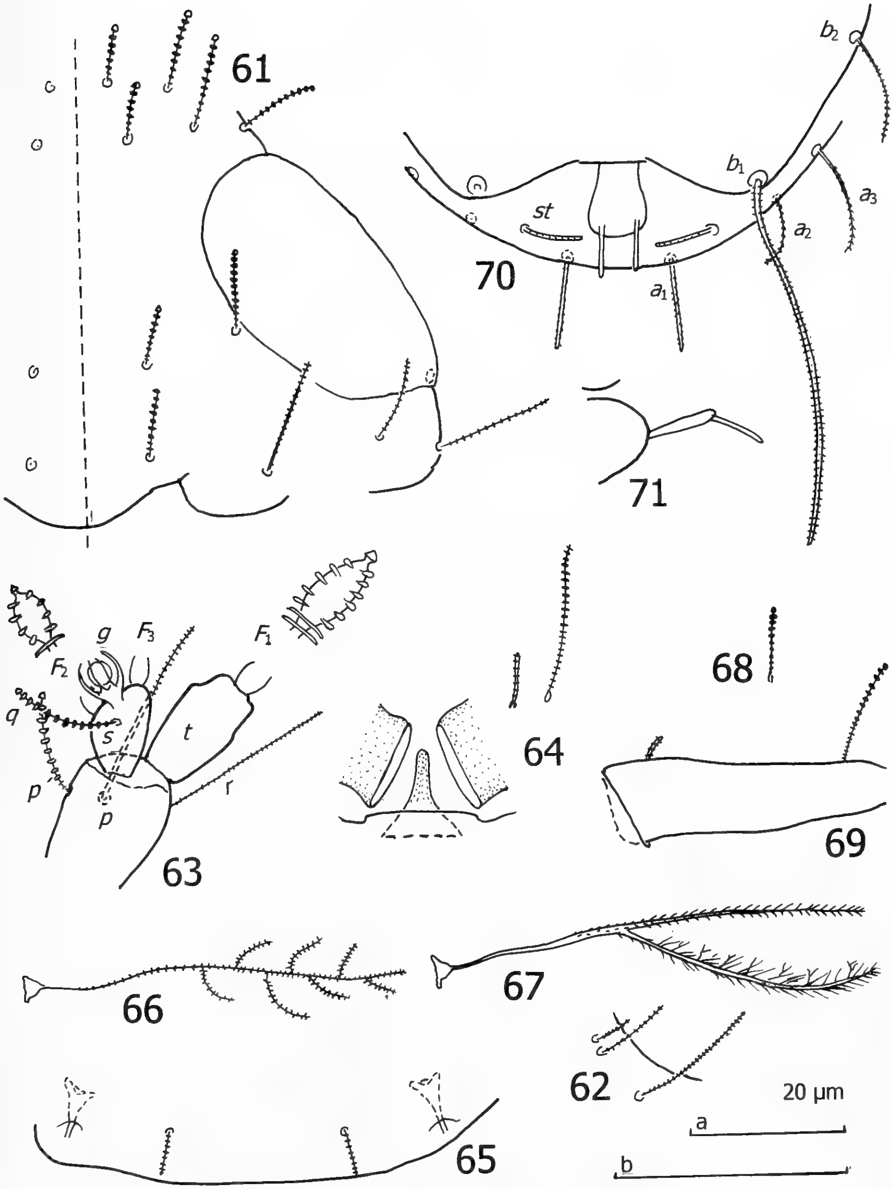
Head (Fig. 61). Tergal setae of medium length, subcylindrical, blunt; most of them annulate, posterolateral ones striate. Relative lengths of setae, 1st row: a_1 = 10, a_2 = (13-)14; 2nd row: a_1 = (9-)10(-11), a_2 = (14-)16, a_3 = 14(-15); 3rd row: a_1 = (10-)11, a_2 = (13-)14(-18); 4th row: a_1 = (10-)12, a_2 = 20(-24), a_3 = 14, a_4 = 20(-24); lateral group (one paratype only) (Fig. 62): $l_1 = 7$, $l_2 = 15$, $l_3 = 24$. Ratio $a_1/a_1 - a_1$ in 1st and 4th rows (0.5-)0.6, in 2nd and 3rd rows 0.5. Temporal organs (1.1-)1.3(-1.4) times as long as their shortest interdistance. Neither pistil nor posterior aperture close to the posterior margin of temporal organ. Head cuticle glabrous.

Antennae (Fig. 63). Segment 4 with setae *p*, *p'* and *r*; *p"* and *p'"* not ascertained. Setae cylindrical, *p* and *p'* annulate, *r* very thin and striate. Relative lengths of setae: *p* = 100, *p'* = (52-)59, *r* = (65-)88. Tergal seta *p* 1.7(2.1) times as long as tergal branch *t*. The latter subcylindrical, 1.8(-2.0) times as long as its greatest diameter and (as long as –)1.1 times as long as sternal branch *s*, this 1.6(-1.7) times as long as its greatest diameter and with its anterodistal corner distinctly truncate. Seta *q* somewhat thinner than *p'*, cylindrical, blunt, annulate, as long as (-1.4 times as long as) length of *s*. Relative lengths of flagella (basal segments included) and basal segments: F_1 = 100, bs_1 = 4(-5); F_2 = 27(-33), bs_2 = 2; F_3 = 71(-75), bs_3 = 4. F_1 (5.7-)6.4 times as long as *t*, F_2 and F_3 (1.7-)1.8 and (4.6-)4.7 times as long as *s*, respectively. Distal calyces with very small caps and distal part of flagella axes strongly fusiform, the one of F_1 almost as large as the whole sternal branch *s*. Globulus *g* 1.2(-1.3) times as long as wide and its width 0.7(-0.8) of greatest diameter of *t*; 9(-10) bracts present. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 64) simple, subcylindrical, blunt, striate, sublateral one annulate distally. Sublateral setae (2.6-)3.0(-3.3) times as long as submedian setae; sternite process narrow, anterior half cylindrical, blunt, without incision; appendages short, very wide, cylindrical, with flat caps. Both process and appendages with very short pubescence.

Setae on tergites as submedian setae on head; 4+4 setae on tergite I, 6+6 on II-IV,? on V and 4+2 on VI. Posterior setae on tergite VI (Fig. 65) 0.3 of their interdistance and 0.5 of the length of pygidial setae a_1.

Bothriotricha (Figs 66, 67). Relative lengths: T_1 = 100, T_2 = (104-)111(-113), T_3 = 112(-119), T_4 = (134-)139, T_5 = (156-)167. All but T_5 branched, axes and branches thin. T_1, T_2 and T_4 similar to each others, with straight main axis and somewhat bow-shaped oblique simple branches; length of these branches reaching 0.2 of length of bothriotrix; T_1 with (5-)7 branches, a little more on T_2 and T_4. T_3 bifurcate, one of the branches thin and straight, the other with thicker axis and curved. In two paratypes curved branch with a small end-swelling. Pubescence oblique-erect, hairs simple except on inner side of curved branch of T_3.



FIGS 61-71

Allopauropus (A.) cylindricus sp. n., 61, 63-71 holotype, ad. 9(♀), 62 paratype ad. 9(♀). 61, head, median and right part, tergal view; 62, lateral group of setae; 63, left antenna, sternal view; 64, collum segment, median and left part, sternal view; 65, tergite VI, posteromedian part; 66, T_1; 67, T_3; 68, seta on coxa of leg 9; 69, tarsus of leg 9; 70, pygidium, sternal view; 71, anal plate, lateral view. Scale a: 64, 66-69; b: Figs 61-63, 65, 70-71.

Legs. Setae on coxa (Fig. 68) and trochanter of all legs simple, cylindrical, striate-annulate, blunt. Tarsus (Fig. 69) of leg 9 tapering, 3.6 times as long as its greatest diameter. Proximal seta short, curved, cylindrical, striate, blunt, 0.1(-0.2) of length of tarsus. Distal seta long cylindrical, annulate, blunt, (2.6-)3.8 times as long as proximal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 70). *Tergum*. Posterior margin rounded. Relative lengths of setae: $a_1 = 100$, $a_2 = (62\text{-})75(\text{-}77)$, $a_3 = (122\text{-})125(\text{-}141)$, $st = 63(\text{-}90)$. Setae thin, cylindrical; a_1 straight, somewhat diverging, annulate; a_2 and a_3 curved inwards and downwards, annulate distally, diverging. *st* curved inwards, converging. Distance $a_1 - a_1$ (as long as –) 1.1 times as long as length of a_1, distance $a_1 - a_2$ 1.5 times as long as distance $a_2 - a_3$; distance *st* – *st* (2.5-)3.2(-3.3) times as long as *st* and 1.8(-2.0) times as long as distance $a_1 - a_1$.

Sternum. Posterior margin between b_1 with broad indentation. Relative lengths of setae (a_1=100): b_1 = (344-)425, b_2 = (95-)118. Setae tapering, striate-annulate, b_2 pointed, diverging, curved inwards. $b_1$1.4(-1.5) times as long as interdistance; b_2 (0.5-)0.6(-0.7) of distance $b_1 - b_2$.

Anal plate (Figs 70, 71) linguiform, narrowest anteriorly, lateral margins (straight –) somewhat indented; plate (1.2-)1.4 times as long as broad, directed backwards. Two posterior appendages protruding from posterosternal margin; appendages thin, straight, cylindrical, blunt, (0.7-)0.8 of length of plate. Plate and appendages glabrous (the latter with minute pubescence).

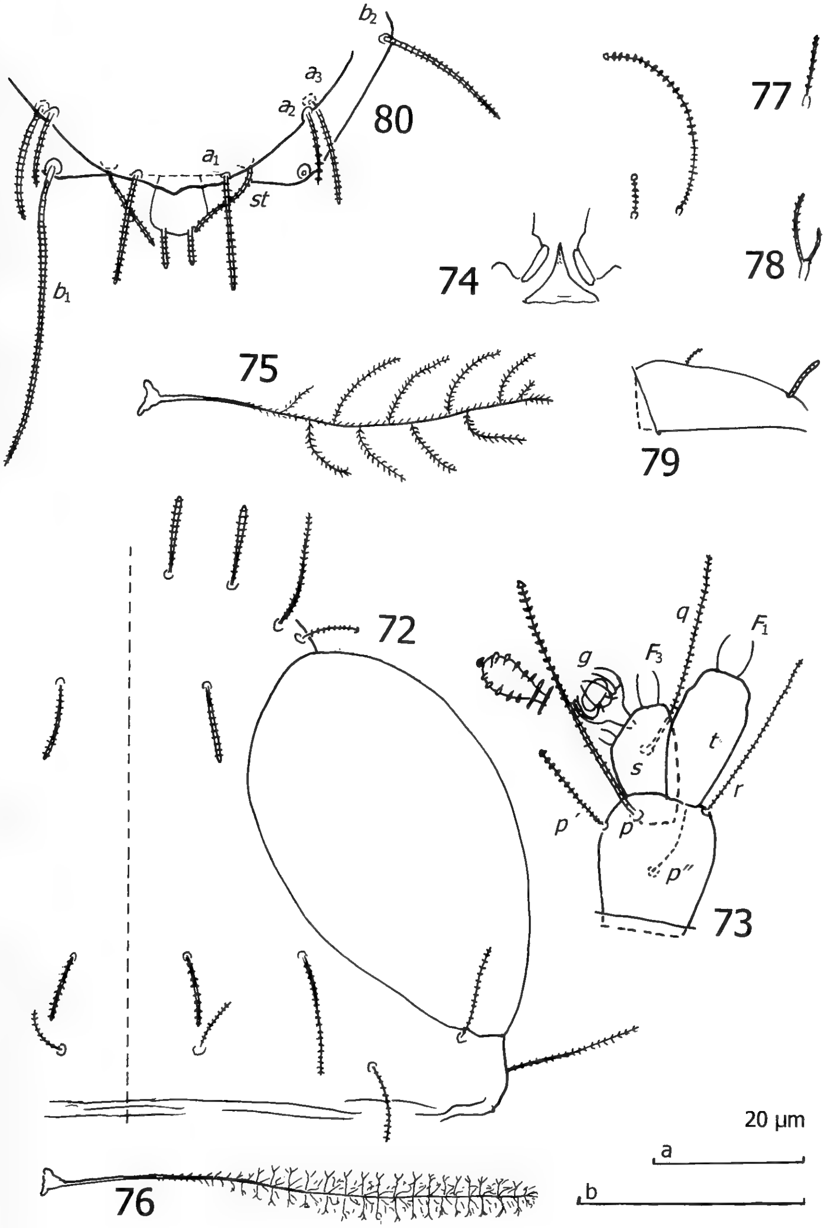
14. *Allopauropus (D.) suppeditatus* sp. n. Figs 72-80

Type material. **Holotype**: ad. 9(♀), GABON, Plateau Forestier d'Ipassa, primary forest, in soil, 17.VI.1966 (loc. IPA7/VM4, leg. Barra). **Paratypes**: GABON, Plateau Forestier d'Ipassa, primary forest, in soil, 1 ad. 9(♀), 17.VI.1966 (loc. IPA7/VM2, leg. Barra); ibidem, 1 subad. 8.(♀), 17.VI.1966 (loc. IPA7/VM5, leg. Barra).

Other material. Edoungavion, at road to Booué, near Ntsibelong, 1 ad. 9(♀), 19.II.1962 (loc. 4, leg. Bernardi).

Total number. 4 specimens.

Diagnosis. *A. (D.) suppeditatus* sp. n. has several characters in common with *A. (D.) tenuis* Remy (1948b), a species widely distributed in the tropics. There are similarities in the general shape of the head, antennae, bothriotricha T_1, T_2 and T_4 and in the chaetotaxy of the pygidium. *A. (D.) suppeditatus* sp. n. is distinguished from *A. (D.) tenuis* by the shape of the distal part of the antennal flagellum F_1 [axes only insignificantly widened in *A. (D.) suppeditatus* sp. n., almost ovoid in *A. (D.) tenuis*], the shape of the antennal globulus *g* [with narrow stalk in *A. (D.) suppeditatus* sp. n., with wide stalk in *A. (D.) tenuis*] and the shape of the T_3 [simple and without end-swelling in *A. (D.) suppeditatus* sp. n., branched and with end-swelling in *A. (D.) tenuis*]. *A. (D.) suppeditatus* sp. n. has also similarities with *A. (D.) cylindricus* sp. n. described above. Distinctive characters are the shape of the T_3 [axis simple in *A. (D.) suppeditatus* sp. n., bifurcate in *A. (D.) cylindricus* sp. n.], the length of the distal seta on the tarsus of leg 9 [twice longer than proximal seta in *A. (D.) suppeditatus* sp. n., 2.6-3.8 times as long as proximal seta in *A. (D.) cylindricus* sp. n.] and the length of the *st* [as long as a_1 in *A. (D.) suppeditatus* sp. n., shorter than a_1 in *A. (D.) cylindricus* sp. n.].



FIGS 72-80

Allopauropus (D.) suppeditatus sp. n., holotype, ad. 9(♀). 72, head, median and right part, tergal view; 73, right antenna, tergal view; 74, collum segment, median and left part, sternal view; 75, T_1; 76, T_3; 77, seta on coxa of leg 9; 78, seta on trochanter of leg 9; 79, tarsus of leg 9; 80, pygidium, sternal view. Scale a: Figs 74-79; b: Figs 72-73, 80.

Etymology. From Latin suppedito = have in abundance (referring to the branches on some bothriotricha).

DESCRIPTION

Length. 0.56(-0.72) mm.

Head (holotype only) (Fig. 72). Tergal setae of medium length, blunt, striate, those in 1st row somewhat clavate, the others cylindrical. Relative lengths of setae, 1st row: $a_1 = 10, a_2 = 11$; 2nd row: $a_1 = 10, a_2 = 17, a_3 = 9$; 3rd row: $a_1 = 9, a_2 = 16$; 4th row: $a_1 = 7, a_2 = 10, a_3 = 13, a_4 = 19$; lateral group: $l_1 = 31, l_2 = 24, l_3 = 16$. Ratio $a_1/a_1 - a_1$ in 1st row 1.1, in 2nd row 0.5, in 3rd row 0.6 and in 4th row 0.4. Temporal organs large, about twice longer than their shortest interdistance. No pistil; posterior aperture not ascertained. Head cuticle glabrous.

Antennae (Fig. 73). Segment 4 with 4 cylindrical, striate-annulate, blunt, setae, r thinnest. Relative lengths of setae: $p = 100$, $p' = 39(41)$, $p' = 25(24)$, $r = (62)65$. Tergal seta p 1.7(1.8) times as long as tergal branch t. The latter fusiform, 2.0(2.2) times as long as its greatest diameter and 1.1(1.2) times as long as sternal branch s, this 1.3(-1.5) times as long as its greatest diameter and with its anterodistal corner distinctly truncate. Seta q somewhat thinner than p, cylindrical, striate, blunt, 1.3 times as long as length of s. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100, bs_1 = 5(6)$; $F_2 = (26)27, bs_2 = 2$; $F_3 = 65(68), bs_3 = 5$. F_1 (6.0)7.1 times as long as t, F_2 and F_3 1.5(1.7) and 3.7(4.3) times as long as s respectively. Distal calyces with small caps and distal part of flagella axes strongly widened in F_2. Globulus g 1.2 times as long as wide; 13(14) bracts present; width of g 0.8(0.9) of greatest diameter of t. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 74) simple, cylindrical, blunt, annulate. Sublateral setae (3.5)4.3 times as long as submedian setae; sternite process triangular, anteriorly pointed, without incision; appendages obliquely cylindrical, with flat caps. Minute pubescence on anterior part of process only.

Setae on tergites as posteromedian setae on head. 4+4 setae on tergite I, 6+6 on II-IV, ? on V and 4+2 on VI.

Bothriotricha (Figs 75, 76). Relative lengths (holotype only): $T_1 = 100$, $T_2 = 102$, $T_3 = 120$, $T_4 = 111$, $T_5 = 176$. All with very thin axes and all but T_3 and T_5 branched. T_1, T_2 and T_4 similar to each other, with straight main axis provided with several simple, bow-shaped, oblique branches, their length reaching up to 0.2 of length of bothriotrix; T_1 with 10 branches, T_2 and T_4 similar to T_1. T_3 and T_5 with simple straight axis, very thin in distal half of the former and in distal 3/5 of the latter. Pubescence on T_1, T_2, T_4 and on most proximal parts of T_3 and T_5 consisting of short straight oblique hairs, on distal half of T_3 long, erect, whorled and partly branched hairs, on most distal part of T_5 short erect hairs which at least partly may be branched.

Legs. Setae on coxa (Fig. 77) and trochanter (Fig. 78) of leg 9 cylindrical, blunt, striate; seta on coxa simple, seta on trochanter furcate with thin secondary branch 0.5 of length of primary branch. More anterior setae simple, straight, blunt, without rudiments of secondary branches. Tarsus of leg 9 (Fig. 79) strongly tapering, 2.5(-3.0) times as long as greatest diameter. Setae on tarsus somewhat curved, cylindrical, blunt, striate; proximal seta 0.1 of length of tarsus and 0.5 of length of distal seta. Tarsus glabrous.

Pygidium (Fig. 80). *Tergum*. Posterior margin rounded. Relative lengths of setae: $a_1 = 100$, $a_2 = (65)70$, $a_3 = 110(121)$, $st = 94(113)$. Setae thin, cylindrical, striate; a_1 straight, somewhat diverging; a_2 and a_3 curved inwards, somewhat diverging, st curved inwards and converging. Distance $a_1 - a_1$ (as long as –) 1.1 times as long as length of a_1, distance $a_1 - a_2$ about 2.5 times as long as distance $a_2 - a_3$; distance $st - st$ 1.5 times as long as st and 1.6 times as long as distance $a_1 - a_1$. Tergum glabrous.

Sternum. Posterior margin between b_1 with shallow indentation. Relative lengths of setae ($a_1 = 10$): $b_1 = 35(42)$, $b_2 = 12$. b_1 and b_2 cylindrical, somewhat tapering, pointed, striate, the latter strongly diverging and curved inwards. b_1 1.2(1.3) times as long as interdistance; b_2 0.8(0.9) of distance $b_1 - b_2$. Sternum glabrous.

Anal plate as long as broad, linguiform, narrowest anteriorly, lateral margins somewhat convex, posterior margin convex, with two posteriorly directed appendages, these thin, straight, cylindrical, striate, blunt, 0.5 of length of plate. Plate glabrous.

15. ***Allopauropus (D.) isodacintrai*** sp. n. Figs 81-89

Type material. **Holotype**: ad. 9(♀), GABON, Edoungavion, at road to Booué, near Ntsibelong, 19.II.1962 (loc. 4, leg. Bernardi). **Paratypes**: same data as holotype, 2 ad. 9(♂,♀).

Other material. Mayiga, Endoumé, forest near the village, 1 ad. 9(♀), 12.II.1962 (loc. 7, leg. Condé & Remy).

Total number. 4 specimens.

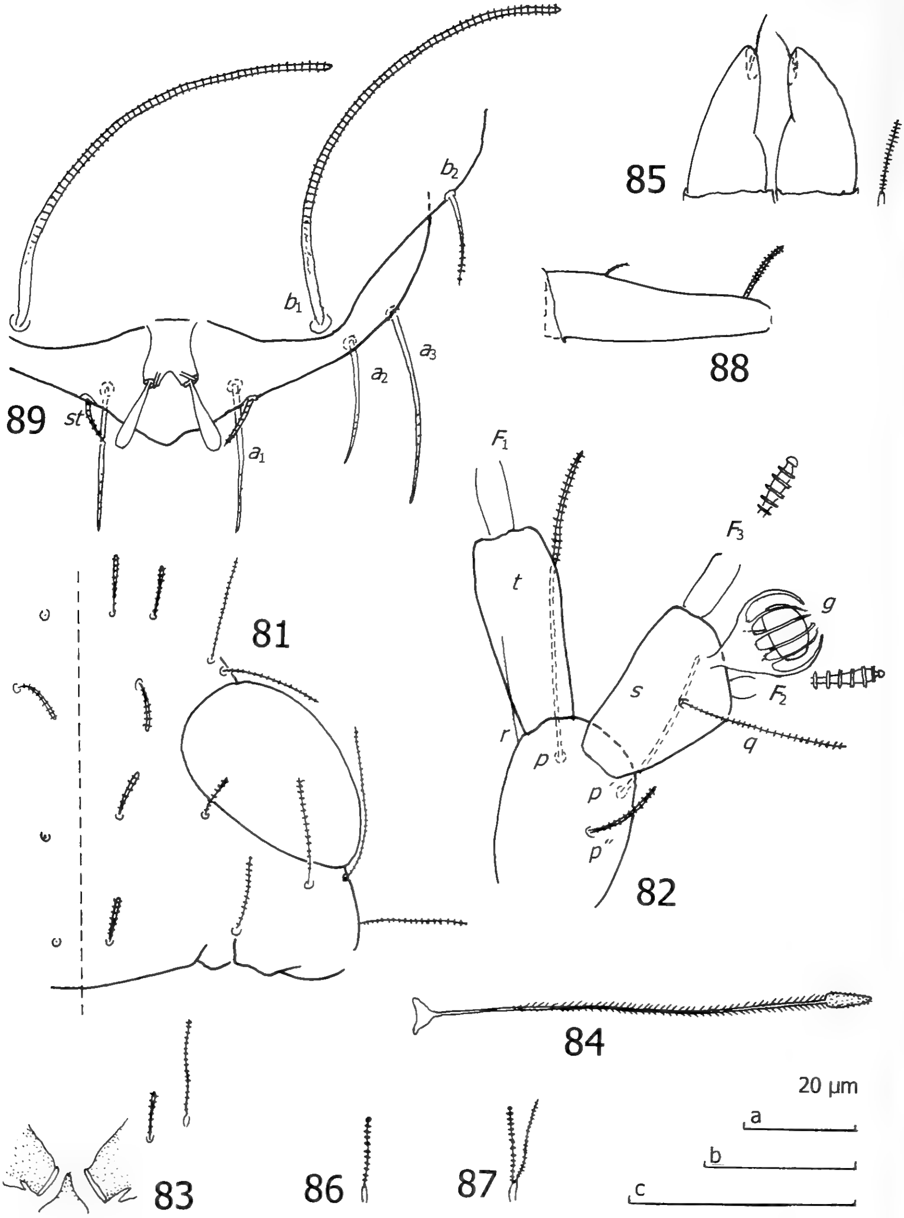
Diagnosis. *A. (D.) isodacintrai* sp. n. is a very close relative of *A. (D.) dacintrai* Scheller from Sierra Leone (Scheller, 1995). The two species are very alike as to the general chaetotaxy of the head, antennae and legs. The shape of the bothriotricha is also similar and the pygidium with the anal plate shows several similarities. The two species are well distinguished by the following characters: the shape of the axis of the distal part of the flagellae F_1 and F_3 [only somewhat widened in *A. (D.) isodacintrai* sp. n., very thick in *A. (D.) dacintrai*], the shape of the process of the collum segment [no incision anteriorly in *A. (D.) isodacintrai* sp. n., incised in *A. (D.) dacintrai*], the size of the end-swelling of bothriotrix T_3 [0.1 of length of bothriotrix in *A. (D.) isodacintrai* sp. n., twice that length in *A. (D.) dacintrai*], the shape of the genital papillae [distal half curved inwards by a transverse fold in *A. (D.) isodacintrai* sp. n., papillae straight with even inner side in *A. (D.) dacintrai*], the st [long and striate in *A. (D.) isodacintrai* sp. n., short and glabrous in *A. (D.) dacintrai*] and the number of appendages of the anal plate [4 in *A.(D.) isodacintrai* sp. n., 2 in *A. (D.) dacintrai*].

Etymology. From Greek isos = like [referring to the resemblance with *Allopauropus (D.) dacintrai*].

DESCRIPTION

Length. (0.38-)0.48 mm.

Head (Fig. 81). Submedian and sublateral setae of medium length, lateral ones fairly long. Relative lengths of setae, 1st row: $a_1 = 10$, $a_2 = 9(-10)$; 2nd row: $a_1 = 9$, $a_2 = 19$, $a_3 = (16\text{-})17$; 3rd row: $a_1 = (8\text{-})9$, $a_2 = 7(-8)$; 4th row: $a_1 = 7(-8)$, $a_2 = 13(-14)$, $a_3 = 18$, $a_4 = 17$; lateral group: $l_1 = 30$, $l_2 = 20(-23)$, $l_3 = 19(-20)$. Ratio $a_1/a_1 - a_1$ in 1st and 4th rows 0.9, in 2nd row 0.4 and in 3rd row 0.8. Temporal organs about as long as shortest interdistance. No pistil; probably posterior aperture at level of l_1 and l_2. Head cuticle glabrous.



FIGS 81-89

Allopauropus isodacintrai sp. n., 81-84, 86-89 holotype, ad. 9(♀), 85, paratype, ad. 9(♀). 81, head, median and right part, tergal view; 82, right antenna, sternal view; 83, collum segment, median and left part, sternal view; 84, T_3; 85, genital papillae, anterior view; 86, seta on coxa of leg 9; 87, seta on trochanter of leg 9; 88, tarsus of leg 9; 89, pygidium, sternal view. Scale a: Figs 83, 85-88; b: Figs 81, 84; c: Figs 82, 89.

Antennae (Fig. 82). Segment 4 with 4 cylindrical, striate, blunt setae, *r* very thin. Relative lengths of setae: $p = 100, p' = (52\text{-})54, p'' = (25\text{-})27, r = 31$. Tergal seta *p* 1.4 times as long as tergal branch *t*. The latter fusiform, (2.0-)2.4 times as long as greatest diameter and (0.9-)1.1 times as long as sternal branch *s*, this 1.6(-1.8) times as long as its greatest diameter and with its anterodistal corner distinctly truncate. Seta *q* subcylindrical, striate, as long as length of *s*. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = (7\text{-})8$; $F_2 = 32$, $bs_2 = 2(\text{-}3)$; $F_3 = 71(\text{-}86)$, $bs_3 = 8(\text{-}9)$. F_1 4.5(-5.5) times as long as *t*, F_2 and F_3 (1.5-)1.6 and 3.6(-4.2) times as long as *s*, respectively. Distal calyces with small caps and distal part of flagella axes only somewhat widened. Globulus *g* large, 1.3 times as long as wide; 16 bracts present; capsule bottom flat; width of *g* 1.1 times as wide as greatest diameter of *t*. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 83) simple, striate, blunt, submedian setae somewhat clavate, sublateral setae cylindrical. Sublateral setae 2.4 times as long as submedian setae; sternite process triangular, pointed anteriorly without incision; appendages subcylindrical with flat caps. Short pubescence on appendages and anterior part of process.

Bothriotricha (Fig. 84). Relative lengths of bothriotricha: $T_1 = 100$, $T_2 = 101(\text{-}105)$, $T_3 = 81(\text{-}109)$, $T_4 = ?$, $T_5 = (?98\text{-})118(\text{-}169)$. All with straight, simple, very thin axes, T_1, T_2 and T_4 exceedingly thin. T_3 with thickest axis which most distally provided with a swelling, 4 times longer than wide and reaching 0.1 of length of bothriotrix. Pubescence of bothriotricha composed of simple, straight, short, oblique hairs, these strongest on distal half of T_3 below the swelling; the latter with very short erect pubescence.

Genital papillae (paratype) (Fig. 85). Subconical, distal half curved inwards, glabrous, 1.8 times as long as their greatest diameter; subapical seta 0.4 of the length of papilla. Coxal seta of leg 2 of the same shape as other coxal setae on anterior legs.

Legs. Setae cylindrical blunt striate, on coxa of leg 9 (Fig. 86) simple, on trochanter (Fig. 87) furcate with the branches subequal in length. Corresponding setae more anteriorly simple, without rudiments of secondary branches. Coxal setae somewhat clavate and shorter than setae on trochanter. Tarsus of leg 9 (Fig. 88) tapering, (3.5-)4 times as long as greatest diameter. Setae on tarsus cylindrical, striate, tapering distally; proximal seta short, curved, 0.1 of length of tarsus; distal seta longer, (1.5-)2.0 times longer than proximal seta. Cuticle of tarsus almost glabrous.

Pygidium (Fig. 89). *Tergum*. Posterior margin broadly triangular behind *st*. Relative lengths of setae: $a_1 = 100$, $a_2 = (80\text{-})85$, $a_3 = 140(\text{-}154)$, $st = 54(\text{-}70)$. Setae subcylindrical, curved inwards, distal half tapering, *st* converging, striate, a_1, a_2 and a_3 almost glabrous. Distance $a_1 - a_1$ 0.8(-0.9) of length of a_1, distance $a_1 - a_2$ about twice longer than distance $a_2 - a_3$; distance $st - st$ (1.9-)2.0 times as long as *st* and (1.1-)1.3 times as long as distance $a_1 - a_1$.

Sternum. Posterior margin between b_1 with shallow indentation. Relative lengths of setae (a_1=100): $b_1 = 308(\text{-}350)$, $b_2 = 61(\text{-}76)$. b_1 cylindrical, striate, blunt; b_2 tapering, curved inwards, pointed, distal half striate. b_1 (1.4-)1.5 times as long as interdistance; b_2 0.5 of distance $b_1 - b_2$.

Anal plate with concave lateral margins, posterior $^1/_4$ divided into two short branches by a V-shaped incision; branches subcylindrical, distally squarely truncate.

Plate with 4 diverging appendages: two large terminal ones, as long as plate, clavate; and two short sternal ones, cylindrical, 0.2 of length of large appendages. Plate and appendages glabrous.

16. ***Allopauropus (D.) stenygros*** sp. n. Figs 90-98

Type material. **Holotype**: ad. 9(♀), GABON, Île aux Singes, in the Ivindo River, 10 km downstream Makokou, primary forest, in soil, 4.VI.1966 (loc. IS2/5, leg. Barra). **Paratypes**: same data as holotype, 3 ad. 9(♀), (leg. Barra); ibidem, 1 ad. 9(♂), 25.V.1966 (loc. IS1/1, leg. Barra); ibidem, 2 ad. 9(♀), 4.VI.1966 (loc. IS2/6, leg. Barra).

Total number. 7 specimens.

Diagnosis. Allopauropus (D.) stenygros sp. n. belongs to a group of species, which occurs in the Oriental region and tropical West Africa, and which possesses linguiform anal plates with two short posterior appendages and also similarities in the shape of the antennae. They are all incompletely known but good distinctive characters for *A. (D.) stenygros* sp. n. have been recognized in the following organs: in relation to *A. (D.) viarti* Remy (Remy, 1961) from Pondichéry (sternal antennal branch, anterior bothriotricha, genital papillae, pygidial setae a_1 and a_2); to *A. (D.) nemoralis* Remy (Remy, 1956b) from Madagascar (setae on leg 9, pygidial setae a_1 and a_2, appendages of anal plate); to *A. (D.) lupiger* Remy (Remy, 1959b) from Mauritius (bothriotricha, setae of pygidial tergum, anal plate); to *A. (D.) socius* Remy (Remy, 1948b) from the Ivory Coast (antennal branches, globulus *g*, posterior part of anal plate); and to *A. (D.) minutissimus* Remy (Remy, 1948b) from the Ivory Coast (tergal antennal branch, anterior bothriotricha, posterior part of anal plate).

Etymology. From Greek stenygros = narrow (referring to the anterior part of anal plate).

DESCRIPTION

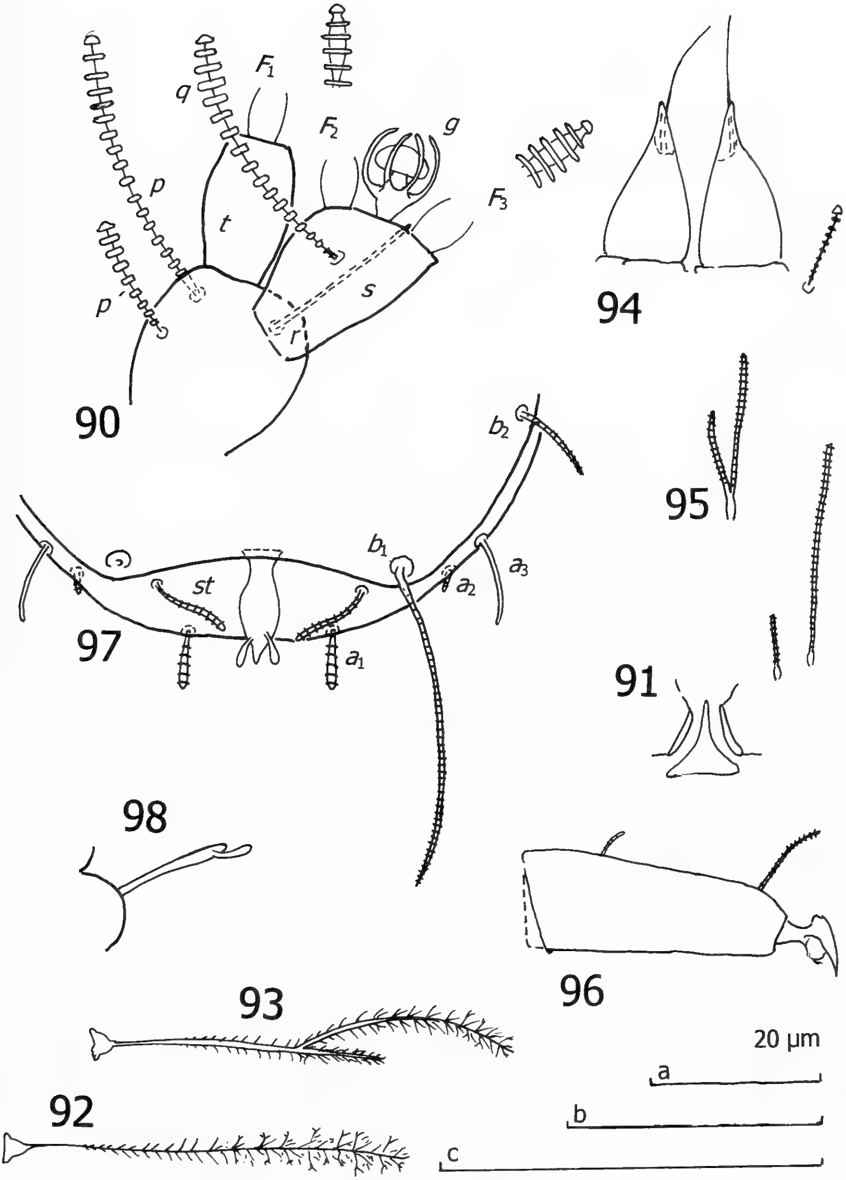
Length. (0.42-)0.43(-0.55) mm.

Head. Not studied.

Antennae (Fig. 90). Segment 4 with 4 blunt setae, *p*, *p'* and *p"* clavate, annulate, *r* cylindrical. Relative lengths of setae: p = 100, p' = (43-)47, p'' = (38-)40(-43), r = (55-)59(-64). Tergal seta *p* (1.8-)2.1 times as long as tergal branch *t*. The latter fusiform, 1.5(-1.7) times as long as its greatest diameter and (1.5-)1.7 times as long as sternal branch *s*, this 1.4(-1.5) times as long as its greatest diameter and with its anterodistal corner truncate. Seta *q* as seta *p*, (1.5-)1.7 times as long as *s*. Relative lengths of flagella (basal segments included) and basal segments: F_1 = 100, bs_1 = 7; F_2 = (35-)38(-40), bs_2 = 3(-4); F_3 = (81-)84(-88), bs_3 = 7. F_1 (5.4-)5.6 times as long as *t*, F_2 and F_3 1.7 and 3.8(-4.2) times as long as *s*, respectively. Distal calyces small, helmet-shaped. Globulus *g* 1.2 times as long as wide; 6-7 bracts present, width of *g* (0.5-)0.7 of greatest diameter of *t*. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 91) simple, cylindrical, blunt, striate, sublateral one (3.5-)3.6(-3.7) times as long as submedian one; narrow anterior part of sternite process without apical incision; appendages short, with flattened caps; both process and appendages glabrous.

Setae on tergites not studied.



Figs 90-98

Allopauropus stenygros sp. n., 90-93, 95-98 holotype, ad. 9(♀), 94, paratype, ad. 9(♀). 90, left antenna, sternal view; 91, collum segment, median and left part, sternal view; 92, T_1; 93, T_3; 94, genital papillae and seta on coxa of leg 2, anterior view; 95, seta on trochanter of leg 9; 96, tarsus of leg 9; 97, pygidium, sternal view; 98, anal plate, lateral view. Scale a: Figs 92-94; b: Figs 91, 95-98; c: Fig. 90.

Bothriotricha (Figs 92, 93). Relative lengths: T_1 = 100, T_2 = (105-)110, T_3 = (105-)104(-111), T_4 = 95(-109), T_5 = 115(-119). All except T_3 with simple axes, the latter bifurcate with branching in the middle. One branch short and straight, the other curved and 0.5 of length of bothriotrix. Pubescence consisting of short simple hairs, oblique on T_5, of increasing length distally and there with partly branched hairs on T_1 - T_4.

Genital papillae. (Fig. 94, paratype). Twice wider than long, widest near base, conical, pointed distally, glabrous, apical seta long, 0.9 of length of papilla. Seta on coxa of leg 2 simple, somewhat clavate, annulate.

Legs. Setae on coxa and trochanter (Fig. 95) of leg 9 furcate, branches thin, cylindrical, blunt, densely striate, secondary branch much shorter than primary branch. Corresponding setae on more anterior legs simple, probably without rudiment of secondary branch.

Tarsus of leg 9 (Fig. 96) tapering, (2.4-)2.5 times as long as its greatest diameter. Setae cylindrical, somewhat curved, striate; proximal seta 0.1(-0.2) of length of tarsus, 0.4 of length of distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 97). *Tergum*. Posterior margin evenly rounded. Relative lengths of setae: a_1 = 10, a_2 = 4(-5), a_3 = (12-)14(-15), *st* = 7(-8). a_1 straight, a_2, a_3 and *st* curved inwards, a_2 and *st* cylindrical converging, striate, a_1 somewhat clavate, a_3 glabrous, tapering, diverging. Distance $a_1 - a_1$ (1.7-)2.2 times as long as a_1, distance $a_1 - a_2$ 3 times longer than distance $a_2 - a_3$; distance *st* – *st* 2.3(-2.5) times as long as *st* and 1.5 times as long as distance $a_1 - a_1$. Tergum glabrous.

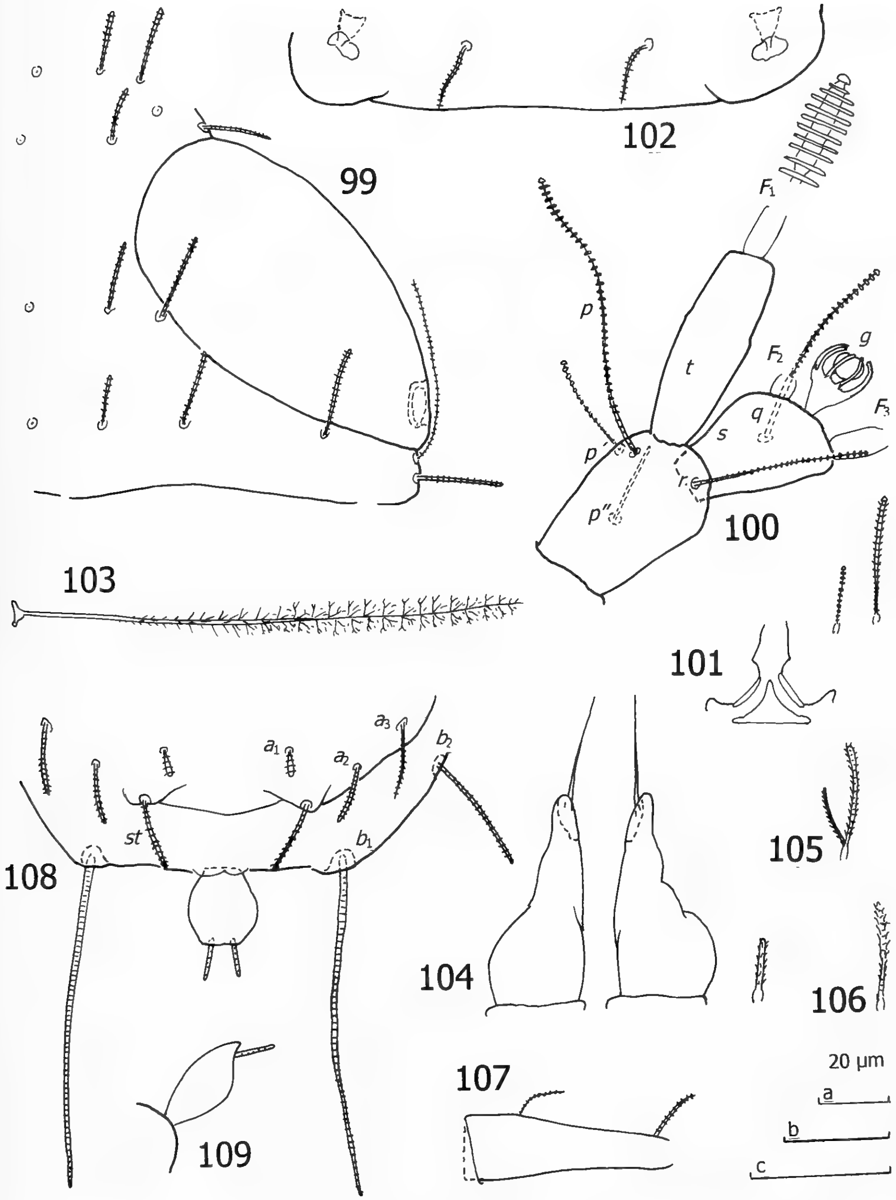
Sternum. Posterior margin between b_1 with broad shallow bow-shaped indentation. Relative lengths of setae (a_1 = 10): b_1 = (48-)52, b_2 = (20-)23(-24). Setae striate, b_1 tapering, b_2 cylindrical. b_1 1.2(-1.3) times as long as interdistance; b_2 0.5 of distance $b_1 - b_2$. Sternum glabrous.

Anal plate (Figs 97, 98) directed obliquely upwards, 1.8 times as long as greatest breadth, broadest in the middle, lateral sides distinctly concave in anterior part, convex in the middle, posteriorly lengthened and sharpened to a point; two diverging clavate glabrous appendages protruding backwards from sternal side of distal part of plate, their length 0.3 of length of plate.

17. ***Allopauropus (D.) phakoides*** sp. n. Figs 99-109

Type material. **Holotype**: ad. 9(♀), Gabon, Île aux Singes, in the Ivindo River, 10 km downstream Makokou, primary forest, in soil, 4.VII.1966 (loc. IS2/3, leg. Barra). **Paratypes**: Gabon, Belinga, at trail along the drinking-water pipe, under piece of wood, 1 ad. 9(♀), 16.III. 1962 (loc. 33, leg. Condé); ibidem, 2 ad. 9(♀), 22.VII.1962 (loc. 55, leg. Condé). – Ntsibelong, right bank of the Ivindo River, under bark, 2 ad. 9(♂,♀), 19.II.1962 (loc. 3, leg. Grassé). – Edoungavion, 1 subad. 9(♀), 26.II.1962 (loc. 12, leg. Condé & Remy).
Total number. 7 specimens.

Diagnosis. *Allopauropus (D.) phakoides* sp. n. is characterized by the following combination of characters: setae thin, antennal branches subequal in length, antennal globulus *g* with many bracts, bothriotricha with thin straight axes, pubescence on T_3 longest and partly branched, pygidial setae a_1 short and clavate, anal plate lens-shaped with two posterior striate appendages. The species has affinities to *A. (D.) eburnensis* and *A. (D.) vesperalis* both described by Remy from the Ivory Coast (Remy, 1957b)



FIGS 99-109

Allopauropus (D.) phakoides sp. n., 99-103, 105-109 holotype, ad. 9(♀), 104, paratype, ad. 9(♂). 99, head, median and right part, tergal view; 100, right antenna, tergal view; 101, collum segment, median and left part, sternal view; 102, tergite VI, posterior part; 103, T_3; 104, genital papillae and seta on coxa of leg 2, anterior view; 105, seta on coxa of leg 9; 106, seta on trochanter of leg 9; 107, tarsus of leg 9; 108, pygidium, tergal view; 109, anal plate, lateral view. Scale a: Figs 101, 103, 105-107; b: Figs 99, 102, 104, 108-109; c: Fig. 100.

but are easily distinguished from them by the shape of the pygidial setae a_1 and the anal plate.

Etymology. From Greek phakos = lentil and lens of the eye (referring to the shape of the anal plate).

DESCRIPTION

Length. (0.54-)0.72 mm.

Head (Fig. 99). Tergal setae of medium length or fairly long, thin, cylindrical, striate-annulate. Relative lengths of setae, 1st row: $a_1 = 10$, $a_2 =$ (10-)12; 2nd row: $a_1 =$ 9(-10), $a_2 =$?(18-20), $a_3 =$ 11(-14); 3rd row: $a_1 =$ (6-)10, $a_2 =$ (11-)14; 4th row: $a_1 =$ (6-)8, $a_2 =$ 12(-15), $a_3 = a_4 =$ (11-)14; lateral group: $l_1 =$ (28-)29(-35), $l_2 =$ (19-)20 (-22), $l_3 =$?(22-23). Ratio $a_1/a_1 - a_1$ in 1st row 1.0(-1.2), 2nd row 0.6(-0.8), 3rd row (0.7-)0.9, 4th row (0.6-)0.7. Temporal organs large, (2.1-)3.1 times as long as their shortest interdistance; small pistil in posterior part and small aperture at posterior margin at level of l_2. Head cuticle glabrous.

Antennae (Fig. 100). Segment 4 with setae p, p' p'' and r; p''' not ascertained. Setae cylindrical, striate-annulate. Relative lengths of setae: $p = 100$, $p' =$ (36-)37(-43), $p'' =$ 30(-42), $r =$ (52-)63. Tergal seta p 1.4(-1.7) times as long as tergal branch t. The latter somewhat fusiform, 2.7(-3.2) times as long as its greatest diameter and (1.1-)1.3 times as long as sternal branch s, this (1.6-)1.7(-1.9) times as long as its greatest diameter and with its anterodistal corner distinctly truncate. Seta q cylindrical, blunt, annulate, (as long as –) 1.3 times as long as length of s. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 =$ 5(-6); $F_2 =$ 27(-37), $bs_2 =$ 2(-3); $F_3 =$ (74-)84(-87), $bs_3 =$ 5(-6). F_1 (4.5-)4.8(5.1) times as long as t, F_2 and F_3 (1.7-)1.9(-2.1) and (4.6-)5.3 times as long as s, respectively. Distal calyces with small caps and distal part of flagella axes only somewhat widened. Globulus g 1.5(-1.6) times as long as wide and its width (0.8-)0.9 of greatest diameter of t; ≈ 12 bracts present. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 101) simple, subcylindrical, blunt, striate-annulate. Sublateral seta (1.8-)1.9 times as long as submedian seta; sternite process narrow anteriorly and without apical incision; appendages short, wide, cylindrical, caps flat. Both process and appendages glabrous.

Setae on tergites as submedian setae on head; 4+4 setae on tergite I, 6+6 on II-IV, 6+? on V and 4+2 on VI. Posterior setae on tergite VI (Fig. 102) (0.3-)0.4(-0.5) of their interdistance and (2.5-)2.8(-3.2) times as long as pygidial setae a_1.

Bothriotricha (Fig. 103). Relative lengths: $T_1 = 100$, $T_2 =$ 137(-150), $T_3 =$ (101-)103(-114), $T_4 =$ 102(-121), $T_5 =$ 172(-182). All with straight and very thin axis. Pubescence consisting of short, simple, oblique hairs on T_1, T_2, T_4 and T_5 but hairs of increasing length distally and there partly branched hairs on T_3.

Genital papillae (Fig. 104, paratype). Conical, narrowing in distal 2/3, 2.1 times as long as their greatest diameter, glabrous; distal seta long, thin, almost 0.6 of length of papilla.

Legs. Setae on coxa and trochanter of leg 9 cylindrical, striate, blunt; coxal seta (Fig. 105) simple, seta on trochanter (Fig. 106) furcate with secondary branch thin and 0.6 of length of primary branch. Corresponding setae on more anterior legs, (including setae on coxa of leg 2 in male), simple, cylindrical, without rudiments of secondary branch. Tarsus of leg 9 (Fig. 107) tapering, 3.1(-3.5) times as long as its greatest diameter. Setae striate-annulate, proximal seta short, tapering, curved, (0.2-)0.3 of length of tarsus; distal seta cylindrical, striate, about as long as proximal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 108). *Tergum*. Posterior margin rounded. Relative lengths of setae: a_1 = 10, a_2 = (20-)22(-25), a_3 = 28(-33), *st* = (22-)27. Setae thin, striate, converging, a_1 short, straight, clavate, a_2, a_3 and *st* somewhat curved inwards, a_3 pointed. Distance $a_1 - a_1$ (3.0-)4.5 times as long as a_1, distance $a_1 - a_2$ about as long as distance $a_2 - a_3$; distance *st* – *st* 2.2(-3.1) times as long as *st* and (as long as –) 1.1 times as long as distance $a_1 - a_1$. Tergum glabrous.

Sternum. Posterior margin between b_1 almost straight apart from small lobe with shallow median incision just below anal plate. Relative lengths of setae (a_1=10): b_1 = 125(-134), b_2 = 48(-57). Setae tapering, striate, b_2 diverging, somewhat curved inwards. b_1 (1.3-)1.4(-1.5) times as long as interdistance; b_2 as long as (– 1.2 times as long as) distance $b_1 - b_2$.

Anal plate (Figs 108, 109) narrowest anteriorly, subcircular, lens-shaped, (1.0-)1.1 times as long as greatest breadth, directed backwards-upwards. Two posterior appendages protruding backwards from its posterosternal part; they are thin, straight, cylindrical, striate, 0.6 of length of plate. Plate and sternum glabrous.

18. ***Allopauropus (D.) bovistellus*** sp. n. Figs 110-118

Type material. **Holotype**: ad. 9(♂), GABON, Plateau Forestier d'Ipassa, primary forest, in soil, 1.VI.1966 (loc. IPA4/AVC3, leg. Barra).

Total number. 1 specimen.

Diagnosis. *A. (D.) bovistellus* sp. n. is unique in the odd shape of its antennal globuli, the shape of the genital papillae and in the short ring-shaped tibiae of legs 2-8 and the stalk of the apical organ of the tarsi.

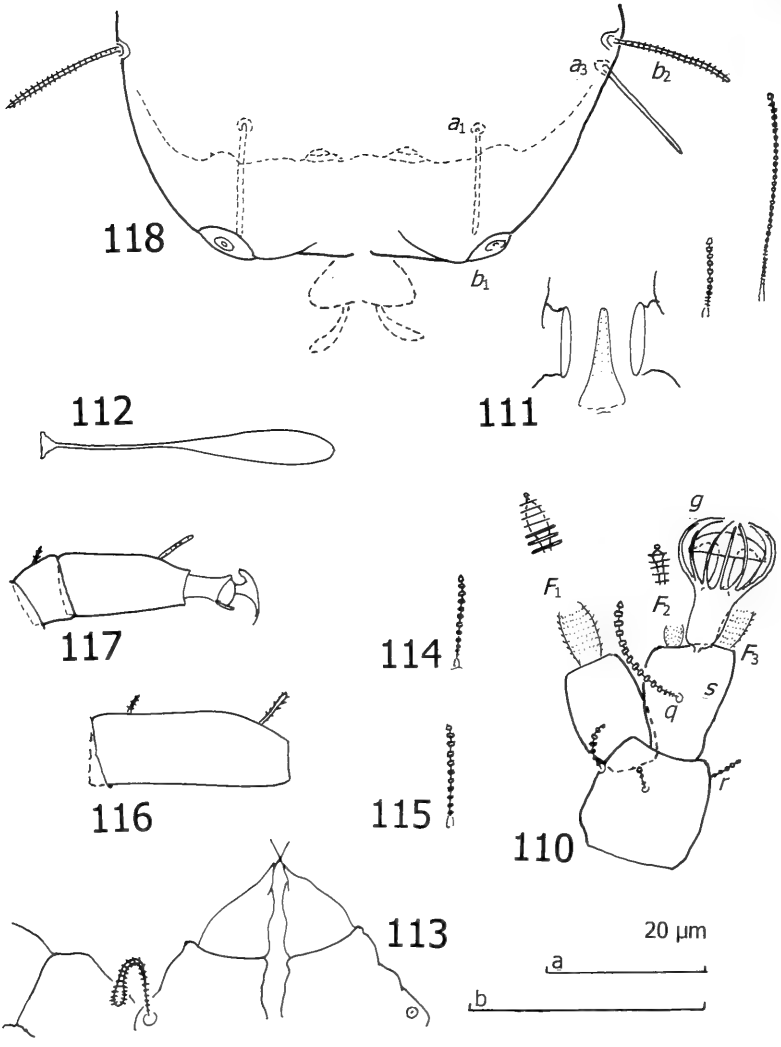
Etymology. From Greek bovista = puffball (referring to the shape of antennal globulus).

DESCRIPTION

Length. 0.77 mm.

Head. Only partly available for study. Tergal setae cylindrical, blunt, striate. Relative lengths of setae, 1st row: $a_1 = a_2 = 10$; 2nd row: $a_1 = 9$, $a_2 = 15$, $a_3 = 7$; 3rd row: a_1 and a_2 = ?; 4th row: $a_1 = 7$, $a_2 = 15$, $a_3 = 12$, $a_4 = 20$; lateral group: $l_1 = l_3 = 20$, $l_2 = 19$. Temporal organs have neither pistil nor posterior aperture.

Antennae (Fig. 110). Segment 4 with at least 3 short annulate setae, probably *p'*, *p"* and *r*. Their length 5, 2 and 3 μm respectively. Tergal branch almost cylindrical, 1.5 times as long as its greatest diameter and as long as sternal branch *s*, this 1.1 times as long as its greatest diameter and with its anterodistal corner somewhat truncate. Seta annulate, 1.1 times as long as length of *s*. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 9$; $F_2 = 23$, $bs_2 = 4$; $F_3 = 70$, $bs_3 = 7$. F_1 5.4 times as long as *t*, F_2 and F_3 1.3 and 3.8 times as long as *s*, respectively. Distal calyces with very small caps and distal part of flagella axes with fusiform widening in



Figs 110-118

Allopauropus (D.) bovistellus sp. n., holotype, ad. 9(♂). 110, left antenna, sternal view; 111, collum segment, median and left part, sternal view; 112, T_3; 113, genital papillae and basal part of leg 2, anterior view; 114, seta on coxa of leg 9; 115, seta on trochanter of leg 9; 116, tarsus of leg 9; 117, tibia and tarsus of leg 8 with claw and empodium; 118, pygidium, sternal view. Scale a: Figs 114-117; b: Figs 110-113, 118.

F_1 and F_3, in the shape of an inverted cone in F_2. Globulus g 1.3 times as long as wide, in shape of a puffball with proximal half almost cylindrical; ≈ 17 very thin bracts; capsule fungiform; width of g 1.2 times as long as greatest diameter of t. Antennae glabrous except for basal segments of flagella, which have distinct pubescence arranged in whorls.

Trunk. Setae of collum segment (Fig. 111) simple, cylindrical, blunt, striate-annulate. Sublateral seta 2.6 times as long as submedian seta; sternite process narrow, without anterior incision; appendages short, wide, with flat caps. Process with minute pubescence.

Setae on tergites not studied.

Bothriotricha. Axes very thin except in T_3 (Fig. 112). The latter thin proximally but widens to a longish club, probably with distal thin lengthening.

Genital papillae (Fig. 113). Small, conical, pointed, protruding from large bases, these as long as papillae; seta 0.3 of length of papilla. "Coxal" seta of leg 2 inserted on lateral part of base of papilla. Seta cylindrical, with distinct end-swelling, striate.

Legs. Setae on coxa and trochanter of all legs simple, blunt, striate-annulate. Seta on coxa (Fig. 114) and trochanter (Fig. 115) of leg 9 cylindrical, annulate; coxal seta longest. Tarsus of leg 9 (Fig. 116) cylindrical, tapering in distal third, 2.8 times as long as its greatest diameter. Setae straight, short, proximal seta pointed, 0.1 of length of tarsus and 0.5 of length of cylindrical distal seta. Cuticle of tarsus glabrous. Tibiae of legs 2-8 short, annulate (Fig. 117). Claw and empodium on distinct stalk, in leg 8 0.3 of length of tarsus.

Pygidium (Fig. 118). *Tergum*. Posterior margin between a_2 almost straight. Relative lengths of setae: $a_1 = 10$, $a_2 = ?$, $a_3 = 11$, $st = ?$. a_1 and a_3 straight, cylindrical, almost glabrous, the latter diverging. a_2 lacking and st not identified, may be very short. Distance $a_1 - a_1$ twice longer than a_1, distance $a_1 - a_2$ considerably shorter than distance $a_2 - a_3$; distance $st - st$ 0.3 of distance $a_1 - a_1$.

Sternum. Posterior margin between b_1 straight, with small median V-shaped incision. Relative lengths of setae ($a_1 = 10$): $b_1 = ?$, $b_2 = 11$. b_2 cylindrical, blunt, striate, almost as long as distance $b_1 - b_2$.

Anal plate narrowest anteriorly, about as broad as long, posterior margin somewhat indented in the middle, posterolateral corners rounded; two diverging appendages protruding backwards from submedian part of posterior margin; appendages lanceolate, curved outwards, diverging, about as long as plate. Sternum glabrous.

Subgenus ***Perissopauropus*** Scheller, 1997

Key to the species of *Perissopauropus*

1 Stalk of antennal globulus g thick, subcylindrical; setae b_1 of pygidial sternum lanceolate .... *tridens* Scheller
\- Stalk of antennal globulus g thin, conical; setae b_1 of pygidial sternum thin, tapering 2
2 Antennal setae u well developed, cylindrical .... *bounourei* Remy
\- Antennal setae u rudimentary, conical 3
3 Pygidial setae a_1 and a_2 thin, tapering, pointed; pubescence on pygidial st long, decreasing in length outwards .... *amphikomos* Scheller
4 Pygidial setae a_1 and a_2 thick, cylindrical, blunt; pubescence on pygidial st distinct but not long, and all of the same length ...... *lambdoides* sp. n.

19. *Allopauropus (Perissopauropus) lambdoides* sp. n. Figs 119-130

Type material. **Holotype**: ad. 9(♀), GABON, Plateau Forestier d'Ipassa, primary forest, at base of plant, 27.VI.1966 (loc. IPA9/AN6, leg. Barra). **Paratypes**: GABON, Edoungavion, under bark on soil, 2 ad. 9(♀), 21.II.1962 (loc. 5, leg. Condé). – Mbeza, secondary forest, near trail at old plantation, 1 subad. 8(♀), 1 juv. 6, 20.II.1962 (loc. 5, leg. Condé & Remy);

Other material. Plateau Forestier d'Ipassa, primary forest, at base of plant, 1 ad. 9(♀), 1 subad. 8(♀), 1 juv. 6, 27.VI.1966 (loc. IPA9/AN2, leg. Barra); ibidem, at base of fern, 1 juv. 6, 27.VI.1966 (loc. IPA9/AN3, leg. Barra). – Mbeza, secondary forest, near trail at old plantation, 1 subad. 8(♀), 20.II.1962 (loc. 5, leg. Condé & Remy). – Edoungavion, at road to Booué, 1 ad. 9(♂), 19.II.1962 (loc. 4, leg. Bernardi); ibidem, under bark, 1 subad. 8(♀), 1 juv. 6, 20.II.1962 (loc. 12, leg. Condé & Remy); ibidem, at foot of big tree, under bark on soil, 1 ad. 9(♀), 2.III.1962 (loc. 12bis, leg. Condé). – Mvadhi, end of trail to Dubost forest, under stones in laterite, 1 subad. 8(♀), 1 juv. 6, 9.IX.1962 (loc. 101, leg. Condé). – Mayiga, Endoumé, right side of road to Booué, at trail near small stream, 2 ad. 9(♀), 12.II.1962 (loc. 7, leg. Condé & Remy); ibidem, 1 juv. 5, 22.II.1962 (loc. 8, leg. Condé & Remy). – Belinga, under moss-covered stone, 1 ad. 9(♂), 17.III.1962 (loc. 35, leg. Condé & Bernardi).

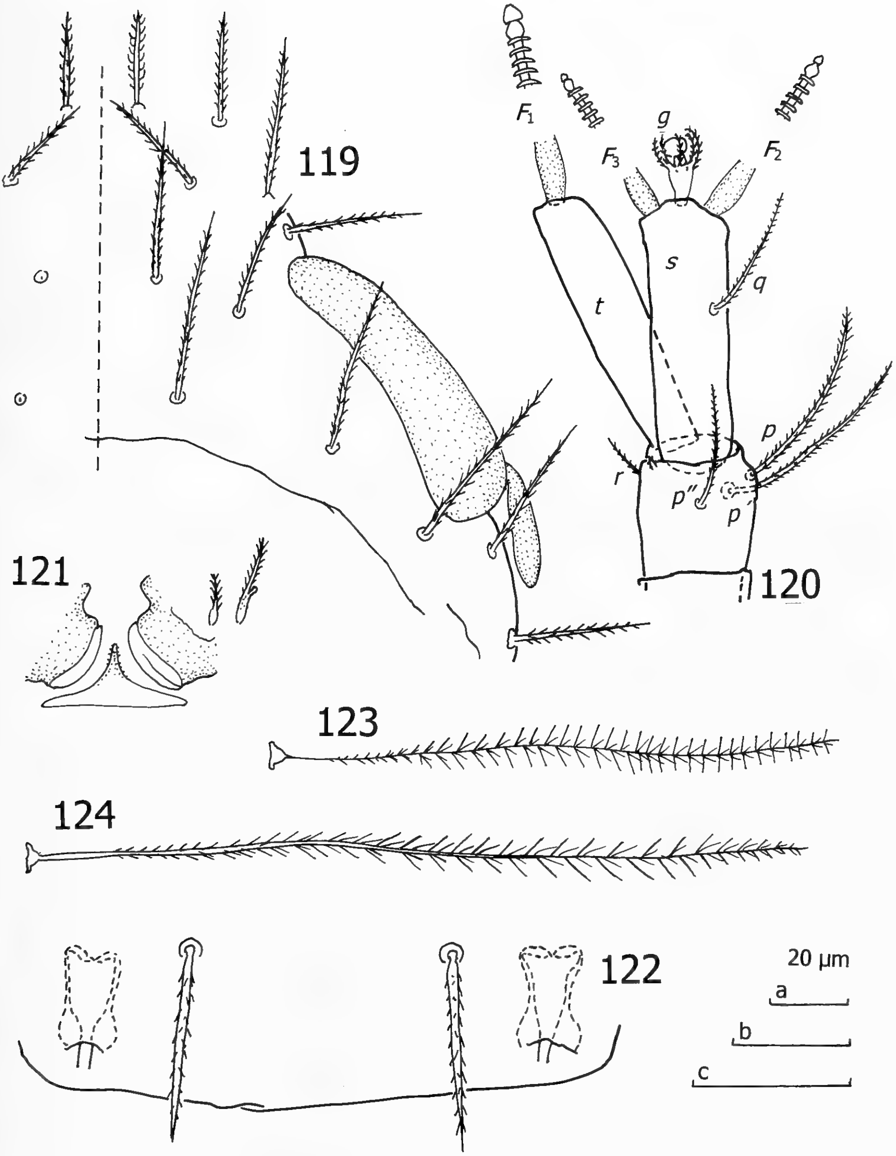
Total number. 20 specimens.

Diagnosis. Three species have been described in the subgenus *Perissopauropus*: *A. (P.) bounourei* Remy from Cameroon (Remy, 1955b), *A. (P.) tridens* Scheller from Angola (Scheller, 1975) and *A. (P.) amphikomos* Scheller from Central Amazonia (Scheller, 1997). They form, together with the species described below, a homogenous group which has many characters in common.

The new species is distinguished from *A. (P.) bounourei* by the shape of the antennal seta *u* (short and conical in *A. (P.) lambdoides* sp. n., longer and cylindrical in *A. (P.) bounourei*), the pygidial seta a_2 (thick, straight, blunt in *A. (P.) lambdoides* sp. n., thin, curved inwards, tapering, pointed in *A. (P.) bounourei*) and by the shape of the anal plate (branches slender and tergal appendages curved inwards in *A. (P.) lambdoides* sp. n., branches short and tergal appendages straight in *A. (P.) bounourei*).

A. (P.) lambdoides sp. n. is distinguished from *A. (P.) tridens* by the shape of the antennal globulus *g* [stalk thin in *A. (P.) lambdoides* sp. n., thick in *A. (P.) tridens*), the shape of the antennal setae and the pubescence of the antennae (setae pointed, antennal stalk, branches and globulus *g* almost glabrous in *A. (P.) lambdoides* sp. n., setae blunt, with distinct pubescence in *A. (P.) tridens*], by the pubescence on the bothriotrix T_5 [sparse and depressed hairs in *A. (P.) lambdoides* sp. n., dense and hairs oblique in *A. (P.) tridens*], by the shape of the *st* [curved inwards and converging in *A. (P.) lambdoides* sp. n., straight, directed backwards in *A. (P.) tridens*], by the pubescence on the pygidial setae a_3 and *st* [fairly dense pubescence of short hairs in *A. (P.) lambdoides* sp. n., a few long hairs in *A. (P.) tridens*], by the shape of the pygidial setae b_1 [curved, tapering, with distinct pubescence on one side only in *A. (P.) lambdoides* sp. n., straight, lanceolate, with very dense short pubescence on all sides in *A. (P.) tridens*] and by the shape of the appendages of the anal plate [distinctly tapering in *A. (P.) lambdoides* sp. n., subcylindrical and blunt in *A. (P.) tridens*].

A. (P.) lambdoides sp. n. is distinguished from *A. (P.) amphikomos* by: the length proportion *p/p'* [1.2 in *A. (P.) lambdoides* sp. n., 1.5 in *A. (P.) amphikomos*], the occurrence of seta *p'''* [rudimentary knob in *A. (P.) lambdoides* sp. n., not visible in *A. (P.) amphikomos*], the shape of the antennal globulus *g* [distinct stalk in *A. (P.) lambdoides* sp. n., very short stalk in *A. (P.) amphikomos*], the shape of the seta *r* on the 4th antennal segment [pointed in *A. (P.) lambdoides* sp. n., blunt and distal part annulate in



Figs 119-124

Allopauropus (Perissopauropus) lambdoides sp. n., holotype, ad. 9(♀). 119, head, median and right part, tergal view; 120, right antenna, sternal view; 121, collum segment, median and left part, sternal view; 122, tergite VI, posterior part; 123, T_1; 124, T_3. Scale a: Figs 121, 123-124; b: Fig. 122; c: Figs 119-120.

A. (P.) amphikomos], the shape of the setae on the pygidial tergum [a_1 and a_2 straight, cylindrical, blunt in *A. (P.) lambdoides* sp. n., curved inwards, tapering in *A. (P.) amphikomos*], the *st* [curved, pubescence hairs of about the same length in *A. (P.) lamb-*

doides sp. n., almost straight, pubescence hairs decrease in length outwards in *A. (P.) amphikomos*], and the length of the submedian appendages of the anal plate [<0.5 of length of plate in *A. (P.) lambdoides* sp. n., >0.5 of length of plate in *A. (P.) amphikomos*].

Etymology. From the Greek letter lambda (referring to the shape of the anal plate).

DESCRIPTION

Length. (0.77-)0.97(-1.02) mm.

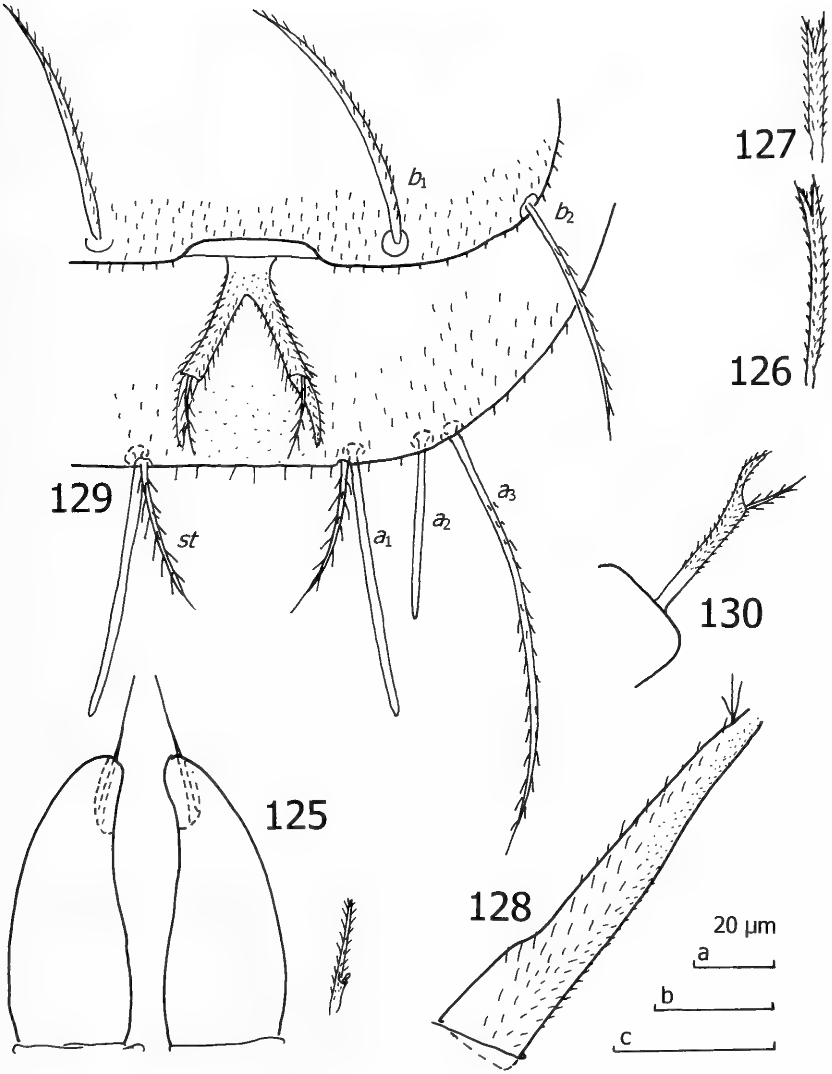
Head (Fig. 119). Tergal and lateral setae long, tapering, all terminated by a thin straight hair and covered with a very distinct pubescence of somewhat curved oblique hairs. Relative lengths of setae, 1st row: a_1 = 10, a_2 = (10-)11; 2nd row: a_1 = (10-)12, a_2 = (13-)15, a_3 = (12-)13; 3rd row: a_1 = (12-)15, a_2 = (10-)12(-13); 4th row: a_1 = (13-)19, a_2 = (15-)19, a_3 = (18-)20(-25), a_4 = (12-)15(-16); lateral group: l_1 = 15(-16), l_2 = (10-)12, l_3 = (15-)19. Ratio $a_1/a_1 - a_1$ in 1st row 1.4, 2nd row (0.5-)0.6, 3rd row 1.3 and 4th row (0.9-)1.2(-1.3). Length of temporal organs 0.9 of their shortest interdistance. No interior pistil present but a clavate vesicular appendage projecting backwards from a point somewhat anterior to posterior margin, length of appendage 0.4 of length of temporal organ. Posterior aperture not ascertained. Head cuticle glabrous, temporal organs with vesicle possessing sparse minute pubescence.

Antennae (Fig. 120). Segment 4 with 5 distal setae, these tapering, pointed, from base and outwards pubescent-striate-annulate, *r* thinnest. Relative lengths of setae: *p* = 100, *p'* = 83(-84), *p"* = (37-)53, *r* = (22-)23, *u* = (3-)5. Tergal seta *p* 0.9(-1.1) times as long as tergal branch *t*. The latter slender, cylindrical, distally obliquely truncate, (4.0-)4.4(-4.9) times as long as its greatest diameter and as long as sternal branch *s*, this subcylindrical, 3.0(-4.1) times as long as its greatest diameter and with its anterodistal and posterodistal corners equally truncate. Seta *q* similar to *p"*, 0.5(-0.6) of length of *s*. Relative lengths of flagella (basal segments included) and basal segments: F_1 = 100, bs_1 = (8-)10; F_2 =74(-78), bs_2 = (7-)9; F_3 = 69(-71), bs_3 = 7. F_1 2.3 times as long as *t*, F_2 and F_3 1.6(-1.7) and 1.5(-1.7) times as long as *s*, respectively. Distal calyces of F_2 and F_3 very small; distal part of flagella axes with a distinct subglobular swelling just below calyx. Globulus *g* pyriform, (1.6-)1.7(-1.8) times as long as wide; 12 bracts present; width of *g* (0.7-)0.8 of greatest diameter of *t*. Antennae glabrous except for bracts of globuli, these with a very distinct pubescence, and the base segments of the flagella, which have a minute pubescence.

Trunk. Setae of collum segment (Fig. 121) furcate, main branch tapering, pointed, with oblique pubescence; secondary branch rudimentary, cylindrical, blunt, glabrous. Sternite process broad, pointed anteriorly. Appendages wide, with flat caps. Sparse short pubescence on anterior part of process and appendages.

Setae on tergites as on tergal side of head, somewhat increasing in length posteriorly. 4+4 setae on tergite I, 6+6 on II-IV, 6+4 on V, 4+2 on VI. Posterior setae on tergite VI (Fig. 122) 1.2 times as long as interdistance and somewhat longer than length of pygidial setae a_1.

Bothriotricha (Figs 123, 124). Relative lengths: T_1 = 100, T_2 = 107(-113), T_3 = 117(-137), T_4 = (169-)197, T_5 = (206-)210(-253). All with simple straight axes;



Figs 125-130

Allopauropus (Perissopauropus) lambdoides sp. n., 126-130, holotype, ad. 9(♀), 125, paratype, ad. 9(♂). 125, genital papillae and seta on coxa of leg 2, anterior view; 126, seta on coxa of leg 9; 127, seta on trochanter of leg 9; 128, tarsus of leg 9; 129, pygidium, sternal view; 130, anal plate, lateral view. Scale a: Fig. 128; b: Figs 125-127; c: Figs 129-130.

pubescence hairs strong, straight, simple, strongest on T_3 and T_5, erect on distal half of T_1 and T_2, otherwise oblique.

Genital papillae (Fig. 125, paratype). Conical, 2.4 times as long as their greatest diameter, glabrous, distinctly narrowing and curved inwards in distal half; seta 0.5 of length of papilla.

Legs. Setae on coxa (Fig. 126) and trochanter (Fig. 127) of leg 9 simple, subcylindrical, cleft distally, with distinct oblique pubescence, seta on trochanter 1.4 times as long as coxal seta and also more slender than seta on coxa. More anterior setae simple, not cleft distally and without rudiments of secondary branches except on coxal seta on leg 2 in males, this with a cylindrical, blunt, glabrous, rudimentary, secondary branch. Tarsus of leg 9 (Fig. 128) slender, straight, tapering, 5.6(-6.8) times as long as greatest diameter. Setae on tarsus very dissimilar: proximal seta straight, tapering, pointed, with long distal hair and a few long depressed more proximal hairs, seta (0.3-)0.4 of length of tarsus and 3.9(-4.7) times as long as distal seta; the latter short, 0.1 of length of tarsus, fork-shaped as a trident with straight spinous prongs, the middle one longest. Pubescence coarse, arranged in rows lengthways, hairs on tergal side long and somewhat increasing in length toward proximal end, there glabrous between proximal seta and the upper end of tarsus. Pubescence on lateral and sternal sides shorter and denser but distinct.

Pygidium (Fig. 129). *Tergum*. Posterior margin straight, with evenly rounded corners. Relative lengths of setae: $a_1 = 100$, $a_2 = (51\text{-})71$, $a_3 = (104\text{-})147$, $st = (43\text{-})59$. Setae of two types: a_1 and a_2 thick, straight, cylindrical, blunt, glabrous; a_3 and st tapering, pointed, filiform distally, curved inwards and with distinct oblique pubescence, strongest on st. Distance $a_1 - a_1$ (0.5-)0.8 of length of a_1, distance $a_1 - a_2$ (1.4-)2.5 times as long as distance $a_2 - a_3$; distance $st - st$ 1.2(-1.3) times as long as st and about as long as distance $a_1 - a_1$. Cuticle of tergum sparsely covered with long spinous pubescence most posteriorly.

Sternum. Posterior margin between b_1 straight apart from shallow indentation just below anal plate. Relative lengths of setae (a_1=100): b_1 = (82-)94(-130), b_2 = (46-)62(-66). b_1 tapering, glabrous on one side, pubescence increasing in length distally; b_2 curved inwards, diverging, with long distal hair. b_1 0.9 of (– as long as) interdistance, b_2 1.2(-1.3) times as long as distance $b_1 - b_2$.

Anal plate (Figs 129, 130) Y-shaped, with its prongs 1.7 times as long as their common base; distal part of each prong terminated by a tapering blunt extension, 0.7 of length of prong; on sternal side of each extension a spine very similar to st but smaller. Plate and appendages with distinct oblique pubescence; cuticle of sternum with long sparse pubescence.

Stage subad. 8. Setae d_1 and d_2 tapering, pointed, with oblique pubescence; d_1 1.4 times as long as distance $d_1 - d_1$ and twice longer than d_2.

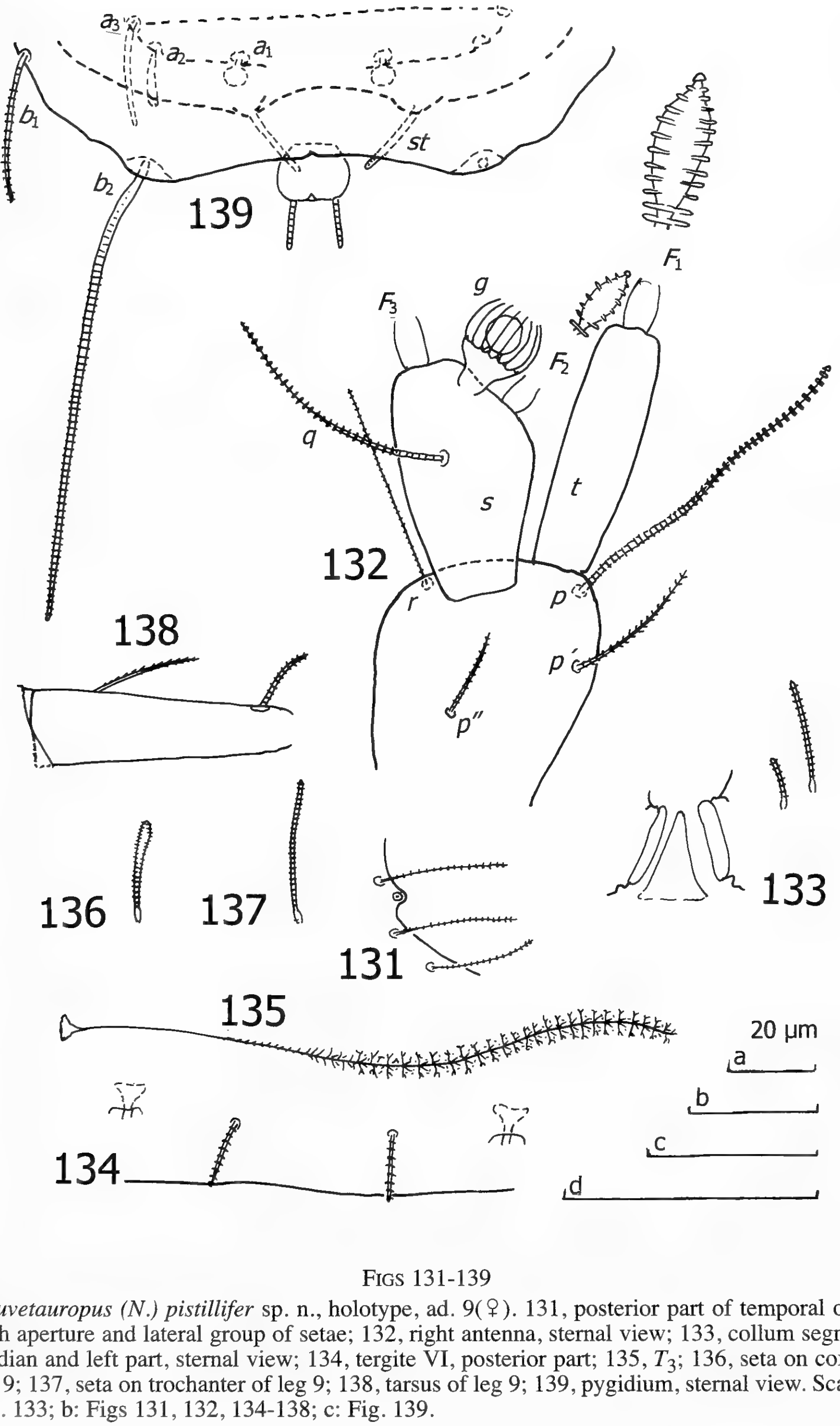
Genus ***Cauvetauropus*** Remy, 1952b
Subgenus ***Nesopauropus*** Scheller, 1997

20. *Cauvetauropus (N.) pistillifer* sp. n. Figs 131-139

Type material. **Holotype**: ad. 9(♀), GABON, Plateau Forestier d'Ipassa, primary forest, in soil, 20.V.1966 (loc. IPA3/b4, leg. Barra).

Total number. 1 specimen.

Diagnosis. *C.(N.) pistillifer* sp. n. may be closest to *C. (N.) subtilis* Scheller from Sri Lanka (Scheller, 1970). They are very alike as to the general shape of the antennae and the bothriotricha, but can be easily distinguished by: the shape of the



Figs 131-139

Cauvetauropus (N.) pistillifer sp. n., holotype, ad. 9(♀). 131, posterior part of temporal organ with aperture and lateral group of setae; 132, right antenna, sternal view; 133, collum segment, median and left part, sternal view; 134, tergite VI, posterior part; 135, T_3; 136, seta on coxa of leg 9; 137, seta on trochanter of leg 9; 138, tarsus of leg 9; 139, pygidium, sternal view. Scale a: Fig. 133; b: Figs 131, 132, 134-138; c: Fig. 139.

tergal antennal branch [3.3 times as long as its greatest width in *C. (N.) pistillifer* sp. n., 2.1 in *C. (N.) subtilis*], the shape of the setae on coxa and trochanter of leg 9 [simple in *C. (N.) pistillifer* sp. n., furcate in *C. (N.) subtilis*], the shape of the setae on the tarsus of leg 9 [proximal seta pointed, 0.4 of the length of the tarsus in *C. (N.) pistillifer* sp. n., blunt, 0.5 of the length of the tarsus in *C. (N.) subtilis*], the shape of the setae a_1 of the pygidial tergum [short, bladder-shaped in *C. (N.) pistillifer* sp. n., long, cylindrical in *C. (N.) subtilis*], and the shape of the anal plate [subcircular with long appendages in *C. (N.) pistillifer* sp. n., subrectangular with short appendages in *C. (N.) subtilis* Scheller].

Etymology. From Latin pistillum = club-shaped pounder and ferre = carry (referring to the setae a_1 of pygidial tergum).

DESCRIPTION

Length. 0.85 mm.

Head. Only partly available for study. Tergal setae cylindrical, blunt, striate. Relative lengths of setae, 1st row: $a_1 = a_2 = 10$; 2nd row: $a_1 = 9$, $a_2 = 15$, $a_3 = 7$; 3rd row: a_1 and a_2 = ?; 4th row: $a_1 = 7$, $a_2 = 15$, $a_3 = 12$, $a_4 = 20$; lateral group: $l_1 = l_3 = 20$, $l_2 = 19$. No pistil; posterior aperture (Fig. 131) close to posterior margin of temporal organ at level of l_1 and l_2.

Antennae (Fig. 132). Segment 4 with 4 thin, cylindrical, striate-annulate setae, *p"* and *r* very thin. Relative lengths of setae: $p = 100$, $p' = 35$, $p'' = 27$, $r = 61$. Tergal seta *p* 1.3 times as long as tergal branch *t*. The latter subcylindrical, 3.3 times as long as its greatest diameter and 1.3 times as long as sternal branch *s*, this1.4 times as long as its greatest diameter and with its anterodistal corner distinctly truncate. Seta *q* similar to *p*, 1.4 times as long as length of *s*. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 4$; $F_2 = 28$, $bs_2 = 3$; $F_3 = 81$, $bs_3 = 4$. F_1 5.2 times as long as *t*, F_2 and F_3 1.9 and 5.7 times as long as *s*, respectively. Distal calyces with very small caps and distal part of flagella axes strongly widened, almost ovoid and with many discs. Globulus *g* 1.3 times as long as wide; 17 bracts present; width of *g* as long as greatest diameter of *t*. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 133) simple, cylindrical, blunt, striate. Sublateral seta 2.2 times as long as submedian seta; sternite process narrow, triangular, without anterior incision; appendages short, wide, caps flat. Process with minute pubescence in anterior half.

Setae on tergites cylindrical, blunt, striate. 4+2 setae on tergite VI (Fig. 134); posterior setae there 0.4 of interdistance and 3.7 times as long as pygidial setae a_1.

Bothriotricha (Fig. 135). Axes very thin and simple. T_1 and T_2 not studied. Lengths of other trichobothria: $T_3 = 98$, $T_4 = 70$ and $T_5 = 135$ μm. Pubescence on all except T_3 very short, erect distally; T_3 with short simple oblique hairs in proximal half, these longer towards distal part, there also arranged in whorls and branched.

Legs. Setae on coxa and trochanter of all legs simple, blunt, striate. Seta on coxa of leg 9 (Fig. 136) somewhat clavate and 0.7 of length of cylindrical seta on trochanter (Fig. 137). Tarsus of leg 9 (Fig. 138) tapering, 3.1 times as long as its greatest diameter. Setae pointed, proximal seta long, somewhat curved, with short oblique pubescence, 0.4 of length of tarsus and 1.5 times as long as distal striate seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 139). *Tergum*. Posterior margin rounded, with shallow indentation between *st*. Relative lengths of setae: $a_1 = 10$, $a_2 = 23$, $a_3 = 40$, $st = 33$. a_1 short, subglobular, a_2 somewhat clavate, a_3 and *st* subcylindrical, blunt; a_2 and a_3 somewhat curved inwards, *st* converging. Distance $a_1 - a_1$ 5.7 times as long as a_1, distance $a_1 - a_2$ 2.5 times as long as distance $a_2 - a_3$; distance $st - st$ 2.5 times as long as *st* and 1.5 times as long as distance $a_1 - a_1$. Tergum glabrous.

Sternum. Posterior margin between b_1 with broad shallow indentation. Relative lengths of setae ($a_1 = 10$): $b_1 = 190$, $b_2 = 62$. b_1 and b_2 tapering distally, pointed, striate, the latter curved inwards. $b_1$1.4 times as long as interdistance; b_2 about as long as distance b_1 - b_2.

Anal plate narrowest anteriorly, short, 1.3 times as broad as long, linguiform, lateral margins convex, posterior margin with shallow sternal incision; each posterior lobe with a cylindrical, blunt, shortly striate and posteriorly directed appendage, 0.9 of length of plate. Sternum with anal plate glabrous.

Genus ***Hemipauropus*** Silvestri, 1902.
Subgenus ***Hemipauropus*** s. str.

21. ***Hemipauropus (H.) elongatus*** sp. n. Figs 140-151

Type material. **Holotype**: ad. 9(♂), GABON, Plateau Forestier d'Ipassa, primary forest, in soil, 7.VI.1966 (loc. IPA5/E5, leg. Barra). **Paratype**: ibidem, 1 ad. 9(♂), 7.VI.1966 (loc. IPA5/E16, leg. Barra).

Other material. Plateau Forestier d'Ipassa, primary forest, in soil, 1 juv. 6, 7.VI.1966 (loc. IPA5/E17, leg. Barra). – Edoungavion, under bark on soil, 1 ad. 9(♂), 21.II.1962 (loc. 12, leg. Condé & Remy).

Total number. 3 specimens.

Diagnosis. *Hemipauropus (H.) elongatus* sp. n. is well delimited from the other species of the genus by the very long and slender tarsi of the last pair of legs and the very thin setae a_3 on the pygidial tergum. It may be closest to *H. (H.) angolanus* Remy from Angola (Remy, 1955a) and *H. (H.) obrei* Remy from Mauritius (Remy, 1959b). Good distinctive characters in relation to *H. (H.) angolanus* are the length of the antennal setae *p* and *p'* [$p>p'$ in *H. (H.) elongatus* sp. n., $p<p'$ in *H. (H.) angolanus*], the shape of the seta *p* [somewhat clavate distally and striate in *H. (H.) elongatus* sp. n., foliform or bladder-shaped in *H. (H.) angolanus*], the shape of the apical organ of the antennal flagella F_2 [long and subcylindrical in *H. (H.) elongatus* sp. n., short and conical in *H. (H.) angolanus*] and the shape of the setae a_3 of the pygidial tergum [very thin distally in *H. (H.) elongatus* sp. n., tapering and blunt in *H. (H.) angolanus* Remy]. The new species is distinguished from *H. (H.) obrei* as follows: the antennal globulus *g* is short-stalked and 1.4-1.5 times as long as its greatest diameter in *H. (H.) elongatus* sp. n., long-stalked and 2.5 times as long as its greatest diameter in *H. (H.) obrei*; the apical organ of the antennal flagella F_1 and F_2 are cylindrical in *H. (H.) elongatus* sp. n., subovoid in *H. (H.) obrei* and the anal plate is more slender, 4.5 times as broad as long in *H. (H.) elongatus* sp. n., 2.5 times in *H. (H.) obrei*.

Hemipauropus (H.) elongatus sp. n. has also similarities with *H. (H.) leonensis* Scheller from Sierra Leone (Scheller, 1995) but that species has a much shorter and

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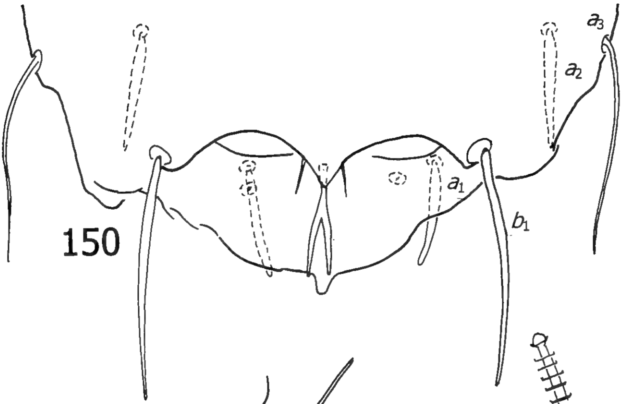

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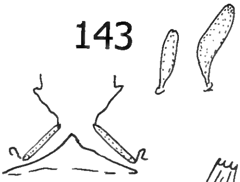

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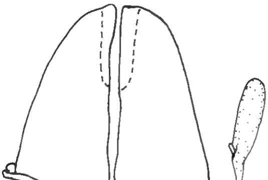

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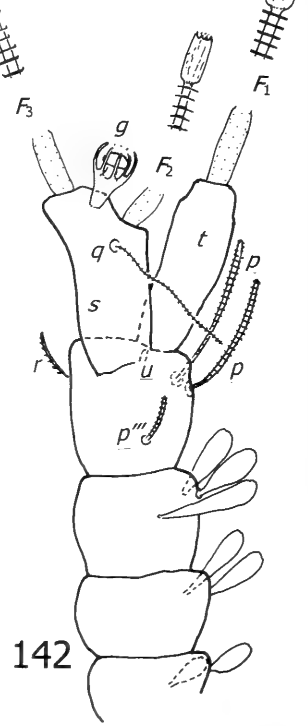

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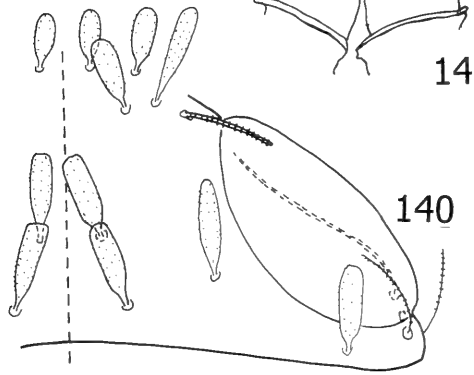

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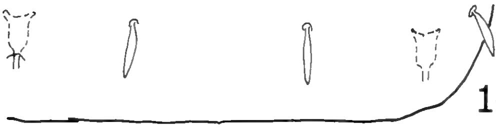

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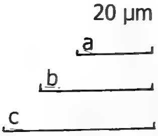


proportionally wider stalk of the antennal globulus *g*, proportionally shorter seta *q* and tarsi, and the seta a_3 on the pygidial tergum is thicker and has a distal hair.

Etymology. From Latin elongatus = prolonged (referring to the tarsi).

DESCRIPTION

Length. 0.62(-0.69) mm.

Head, holotype only (Fig. 140). Tergal setae of 1st row and a_1 in 2nd row of medium length, other tergal and lateral setae fairly long; main part of them leaf-shaped, glabrous or with very minute pubescence; a_3 in 2nd and 4th rows thin, striate, the former cylindrical, blunt, and the latter tapering, pointed. Relative lengths of setae, 1st row: $a_1 = 10, a_2 = 11$; 2nd row: $a_1 = 13, a_2 = 18, a_3 = 16$; 3rd row: $a_1 = 16, a_2 = 17$; 4th row: $a_1 = 16, a_2 = 15, a_3 = 21, a_4 = ?$; lateral group: $l_1 = 16, l_2 = 20, l_3 = 40$. Ratio $a_1/a_1 - a_1$ in 1st row 1.1, 2nd row 0.6, 3rd row 1.6 and 4th row 0.8. Length of temporal organs about as long as shortest interdistance. No pistil but very small aperture at posterior margin of temporal organs (Fig. 141). Head cuticle glabrous.

Antennae (Fig. 142). Segment 4 with 5 cylindrical, blunt, striate setae, *p* somewhat widened distally. Relative lengths of setae: $p = 100, p' = 85(90), p'' = 35(40), r = 35(39), u = 5$. Tergal seta *p* 0.9 of length of tergal branch *t*. The latter fusiform, 2.9(3.1) times as long as greatest diameter and (0.8)0.9 of length of sternal branch *s*, this 2.3(2.4) times as long as greatest diameter and with anterodistal corner distinctly truncate. Seta *q* thinner than *p* and *p'*, cylindrical, blunt, striate, (0.7)0.8 of length of *s*. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = (14)16$; $F_2 = (54)60$, $bs_2 = (11)13$; $F_3 = (94)95$, $bs_3 = (13)14$. F_2 and F_3 thinner than F_1. F_1 2.7(3.0) times as long as *t*, F_2 and F_3 (1.4)1.5 and 2.4 times as long as *s*, respectively. Distal organs of F_1 and F_2 subcylindrical, 2.5 times as long as greatest diameter and consisting of slightly curved and flattened bracts around a sessile ovoid capsule; distal organ of F_1 almost twice longer and also thicker than that of F_2; those of F_2 small and subhemispherical, without surrounding bracts. Globulus *g* 1.5 times as long as wide, with thin stalk; 10 bracts present; width of *g* 0.8 of greatest diameter of *t*. Antennae glabrous except for basal segments of flagella, these with a minute pubescence.

Trunk. Setae of collum segment (Fig. 143) furcate, main branch leaf-shaped, broadest in the middle, with minute pubescence; secondary branch rudimentary, cylindrical; these setae 4 times longer than their greatest diameter; sublateral seta 1.7 times as long as submedian seta; sternite process short, broad, triangular, not cleft distally, glabrous; appendages cylindrical with wide and flat caps, the latter minutely pubescent.

FIGS 140-151

Hemipauropus (H.) elongatus sp. n., holotype, ad. 9(♂). 140, head, median and right part, tergal view; 141, part of temporal organ and lateral group seta l_2; 142, right antenna, sternal view; 143, collum segment, median and left part, sternal view; 144, tergite VI, posterior part; 145, T_3; 146, genital papillae and seta on coxa of leg 2, anterior view; 147, seta on coxa of leg 9; 148, seta on trochanter of leg 9; 149, tarsus of leg 9; 150, pygidium, sternal view; 151, anal plate, lateral view. Scale a: Fig. 143; b: Figs 140-141, 144-149; c: Fig. 142; d: Figs 150-151.

Setae on tergite I as submedian setae on head, narrower more posteriorly. Anterior tergites transversely divided, I and II distinctly so, III incompletely so; 4+4 setae on I, 6+6 on II-V and a single row of 4 setae on VI (Fig. 144). Reticular cuticle pattern very weak, visible on tergites III-VI only.

Bothriotricha (Fig. 145). Relative lengths (holotype only): $T_1 = 100$, $T_2 = 78$, $T_3 = 97$, $T_4 = ?$, $T_5 = 174$. All with very thin axes and minute pubescence; axes of T_3 thickest.

Genital papillae (Fig. 146). Basal segments short but well developed, with narrow collar. Papillae twice longer than greatest diameter, slowly tapering distally, inner side almost straight, outer side strongly curved in distal third. Distal seta very short and thin. Setae on coxa of leg 2 not deviating from other coxal setae of anterior legs.

Legs. Setae on coxa (Fig. 147) and trochanter (Fig. 148) of leg 9 furcate; primary branch leaf-shaped, with subparallell lateral margins, 3.7 times as long as greatest width; secondary branch clavate, much shorter and thinner, about 0.6 of length of main branch. Both branches minutely pubescent. Corresponding setae more anteriorly with rudimentary secondary branches.

Tarsus of leg 9 (Fig. 149) long, tapering, very slender, (6.7)8.0 times as long as greatest diameter. Both setae tapering, pointed, almost glabrous; proximal seta 0.1(0.2) of length of tarsus and 1.3(1.9) times as long as distal seta. Cuticle of tarsus almost glabrous.

Pygidium (Fig. 150). *Tergum*. Posterior margin with rounded median bulge carrying small but distinct posteromedian extension. Relative lengths of setae: $a_1 = 100$, $a_2 = 110$, $a_3 = (189)194$, $st = ?$. Setae glabrous, a_1 and a_2 lanceolate, broadest in proximal third, a_3 thin, tapering, pointed, a_1 and a_3 curved inwards. *st* very small or lacking. Distance $a_1 - a_1$ 1.3(1.9) times as long as a_1, distance $a_1 - a_2$ twice longer than distance $a_2 - a_3$; distance $st - st$ 0.8 of distance $a_1 - a_1$.

Sternum. Margin between b_1 with a broad median pointed triangular lobe projecting backwards below anal plate. Relative lengths of setae ($a_1 = 100$): $b_1 = 210(260)$. Neither b_2 nor b_3 present. b_1 proportionately short, 0.7 of interdistance, tapering, glabrous, somewhat curved inwards.

Anal plate (Figs 150, 151) glabrous, with broad base with two thin, almost straight posterolateral spines and a posteromedian, unusually thin, forked appendage, 3 times longer than breadth of plate at base.

22. ***Hemipauropus (H.) bilobatus*** sp. n. Figs 152-160

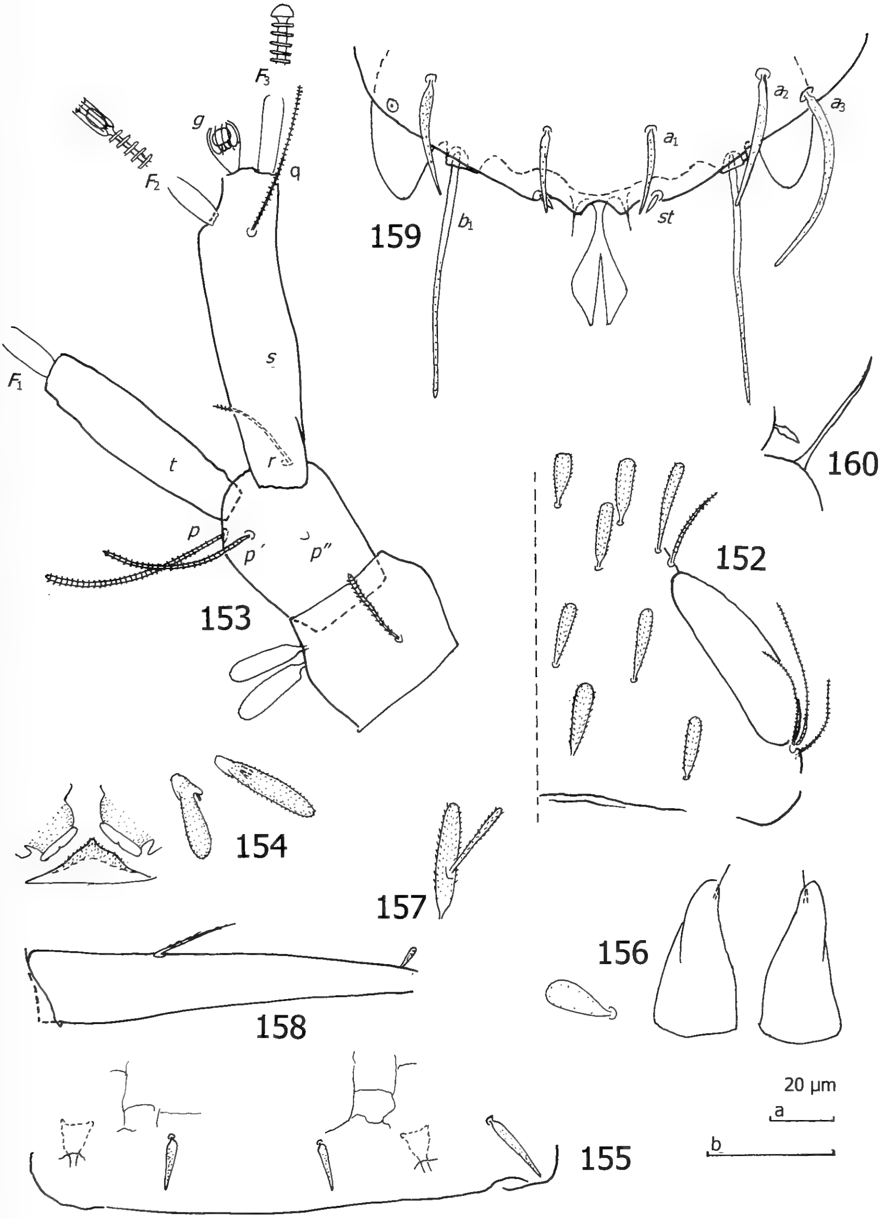
Type material. **Holotype**: ad. 9(♀), GABON, Edoungavion, beginning of trail to Alarmintang, near small stream, under wood, 2.III.1962 (loc. 15, leg. Condé). **Paratypes**: same data as for holotype, 2 ad. 9(♂ ♀).

Other material. Edoungavion, under bark on soil, 3 ad. 9(2♀,1sex ?), 2.III.1962 (loc. 15bis, leg. Condé & Remy).

Total number. 6 specimens.

Diagnosis. The large posterolateral lobes on the pygidial sternum have not been found in other species of the genus.

Etymology. From Latin bis = two and lobus = rounded projection (referring to the posterior part of the pygidial sternum).



Figs 152-160

Hemipauropus (H.) bilobatus sp. n., 152-155, 157-160, holotype, ad. 9(♀), 156 paratype, ad. 9(♂). 152, head, median and right part, tergal view; 153, left antenna, sternal view; 154, collum segment, median and left part, sternal view; 155, tergite VI, posterior part; 156, genital papillae and seta on coxa of leg 2, anterior view; 157, seta on trochanter of leg 9; 158, tarsus of leg 9; 159, pygidium, tergal view; 160, anal plate, lateral view. Scale a: Figs 152, 154-158; b: Figs 153, 159-160.

DESCRIPTION

Length. (0.98-)1.20(-1.21) mm.

Head, holotype only (Fig. 152). Tergal setae fairly long; main part of them leaf-shaped, with short dense pubescence; a_3 in 2nd and 4th rows thin, pointed, striate. Relative lengths of setae, 1st row: $a_1 = 10$, $a_2 = 12\text{-}13$; 2nd row: $a_1 = 13$, $a_2 = 18\text{-}19$, $a_3 = 18$; 3rd row: $a_1 = 13$, $a_2 = 14$; 4th row: $a_1 = 15$, $a_2 = 13$, $a_3 = ?$, $a_4 = ?$; lateral group: $l_1 = 22$, $l_2 = 30$, $l_3 = 21$. Ratio $a_1/a_1 - a_1$ in 1st row 1.2, 2nd row 0.5, 3rd row 1.6 and 4th row 1.0. Length of temporal organs 0.8 of shortest interdistance. No pistil but very small aperture at posterior margin of temporal organ. Head cuticle glabrous.

Antennae (Fig. 153). Segment 4 with 3 striate setae, p and p' cylindrical, blunt, r subcylindrical, tapering, pointed, p'' a rudimentary knob only. Relative lengths of setae: $p = 100$, $p' = (85\text{-})87$, $r = (46\text{-})51$. Tergal seta p (0.8-)0.9 of length of tergal branch t. The latter fusiform, 3.9(-4.6) times as long as greatest diameter and 0.7(-0.8) of length of sternal branch s, this (3.5-)4.2 times as long as greatest diameter and with anterodistal corner distinctly truncate. Seta q thinner than p and p', subcylindrical, tapering, striate, 0.5(-0.6) of length of s. Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 10(\text{-}11)$; $F_2 = (52\text{-})54(\text{-}55)$, $bs_2 = 10$; $F_3 = (96\text{-})112$, $bs_3 = (12\text{-})14$. F_1 2.4 times as long as t, F_2 and F_3 0.9 and (1.8-)1.9 times as long as s, respectively. Distal organs of F_1 and F_2 similar, subcylindrical, somewhat campanulate, 2.1 times as long as greatest diameter and consisting of thin, slightly curved bracts around a sessile ovoid capsule; distal organ of F_3 small and subhemispherical, without surrounding bracts. Globulus g 1.6(-1.8) times as long as wide with conical stalk; ≈ 10 bracts present; width of g 0.6 of greatest diameter of t. Antennae glabrous.

Trunk. Setae of collum segment (Fig. 154) furcate, main branch leaf-shaped, broadest in the middle, with minute pubescence; secondary branch rudimentary, cylindrical; these setae 3.8-5.8(-5.9) times as long as greatest diameter; sublateral seta 1.3(-1.4) times as long as submedian seta; sternite process short, broad, triangular; not cleft distally, anterior part distinctly pubescent; appendages widest proximally; caps flat, wide, glabrous; base segments with minute pubescence.

Setae on tergite I as submedian setae on head, more posteriorly narrower. 4+4 setae on I, 6+6 on II-IV, 4+2 on V and a single posterior row of 4 setae on VI. Submedian setae on VI (Fig. 155) lanceolate, broadest in proximal part, almost glabrous, 0.3 of interdistance. Reticular cuticle pattern very weak.

Bothriotricha. Axes very thin, pubescence very short, T_1, T_2 and T_4 thinnest. Relative lengths: $T_1 = 100$, $T_2 = \approx 100$, $T_3 = (141\text{-})168$, $T_4 = 150(\text{-}153)$, $T_5 = (237\text{-})288$.

Genital papillae (Fig. 156). Conical, twice longer than greatest diameter; distal seta short, thin, 0.2 of length of papilla. Setae on coxa of leg 2 not deviating from other anterior coxal setae.

Legs. Setae on coxa and trochanter of leg 9 (Fig. 157) furcate; primary branch leaf-shaped, with subparallell lateral margins, seta on trochanter 5.4 times as long as greatest width; seta on coxa proportionately broader; secondary branch shorter and thinner than primary branch, somewhat clavate, about 0.7 of length of main branch; distinct oblique pubescence on both branches. Corresponding setae on more anterior legs with rudimentary secondary branches. Tarsus of leg 9 (Fig. 158) slender, tapering, 5.4(-5.7) times as long as greatest diameter. Setae minutely pubescent, proximal seta thin, tapering, pointed; distal seta short, clavate. Proximal seta 0.2 of length of tarsus and (3.6-)4.1 times as long as distal seta. Cuticle of tarsus with faint pubescence.

Pygidium (Fig. 159). *Tergum*. Posterior part of pygidium broadly triangular, margin between *st* with two small submedian lobes separated by a rounded indentation. Relative lengths of setae: a_1 = 10, a_2 = (14-)15, a_3 = 23(-27), *st* = 2(-3). Setae almost glabrous, a_1 and a_2 lanceolate, broadest in proximal third, somewhat curved inwards; a_3 tapering, strongly curved inwards. *st* short, lanceolate. Distance $a_1 - a_1$ (1.1-)1.2 times as long as a_1, distance $a_1 - a_2$ (2.3-)2.8 times as long as distance $a_2 - a_3$; distance *st* – *st* (1.2-)1.3 times as long as distance $a_1 - a_1$.

Sternum. Margin between b_1 with one large median and two small submedian posterior bulges. Lateral margins just outside b_1 with large lobes projecting posteriorly; lobes blunt, with convex sides. Relative lengths of setae (a_1 = 10): b_1 = (26-)29. Neither b_2 nor b_3 present. b_1 almost straight, tapering, minutely pubescent, (0.8-)0.9 of interdistance.

Anal plate (Figs 159, 160) with somewhat coarse surface, broad base with two short thin almost straight diverging posterolateral spines and a long and broad forked posteromedian appendage, 2.2 times as long as breadth of plate at base.

Genus ***Polypauropus*** Remy, 1932

23. ***Polypauropus afrioccidentalis*** Scheller

Polypauropus afrioccidentalis Scheller, 1995: 41-43, figs 177-188.

Material examined. GABON, Plateau Forestier d'Ipassa, primary forest, in soil, ad. 9(♀), 17.VI.1966 (loc. IPA7/VM4, leg. Barra).

Total number. 1 specimen.

Taxonomic remarks. Compared with the type material from Sierra Leone, the specimen from Gabon has proportionately long pygidial setae a_1 and b_1, somewhat larger setae t_1 and the posterior margin of the small process between the anal plate setae has two glabrous posterior lobes instead of an undulated margin with some pubescence hairs.

General distribution. Previously known only from the locus typicus in Sierra Leone (Scheller, 1995).

REMARKS ON THE WEST AFRICAN PAUROPODA FAUNA

Many species were previously known from tropical West Africa, from Senegal in the north to Angola in the south. Remy has reported the main part by the describing of material from the Ivory Coast (1948b, 1952a, 1953, 1957b), Congo (1954, 1956a, 1962), Angola (1955a), Cameroon (1955b), Senegal (1957c), Gambia (1958a) and Guinea (1959a). The rest of the species have been described by Scheller, who has studied material from Angola (1975) and Sierra Leone (1995). From these papers, and with addition of the species reported here, a list of 111 identified species can be put together, about 15% of the world-fauna known up to now. Most of them, 91species or 82% of the known West African fauna, have not been collected elsewhere, indicating both a high diversity and a high degree of endemism. Those 20 species found outside tropical West Africa have mostly ranges which include the islands of the Indian Ocean and/or south Asia, but seldom North Africa and never South Africa. A few species have extremely large distribution ranges (*Allopauropus sphaeruliger* Remy, *A. bouini* Remy and *A. proximus* Remy) and may belong to an old subcosmopolitan element, and some of the new species show similarities with species now living far away. For example *Allopauropus singesensis* sp. n. has relations to species in Paraguay and Thailand, *A. stenygros* sp. n. to species in the Oriental region, *A. lambdoides* sp. n. to species not only in tropical Africa but also in Brazil, *Cauvetauropus pistillifer* sp. n. seems to be related to congeners in Sri Lanka and *Hemipauropus elongatus* sp. n. not only to African species but also to a species on Mauritius.

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REVUE SUISSE DE ZOOLOGIE 112 (2): 511-517; juin 2005

Two new taxa of *Galagete* (Lepidoptera, Autostichidae) from the Galápagos Islands, Ecuador

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Two new taxa of *Galagete* (Lepidoptera, Autostichidae) from the Galápagos Islands, Ecuador. - A new species and a new subspecies of the genus *Galagete* (Lepidoptera, Autostichidae) from the Galápagos Islands are described and illustrated. *Galagete griseonana* sp. n., known only from males, is endemic to the island of Santa Cruz. *Galagete pecki flavofasciata* ssp. n., known from both sexes, occurs on the islands of Santa Cruz and Santiago, where it is also believed to be endemic.

Keywords: Micro moths - Autostichidae - new species - new subspecies - endemic - Galápagos Islands.

INTRODUCTION

Autostichidae are gelechioid moths characterised by the gnathos being an articulated band with an unarticulated mesial hook, and by the presence of spiniform setae in a band across the abdominal terga. The caterpillars feed on dead or decaying plant or animal tissue (Hodges, 1998).

With a total of 13 species (one of which is not described), the genus *Galagete* Landry represents the first documented case of an extensive radiation of endemic Lepidoptera in the Galápagos Islands comparable in size to the radiation of the Darwin's finches with some species confined to one single island (Landry, 2002). The second largest radiation in Galápagos Lepidoptera found so far contains only three species (genus *Utetheisa* Hübner, Arctiidae).

For the purpose of enabling recognition and documentation of the elements of the *Galagete* radiation, and because we were able to obtain sufficient material in early 2004, we are describing below a new species of *Galagete* and a new subspecies of *Galagete pecki* Landry.

MATERIAL AND METHODS

The 51 specimens forming the basis of this study were collected by ourselves mostly during one expedition to the Galápagos in March-April 2004. Three of the specimens were collected by the second author in 1989 and 1992. The moths were collected at light, either with an ultra-violet light or a mercury vapour light suspended next to a white sheet.

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In listing the label data of the holotypes, the information is copied as found on the labels with slashes to express changes of lines, and abbreviations spelled out in square brackets, except "m" for "meters." As regard the lists of paratypes, the specimens' data are listed first in alphabetical order of island collected and then in order of dates collected, the information is recorded without indications of line changes, the abbreviations, except for distances, "GPS" (= Global Positioning System), and cardinal points, are spelled out only once at first encounter, collecting localities are reported without accented letters, dates are standardised, and collectors' information is standardised and placed in parentheses. For each taxon's holotype the data label is printed in black on white card stock while the holotype label is hand-written in black ink on red card stock. Other than the above mentioned, the following acronyms are used: BMNH for The Natural History Museum (London, England), CNC for Canadian National Collection of Insects, Arachnids, and Nematodes (Ottawa, Ontario, Canada), CDRS for Charles Darwin Research Station (Santa Cruz Island, Galápagos), MHNG for "Muséum d'histoire naturelle de Genève" (Geneva, Switzerland), and USNM for National Museum of Natural History (Washington, D. C., USA).

Genitalia were dissected after the abdomen had macerated in a cold 20% KOH solution overnight. The dissected parts were kept in lactic acid stained with orange G for description purposes. They were subsequently stained with chlorazol black and mounted on slides in Euparal. The forewing lengths were measured with a reticule on a stereomicroscope. The illustrations of the moths and genitalia were made with the AutoMontage® system using a JVC® video camera mounted on a Leica MZ APO stereomicroscope or a Zeiss Axioskop compound microscope. Illustrations of all *Galagete* species can be viewed on the web site of the MHNG at www.geneva-city.ch/musinfo/mhng/.

RESULTS

Our expedition to the Galápagos in 2004 brought only one new island record for previously described *Galagete* species: *G. turritella* Landry is also present on San Cristobal Island. Contrary to what is recorded in Landry (2002, p. 848) the holotype of *G. consimilis* Landry is not dissected and in the diagnosis for *G. consimilis* (same page of Landry, 2002), the 3rd line should read "*G. darwini*" instead of "*G. consimilis*". One of the paratype females of *G. seymourensis* Landry was wrongly associated with slide number BL 1344; the correct slide number is BL 1343.

DESCRIPTIONS

Galagete griseonana sp. n. Figs 1, 3-5

Galagete sp.; Landry, 2002: 819, 820, fig. 15.

Holotype ♂, [1] "ECU[ADOR], Galápagos, Santa Cruz/ C[harles] D[arwin] R[esearch] S[tation]/ base of El Barranco/ GPS: S 00°44.305' W 90°18.105'/ 18.iii.2004, u[ltra] v[iolet] l[ight]/ *leg[it]*. B[ernard]. Landry, P[atrick]. Schmitz". [2] "HOLOTYPE/ Galagete/ griseonana/ Schmitz & Landry". Specimen in perfect condition deposited in the MHNG.

Paratypes, Ecuador: 30 ♂, from the island of Santa Cruz, Galápagos Islands, collected at UVL by B. Landry and P. Schmitz, unless specified otherwise. 1 ♂ (dissected, slide MHNG 2703), CDRS, arid zone, 3.ii.1989, M[ercury] V[apour] L[amp] (B. Landry); 2 ♂, with same data as holotype; 7 ♂ (one dissected, slide BL 1596), CDRS wall of Invert[ebrate]s. Lab[oratory]., GPS: S 00°44.478' W 90°18.132', 19.iii.2004; 20 ♂ (one dissected, slide BL 1595), same locality but 6.iv.2004. Deposited in the BMNH, CNC, CDRS, MHNG, and USNM.

Diagnosis. Among the species of *Galagete*, *G. griseonana* can be distinguished by its very small size (wingspan: 5.7-7.1 mm) and by its forewing appearing uniformly grey-brown. This combination of size and colour is unique. Some specimens of *Galagete darwini* Landry (wingspan: 7.0-9.0 mm) and *Galagete pecki* Landry (wingspan: 7.5-8.7 mm) are only slightly larger, but their background colour is brown or beige respectively with distinct markings (see Landry, 2002, figs 7, 8, and 13). *Galagete cinerea* Landry is also a grey-brown species, but it is much larger (wingspan: 8.5-11.2 mm) and has darker markings (see Landry, 2002, fig. 14).

Description. MALE (n=31) (fig. 1). Head grey-brown with whitish beige scales around eye. Haustellum and maxillary palpus whitish beige. Labial palpus grey-brown on first segment; second segment whitish beige medially and dorsally, laterally grey-brown except for apical whitish beige ring laterally and ventrally; third segment grey-brown ventrally, whitish beige dorsally. Antennal scape with few whitish beige scales apically; flagellum grey-brown. Thorax dorsally grey-brown except for shining whitish grey-brown metascutellum. Foreleg coxa grey-brown at base, whitish beige apically; femur, tibia, and tarsomeres mostly grey-brown with whitish beige at apex of tibia and apex of tarsomere I and V. Midleg femur whitish beige with grey-brown on dorsal edge apically; tibia pale grey-brown with whitish beige apically and on spurs; tarsomeres I-V mostly whitish beige with grey-brown at base of each segment. Hindleg whitish beige. Male wingspan: 5.7-7.1 mm (Holotype: 6.8 mm). Forewing grey-brown, with sometimes slightly darker grey-brown markings as small spots submedially and in cubital fold and postmedially at the end of cell; fringe grey-brown. Hindwing pale greyish brown, fringe pale whitish beige. Abdomen whitish beige, without modified scales.

Male genitalia (n=3) (figs 3-5). Basal half of uncus only slightly angled from second half; second half not produced dorsally, apical margin only slightly concave; arms slightly laterally compressed, triangular, short, apically rounded; dorsal crests broadly rounded, poorly demarcated. Median hook of gnathos rather short and thick, very slightly upturned and pointed apically. Dorsal connection of tegumen wide; pedunculi short and broad. Lateral arms of transtilla moderately long, broad, rounded, median surface with fan-shaped scales towards base and setae mostly apically, edges setose; median arm as long as or slightly longer than lateral arms, very narrow for whole length. Valva of medium length and width, dorsal margin angled ventrally very gently before apex; ventral margin angled dorsally from about 1/3 and with subbasal notch; apex broadly rounded; costa melanised from base to about 2/3; sacculus rather wide, of medium length, apically flattened and blunt. Juxta symmetrical, somewhat heart shaped, with rather shallow and broadly rounded median notch. Vinculum bulbous, short and rounded, not projecting dorsoapically. Aedeagus narrow, slightly arched, larger at base with very short coecum penis; apical 1/3 open ventrally, dorsal wall slightly bent to right, narrowly rounded; vesica with abundant spicules, without cornuti.

FEMALE. Unknown.

Etymology. From the Latin *griseus*, grey, and *nanus*, a dwarf, referring to the colour of the forewing and the size of this species.

Biology. Unknown although moths are attracted to light in the arid zone between February and April.

Distribution. Currently known only from the Galápagos island of Santa Cruz; presumed to be endemic to the archipelago and possibly to Santa Cruz.

Remarks. This species had been recognised as new by Landry (2002) but was not described then because only one damaged specimen was available. Based on our collecting experience, the available sample being made of males only may reflect a sexually-linked seasonality pattern, or that the females are flightless, or that they are not attracted to light, or that their flying period each night is later than that of the males. It remains to be tested.

Galagete pecki flavofasciata ssp. n. Fig. 2

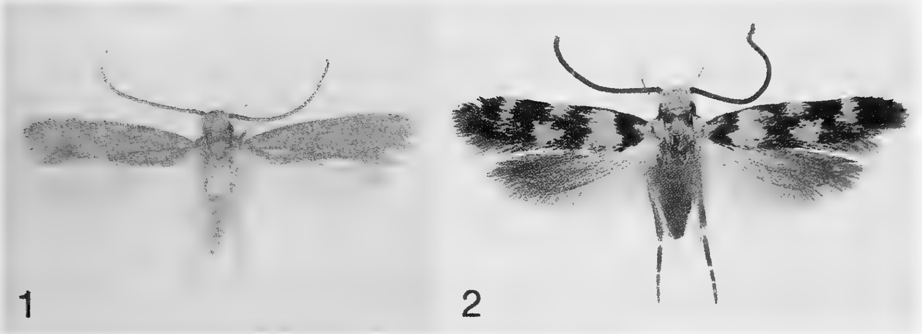
Galagete sp.; Landry, 2002: 866, fig. 36 E, F.

Holotype ♂, [1] "ECU[ADOR], Galápagos, Santa Cruz/ C[harles] D[arwin] R[esearch] S[tation], wall of Invert[ebrate]s. Lab[oratory]./ GPS: elev[ation]. 11 m, S 00°44./478' W 90°18.132' 6.iv.2004/ u[ltra] v[iolet] l[ight]/ *leg[it]*. B[ernard]. Landry, P[atrick]. Schmitz". [2] "HOLOTYPE/ Galagete/ pecki flavofasciata/ Schmitz & Landry". Specimen complete except for small notch at apex of left forewing and few segments missing on left flagellum. Deposited in the MHNG.

Paratypes, Ecuador: 9 ♂, 10 ♀ from the Galápagos Islands, collected at UVL by B. Landry and P. Schmitz, unless specified otherwise. *Santa Cruz:* 1 ♂, 3 ♀, transition zone, recently cut road, GPS: S 00°42.528' W 90°18.849', 12.iii.2004; 1 ♂, 1 ♀, low agriculture zone, GPS: S 00°42.132' W 90°19.156', 13.iii.2004; 6 ♂ (one dissected, slide BL1600), 2 ♀ (one dissected, slide BL 1601), CDRS base of El Barranco, GPS: S 00°44.305' W 90°18.105', 18.iii.2004; 1 ♂, 1 ♀, CDRS wall of Inverts. Lab., GPS: elev[ation]. 11 m, S 00°44.478' W 90°18.132', 19.iii.2004; 1 ♀ (dissected, slide BL 1306), Finca Vilema, 2 km W [of] Bella Vista, 1.iv.1992, M[ercury] V[apour] L[amp] (B. Landry); 1 ♀, with same data as holotype. *Santiago:* 1 ♀, Aguacate, 520 m elev., 7.iv.1992, M[ercury] V[apour] L[amp] (B. Landry). Deposited in the BMNH, CNC, CDRS, MHNG, and USNM.

Diagnosis. Among the species of *Galagete*, *G. pecki flavofasciata* can be easily distinguished by its yellowish-orange (or whitish beige) forewing markings. Only *Galagete pecki pecki*, *G. levequei* Landry, and *Galagete cristobalensis* Landry are similar in wing markings (see Landry, 2002, figs 10-13), but the background colour of their forewings is white to beige or pale greyish brown.

Description. MALE (n=10) (fig. 2). Head whitish beige to yellowish-orange with few thin dark brown scales along posterior eye margin. Haustellum and maxillary palpus whitish beige. Labial palpus greyish brown, shining on first segment; whitish beige on second segment sometimes with brown scales laterally at base; third segment whitish beige except for pair of usually connected blackish brown spots on second half laterally and ventrally and with small blackish brown spot ventrally at base. Antennal scape and flagellum blackish brown. Thorax dorsally blackish brown at base to 1/5-1/3, less so on tegula, whitish beige to yellowish orange in middle including most of tegula and lateroposteriorly, dark greyish brown at apex medially; metascutellum greyish brown, shining. Foreleg coxa whitish beige; femur blackish brown with whitish beige at apex; tibia blackish brown with whitish beige at apex, base, and small patch medially; tarsomere I blackish brown with whitish beige at apex; tarsomeres II-IV



FIGS 1-2
Holotypes of *Galagete* species. 1. *Galagete griseonana* sp. n.; 2. *G. pecki flavofasciata* ssp. n.

blackish brown. Midleg femur and tibia as in foreleg, tibial spurs whitish beige; tarsomere I, II and V blackish brown with whitish beige at apex; tarsomere III and IV blackish brown. Hindleg femur whitish beige; tibia greyish brown with whitish beige apically, spurs whitish beige; tarsomere I, II, and V with whitish beige at apex; tarsomere III and IV blackish brown. Wingspan: 6.0-6.9 mm (Holotype: 6.5 mm). Forewing blackish brown with whitish beige to yellowish-orange as small basal spot, subbasal band of variable width sometimes separated by line of blackish brown scales in cubital fold, two small spots of variable shape, sometimes connected, one on coastal margin between 2/5 and 1/2 and one slightly larger on inner margin at 1/2, and a transverse band of variable width postmedially from costa to below cell or to inner margin; fringe dark greyish brown. Hindwing and fringe greyish brown. Abdomen greyish brown, shining, without modified scales, but whitish beige on valvae.

Male genitalia (n=1) (fig. 30 A-D in Landry, 2002) as in *Galagete pecki pecki*.

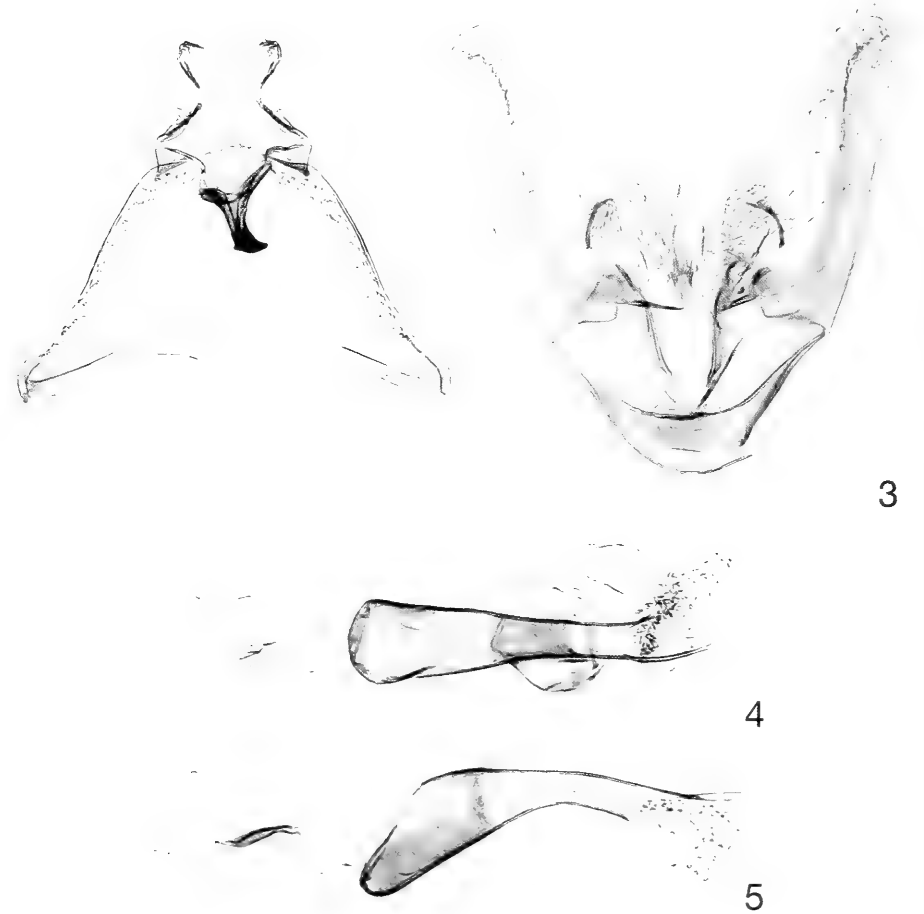
FEMALE. (n=10). Colour as in males but often with more extensive whitish beige to yellowish orange markings. Antenna slightly thinner than those of males. Forewing length: 6.4-8.2 mm.

Female genitalia (n=2) (fig. 36 E, F in Landry, 2002) as *Galagete pecki pecki* (fig. 32 A, B in Landry, 2002). Other dissected specimen differs from that illustrated on fig. 36 E, F (Landry, 2002) in having more broadly rounded lobes of sternum VIII, more broadly emarginated apical margin of tergum VIII, and more distinct scobination on membrane posterad ostium. Both dissected specimens differ from *G. p. pecki* in having a more simple signum, without smaller spines at base of lateral spines, and no scobination on corpus bursae.

Etymology. From the Latin *flavus*, yellow, and *fascia*, band, referring to the colour and pattern of the forewings.

Biology. Unknown except for the fact that adults come to light and fly from March to April in habitats between near sea level to 520 m in elevation.

Distribution. Presently known only from the islands of Santa Cruz and Santiago, the subspecies is presumed to be endemic to the Galápagos.



FIGS 3-5
Male genitalia of *Galagete griseonana* sp. n. 3. Whole genitalia without aedeagus (slide BL 1595); 4. Aedeagus in dorsal view (slide BL 1595); 5. Aedeagus in lateral view (slide BL 1596).

Remarks. The absence of noticeable differences in the genitalia was the first reason we decided to recognise this species as part of *Galagete pecki*. However, the male (6.0-6.9 mm) and female (6.4-8.2 mm) wingspans of *Galagete pecki flavofasciata* are smaller than those of the respective sexes (7.5-8.7 and 8.2-8.3 mm) of *G. pecki pecki*, which is known only from Isabela Island. These differences in wing size and forewing coloration in addition to their allopatry were the reasons we decided to describe the *G. pecki* specimens collected on the islands of Santa Cruz and Santiago as a distinct subspecies (*G. pecki flavofasciata*). We were also comforted in this decision when we found that a specimen of *G. pecki flavofasciata* had a 2.7 % sequence divergence in a 1.4-kb fragment of the Cytochrome Oxidase I (COI) gene with *G. p. pecki* (P. Schmitz, unpublished). This amount of intraspecific divergence in this gene is within the range of results obtained in other Lepidoptera studies (Landry *et al.*, 1999). In comparison, the smallest amount of interspecific divergence in the same fragment of COI between *Galagete* species that are easily recognised on the basis of genitalic characters is 4.9 % (P. Schmitz, unpublished). Hopefully these subspecies of *Galagete pecki* will not be united by anthropogenic factors that would alter their evolutionary paths.

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REVUE SUISSE DE ZOOLOGIE 112 (2): 519-539; juin 2005

The Western Palaearctic species of *Stenomicra* Coquillett (Diptera, Periscelididae, Stenomicrinae), with description of a new species of the subgenus *Podocera* Czerny

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The Western Palaearctic species of *Stenomicra* Coquillett (Diptera, Periscelididae, Stenomicrinae), with description of a new species of the subgenus *Podocera* Czerny. - *Stenomicra* (*Podocera*) *soniae* sp. n. is described from Central and Southeast Europe, and compared with morphologically similar species. The type material of *Stenomicra (Podocera) delicata* (Collin, 1944) is revised and the species redescribed. Both European species of *Podocera* Czerny are illustrated and their biology and distribution reviewed with a number of new records. A key to the four Western Palaearctic species of *Stenomicra* is presented.

Keywords: Periscelididae - *Stenomicra* (*Podocera*) - new species - Western Palaearctic.

INTRODUCTION

The systematic position of *Stenomicra* Coquillett was for a long time subject to controversial opinions since Coquillett (1900) originally placed it in the Drosophilidae. The genus was later included in the Anthomyzidae (Collin, 1944; Sabrosky, 1965), Asteiidae (Malloch, 1927), Aulacigastridae (Hennig, 1971; Sabrosky, 1975; Cogan, 1976; Irwin, 1982; Teskey, 1987) or treated as separate family, Stenomicridae (Roháček, 1983, 1987, 1997; Papp, 1984, 2001; Khoo & Sabrosky, 1989; Andersson, 1991, Tschirnhaus, 1992; Bächli, 1997, 1998; Chandler, 1998; Roháček & Barták, 2001; Merz, 2002; Drake, 2004). McAlpine (1978) provisionally referred the genus to the Periscelididae. This proposition is now widely accepted, often with subfamilial status given to the group (Grimaldi & Mathis, 1993; Mathis & Papp, 1998; Tschirnhaus, 1999; Freidberg & Mathis, 2002) and is therefore adopted in the present paper.

Sabrosky (1975) proposed that *Stenomicra* may be divided into two well-distinguished subgenera, *Stenomicra* s. str. and *Podocera* Czerny, 1929, and this division was followed by subsequent workers (Papp, 1984; Freidberg & Mathis, 2002). Chandler (1998) suggested, however, that *Podocera* Czerny is preoccupied by *Podo-*

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cera Latreille, 1817. The latter spelling (*Podocera*, Latreille, 1817) must be considered an incorrect subsequent spelling of *Podocerus* Leach, 1814, to which Latreille explicitly refers. For this reason the name *Podocera* Latreille does not fall within the rules of the Code and *Podocera* Czerny is the valid genus-group name (ICZN, Articles 33.3 and 33.5).

Very little is known about the biology of *Stenomicra*. According to Williams (1939), larvae of a Hawaiian species were found in water-holding leaf bases of several monocotyledones. Adults of *S. delicata* (Collin, 1944) were collected on vegetation in an old empty pond (Collin, 1944) and subsequently recorded to be closely associated with tussocks of large *Carex* species (Howe & Howe, 2001; Howe *et al.,* 2001; Drake 2004). *Stenomicra cogani* Irwin, 1982, was originally found in vegetation beside a small lake (Irwin, 1982), later collected in bogs and marshes from large stands of *Carex paniculata* (Howe & Howe, 2001), *Typha* (Merz, 2002), large *Carex* spp. [*C. paniculata, C. elata, C. rostrata, C. acutiformis* (Drake, 2004)], and on large *Carex* in a water pond in Northern Italy (Merz, unpublished observation). Freidberg & Mathis (2002) described *S. jordanensis* from specimens swept on *Cyperus*. These observations suggest that most *Stenomicra* may be associated with grass-like monocotyledones in wetland habitats and may be either phytophagous or saprophagous.

Stenomicra has an almost world-wide distribution, with about 20 extant species described from all biogeographical regions (Freidberg & Mathis, 2002) and two fossil species from Dominican Amber (Grimaldi & Mathis, 1993). However, according to Freidberg & Mathis (2002) over 100 species from the Neotropical Region await description. About 10 undescribed species are deposited in the collection of the “Muséum d’histoire naturelle, Genève”, mainly from the Oriental and Australasian Regions. Evidently, these tiny flies are still very incompletely studied. Collin (1944) described the first species, *S. delicata*, occuring in the Western Palaearctic Region. Later, Irwin (1982) added a species from Wales, and Freidberg & Mathis (2002) a species from Israel. Andersson (1991) mentioned two probably undescribed species from Sweden but he did not describe them.

During a recent field trip near Geneva three specimens of a *Stenomicra* (*Podocera*) were collected by beating tussocks of *Carex*. Their identification showed that previous records of *S. delicata* from Switzerland (Bächli, 1997, 1998), Czech Republic (Roháček, 1995a, 1997; Roháček & Barták, 2001) and Slovakia (Papp, 1978; Roháček, 1983, 1986, 1987, 1995b, 1997) were misidentifications and refer to a hitherto undescribed species. To clear up the morphological limits of the two Western Palaearctic species of the subgenus *Podocera* a key and detailed descriptions of both species are presented below.

MATERIAL AND METHODS

The material which was studied in this paper is deposited in the following collections:

BUB	Fakultät für Biologie, Universität Bielefeld, Germany
HNHM	Hungarian Natural History Museum, Budapest, Hungary
MHNG	Muséum d’histoire naturelle, Genève, Switzerland

SMO	Silesian Museum, Opava, Czech Republic
TAU	Entomological collection of the Tel-Aviv University, Tel-Aviv, Israel
UMO	Hope Entomological Collections, University Museum, Oxford, Great Britain
CGB	private collection G. Bächli, Dietikon, Switzerland
CMB	private collection M. Barták, Praha, Czech Republic

In the "Material" section the Swiss cantons are indicated according to the official abbreviations: GE = Genève, JU = Jura, TI = Ticino, VS = Valais, ZH = Zürich. Terminology of morphological structures follow the first chapters in Papp & Darvas (2000) and Freidberg & Mathis (2002). Structures of antennae are according to Stuckenberg (1999). Abdominal sternites and tergites are abbreviated as "S" and "T" respectively in the descriptions.

KEY TO WESTERN PALAEARCTIC SPECIES OF *STENOMICRA* COQUILLETT, 1900

1 Costal section between apices of veins R2+3 and R4+5 at least 3 times as long as section between R4+5 and M1+2 (Fig. 29); anterior fronto-orbital seta much smaller and shorter than posterior fronto-orbital seta, usually reclinate .... subgenus *Stenomicra* s. str. 2

\- Costal section between apices of veins R2+3 and R4+5 shorter or about as long as section between R4+5 and M1+2 (Figs 4, 17); both fronto-orbital setae subequal in length and strength, anterior seta usually inclinate (Figs 1, 2,13, 14) .... subgenus *Podocera* 3

2 Posterior crossvein (DM-Cu) absent; body almost entirely yellow (Fig. 28) .... *S. cogani* Irwin, 1982

\- Both crossveins present; body yellow with longitudinal black vittae on scutum (laterally of line of dorsocentral setae), pleurae (anepisternum and katepisternum, Fig. 29), scutellum (laterally at base) and abdomen (paired spots on T 3 and 4, see Freidberg & Mathis, 2002, Fig. 2) .... *S. jordanensis* Freidberg & Mathis, 2002

3 Wing (Fig. 4) without alula, CuA2 developed as a fold (cell cup partly closed); base with broad milky white crossband; pterostigma brown, distally uniformly hyaline; no gap between last two dorsocentral setae (Fig. 25); all femora and tibiae uniformly yellow (Fig. 24); basal two abdominal tergites ivory yellow, remaining tergites orange-yellow to pale brown (T 3 and 4); surstylus bilobate (Figs 8, 12); two bare, asymmetric pregonites present (Figs 10, 11); only left postgonite developed (Fig. 10) .... *S. delicata* (Collin, 1944)

\- Wing with a small alula, without trace of CuA2 (cell cup open); surface uniformly hyaline, but base of wing with very narrow milky white crossband and both crossveins bordered with milky frame (Fig. 17); last two dorsocentral setae separated by a distinct gap (Fig. 27); hind femur and hind tibia each with a black ring (Fig. 26); abdomen more or less uniformly brown; surstylus simple (Figs 20, 23); only right pregonite present, covered with small tubercles (Figs 19, 22); two rather large postgonites developed (Fig. 22) .... *S. soniae* sp. n.

TAXONOMIC PART

Stenomicra Coquillett

Stenomicra Coquillett, 1900: 262. Type species: *Stenomicra angustata* Coquillett, by original designation.

Subgenus ***Podocera*** Czerny

Podocera Czerny, 1929: 93. Type species: *Podocera ramifera* Czerny, by original designation. Synonymy and subgeneric status with *Stenomicra* by Hendel, 1931: 10.

Neoscaptomyza Séguy, 1938: 347. Type species: *Neoscaptomyza bicolor* Séguy, by original designation. Synonymy with *Stenomicra* (*Podocera*) by Sabrosky, 1975: 664.

Diadelops Collin, 1944: 265. Type species: *Diadelops delicata* Collin, by original designation. Synonymy with *Stenomicra* s. lat. by Sturtevant, 1954: 560. Synonymy with *Podocera* by Irwin, 1982: 235.

Stenomicra (Podocera) delicata (Collin) Figs 1-12, 24-25

Diadelops delicata Collin, 1944: 266.

Stenomicra delicata: Sabrosky, 1965: 211; Howe & Howe, 2001:48; Howe *et al.*, 2001: 148; Drake, 2004: 3.

Stenomicra (Podocera) delicata: Irwin, 1982: 235; Papp, 1984: 62; Tschirnhaus, 1999: 171.

Stenomicra (Diadelops) delicata: Chandler, 1998: 142.

TYPE MATERIAL

Lectotype ♂ (here designated), **Great Britain**: "S. L. [= Sussex Lodge], Nmkt. [= Newmarket], dry pond, 11.7.43 [= 11.VII.1943]", "VC-Type 645, *Diadelops, delicata* Collin ♀" (UMO). Paralectotypes: 1♀, same data; 1♀, same data, but 5.VII.1942; 1♀, same data, but 1.VII.1942; 1♂, same data, but 19.VII.1942 (all UMO).

This species was described based on 4♂♂, 5♀♀ all from the same locality (Collin, 1944; Pont, 1995). Of these, the above listed 2♂♂ and 3♀♀ could be examined. The male which is herewith selected as lectotype is pinned on a minuten pin, in good condition with few setae on the head missing and with the minuten pin obscuring some setulae on the scutum. The other male was dissected. Its terminalia agree with Figs 1-12.

ADDITIONAL MATERIAL (5 specimens)

Germany: 1♂, NW [= Nordrhein-Westfalen], Bielefeld, Hohberge, 30.VI. 1992, F. Püchel (BUB). 1♀, SH [= Schleswig-Holstein], Kreis Plön, Trentmoor, between Preetz and Plön, 23.IV.1993, Malaise trap, Kassebeer (BUB).

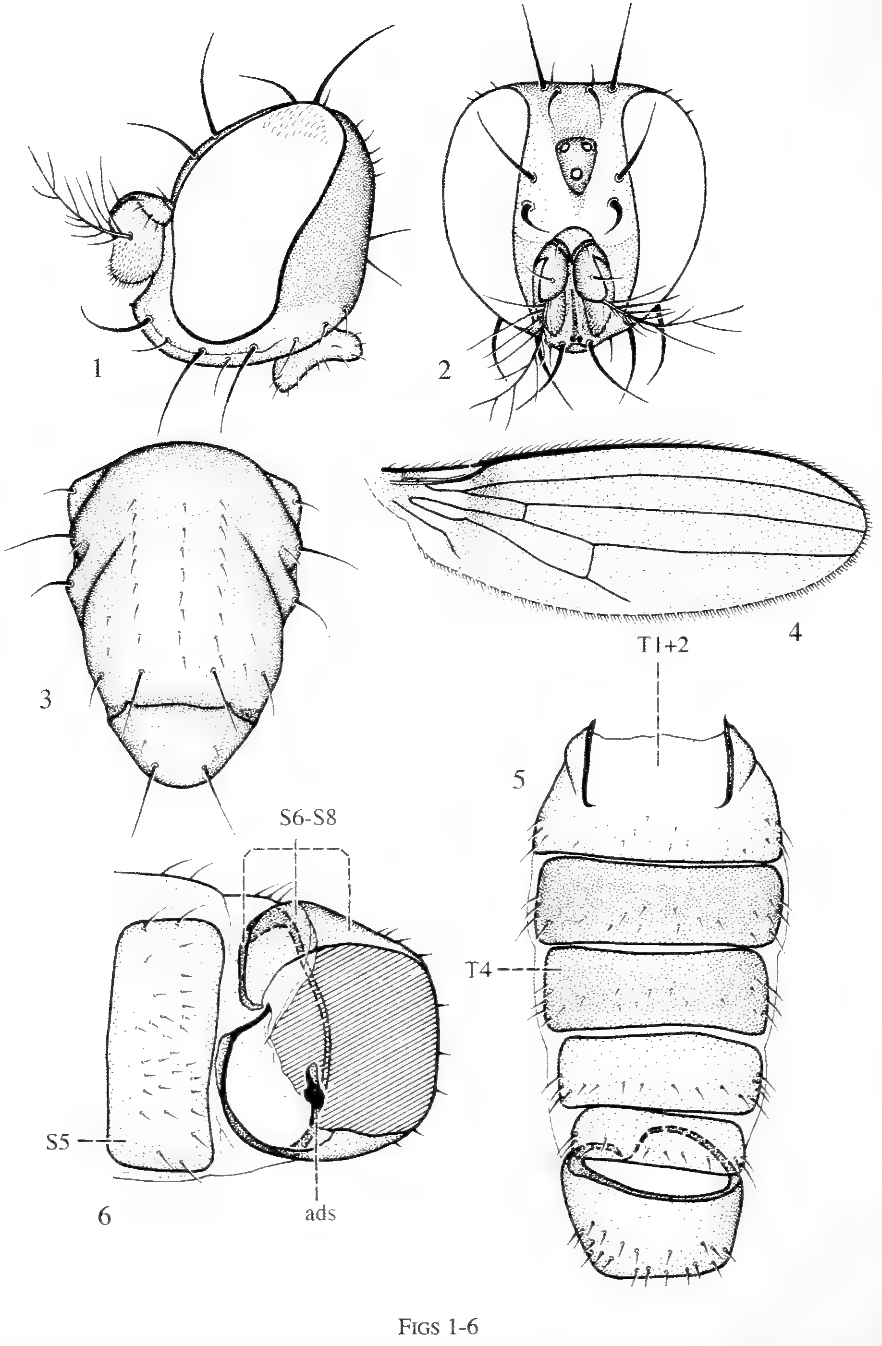
Switzerland: 1♂, 2♀♀, GE, Jussy, Prés de Villette, 475 m, 18.V.2004, B. Merz (MHNG).

DIAGNOSIS

This is a very small, slender species (wing length less than 2 mm) which can be distinguished from the other, more robust Western Palaearctic species of *Podocera* (*S. soniae*) by the absence of an alula, but the presence of a faint CuA2 (cell cup therefore partly closed); the broad white crossband at wing base with brown pterostigma, remaining wing surface uniformly hyaline; the grey thorax including scutellum but ventral half of pleura yellow (Figs 24, 25); all femora and tibiae entirely yellow; the basal two abdominal tergites ivory yellow, the remaining tergites orange-yellow to pale brown, and very different male terminalia. Further differences are given in Tab. 1.

TABLE 1. Comparison of morphology of *Stenomicra delicata* (Collin, 1944) and *S. soniae* sp. n. Abbreviations: A = Abdomen; G = Genitalia (male); H = Head; L = Legs; T = Thorax; W = Wing.

Character	*S. delicata* (Collin)	*S. soniae* sp. n.
H: small postocellar setae on occiput	present (Fig. 2)	absent (Fig. 14)
H: frons	higher than wide (Fig. 2)	wider than high (Fig. 14)
T: colour scutellum	uniformly grey	grey, apically yellow
T: colour anepisternum	dorsally grey, ventrally yellow	uniformly grey
T: dorsocentral setae	only last dorsocentral seta longer, not separated by a gap (Fig. 3)	last two dorsocentral setae long, separated by broad gap (Fig. 16)
W: length : width ratio	3:1 (Fig. 4)	2.7:1 (Fig. 17)
W: alula	absent	small, but distinct (Fig. 17)
W: base	with broad milky-white crossband (Fig. 4)	very narrow milky-white crossband (Fig. 17)
W: distal margin of anal cell	faint, convex crossvein (Fig. 4)	no trace of crossvein (Fig. 17)
W; crossveins (R-M; DM-Cu)	uniformly hyaline as rest of wing (Fig. 4)	bordered by milky-white frame (Fig. 17)
W: knob of halter	white	brown to black (specimens in alcohol: very pale)
L: colour hind femur and tibia	uniformly yellow	apical third of femur and basal third of tibiae with black ring
A: colour	basal two tergites ivory-yellow, posterior tergites orange-yellow to pale brown	uniformly brown
G: Surstylus	apically bilobate (Fig. 12)	apically simple (Fig. 23)
G: pregonite	2 asymmetric present, both bare (Figs 10, 11)	only right present, rugulose (Fig. 22)
G; postgonite	only left present, small (Fig. 10)	2 asymmetric present (Fig. 22)
G: Phallapodeme	stout (Fig. 9)	slender (Fig. 21)



Figs 1-6

Stenomicra (*Podocera*) *delicata* (Collin). 1, head laterally; 2, head dorsofrontally; 3, thorax dorsally; 4, wing; 5, abdomen dorsally; 6, postabdomen + 5th sternum ventrally (genitalia omitted). Abbreviations: ads = additional sclerite; S = Sternite; T = Tergite. (Del. J. Roháček)

DESCRIPTION OF MALE

Wing length. 1.60 mm. Body length: 1.3 mm (1.25-1.5 mm according to Collin, 1944).

Head (Figs 1-2). Yellow, but thinly ash-grey microtrichose on posterior part of frons and partly on occiput posterior of compound eye; compound eye with short, but distinct interfacetal setulae; form as in *S. soniae*; frons bare, parallel-sided, about 1.35 times as high as wide; ocellar triangle slightly raised, in the middle of frons; face as in *S. soniae*, the pair of small sensillae medially more closely together; antenna as in *S. soniae*; arista large, plumose, rays much longer than diameter of postpedicel, dorsally with 5, ventrally with 3 long rays; mouthparts as in *S. soniae*. Chaetotaxy: colour of major setae and setulae yellow to brown depending on viewing angle and illumination; 2 subequal fronto-orbital setae in anterior half of frons, anterior fronto-orbital seta proclinate and inclinate, posterior fronto-orbital seta reclinate; 1 long, lateroclinate medial vertical seta; anteromedially with 1 slightly shorter, proclinate pseudopostocellar seta; dorsally of pseudopostocellar seta with 1 very short, upright postocellar seta on occiput; no ocellar seta; 1 porrect, lateroclinate and slightly dorsoclinate pseudovibrissa; ventrally of them with 1 short, dorsoclinate seta and with 2 long and 3 short ventroclinate genal setae.

Thorax (Fig. 3). Ground colour yellow, but scutum, scutellum, subscutellum and dorsal half of pleura to a line of middle of anepisternum and base of halter thinly ash grey microtrichose. Chaetotaxy: colour of setae and setulae as on head; 5 minute acrostichal setulae in 1 row in anterior half of scutum; 1 strong posterior dorsocentral seta and 7-8 much shorter setulae anteriad in 1 line, without gap between last two setae; 1 short postpronotal seta; 2 stronger subequal notopleural setae; 1 postalar seta; 2 minute setulae dorsally of notopleuron anterior of suture; 1-2 minute postsutural intraalar setulae; scutellum with 1 apical scutellar seta and 1 minute dorsolateral setula; 1 katepisternal seta.

Wing (Fig. 4). Rather elongate, maximal length:width ratio 3:1; alula absent; vein CuA2 present as fold, convex, below better developed, other venation as in *S. soniae*; ratios on C: section 2/3 (distance between R1 and R2+3/R3+3 and R4+5) about 18; section 3/4 (distance between R2+3 and R4+5/R4+5 and M) about 0.85. Last section on M (DM-Cu to tip) about 3 times as long as distance between crossveins. Halter white; squamae yellow, small.

Legs. Entirely yellow, only last tarsal segment of fore and mid leg blackish, and apical third of last hind tarsomere slightly brownish; fore femur with 2 posteroventral brown setae; mid tibia with one brown, ventral apical seta.

Abdomen (Figs 5-6). Tergites 1+2 ivory-yellowish, remaining tergites of yellow ground colour, but with badly delimited brown patches, T3 and T4 darkest, T5 and T6 distinctly paler. T3-T6 less transverse and narrower than those of *S. soniae* (Fig. 5). T6 well developed, relatively long (twice as long as in *S. soniae*). Sternites large, pale yellow; S1 short, transverse and wider than S2; S2-S5 becoming wider posteriorly, subequal in length or S5 slightly shorter. Abdominal spiracles strongly reduced, hardly visible. Postabdominal sclerites (S6-S8, see Fig. 6) fused to asymmetrical complex, markedly longer than in *S. soniae*, but similarly shaped. Strip-shaped marginal part belonging to S6 and stripe-like ventral projection of right anterior corner of S8 meeting

(Fig. 6) on ventral side. Additional sclerite (Fig. 6) on right side behind S6-S8 complex larger and darker brown than that of *S. soniae*, somewhat resembling a head of mattock.

Male genitalia (Figs 7-12). Epandrium (Figs 7, 8) orange yellow, distinctly higher than long, shortened ventrally and less broad than that of *S. soniae* but with similar setosity including 3 anteroventral setae on each side. Anal fissure broad but cerci smaller and closer each to other than those of *S. soniae*. Surstylus (Figs 8, 12) normally so strongly bent inside (inclined) that almost invisible in lateral view (and therefore omitted in Fig. 7; in Fig. 8 the surstylus is somewhat unnaturally straightened); in widest extension view (Fig. 12) more slender than in *S. soniae* with dilated and densely micropubescent proximal third, slender middle part and widened distal third provided with 2 distinct teeth. Bacilliform sclerite formed by two separate and setose sclerites (Figs 7, 8), more slender than in *S. soniae*. Hypandrium (Figs 7, 10, 11) similarly formed as in *S. soniae* but both its lateral parts provided with robust anteroventral appendages (? pregonites) being different on left (having apical and ventral preapical tooth, Fig. 10) and right (simply apically pointed, Fig. 11) sides. Aedeagal complex asymmetrical, with only left postgonite developed (Fig. 10) though small and weakly sclerotized (right postgonite absent in contrast to large one in *S. soniae*). Basiphallus (Fig. 9) more robust than in *S. soniae*, with short and blunt epiphallus and with richly microsetulose ventrolateral lobes. Distiphallus similarly armed as that of *S. soniae*, but apical processes (including preapical sclerite) smaller and differently shaped (Fig. 9). Phallapodeme (Fig. 9) more robust than in *S. soniae*, with strongly bent ventral process. Ejaculatory apodeme (Fig. 7) also thicker than in *S. soniae* with more robust distal part and with smaller dark proximal part.

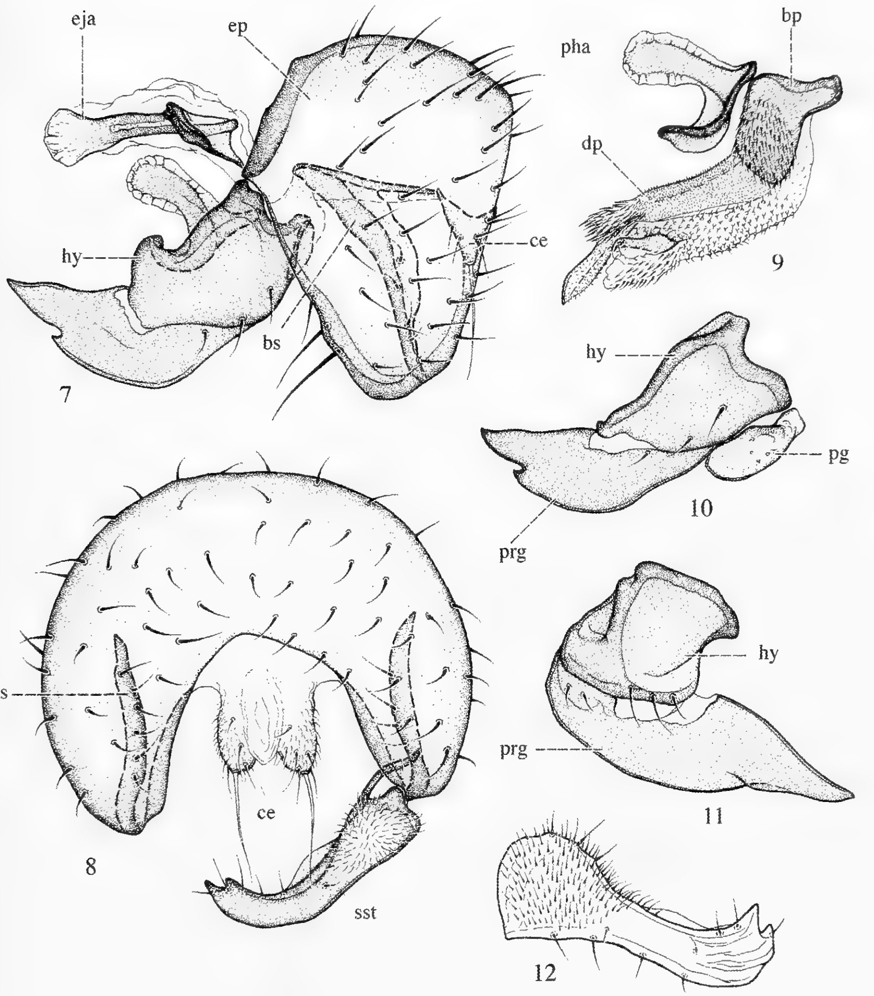
DESCRIPTION OF FEMALE

Wing length. 1.75-1.95 mm. Body length: 1.5 mm.

Morphology. As male, but differing in the following points: Head more extensively darkened, with only anterior margin of frons yellow; face medially grey microtrichose; most of occiput and postgena grey microtrichose. Abdominal tergites 3-7 yellow, laterally indistinctly darkened; 2 large, black spermathecae translucent on level of segment 7. Terminalia not dissected.

BIOLOGICAL OBSERVATIONS

The specimens from Jussy were collected by holding an insect net under large tussocks of *Carex*, which were beaten and shaken with a wooden stick (= "tussocking", see Drake, 2004). The flies were sitting on dead leaves and did not fly away when approched by an aspirator. In the tubes they were crawling into a piece of paper and did not come out even when shaking the tube. One specimen was observed walking anteriorly, posteriorly and laterally with the same speed, with the head always directed upwards in the net. A similar behaviour was observed by Williams (1939) and Sabrosky (1975). The wings remained closed during these movements. Despite two hours of careful searching at the same place no additional specimens were collected. In England *S. delicata* is closely associated with tussocks of large species of *Carex* (eg. *C. paniculata*, *C. acutiformis*) in both inland and coastal wetlands and may be obtained



FIGS 7-12

Stenomicra (*Podocera*) *delicata* (Collin), male genitalia (specimen from Germany, Bielefeld). 7, genitalia laterally (surstylus omitted); 8, external genitalia caudally (left surstylus omitted); 9, aedeagal complex laterally (ejaculatory apodeme and postgonite omitted); 10, left side of hypandrial complex with postgonite laterally; 11, right side of hypandrial complex laterally; 12, left surstylus ventrocaudally (widest extension). Abbreviations: bp = basiphallus; bs = bacilliform sclerite; ce = cercus; dp = distiphallus; eja = ejaculatory apodeme; ep = epandrium; hy = hypandrium; pg = postgonite; pha = phallapodeme; prg = pregonite; sst = surstylus. (Del. J. Roháček)

only by beating or suction sampling method (Drake, 2004; P. J. Chandler, J. W. Ismay & B. Schulten, personal communication, 2004).

DISTRIBUTION

Described from Great Britain and later found in Germany (Tschirnhaus, 1999) and Switzerland (new record).

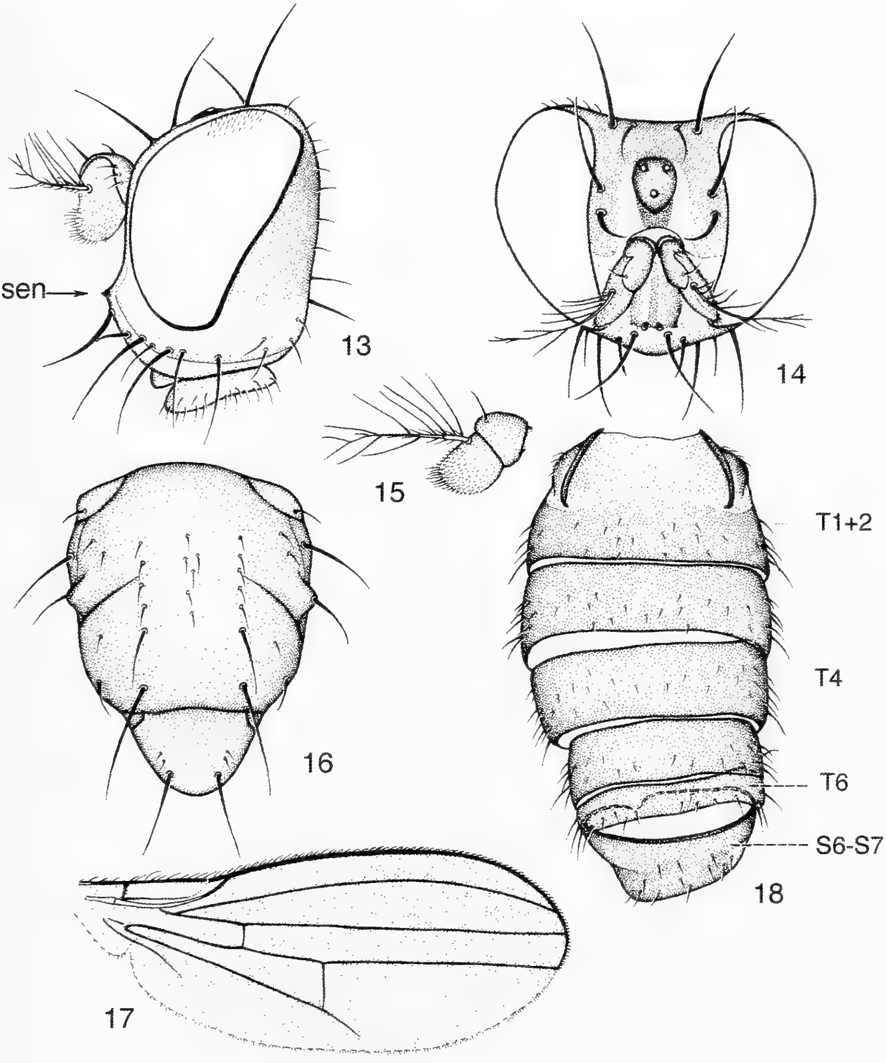
Stenomicra (Podocera) soniae sp. n. Figs 13-23, 26-27

Stenomicra delicata: Papp, 1978: 198; Bächli, 1997: 34, 1998: 289; Roháček, 1997: 79; Roháček & Barták, 2001: 378. (Misidentifications)
Stenomicra (Podocera) delicata: Roháček, 1983: 133, 1986: 146, 1987: 255, 1995a: 173, 1995b: 150. (Misidentifications)
Stenomicra sp. n.: Tschirnhaus, 1992: 458.
Stenomicra spec.: Buck, 1996: 371.

MATERIAL (74 specimens)

Holotype ♂, **Czech Republic**: "CS, Kunice-garden, Malaise trap, Barták, 49.56N/14.40E, 430 m, 8-9.VI.1985" (SMO). The holotype is laterally pinned on a cardpoint and is in very good condition.

Paratypes: **Bulgaria**: 1♀, Sliven, 13 km N, 42.49N/26.16E, 800 m, damp valley, 21.VII.1987, Barták (CMB). **Czech Republic**: 1♀, same data as holotype, but 13-19.VII.1985 (MHNG); 1♂, Prostějov-Kunštát, car net, 5.VIII.1992, Barták (SMO); 1♀, Duchcov, 50.36.30N/13.43.30E, 220 m, floodplain forest, MT [= Malaise trap], 18.V.-15.VI.1998, Barták (CMB); 1♂, same data, but 25.vi.-23.vii.1998, Barták leg. (SMO); 1 ♂, Podyjí NP, Braitava, 48°52'N, 15°49'E, 31.V.-2.VI.2002, mixed wood, car-net, Barták (CMB); 1♀, Bohemia, Hradec Králové, 5.VII.1997, Zeman leg. (Museum of East Bohemia, Hradec Králové). **Germany**: 1♀, BW [=Baden-Württemberg], Niefern nr. Pforzheim, 13.-22.VI.1992, Malaise-trap, Schmid-Egger (BUB); 3♀♀, BW, Ravensburg, Bad Waldsee, 16.VI.-15.VII.1995, Eklektor, M. Buck (BUB); 1♂, Hessen, Darmstadt, 18.VI.-2.VII.1989, Eklektor, M. Buck (BUB); 1♂, NW [= Nordrhein-Westfalen], Bielefeld, Universität, 3.-10.VII.1986, pan trap, M. von Tschirnhaus (BUB); 9♀♀, NW, Bielefeld, Werther Str., 23.-30.VI.1987, pan traps, M. von Tschirnhaus (BUB, MHNG); 22♀♀, NW, Bad Lippspringe, 18.VI.1989, B. Robert (BUB, MHNG); 3♀♀, NW, Köln, Dünnwald, 27.VI.-4.VII.1989, Malaise trap, J. Wehlitz (BUB); 2♀♀, NW, Köln-Pöll, 30.V.-6.VI.1989, Malaise trap, J. Wehlitz (MHNG); 1♀, same, 27.VI.-4.VII.1989 (BUB); 1♀, same, 11.-18.VII.1989 (BUB); 1♀, same, 1.-8.VIII.1989 (BUB); 1♂, NW, SE Krefeld, Nature Reserve "Die Spey", 26.V.-2.VI.1990, Malaise trap, Birnbrich *et al.* (BUB); 1♀, same, 2.-9.VI.1990 (BUB); 1♂, same, 9.-16.VI.1990 (BUB); 1♀, same, 16.-24.VI.1990 (BUB); 1♂, same, 24.VI-1.VII.1990 (MHNG); 1♂, same, 8.-15.VII.1990 (MHNG); 1♂, RP [= Rheinland-Pfalz], Eifel-Gebirge, Kr. Daun, Gönnersdorf, 29.VI.-6.VII.1991, Malaise trap, Cölln & Pompé (BUB); 1♀, SH [= Schleswig-Holstein], Kr. Plön, Sieversdorf, Postsee, 22.-29.V.1983, yellow pan trap, M. von Tschirnhaus (BUB). **Romania**: 1♀, Carasova, 6 km N, 45.16N/21.53E, flowering meadow, 3.VII.1987, Barták (SMO). **Slovak Republic**: 1♀, Slovakia or., Slovensky kras, Zádiel (at light) 15.VI.1981, J. Roháček (SMO); 1♀, same, but 16.VI.1981 (SMO); 1♀, Slovakia or., Nová Sedlica env. (distr. Humenné), sweeping over boggy meadow, 7.VII.1993, J. Roháček (SMO); 1♀, Bártfa [= Bardejov, NE Slovakia], Csergö h. [= Čergov Mts.], 5.VII.1969, Mihályi (HNHM). **Switzerland**: 1♀, GE, Geneva, in a glass pavilion, 20.VII.1982, J. Steffen (MHNG); 1♀, JU, Delémont, 2-6.VIII.1974, G. Bächli (CGB); 1♀, TI, Bolle di Magadino, 17-20.VI.1995, FZ [= Fangzelt], Merz & Bächli (HNHM); 2♀♀, TI, Gordola, 580-660 m, 1997, M. Moretti (CGB); 1♀, VS, Leuk-Pfynwald, 614100/290070, 600m, 7.VI.2001, Merz & Landry (MHNG); 1♀, ZH, Embrach-Haumüli, 400 m, 10.VII.1997, B. Merz (MHNG); 1♀, ZH, Dietikon, 15-19.VII.1989, G. Bächli (CGB); 1♀, ZH, Dietikon, 26.VI.-21.VII.1997, C [= Canopy], G. Bächli (CGB).



FIGS 13-18

Stenomicra (*Podocera*) *soniae* sp. n. 13, head laterally; 14, head dorsofrontally; 15, antenna laterally (medial side); 16, thorax dorsally; 17, wing; 18, abdomen dorsally. Abbreviations: sen = sensilla; S = Sternite; T = Tergite. (Del. J. Roháček)

ETYMOLOGY

Named after Mrs Sonia Guyot who supports the scientific work of the senior author in many ways.

DIAGNOSIS

This species is unmistakable among Western Palaearctic *Stenomicra* by the following combination of characters: body mainly ash grey (Figs 26, 27); wing with small, but distinct alula, cell cup open; hyaline with very narrow milky-white crossband at base and with both crossveins bordered by a narrow milky-white frame; legs yellow, but mid and hind femora and corresponding tibiae each with black ring; abdomen uniformly brown.

DESCRIPTION OF MALE

Wing length. 1.75-2.05 mm. Body length: 1.4-1.5 mm.

Head (Figs 13-15). Ground colour ash-grey, but a narrow stripe along posterior margin of compound eyes, gena and face translucent yellow; antennae and proboscis yellow; compound eye with short, but distinct interfacetal setulae; in lateral view elongate oval, oblique, slightly kidney shaped with posterior margin concave; gena at most one eighth as high as compound eye; frons bare, slightly wider than high, parallel-sided, ocellar triangle slightly raised in the middle of frons; fronto-orbital plate raised; face concave, raised ventrally at vibrissal angle; medially with carina; mediodorsally with a pair of sensillae (very shortened spine-like setae - see Figs 13, 14); antenna (Fig. 15): scape very small, ring-like, with one black dorsal setula; pedicel large, as long as postpedicel, cape-like, apicodorsally with one outstanding black seta, basally with a ring of 5-6 black setulae; postpedicel dorsoapically with a brush of soft, pale setulae; arista black, *Drosophila*-like with long rays which are much longer than width of postpedicel; in addition to apical fork dorsally with 5-6 and ventrally with 2-3 rays; mouthparts: palpus minute, about as long as wide, almost invisible; proboscis not projecting in front of vibrissal angle, with fleshy labellae. Chaetotaxy: colour of major setae paler or darker brown depending on viewing angle and illumination; 2 subequal fronto-orbital setae in anterior half of frons, anterior fronto-orbital seta proclinate and inclinate, posterior fronto-orbital seta reclinate; 1 long, lateroclinate medial vertical seta; anteromedially with 1 slightly shorter, proclinate pseudopostocellar seta; postocellar seta on occiput dorsally of pseudopostocellar absent; no ocellar seta; 1 porrect, lateroclinate and slightly dorsoclinate pseudovibrissa; ventrally with 1 short, dorsoclinate seta, and with 2 long and 3 short ventrally directed genal setae along mouth margin.

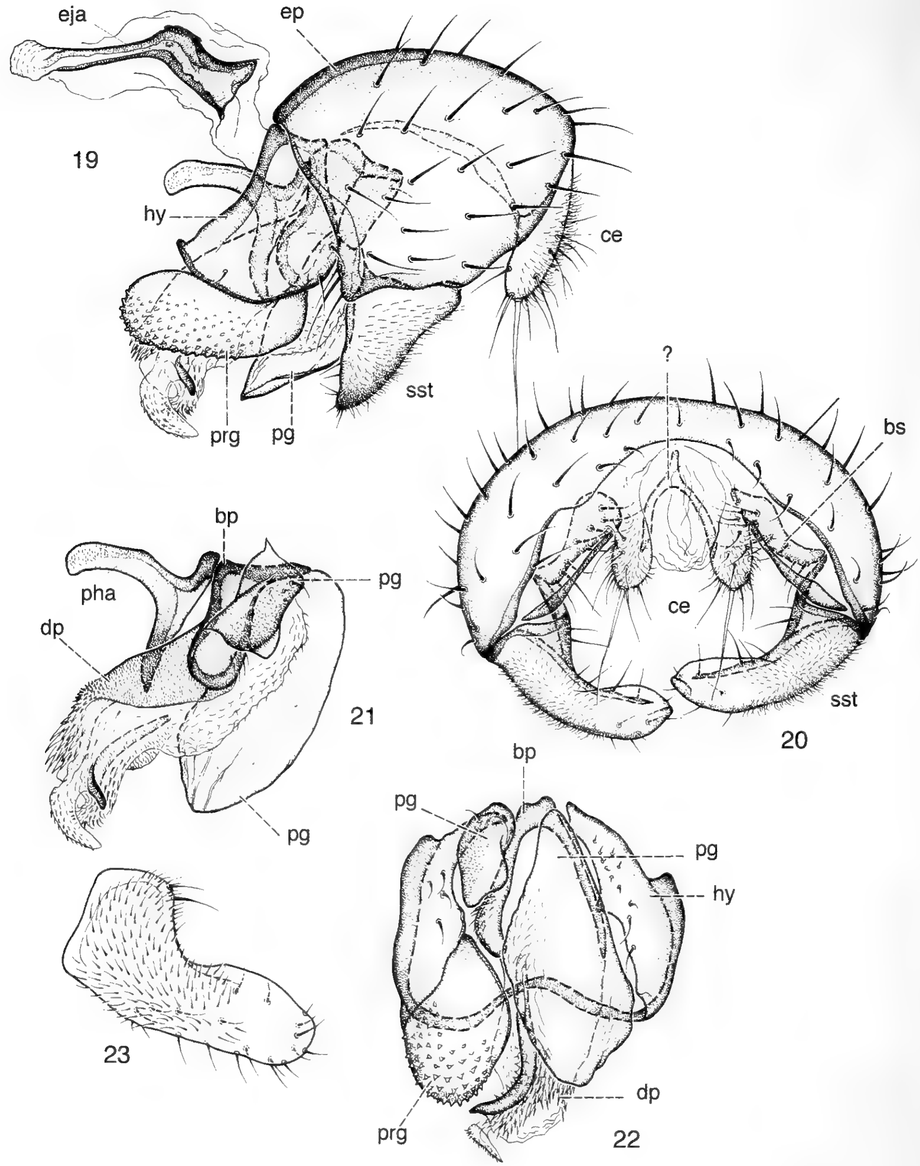
Thorax (Fig. 16). Ash-grey microtrichose, but tip of scutellum and ventral part of pleura between coxae yellow. Chaetotaxy: colour of setae and setulae as on head; 5-7 minute acrostichal setulae in 1-2 irregular rows in anterior half of scutum; one row of 5-7 dorsocentral setae, the penultimate much longer than the anterior setulae and separated from the longer and stronger prescutellar dorsocentral seta by a distinct gap; 1 short postpronotal seta; 2 long, subequal notopleural setae; 1 postalar seta; 1-2 minute presutural and 1-2 minute postsutural intraalar setulae; scutellum with 1 apical scutellar seta and with 1-2 small dorsolateral setulae; 1 katepisternal seta, other pleural sclerites bare.

Wing (Fig. 17). Less elongate than in *S. delicata*, length/width ratio of 2.7; alula small, but distinct; C reaching M; BM-Cu absent; no trace of CuA2, cell cup entirely open; crossveins R-M and DM-Cu present; distance between crossveins 1.5-2 times the length of DM-Cu; R2+3 very long and converging towards M near tip; ratios on C: section 2/3 (distance between R1 and R2+3/R2+3 and R4+5) over 10; section 3 and 4 (distance between R2+3 and R4+5/R4+5 and M) of about same length; last section of M about 2.5 times as long as penultimate section between crossveins; Sc weak, reaching C as fold where the latter has an indistinct break; surface of wing hyaline, but with a milky-white, narrow stripe from node of R2+3 and R4+5 to vein CuA1, and with both crossveins surrounded by milky-white frame. Halter with yellow stem and black knob (but knob usually yellow in specimens in alcohol), squamae small, dark brown, fringe blackish.

Legs. Mainly yellow, but apical third of hind femur and basal third of hind tibia each with a distinct, broad black ring; mid femur and mid tibia with indistinct, small brown infuscation around knee; last tarsal segment of front and mid leg blackish, and apical third of last hind tarsomere slightly brownish; fore femur posteroventrally with 2 brown, long setae; mid tibia with one apicoventral brown seta; tibiae without dorsal preapical seta.

Abdomen (Fig. 18). Tergites completely brown, T1 medially and T6 somewhat paler. T3-T6 distinctly wider and more transverse than those of *S. delicata*, bent on lateral sides of abdomen; T6 particularly shortened (Fig. 18). Preabdominal sternites S2-S5 large, orange brown. S1 short and transverse, with only lateral parts dark pigmented and looking like divided in 2 small sclerites. S2 longest (distinctly longer than any of other sternites) but narrowest; S3-S5 becoming slightly wider and shorter posteriorly, S5 widest and most transverse. Abdominal spiracles near margins of tergites, strongly reduced. Postabdominal sclerites (S6-S8) forming a fused complex shorter than that of *S. delicata*. S6 reduced to transverse anterior marginal stripe of this complex; part belonging to S7 also small, subtriangular on left side. S8 slightly asymmetrical but its right anterior corner far projecting as strip-like process on ventral side almost to meet S6. There is a small, pointed additional sclerite in membrane on right side behind the latter process.

Male genitalia (Figs 19-23). Epandrium relatively long, longer than high and very broad (see Figs 19-20), uniformly shortly setose and with 3 setae in anteroventral corners. Anal fissure broadly semicircular. Cerci well developed, widely separate, each with 1 long apical seta and number of short setae. Surstylus (Figs 19, 20, 23) strongly inclined, in widest extension view (Fig. 23) with simply rounded apex, broader and densely microtrichose in proximal two-thirds of lateral side and with setae mainly concentrated on medial side. Bacilliform sclerite bipartite, not fused medially; each its part movably connected with surstylus and distinctly setose (Fig. 20), anteriorly reaching to posterior margin of hypandrium as also is an Y-shaped slender sclerite attached by its arms to cerci (Fig. 20). Hypandrium (Figs 19, 22) asymmetrically frame-shaped, but posteromedially disconnected; its lateral parts expanded and sparsely setulose, anteromedial part slender and connected with ventral process of phallapodeme; left side of hypandrium anteroventrally provided with a large, suboval, densely tuberculate appendage (? pregonite, see Figs 19, 22) while right side is simple but with more setulae (Fig. 22). Aedeagal complex distinctly asymmetrical (see Figs 21, 22), particularly as regards unevenly developed postgonites, left being small and suboblong (in lateral view), right one very large but pale pigmented, lobe-shaped, with concave inner side and convex outer side. Basiphallus short, inversely V-shaped in caudal view (Fig. 22), with distinct posterodorsal process (epiphallus) and ventrolateral lobes rounded and distinctly microsetulose (on left side – Fig. 21). Distiphallus (Fig. 21) relatively small, ventrally largely membranous, dorsally weakly sclerotized and



Figs 19-23

Stenomicra (*Podocera*) *soniae* sp. n., male genitalia (specimen from Germany, Krefeld). 19, genitalia laterally; 22, internal genitalia caudally; 20, external genitalia caudally; 21, aedeagal complex laterally (ejaculatory apodeme omitted); 23, left surstylus ventrolaterally (widest extension). Abbreviations: bp = basiphallus; bs = bacilliform sclerite; ce = cercus; dp = distiphallus; eja = ejaculatory apodeme; ep = epandrium; hy = hypandrium; pg = postgonite; pha = phallapodeme; prg = pregonite; sst = surstylus. (Del. J. Roháček) micropubescent, with densely spinose apex including a slender, left-curved and pointed sclerite and a small terminal, finely spinulose lobe. Phallapodeme short (Fig. 21), with simple anterior rod and distinct ventral process connected with hypandrium. Ejaculatory apodeme (Fig. 19) larger than phallapodeme, with darker and more robust proximal part and slender anterior rod with expanded but hyaline apex.

Description of Female

Wing length. 2.00-2.40 mm. Body length: 1.6-2.0 mm.

Morphology. As male, but differing in the following points: Head more extensively darkened, with only gena and antennal grooves yellow, but facial carina grey microtrichose; abdominal tergites uniformly brown, posterior margin of tergites 3 and 4 narrowly yellow, posterior tergites slightly darker; sternites orange-brown. Spermathecae not visible externally without dissection. Terminalia not studied.

Biological observations

Almost nothing is known about the biology of *S. soniae*. Tschirnhaus (1992) suggested that larvae may develop in axils of *Angelica silvestris* filled with water. Most specimens were collected with various traps, and only 3 specimens were swept with a net (Tab. 2). It is remarkable that males were almost exclusively collected with Malaise traps, whereas females could be obtained with all methods. The apparent rarity of these flies may be explained by the difficulties in collecting them with the sweeping of vegetation, the most frequently used collecting method. The discovery of a number of specimens collected “in the air” with car nets, window traps and at light is an indication that *S. soniae* is rather vagile, unlike *S. delicata* (see above).

The ecological tolerance of *S. soniae* seems to be much less specific than of the other 3 species of the genus in the Western Palaearctic region that are all associated with a wet environment and the presence of large Cyperaceae (*Carex*, *Cyperus*, see introduction). Only 4 males and 13 females were collected in swampy areas, whereas the other specimens were found in various dry to wet open grassland and in forests (Tab. 3). Even garden vegetation and towns offer suitable habitats for this species with at least 1 male and 8 females caught in these places. This observation gives evidences that *S. soniae* is much more abundant than the material in museums would suggest.

Adults were found from May to August.

TABLE 2. Collecting methods for *Stenomicra soniae* sp. n. Abbreviations for countries: CH = Switzerland; CZ = Czech Republic; GE = Germany; SK = Slovakia.

Method	males	females	origin	depository
Malaise trap	9	13	CZ, GE	BUB, SMO, CMB
pan trap	1	10	GE	BUB
eclector	1	3	GE	BUB
window trap		3	CH	MHNG, CGB
light		2	SK	SMO
car net	1	1	CZ	SMO, CMB
beer trap		1	CH	CGB
banana-yeast trap		1	CH	CGB
sweeping		3	CH, SK	MHNG, SMO
no information		25		

TABLE 3. Habitats for *Stenomicra soniae* sp. n. Information was taken from unpublished Excel file data from M. von Tschirnhaus (received together with specimens), field book notes of the first author, and label data.

Habitat	males	females
garden, town	1	8
meadows	1	2
pastures	1	9
shrubs	4	6
forests (open, deciduous)	1	9
unknown	4	28

DISTRIBUTION

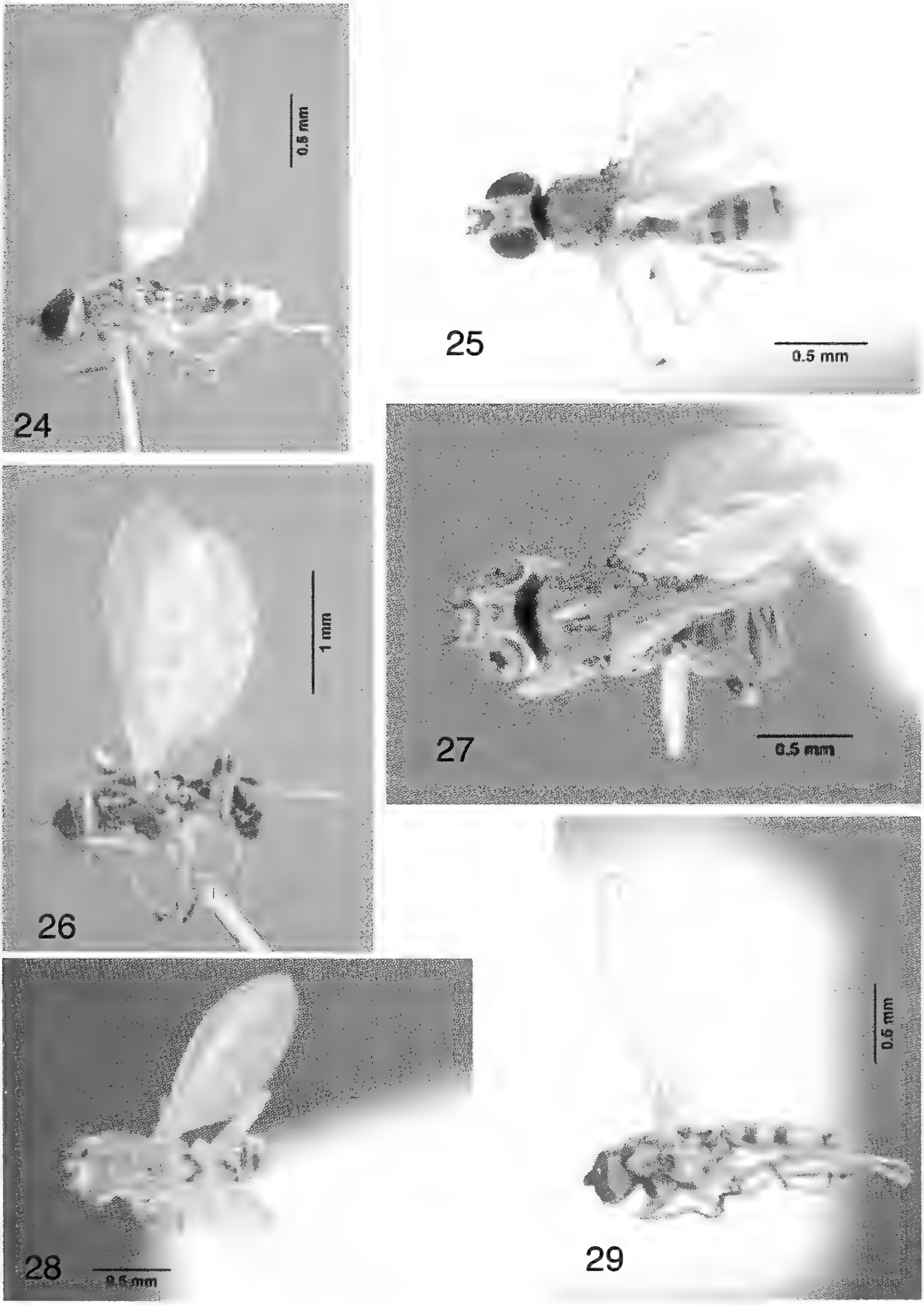
Widely distributed in Central and Southeastern Europe from Northern Germany to Bulgaria.

AFFINITIES

The following remarks are based on descriptions and illustrations, but not on examination of specimens, except for *S. fascipennis* Malloch (Material studied: 2♂♂, 2♀♀, Japan, Mt. Enaki, Yokohama City, Honshu, 15.VIII.2002, M. Sueyoshi, MHNG). The new species belongs undoubtly to the subgenus *Podocera* Czerny by the subgeneric characters given in the key above, which is partly taken from Sabrosky (1975) and Freidberg & Mathis (2002). Within the 12 valid species of *Podocera* 5 species have characteristic milky-white crossveins R-M and DM-Cu as in *S. soniae*: *S. fascipennis* Malloch, 1927, from the Eastern Palaearctic and Oriental Regions, *S. taeniata* Hennig, 1956, from the Neotropics, and the Afrotropical species *S. biconspicua* Sabrosky, 1975, *S. trimaculata* Sabrosky, 1975, and *S. uniconspicua* Sabrosky, 1975.

S. fascipennis differs from all other species, including *S. soniae*, by the presence of a fourth whitish crossband near the distal margin of the wing and by the extremely short ultimate section of CuA1 which is much shorter than DM-Cu (in *S. soniae* at least 1.35 times as long, see Sueyoshi & Mathis, 2004, Fig. 2f). The 3 Afrotropical species all have a more extensive milky-whitish spot over DM-Cu which reaches dorsally at least R4+5, and all species have the ventral half of the anepisternum yellow, as well as entirely yellow femora (Sabrosky, 1975). In *S. soniae* the milky-white area is confined to a small surface around DM-Cu without reaching R4+5, the anepisternum is entirely grey, and the mid and hind femora have both a subapical brown to black ring. According to Hennig (1956), *S. taeniata* seems to have a rather similar wing pattern as *S. soniae*, but the wing base is more broadly whitish (only very narrowly in *S. soniae*), and the prescutellar dorsocentral seta is not separated by a gap from the penultimate seta (in *S. soniae* with a distinct gap). All dorsocentral setae except for the prescutellar dorsocentral seta are short in *S. taeniata*, whereas the last two dorsocentral setae are distinctly longer than the other dorsocentral setae in *S. soniae*.

Our knowledge of the genus is still preliminary. Probably less than 10% of the species that are stored in entomological collections are named. It is therefore premature to propose phylogenetic relationships. Moreover, no safely identified species outside the Western Palaearctic region were available for study. However, based on the comparison with other species of *Stenomicra* it is reasonable to assume that *S. soniae*



FIGS 24-29. Habitus photos of Western Palaearctic *Stenomicra*. 24, *S. delicata* (Collin), lateral view; 25, same, dorsal view; 26, *S. soniae* sp. n., lateral view; 27, same, dorsal view; 28, *S. cogani* Irwin, dorsal view; 29, *S. jordanensis* Freidberg & Mathis, lateral view. (Photos by A. Nobile, San Francisco).

may be more closely related to the 3 Afrotropical species based on wing pattern (Sabrosky, 1975, Figs 5-7) and general description than to *Stenomicra* (*Podocera*) from other biogeographical regions.

Subgenus ***Stenomicra*** Coquillett

Stenomicra Coquillett, 1900: 262.

Stenomicra* (s. str.) *cogani Irwin Fig. 28

Stenomicra cogani Irwin, 1982: 235.

Material studied: **Germany**: 1♀, Nordrhein-Westfalen, Bielefeld-Nord, 2.VII. 1999, M. v. Tschirnhaus (BUB); 1♂, Schleswig-Holstein, Kr. Plön, Lauker See, Kühren, 6.VI.992, M. v. Tschirnhaus (BUB). **Italy**: 10♂♂, 3♀♀, Mantova pr., Marmirolo, Bosco d. Fontana, 50 m, 45.12N/10.45E, 25.V.2001, Merz & Mason (MHNG); **Spain (new record)**: 1♂, 3♀♀, Andalusia, Alcalá de los Gazules, 48km NNW Tarifa, road no 440, 6.IV.1993, M. v. Tschirnhaus (BUB).

In 1982, Irwin described and illustrated this species, including its external male terminalia, but no information was given about hypandrium and the aedeagal complex. The species is unique in the Western Palaearctic Region by its entirely yellow colour and the absence of the DM-Cu-crossvein (Fig. 28).

Stenomicra* (s. str.) *jordanensis Freidberg & Mathis Fig. 29

Stenomicra jordanensis Freidberg & Mathis, 2002: 48.

Material studied: 1♂, 2♀♀, **Israel**: Park HaYarden, 14.IV.1999, A. Freidberg (TAU) (Paratypes).

An excellent description was provided by Freidberg & Mathis (2002). The terminalia of this species, however, were not studied. *S. jordanensis* can be distinguished from the other 3 Western Palaearctic species by the presence of vittae on the thorax (Fig. 29).

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Synonymic note on the monobasic genus *Ophryomedon* Wasmann, 1916 (Coleoptera, Staphylinidae, Paederinae)*

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Synonymic note on the monobasic genus *Ophryomedon* Wasmann, 1916 (Coleoptera, Staphylinidae, Paederinae). - *Ophryomedon marginatus* Naomi, 1995 is designated a junior synonym of *Ophryomedon crenatus* Wasmann, 1916.

Keywords: Staphylinidae - Paederinae - *Ophryomedon crenatus* - *marginatus* - synonymy.

Wasmann (1916) described the myrmecophilous beetle *Ophryomedon crenatus* from Malacca, Malaysia. Naomi (1995) described *Ophryomedon marginatus* from Japan (Honshu and Kyushu) and, relying on Wasmann's description, gave as diagnostic differences a longer third segment of the labial palpi, different colour pattern, and broader abdomen of the Japanese specimens.

While sorting unidentified Staphylinidae in the collection of the Geneva Natural History Museum I found eight specimens belonging to the genus *Ophryomedon* labelled as follows:

4 exx.: JAPON, Nara, Nara, 27-31.VII.1980, Cl. Besuchet (coll. Geneva Mus., 1 ex. coll. Rougemont); 1 ex.: INDIA, U.P., Kumaon, Bhim Tal 1450-1550 m., 5.X.1979, I. Löbl (coll. Geneva Mus.); 1 ex.: INDIA, Assam, Manas, 200 m., 22.X.1978, Besuchet – Löbl (coll. Rougemont).

Naomi (1995) has provided a good description and illustrations of *O. marginatus* Naomi, with which the new material agrees in all respects. The colouration and extent of the dark elytral band are somewhat variable, and in one specimen from Nara the whole body is slightly infuscate, so that the elytral marking almost disappears from lack of contrast with the ground colour. Even without examining the type of *O. crenatus* Wasmann, it can be confidently asserted that all specimens examined belong to a single, evidently widely distributed species. The new synonymy established is thus:

Ophryomedon crenatus Wasmann 1916: 202.

Ophryomedon marginatus Naomi, 1995: 162. **Syn. n.**

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* 45th contribution to the knowledge of Staphylinidae

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REVUE SUISSE DE ZOOLOGIE 112 (2): 543-558; juin 2005

Ten years trends in the oligochaete and chironomid fauna of Lake Neuchâtel (Switzerland)

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Ten years trends in the oligochaete and chironomid fauna of Lake Neuchâtel (Switzerland). - Quantitative surveys of benthic macroinvertebrates (oligochaetes and chironomids) were conducted during 1992, 1997, 2000 and 2002 at a depth of 40 m to monitor the biological quality of sediments in Lake Neuchâtel. Recent declines in frequency of occurrence and abundance of oligochaete species characteristic of oligotrophic conditions (*Stylodrilus heringianus*, *Embolocephalus velutinus*) contrasted with the improvement of water quality metrics. Total phosphorus concentrations in lake waters decreased from 63 mg m^{-3} in 1980 to 10 mg m^{-3} in 2002. Since 1992, significant reductions of total zoobenthic biomass have been recorded and the chironomid community structure reflects typical oligo-mesotrophic conditions in the upper sediment layer. The population of the oligochaete species *Potamothrix vejdovskyi* is in clear expansion and indicates that this new species for the lake (1986) has found good conditions for a successful colonization. These divergent responses within the zoobenthic community are discussed according to three main hypotheses: implications of toxic pollutants like heavy metals and organic micropollutants in the sediment, impact of algae on oxygen conditions on the bottom layer and different biological responses of oligochaetes to competition for food and space.

Keywords: Zoobenthos - biomonitoring - profundal zone - sediment contamination - organic deposition - micropollutant.

INTRODUCTION

In marine and lacustrine ecosystems, it is generally accepted that pelagic phytodetrital organic material, derived from autochtonous and allochthonous inputs, drives profundal zoobenthos production (Brinkhurst, 1974; Graf, 1989). The major part of autochtonous input arises from phytoplankton primary production which is controlled largely by nutrient elements (mainly P and N) coming in the system (Håkanson & Jansson, 1983). Thus, profundal macroinvertebrate growth is supported directly by nutrients in fresh or decaying algae or indirectly via microbial production (Johnson & Wiederholm, 1992).

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The deep bottom fauna of lakes is dominated by oligochaete worms and chironomid larvae. Additional invertebrates are molluscs, crustaceans, watermites, flatworms and minor insect taxa which usually occur in rather limited numbers (Wiederholm, 1980). The two main taxa have different biological traits: chironomid larvae have a surface deposit-feeding strategy, which show many diets (algae and freshly deposited detritus, sediment bacteria and invertebrates), whereas oligochaete are subsurface deposit-feeders (mainly bacterial food and organic matter). Their reproductive behavior is also distinctive: oligochaetes reproduce within the sediment whereas chironomids have aerial stages and oviposit on the water surface (Johnson & Wiederholm, 1992; Goedkoop & Johnson, 1993). Therefore, they do not respond equally to environmental changes. Under conditions of recovery, oligochaetes seem to maintain their community structure for a longer time than chironomids (Wiederholm, 1980; Lang, 1998).

In Lake Neuchâtel, despite decreasing phosphorus concentration since the 1980s, densities of oligochaete species intolerant of oxygen depletion and organic deposition tended to decrease after 1992 (Lang 1999, 2001). To examine this trend, the same biomonitoring survey as in 1992, 1997 and 2000 was performed in 2002 in order to monitor the zoobenthic assemblages and further investigations were carried out on potential toxic contaminants of lake sediments. The present study focuses also on the change of the zoobenthic communities during the last ten years.

STUDY AREA, SITES AND METHODS

STUDY AREA

Lake Neuchâtel, located at the southern foot of the Jura Mountains, is one of the largest Swiss lakes with a surface area of 215 km^2. Its orientation is parallel to the major wind directions, resulting in a good oxygen supply even to the deepest waters. Oxygen concentrations one meter above bottom sediment have always been above 7 mg L^{-1} from 1982 to 2002 (Pokorni-Aebi, 2002). Six major tributaries discharge into both ends of the lake (Fig 1). The main characteristics of the lake are given in Table 1. In 2002, physico-chemical and phytoplanktonic features classified this lake as mesotrophic (Håkanson, 1980).

SAMPLING SITES

In 2002, 30 sites were sampled along the southeasthern shore of Lake Neuchâtel (Fig. 1), between the villages of Portalban and Font. This biomonitoring transect is located along the largest fringing wetland in Switzerland (The "Grand Cariçaie" reserve), which is an almost 40 km-long continuous marshland belt. The sites, distributed evenly (500 m apart), were sampled six times in May, before the mass emergence of chironomids. At each site, six cores (16 cm^2, 30 cm long) were taken with a gravity corer lowered from the water surface.

Similar biomonitoring surveys were previously undertaken in 1992, 1997 and 2000 respectively by Lang & Reymond (1993) and Lang (1999, 2001). In 1984, 16 sampling sites were distributed along four transects, regularly spaced (4 km apart) in the same area. Along each transect, samples were collected at 40, 60, 90 and 120 m deep.

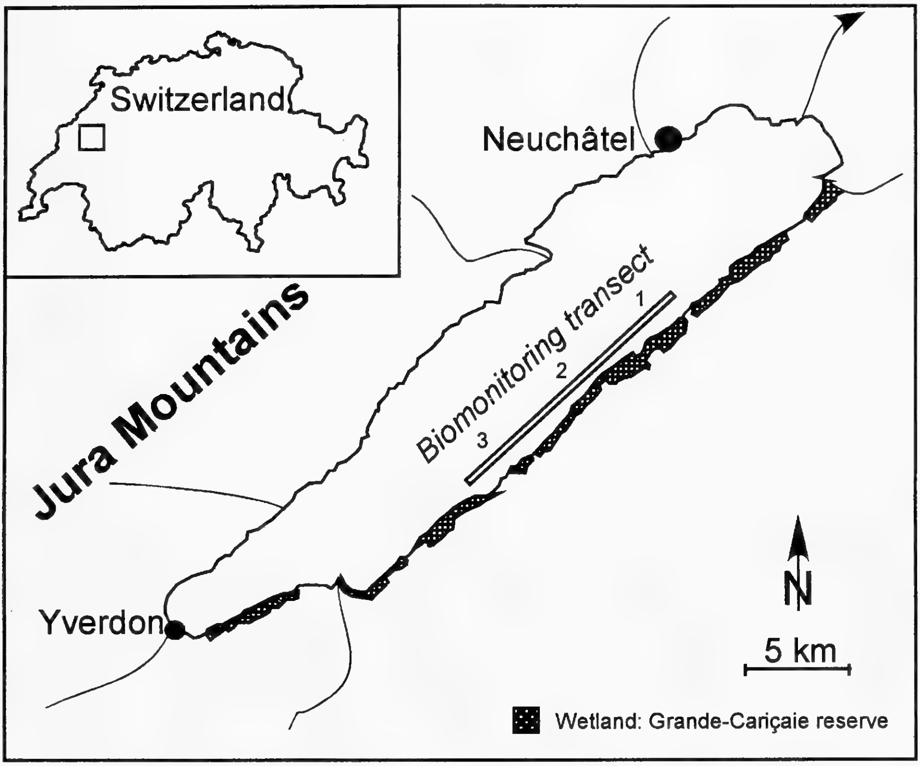


FIG. 1

Lake Neuchâtel showing inflows, outflow and sampling sites divided into 3 zones.

TABLE 1. Main characteristics of Lake Neuchâtel (Lang, 1996; Pokorni-Aebi, 2002)

Depth (m)	Mean	64
	Max	153
Lake surface area (km^2)		215
Volume (km^3)		13.8
Altitude of lake surface (m a.s.l.)		429
Area of drainage basin (km^2)		2672
Average altitude of the basin		780
No. of total circulation per year		2
Theoretical residence time (year)		8.2
Total phosphorus (mg m^{-3})[a]	1980	63.0
	2002	10.0
Secchi disc transparency (m)	2002	2.5-9.0
Mean algal biomass (0-20 m)(g m^{-3})	2002	1.26
Chlorophyll-a (0-20 m)(mg m^{-3})	2002	2.2-6.5

[a] Mean value for the spring circulation

Three zones on the 2002 transect were differenciated along a gradient of organic sedimentation (Lang, 2001).

CORE INVESTIGATIONS

From 1997, each sediment core was described in the laboratory according to thickness of three main vertical layers: i) the thin brownish surface layer of oxydized sediment, ii) the intermediate reduced black layer, which can be considered as a descriptor of organic deposition and matches with the 1940s to 1950s (Steinmann *et al.*, 2003) and iii) the compact grey or brown clay found underneath. After measurement of the thickness of the reduced black layer to the nearest 0.5 cm, each core sediment was sieved (mesh size 0.2 mm) and retained material preserved in 5% formalin. Collected macrofauna consisted mainly of lumbriculids, tubificids and chironomids which were sorted out and counted under a low magnification (6x) binocular microscope. Oligochaetes and chironomids were then mounted (Reymond, 1994) and identified to species or groups of species according to Brinkhurst (1971), and Wiederholm (1983, 1986).

Some species of lumbriculids and tubificids are known to be sensitive to oxygen depletion and organic deposition (Jónasson, 1969; Milbrink, 1978, 1980; Lang, 1990), and can be considered as bioindicators of oligotrophic conditions. The bioindicative value of species or species groups for chironomid larvae was based on Saether (1979). In 1984 and 1992, chironomids were counted separetely in each core, but they were identified only as a whole sample based on 64 and 171 cores, respectively. In 1997, 2000 and 2002, chironomids were counted and identified separetely in each core. Chironomid material prior to 2002 was re-examined and identified to species or groups of species.

CHEMICAL ANALYSES

In 2003, three composite samples were collected along the same transect including the upper 5 cm of sediment which represent approximately twenty years of sedimentation (Steinmann *et al.*, 2003). Chemical analyses were then performed on heavy metals (Cd, Cu, Cr, Ni, Pb and Zn) using Inductively Coupled Plasma – Atomic Emission Spectrometry (ICP-AES). PCBs were determined by GC/MS after purification. Seven congeners were included (No. 28, 52, 101, 118, 138, 153, 180). PAHs (PolyAromatic Hydrocarbons) were determined by HPLC coupled with a fluorescence detector. They include Fluoranthene, Benzo(b)Fluoranthene, Benzo(k)Fluoranthene, Benzo(a)Pyrene, Benzo(g,h,i)Perylene, Indeno(1,2,3-cd)Pyrene.

STATISTICAL ANALYSES

Frequency of occurrence was calculated as the number of samples containing a particular species divided by the total number of samples. Relative abundance was the total number of individuals of a particular species collected in all samples in one particular year divided by the total number of oligochaetes or chironomids. Differences between years or zones for sediment parameters were tested with a one-way ANOVA. Kruskall-Wallis rank tests were used to test differences in zoobenthic abundance and biomass. All analyses and graphical displays were undertaken using SPSS software (10.1) for Windows.

RESULTS

SEDIMENT CONDITION AND CONTAMINATION

The thickness of the reduced black layer of soft sediment decreased significantly in 2002 along a eastern-western gradient (zone 1 to 3) ($F = 30.80$, $P < 0.0001$). Similar trends occurred in 1997 and 2000 ($F = 7.99$ and 38.24 respectively, $P < 0.0001$) (Fig. 2).

Micropollutant analyses of heavy metals, PCBs and PAHs in bottom sediments showed similar results in the three zones defined above (Table 2). Few values for PCBs and PAHs were above the quantitation limits of the methods. Fluorantene had the most elevated concentration (0.274 mg Kg^{-1} in zone 3).

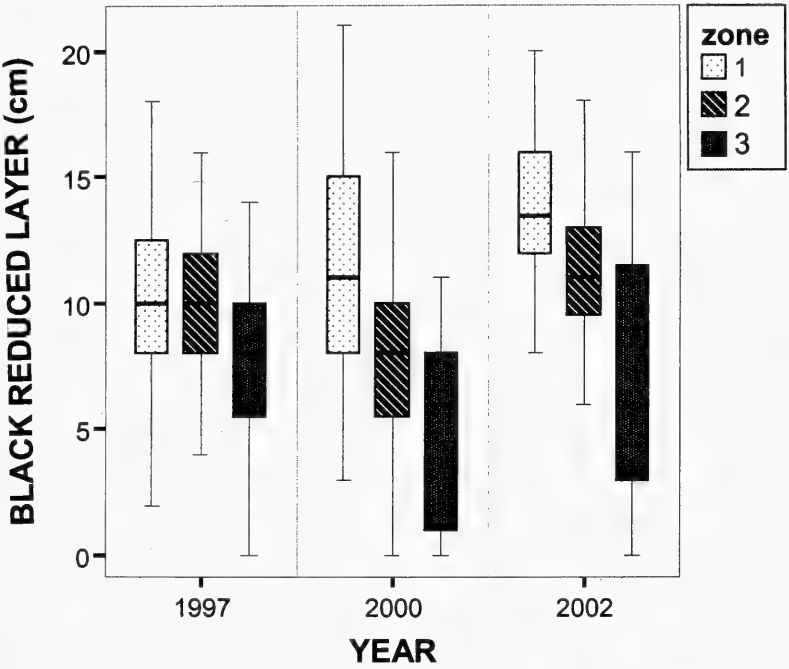


FIG. 2

Gradient of organic deposition, expressed as the thickness of the dark reduced layer between 1997 and 2002 and between zones. The median, percentiles (25th and 75th) and 1.5 interquartile range are indicated.

TABLE 2. Chemical characteristics of superficial sediments in the three zones of Lake Neuchâtel. All values are expressed as mg Kg^{-1} on a dry sediment weight basis. REF: reference values

Zone	Cd	Cr	Cu	Ni	Pb	Zn	Σ7PCB	Σ6 HAP
1	0.220	12.3	13.6	12.6	10.7	26.8	< 0.139	< 1.092
2	0.264	12.4	13.1	12.6	11.1	29.4	< 0.105	< 1.111
3	0.265	14.1	14.2	14.6	12.5	33.2	< 0.105	< 1.159
								Σ16 HAP
REF	0.2[1]		30[1]		30[1]	60[1]	0.1[2]	1.0[2]

[1] : reference values (Vernet & Viel, 1984); [2] : reference values (Osol, 1998)

TABLE 3. Presence, frequency of occurrence and abundance (± SD) of oligochaete and chironomid fauna collected in the Lake Neuchâtel.

		Frequency of occurrence (%)						Abundance (No.m^{-2})					
		1918	1984	1992	1997	2000	2002	1992	1997	2000	2002	F	*P*
	OLIGOCHAETA												
o	*Bichaeta sanguinea* Bretscher	*	37.5	20.5	12.6	27.2	12.8	157 ± 26	82 ± 17	205 ± 30	94 ± 20	5.82	*0.001*
o	*Stylodrilus heringianus* Claparède	*		26.3	4.0	1.1	1.1	398 ± 51	25 ± 9	7 ± 5	7 ± 5	55.53	*< 0.001*
o	*Spirosperma velutinus* (Grube)	*	17.2	19.3	11.4	11.7	8.4	164 ± 30	82 ± 18	76 ± 16	62 ± 16	4.92	*0.002*
o	*Spirosperma ferox* (Eisen)	*	1.6	13.5	19.4	20.0	13.9	102 ± 22	129 ± 20	153 ± 26	104 ± 21	1.11	*0.343*
	Potamothrix vejdovskyi (Hrabe)		0	23.4	42.9	51.1	67.2	259 ± 47	696 ± 84	1118 ± 118	1281 ± 128	20.41	*< 0.001*
	Limnodrilus hoffmeisteri (Claparède)	*	40.6										
	Limnodrilus profundicola (Verrill)	*		28.1	49.1	64.4	75.0	288 ± 49	660 ± 79	930 ± 81	139 5 ± 153	21.88	*< 0.001*
	Limnodrilus (juveniles)												
	Potamothrix hammoniensis (Michaelsen)	*	100	67.3	62.0	68.3	48.3	895 ± 74	821 ± 76	875 ± 72	580 ± 63	4.20	*0.006*
	Tubifex tubifex (Müller)	*											
	Branchiura sowerbyi (Beddard)						*				*		
	Potamothrix moldaviensis (Vejdovsky & Mrazek)			*	*		*	*	*		*		
	Psammoryctides barbatus (Grube)	*				*	*			*	*		
	CHIRONOMIDAE												
o	*Macropelopia fehlmanni* (Kieffer)		*	*	0.1	2.2	3.3	63 ± 67	21 ± 9	14 ± 7	21 ± 8	0.18	*0.907*
o	*Paracladopelma nigritula* gr.			*	7.4	12.8	21.7	375 ± 170	46 ± 12	87 ± 18	160 ± 25	6.06	*< 0.001*
o	*Micropsectra notescens* gr.		*	*	71.4	26.7	52.9	128 ± 106	1164 ± 126	236 ± 37	691 ± 72	19.4	*< 0.001*
	Procladius (H.) spp.		*	*	24.0	14.4	38.3	267 ± 121	175 ± 26	90 ± 16	309 ± 40	9.8	*< 0.001*
	Sergentia coracina (Zettersdedt)		*	*	6.3	18.9	0.0	17 ± 20	39 ± 11	132 ± 21	0	15.7	*< 0.001*
	Cryptochironomus spp.		*			*	*			*	*		
	Dicrotendipes spp.				*				*				
	Microtendipes chloris (Meigen)						*				*		
	Polypedilum nubeculosum gr.			*	*		*	*	*		*		
	Tanytarsus spp.				*	*	*		*	*	*		
	No. of cores		*64*	*171*	*175*	*180*	*180*	*171*	*175*	*180*	*180*		

* : presence of the taxa; o : indicator of oligotrophic conditions

EVOLUTION OF ZOOBENTHIC COMMUNITIES

In 2002, zoobenthos (Table 3) consisted mainly of lumbriculid and tubificid worms (12 species) and chironomid larvae (8 taxa). The main oligochaete taxa were present at each biomonitoring survey. *Branchuira sowerbyi, Potamothrix moldaviensis* and *Potamothrix vejdovskyi* were recent for the lake and the latter is a new colonist since 1986 (Lang & Reymond, 1993).

For two of the four oligochaete species bioindicators of oligotrophic conditions (*Stylodrilus heringianus* and *Embolocephalus velutinus*), frequency of occurence and relative abundance tended to decrease through years with a strong shift after 1992 (Fig. 3A), whereas for *Bichaeata sanguinea* and *Spirosperma ferox*, no characteristic trends were seen (Fig. 3A and 3B, Table 3). Concerning the non-oligotrophic type worms, *Potamothrix vejdovskyi* showed a significant pattern, expanding spatially (present in 67% of the sites in 2002) and numerically (its population was five times higher in 2002 than in 1992) in no more than ten years (Kruskall-Wallis rank test, $k = 76.13$, $p < 0.05$) (Table 3 and Fig 3B). Populations of *Potamothrix hammoniensis* and *Tubifex tubifex* were started to decrease (Kruskall-Wallis rank test, $k = 18.10$, $p < 0.05$). In contrast, *Limnodrilus* species showed an inverse trend (Kruskall-Wallis rank test, $k = 101.28$, $p < 0.05$).

The chironomid community was dominated by three taxa bioindicators of oligotrophic conditions, *Macropelopia fehlmanni*, *Paracladopelma nigritula* gr. and *Micropsectra notescens* gr. which occurred in 42-78% of the samples (Fig 3C), depending on years. The presence of *Micropsectra contracta* (*notescens* gr.) was confirmed by pupal examination. *Procladius*, a rather euryecious and predatory genus was the fourth dominant taxon in terms of frequency of occurrence and abundance.

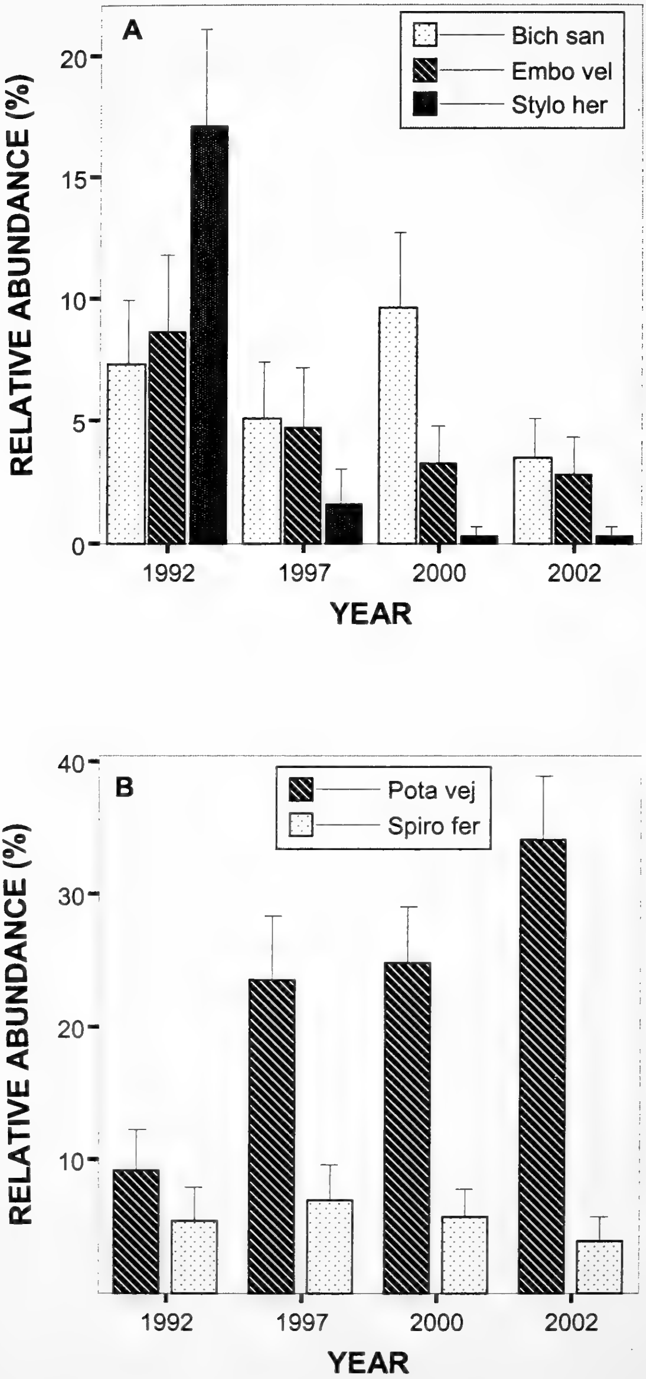
Total mean zoobenthic biomass (oligochaete and chironomid larvae) decreased significantly between 1992 and 2002 (Kruskall-Wallis rank test, $k = 50.67$, $p < 0.05$) and also between the three zones (Fig 4, Table 4) following the same east-west gradient of organic deposition.

Mean total abundance of worms (Fig 5) increased significantly through years (Kruskall-Wallis rank test, $k = 58.72$, $p < 0.05$); *Potamothrix vejdovskyi* and *Limnodrilus* were mainly responsible for this change. The major augmentation in oligochaetes occurred between 1997 and 2000. Chironomid assemblages showed an up-and-down pattern in their total abundance, mainly reflecting variations in *Micropsectra* density (Kruskall-Wallis rank test, $k = 52.10$, $p < 0.05$).

DISCUSSION

DIVERGENT TRENDS AT THE ZOOBENTHIC COMMUNITY LEVEL

The zoobenthic communities reflected different trends with regard to the timescale and the type of organism considered. Despite a phase of eutrophication during the 1970s, oligochaete assemblages retained their native composition since the beginning of the XXth century (Monard, 1919). Three new species of oligochaetes, from the Ponto-Caspian area, appeared in the lake during the last century (*Potamothrix moldaviensis, P. vejdovskyi* and *Branchiura sowerbyi* (Brinkhurst & Jamieson, 1971; Lang, 1984; Lang & Reymond, 1993). In 1918, *Embolocephalus velutinus* was the most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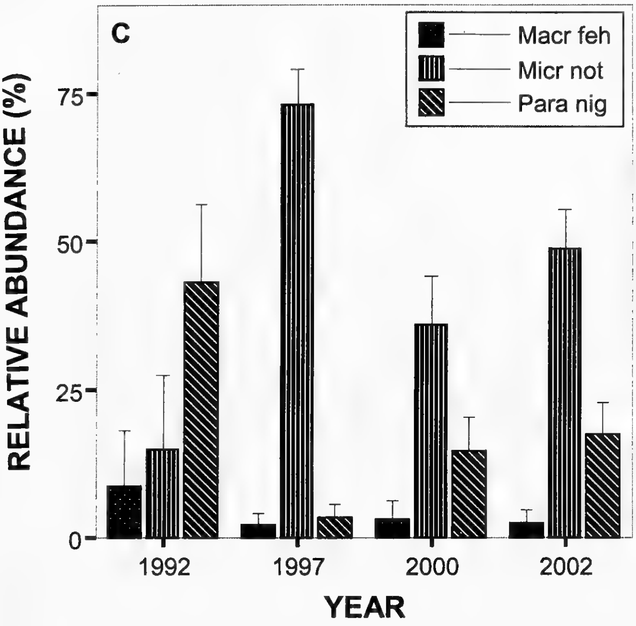

FIG. 3

Relative abundance of species (± CL) between 1992 and 2002. A: 3 oligochaete species indicators of oligotrophic conditions (Bich san: *Bichaeta sanguinea*; Embo vel: *Embolocephalus velutinus*; Styl her: *Stylodrilus heringianus*); B: more tolerant oligochaete species to oxygen depletion and organic deposition: Pota vej: *Potamothrix vejdovskyi* and Spir fer: *Spirosperma ferox*; C: chironomid taxa (Macr feh: *Macropelopia fehlmanni*; Micr not: *Micropsectra notescens* gr.; Para nig: *Paracladopelma nigritula* gr.).

frequent species followed by *Potamothrix hammoniensis*, *Stylodrilus heringianus* and *Tubifex tubifex* (Monard, 1919). Since 1984, oligochaete fauna has been dominated by the more tolerant taxa *Potamothrix hammoniensis* and *Tubifex tubifex* in terms of frequency and abundance. After 1992, a strong reduction in density of two species intolerant to oxygen depletion and/or organic deposition (Brinkhurst, 1964; Milbrink, 1978, 1983) was noted (*Stylodrilus heringianus* and *Embolocephalus velutinus*). The dominating position of *Tubifex tubifex* at both ends of the trophic scale would seem to be rather controversial (Milbrink, 1978, 1980). As is now widely recognized, at low organic content, *T. tubifex* is generally a dominating species together with *Stylodrilus* and *Embolocephalus* species and abundances remains low (Milbrink, 1978; Milbrink *et al.*, 2002). This was the case in the beginning of the XXth century in Lake Neuchâtel. The persistance in 2002, of a low density of *Stylodrilus heringianus* and *Embolocephalus velutinus*, combined with a reduction *Potamothrix hammoniensis* and *Tubifex tubifex* (frequency and abundance) indicated that the oligochaete species structure does not provide a coherent signature of the lake sediment quality.

In contrast to oligochaetes, the bioindicative value of chironomid communities suggested good conditions at the water-sediment interface since 1992 with, in addition,

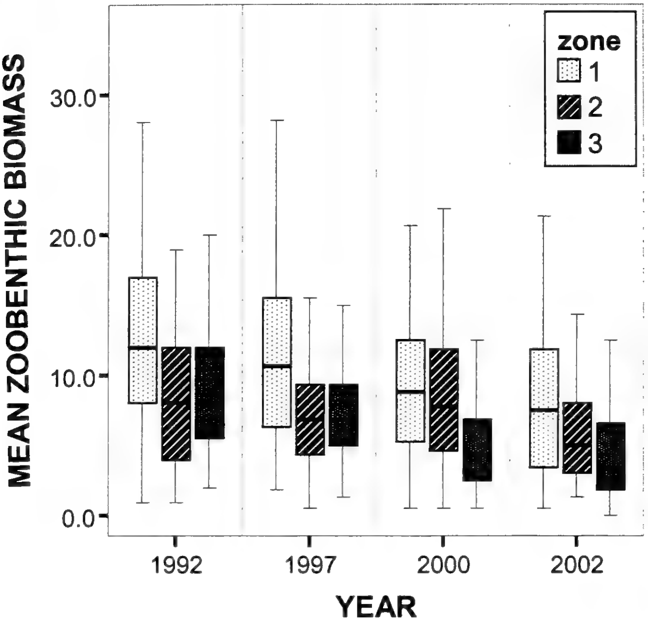

FIG. 4

Mean zoobenthic biomass (oligochaete worms and chironomid larvae) (FW, g m^{-2}) between 1992 and 2002 and between zones. The median, percentiles (25th and 75th) and 1.5 interquartile range are indicated.

TABLE 4. Summary of the analysis of variance (one-way ANOVA) inter-zones for two variables.

Variable		ANOVA inter-zone	
		F	*P*
Black reduced layer	1997	7.99	*< 0.001*
	2000	38.24	*< 0.001*
	2002	30.80	*< 0.001*
Zoobenthic mean biomass	1992	5.33	*0.006*
	1997	10.52	*< 0.001*
	2000	15.49	*< 0.001*
	2002	4.46	*0.013*

the presence and the settlement of *Paracladopelma nigritula* gr., a species group characteristic of oligotrophic lakes (Saether, 1979). This taxon was also present in Lake Geneva at a depth of 40 m in 1995 (Lods-Crozet, unpubl. data) and in Lake Annecy (Verneaux & Verneaux, 2002). Chironomid composition and richness (11 taxa) during the last ten years is analogous to that of other lakes of the Alpine region, for the same depth: Lake Constance (Reiss, 1968), Lake Geneva (Lods-Crozet & Lachavanne, 1994) and Lake Starnberger (Gerstmeier, 1989). Furthermore, the inter-annual up and down pattern (Fig. 5) could be explained by the fact that, if profundal communities are food limited, then year-to-year fluctuations in autochtonous algal production may ulti-

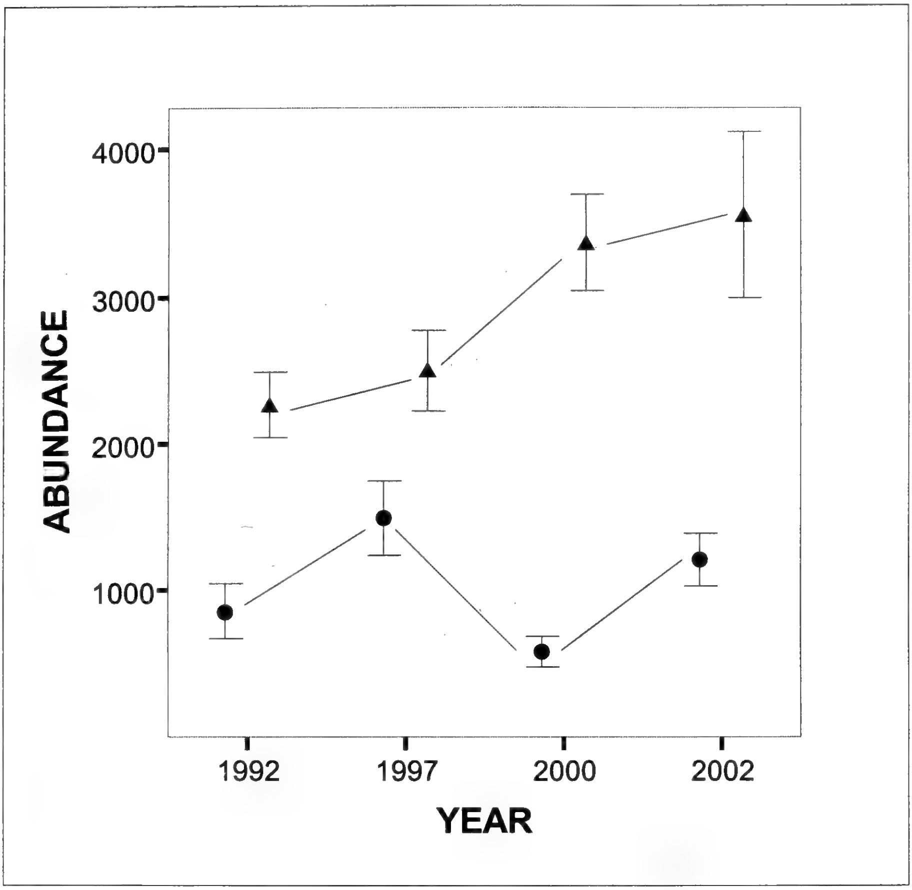

FIG. 5

Total abundance (No. m^{-2}) of oligochaete worms (circles) and chironomid larvae (triangles) (± CL) between 1992 and 2002.

mately affect profundal zoobenthos communities resulting in time-delayed population responses (Johnson & Wiederholm, 1992).

In addition, two species of molluscs (*Pisidium conventus, P. personatum*), typical of deep lakes were found. These two species were also present in the deep zone of the oligotrophic Lake Annecy, France (Mouthon, 2002) and were rare or absent in meso-eutrophic Swiss lakes (P. Stucki, pers. comm.)

THE EFFECTS OF ABIOTIC AND BIOTIC FACTORS

Chemical and phytoplanktonic metrics in the pelagic waters of lake Neuchâtel indicate that mean total phosphorus concentrations in the water column have markedly decreased from 38 mg m^{-3} in 1984 to 18 mg m^{-3} in 1992 and 10.0 mg m^{-3} in 2002. Consequently, mean algal biomass has also decreased (Pokorni-Aebi, 1997, 2002). In contrast, during a similar phase of recovery from eutrophication in Lake Geneva, good relationships were found between pelagic chemical parameters and zoobenthic communities, with a significant increase of oligochaete species bioindicators of oligotrophic conditions (Lang, 1998).

In order to understand these divergent trends between zoobenthic groups we have explored three main hypotheses. One of them is contamination of sediment by micropollutants (heavy metals, PCBs and PAHs) and their potential impact on zoobenthic communities. Anthropogenic contaminants were detected along the 15 kilometres-long transect, but no spatial differences were noted. Heavy metals concentrations were relatively low compared to those measured in Lake Geneva in 1983 (Mondain-Monval *et al.*, 1983) and in 2003 at 70 m-depth in the same lake (Lods-Crozet, unpublished data). Compared to background concentrations observed prior to industrialisation (Vernet & Viel, 1984) mean values were close and even lower than background levels (Table 4). PCBs in Lake Neuchâtel have similar values as at 70 m-depth in Lake Geneva (Lods-Crozet, 2003, unpublished data). Their long-term persistence in the upper layer of bottom sediments, despite their banning in industrial processes since 1986, could explain the residual contamination. PAHs levels are higher than those measured at 70 m depth in Lake Geneva: 0.193 mg Kg^{-1} (Lods-Crozet, 2003, unpublished data). The Swiss reference is a zero value for these synthetic and persistant contaminants (PCBs and PAHs) but reasonable limits could be chosen on the basis of threshold values determined for agricultural valorisation of wastewater sludges (Osol, 1998) (Table 2).

Similar levels of sediment contamination by heavy metals and PAHs were found in Lake St-François, Canada (Pinel-Alloul *et al.*, 1996) and attempts to correlate contaminants and macroinvertebrate metrics were unsuccessful. It should be stressed that sediment toxicity assessment is not an easy task (Luoma & Carter, 1993) and sediment quality criteria essentially take into account the capacity of benthic organisms to tolerate the different contaminant concentrations. Substantial doubt exists about pollutants concentrations that pose significant ecological dangers because the bioavailable fraction of toxicants in sediments is rarely measured (Pardos *et al.*, 2004). The use of sediment quality assessment metrics, developped by Smith *et al.* (1996) permitted the following considerations. The Probable Effect Level (PEL) on benthic organisms, showed that the concentrations of metallic and organic (PAHs) contaminants detected were well below those estimated by the PEL (Smith *et al.*, 1996). On the other hand, in laboratory experiments, Nalepa (1991) pointed out that sublethal effects were apparent at lower concentrations than those reported from Lake Ontario sediments. For instance, *Stylodrilus heringianus* ceased feeding after 58 days at PCB concentrations over 0.05 mg Kg^{-1} (PCB congeners not known). Concentrations at this level were found in Lake Neuchâtel in 2003. In addition, tubicifids feed continuously in a conveyor-belt fashion by ingesting particles in bulk at depth and defecating on the sediment surface. Such bioturbation has been reported to significantly increase the flux of metals and organic contaminants from sediment into the water column (Reynoldson, 1987; Reible *et al.*, 1996). While results of laboratory experiments may not be applicable to the field situation, these results do demonstrate the possibility of low-level, long-term chronic impacts of pollutants on oligochaete populations (Nalepa, 1991).

Another hypothesis, proposed by Lang (1999) was the changes in the phytoplankton composition between 1993 and 1996, with the dominance of large diatoms (Butty *et al.*, 2003). These have a high sinking rate and as a result, sedimented intact on the bottom surface. Algal signatures at the sediment level were also observed by Steinmann *et al.* (2003) using the analysis of suspended material from the lake epilimnion. Settlement of these algae is known to increase oxygen uptake at the water-sediment interface (Johnson *et al.*, 1989; Lang, 1999). Consequently, some oligochaete species, sensitive to oxygen depletion, were able to be disturbed in their growth and reproductive behavior.

The last hypothesis concerned competition mechanisms. Few studies have actually demonstrated increases or decreases in population growth rate by interaction between oligochaete species (Milbrink, 1993; Timm, 1996). The rapid expansion of Ponto-Caspian *Potamothrix vejdovskyi,* which may compete for habitat and food with other oligochaete species like *Stylodrilus heringianus* and *Embolocephalus velutinus,* should not to be neglected. Furthermore, increase of lake water temperature during the last fifteen decades (Lazzarotto *et al.*, 2002; Pokorni-Aebi, 2002) may have enhance growth and reproduction of this opportunistic species and strengthened up its expansion over more stenothermic native species.

Our study confirms the potential multiple controls of the macroinvertebrate community in anthropogenically stressed ecosystems by both simple and combined effects of chemical, toxicological, biological and ecological factors. Further improvement of lake biomonitoring programs must address assessment of the structure of predominant and profundal zoobenthic community (oligochaetes, chironomids and bivalves molluscs). We consider that Lake Neuchâtel, in terms of biological quality of sediments is in phase of recovery from eutrophication, by using zoobenthic biomass, chironomid community structure and *Pisidium* assemblages as descriptors. The decline of characteristic oligochaete species indicators of oligotrophic conditions from 1992 should be monitored further in order to better understand the causes of this apparent degradation.

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Three new species of *Ancistrus* Kner (Teleostei: Siluriformes: Loricariidae) from the upper Tapajós and Tocantins rivers

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Three new species of *Ancistrus* Kner (Teleostei: Siluriformes: Loricariidae) from the upper Tapajós and Tocantins rivers. - Three new species of *Ancistrus* are described: *Ancistrus tombador* sp. n. from the upper rio Tapajós basin, and *Ancistrus reisi* sp. n. and *Ancistrus jataiensis* sp. n. from the upper rio Tocantins basin. The three species differ from their congeners by the absence of an adipose fin. Loss of the adipose fin was only rarely observed in Ancistrini. In the three new species it is replaced by a series of small unpaired platelets forming a low crest. *Ancistrus tombador* further differs from all congeners by a unique combination of characters: naked margin of snout large and tentacles usually absent in both sexes; body very narrow (cleithral width 27.5-31.2% SL); long caudal peduncle particularly depressed (depth 8.3-9.2% SL). *Ancistrus reisi* is distinguished from *A. jataiensis* by measurements, including: predorsal length (respectively: 43.8-46.4% SL versus 47.5-49.3% SL); occipital depth (14.9-17.0% SL versus 17.0-19.5% SL); and caudal peduncle length (27.7-30.9% SL, versus 24.6-27.1% SL).

Keywords: Ancistrini - new species - Amazon River drainage - Brazil - catfishes - taxonomy.

INTRODUCTION

With 53 valid species plus numerous undescribed forms (Fisch-Muller, 1999, 2003), *Ancistrus* Kner, 1854 is the type genus and the most speciose genus of the Ancistrini Kner, 1853. This latter taxon was recently moved from subfamily to tribe rank in subfamily Hypostominae by Armbruster (2004). *Ancistrus* exhibits a wide distribution in the Neotropical Region with highest species diversity observed in the Amazon system. It was found to be monophyletic on the basis of osteological (Schaefer, 1987), molecular (Montoya-Burgos *et al.*, 1997, 1998), and biochemical (Fisch-Muller, 1999) data.

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During a field expedition of the Laboratory of Ichthyology of PUCRS (MCP) to Central Brazil in January 2002, with the exploration of upper rio Tapajós basin, a very distinct new species of *Ancistrus* was discovered. This new species is peculiar in the absence of the adipose fin, which is replaced by median platelets forming a low crest, a character never described for *Ancistrus* until present. In the same year, the MCP received some fishes from the upper Tocantins basin collected by the Centro de Biologia Aquática (UCG) for identification, and surprisingly two additional and new species of *Ancistrus* with a similar loss of the adipose fin were recognized. The objective of this paper is to describe these recently discovered species, while contributing to the advancement of the "All Catfish Species Inventory".

MATERIAL AND METHODS

Measurements and counts follow Fisch-Muller *et al.* (2001). Morphometric characters other than standard length (SL) are expressed as percentages of SL, except for sub-units of the head, which are expressed as percentages of head length (HL). Specimens are deposited in the Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre (MCP) and in the Muséum d'histoire naturelle, Geneva (MHNG). Vertebrae counts, including Weberian and ural complexes, were done on radiographs of type specimens, and the plates replacing the adipose fin were examined on cleared and stained specimens (c&s) prepared according to the method of Taylor & Van Dyke (1985). Comparative material includes the primary type specimens of all but six described *Ancistrus* species.

DESCRIPTIONS OF NEW SPECIES

Ancistrus tombador sp. n. Fig. 1; Table 1

Holotype. MCP 33000, male, 62.8 mm SL; Brazil: Mato Grosso: Porto dos Gaúchos: igarapé Ribeirão Preto, on the road MT-338, about 26 km SE from Porto dos Gaúchos (11°39'27"S, 57°12'7"W), a tributary of rio Arinos, upper rio Tapajos basin; coll. R. E. Reis, L. R. Malabarba, E. H. Pereira, V. A. Bertaco, and A. R. Cardoso, 19 Jan 2002.

Paratypes. Brazil: Mato Grosso: rio Arinos basin, rio Tapajos drainage. MCP 33001, 11 (10 measured; 1 c&s), 24.9-57.6 mm SL; MHNG 2647.55, 5, 35.1-55.6 mm SL; collected with the holotype. MCP 33002, 2 (1 measured), 13.7-52.9 mm SL, stream on the road MT-338, about 39 km N from Tapurah (12°1'49"S, 56°33'59"W), Tapurah, same collectors, 19 Jan 2002. MCP 33004, 1, 52.0 mm SL; stream in the road between the ferryboat of rio Arinos and Tapurah, about 6 km E from Tapurah, same collectors, 18 Jan 2002.

DIAGNOSIS. *Ancistrus tombador* is easily distinguished from all congeners except *A. reisi* and *A. jataiensis* by the absence of an adipose fin. A series of 3 to 5 median, unpaired platelets forming a low crest is present in place of the adipose fin. These platelets are followed by at least two dermal plates (more often three) of the dorso-lateral series that join dorsally, while in *A. reisi* and *jataiensis* they are nearly immediately followed by the plate-like procurrent caudal rays. *Ancistrus tombador* further differs from all described *Ancistrus* species by the unique combination of the following characters: naked margin of snout large and tentacles usually absent in both sexes, body very narrow (cleithral width 27.5-31.2% SL, mean 29.4), and long caudal peduncle particularly depressed (depth 8.3-9.2% SL, mean 8.7).

FIG. 1

Ancistrus tombador sp. n., holotype, MCP 33000, male, 62.8 mm SL; Brazil: Mato Grosso: igarapé Ribeirão Preto, upper Tapajós basin.

DESCRIPTION. Morphometrics and meristics presented in Table 1. Possibly small-sized species; body very narrow at origin of dorsal fin, narrowing progressively and regularly to caudal peduncle end; head and body strongly depressed, postoccipital elevation weak when present, caudal peduncle very low.

Snout rounded with large naked margin in both sexes. Tentacles absent in both sexes except in one specimen (male, 52.9 mm SL) with single small tentacle on dorso-lateral extremity of naked area.

Eye medium-sized, dorsal margin of orbit elevated, interorbital area slightly concave. Exposed part of opercle roughly triangular with posterior part elongated; dermal plates of postopercular area never numerous, generally large and contiguous with pterotic-supracleithrum, leaving large naked area around opercle. Evertible cheek odontodes short, not reaching posterior margin of opercle, with fleshy base variable in length and thickness.

Oral disk roughly circular, lips covered with minute papillae. Lower lip large but not reaching pectoral girdle, its border with very small papillae. Maxillary barbel short, about as long as buccal papilla. Mandibular tooth row short, premaxillary tooth row slightly wider; teeth numerous, bifid, with main cusp large; lateral cusp minute, pointed, never reaching more than one third mesial cusp length.

Supraoccipital plate usually well delimited from surrounding plates, particularly from central plate of first predorsal row. Curved to triangular nuchal plate always present before dorsal-fin spinelet. Five series of lateral plates; mid-dorsal, and mid-ventral series ending at level of small median platelets replacing the adipose fin. Last plate in median series usually of similar size and shape that penultimate plate. Odontodes present on body plates except along dorsal-fin base and on widely extended area below anal fin; odontodes generally short, only very slightly longer on ventral margin of opercle and on pectoral-fin spine of males. Abdomen entirely devoid of plates. Presence of small preanal platelet (first anal-fin pterygiophore) covered with odontodes.

Dorsal-fin origin slightly anterior to pelvic-fin origin; dorsal fin short, when laid back its tip not reaching series of median platelets replacing adipose fin. Adipose fin absent, replaced by series of 3 to 5 small median platelets between lateral scutes, forming slightly raised crest. These platelets separated from usual median platelets preceeding caudal fin (procurrent caudal rays) by 2 or 3 plates of dorso-lateral series that join dorsally. Pectoral spine reaching anterior third of ventral spine. Anal fin short. Caudal fin short, slightly concave. Fin-ray formulae: D i,7; P i,6; V i,5; A i,4; C i, 13, i (1 ex.) or C i,14, i (16 ex.).

Vertebrae: 28 (holotype and one paratype)

COLORATION IN ALCOHOL. Head brownish; body dorsally and laterally brownish with four or five weak ill-defined paler bands; inferior part of caudal peduncle paler. Insconspicuous small round spots on naked margin of snout only, or up to dorsal-fin origin. These spots generally whitish and sprinkled with dark chromatophores; dark chromatophores sometimes numerous on whitish area, thus resulting in dark spots instead of ligth spots (more often in small specimens). Lips yellowish. Ventral surface of head and abdomen pale brown to yellowish. Fin rays generally brown spotted whitish to orange; membranes hyaline, unpigmented at least in their middle. Spots sometimes forming bands on dorsal and caudal fins, with tips yellowish to orange-colored (Fig. 1).

DISTRIBUTION. *Ancistrus tombador* was collected in small rivers of the rio Arinos basin, upper rio Tapajós drainage, in Mato Grosso state (Fig. 2).

TABLE 1. Morphometric and meristic data of the holotypes (H) and paratypes of *Ancistrus tombador* sp. n., *Ancistrus reisi* sp. n. and *Ancistrus jataiensis* sp. n.

	Ancistrus tombador				*Ancistrus reisi*				*Ancistrus jataiensis*			
	H	n	Range	Mean	H	n	Range	Mean	H	n	Range	Mean
Standard length (mm)	62.8	17	34.8-62.8	46.9	60.8	13	35.6-60.8	45.4	54.0	6	40.5-54.0	45.9
PERCENTS OF STANDARD LENGTH												
Predorsal length	44.1	17	42.7-45.1	44.3	45.7	13	43.8-46.4	44.9	49.3	6	47.5-49.3	48.1
Occipital depth	16.2	17	15.6-16.9	16.2	16.9	13	14.9-17.0	16.0	19.5	6	17.0-19.5	18.1
Cleithral width	28.7	17	27.5-31.2	29.4	34.5	13	31.6-34.5	33.1	35.4	6	33.6-35.6	34.9
Head length	34.0	17	34.0-37.6	35.8	37.5	13	34.7-37.5	36.4	40.2	6	36.2-40.2	38.9
Dorsal spine length	23.8	17	22.8-26.5	24.6	23.6	10	22.7-25.3	24.2	24.3	6	21.7-24.3	22.9
Dorsal fin base length	23.0	17	19.5-23.0	21.4	22.5	13	20.4-22.7	22.1	22.1	6	21.2-23.2	22.2
Pectoral spine length	28.5	17	25.7-29.4	27.8	28.2	13	25.8-28.3	27.3	27.8	5	25.3-27.8	26.4
Pelvic spine length	24.3	17	23.9-26.2	24.9	25.0	13	23.0-26.0	24.7	25.9	6	23.2-25.9	24.0
Thoracic length	24.1	17	22.5-24.8	23.5	23.4	13	23.2-24.5	23.8	25.0	6	22.3-26.6	24.5
Abdominal length	22.2	17	19.1-22.5	20.9	22.2	13	20.4-22.5	21.5	20.9	6	20.6-22.7	21.5
Caudal peduncle length	29.4	17	29.4-32.4	30.9	28.1	13	27.7-30.9	28.7	26.1	6	24.6-27.1	26.3
Caudal peduncle depth	8.4	17	8.3-9.2	8.7	10.2	13	9.6-10.7	10.2	10.7	6	10.1-10.7	10.4
Anal fin length	11.2	17	9.8-11.4	10.7	13.1	13	9.8-13.1	11.3	14.4	6	11.0-14.4	12.2
Upper caudal spine length	22.3	12	22.2-26.8	24.8	25.0	6	25.0-28.0	26.8	27.6	5	23.1-27.6	25.4
Lower caudal spine length	28.4	14	26.5-32.5	29.8	33.2	10	32.7-37.5	35.2	34.8	6	31.9-34.8	33.1
Body width at dorsal fin origin	26.2	17	22.8-26.9	25.6	27.6	13	25.8-29.2	27.0	29.0	6	27.5-30.5	28.9
PERCENTS OF HEAD LENGTH												
Supracleithral width	79.4	17	70.6-80.1	76.9	87.9	13	81.3-88.0	84.8	86.4	6	80.8-90.0	84.8
Snout length	60.2	17	56.9-60.8	58.6	57.7	13	57.1-60.8	58.9	58.5	6	57.7-61.3	59.7
Interorbital width	38.9	17	34.2-41.9	38.3	42.3	13	37.5-42.3	39.1	43.3	6	36.2-43.3	40.2
Plated internostril distance	19.4	17	16.6-20.5	18.6	14.9	13	14.3-16.7	15.4	16.8	6	16.0-18.0	16.9
Orbital diameter	17.1	17	16.6-18.8	17.7	14.3	13	14.3-17.5	16.0	13.6	6	13.4-15.4	14.3
Opercle length	16.4	17	13.9-17.0	15.4	11.0	13	11.0-15.1	13.5	11.8	6	11.8-14.4	13.0
Mandibular tooth row length	15.0	17	13.6-16.4	14.8	20.8	13	20.7-23.2	22.3	19.4	6	19.4-24.0	21.6
Interbranchial distance	54.8	17	45.0-54.8	51.0	57.2	13	54.8-58.6	57.2	50.0	6	50.0-55.6	53.4
COUNTS												
Total lateral median plates	24	17	24-25	24.2	24	13	24-25	24.2	24	6	23-25	24.2
Plates along dorsal-fin base	6	17	6-7	6.2	7	13	7	7	7	6	7	7
Plates between anal and caudal fins	11	17	11-12	11.1	11	13	10-11	10.6	10	6	10-11	10.4
Postopercular plates	4	15	3-5	4.3	12	13	5-12	7.6	8	6	5-8	6.8
Dentary teeth	54	17	41-72	53.6	78	13	64-79	72.6	72	6	62-80	73.8
Premaxillary teeth	60	17	39-65	56.1	74	13	61-75	67.0	72	6	68-78	72.8
Interopercular spines	13	17	10-16	13.0	18	13	12-18	14.3	18	6	14-18	15.8

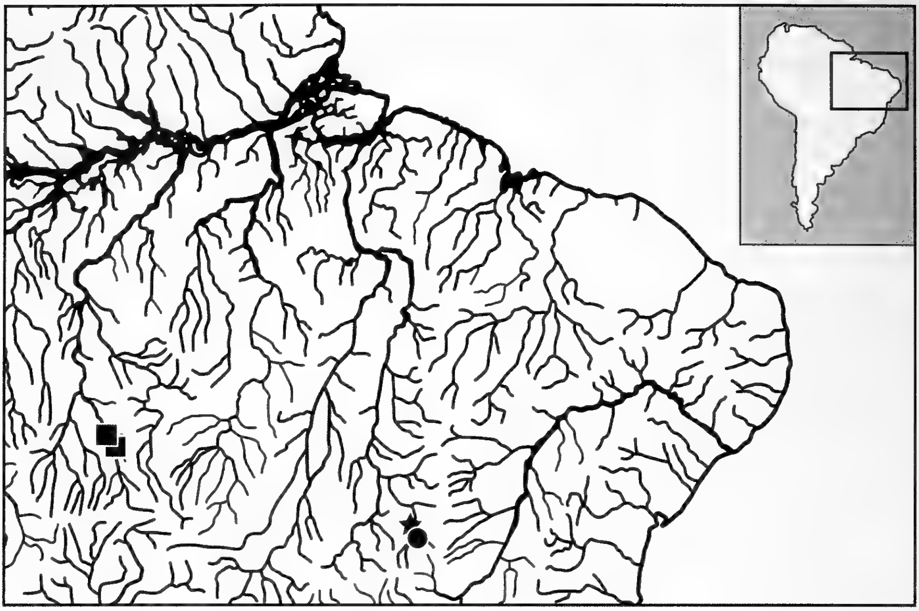

FIG. 2

Collection localities of *Ancistrus tombador* sp. n. (squares) from upper Tapajós basin, *Ancistrus reisi* sp. n. (circle) and *Ancistrus jataiensis* sp. n. (star) from upper Tocantins basin. Symbols may represent more than one locality.

ETYMOLOGY. The specific name *tombador* (a noun in apposition) refers to the Serra do Tombador, where the type locality is situated, in Mato Grosso.

Ancistrus reisi sp. n. Fig. 3; Table 1

Holotype. MCP 34818, male, 60.8 mm SL; Brazil: Goiás: Mambaí: córrego das Dores, tributary of the rio Vermelho (14°29'S, 46°6'W), rio Tocantins basin; coll. Centro de Biologia Aquática - UCG, 15 Dec 2002.

Paratypes. Brazil: Goiás: Mambaí: rio Tocantins basin. MCP 33924, 4 (2 measured), 19.8-49.8 mm SL, collected with the holotype. MCP 33922, 5 (4 measured; 1 c&s), 35.6-54.5 mm SL; MHNG 2652.91, 4 (3 measured), 22.4-37.8 mm SL; same locality and collector as holotype, 9 Sep 2002. MCP 33925, 7 (2 measured), 15.9-47.9 mm SL; ribeirão das Araras, tributary of rio Vermelho (14°29'S, 46°6'W); same collector as holotype, 14 Dec 2002.

DIAGNOSIS. *Ancistrus reisi* differs from all congeners except *A. tombador* and *A. jataiensis* by the absence of an adipose fin. A series of 2 to 4 median unpaired platelets forming a low crest replaces the adipose fin. These platelets are nearly immediately followed by the plate-like procurrent caudal rays, while in *A. tombador* they are followed by at least two lateral plates that join dorsally before the procurrent caudal rays. *Ancistrus reisi* further differs from *A. tombador* by several morphometric and meristic characters, by the coloration pattern, and by the snout bearing tentacles (see under diagnosis of *A. tombador*). It is distinguished from *A. jataiensis* by the following morphometric characters: predorsal length (43.8-46.4% SL, mean 44.9,

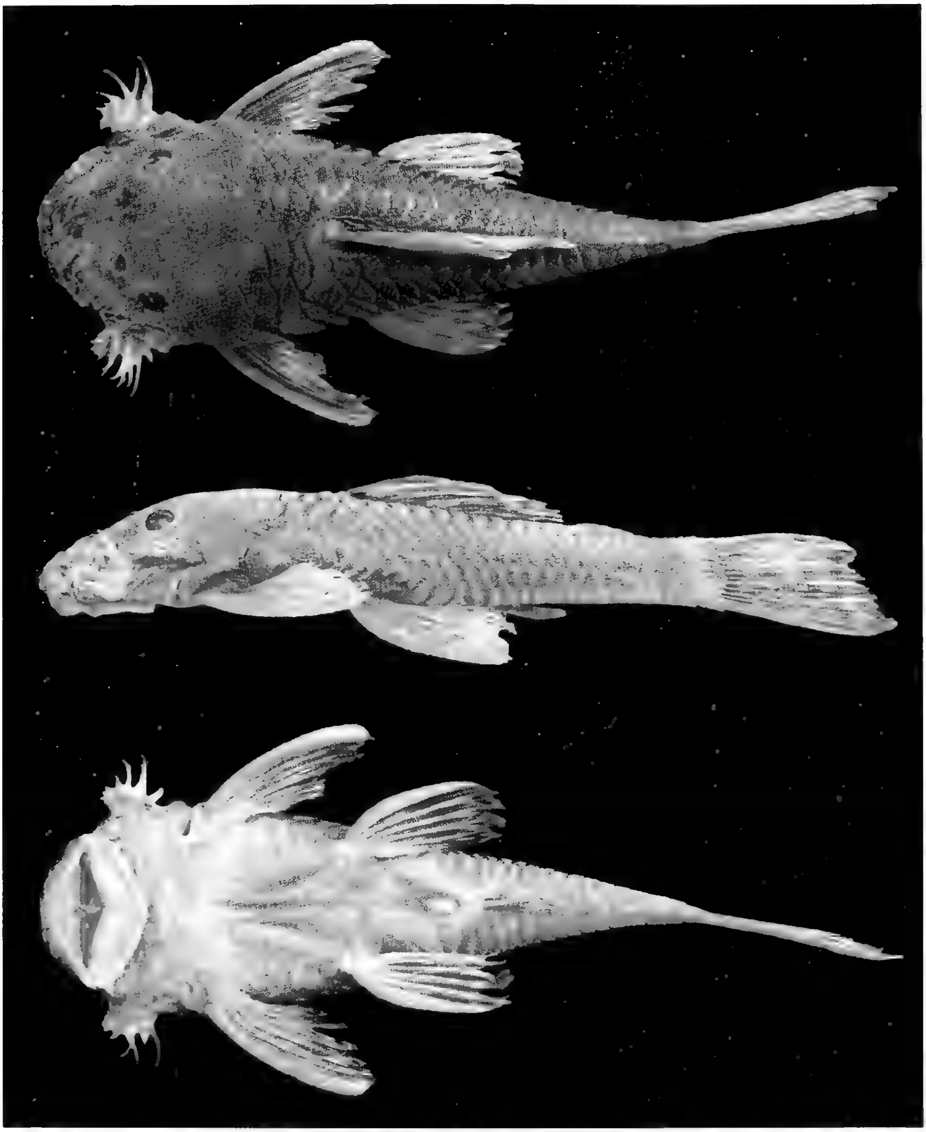

FIG. 3

Ancistrus reisi sp. n., holotype, MCP 34818, male, 60.8 mm SL. Brazil: Goiás: córrego das Dores, upper Tocantins basin.

versus 47.5-49.3% SL, mean 48.1), occipital depth (14.9-17.0% SL, mean 16.0, versus 17.0-19.5% SL, mean 18.1), and caudal peduncle length (27.7-30.9% SL, mean 28.7, versus 24.6-27.1% SL, mean 26.3).

DESCRIPTION. Morphometrics and meristics presented in Table 1. Small species; body large, narrowing regularly to caudal peduncle end; head strongly depressed, postoccipital elevation weak when present.

Snout rounded with naked margin generally ill-delimited by posterior dermal plates; these plates not regular in size and shape, and rarely joined together. Naked area in males large but never reaching nostrils (narrower in females), with fleshy tentacles (up to 20, in holotype). Tentacles restricted to dorso-lateral portion of naked area in small males (from 36.5 mm SL); also present on anterior portion of snout in larger males (from 54.3 mm SL); present in one row bordering snout as well as dorsally in largest specimen (holotype). Tentacles not branched.

Eye small, dorsal margin of orbit not elevated, interorbital area slightly convex. Exposed part of opercle variable in shape but never very long; dermal platelets of postopercular area variable in shape, some large and contiguous with pterotic-supracleithrum, smaller anteriorly. Evertible cheek odontodes long respective to size of specimens, posterior one reaching often far beyond posterior margin of opercle, with fleshy base sometimes long and thick.

Oral disk enlarged, widened laterally; lips covered with minute papillae. Lower lip large but not reaching pectoral girdle, its border formed by unequal small flaps and smooth. Maxillary barbel short. Mandibular tooth row wide, premaxillary tooth row equal in length or slightly shorter; teeth numerous, bifid, with main cusp large and long; lateral cusp minute, pointed, never reaching more than one third mesial cusp length.

Supraoccipital plate usually well delimited from surrounding plates, particularly from central plate (or two plates) of first predorsal row. Odontodes very short on head; central part of supraoccipital slightly granular. Exposed part of nuchal plate minute or totally covered with skin and dorsal-fin spinelet often reduced. Five series of lateral plates; mid-dorsal and mid-ventral series ending at level of median platelets replacing adipose fin. Last plate of median series sometimes smaller than penultimate plate. Odontodes present on body plates except along dorsal-fin base and on widely extended area below anal fin; odontodes slightly longer on ventral margin of opercle and on pectoral-fin spine of males. Abdomen entirely devoid of plates. First anal-fin pterygiophore totally covered by skin.

Dorsal-fin origin slightly anterior to pelvic-fin origin; dorsal fin short, when laid back its tip not reaching median platelets replacing adipose fin. Adipose fin absent, replaced by 2 to 4 small median platelets between lateral scutes, forming slightly raised crest. These platelets immediately followed by smaller and unraised median platelets (procurrent caudal rays) preceeding caudal fin. Pectoral spine reaching anterior third of ventral spine. Anal fin short. Caudal fin short, slightly concave. Fin-ray formulae: D i,7; P i,6; V i,5; A i,4; C i, 13, i (4 specimens, including holotype) or more generally i,14, i .

Vertebrae: 28 (holotype and one paratype)

COLORATION IN ALCOHOL. Dorsal surface brown, with undefined brown-reddish or brown-yellowish areas; small and rounded lighter spots often present on snout but never very contrasted (including holotype; Fig. 2). Ventral surface lighter; lips yellowish; belly yellowish (rarely) to light brown; when pigmented, chromatophores present on its entire surface including central part, and unspotted. Fin rays generally brown, finely spotted with whitish to orange, membranes hyaline, unpigmented at least in their middle. Except in largest specimens, spots usually forming narrow bands on caudal fin; caudal fin with lower and upper tips often yellowish to orange.

DISTRIBUTION. *Ancistrus reisi* was collected in small rivers of the upper Tocantins drainage in Tocantins State (Fig. 2).

ETYMOLOGY. The new species is named after Roberto Reis for his active contribution to the knowledge of the Neotropical ichthyofauna.

Ancistrus jataiensis sp. n. Fig. 4; Table 1

Holotype. MCP 35244, male, 54.0 mm SL; Brazil: Goiás: Mambaí: córrego Jataí, tributary of the rio Vermelho (14°29'S, 46°6'W), rio Tocantins basin; coll. Centro de Biologia Aquática - UCG, 8 Sep 2002.

Paratypes. MCP 33921, 3 (1 c& s), 41.6-50.6 mm SL; MHNG 2652.92, 1, 44.2 mm SL; collected with the holotype. MCP 33923, 1, 40.5 mm SL; same locality and collector as holotype, 15 Dec 2002.

DIAGNOSIS. *Ancistrus jataiensis* differs from all congeners except *A. tombador* and *A. reisi* by the absence of an adipose fin. A series of 2 to 4 median unpaired platelets forming a low crest replaces the adipose fin. These platelets are nearly immediately followed by the plate-like procurrent caudal rays, while in *A. tombador* they are followed by at least two lateral plates that join dorsally before the procurrent caudal rays. *Ancistrus jataiensis* further differs from *A. tombador* by several morphometric and meristic characters, by the coloration pattern, and by the snout bearing tentacles (see under diagnosis of *A. tombador*). It is distinguished from *A. reisi* by the following morphometric characters: predorsal length (47.5-49.3% SL, mean 48.1, versus 43.8-46.4% SL, mean 44.9), occipital depth (17.0-19.5% SL, mean 18.1, versus 14.9-17.0% SL, mean 16.0), and caudal peduncle length (24.6-27.1% SL, mean 26.3, versus 27.7-30.9% SL, mean 28.7).

DESCRIPTION. Morphometrics and meristics presented in Table 1. Small species; body thickset, predorsally long and large, with short caudal peduncle; head moderately depressed, weak postoccipital elevation.

Snout rounded with naked margin generally ill-delimited by posterior dermal plates; these plates not regular in size and shape, and rarely joined together. Naked area relatively large in males (narrower in females), with fleshy tentacles (up to 27, in holotype). Tentacles present at dorso-lateral portion of naked area and on anterior portion of snout in males from 41.6 mm SL; in one row bordering snout as well as dorsally in largest specimens (from 50.6 mm SL). Some tentacles branched in larger males (including holotype).

Eye very small, dorsal margin of orbit not elevated; interorbital large, particularly in large specimens, and slightly convex. Exposed part of opercle of variable shape but never very long; dermal platelets of postopercular area variable in shape, generally large and contiguous with pterotic-supracleithrum. Evertible cheek odontodes strong and numerous, long respective to size of specimens, posterior one reaching far beyond posterior end of opercle in largest specimens (including holotype), with fleshy base sometimes long, thick and branched.

Oral disk enlarged, widened laterally; lips covered with minute papillae. Lower lip reaching or almost reaching anterior margin of pectoral girdle, its border formed by unequal small flaps, and smooth. Maxillary barbel short. Mandibular tooth row wide, premaxillary tooth row equal in length or slightly shorter; teeth numerous, bifid, with

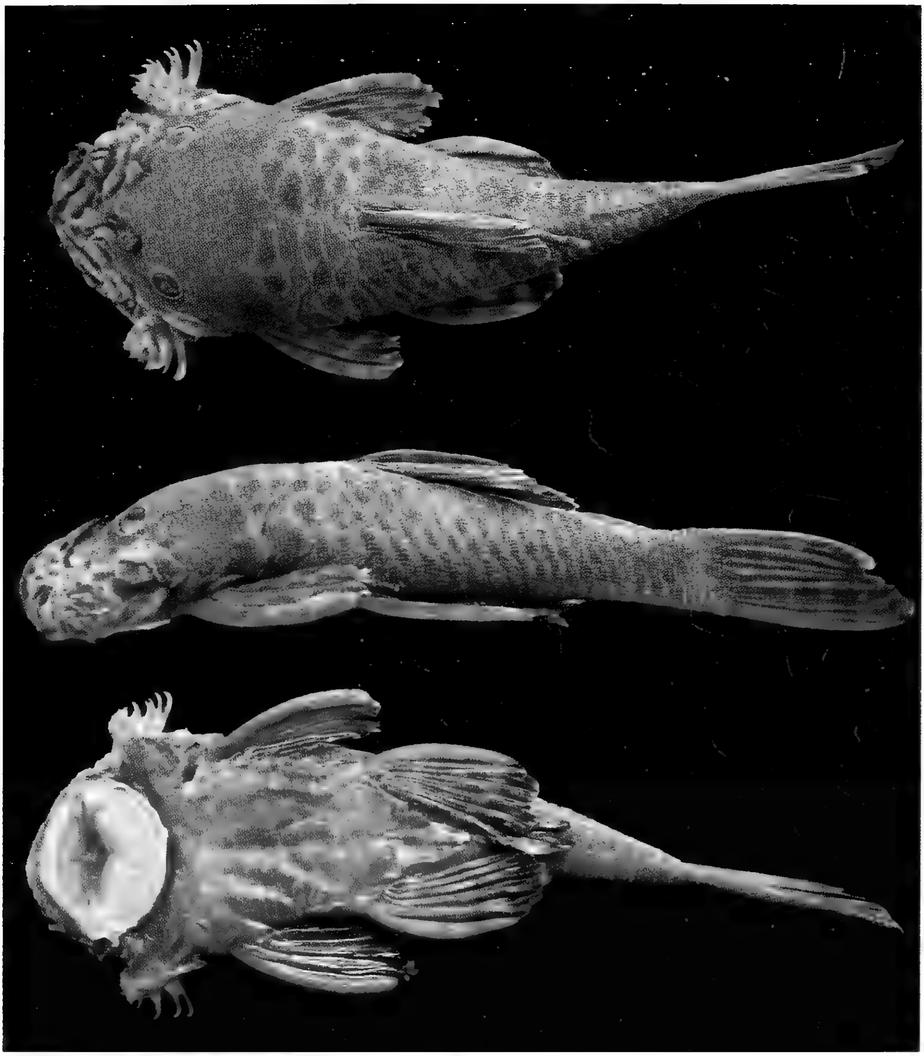

FIG. 4

Ancistrus jataiensis sp. n., holotype, MCP 35244, male, 54.0 mm SL. Brazil: Goiás: córrego Jataí, upper Tocantins basin.

main cusp large and long; lateral cusp minute, pointed, never reaching more than one third mesial cusp length.

Supraoccipital plate usually hardly delimited from surrounding head plates; well delimited from central plate (or two plates) of first predorsal row. Odontodes very short on head; central part of supraoccipital slightly granular. Exposed part of nuchal plate minute or totally covered with skin and dorsal-fin spinelet often reduced. Five series of lateral plates; mid-dorsal and mid-ventral series ending at level of median platelets replacing adipose fin. Last plate of median series rarely smaller than penultimate plate. Odontodes present on body plates except along dorsal-fin base and on widely extended area below anal fin; odontodes slightly longer on ventral margin of opercle and on pectoral-fin spine of males. Abdomen entirely devoid of plates. First anal-fin pterygiophore totally covered by skin.

Dorsal-fin origin slightly anterior to pelvic-fin origin; dorsal fin short, when laid back its tip not reaching median platelets replacing adipose fin. Adipose fin absent, replaced by 2 to 4 small median platelets between lateral scutes, forming slightly raised crest. These platelets immediately followed by smaller and unraised median platelets (procurrent caudal rays) preceeding caudal fin. Pectoral spine reaching anterior third of ventral spine. Anal fin short. Caudal fin short, slightly concave. Fin-ray formulae: D i,7; P i,6; V i,5; A i,4; C i,14, i .

Vertebrae: 28 (holotype and one paratype)

COLORATION IN ALCOHOL. Dorsal surface light reddish-brown to dark brown (including holotype; Fig. 4); small and rounded lighter spots present on snout or on entire head (holotype), rarely very contrasted. Ventral surface slightly lighter; lips yellowish; belly light brown to dark brown, with chromatophores present on its entire surface including central part, and usually covered with light spots of variable shape. Fins brownish similar to dorsal surface, spotted with whitish to orange, membranes variably pigmented; spots usually forming bands on caudal fin, with upper and lower tips often yellowish to orange.

DISTRIBUTION. *Ancistrus jataiensis* was found only at the type locality, a small tributary of the rio Vermelho, upper Tocantins basin (Fig. 2).

ETYMOLOGY. The specific epithet *jataiensis* (an adjective) is derived from Jataí, the name of the only river where the species was found, in Goiás state.

DISCUSSION

The absence of an adipose fin is known for several loricariids but it is quite rare for Ancistrini, where it is characteristic of the few species of the genera *Acanthicus* Spix & Agassiz, 1829, *Leptoancistrus* Meek & Hildebrand, 1916, *Lipopterichthys* Norman, 1935, and of two species of *Lithoxus* (*L. pallidimaculatus* Boeseman, 1982; *L. surinamensis* Boeseman, 1982). The adipose fin is also absent occasionally in *Chaetostoma anomalum* Regan, 1903 and in *C. venezuelae* (Schultz, 1944). The loss of the adipose fin was never observed before in *Ancistrus*. All described species of the genus have an adipose fin formed by a raised and curved spine and by a membrane, that often extends beyond the end of the spine. This adipose fin is preceded by one or more small median unpaired bony plates, named pre-adipose scutes in Schaefer (1987). In the three *Ancistrus* species described here, a series of unpaired median platelets replacing the adipose fin forms a slightly raised crest. Replacement of the adipose fin by such plates was described for *Lipopterichthys*, and in Hypostomini tribe for species of *Corymbophanes* Eigenmann, 1909 and *Hemipsilichthys vestigipinnis* Pereira & Reis, 1992.

Ancistrus is characterized by a naked anterior snout margin with fleshy tentacles that develop during growth. The width of the naked margin, as well as the distribution, number, and size of tentacles vary between sexes and, to a lesser extent, between species (Muller, 1990; Sabaj *et al.*, 1999). In all species but *A. bolivianus* (Steindachner, 1915), *A. aguaboensis* Fisch-Muller, Mazzoni & Weber, 2001, *A. minutus* Fisch-Muller Mazzoni & Weber, 2001, and an undescribed Peruvian species, the naked area is very narrow along the entire snout margin in females while it is much wider at least laterally on the snout in both small and large males, allowing for sex identification. *Ancistrus tombador* is thus one additional described *Ancistrus* species for which sex cannot be easily determined on the basis of this character. The possibility that specimens described here are all immatures, and that this species grows to a much larger size than observed cannot be excluded. However, in comparison to all examined material, it is evident that it is characterized by the poor development of these fleshy protuberances. The genus name *Xenocara* Regan, 1904, a synonym of *Ancistrus* which is still sometimes found in the aquarium trade, was used by some authors to include species without tentacles, as proposed by Eigenmann (1905, 1910). However, we have never observed any *Ancistrus* species [including *Ancistrus latifrons* (Günther, 1869), type species of *Xenocara*] completely without tentacles.

Ancistrus reisi and *A. jataiensis* from the upper Tocantins basin are quite similar to each other in appearance, as they are also to *A. aguaboensis* and *A. minutus*. The latter two are very likely endemic from the upper rio Tocantins basin and were collected at the Serra da Mesa dam. However, while they were found to be cryptic, *A. reisi* and *A. jataiensis* can be distinguished by several morphometric characters. The body of *A. jataiensis* is more elongated anteriorly and shortened at the caudal peduncle; it is deeper and larger than in *A. reisi*, it shows a larger interorbital and internostril, a smaller eye relative to head length, and has shorter paired and unpaired fins except for the anal fin. In addition to the absence of the adipose fin, the two new species each differ from *A. aguaboensis* and *A. minutus* by several measurements, counts, and the color pattern. Other known *Ancistrus* species from the upper Tocantins basin are *Ancistrus cryptophthalmus* Reis, 1989, a blind species living in caves of the rio Angélica-Bezerra system, and at least one undescribed epigean species found in the same area (Fisch-Muller *et al.*, 2001).

Reports on the ichthyofaunal composition of the Tocantins and Tapajós rivers are rare (e.g. Santos *et al.*, 1984; Merona, 1987; Miranda & Mazzoni, 2003) and the ichthyofauna of the upper reaches of these basins is still poorly known. However the Tocantins river basin was pointed out as an area of endemism for several Neotropical freshwater fish groups by different authors (e.g. Vari, 1988; Menezes & Lucena, 1998; Lima & Moreira, 2003). In its upper part especially, it also appears to represent an area of high endemism for the Ancistrini as shown by the presence of three recently discovered *Hemiancistrus* species (Cardoso & Lucinda, 2003), and by at least six distinct and apparently endemic species of *Ancistrus* including those described here.

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PSOCOPTERA (INSECTA): WORLD CATALOGUE AND BIBLIOGRAPHY (*Instrumenta Biodiversitatis* V), C. Lienhard & C. N. Smithers, xli + 745 p., 2002	Fr. 180.—
REVISION DER PALÄARKTISCHEN ARTEN DER GATTUNG *BRACHYGLUTA* THOMSON, 1859 (COLEOPTERA, STAPHYLINIDAE) (1. Teil) (*Instrumenta Biodiversitatis* VI), G. Sabella, Ch. Bückle, V. Brachat & C. Besuchet, vi + 283 p., 2004	Fr. 100.—

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Mertens, R. & Wermuth, H. 1960. Die Amphibien und Reptilien Europas. *Kramer, Frankfurt am Main*, XI + 264 pp.

Handley, C. O. Jr 1966. Checklist of the mammals of Panama (pp. 753-795). *In:* Wenzel, R. L. & Tipton, V. J. (eds). Ectoparasites of Panama. *Field Museum of Natural History, Chicago*, XII + 861 pp.

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