









QL  
1  
R454  
NH.

LES

de la  
SOCIÉTÉ SUISSE DE ZOOLOGIE  
et du  
MUSÉUM D'HISTOIRE NATURELLE  
de la Ville de Genève

tome 107  
fascicule 3  
2000

SWISS JOURNAL OF ZOOLOGY

**REVUE SUISSE DE ZOOLOGIE**



# REVUE SUISSE DE ZOOLOGIE

TOME 107 — FASCICULE 3

Publication subventionnée par:  
ACADÉMIE SUISSE DES SCIENCES NATURELLES ASSN  
VILLE DE GENÈVE  
SOCIÉTÉ SUISSE DE ZOOLOGIE

VOLKER MAHNERT  
Directeur du Muséum d'histoire naturelle de Genève

MANUEL RUEDI  
Chargé de recherche au Muséum d'histoire naturelle de Genève

CHARLES LIENHARD  
Chargé de recherche au Muséum d'histoire naturelle de Genève

## *Comité de lecture*

Il est constitué en outre du président de la Société suisse de Zoologie, du directeur du Muséum de Genève et de représentants des Instituts de zoologie des universités suisses.

Les manuscrits sont soumis à des experts d'institutions suisses ou étrangères selon le sujet étudié.

La préférence sera donnée aux travaux concernant les domaines suivants: biogéographie, systématique, évolution, écologie, éthologie, morphologie et anatomie comparée, physiologie.

## *Administration*

MUSÉUM D'HISTOIRE NATURELLE  
1211 GENÈVE 6

Internet: <http://www.ville-ge.ch/musinfo/mhng/page/rsz.htm>

## PRIX DE L'ABONNEMENT:

SUISSE Fr. 225.—

UNION POSTALE Fr. 230.—  
(en francs suisses)

Les demandes d'abonnement doivent être adressées  
à la rédaction de la *Revue suisse de Zoologie*,  
Muséum d'histoire naturelle, C.P. 6434, CH-1211 Genève 6, Suisse

ANNALES

de la  
SOCIÉTÉ SUISSE DE ZOOLOGIE  
et du  
MUSÉUM D'HISTOIRE NATURELLE  
de la Ville de Genève

tome 107  
fascicule 3  
2000



SWISS JOURNAL OF ZOOLOGY

REVUE SUISSE DE ZOOLOGIE



GENÈVE SEPTEMBRE 2000 ISSN 0035 - 418 X

# REVUE SUISSE DE ZOOLOGIE

TOME 107 — FASCICULE 3

Publication subventionnée par:  
ACADÉMIE SUISSE DES SCIENCES NATURELLES ASSN  
VILLE DE GENÈVE  
SOCIÉTÉ SUISSE DE ZOOLOGIE

VOLKER MAHNERT  
Directeur du Muséum d'histoire naturelle de Genève

MANUEL RUEDI  
Chargé de recherche au Muséum d'histoire naturelle de Genève

CHARLES LIENHARD  
Chargé de recherche au Muséum d'histoire naturelle de Genève

## *Comité de lecture*

Il est constitué en outre du président de la Société suisse de Zoologie, du directeur du Muséum de Genève et de représentants des Instituts de zoologie des universités suisses.

Les manuscrits sont soumis à des experts d'institutions suisses ou étrangères selon le sujet étudié.

La préférence sera donnée aux travaux concernant les domaines suivants: biogéographie, systématique, évolution, écologie, éthologie, morphologie et anatomie comparée, physiologie.

## *Administration*

MUSÉUM D'HISTOIRE NATURELLE  
1211 GENÈVE 6

Internet: <http://www.ville-ge.ch/musinfo/mhng/page/rsz.htm>

## PRIX DE L'ABONNEMENT:

SUISSE Fr. 225.—

UNION POSTALE Fr. 230.—  
(en francs suisses)

Les demandes d'abonnement doivent être adressées  
à la rédaction de la *Revue suisse de Zoologie*,  
Muséum d'histoire naturelle. C.P. 6434, CH-1211 Genève 6, Suisse



**The genus *Dianous* Leach in China (Coleoptera, Staphylinidae)  
261. Contribution to the knowledge of Steninae**

Volker PUTHZ

c/o Limnologische Fluss-Station des Max-Planck-Instituts für Limnologie  
Damenweg 1, D-36110 Schlitz, Germany.

**The genus *Dianous* Leach in China (Coleoptera, Staphylinidae). 261. Contribution to the knowledge of Steninae.** - A revision of the species of *Dianous* Leach of China, including 4 new synonyms and descriptions of 36 new taxa, 10 of them from Taiwan (= T), 2 from Laos, 1 from Vietnam and 1 from the Philippine Islands, is presented: *Dianous adonis* sp. n., *D. alcyoneus* sp. n. (Laos), *D. angulifer* sp. n. (T), *D. ater* sp. n. (T), *D. atrocoeruleus* sp. n., *D. atrocyaneus* sp. n. (T), *D. atroviolaceus* sp. n., *D. biguttulus* sp. n., *D. bilunatus* Puthz, 1994 syn. n. = *D. taiwanensis* Puthz, 1971, *D. bioculatus* sp. n., *D. brevicornis* sp. n., *D. cebuensis* sp. n. (Philippine Islands), *D. coeruleovestitus* sp. n., *D. coeruleotinctus* sp. n., *D. cupreogutta* sp. n. (T), *D. cyaneocupreus* sp. n. (T), *D. dubiosus* sp. n., *D. electrigutta* sp. n. (T), *D. fauveli* sp. n. (Vietnam), *D. gemmosus* sp. n., *D. gonggamontis* sp. n., *D. grandistigma* sp. n., *D. haraldi* sp. n. (Laos), *D. inaequalis laevior* ssp. n. (T), *D. karen* Rougemont, 1981 spec. propr. (not syn. of *D. vietnamensis* Puthz), *D. lobatipes* sp. n., *D. mendax* sp. n. (T), *D. miripes* Rougemont, 1985 syn. n. = *D. latitarsis* L. Benick, 1942, *D. ocellifer* sp. n., *D. puberulus* L. Benick, 1942 syn. n. = *D. punctiventris* Champion, 1919, *D. rougemontianus* sp. n., *D. rugipennis* sp. n., *D. rugosipennis* sp. n., *D. schoenmanni* sp. n., *D. senex* sp. n., *D. septentrionalis* Naomi, 1988 syn. n. = *D. japonicus* Sawada, 1960, *D. sucinigutta* sp. n. (T), *D. suciniguttatus* sp. n., *D. sucininotatus* sp. n. (T), *D. variegatus* sp. n., *D. yangae* sp. n.. Some morphological characters are discussed, and the genus is tentatively grouped. 24 first records for various species and countries, distribution tables, and a key to species are presented.

**Key-words:** Coleoptera – Staphylinidae – *Dianous* – South-East Asia - China – taxonomy – morphology – distribution.

INTRODUCTION

The genus *Dianous* Leach, with (now) 200 taxa, is mainly distributed in the mountainous areas of the Oriental region. When I first revised the genus (Puthz, 1980, 1981) 17 species were known from China. Recent collections have increased species

number considerably, a tendency which is still in progress. In this revision 78 species, 32 of them new to science, are reported from China.

This study was started in 1992 and exclusively focussed on the Taiwanese species, but later on it was extended to the whole of China, including also neighbouring countries. The constant influx of new material required a permanent extension. Besides, an unexpected impediment delayed completion of the manuscript: in 1993 and 1994 Zheng published two articles on Chinese *Dianous* in Chinese with short English summaries, but reprints and some paratypical material for comparison were not sent to me until 1998! Consequently, I had to change the manuscript several times. Fortunately, most of the species described by Zheng were found among the material at hand, but original material of four taxa (*D. acutus*, *D. alternans*, *D. bashanensis*, *D. emeiensis*) is still missing.

Although the revision of the Chinese *Dianous* is still at its beginning, I think it reasonable and necessary to fix the present state of knowledge, on which future investigations may be based. General remarks on the grouping of the species are added, and the present knowledge of their distribution is given in tables, including numerous first records.

## PART I: GENERAL REMARKS

In 1981, I proposed two groups of the genus: group I, including all those species which were at first thought to belong to the genus *Stenus* Latreille (middle of frons concave, medial portion not elevated, eyes very large, without or with very short temples); group II, with species in which the frons has two distinct lateral furrows and a distinctly elevated medial portion (eyes mostly smaller, distinct temples present). This grouping works in most cases. Only few species do not exactly fit the group definitions: *D. corticicola* Puthz, *D. puthzi* Lundgren, *D. naicus* Puthz, *D. smetanai* Puthz have more or less elevated medial portions of the frons and/or distinct temples. The latter two seem to be intermediate between both groups.

Species of group I, about 30 % of all *Dianous*, represent a close complex (large, *Stenus*-like eyes, tarsal structure simple, structure of sternum 9 and of the aedeagus rather uniform, sculpture of the exoskeleton also rather uniform). The following are the taxa of group I (distribution only given for species which are not listed in table 1):

<i>amicus</i> Puthz: Borneo	<i>carinipennis</i> (Bernhauer)
<i>araeocerus</i> (L. Benick): Borneo	<i>cebuensis</i> sp. n.: Philippine Islands
<i>aurichalceus</i> (Champion)	<i>concretus</i> Puthz: Borneo
<i>baliensis</i> Rougemont: Bali	<i>corticicola</i> (Puthz)
<i>benicki</i> Puthz: Philippine Islands	<i>cupreoaeneus</i> (Champion)
<i>bhotius</i> Rougemont	<i>cyaneovirens</i> (Cameron)
<i>bhutanensis</i> Rougemont	<i>dajak</i> Puthz: Borneo
<i>boops</i> Puthz: Borneo	<i>davaomontium</i> (Puthz): Philippine Islands
<i>bracteatus</i> (Champion)	<i>flavicoxatus</i> (L. Benick): Sumatra
<i>burckhardti</i> Puthz: Borneo	<i>fluctivagus</i> Puthz

<i>haraldi</i> sp. n.	<i>nokrekensis</i> Puthz
<i>hirsutus</i> Rougemont	<i>philippinus</i> Puthz: Philippine Islands
<i>hygrobius</i> (L. Benick): Java	<i>pykaranus</i> (Cameron)
<i>inconspicuus</i> Rougemont	<i>reformator</i> Rougemont
<i>iridicolor</i> (Scheerpeltz)	<i>rougemonti</i> Puthz: Borneo
<i>jaechi</i> Puthz: Ceram	<i>saxicola</i> (Puthz): Philippine Islands
<i>javanicola</i> Puthz: Java	<i>schillhammeri</i> Puthz: Sumatra
<i>kinabalumontis</i> Puthz: Borneo	<i>semicoeruleus</i> (Cameron): Malaysia
<i>lahu</i> Rougemont	<i>shan</i> Rougemont
<i>lasti</i> Puthz	<i>siberutensis</i> Puthz: Siberut
<i>lividus</i> (L. Benick): Philippine Islands	<i>striatellus</i> (L. Benick): Java, Bali
<i>loebli</i> Rougemont	<i>sulcipennis</i> Puthz
<i>loeblianus</i> Puthz : Borneo	<i>tiomanensis</i> Puthz: Tioman
<i>martensi</i> Rougemont	<i>tonkinensis</i> (Puthz)
<i>meo</i> Rougemont	<i>uncinipennis</i> Puthz
<i>naganontium</i> Puthz	<i>viridicupreus</i> Rougemont
<i>nepalensis</i> Rougemont	<i>viriditinctus</i> (Champion)
<i>niger</i> Rougemont	<i>wittmeri</i> Rougemont
<i>nigrovirens</i> (Fauvel)	<i>yao</i> Rougemont
<i>nilgiriensis</i> Puthz	

About 70% of the *Dianous* belong to group II with a variety of morphological types and probably also monophyletic complexes, which are here tentatively distinguished. Some of the morphological characters which are used in defining species complexes need some explanation and comments, respectively:

(a) The tarsal shoe (figs 1-6): this very peculiar character has been described by Rougemont (1985: p. 136 nota 2) who states that there are several species which have such "soles" and that this character is more or less developed in different species. The tarsal shoe consists of densely set, long setae, which in some species are modified into willow-like leaves (figs 3, 5). These setae are found on all tarsal segments or on the distal ones. The tarsal shoe can be best seen in tarsi, which are free of mounting glue, and should be observed in ventral aspect of the protarsi and in lateral aspect of the last tarsal segment of meso- and of metatarsi (as in figs 1, 4). In species which have a weak tarsal shoe one finds a thin setaceous sole which is longer than half the length of tarsal segment 5. For functional analysis I refer to my friend Rougemont: "It may be assumed that the structure is functional, increasing the tarsus' resistance to the surface tension of water, and possibly also increasing the animal's bouyancy by trapping air between the sole, the setae and the tarsus".

(b) Structure of tarsal segment 4: most species have "simple tarsi" without any lobes. In few species tarsal segment 4 is asymmetrically lobed (fig. 7), in other very deeply bilobed (figs 8, 9). Intermediate forms occur between these three character states (figs 10-12, 139-142, 219, 220). In some species segment 3, too, is bilobed. For grouping the species, this character is of much more restricted value than in the genus *Stenus* Latreille.

(c) Female sternum 8: The outline of the female sternum 8 is an important taxonomic character and requires description. Usually this sternum has an evenly rounded posterior margin, but in some groups there are emarginations of different depth (figs 47, 48, 76, 77, 79, 80, and variability: figs 61-67), in others the medioposterior portion is elongated and more or less projecting (e. g. figs 88, 93-98, 193-199).

(d) Sternum 9: The outline of this sternum, including apicolateral brush (length, strength), is also an important character, which should be described. Posterior margin of this sternum can be acute laterally (with a distinctly prominent "tooth": figs 50, 90, 95, 99, 100, 116, 118-120, 135, 136, 138, 150, 204-208, 237), serrate (figs 75, 78, 91, 96, 117, 229-233) or smooth (without cuticular fringes: figs 42, 43, 53). This character is of restricted value for species grouping, since there are intermediate forms. In the males of numerous species, sternum 9 has peculiar cuticular structures apicoventrally: the most usual type is represented by apically spinulose arcuate cuticular laminae (= asa1; figs 13-18) which can be seen even by higher light-microscopical magnifications. Additionally, there are areas with glandular openings (figs 16, 18). Similar cuticular characters are widely distributed in arthropods (e. g. in Isopoda (Eisenbeis & Wichard, 1985: 125), Plecoptera (Kapoor, 1997), Trichoptera (Wichard *et al.*, 1995: 201). In *Dianous*, they are specific not only for single species but also for species complexes. Number, density and distribution of these cuticular structures might be also of taxonomic value and should be studied carefully. Narrow cuticular protuberances on sternum 9 and at the actual posterior margin of that sternum render it fimbriate (fig. 14). In *Dianous gemmosus* sp. n. there is a field of fine cuticular spines apicomediaally (fig. 117).

(e) Aedeagus: Compared to *Stenus* Latreille, the aedeagi of *Dianous* are much more uniform both in outline and in internal structure. Nevertheless some "types" can be distinguished: (1) Species which have two groups of parameral setae (groups which differ in their setal strength and groups which are placed on different portions of the parameres; this is an easy observable character: figs 82, 83). (2) Species with an entire outline of the anterior median lobe, which in most cases is narrowed triangularly (e. g. figs 38-40, 74, 177-181, 209-214). (3) Species which have an excavated anterior portion of the median lobe (figs 19, 121-130, 143, 144). (4) Species with a basally case-like internal sac (figs 39, 40, 44-46, 69) or with a distally nightcap-like internal sac (fig. 113) or with membranous structures densely set with chitinous tufts (fig. 70).

(f) It should be noted that in some species the outline of tergum 10 differs between male and female; in those cases, the female tergum is distinctly triangular, not or much less so in the males (figs 71-73, 200, 201).

(g) Pubescence: Numerous species are characterized by special arrangement of the pubescence, especially that of the elytra, forming whirls or other patterns (fig. 20). Some species have very long pubescence, which can be erect (figs 21, 22) or curved and/ or more or less recumbent (figs 23, 24).

(h) Sculpture of the exoskeleton: Besides a punctuation of differing strength and density, numerous species have areas in which the sculpture is rugose, coalescent or vorticose (figs 25-28). The microsculpture may be more or less distinct and was found to be of diagnostic value.

Proposed species complexes of group II (? = one of both sexes missing or has to be verified by more material):

(1) *calceatus*-complex: mostly relatively small eyes, temples at least 1/2 the length of eye, tarsi (mostly) with a distinct tarsal shoe (setae willow-like broadened in \*, figs 3, 5) (missing in #), segment 1 of metatarsi (mostly) much longer than the combined length of segments 2-4, segment 4 simple or asymmetrical. Sternum 9 (mostly) serrate or smooth apicolaterally, lacking apically spinulose arcuate cuticular laminae. Male: median lobe narrowed conically (broadly rounded in *D. gregarius*), apex rounded, internal structures membranous with tufts and a case-like structure basally, setae of parameres uniform, arranged equally. Female: Sternum 8 broadly rounded or (mostly) emarginate apically. Sculpture of exoskeleton mostly fine and dense (not coarse and rugose). Coloration variable: unicolorous, metallic and/ or with yellowish spots on elytra.

<i>adonis</i> sp. n.	<i>gregarius</i> Rougemont
* <i>arachnipes</i> Puthz	<i>inaequalis</i> Champion
<i>alternans</i> Zheng	<i>inaequalis laevior</i> ssp. n.
<i>annaudalei</i> Bernhauer	<i>kabakovi</i> Puthz
# <i>assamensis</i> Cameron	* <i>latitarsis</i> L. Benick
<i>bifoveifrons</i> Champion	<i>malayanus</i> Cameron
# <i>brevitarsis</i> Puthz	<i>margaretae</i> Rougemont
<i>caeruleonotatus</i> Champion	* <i>moritai</i> Naomi
* <i>calceatus</i> Puthz	# <i>nigrocyaneus</i> Puthz
# <i>camelus</i> Puthz	<i>obliquenotatus</i> Champion
<i>cameronianus</i> Jarrige	<i>obscuroguttatus</i> Cameron
<i>chetri</i> Rougemont	? <i>pallitarsis</i> L. Benick
<i>coeruleomicans</i> Puthz	<i>ponticus</i> Fagel
<i>coeruleotinctus</i> sp. n.	<i>punctiventris</i> Champion
<i>coeruleovestitus</i> sp. n.	# <i>robustus</i> Cameron
<i>consors</i> Cameron	<i>scabricollis</i> Champion
<i>convexifrons</i> Puthz	<i>schoenmanni</i> sp. n.
<i>cyanogaster</i> Champion	* <i>sichuanensis</i> Puthz
<i>elegantulus</i> Zheng	<i>siwalikensis</i> Cameron
<i>fauveli</i> sp. n.	<i>srivichaii</i> Rougemont
<i>flavoguttatus</i> Puthz	<i>tumidifrons</i> Puthz
* <i>gracilipes</i> Champion	<i>versicolor</i> Cameron

(2) *yunnanensis*-complex: similar to the *calceatus*-complex, tarsal shoe thin, segment 1 of metatarsi as long as or slightly less long than the combined length of segments 2-4, sternite 9 rounded apicolaterally. Male: internal structures of aedeagus different: no case-like structure basally, but with spinulose, membranous or strongly sclerotized tube (figs 70, 74). Female: sternum 8 emarginate apically.

<i>acuminifer</i> Puthz	<i>uniformis</i> Zheng
<i>angulifer</i> sp. n.	<i>yunnanensis</i> Puthz

(3) *lobigerus*-complex: large eyes, temples less than 1/2 the length of eye, without tarsal shoe, tarsal segment 4 very deeply bilobed (figs 8, 9), sternum 9 with a long tooth apicolaterally (one exception: rounded-serrate in *D. spiniventris*), no spinulose arcuate cuticular laminae apicomediaally. Male: Apical portion of median lobe broadly lanceolate or narrowly triangular with ventral pubescence, internal sac with a moderately broad, long, sclerotized tube (some species have an strongly sclerotized expulsion mechanism distally: \*), parameres with one group of uniform setae. Female: sternum 8 broadly rounded or with a rounded projection apicomediaally. Sculpture mostly coarse, well-defined or rugose. Coloration: black or metallic, some species have elytral spots.

*azureus* Champion  
 \* *bimaculatus* Cameron  
*cribrarius* Champion  
*cruentatus* L. Benick  
 \* *flavoculatus* Puthz  
 \* *hainanensis* Puthz

*lobigerus* Champion  
*luteoguttatus* Champion  
 \* *siamensis* Rougemont  
*spiniventris* Puthz  
 \* *strabo* Puthz

(4) *aereus-andrewesi*-complex: eyes large, temples less than 1/2 the length of eyes, without tarsal shoe, tarsal segment 4 simple, sternum 9 serrate apicolaterally (2 exceptions: \*), with spinulose arcuate cuticular laminae or spines. Male: median lobe narrowed conically, apex not emarginate, apical portion densely set with long setae and/or ventral ridges (+), internal sac with coarse tufts basally, parameres with two groups of setae of different strength. Female: sternum 8 roundly prominent apicomediaally. Sculpture of the exoskeleton variable, mostly with rugose areas. Coloration: metallic, no yellowish spots on elytra.

+ *aeneus* Cameron  
 + *aereus* Champion  
 + *andrewesi* Cameron  
 ? *brevicornis* sp. n.  
 + *championi* Cameron  
 ? *cupreoviolaceus* Puthz  
 ? *femorialis* Cameron  
 + *frater* Cameron  
 + *gracilis* Puthz  
 + *karen* Rougemont

+ *minor* Champion  
 + ? *radiatus* Champion  
 + *rougemontianus* sp. n.  
 + *ruginosus* Zheng  
 ? *rugipennis* sp. n.  
 ? *rugosipennis* sp. n.  
 + *vietnamensis* Puthz  
 + *viridipennis* Cameron  
 + \* *violaceus* Puthz

(5) *ocellatus*-complex: eyes large, temples less than 1/2 the length of eye, without tarsal shoe, tarsal segment 4 (mostly) shortly bilobed, sternum 9 serrate or acute apicolaterally with spinulose arcuate cuticular laminae apicomediaally. Male: Median lobe more or less triangularly narrowed, rounded apically, densely pubescent apicoventrally (figs 85, 177-181), internal sac with a nightcap-like distal portion, parameres with one group of uniform setae. Female: sternum 8 rounded, mostly projecting apicomediaally. Sculpture variable, moderately coarse, punctation well-defined or rugose. Coloration: most species have elytral spots.

<i>alcyoneus</i> sp. n.	<i>ocellatus</i> Cameron
<i>atrocoeruleus</i> sp. n.	(incl. <i>acutus</i> Zheng)
<i>distigma</i> Champion	<i>ocellifer</i> sp. n.
<i>emarginatus</i> Zheng	<i>oculatipennis</i> Puthz
<i>grandistigma</i> sp. n.	<i>variegatus</i> sp. n.
<i>luteolunatus</i> Puthz	<i>verticosus</i> Eppelsheim
<i>luteostigmaticus</i> Rougemont	? <i>psilopterus</i> L. Benick

(6) *chinensis*-complex: large eyes, temples less than 1/2 the length of eye, without tarsal shoe, tarsal segment 4 simple to moderately bilobed (figs 9-11, 139-142), sternum 9 serrate or acute apicolaterally with spinulose arcuate cuticular laminae. Male: apical portion of median lobe broad, emarginate, internal sac with a nightcap-like distal portion (fig. 113), parameres with two groups of setae of different strength. Female: sternum 8 roundly prominent apicomediaally. Sculpture of the exoskeleton variable. Coloration: metallic, mostly with yellowish spots on elytra.

<i>aequalis</i> Zheng	<i>hammondi</i> Rougemont
<i>atrocyaneus</i> sp. n.	<i>hummeli</i> Bernhauer
<i>atroviolaceus</i> sp. n.	<i>senex</i> sp. n.
<i>banghaasi</i> Bernhauer	<i>socius</i> Zheng
<i>bashanensis</i> Zheng	<i>subtortuosus</i> Champion
<i>bioculatus</i> sp. n.	<i>subvorticosus</i> Champion
<i>chinensis</i> Bernhauer	<i>taiwanensis</i> Puthz
<i>cyaneocupreus</i> sp. n.	<i>tortuosus</i> Champion
<i>dubiosus</i> sp. n.	<i>tortus</i> Cameron
<i>emeiensis</i> Zheng	<i>yangae</i> sp. n.
<i>gemmosus</i> sp. n.	<i>yoshidai</i> Naomi
<i>gongamontis</i> sp. n.	

(7) *coerulescens*-complex: eyes large, temples less than 1/2 the length of eye, without tarsal shoe, tarsal segment 4 simple or bilobed (\*), sternum 9 rounded-serrate, or acute apicolaterally, spinulose arcuate cuticular laminae present apicomediaally. Male: Apical portion of median lobe more or less triangularly narrowed, internal sac distally simple or pointed (#, figs 209, 218, 220), parameres with one group of uniform setae. Female: sternum 8 rounded or slightly projecting apicomediaally. Sculpture: punctuation mostly well-defined. Coloration: unicolorous, metallic and/ or with elytral spots.

Some species (see below) are close to group I of the genus by their general habitus, one of them (*D. puthzi*) has thin tarsal shoes and resemble *D. malayanus* Cameron, but the internal structure of the aedeagus and the 8<sup>th</sup> sternum of the female do not fit the definition of the *calceatus*- complex.

# <i>amamiensis</i> Sawada	* <i>cameroni</i> Champion
<i>ater</i> sp. n.	<i>chalybaeus</i> Le Conte

<i>coerulescens</i> Gyllenhal	<i>morimotoi</i> Naomi
(with ssp. <i>anatolicus</i> Korge and ssp. <i>elegans</i> Khnzorian)	<i>nitidulus</i> Le Conte
<i>cupreogutta</i> Puthz	<i>shibatai</i> Sawada
<i>cupreostigma</i> Puthz	#* <i>sucinigutta</i> sp. n.
#* <i>electrigutta</i> sp. n.	#* <i>suciniguttatus</i> sp. n.
# <i>freyi</i> L. Benick	#* <i>sucininotatus</i> sp. n.
<i>gongen</i> Watanabe	* <i>sulcatipennis</i> Puthz
<i>iwakisanus</i> Watanabe	<i>viridicatus</i> Naomi
<i>japonicus</i> Sawada	near <u><i>Dianous</i> group I:</u>
# <i>klapperichi</i> L. Benick	<i>naicus</i> Puthz
* <i>lobatipes</i> sp. n.	<i>puthzi</i> Lundgren
* <i>mendax</i> sp. n.	<i>smetanai</i> Puthz

Concerning the ecology of *Dianous*-species (Puthz, 1981: 91 f.), there is only little supplementary information: G. M. de Rougemont published some substantial observations in 1985; e. g. concerning *Dianous robustus* Cameron: "...was found clinging to and moving over a vertical rock face down which ran a steady film of water, some of the insects 'up to their knees' in the water, while 2 exx. were seen totally submerged." New records confirm the published data according to which several *Dianous* species occur together in the same habitat (see also Puthz, 1988: 633), sometimes in large numbers (figs 29, 30).

Most *Dianous* are steneaceous and belong to the bryomadiculous fauna (Vaillant, 1955). There are, however, some exceptions: *D. corticicola* Puthz (Vietnam) was found by sifting bark of tree, *D. concretus* Puthz (Borneo), remarkable species by the concrescent elytra, by sifting dead leaves and dry mosses in open forest (Puthz, 1988: 638), and some of the new described Taiwanese species (*D. sucinotatus*, *D. electrigutta*, *D. ater*) were found in soaking wet moss growing on rotten wood around small ponds in a coniferous forest, by sifting moss and debris on a forest seepage, by sifting of wet moss on large fallen trees in an *Abies*-forest and in tufts of *Carex* at swampy edge of a small lake. Since there are no records from exclusively dry habitats, it can be assumed that species, which do not live in or near torrents, on rocks in running waters, at sprays of waterfalls etc. nevertheless need a wet or humid environment as is provided by mosses and humus in humid forests. – The genus occurs from lower elevations to nearly the alpine zone: a Taiwan locality below of Yushan main Peak (3650 m) is the highest hitherto known locality (see below: *D. sucinigutta* sp. n.).

The distribution of species is shown in three tables: (1) a table which lists all the *Dianous* species of the Oriental region except those which are restricted to Malaysia and the Sunda-Archipelago, (2) a table showing the distribution of all species known from China including neighbouring countries, (3) a distribution table of the Taiwanese species according to Taiwanese provinces.

Table 1 is divided into 13 columns for the respective countries; India is listed in three columns, since there is a (relictal) special *Dianous*-fauna found in the South



Indian mountains and some differences between the Assam-fauna and that of the rest of northwest India. Aside from records given in the taxonomic section of this article, the following first records are included:

*Dianous aereus* Champion: Burma: 23 ♂♂, 28 ♀♀; Myanmar, Mandalay Division, 8 km E Piyin Oo Lwin, 1070 m, 22°03.523' N 96°31.956'E, Pwe Kauk Wf., 19. X. 1998, Schillhammer (20) (NHMW, cP).

*Dianous bimaculatus* Cameron: Nepal: 1 ♂: env. Shivalaya, banks of Kimti Khola, 2. V. 1993, A. Kleeberg (cP).

*Dianous cribrarius* Champion: Nepal: 2 ♂♂, 2 ♀♀, Annapurna Reg., env. Biretanthi, 1200 m, Bhurungdi Khola, 4. X. 1992, A. Weigel (Naturhistorisches Museum Erfurt, cP). Laos: 1 ♀: Prov. Lg. Nam Tha ca. 5 km S Muang Sing, 650 m, Huay Giuom river, 10. VI. 1996, Schillhammer (21) (NHMW).

*Dianous hammondi* Rougemont: N. India: 1 ♂, 2 ♀♀, Khasi Hills (IRSnB, MHNG).

*Dianous hirsutus* Rougemont: Vietnam: 1 ♀ (cf. det.), 40 km NW An Khe Buon Luoi, 620-750 m, 14°10' N, 108°30' E, 28. III.-12. IV. 1995, Pacholatko & Dembicky (NHMW).

*Dianous kabakovi* Puthz: Laos: 6 ♂♂, 5 ♀♀, Prov. Lg. Nam Tha, ca. 20 km SE Muang Sing, 950 m, 12./13. VI. 1996, Schillhammer (25) (NHMW, cP); 1 ♂, Bolikhamsai prov., Ban-Nape-Kaow-Nua-Pass, 18. IV. - 1. V. 1998, Jendek & Sausa (coll. Hromádka).

*Dianous lobigerus* Champion: Nepal: 1 ♂, env. Shivalaya, banks of Kimti Khola, 2. V. 1993, A. Kleeberg (cKleeberg).

*Dianous minor* Champion: Laos: 8 ♂♂, 7 ♀♀, Prov. Lg. Nam Tha, ca. 20 km SE Muang Sing, 950 m, 12./13. VI. 1996, Schillhammer (25) (NHMW, cP); 3 ♂♂, 2 ♀♀: Prov. Lg. Nam Tha, ca. 30 km NW Lg. Nam Tha, 800 m, 16./18. VI. 1996, Schillhammer (28, 30) (NHMW, cP).

*Dianous obliquenotatus* Champion: Thailand: 1 ♀, Sob Pong, 24. XII. 1989, H. Malicky (cP); 1 ♀, Doi Inthanon, Bang Khun Klang, 98°32'E, 18°32'N, 900 m, 6. I. 1990, Chantaramongkoi & Malicky (MHNG).

*Dianous scabricollis* Champion: Laos: 1 ♂, Prov. Lg. Nam Tha, ca. 20 km SE Muang Sing, 950 m, 12./13. VI. 1996, Schillhammer (25) (NHMW): This specimen is distinguished from N. Indian specimens (types) by the in general dark Prussian-blue colour, elytral band sky-blueish, posteriolateral quarters of elytra strongly aeneous; aedeagus similar to that of the type series.

*Dianous siamensis* Rougemont: Vietnam: 1 ♀, 12 km N Dalat, Lang Bian, 28.-30. IV. 1994, Pacholatko & Dembicky (NHMW); 1 ♀, 16 km N Dalat-Ankroat, 1400 m, 12°05'N, 108°24' E, 15. IV. 1995, Pacholatko & Dembicky (NHMW).

*Dianous siwalikensis* Cameron: Vietnam: 1 E, Tonkin: Kao-Bang (IRScNB).

*Dianous srivichaii* Rougemont: Laos: 17 ♂♂, 15 ♀♀, Prov. Lg. Nam Tha, ca. 20 km SE Muang Sing, 950 m, 12./13. VI. 1996, Schillhammer (25) (NHMW, cP). Burma: 1 ♂, 7 ♀♀: Myanmar, Mandalay Division, 8 km E Piyin Oo Lwin, 1070 m, 22°03.523' N 96°31.956'E, Pwe Kauk Wf., 19. X. 1998, Schillhammer (20) (NHMW, cP).

*Dianous strabo* Puthz: Thailand: 1 ♂, Phetchanban Prov., Nam Nao N.P., 24. XI. 1995, Zettel (22) (NHMW).

*Dianous yunnanensis* Puthz: Nepal: 1 ♂, 2 ♀♀, Sindhupalchowk District, Dolalghat, Sunkoski, 7. XI. 1993, Moog & al. (NHMW, cP).

Table 2 lists the occurrence of *Dianous* species in 26 main administrative units of China (mostly provinces, indicated by letters) and in 8 adjacent countries (number). The following 6 biogeographic units are recognized (separated by #):

#### *Biogeographic unit 1*

(1) N. INDIA, Kashmir; (2) NEPAL, BUTHAN; (A) Sichuan; (3) VIETNAM, LAOS, BURMA, THAILAND; (B) Yunnan; (C) Guizhou

*Biogeographic unit 2*

(D) Guangxi; (E) Guangdong + Hongkong + Hainan; (F) Fujian; (G) Taiwan; (4) RIUKU-Islands & other Japanese Islands

*Biogeographic unit 3*

(H) Hunan; (I) Hubei; (J) Jiangxi; (K) Zhejiang + Shanghai

*Biogeographic unit 4*

(L) Jiangsu; (M) Anhui; (N) Henan; (O) Shaanxi; (P) Shanxi; (Q) Shandong; (R) Hebei + Beijing + Tianjin; (S) Liaoning

*Biogeographic unit 5*

(5) JAPAN (main country); (6) KOREA; (T) Jilin; (U) Heilongjiang; (7) RUSSIA E of 120°E

*Biogeographic unit 6*

(V) Tibet; (W) Quinghai; (X) Gansu + Ninxia Hui; (Y) Xinjiang Uighur; (Z) Nei Mongol (Inner Mongolia); (8) MONGOLIA

There are two well-founded proposals for dividing China into major biogeographical regions, that of Takhtajan (1986) and that of Jäch & Li (1995). Since China has an extremely complicated topography and orography the limits of distinguished regions in both proposals are more or less arbitrary and do not work exactly to classify each individual locality. Therefore, in my table 1 prefer to use the exactly defined political borders of the provinces (or administrative units) and arranging these units according to the aforementioned biogeographical concepts as much as possible. Except for the South China Region and for Sichuan (which should belong to three different zoogeographical regions), most of the other proposed regions in Jäch & Li fit to some degree the complexes of administrative units used in my table. This table will be used also in a series of papers in preparation on the Chinese *Stenus*-fauna and consequently takes into consideration the adjacent Palaearctic areas, from which no *Dianous* has hitherto been reported.

The genus *Dianous* is of Northern Oriental origin and has its distribution centre in the mountainous areas between the Palaearctic and the Oriental regions south of 31° northern latitude as can be seen from map 1 (fig. 31 a). Few species occur either in Europe, in the Caucasus and in the Altai mountains (*D. coerulescens* with subspecies) or in North America (*D. chalybeus* Lec. and *D. nitidulus* Lec.). Today there is a considerable distance between the Altai population of *D. coerulescens* and its main range in Europe and the Caucasus, and also between the East Asian *Dianous* and those of North America (compare map 1 in Puthz, 1981). Since all my hypotheses to explaining these disjunctions are highly speculative, I only present the facts, new records might bring light into the matter. Regarding group- and species- diversity, the distribution centre of *Dianous* seems a major centre both of speciation and of the preservation of ancient forms.

A comparison of map 1 (fig. 31 a) with map 3 in my first revision of the genus in 1981 shows a considerable increase of knowledge concerning species numbers of different countries and areas, especially for China. Furthermore the distribution area of

group II now also includes Sumatra and Java, the South Japanese islands and Japan. It may be noted that group II does not transgress Wallace's line (sensu Huxley). *Dianous jaechi* Puthz from Ceram extends the range of the species of group I eastward to Lydekker's line (no *Dianous* has been reported from New Guinea!).

Map 2 (fig. 31 b) shows the distribution of *Dianous* in China according to administrative units of that country. Most species are known from Southern Sichuan and from Yunnan, areas which are close to Assam and to Nepal/ Northwest India and which belong to the centre of evolution of the genus. The number of species decreases from southern to northern China and from the west to the east, showing that *Dianous* is mainly an Oriental element.

Six *Dianous* are reported from Hainan, 5 of them endemic, 1 of them (*D. punctiventris*) is widespread in the central range of the genus and also known from Vietnam, Yunnan and Burma. The Hainan species belong to three different complexes of group II of the genus, which indicates that at least three different ancestors lived in the larger SE-Indochinese area, from which Hainan now is separated as an island. Close relatives have been recorded from Vietnam, which supports close relationships between Hainan and the mainland fauna. I would also expect a species of group I of the genus, but as in the much better known Taiwan none has hitherto been found.

Apart from 1 species (*D. luteoguttatus*), the remaining 14 *Dianous* from Taiwan are endemic (not counting *D. dubiosus*, for which the record needs confirmation). Most of the species occur in the warm temperate mixed forest zone (800-2000 m) and in the cool temperate coniferous forest zone (1900-2800 m), some (*D. electrigutta*, *D. sucininotatus*, *D. sucinigutta*) also or mainly in the cold temperate coniferous forest zone (2600-3000 m) and/ or in the subalpine coniferous forest zone (3000-3600 m). *D. sucinigutta* has been found from 1660 m up to 3650 m. The Taiwanese species belong to five different complexes of group II of the genus and have mostly strong affinities to the mainland fauna or to the fauna of the southern Japanese islands. This phenomenon is shown in the following closely related species: *D. arachnipes* – *D. moritai* (Amami-Ōshima); *D. sucinigutta* – *D. freyi* (Fujian), *D. amamiensis* (Amami, Nansei); *D. inaequalis laevior* – *D. inaequalis* (Sichuan, Yunnan); *D. atrocyaneus* – *D. yoshidai* (Iriomote); *D. taiwanensis* – *D. banghaasi* (Fujian). Of special interest is *D. luteoguttatus* Champion because of its wide range (Western Himalaya/ Nepal – Taiwan) and the broad disjunction between these areas. This species is an example of the strong connection between the old Himalayan fauna and the fauna of Taiwan. Although many Taiwanese *Dianous* occur at high elevations, no Palearctic element was found, as e. g. in the genus *Stenus* Latreille; this is explained by the Oriental origin of *Dianous*. However, it is worth noting that the most common Taiwanese species, *D. taiwanensis*, reported from 1600 m up to 2600 m, is closely related to several Northeastern Chinese species which also occur at high elevations (e. g. *D. gonggamontis*) and which in their general habitus resemble the *Dianous* of the northern hemisphere. - Two complexes of group II of the genus have not been reported from Taiwan (*aereus-andrewesi*- complex; *ocellatus*-complex); the former, however, is known from Hainan. This indicates a different faunal history and supports published data that the Taiwanese fauna is of greater age and has fewer Oriental elements than the fauna of Hainan. The high species

number of Taiwan in relation to the adjacent mainland provinces of China seems to be striking. I would expect many more species to occur in Fujian and Zhejiang than are now known; future collecting may be hoped to fill the gap.

In the descriptions the following abbreviations are used:

- acam : antecoxal area of metasternum  
 asacl : apically spinulose arcuate cuticular laminae  
 adE : average distance between eyes  
 alS : apicolateral setae of parameres  
 amS : apicomedial setae of parameres  
 AT : allotype  
 HT : holotype  
 IE: eye length  
 lEl: length of elytra  
 lP: length of pronotum  
 lS: length of suture  
 lTe: length of temples  
 PM : proportional measurements  
 PT : paratype(s)  
 wEl : greatest width of elytra  
 wH: width of head  
 wP : width of pronotum
- BMNH: British Museum, Natural History, London (now: The Natural History Museum, London)  
 FMCh: Field Museum of Natural History, Chicago  
 cP: coll. Puthz  
 cR: coll. de Rougemont  
 cS: coll. Smetana  
 IRScNB: Institut Royal des Sciences Naturelles de Belgique, Bruxelles  
 MHNG : Muséum d'histoire naturelle, Genève  
 MM: Museo civico di Storia naturale, Milano  
 MNHNP: Muséum National d'Histoire Naturelle, Paris  
 NHMB: Naturhistorisches Museum Basel  
 NHMW: Naturhistorisches Museum Wien  
 USNM: United States National Museum, now known as National Museum of Natural History, Washington, D.C.  
 ZMB: Museum für Naturkunde (der Humboldt-Universität) Berlin

My thanks are due to all colleagues and institutions which provided their material for study. Above all, I am deeply indebted to Dr. Ales Smetana who contributed a major portion of the material, especially from Taiwan, and who revised the major portion of my English descriptions and key. Warm thanks are also due to my friend Guillaume de Rougemont, who generously left his material from China at my

disposal, and to Andreas Pütz and Michael Schülke who provided their Chinese material for study. I thank Dr. O. Betz (Kiel) for the REM-photographs and last but not least Volker Assing for correcting the English text of the introduction and of the general remarks.

## PART II: TAXONOMY AND FAUNISTICS

### *Dianous yao* Rougemont

*Dianous yao* Rougemont, 1981a: 330 ff. figs.; 1981b: 359; 1983: 18

*Distribution.* This species, previously known from Burma and Thailand, occurs also in China: Guizhou: 6 specimens Huangguoshu, X. 1986, G. M. de Rougemont (Rougemont i. l., cR). **N e w t o C h i n a.**

*Comments.* The ♀ recorded by L. Benick (1942) as “*Stenus cf. assamensis* Cameron” from Kambaiti, 2000 m, 1./6. VI. 1934, Malaise (Museum Stockholm) belongs to *D. yao*.

### *Dianous cebuensis* sp. n.

Type Material. Holotype (♀): Philippine Islands: Cebu: S Badian Matutinao, Kawasan Falls, 2-50 m. 23.- 24. II. 1997, H. Zettel (116) (coll. Zettel in NHMW).

PM of HT: wH: 38.5; aE: 22; wP: 28.4; IP: 32; wEl: 37; IEI: 41; IS: 34.

This new species belongs to group I of the genus and resembles closely *D. saxicola* (Puthz) and *D. tonkinensis* (Puthz). It is remarkable by the sparsely punctate frons.

Strongly shining, black with dark bluish-olivaceous reflection, frons moderately coarsely, sparsely punctate, punctuation of the pronotum coarse, dense, slightly confluent, elytral punctuation (except on sides and near posterior margin) very coarse and transversely confluent, abdomen very finely and sparsely punctate. Pubescence of the fore parts indistinct, distinct and recumbent on the abdomen. Antennae reddish brown, club infusate, maxillary palpi reddish yellow, segment 3 infusate, legs reddish yellow, kees narrowly blackish, tarsi slightly infusate. Clypeus and labrum dark-metallic, sparsely pubescent.

Length: 4.0 - 4.5 mm (fore parts: 2.4 mm).

Male: unknown.

Female: Sternite 8 somewhat triangularly projecting apically (about as in fig. 198). Valvifer serrate apically, apical brush thin. Tergite 10 subtriangular.

Head broader than elytra, frons moderately deeply impressed in anterior half, punctuation moderately coarse and sparse, diameter of punctures about as large as basal cross section of antennal segment 3, interstices at least as large as diameters of punctures, mostly somewhat larger. Antennae slender, the last segment extends beyond the posterior margin of the pronotum when reflexed, penultimate segments nearly 1.5 x as long as broad. Shape of pronotum as in the related species; punctuation coarse and dense, slightly confluent transversely on about middle, diameter of punctures about as large as apical cross section of antennal segment 2, interstices nearly half as wide as diameters of punctures. Elytra subquadrate, longer than broad, punctuation very coarse

and very dense (except on the declining side portions and a narrow area posteriorly and laterally, where the punctures become extinct), forming long transverse rugae. Abdomen as in the related species; punctuation of paratergites very fine and extremely sparse, punctuation of tergites very fine and sparse, interstices often twice as large as diameters of punctures. Legs very slender, metatarsi  $3/4$  as long as metatibiae, segment 1 distinctly longer than segments 2-4 combined, much longer than segment 5. The whole body lacks groundsculpture.

*Comments.* *Dianous cebuensis* is easy to identify by the moderately coarse and sparse punctuation of the frons. In my key to the species of group I it has to be placed at couplet # 26 (25): From *D. tonkinensis* (Puthz) it is distinguished by the much finer and sparser punctuation of the frons, nearly extinct punctuation of the outer border-areas of the elytra and by the much sparser abdominal punctuation; from *D. saxicola* (Puthz) by the same characters.

*Dianous haraldi* sp. n.

Type material. Holotype (♂): N Laos: Prov. Lg. Nam Tha, ca. 20 km SE Muang Sing, 950 m, 12./13. VI. 1996, Harald Schillhammer (25) (NHMW).

PM of HT: wH: 32; aE: 28; wP: 25.5; IP: 26; wEl: 34.5; IEl: 37; IS: 30.

This new species belongs also to group I of the genus, where it is the sister species of *D. meo* Rougemont, to which it is very similar so that a full description is not necessary.

Moderately shining, black with dark purple reflection, frons moderately finely and very densely punctate, punctuation of the pronotum coarse, very dense, strongly confluent, elytral punctuation yet coarser, arranged into long rugae, punctuation of the abdomen very fine and very dense. Pubescence of the fore parts indistinct, that of the abdomen dense and recumbent. Antennae black with some metallic reflection. Maxillary palpi with the first segment and bases of segments 2 and 3 reddish yellow, rest dark brown. About basal third of the femora reddish yellow, rest black with some metallic reflection, tibiae blackish brown, tarsi dark brown. Clypeus and labrum black with metallic reflection, sparsely pubescent.

Length: 3.4 – 3.9 mm (fore parts: 2.1 mm).

Male: Sternite 8 with a triangular notch in about posterior fifth. Sternite 9 with a small tooth apicolaterally, apicolateral brush moderately strong. Tergite 10 rounded. Aedeagus with a triangularly narrowed median lobe (fig. 240) which has a moderately strongly sclerotized expulsion mechanism as also has *D. meo*.

Female: unknown.

Head, antennae and pronotum almost similar to those of *D. meo* (punctuation of the frons yet finer than that of the pronotum; on the pronotum the punctures are only well-defined on the actual middle, on the rest of surface punctures are confluent into long transverse rugae). Sculpture of elytra generally similar to that of *D. meo*, but coarser and stronger on anterior half, rugae nearly as broad as antennal segment 2. Abdomen similar to that of *D. meo*, finely and very densely punctate including the paratergites. Legs as in *D. meo*.

*Comments.* *Dianous haraldi* – which I warmly dedicate to my friend Harald Schillhammer, Vienna, who collected the holotype – has to be placed in my key (1981) at couplet # 63 (64) [spec. 6 Rougemont = *D. meo* Rougemont]. It is distinguished from *D. meo* by the reddish yellow bases of femora, by the coarser elytral sculpture and by the sexual characters (in *D. meo* the apical portion of the median lobe has a different outline (fig. 239) and the apical notch of sternite 8 is less deep); from *D. tiomanensis* Puthz it is distinguished by the coarser elytral sculpture, the less extended reddish yellow coloration of the bases of femora and by the sexual characters.

### *Dianous arachnipes* Puthz

*Dianous arachnipes* Puthz, 1971a: 90f.; Shibata, 1979: 7 f. figs; Puthz, 1984a: 101; Naomi, 1997: 2 fig.

*Distribution.* This species is widely distributed in Taiwan (see map in Shibata): Taipei Hsien: 3 ♀♀; Nanshi Str. (seapage area) 2 km S. Wulai, 22. III. 1991, H. G. Nelson (FMCh, cP). Ilan Hsien. Taoyüan Hsien. Taichung Hsien. 1 ♀: Pahsienshan, 11. VII. 1932, Eaki (Kyushu University). Nantou Hsien. Chiayi Hsien. Kaohsiung Hsien. Hualien Hsien: 1 ♀; Urai, 1.X. 1921, Esaki (Kyushu University).

### *Dianous latitarsis* L. Benick

*Dianous latitarsis* L. Benick, 1942: 42 ff. figs; Rougemont, 1983a: 11 f.; Zheng, 1993: 199.

*Dianous miripes* Rougemont, 1985: 134 f. figs. **syn. nov.**

Material examined: Holotype (♂) from Burma; Sichuan: 1 ♂: Emei Shan, X. 1986. G. M. de Rougemont (cP), 21 more specimens from Emei Shan in cR. (in litt.). Zheng (1993) also records this species from Emei Shan.

*Comments.* This species is easily to identify by its “pseudotetramerous” tarsi with segment 4 having a tube-like bristle shoe enveloping segment 5 except claws. This character distinguishes it easily from *D. gracilipes* Champion. Slight differences noted in the description of *D. miripes* belong to the range of variability, as confirmed by my friend de Rougemont (in litt.).

### *Dianous versicolor* Cameron

*Dianous versicolor* Camaron, 1915: 533 f.; 1930: 411 f. fig.; Puthz, 1981a: 114 f. fig.; Rougemont, 1985: 136 f.; Puthz, 1990: 123

Material examined: 1 ♂: Yunnan: 100 km W. Baoshan, Gaoligongshan Natural Reserve, 14.- 21. VI. 1993, E. Jendek & R.Sausa (NHMW); Sichuan: 18 exx. Emei Shan, X. 1986. G. M. de Rougemont (t. Rougemont, cR); 2 ♀♀: Emei Shan, 1530 m, 22. VI. 1994, torrent on slate with large crystalline rocks, H. Schillhammer (NHMW, cP).

*Comments.* This species is very remarkable because of its asymmetrical, distinctly bilobed fourth tarsal segment with strong bristle shoe (figs 4-7). The female sternite 8 has only a minute medio apical excision (fig. 32). *Dianous versicolor* was previously known from India, Nepal, and Bhutan; new for China.

### *Dianous chetri* Rougemont

*Dianous chetri* Rougemont, 1980: 172 ff. figs; 1985: 139

Material examined: Yunnan: 1 ♀: Daju, Tiger George, 27°21' N, 100°19' E, 24.-28. VI. 1992, E. Jendek (NHMW); 2 ♀♀: 100 km W Baoshan, Gaoligongshan Natural Reserve, 14.-21. VI. 1993, E. Jendek & O. Sause (NHMW). Sichuan: 1 ♂: Emei Shan, X. 1986, G. M. de Rougemont (cR). 1 ♂: NE India: Meghalaya, W Garo Hills, Nokrekek N. P., ca. 1100 m, 25°29.6' N, 90°19.5' E, 9.-17. V. 1996, Jendek & Sausa (HNMW); 1 ♀: W. Almorá, Kumaon, H. G. Champion (cP): n e w f o r I n d i a. 1 ♂: N. Laos: Prov. Lg. Nam Tha, ca. 30 km NW Lg. Nam Tha, 800 m, 16./18. VI. 1996, Schillhammer (NHMW): n e w f o r L a o s !

PM of the male from Sichuan: wH: 59; adE: 39; lE: 20; lT: 15; wP: 45; lP: 43; wEl: 73; lEl: 79; lS: 68.

Male: In general similar to that of *D. alternans* Zheng. Metasternum broadly impressed medially, shining area broader (as broad as long), each side of it with about 10 moderately fine punctures. Impunctate, but microsculptured, middle area of sternites 3-6 broader, about half as broad as sternites, sternite 6 simple (not impressed) medially, with a few, very sparse, moderately fine punctures. Sternites 7 to 9 same as those of *D. alternans*. A e d e a g u s similar to that of the compared species, but median lobe relatively broader anteriorly, apex with five lateral setae, internal sac less strongly sclerotized and somewhat different in shape (fig. 46), parameres with 15 or 16 setae, two proximate setae widely separate from the following ones.

*Comments.* The male specimen from Emei Shan, found together with *D. alternans* Zheng, differs in some apparently minor respects from typical specimens of *D. chetri*: Head and elytra at shoulders are bluish (as it is seen in specimens from N. India, Kumaon), and the punctation of pronotum is nearly obsolete anteriorly and posteriorly (much less distinct than in Nepalese specimens). The median lobe is somewhat broader anteriorly, but has also 5 apicolateral setae, parameres have fewer and evenly set setae (paratype from Sundarikal Cascades, Nepal, has 19/17 setae). Because the internal sac is identical with that of *D. chetri*, I believe that the differences fall within the variability range of the species. The Yunnan specimens resemble very much those from Nepal. N e w t o C h i n a.

### *Dianous alternans* Zheng 1993

*Dianous alternans* Zheng, 1993: 36: 201 ff. figs

Material examined: 4 ♂♂, 3 ♀♀: Sichuan: Emei Shan, 7. X. 1985/ X. 1986, G. M. de Rougemont (cR, cP); 4 ♂♂, 5 ♀♀: ibidem 1530 m, 22. VI. 1994, torrent on slate with large crystalline rocks, H. Schillhammer (NHMW, cP).

This species is the sister species of *D. chetri* Rougemont; it also has „tarsal shoes“.

Moderately shining, variegate metallic: head blue, pronotum bluish anteriorly, posteriorly, and laterally, brassy medially, or totally brassy; elytra (fig. 34) aeneous and/or with coppery tint on some areas, each with a large, remarkable bright bluish band extending from base through shoulders and then directed inwards; abdomen dark blue. Head, elytra, and abdomen finely and very densely punctate, pronotum with somewhat coarse punctation anteriorly, posteriorly, and laterally, but very finely and sparsely punctate in middle, punctation even becoming obsolete there. Antennae dark blue metallic, narrow bases of segments brownish, club more or less dark brown. Maxillary palpi dark, blue metallic, base of segments reddish. Legs dark blue metallic,



bases of trochanters reddish yellow. Clypeus and labrum bright bluish, densely set with long setae, lateral pubescence of clypeus particularly dense. Segment 4 of metatarsi simple, with a narrow bristle shoe.

Length: 6.5 – 8.5 mm (fore parts : 3.7 – 4.2 mm).

PM of one male from Emei Shan: wH: 63; adE: 41; IE: 23; IT: 15; wP: 45; IP: 45; wEl: 68; IEl: 76; IS: 65.

Male: Metasternum broadly convex, slightly impressed posteriomediaally, with a shining triangular area in middle slightly longer than broad, each side of this area sparsely set with about 10-16 moderately fine punctures, shining area densely, isodiametrically microsculptured, acam impunctate but shallowly microsculptured, sides of metasternum abruptly, very densely and finely punctate and pubescent. Sternites 3-5 with broad, impunctate shining area distinctly less broad than half the sternite (e. g. 22: 55 on sternite 4), medially, area finely microsculptured, Sternite 6 broadly impressed medially, sparsely set with moderately fine punctures, Sternite 7 with a broad and distinct medial impression more densely and somewhat more coarsely punctate than sides, densely set with yellowish pubescence posteriorly, posterior margin shallowly emarginate. Sternite 8 with a broad, obtusely-angled notch in about posterior tenth. Sternite 9 (fig. 50) with a broad and distinct tooth apicolaterally, sparsely set with numerous very short setae and few longer setae ventrally, apicolateral brush strong and dense, curved inwards distally, nearly as long as the entire sternite. Tergite 10 broadly rounded. Aedeagus (fig. 38) with a triangularly narrowed median lobe, its apical portion about twice as broad as parameres at broadest point, broadly rounded apically, with 2-3 distinct setae on each side. Internal sac strongly sclerotized (outline: fig. 45). Parameres distinctly longer than median lobe, with 12-16 strong setae.

Female: Ventral characters resembling those of male, but sternite 6 simple and impunctate medially, sternite 7 very shallowly impressed medio-apically, apical margin very shallowly emarginate. Sternite 8 with a distinct medio-apical notch in triangularly produced medio-apical portion (figs 56- 58). Valvifers more or less rounded apically. Tergite 10 moderately broadly rounded, with a slight, concave median impression.

Head as that of *D. chetri*, with shallow longitudinal furrows on anterior half of frons, punctuation fine, even, very dense. Antennae slender, by about 3 outer segments extending beyond posterior margin of pronotum when reflexed, penultimate segments nearly twice as long as broad. Pronotum with deep impressions and lateral tubercles, slightly deeper and more elevated than those of *D. chetri*, posterior impressions coarsely and moderately densely punctate, rest of pronotum moderately finely to very finely punctate, punctuation in middle very sparse, microsculpture dense, isodiametrical, variegate and deep (see below). Elytra with curved bands of whitish pubescence and an area of whitish pubescence medio-laterally; punctuation about as fine as that on head, very dense on bluish bands, less dense on antero-medial portion, with interstices slightly larger than half diameter of punctures. Abdomen with broad, slightly upwards directed finely and very densely punctate paratergites, paratergites of tergite 4 about as broad as metatibia at apex, tergite 7 with a broad palisade fringe apically, punctuation throughout fine and very dense, that of tergites 8 and 10 abruptly coarser and less

dense. Legs slender, metatarsi  $3/5$  as long as metatibiae, first segment about as long as the fifth, distinctly longer than segments 2-4 combined, fourth segment simple with a narrow „shoe“ of long setae  $3/5$  length of claw segment. Pronotum more or less deeply reticulate, rest of body with more or less faint groundsculpture.

Variability: One male paratype differs from the other paratypes by smaller size: fore parts: 3.5 mm, total length: 6.0- 7.0 mm, by the median lobe slightly narrower anteriorly and bearing only two setae at each side, and by the lower number of paramere setae (13/12). Specimens captured by Schillhammer have much deeper reticulation than the series captured by de Rougemont, especially on pronotum, also the pronotum is totally dull with less distinctly pierced punctation, while in the holotype the pronotum is distinctly shining because of much shallower reticulation. At the first these specimens seem to belong to a different species, but I can not find any additional differences, e. g. in the ventral punctation or in the genitalia, to support this concept.

*Comments.* *Dianous alternans* Zheng differs from *D. chetri* Rougemont, which has been captured at the same place, by the sharply delimited blue elytral band (in the middle of the elytra of *D. chetri* are two more or less greenish blue areas that may be variably confluent), by more brilliant (less dull) pronotum, and by the sexual characters. In *D. alternans* head and shoulders are bluish, while in most specimens of *D. chetri* they are greenish-olivaceous, but there are also specimens of *D. chetri* with bluish head and bluish shoulders.

#### *Dianous coeruleovestitus* sp. n.

Type Material. Holotype (♂): Hongkong: New Territories, Great Falls, Kadoorie Experimental Farm, CL 2209, 23. XI. 1985. J. T. & D. A. Polhemus (USNM); 8 ♂♂, 5 ♀♀: Tai Mo Shan, 28. IV. 1996. G. M. de Rougemont (cR, cP).

This new species resembles at first glance *D. inaequalis* Champion, it is the sister species of *D. coeruleomicans* Puthz.

Moderately shining, green/blue metallic, head, broad band on elytra (fig. 33), and abdomen bluish, pronotum blackish blue, elytra on medial basal half and on posterior fifth greenish-olivaceous with some brassy tint. Head, elytra, and abdomen very finely and very densely punctate and pubescent, pronotum moderately finely to very finely and sparsely punctate, interstices nearly smooth, brilliant. Antennae dark blue-violet, club brownish. Palpi dark brown. Legs dark blue-violet, bases of trochanters reddish yellow, tarsi blackish brown. Clypeus and labrum blue, densely pubescent. Legs as those of compared species: segment 4 of metatarsi simple, with narrow bristle-shoes.

Length: 6.0 – 6.2 mm (fore parts: 3.0 mm).

PM of HT: wH: 44,5; adE: 30; lE: 17; IT: 9; wP: 34,5; lP: 35; wEl: 51,5; lEl: 59; lS: 51.

Male : Metasternum convex, shallowly impressed posteriomedially, with a long, triangular shining area in middle about  $1/3$  narrower than long, densely and shallowly microsculptured, and with about 10 moderately fine punctures on each half; sides of metasternum abruptly, very finely and very densely punctate and pubescent, acam almost impunctate. Sternites 3- 5 with an impunctate, shining median area about  $1/3$  as

broad as sternite and very shallowly microsculptured, sternite 6 medially somewhat more coarsely and less densely punctate than laterally, posterior margin very broadly, shallowly emarginate; sternite 7 with moderately deep, very finely and very densely punctate and pubescent impression posteriomediaally, posterior margin moderately shallowly emarginate. Sternite 8 with a broad emargination in about posterior ninth. Sternite 9 with a broad, blunt tooth (fig. 41) apicolaterally, ventrally with sparse short setae, apicolateral brush strong and dense, about as long as whole sternite. Tergite 10 broadly rounded. Aedeagus (fig. 39) with median lobe triangularly narrowed, apex slightly broader than parameres at tip, with 4 moderately strong setae laterally, internal sac resembling that of *D. chetri*. Parameres longer than median lobe, with 11 or 12 setae apically (no setae at base).

Female: Ventral characters similar to those of male. Sternite 8 with a shallow notch apicomediaally (about as in fig. 76). Valvifer broadly rounded apically, with a strong brush, 1.5 x as long as the valvifer. Tergite 10 broadly rounded.

Head and antennae in general as in *D. chetri*. Pronotum about as in *D. alternans*, but brilliant, groundsculpture almost obsolete, punctation laterally and posteriorly somewhat coarser, anteriorly as coarse as on head, becoming finer medially, almost obsolete on middle; interstices in lateral impressions and posteriorly nearly as large as diameter of punctures, much wider medially. Elytra (fig. 33) in general as in *D. alternans*, but bluish areas larger and less distinctly separate from greenish areas (several violet-coppery transition zones present), surface less deeply impressed, punctation and pubescence very similar. Abdomen about as in *D. alternans*, but paratergites slightly narrower, those of tergite 4 about as broad as metatibia at middle.

*Comments.* *Dianous coeruleovestitus* can be distinguished from both *D. chetri* Rougemont and *D. alternans* Zheng by the smaller size, by the coloration of the elytra, by the structures (degree of shininess) of the pronotum, and by the sexual characters, from *D. coeruleomicans* Puthz by different metallic reflection and the aedeagus.

Etymology: *coeruleus* (Latin) = blue; *vestitus* (Latin) = clothed : Clothed with blue.

### *Dianous coeruleotinctus* sp. n.

Type Material. Holotype (♂) and allotype (♀): NW- Hunan: Wulingyuan, N. Dayong Sioxiyu, 400 m, 31. X. 1993, large river in broad and shallow metal bed (NHMW). Paratypes: 4 ♂♂, 3 ♀♀: same data as holotype (NHMW, cP).

This new species is allied to *D. malayanus* Cameron; it resembles several blue metallic species, e. g. *D. acuminifer* Puthz.

Bright blue metallic, moderately shining, head, elytra, and abdomen finely, or moderately finely, and very densely punctate, pronotum finely to moderately coarsely and more or less sparsely punctate, shiny. Pubescence whitish yellow, dense, recumbent, elytra with distinct tortuous bands of pubescence. Antennae, palpi, and legs blue metallic, antennal club brownish. Clypeus and labrum blue metallic, densely pubescent. Fourth tarsal segment simple with a sparse and short bristle shoe.

Length: 5.2 – 6.5 mm (fore parts: 3.0 – 3.3 mm).

PM of HT: wH: 45.5; aE: 29; IE: 17; IT: 9; wP: 37; IP: 37.5; wEl: 56.5; lEl: 63; IS: 54.

Male: Metasternum broadly convex, triangular medial area flat, moderately finely, regularly, and very densely punctate, narrow interstices with fine groundsculpture, with medial, narrow, impunctate shining area about as broad as last antennal segment; acam finely and very densely punctate throughout; declining lateral areas of metasternum about as coarsely and densely punctate as medial area. Abdominal sternites 3-6 very densely and finely punctate throughout, sternite 7 posteriomedially with a shallow but distinct impression slightly more densely punctate and pubescent than sides, posterior margin shallowly emarginate. Sternite 8 with a broad emargination in about posterior fourteenth. Sternite 9 short and broad, posterior margin nearly blunt, finely crenulate (fig. 53), apicolateral brush very strong and dense, about 1.5 x as long as sternite. Tergite 10 very broadly rounded. A e d e a g u s (fig. 40) with median lobe triangularly narrowed, apically slightly broader than parameres at apex, apex rounded, internal structures resembling those of *D. inaequalis* Champion. Parameres slightly longer than median lobe, with about 12 evenly set long setae.

Female: Ventral characters similar to those of male, but sternite 7 not impressed. Sternite 8 with two oval areas densely set with short setae, apically more or less deeply excavate (figs 52, 55). Valvifer rounded, apical brush very strong, 1.5 x as long as valvifer. Tergite 10 obtusely angulate apically.

Head similar to that of *D. acuminifer*. Antennae slender, with at least last 3 segments extending beyond posterior margin of pronotum when reflexed, penultimate segments about 1.5 x as long as broad. Pronotum with deep lateral and oblique impressions, middle area appearing somewhat bumplike elevated, punctuation variable, coarse and dense laterally and on basal impressions, with punctures possibly nearly as large as middle cross section of third antennal segment and interstices smaller than half diameters of punctures; distinctly less coarse and less dense on anterior portion of pronotum, with diameters of punctures about as large as one middle eye facet and interstices as large as diameters of punctures or larger; punctuation in very middle even finer and sparser, but so irregular that a distinctly separate shining area can not be identified. Elytra subquadrate, sutural impression deep and long, humeral impressions shallow, punctuation about as coarse as that on head but extremely dense, rough on posterior half. Abdomen broadly margined, paratergites distinctly directed upwards, those of segment 4 nearly as broad as metatibia at apex, punctuation of paratergites fine and very dense, still denser than punctuation of tergites which appears very dense throughout, except slightly sparser on middle portions of tergites; tergite 7 with a broad palisade fringe apically (the insect is fully winged); tergite 8 with punctuation much coarser and less dense than that of tergite 7; tergite 10 with a few very fine punctures. Legs slender, metatarsi about 3/5 as long as metatibiae, first segment distinctly longer than following 3 segments combined (37: 33), somewhat longer than last segment (37: 35), fourth segment simple, bristle shoe thin. Interstices of frontal punctuation smooth, pronotum densely but very shallowly reticulated (shiny !), abdomen with shallow ground sculpture.

*Comments.* *Dianous coeruleotinctus* is distinguished from *D. malayanus* Cameron by its bright blue metallic lustre (*D. malayanus* Cameron has a more blue-violet shine), coarser pronotal punctuation, coarser punctuation of elytra, and the sexual

characters, from *D. acuminifer* Puthz and very similar species by much coarser punctate and shiny pronotum.

Etymology: *coeruleus* (Latin) = bright blue, *tinctus* (Latin) = dipped/colored.

### *Dianous inaequalis* Champion

*Dianous inaequalis* Champion, 1919: 45; Cameron, 1930: 415 f. fig.; Puthz, 1971a: 91 fig.; Puthz, 1981a: 99, 122, fig. 42; Rougemont, 1983a: 2; Puthz, 1984a: 104 (see below)

*Dianous caeruleoguttatus* Cameron, 1927: 8

Material examined: Yunnan: 1 ♂: Kunming, 5. X. 1985, G. M. de Rougemont (cR); 1 ♀: Dali, X. 1986, G. M. de Rougemont (cR); 3 ♀♀: Lugu Lake – Luo Shui, 27°45'N, 100°45'E, 8.-9. VII. 1992, E. Jendek (NHMW, cP); 1 ♂: ca. 100 km NW Lijiang, Hengduanshan, 2200 m, Jiduan – Weixi, 1. VII. 1994, H. Schillhammer (10) (NHMW). Sichuan: 1 ♂: Emei Shan, X. 1986, G. M. de Rougemont (cR).

This is one of the most widely distributed species of group II. It has already been recorded from China (Sichuan: Puthz, 1971a).

Male: Metasternum broadly convex, flat medially, middle very slightly impressed posteriorly, anterior process not separate from rest of metasternum by any kind of impression or transverse incision; sides finely and very densely punctate and shortly pubescent; middle with a broad, triangular shining area: moderately finely and sparsely punctate posteriorly, impunctate in very middle; triangular area about 1/3 as broad as entire width of metasternum posteriorly, its microsculpture deep, very dense, about isodiametrical. Ventral aspect of abdomen: fig. 116, Cameron, 1930. Sternites 3-5 medially with a moderately broad, impunctate, finely chagrined area, about 1/4 as broad as respective sternite, sternite 6 medially punctate, punctuation sparser than that on sides (no distinctly differentiated impunctate area in middle). Rest of abdomen as in the Taiwanese subspecies (see below). *A e d e a g u s* (about as in fig. 69), median lobe slightly longer but also less long as parameres, parameres (mostly ?) with less than 20 long setae.

Female: Metasternum and sternites 3- 5 about as in male. Sternite 6 medially with a narrow impunctate 1/8 or 1/9 of width of sternite, impunctate area distinctly narrower than that of sternite 5. Rest of abdomen as in Taiwanese subspecies, sternite 8 (figs 59, 60).

*Comments.* The ventral characters in all specimens listed above are same as in the Indian specimens. The bluish areas of the elytra are slightly larger than those of the typical specimens, but are distinctly less large than in the Taiwanese subspecies. One female from Luo Shui has also bluish color on the humeral portion, but the blue color is not quite the same as that in the middle of elytra: some violet or brassy tint amongst the blue is apparent. At present, the Chinese material is not sufficient to allow the decision whether the slight differences between the Chinese and Indian/Nepalese specimens are clinal differences or belong to the general variability.

### *Dianous inaequalis laevior* ssp. n.

*Dianous inaequalis*: Puthz, 1984a: 104

Type Material. Holotype (♂) and allotype (♀): Taiwan: Nantou Hsien: Shanlinchi, 1650

m, 19. V. 1991, on bear moits rocks directly in a creek (see photo 2 in Smetana, 1995), A. Smetana (MHNG).

Paratypes: 59 ♂♂, 53 ♀♀: same data as HT (cP, cR, cS); 1 ♂: cataract nr Choshui Hast., rte. 151 0.7 km S. Hsitou (11 km SSE Luku) 6.IV.1991, H. G. Nelson (FMCh). Ilan Hsien: 1 ♂: Taipingshan, 1820 m, 15. VII. 1993, same habitat as HT, A. Smetana (cS). Kaohsiung Hsien: 5 ♂♂, 2 ♀♀: Peinantashan trail, 2065 m, 6. VII. 1993, on wet vertical wall with running water, A. Smetana (cP, cS). Chiayi Hsien: 3 ♂♂: Alishan, 2400 m, 3.-9. VII. 1972, T.C.Maa (Bishop Museum, cP). Hualien Hsien: 2 ♂♂, 2 ♀♀: Taroko N. P., Nanhushi Hut, 2200 m, 8. V. 1990, on wet large rocks with thin layer of soaking fallen leaves in a creek, A. Smetana (cP, cS).

This *Dianous* represents the Taiwanese subspecies of the variable *Dianous inaequalis*, which is one of the most wide-spread central-oriental *Dianous*. The Taiwanese specimens resemble very closely in nearly all respects the mainland nominate form, but show some differences in the coloration, and distinct differences in the ventral punctation.

Length: 6.0 – 7.5 mm (for parts 3.4 – 3.8 mm).

Male: Metasternum broadly convex, flat medially, posteriomediaally very slightly impressed, anterior process separate from rest of metasternum by a more or less deep, narrow transverse incision; sides of metasternum finely and very densely punctate and shortly pubescent; middle of metasternum with a very broad, triangular, sharply delimited impunctate area (only a few fine punctures on sides of shining area), somewhat broader than half of entire width of metasternum, with dense, moderately deep, sometimes slightly transverse microsculpture. Abdominal sternites 3-5 medially with a broad, finely chagreened impunctate shining area, at least 1/3 as broad as respective sternite; sternite 6 medially also with that remarkable impunctate area, 1/4 to 2/5 as broad as the sternite; sternite 7 broadly and shallowly impressed posteriomediaally, impression very densely and moderately finely punctate, and with long, yellowish, brushlike pubescence, posterior margin broadly emarginate. Sternite 8 with a broad medio-apical notch in about posterior 10<sup>th</sup> to 11<sup>th</sup>. Sternite 9 (fig. 68), with a more or less blunt tooth latero-apically. Tergite 10 very broadly rounded at posterior margin. A e d e a g u s (fig. 69) with median lobe triangularly narrowed, internal sac densely set with spines; parameres extending well beyond apex of median lobe, slender, with many (20- 25) long setae.

Female: Metasternum about same as in male, anterior process sometimes separate from rest of metasternum by a transverse impression. Abdominal sternites 3-6 medially with a broad, shining impunctate area, resembling that of male, sternite 6 about same sternite 5; sternite 7 densely and moderately finely punctate medially, more densely so near broadly and shallowly emarginate posterior margin; yellowish pubescence very dense posteriorly, long, brushlike convergent, distinctly extending beyond posterior margin of sternite; sternite 8 with a more or less deep apical notch (variability: figs 61-67). Valvifer rounded apically, apical brush 1.5 – 2 x as long as valvifer. Tergite 10 broadly, triangularly narrowed, rounded apically.

Shining, head and abdomen blue to blue-black, sometimes with slight brassy or coppery reflex, pronotum dark-blue with variegate tints (olive, coppery, bronze), elytra golden- to brassy-metallic with a large and broad, curved blue-metallic band, and with some coppery tint in narrow transition zone between golden/brassy and blue-metallic

areas. Punctuation of head and abdomen fine and very dense, except tergite 8 moderately coarsely and sparsely punctate; pronotum moderately coarsely and moderately densely (varying) punctate; upper golden/brassy areas of elytra very finely, more or less densely punctate (see below), less finely and extremely densely punctate laterally and on bluish areas. Pubescence short and dustlike-dense, on elytra brushed in different directions: a distinctly separate whitish area of pubescence laterally slightly before the middle, a narrow curved band of whitish pubescence on each elytron beginning behind shoulder (about 1/4 of elytral length from anterior margin) turning toward suture at about middle of elytron and then turning again backwards in sutural quarter, ending about 1/4 of elytral length before posterior margin of elytra. Antennae, palpi, and legs bluish-black, bases of trochanters brownish. Head and abdomen with shallow microsculpture, pronotum with deep and dense, nearly isodiametrical microsculpture, elytra between punctures mainly smooth (see below). Legs slender; metatarsus 3/5 as long as metatibia, segment 1 somewhat longer than the following 3 segments combined, about as long as last segment, segment 4 simple with a distinct, but narrow bristle-shoe about 2/3 as long as claw-segment.

*Comments.* *Dianous inaequalis laevior* is distinguished from *D. inaequalis inaequalis* by the elytral coloration. Bluish areas are distinctly larger: a broad and long area extends from shoulders somewhat behind middle, at its narrowest portion the transverse bluish band is mostly 1/3 – 1/4 (in the nominate form 1/6 – 1/5) as wide as the length of elytra. The elytra are bluish behind shoulders in all specimens; the brassy/golden anterior area of the elytra is distinctly separate from the lateral bluish portion in most specimens; the bluish portion behind shoulders may be 1/5 – 1/4 as wide as one elytron (in dorsal aspect); in a few specimens the lateral bluish portion may become only 1/10 as wide as one elytron, but the brassy/golden anterior coloration does not extend to the declining lateral portion behind shoulders, as it does in *D. inaequalis inaequalis*. The elytral punctuation is also somewhat variable: interstices of the punctuation on the basal brassy/golden area are about equal to diameters of punctures or slightly larger in most specimens, but the punctures in one female PT are slightly larger with interstices slightly larger than half the diameter of punctures (the microsculpture is also more distinct in this female).

Etyymology: comparative of Latin *laevis* = smooth; „more shining“.

### *Dianous elegantulus* Zheng 1993

*Dianous elegantulus* Zheng, 1993: 203 figs.

Material examined: 3 ♂♂, 3 ♀♀ Sichuan: Emei Shan, 7. X. 1985, G. M. de Rougemont (cR, cP); 1 ♀: Sichuan: Yachow, 2200 ft., 15. I. 1929, D. C. Graham (USNM). NW-Hunan: 9 ♂♂, 12 ♀♀: Wulingyuan, N. Dayong Suoxiyu, 400 m, 31. X. 1993, large river in broad and shallow metal bed, H. Schillhammer (NHMW, cP); 1 ♂, 1 ♀: ca. 60 m W Ya'an, 1500 m and 1600 m, 4 km W Xingou Village, Ji & Wang, 12./13. VI.1996 (CWBS 232: stream, ca. 2-3 m wide, tributary to Tianqian He, cold and fast flowing through secondary forest, shaded: 233: upstream of loc. 232, small stream, ca. 1- 2 m wide, cold and fast flowing through secondary forest, large stones, leaf packs) (NHMW); 1 ♂, 1 ♀ - PT: Emei Shan, 710- 1120 m, 23.- 24. VII. 1983, Lu Ying & Gou Zheng-yue [HT and other PT in the Department of Biology, Sichuan Teacher's College, Nanchong].

This *Dianous* is one of the most beautiful species of the genus. It resembles at first glance *D. ponticus* Fagel externally, but it is more closely related to *D. inaequalis* Champion and resembling species; its sister species is *D. adonis* sp. n. (see below).

Moderately shining, variegate metallic: Head, abdomen, and legs blue, pronotum dark blue with violet or greenish tint, elytra tricolorous (fig. 36); central, sharply delimited, cross bright blue (dull), outer quarters brilliant brassy-golden-coppery. Head, elytra, and abdomen finely and very densely punctate and pubescent, pronotum moderately coarsely and moderately densely to moderately sparsely punctate. Antennae and palpi blue metallic, antennal club brownish. Bases of trochanters brownish, tarsi blackish, becoming dark brown toward apex. Clypeus and labrum blue, densely pubescent. Tarsi simple, 4th segment with a distinct bristle-shoe.

Length: 7.5 – 9.5 mm (fore parts: 4.3 – 4.7 mm).

PM of a male from Emei Shan: wH: 68; adE: 44; IE: 21.5; IT: 17; wP: 49; IP: 46; wEl: 82; IEI: 90; IS: 77.

Male: Metasternum convex with a shining, plain or slightly impressed triangular median area  $2/3$  as broad as long, distinctly but shallowly microsculptured, impunctate medially, with 10-12 moderately coarse punctures on each side; acam impunctate, with nearly obsolete groundsculpture: sides of metasternum abruptly, very finely and densely punctate and pubescent. Abdominal sternites 3-6 medially with impunctate (but microsculptured) area about  $1/5$  –  $1/6$  as broad as respective sternite, sternite 7 posterior-medially more or less (very shallowly) impressed and moderately finely, very densely punctate and pubescent, posterior margin very shallowly emarginate. Sternite 8 with a very broad, obtusely angulate excision in about posterior fourteenth. Sternite 9 (fig. 43) obtuse apically, irregularly crenulate, with sparse short setae, apicolateral brush strong and dense, about 1.5 x as long as the entire sternite. Aedeagus (fig. 44) with median lobe triangularly narrowed toward broadly rounded apical portion about twice as broad as parameres apically, with 4 small lateral setae; internal sac moderately strongly sclerotized, resembling that of related species. Parameres longer than median lobe, with about 18 moderately strong setae, a few of them situated in basal half.

Female: Ventral characters about as those of male. Sternite 8 apically with a bifid projection with variable medial excision (figs 51, 54). Valvifer broadly rounded-serrate apically, with a very long and strong brush. Tergite 10 triangularly narrowed.

Head about as in *D. ponticus*, with long lateral furrows, comparatively small eyes and strongly rounded temples (temple-suture can be seen from above). Antennae slender, about 3 outer segments extending beyond the posterior margin of pronotum when reflexed, penultimate segments 1.5 – 1.8 x as long as broad. Pronotum with deep oblique impressions in posterior half, a constriction near anterior margin, a lateral impression near base and two less deep impressions medially near posterior margin; punctuation of basal impressions moderately coarse and dense, diameters of punctures about as large as cross section of one tarsal claw, interstices slightly less large than diameters of punctures: anterior punctuation nearly as coarse as, medial and lateral punctuation distinctly finer and sparser than that of basal impressions, finest punctures finer than those on frons, interstices at least as large as to 2-3 times larger than diameters of punctures (see also below). Elytra (fig. 36) with punctuation on bright blue



dull central cross extremely dense, that of brassy-golden-coppery areas less dense, shining interstices no larger than diameters of punctures. Abdomen very broad with very broad, somewhat upward directed paratergites, paratergites of tergite 4 at least as broad as metatibia at apex. Legs slender, metatarsi 2/3 as long as metatibae, first segment slightly longer than the 3 following combined, about as long as the last segment. Head with nearly obsolete microsculpture, pronotum distinctly but not deeply, isodiametrically microsculptured, central portions of bluish area of elytra densely and deeply reticulated, outer quarters smooth, abdomen shallowly to very shallowly reticulated.

Variability: Punctuation of the middle of pronotum may be nearly as coarse and dense as that on anterior portions.

*Comments.* *Dianous elegantulus* can be distinguished at first glance from all other *Dianous* by its very beautiful coloration, from *D. adonis* by the stronger elytral punctuation, different elytral color, the ventral and the sexual characters.

### *Dianous adonis* sp. n.

Type material. Holotype (♂), allotype (♀) and 1 ♀- paratype: Sichuan: Ganzi pref.. Daxue shan, 5 km E Kangching, 102°00'E, 30°03'N, river valley, ca. 3000 m, 20.-23.V.1977. A. Pütz (ZMB, coll. Pütz, cP).

This new species resembles strongly *D. elegantulus* Zheng and is its sister species.

Moderately shining, variegate metallic: Head, pronotum, abdomen and legs dark blue-metallic, elytra bicolorous (fig. 37), main surface including central area shining blue, smaller areas near base and on outer posterior quarter brilliant brassy-golden. Head finely and very densely punctate, diameters of punctures as large as medial eye facets, interstices mostly smaller than half diameters of punctures. Pronotum moderately finely and sparsely punctate (central area) to coarsely and densely punctate (near posterior margin). Elytral punctuation slightly finer and slightly less dense than that on frons. Abdomen finely and densely punctate. Pubescence remarkable, except on pronotum short and dense throughout, elytral pubescence variegate in color and arrangement: curved fields of golden shining setae-bands contrast with the darker main pubescence. Antennae and maxillary palpi dark blue metallic, antennal club brownish. Clypeus and labrum blue metallic, moderately densely pubescent. Tarsi simple, segment 4 with a distinct bristle shoe, first segment as long or slightly longer than the last segment.

Length: 8.0 – 9.5 mm (fore parts: 4.2 – 4.4 mm).

PM of HT: wH: 64.5; adE: 44; IE: 21; IT: 18; wP: 45; IP: 46; wEl: 71; IEI: 75; IS: 66.

Male: Metasternum convex with a broad, plain or slightly impressed shining median area, which is shallowly reticulate with 8-10 fine punctures on each side; punctuation of the sides of metasternum different, sharply delimited: finely and densely punctate and pubescent, acam impunctate. Sternites 3-6 with a broad, impunctate and finely reticulate shining median area (that of sternite 4 somewhat narrower than half width of sternite: 25:57), sides finely and densely punctate and pubescent. Sternite 7

impunctate and densely reticulate medially, moderately finely to finely punctate and long yellowish pubescent posteromedially. Sternite 8 with a broad obtusely-angled moderately shallow apical emargination (length of sternite: depth of emargination = 100: 6). Sternite 9 as in *D. elegantulus*, apical brush strong, distinctly longer than the sternite. Tergite 10 broadly rounded. *Aedeagus* nearly as in *D. elegantulus*, the median lobe less broad anteriorly, parameres with 15-16 setae.

Female: Ventral characters similar to the male, sternite 8 with a bifid projection as in *D. elegantulus*. Valvifer and tergite 10 as in the compared species.

Variability: The anterior brassy area of elytra is occasionally narrower than in fig. 35.

*Comments.* *D. adonis* is distinguished from *D. elegantulus* by the much finer and less dense punctation of the bluish elytral centre, by the differently colored elytra, by the narrower pronotum, by the broader shining median areas of sternites and by the sexual characters.

*Etymology:* *Adonis* (Latin): in Greek mythology a very handsome young man loved by Aphrodite.

### *Dianous schoenmanni* sp. n.

Type material. Holotype (♂): Sichuan: Guan Xian Co., Balang Shan, 3 km W, stream, 0.5 – 1.0 m wide, fast flowing, cold, flowing through meadows, partly shaded by bushes, small crystalline gravel and sand, ca. 1950 m, l. VIII. 1998, Schönmann, Ji, Wang (CWBS 343) (NHMW).

This new species also resembles *D. elegantulus* Zheng and is closely related to it.

Moderately shining, metallic blue with small brassy to coppery areas on elytra (fig. 35). Head finely and very densely punctate, diameters of punctures as large as medial eye facets, interstices mostly smaller than half diameter of punctures. Pronotum finely and moderately sparsely punctate anteriorly and posteriorly, very sparsely on central area. Elytral punctation nearly as fine as that on frons. Abdomen finely and densely punctate. Except on pronotum the pubescence is distinct, particularly conspicuous on the elytra, where a narrow transverse band can be seen medially, which after a short interruption seems to be continued on declining sides laterally, where a round area of shining pubescence exists; also on posterior angles the pubescence is more conspicuous than on the rest of the surface. Antennae, maxillary palpi and legs dark blue-metallic. Clypeus and labrum blue-metallic, moderately densely pubescent. Tarsi simple, segment 4 with a distinct bristle-shoe, three quarters of the length of the claw segment; segment 1 slightly longer than the following 3 segments combined (18: 16), slightly shorter than the last segment (18: 19). Pronotum and abdomen with shallow ground sculpture.

Length: 6.5 – 7.5 mm (fore parts: 4,1 mm).

PM of HT: wH: 61; adE: 42; lE: 21; IT: 18; wP: 43.5; lP: 43.5; wEl: 68.5; lEl: 74; lS: 65.

Male: Metasternum with a broad, triangular, flat shining median area which is shallowly reticulate and has some 4-6 moderately fine punctures laterally, acam

smooth. Sternites 3-6 with moderately broad impunctate median areas, nearly one third as broad as the respective sternites. Sternite 7 moderately sparsely and slightly more coarsely punctate medially than laterally, densely pubescent near posterior margin, which is very shallowly emarginate. Sternite 8 with a broad obtusely-angled emargination in about posterior 12<sup>th</sup> (8: 94). Sternite 9 similar to that of *D. elegantulus* (see fig. 43) but more prominent apicolaterally (fig. 42), posterior margin smooth medially, apicolateral brush strong, distinctly longer than the sternite. Tergite 10 broadly rounded. Aedeagus nearly as in *D. elegantulus* (see fig. 44), apical portion of median lobe about as broad as in the compared species, parameres less long, slightly longer than the median lobe with 19 setae.

Female: unknown.

*Comments.* *Dianous schoemmanni* may be distinguished from *D. elegantulus* Zheng by the longer, much finer punctate pronotum, by the narrower elytra with much smaller brassy areas and by the median areas of sternites, which are much broader impunctate. It is distinguished from *D. adonis* sp. n. by the minor length, sparser medial punctation of the pronotum, less large brassy areas on elytra, narrower impunctate median areas of sternites and broader apical portion of the median lobe.

*Etymology:* This new species is named in honour of Dr. H. Schönmann, Vienna, who collected the new insect.

### *Dianous punctiventris* Champion

*Dianous punctiventris* Champion, 1919: 48; Cameron, 1930: 420 fig.; Puthz, 1981a: 123 fig.

*Dianous puberulus* L. Benick, 1942: 39 ff. figs, **syn. nov.**; Puthz, 1981a: 123 fig.

Material examined: India: 1 ♂, 1 ♀: W. Almora, Champion (types; BMNH); 1 ♂: Chakrata district: Bangar, 6000 feet, 1. V. 1921, Cameron (cP); 1 ♂, 2 ♀♀: Dehra Dun, 1940-45, Liesenfeldt (FMCh, cP); BURMA: 1 ♂, 6 ♀♀: Washaung, 200 m, 16. III. 1934, R. Malaise (syntypes of *D. puberulus*; FMCh, Museum Stockholm, cP); 12 ♂♂, 12 ♀♀: Shingbwiang, 10. III. 1914, L. C. Kuitert (Snow Ent. Mus., Kansas; cP). Laos: 1 ♂: Prov. Lg Nam Tha, ca. 20 km SE Muang Sing, 950 m, 12.-13. VI. 1996, Schillhammer (25) (NHMW). Vietnam: 2 ♂♂, 2 ♀♀: Bao Lac (coll. Fauvel, IrScNB); 1 ♂, 4 ♀♀: Cao Bang, 1. XI. 1893, Dr. Billet (coll. Fauvel; IrScNB, cP). China: Yunnan: 1 ♂, 1 ♀: Kingtung, 1200 m, 10. III. 1957, Panfilov (Museum Leningrad, cP); 4 EE: Ruli, 4. II. 1993, G. M. de Rougemont (cR, cP). Hainan: 2 ♀♀: 3 km NE Maoyang; Wuzhi Shan River slowly flowing through wide, deforested valley, only few riffles, banks with sand, grass and mud, 100 m, 19. I. 1996, Ji & Wang (198) (NHMW, cP); 1 ♀: 2 km S Mao'an, 250 m, 20. I. 1996, Jäch (199) (NHMW).

*Comments.* For a long time I doubted the status of both taxa. After having studied more than 50 specimens from various localities, amongst them several males with everted aedeagi, I am convinced that both taxa are conspecific. As I noted (1980a: 238), the aedeagus-figure published by Jarrige 1950 for *D. cameronianus* Jarrige (taken from an unknown specimen, not from the HT) shows the everted aedeagus of *D. punctiventris*. In *D. punctiventris* (normal state) the median lobe is narrowly, triangularly narrowed (fig. 44, Puthz, 1981a). As known from related species (e. g. figs 61-66), in females the shape of the posterior portion of sternite 8 is variable, it can be more or less deeply excised.

*Dianous fauveli* sp. n.

Type material. Holotype (♂): Vietnam: Cao Bang, Dr. Billet (IRScNB).

PM of HT: wH: 55; adE: 37; lE: 19; lT: 10; wP: 45,5; lP: 45; wEl: 76; lEl: 78; lS: 65.

This new species is closely allied and similar to *D. yunnanensis* but differs markedly in some respects. It was found amongst the historical material in the Fauvel-collection.

Blackish blue metallic, rather dull, head moderately finely and densely punctate, pronotum slightly more finely and densely punctate (also medially), punctation of elytra about as coarse as that on head, but very dense, extremely densely and rough on posterior half, abdomen finely and very densely punctate. Pubescence whitish yellow, dense, recumbent, elytra with tortuous bands of pubescence. Antennae, palpi, and legs black with blue metallic tint. Clypeus and labrum blue metallic, densely pubescent. Fourth tarsal segment simple, with sparse and short bristle shoe.

Length: 7.0 – 8.5 mm (fore parts: 4.0 mm).

Male: Trochanters with very small, inconspicuous, blunt tooth. Metasternum broadly convex, medial area very broad, nearly as broad as long, narrowly and shallowly impressed medially, with linear impunctate area, punctation of rest of median area moderately fine (less regular in size of punctures than in *D. uniformis*) and very dense, interstices distinctly reticulate; acam finely and densely punctate throughout, not only medially. Abdominal sternites 3-6 finely and densely punctate throughout; sternite 7 with a shallow posteriomedian impression densely punctate and set with long pubescence, posterior margin distinctly but shallowly emarginate. Sternite 8 with a shallow round emargination in about posterior thirteenth. Sternite 9 broadly rounded and crenulated apically, very shallowly emarginate, apicolateral brush strong and dense, slightly longer than sternite. Tergite 10 broadly rounded. *A e d e a g u s* relatively short and broad, much shorter than those of *D. acuminifer* and of *D. yunnanensis*, apical portion (fig. 49) triangularly narrowed, apically as broad as parameres at apex, internal structures (everted in HT) resembling those of *D. yunnanensis*: a long and broad, strongly sclerotized tube and some weak membranes set with indistinct elements. Parameres slightly longer than median lobe, with about 20- 22 long setae on anterior half.

Female: unknown.

*Comments.* *Dianous fauveli* resembles in nearly all respects *D. yunnanensis*, but differs by the distinctly different sexual characters. The holotype is an old, somewhat damaged specimen (antennae and legs partly missing).

*Etymology:* Dedicated to the great staphylinidologist Albert Fauvel (1840-1921) in which's collection this specimen was found as „*Dianous billeti* sp. n.“.

*Dianous acuminifer* Puthz

*Dianous acuminifer* Puthz. 1984b: 104 fig.

Material examined. Taiwan: Nantou Hsien: 2 ♂♂, 1 ♀: Shanlinchi 1650 m, 16. V. 1990, on wet large rocks in a creek (see photo 2 in Smetana, 1995). A. Smetana (cS, cP): 11 ♂♂, 9

♀ ♀: Sun Lin Sea, rte. 151, 16 km SSE Luku, 6. IV. 1991, H. G. Nelson (FMCh, cP); 1 ♀: tr. Chen Yu Lau, 2 km above Lona, 37 km S Shuli (6.3 km ex jct. rte. 21), 7. IV. 1991, H. G. Nelson (FMCh). Taitung Hsien: Tzepeng, I.-II. 1964, T. C. Maa (HT; Bishop Museum). Hualien Hsien: 1 ♀: Taroko National Park, Chungyantienshi (River) Waterfall, 2300 m, 10. V. 1990, wet moss and debris in a spray zone of a waterfall, A. Smetana (cS). 1 ♀: Nantou Hsien: Sun Lin Sea, rte. 151, 16 km SSE Luku, 6. IV. 1991, H. G. Nelson (FMCh) (cf. det.).

PM of a male from Shanlinchi: wH: 56; adE: 39; IE: 18; IT: 11; wP: 44.5; IP: 45; wEl: 71.5; IEI: 75; IS: 65.

Male: Trochanters simple. Medial area of metasternum flat, narrowly impressed and impunctate posteriomediaally, remainder of medial area finely and very densely punctate, interstices much narrower than half diameters of punctures; with shallow microsculpture; acam with a slightly finer and slightly less dense punctation, punctation of sides of metasternum about as coarse as, but slightly less dense and shallower, than that on medial area. Sternites 3-6 finely and densely punctate throughout, interstices smooth, sternite middle indistinctly impressed posteriomediaally, more densely punctate and pubescent medially, posterior margin distinctly emarginate. Sternite 8 with a broad emargination in about posterior sixth. Sternite 9 broadly rounded and crenulated apically (fig. 78), apicolateral brush strong and dense, distinctly longer than the sternite. Tergite 10 as in fig. 72, less triangularly pointed than in female (see fig. 71). Aedeagus long with median lobe triangularly narrowed (fig. 74), apical portion at least as broad as parameres anteriorly, internal sac consisting of a long and broad, strongly sclerotized tube and of membranes with strong spines basally and less strong spines apically. Parameres somewhat longer than median-lobe, with about 30 evenly set setae.

*Comments.* The male is here described for the first time. *Dianous acuminifer* is in external characters quite similar to several related species and may be positively identified only by its sexual characters. The metallic color is variable in specimens from Sun Lin Sea: some areas are bright bluish, others brassy to dark-green, no specimen is totally bluish. One female of this series differs from the other 9 by shape of sternite 8 (fig. 80) and by weak brush of valvifer, but the punctation of tergite 8 and the metallic tint fit well the other specimens, so this single female is regarded as a variation of *D. acuminifer*.

### *Dianous angulifer* sp. n.

Type Material. Holotype (♀): Taiwan: Chiayi Hsien: Alishan, 2180 m. Sister Ponds, forest litter, 26. IV. 1990, L. LeSage (LL 24 a) (MHNG).

This new species is the sister species of *D. acuminifer* Puthz which it resembles in nearly all respects, but it differs mainly by the distinctly different shape of the terminal abdominal sterna.

Dark blue metallic, rather dull, entire body moderately finely and very densely punctate and densely set with golden, recumbent pubescence, elytra with remarkable tortuous bands of pubescence. Antennae, palpi, and legs black with blue metallic tint, antennal club and tarsi blackish brown. Clypeus and labrum bright blue metallic, densely pubescent. Segment 4 of metatarsi simple, with a short bristle shoe.

Length: 6.5 – 7.5 mm (fore parts: 3.7 mm).

PM of HT: wH: 54; adE: 37; lE: 17; IT: 10; wP: 42; IP: 41.5; wEl: 70; lEl: 73; IS: 62.

Male: Unknown.

Female: Ventral characters closely resembling those of *D. acuminifer* (see above), but punctuation of sternite 8 somewhat coarser and distinctly denser, interstices distinctly less large than diameter of punctures, posterior margin shallowly emarginate (fig. 76). Valvifer rounded apically, apical brush much weaker than that of *D. acuminifer*, 2/3 as long as valvifer. Tergite 10 (fig. 73) triangularly narrowed, apex rounded.

In most other respects quite similar to *D. acuminifer*, but interstices between punctuation of head smooth, interstices of pronotal punctuation nearly smooth, broad abdominal paratergites directed slightly more (distinctly) upwards, the punctuation of tergite 8 about as coarse as that on elytra and dense, interstices distinctly smaller than half diameters of punctures (in all *D. acuminifer* except one specimen punctuation of tergite 8 is distinctly less coarse and less dense, interstices as large as half diameters of punctures or larger).

*Comments.* It may be argued that the described characters fit into the variation range of *D. acuminifer*. But I do not think so, mainly because of the entirely different apical brush of the sternum 9 (valvifer). This character distinguishes *D. angulifer* positively also from *D. uniformis* Zheng and *D. fauveli* sp. n. 1 ♀: Nantou Hsien: Sun Lin Sea. rte. 151, 16 km SSE Luku, 6. IV. 1991, H. G. Nelson (FMCh) is with some doubt regarded as belonging to *D. angulifer* (see Comments under *D. acuminifer*). *Dianous angulifer* is also very near to *D. yunnanensis* Puthz but differs from it by the lack of spine at metatrochanters.

Etymology: *angulus* (Latin) = angle: *Dianous* who has an (apical) angle.

### *Dianous uniformis* Zheng

*Dianous uniformis* Zheng, 1993: 203 f. figs.

Material examined: 8 ♂♂, 2 ♀♀: Sichuan: Emei Shan, 7.X.1985, G. M. de Rougemont (cR, cP); 2 ♂♂, 2 ♀♀-PT: Emei Shan, 23-24.VII.1983, Gou Zheng-yue & Lue Ying (cP). [HT and other PT ♂♂, 2 ♀♀-PT: Emei Shan, 23-24.VII.1983, Gou Zeng-yue & Lu Ying (cP). [HT and other PT deposited in the Dept. Biol., Sichuan Teachers College]

This species is very similar, and closely related, to *D. acuminifer* and *D. angulifer*.

Blackish blue metallic (sometimes with olivaceous shine), rather dull, head moderately finely and densely punctate, pronotum (except for narrow medial area) slightly more finely and densely punctate, elytra somewhat more coarsely and very densely punctate (punctuation less dense on anterior half, extremely dense, nearly confluent posteriomedially), abdomen finely and densely punctate, somewhat less densely so medially. Pubescence whitish yellow, very distinct, recumbent, especially remarkable on elytra with tortuous bands of pubescence. Antennae, palpi, and legs dark blue metallic. Clypeus and labrum blue metallic, densely pubescent. Fourth metatarsal segment simple, with moderately sparse bristle shoe.

Length: 7.5 – 9.5 mm (fore parts: 4.3 mm).

PM of one male: wH: 61; adE: 41; IE: 21; IT: 11; wP: 46; IP: 47,5; wEl: 79; lEl: 85; lS: 73.

Male: Trochanters simple. Medial area of metasternum flat, slightly impressed posteriomediaally with narrow, impunctate shining area medially about as broad as second segment of maxillary palpi, lateral areas finely and densely punctate, interstices nearly half as large as half diameters of punctures, shallowly microsculptured, acam more finely and less densely punctate. Punctuation on middle of sternites 3-6 about as fine and dense as that on lateral portions, sternite 7 simple, very finely and very densely punctate and pubescent posteriomediaally, posterior margin shallowly emarginate. Sternite 8 with a broad and shallow emargination in about posterior tenth. Sternite 9 rounded and crenulated apically (fig. 75), apicolateral brush strong and dense, slightly longer than sternite. Tergite 10 very broadly rounded at posterior margin. A e d e a g u s in general as that of *D. acuminifer*, but apical portion of median lobe (fig. 70) narrower, narrower than parameres at apex, internal sac consisting of broad, strongly sclerotized tube and numerous membranes densely set with short, strong spines. Parameres slightly longer than median lobe, with about 22 long and strong setae on apical quarter.

Female: Ventral characters as those of male, but sternite 7 without apical emargination. Sternite 8 with distinct excision apically (fig. 79). Valvifer rounded apically, with strong brush about 1/3 longer than valvifer. Tergite 10 as that of *D. angulifer* (see fig. 73).

Punctuation and pubescence very similar to that of *D. acuminifer*, but punctuation of fore parts not as dense, interstices of frontal punctuation repeatedly as large as diameters of punctures, punctuation of pronotum less crowded, punctuation of anterior half of elytra slightly less dense, interstices often half as large as half diameters of punctures, rarely larger, punctuation near posterior margin of elytra less rough.

*Comments.* *Dianous uniformis* may be easily distinguished from *D. acuminifer* and *D. angulifer* by its blackish blue metallic habitus, by the slightly less dense punctuation, and by the sexual characters. It differs from *D. yunnanensis* Puthz by the broader head, slightly longer pronotum, larger size, and the sexual characters (the aedeagus of *D. yunnanensis* is similar externally, but has a totally different internal sac with a very broad internal tube narrowed posteriorly, and only very weakly sclerotized membranes set with indistinct toothlike elements; also parameres have strong setae at least on anterior half).

### *Dianous luteoguttatus* Champion

*Dianous luteoguttatus* Champion, 1919: 98 f.; Puthz, 1980b: 6, fig.; Rougemont, 1987a: 49

Material examined: Taiwan: Nantou Hsien: 1 ♀: Shanlinchi, 1650 m, 19. V. 1991, on wet rocks in a creek (see photo 2 in Smetana, 1995), A. Smetana (cS); 1 ♀: ibidem, 10. V. 1990, fanchage dans forêt primaire, L. LeSage (LL 90-4) (coll. LeSage).

*Comments.* This species was until now known from N. India and Nepal: n e w t o C h i n a. The elytral spot is somewhat larger in the Taiwanese females than in the Nepalese male (from Induwa Kholā Valley), with diameter nearly as large as the length of the first segment of metatarsus, while in the Nepalese male it is only as large as the

length of the eighth antennal segment. In the Taiwanese females the sternites 3-6 are more sparsely punctate than in the male described below, with the interstices of the medial punctation distinctly larger (up to twice as large) than diameters of punctures.

The male sexual characters have not been described yet, therefore their description based on a male from Nepal follows:

Male: Metasternum convex, median area plain, with a narrow, medial, line-like incised longitudinal impression, lateral punctation rather fine and moderately dense, diameters of punctures smaller than basal cross section of third antennal segment, interstices shallowly microsculptured, larger than diameters of punctures but less large than two punctures combined. acam very finely and densely punctate and pubescent; declining lateral areas of metasternum finely and densely punctate, interstices shallowly reticulated. Medial punctation of sternites 3-6 slightly coarser and somewhat sparser than lateral punctation, interstices mostly nearly as large as diameters of punctures; sternite 7 much more densely punctate and pubescent medially than laterally, posterior margin slightly emarginate; sternite 8 with a broad emargination in about posterior eighth; sternite 9 with a distinct tooth apicolaterally (fig. 90), some sclerotized fringes and asa $\bar{c}$ l apicomediaally, apicolateral brush moderately strong, 3/4 as long as sternite. Tergite 10 broadly rounded. A e d e a g u s (fig. 87) with long, anteriorly narrow, lanceolate median lobe, apical portion about twice as broad as parameres at apex; internal sac consisting of a broad, strongly sclerotized tubal piece and several membranes set with differently shaped spines. Parameres slender, with 11 or 12 long setae only on anterior half.

Female: Ventrally similar to those of male, but sternite 8 broadly rounded apically (no projection). Valvifer (fig. 1. Puthz, 1980b), apical brush somewhat shorter than the valvifer. Tergite 10 rounded apically.

### *Dianous rougemontianus* sp. n.

*Dianous vietnamensis*; Zheng, 1994: 479

Type material. Holotype (male) and allotype (female): Sichuan: Emei Shan, X. 1986. G. M. de Rougemont (cR in BMNH). Paratypes: 4 ♂♂, 8 ♀♀ same data as holotype (cR, cP); 1 ♀: ibidem 600-1050 m, 5.-19. V. 1989. L. Bocák (NHMB); 2 ♂♂: ibidem 1530 m, 22. VI. 1994. H. Schillhammer (4a) (NHMW); 2 ♂♂: Da Bai Shan, IX. 1980. Zhou Ping (cP, cZheng). The specimens recorded as „*D. vietnamensis*“ by Zheng should be regarded as belonging to this new species.

This new species is closely allied to *D. vietnamensis* Puthz and has been confounded with him. It also resembles very much *D. ruginosus* Zheng.

Blackish green metallic, with olivaceous and/or brassy tint, moderately shining, head moderately coarsely and densely punctate, pronotum coarsely and very densely, slightly confluent punctate, elytral sculpture consisting of mostly long rugae, directed on anterior half from suture posteriolaterad to about middle and from there posterio-mediad on posterior half; abdomen very finely and very densely punctate. Pubescence of head and abdomen distinct, short, recumbent. Antennae, palpi, and legs black with metallic tint, three outer segments lighter, tarsi  $\pm$  brownish. Clypeus and labrum greenish-blue, moderately sparsely pubescent. Fourth tarsal segment simple, lacking bristle shoe.



Length: 4.3 – 5.8 mm (fore parts: 2.7 – 2.9 mm).

PM of the HT: wH: 42; adE: 25.5; lE: 18; lT: 5; wP: 33.5; lP: 34.5; wEl: 48; lEl: 51; lS: 44.

Male: Metasternum broadly and shallowly impressed, deeply and densely reticulate, but not as dull as e. g. that of *D. aereus*, impunctate medially, lateral areas of triangular medial area with about 18-20 moderately coarse punctures as large as basal cross section of third palpal segment, acam very finely and sparsely punctate, interstices with very shallow groundsculpture, shiny. Sternites 3-5 very sparsely, finely punctate medially, but without distinct separate smooth area; sternite 6 with a distinct and broad posteriomedial impression, medial punctation about as dense as that on sides, posterior margin broadly emarginate; sternite 7 with a distinct medial impression, sides of impression distinctly elevated and toothlike prominent posteriorly, distinctly extending beyond semicircularly emarginate posterior margin of sternite; sternite 8 with a deep notch in posterior third (length of sternite: depth of notch = 83: 28); sternite 9 (fig. 99), with sclerotized fringes and asac apicomediaally, apicolateral brush strong but distinctly shorter than sternite. Tergite 10 broadly rounded. *Aedeagus* (fig. 83), anterior portion of median lobe with long and distinct ventrolateral ridges (missing in *D. vietnamensis*, but present in *D. karen* and in *D. aereus*), strongly and densely pubescent; parameres with 18 very strong and long equally set amS and with additional dorsal series of about 12 shorter setae.

Female: Ventral characters similar to those of male, but sternites 6 and 7 not impressed; sternite 8 (fig. 97). Valvifer subtriangular apically, apical brush shorter than valvifer. Tergite 10 triangular.

In most respects as *D. ruginosus* Zheng, but larger, punctation of head somewhat coarser, median portion of frons less strongly elevated, antennae longer; extending by 3.5 segments (in *D. ruginosus* by 3 segments) beyond posterior margin of the pronotum when reflexed, pronotum less broad, slightly coarser but less confluent punctate, elytra narrower (longer than broad), punctures antero-medially mostly well-defined (in *D. ruginosus* mostly confluent). Metatarsi about 4/5 as long as metatibiae, segment I slightly shorter than three following segments combined, distinctly longer than last segment. Entire body distinctly, but shallowly reticulated.

*Comments.* *Dianous rougemontianus* differs from *D. vietnamensis* Puthz and *D. karen* Rougemont by the greenish-olivaceous tint of the fore parts (blackish-blue in the compared species), by the broader head, longer antennae and longer elytra, by the coarser but somewhat less rugose punctation of the fore parts, and by the the sexual characters. It differs from *D. aereus* Champion by the less elevated medial portion of the frons, by the coarser punctation of the head, the longer antennae, and by the sexual characters.

*Etymology:* This new species is warmly dedicated to my dear friend Guillaume de Rougemont (London), who made substantial contributions to the knowledge of the genus *Dianous* and who provided his Chinese *Dianous* for this study.

*Dianous vietnamensis* Puthz

*Dianous vietnamensis* Puthz, 1980a: 234 f. fig.

Material examined: 2 ♂♂: Hainan: 30 km E Maoyang, above Wuzhi Shan Resort, stream ca. 5 m wide, densely shaded, flowing partly through primary forest, 700-800 m. 18. I. 1996, Jäch (194) (NHMW); 1 ♀ (cf. det.): Xishuangbanna, 20. I. 1993, G. M. de Rougemont (cR). 1 ♂, 1 ♀: N Laos: 28 ♂♂, 36 ♀♀, Prov. Lg. Nam Tha, ca. 20 km SE Muang Sing, 950 m, 12./13. VI. 1996, Schillhammer (25) (NHMW, cP); 4 ♂♂, 7 ♀♀, Prov. Lg. Nam Tha, ca. 30 km NW Lg. Nam Tha, 800 m, 16./18. VI. 1996, Schillhammer (28, 30) (NHMW, cP); 1 ♂, Bolikhamsai Prov., Ban Nape-Kaew-Nua-Pass, 600 m, 18°22.3' N, 105° 9.1 E, 18. IV. – 1. V. 1998, Jendek & Sausa (cHromádka).

Described from Vietnam: new to China and Laos.

The identification of the Yunnan-female has to be assured by the respective male.

*Dianous karen* Rougemont spec. propr.

*Dianous karen* Rougemont, 1981a: 357 ff. figs.: 1983a: 12; 1986: 265 f.

The description of *D. rougemontianus* made it necessary to revise closely related taxa. The improvement of our knowledge of the genus has considerably increased in the last years, allowing the usage of characters that were formerly neglected, misvalued, or not really understood, e. g. arrangement and number of the setae on parameres, sculpture of the metasternum, shape of tergite 10, etc. Using this knowledge, I believe now that *D. karen*, which has been synonymized by its author with *D. vietnamensis* in 1986, is a good species. It is distinguished from *D. vietnamensis* by the number and arrangement of the parameral setae, by the sculpture of the metasternum, and by the generally less strongly pronounced ventral characters of the terminal sternites in the male.

To make the comparison of the two species possible, these are the PM of a Thailand male: wH: 37; adE: 20; lE: 15; lT: 3; wP: 29; lP: 28.5; wEl: 45; lEl: 46.5; lS: 40. Length of body: 3.7 – 4.5 mm (fore parts: 2.3 – 2.4 mm).

Male (from Doi Suthep, 1000 m. 14. I. 1990, H. Malicky, cP): Medial area of metasternum broadly flattened somewhat impressed posteriomediaally, entire medial area deeply and very densely reticulated, dull with faint shine, reticulation becoming slightly less dense toward middle coxae, but there is no distinct bipartition in sculpture as in *D. vietnamensis* (metasternum shallowly reticulate, shiny and moderately coarsely and moderately sparsely punctate anterio-medially, but extremely densely and deeply reticulate and quite dull, with punctation indistinct posteriomediaally), punctation of medial area moderately fine to moderately coarse and moderately sparse, acam finely and moderately densely punctate, interstices distinctly reticulated but shiny. Sternites 3-6 medially slightly more coarsely and somewhat more sparsely punctate than laterally; sternite 7 distinctly impressed posteriomediaally, posterior sides of impression carinate, tooth-like extending beyond posterior margin of sternite, which is distinctly emarginate between teeth (impression and teeth somewhat stronger in *D. vietnamensis*). Sternite 8 with a deep notch in about posterior quarter; sternite 9 (fig. 96), with fine sclerotized fringes and asacI apicomediaally, apicolateral brush strong, somewhat shorter than sternite. Tergite 10 broadly rounded. Aedeagus (fig. 82); proximal half of each

paramere without setae, distal half with 9 (published figure of the holotype) – 11 (Doi Suthep) strong setae, dorsal series of each paramere setae with 7 setae in my Doi Suthep specimen (holotype: ?, not figured; aedeagus lost: Rougemont, 1981). The species lives also in Laos: 1 ♂ Laos c.: Bolikhamsai Prov., Ban-Nape-Kaow-Nua-Pass, 18. IV.- 1. V. 1998, Jendek & Sousa (cHromádka); n e w t o L a o s.

*Comments.* Since the material is still sparse, the variability ranges of *D. vietnamensis* and *D. karen* cannot be positively assessed; the number of setae is probably variable in a limited space, I think it is reasonable to consider the differences in the arrangement of parameral setae as a specific character.

### *Dianous brevicornis* sp. n.

Type material. Holotype (female) and 1 ♀-paratype: Yunnan: 50 km N. Lijiang, Yulongshan Natural Reserve, (NHMW, c P).

Very similar to *D. aereus* Cameron, and different only as follows.

Greenish-aeneous metallic, rather shiny, head moderately finely and densely punctate, pronotum moderately coarsely, irregularly and confluent punctate, elytral sculpture consisting of long rugae directed on anterior half from suture posteriomedial, on posterior half from middle backwards toward the suture; abdominal punctation very fine and very dense. Antennae, palpi, and legs black with greenish metallic tint, antennal club and tarsi indistinctly paler. Clypeus and labrum greenish, sparsely pubescent. Pubescence of pronotum and elytra indistinct, that of head and abdomen distinct, short, dense, recumbent. Fourth segment of metatarsus simple, with a few longer setae, lacking bristle shoe.

Length: 3.3 – 4.1 mm (fore parts: 2.2 mm).

PM of HT: wH: 32.5; adE: 21; lE: 14.5; IT: 4; wP: 27.5; IP: 27.5; wEl: 42; lEl: 42.5; lS: 35.

Male: Unknown.

Female: Metasternum strongly convex, medial area very broadly flat, shallowly impressed and impunctate posteriomedially, lateral portions of medial area each with 18-20 moderately fine punctures, interstices densely but moderately shallowly reticulate, strongly shiny (thus distinctly different from *D. aereus* Cameron and *D. ruginosus* Zheng), acam nearly impunctate, ground sculpture even shallower than that of middle of metasternum. Sternites 3-6 finely and very sparsely punctate medially, interstices at least twice as large as diameters of punctures; sternite 7 more densely punctate and pubescent medially than on sides, not impressed, posterior margin very slightly emarginate. Sternite 8 about as in fig. 97. Valvifer obliquely truncate apically, apical brush thin, nearly half as long as valvifer. Tergite 10 moderately triangularly pointed.

Antennae distinctly shorter than those of *D. aereus*, extending beyond posterior margin of pronotum by 1-5 segments when reflexed, outer segments nearly as broad as long. Punctation on middle of abdominal tergites somewhat less dense, interstices on middle of tergite 6 distinctly larger than very fine punctures (in *D. aereus* less large than diameters of less fine punctures).

*Comments.* *Dianous brevicornis* differs from *D. aereus* Cameron by the distinctly shorter antennae and by the ventral characters described above, particularly by the the median area of metasternum, which, in *D. aereus*, is completely dull because of the extremely dense and deep reticulation.

Etymology: *brevicornis* (Lat.) = with short antennae.

### *Dianous ruginosus* Zheng

*Dianous ruginosus* Zheng, 1993: 204 figs.

Material examined: 1 ♂: Sichuan: Emei Mt., 500 m. 4.-20. V. 1989 (NHMB); 2 ♀♀: Mt. Emei, ♀♀-PT: Emei Shan, 1500 m. 30. VII. 1982, Gao Xin-fen (cP) [HT and more PT in the Dept. Biol., Sichuan Teachers College.]

This species also closely resembles *D. aereus* Cameron.

Blackish-green metallic with olivaceous tint, moderately shining, head moderately finely and densely punctate, pronotum moderately coarsely and very densely, confluent punctate, elytral sculpture consisting mostly of long rugae, directed on anterior half from suture posteriolaterad to about middle and from there posteriomedial on posterior half; abdomen very finely and very densely punctate. Pubescence of head and abdomen distinct, short, recumbent. Antennae, palpi, and legs black with metallic tint, three outer antennal segments paler, sometimes light brown, tarsi more or less brownish. Clypeus and labrum blackish with metallic tint, moderately sparsely pubescent. Fourth segment of metatarsi simple, lacking bristle shoe.

Length: 3.8 – 4.7 mm (fore parts: 2.3 – 2.4 mm).

PM of one male: wH: 38; adE: 24; lE: 17; lT: 4; wP: 30.5; lP: 31; wEl: 44; lEl: 44; lS: 38.

Male: Medial area of metasternum broadly flat, densely and deeply reticulate, with a faint shine (not quite dull as in *D. aereus*), middle shallowly impressed, punctation about equally distributed, moderately coarse, diameters of punctures about as large as basal cross section of third palpal segment, each half of medial area with about 20 punctures, acam with a few finer, shallow punctures, interstices with shallower reticulation than that on medial area of metasternum, declining lateral areas of metasternum finely and densely punctate, interstices with very shallow ground-sculpture, shiny. Medial punctation of sternites 3-6 as fine as, but slightly sparser, than that on sides, interstices larger than diameters of punctures, but less large than two punctures combined; sternite 6 with a broad and very shallow emargination posteriorly; sternite 7 with a distinct impression posteriomedially, sides of impression elevate and carinated posteriorly, somewhat extending beyond posterior margin of sternite, punctation of impression denser than lateral punctation, posterior margin distinctly emarginate. Sternite 8 with a broad and deep emargination in about posterior quarter; sternite 9 acute apicolaterally (fig. 100), with short sclerotized fringes apicomediaally, apicolateral brush yellowish brown, weak and moderately short, about two thirds as long as sternite. Tergite 10 broadly rounded. A e d e a g u s as in fig. 81, median lobe broadly rounded anteriorly, with long setae ventrally, internal sac with broad tube, and with strongly spinose membranes proximally, and finely crenulate membranes distally.

Parameres much longer than median lobe, each with about 20 evenly set moderately strong setae.

Female: Ventral characters similar to those of male; sternite 7 slightly more densely punctate and pubescent posteriomedially than laterally, no impression, no apical emargination. Sternite 8 as in fig. 98. Valvifer acute apically, apical brush short, indistinct, distinctly shorter than valvifer. Tergite 10 triangularly narrowed.

In most respects as *D. aereus* Cameron, but differs by the last 3 antennal segments lighter than the rest of antennae, and by the ventral characters: in *D. aereus* the median area of the metasternum is completely dull, the apical brush of the sternum 9 is brownish and longer, and the aedeagus is clearly different

*Comments.* I originally considered *Dianous ruginosus* Zheng to represent a subspecies of the Himalayan *D. aereus* Cameron. – One female is a more robust specimen and mainly black (PM: wH: 39; adE: 25; IE: 18; IT: 4; wP: 32.5; IP: 33; wEl: 44; IEl: 44; IS: 36), sternites 3-6 are somewhat more sparsely punctate, interstices medially two times as large as diameters of punctures

### *Dianous rugipennis* sp. n.

Type material. Holotype (♀): NW- Hunan: Wulingyuan, N. Dayong Sixiuyu, 400 m, 31. X. 1993 (NHMW).

This new species resembles both *D. championi* Cameron and *D. cupreogutta* sp. n., it is the sister species of *D. rugosipennis* sp. n.

Black with dark blue metallic tint, shining, fore parts coarsely and densely punctate, sculpture of almost entire elytra strongly rugose, forming long confluent rugae. Abdomen finely and moderately sparsely punctate. Pubescence of fore parts moderately distinct, abdomen with rather dense and recumbent pubescence. Antennae black, club dark brown. Maxillary palpi with first segment brown, segments 2 and 3 dark brown. Legs black, trochanters and tarsi blackish brown. Clypeus and labrum black with faint bluish tint, sparsely pubescent. Segment 4 of metatarsi simple.

Length: 4.3 – 5.3 mm (fore parts: 2.6 mm).

PM of HT: wH: 42; adE: 23; IE: 21; IT: 5; wP: 29; IP: 32; wEl: 43.5; IEl: 48; IS: 38.

Male: Unknown.

Female: Midline of middle portion of metasternum narrowly impunctate, sides moderately densely set with coarse punctures, acam with some very fine punctures. Abdominal sternites 3-6 finely and moderately sparsely punctate medially, sternite 7 finely and densely punctate and pubescent posteriomedially, posterior margin simple. Sternite 8 (fig. 93). Valvifer (fig. 92) apically acute, apical brush moderately distinct, less than half as long as valvifer. Tergite 10 rounded.

Head distinctly but slightly narrower than elytra, longitudinal furrows deep and very long, median portion of frons about as broad as and as strongly elevated as each of the side portions; punctuation coarse and dense, diameters of punctures slightly less than basal cross section of third antennal segment, interstices mostly narrower than half diameter of punctures, but becoming as large as, to somewhat larger on a small area

posteriorly near medial eye margins (not on middle of frons). Antennae moderately slender, when reflexed, extending only by last segment beyond posterior margin of pronotum, outer segments nearly 1.5 x as long as broad. Pronotum distinctly constricted anteriorly and posteriorly, impressions about same as in *D. cupreogutta*, thus less deep than in *D. championi*; punctuation coarse and dense, rarely slightly confluent, diameters of punctures as large as, or slightly larger, than basal cross section of third antennal segment, interstices smaller than half diameter of punctures, except posteriomedially, on small impunctate area about as broad as two and as long as three punctures combined. Elytra subquadrate, sutural and humeral impressions distinct; punctuation coarser than that on pronotum, forming long oblique rugae directed laterad in anterior half, mediad in posterior half; some vorticose sculpture present on posterior half but no distinct rosette and no traces of coppery or any other similar spot. Abdomen relatively convex, paratergites narrower than those of compared species, appreciably declining (sides of sternites visible in dorsal aspect), paratergites of segment 4 about as broad as metatibia at base, punctuation of paratergites very fine, dense anteriorly, becoming sparser posteriad; punctuation of tergites 3-7 very fine and moderately sparse, diameters of punctures slightly less than one inner eye facet, interstices at least 1.5 x as wide as diameters of punctures, somewhat larger on middle of tergites. Legs moderately slender, metatarsi about 5/8 as long as metatibiae; first segment slightly shorter than 3 following segments combined (25: 27), distinctly shorter than last segment (25: 30), segment 4 simple. No microsculpture, except tergite 7 faintly reticulated, tergite 8 with shallow microsculpture, tergite 10 nearly smooth.

*Comments.* *Dianous rugipennis* is distinguished from *D. cupreogutta* by its unicolorous elytra, the denser punctuation of the head and pronotum, by the more strongly rugose sculpture of the anterior portion of the elytra, by the narrower, declining paratergites, and by the simple tarsi. It differs from the very similar *D. championi* (specimens of which are not fully winged) by the denser punctuation of the head and the pronotum, by the shorter antennae and legs, the not acute rugae on elytra (rugae are narrowly rounded above), the narrower, declining paratergites, the golden (not silver) pubescence, and by the simple fourth tarsal segment. From *D. rugosipennis* sp. n. it is distinguished by smaller elytra, less coarse sculpture, longer antennae and smooth interstices of the punctuation of tergite 3-6 (see above).

Etymology: *ru*ga (Latin) = fold or ruga, *-pennis* (Latin) = on elytra: *Dianous* with rugae on the elytra.

### *Dianous rugosipennis* sp. n.

Type material. Holotype (♂): Fujian: Chong'an Wuyi Shan, 1 km W Wuyi Gong Village (= Shanqian, ca. 10 km S Chong'an City), residual pools in dry riverbed in steep valley, crystalline rock, 250 m, 15./ 18. I. 1997, Ji & Wang (CWBS 240) (NHMW). Paratypes: 1 ♂, 4 ♀♀: Anhui: Huang Shan 60 km NNW Huang Shan City [=Tunxi], stream (beneath cable car), ca. 3- 5 m wide, almost completely dried out, surrounded by primary forest, very big granitic rocks and sand, short sections with running water (20-30 cm wide), small residual pools with decaying leaves, near Tang Kou, 900-1000 m [figs 17, 20 in Jäch & Li, 1998], 31. X. 1997. Schönmann (CWBS 292) (NHMW, cP).

This new species resembles *D. radiatus* Champion in general habitus, it is very similar to its sister species *D. rugipennis* sp. n..

Moderately shining, black with more or less distinct dark-greenish metallic tint. Head coarsely and densely punctate, pronotum very coarsely and slightly confluent punctate, elytra very coarsely punctate, sculpture confluent, abdomen finely and moderately densely punctate. Pubescence of fore parts less distinct, that of abdomen distinct and recumbent. Antennae, maxillary palpi, and legs blackish with faint metallic tint, last antennal segments slightly infusate. Clypeus and labrum dark-metallic, sparsely pubescent. Segment 4 of metatarsi simple.

Length: 4.8 – 5.8 mm (fore parts: 2.8- 3.0 mm).

PM of HT: wH: 44; adE: 26; IE: 21; IT: 5; wP: 33.5; IP: 35; wEl: 50.5; IEl: 46; IS: 46.

Male: Metasternum broadly convex, median area strongly shining with very faint microsculpture, punctation moderately fine and sparse, diameters of punctures smaller than basal cross section of second segment of maxillary palpi, interstices twice and more as wide as diameters of punctures, posterior middle narrowly impunctate, acam almost smooth, with a few very fine punctures. Medial punctation of sternites fine and sparse. Sternite 7 shallowly impressed and densely punctate and pubescent postero-medially, posterior margin shallowly emarginate. Sternite 8 with a semicircular emargination in about posterior eighth. Sternite 9 acute apicolaterally (fig. 95), apical brush about half as long as the sternite, with a small area set with asacI apicomediaIly. Tergite 10 rounded. *A e d e a g u s* (fig. 84, 86) with slender median lobe triangularly pointed apically, apical portion densely set with moderately long setae ventrally, internal sac strongly sclerotized. Parameres slender with 15-16/ 24-25 equally distributed setae.

Female: Sternite 8 (fig. 94), stronger triangular apically than in *D. rugipennis*. Valvifer about as in *D. rugipennis*, apical brush stronger, nearly as long as stronger sclerotized portion of the valvifer. Tergite 10 rounded.

Head distinctly narrower than elytra, longitudinal furrows of frons deep and very long, median portion nearly as broad as each of the side portions, flat anterior, distinctly elevated posterior; punctation coarse and dense, diameters of punctures variable, large punctures about as large as basal cross section of third antennal segment, interstices mostly smaller than half diameters of punctures. Antennae short, when reflexed extending to about posterior margin of the pronotum, penultimate segments about one third longer than broad. Pronotum with the sides strongly convex in anterior half, strongly concave posteriorly; a deep transverse impression near anterior margin, deep lateral impressions in about middle, two distinctly elevated portions posteriorly behind the lateral impressions; punctation very coarse and dense, distinctly rugose near posterior margin, diameters of punctures about as large as medial cross section of third antennal segment, interstices mostly smaller than half diameters of punctures, some exceptions posteromedially, where interstices can become as large as punctures. Elytra subquadrate, posterior margin deeply emarginate, sutural impression distinct in anterior half, a shallow impression in lateral middle where internal rugae end in a point; sculpture very coarse and dense with long rugae, which are directed posterolaterad in anterior half of elytra, anterolaterad in posterior half; rugae about as wide as first segment of middle

tarsi. Abdomen moderately convex, paratergites moderately broad, in sagittal level, those of segment 4 about as broad as metatibiae at broadest point of its anterior third, punctation of paratergites fine and very dense anteriorly, distinctly sparser posteriorly; punctation of tergites 3-7 fine and moderately dense, interstices about as large or slightly larger than diameters of punctures; punctation of tergites 8 and 10 fine and sparse, distinctly sparser than that of tergite 7. Legs slender, metatarsi two thirds as long as metatibiae, first segment slightly shorter than 3 following segments combined (30: 32), about as long as segment 5, segment 4 simple. Fore body with very shallow traces of microsculpture, microsculpture of abdomen slightly more distinct (for identification in a key this species should run amongst those which are lacking microsculpture).

Variability: The specimens from Anhui are black with faint greenish tint; the aedeagus is almost identical to that of the HT, but parameres have 24-25 setae.

*Comments.* *Dianous rugosipennis* is distinguished from *D. radiatus* Champion by coarser and denser punctation of head and pronotum, by the shorter antennae, and by the darker greenish shine, from *D. championi* Cameron also by coarser and denser punctation of head and pronotum and shorter antennae, and by the distinct greenish shine. From both species by the aedeagus, especially by the equal distribution of paramere setae. From the very similar *D. rugipennis* it is distinguished by the much larger elytra (wH: wEl in *D. rugipennis* = 0.97, in *D. rugosipennis* = 0.84- 0.90), coarser sculpture of the fore parts, shorter antennae and faint but distinct microsculpture on abdomen.

Etymology: *rugosipennis* (Latin) = having rugosely sculptured elytra.

### *Dianous atrocyaneus* sp. n.

Type material. Holotype (♂): Taiwan: Taoyuan Hsien: Takuanshan Forest, 1600 m, 17. IV. 1990. on wet rocks in a creek. A. Smetana (cS).

This new species belongs to the group of *D. chinensis* Bernhauer and is the sister species of *D. yoshidai* Naomi from Iriomote Island near Taiwan. In general habitus (proportions and sculpture), it closely resembles *D. banghaasi* Bernhauer.

Moderately shining, fore parts completely black dorsally, entire abdomen and fore parts bright blue metallic ventrally. Punctation of fore parts coarse and dense, slightly confluent on some areas of elytra, abdomen finely and densely punctate. Pubescence of fore parts whitish, long, erect, especially conspicuous at sides of elytra, abdomen with dense, moderately recumbent golden pubescence. Antennae black, club brownish. Palpi dark brown. Legs black with dark blue metallic tint, trochanters dark brown. Clypeus and labrum dark blue metallic with long and moderately dense pubescence. Fourth segment of metatarsi slightly but distinctly bilobed.

Length: 5.2 – 6.2 mm (fore parts: 3.0 mm).

PM of HT: wH: 41.5; adE: 25; IE: 18; ITe: 6; wP: 34.5; IP: 36.5; wEl: 55.5; IEI: 55; IS: 49.

Male: Metasternum broadly convex, flat medially, narrow medial area (as wide as 4-5 punctures combined) impunctate, punctation coarse and rather dense, becoming



much finer and sparser toward declining lateral portions of metasternum, acam almost smooth. Sternites 3-5 medially finely and somewhat sparser punctate than on the sides; sternite 6 very shallowly impressed in posterior middle, punctuation as on the sides, sternite 7 with long, distinct medial impression finely and densely punctate posteriorly and very densely pubescent at posterior border, posterior margin shallowly emarginate. Sternite 8 with a deep, broad, rounded emargination in about posterior quarter. Sternite 9 with a distinct prominent tooth apicolaterally (fig. 116), apicolateral brush about 2/3 as long as sternite. Tergite 10 broadly rounded. A e d e a g u s (fig. 113) of the „*chinensis*-type“, parameres with 8 + 10/12 setae, apex of median lobe with about 26 short setae ventrolaterally.

Female: Unknown.

Head similar to that of *D. banghaasi*, punctuation of frons coarse and dense, diameters of punctures slightly less than cross section of third antennal segment, interstices mostly smaller than half diameter of punctures, somewhat larger, medially and posteriolaterally, rarely as large as or larger than diameters of punctures. Antennae slender, similar to those of *D. banghaasi*. Pronotum similar to that of *D. banghaasi*, punctuation coarser than on head, diameters of punctures may become as large as middle cross section of third antennal segment, punctuation transversely confluent near posterior margin. Elytra very large, subquadrate, sutural impression long and distinct, humeral impression shallow; punctuation as coarse as or somewhat coarser than in *D. banghaasi*, somewhat confluent in middle of each elytron, diameters of largest punctures about as large as cross section of second antennal segment, interstices distinctly smaller than half diameter of punctures, distinctly larger posteromedially on each elytron. Abdomen similar to that of *D. banghaasi*, with very broad paratergites, and fine and dense punctuation. Legs slender, metatarsi at least 2/3 as long as metatibiae, first segment much shorter than the 3 following segments combined (36: 47), about as long as last segment, segment 4 shortly bilobed (most distinct in anterior tarsi). Elytra with very faint traces of microsculpture, interstices of abdominal punctuation, except on tergite 8, nearly smooth.

*Comments.* *Dianous atrocyaneus* may be distinguished from all closely related species by the coloration. It differs from *D. yoshidai* Naomi (which has a dark coppery dot in the middle of the elytra just behind middle, a character that was not indicated in the original diagnosis but was taken from the holotype) by its larger size and by larger elytra. The hitherto undescribed male sexual characters of *D. yoshidai* are very similar to those of *D. atrocyaneus*, but sternite 8 has a deeper apical notch (in about posterior third), the median lobe has some more small setae ventro-laterally (27-30), parameres with less setae (7- 8).

Etymology: *ater* (Latin) = black, *cyaneus* (Latin) = bright blue. Refers to the coloration.

### *Dianous gemmosus* sp. n.

Type material. Holotype (♂) and allotype (♀): Yunnan: 100 km W Kunming. Diaolin Natural Reserve, 22. V.-2. VI. 1993 (NHMW, cP). Paratypes: 7 ♂♂, 5 ♀♀: Yunnan: Yipinglang, 1800 m, 25°05'N, 101°53'E, 8.-10.VI.1993, Bolm (NHMB, cP); 1 ♀: ibidem 2000 m, 25°05'N, 101°55'E, V. Kubán (NHMB).

This new species belongs to the *chinensis*-complex and is the sister species of *D. hammondi* Rougemont which it resembles closely. It is distinguished from him e. g. by a narrow triangular golden shining area in posterior middle of elytra.

Rather shining, black with bluish and some aeneous tint, elytra each with conspicuous golden-coppery area on posterior half near suture. Head moderately coarsely and densely punctate, pronotum coarsely and mostly densely punctate, somewhat rugose near anterior margin and in posterior impressions, elytra each coarsely sculptured, with long, mostly oblique rugae, which form a  $\pm$  regular oval rosette on posterior two thirds (figs 27, 28), abdomen, except tergites 8 and 10, very finely and densely punctate. Pubescence of fore parts moderately distinct, that of abdomen distinct and recumbent. Antennae blackish with slight metallic tint, base of individual segments narrowly brown, club dark brown. First segment of maxillary palpi brown, second and third segments blackish brown, bases of segments lighter. Legs black with some metallic tint, trochanters brownish, tarsi blackish brown. Clypeus and labrum blue metallic, moderately densely pubescent. Segment 4 of metatarsi distinctly bilobed (fig. 114).

Length: 5.3 – 6.5 mm (fore parts: 3.0 – 3.2 mm).

PM of HT: wH: 45; adE: 28; lE: 19; lT: 8; wP: 35,5; lP: 37,5; wEl: 55; lEl: 59; lS: 51.

Male: Metasternum broadly convex, broad triangular median area dull, extremely densely reticulated, medially impunctate, laterally moderately sparsely set with numerous moderately fine punctures, declining lateral areas of metasternum finely and densely punctate and pubescent, interstices smooth and shiny, acam finely and densely punctate and pubescent. Punctuation of sternites 3-5 in middle slightly less fine and somewhat sparser than that on sides, sternite 6 with distinct impression in posterior half, punctuation about same as that on previous sternites, posterior margin shallowly emarginate in similar way as that of sternite 5; sternite 7 with a long and narrow median impression, posterior half of impression bordered laterally by sharp keel toothlike prominent posteriorly, anterior half of impression very finely and very sparsely punctate, punctuation of posterior half moderately fine and very dense, posterior margin broadly emarginate. Sternite 8 with a round emargination in about posterior fifth. Sternite 9 serrate apically (fig. 117), apicolateral brush strong and long, as long as sternite. Tergite 10 broadly rounded. *A e d e a g u s* (fig. 123) with median lobe broad, deeply, about V-like emarginate apically, apical portion with about 30 short setae ventro-laterally. Parameres with two groups of setae: 9 or 10 long and strong ventral setae at apex, and about 7 shorter setae dorsally in anterior half.

Female: Ventral characters resembling those of male, but medial area of metasternum very shallowly reticulate and moderately shiny, lateral portions of medial area moderately coarsely and moderately densely punctate; sternite 6 simple, sternite 7 with a very shallow impression posteriomedially, moderately finely and very densely punctate, posterior margin very shallowly emarginate. Sternite 8 (fig. 115) triangularly rounded apically. Valvifer acute apically, apical brush longer than entire valvifer. Tergite 10 rounded, densely set with short and strong setae apically.

Head in general similar to that of the previous species; diameters of punctures on frons about as large as basal cross section of third palpal segment (thus distinctly smaller than basal cross section of third antennal segment), interstices mostly smaller than half diameters of punctures, distinctly larger posteriolaterally and on elevated medial portion, where they may exceed diameters of neighbouring punctures. Antennae very long, at least extending by last four segments well beyond posterior margin of the pronotum when reflexed, penultimate segments about twice as long as broad. Pronotum in general as that of the previous species; punctuation distinctly coarser than on head, diameters of punctures about as large as basal cross section of third antennal segment, interstices mostly slightly smaller than half diameters of punctures laterally, larger centrally, middle with distinct impunctate area about as long as fourth antennal segment and as broad as length of tenth antennal segment; punctuation on anterior transverse impression slightly confluent, punctuation of the posterior impressions (near posterior margin) distinctly confluent. Elytra subquadrate, sutural and humeral impressions distinct: in anterior third with punctuation about as coarse as that on middle of pronotum, but punctures obliquely extended; posterior two thirds with mainly long oblique rugae directed from middle of lateral margin posteriomediad toward suture and forming an obliquely-oval, more or less distinct rosette on lateral half (fig. 28); despite deep rugae and very narrow interstices surface of elytra distinctly shiny, not as dull as e. g. in *D. frater* Cameron. Abdomen with broad, slightly upwards directed paratergites, those of segment 4 about as broad as middle cross section of metatibia, punctuation of paratergites very fine and very dense throughout; tergite 7 with a broad palisade fringe apically (the species is fully winged); punctuation very fine and dense, diameters of punctures smaller than medial eye facets, interstices about as large as (laterally) or somewhat larger (medially) than punctures; punctuation of tergite 8 coarser but also dense; tergite 10 finely and sparsely punctate. Legs slender, metatarsi 2/3 as long as the metatibiae, first segment distinctly shorter than following 3 segments combined (43: 54), distinctly longer than last segment (43: 34), segment 4 distinctly, moderately deeply bilobed (fig. 114). Fore parts lack microsculpture, abdomen with traces of very shallow groundsculpture, tergite 8 with shallow reticulation, tergite 10 rather smooth.

*Comments.* *Dianous gemmosus* is distinguished from *D. hammondi* Rougemont by the less regular punctuation of the frons, by the coarser punctuation of pronotum which has no median longitudinal furrow, by the golden elytral area, the less dense abdominal punctuation, and by the sexual characters (in *D. hammondi*, the anterior emargination of the median lobe is broadly rounded and there are only about 20 short ventral setae on each side of the apex of the median lobe).

Etymology: *gemma* (Latin)= precious stone, jewel; *Dianous* set with precious stone or jewel.

### *Dianous chinensis* Bernhauer

*Dianous chinensis* Bernhauer, 1916: 28; Puthz, 1971a: 89 figs.

Material examined: Shandong: 4 ♂♂, 4 ♀♀: Kiautschau [Chiao-chou Wan] (types) (FMCh, ZMB, cP). Jiangxi: 1 ♀ „Kiangsi“ without further indication (MM). Hunan: 7 ♂♂, 1 ♀: Wulingyuan, N. Dayong Sixixiyu, 400 m, 30. X. 1993, H. Schillhammer (5) (NHMW, cP).

Shaanxi: 1 ♂: „Tsinling [Ching-ling Shan], Hsin-nganfu-Peiho (= Si-an-fu, Wie-ho, see Filchner, 1925: 69 ff.: = Xi'an) (ZMB).

*Comments.* This species seems to be rare. It may be easily recognized by the dense and very regular punctation and by the distinct reticulation throughout. Elytra: fig. 102. Sternite 9 of male (figs 118, 119). Aedeagus (figs 121, 122), ratio of breadth of median lobe at bottom of apical emargination to depth of apical emargination = 1.9-2.3; parameres with 7-9 aIS and 8-13 amS, apical lobes of median lobe with 29-34 short setae. This species is also very close to *D. aequalis* Zheng but larger, reticulated, the median lobe less deeply emarginate, in the female apicomedial projection of sternite 8 is less narrow and less long.

In the NHMW there are two females from Fujian, which differ from typical *D. chinensis* by dark blue color (lacking greenish tint), one of them has a very large elytral spot (larger than the length of antennal segment 3), the other a distinctly smaller elytral spot. Since I have no males from the respective localities these two specimens should be regarded as „*chinensis* abw.“ 1 ♀: Fujian: Longyan 2 km S Dachi, 750 m, Ceyan Shan, stream ca. 1-2 m wide, rocky steps with waterfalls, pools with crystalline sand, coarse granitic gravel, in the upper section surrounded by broadleaf forest. 29. I. 1997, Ji & Wang (CWBS 262); 1 ♀: Longyan Xiachi (20 km W Longyan), Meihua Shan, 650 m, mountain stream, 3-5 m wide, flowing through densely forested (broadleaf trees) steep valley descending from Meihua Shan, small waterfalls (figs 14, 16 in Jäch & Li, 1998), 30. I. 1997, Ji & Wang (CWBS 263).

### *Dianous yangae* sp. n.

*Dianous chinensis*: Zheng, 1993: 198

Type material. Holotype (male) and allotype (female): Sichuan: Emei Shan, 7. X. 1985, G. M. de Rougemont (cR in BMNH). Paratypes: (4) ♀♀, (4) ♀♀: same data as HT (cR, cP); 2 ♂♂: Suifu, 1.-10. XI. 1929, D. C. Graham (USNM); 1 ♂: Sichuan: Qingfeng Shan NW Chengdu, 600 m, Flusssufer, 30.55 N, 103.30 E, 4. VI. 1997, M. Schülke (cSchülke); 2 ♂♂, 2 ♀♀: Emei Shan, 630-710 m, 23. VII. 1983 („*chinensis*“ det. Zheng)(cP).

This new species is the sister species of *D. chinensis*, from which it may be distinguished at first glance by the much smaller elytral spots.

Moderately shining, Prussian-blue metallic, elytra each with a moderately large orange spot (fig. 103). Head and pronotum moderately coarsely and densely punctate, elytral punctation coarse and dense, regular, abdomen finely and very densely punctate. Pubescence remarkably dense, whitish yellow, long and semierect. Antennae, maxillary palpi, and legs blackish blue. Clypeus and labrum blue, densely pubescent. Fourth tarsal segment distinctly, moderately deeply bilobed.

Length: 6.7-7.5 mm (fore parts: 3.3 – 3.6 mm).

PM of HT: wH: 45; adE: 29; IE: 18; lTe: 6; wP: 37.5; IP: 40; wEl: 64; lEl: 64; lS: 55.

Male: Medial area of metasternum flattened, slightly impressed posterior-medially, punctation moderately coarse and very dense, diameters of punctures nearly as large as basal cross section of third segment of maxillary palpi, interstices mostly smaller than half diameters of punctures, densely reticulated; narrowly impunctate

posteriomedially; acam finely and densely punctate, interstices nearly smooth; declining lateral areas of metasternum about as coarsely and densely punctate as medial area. Sternites 3-6 moderately finely and very densely punctate throughout; sternite 7 with a broad and shallow postero-medial impression more densely punctate and pubescent than sides, posterior margin broadly emarginate. Sternite 8 with a broad and deep notch in nearly posterior quarter. Sternite 9 acute apicolaterally (fig. 120), with dense sclerotized fringes and asacI apicomediaIly, apicolateral brush strong, nearly as long as sternite. Tergite 10 blunt or very shallowly emarginate apically. A e d e a g u s (figs 124, 125) similar to that of *D. banghaasi*, ratio of breadth of median lobe at bottom of apical emargination : depth of apical emargination = 1.5 – 1.9; parameres with 11 alS and 12-14 amS; apical lobes of median lobe with 22- 26 ventral setae.

Female: Ventral characters similar to those of male, but sternite 7 not impressed. very finely and densely punctate and pubescent posteriomedially. Sternite 8 (fig. 153). Valvifer acute, apical brush about as long as valvifer. Tergite 10 distinctly, but moderately triangular.

Punctuation generally remarkably regular, that of head and pronotum equally coarse and dense, diameters of punctures about as large as basal cross section of second segment of maxillary palpi, distinctly smaller than basal cross section of third antennal segment, interstices mostly smaller than half diameters of punctures, larger posteriorly near inner margins of eyes and on midline of pronotum (but no distinctly separate impunctate areas). Antennae long, extending beyond posterior margin of pronotum by about 4 segments when reflexed, outer segments nearly 1.5 x as long as broad. Pronotum with distinct, but shallow oblique lateral impressions on posterior half. Elytra coarsely, very densely, regularly punctate, all individual punctures well-defined, diameters of punctures as large as basal cross section of third antennal segment, interstices distinctly smaller than half diameters of punctures, shallowly reticulated, punctuation becoming somewhat finer and sparser anteriorly and posteriorly. Abdomen with very broad, upwards directed, finely and very densely punctate paratergites; punctuation of tergites fine and very dense, diameters of punctures nearly as large as medial eye facets, interstices mostly as large as half diameters of punctures, middle of each tergite hardly more sparsely punctate; punctuation of tergites 8 and 10 slightly coarser than that of the previous tergites. Legs slender, metatarsi as long as metatibiae, first segment distinctly shorter than three following segments combined, slightly longer than last segment, fourth segment distinctly bilobed. Entire dorsal surface densely, more or less deeply reticulated, resulting in somewhat fatty lustre.

*Comments.* *Dianous yangae* differs from *D. chinensis* by the much smaller elytral spots (compare fig. 102), by the narrower apical lobes of the median lobe, by the different ratio of anterior median lobe (2.3 in one male syntype of *D. chinensis*), and by the larger size. The specimens from Emei Shan quoted by Zheng as „*chinensis* Bernhauer“ belong to *D. yangae* as could be verified by specimens from the quoted series.

*Etymology:* Dedicated to Miss Yang Ping, who helped in collecting.

*Dianous senex* sp. n.

Type material. Holotype (♂) and allotype (♀): China: W-Sichuan: Daxue Shan, Hailuogo Glacier Park, Camp 1, 2100 m, 29.36.00 N, 102.03.35 E, 27.- 31. V. 1997, M. Schülke (ZMB); Paratypes: 2 ♂♂: same data as HT (cP, cSchülke); 2 ♂♂: ibidem 102°04' E, 29°36' N, river valley ca. 3 km above Camp I, 2100 m, 28./ 31. V. 1997, A. Pütz, D. Wrase (coll. Pütz, coll. Schülke).

This new species belongs to the group of *D. chinensis* and resembles many species of that group, especially *D. yangae*. It is remarkable by moderately long greyish pubescence of the fore parts.

Moderately shining, black with (Prussian-)blue metallic reflection, elytra each with a moderately large, oval, orange spot. Punctuation of fore parts coarse and dense, very slightly confluent between elytral spot and suture, abdominal punctuation fine and dense. Woolly pubescence of the fore parts greyish, moderately long, half erect, longest setae of pronotum about as long as antennal segment 4, abdominal pubescence yellowish, dense, recumbent. Antennae, maxillary palpi, and legs black with blue metallic tint, trochanters black/metallic. Clypeus and labrum blue metallic with long and dense pubescence. Sternum 9 with distinct apicolateral tooth (fig. 135). Fourth tarsal segment shortly bilobed, distinct also at metatarsi.

Length: 5.2 – 6.4 mm (fore parts: 3.0 – 3.1 mm).

PM of HT: wH: 45; adE: 29; IE: 18; ITe: 7; wP: 35; IP: 37; wEl: 54; IEl: 55; IS: 49.

Male: Metasternum moderately convex, medial area coarsely and moderately densely punctate except on actual middle which is impunctate, interstices distinctly reticulated, acam with some fine punctures, punctuation of sternites moderately coarse and moderately dense, interstices nearly smooth. Sternite 7 with a broad impression apicomediaally which is very densely punctate and pubescent, posterior margin shallowly emarginate. Sternite 8 with a broad, rounded emargination in about posterior quarter. Sternite 9 (fig. 135), densely set with sclerotized fringes and asac apicomediaally, apical brush strong, about as long as the sternite. Tergite 10 broadly rounded and slightly concave apicomediaally. *A e d e a g u s* (fig. 126) about as in the related species, with a strongly sclerotized, nightcap-like internal sac, parameres with 8/10 aIS and 12/16 amS, apex of median lobe with about 17-22 short setae ventrolaterally.

Female: Ventral characters similar to those of male, sternite 8 rounded (probably triangular apicomediaally; incomplete in the allotype). Apical brush of valvifer nearly as long as valvifer. Tergite 10 triangularly rounded.

Pubescence of fore parts greyish and woolly on head and pronotum. Head and pronotum less densely punctate than elytra, in the middle of pronotum an impunctate area about as long as antennal segment 4 and about as broad as three punctures combined. Diameter of oval elytral spot less long than antennal segment 3, about as long as antennal segments 6 + 7 combined, punctuation of elytra coarse and very dense, except on a small elevated area between humeral and sutural impressions in anterior third, where interstices may become half as large as diameters of punctures, and except on posteriolateral quarter; punctuation of elytral spots dense, between spot and suture very dense or slightly confluent longitudinally. Punctuation of abdomen fine and dense,

punctures slightly smaller than medial eye facets, interstices also in middle of tergites at most as large as diameters of punctures, punctation of tergite 8 coarser, punctures about as large as medial eye facets; punctation of paratergites fine and extremely dense. Reticulation at places faint, somewhere distinct, at places missing.

*Comments.* *Dianous senex* differs from *D. yangae* by smaller size, smaller elytra, less dense and coarser punctate metasternum, by the elytral spot which is comparatively larger and (longitudinally-) oval, and by the slightly coarser punctation of pronotum's disc, from *D. mendax*, *D. emeiensis*, *D. hummeli*, and *D. dubiosus* by distinct apicolateral tooth of sternum 9, from *D. atroviolaceus*, *D. banghaasi*, *D. bashanensis*, *D. bioculatus*, *D. gongganontis*, *D. socius* and *D. taiwanensis* by the greyish pubescence of the fore parts, and from some of them furthermore by semierect pubescence, from *D. chinensis* by the shorter, woolly pubescence of pronotum, from all by the sexual characters. This new species is very close to *D. yangae* sp. n. and might represent a subspecies of it, which is restricted to high mountains.

Etymology: *senex* (Lat.) = aged man. Refers to its greyish pubescence.

### *Dianous banghaasi* Bernhauer, 1916

*Dianous Bang-Haasi* Bernhauer, 1916: 27 f.; L. Benick, 1940: 575 figs.

*Dianous banghaasi*; Puthz, 1970: 32; Puthz, 1971a: 89 fig.; Zheng, 1993: 198

*Dianous pilosus* Champion, 1919: 54 f.

Material examined: Shandong: 5 ♂♂, 2 ♀♀: Kiautschau [Chiao-chou Wan] (including types of *D. banghaasi*) (FMCh, MM, cP). Zhejiang: 3 ♂♂, 4 ♀♀: Ningpo [Yin-hsien] (including 1 type of *D. pilosus*) (BMNH, IRScNB, ZMB, cP); 1 ♂: Da-zeh near Tychau, Walker (syntype of *D. pilosus*) (BMNH). Jiangxi: 1 ♂ (without precise locality) (syntype of *D. banghaasi*) (FMCh); 1 ♂: Kuling near Kiukiang [Jiujiang], H. F. Loomis, 18. X. 1919 (USNM); 8 ♂♂, 3 ♀♀: Tienmuschan, Reitter (FMCh, NHMW, ZMB, cP). Hunan: 1 ♂, 1 ♀: Shaoshan, 18. X. 1966. P. M. Hammond (BMNH); 7 ♂♂, 2 ♀♀: SW Huitong, env. Guangping, 300 m, 2. XI. 1993, H. Schillhammer (7), 3 ♂♂, 3 ♀♀: ibidem 350 m, 4. XI. 1993, H. Schillhammer (10 a); 1 ♀: ibidem 350 m, 8. XI. 1993, L. Li (16) (NHMW); 7 ♂♂, 4 ♀♀: Wulingyuan, N. Dayong Zangjiajie, 450 m, 30. X. 1993, H. Schillhammer (4), 1 ♀: Wulingyuan, N. Dayong Sioxiyu, 400 m, 31. X. 1993, H. Schillhammer (5) (NHMW, cP). Guizhou: 1 ♂, 5 ♀♀: no further indication (NHMW); 5 ♀♀: „Kouy-tcheou, région de Pin-fa, 1906. J. Cavalerie (IRScNB, MNHNP); 2 ♂♂: Huangguoshu, X. 1986. G. M. de Rougemont (cR, cP), 31 exx. Longong, Huaxi, and Huangguoshu, X. 1986. G. M. de Rougemont (t. Rougemont, cR); 4 ♂♂, 8 ♀♀: Bije Pref., Minxi Co., Dou Lou Lake, 1200-1300 m, 30. VII. 1997, M. Wang (NHMW, cP). Guangxi: 1 ♂: Dist. Lipu, 120 km S Guilin, Berge bei Siuren, 350 m, 12. XI. 1993, Schönmann & Schillhammer (19) (NHMW). Fujian: 13 ♂♂, 21 ♀♀: Chungan, Bohea Hill, 16. II., 24. IV., 30. IV., 3. V. 1940, 1 ♂: Shaowu, Shuipueichieh, 13. I. 1940, 1 ♂: Shaowu, Kaishow, 4. I. 1944, 2 ♀♀: Shaowu, Ku Hsien kai, 6. VI. 1943, 16. III. 1944, 1 ♂, 1 ♀: Changting, Hotien, 15. IV. 1941, 1 ♂: Changting, Ningling, 24. IV. 1941, 1 ♂: Yungan, 31. III. 1941: all leg. T. C. Maa (Bishop Museum, cP); 1 ♂: Shaowu, 500 m, 29. X. 1937, J. Klapperich (cP). Guangdong: 10 ♂♂, 13 ♀♀: „Canton, lebend in den Kisten“, Mell (ZMB, cP). Sichuan: 1 ♂ (abw.): N Ya'an, Baoxing County, ca. 5 km SW Baoxing, 900 m, river (Xichuan He), ca. 5 m wide, with pebbles and cobbles, cold, fast flowing through forest, Ji & Wang, 11. VI. 1996 (CWBS 228) (NHMW); 1 ♂ (abw.): Emei Shan, 7. X. 1985, G. M. de Rougemont (cR). Zheng records numerous specimens from Emei Shan, of which he sent me 2 ♂♂, 2 ♀♀ (15. VI., 15. VII. and 23. VII. 1983).

*Comments.* This is the most common *Dianous* of China, easy to identify by its remarkably erect pubescence and the large elytral spots (fig. 104). The extension of the elytral spots seems to be variable. In most specimens examined (including types) the

large, somewhat transverse spot on each elytron extends toward the declining lateral areas and is seemingly (in dorsal view) fused with lateral margin but is (in lateral view) actually separate from the lateral margin by a distance about equal to about the length of the fourth antennal segment. In one of the two males from Guizhou: Huangguoshu, the elytral spot is somewhat smaller and thus in dorsal view separate from darker elytral sides (the diameter of the spot is about as large as the length of the third antennal segment; about as large as the length of the third and fourth antennal segments combined in typical specimens of *D. banghaasi*). Some specimens from Sichuan: Emei Shan have the spots broader than long but narrower than in the typical specimens, with the length slightly larger than the length of the third antennal segment. Dissection of the genitalia and careful study of the ventral characters confirmed that these are only somewhat aberrant specimens. The labels are marked with „abw.“ (= aberrant). *Dianous banghaasi* probably reaches the distributional limits in Sichuan and Guizhou and is represented there by peripheric populations which to some degree differ from the populations in the centre of the distribution areal (as it is known in *D. coerulescens* Gyllenhal, see Puthz, 1980b: 7 ff.).

The aedeagus (fig. 127) is also variable in the number of the setae: the parameres have 8-11 aLS and 9-11 aMS, the apicolateral lobes of the median lobe have 18-24 small ventral setae; the number of setae varies both in one specimen and in specimens from the same series. A good working distinguishing character is the ratio of breadth of median lobe at bottom of apical emargination: depth of emargination, which varies in the material examined between 1.2-1.4 (this ratio differs from that of the related species, e. g. *D. taiwanensis* Puthz, *D. aequalis* Zheng, *D. bioculatus* sp. n.). Sternite 8 of the female has a distinct triangular projection apically (fig. 131).

### *Dianous aequalis* Zheng

*Dianous aequalis* Zheng, 1993: 199 f. fig.

Material examined: 1 ♂-PT: Sichuan: Emei Shan, 710- 1120 m. Gou Zheng-yue (cP) [HT, AT and 4 PT in the Dept. Biol., Sichuan Teachers College, Nanchong]. Guangdong: 2 ♂♂, 1 ♀: „China, Canton, lebend in den Kisten“, Mell (ZMB, cP).

This species is closely related to *D. banghaasi*, it also has conspicuous erect pubescence. The description is taken from a male labelled „Canton“ (see below).

Moderately shining, black with violet (-bluish) tint, each elytron with a large orange spot (diameter about as large as length of third antennal segment, or even larger). Head moderately coarsely and moderately densely punctate, pronotum coarsely and densely, near posterior border somewhat coalescently, punctate, elytral punctation coarse, mostly well-defined, except sometimes slightly confluent near medial border of elytral spot, abdomen finely and moderately densely punctate. Pubescence yellowish, long, dense, erect. Antennae brown, club lighter, maxillary palpi brownish, legs blackish brown, tarsi lighter. Clypeus and labrum bluish, densely pubescent. Fourth segment of metatarsi distinctly but shortly bilobed.

Length: 4.2 – 5.2 mm (fore parts: 2.5 – 2.7 mm).

PM of ♂ from „Canton“: wH: 38; adE: 23; IE: 17; ITe: 4; wP: 31; IP: 33; wEl: 49; IEI: 49; IS: 42.



Male: Metasternum broadly convex, medial area slightly impressed and impunctate posteriorly (impunctate area triangular, about as long as fifth segment of metatarsus, and as broad as length of second metatarsal segment posteriorly), punctation moderately coarse, regular, dense, diameters of punctures about as large as basal cross section of third segment of maxillary palpi, interstices slightly larger than half diameters of punctures, nearly smooth, acam with some fine and scattered punctures, shiny. Sternites 3-6 somewhat more sparsely punctate medially than laterally; sternite 7 with very shallow posteriomedial impression, punctation and pubescence of impression fine and very dense, posterior margin simple. Sternite 8 with round notch in about posterior quarter. Sternite 9 with acute tooth apicolaterally (fig. 136), densely set with long sclerotized fringes and asael on an oval field apicomediaally, apicolateral brush strong, as long as sternite. Tergite 10 broadly rounded. Aedeagus similar to those of related species, apical emargination of median lobe deep (fig. 128), ratio of breadth of median lobe at bottom of apical emargination: depth of apical emargination = 1.3 – 1.7; parameres slightly longer than median lobe, with 5-7 (8) aIS and 8-9 (10) aMS; apical lobes of median lobe with 13-19 small ventral setae.

Female: Ventral characters similar to those of male. Sternite 8 (fig. 132) with a long triangular projection. Valvifer acute apically, apical brush about as long as valvifer. Tergite 10 rounded.

*Dianous aequalis* is in many respects very close to *D. banghaasi*, but the outer antennal segments are longer, nearly twice as long as broad, the elytral sculpture denser, intermediate between *D. banghaasi* and *D. chinensis* with postero-lateral quarter coarsely and densely punctate, punctures as coarse as on anterior half of elytra, interstices smaller than half diameters of punctures (see below), elytral spots (in dorsal view) distinctly separate from the blackish-blue lateral areas.

Variability: In the PT from Emei Shan the posteriolateral punctation of elytra is less coarse and less dense than in the Canton-♂, but distinctly more dense than in *D. banghaasi*; the parameres have 7/8 aIS and 10 aMS.

*Comments.* *Dianous aequalis* Zheng is distinguished from *D. banghaasi* by smaller size, by the characters given above, and by the sexual characters, from *D. chinensis* also by smaller size, by the smooth interstices of punctation, and by the aedeagus with narrower apical lobes of the median lobe and deeper apical emargination.

R. E. Mell (1878- 1970) lived a long time in Canton; possibly the material has been collected there and shipped alive to the Berlin museum; pers. comm. Dr. Uhlig.

### *Dianous dubiosus* sp. n.

Type material. Holotype (♂): Guizhou: Huangguoshu, X. 1986, G. M. de Rougemont (coll. Rougemont in BMNH). 1 ♀ paratype: Guangxi: Da Ming Shan, 1000 m, 13. V. 1997, J. Fellowes (cP).

This *Dianous* resembles in almost all characters very strongly *D. emeiensis* Zheng but has a distinct aedeagus and a more deeply (distinctly) bilobed segment 4 of the metatarsi (fig. 141).

Moderately shining, blackish-blue-metallic (Prussian blue), elytra each with a moderately large orange spot (about as in fig. 105 or slightly smaller). Punctation of

head coarse and very dense, interstices mostly smaller than half diameters of punctures, deeply reticulated, punctuation of pronotum as coarse as in *D. emeiensis* but slightly denser, elytral sculpture very coarse, and dense, slightly transversely coalescent on lateral portions of anterior half, also coalescent around anterior and sutural border of orange spots, abdomen moderately finely but more densely punctate than in *D. emeiensis*. Pubescence, antennae, palpi, and legs as in *D. emeiensis*, segment 4 of metatarsi distinctly, but shortly bilobed (fig. 141).

Length: 4.5-5.7 (fore parts: 2.7-2.8 mm).

PM of HT: wH: 40.5; adE: 24; wP: 33; IP: 34,5; wEl: 52; lEl: 55; lS: 47.

Male: Metasternum strongly convex, medial area not flattened, with midline narrowly impunctate, sides moderately finely and densely punctate, punctures smaller than basal cross section of palpal segment 3, interstices smaller than diameters of punctures, very densely, moderately shallowly reticulated, shiny; acam very finely, sparsely punctate, interstices smooth. Medial punctuation of sternites 3-6 moderately fine, slightly sparser than lateral punctuation, sternite 7 with posterior broad, shallow impression more densely punctate than sides, posterior margin shallowly emarginate. Sternite 8 with a broad and deep notch in about posterior quarter to fifth. Sternite 9 as in fig. 137, irregularly serrate apically, without apicomедial fringes, apicolateral brush strong, distinctly shorter than sternite. Tergite 10 very broadly rounded, slightly concave posteriomedially. Aedeagus as in fig. 130, resembling that of *D. bashanensis* Zheng (fig. 144), apical portion of median lobe less deeply emarginate, with about 16-17 apicoventral short setae on each side; parameres longer than in *D. bashanensis* and stronger apically, with 7 aLS and 11 aMS.

Female: Metasternum nearly as in the male, but no distinct microsculpture throughout. Sternite 8 pointed apicomедially. Valvifer oblique-triangular posteriorly, apical brush nearly as long as valvifer. Tergite 10 rounded.

Variability: The elytral spot of the ♀-paratype is smaller than that of the holotype.

*Comments.* *Dianous dubiosus* is distinguished by the aedeagus and the distinctly bilobed segment 4 of metatarsus. It is more coarsely sculptured and more densely reticulated than *D. emeiensis*. It can be distinguished from *D. bashanensis* Zheng by the larger elytra, the stronger metallic tint, and by the elytral spot situated in about posterior half of elytra.

1 ♀: Taiwan: Nantou Hsien: Sun Lin Sea, rte. 151, 16 km SSE Luku, 6.IV.1991, H.G.Nelson (FMCh): cf. det.: This specimen resembles closely the type of *D. dubiosus* but elytral sculpture is even coarser, abdominal punctuation slightly less dense.

Etymology: *dubiosus* = dubious; it refers to the difficulty to distinguish this species from *D. emeiensis* by the external characters and to the lack of the type material for comparison.

### *Dianous cyaneocupreus* sp. n.

Type material. Holotype (♂): Taiwan: Taipei Hsien: South Fork Ching Mei Str., 3 km SE Ching Mei (19 km SE Taipei), 26. III. 1991, H. G. Nelson (FMCh).

This new species resembles many of the bluish species with elytral spots, it belongs to the group of *D. chinensis* Bernhauer.

Moderately shining, black with distinct bluish tint, elytra each with a large cupreous spot. Punctuation of fore parts coarse and dense, somewhat confluent on some areas of elytra, abdomen very finely and sparsely punctate. Pubescence of fore parts brownish, very long, erect, especially remarkable on clypeus and on pronotum; abdomen with dense, long, recumbent, golden pubescence. Antennae, maxillary palpi, and legs black with some dark bluish metallic tint, trochanters dark brown. Clypeus and labrum blue metallic with very long pubescence. Fourth segment of pro- and mesotarsi distinctly but slightly bilobed, that of metatarsi almost simple (fig. 142).

Length: 5.0 – 6.0 mm (fore parts: 3.0 mm).

PM of HT: wH: 44; adE 27; IE: 19; IT: 6; wP: 35; IP:38; wEl: 55; IEI: 57; IS: 49.

Male: Metasternum, acam and ventral abdomen about as in *D. atrocyaneus*, punctuation of sternites very fine, medially slightly sparser than laterally. Sternite 8 with a deep, broad, rounded emargination in about posterior quarter. Outline of sternite 9 about as in *D. atrocyaneus*, with a broad area densely set with long sclerotized fringes and minute asacral apicomedia (fig. 138), apicolateral brush strong, 5/6 as long as the sternite. Tergite 10 broadly rounded. Aedeagus about as in *D. atrocyaneus* (see fig. 113), parameres with 6 + 12 setae, apex of median lobe with about 23-27 short setae ventrolaterally.

Female: Unknown.

Elytra with a large cupreous spot in posterior half, diameter slightly smaller than length of antennal segment 3; elytral punctuation even coarser and mostly denser than on pronotum, in anterior half transversely confluent, between spot and suture longitudinally confluent, very dense and slightly confluent on the spot.

*Comments.* *Dianous cyaneocupreus* differs from *D. cupreostigma* Puthz by much longer pubescence and finer and sparser abdominal punctuation, from *D. yoshidai* Naomi by coarser punctuation of frons and elytra, longer pubescence and much finer and sparser abdominal punctuation, from *D. taiwanensis* Puthz by color, longer pubescence of pronotum and very dense punctuation of paratergites, from *D. dubiosus* sp. n. by very fine and very sparse abdominal punctuation and smooth interstices of punctuation of nearly the whole insect, from all these species by the aedeagus.

Etymology: *cyaneus* (Latin) = bright blue, *cupreus* (Latin) = cupreous. Refers to the coloration.

### *Dianous hummeli* Bernhauer, 1936

*Dianous Hummeli* Bernhauer, 1936: 3; Puthz, 1971a: 90f. figs.

*Dianous szechuanus* Bernhauer, 1936, l.c. : 3 f.

Material examined. Sichuan: Holotype (male) of *D. hummeli* and holotype (female) of *D. szechuanus*: Kia-ling-ho, Youen-kou (FMCh).

Male: Metasternum broadly convex, medial area flattened, with midline narrowly impunctate, sides of medial area moderately coarsely, densely punctate, diameters of punctures slightly smaller than basal cross section of palpal segment 3,

interstices slightly larger than half diameters of punctures, distinctly reticulated, moderately shiny, acam finely and sparsely punctate, interstices nearly smooth. Sternites 3-6 finely punctate (punctures distinctly smaller than one eye facet), there are fewer punctures medially than laterally, sternite 7 slightly flattened medially, but not impressed, very densely punctate and pubescent, posterior margin simple. Sternite 8 with a broad and very deep notch in about posterior third to fourth. Sternite 9 as in fig. 152, posterior margin with medial sclerotized fringes, apicolateral brush strong, about as long as sternite. Tergite 10 broadly rounded. *Aedeagus* (fig. 143) with median lobe broad and broadly emarginate at apex; apical lobes each with about 20 short ventral setae; parameres not much longer than median lobe, each with 6 aS and 10-11, strong and moderately long, amS.

Female: Ventral characters similar to that of male. Sternite 8 (fig. 134) Tergite 10 subtriangular.

*Comments.* The punctuation of head and pronotum is comparatively sparse and not as coarse as in the following two species: the diameters of punctures on frons are nearly as large as basal cross section of palpal segment 3, interstices are mostly larger than half diameters of punctures, but can be also as large as diameters of punctures. The punctuation of the pronotum is somewhat coarser than that on frons, but it is relatively sparse in the middle, where interstices become much wider than diameters of punctures; the impunctate area in the middle of the pronotum is about as broad as the length of the antennal segment 11; the medial punctures of pronotum are slightly smaller than the basal cross section of antennal segment 3, but the punctuation becomes much coarser and much denser toward posterior margin, where slight coalescence can be seen; the interstices of pronotal and frontal punctuation are nearly smooth, without appreciable reticulation.

*Dianous emeiensis* Zheng, 1993 sp. propr.

*Dianous hummeli emeiensis* Zheng, 1993: 201 figs.

Material examined: 4 ♂♂, 4 ♀♀ Guizhou: Huaxi, X. 1986, G. M. de Rougemont (coll. Rougemont, coll. Puthz).

This *Dianous* closely resembles *D. hummeli* Bernhauer and is its sister species. Main differences, that are of specific rank, are in male genitalia.

Moderately shining, blackish- blue- metallic (Prussian blue), elytra each with a moderately large orange spot (fig. 105). Punctuation of head moderately coarse and dense, that of pronotum conspicuously coarser, very dense and somewhat coalescent, punctuation of elytra about as coarse as on pronotum, coalescent around orange spots, abdomen moderately finely, densely punctate. Pubescence whitish, conspicuously dense, long and semi-erect. Antennae, palpi, and legs black with blue metallic tint, trochanters with brownish tint. narrow bases of middle antennal segments reddish. Clypeus and labrum black with blue metallic tint, moderately densely pubescent. Segment 4 of metatarsi very shortly (indistinctly) bilobed (fig. 140).

Length: 5.0-6.5 mm (fore parts: 2.8-3.0 mm).

PM of one male: wH: 40; adE: 25.5; wP: 32; IP: 34; wEl: 54; lEl: 54; IS: 46.

Male: Ventral characters very close to those of *D. hummeli*, but punctuation of sternites less fine, punctures on middle of sternites about as coarse as one eye facet. Sternite 8 with a broad notch in about posterior quarter to fifth (less deep than in *D. hummeli*). Sternite 9 as in fig. 149, middle of posterior margin with numerous sclerotized fringes and a field of asacI apicomediaIly, apicolateral brush strong, a little longer than sternite. Tergite 10 broadly rounded. A e d e a g u s as in figs 145, 147, 148, median lobe broad, apical portion less broadened than in *D. hummeli*, apical margin variable, not emarginate; apical lobes each with 20-26 short ventral setae; parameres longer than in *D. hummeli*, number of setae variable: 6-10 aIS and 11-19 amS, setae very strong and somewhat longer than in *D. hummeli*.

Female: Ventral characters similar to those of male, sternite 8 as in fig. 146, apicomediaI projection narrower than in *D. hummeli*. Tergite 10 subtriangular.

*Comments.* *Dianous eueieusis* is more robust than *D. hummeli*, punctuation of the fore parts, especially the head and pronotum, is coarser and denser. The vorticose sculpture near the elytral spots is more distinct, and the punctuation of the abdomen is slightly coarser than in *D. hummeli*.

*Dianous bashanensis* Zheng, 1994: 480 f. figs.

Material examined: NW Hunan: 1 ♀ Wulingyuan N. Dayong, Zangjiajie, 650 m, 29. X. 1993, Schillhammer; 2 ♂♂: Wulingyuan N. Dayong, Sioxiyu, 450 m, 31. X. 1983, Schönmann (NHMW, cP).

PM of a male from NW Hunan: wH: 40; adE: 25; wP: 32; IP 32.5; wEl: 46; IEl: 46; IS: 38.

Male: Metasternum with an impunctate and strongly shining triangular area medially, posteriorly this area is about as broad as the length of segment 2 of the maxillary palpi; sides of shiny area moderately finely and moderately densely punctate, diameters of punctures somewhat smaller than basal cross section of palpal segment 3, interstices about as large as diameters of punctures, smooth; toward the declining sides follows a narrow strip of very fine and very dense punctuation laterally, declining sides moderately finely and sparsely punctate, acam with very few fine punctures. Sternites 3-5 medially finely and distinctly sparser punctate than laterally, sternite 6 broadly flattened, medial punctuation slightly coarser than lateral one. Sternite 7 with a shallow longitudinal impression, sparsely punctate anteriorly, densely punctate and pubescent near posterior border, where it is shallowly emarginate. Sternite 8 with a broad rounded notch in about posterior quarter to fifth. Sternite 9 (fig. 150), with numerous sclerotized fringes and dense asacI apicomediaIly, apicolateral brush moderately strong, as long as the sternite. Tergite 10 broadly rounded. A e d e a g u s (fig. 144), apical portion of median lobe broad and deeply emarginate, each side ventrally with 14-16 small setae; parameres slender, distinctly longer than the median lobe, with about 7 aIS and about 10 amS.

Female: Sternite 8 (fig. 133). Valvifer acute apically. Tergite 10 subtriangular.

*Comments.* This species was described from Sichuan: Da Bai Mountains. It is very close to *D. socius* Zheng, from which it is distinguished best by its sexual characters.

*Dianous atroviolaceus* sp. n.

Type material. Holotype (♂) and allotype (♀): NW Yunnan: ca. 10 km SW Lijiang, 2700 m, 5. VII. 1994, Li (14) (NHMW). Paratypes: 3 ♂♂ same data as HT; 1 ♂, 2 ♀♀: Yunnan: 100 km W Kunming, Diaolin Natural Reserve, 22. V.-2. VI. 1993, E. Jendek & O. Sausa; 1 ♀: Lugu Lake – Luo Shui, 27°45' N, 100°45' E, 8.-9.VII.1992, E. Jendek (NHMW, cP).

This new species is very closely related to *D. taiwanensis*, from which it differs easily by the dark violet tint. In general habitus the micropterous form resembles strongly *D. taiwanensis*, the macropterous form *D. chinensis* Bernhauer.

Variably winged, moderately shining, black with dark violet tint, elytra each with variably large orange spot. Punctuation of head moderately coarse and moderately dense, that of pronotum somewhat coarser, mostly dense, slightly confluent near posterior margin, punctuation of elytra coarse, dense, punctures obliquely extended, coalescent between spots and suture (also somewhat coalescent at lateral border of orange spot), abdomen very finely and moderately sparsely punctate. Pubescence blackish, dense, that of fore parts half erect, longest setae nearly as long as second antennal segment. Antennae, maxillary palpi, and legs blackish with dark violet to dark coppery tint. Clypeus and labrum dark violet, moderately densely pubescent. Fourth segment of metatarsi distinctly, shortly bilobed.

Length: 4.7 – 6.0 mm (fore parts: 2.4 – 3.0 mm).

PM of the (incompletely winged) HT and of the (fully winged) ♂- PT from Diaolin Nat.Res.: wH: 40 (42.5); adE: 26.5 (28); lE: 16.5 (17); lTe: 7 (7); wP: 31 (36); lP: 32 (36); wEl: 43.5 (58); lEl: 43.5 (59); lS: 37 (51).

Male: Medial area of metasternum broadly flattened, triangularly impunctate posteriomediaally, side portions moderately coarsely and moderately densely punctate, diameters of punctures about as large as basal cross section of third segment of maxillary palpi, interstices as large as, or slightly larger, than diameters of punctures, densely reticulated but shiny; acam very finely and sparsely punctate, nearly smooth; declining lateral areas of metasternum finely and moderately sparsely (near medial area) to moderately coarsely and densely (laterally) punctate. Medial punctuation of abdominal sternites 3-6 somewhat sparser than lateral punctuation; sternite 7 distinctly impressed posteriomediaally, punctuation of impression moderately fine and dense, posterior margin distinctly, shallowly emarginate. Sternite 8 with a deep notch in about posterior quarter. Sternite 9 (about as in fig. 135), numerous sclerotized fringes and dense asacel apicomediaally, apicolateral brush strong, as long as the sternite. Tergite broadly rounded. A e d e a g u s (fig. 154) of the *D. banghaasi*-type, ratio of breadth of the median lobe at bottom of apical emargination to depth of apical emargination = 1.50 – 1.60; parameres each with 7-9 aIS and 9-12 amS; apical lobes of median lobe with 28-30 small setae.

Female: Ventral characters similar to those of male, but sternite 7 not impressed. Sternite 8 (fig. 164). Valvifer triangular apically, apical brush strong, as long as valvifer. Tergite 10 subtriangular.

In nearly all respects about same as the variable *D. taiwanensis* but differs as follows: color dark violet, not black or black with greenish blue tint, elytral sculpture denser, with punctures very dense and slightly longitudinally confluent also near lateral

border of orange spots (not at all so in *D. taiwanensis*), and ventral punctation less coarse and less dense.

*Comments.* *D. atrovioleaceus* differs from *D. bioculatus* by the slightly confluent punctation near the lateral borders of the elytral spots, and by the male sexual characters. The males of *D. atrovioleaceus* from 2700 m are much narrower and have smaller elytral spots (nearly as large as the length of the third antennal segment) than the male from Diaolin Natural Reserve (diameter of its elytral spot distinctly larger than length of 3<sup>rd</sup> antennal segment), but in the females from the respective localities the size of the spot varies.

*Etymology:* *ater* (Lat.) = black, *violaceus* (Lat.) = violet.

### *Dianous gonggamontis* sp. n.

Type material. Holotype (♂) and allotype (♀): Sichuan: Gongga Shan, above Camp 3, 3050 m, on silty soil near a creek, 22. VII. 1994, A. Smetana (NHMG). Paratypes: 7 ♂♂, 4 ♀♀: same data as HT; 1 ♂ : ibidem, 3300 m, gravel bank of a creek, 23. VII. 1994, A. Smetana (cS, cP); 1 ♂, 3 ♀♀: Gonggashan: Hailuogou, 1900-2900 m, 29°36' N, 102°06' E, 6. VII. 1994, D. Král & J. Farkac (coll. Hromadka, cP); 1 ♂: W- Sichuan: Daxue Shan, Hailuoguo Glacier Park, Camp 2, 2550- 2700 m, 29.35.16 N, 102.01.53 E, 30./ 31. V. 1997, M. Schülke (cSchülke); 2 ♂♂: ibidem 2650 m, 30. V. 1997, A. Pütz (coll. Pütz); 1 ♂: ibidem, 2500-2700 m, 30./ 31. V. 1997, Wrase (coll. Schülke).

Material „cf. det.“: Sichuan: 1 ♀: Guan Xian Co., Balang Shan 15 km SW Wolong, ca. 2300 m, mountain stream, 5 – 10 m wide (river bed up to 50 m wide), crystalline gravel and sand, very fast flowing, very cold, 1. VIII. 1998, Schönmann, Ji, Wang (CWBS 342) (NHMW); 1 ♂, 1 ♀: Wanglang, 15. VII. 1988 (cP).

This new species closely resembles *D. banghaasi* Bernhauer, also in its sexual characters, but the elytral spot is smaller and the pubescence of the fore parts much shorter, and semierect.

Blackish-blue-metallic (Prussian blue), shining, elytra each with a large orange spot, which is mostly somewhat less large than the length of antennal segment 3 (exceptions !) and distinctly separate from the elytral side. Fore parts coarsely and very densely punctate, punctation coalescent between orange spot and suture (short rugae), abdominal punctation fine and moderately dense, moderately sparse in middle of tergites, where interstices are distinctly or much larger than diameters of punctures; punctation of tergite 8 distinctly, but not conspicuously, coarser than that of tergite 7. Pubescence blackish, dense, short, semierect, setae of pronotum not as long as antennal segment 2. Antennae, palpi, and legs blackish, with blue-metallic tint. Clypeus and labrum dark blue-metallic, moderately densely pubescent. Segment 4 of metatarsi simple (lobation about as in *D. emeiensis*, see fig. 140).

PM of HT: wH: 40; adE: 24; wP: 31.5; lP: 32; wEl: 45.5; lEl: 48; lS: 40.

Male: Metasternum broadly flattened, narrowly impunctate posteriomediaally, punctation on disc moderately coarse and moderately sparse, diameters of punctures about as large as basal cross section of palpal segment 3, interstices mostly distinctly larger than diameters of punctures, may become twice as large as, shallowly reticulated, shiny; declining sides finely and sparsely punctate (no distinct strip of denser punctation between fine lateral and coarse medial punctation), acam nearly smooth. Medial punctation of sternites 3-5 slightly coarser and slightly sparser than lateral

punctuation, sternite 6 flattened posteriomediaally, somewhat denser punctate than on the sides, posterior margin slightly emarginate. Sternite 7 shallowly impressed posteriomediaally, impression finely and densely punctate and pubescent, posterior margin shallowly emarginate. Sternite 8 with a deep notch in about posterior quarter. Sternite 9 about as in *D. banghaasi*, with numerous sclerotized fringes and fine asael apicomediaally and a broad tooth apicolaterally. Tergite 10 broadly rounded. Aedeagus about as in *D. banghaasi*, median lobe broadened apically, deeply emarginate apicomediaally (index 1.30-1.40), parameres with 8-10 aIS and 9-13 aMS.

Female: Ventral characters similar to those of male, except last sternites; sternite 7 in posterior middle finely and densely punctate and pubescent, sternite 8 subtriangular, about as in *D. banghaasi*. Tergite 10 moderately narrowly rounded, not distinctly subtriangular.

*Comments.* Some specimens from Sichuan differ from the type series by slightly different sculpture and are therefore not labelled as paratypes. *Dianous gonggamontis* sp. n. is distinguished by its short, semierect pubescence and sparse punctuation of the apical quarter of elytra.

### *Dianous taiwanensis* Puthz

*Dianous taiwanensis* Puthz, 1971a: 88 f. fig.; Puthz, 1984a: 101

*Dianous bilunatus* Puthz, 1984a: 101 f. figs **syn. nov.**

Material examined: holotype (♂): Taiheizan, 6. V. 1932, L. Gressitt (USNM). Taipei Hsien: 1♂: Pihu, 49 km E. of Taipei, on Highway 9 (to Yilan), 18. II. 1972, T. C. Maa (Bishop Museum). Ilan Hsien: 9♂♂, 9♀♀: Taipingshan, 1880 m, 14. VII. 1993, in soaking wet moss on a vertical wall in a creek; 7♂♂, 4♀♀: ibidem 1820 m, 15. VII. 1993, in wet moss on large rocks directly in a creek. Taoyuan Hsien: 6♂♂: Takuanshan Forest, 1600 m, 17. IV. 1990, on wet rocks in a creek. Nantou Hsien: 2♂♂ (abw.): Shanlinchi, 1650 m, 16. V. 1990, same habitat as previous; 2♂♂, 1♀: ibidem 19. V. 1991 all leg. A. Smetana (cS, cP). Chiayi Hsien: 1♂, 2♀♀: Alishan, 2400 m, 3.-9. VII. 1972, T. C. Maa (types of *D. bilunatus*) (Bishop Museum, cP); 1♂: ibidem 2300 m, 9. IV. 1965, Y. Hirashima (Kyushu Univ.); 1♂: ibidem, 17. V. 1968, Y. Watanabe (cP); 1♂: Alishan, Sister Ponds, 2180 m, 26. IV. 1990, soaking wet moss on rotting wood around small ponds, A. Smetana (cS). Kaohsiung Hsien: 1♂, 2♀♀: Creek 2 km E Tien Chih, Hwy. 20, 2400 m, in soaking wet moss on a forest sepage, 22. VII. 1993; 10♂♂, 14♀♀: Creek 4 km E Yakou, 2600 m, 23. VII. 1993, in soaking wet moss on large rocks in a creek, A. Smetana. Pingtung Hsien: 2♀♀: Peitawushan Kuai-Ku Hut, 2120 m, 27. IV. 1992, wet moss on a large fallen tree. Hualien Hsien: 7♂♂, 5♀♀: Taroko N.P., Nanhushi Hut, 2220 m, 8. V. 1990, in wet leaf litter on large rocks along a creek; 3♂♂, 2♀♀: Taroko N.P., Chungyantienshi (River) Waterfall, 2300 m, 10. V. 1990, in soaking wet moss on a vertical wall near a creek, all leg. A. Smetana (cS, cP).

*Comments.* This species is widely distributed in Taiwan and considerably variable. Main differences given in my descriptions of both taxa (*D. taiwanensis* and *D. bilunatus*) proved to fall within the variability range: (a) proportions of the individual tagmata vary in size (figs 107-112) but no specimen is as fully winged as e. g. *D. banghaasi*, wings are in different degrees shortened, (b) the size of the elytral spot varies in the same series (figs 108, 112), (c) the rugoseness of the elytral sculpture is variable: most (somewhat backwards extended) punctures are well-defined, or (in other specimens from the same locality) confluent longitudinally, but they are distinctly separate at lateral borders of spots, (d) the reticulation varies: interstices of the fore



parts are smooth in some specimens, shallowly reticulate in others, (e) punctation of the broad median area of the metasternum is slightly variable: the median portion is impunctate, the side portions are moderately coarsely and sparsely punctate; interstices vary from about as large as diameters of punctures to twice as large, reticulation of the surface of interstices varies from very shallow to deep, (g) most specimens are black, some  $\pm$  bluish (-green).

A e d e a g u s in general as in *D. banghaasi* and related species (figs 157-160), the number of setae on parameres varies between 8-11 a1S and 8-13 aM and between 19-24 ventrally on apical lobes of the median lobe; the ratio width of median lobe at base of apical emargination: depth of emargination varies from 1.27 (T 60) – 1.82 (T 24).

The two males from Shanlinchi (T 60) differ from other specimens by the larger elytra (fig. 107), the deep reticulation of the entire body, and by the deep apical emargination of the median lobe (ratio: 1.27), but I cannot find any other characters which would justify a separate status of these extreme specimens.

*Dianous taiwanensis* is very close to *D. bioculatus* sp. n., but it may be easily distinguished by the more oblique shoulders, the shorter pubescence, and by the aedeagus.

### *Dianous bioculatus* sp. n.

Type material. Holotype ( $\sigma$ ) and allotype ( $\varphi$ ): Yunnan: 100 km W. Kunming, Diaolin Natural Reserve, 22. V.- 2. VI. 1993, E. Jendek & O. Sausa (NHMW). Paratypes: 11  $\sigma$   $\sigma$ ; 19  $\varphi$   $\varphi$ : same data as holotype; 2  $\sigma$   $\sigma$ , 10  $\varphi$   $\varphi$ : Yunnan: Yipinglang, 1800 m, 25°05'N, 101°53', 8.- 10. VI. 1993, Bolm (NHMB. cP, cZheng).

This new species is allied to *D. taiwanensis* which it closely resembles.

Moderately shining, black with very faint dark blue tint, elytra each with a moderately large orange spot (about as in fig. 107). Punctation of head moderately coarse and dense, that of pronotum somewhat coarser, also dense, punctation of elytra coarse and dense, more or less coalescent around orange spots, abdomen finely and moderately sparsely punctate. Pubescence conspicuous, blackish, dense, long, erect. Antennae, maxillary palpi, and legs black with some metallic tint, trochanters brownish, narrow bases of intermediate antennal segments reddish. Clypeus and labrum black with blue/violet metallic tint, moderately densely pubescent. Fourth segment of metatarsi distinctly but shortly bilobed.

Length: 4.5 – 6.0 mm (fore parts: 2.4 – 2.9 mm).

PM of HT: wH: 40.5; adE: 25.5; iE: 17.5; iTe: 6; wP: 32.5; IP: 34; wEl: 47; iEl: 49; IS: 41.

Male: Medial area of metasternum triangularly flattened, shallowly impressed and impunctate but shallowly reticulated posteriomedially, lateral punctation moderately coarse and moderately dense, diameters of punctures about as large as basal cross section of third palpal segment, interstices somewhat larger than diameters of punctures, acam with some 2 or 3 very fine punctures, smooth; declining lateral portions of metasternum finely and densely punctate, punctation becoming coarser and denser toward lateral borders. Medial punctation of sternites 3-5 slightly less dense than lateral

punctuation; sternite 6 with shallow impression posteriomedially with punctuation and pubescence denser than that of sides, posterior margin very shallowly, broadly emarginate; sternite 7 with distinct finely and densely punctate and pubescent median impression in about posterior two thirds, posterior margin shallowly emarginate. Sternite 8 with round notch in about posterior fourth. Sternite 9 with acute tooth apicolaterally (fig. 162), numerous sclerotized fringes and dense asacral apicomedially, apicolateral brush strong, slightly shorter than sternite. Tergite 10 broadly rounded. Aedeagus similar to that of *D. banghaasi*, but apical lobes of median lobe shorter and broader (fig. 155), ratio of breadth of median lobe at bottom of apical emargination: depth of apical emargination = 2.8-4.0; parameres each with about 7-8 aIS and 8-11 amS; apical lobes of median lobe with about 27 short ventral setae.

Female: Ventral characters similar to those of male, but sternites 6 and 7 simple, sternite 7 posteriomedially more densely punctate and pubescent than on sides. Sternite 8 with a considerable triangular projection (fig. 165). Valvifer obliquely acute apically, apical brush about as long as valvifer. Tergite 10 broadly rounded, not triangular.

Head small, much narrower than elytra, longitudinal furrows of frons distinct but not as deep posteriorly as those of *D. distigma* and closely related species, medial and lateral portions broadly elevated, distinctly extending beyond level of inner eye margins, punctuation moderately coarse and dense, diameters of punctures nearly as large as basal cross section of third antennal segment, some interstices about as large as half diameters of punctures, some (especially posteriomedially and near posterior inner eye margins) larger, becoming as large as diameters of punctures, but not forming distinctly separate shining areas. Antennae very long, extending beyond posterior margin of pronotum when reflexed by nearly four segments. Pronotum with deep oblique impressions on posterior half and with transverse impression near anterior margin; punctuation coarse and dense (except on actual middle), diameters of punctures as large as basal cross section of third antennal segment or slightly larger, interstices mostly distinctly smaller than half diameters of punctures, sculpture sometimes more or less coalescent e. g. posteriomedially; a distinct impunctate shining area, about 2-3 punctures broad and 4-6 punctures long, or shallow longitudinal impression in middle. Elytra subquadrate, shoulders prominent, sculpture coarser and denser than that of pronotum, largest punctures nearly as large as apical cross section of third antennal segment, punctuation becoming somewhat confluent and somewhat tortuous around elytral spots, but rugae are short, not forming long channels. Abdomen with broad, upwards directed, finely and very densely punctate paratergites, punctuation of tergites even finer and sparser, punctures nearly as large as medial eye facets, interstices about twice as large as diameters of punctures, punctuation of tergites 8 and 10 slightly coarser. Legs slender, metatarsi 5/7 as long as metatibiae, first segment distinctly shorter than following three segments combined, somewhat longer than last segment, fourth segment distinctly, but shortly bilobed. Faint reticulation on tergites 7-10, rest of surface lacking any groundsculpture.

*Comments.* *Dianous bioculatus* differs from *D. taiwanensis* by the rectangular shoulders, by the slightly longer pubescence, and by the the aedeagus.

Etymology: *bi-oculatus* (Lat.) = with two eyes.

### *Dianous socius* Zheng

*Dianous socius* Zheng, 1993: 200 f. figs.

Material examined: 1 ♂: Sichuan: Mt. Emei, 600-1050 m, 5.-19. V. 1989, L. Bocák (NHMB); 1 ♀: Emei Shan, 7. X. 1985, G. M. de Rougemont (cR); 1 ♂: Qingcheng Shan 65 km NW Chengdu, 103.33 E, 30.53 N, 8 km W Talping, 800-1000 m, 18. V./3.-4. VI. 1997, A. Pütz (coll. Pütz); 2 ♂♂-PT: Emei Shan, 710-1120 m, Gou Zheng-yue & Lu Ying (cP). [HT, AT and 4 paratypes from Emei Shan in the Dept. Biol. Sichuan Teacher's College, Nanchong.]

PM of the first ♂ listed above: wH: 42; adE: 27; lE: 17.5; lTe: 7; wP: 34.5; lP: 35.5; wEl: 52; lEl: 53.5; lS: 47.

This species is allied to *D. banghaasi* Bernhauer, which it closely resembles in general habitus except for much smaller elytral spots.

Shining black with faint dark-blue metallic tint, elytra each with a moderately large orange spot (diameter about as large as length of first metatarsal segment). Head moderately coarsely and moderately densely punctate, pronotum coarsely and densely punctate, punctation of elytra even coarser than that of pronotum, slightly coalescent at antero-medial border of orange spots, abdomen finely and moderately sparsely punctate. Pubescence remarkably long, dense and erect, even slightly longer than in *D. banghaasi*. Antennae, maxillary palpi, and legs black with some metallic tint, narrow bases of intermediate antennal segments reddish, club brownish, trochanters brownish, tarsi sometimes brownish. Clypeus and labrum bluish, densely pubescent. Fourth segment of metatarsi distinctly but shortly bilobed.

Length: 4.7 – 6.2 mm (fore parts: 2.9 – 3.0 mm).

Male: Metasternum broadly convex, shallowly impressed posteriomedially, impunctate and smooth on a small triangular area, sides of medial area moderately coarsely and densely punctate, diameters of punctures about as large as basal cross section of second segment of maxillary palpi, smooth interstices mostly about as large as diameters of punctures, acam with a few very fine, scattered punctures. Medial punctation of sternites 3-6 fine and sparse, smooth interstices twice as large, or even larger, than diameters of punctures; sternite 7 shallowly impressed posteriomedially, finely and moderately densely punctate and pubescent, posterior margin nearly imperceptibly emarginate. Sternite 8 with a broad and deep notch in apical quarter. Sternite 9 with a very strong tooth apicolaterally (fig. 163), apicolateral brush strong, slightly shorter than sternite. Tergite 10 broadly rounded. A e d e a g u s in general similar to those of related species but apical lobes of the median lobe very broad, apical emargination relatively shallow (fig. 156, ratio of breadth of median lobe at bottom of apical emargination : depth of apical emargination = 3.1-3.3); parameres with 8 alS and 11-13 amS; apical lobes of median lobe with about 18-21 short ventral setae.

Female: Ventral characters similar to those of male, but sternite 8 with a remarkable, long triangular projection apically (fig. 167). Valvifer triangularly acute apically, apical brush about as long as sternite. Tergite 10 rounded.

In most respects as *D. banghaasi*, that is with small head, shallow posterior longitudinal furrows of frons, moderately coarse and dense punctation of frons, very

long antennae extending beyond posterior margin of pronotum by four segments when reflexed, relatively shallow pronotal impressions. Different by the punctuation of the pronotum being slightly coarser and somewhat confluent posteriomedially (less regular, less distinctly well-defined than in *D. banghaasi*), and by the presence of a distinct but small impunctate shining area on actual middle of the pronotum. Elytral sculpture very similar to that of *D. banghaasi*, but distinctly confluent at anterior and medial borders of the orange spots, which are much smaller than in *D. banghaasi*. No microsculpture, except for faint traces on tergites 8 and 10.

*Comments.* *Dianous socius* Zheng is easily distinguished from *D. banghaasi* Bernhauer by its much smaller elytral spots, generally blackish coloration throughout, and the sexual characters especially the very long apicolateral tooth of sternum 9. These characters also distinctly distinguish *D. socius* from one male of *D. banghaasi* from Emei Shan, which has smaller elytral spots than usual (see above).

### *Dianous ocellatus* Cameron, 1930

*Dianous ocellatus* Cameron, 1930: 430 f. fig.; Puthz, 1980b: 10 fig.  
? *Dianous acutus* Zheng, 1994: 479 f. figs.

Material examined: Yunnan: 8 ♂♂, 11 ♀♀: Xishuangbanna, 20./ 24. I. 1993, G. M. de Rougemont; 1 ♂: Ruili, 4. II. 1993, G. M. de Rougemont (cR, cP). 4 ♂♂, 2 ♀♀: Thailand: Chiang Mai Prov., Doi Suthep, 750- 800 m, 2. XI. 1995. Zettel (4) (NHMW, cP).

*Comments.* These specimens differ from Assam specimens (types) in having a larger elytral spot, but sexual characters are almost the same (see figs 177, 182, 183, 196, 202, 203) (number and strength of apicomedial sclerotized fringes of sternite 9 are somewhat different). *Dianous ocellatus* was described from India (Assam) and is also known from Vietnam. N e w t o C h i n a and T h a i l a n d. Zheng described *Dianous acutus* based on specimens from Sichuan. Regarding the figures given by Zheng, this taxon seems to be very close to *D. ocellatus*. Verification by the comparison of the types is necessary. Unfortunately, my attempt to get the types for study was not successful.

### *Dianous ocellifer* sp. n.

Type material. Holotype (male) and allotype (female) and 1 ♀ - PT: Yunnan: Ruili, 4. II. 1993, G. M. de Rougemont (cR in BMNH, cP). 1 ♂, 2 ♀♀ - PTT: N Laos: Prov. Lg Nam Tha, ca. 20 km SE Muang Sing, 950 m, 12.- 13. VI. 1996, Schillhammer (25)(NHMW, cP). 1 ♂: Laos C.: Bolikhamsai Prov., Ban-Nape-Kaow-Nua-Pass, 18. IV.- 1. V. 1998, Jendek & Sausa (cHromádka).

This species closely resembles *D. ocellatus* Cameron.

Moderately shining with blue metallic and/or coppery tint, each elytron with a large orange spot (resembling that of *D. grandistigma*). Head moderately finely and densely punctate. punctuation of pronotum moderately coarse and dense, punctuation on basal third of elytra about as coarse as that on pronotum. rest of elytra with dense, oblique sculpture of long rugae, abdomen very finely and densely punctate. Pubescence distinct, whitish yellow, that of fore parts semierect, that of abdomen very distinct, recumbent. Antennae blackish. bases of individual segments remarkably reddish, club

brownish. Palpi blackish. Trochanters reddish, legs black with metallic tint, tarsi sometimes blackish brown. Clypeus and labrum blue metallic, densely pubescent. Fourth tarsal segment deeply bilobed.

Length: 4.8- 5.8 mm (fore parts: 2.9 mm).

PM of the HT: wH: 45; adE: 27; IE: 19; IT: 5; wP: 35; IP: 35; wEl: 53; IEl: 53; IS: 45.

Male: Medial area of metasternum moderately coarsely and densely punctate, interstices reticulated, moderately shiny. Sternites 3-6 slightly more sparsely punctate medially than laterally, sternite 6 with a very shallow impression posteriomedially, sternite 7 with a distinct medial impression on posterior half, punctation and pubescence dense, posterior margin with distinct emargination; sternite 8 with a deep subtriangular excision in about posterior third; sternite 9 with a blunt tooth apicolaterally (fig. 207), fields of fine striae apicomedialely, apicolateral brush moderately strong, as long as sternite. Tergite 10 broadly rounded. *Aedeagus* (figs 180, 189) broad, apical portion of median lobe broadly lanceolate, densely set with strong and very long setae ventro-laterally, internal structures similar to those of *D. distigma*. Parameres somewhat exceeding median lobe, evenly set with about 22 long setae.

Female: Ventral characters similar to those of male. Sternite 7 with more finely and more densely punctate posteriomedially. Sternite 8 (fig. 198). Valvifer with a strong apical brush, as long as the valvifer. Tergite 10 slightly subtriangular, not as rounded as in *D. ocellatus* Cameron.

Head with strongly elevated medial and lateral portions of frons, diameters of punctures nearly as large as basal cross section of third palpal segment, interstices on half of the frons about as large as half diameters of punctures, on other half of frons (particularly posteriorly) about as large as diameters of punctures, rarely larger, no distinct shining area. Antennae very long, by about four segments extending beyond posterior margin of pronotum when reflexed. Pronotum with deep oblique impressions on posterior half and with transverse impression near anterior margin, rest of surface comparatively even (e. g. no median impression); punctation regular, moderately coarse, diameters of punctures somewhat smaller than basal cross section of third antennal segment (but distinctly larger than those on frons), interstices mostly smaller than half diameters of punctures, with a small shining area on very middle. Elytra similar to those of *D. ocellatus*, but orange spot larger than in the typical form (as large as in the Yunnan-populations), no vortex of rugae on posterior quarter. Abdomen similar to that of *D. ocellatus*. Legs moderately slender, metatarsi 5/7 as long as metatibiae, first segment distinctly shorter than following three segments combined, somewhat longer than last segment, third segment broad, shortly bilobed, fourth segment deeply bilobed. Groundsculpture of fore parts nearly obsolete, that of abdomen distinct.

*Comments.* *Dianous ocellifer* may be distinguished from *D. ocellatus* Cameron by the male sexual characters: in *D. ocellatus*, the posteriomedial impression of sternite 7 is much shallower and the posterior emargination is much shallower, the notch of sternite 8 is found in posterior quarter, the apicolateral brush of sternite 9 is nearly as long as the sternite, the aedeagus is much larger (compare that of *D. ocellifer*, fig. 177).

the apical portion of the median lobe (fig. 189) is not lanceolate and is differently setose. The two species are so close in the sculpture of the exoskeleton that good distinguishing characters cannot be given at the moment (punctuation of elytra in posteriolateral quarter seems to be less vorticose, punctures more distinctly well-defined); the elytral spot is larger than in the type specimens from Assam, as large as in Yunnan specimens.

Etymology: *ocellifer* (Latin) = bearing little eyes.

***Dianous grandistigma* sp. n.**

Type material. Holotype (male) and allotype (female): Yunnan: Xishuangbanna, 24. I. 1993, G. M. de Rougemont (cR in BMNH). Paratypes: 15 ♂♂, 6 ♀♀: Xishuangbanna, 20. and 24. I. 1993, G. M. de Rougemont (cR, cP).

This new species closely resembles *D. distigma* Champion and *D. variegatus* sp. n.. The female has very striking characters on valvifer.

Moderately shining with faint blue metallic tint, elytra each with large orange spot posteriomedially (fig. 171). Head moderately finely to moderately coarsely and densely punctate; pronotum coarsely and very densely punctate, rugose anterior- and posteriomedially, medial area more or less impunctate, shining; elytra about as coarsely punctate as pronotum, densely rugose on posterior half, vorticose at spots; abdomen very finely and densely punctate. Pubescence of head and elytra whitish, moderately long, semierect, that of abdomen very dense recumbent. Antennae blackish brown, club brownish, palpi dark brown, trochanters reddish, legs black with metallic tint, tarsi sometimes blackish brown. Clypeus and labrum blue metallic, very densely pubescent. Fourth tarsal segment deeply bilobed.

Length: 5.0 – 6.5 mm (fore parts: 2.8 – 3.0 mm).

PM of HT: wH: 45.5; adE: 28; IE: 19; IT: 6; wP: 36; IP: 37; wEl: 55; IEl: 55; IS: 47.

Male: Medial area of metasternum moderately broadly flat, with a narrow medial impression, punctuation of medial area moderately coarse and dense, punctures nearly as large as basal cross section of second palpal segment, interstices one to two times as large as diameters of punctures, densely isodiametrically reticulated and shiny, acam very finely and moderately densely punctate and pubescent, interstices with very shallow groundsculpture; declining lateral areas of metasternum finely and moderately sparsely punctate, interstices nearly smooth. Sternites 3-6 slightly more sparsely punctate medially than laterally, interstices one and one half to two times as large as diameters of punctures, shining, groundsculpture nearly extinct; sternite 6 very shallowly impressed posteriomedially, sternite 7 with a distinct medial impression on posterior three quarters, punctuation moderately fine and very dense, pubescence long, dense, convergent, posterior margin distinctly but shallowly emarginate. Sternite 8 with a deep subtriangular notch in about posterior quarter; sternite 9 with a distinct tooth apicolaterally as in fig. 205, distinct sclerotized fringes and fields of asacI apicomediaIly, apicolateral brush moderately strong, slightly shorter than sternite. Tergite 10 broadly rounded. A e d e a g u s (figs 178, 186), median lobe triangularly narrowed and strongly curved upwards, dorsally with a longitudinal ridge on each side, apical

portion densely set with moderately long setae inserted mainly dorso-laterally, internal structures similar to those of *D. distigma*. Parameres distinctly longer than median lobe, evenly set with (about) 20-22 long setae.

Female: Punctuation of metasternum as in male, but interstices very shallowly reticulated, shiny. Punctuation of sternites as in male, sternite 7 finely and very densely punctate and pubescent posteriomediaally. Sternite 8 as in fig. 194. Valvifer (fig. 192) narrowly rounded apically, dorsal side smooth and shiny, ventral side densely set with moderately long, very strong, modified setae (comblike, fig.191). Tergite 10 slightly subtriangular.

In most respects very similar to *D. distigma* Champion, but the elytral spot considerably larger, elytra shorter, and the male's sexual characters different: the flattened median area of the metasternum is distinctly less broad and its posterior middle punctate, the aedeagus narrower, its apical portion shorter (see figs 181, 187). Valvifer totally different.

*Comments.* This species is the first one observed with such conspicuous characters on valvifers; these characters make it easy, to distinguish it from other species similar in exoskeletal habitus. – One male in the Zoological Museum in St. Petersburg from Vietnam: Mountains near Tuan Giao, 800 m, 28. XI. 1962, G. Kabakov has also larger elytral spots than those of the Himalayan specimens of *D. distigma*, and with the aedeagus strongly resembling that of *D. grandistigma*. This specimen (not at hand) may belong actually to *D. grandistigma*.

Etymology: *grandis* (Lat.) = large, *stigma* (Lat.) = a mark.

### *Dianous variegatus* sp. n.

Type material. Holotype (♂), allotype (♀), and 1 ♀ - paratype: Yunnan: Ruili, 4. II. 1993, G. M. de Rougemont (cR in BMNH, cP).

This new species is the sister species of *D. grandistigma* sp. n. based e. g. on the modified setae on the valvifer. It also closely resembles *D. verticosus* Eppelsheim.

Variagate metallic (blue-violet-coppery), rather shining, elytra each with a large orange spot posteriomediaally (about as large as length of antennal segment 4). Head moderately finely and moderately densely punctate, pronotum coarsely and very densely punctate (except centre), somewhat coalescent anteriorly and posteriorly; punctuation of elytra about as coarse as that on pronotum, but vortucose on posterior half; abdomen very finely and densely punctate. Pubescence, antennae, palpi, and legs same as in *D. grandistigma*.

Length: 5.5-6.5 mm (fore parts: 3.0- 3.1 mm).

PM of the holotype: wH: 48; adE: 29; wP: 37,5; IP: 39,5; wEl: 57,5; IEI: 57,5; IS: 50.

Male: Ventral characters similar to those of *D. grandistigma*, but punctuation of metasternal disc distinctly finer and slightly sparser, reticulation shallower (interstices strongly glistening), diameter of punctures distinctly smaller than basal cross section of palpal segment 2, interstices often more than two times as large as diameters of punctures. Interstices between the punctures on sternites with very faint but distinct

reticulation. Sternite 8 with a broad and deep triangular excision in about posterior quarter (length of sternite: depth of excision = 92: 21). Sternite 9 (fig. 204). Tergite 10 broadly rounded. *A e d e a g u s* (fig. 184) in general as in *D. grandistigma*, apical portion of median lobe broader, no dorsal ridge at apical portion.

Female: Punctuation of metasternum finer and sparser, more strongly shining than that of *D. grandistigma*. Sternite 8 (fig. 193), less sharply triangular posteriorly. Valvifers about as in *D. grandistigma*, also with long and strong modified setae; setae not as densely set as in *D. grandistigma*, somewhat narrower and much more acute on central portion (modified setae at posterior border of valvifer rounded apically as in *D. grandistigma*). Tergite 10 subtriangular (fig. 201).

*Comments.* *D. variegatus* is more shining than *D. grandistigma* and more brightly variegate-metallic. It is also distinguished by its sexual characters, although they are close to those of *D. grandistigma*. Since nothing is known about variability of that species, the differences may fall within the variability of *D. grandistigma*, or be of subspecific rank. - The new species also resembles externally the variable *D. verticosus* Eppelsheim, but the elytral spot is larger, the apical portion of the median lobe is narrower (compare fig. 185), sternite 8 of the female is less triangular (fig. 195) and the valvifer is different (in *D. verticosus* all the setae are pointed).

### *Dianous emarginatus* Zheng, 1993

*Dianous emarginatus* Zheng, 1993: 201 figs.

Material examined: 1 ♂, 1 ♀: Yunnan: Heishui, 35 km N Lijiang, 27°13' N, 150°19' E, 1.-19. VII. 1993, E. Jendek (NHMW, cP); 4 ♂♂, 3 ♀♀: ibidem 18. VI.- 4. VII. 1993, S. Becvar (NHMG, cP); 1 ♀: Lugu Lake - Luo Shui, 27°45' N, 100°45' E, 8.- 9. 7. 1992, E. Jendek (NHMW). 1 ♂-PT: Sichuan: Emei Shan, 1600 m. 30. VII. 1982, Tian Hua (cP) [HT and 3 PT in the Dept. Biol., Sichuan Teacher's College, Nanchong]. - 1 ♀ (cf. det.): Burma: Carin Asciiui Chebà, 800- 1400 m, XII. 1887. L. Fea (coll. Fauvel. IRScNB).

This species is allied and closely similar to *D. distigma* Champion.

Moderately shining, black with faint blue metallic tint, elytra each with a moderately large orange spot posteriomedially (compare fig. 172). Head moderately finely and densely punctate, pronotum coarsely and densely, near anterior and posterior borders rugosely, punctate, elytra punctate about as coarsely as pronotum, each with close oblique rugae on posterior half, abdomen very finely and densely punctate. Pubescence, except on pronotum, distinct, especially on abdomen, whitish, semierect on fore parts, recumbent on abdomen. Antennae blackish brown, club brownish, palpi dark brown, trochanters reddish, legs blackish with metallic tint, tarsi occasionally dark brown. Clypeus and labrum black with bluish tint, densely set with short setae. Fourth tarsal segment narrowly and deeply bilobed.

Length: 4.5 - 5.5 mm (fore parts: 2.6 mm).

PM of a Yunnan- ♂: wH:41; adE:26; IE: 18; IT: 5; wP: 32; IP: 31; wEl: 48; lEl: 49.5; IS: 42.

Male: Medial area of metasternum broadly flat, with a short impression posteriomedially, impunctate around impression, otherwise moderately finely and densely punctate; interstices distinctly reticulated, diameters of punctures nearly as large as



basal cross section of second palpal segment, interstices nearly as large as half diameters of punctures, acam finely and moderately sparsely punctate, reticulation of interstices even shallower than that of medial area; declining lateral areas of metasternum finely and moderately densely punctate, interstices very shallowly reticulated, shining. Sternites 3-6 slightly more sparsely punctate medially than laterally, interstices nearly twice as large as diameters of punctures, sternite 7 with a distinct but shallow, finely and very densely punctate and pubescent median impression in posterior two fifths, posterior margin shallowly emarginate; sternite 8 with a deep subtriangular notch in about posterior fifth; sternite 9 with a short, blunt tooth apicolaterally (fig. 206), fields of fine striae apicomediaally, apicolateral brush short, about half as long as sternite. Tergite 10 broadly rounded. *A e d e g u s* (figs 179, 188), median lobe broader than that of *D. distigma* (figs 181, 187), apical portion densely set with very long setae ventro-laterally, internal structures consisting of expulsion bands, a strongly sclerotized tube-like internal piece, and a complex of densely spinose membranes. Parameres slightly exceeding apex of median lobe, evenly set with about 16- 22 long setae (much longer in *D. distigma*).

Female: Ventral characters similar to those of male, interstices of medial punctation of metasternum slightly larger, nearly as large as diameters of punctures, sternite 7 simple, apical emargination nearly imperceptible. Sternite 8 (fig. 197). Valvifer with a distinct tooth apically, apical brush 2/3 as long as valvifer. Tergite 10 evenly rounded apically.

In most respects very similar to *D. distigma*: Head with strongly elevated medial and lateral portions of frons, diameters of punctures nearly as large as basal cross section of third palpal segment, interstices mostly smaller than half diameters of punctures, small impunctate area posteriorly near inner eye margin, medial portion of frons slightly less densely punctate than rest of frons, but interstices rarely as large or slightly larger than diameters of neighbouring punctures, no distinct shining area. Antennae very slender, by 3-4 segments extending beyond posterior margin of pronotum when reflexed. Punctuation of pronotum slightly less dense than that of *D. distigma*, diameters of punctures as large as basal cross section of third antennal segment, interstices mostly distinct, nearly as large as half diameters of punctures, larger in very middle, which is shiny and slightly impressed; punctuation transversely confluent near anterior and especially near posterior border. Elytra less large than those of *D. distigma*, punctuation on anterior half mostly well-defined, interstices regularly larger than diameters of punctures anteriomedially; posterior half with dense, obliquely-rugose sculpture, rugae somewhat convex at orange spot, but not distinctly vorticosae. Abdomen and legs as those of *D. distigma*, metatarsi about 2/3 as long as metatibiae, first segment distinctly shorter than three following segments combined, slightly longer than last segment, third segment shortly bilobed, fourth segment deeply bilobed. Entire body with very shallow reticulation.

*Comments.* *Dianous emarginatus* Zheng differs from *D. distigma* Champion by its narrower body and by the sexual characters; it differs from *D. grandistigma* sp. n. by the much smaller elytral spot, by the shorter antennae, and by the sexual characters.

*Dianous luteolunatus* Puthz

*Dianous luteolunatus* Puthz, 1980b: 3 figs.

Material examined: SE Guanxi: 1 ♀: District Yulin, Liuwan Mountains SW Yulin, Kuishan 300 m, 17. XI. 1993, H. Schillhammer (22) (NHMW). Laos: 17 ♂♂, 12 ♀♀, Prov. Lg. Nam Tha, ca. 20 km SE Muang Sing, 12./13. VI. 1996, Schillhammer (25) (NHMW, cP); 2 ♂♂, 4 ♀♀, Prov. Lg. Nam Tha, ca. 30 km NW Lg. Nam Tha, 800 m, 16.-18. VI. 1996, Schillhammer (28, 30) (NHMW); 1 ♀, Bolikhamsai prov., Ban- Nape- Kaow- Nua- Pass, 18. IV.- 1. V. 198, Jendek & Sausa (cHromádka).

*Comments.* This species was described from a single male from Vietnam (Mountains NO Thai Nguyen), new to China and Laos.

*Dianous atrocoeruleus* sp. n.

Type material. Holotype (male) and allotype (female): Yunnan: 100 km W. Kunming, Diaolin Natural Reserve, 22. V.-2. VI. 1993, E. Jendek & O. Sausa (NHMW). Paratypes: 2 ♂♂, 2 ♀♀: same data as holotype.

This new species is closely related to the orange spotted species *D. luteolunatus* Puthz and *D. luteostigmaticus* Rougemont, but differs from both easily by the unicolorous surface of the elytra.

Black with Prussian-blue metallic tint, rather dull, head moderately finely and densely punctate, pronotum coarsely and mostly densely punctate, elytra coarsely sculptured, each with long rugae directed on anterior half from suture posterior-laterad toward middle of elytron and from there posterior-mediad toward suture to form rugose cross with its center in middle of combined elytra; punctation on antero-lateral areas of elytra mostly separate, on posterior-lateral quarters mostly shortly confluent the fore parts moderately erect, that of abdomen recumbent. Antennae, maxillary palpi and legs black with blue metallic reflection, bases of trochanters reddish, last antennal segments may be slightly brownish. Clypeus and labrum blackish-blue metallic, densely pubescent. Tarsal 4 segment simple with some weak shoe-bristles.

Length: 4.8 – 6.0 mm (fore parts: 2.8 – 3.1 mm).

PM of the HT: wH: 40; adE: 26.5; IE: 17; IT: 6; wP: 33; IP: 34; wEl: 53; lEl: 57; IS: 48.

Male: Metasternum strongly convex, narrow triangular medial area flat, extremely densely and deeply reticulated but with a faint reflex, impunctate in middle, laterally with about 10 moderately fine punctures, acam with a few moderately fine punctures, densely but much more shallowly reticulated and slightly more shining than medial area; declining lateral portions of metasternum finely and very densely punctate and pubescent, interstices shiny with shallow ground sculpture. Medial punctation of sternites 3 and 4 somewhat coarser and slightly sparser than lateral punctation; medial punctation of sternites 5 and 6 nearly same as that on sides, posterior margins of sternites 3 and 4 shallowly emarginate; sternite 7 distinctly but shallowly impressed posteriorly, finely and very densely punctate and pubescent, posterior margin with a distinct emargination. 8<sup>th</sup> sternite with a round and deep emargination nearly in posterior third; sternite 9 broad, apicolaterally with more or less distinct tooth apicolaterally (fig. 101), with strong sclerotized fringes and fields of fine asac apico-

medially, apicolateral brush strong and dense, nearly as long as sternite. Tergite very broadly rounded. *A e d e a g u s* (fig. 85), anterior portion of median lobe broadly lanceolate, densely set with long ventral setae anteriolaterally, internal structures consisting of a stronger sclerotized, broad tube and densely spinose membranes. Parameres somewhat longer than median lobe, densely set with 29 moderately strong, long setae.

Female: Ventral characters similar to those of male, but sternite 7 simple, except for very shallow apical emargination; sternite 8 (fig. 88). Valvifer more or less obliquely truncate apically, apical brush about as long as valvifer. Tergite 10 slightly triangularly narrowed, apex rounded.

Punctuation of head moderately fine, diameters of punctures nearly as large as basal cross section of third palpal segment (thus much smaller than basal cross section of third antennal segment), interstices mostly smaller than half diameters of punctures, slightly larger on elevated median portion and posteriolaterally, but no distinct shining areas. Antennae moderately slender, by about two segments extending beyond posterior margin of the pronotum when reflexed, outer segments slightly longer than broad. Pronotum with a deep, transverse impression near anterior margin and deep, oblique lateral impressions on posterior half; punctuation deeply pierced, mostly dense, diameters of punctures as large as basal cross section of third antennal segment, interstices smaller than half diameters of punctures, much larger posteriomedially on a shining, but finely reticulated area, of which the width possibly as large as length of antennal segment eighth; punctuation somewhat confluent near anterior margin and in posterior impressions near base. Elytra strongly rugose, rugae may form more or less distinct vortex latero-medially. Abdomen with broad, distinctly upwards directed, paratergites, those of segment four about as broad as metatibiae in apical third, punctuation of paratergites fine and very dense, nearly as fine as that of tergites. Tergite 7 with a broad apical membranous fringe (winges fully developed). Punctuation of tergites 8 and 10 twice as coarse and much sparser than that of tergite 7. Legs moderately slender, metatarsi 2/3 as long as metatibiae, first segment distinctly shorter than three following segments combined (33: 38), longer than last segment (33: 28), fourth segment simple. Entire body densely, more or less deeply reticulated.

*Comments.* *Dianous atrocoeruleus*. is similar in general appearance to *D. luteolunatus* Puthz and *D. luteostigmaticus* Rougemont, but differs by the lack of the orange elytral spots and by the different sexual characters.- The allotype has some attached mites.

Etymology: *ater* (Latin) = black, *coeruleus* (Latin) = blue: blackish blue *Dianous*.

### *Dianous alcyoneus* sp. n.

Type material. Holotype (♂) and allotype (♀) and 1 ♂, 2 ♀♀ - paratypes: N Laos: Prov. Lg. Nam Tha: ca. 30 km SE Muang Sing, 800 m, 16./ 18. VI. 1996, H. Schillhammer (28. 30) (NHMW, cP).

This new species is the sister species of *D. atrocoeruleus* sp. n..

Moderately shining, black with Prussian-blue reflection, elytra with a silver-bluish spot posteriolaterally, frons moderately coarsely and densely punctate, pronotum coarsely, densely and somewhat confluent punctate, elytral sculpture coarse, rugose, vortucose, abdomen finely and very densely punctate; pubescence of the fore parts indistinct, on abdomen short, dense, recumbent. Antennae, maxillary palpi and legs black with some metallic reflection. Clypeus and labrum blackish blue metallic, moderately densely pubescent.

Length: 4.7 – 5.6 mm (fore parts: 2.6 – 2.8 mm).

PM of HT: wH: 40; aE: 24; IE: 17; IT: 6; wP: 34; IP: 33; wEl: 55; IEl: 58; IS: 49.

Male: Metasternum strongly convex, narrow triangular median area flat, extremely deeply and densely reticulate, completely dull, with a few moderately fine punctures, acam finely and densely punctate throughout with shallow microsculpture (much more shining than median area of metasternum). Sternite 3 with a triangular impunctate area medially, sternite 4-5 slightly coarser and slightly less densely punctate medially than laterally, sternite 6 densely punctate medially, sternite 7 very densely punctate and pubescent posteriomediaally (no distinct impression), posterior margin very shallowly emarginate. Sternite 8 with a broad notch in about posterior sixth. Sternite 9 serrate apically (fig. 241) with a small area of asac posterioriomediaally, apical brush strong, as long as the sternite. Tergite 10 broadly rounded. Aedeagus resembling that of *D. atrocoeruleus* (fig. 85; also very similar to that of *D. luteostigmaticus* Rougemont) but the apical portion of the median lobe different (fig. 243); internal structures similar to those of the compared species, parameres with 21 setae.

Female: Ventral characters as in the male, but sternite 7 simple. Sternite 8 broadly rounded and slightly bent upwards posteriorly. Tergite 8 with a broad excision apically (fig. 242). Valvifer serrate apically, brush very strong. Tergite 10 triangular.

*Comments.* In nearly all respects similar to *D. atrocoeruleus* but the sexual characters different: sternite 8 of the male is much less emarginate, aedeagus slightly but distinctly different. Tergite 8 of the female has an apical excision. In my key (1981) the new species should be placed at # 150 (151); it is distinguished from *D. vietnamensis* Puthz by the larger size, by the shorter antennae with broader penultimate segments and by the sexual characters; in the key of this article it might be placed either at # 204 or at # 214 (it is distinguished from *D. subvorticosus* by lacking dense pubescence of the fore body).

Etymology: *Alcyoneus* (Latin) = resembling a kingfisher by its silver-bluish elytral spot.

### *Dianous oculatipennis* Puthz

*Dianous oculatipennis* Puthz. 1980b: 3 ff. figs.

Material examined: Yunnan: 2 ♂♂, 2 ♀♀: Xishuangbanna, 20./ 24. 1. 1994, G. M. de Rougemont (cR, cP).

Male: Metasternum flattened medially, narrowly impressed posteriomediaally, punctuation of disc moderately coarse and sparse, diameters of punctures nearly as large as basal cross section of palpal segment 2, interstices two to three times as large as

diameters of punctures, densely and deeply reticulated, weakly glistening (neither shining nor dull), acam very finely and sparsely punctate, interstices nearly smooth. Sternites 3-6 medially as fine and sparse punctate as on the sides, punctures much smaller than eye facets, interstices twice as large as punctures, groundsculpture nearly extinct. Sternite 5 and 6 very shallowly emarginate at posterior margin, sternite 7 with shallow but distinct impression posteriomedially, punctation and pubescence of impression fine and very dense, posterior margin shallowly emarginate. Sternite 8 with a broad, triangular notch nearly in posterior third. Sternite 9 (fig. 208). Tergite 10 broadly rounded. *A e d e a g u s* (fig. 190).

Female: Punctation of metasternum as in male, but interstices narrower (although distinctly larger than diameters of punctures), and shallowly reticulated, shining. Sternites as in male, sternite 7 with medial punctation and pubescence denser than that on sides. Sternite 8 triangular (fig. 199). Valvifer irregularly serrate apically, apical brush strong, nearly as long as valvifer. Tergite 10 rounded, not subtriangular.

*Comments.* This species was described from a single male from Yunnan (Siamonyang, 25 km N Ch'e-li).

### *Dianous lobatipes* sp. n.

Material: Holotype (♂): Anhui: Huang Shan, 60 km NNW Tunxi nr. Tang Kou, 900-1000 m, stream (beneath cable car), ca. 3-5 m wide, almost completely dried out, surrounded by primary forest, very big granitic rocks and sand, short sections with running water (figs 17, 20 in Jäch & Li, 1998), 31. X. 1997, M. Wang (CWBS 292) (NHMW).

Moderately shining, head blue-metallic with olive tint, rest of insect olivegreen-metallic, head moderately finely, densely punctate, pronotum and elytra coarsely and mostly confluent punctate, abdomen very finely and very densely punctate; pubescence short, recumbent, conspicuous on abdomen. Antennae, maxillary palpi and legs dark green-metallic, last segments of antennae and last tarsal segments slightly brownish. Clypeus and labrum blue-metallic, moderately densely pubescent. Fourth tarsal segment very deeply bilobed.

Length: 5.0- 5.8 mm (fore parts: 2,7 mm).

Male: Metasternum broadly convex, triangularly impressed posteriomedially, median portion shining, almost smooth, about 10 moderately fine punctures on each side, acam smooth. Sternites 3-6 almost impunctate medially with faint microsculpture, shining median area about 1/4 as broad as the respective sternite, not sharply delimited laterally, transition zone between impunctate and densely punctate areas sparsely and moderately finely punctate. Sternite 7 finely and densely punctate with dense pubescence posteriomedially, posterior margin very shallowly emarginate. Sternite 8 with a broad, rounded notch in about posterior 6th. Sternite 9 apically serrate (fig. 238), apicolateral brush strong, distinctly somewhat shorter than length of sternite. Tergite 10 broadly rounded. Outline of *a e d e a g u s* resembling that of *D. rugosipennis* (see figs 84, 86), but internal structure totally different: no strongly sclerotized basal portion of internal sac but a broad and long membranous sac densely set with tufts; stronger sclerotized lateral portions of the apical portion narrower than in the compared species with few short setae (fig. 224); parameres with 15- 16 long setae in apical half.

Female: unknown.

Head slightly broader than elytra (45: 43,5), eyes large (IE: 21; IT: 5), frons broad (adE 27) with distinct, complete longitudinal furrows, median portion about as broad as each of the side portions, slightly but distinctly convex, elevated to about level of inner eye margins; punctation moderately fine and dense, diameters of punctures nearly as large as basal cross section of segment 3 of the maxillary palpi, interstices mostly distinctly smaller than diameter of punctures, larger at few places. Antennae very long, last four segments extend beyond the posterior margin of the pronotum when reflexed, penultimate segments 1.5 x as long as broad. Pronotum slightly longer than broad (36: 33,5), sides convex anteriorly, concave in posterior third, a distinct round impression on each side of the middle; punctation coarse, coarser anteriorly and posteriorly, less coarse on middle, very dense and rugose anteriorly and posteriorly, dense laterally or moderately dense on actual middle, largest punctures about as large as medial cross section of antennal segment 3, smallest punctures (on the centre) about as large as basal cross section of antennal segment 8, interstices mostly much narrower than half diameter of punctures, as large or somewhat larger than punctures on medial centre. Elytra rectangular, slightly narrower than head (43,5: 45), distinctly longer than broad (48: 43,5), no distinct impressions; sculpture coarse, dense and rugose, rugae slightly vorticose on posterior half, about as broad as medial cross section of antennal segment 3, interstices smaller than half width of rugae; declining sides of elytra coarsely or moderately coarsely punctate, shining interstices as large as diameter of punctures or larger. Abdomen with broad, upwards directed paratergites, basal furrows of tergites very deep, tergite 7 with a broad membranous fringe apically (the insect is fully winged); punctation very fine and very dense, tergite 8 moderately finely and moderately densely punctate, interstices as large as diameter of punctures or larger, tergite 10 with some moderately fine punctures. Legs slender, metatarsi longer than half metatibiae (35: 58), first segment slightly shorter than the following 3 segments combined (14: 16), slightly longer than the last segment (14: 12); segment 4 narrowly and deeply bilobed, lobes as long as half of the claw segment. Faint microsculpture on frons, abdominal microsculpture distinct on tergite 8-10.

*Comments.* This new species is remarkable by the deeply bilobed fourth tarsal segment, narrow general facies and apically serrate tergite 10. There are several species which have resembling aedeagi (*D. luteostigmaticus* Rougemont, *D. rugosipennis* sp. n.), but the internal structures are different from that of the new species. So, at present, I do not know its sister-species. Tentatively the new species should be placed into the complex of *Dianous coeruleescens*.

*Etymology:* *lobus* (Latin) = lobe, *pes* (Latin) = foot.

### *Dianous cupreogutta* sp. n.

Type material. Holotype (♂): Taiwan: Nantou Hsien: Shanlinchi, 1650 m, 19. V. 1991, A. Smetana, on wet rocks in a creek (see photo 2 in Smetana, 1995). A. Smetana (MHNG); allotype (♀): same, 16. V. 1990, A. Smetana (cS). Paratypes. 1 ♂, 1 ♀: same data as HT and AT (cS, cP). Kaohsiung Hsien: 1 ♂: road from Tengchih to Chuyenshan, 1400 m, 25. IV. 1990, A. Smetana (cS).

This new species is remarkable by the dark, brilliant general habitus and by the coarse, rugose sculpture of the elytra, which have a small coppery spot on the posterior half. It resembles *D. championi* Cameron but is closer related to *D. cameroni* Champion. It also resembles in general appearance the west Palaearctic *Stenus asphal-tinus* Erichson.

Brilliant black with slight blue metallic tint (head anteriorly, pronotum laterally, tip of abdomen), elytra on posterior half with a small, sometimes indistinct, coppery spot. Punctuation of head and pronotum moderately coarse, moderately dense (frons) to moderately sparse (pronotum), elytra coarsely, rugosely sculptured with long vorticoso rugae on posterior half, abdomen very finely and sparsely punctate except last 3 tergites. Pubescence rather long, moderately recumbent, that of abdomen quite distinct. Antennae black, club somewhat blackish brown. First segment of maxillary palpi light brown, second segment brown, third segment dark brown. Legs black, trochanters brownish, tibiae and tarsi with brownish tint. Clypeus and labrum dark blue metallic, sparsely pubescent. Segment 4 of metatarsi short, slightly bilobed.

Length: 3.8 – 4.8 mm (fore parts: 2.3 – 2.5 mm).

PM of HT: wH: 41; adE: 22; IE: 19; IT: 4,5; wP: 30; IP: 31; wEl: 41; IEI: 42; IS: 37.

Male: Middle of metasternum plain, moderately impressed posteriorly, brilliant, impunctate medially, with 8-9 moderately coarse punctures on each side, acam impunctate. Abdominal sternites 3-6 medially finely and very sparsely punctate, punctation slightly sparser than that on sides, sternite 7 shallowly impressed posteriorly, finely and very densely punctate and pubescent, posterior margin shallowly emarginate. Sternite 8 with a broad emargination in about posterior eighths to ninth. Sternite 9 (fig. 228) with a broad tooth apicolaterally, with short sclerotized fringes apicomediaally, densely set with rather long setae ventrally, some fields of fine, short striae apicodorsally, apicolateral brush somewhat shorter than sternite. Tergite 10 broadly rounded. A e d e a g u s (fig. 214) of the „*coerulescens*-type“, median lobe triangularly narrowed, apical portion with numerous long setae, most of them dorsally. Parameres slender, with about 12-16 long setae.

Female: Ventral characters almost as those of male, but apical impression and emargination of sternite 7 shallower. Sternite 8 rounded, obtusely angulated produced medially (about as in fig. 215). Valvifer apically moderately acute. Tergite 10 narrowly rounded.

Head about as broad as elytra in male (may be slightly narrower or slightly broader), slightly, but distinctly, narrower in female (e. g. 41.5: 45.5); longitudinal furrows deep and long, middle portion nearly as broad as each of lateral portions, strongly elevated, as high as elevated lateral portions of frons; punctuation moderately coarse, moderately dense, diameters of punctures about as large as basal cross section of third antennal segment, interstices mostly as large or slightly larger than diameters of punctures, narrower in longitudinal furrows. Antennae moderately slender, about one and half of the outer segments extending well beyond posterior margin of pronotum when reflexed, penultimate segments about 1.5 x as long as broad. Pronotum with distinct oblique impressions posteriolaterally and with transverse impression near

anterior margin; posterior third distinctly constricted, with conspicuous bump posterio-laterally; punctation about as coarse or somewhat coarser than that on head, moderately dense laterally, sparse to very sparse medially, interstices 3 or more times wider than diameters of punctures in very middle. Elytra subquadrate, sutural and humeral impressions shallow; punctation on anterior half mostly well-defined (occasionally confluent), on posterior half strongly vorticoso forming a more or less distinct rosette around small coppery spot situated directly behind longitudinal middle, diameter of coppery spot about as large as length of antennal segment 5 or 6; the cavity of largest furrows can receive second antennal segment. Abdomen with broad, slightly upward directed paratergites, those of tergite 4 as broad as metatibia at apex, punctation of paratergites dense anteriorly, becoming very sparse posteriorly; punctation of tergites 3-7 very fine and sparse, diameters of punctures smaller than medial eye facets, interstices medially at least three times as large as diameters of punctures; Tergite 7 with a broad palisade fringe apically (the species is fully winged), punctation of tergites 8 and 10 coarser and denser. Legs moderately slender, metatarsi about 3/4 as long as metatibiae, first segment distinctly shorter than 3 following combined (e. g. 32: 35), very slightly longer than last segment, segment 4 slightly broader than segment 3, distinctly but shortly bilobed. Most parts of this insect are brilliant lacking microsculpture, faint groundsculpture can be seen on tergites 6 and 7, distinct reticulation on the last 3 tergites.

*Comments.* I suppose that this species is more variable in the size of the elytra (in relation to that of the head) than described above, as it is the case in *D. championi*. *Dianous cupreognata* may be distinguished from *D. championi* Cameron by smaller size, the coppery elytral spot, the relatively broader paratergites, by the more sparsely punctate pronotum lacking longitudinal median impression, and by the sexual characters. It differs from *D. cameroni* Champion, which has a very resembling aedeagus, by the much sparser punctation, the brilliant lustre, by the smaller size, and by the shorter tarsi. Since the degree of bilobation of segment 4 of the metatarsi is not so clear in this species, in keys it should be quoted in both columns: with simple and with bilobed tarsi.

Etymology: *cupreus* (Latin) = coppery, *gnata* (Latin) = drop; *Dianous* with coppery drops.

### *Dianous ater* sp. n.

Type material. Holotype (♂) and allotype (♀): Taiwan: Taoyuan Hsien, Takuanshan Forest. 1600 m, on wet rocks in a small mountain stream, 17. IV. 1990, A. Smetana (NHMG).

Paratypes: 93 ♂♂, 120 ♀♀: same data as holotype (cP, cR, cS). Ilan Hsien: 6 ♂♂, 14 ♀♀: Chyr Duan 1050 m, 18. IV. 1990, same habitat as HT, A. Smetana (cP, cS); 1 ♂, 2 ♀♀: ibidem, 1100 m, 18. IV. 1990, swampy edge of a small lake, in tufts of *Carex*, A. Smetana (cS).

This species is closely related to *D. amamiensis* Sawada, which it resembles in general habitus and sculpture, but it is easily distinguished by the blackish legs. At first glance, it seems to represent a species of *Stenus* near the Palaearctic *S. intricatus* Er.

Moderately shining, upper surface black with very faint dark-green-metallic tint (distinct only on anterior portion of head and on last 3 abdominal segments, more or



less distinct also on posteriolateral rugose portion of elytra, ventral side distinctly greenish-metallic. Punctuation of fore parts coarse and very dense, coalescent on parts of pronotum and on posterior half of elytra, abdomen finely and very densely punctate. Pubescence of fore parts short and little distinct, abdomen densely pubescent. Antennae blackish with faint metallic tint, penultimate segments brownish. Maxillary palpi with segment 1 and narrow base of segment 2 brownish, rest black with metallic tint. Legs blackish with metallic tint, femora dark brown in about basal half, trochanters reddish brown. Labrum and clypeus black with dark-green tint, moderately densely pubescent. Segment 4 of metatarsi distinctly, moderately broadly bilobed.

Length: 4.7- 5.7 mm (fore parts: 2.8- 3.0 mm).

Male: Metasternum broadly convex, very slightly impressed posteriomediaally; punctuation of flat triangular middle moderately coarse and moderately dense, much coarser than that on declining lateral portions, interstices mostly as large as punctures, with more or less deep, isodiametrical groundsculpture, posteromedial area narrowly impunctate, acam with some fine punctures. Abdominal sternites 3-6 moderately finely and densely punctate, interstices with more or less distinct groundsculpture; sternite 7 shallowly impressed posteriomediaally, impression finely and very densely punctate and pubescent, posterior margin shallowly emarginate. Sternite 8 with a broad triangular excision in about posterior eighth. Sternite 9 (fig. 229) blunt and serrate apicolaterally, apical brush about 2/3 length of sternite. Tergite 10 broadly rounded at posterior margin. *A e d e a g u s* (fig. 209) with apical portion of median lobe triangularly narrowed and curved toward ventral side.

Female: Ventral characters about same as in male, apical impression of sternite 7 very shallow. Sternite 8 (fig. 215) with rounded projection posteriomediaally. Valvifer apically rounded-serrate. Tergite 10 broadly rounded.

Length: 4.7- 5.7 mm (fore parts: 2.8- 3.0 mm).

Head much narrower than elytra (40.5: 50), eyes large (IE: 20; IT: 4); frons broad (adE: 23) with two distinct longitudinal furrows, medial portion about as broad as each of side portions, distinctly elevated, extending well beyond the level of inner eye margins; sides portions distinctly elevated posteriorly; punctuation coarse and dense, diameter of punctures about as large as cross section of basal third of antennal segment 3, interstices distinctly smaller than half diameter of punctures, larger on middle portion and on elevated side portions, with interstices becoming as large as (about) one neighbouring puncture. Antennae moderately long, extending slightly more than by last segment beyond posterior margin of pronotum when reflexed, penultimate segments 1.5 x as long as broad. Pronotum slightly longer than broad (34: 31), broadest at about middle, moderately convex in anterior two thirds, distinctly constricted in posterior third; with moderately deep impression laterally somewhat behind middle, transverse impression near anterior margin, and sharp, very narrow, short, and more or less distinct medial impression at about middle. Punctuation coarser than that on head and more or less coalescent, distinctly coalescent on posterior half, diameters of punctures about as large as middle cross section of antennal segment 3, interstices always much smaller than half diameter of punctures. Elytra subquadrate, much broader than head (50: 40.5), slightly longer than broad (53: 50), shoulders prominent, sides shallowly

rounded, posterior margin deeply emarginate (IS: 44); sutural impression distinct, humeral impression less distinct, shallow. Punctuation as coarse or slightly coarser than that on pronotum, very dense and mostly distinctly coalescent on following areas: anteriorly near suture (short transverse rugae in most specimens), on inner third of posterior half there are oblique rugae directed posteriad from elytral middle toward suture, and in lateral two thirds directed straight toward posterior margin or somewhat curved, but not forming a distinct (or complete) rosette. Abdomen with broad paratergites, those of segment 4 as broad as metatibia at its broadest portion, slightly directed upwards and very finely and densely punctate. Basal impression of basal tergites deep, tergite 7 with distinct palisade fringe apically (wings fully developed). Punctuation fine and very dense throughout, punctures about as large as medial eye facets, interstices smaller than diameters of punctures, sternite 8 with punctuation distinctly coarser and slightly less dense than that of tergite 7, tergite 10 moderately finely and moderately densely punctate. Legs slender, metatarsi (fig. 220) nearly 4/5 as long as metatibiae, segment 1 distinctly shorter than following 3 segments combined, much longer than last segment; segment 4 distinctly, moderately broadly bilobed (fig. 220). Entire surface with more or less deep ground sculpture.

Variability: In general the punctuation of frons is very dense, the very small impunctate areas are completely reduced in numerous specimens. The coalescent areas of elytra are of different sizes: the rugae are apparent only on the middle portion of the posterior half of elytra and are short and very slightly curved (nearly straight) in some specimens, while in others the rugose areas are much more distinct; however there is not one specimen amongst the large type series which completely lacks rugae. One paratype is much deeper microsculptured than the rest of the material. A few (less mature ?) specimens have the legs brownish.

*Comments.* *Dianous ater* may be easily distinguished from *S. amamiensis* Sawada (and from the closely related spotted species, as e. g. *D. freyi* L.Benick) by dark body with dark-greenish-metallic tint, and by blackish legs.

Etymology: *ater* (Lat.) = black.

### *Dianous sucinigutta* sp. n.

Type material. Holotype (♂) and allotype (♀): Taiwan: Chiai Hsien: Alishan, Sister Ponds, 2180 m. 18. IV. 1990, in soaking wet moss growing on rotten wood around small ponds in a coniferous forest, A. Smetana (NHMG).

Paratypes: 11 ♂♂, 12 ♀♀: same data as HT. Ilan Hsien: 1 ♂: Taipingshan, 1880 m. 14. VII. 1993, in wet moss on large rocks at the base of a vertical wall in a creek. Taoyuen Hsien: 1 ♂, 2 ♀♀: Takuanshan Forest, 1660 m. 17. IV. 1990; 1 ♂: same, 1600 m, in moss on rocks in a small creek. Taichung Hsien: 2 ♂♂, 1 ♀: Hsiaohsueh Shan, 2650- 2750 m. 1. V. 1990, among vegetation on a small seepage; 1 ♀: Anmashan, 2120 m. 1.V.1990, in wet moss on a fallen tree in a forest seepage; 1 ♀: Anmashan, Creek, 2136 m. 12. V. 1992, same habitat as previous. Nantou Hsien: 13 ♂♂, 7 ♀♀: Houhuanshan Kuenyang, 3050 m. 27. IV. 1990, in soaking wet moss on a vertical wall; 3 ♂♂, 1 ♀: same, 4. V. 1991, same as previous; 1 ♂, 2 ♀♀: same; 10 ♂♂, 7 ♀♀: Houhuanshan, 3175 m. 15. V. 1990, in soaking wet moss at edges of a small creek; 5 ♂♂, 1 ♀: Maifeng, 2130 m, 3. V. 1991, among vegetation on wet vertical wall; 3 ♂♂: Yushan N.P., Mun-Li Cliff, 2700 m. 13. V. 1991; 5 ♂♂: same, 18.V.1991; 1 ♀: SW Slope below Yushan Mountain Peak, 3650 m, 14. V. 1991, debris on wet forest floor; 2 ♂♂: Nankaoshan trail, Yuenhai Hut, 2350 m, 4. V. 1992, sifting lush vegetation along wet edges of a small creek; 2 ♂♂: same,

Tenchi Hut, 2900 m, 5. V. 1992, in wet moss on fallen trees along a creek; 1 ♂, 2 ♀♀: Nankaoshan, 1.5 km SW Tenchi Hut, 2830 m, 6. V. 1992, sifting of fallen leaves and moss at the base of a vertical wall (cf. photo fig. 16 in Bousquet & Smetana 1996); 1 ♂: Tenchi Hut, 2895 m, 7. V. 1992, same as previous. Chiai Hsien: 3 ♂♂: Yushan N.P., Ta-Ta Chia, 2750 m, 27. IV. 1990, in wet moss on fallen trees; 1 ♀: Alishan, 2300 m, 9. V. 1965, Y. Hirashima (Ent.Lab., Kyushu Univ.). Kaohsiung Hsien: 1 ♂: Kuanshan, Kuanoshing Hut, 2950 m, 18. IV. 1992; 1 ♂, 2 ♀♀: Creek 2 km E. Tien Chih, Hwy 20, 2400 m, 22. VII. 1993, in soaking wet moss on a seepage near a creek; 1 ♂: Creek 4 km E. Yakou, 2600 m, 23. VII. 1993, in soaking wet moss on rocks directly in a creek. Hualien Hsien: 1 ♂, 2 ♀♀: Taroko N.P., Chungyantsianshi (River) waterfall, 2300 m, 10. V. 1990, soaking wet moss and other debris in a spray of a waterfall; 1 ♂: same, 2280 m, 10. V. 1990; 1 ♂: Taroko N.P., Nanhushi Hut, 2220 m, 12. V. 1990, wet moss on rocks in a creek, except 1 all leg. A. Smetana (cS, cP, cR).

This new species and the following two are closely related to the complex of *D. freyi* L. Benick, *D. klapperichi* L. Benick, and *D. amamiensis* Sawada, but may be easily distinguished from them by the very broad head and short wings.

Shortwinged, shining, black, abdomen with very faint aeneous tint, elytra with a slightly elevated, small orange spot (fig. 175). Punctuation of fore parts coarse and dense, more or less coalescent on pronotum, distinctly coalescent on elytra; abdominal punctuation moderately fine and moderately sparse (variable: s. b.). Pubescence of fore parts indistinct, that of abdomen sparse. First antennal segment dark brown, segment 2 brown, segments 3-5 (6) light brown to reddish brown, remaining segments slightly infusate. Maxillary palpi reddish brown, third segment infusate toward apex. Legs reddish brown to brownish, posterior half of femora (often) slightly infusate (especially on dorsal side), apical portion of femora narrowly dark brown, tarsi distinctly darker (mostly dark brown) than tibiae. Clypeus and labrum black, sparsely pubescent. Segment 4 of metatarsi moderately deeply and narrowly bilobed.

Length: 4.8- 6.4 mm (fore parts: 2.8- 3.1 mm).

Male: Metasternum broadly convex, narrowly and slightly impressed posteriorly, punctuation on middle portion coarse and dense, diameters of punctures about as large as basal cross section of segment 2 of the maxillary palpi, interstices mostly as large as half diameter of punctures; narrow triangular area impunctate posteriorly; acam finely and moderately sparsely punctate. Punctuation of basal abdominal sternites moderately fine and moderately dense, about same as that on sides of sternites; sternite 6 posteriorly with slightly finer and denser punctuation than that on sides, posterior margin slightly emarginate; sternite 7 with distinct but not deep medial impression in posterior 2/3, its punctuation fine and very dense, posterior margin shallowly emarginate. Sternite 8 with broad, subtriangular notch in about posterior fifth. Sternite 9 (fig. 233), rounded-serrate apicolaterally, apical brush slender, nearly half as long as sternite. Tergite 10 very broadly rounded posteriorly. A e d e a g u s (figs 210, 211, 218) with median lobe with subtriangular apical portion, its apical „knob“ more or less pronounced and slightly curved upwards, parameres much longer than median lobe, each with about 15 long setae.

Female: Ventral characters about same as in male, but sternite 7 posteriorly finely and very densely punctate and pubescent. Sternite 8 slightly, obtusely rounded, no distinct median projection. Valvifer apically rounded-serrate. Tergite 10 (about) semicircularly rounded at posterior margin.

Head very large, distinctly broader than elytra (48: 45), eyes large (IE 22), temples moderately long (IT 8), frons broad (adE 27) with two deep longitudinal furrows, medial portion narrower than side portions, distinctly elevated to about level of inner eye margins, lateral portions elevated posteriorly, forming impunctate swelling diameter of which sometimes about as large as length of antennal segment 2. Punctuation coarse and dense, diameters of punctures as large as basal to middle cross section of antennal segment 3, interstices mostly smaller than half diameter of punctures, possibly (mostly about as large as diameter of punctures) in middle of frons and on lateral swelling, latter in most cases more distinct than impunctate median area. Antennae moderately slender, extending by last or last two segments beyond posterior margin of pronotum when reflexed, penultimate segments 1.5 x to twice as long as broad. Pronotum little longer than broad (37: 34), broadest at about middle, sides convex in anterior 2/3, moderately concave posteriorly; with deep, oblique impression directed from sides posteriomedial in posterior half, with a transverse impression near anterior margin, and with short, narrow, and less distinct longitudinal impression just behind middle in most specimens. Punctuation coarse, dense and irregular, more or less coalescent anteriorly and posteriorly, diameters of punctures becoming as large as apical cross section of antennal segment 3, interstices mostly distinctly smaller than half diameter of punctures, rarely becoming as large as diameters of punctures. Elytra (fig. 175) narrower than head (45: 48), slightly longer than broad (47.5: 45), shoulders prominent, sides feebly rounded, posterior margin moderately deeply emarginate, with distinct humeral impression. Punctuation coarse to very coarse, irregular, coalescent, dense but less dense than on pronotum, interstices often as large as half diameter of punctures, in some areas larger; long and somewhat curved rugae around the slightly elevated orange spot in most specimens present, orange spot coarsely punctate but not rugose. Interstices may become larger near posterior border of elytra, sometimes also near suture, and/or near middle of anterior half of elytra. Abdomen broadly marginate, paratergites of segment 4 as broad as metatibiae at middle ( $\delta$ ) or at apex ( $\text{♀}$ ), moderately finely and moderately sparsely punctate; basal furrows of first tergites deep, tergite 7 with a broad palisade fringe apically (the insect is winged, but wing length is distinctly reduced in comparison to macropterous species). Punctuation variable: moderately fine to fine and moderately dense to moderately sparse, interstices on first tergites distinctly smaller than diameters of punctures or distinctly larger than diameters of punctures. In general abdominal punctuation on most tergites, especially posterior ones, is moderately sparse with interstices distinctly larger than punctures. Punctures of tergite 7 about as large as one inner eye facet, interstices up to 2 x as large as diameter of punctures. Punctuation of tergite 8 slightly coarser and denser, tergite 10 with few fine scattered punctures. Legs slender, metatarsi about 5/7 as long as metatibiae, segment 1 slightly longer than two following segments combined, distinctly but not much longer than last segment; segment 4 moderately deeply and narrowly bilobed (about as in fig. 219). Entire dorsal surface distinctly microsculptured in most specimens, with microsculpture of fore parts shallow, distinct only on a few areas: abdomen mostly more distinctly, although sometimes very faintly, microsculptured, occasionally nearly smooth.

Variability: The elytra are slightly broader than head in a few females. The degree of the elevation of the median portion of frons is variable; it is distinctly less elevated than the level of inner eye margins in some specimens, in others it distinctly extends beyond that level. Also the antennae vary somewhat in their length (s. a). The size of the elytral spot normally varies between the two sizes shown in fig. 175 (about half of the specimens have larger spots, about as long as the first segment of mesotarsi, in about the other half the spots are about as long as the second antennal segment); one specimen has larger spots (about as long as third antennal segment), in a few specimens the elytral spot is reduced to the size of two or one punctures and is therefore very indistinct. Middle of the pronotum has rarely a more or less distinct shining area. The most remarkable variability is found in the abdominal punctation, which varies considerably even in specimens from the same locality.

*Comments.* This species occurs mostly in seepages or other quite wet habitats in coniferous, or mixed broadleaved + coniferous forests; it seems to avoid creeks or other running water (where *Dianous* species live usually). The specimens were taken by sifting moss, leaf litter, and other debris, sometimes moss on large fallen trees; all these habitats are not the typical *Dianous* habitats as we know them. The locality below of Yushan main Peak (3650 m) is the highest hitherto known locality for the genus.

*Dianous sucinigutta* may be distinguished from the other two related Taiwanese species, *D. sucininotatus* sp. n. and *D. electrigutta* sp. n. by the smaller size of its elytra spot, from *D. sucininotatus* also by the in general shorter elytra and less broad head; from *D. electrigutta* by the different outline of the elytra (rounded, not trapeziform), by the oblique rugae in posterior sutural third, and by the mostly somewhat sparser and finer abdominal punctation.

Etymology: The name combines the Latin word for amber and for drop = *Dianous* with amber drops.

#### *Dianous sucininotatus* sp. n.

Type material. Holotype (♂) and allotype (♀): Taiwan: Pingtung Hsien: Peitawushan above Kuai- Ku Hut, 2750 m, 29. IV. 1992. sifting of moss and debris on wet habitats along a creek, A. Smetana (MHNG, cS). Paratypes: 2 ♂♂, 2 ♀♀: same data as HT; 2 ♀♀: same, 22. IV. 1991. sifting moss and debris on a forest seepage, A. Smetana (cS, cP).

In nearly all respects very closely resembling *D. sucinigutta* and is probably its sister species.

Shortwinged, shining, black with faint aeneous tint, elytra with a slightly elevated large orange spot (fig. 174). Punctation of fore parts coarse and dense, somewhat coalescent around elytral spot, abdominal punctation moderately fine and moderately dense. Pubescence of fore parts indistinct, that of abdomen short and sparse. First antennal segment dark brown, second segment brown, segments 3-5 (or 6) light brown, remaining segments more or less infusate. Maxillary palpi reddish brown, third segment infusate at apex. Legs reddish brown, apices of femora narrowly darkened, tarsi distinctly infusate. Clypeus and labrum black, sparsely pubescent. Fourth segment of metatarsi moderately deeply and narrowly bilobed.

Length: 5.0-6.3 mm (fore parts: 3.0- 3.2 mm).

Male: Ventral characters about same as those of *D. sucinigutta*, median punctation of metasternum slightly less coarse, sternite 6 lacking special characters, impression of sternite 7 very shallow, sternite 8 with a broad, subtriangular notch in about posterior fifth. Sternite 9 rounded-serrate apically, apical brush slender, distinctly shorter than half sternite. Tergite 10 very broadly rounded posteriorly. Aedeagus as in fig. 212, not significantly different from that of *D. sucinigutta*.

Female: As in *D. sucinigutta*.

Head, antennae and pronotum about same as those of *D. sucinigutta*, but sculpture of pronotum less coarse, not as dense, and nearly completely separate (sometimes slightly confluent near posterior margin). Elytra with a very large spot, which can be enlarged inwards at its anterior portion, where it becomes darker/brownish and less distinct. Elytral sculpture less confluent than that of *D. sucinigutta*, more regular, some oblique rugae running from the spot backwards and inwards, more rugae sometimes present around elytral spot; shiny interstices of punctation often as large as half diameter of punctures. Abdomen and legs as those of *D. sucinigutta*, metatarsi as in fig. 219. Microsculpture of fore parts mostly indistinct, that of abdomen dense and distinct.

*Comments.* *Dianous sucininotatus* may be distinguished from *D. sucinigutta* by the much larger elytral spots, (lighter colored legs), and by the less coarse and less rugose sculpture of the fore parts; from *D. electricgutta* sp. n. by the longer, rounded elytra with larger spots and by the less coarse and less dense punctation of the entire body.

*Dianous sucininotatus* is probably the sister species of *D. sucinigutta*. It seems to represent this *Dianous*-type in most southern mountain ranges in southern Taiwan.

*Etymology:* *sucini-notatus* (Latin) = marked with amber.

### *Dianous electricgutta* sp. n.

Type material. Holotype (♂) and allotype (♀): Taiwan: Nantou Hsien: Yushan N.P., 2 km W Pai-Yun Hut, 3350 m, 16. V. 1991, sifting of wet moss on large fallen trees in an *Abies*-forest. A. Smetana (MHNG). Paratypes: 7 ♂♂, 5 ♀♀: same data as holotype; 3 ♂♂, 1 ♀: same but 3528 m, 15. V. 1991, sifting of wet moss, grasses, and bamboo debris along a trickle in a coniferous forest (T 83); 9 ♂♂, 5 ♀♀: same but 3375 m, 17. V. 1991, same habitat as HT, all leg. A. Smetana (cS, cP).

Closely related and similar to *D. sucinigutta* and *D. sucininotatus*, but different by sculpture and by the elytral spot.

Shortwinged, moderately shining, black with feeble aeneous tint, elytra each with a large, oblong orange spot (fig. 176). Fore parts very coarsely and densely punctate, punctation slightly coalescent on elytra, abdominal punctation moderately coarse and dense. Pubescence of fore parts indistinct, abdomen with short and sparse pubescence. Antennae with two segments blackish to dark brown, third segment (and sometimes a following segments) reddish brown, segments 6 to 8 mostly dark brown, club lighter brown. Maxillary palpi reddish brown, last segment infusate. Legs reddish brown, apices of femora narrowly infusate, tarsi remarkably darker than tibiae, nearly

blackish. Clypeus and labrum black, sparsely pubescent. Segment 4 of metatarsi moderately deeply and narrowly bilobed.

Length: 5.0- 6.0 mm (fore parts: 2.7- 3.0 mm).

PM of HT: wH: 47.5; adE: 27; IE: 21.5; IT: 8; wP: 33,5; IP: 36; wEl: 44,5; IEl: 46; IS: 38.

Male: Ventral characters about same as those of *D. sucinigutta*, but metasternal punctation coarser, sternite 6 simple, sternite 7 with a very shallow impression in posterior half, sternite 8 with a broad, subtriangular notch in posterior fifth. Sternite 9 and tergite 10 as in *D. sucinigutta* sp. n. A e d e a g u s (fig. 213) very similar to that of *D. sucinigutta*, apical tip of median lobe seems to be slightly more set off.

Female: Ventral characters about same as those of *D. sucinigutta*.

Head in general as that of *D. sucinigutta*, punctation coarse and very dense, narrow interstices distinctly reticulate, impunctate areas reduced, indistinct. Antennae shorter than in most specimens of *D. sucinigutta* extending beyond posterior margin of pronotum by more than last segment when reflexed, penultimate segments about 1.5 x as long as broad. Punctation of pronotum as coarse as in *D. sucinigutta* but denser, interstices generally much smaller than half diameters of punctures, often only few punctures are confluent. Elytra slightly shorter, more divergent, elytral spot oval. Punctation slightly coarser than that on pronotum, mostly somewhat extended longitudinally, more or less distinctly coalescent at lateral border of elytral spot and/or between elytral spot and suture. Abdominal punctation in general dense, as dense as in most densely punctured specimens of *D. sucinigutta*, ground sculpture very dense and deep.

Variability: Coalescently punctured areas of pronotum and elytra vary in size; most of the punctation may be clearly separate in some specimens.

Comments. *D. electrigutta* may be easily distinguished from *D. sucinigutta* and from *D. sucininotatus* by its trapezoid elytra, by the size and shape of the elytral spot, and by the very dense but relatively rare coalescence of the punctation.

Etymology: *electrum* (Latin) = amber, *gutta* (Latin) = drop; *electrigutta* = with amber drops

### *Dianous suciniguttatus* sp. n.

Type material. Holotype (♂) and allotype (♀): Sichuan: Emei Shan, 7. X. 1985, G. M. de Rougemont (cR in BMNH, cP). Paratypes: 2 ♂♂, 2 ♀♀: Quingcheng Shan 65 km NW Chengdu, 8 km W Taiping, 800-1000 m, 103°33'E, 30°53'N, 18.V./ 3.-4. VI. 1997, A. Pütz (coll. Pütz, cP); 1 ♂, 3 ♀♀: ibidem, 18. V. 1997, Wrase (coll Schülke, cP).

Closely resembling *D. sucinigutta* but easily distinguished by the much narrower head and by the shining surface, especially that of abdomen.

Shining, black with faint aeneous-coppery tint, elytra with a slightly elevated orange spot (fig. 173). Punctation of fore parts coarse and dense, coalescent posteriorly on pronotum and around elytral spots, abdominal punctation fine to moderately fine and moderately dense, distinctly less dense on middle of tergites; pubescence of fore parts indistinct, abdominal pubescence dense, long, recumbent. First antennal segment dark brown, remaining segments light brown to yellowish brown. Maxillary

palpi reddish brown, third segment infusate. Legs light reddish brown, apical portion of femora distinctly infusate, bases of tibiae darker than apical two thirds, tarsi as light as tibiae apically. Clypeus and labrum black, moderately densely pubescent. Segment 4 of metatarsi moderately deeply and narrowly bilobed.

Length: 5.0 – 6.4 mm (fore parts 3.0 mm).

PM of HT: wH: 46; adE: 25; IE: 21.5; IT: 6; wP: 34; IP: 37; wEl: 52; IEI: 52; IS: 44.

Male: Ventral characters about same as those of *D. sucinigutta* but punctuation mostly coarser, sternite 7 with posteriomedian impression slightly more distinct. Sternite 8 with a broad, triangular notch in about posterior fifth. Sternite 9 (fig. 237) with a prominent, blunt tooth apicolaterally, apical brush slender, about 1/3 as long as sternite. Tergite 10 broadly rounded. Aedeagus (fig. 221) with median lobe with a subtriangular, apically broadly rounded apical portion. Parameres slender, with about 20 long setae.

Female: Ventral characters resembling those of male. Sternite 8 apically rounded, slightly produced in middle. Valvifers acute apically. Tergite 10 broadly rounded.

Head remarkably narrower than that of *D. sucinigutta*. Impressions of pronotum as those of *D. sucinigutta* but the punctuation less coarse and more equal in size, diameter of punctures about as large as medial cross section of 3<sup>rd</sup> antennal segment, interstices smaller than half the diameter of punctures. Elytra subquadrate with coarse and deep punctuation and long rugae around elytral spot. Abdomen similar to that of *D. sucinigutta* but more convex (parts of sternites are visible in dorsal aspect), punctuation of middle portions of tergites distinctly less dense than that of the sides. Entire dorsal surface lacks microsculpture, except for only traces on tergite 8.

*Comments.* *D. suciniguttatus* is distinguished from *D. amamiensis* Sawada by the broader head, the much deeper longitudinal furrow of frons, by the deeper impressions of pronotum, the coarser and less dense punctuation of the entire body, by the declining, finely and moderately sparsely punctate paratergites, and by the aedeagus. In addition from *D. freyi* L. Benick by the light color of the legs, which may be found only in immature specimens of *D. freyi*.

*Etymology:* The name combines the Latin word for amber and for dropped = amber-dropped *Dianous*.

### *Dianous freyi* L. Benick

*Dianous Freyi* L. Benick, 1940: 593 ff.; L. Benick, 1942: 76-79. figs; Puthz, 1971a: 88; Zheng, 1993: 199.

Material examined. Zhejiang: T'ein-mu Shan (holotype) (NHMB); 1 ♂. 1 ♀: Ning-po (FMCh); Jiangxi: 18 ♂♂. 19 ♀♀: Kuling near Kiu Kiang, 18. X. 1919, H. F. Loomis (USNM, cP); Fujian: 4 ♂♂. 2 ♀♀: Shaowu, 1937, J. Klapperich (FMCh, cP); 1 ♀: Kuantun, IV. 1938, J. Klapperich (DED); 10 ♂♂. 10 ♀♀: Chungan, Bohea Hills, IV. 1940, IV. 1941, T. C. Maa (Bishop Museum, cP); 1 ♀: Yungan, 11. II. 1940, T. C. Maa (Bishop Museum); 1 ♀: Changting; Niuling, 24. IV. 1941, T. C. Maa (Bishop Museum). Anhui: 1 ♀: Huang Shan, 30 km NW Tunxi, 5 km E Nantang, 350-400 m. 28. X. 1997, M. Wang (NHMW). Hunan: 1 ♀: Wulingyuan, N. Dayong Zangjajie, 650 m. 29. X. 1993, H. Schillhammer (1) (NHMW); 1 ♂: Wulingyuan, N. Dayong Siouxiyu, 400 m. 31. X. 1993, H. Schillhammer (5) (NHMW); 1 ♂. 5 ♀♀: env.



Guidong, 26°04' N, 113°56' E, 26.-31. V. 1994 (NHMW, cP). Guizhou: 1 ♂, 2 ♀♀: Huangguoshu, X. 1986, G. M. de Rougemont (cR). Yunnan: 2 ♂♂: Yulongshan, 3000-3500 m, 27°06' N, 100°15' E, Ganhaizi pass, 18.-23. VII. 1990, V. Kubán (NHMB); 12 ♂♂, 12 ♀♀: Leigongshan, Xijiang, 1200-1900 m, 28. V. - 2. VI. 1997, Bolm (NHMB, cP). Sichuan: 1 ♀: Xichuan, X. 1986, G. M. de Rougemont (cR); 80 ♂♂, 55 ♀♀: Mt. Emei, 500-1200 m, 4.-18. V. 1989, S. & J. Kolibec; 55 ♂♂, 68 ♀♀: ibidem 600-1050 m, 5.-19. V. 1989, L. Bocák, 56 ♂♂, 43 ♀♀: ibidem 4.-20. V. 1989, V. Kubán (NHMB, cP); 25 exx. ibidem, X. 1985, X. 1986, G. M. de Rougemont (cR); 1 ♂, 2 ♀♀: ibidem, above Fuhu Monastery, 700-1000 m, stream, ca. 2 m wide, slowly flowing through deep gorge, shaded, with gravel, boulders and sand, Ji & Wang, 15. VI. 1996 (CWBS 238) (NHMW); 1 ♂: ca. 16 km N Ya'an City, 3 km N Shangli, 950 m, small stream, ca. 0.5 m wide, Ji & Wang, 9. VI. 1996 (CWBS 225) (NHMW).

*Comments.* This is a variable species very closely allied to *D. klapperichi* (see below).

### *Dianous klapperichi* L. Benick

*Dianous Klapperichi* L. Benick, 1942: 76 ff. figs.

Material examined. Fujian: 2 ♂♂, 1 ♀: Shaowu, 500 m, XI. 1937, J. Klapperich (syntypes) (FMCh). Sichuan: 2 ♂♂, 3 ♀♀: Mt. Emei, 500 m, 4.-20. V. 1989, V. Kubán (NHMB, cP); 1 ♂ ibidem, 7. X. 1985, G. M. de Rougemont (cR); 1 ♂: ibidem 1530 m, 22. VI. 1994, Schillhammer (4 a) (NHMW); 2 ♂♂: ca. 16 km N Ya'an City, 3 km N. Shangli, 950 m, small stream, ca. 0.5 m wide, Ji & Wang, 9. VI. 1996 (CWBS 225) (NHMW, cP); 1 ♂: ca. 14 km N Ya'an Vity, rd. To Shangli, 800 m, river, ca. 5-8 m wide, with large rocks, some of these partly moss-covered, flowing through secondary forest, Ji & Wang, 8. VI. 1996 (CWBS 221) (NHMW).

*Comments.* This species is very close to the variable *D. freyi* and possibly only an extreme, robust form of this species. I was repeatedly in doubt about the status of this taxon, and today I am still not sure about it, but I propose to regard it tentatively as a distinct species. It differs from *D. freyi* by the coloration of the femora (basal half reddish, apical half, rather sharply delimited, blackish as compared to only basal third more or less reddish, mostly darker, in *D. freyi*, but this cannot be seen in immature specimens) and by the male sexual characters: In *D. klapperichi* the sternites 5 and 6 are shallowly emarginate posteriorly (in *D. freyi* simple), the apical portion of the median lobe is shorter than in *D. freyi* (figs 226, comp. 222, 223, 225), but *D. freyi* is also variable in this character (fig. 12 b in Benick, 1942 is an artefact, the apex of the median lobe has been broken (split) in this specimen). *Dianous klapperichi* is more robust than most specimens of *D. freyi* and has smaller elytral spots (diameter about as large as length of fourth antennal segment). Both species, *D. freyi* and *D. klapperichi* differ easily from similar species by their apically serrate sternum 9 (figs 230, 231).

### *Dianous cupreostigma* Puthz

*Dianous cupreostigma* Puthz, 1984a: 102 ff. figs.

Material examined: 1 ♂: Taiwan: Nantou Hsien: Shanlinchi, 1650 m, 16. V. 1990, on wet rocks in a creek (see photo 2 in Smetana, 1995), A. Smetana, (cS).

*Comments.* This species was described from Chito Experimental Forest, 1150 m (holotype in the B. P. Bishop Museum, Honolulu, paratype in cP). The specimen from Shanlinchi differs from the original specimens in having a distinct orange spot on the elytra (not a coppery mark); the spot is distinctly separate from the darker ground color

of the elytra and has a narrow coppery transition zone at periphery. In all other respects, the specimen agrees well with the original specimens.

*Dianous mendax* sp. n.

Type material. Holotype (male) and allotype (female): Taiwan: Nantou Hsien, Shanlinchi, 1650 m, 19. V. 1991, on wet rocks in a creek (see photo 2 in Smetana, 1995). A. Smetana (MHNG, cS). Paratypes: Taoyuan Hsien: 1 ♀: Takuanshan Forest, 1600 m, 17. IV. 1990, same habitat as HT, A. Smetana (cP). Hualien Hsien: 1 ♀: Rakao National Park, Chungyantienshi (River) Waterfall, 2300 m, 10. V. 1990, wet moss and debris in spray zone of a waterfall, A. Smetana (cS).

This new species is the sister species of *D. cupreostigma* Puthz, which it closely resembles.

Moderately shining, black with bluish and some aeneous tint, elytra each with a rather large orange spot (slightly larger than in fig. 172), distinctly delimited but with coppery transition zone at periphery. Head moderately coarsely and densely punctate, pronotum coarsely and very densely punctate, punctures somewhat coalescent near anterior and posterior margins, punctuation of basal third of elytra same as that on pronotum, sculpture of posterior two thirds becoming increasingly more confluent around not confluent orange spots, but not forming long rugae as e. g. in *D. grandistigma*; abdominal punctuation fine and dense. Pubescence whitish, that of the fore parts dense and semierect, that of abdomen very dense and recumbent. Antennae, palpi and legs blackish with some metallic tint, antennal club, palpi, and tarsi sometimes slightly lighter. Clypeus and labrum blackish blue, moderately densely pubescent. Fourth tarsal segment distinctly bilobed (fig. 9).

Length: 4.8 – 6.2 mm (fore parts: 2.0 – 3.0 mm).

PM of HT: wH: 45; adE: 26; lE: 21; IT: 5; wP: 32.5; lP: 33.5; wEl: 50; lEl: 52; lS: 45.5.

Male: Medial area of metasternum moderately broadly flat, shallowly impressed and impunctate posteriomedially, brilliant, sides of medial area coarsely and moderately densely punctate, interstices nearly smooth, brilliant, diameters of punctures about as large as basal cross section of third antennal segment, interstices about as large or slightly larger than diameters of punctures, acam impunctate, brilliant. Sternites 3-6 somewhat less dense punctate medially than laterally, sternite 7 slightly flattened posteriomedially, finely and very densely punctate and pubescent, posterior margin very shallowly emarginate; sternite 8 with a broad emargination in about posterior sixth; sternite 9 rounded-serrate apically (fig. 232), apical brush moderately strong, somewhat shorter than the sternite. Tergite 10 broadly rounded. *A e d e a g u s* (fig. 217), median lobe broad and ± rounded anteriorly, with many long setae ventrolaterally, internal structures consisting of small expulsion bands, a strong tube, and densely spinose membranes. Parameres somewhat longer than the median lobe, evenly set with 17- 20 long setae.

Female: Ventral characters similar to those of male. Sternite 8 (fig. 216), less prolonged apically than in *D. cupreostigma* (fig. 227). Valvifer obliquely rounded-serrate apically, apical brush as long as valvifer. Tergite 10 moderately narrowly rounded (not triangular).

Head broad, frons with long and deep longitudinal furrows, medial portion distinctly elevated, but not as much as the side portions, punctation coarse and mostly dense, diameters of punctures as large as basal cross section of third antennal segment, interstices mostly smaller than half diameters of punctures, distinctly larger posteriorly on side portions and on elevated medial portion, but rarely as large, or slightly larger, than diameters of punctures (therefore no distinctly separate shining areas). Antennae moderately slender, extending beyond posterior margin of pronotum by two segments when reflexed. Pronotum with usual oblique impressions on posterior half and with transverse impression near anterior margin; punctation coarse and very dense, diameters of punctures about as large as median cross section of third antennal segment, interstices much smaller than half diameters of punctures, distinctly larger posteriomedially near a small impunctate area (as large as one or two neighbouring punctures). Elytra similar to those of *D. cupreostigma*, but spots much larger. Abdomen as in *D. cupreostigma* with very broad, upwards directed, finely and very densely punctate paratergites; punctation of tergites fine and dense, less dense medially with interstices exceeding diameters of punctures; tergite 8 somewhat more coarsely and densely punctate than sternite 7, tergite 10 moderately sparsely punctate. Legs slender, metatarsi as long as metatibiae, first segment slightly shorter than three following segments combined, slightly longer than last segment, fourth segment moderately deeply bilobed (fig. 9). Entire surface more or less shallowly reticulated (reticulation may be nearly obsolete on fore parts).

*Comments.* *Dianous mendax* may be distinguished from the very similar *D. cupreostigma* Puthz by the larger elytral spots (at least 1.5 x as large as those of *D. cupreostigma*), by the more bilobed fourth tarsal segment (fig. 9, compare fig. 12), and by the sexual characters.

Etymology: *mendax* (Latin) = false; this species „imitates“ *D. cupreostigma*.

### PART III: KEY TO THE *DIANOUS*-SPECIES OF CHINA AND JAPAN

- 1 (4) Frons concave, medial portion not elevated (group I, Puthz, 1981a), temples very short. [Note: In *D. latitarsis* L. Benick the frons is broadly concave but its medial portion is slightly to distinctly elevated. This large species is easily recognized by its long temples at least half as long as the eyes: see # 10]; sternite 9/valvifer apically serrate, apicolateral brush short, less than half as long as sternite/valvifer
- 2 (3) Head about as broad as, or broader than elytra, lateral portions of frons even, not declining, medial portion impressed. Interstices of punctation of head and pronotum narrow but distinct, strongly shining. Male: apical notch of sternite 8 triangular with straight sides. Aedeagus (fig. 16, Puthz, 1981a). 4.0 - 5.0 mm. . . . . *D. tonkinensis* (Puthz)  
Vietnam, Thailand, Indonesia (Borneo, Sulawesi), China: Yunnan: 1 ♂:  
Xishuangbanna, 22. I. 1993, G. M. de Rougemont (cR): n e w t o C h i n a.
- 3 (2) Head distinctly narrower than elytra, entire frons (including lateral portions) concave, interstices of punctation of head and pronotum

extremely narrow (punctuation somewhat confluent), head and pronotum nearly dull. Male: Apical notch of sternite 8 triangular, with sinuate sides. Aedeagus as in fig. 2 A, Rougemont (1981a).

4.0 - 5.2 mm. . . . . *D. yao* Rougemont  
Burma, Thailand, China: Guizhou

- 4 (1) Medial portion of frons distinctly elevated, frons with two distinct longitudinal furrows, or broadly elevated with shallow, longitudinal impressions (group II, Puthz, 1981a)
- 5 (44) First segment of metatarsus distinctly longer than following three segments combined (species doubtful in this character are treated in both couplets). Fourth segment of metatarsus symmetrical or asymmetrical
- 6 (13) First segment of metatarsus longer than remaining segments combined
- 7 (12) Tarsi pseudotetramerous: tarsal segment four with tube-like bristle shoe, enveloping segment five except claws
- 8 (11) Frons with broad and shallow but distinct impression posteriomedially
- 9 (10) Head as broad as or broader than elytra (fig. 1, Shibata, 1979), eyes smaller (IT: IE > 0.75). Punctuation of frons less dense, interstices on posteriolateral portions as large as, or slightly larger, than diameters of punctures. Elytra with distinct impressions. Male: aedeagus (fig. 2, Shibata, 1979), a button-shaped apex of median lobe projection dorsally (about as in fig., 20, Puthz, 1981). Female: 8th sternite broadly rounded. 7.0 - 9.5 mm. . . . . *D. arachnipes* Puthz  
China: Taiwan
- 10 (9) Head distinctly narrower than elytra, eyes larger (IT: IE < 0.75). Punctuation of frons denser, interstices on posteriolateral portions distinctly smaller than diameters of punctures. Elytra nearly even. Male: aedeagus (fig. 19, Puthz, 1981), anterior portion of median lobe triangularly narrowed, apex less button shaped and slightly curved dorsally. Female: 8th sternite rounded. 7.5 - 9.5 mm. . . . . *D. latitarsis* L. Benick  
India: Sikkim; Kashmir; Nepal; Thailand; China: Sichuan
- 11 (8) Frons not impressed posteriomedially, broadly convex, oval impression only around ocelli. Pronotum impunctate. Larger species. Head broader than elytra, eyes relatively small (IT: IE ≈ 0.80). Elytra nearly even, no distinct impressions. Male: unknown. Female: 8th sternite broadly rounded. 7.0 - 8.0 mm. . . . . *D. moritai* Naomi  
Japan: Amami Islands
- 12 (7) Tarsi distinctly 5- segmented, tarsal shoe present only on ventral third of segment 5. Pronotum distinctly punctate. Smaller species. Head broader or nearly as broad as elytra, eyes relatively large (ITe: IE ≈ 0.6). Elytra nearly even. Male: sternite 8 with a broad and shallow emargination in about posterior fifteenth. Sternite 9 (fig. 6, Puthz, 1997), bluntly produced apicolaterally. Tergite 10 broadly rounded. Aedeagus (fig. 7, Puthz, 1997), median lobe triangularly narrowed, apex narrowly rounded, parameres slightly longer than median lobe with about 16 long

setae. Female: sternite 8 very broadly rounded, slightly emarginated apicomediaally. Tergite 10 broadly rounded.

6.5 - 7.5 mm. . . . . *D. nigrocyaneus* Puthz  
China: Hainan

- 13 (6) First segment of metatarsus distinctly shorter than remaining segments combined, segment four with more or less distinct bristle shoe
- 14 (33) Elytra bi- or tricolorous (specimen to be observed under various directions of light; e. g. a bluish area in middle of a greenish area is sometimes immediately apparent)
- 15 (24) Longitudinal furrows of frons distinct posteriorly
- 16 (21) Elytra blue with 4 separate, variegated-metallic areas (figs 35- 37)
- 17 (18) Outer quarters of elytra brilliant brassy-golden-coppery, centre bright blue (fig. 36). Impunctate shining median areas of sternites less broad than of the width of sternite. Male: sternum 9 (fig. 43), tergite 10 broadly rounded, aedeagus (fig. 44). Female: sternite 8 (figs 48, 51, 54), tergite 10 triangular. 7.5 - 9.5 mm. . . . . *D. elegantulus* Zheng  
China: Sichuan, Hunan
- 18 (17) Elytra blue with 4 brassy-golden-coppery areas on lateral quarters, which are separate from the sides by metallic blue (figs 35, 37). Impunctate shining median areas of sternites broader than of the width of sternite
- 19 (20) Larger: 8.0 -9.5 mm, brassy areas on elytra larger (fig. 37), impunctate median areas of sternites nearly half as broad as width of sternite. Male: aedeagus about as in *D. elegantulus*, median lobe slightly less broad anteriorly. Female: as in *D. elegantulus*. . . . . *D. adonis* sp. n.  
China: Sichuan
- 20 (19) Smaller: 6.5 -7.5 mm, brassy areas on elytra smaller (fig. 35), impunctate median areas of sternites nearly 1/3 as broad as width of sternite. Male: aedeagus similar to that of *D. elegantulus*, but parameres shorter, slightly longer than the median lobe. Female: unknown. *D. schoenmanni* sp. n.
- 21 (17) Elytra differently colored
- 22 (23) Bluish areas of elytra smaller, transverse bluish band in middle of elytra at its narrowest point 1/6-1/5 as wide as length of elytra; brassy/golden anterior coloration of elytra extending laterally toward the sloping portion of elytra behind shoulders. Sternites 3-5 medially with a moderately broad impunctate area, about as broad as respective sternite. Male: as subspecies, see below. Female: sternite 8 (figs 59, 60).  
6.0 - 7.5 mm. . . . . *D. inaequalis inaequalis* Champion  
India: U.P., Sikkim, Assam; Nepal; China: Yunnan, Sichuan
- 23 (22) Bluish areas of elytra larger, transverse bluish band in middle of elytra at its narrowest point 1/3 - 1/4 as wide as length of elytra; brassy/golden anterior coloration of elytra distinctly separate from lateral bluish portion. Sternites 3-5 medially with broader impunctate area (1/4-2/5 as

- broad as the respective sternite). Male: aedeagus (fig. 69). Female: sternite 8 as in figs 61-67. 6.0 - 7.5 mm. . . . . *D. inaequalis laevior* sp. n.  
China: Taiwan
- 24 (14) Longitudinal furrows of frons becoming obsolete posteriorly
- 25 (32) Tarsi simple, fourth segment of protarsus broad but not bilobed, bristle shoe distinct but not remarkably strong
- 26 (31) Pronotum distinctly punctate, diameters of punctures, especially near posterior margin, at least as large as one medial eye facet. Blue areas of elytra larger, distinctly separate
- 27 (28) Larger species: 6.5 - 8.5 mm. Bluish areas of elytra (fig. 34). Pronotum deeply reticulated, moderately shining or dull. Tergite 10 rounded. Male: aedeagus (fig. 38). Female: sternite 8 (figs 56-58). . *D. alternans* Zheng  
China: Sichuan
- 28 (27) Smaller species, bluish areas of elytra as in fig. 33. Pronotum nearly without groundsculpture, brilliant. Two very closely related species
- 29 (30) Elytra with brassy- greenish reflection on anterior sutural half (fig. 33). Male: sternite 9 (fig. 41). Tergite 10 rounded. Aedeagus (fig. 39), median lobe broader, parameres with only 11-12 setae apically. Female: sternite 8 shallowly emarginated apicomediaally (about as in fig. 76). 5.0 - 6.2 mm. . . . . *D. coeruleovestitus* sp. n.  
China: Hongkong
- 30 (29) Elytra with violet-coppery reflection on anterior half. Male: sternite 9 (fig. 8, Puthz, 1997) resembling fig. 41. Tergite 10 rounded. Aedeagus (fig. 9, Puthz, 1997), median lobe narrower, parameres with 19-20 setae distributed along entire length of each paramere. Female: unknown. 5.5 - 6.7 mm. . . . . *D. coeruleomicans* Puthz  
China: Hainan
- 31 (26) Pronotum impunctate or indistinctly punctate, diameters of punctures smaller than one medial eye facet. Bluish areas of elytra smaller, less distinct, and less distinctly separate. Tergite 10 rounded. Male: aedeagus about as in fig. 40, apical portion of median lobe broader than in previous species. Female: sternite 8 (fig. 8, Puthz, 1981a) about as in fig. 56. 7.0 - 8.7 mm. . . . . *D. chetri* Rougemont  
India: U.P.; Nepal; Bhutan; Laos; China: Yunnan, Sichuan
- 32 (25) Tarsi asymmetrically bilobed (fig. 7), fourth segment of protarsus bilobed in about apical quarter, and with a very strong bristle shoe. Male: aedeagus as in fig. 28, Puthz, 1981a, with median lobe broadly rounded anteriorly. Female: sternite 8 (fig. 32) 6.0 - 7.5 mm. . . . . *D. versicolor* Cameron  
India: Nepal; Bhutan; China: Yunnan, Sichuan
- 33 (14) Elytra unicolorous, sometimes with various metallic tint, without distinctly delimited areas contrasting in color from main color of elytra
- 34 (35) Elytra with coarse and dense vorticoso sculpture, punctures/ rugae as large as basal cross section of antennal segment 3 or larger. Male:

sternite 9 (fig. 151). Aedeagus (fig. 27, Puthz, 1981a), parameres spoonlike broadened apically. Female: sternite 8 about as in fig. 198.

5.5 - 6.5 mm. . . . . *D. andrewesi* Cameron  
India, Nepal, China: Yunnan: 1 ♂: Xishuangbanna, 22. I. 1993, G. M. de Rougemont (cR), n e w t o C h i n a.

- 35 (34) Elytra (moderately) finely punctate, not coarsely vorticose, punctures much smaller than basal cross section of antennal segment 3
- 36 (39) Punctuation of pronotum slightly finer than that of head and elytra, dense, interstices mostly about as large as half diameters of punctures
- 37 (38) Metatrochanter in both sexes with distinct prominent tooth. Male: tergite 10 very broadly rounded or blunt apically, aedeagus (fig. 1, Puthz, 1980a). Female: sternite 8 (fig. 5, Puthz, 1980a, apical notch deeper than in fig. 76). Tergite 10 triangular, apical point less prominent as that of *D. angulifer*. 6.0 - 7.5 mm. . . . . *D. yunnanensis* Puthz  
China: Yunnan; India: Assam
- 38 (37) Metatrochanter simple
- 39 (36) Punctuation of pronotum, at least partially, distinctly coarser than that of head and elytra, mostly less dense
- 40 (43) Smaller species, less than 6.5 mm long
- 41 (42) Elytral punctuation very fine and extremely dense, elytra quite dull, punctures smaller than one medial eye facet; pronotum with deep impressions and four conspicuous calli, punctuation mostly dense, interstices mostly smaller than diameters of punctures. Male: tergite 10 rounded, aedeagus as in fig. 1A (Rougemont, 1981b) median lobe triangularly narrowed, apical portion twice as long as broad. Female: sternite 8 (fig. 47), tergite 10 obtusely angled.  
4.8 - 6.0 mm. . . . . *D. srivichaii* Rougemont  
Burma; Thailand; Vietnam; Laos; China: Yunnan: 1 ♂: Xishuangbanna, 22. I. 1993, G. M. de Rougemont (cR), Fujian
- 42 (41) Elytral punctuation less fine and less crowded, elytra somewhat shiny, punctures somewhat larger than one medial eye facet; pronotum with shallow impressions, 5.2 - 6.5 mm. . . . . *D. coeruleotinctus* sp. n.  
China: Hunan
- 43 (40) Larger species exceeding 6.5 mm. Male: tergite 10 broadly rounded. Aedeagus as in fig. 44, Puthz (1981a) median lobe narrowly triangularly narrowed. Female: sternite 8 with a distinct apical excision as in figs 10, 11, Puthz (1981a) about as in fig. 48; tergite 10 broadly triangular. 6.5 - 7.5 mm. . . . . *D. punctiventris* Champion  
India; Burma; Laos; Vietnam; China: Yunnan, Hainan
- 44 (5) First segment of metatarsus as long as, or shorter than following three segments combined. Fourth segment of metatarsus more or less symmetrical
- 45 (72) Head broader than elytra or about as broad as elytra, definitely not narrower than elytra (this character might be deceptive; in some cases measurements should be taken)

- 46 (67) Legs black or preponderantly dark (dark brown to black)
- 47 (52) Fourth segment of metatarsus conspicuously, deeply bilobed (fig. 8).
- 48 (51) Larger species with yellowish spotted elytra. Sternum 9/valvifer with very distinct apicolateral teeth/tooth (e. g. fig. 90)
- 49 (50) Punctuation of pronotum and elytra coarse, very dense and rugose punctate, interstices microsculptured. Elytral spot much smaller. Male: aedeagus (fig. 87), median lobe with a narrow triangular apical portion, which is much longer than broad, parameres shorter than median lobe. Female: sternite 8 broadly rounded, valvifer (fig. 1, Puthz, 1980b), with a remarkable tooth. 6.0-7.2 mm. . . . . *D. luteoguttatus* Champion  
India; Nepal; China: Taiwan
- 50 (49) Punctuation of pronotum and elytra moderately coarse, moderately dense, distinctly well-defined, interstices smooth. Elytral spot much larger (fig. 168). Male: aedeagus (fig. 15, Puthz, 1997), median lobe with a broad triangular apical portion, which is broader than long; parameres longer than median lobe. Female: similar to previous species 5.2 - 6.5 mm. . . . . *D. hainanensis* Puthz
- 51 (48) Smaller species, elytra lack yellowish spots. Male: sternite 9 serrate apically (fig. 238). Aedeagus with a broad lanceolate apical portion of the median lobe (fig. 224). Female: unknown. 5.0 - 5.8 mm. *D. lobatipes* sp. n.  
China: Anhui
- 52 (47) Fourth segment of metatarsus not, or only slightly bilobed.
- 53 (56) Fore body without microsculpture, dark blue-violet or brilliant-black with a coppery spot on each elytron
- 54 (55) Dark blue-violet, punctuation of pronotum coarse and dense, confluent anteriorly and posteriorly. Paratergites narrower, those of segment 4 as broad as antennal segment 10. Male: sternite 8 with a triangular excision in about posterior quarter. Sternite 9 (fig. 2, Puthz, 1997) with a distinct tooth apicolaterally. Aedeagus (fig. 1, Puthz, 1997), median lobe triangular apically, with ventrolateral ridges, and dense, long setae on apical portion, parameres about as long as median lobe with about 10-12 setae. Female: unknown. 3.7 - 4.7 mm. . . . . *D. violaceus* Puthz  
China: Hainan
- 55 (54) Brilliant-black, elytra each with a small coppery spot on posterior half, punctuation punctures. Paratergites broader, those of segment 4 broader than antennal segment 10. Male: sternite 9 (fig. 228); Tergite 10 broadly rounded. Aedeagus (fig. 214). Female: sternite 8 about as in fig. 215; tergite 10 narrowly rounded. 3.8 - 4.8 mm. . . . . *D. cupreogutta* sp. n.  
China: Taiwan
- 56 (53) Fore body with microsculpture (at least partially), coloration different, mostly dark bronze-green
- 57 (58) Paratergites narrow and directed downwards, paratergites of segment 4 about as broad as first antennal segment, with punctuation fine and mode-



rately sparse. Fore parts as in fig. 2. Sawada, 1960.

5.0 - 6.0 mm. . . . . *D. shibatai* Sawada  
Japan: Honshu

58 (57) Paratergites broader and mostly directed upwards, sometimes sagittal, paratergites of segment 4 at least twice as broad as third antennal segment (Five taxa described from Japan, which are very closely related and may belong to one variable species) couplets 51-56 in this key are mostly taken from Naomi, 1988 and Watanabe, 1984

59 (60) Larger species, more than 4.5 mm long, when abdomen extended. Male: aedeagus as in figs 6, 7, Watanabe, 1984.

4.3 - 4.8 mm. . . . . *D. iwakisanus* Watanabe  
Japan: Honshu

60 (59) Smaller species, not exceeding 4.5 mm in length, when abdomen extended

61 (62) Black with dark bluish reflection. Male: median lobe of aedeagus parallel-sided in apical quarter (figs 3, 4, Watanabe, 1984). Shape of body: fig. 1, l.c. 3.9 - 4.2 mm. . . . . *D. gongen* Watanabe  
Japan: Honshu

62 (61) Black with bronze-green reflection. Male: median lobe of aedeagus more or less narrowed apically

63 (64) Metallic reflection very distinct. Male: median lobe about as in *D. japonicus* (see below), parameres slightly shorter (fig. 2 B, Naomi, 1997). 3.1 - 4.2 mm. . . . . *D. viridicatus* Naomi  
Japan: Honshu

64 (63) Almost black, with feeble metallic reflection

65 (66) Broader; pronotum covered with subrugose punctures on base. Male: parameres of aedeagus longer, with denser and longer setae apically (fig. 1 C, Naomi, 1988). Shape of body: fig. 1, Sawada, 1960.

3.8 - 4.6 mm. . . . . *D. japonicus* Sawada  
Japan: Honshu.

Through the kindness of Drs. Sawada and Naomi I studied the holotype of *D. japonicus* and two paratypes of *D. septentrionalis* Naomi, together with some males in my collection. Sculptural differences between both taxa (as noted by Naomi), as well as slight differences in the shape of the anterior portion of the median lobe, fall within the range of variability. *Dianous septentrionalis* should be regarded as a synonym of *D. japonicus*. **syn. nov. !**

66 (65) Narrower; pronotum densely covered with round punctures on base. Male: parameres of aedeagus shorter, with sparser and shorter setae apically (fig. 1 B, Naomi, 1988). 3.9 mm. . . . . *D. morimotoi* Naomi

Japan: Kyushu

67 (46) Legs reddish or paler

- 68 (69) Elytra trapeziform, elytral spot large, oval (fig. 176). Male: sternite 9 (fig. 236). Aedeagus (fig. 213). Female: sternite 8 slightly, obtusely rounded. 5.0 - 6.0 mm . . . . . *D. electrigutta* sp. n.  
China: Taiwan
- 69 (68) Elytra subquadrate, elytral spot less oval
- 70 (71) Elytral spot smaller as in fig. 175; head narrower; elytral sculpture more confluent. Male: sternite 9 (figs 233, 234). Aedeagus (figs 210, 211). Female: sternite 8 slightly, obtusely rounded.  
4.8 - 6.4 mm. . . . . *D. sucinigutta* sp. n.  
China: Taiwan
- 71 (70) Elytral spot larger, as in fig. 174; head broader; elytral sculpture more regular, less confluent. Sexual characters resembling those of the previous species (see figs 212, 235). 5.0 - 6.3 mm. . . *D. sucininotatus* sp. n.  
China: Taiwan
- 72 (45) Head distinctly narrower than elytra
- 73 (76) Legs predominantly reddish
- 74 (75) Smaller species. Head much narrower than elytra. Paratergites broader, distinctly directed upwards, very densely punctate. Male: aedeagus as in fig. 1 A, Naomi, 1988, about as in figs 222, 223. Shape of body: fig. 3, Sawada, 1960. 4.0 - 5.0 mm. . *D. amamiensis* Sawada  
Japan: Amami Oshima Is.
- 75 (74) Larger species. Head distinctly, but not remarkably narrower than elytra. Paratergites narrower, directed downwards, moderately sparsely punctate. Male: sternite 9 (fig. 237). Aedeagus (fig. 221). Female: sternite 8 rounded, slightly produced in middle.  
China: Sichuan
- 76 (73) Legs black or predominantly dark, often with metallic tint
- 77 (78) Longitudinal furrows of frons obsolete posteriorly, frons evenly convex posteriorly: see # 32: *D. versicolor*
- 78 (77) Longitudinal furrows of frons complete, extending from antennal tubercles to neck
- 79 (158) Fourth segment of metatarsus distinctly bilobed (figs 8-12, 114, 219, 220x). Species doubtful in this character are treated in both couplets. (Note: Lobation of metatarsi is less strong than that of anterior tarsi).
- 80 (101) Elytra unicolorous or variegate metallic, without orange spot
- 81 (88) Punctuation of elytra distinctly well- defined (sometimes a few punctures may be confluent; if dark coppery- violet : see # 93: *D. cupreoviolaceus* Puthz)
- 82 (83) Fourth segment of metatarsus deeply bilobed, lobes longer than half segment 5. Abdominal punctuation sparser, interstices on tergite 4 at least twice as large as diameters of punctures. Male: Sternites 3-6 with an acute projection apicolaterally; tergite 10 broadly rounded. Aedeagus as in fig. 2, Puthz, 1980a. Female: Sternite 8 triangular; tergite 10 truncate- triangular.

- 5.3 - 6.7 mm. . . . . *D. spiniventris* Puthz  
China: Yunnan
- 83 (82) Fourth segment of metatarsus less deeply bilobed, lobes shorter than half segment 5. Abdominal punctation denser, interstices on tergite 4 less than twice as large as diameters of punctures
- 84 (85) Eyes larger, temples about 1/5 as long as eyes. Abdominal punctation very dense, interstices on tergite 4 smaller than diameters of punctures. 4.7 - 5.7 mm. . . . . (*D. ater* sp. n.) see # 89
- 85 (84) Eyes smaller, temples about 1/3 as long as eyes. Abdominal punctation less dense, interstices on tergite 4 larger than diameters of punctures
- 86 (87) Larger species. Elytra entirely black. Male: sternite 8 with apical notch in about posterior quarter; sternite (fig. 116). Aedeagus (fig. 113), parameres with 8 + 10 (-12) setae.  
5.2 - 6.2 mm. . . . . *D. atrocyaneus* sp. n.  
China: Taiwan
- 87 (86) Smaller species. Elytra with a cupreous spot on posterior half. Male very similar to that of *D. atrocyaneus*, sternite 8 with deep notch in about apical third, aedeagus about same as in *D. atrocyaneus*, but parameres with 7+ 7 (- 8) setae. 4.5 - 5.2 mm. . . . . *D. yoshidai* Naomi  
Japan: Iriomote Is.
- 88 (81) Punctation of elytra (most of it) distinctly confluent
- 89 (90) Elytra entirely black, abdominal punctation very dense, interstices on tergite 4 smaller than diameters of punctures. Tergite 10 broadly rounded. Male: sternite 9 (fig. 229). Aedeagus (fig. 209). Female: sternite 8 (fig. 215). 4.7 - 5.7 mm. . . . . *D. ater* sp. n.  
China: Taiwan
- 90 (89) Elytra with more or less distinct metallic tint
- 91 (92) Pronotum broader than long. Elytra with bluish tint and a more or less distinct, skyblue spot on posterior half. Male: sternite 9 serrate apically; tergite 10 broadly rounded. Aedeagus as in figs 24-26 (Puthz, 1981a), apical portion of median lobe enlarged, ore or less emarginated medially. Female: sternite 8 about as in fig. 93. Tergite 10 narrowly rounded. 5.5 - 7.0 mm. . . . . *D. subvorticosis* Champion  
India; China: Yunnan
- 92 (91) Pronotum longer than broad
- 93 (94) Dark with strong coppery-violet reflection. Punctation of elytra well-defined on sutural third, more or less confluent on lateral two thirds. Paratergites not directed upwards, narrower, those of segment four as broad as antennal segment 2. Male: sternite 8 with a subtriangular notch in about posterior third. Sternite 9 (fig. 5, Puthz, 1997) with a broad tooth apicolaterally. Tergite 10 broadly rounded. Aedeagus (fig. 3, Puthz, 1997) with a lancolate apex of median lobe which is curved dorsally and densely set with granules and some longer setae.

parameres longer than median lobe, densely set with long setae. Female: sternite 8 (fig. 4, Puthz, 1997), narrowly rounded apico-medially. Tergite 10 semicircularly rounded.

3.8 - 5.0 mm. . . . . *D. cupreoviolaceus* Puthz

China: Hainan

94 (93) Differently colored. Punctuation of elytra confluent, including sutural third. Paratergites directed upwards, broader, those of segment 4 twice as broad as antennal segment 2

95 (96) Metatarsal segment four very shortly bilobed, lobes much shorter than 1/3 segment 5 (fig. 12). Pronotum with strong and homogeneous punctuation lacking deep impressions. Elytra bluish with a coppery spot on posterior half. Male: sternite 9 serrate apically; tergite 10 broadly rounded. Aedeagus as in fig. 4 (Puthz, 1984a), apical portion of median lobe triangular, densely set with long ventro-lateral setae. Female: sternite (fig. 227); tergite 10 narrowly rounded.

4.6 - 5.6 mm. . . . . *D. cupreostigma* Puthz

China: Taiwan

96 (95) Metatarsal segment four deeply trilobed, lobes as long as 1/3 of segment 5 (fig. 114, see also fig. 16, Puthz, 1998). Pronotum with coarse, variegate dense punctuation and deep impressions

97 (100) Medial portion of frons strongly elevated, extending well beyond the level of medial eye margins

98 (99) Abdominal punctuation very dense, interstices smaller than punctures, tergite 8 finely and densely punctate with fatty reflex, interstices about as large as diameters of punctures, deeply reticulate; interstices of ventral abdominal punctuation distinctly reticulate. Elytra blackish-blue with a coppery reflex (or an orange spot) behind middle. Male: apical portion of median lobe rounded, fig. 185). Female: sternite 8 (fig. 195). Tergite 10 subtriangular (fig. 200).

5.5 - 6.5 mm. . . . . *D. verticosus* Eppelsheim

India, Burma, Vietnam, China: Yunnan, ? Sichuan

99 (98) Abdominal punctuation less dense, interstices as large as punctures, tergite 8 less finely and less densely punctate, more brilliant- shining, interstices larger than diameters of punctures, less deeply reticulate; interstices of ventral abdominal punctuation smooth. Elytra dark blue with a golden- coppery area on posterior half near suture. Tergite 10 rounded. Male: sternite 9 (fig. 117). Aedeagus (fig. 123). Female: sternite 8 (fig. 115). Tergite 10 rounded. 5.3 - 6.5 mm. . *D. gemmosus* sp. n. China: Yunnan

100 (97) Medial portion of frons less elevated, not extending to the level of medial eye margins. Elytra bronze-black-bluish with a bluish or coppery reflex on the rosette. Tergite 10 rounded. Male: sternite 9 serrate apicolaterally. Aedeagus with the median lobe triangularly

- narrowed (fig. 30, Puthz, 1981). Female: sternite 8 triangular as in the previous species. 4.8 - 5.8 mm. . . . . *D. cameroni* Champion  
Pakistan (Punjab), India, Nepal, China: Yunnan
- 101 (80) Elytra with distinct orange spots
- 102 (123) Diameter of elytral spot about as large as length of third antennal segment or larger
- 103 (106) Pubescence of fore parts conspicuously long and erect, single setae as long as fourth antennal segment
- 104 (105) Smaller: 4.2- 5.2 mm. Coloration mainly blackish-violet. Interstices of punctation smooth. Tergite 10 rounded. Male: sternite 9 (fig. 136). Aedeagus (fig. 128), apical emargination of median lobe deeper, apical lobes narrower. Female: sternite 8 (fig. 132). 4.2 - 5.2 mm. . . . . *D. aequalis* Zheng  
China: Sichuan, Guangdong (?)
- 105 (104) Larger: 4.6 - 6.3 mm. Coloration markedly bluish (-green). Interstices of punctation more or less distinctly reticulated. Tergite 10 rounded. Male: sternite 9 (figs 118, 119). Aedeagus (figs 121, 122), apical emargination of median lobe less deep, apical lobes broader. Female: sternite 8 about as in fig. 131. . . . . *D. chinensis* Bernhauer  
China: Shandong, Shaanxi, Anhui, Hunan, Jiangxi, ? Fujian
- 106 (103) Pubescence of fore parts less long, less conspicuous, half erect or recumbent, longest setae distinctly shorter than fourth antennal segment
- 107 (114) Sculpture of elytra very distinctly confluent/rugose around, and partly on, orange spot. Fully winged species
- 108 (109) Elytral spot larger, diameter as large as length of antennal segments 3 and 4 combined; abdominal punctation sparser, interstices in middle of tergites twice as large as diameters of punctures. Male: sternite 9 (fig. 208, see also fig. 6, Puthz, 1980b), with a distinct tooth apicolaterally; tergite 10 broadly rounded. Aedeagus (fig. 190, see also fig. 5, Puthz, 1980b), apical portion of median lobe broadly triangular, densely set with long ventrolateral setae. Female: sternite 8 (fig. 199), tergite 10 rounded apically. 5.0 - 6.0 mm. . *D. oclatipennis* Puthz  
China: Yunnan
- 109 (108) Elytral spot smaller, diameter distinctly smaller than length of antennal segments 3 and 4 combined; abdominal punctation denser, interstices in middle of tergites mostly at most as large as diameters of punctures
- 110 (111) Elytral sculpture around orange spot and on its periphery strongly vorticose, in centre of spot some (more or less) punctures well-defined. Male: sternite 9 (fig. 205) with a distinct tooth apicolaterally; tergite 10 broadly rounded. Aedeagus (fig. 178). Female: valvifers (fig. 192) densely set with moderately long, very strong setae on its posterior half (fig. 191). 5.0 - 6.5 mm. . . . . *D. grandistigma* sp. n.  
China: Yunnan; Vietnam (?)

- 111 (110) Elytral sculpture, including (complete) sculpture of orange spots, densely confluent on posterior half, long and narrow rugae pass obliquely backwards. Two very similar species
- 112 (113) Male: apical notch of sternite 8 in about posterior third. Aedeagus as in fig. 179, apical portion of median lobe broader (fig. 189). Female: sternite 8 (fig. 198), apical projection shorter; tergite 10 slightly subtriangular. 4.8 - 5.8 mm. . . . . *D. ocellifer* sp. n.  
China: Yunnan; Laos
- 113 (112) Male: apical notch of sternite 8 in about posterior quarter. Sternite 9 (figs 202, 203). Aedeagus (figs 177, 182, 183), median lobe narrower. Female: sternite 8 (fig.196), apical projection longer; tergite 10 apically rounded.  
4.8 - 6.0 mm. . . . . *D. ocellatus* Cameron (incl. *acutus* Zheng)  
India: Assam; Thailand; Vietnam; China: Yunnan; Sichuan
- 114 (107) Sculpture of elytra more or less confluent only on area between orange spot and suture. Fully winged or brachypterous species
- 115 (116) Segment four of metatarsus broadly and deeply bilobed. Elytra (fig.170), orange spots extending towards declining sides. Male: sternite 9 as in fig. 13 (Puthz, l.c.). Aedeagus as in fig. 11 (Puthz, l.c.). Female: unknown. 5.0 - 6.5 mm. . . . . *D. strabo* Puthz  
China: Yunnan; Thailand
- 116 (115) Segment four of metatarsus very slightly bilobed. Elytral spots distinctly separate from declining sides (as in figs 105-112)
- 117 (118) Abdominal punctation less fine and denser, punctures of tergite 5 as large as one punctures; punctation of paratergites very dense, all interstices distinctly smaller than half diameters of punctures. Male: sternite 9 (fig. 137); tergite 10 very broadly rounded, slightly concave in posterior middle. Aedeagus (fig. 130). Female: sternite 8 pointed apicomediaally. 4.5 - 5.7 mm. . . . . *D. dubiosus* sp. n.  
China: Guizhou, Guangxi. ? Taiwan
- 118 (117) Abdominal punctation finer and less dense, punctures of tergite 5 smaller than one eye facet, interstices in middle of tergites much larger than diameter of punctures; punctation of paratergites less dense, interstices at least somewhere as large as half diameters of punctures, or larger
- 119 (122) Punctures near lateral border of elytral spot distinctly well-defined
- 120 (121) Black, or with dark blue (-green) metallic tint. Punctation of posterior-lateral quarter of elytra very coarse and dense, interstices mostly much smaller than diameters of punctures: see # 135 *D. taiwanensis* Puthz
- 121 (120) (Blackish) blue metallic (Prussian blue). Punctation of posterior-lateral quarter of elytra moderately coarse and moderately dense to moderately sparse, interstices often as large as diameters of punctures, or larger: see # 178 *D. gonggamontis* sp. n.

- 122 (119) Punctures near lateral border of elytral spot very dense and slightly longitudinally confluent. Black with dark violet tint. See # 136 *D. atrovioleaceus* sp. n.
- 123 (102) Diameter of elytral spot smaller than length of third antennal segment
- 124 (137) Elytral sculpture simple, punctures well-defined, not confluent or vorticoso (rarely, a few punctures coalescent)
- 125 (128) Pubescence of fore parts conspicuously long and erect, single setae as long as fourth antennal segment (similar to fig. 22)
- 126 (127) Black with faint bluish tint. Abdominal punctation much sparser, interstices on groundsculpture. Tergite 10 rounded. Male: sternite 9 (fig. 163), with a very long apicolateral tooth. Aedeagus (fig. 156). Female: sternite 8 (fig. 167); valvifer triangularly acute apically. 4.7 - 6.2 mm. . . . . *D. socius* Zheng  
China: Sichuan
- 127 (126) Distinctly bluish. Abdominal punctation much denser, interstices on middle of tergite 4 about as large as diameters of punctures, moderately shiny with distinct reticulation. 4.8 - 6.0 mm. See # 105 *D. chinensis* Bernhauer
- 128 (125) Pubescence of fore parts shorter, half erect, single setae about as long as second antennal segment, if longer, then distinctly curved (see fig. 24)
- 129 (132) Pubescence of fore parts greyish
- 130 (131) Larger species with smaller elytral spot (fig. 103). Abdominal punctation dense, interstices on middle of tergites smaller than half diameters of punctures, reticulate. Male: sternite 9 (fig. 120); tergite 10 blunt or very shallowly emarginate apically. Aedeagus (figs 124, 125). Female: sternite 8 (fig. 153); tergite 10 moderately triangular. 6.0 - 7.5 mm. . . . . *D. yangae* sp. n.  
China: Sichuan
- 131 (130) Smaller species with larger, longitudinally-oval spot. Abdominal punctation less dense, interstices on middle of tergites about as large as diameters of punctures, smooth or indistinctly reticulate. Male: sternite 9 (fig. 135); tergite 10 as above. Aedeagus (fig. 126). Female: sternite 8 (?), tergite 10 as above. 5.2 - 6.4 mm. . . . . *D. senex* sp. n.  
China: Sichuan
- 132 (129) Pubescence of fore parts blackish
- 133 (134) Pubescence of fore parts longer, longer than second antennal segment, more erect. Elytra subquadrate. Tergite 10 rounded. Male: sternite 9 (fig. 162). Aedeagus (fig. 155). Female: sternite 8 (fig. 165). 4.5 - 6.0 mm. . . . . *D. bioculatus* sp. n.  
China: Yunnan
- 134 (133) Pubescence of fore parts somewhat shorter, about as long as second antennal segment, less erect

- 135 (136) Black or with dark blue (-green) metallic tint. Punctures near lateral margin of elytral spot distinctly well-defined. Medial area of metasternum broadly-triangularly impunctate in middle, side portions of medial area each with at most 20 coarse punctures. Medial punctuation of sternites moderately fine. Male: sternite 9 (fig. 161); tergite 10 broadly rounded. Aedeagus (figs 157-160). Female: sternite 8 (fig. 166); tergite 10 subtriangular. General outline and size of elytral spot variable (figs 107-111). . . . . *D. taiwanensis* Puthz  
China: Taiwan
- 136 (135) Black with dark violet tint. Punctures near lateral margin of elytral spot very dense triangularly impunctate, side portions of medial area with distinctly more than 20 more or less coarse punctures. Medial punctuation of sternites fine. Male: sternite 9 (fig. 89); tergite 10 broadly rounded. Aedeagus (fig. 154). Female: sternite 8 (fig. 164); tergite 10 subtriangular. General outline and size of elytral spot very variable. 4.5 - 6.0 mm. . . . . *D. atroviolaceus* sp. n.  
China: Yunnan
- 137 (124) Elytral sculpture at least partly confluent, mostly confluent between orange spot and suture
- 138 (145) Both sternite 9 and valvifer rounded- serrate apically (figs 230-232). (If decision is doubtful, try also opposite couplet)
- 139 (140) Head broader (bEl: bH < 115). Entire body with distinct bluish tint. Male: sternite 9 (fig. 232); tergite 10 broadly rounded. Aedeagus (fig. 217). Female: sternite 8 (fig. 216); tergite 10 narrowly rounded. 4.8 - 6.2 mm. . . . . *D. mendax* sp. n.  
China: Taiwan
- 140 (139) Head narrower (bEl: BH > 120)
- 141 (142) Body blackish-blue-metallic (Prussian blue). Legs entirely black. Pronotum with distinct pubescence. Fore body very densely punctate and reticulate, less shining . . . . . *D. dubiosus* sp. n. (see # 117)
- 142 (141) Body blackish. Legs at least at parts brownish or lighter. Pronotum lacking pubescence. Fore body less densely punctate, without or with faint microsculpture, more shining. Two closely related taxa, belonging possibly to one variable species
- 143 (144) Basal half of femora reddish, rather distinctly delimited from blackish apical half. Male: shorter. 4.5 - 5.5 mm. . . . . *D. klapperichi* L. Benick  
China: Fujian, Sichuan
- 144 (143) Basal third of femora ± reddish, mostly darker, indistinctly delimited from darker apical portion. Male: sternite 9 (fig. 230). Aedeagus (figs 222, 223, also 225), apical portion of median lobe longer. 4.5 - 5.5 mm. . . . . *D. freyi* L. Benick  
China: Zhejiang, Anhui, Jiangxi, Hunan, Fujian, Guizhou, Yunnan, Sichuan
- 145 (138) Both sternite 9 and valvifer with a more or less distinct tooth apicolaterally (figs 152, 161, 204, 206)



- 146 (151) Elytral sculpture more rugose, rugae present also on orange spot
- 147 (148) Pronotum broader than long. Smaller: 4.5-5.5 mm. Black, with faint (blue-) metallic tint. Male: notch of sternite 8 in about posterior fifth. Aedeagus (figs 179, 188). Female: sternite 8 (fig. 197); valvifer with apical brush; tergite 10 rounded. 4.5 - 5.5 mm. . . . . *D. emarginatus* Zheng  
China: Sichuan, Yunnan; ? Burma
- 148 (147) Pronotum longer than broad. Larger: 5.5- 6.5 mm
- 149 (150) Variegate metallic (blue-violet-coppery). Male: notch of sternite 8 in about posterior strong, apically rounded setae, about as in fig. 191; tergite 10 subtriangular (fig. 201). 5.5 - 6.5 mm. . . . . *D. variegatus* sp. n.  
China: Yunnan
- 150 (149) Elytra blackish-blue with a coppery reflex or an orange spot behind middle. Male: notch of sternite 8 in about posterior fourth. Apical portion of median lobe broader, rounded (fig. 185). Female: sternite 8 more triangular (fig. 195), valvifer with apically pointed setae; tergite 10 subtriangular (fig. 200) 5.5 - 6.5 mm. . . . . *D. verticosus* Eppelsheim  
India, Burma, Vietnam, China: Yunnan, ? Sichuan
- 151 (146) Elytral sculpture less rugose, no rugae on orange spot, rugae only around orange spot or between spot and suture. Three very similar species
- 152 (157) Black, with more or less distinct, Prussian-blue or bluish-green, metallic tint
- 153 (154) Black and/or metallic. Punctuation of posteriolateral quarter of elytra very coarse and dense, interstices mostly much smaller than diameters of punctures. Tergite 10 rounded. Male: sternite 9 (fig. 161), mostly with a distinct tooth apicolaterally. Aedeagus (figs 157-160). Female: sternite 8 (fig. 166). 4.3 - 5.7 mm. . . . . *D. taiwanensis* Puthz (pars)  
China: Taiwan
- 154 (153) Distinctly blue metallic. Punctuation of posteriolateral quarter of elytra moderately coarse and moderately dense to moderately sparse, interstices often as large as diameters of punctures, or larger
- 155 (156) Head much narrower ( $wEl: wH > 1.30$ ), elytra quadrate with rectangular shoulders. Pubescence of pronotum whitish. Punctuation of head moderately coarse and moderately sparse. Male: sternite 9 (fig. 152; see also fig. 7, Puthz, 1971a), serrate apically, with toothlike projection laterally; tergite 10 rounded. Aedeagus (fig. 143), apical portion of the median lobe more or less truncate and broadly emarginate. Female: sternite 8 (fig. 134); tergite 10 subtriangular. 4.7 - 5.5 mm. . . . . *D. hummeli* Bernhauer  
China: Sichuan
- 156 (155) Head broader ( $bEl: bH < 1.25$ ), elytra slightly trapeziform with somewhat oblique shoulders. Pubescence of pronotum brownish. Punctuation of head coarse and very dense. See # 178 *D. gongga-*  
*montis* sp. n.

- 157 (152) Black, with bluish-violet metallic tint. Brachypterous or fully winged. See # 136. . . . . *D. atroviolaceus* sp. n.
- 158 (79) Fourth segment of metatarsus simple
- 159 (186) Elytra with distinct orange spots
- 160 (163) Elytral spot very large, diameter distinctly larger than length of third antennal segment (e.g. fig. 104)
- 161 (162) Pubescence conspicuously long, erect, setae of pronotum distinctly longer than antennal segment 2 (figs 23, 24). Elytral spot very large, extending mostly to sides of elytra in dorsal view (fig. 104). Tergite 10 rounded. Male: sternite 9 (about as in fig. 135). Aedeagus (fig. 127). Female: sternite 8 (fig. 131) 4.8 - 6.0 mm. . . . *D. banghaasi* Bernhauer  
China: Shandong, Shaanxi, Anhui, Jiangxi, Hunan, Guizhou, Guangdong, Guangxi, Fujian, Sichuan
- 162 (161) Pubescence much shorter, semierect, setae of pronotum shorter than antennal segment 2. Elytral spot smaller, slightly larger than length of antennal segment 3, not extending to sides of elytra in dorsal view. See # 178. . . . . *D. gonggamontis* sp. n.
- 163 (160) Elytral spot smaller, diameter as wide as, or distinctly smaller, than length of third antennal segment
- 164 (183) Abdominal punctation fine, or moderately fine, moderately dense to moderately sparse, interstices on middle of tergites distinctly larger than diameters of punctures; punctation of tergite 8 distinctly, but not conspicuously, at most twice as coarse as that on tergite 7
- 165 (180) Pubescence of pronotum darker, brownish
- 166 (175) Pubescence of pronotum erect
- 167 (170) Pubescence of fore parts longer, longer than antennal segment 2, more erect
- 168 (169) Punctation on posteriolateral quarter of elytra much denser, interstices much smaller than diameters of punctures. Head broader (bH: bE = 0.86). Male: sternite 8 (fig. 162). Aedeagus (fig. 155), apical portion of median lobe broader excavated, with more apicoventral setae (27). Female: sternite 8 (fig. 165), less strongly triangular. 4.5 - 6.0 mm. . . . . *D. bioculatus* sp. n.  
China: Yunnan
- 169 (168) Punctation on posteriolateral quarter of elytra much sparser, interstices often as large as or larger than diameters of punctures. Head narrower (bH: bE = 0.81). Male: sternite 9 (fig. 163). Aedeagus (fig. 156), apical portion of median lobe less broadly excavated, with less apicoventral setae (18-19). Female: sternite 8 (fig. 167), stronger triangular. 4.7 - 6.2 mm. . . . . *D. socius* Zheng  
China: Sichuan
- 170 (167) Pubescence of fore parts somewhat shorter, about as long as antennal segment 2, or shorter, less erect

- 171 (172) Black with dark violet tint. Punctures near lateral margin of elytral spot very dense and slightly confluent longitudinally. Male: sternite 9 (about as in fig. 150). Aedeagus (fig. 154). Female: sternite 8 (fig. 164). General outline and size of elytral spot very variable. 4.5 - 6.0 mm. . . . . *D. atroviolaceus* sp. n.  
China: Yunnan
- 172 (171) Black, or with dark blue (-green) metallic tint. Punctures near lateral margin of elytral spot distinctly well-defined
- 173 (174) Abdominal punctation less fine and denser, diameters of punctures nearly as large as one eye facet, interstices in middle of tergites slightly larger than diameters of punctures; punctation of paratergites very dense, interstices smaller than half diameters of punctures. Male: sternite 9 (fig. 150). Aedeagus (fig. 144), median lobe nearly parallel-sided, anterior margin less deeply emarginated. Female: sternite 8 (fig. 133), slightly less triangular. 4.0 - 5.0 mm. *D. bashanensis* Zheng  
China: Sichuan, Hunan
- 174 (173) Abdominal punctation finer and sparser, punctures distinctly smaller than one eye facet, interstices in middle of tergites at least twice as large as diameters of punctures; punctation of paratergites less dense, interstices often larger than diameters of punctures. Male: sternite 9 (fig. 161). Aedeagus (figs 157-160), median lobe concave laterally, anterior margin deeply emarginated. Female: sternite 8 (fig. 166), a little more triangular. General outline and size of elytral spot very variable (figs 107-111). 4.3 - 5.7 mm. . . . . *D. taiwanensis* Puthz (pars)  
China: Taiwan
- 175 (166) Pubescence of pronotum semierect
- 176 (179) Punctuation of paratergites very dense, interstices much smaller than diameters of punctures
- 177 (178) Punctuation of the fore parts very coarse and very dense.  
See # 117. . . . . *D. dubiosus* sp. n.
- 178 (177) Punctuation of the fore parts less coarse and less dense. Male and female: About as in *D. banghaasi* (compare figs 127, 131, 135). 4.2 - 5.2 mm. . . . . *D. gonggamontis* sp. n.  
China: Sichuan
- 179 (176) Punctuation of paratergites less dense, interstices often as large as diameter of punctures, or larger see # 174 *D. taiwanensis* Puthz
- 180 (165) Pubescence of pronotum whitish and semi-erect
- 181 (182) Punctuation of fore parts less coarse and less dense, diameters of punctures on frons nearly as large as basal cross section of palpal segment 3, interstices mostly larger than half diameters of punctures, often as large or larger than diameters of punctures. Male: sternite 9 (fig. 152). Aedeagus (fig. 143), median lobe distinctly emarginate apically. Female: sternite 8 (fig. 134). 4.5 - 5.3 mm. . *D. hummeli* Bernhauer  
Sichuan (NO)

- 182 (181) Punctuation of the fore parts coarser and denser, diameters of punctures on frons slightly larger than basal cross section of palpal segment 3, interstices mostly as large as, or slightly larger, than diameters of punctures. Male: sternite 9 (fig. 149). Aedeagus (figs 145, 147, 148), median lobe not emarginate apically. Female: sternite 8 as in fig. 134. 5.0 - 6.0 mm. . . . . *D. emeiensis* Zheng  
Sichuan, Guizhou
- 183 (164) Abdominal punctuation very dense and very fine, interstices in middle of tergites distinctly smaller than diameters of punctures, punctuation on tergite 8 conspicuously coarser, at least twice as coarse as that of tergite 7
- 184 (185) Punctuation of fore parts coarser, punctures on pronotum about as large as basal cross section of third antennal segment. Three or four incomplete oblique rugae between orange spot of elytra and suture. Male: sternite 9 with a broad, blunt tooth apicolaterally. Aedeagus as in fig. 2, Rougemont, 1986, median lobe broadly lanceolate. Female: tergite 10 subtriangular. 4.5 - 5.8 mm. . . . . *D. luteostigmaticus* Rougemont  
China: Hongkong
- 185 (184) Punctuation of fore parts less coarse, punctures of pronotum about as large as basal cross section of second palpal segment. About four rather complete, oblique rugae between orange spot of elytra and suture. Male: sternite 9 with a short tooth apicolaterally (fig. 4, Puthz, 1980b). Aedeagus (fig. 3, Puthz, 1980b), with apical portion of median lobe triangular. Female: tergite 10 triangular. 4.0 - 5.2 mm. . . . . *D. luteolunatus* Puthz  
Vietnam; Laos; China: Guangxi  
[Specimens recorded from Thailand probably belong to a closely related new species.]
- 186 (159) Elytra variegate, without orange spots
- 187 (188) Punctuation of pronotum very fine and sparse, punctures distinctly smaller than medial eye facets. Fourth tarsal segment with conspicuous bristle shoe (figs 1-3). Tergite 10 broadly rounded. Male: sternite 8 (fig. 9, Puthz, 1990), with a broad tooth apicolaterally. Aedeagus (fig. 6, Puthz, 1990), with median lobe broadly triangular apically. Female: sternite 8 broadly rounded, apical middle truncate or slightly emarginate medio-apically. 7.5 - 9.0 mm. . . . . *D. sichuanensis* Puthz  
China: Sichuan
- 188 (187) Punctuation of pronotum coarser and denser, punctures at least as large as medial eye facets. Fourth tarsal segment without bristle shoe, or only with rather thin, sparse bristles
- 189 (216) Punctuation of pronotum as coarse as, or distinctly coarser, than that of frons
- 190 (215) Elytral punctuation distinctly confluent, at least on some areas

- 191 (208) Elytra unicolorous, without distinct, differentiated area of different colour (except an indistinctly delimited silver-bluish area on posterior half)
- 192 (195) Punctuation of paratergites variegate, very dense anteriorly, distinctly sparser posteriorly
- 193 (194) Head much narrower than elytra (wH: wEl = 0.84- 0.90), antennae shorter, when reflexed extending towards posterior margin of pronotum, abdomen with faint microsculpture throughout. Male: sternite 8 with a broad, semicircular emargination in posterior 8th. (figs 84, 86). Female: sternite 8 (fig. 94).  
4.8 - 5.8 mm. . . . . *D. rugosipennis* sp. n.  
China: Fujian, Anhui
- 194 (193) Head broader, nearly as broad as elytra (wH: wEl = 0.97), antennae longer, when reflexed last segment extending beyond posterior margin of pronotum, abdomen, except tergite 7-10, without microsculpture. Male unknown. Female: sternite 8 (fig. 93).  
3 - 5.3 mm. . . . . *D. rugipennis* sp. n.  
China: Hunan
- 195 (192) Punctuation of paratergites uniform, very dense
- 196 (203) Species with greenish-metallic shine
- 197 (202) Head broader (bEl: bH < 1.22), with larger eyes. Metasternum deeply reticulated
- 198 (199) Frons broader, medial portion posteriorly as elevated as middle. Male: sternite 9 (fig. 99), tergite 10 broadly rounded. Aedeagus (fig. 83). Female: sternite 8 (fig. 97; tergite 10 triangular).  
4.3 - 5.8 mm. . . . . *D. rougemontianus* sp. n.  
China: Sichuan
- 199 (198) Frons narrower, medial portion more elevated posteriorly than middle
- 200 (201) Antennae entirely dark. Male: medial area of metasternum completely dull. Sternite 9 (fig. 91). Aedeagus (fig. 36. Puthz, 1981a), parameres broadened apically, with about 8-12 very strong and very long medial and 8-9 fine and short dorsomedial setae. Female: sternite 8 about as in fig. 93, broader triangular apically; tergite 10 triangular.  
4.0 - 5.5 mm. . . . . *D. aereus* Champion  
India, Nepal, Bhutan, Burma, China: Yunnan: 1 ♂: Ruili, 4.II.1993, G.M. de Rougemont (cR): n e w t o C h i n a.
- 201 (200) Three outer antennal segments lighter than rest of antennae. Male: medial area of metasternum densely and deeply reticulated, but with a faint shine. Sternite 9 (fig. 100). Aedeagus (in fig. 81), parameres slender apically, with about 20 equally set, moderately strong and moderately long setae. Female: sternite 8 (fig. 98), narrower triangular apically; tergite 10 triangular. 3.8 - 4.7 mm. . . . . *D. ruginosus* Zheng  
China: Sichuan

- 202 (197) Head narrower (bEl: bH > 1.26), with smaller eyes. Metasternum shallowly reticulated, strongly shining. Male unknown. Female: sternite 8 about as in fig. 97; tergite 10 triangular.  
3.3 - 4.1 mm. . . . . *D. brevicornis* sp. n.  
China: Yunnan
- 203 (196) Species predominantly bluish (blackish blue, greenish blue), elytra with a silver-bluish shining area posteriolaterally
- 204 (205) Punctuation of frons much finer than that of pronotum. Blackish blue. Male: sternite 9 with a (more or less) distinct tooth apicolaterally (fig. 101); tergite 10 broadly rounded. Aedeagus (fig. 85). Female: sternite 8 (fig. 88); tergite 10 slightly triangular.  
4.8 - 6.0 mm. . . . . *D. atrocoeruleus* sp. n.  
China: Yunnan
- 205 (204) Punctuation of frons about as coarse as that of pronotum, or only slightly finer
- 206 (207) Larger species: 5.5 - 7.0 mm. Elytral sculpture finer, with completely bright (silvery) bluish shine. See # 91. . . . . *D. subvorticosus* Champion
- 207 (206) Smaller species: 3.7 - 5.0 mm. Elytral sculpture coarser, coarse rugae not forming complete vortex on posterior half. Male: sternite 9 about as in fig. 99. Aedeagus (fig. 4, Puthz. 1980 a) about as in fig. 83, median lobe broadly rounded apically (not triangular), parameres with strong setae also in basal half. Female: tergite 10 triangular. [see also *D. karen* Rougemont in part I of this article]. . . . *D. vietnamensis* Puthz  
Vietnam; Laos; China: Hainan, ?Yunnan
- 208 (191) Elytra with a differentiated area of different metallic color
- 209 (212) Pubescence of pronotum very long, erect, longest setae about as long as antennal segment 4
- 210 (211) Elytral punctuation coarser, largest punctures as large as apical cross section of antennal segment 3, abdominal punctuation very fine and very sparse, elytra with a distinct cupreous spot, diameter nearly as large as the length of antennal segment 3. Male: sternite 9 (fig. 138). Aedeagus (fig. 129). Female unknown.  
5.0 - 6.0 mm. . . . . *D. cyaneocupreus* sp. n.  
China: Taiwan
- 211 (210) Elytral punctuation less coarse, largest punctures about as large as medial cross section of antennal segment 3, abdominal punctuation fine and moderately dense, elytra with indistinct cupreous spot, diameter about as large as antennal segment 11. See # 87. *D. yoshidai* Naomi
- 212 (209) Pubescence of pronotum much shorter, curved distally, longest setae about as long as antennal segment 10
- 213 (214) Pronotal punctuation coarse, diameters of punctures as large as widest cross section of antennal segment 3, interstices smooth, elytra each with cupreous spot. See # 95. . . . . *D. cupreostigma* sp. n.

- 214 (213) Pronotal punctation moderately fine, diameters of punctures smaller than basal cross section of antennal segment 3, interstices reticulate. See # 91. . . . . *D. subvorticosis* Champion
- 215 (190) Elytral punctation well-defined (rarely a few punctures slightly coalescent). See # 86. . . . . *D. atrocyanus* sp. n.
- 216 (189) Punctation of pronotum less coarse than punctation of frons. Four very similar species
- 217 (218) Metatrochanter with distinct tooth in both sexes. See # 37 *D. yunnanensis* Puthz
- 218 (217) Metatrochanter simple
- 219 (222) Punctation of tergite 8 less coarse and less dense, interstices as large as half diameters of punctures or even larger, mostly with shallow reticulation. Apicolateral brush of sternum 9 strong, longer than the sternum. Female: apical emargination of sternite 8 at least as deep as wide (figs 77, 79, 80)
- 220 (221) Punctation slightly less dense. Blackish blue. Male: sternite 9 (fig. 75); tergite 10 broadly rounded. Aedeagus (fig. 70). Female: sternite 8 (fig. 79); tergite 10 triangular, narrowly rounded apically (about as in fig. 73) 7.5 - 9.5 mm. . . . . *D. uniformis* Zheng  
China: Sichuan
- 221 (220) Punctation somewhat denser. Dark blue metallic. Male: sternite 9 (fig. 78); tergite 10 (fig. 71). Aedeagus (fig. 74). Female: sternite 8 (fig. 77); tergite 10 (fig. 72). 6.0 - 7.5 mm. . . . . *D. acuminifer* Puthz
- 222 (219) Punctation of tergite 8 coarser and very dense, as coarse as on elytra, interstices smaller than half diameters of punctures, deeply reticulated. Apicolateral brush of valvifer weak, shorter than valvifer. Female: sternite 8 (fig. 76), apical emargination much less deep; tergite 10 (fig. 73) less acute. Male: unknown.  
6.5 - 7.5 mm. . . . . *D. angulifer* sp. n.  
China: Taiwan









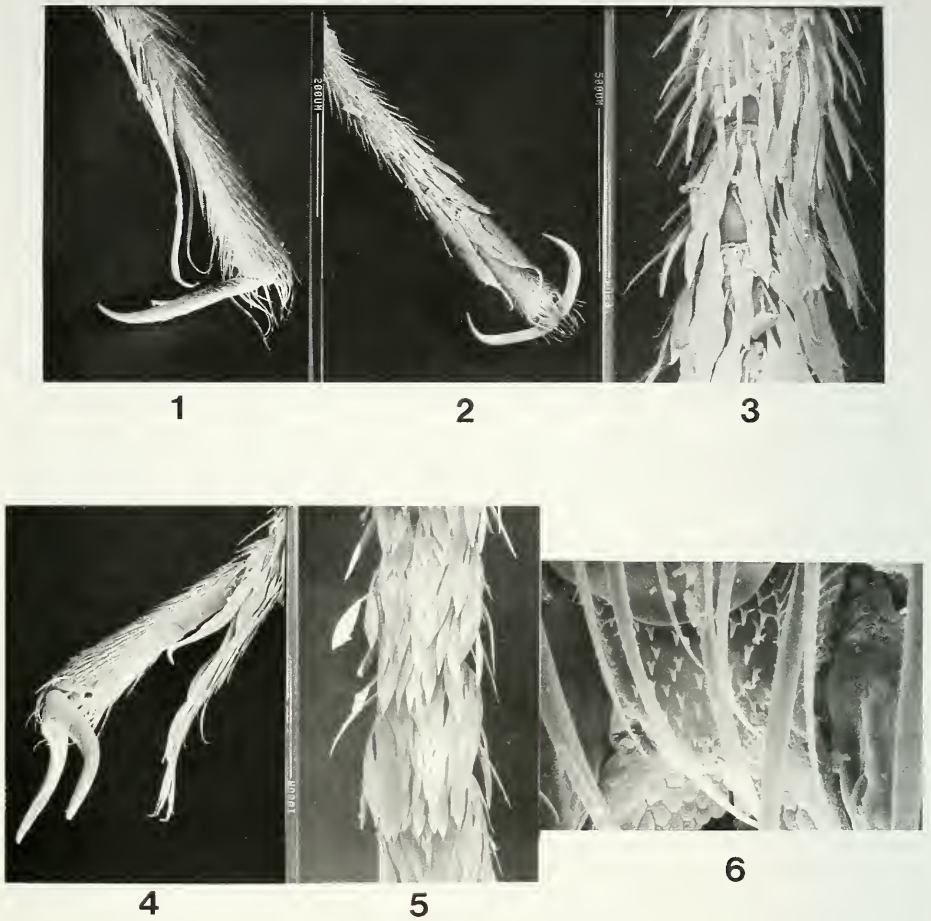




TABLE 3

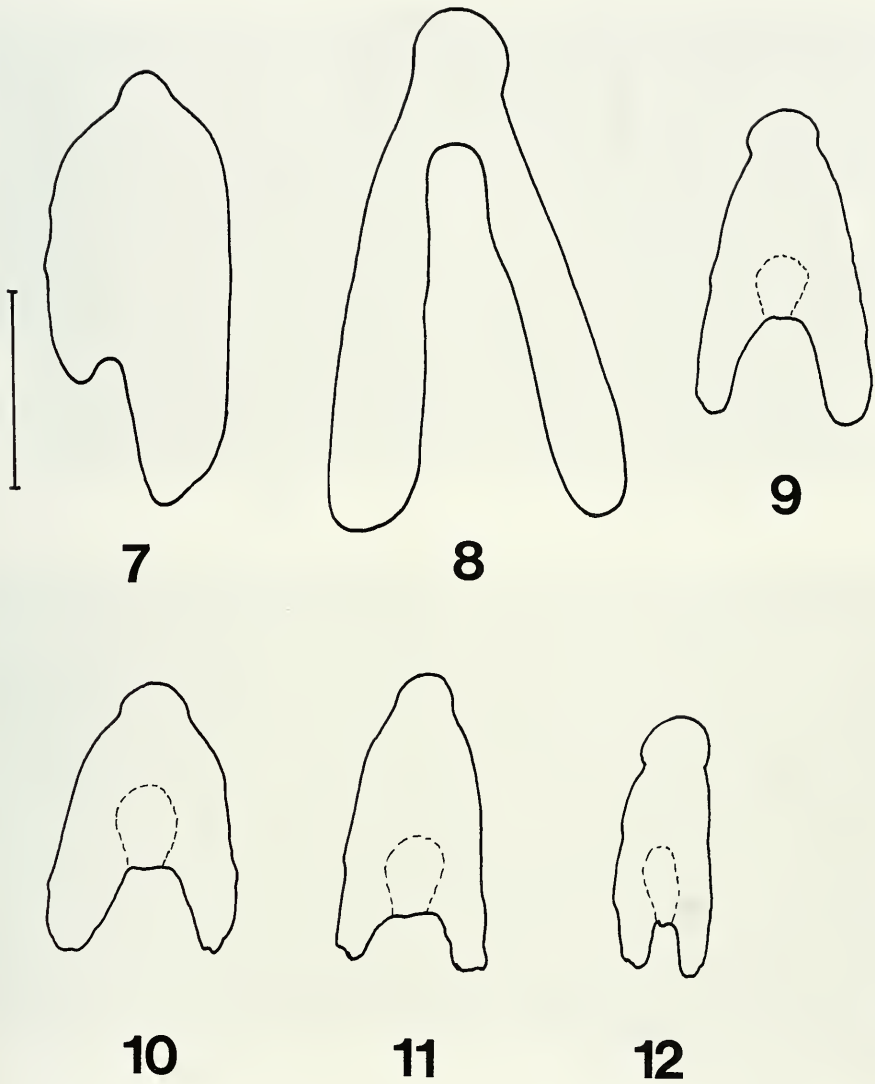
Distribution of *Dianous* in Taiwan according to districts (hsien) (see also map 3, fig. 31 c). 1: Taipei, 2: Ilan, 3: Hsinchu, 4: Taoyuan, 5: Miaoli, 6: Taichung, 7: Changhua, 8: Nantou, 9: Chiayi, 10: Yunlin, 11: Tainan, 12: Kaohsiung, 13: Pingtung, 14: Taitung, 15: Hualien.

<i>Dianous</i> in Districts of Taiwan	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>acuminifer</i> Puthz								x						x	x
<i>angulifer</i> sp. n.									x						
<i>araclinipes</i> Puthz	x	x		x		x		x	x			x			x
<i>ater</i> sp. n.		x		x											
<i>atrocyaneus</i> sp. n.				x											
<i>cupreogutta</i> sp. n.								x				x			
<i>cupreostigma</i> Puthz								x							
<i>cyaneocupreus</i> sp. n.	x														
<i>dubiosus</i> sp. n.								?							
<i>electrigutta</i> sp. n.								x							
<i>inaequalis laevior</i> ssp. n.		x						x	x			x			x
<i>luteoguttatus</i> Champion								x							
<i>mendax</i> sp. n.				x				x							
<i>sucinigutta</i> sp. n.		x		x		x		x	x			x			x
<i>sucinotatus</i> sp. n.													x		
<i>taiwanensis</i> Puthz	x	x		x				x	x			x	x		
16 species	3	5	-	6	-	2	-	11	5	-	-	5	2	1	4



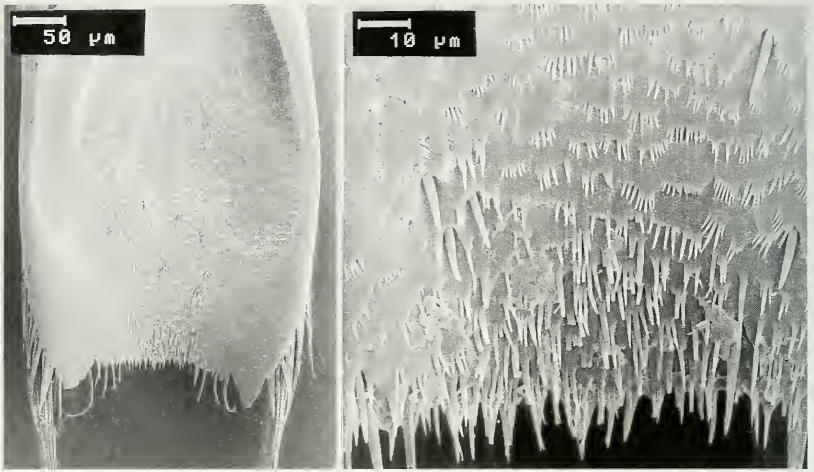
FIGS 1-6

Figs 1-3: Tarsal shoe of *Dianous sichuanensis* Puthz (♀-PT): Apex of metatarsus, lateral aspect (1), ventral aspect (2), detail of latter (3). – Figs 4-6: Metatarsus of *Dianous gracilipes* Champion (♂, Naga Hills): Lateral aspect of apex (4), ventral aspect of segments 2-4 with willow-leave-like setae (5), ventral aspect of segment 5 between claws (6).



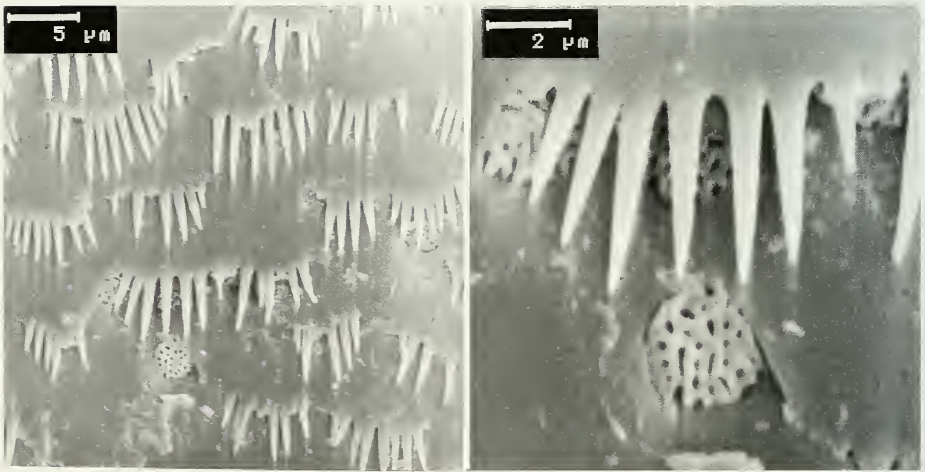
FIGS 7- 12

Outline of tarsal segment 4: *Dianous versicolor* Cameron (Emei Shan, metatarsus of ♂, 7). *D. azureus* Champion (Tanakpur, metatarsus of ♂, 8). *D. mendax* sp. n. (♀-PT, metatarsus, 9). *D. banghaasi* Bernhauer (Emei Shan, protarsus and metatarsus of ♀, 10, 11). *D. cupreostigma* Puthz (♀-PT, metatarsus, 12).- Scale = 0.1 mm.



13

14



15

16

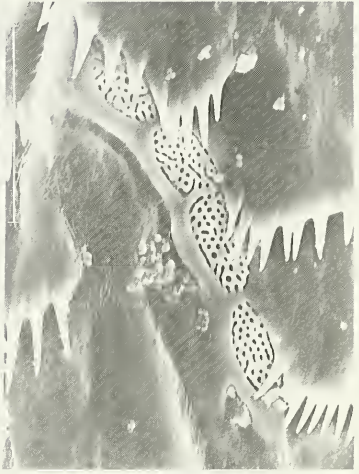
FIGS 13-16

Figs 13, 14: *Dianous taiwanensis* Puthz: Male sternite 9, dorsal aspect, with apically spinulose arcuate cuticular laminae. – Figs 15, 16: *Dianous taiwanensis* Puthz: Male sternite 9, dorsal aspect, apically spinulose arcuate cuticular laminae and glandular openings.





17



18



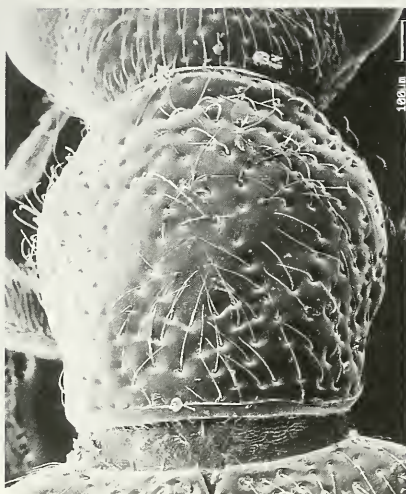
19



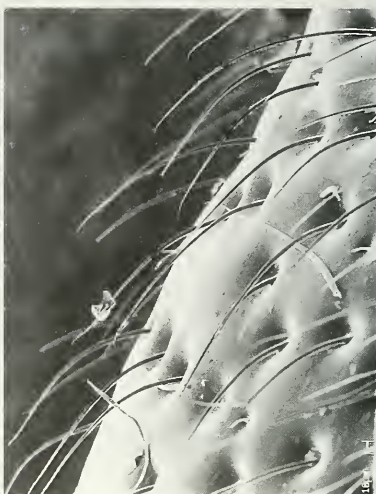
20

FIGS 17-20

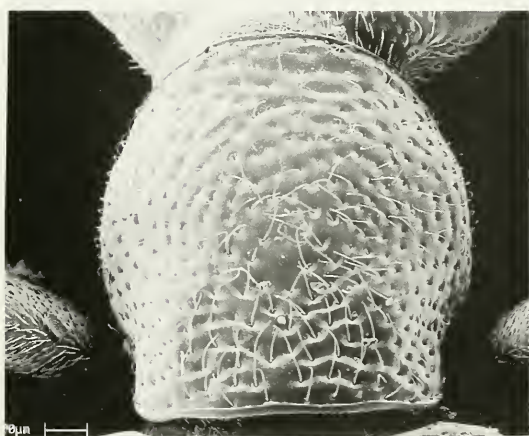
Figs 17, 18: *Dianous taiwanensis* Puthz: Male sternite 9 (T 152), dorsal aspect, apically spinulose arcuate cuticular laminae and glandular openings. – Figs 19, 20: *Dianous taiwanensis* Puthz (T 162): Apical portion of the median lobe of the aedeagus (19), *Dianous elegantulus* Zheng (Wulingyuan): Left elytron with dense pubescence in characteristic arrangement (20).



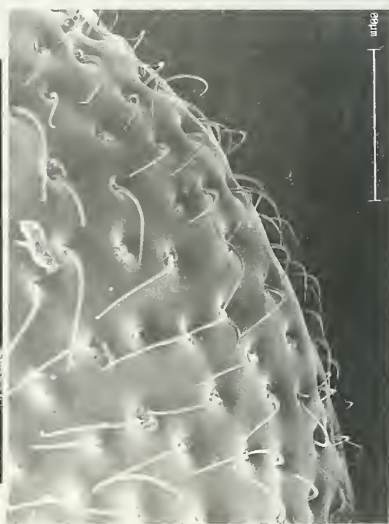
21



22



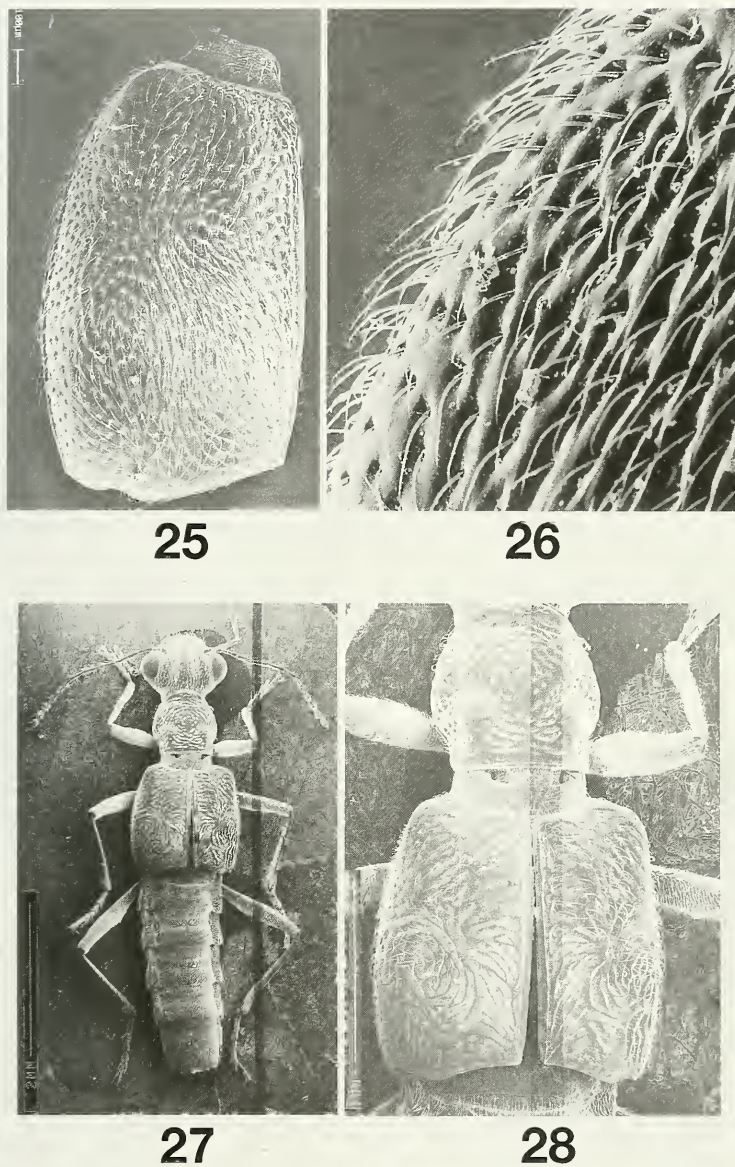
23



24

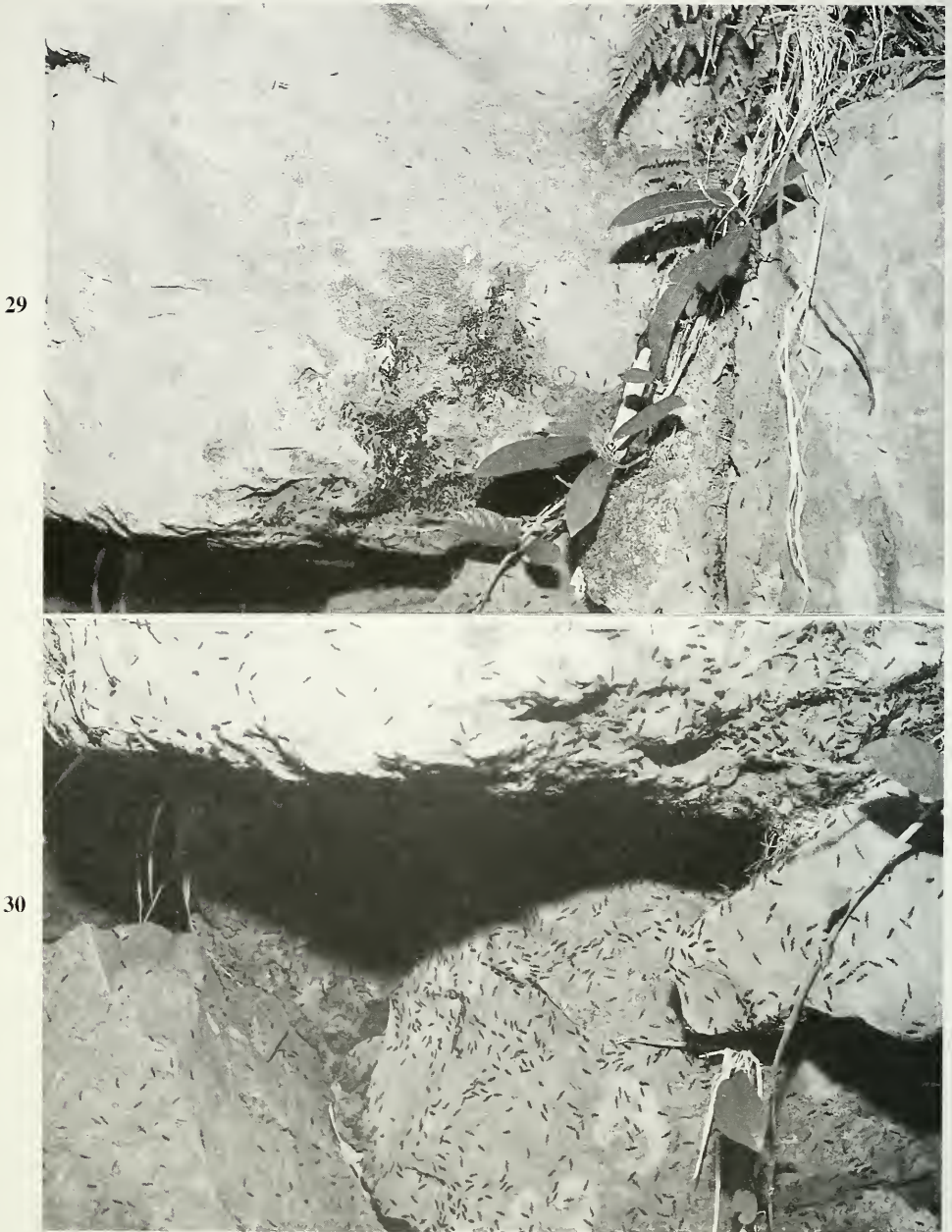
FIGS 21-24

Figs 21, 22. *Dianous banghaasi* Bernhauer (env. Guangping): Pronotum (dorsal and tangential aspect) with long, erect pubescence (compare figs 23, 24). – Figs 23, 24: *Dianous gonggamontis* sp.n. (PT): Pronotum (dorsal and tangential aspect) with moderately long, curved/ recumbent pubescence (compare figs 21, 22).



FIGS 25-28

Figs 25, 26: *Dianous ocellatus* Cameron (Xishuangbanna): Left elytron with rugose-coalescent sculpture. — Figs 27, 28: *Dianous gemmosus* sp.n. (PT): Habitus showing coarse vorticoso sculpture on the elytra.



FIGS 29, 30

Large numbers of *Dianous* (f. e. *D. freyi* L. Benick) in small humid places at the Emei Shan, Sichuan (photograph by Zheng Fa-ke).

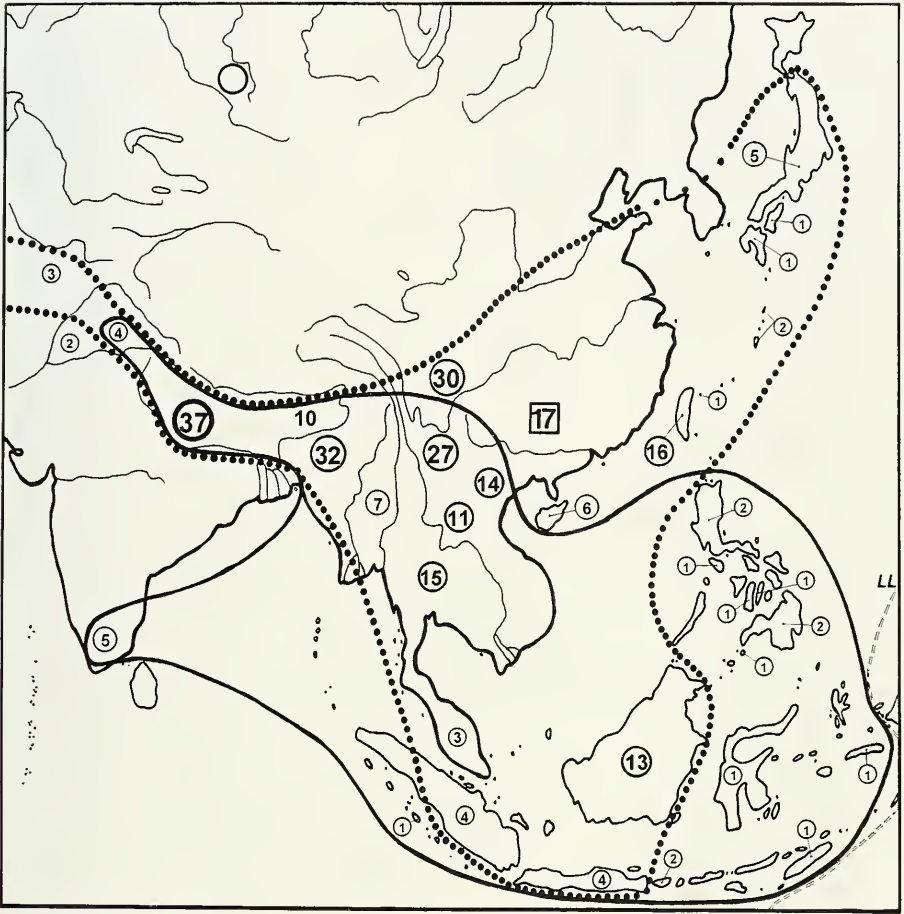


FIG. 31 a

The genus *Dianous* Leach in Southeast Asia. Numbers indicate the number of species recorded from the respective countries, islands or provinces (Yunnan and Sichuan): 37 from NW-India and from Nepal, 32 from Assam, 30 from Sichuan, 27 from Yunnan, 17 from China (excluding Sichuan, Yunnan, Hainan and Taiwan), 16 from Taiwan, 15 from Thailand, 14 from Vietnam, 13 from Borneo, 11 from Laos, 10 from Bhutan, 7 from Burma, 6 from Hainan, 5 from Madras and from Honshu, 4 from Punjab, Sumatra and from Java, 3 from Afghanistan and from Malaysia, 2 from Afghanistan, Bali, Luzon, Mindanao, Ryukyu, 1 from Siberut, Timor, Sulawesi, Ceram, Negros, Basilan, Cebu, Mindoro, Kyushu, Shikoku. The black line delimites the distribution of group I of the genus, the dotted line that of group II. The open circle shows an isolated record from the Altai mountains. LL = Lydekker's line.



FIG. 31 b

The genus *Dianous* Leach in China and neighbouring countries; numbers indicate the number of species recorded from the individual provinces of China and the surrounding countries (see also table 2).

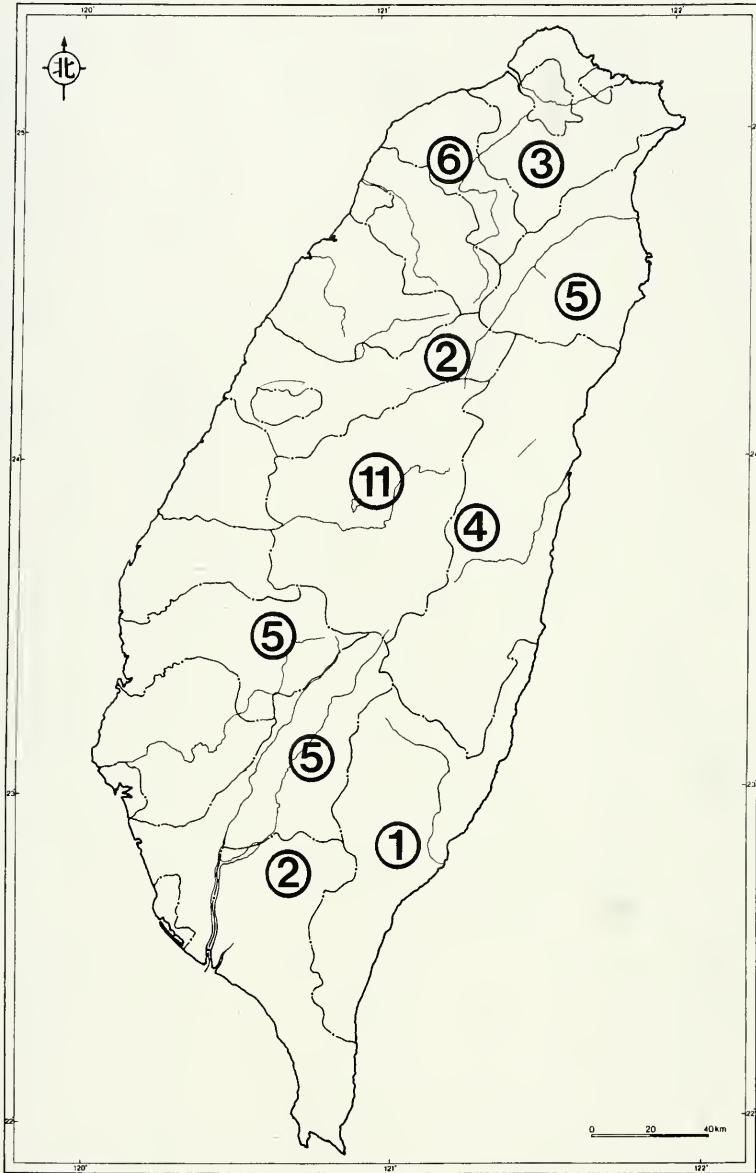
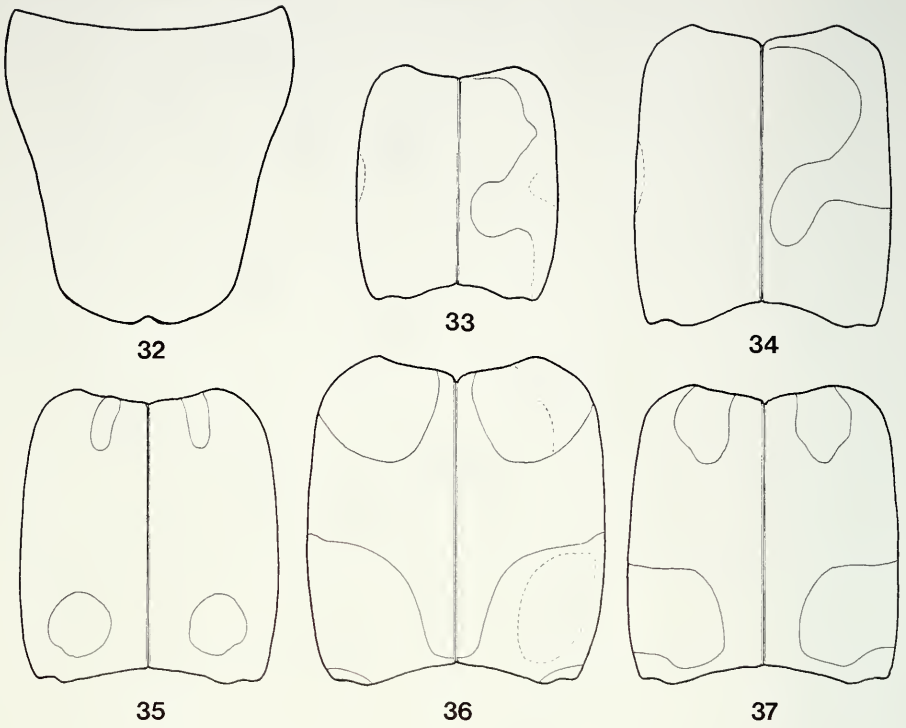


FIG. 31 c

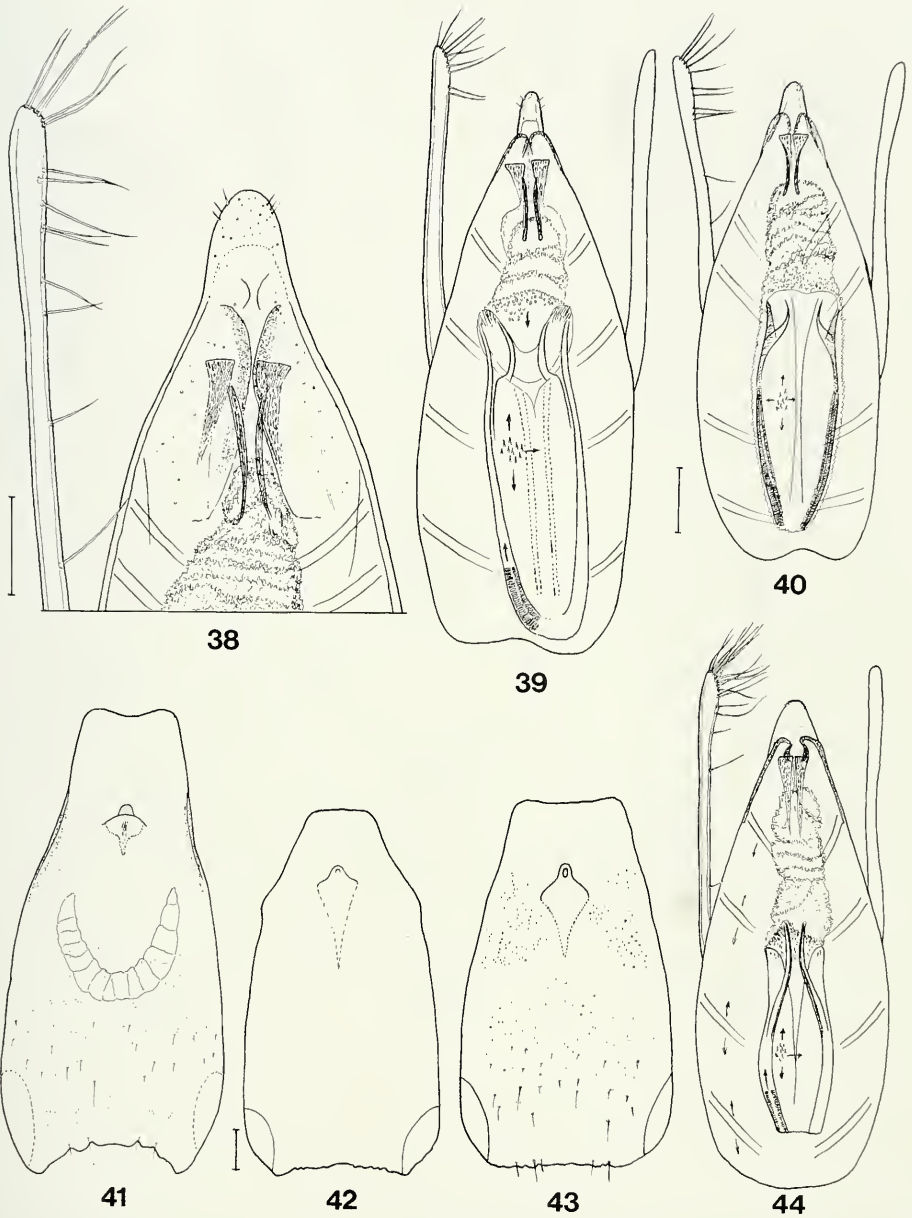
The genus *Dianous* Leach in Taiwan: numbers indicate the number of species recorded from the individual districts (see also table 3).



FIGS 32-37

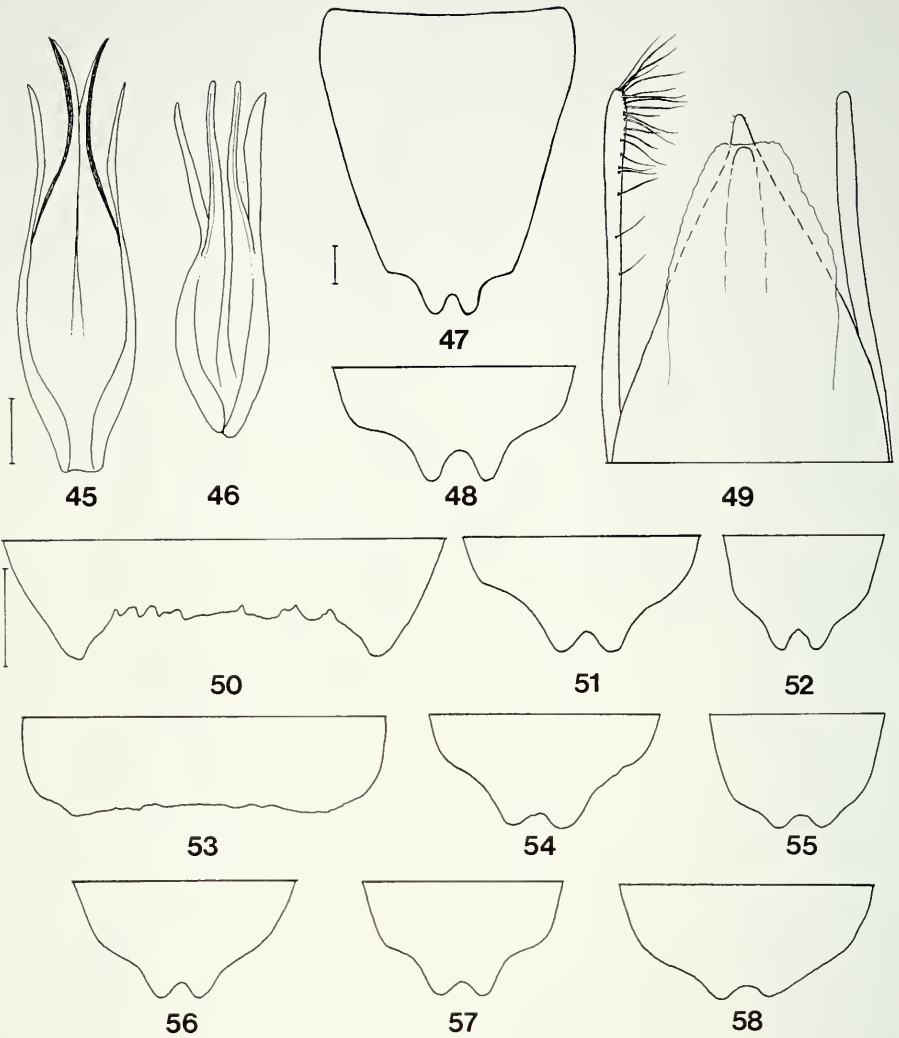
Sternite 8 of the female (32) and coloration of the elytra (33-37, see descriptions): *Dianous versicolor* Cameron (Emei Shan, 32), *D. coeruleovestitus* sp.n. (PT, 33), *D. alternans* Zheng (Emei Shan, 34), *D. schoenmanni* sp.n. (HT, 35), *D. elegantulus* Zheng (Sioxiyou, 36), *D. adonis* sp.n. (HT, 37).





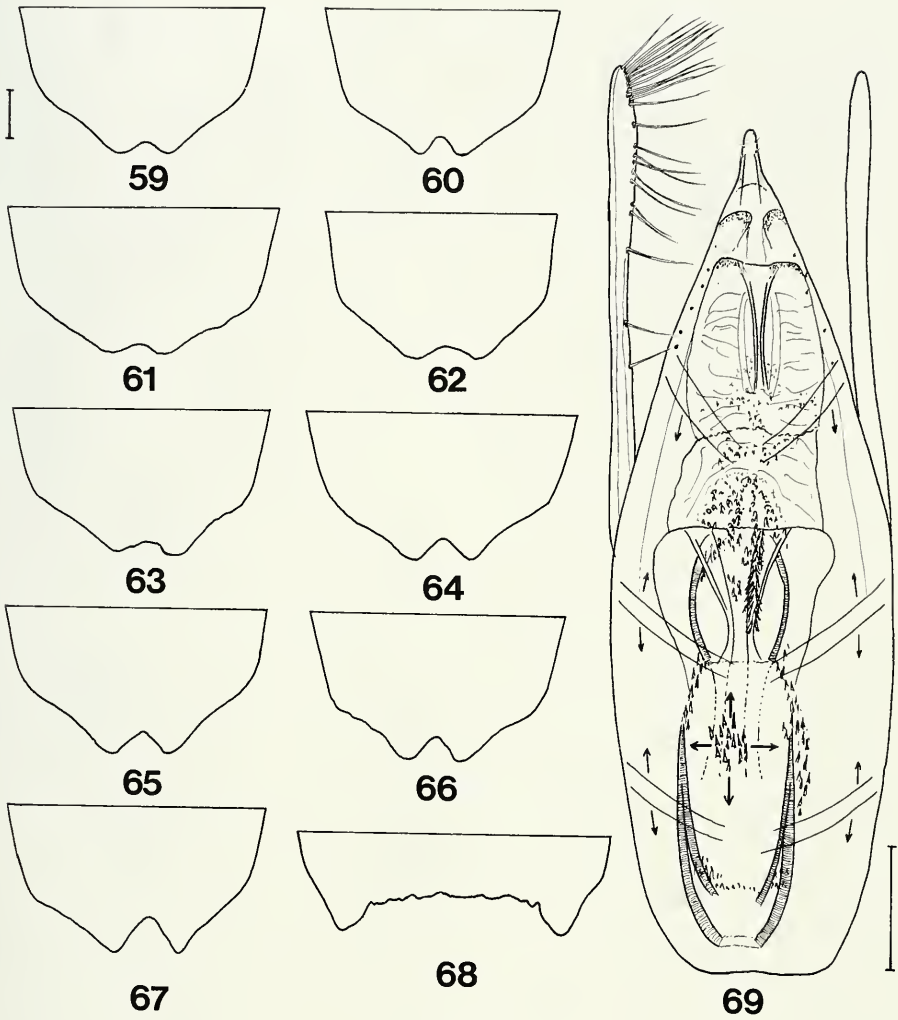
FIGS 38-44

Ventral aspect of the aedeagus (38-40, 44) and ♂ sternite 9 (41-43): *Dianous alternans* Zheng (Emei Shan, 38), *D. coeruleovestitus* sp.n. (HT, 39, 41), *D. coeruleotinctus* sp.n. (PT, 40), *D. schoenmanni* sp. n. (HT, 42), *D. elegantulus* Zheng (Emei Shan, 43, 44). Scale = 0.1 mm (40 = 39, 41; 42 = 43, 44).



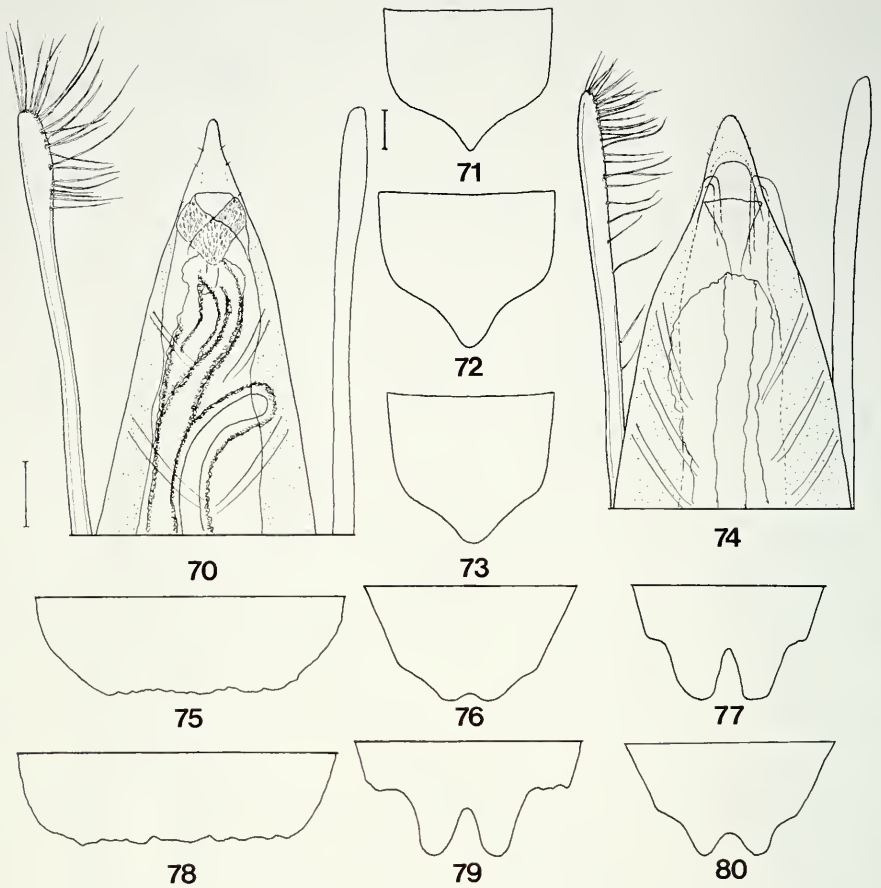
FIGS 45-58

Stronger sclerotized portion of the internal sac (45, 46), outline of the ♀ sternite 8 (total: 47; posterior portion: 48, 51, 52, 54-58), outline of the anterior portion of the aedeagus (49), posterior portion the ♂ sternite 9 (50, 53); *Dianous alternans* Zheng (Emei Shan, 45, 50, 56-58), *D. chervi* Rougemont (Emei Shan, 46), *D. srivichaii* Rougemont (Thailand: Mae Yao, 47), *D. elegantulus* Zheng (Emei Shan, 48, 51, 54), *D. fauveli* sp.n. (HT, 49), *D. coeruleotinctus* sp.n. (PT, 52, 53, 55). Scale = 0.1 mm (45= 46, 49; 47= 48, 51, 52, 54-58; 50= 53).



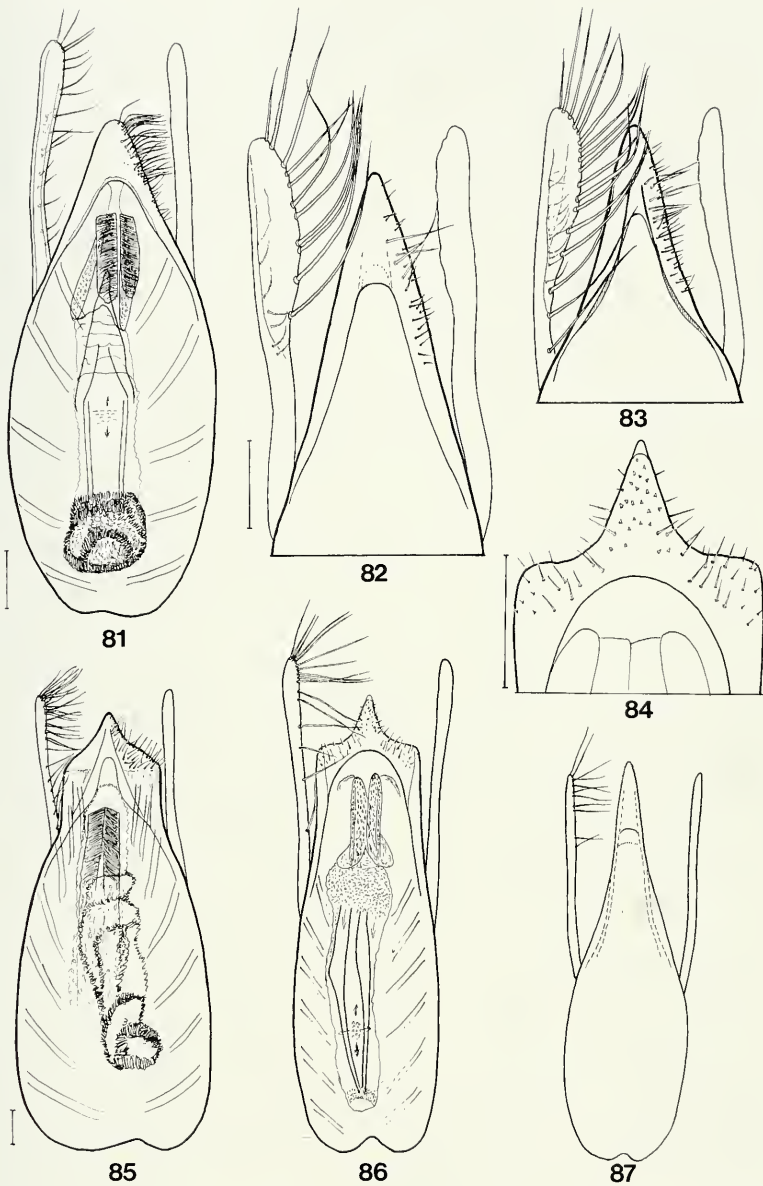
FIGS 59-69

Outline of the posterior portion of the ♀ sternite 8 (59-67), outline of the posterior portion of the ♂ sternite 9 (68), ventral aspect of the aedeagus (69): *Dianous inaequalis* Champion (Nepal: Basantapur: 59; Yunnan: Lugu Lake: 60), *D. inaequalis laevior* ssp. n. (PTT: Taiwan loc. 87: 61-69). Scale = 0.1 mm (59 = 60-67; 69 = 68).



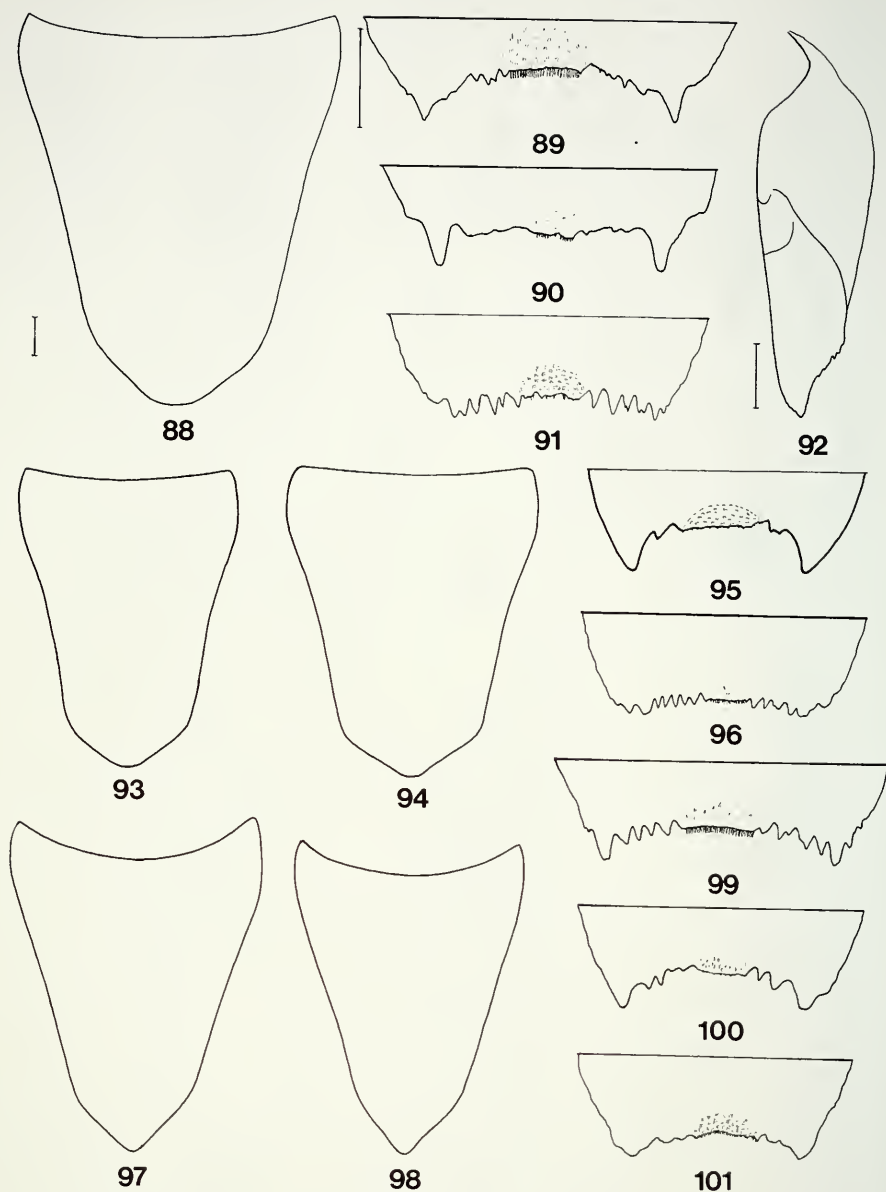
FIGS 70-80

Anterior portion of the aedeagus, ventral aspect (70, 74), tergite 10 (71, 72, 73), outline of the posterior portion of the ♀ sternite 8 (76, 77, 79, 80), outline of the posterior portion of the ♂ sternite 9 (75, 78): *Dianous uniformis* Zheng (Emei Shan, 70, 75, 79), *D. acuminifer* Puthz (♂ Taiwan T 50: 71; ♀ Taiwan: Sun Lin Sea: 72; T 50: 77; T 60: 74, 78; Sun Lin Sea: 80), *D. angulifer* sp.n. (♀ HT: 73, 76). Scale = 0,1 mm (70= 74, 75, 78; 71 = 72, 73, 76, 77, 79, 80).



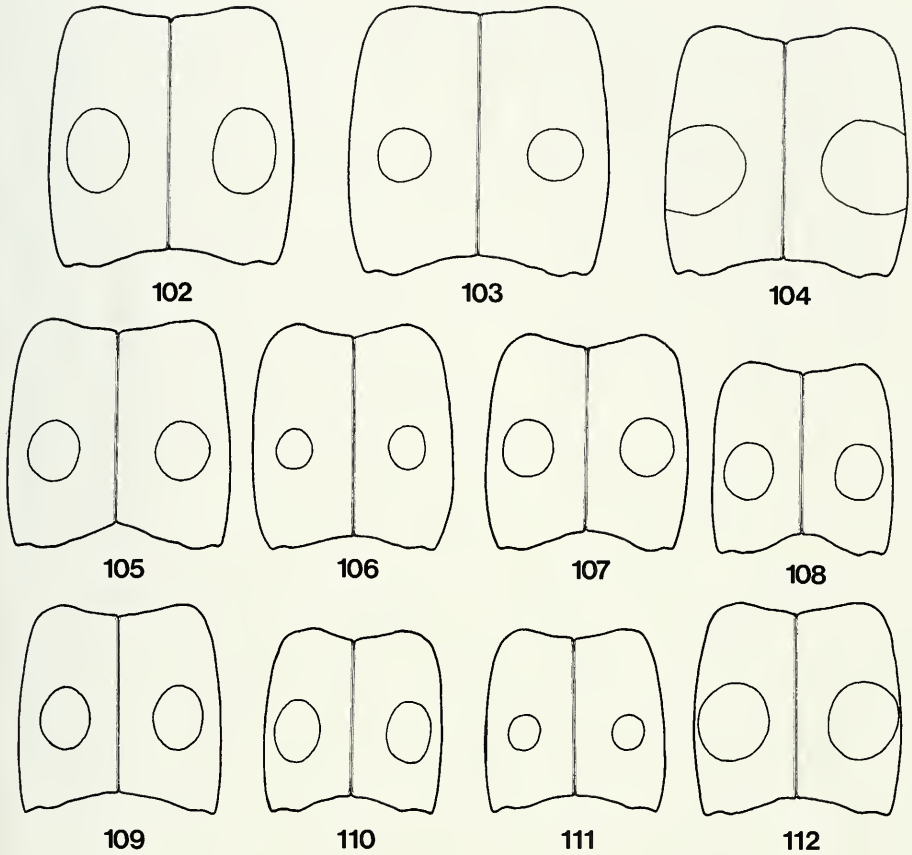
FIGS 81-87

Ventral aspect of the aedeagus and the anterior portion of the aedeagus, respectively: *Dianous ruginosus* sp. n. (HT, 81), *D. karen* Rougemont (Thailand: Doi Suthep, 82), *D. rougemontianus* sp. n. (PT, 83), *D. rugosipennis* sp. n. (HT, 84, 86), *D. atrocoeruleus* sp. n. (PT, 85), *D. luteoguttatus* Champion (Nepal: Induwa Khola Valley, 87). Scale = 0,1 mm (81 = 86; 82 = 83; 85 = 87).



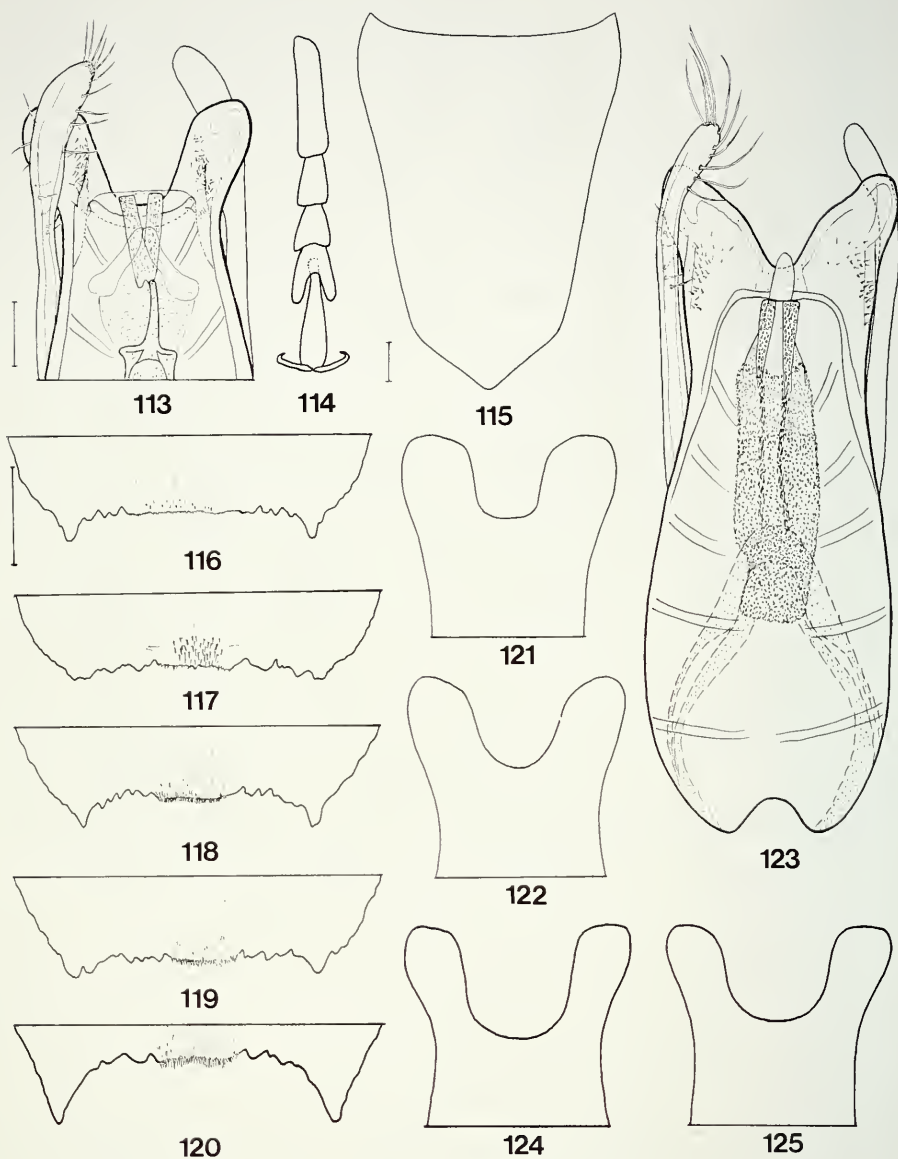
Figs 88-101

Outline of the ♀ sternite 8 (88, 93, 94, 97, 98), outline of the posterior portion of the ♂ sternite 9 (89-91, 95, 96, 99-101), outline of the valvifer (92): *Dianous atrocoeruleus* sp.n. (PT, 88, 101), *D. atroviolaceus* sp.n. (PT, 89), *D. luteoguttatus* Champion (Nepal: Induwa Khola Valley, 90), *D. aereus* Champion (Ruili, 91), *D. rugipennis* sp.n. (HT, 92, 93), *D. rugosipennis* sp. n. (PT, 94, 95), *D. karen* Rougemont (Thailand: Doi Suthep, 96), *D. rougemontianus* sp. n. (PTT, 97, 99), *D. ruginosus* Zheng (Emei Shan 98, 100). Scale = 0.1 mm (88 = 93, 94, 97, 98; 89 = 90, 91, 95, 96, 99-101).



FIGS 102-112

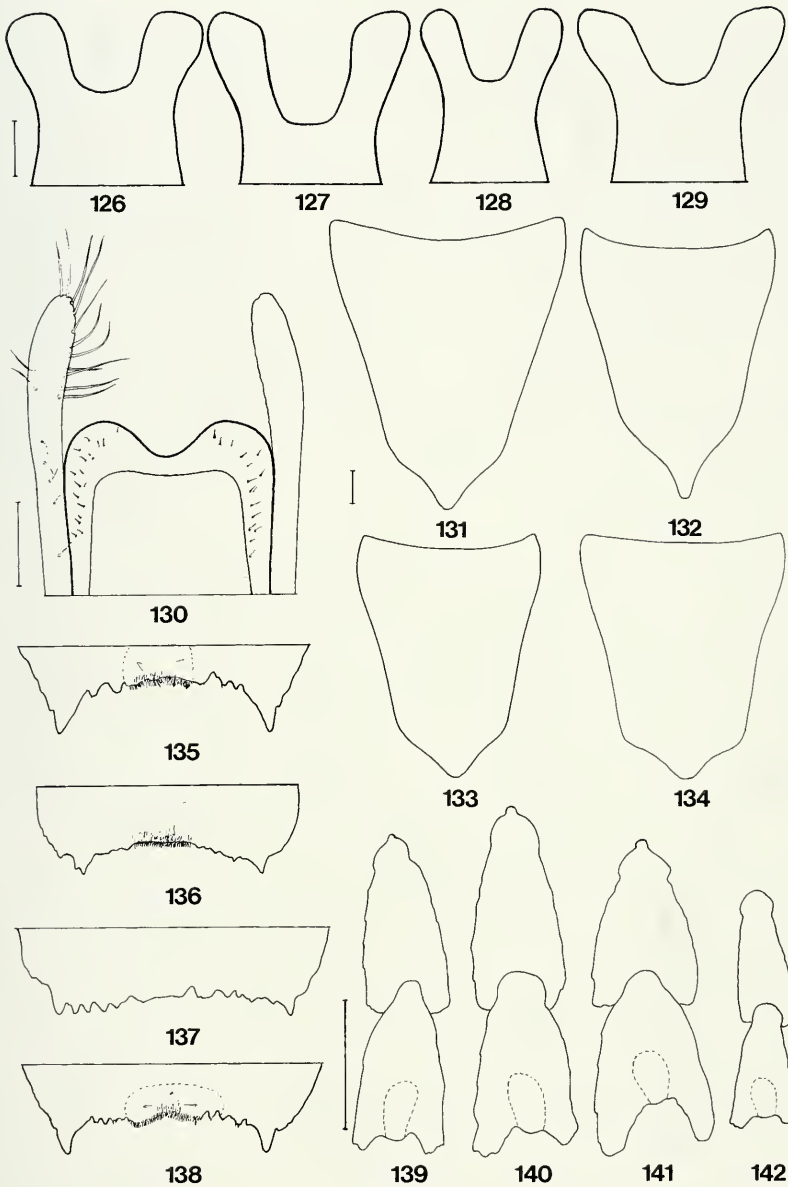
Elytra of various *Dianous* species (including the variability of *D. taiwanensis*): *D. chinensis* Bernhauer (PT, 102), *D. yangae* sp. n. (PT, 103), *D. banghaasi* Bernhauer (Emei Shan, 104), *D. emeiensis* Zheng (Huaxi, 105), *D. bimaculatus* Cameron (Nepal: env. Shivalaya, 106), *D. taiwanensis* Puthz (T 60: 107; T 87: 108, 112; T 48: 109; T 54: 110; T 152: 111).



FIGS 113-125

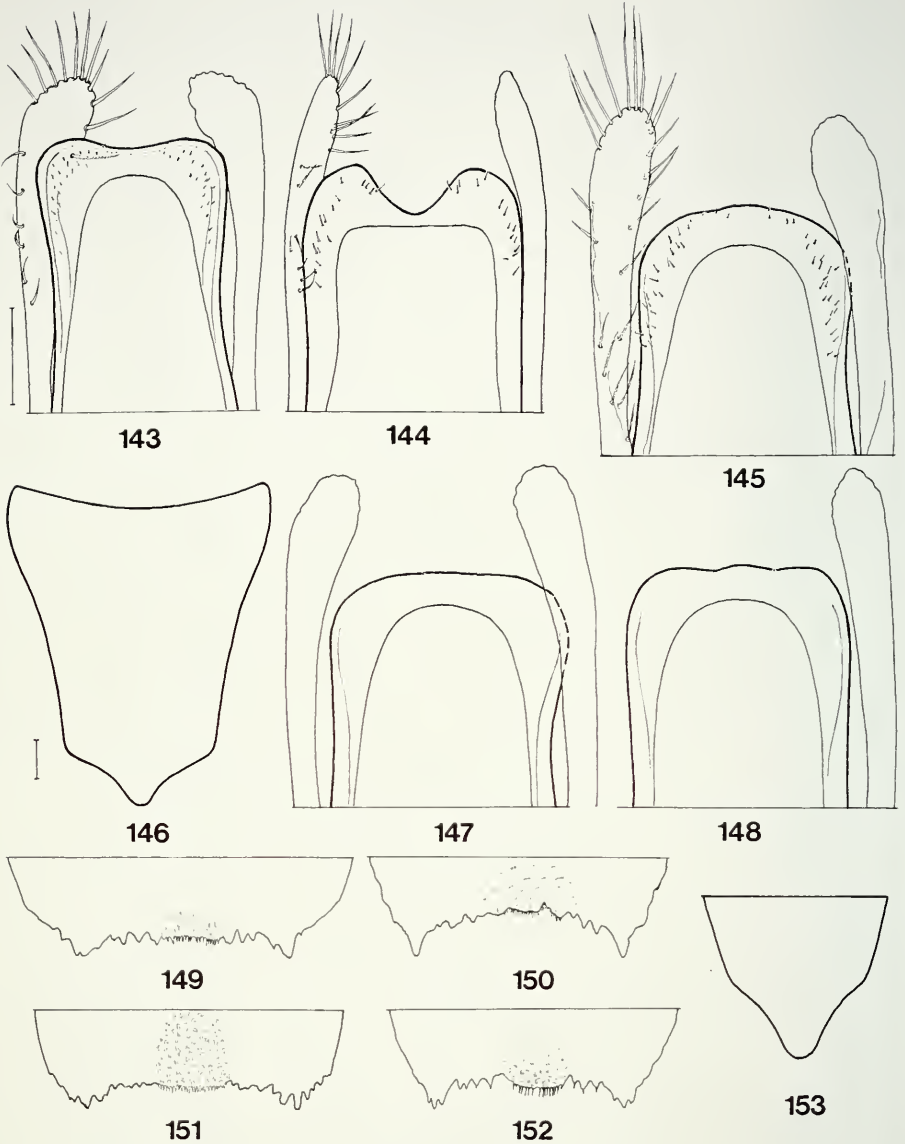
Ventral aspect of the aedeagus (apical portion: 113, complete: 123, outline of the apical portion of the median lobe: 121, 122, 124), mesotarsi (114), outline of the ♀ sternite 8 (115), outline of the posterior portion of the ♂ sternite 9 (116-120). *Dianous atrocyaneus* sp. n. (HT: 113, 116), *D. gemmosus* sp. n. (PT: 114, 115; HT: 117, 123), *D. chinensis* Bernhauer (PT: 118, 121; Wulingyuan: 119, 122), *D. yangae* sp. n. (PTT: 120, 124, 125). Scale = 0.1 mm (113 = 121-125; 116 = 117-120).





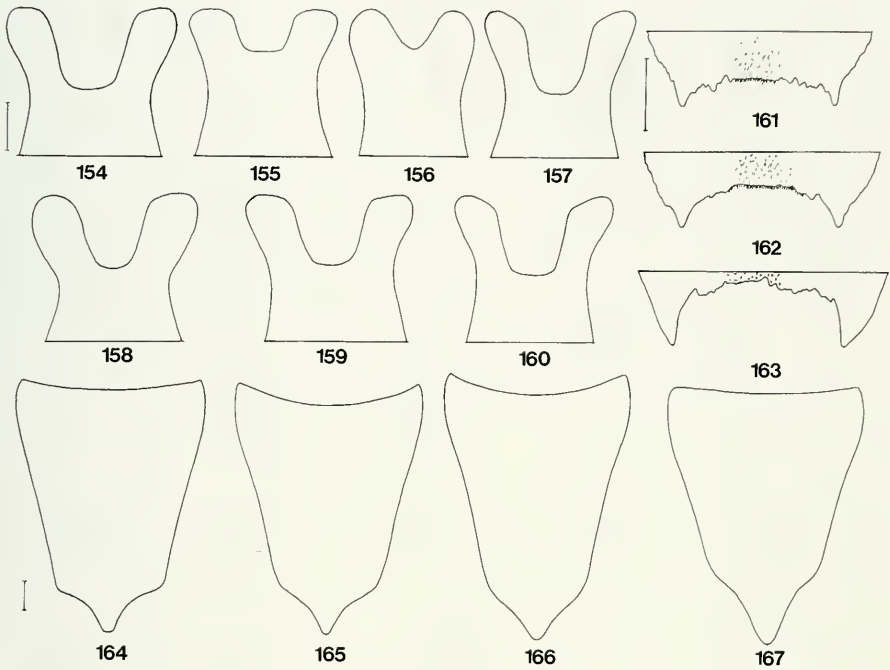
FIGS 126-142

Outline of the anterior portion of the median lobe or aedeagus (126-130), outline of the ♀ sternite 8 (131-134), outline of the posterior portion of the ♂ sternite 9 (135-138), segments 4 and 5 of the metatarsi (139-142): *Dianous senex* sp. n. (PT, 126, 135), *D. banghaasi* Bernhauer (PT, 127: „Kanton“, 135), *D. aequalis* Zheng („Kanton“, 128, 132, 136), *D. cyaneocupreus* sp.n. (HT, 129, 138, 142), *D. dubiosus* sp. n. (HT, 130, 137, 141) *D. bashanensis* Zheng (Zangjijajie, 133), *D. hummeli* Bernhauer (HT of *D. szechuanus*, 134, HT of *D. hummeli*, 139), *D. emeiensis* Zheng (Huaxi, 140). Scale = 0.1 mm (126 = 127-129; 130 = 135-138; 131 = 132-134; 139 = 140-142).



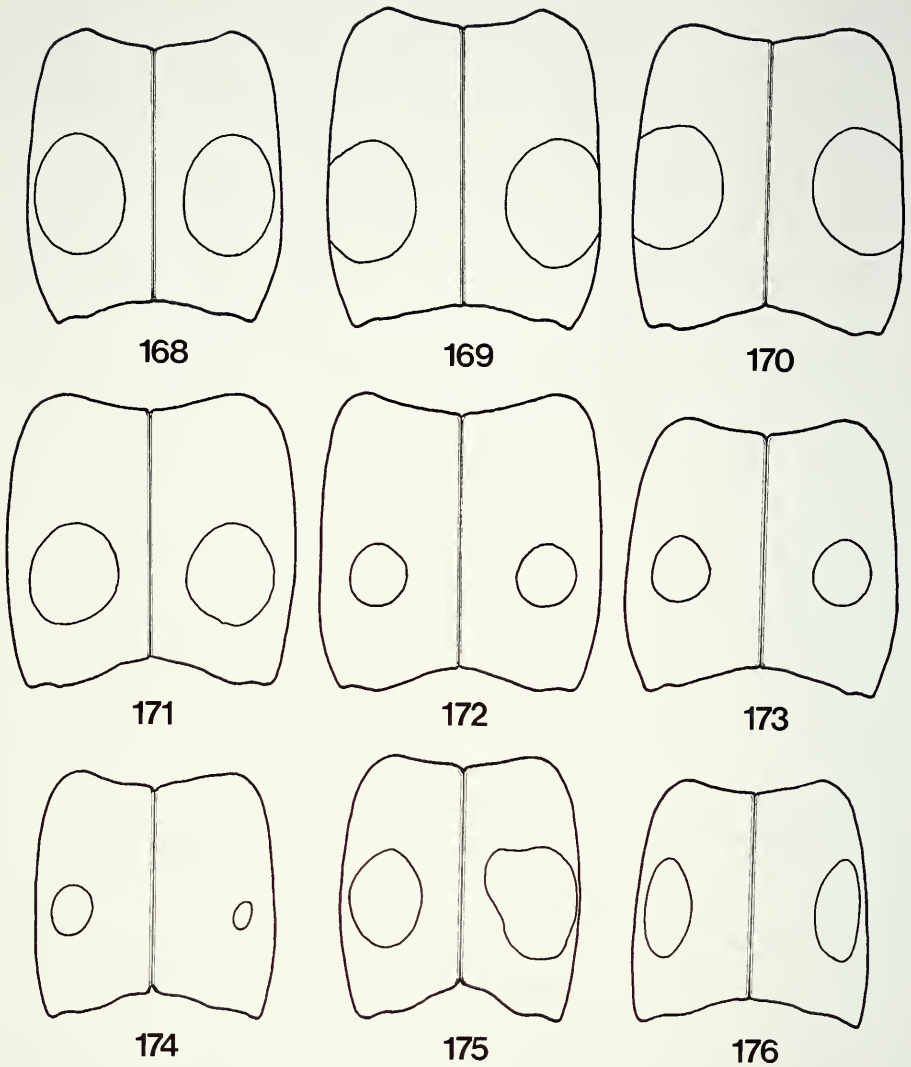
FIGS 143-153

Apical portion of the aedeagus without internal structures (143-145, 147, 148), Outline of the ♀ sternite 8 (146; posterior portion: 153), outline of the posterior portion of the ♂ sternite 9 (149-152: *Dianous hummeli* Bernhauer (HT, 143, 152), *D. bashanensis* Zheng (Wulingyuan, 144, 150), *D. emeiensis* Zheng (Huaxi, 145-149), *D. andrewesi* Cameron (Naga Hills, 151), *D. yangae* sp. n. (PT, 153). Scale = 0.1 mm (143 = 144, 145, 147-152; 146 = 153).



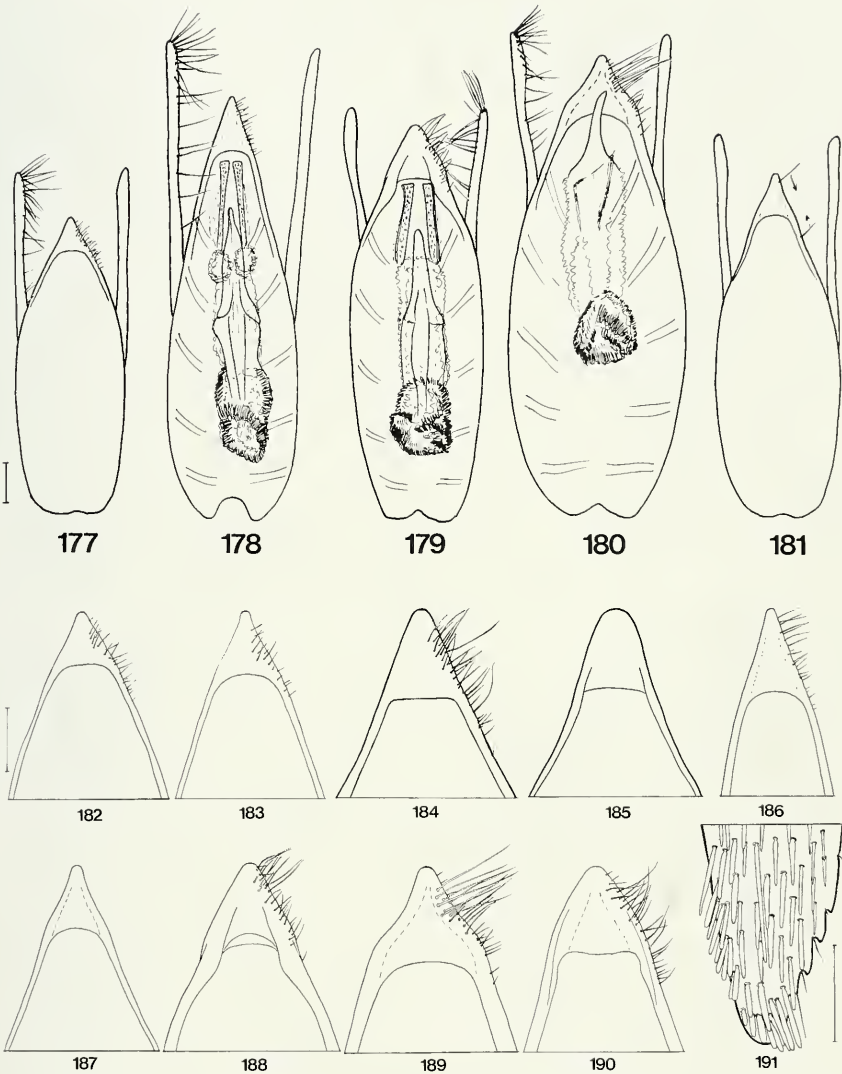
FIGS 154-167

Outline of the anterior portion of the median lobe (154-160), outline of the posterior portion of the ♂ sternite 9 (161-163), outline of the ♀ sternite 8 (164-167): *Dianous atrovioleaceus* sp.n. (PTT, 154, 164), *D. bioculatus* sp.n. (PT, 155, 162, 165), *D. socius* Zheng (Eimei Shan, 156, 163, 167), *D. taiwanensis* Puthz (T 60: 157; HT: 158; T 24: 159; Alishan: 160; T 50: 161, 166). Scale = 0.1 mm (154 = 155-160; 161 = 162, 163; 164 = 165-167).



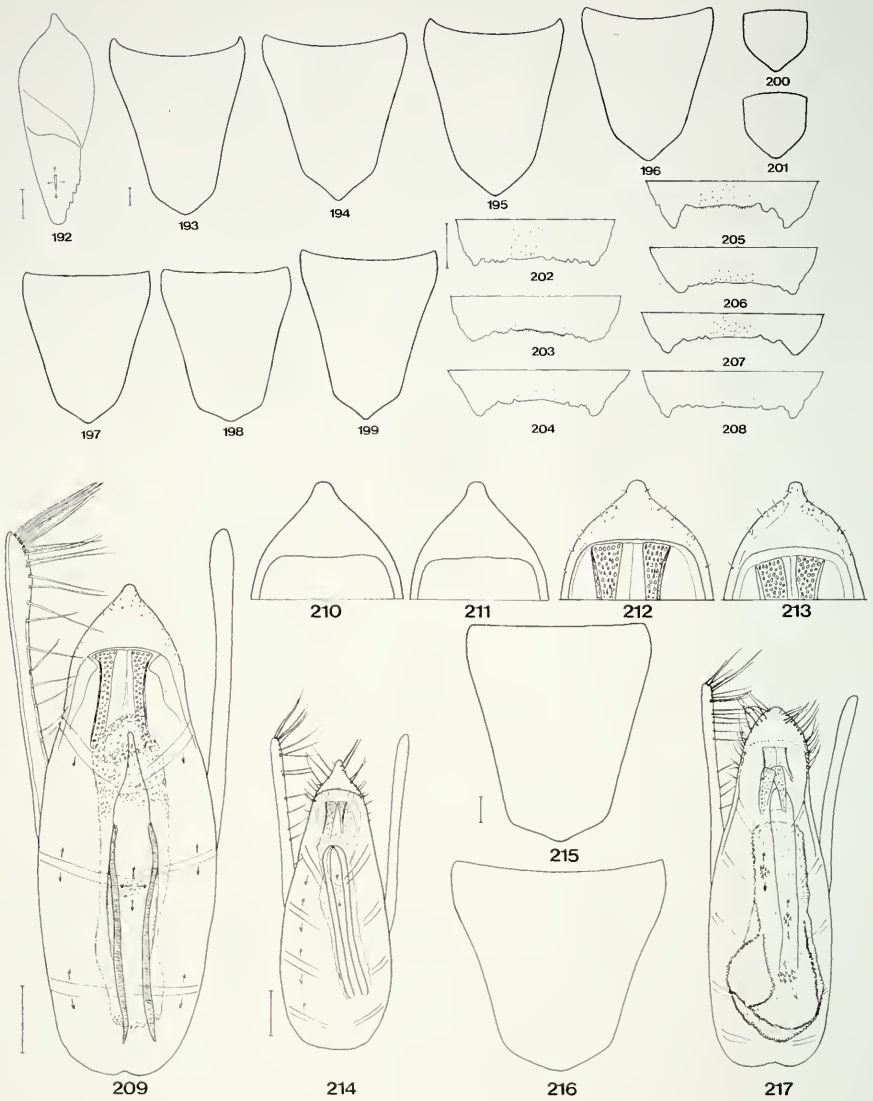
FIGS 168-176

Elytra of *Dianous hainanensis* Puthz (HT, 168), *D. flavoculatus* Puthz (PT, 169), *D. strabo* Puthz (PT, 170), *S. grandistigma* sp. n. (PT, 171), *D. distigma* Champion (PT, 172), *D. sucinigtatus* sp.n. (HT, 173), *D. suciniotatus* sp.n. (left and right elytron taken from 2 PTT, T 107, 174), *D. sucinigutta* sp.n. (left and right elytron taken from 2 PTT, T 24, 175), *D. electricigutta* sp.n. (PT, 176).



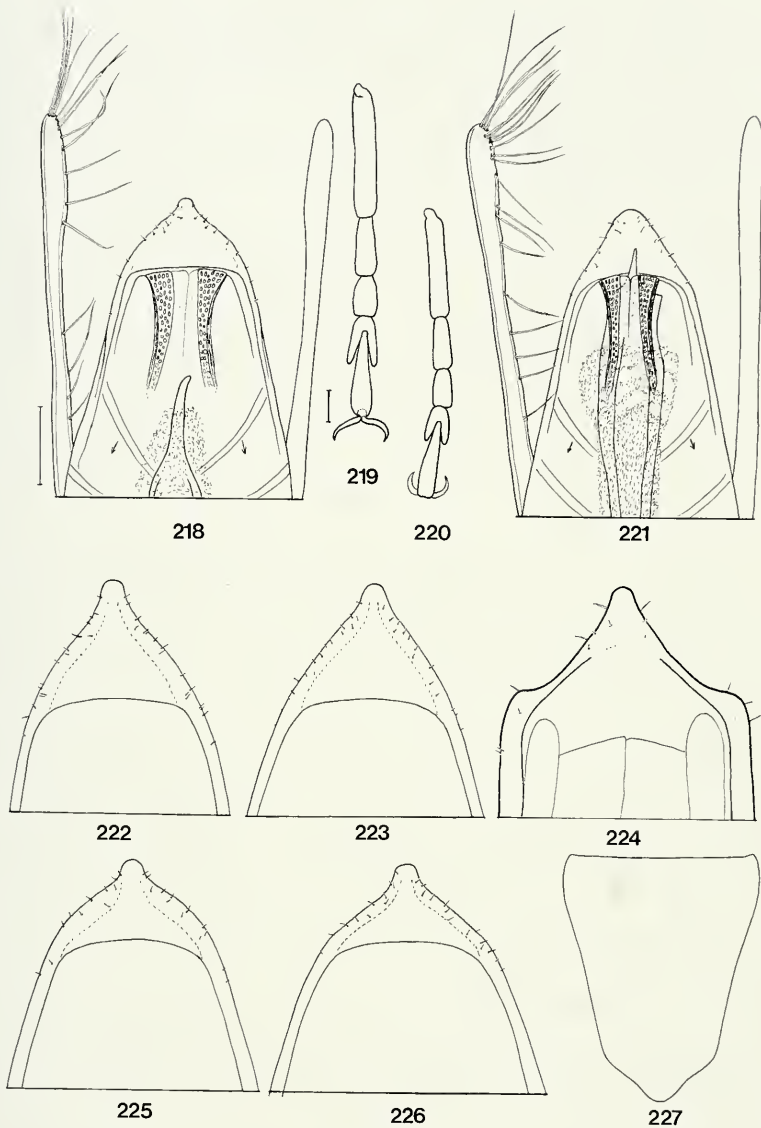
FIGS 177-191

Figs 177-181: Ventral aspect of the aedeagus, internal sac and setae partly omitted: *Dianous ocellatus* Cameron (PT, 177), *D. grandistigma* sp. n. (HT, 178), *D. euargiuatus* Zheng (Heishui, 179), *D. ocellifer* sp. n. (HT, 180), *D. distigma* Champion (HT, 181). Scale = 0.1 mm. – Figs 182-191: Outline of the apical portion of the median lobe (ventral aspect; 182-190), posterior portion of the valvifer (191): *Dianous ocellatus* Cameron (PT: 182; Ruli: 183), *D. variegatus* sp. n. (HT, 184), *D. verticosus* Eppelsheim (setae omitted, Burma: Irawaddi, 185), *D. grandistigma* sp. n. (HT, 186; PT, 191), *D. distigma* Champion (setae omitted, HT, 187), *D. euargiuatus* Zheng (Heishui, 188), *D. ocellifer* sp. n. (HT, 189), *D. oculatipennis* Puthz (Xishuangbanna, 190). Scale = 0.1 mm (182 = 183-190).



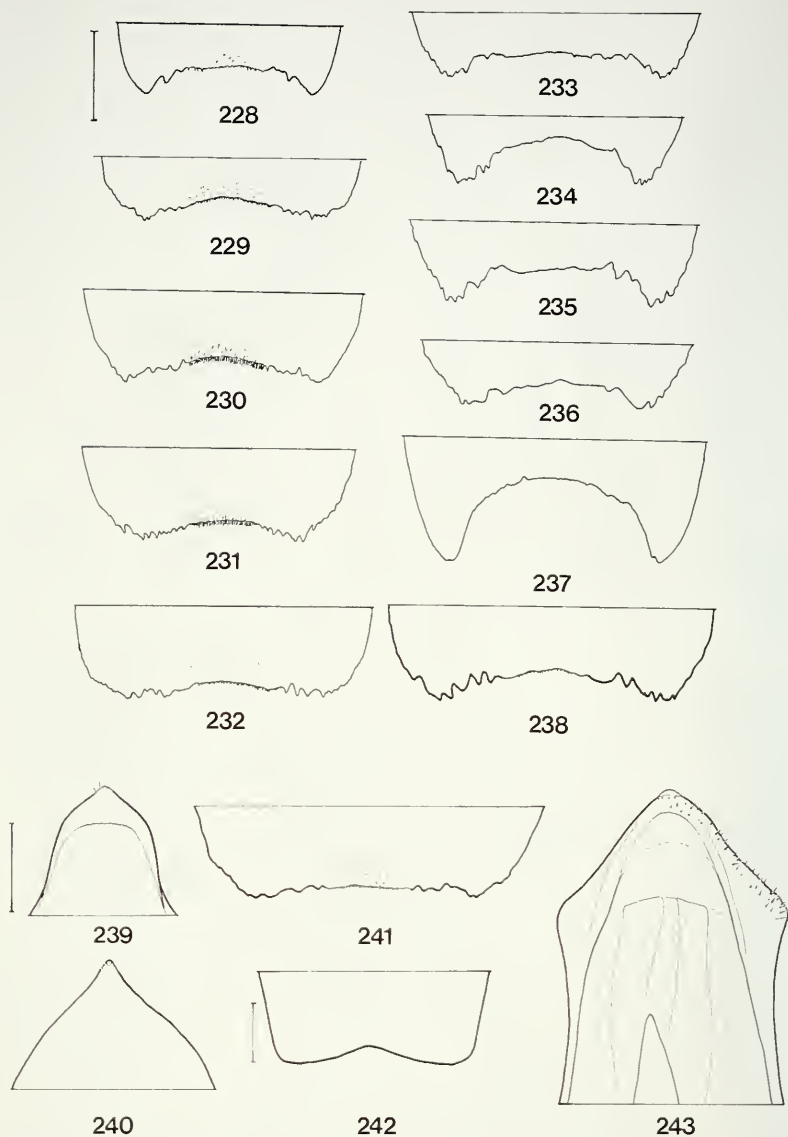
Figs 192-217

Figs 192-208: Valvifer (192), outline of the ♀ sternite 8 (193-199), outline of the ♀ tergite 10 (200-201), outline of the posterior portion of the ♂ sternite 9 (202-208); *Dianous grandistigma* sp. n. (PT, 192, 194; HT, 205). *D. variegatus* sp.n. (PT, 193, 201; HT, 204), *D. verticosus* Eppelsheim (HT, 195, 200), *D. ocellatus* Cameron (Xishuangbanna, 196, 202; Ruli, 203), *D. emarginatus* Zheng (Heishui, 197, 206). *D. ocellifer* sp. n. (PT, 198, 207), *D. oculatipennis* sp.n. (Xishuangbanna, 199, 208). Scale = 0.1 mm (193 = 194-201; 202 = 203-208). – Figs 209-217: Ventral aspect of the aedeagus and the anterior portion of the median lobe, respectively (209-214, 217), outline of the ♀ sternite 8 (215, 216); *Dianous ater* sp. n. (PT, 209, 215), *D. sucinigtuta* sp. n. (PTT, T 24, T 24, 210, 211), *D. sucininotatus* sp. n. (PT, 212), *D. electrigutta* sp. n. (PT, 213), *D. cupreogutta* sp. n. (PT, 214), *D. mendax* sp. n. (PT, 216; HT, 217). Scale = 0.1 mm (209 = 210-213; 214 = 217; 215 = 216).



FIGS 218-227

Figs 218-221: Anterior portion of the aedeagus (218, 221), metatarsus (219, 220): *Dianous sucinigutta* sp. n. (PT, T 29, 218), *D. sucininotatus* sp. n. (PT, 219), *D. ater* sp. n. (PT, 220), *D. suciniguttatus* sp. n. (HT, 221). Scale = 0.1 mm (218 = 221; 219 = 220). – Figs 222-227: Outline of the anterior portion of the median lobe (222-226), outline of the ♀ sternite 8 (227): *Dianous freyi* L. Benick (Emei Shan: 222; Wulingyuan: 223; Kuling: 225); *D. lobatipes* sp.n. (HT, 224), *D. klapperichi* L. Benick (Emei Shan: 226); *D. cupreostigma* sp. n. (PT, 227). Scale = 0.1 mm (222 = 223- 226).



Figs 228-243

Figs 228-238: Outline of the posterior portion of the  $\delta$  sternite 9 (233-238 without asa1): *Dianous cupreogutta* sp. n. (PT, 228), *D. ater* sp. n. (PT, 229), *D. freyi* L. Benick (Emei Shan, 230), *D. klapperichi* L. Benick (Emei Shan, 231), *D. mendax* sp. n. (HT, 232), *D. sucinigutta* sp. n. (PT, T 24: 233; T 13: 234), *D. succinnotatus* sp. n. (PT, 235), *D. electrigutta* sp. n. (PT, 236), *D. succinigtatus* sp. n. (HT, 237), *D. lobatipes* sp. n. (HT, 238). Scale = 0,1 mm. – Figs 239-243: Outline of the anterior portion of the median lobe (239, 240, 243), outline of the posterior portion of the  $\delta$  sternite 9 (241), outline of the posterior portion of the  $\delta$  tergite 8 (242): *Dianous meo* Rougemont (Thailand, Mokfa waterfalls, 239), *D. haraldi* sp. n. (HT, 240), *D. alcyoneus* sp. n. (PT und AT, 241-243). Scale = 0.1 mm (239 = 240-241, 243).



## BIBLIOGRAPHY

- BENICK, L. 1940. Ostpaläarktische Steninen (Col. Staph.). *Mitteilungen der Münchner Entomologischen Gesellschaft* 30: 559-575.
- BENICK, L. 1942a. Weitere ostchinesische Steninen (Col. Staph.). *Stettiner entomologische Zeitung* 102: 274-285.
- BENICK, L. 1942b. Entomological Results from the Swedish Expedition 1934 to Burma and British India. Coleoptera: Staphylinidae. gesammelt von Rene Malaise. *Arkiv för Zoologi* 33 A 17: 1-48.
- BERNHAEUER, M. 1916. Kurzflügler aus dem deutschen Schutzgebiete Kiautschau und China. *Archiv für Naturgeschichte* A 81(1915): 27-34.
- BERNHAEUER, M. 1936. Schwedisch chinesische wissenschaftliche Expedition nach den nordwestlichen Provinzen Chinas, unter Leitung von Dr. Sven Hedin und Prof. Sü Ping-Chang. Insekten gesammelt vom schwedischen Arzt der Expedition Dr. David Hummel 1927-1930.39. Coleoptera. 7.B. Staphylinidae. *Arkiv för Zoologi* 27 A 19: 2-5.
- BOUSQUET, Y. & SMETANA, A. 1996. A review of the tribe Opisthiini (Coleoptera: Carabidae). *Nouvelle Revue d'Entomologie* (N.S.) 12 (1995): 216-232.
- CAMERON, M. 1914. Descriptions of new species of Staphylinidae from India. *Transactions of the Entomological Society of London* 1913: 525-544.
- CAMERON, M. 1927. New Species of Indian *Dianous*. *The Entomologist's monthly Magazine* 63: 6-10.
- CAMERON, M. 1930. The fauna of British India, including Ceylon and Burma. Coleoptera, Staphylinidae I. *London*, XVII + 471 pp., 1 map, 3 pls.
- CHAMPION, G.C. 1919. The Genus *Dianous* Samouelle (sic), as represented in India and China (Coleoptera). *The Entomologist's monthly Magazine* 55: 41-55.
- EISENBEIS, G. & WICHARD, W. 1985. Atlas zur Biologie der Bodenarthropoden. *Stuttgart, New York*.
- ESAKI, T. 1926. Über die Zoogeographie des Japanischen Archipels. *Allattani Közlemenyek* 23: 116-122.
- FILCHNER, W. 1925. Tschung-kue Das Reich der Mitte. Alt-China vor dem Zusammenbruch. *Berlin*.
- FRANZ, H. 1970. Die gegenwärtige Insektenverbreitung und ihre Entstehung. *Handbuch der Zoologie* 4-2 1/6: 1-111.
- ILLIES, J. 1974. Introduction to Zoogeography. *London*, VII + 120 pp.
- JÄCH, M. A. & JI, L. 1995. Introduction. *In: Water Beetles of China*. *Wien*, I: 5-32.
- JÄCH, M. A. & JI, L. 1998. China Water Beetle Survey (1995 – 1998). *In: Water Beetles of China* II: 1-23.
- JARRIGE, J. 1950. Brachélytres nouveaux ou mal connus d'Indochine française (Col.). *Bulletin de la Société entomologique de France* 55: 132-135.
- KAPOOR, N. N. 1997. A scanning electron microscopic study of the cuticular lining of the gut of a stonefly nymph, *Paragnetina media* (Walker) (Plecoptera: Perlidae) (pp. 338-342). *In: LANDOLT, P. & SARTORI, M. (eds.). Ephemeroptera & Plecoptera: Biology-Ecology-Systematics*. *Fribourg*.
- LUNDGREN, R. W. 1984. A New Name for *Dianous borneensis* Puthz, 1976 (Coleoptera: Staphylinidae). *Coleopterist's Bulletin* 38: 180.
- NAOMI, S. I. 1988. Studies on the subfamily Steninae from Japan I. New or little known species of the genus *Dianous* Leach (Coleoptera: Oxyporidae). *Transactions of the Shikoku Entomological Society* 19: 47-54.
- NAOMI, S. I. 1991. Studies on the subfamily Steninae (Coleoptera: Staphylinidae) from Japan. XIX The Steninae deposited in the Entomological Institute, Hokkaido University. *Transactions of the Shikoku Entomological Society* 19: 163-166.

- NAOMI, S. I. 1997. Two New *Dianous* Leach (Coleoptera, Staphylinidae) from Japan, with Taxonomic Notes on Some Japanese *Stenus* Latreille. *New Entomologist* 46: 1-7.
- PUTHZ, V. 1970. On a collection of Steninae from China (Coleoptera: Staphylinidae). *Proceedings of the Royal entomological Society* (B) 39: 29-32.
- PUTHZ, V. 1971a. Die bisher aus China und Formosa bekannten *Dianous* Arten (Coleoptera, Staphylinidae). 110. Beitrag zur Kenntnis der Steninen. *Entomological Review of Japan* 23: 88-92.
- PUTHZ, V. 1971b. Revision der afrikanischen Steninenfauna und Allgemeines über die Gattung *Stenus* Latreille (Coleoptera, Staphylinidae). (56. Beitrag zur Kenntnis der Steninen). *Annales du Musée Royal de l'Afrique centrale*. Ser. 8°. No.187: VI + 376 pp.
- PUTHZ, V. 1980a. Beiträge zur Kenntnis der Steninen CLXXVI. Neue *Dianous* Arten (Staphylinidae, Coleoptera). *Philippia* 4: 234-240.
- PUTHZ, V. 1980b. Die gelblich gemakelten *Dianous*-Arten der Welt: Bestimmungstabelle und Neubeschreibungen (Coleoptera, Staphylinidae). 175. Beitrag zur Kenntnis der Steninen. *Reichenbachia* 18: 23-41.
- PUTHZ, V. 1981a. Was ist *Dianous* Leach, 1819. was ist *Stenus* Latreille, 1796 ? Oder: Die Aporie des Stenologen und ihre taxonomischen Konsequenzen (Coleoptera, Staphylinidae). 180. Beitrag zur Kenntnis der Steninen. *Entomologische Abhandlungen des Staatlichen Museums für Tierkunde, Dresden* 44 (1980): 87-132.
- PUTHZ, V. 1981b. Steninen aus Jünnan (China) und Vietnam (Coleoptera, Staphylinidae). 182. Beitrag zur Kenntnis der Steninen. *Reichenbachia* 19: 1-21.
- PUTHZ, V. 1983. Alte und neue Steninen aus Hinterindien und China (Coleoptera, Staphylinidae). 194. Beitrag zur Kenntnis der Steninen. *Reichenbachia* 21: 1-13.
- PUTHZ, V. 1984a. Weitere Steninen von Taiwan (Coleoptera, Staphylinidae). *Reichenbachia* 22: 101-112.
- PUTHZ, V. 1984b. Die Steninen der indischen Halbinsel (Coleoptera, Staphylinidae). 202. Beitrag zur Kenntnis der Steninen. *Revue suisse de Zoologie* 91: 563-588.
- PUTHZ, V. 1988. Die Steninen von Borneo II (Coleoptera, Staphylinidae). Neue und alte Arten, vorwiegend aus den Ausbeuten des Genfer Naturhistorischen Museums. 218. Beitrag zur Kenntnis der Steninen. *Revue suisse de Zoologie* 95: 631-679.
- PUTHZ, V. 1990. Fünf neue orientalische *Dianous* Arten (Insecta, Coleoptera, Staphylinidae: Steninae). 220. Beitrag zur Kenntnis der Steninen. *Reichenbachia* 27: 115-125.
- PUTHZ, V. 1994. Steninen von den Inseln Ceram und Ambon (Indonesien). 233. Beitrag zur Kenntnis der Steninen (Coleoptera: Staphylinidae). *Koleopterologische Rundschau* 64: 51-58.
- PUTHZ, V. 1995. Beiträge zur Kenntnis der Steninen CCXLII. Neue *Dianous* Arten (Staphylinidae, Coleoptera). *Philippia* 7: 185-194.
- PUTHZ, V. 1997. Beiträge zur Kenntnis der Steninen CCLII. Neue Arten der Gattung *Dianous* Leach. *Philippia* 8: 93-116.
- PUTHZ, V. 1998. Die von Theodor Krása beschriebenen *Stenus* Arten (Coleoptera, Staphylinidae) nebst taxonomischen Bemerkungen zu anderen Arten. 257. Beitrag zur Kenntnis der Steninen. *Entomologische Blätter für Systematik und Biologie der Käfer* 94: 147-151.
- ROUGEMONT, G. M. DE 1980. Stenine beetles from Nepal (Col. Staphylinidae). *Entomologica Basiliensis* 5: 170-186.
- ROUGEMONT, G. M. DE 1981a. New and little known Steninae from Burma (Coleoptera Staphylinidae). *Annali del Museo civico di Storia naturale „Giacomo Doria“* 83: 325-348.
- ROUGEMONT, G. M. DE 1981b. The Stenine beetles of Thailand (Coleoptera Staphylinidae). *Annali del Museo civico di Storia naturale „Giacomo Doria“* 83: 349-386.
- ROUGEMONT, G. M. DE 1983a. *Dianous martensi* n. sp. from Nepal (Insecta: Coleoptera: Staphylinidae). *Senckenbergiana biologica* 83 (1982): 363-366.

- ROUGEMONT, G. M. DE 1983b. More Stenine beetles from Thailand (Coleoptera, Staphylinidae). *Natural History Bulletin of the Siam Society* 31: 9-54.
- ROUGEMONT, G. M. DE 1984. Steninae Collected by the Author in Indonesia 1975-1982 (Coleoptera, Staphylinidae). 10<sup>th</sup> Contribution to the Knowledge of Steninae. *Reichenbachia* 22: 27-242.
- ROUGEMONT, G. M. DE 1985. In the footsteps of H. G. Champion: New *Dianous* species from the Himalaya (Coleoptera, Staphylinidae). *Entomologica Basiliensia* 10: 123-144.
- ROUGEMONT, G. M. DE 1986. Nouvelles données sur les Steninae d'Orient (Coleoptera, Staphylinidae). *Nouvelle Revue d'Entomologie* (N.S.) 3: 263-269.
- ROUGEMONT, G. M. DE 1987. New *Dianous* species from Khandbari District, Nepal (Coleoptera, Staphylinidae). 20<sup>th</sup> contribution to the knowledge of Staphylinidae. *Revue suisse de Zoologie* 94: 49-53.
- SAWADA, K. 1960. The New Species of the Genus *Dianous* Leach. 1819 from Japan (Coleoptera: Staphylinidae). *Entomological Review of Japan* 11: 9-11, 1 pl.
- SHIBATA, Y. 1973. Preliminary check list of the family Staphylinidae of Taiwan (Insecta: Coleoptera). *Annual Bulletin of the Nichidai Sanko* 16: 21-88.
- SHIBATA, Y. 1976. Provisional check list of the family Staphylinidae of Japan. I (Insecta: Coleoptera). *Annual Bulletin of the Nichidai Sanko* 19: 71-212.
- SHIBATA, Y. 1979. (On *Dianous arachnipes* Puthz; in Japanese). *Coleopterist's News* 46: 7-8.
- SHIBATA, Y. 1986. A list of genera and species new to Taiwan and new data on distribution of the Staphylinidae discovered from Taiwan since 1973 (Insecta: Staphylinidae). *Annual Bulletin of the Nichidai Sanko* 24: 109-128.
- SJÖSTEDT, Y. & HUMMEL, D. 1933. Schwedisch chinesische wissenschaftliche Expedition nach den nordwestlichen Provinzen Chinas, unter der Leitung von Dr. Sven Hedin und Prof. Sü Ping-chang. Insekten gesammelt vom schwedischen Arzt der Expedition Dr. David Hummel 1927-1930. Einleitung. *Arkiv för Zoologi* 5 A, 3: 34 pp., 2 maps, 9 pl.
- SMETANA, A. 1995. Revision of The Tribes Quediini and Tanygnathini. Part III. Taiwan. (Coleoptera: Staphylinidae). *Special Publications of the Museum of Natural Science, Taichung*, 6: 1-145.
- TAKHTAJAN, A. 1986. Floristic Regions of the World. *Berkeley, Los Angeles, London*.
- VAILLANT, F. 1955. Recherches sur la faune madicole de France, de Corse et d'Afrique du Nord. *Mémoires du Muséum National d'Histoire naturelle Paris, Zool.* 11, in-8°, 1-258, 6 pl.
- WATANABE, Y. 1984. The Brachypterous Staphylinid Beetles from the Tōhoku District, Northeast Japan, with Descriptions of Four New Species. *Memoirs of the National Science Museum, Tokyo* 17: 131-144.
- WICHARD, W. *et al.* 1995. Atlas zur Biologie der Wasserinsekten. *Stuttgart, Jena, New York*.
- ZHENG, F. K. 1993. A preliminary study on *Dianous* Leach from Sichuan and Yunnan Provinces, China (Coleoptera: Staphylinidae, Steninae). *Acta entomologica sinica* 36: 198-206.
- ZHENG, F. K. 1994. Notes on genus *Dianous* Leach from Dai Ba Mountains, Sichuan (Coleoptera: Staphylinidae, Steninae). *Acta entomologica sinica* 37: 479-482.

## INDEX

New names in bold letters, synonyms in italics

- |   |   |
|---|---|
| acuminifer Puthz 423, <b>446</b>        | alternans Zheng 423, <b>434</b>         |
| acutus Zheng 425, 478                   | amamiensis Sawada 425, 429              |
| <b>adonis</b> sp.n. 423, <b>443</b>     | amicus Puthz 420                        |
| aeneus Cameron 424                      | anatolicus Korge 426                    |
| aequalis Zheng 425, <b>466</b>          | andrewesi Cameron 424, 505              |
| aereus Champion 424, 427, 453, 519      | <b>angulifer</b> sp. n. 423, <b>447</b> |
| <b>alcyonius</b> sp. n. 425, <b>485</b> | annandalei Bernhauer 423                |

- arachnipes Puthz 423, 429, 433  
 araeocerus (L. Benick) 420  
 assamensis Cameron 423  
**ater** sp. n. 425, **490**  
**atroeruleus** sp. n. 425, **484**  
**atrocyaneus** sp. n. 425, 429, **458**  
**atrovioleaceus** sp. n. 425, **472**  
 aurichalceus (Champion) 420  
 azureus Champion 424  
 baliensis Rougemont 420  
 banghaasi Bernhauer 425, 429, **465**  
 bashanensis Zheng 425, **471**  
 benicki Puthz 420  
 bhotius Rougemont 420  
 bhutanensis Rougemont 420  
 bifoveifrons Champion 423  
*bilunatus* Puthz 474  
 bimaculatus Cameron 424, 427  
**bioculatus** sp. n. 425, **475**  
 boops Puthz 420  
 bracteatus (Champion) 420  
**brevicornis** sp. n. 424, **453**  
 brevitarsis Puthz 423  
 burckhardti Puthz 420  
*caeruleoguttatus* Cameron 439  
 caeruleonotatus Champion 423  
 calceatus Puthz 423  
 camelus Puthz 423  
 cameroni Champion 425  
 cameronianus Jarrige 423  
 carinipennis (Bernhauer) 420  
**cebuensis** sp. n. 420, **431**  
 chalybaeus LeConte 425, 428  
 championi Cameron 424  
 chetri Rougemont 423, 433, 436  
 chinensis Bernhauer 425, **461**  
 coeruleomicans Puthz 423  
**coeruleotinctus** sp. n. 423, **437**  
**coeruleovestitus** sp. n. 423, **436**  
 coerulescens Gyllenhal 426, 428  
 coerulescens anaticolicus Korge 426  
 coerulescens elegans Khnzorian 426  
 concretus Puthz 420, 426  
 consors Cameron 423  
 convexifrons Puthz 423  
 corticicola (Puthz) 420, 426  
 cribrarius Champion 424, 427  
 cruentatus L. Benick 424  
 cupreoaeneus (Champion) 420  
**cupreogutta** sp. n. 426, **488**  
 cupreostigma Puthz 426, **499**  
 cupreovioleaceus Puthz 424  
**cyaneocupreus** sp. n. 425, **468**  
 cyaneovirens (Cameron) 420  
 cyanogaster Champion 423  
 dajak Puthz 420  
 davaomontium (Puthz) 420  
 distigma Champion 425  
**dubiosus** sp. n. 425, **467**  
**electrigutta** sp. n. 426, 429, **496**  
 elegans Khnzorian 426  
 elegantulus Zheng 423, **441**  
 emarginatus Zheng 425, **482**  
 emeiensis Zheng 425, **470**  
**fauxveli** sp. n. 423, **446**  
 femoralis Cameron 424  
 flavicoxatus (L. Benick) 420  
 flavoculatus Puthz 424  
 flavoguttatus Puthz 423  
 fluctivagus Puthz 420  
 frater Cameron 424  
 freyi L. Benick 426, 429, 498  
**gemmosus** sp. n. 425, 459  
 gongen Watanabe 426  
**gonggamontis** sp. n. 425, **473**  
 gracilipes Champion 423  
 gracilis Puthz 424  
**grandistigma** sp. n. 425, **480**  
 gregarius Rougemont 423  
 hainanensis Puthz 424  
 hammondi Rougemont 425, 427  
**haraldi** sp. n. 421, **432**  
 hirsutus Rougemont 421, 427  
 hummeli Bernhauer 425, **469**  
 hygrobius (L. Benick) 421  
 inaequalis Champion 423, 429, **439**  
**inaequalis laevior** ssp. n. 423, 429, **439**  
 inconspicuus Rougemont 421  
 iridicolor (Scheerpeltz) 421  
 iwakisanus Watanabe 426  
 jaechi Puthz 421, 429  
 japonicus Sawada 426, 507  
 javanicola Puthz 421  
 kabakovi Puthz 423, 427  
 karen Rougemont 424, **452**  
 kinabalumontis Puthz 421  
 klapperichi L. Benick 426, **499**  
 lahu Rougemont 421  
 lasti Puthz 421  
 latitarsis L. Benick 423, 433  
 lividus (L. Benick) 421  
**lobatipes** sp. n. 426, **487**  
 lobigerus Champion 424, 427  
 loebli Rougemont 421  
 loeblianus Puthz 421  
 luteoguttatus Champion 424, 429, **449**  
 luteolunatus Puthz 425, 484  
 luteostigmaticus Rougemont 425  
 malayanus Cameron 423, 438  
 margaretae Rougemont 423

- martensi* Rougemont 421  
*mendax* sp. n. 426, **500**  
*meo* Rougemont 421, 433  
*minor* Champion 424, 427  
*miripes* Rougemont 433  
*morimotoi* Naomi 426  
*moritai* Naomi 423, 429  
*nagamontium* Puthz 421  
*naicus* Puthz 420, 426  
*nepalensis* Rougemont 421  
*niger* Rougemont 421  
*nigrocyanus* Puthz 423  
*nigrovirens* (Fauvel) 421  
*nilgiriensis* Puthz 421  
*nitidulus* LeConte 426, 428  
*nokrekensis* Puthz 421  
*obliquenotatus* Champion 423, 427  
*obscuroguttatus* Cameron 423  
*ocellatus* Cameron 425, **478**  
*ocellifer* sp. n. 425, **478**  
*oculatipennis* Puthz 425, 486  
*pallitarsis* L. Benick 423  
*philippinus* Puthz 421  
*pilosus* Champion 465  
*ponticus* Fagel 423  
*psilopterus* L. Benick 425  
*puberulus* L. Benick 445  
*punctiventris* Champion 423, 429, **445**  
*puthzi* Lundgren 420, 426  
*pykaranus* (Cameron) 421  
*radiatus* Champion 424  
*reformator* Rougemont 421  
*robustus* Cameron 423, 426  
*rougemonti* Puthz 421  
*rougemontianus* sp. n. 424, **450**  
*ruginosus* Zheng 424, **454**  
*rugipennis* sp. n. 424, **455**  
*rugosipennis* sp. n. 424, **456**  
*saxicola* (Puthz) 421  
*scabricollis* Champion 423, 427  
*schillhammeri* Puthz 421  
*schoenmanni* sp. n. 423, **444**  
*semicoeruleus* (Cameron) 421  
*senex* sp. n. 425, **464**  
*septentrionalis* Naomi 507  
*shan* Rougemont 421  
*shibatai* Sawada 426  
*siamensis* Rougemont 424, 427  
*siberutensis* Puthz 421  
*sichuanensis* Puthz 423  
*siwalikensis* Cameron 423, 427  
*smetanai* Puthz 420, 426  
*socius* Zheng 425, **477**  
*spiniventris* Puthz 424  
*srivichaii* Rougemont 423, 427, 505  
*strabo* Puthz 424, 427  
*striatellus* (L. Benick) 412  
*subtortuosus* Champion 425  
*subvorticatus* Champion 425  
*sucinigutta* sp. n. 426, 429, **492**  
*suciniguttatus* sp. n. 426, 429, **497**  
*sucininotatus* sp. n. 426, **495**  
*sulcatipennis* Puthz 426  
*sulcipennis* Puthz 421  
*szechuanus* Bernhauer 469  
*taiwanensis* Puthz 425, 429, **474**  
*tiomanensis* Puthz 421  
*tonkinensis* (Puthz) 421, 501  
*tortuosus* Champion 425  
*tortus* Cameron 425  
*tumidifrons* Puthz 423  
*uniformis* Zheng 423, **448**  
*uncinipennis* Puthz 421  
*variegatus* sp. n. 425, **481**  
*versicolor* Cameron 423, 433  
*verticosus* Eppelsheim 425, 482  
*vietnamensis* Puthz 424, 452  
*violaceus* Puthz 424  
*viridicatus* Naomi 426  
*viridicupreus* Rougemont 421  
*viridipennis* Cameron 424  
*viriditinctus* Champion 421  
*wittmeri* Rougemont 421  
*yangae* sp. n. 425, **462**  
*yao* Rougemont 421, 431  
*yoshidai* Naomi 425, 429, 459  
*yunnanensis* Puthz 423, 427



## Contribution to the systematics of the genus *Dabulamanzia* (Ephemeroptera: Baetidae) in Madagascar

J.-L. GATTOLLIAT & M. SARTORI

Museum of Zoology, P.O. Box 448, CH-1000 Lausanne 17, Switzerland;  
e-mail: Jean-Luc Gattolliat@ie-zea.unil.ch

**Contribution to the systematics of the genus *Dabulamanzia* (Ephemeroptera: Baetidae) in Madagascar.** - At the present time, the Afro-Malagasy genus *Dabulamanzia* is represented at Madagascar by two species. Three new species *D. gladius*, *D. gigantea* and *D. concolorata* are described at the larval stage. *D. gladius* and *D. gigantea* present a high degree of specialisation of the mandibles and labrum that clearly distinguish them from any other species of *Dabulamanzia*. *D. concolorata* also owns characteristic mouthparts, especially the labrum. A fourth species is described at the imaginal stage, but unnamed as long as its larva remains unknown. The relative position of these new species is discussed.

**Key-words:** Ephemeroptera - Baetidae - *Dabulamanzia* - new species - Madagascar.

### INTRODUCTION

The genus *Dabulamanzia* has been recently erected for some species previously assigned to the *tarsale* group of *Afroptilum* Gillies (Lugo-Ortiz & McCafferty, 1996b). This genus is well defined at the larval stage by the following apomorphies: bulbous segment 3 of the labial palp and a small proximal arc of setae on the tibiae; at the imaginal stage, hindwing with a single hooked spur and a well-developed apophysis at the base of the first segment of the gonopod are the main characters. Some of these characters suggest that *Dabulamanzia* is related to the *Cloeodes* complex, even if the imaginal stage differs greatly by the number of intercalary veins, the presence of hindwing and the shape of the gonopods (Lugo-Ortiz & McCafferty, 1996a).

The first species of *Dabulamanzia* from Madagascar has been recently described (Lugo-Ortiz & McCafferty, 1997c). Its name, *D. improvida* indicates the unexpected discovery of the genus in Madagascar. Since then, another species has been found in this Island (Gattolliat *et al.*, 1999). Herein we describe three new species and we discuss their position within the genus.

The holotypes and some of the paratypes are housed in the Museum of Zoology, Lausanne, Switzerland. Other paratypes are deposited in the Museum National d'Histoire Naturelle, Paris.

*Dabulamanzia gladius* Gattolliat sp. n.

*Holotype*. Larva. P0861. Madagascar, Rianila Bas., unnamed riv., Loc. road to Lakato. Long. 48°21'48" E. Lat. 19°02'40" S. Alt. 1050m. 8.4.1999. J.-L. Gattolliat and N. Raberiaka.

*Paratypes*. Two larvae same data as holotype. Two larvae, P0693, same locality as holotype, 22.4.1997. J.-L. Gattolliat. C. Rochat and N. Raberiaka. Three larvae, P0862. Madagascar, Rianila Bas., tributary riv. to Sahatandra Riv., Loc. near Ambalafotsy, road to Lakato. Long. 48°21'51" E. Lat. 19°02'22" S. Alt. 1050m. 8.4.1999. J.-L. Gattolliat and N. Raberiaka.

*Other material*. One female larva (91b). Madagascar. Manampanihy Bas., tributary riv. of Manampanihy Riv., Loc. Fenoevo, Long. 46°53'39" E. Lat. 24°41'00" S. Alt. 72m. 15.4.1992. J.-M. Elouard. One larva. P0814. Madagascar. Antongombato Bas., Makis Riv., Loc. 100m downstream of the Great Wasterfall, Long. 49°10'14" E, Lat. 12°29'17" S, Alt. 675m, 22.3.1999. J.-L. Gattolliat and Z. Rabeantoandro.

## LARVA

Maximal length (no mature specimens): Body 6.7 mm. Cerci and terminal filament broken.

*Head*. Coloration almost uniformly light yellow, except brown between the eyes without vermiform marking on vertex and frons. Antennae pale light yellow. Eyes and ocelli black.

Labrum (Fig. 1a) rectangular, with distal margin almost straight, with two kinds of setae, one row of feathered setae (Fig. 1b) and one row of multifid setae (Fig. 1c); dorsally with a continuous arc of about 20 long setae, abundant setae in the proximal half; without setae ventrally.

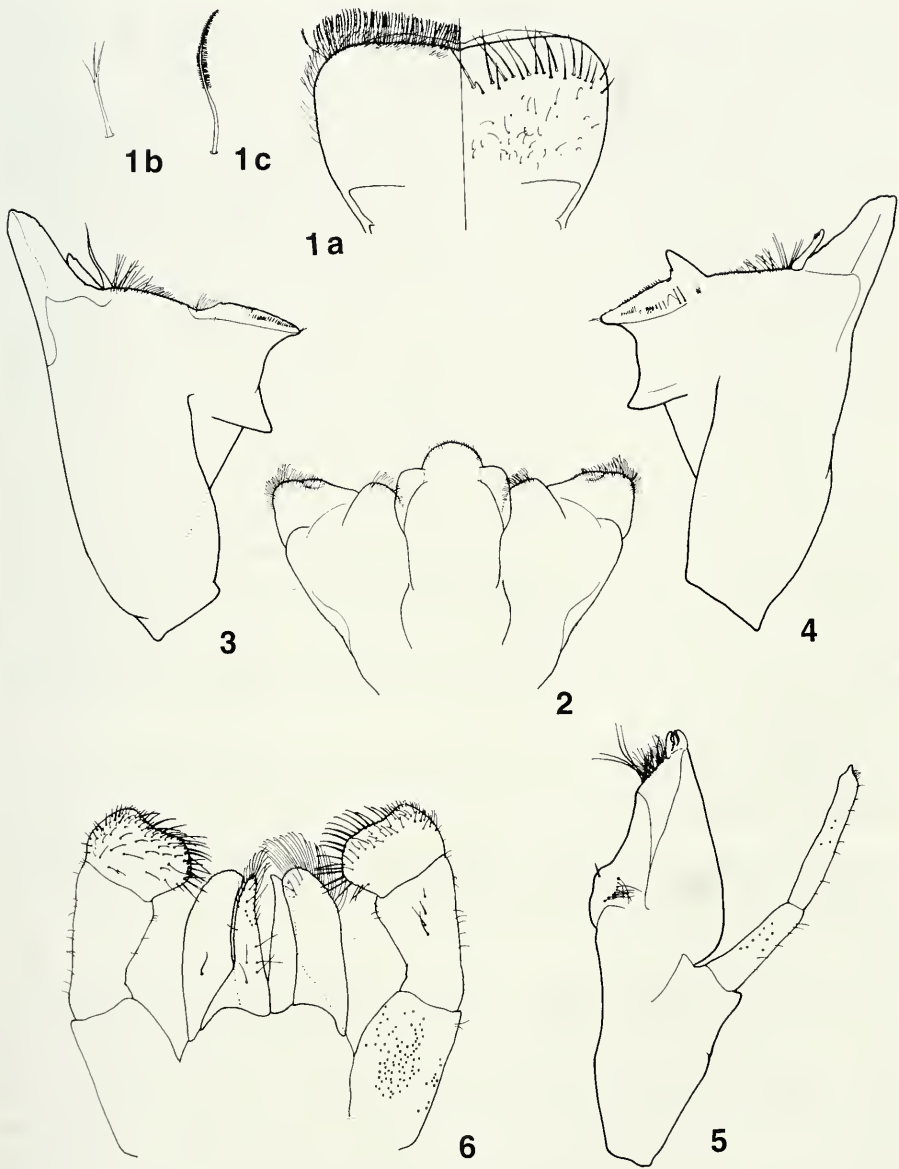
Hypopharynx as in figure 2, lingua with minute thin setae, superlinguae well developed and clearly separated of the lingua.

Right mandible (Fig. 3) with two sets of incisors, the outer formed only by one single well-developed and laterally reinforced tooth and the inner one reduced to a single small tooth; prostheca long and thin, without apical teeth; length of the tuft of setae between prostheca and mola reducing toward the mola; tuft of small setae near the mola well-developed; tuft of setae at the apex of the mola reduced to 2 or 3 setae; basal half without setae dorsally. Left mandible (Fig. 4) with incisors fused in a single tooth; prostheca with 4 teeth, the apical one much more developed; length of the tuft of setae between prostheca and mola reducing toward the mola; tuft of setae at the apex of the mola reduced to 3 setae; basal half without setae dorsally.

Maxillae (Fig. 5) with 4 teeth, the distal one opposed to the three others; 2 rows of setae, the first one formed by abundant small setae and the second by long stout setae ending with 4 twice as long as the others, without pectinate or spine-like setae in the middle of the range; 6 to 7 setae at the base of the galea roughly arranged in a row; 1 single small seta perpendicularly to the margin of the galea; palp 2-segmented as long as the galealacinia, first segment 1.4 time shorter than the second; second segment ending with a small rounded protuberance; thin setae on the external margin of the first and second segments, especially numerous at the apex of the second.

Labium (Fig. 6) with glossae subequal in length to paraglossae, and more slender than them; apical half of glossae with stout setae, long setae randomly distributed on the basal half of the ventral side; paraglossae apically rounded, with 2 rows of simple setae; one simple long seta on the margin of the paraglossae. Labial palp





FIGS 1 to 6. Larval structures of *Dabulamanzia gladius* : 1a : labrum (left : ventral; right : dorsal). 1b : multifid seta of the labrum. 1c : feathered seta of the labrum. 2 : hypopharynx. 3 : right mandible. 4 : left mandible. 5 : left maxilla. 6 : labium.

3-segmented; first segment stout, 1.3 time smaller than the second and third combined; second segment enlarged at the apex, row of about 4 setae; third segment very broad, truncated and incurved at the apex, almost completely covered with setae.

*Thorax.* Coloration light brown. Hindwing pad present. Legs yellow, except the apex of femora and tibia light brown. Forelegs (Fig. 7a) with coxa with few setae. Femora dorsally with a row of 12 long setae, only 2 of them in the distal half, apical half with thin short setae; 6 submarginal blunt setae; femoral patch of 4 spatulated setae; numerous short setae on the ventral margin. Tibiae dorsally with only short and thin setae, small subproximal arc of short setae; apex dorsally with a single long curved seta; ventral margin with abundant setae; tibio-patellar suture absent. Tarsi dorsally with only short and thin setae, subproximal arc of setae absent; ventral margin with a row of stout setae; tarsal claws (Fig. 7b) with a single row of 3 subequal teeth, subapical pair of setae absent. Second and third legs similar to foreleg, except setae of the ventral margin less abundant and tibio-patellar suture present.

*Abdomen.* Coloration of the terga uniformly light brown, except terga 5 and 6 brown, darker proximally and laterally. Sterna yellow except 5 and 6 brown. Asymmetrical gills (Fig. 8a) on abdominal segments 1 to 7; dark tracheation well developed, serrated with thin setae apically and posteriorly (Figs 8b and 8c). Paraproct (Fig. 9) unusually elongated, with about 25 pointed marginal spines, increasing in length at the apex; surface covered with more than 35 scale bases; setae insertion randomly distributed more abundant near the apex; postero-lateral extension with numerous minute spines along the margin; about 10 scale bases close together. Cerci and median caudal filament dark brown.

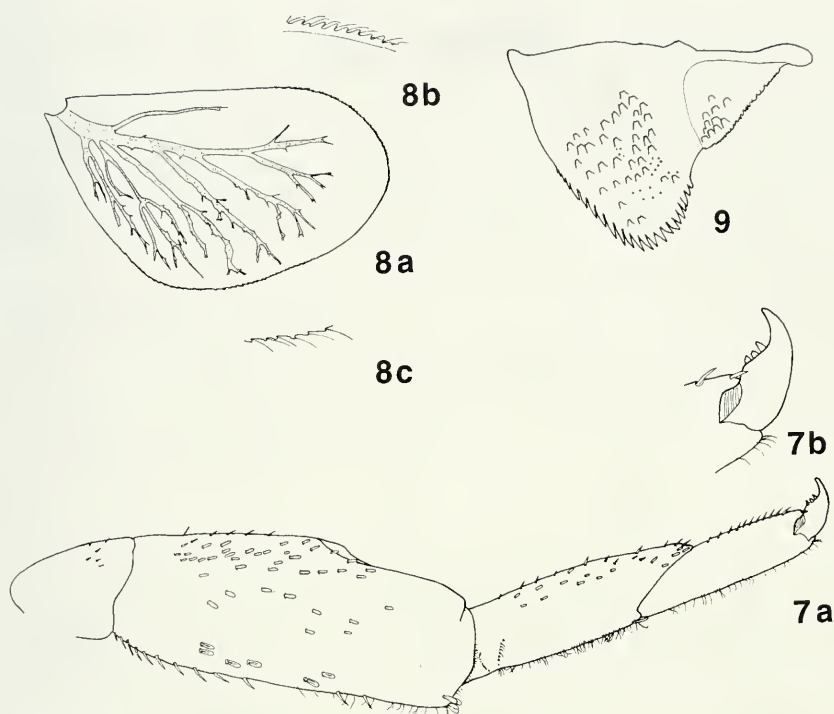
Male and female imagoes unknown.

*Dabulamanzia gigantea* Gattolliat sp. n.

*Holotype.* One female subimago with larval skin. (167a), Madagascar, Manampatrana Bas., Sahanivoraky Riv., Loc. tributary riv. of Iantara Riv., Long. 47°00'41" E, Lat. 22°13'33" S, Alt. 1400m. 19.11.1993. J.-M. Elouard, F.-M. Gibon.

LARVA

*Head.* Labrum (Fig. 10) sub-rectangular, with a smooth anteromedial emargination; distal margin bordered with two kinds of setae, one row of feathered setae (as in Fig. 1b) and one row of multifid setae (as in Fig. 1c); dorsally with a continuous row of about 15 long setae, abundant setae and insertion of setae in the proximal half; ventral face with a single small seta laterally and a row of thin setae medially. Hypopharynx similar to figure 2. Right mandible (Fig. 11a) with two sets of incisors; prostheca long, thin and unforked, without apical teeth (Fig. 11b); length of the tuft of setae between prostheca and mola reducing toward the mola; tuft of small setae near the mola; tuft of setae at the apex of the mola reduced to 2 or 3 setae; basal half without setae dorsally. Left mandible (Fig. 12a) with incisors fused; prostheca with 4 teeth and the apical much more developed (Fig. 12b); tuft of setae between prostheca and mola present; tuft of setae at the apex of the mola reduced to 3 setae; basal half without setae dorsally.

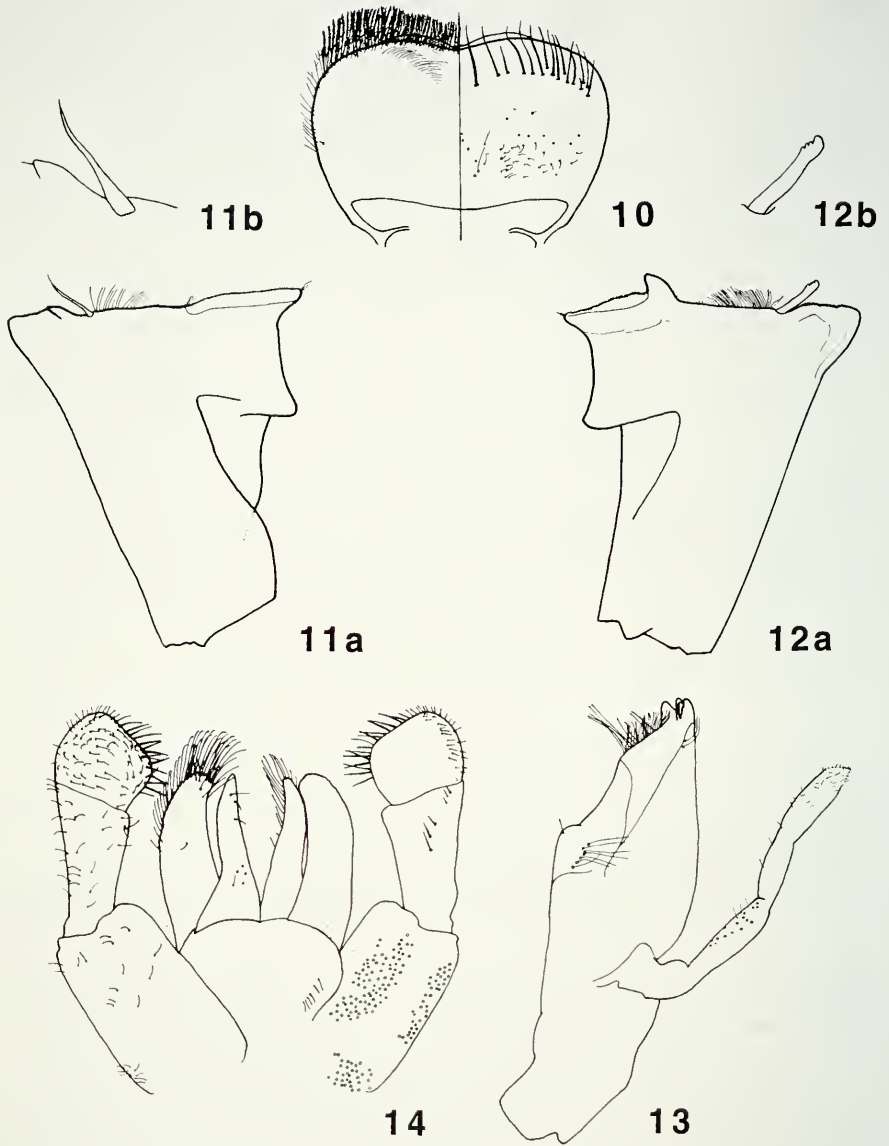


Figs 7 to 9. Larval structures of *Dabulamanzia gladius* : 7a : left foreleg. 7b : tarsal claw. 8a : fourth gill. 8b : anterior margin of the fourth gill. 8c : posterior margin of the fourth gill. 9 : paraproct.

Maxillae (Fig. 13) with 4 teeth, the distal one distinct from the three others; one row of small setae with, in the middle three stouter setae and apically five setae twice as long as the others; row of 7 setae at the base of the galea; 1 single small seta perpendicularly to the margin of the galea on a well-marked apophysis; palp 2-segmented longer than galealacinia, first segment 1.4 time shorter than the second; thin setae on the inner margin of the first and second segments, especially numerous at the apex of the second; micropores on the inner margin of the first segment.

Labium (Fig. 14) with glossae subequal in length to the paraglossae; apical half of glossae with stout setae, patch of five setae on the basal half of the ventral side; paraglossae apically rounded, with 2 rows of simple setae. Thin setae on the lateral side of the mentum. Labial palp 3-segmented; first segment stout, 1.1 smaller than the second and third combined; second segment much larger at the apex than at the base, dorsally with a row of about 4 setae ending with three smaller setae; third segment broad, apex truncated and substraight, ventrally almost completely covered with setae, much larger apico-laterally.

*Thorax.* Hindwing pad present. Forelegs (Fig. 15a) with coxa covered with few spines and an arc of micropores. Femora with a dorsal row of at least 20 long setae,



FIGS 10 to 14. Larval structures of *Dabulamanzia gigantea* : 10 : labrum (left : ventral; right : dorsal). 11a : right mandible. 11b : right prosthema. 12a : left mandible. 12b : left prosthema. 13 : left maxilla. 14 : labium.

especially numerous in the proximal half, submarginal setae absent, apical half of dorsal margin with thin short setae; femoral patch of at least 10 spatulated setae; numerous short setae on the ventral and lateral margins; arc of fine setae absent. Tibiae dorsally with only short and thin setae, small subproximal arc of short setae visible on the both sides; apex dorsally with a single long curved setae (Fig. 15b); ventral margin with abundant setae, apex with 3 long and acute setae; tibio-patellar suture absent. Tarsi dorsally with only short and thin setae, subproximal arc of setae absent, apex with a patch of thin setae; ventral margin with a row of short and stout setae; tarsal claws (Fig. 15c) with a single row of 5 teeth, the apical two much smaller, subapical pair of setae absent. Second and third legs similar to foreleg, except setae of the ventral margin less abundant and tibio-patellar suture present.

*Abdomen.* Elongated and asymmetrical gills (Fig. 16) on abdominal segments 1 to 7, dark tracheation well-developed, serrated with thin setae apically and posteriorly, anterior and posterior margin well-sclerotized.

Male and female imagoes unknown.

#### FEMALE SUBIMAGO

Forewing length 8.8 mm. Pterostigma with 5 vertical cross-veins. One intercalary vein between longitudinal veins except apically, two transverse veins between the subcostal and first radial veins (fig. 17). Hindwing length 1.7 mm. Two longitudinal veins well-marked, joined at the base. Two incomplete and less marked veins. Single spur weakly developed (Fig. 18).

#### *Dabulamanzia concolorata* Gattolliat sp. n.

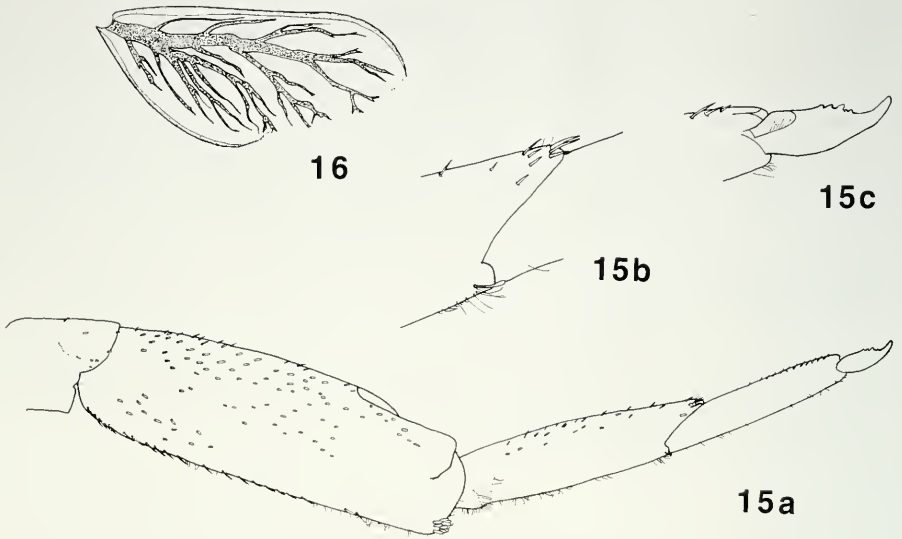
*Holotype.* Larva female (818a), Madagascar, Antongombato Bas., Makis Riv., Loc. Camp base WWF, Sacred Waterfall, Long. 49°10'09" E, Lat. 12°31'40" S. Alt.1075m, 23.3.1999. J.-L. Gattolliat and Z. Rabeantoandro.

*Paratypes.* Four larvae, same data as holotype. Four larvae, P0810, Madagascar, Antongombato Bas., Makis Riv., Loc. Camp base, 500m downstream of P0818, Long. 49°10'21" E, Lat. 12°31'27" S. Alt.1030m, 21.3.1999. J.-L. Gattolliat and Z. Rabeantoandro. Two larvae, P0814, Madagascar, Antongombato Bas., Makis Riv., Loc. 100m downstream of the Great Waterfall, Long. 49°10'14" E, Lat. 12°29'17" S, Alt.675m, 22.3.1999. J.-L. Gattolliat and Z. Rabeantoandro. Two larvae, P0822, same locality as P0814, 24.3.1999. J.-L. Gattolliat and Z. Rabeantoandro.

#### LARVA

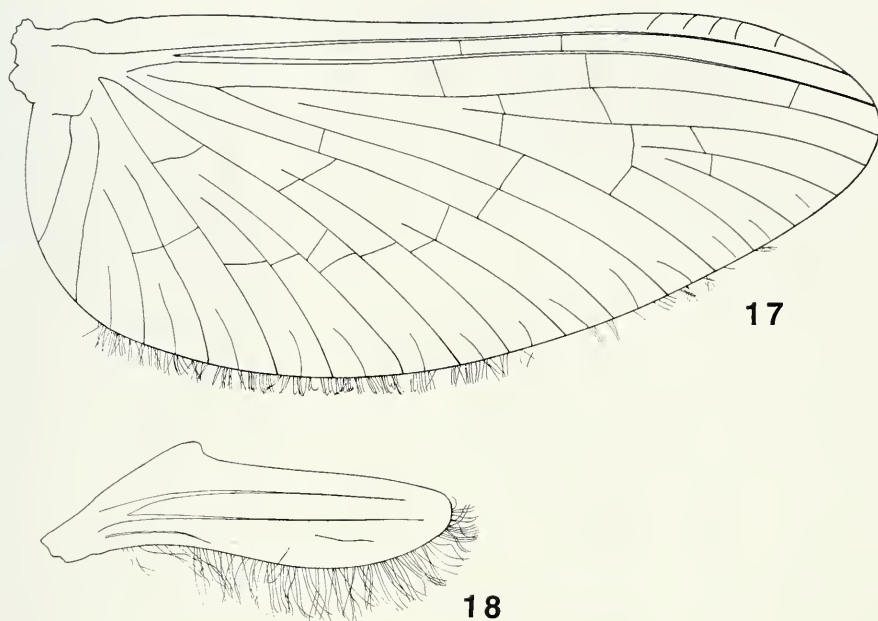
Maximal length : Body 7.2 mm. Cerci 2.5 mm. Terminal filament subequal to the cerci.

*Head.* Coloration almost uniformly light yellow, except brown between the eyes without vermiform marking on vertex and frons. Antennae pale light yellow, except scapus and pedicellus light brown. Eyes and ocelli black. Labrum (Fig. 19) narrow, rounded with a narrow anteromedial emargination; distal margin bordered with simple fine setae; without other setae ventrally; dorsally with an arc of five long setae and a submedial setae, few setae in the proximal half. Hypopharynx as in figure 20. lingua



FIGS 15 to 16. Larval structures of *Dabulamanzia gigantea*: 15a: left foreleg. 15b: apex of the foretibia. 15c: tarsal claw. 16: fourth gill (damaged apically).

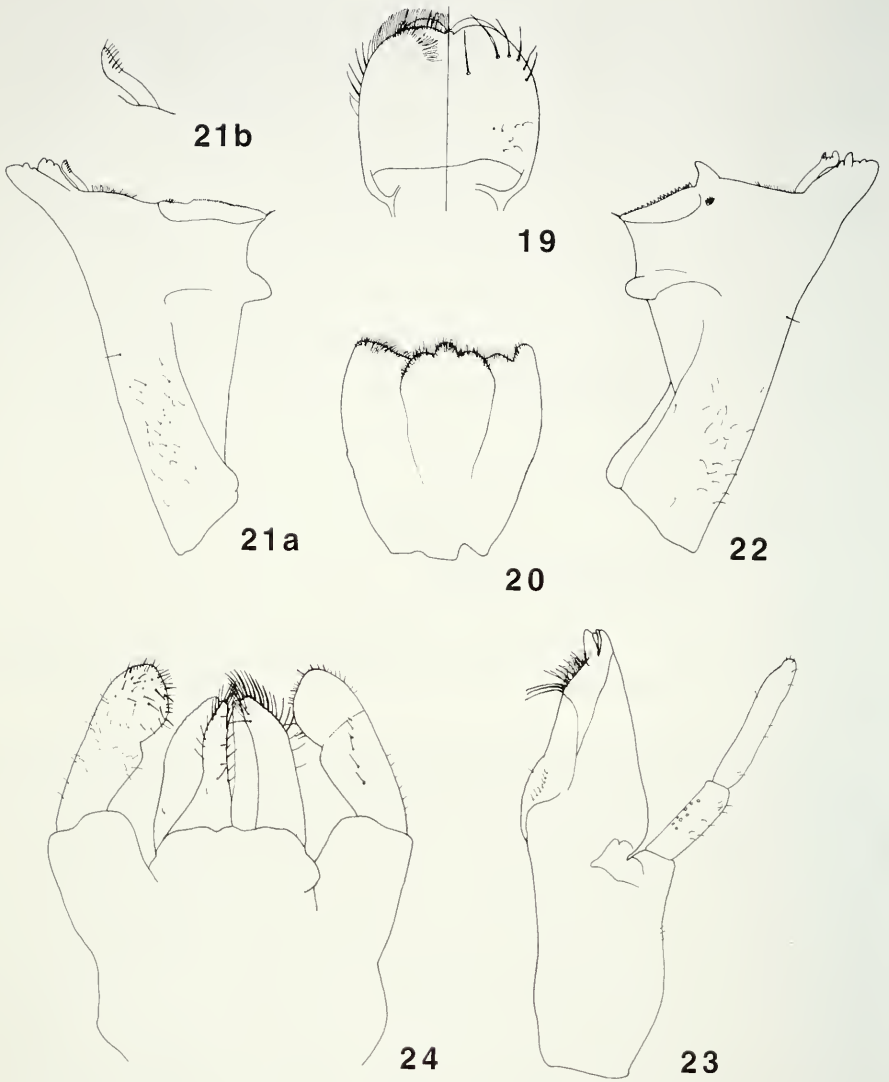
covered with numerous setae, superlinguae poorly developed. Right mandible (Fig. 21a) with two sets of incisors, slender and turned backwards; prostheca (Fig. 21b) short and stout, with about seven stout setae; the tuft of setae between prostheca and mola quite short; tuft of small setae near the mola well-developed; tuft of setae at the apex of the mola reduced to 2 stout setae; basal half with setae dorsally. Left mandible (Fig. 22), incisors fused to a group of five teeth; prostheca with 4 teeth, the apical one much more developed and a comb-shaped structure; length of the tuft of setae between prostheca and mola reducing toward the mola; tuft of setae at the apex of the mola reduced to 3 setae; basal half with setae dorsally. Maxillae (Fig. 23) with 4 teeth, the distal one opposed to the three others; 2 rows of setae formed by abundant small setae and long stout setae ending with 3 much longer setae, without pectinated or spine-like setae in the middle of the range; 6 to 7 short setae at the base of the galea arranged in a row; a couple of small setae perpendicularly to the margin of the galea; palp 2-segmented, longer than galealacinia, first segment 1.5 time shorter than the second; few thin setae on the external margin of the first and second segments. Labium (Fig. 24) with glossae subequal to paraglossae; apical half of glossae with stout setae, row of setae subparallel to the inner margin; paraglossae apically rounded, with 2 rows of simple setae. Labial palp 3-segmented; first segment stout, 1.25 smaller than the second and third combined; second segment moderately enlarged at the apex, row of about 6 setae; third segment apically rounded, as broad as the apex of the second.



FIGS 17 to 18. Female subimaginal structures of *Dabulamanzia gigantea* : 17 : forewing. 18 : hindwing.

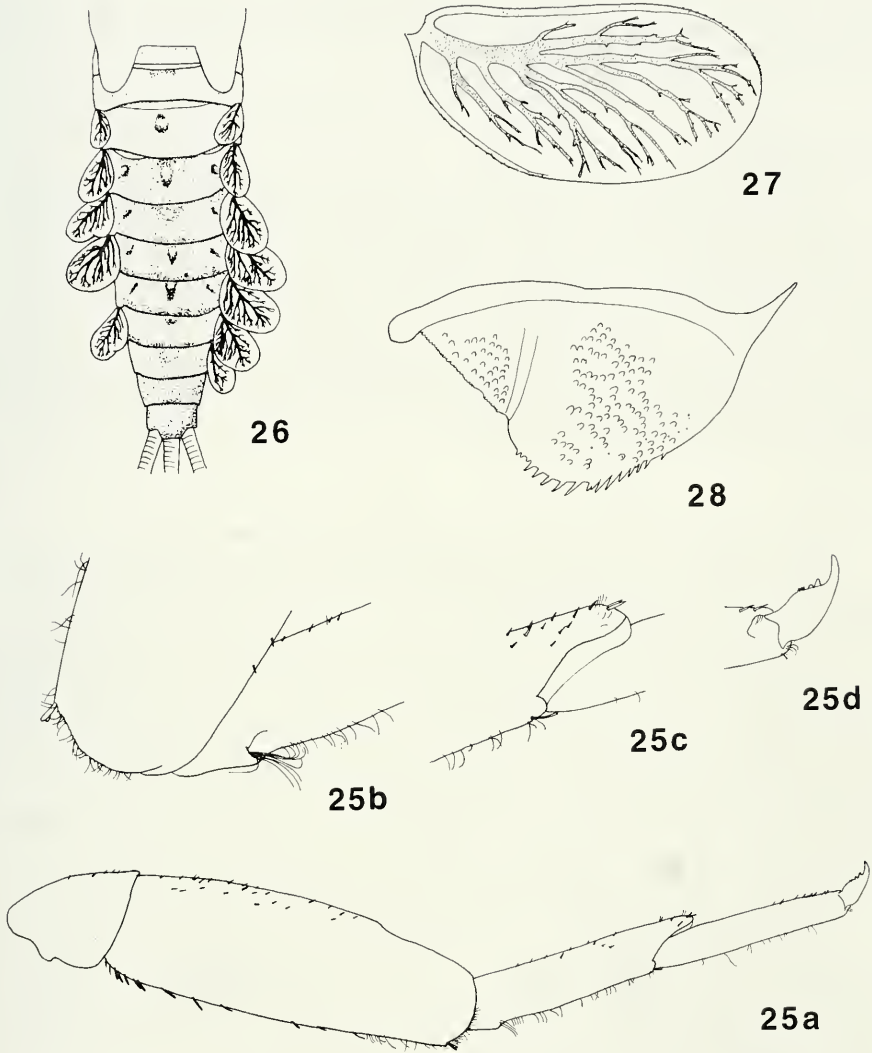
*Thorax.* Coloration light brown. Hindwing pad present. Legs yellow, except the dorsal margin of the whole leg and the apex of femora light brown. Forelegs (Fig. 25a), coxa with few setae. Femora with dorsal row of 13 long and broad setae, only 2 or 3 of them in the distal half, no submarginal seta, apical half of dorsal margin with thin setae; femoral patch of 2 spatulated setae; apex crenated with thin setae (Fig. 25b); short setae on the ventral margin. Tibiae dorsally with only thin setae, small subproximal arc of long and thin setae (Fig. 25b); apex dorsally with a single long curved seta (Fig. 25c); ventral margin with few short setae; tibio-patellar suture absent. Tarsi dorsally with only thin setae, subproximal arc of setae absent; ventral margin with a row of short setae; tarsal claws (Fig. 25d) with a single row of 3 short and 2 long teeth, subapical pair of setae absent. Second and third legs similar to foreleg, except setae of the ventral margin less abundant, tibio-patellar-suture present and the subproximal arc of setae longer.

*Abdomen.* Coloration of the terga almost uniformly light brown, except a yellow spot on segments 2 to 9, sometimes surrounded with brown, distal margin darker on segments 4 to 9, segments 3 to 6 with a brown mark laterally (Fig. 26). Sterna yellow except sternite 9 and paraproct light brown. Asymmetrical gills (Fig. 27) on abdominal segments 1 to 7; dark tracheation well developed, apically and posteriorly serrated with thin setae; anterior and to a less extent posterior margin sclerotized. Paraproct (Fig. 28), with about 16 pointed marginal spines; surface covered with more than 80 scale bases;



FIGS 19 to 24. Larval structures of *Dabulamanzia concolorata* : 19 : labrum (left : ventral; right : dorsal). 20 : hypopharynx. 21a : right mandible. 21b : right prostheca. 22 : left mandible. 23 : left maxilla. 24 : labium.





FIGS 25 TO 28. Larval structures of *Dabulamanzia concolorata* : 25a : left foreleg. 25b : apex of the forefemur. 25c : apex of the foretibia. 25d : tarsal claw. 26 : abdomen (dorsal view). 27 : fourth gill. 28 : paraprot.

setae insertion randomly distributed more abundant near the apex; postero-lateral extension with about 35 minute spines along the margin; about 30 scale bases. Cerci and median caudal filament uniformly brown.

Male and female imagoes unknown.

### *Dabulamanzia* sp. A

*Material examined.* Five male imagoes, two males subimagoes, P0658, Madagascar, Rianila Bas., unnamed Riv., Loc. Road to Lakato, Long. 48°21'48" E, Lat. 19°02'40" S, Alt. 1050m, 26.11.1996. J. Legrand and D. Ramdriamasimanana. One male imago, P0792, same locality P0658, 18.11.1998. J. Legrand and N. Raberiaka. One male imago, P0292, Madagascar, Sakanila Bas., Lakato Riv., Loc. Road to Lakato, Long. 48°25'08" E, Lat. 19°08'33" S, Alt. 690m, 20.3.1995. J.-M. Elouard. Twenty two male imagoes and subimagoes, P0764, same locality as P0292, 17.10.1998. J. Legrand and N. Raberiaka. One male imago, P0771, Madagascar, Sakanila Bas., Lakato Riv., Loc. Road to Lakato, Long. 48°21'38" E, Lat. 19°03'07" S, Alt. 1050m, 26.10.1998. J. Legrand and N. Raberiaka. Six male imagoes, P0794, Madagascar, Rianila Bas., Sahatandra Riv., Loc Road to Lakato, Long. 48°21'43" E, Lat. 19°02'40" S, Alt. 1050m, 19.11.1998. J. Legrand and N. Raberiaka.

### MALE IMAGO

Maximal length : Body 7.3 mm; caudal filaments 18 mm.

*Head.* Yellowish brown without marks (Figs 29 and 30). Turbinate, subcylindrical eyes deep orange (becoming honey-brown after preservation and storage in alcohol). Stout carina between the antennae.

*Thorax.* Prothorax light brown with dark brown pattern, meso and metathorax uniformly light brown. Forewing length 6.8 mm. Surface hyaline except pterostigma light grey, with 5 to 7 vertical cross-veins not reaching the Sc vein. One intercalary vein between longitudinal veins except between subcostal and first radial veins (fig. 31a). Costal margin serrated (Fig. 31b). Hindwing length 1.1 mm. Surface hyaline. Two well-marked longitudinal veins, joined at the base. Third vein free, incomplete and less marked than two others. Single stout spur covered with small teeth (Fig. 32). Legs yellowish brown, except the apex of tibiae and of each article of the tarsi dark brown.

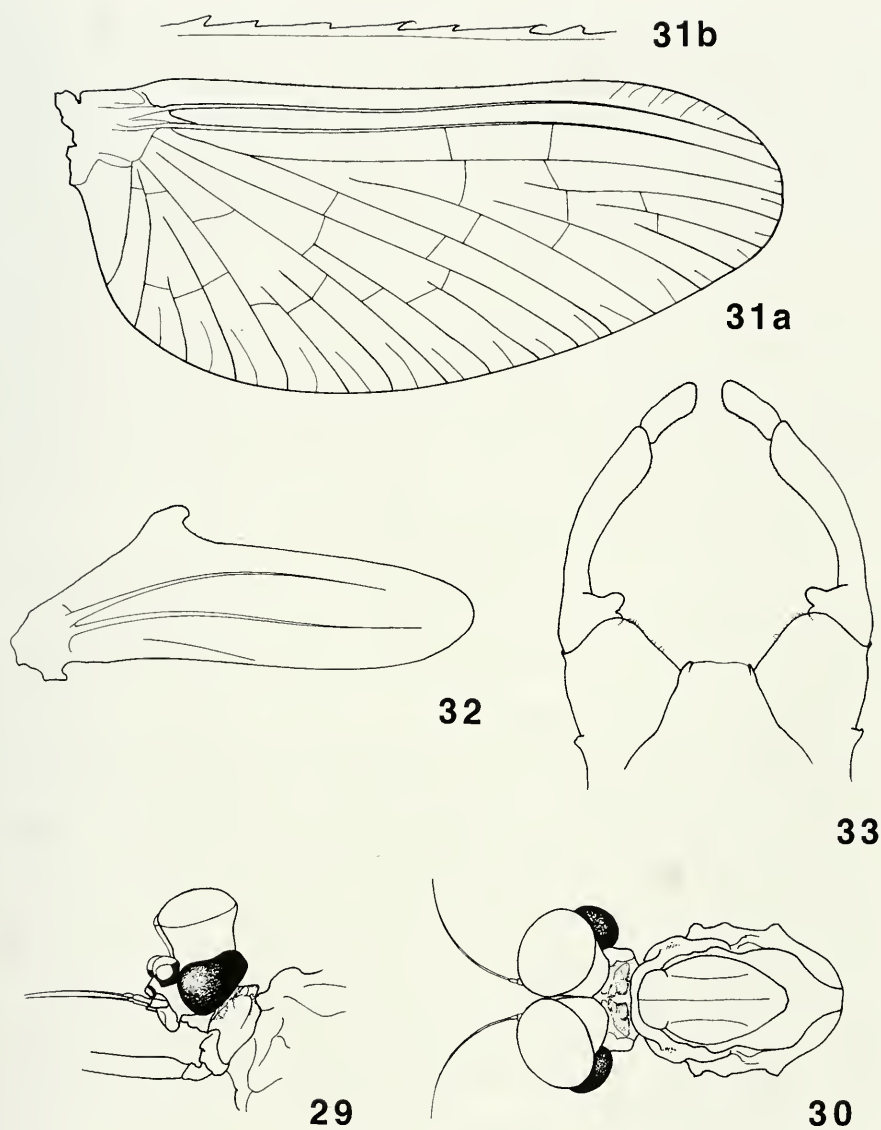
*Abdomen* pale cream, with a brown narrow transverse line in the distal part of each segment. Genitalia formed by three-segmented gonopods, the limit between the first and the second not visible. Length of articles 1 and 2 0.50 mm. Article 3 0.14 mm. Second segment long, clearly enlarged subapically, with the inner margin covered with small teeth, base of the first segment with a stout apophysis without a brush of setae. Third segment elongated, with the inner margin incurved (Fig. 33).

Female imago unknown.

Larva unknown.

### MALE SUBIMAGO

Similar to the male imago.



FIGS 29 to 33. Male imaginal structures of *Dabulamanzia* sp. A : 29 : head (lateral view). 30 : head (dorsal view). 31a : forewing. 31b : costal margin of the forewing. 32 : hindwing. 33 : genitalia.

## AFFINITIES

The presence of a subproximal arc of setae on the tibiae of *D. gladius* sp. n., *D. concolorata* sp. n. and *D. gigantea* sp. n. (Figs 7a, 15a and 25a), tibio-patellar suture present only on the second and third legs and serrated costal margin of forewing (Fig. 31b) suggest that these species belong to the *Cloeodes* complex (Lugo-Ortiz & McCafferty, 1996a; Lugo-Ortiz & McCafferty, 1996b). The presence of teeth on the tarsal claws (Figs 7b, 15c and 25d), the presence of hindwings, the absence of arc of setae on the tarsi clearly demonstrate that these three species do not belong to *Cloeodes* (Waltz & McCafferty, 1987b; Waltz & McCafferty, 1987a) nor to *Maliqia* (Lugo-Ortiz & McCafferty, 1997a). The absence of a thumb-like distomedial process on labial palp segment 2 (Figs 6, 14 and 24) and the two subapical not extremely enlarged teeth of the tarsal claw (Figs 7b, 15c and 25d) distinguish these three species from the genus *Crassabwa* (Lugo-Ortiz & McCafferty, 1996a). At the opposite, the shape of the labial palp (Figs 6, 14 and 24), especially of the second and third segments, the single row of subequal teeth on the tarsal claws (Figs 7b, 15c and 25d), the shape, the venation and the serration of the gills (Figs 8a, 8b, 8c, 16 and 27) are apomorphic features of the genus *Dabulamanzia* (Lugo-Ortiz & McCafferty, 1996b).

*D. sp. A* presents the following features which clearly argue that this species belongs to the genus *Dabulamanzia*: hindwing with a single hooked spur (Fig. 32), forewing with single intercalary veins (Fig. 31a) and serrated costal margin (Fig. 31b) and male genital forceps with a well-developed apophysis on the first segment (Fig. 33).

Larvae of *D. gladius* and *D. gigantea* are quite close. The great size of *D. gigantea*, the shape of the apex of the third segment of the labial palp (Figs 6 and 14), the shape of the labrum (Figs 1a and 10), the shape of the legs (Figs 7a and 15a) and the number of tarsal teeth (Figs 7b and 15c) allow us to separate these two species. They are distinguished from African and all the other Malagasy larvae of *Dabulamanzia* by the shape of the labrum, the shape of the third segment of the labial palp, the right prostheca and the fused teeth of the mandibles (Wuillot & Gillies, 1993; Lugo-Ortiz & McCafferty, 1996b; Lugo-Ortiz & McCafferty, 1997c; Gattolliat *et al.*, 1999). They appear much closer to *D. tarsale* (Gillies): the shape of the labrum and of the third segment of the labial palp are very similar. However, the right prostheca is different, bifid in *D. tarsale* (Gillies, 1990) and reduce to a single bristle-like in *D. gladius* and *D. gigantea* (Figs 3 and 11b). Moreover the incisors of the mandibles of *D. gladius* and *D. gigantea* are very characteristic.

*D. concolorata* differs clearly from all other species of *Dabulamanzia* by the shape of the labrum (Fig. 19). It is closely related to *D. duci* Gattolliat & Elouard and *D. improvida* Lugo-Ortiz & McCafferty (Lugo-Ortiz & McCafferty, 1997c; Gattolliat *et al.*, 1999). However, it differs from them in the coloration of the abdomen (Fig. 26), the shape of third segment of the labial palp (Fig. 24), the right mandible with incisors slender and turned backwards (Figs 21a and 22) and the maxillae with an unusual couple of small setae perpendicularly to the margin of the galea (instead of a single seta in most of the other species and genera of Baetidae) (Fig. 23).

*D. sp. A* differs from the African species by the shape of the apophysis of the first segment of the gonopods (Fig. 33). It appears more closely related to the Malagasy species *D. duci*. The following features allow us to distinguish the two species: second segment of the gonopod clearly enlarged subapically and apophysis of the first segment without a brush of setae. inner margin of the third segment incurved (Fig. 31). As this species is only known at the imaginal and subimaginal stages, we refrain to name it, even if the above-mentioned features distinguish it from all the other Malagasy species. The great size of *D. sp. A* clearly indicates that it could not be the imago of *D. gladius*, even if these two species are present in the same area.

## DISCUSSION

The genus *Dabulamanzia* is actually known by 11 species, 6 in mainland Africa and 5 in Madagascar. However, we cannot conclude that this genus presents the same diversity in both areas. The number of species is greatly underestimated in Africa for two main reasons. First, the baetid fauna of most African regions is poorly known (McCafferty & de Moor, 1995) and secondly, even if *Dabulamanzia* is widespread and very common, it is seldom caught by light-traps (Gillies, 1990). This could be due to the peculiar mating behaviour of the males: they wait in the morning for the females in an horizontal flight a few centimetres above flat stones or rocks (Gattolliat *et al.*, 1999).

The status of the genus *Dabulamanzia* is not clear in Madagascar. Two of the five species, *D. improvida* and *D. duci* are extremely close. Moreover, a third species, *Nesydenius polhemusorum* Lugo-Ortiz & McCafferty, appears to be also very close to them. These authors claim that the presence of thin setae on the dorsal margin of the legs and the relative size of the subapical teeth of the tarsal claws are apomorphies, distinguishing the monospecific genus *Nesydenius* from others species of *Dabulamanzia* (Lugo-Ortiz & McCafferty, 1998). A single specimen of *Nesydenius polhemusorum* was mounted; consequently the intraspecific variation among and between populations cannot be correctly estimated. The tiny differences observed between single specimens of *N. polhemusorum* and *D. improvida* need to be strengthened and the validity of the genus *Nesydenius* confirmed.

The mouthparts of *D. gladius* and *D. gigantea* show clear adaptation for scraping the tops of stones. They share this kind of specialisation with the genus *Xyrodromeus* Lugo-Ortiz and McCafferty that also shows the same adaptations: teeth of the mandibles fused and extremely developed, labrum almost straight (Lugo-Ortiz & McCafferty, 1997b). Similar adaptations are also present in other genera such as *Baetis* (Müller-Liebenau, 1969). However, they must be strictly considered as a convergence due to the same foraging behaviour. The shape of the labial palp, the maxillae, the subproximal arc of setae on the tibiae and especially the single row of teeth on the tarsal claw clearly distinguish these three genera and demonstrate that they do not belong to the same complex of genera.

Since the remaining species lack apomorphic features and *D. gladius* and *D. gigantea* share with the other *Dabulamanzia* species a number of apomorphies, it is not justified to erect a new genus for these two species.

KEY TO THE MALAGASY SPECIES OF *DABULAMANZIA*

1. Distal margin of the labrum almost straight; mandibles with fused incisors; third segment of the labial palp apically truncated . . . . . 2  
 - Distal margin of the labrum with a clear anteromedial emargination, mandibles with incisors not fused; third segment of the labial palp apically rounded or pointed . . . . . 3
2. Third segment of the labial palp apically concave; labrum almost quadrangular; femora with a dorsal row of about 12 setae . . . . . *D. gladius*  
 - Third segment of the labial palp apically straight; labrum more rounded; femora with a dorsal row of at least 20 setae . . . . . *D. gigantea*
3. Tergae almost uniform light brown; labrum narrow; third segment of the labial palp not broader than the second . . . . . *D. concolorata*  
 - At least tergae 3 to 6 brown with 3 lighter median spots, labrum rounded not narrow, third segment of the labial palp broader than the second . . . . . 4
4. Third segment of the labial palp rounded, second segment of the maxillary palp slender and pointed . . . . . *D. improvida*  
 - Third segment of the labial palp slightly pointed, second segment of the maxillary palp as broad as the second . . . . . *D. duci*

## ACKNOWLEDGEMENTS

We thank the whole team of the LRSAE (Laboratoire de Recherche sur les Systèmes Aquatiques et leur Environnement, Antananrivo, Madagascar), especially its director Dr J.-M. Elouard for logistical assistance and donation of specimens, and Sophie Rabeantoandro for great help during our field work in Madagascar. We also want to thank Dr M.T. Gillies, Lewes England, for useful comments on this paper. A travel grant was provided to JLG by the Swiss Academy of Sciences. This paper is the contribution n° 39 to the series "Aquatic Biodiversity of Madagascar".

## REFERENCES

- GATTOLLIAT, J.-L., SARTORI, M. & ELOUARD, J.-M. 1999. Aquatic Biodiversity from Madagascar 12: three new species of Baetidae (Ephemeroptera) from the Réserve Naturelle Intégrale d'Andohahela. *Fieldiana* ns 94: 115-124.
- GILLIES, M. T. 1990. A revision of the African species of *Centropitulum* Eaton (Baetidae, Ephemeroptera). *Aquatic Insects* 12(2): 97-128.
- LUGO-ORTIZ, C. R. & MCCAFFERTY, W. P. 1996a. *Crassabwa*: a new genus of small minnow mayflies (Ephemeroptera: Baetidae) from Africa. *Annales de Limnologie* 32(4): 235-240.
- LUGO-ORTIZ, C. R. & MCCAFFERTY, W. P. 1996b. The composition of *Dabulamanzia*, a new genus of Afrotropical Baetidae (Ephemeroptera), with description of two new species. *Bulletin de la Société d'Histoire Naturelle de Toulouse* 132: 7-13.
- LUGO-ORTIZ, C. R. & MCCAFFERTY, W. P. 1997a. *Maliqua*: a new genus of Baetidae (Ephemeroptera) for a species previously assigned to *Afroptilum*. *Entomological News* 108: 367-371.
- LUGO-ORTIZ, C. R. & MCCAFFERTY, W. P. 1997b. New Afrotropical genus of Baetidae (Insecta: Ephemeroptera) with bladelike mandibles. *Bulletin de la Société d'Histoire Naturelle de Toulouse* 133: 41-46.

- LUGO-ORTIZ, C. R. & MCCAFFERTY, W. P. 1997c. New species and first reports of the genera *Cheleocloeon*, *Dabulamanzia* and *Mutelocloeon* (Insecta : Ephemeroptera) from Madagascar. *Bulletin de la Société d'Histoire Naturelle de Toulouse* 133: 47-53.
- LUGO-ORTIZ, C. R. & MCCAFFERTY, W. P. 1998. Phylogeny and biogeography of *Nesydenius*, n. gen., and related Afrotropical genera (Insecta : Ephemeroptera : Baetidae). *Bulletin de la Société d'Histoire Naturelle de Toulouse* 134: 7-12.
- MCCAFFERTY, W. P. & DE MOOR, F. C. 1995. South African Ephemeroptera : Problem and priorities. (pp. 463-476). In: Ciborowski C. L.D & J. H. H. (eds.). Current directions in research in Ephemeroptera. *Canadian Scholars' Press, Toronto*.
- MÜLLER-LIEBENAU, I. 1969. Revision der Europäischen Arten der Gattung *Baetis* Leach, 1815. *Gewässer und Abwässer* 53/54: 1-214.
- WALTZ, R. D. & MCCAFFERTY, W. P. 1987a. Generic revision of *Cloeodes* and description of two new genera (Ephemeroptera: Baetidae). *Proceedings of the Entomological Society of Washington* 89(1): 177-184.
- WALTZ, R. D. & MCCAFFERTY, W. P. 1987b. Revision of the genus *Cloeodes* Traver (Ephemeroptera: Baetidae). *Annals of the Entomological Society of America* 80(2): 191-207.
- WUILLOT, J. & GILLIES, M. T. 1993. New species of *Afroptilum* (Baetidae, Ephemeroptera) from West Africa. *Revue d'Hydrobiologie Tropicale* 26: 269-277.





## Das Männchen von *Zelotes zellensis* Grimm (Araneae: Gnaphosidae)

Christoph MUSTER & Konrad THALER  
Institut für Zoologie und Limnologie der Universität,  
Technikerstraße 25, A-6020 Innsbruck, Austria.

**The male of *Zelotes zellensis* Grimm (Araneae: Gnaphosidae).** – The previously unknown male of *Zelotes zellensis* Grimm, 1982 is described from the Bavarian Alps (Germany). Characters to distinguish this species from the closely related *Z. aeneus* (Simon, 1878) are indicated and illustrated. For both species notes on habitat, maturity period and distribution are given.

**Key-words:** Araneae - Gnaphosidae - *Zelotes* - Alps.

### EINLEITUNG

Die Gnaphosidae Mitteleuropas bergen, obwohl von Grimm (1985) gründlich revidiert, noch ungelöste taxonomische Probleme, besonders im alpinen Raum. Dort finden sich die vier Arten, deren Männchen Grimm unbekannt blieben: *Berlaudina nubivaga* (Simon, 1878) und *Gnaphosa alpica* Simon, 1878 in den Westalpen, sowie die erst rezent von Grimm (1982) beschriebenen *Zelotes devotus* und *Z. zellensis*. Die Männchen von *G. alpica* und von *Z. devotus* wurden inzwischen identifiziert (Ovtsharenko *et al.*, 1992; Thaler, 1989a). Von *Z. zellensis* waren bisher nur das Holotypus-Weibchen und ein subadultes Exemplar aus den Kitzbühler Alpen (Salzburg) bekannt. Einzelne Männchen der Art aus den Bayerischen Alpen haben bereits vor Jahren J. Wunderlich vorgelegen (in litt.). Sie wurden als *Z. aeneus* (Simon, 1878) nahestehend erkannt, eine nähere taxonomische Zuordnung war damals jedoch nicht möglich. Das Auffinden einer größeren Serie von Exemplaren beider Geschlechter am Geigelstein (Chiemgauer Alpen) im Jahr 1999 erlaubt es nun, das Männchen von *Z. zellensis* zu beschreiben sowie Verbreitung und Habitat dieser Art zu schildern.

*Abkürzungen:* CM = Coll. C. Muster, CTh = Coll. K. Thaler, MHNG = Muséum d'histoire naturelle Genève, NMW = Naturhistorisches Museum Wien, ZMH = Zoologisches Museum Hamburg. Maßangaben sind in mm.

### *Zelotes zellensis* Grimm, 1982

*Z. zellensis* Grimm, 1982: 177-178, Beschreibung des ♀; Grimm (1985: 262, ♀); Platnick (1989: 496, 1993: 671); Heimer & Nentwig (1991: 450, ♀).

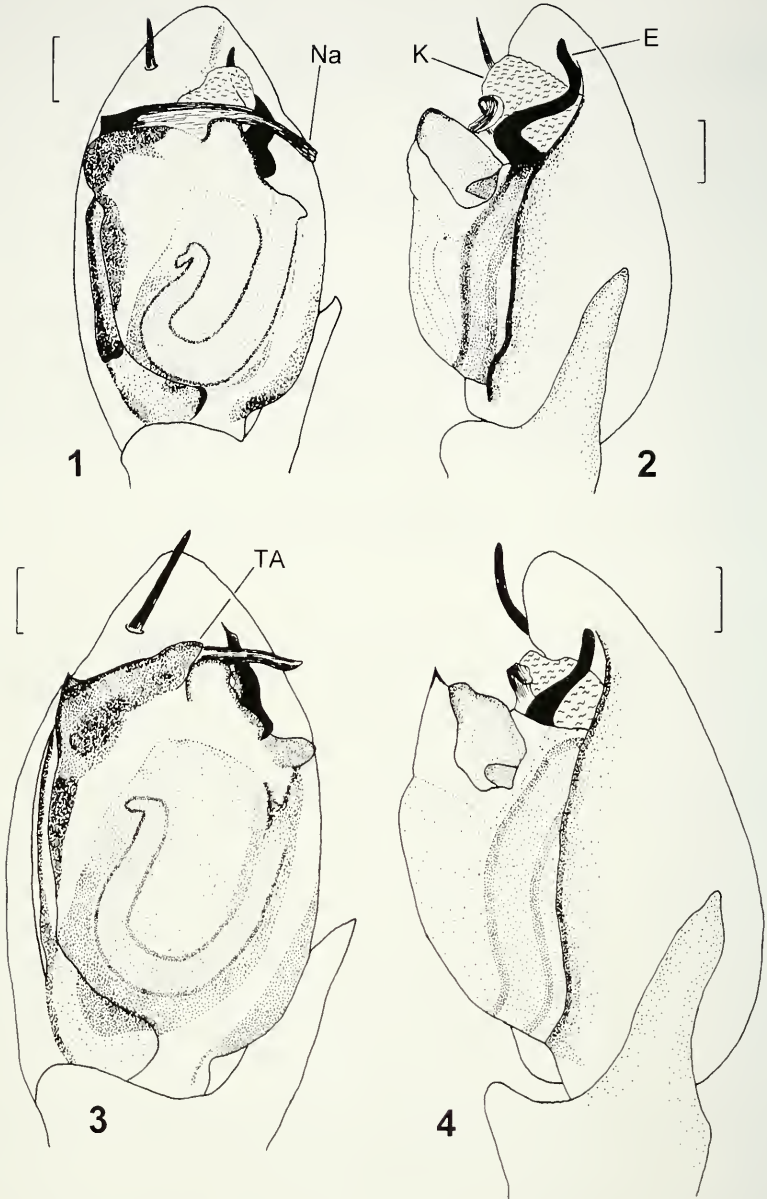


ABB. 1-4: *Zelotes zellensis* Grimm (1, 2), *Z. aeneus* (Simon) (3, 4). ♂-Taster von ventral (1, 3) und retrolateral (2, 4). Abkürzungen: E Embolus, K Konduktor, Na Nebenarm des Endapparates, TA Terminalapophyse des Tegulum. Maßstab 0,1 mm.

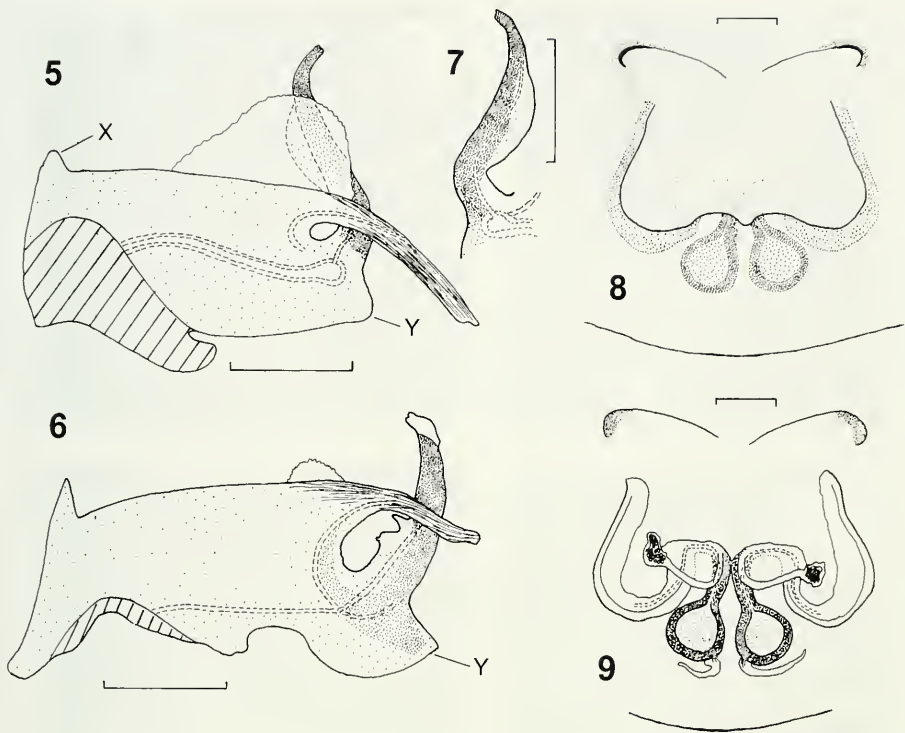


ABB. 5-9: *Zelotes zellensis* Grimm (5, 7, 8, 9), *Z. aeneus* (Simon) (6). ♂-Taster, Endapparat von ventral (5, 6), Embolus von dorsal (7), Epigyne von ventral (8), Vulva von dorsal (9). Maßstab 0,1 mm.

Material: DEUTSCHLAND: BAYERN, Karwendel, Soiernspitze, 1780 m, 1 ♂ (10.08.-10.09.1998); Chiemgauer Alpen, Geigelstein, 1650 – 1800 m, 1 ♀ (25.09.1998-18.05.1999), 2 ♂, 1 ♀ (30.06.-29.7.1999), 2 ♂ (29.07.-21.08.1999), 1 ♂, 4 ♀ (21.08.-11.09.1999), 2 ♂, 6 ♀ (11.09.-17.10.1999); ÖSTERREICH: SALZBURG, Tennengebirge, Samer Alm, 1520 m, 1 ♂ (07.07.-04.08.1999); Kitzbühler Alpen, Schmittenhöhe bei Zell am See, 1400-1800 m, 1 ♀ Holotypus (ZMH, 05.07.1979, leg. Grimm).

Mit Ausnahme des Holotypus wurden alle Ex. in Barberfallen gefangen. leg. Muster. Deponierung: Ex. vom Geigelstein 1 ♂, 2 ♀ MHNG, 1 ♂, 1 ♀ NMW, 1 ♂, 1 ♀ ZMH, 1 ♂, 1 ♀ CTh, übrige Ex. CM.

**Männchen:** Maße (n = 8): Gesamtlänge 4,5 (4,0 – 5,0), Prosomalänge 1,85 (1,7 – 1,9), Prosomabreite 1,4 (1,3 – 1,5), Sternumlänge 1,1 (1,0 – 1,2), Cymbiumlänge 0,65 (0,62 – 0,67), Bein I: Fe 1,33 (1,23 – 1,37), Pt 0,74 (0,67 – 0,80), Ti 1,06 (0,98 – 1,25), Mt 0,80 (0,75 – 0,87), Ta 0,78 (0,72 – 0,80).

Cheliceren: vorderer Klauenfurchenrand mit 3-4, hinterer mit 1-2 Zähnen. Beinbewehrung: Mt I und II mit 2 Paar ventraler Stacheln, je eines im basalen und im mittleren Drittel des Beinsegmentes; gelegentlich nur 2 oder 3 Stacheln vorhanden. Opisthosoma: mit großem, dunkelbraunem Scutum, ca. 40% der Abdomenlänge einnehmend.

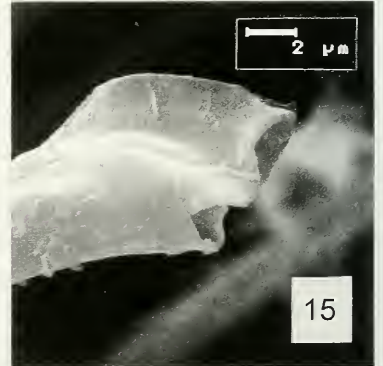
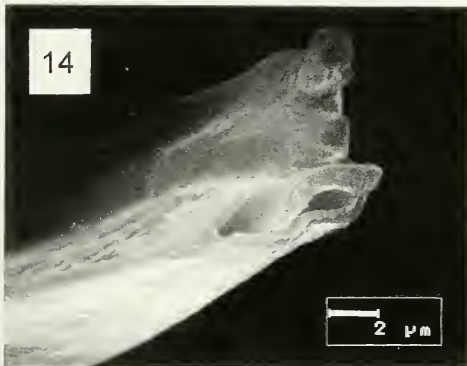
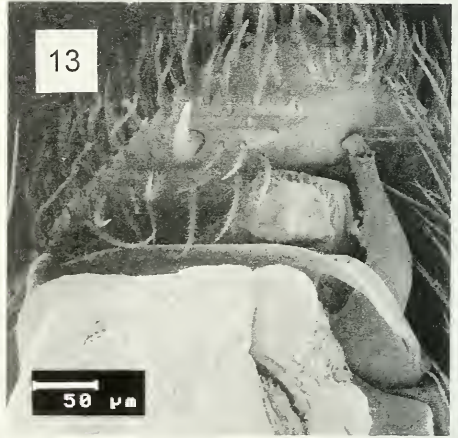
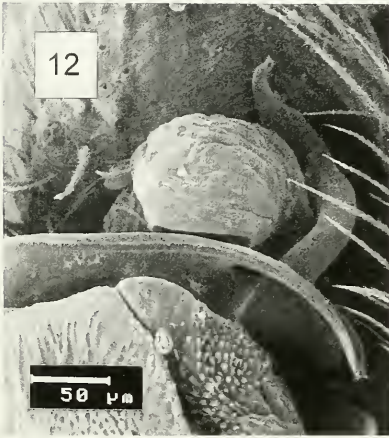
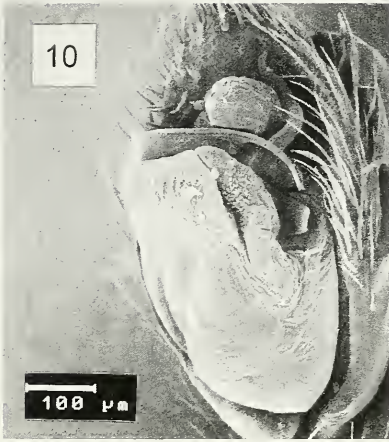


ABB. 10-15: *Zelotes zellensis* Grimm (10, 12, 14), *Z. aeneus* (Simon) (11, 13, 15). ♂-Taster von schräg ventral (10, 11). Endapparat von schräg ventral (12, 13). Spitze des Nebenarmes (14, 15).

Pedipalpus: Abb. 1, 2, 10. Tibia-Apophyse gerade, Tegulum und Retinaculum ohne Besonderheiten. Endapparat: Abb. 5, prolateral-distal mit Höcker (X), retrolateral-proximal gerundet (Y); Nebenarm (Na in Abb. 1) lang dornförmig, schwach gebogen; Konduktor (K in Abb. 2) groß, polsterförmig, von ventral deutlich sichtbar und Embolus teilweise überdeckend; Embolus (E in Abb. 2) lang, S-förmig, prolateral mit ganzrandigem, lamellösem Saum; Spermophor vor Eintritt in den Embolus blasenartig erweitert.

Nebenarm des Endapparates wie bei einigen anderen Arten der Gattung (Miller, 1967: 256) von einem feinen Kanal durchzogen, der an der Erweiterung des Spermophor vorbei in den Embolus führt und dort nicht weiter zu verfolgen war. Der Nebenarm erscheint demnach als ein "2. Embolus" (Grimm, 1985: 188). Die biologische Bedeutung dieses "rätselhaften Organs" (Miller, 1967: 256) ist nach wie vor unbekannt. Nach Grimm (1985: 18/19) weist der Nebenarm im distalen Bereich eine Skleritfalte auf; Abb. 14, 15 zeigen die komplizierten Mündungsstrukturen.

*Weibchen*: Mit den Beschreibungen von Grimm (1982, 1985) gut übereinstimmend, Maße (n = 11): Gesamtlänge 5,1 (4,5 – 5,6), Prosomalänge 1,9 (1,8 – 2,1), Prosomabreite 1,5 (1,3 – 1,6), Sternumlänge 1,2 (1,0 – 1,2), Bein I: Fe 1,24 (0,95 – 1,40), Pt 0,75 (0,63 – 0,80), Ti 0,98 (0,92 – 1,05), Mt 0,80 (0,75 – 0,87), Ta 0,75 (0,72 – 0,78); Epigyne und Vulva Abb. 8, 9. In Tab. 1 wird das Mittelfeld der Epigyne in Anlehnung an Chyzer & Kulczynski (1897: 195, Fußnote 1), Schenkel (1925) und Lohmander (1944) als "Areola" bezeichnet.

#### VERWANDSCHAFTSBEZIEHUNGEN

Die Zugehörigkeit von *Z. zellensis* zur *Z. subterraneus*-Gruppe (Grimm, 1982) wird durch die Merkmale des ♂-Tasters bestätigt: Embolus relativ kurz, distal retrolateral entspringend, Endapparat mit Nebenarm (embolar projection) (Platnick & Shabad, 1983; Grimm, 1985). Größte Ähnlichkeit besteht zu *Z. aeneus* (Abb. 1, 2, 10 vs. 3, 4, 11), insbesondere da bei beiden Arten der Nebenarm den Rand des Cymbiums erreicht. Unterschiede zeigen sich im Detail (Abb. 5, 12 vs. 6, 13): bei *Z. aeneus* ist der Embolus kürzer, nicht so stark gewunden, der Innensaum mit unregelmäßiger Kontur, nach Job (1969) "in eine feine...Spitze ausgezogen", der Endapparat erscheint retrolateral-proximal beilförmig (Y in Abb. 6). Der Spermophor von *Z. aeneus* ist im Endapparat vor der Einmündung in den Embolus nicht blasenartig erweitert, der Konduktor ist kleiner, das Tegulum distal-medial zu einer Spitze ausgezogen ("terminal apophysis", Platnick & Shabad, 1983, TA in Abb. 3). Zudem unterscheiden sich beide Arten deutlich in ihren Dimensionen, besonders in der Länge des Cymbiums (Abb. 16, 17). *Zelotes aeneus* ist in beiden Geschlechtern die größere Art, die Variabilität ist im Gegensatz zu *Z. zellensis* beträchtlich. Die wesentlichen Unterschiede zwischen den beiden Arten sind in Tab. 1 zusammengefaßt.

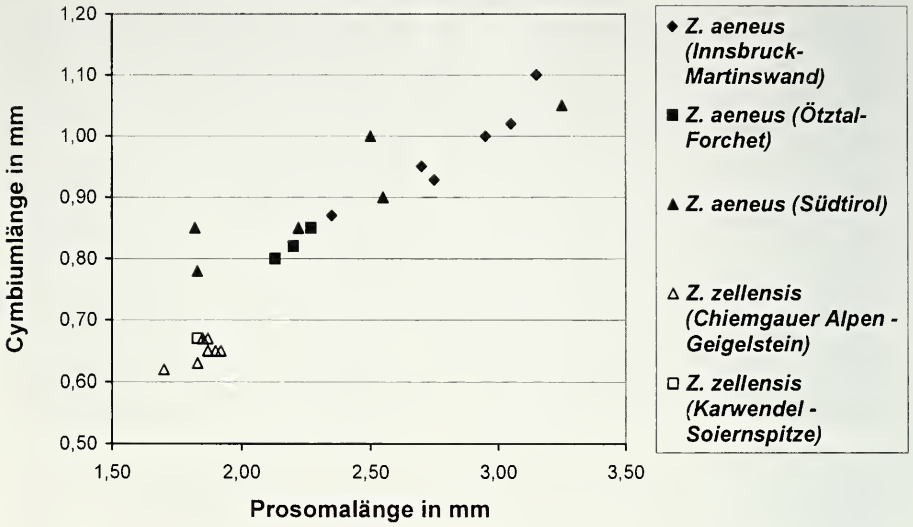


ABB. 16: Relation zwischen Cymbium- und Prosomalänge bei adulten Männchen von *Zelotes zellensis* und *Z. aeneus*.

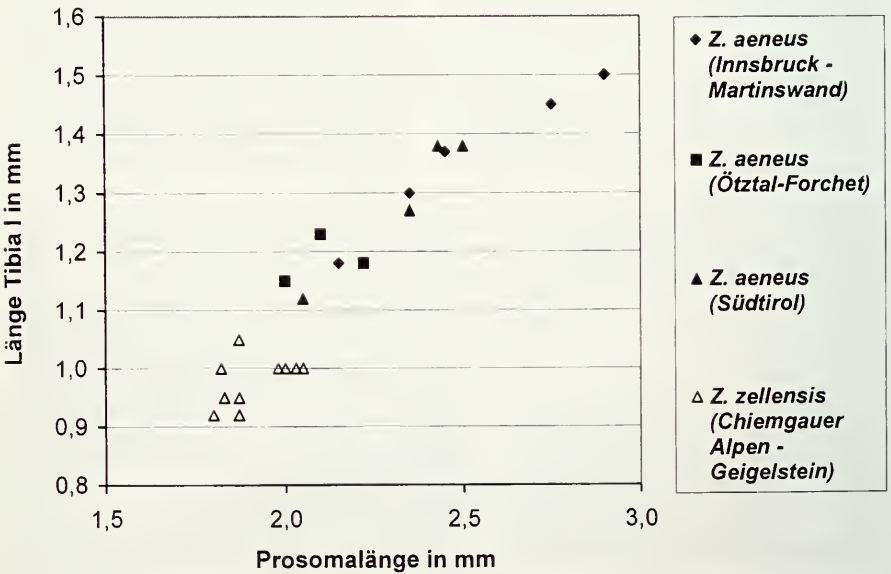


ABB. 17: Relation zwischen Länge der Tibia I und Prosomalänge bei adulten Weibchen von *Zelotes zellensis* und *Z. aeneus*.

TAB. 1: Differenzierung von *Zelotes aeneus* und *Z. zellensis*

Merkmal	<i>aeneus</i>	<i>zellensis</i>
♂: Cymbiumlänge	0,78 – 1,1 mm	0,62 – 0,67 mm
♂: Embolus	kürzer, Innensaum unregelmäßig (Abb. 6, 13)	länger, stärker gewunden, Innensaum ganzrandig (Abb. 5, 7, 12)
♂: Tegulum	distal-medial mit Spitze (TA, Abb. 3, 4)	distal-medial gerundet (Abb. 1, 2)
♂: Opisthosoma	Scutum klein (< 1/3 Abdomen-Länge)	Scutum größer (> 1/3 Abdomen-Länge)
♀: Länge Tibia I	1,1 – 1,5 mm	0,9 – 1,1 mm
♀: Epigyne	Areola fast quadratisch, Vorderecken der Epigyne weit vor der Areola (Grimm, 1985: Abb. 310)	Areola herzförmig, Vorderecken der Areola genähert (Abb. 8)
♂, ♀: Bestachelung des Metatarsus I	ventral 1 Paar	ventral meist 2 Paare
Lebensraum	Fels- und Steppenheide unter 1300 m	Geröllfelder, Felsrasen und Zwergstrauchheide der Subalpinstufe in 1400 – 1800 m
Gesamtverbreitung	Westeuropa, dispers in Mitteleuropa (Grimm, 1985: 298)	mittlere Nordalpen (Abb. 18)

## EINNISCHUNG UND VERBREITUNG

Die beiden Vergleichsarten sind geographisch und vor allem ökologisch voneinander isoliert. *Zelotes zellensis* ist anscheinend auf die subalpine Höhenstufe der Ostalpen beschränkt. *Z. aeneus* in Mitteleuropa dispers an Xerothermstandorten in Höhenlagen unter 1300 m verbreitet. Alle Individuen von *Z. zellensis* wurden an südexponierten Hängen im Bereich der Krummholzzone zwischen 1400 und 1800 m gefangen. Vorzugslebensraum sind Kalkschutthalden im Mosaik mit Legföhren und Zwergstrauchbeständen. Die höchsten Fangzahlen am Geigelstein wurden in Barberfallen erzielt, die direkt im vegetationsfreien Blockschutt installiert waren. Das Weibchen aus dem Tennengebirge stammt von einem ausgedehnten Borstgrasrasen über Werfener Schiefer.

Die Hauptaktivitätszeit von *Z. zellensis* liegt wie bei *Z. aeneus* (siehe Steinberger, 1990) in den Herbstmonaten. Adulte Individuen wurden von Juli bis Oktober gefangen, mit einem Aktivitätsmaximum im September. Bei diesen Arten fehlt somit eine Aktivitätsspitze im Frühjahr, wie sie andere in subalpinen Lebensräumen am Nordabfall der mittleren Ostalpen vorkommende *Zelotes*-Arten nach der Überwinterung aufweisen: *Z. apricorum* (L. Koch, 1876), *Z. clivicola* (L. Koch, 1870), *Z. petrensis* (C. L. Koch, 1839), *Z. similis* (Kulczynski, 1887).

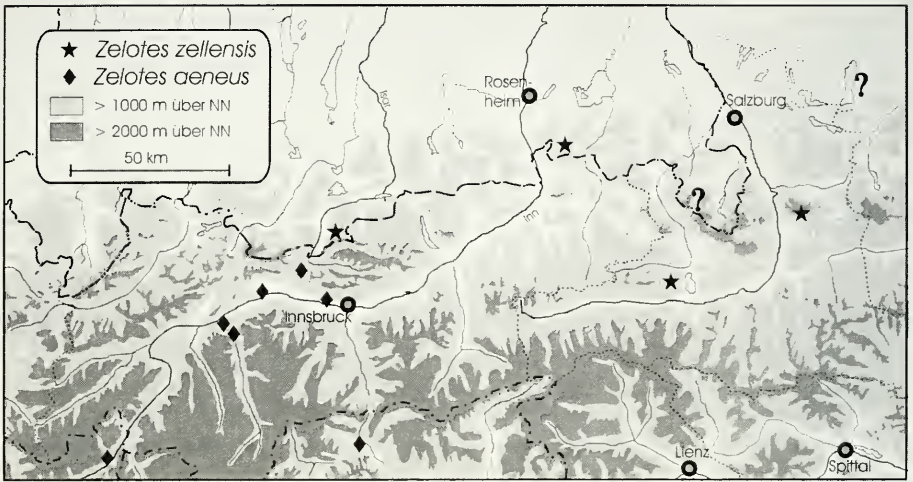


ABB. 18: Verbreitung von *Zelotes zellensis* (Gesamtareal) und *Z. aeneus* in den mittleren Ostalpen. Fundorte von *Z. aeneus* nach Noflatscher (1991), Thaler (1995, 1997). Fragezeichen markieren die vermutlichen Fundorte von *Z. zellensis* im Wimbachgries (Korge, 1977) und am Attersee (Pfeiffer, 1901).

Nach aktuellem Wissensstand ist *Z. zellensis* ein Endemit der Ostalpen. Die Art wurde bisher nur nördlich des Alpenhauptkammes gefunden, an wenigen Standorten des Alpennordrandes zwischen Isar und Tennengebirge (Abb. 18). Wir erwarten, dass sie in diesem Gebiet in ihrem Vorzugshabitat regelmäßig anzutreffen sein wird. Auch die Funde von "*Zelotes aeneus*" im Nationalpark Berchtesgaden (Korge, 1977) und in den Bayerischen Alpen (ohne nähere Angaben, Platen in Blick & Scheidler, 1991) dürften mit hoher Wahrscheinlichkeit auf *Z. zellensis* zu beziehen sein. Korge sammelte seine Exemplare ja an "Schotterflächen mit primären Schuttbesiedlern...bei noch recht geringem Bedeckungsgrad" in 1400 m Höhe. Unklar bleibt die Arealgrenze im Süden und Osten. Der Locus typicus am Ostrand der Kitzbühler Alpen ist der südlichste Fundort. In den Zentralalpen scheint die Art weitgehend zu fehlen, wie Fallenfänge in den Untersuchungsräumen Obergurgl (Puntscher, 1980) und Hohe Tauern (Thaler, 1989b; Relys, 1996) nahelegen. Auch aus den Nordostalpen ist den Verfassern keine unmittelbar auf *Z. zellensis* zu beziehende Angabe bekannt (siehe Wiehle & Franz 1954). Vielleicht hat aber schon Kulczynski (1915: 916) ein Männchen von *Z. zellensis* gesehen. Es handelt sich um das bereits von Pfeiffer (1901, sub *Prothesima setifera*) genannte Exemplar von "*Z. aeneus*" aus Oberösterreich. Der Fundort Weyeregg am Attersee liegt in der Nähe des Tennengebirges und weit vom nächsten *aeneus*-Vorkommen entfernt. Dieser Verdacht wird durch die folgende Überlegung gestützt: dieses ♂ soll sich nämlich in Details von einem von Kulczynski (1887, Abb. 63, sub *P. sarda*) aus Südtirol abgebildeten Exemplar unterscheiden. Diese Abbildung dürfte aber den "echten" *Z. aeneus* darstellen, zumindest ist die mediale Spitze des Tegulum deutlich erkennbar. An



Wärmestandorten Südtirols wurde *Z. aeneus* im Sinne der rezenten Autoren inzwischen konstant und abundant nachgewiesen (Noflatscher, 1988, 1991).

Möglicherweise kommt *Z. zellensis* auch in den Karpaten vor. Miller & Svaton (1978) bilden mit gewissem Vorbehalt ein "*Z. aeneus*" - ♂ aus der Slowakei ab, das viele Merkmale von *Z. zellensis* aufweist: Innensaum des Embolus ganzrandig. Konduktor groß. Vorderrand des Tegulum ohne Spitze. Leider ist das Exemplar in der Sammlung Miller nicht mehr vorhanden (Kürka, 1994).

Dagegen ist *Z. aeneus* eher als atlantisches Faunenelement anzusprechen, mit deutlichem Verbreitungsschwerpunkt in Westeuropa (Grimm, 1985: 298) und dispersen Vorkommen in Mitteleuropa. Die Fundorte in Nordtirol (Thaler, 1997) lassen eine Besiedlung von Südtirol aus über den Reschenpaß vermuten. Periphere Vorkommen bestehen im Raum Innsbruck und bei Seefeld (Murphy & Murphy, 1984). Weiter östlich, wie in der Steiermark (Kropf & Horak, 1996) und weiten Teilen Kärntens (Komposch & Steinberger, 1999), scheint die Art dagegen großräumig zu fehlen. Die Nennung vom Magdalensberg in Kärnten ist auf *Z. latreillei* (Simon, 1878) zu beziehen (Steinberger, 1988 und in litt.). Das kürzlich festgestellte Vorkommen am Dobratsch bei Villach (Komposch, 1997) könnte mit einem entlang des Alpensüdrandes zu vermutenden Teilareal in Verbindung stehen. Auch der Fundort bei Wiener Neustadt (Malicky, 1972) sollte aus dem Vorland erreicht worden sein.

## DANK

Wir danken Herrn Dr. H. Dastych (Hamburg) für die Ausleihe des Typusmaterials von *Z. zellensis*, Herrn Dr. K. H. Steinberger (Innsbruck) für Vergleichsmaterial von *Z. aeneus* und den Herrn K. Eller und K. Schatz (Innsbruck) für Hilfe bei den Rasteraufnahmen. Die Arbeit ist Teil des Dissertationsvorhabens von C. M. im FB Biologie der Universität Hamburg. Der Erstautor dankt für finanzielle Unterstützung der Graduiertenförderung Hamburg, dem DAAD und dem Evangelischen Studienwerk Haus Villigst e.V.

## LITERATUR

- BLICK, T. & SCHEIDLER, M. 1991. Kommentierte Artenliste der Spinnen Bayerns (Araneae). *Arachnologische Mitteilungen* 1: 27-80.
- CHYZER, C. & KULCZYNSKI, L. 1897. Araneae Hungariae. *Editio Academiae Scientiarum Hungaricae, Budapest*, Vol. 2b: 147-366, Tab. 6-10.
- GRIMM, U. 1982. Sibling species in the *Zelotes subterraneus*-group and descriptions of 3 new species of *Zelotes* from Europe (Arachnida: Araneae: Gnaphosidae). *Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg (NF)* 25: 169-183.
- GRIMM, U. 1985. Die Gnaphosidae Mitteleuropas (Arachnida: Araneae). *Abhandlungen des Naturwissenschaftlichen Vereins in Hamburg (NF)* 26: 1-318.
- HEIMER, S. & NENTWIG, W. 1991. Spinnen Mitteleuropas. *Paul Parey, Berlin und Hamburg*, 543 pp.
- JOB, W. 1969. *Zelotes aeneus*, eine in Deutschland seltene Gnaphosidae (Arachnida: Araneae: Gnaphosidae). Zur Spinnenfauna Deutschlands. VIII. *Senckenbergiana biologica* 50: 375-379.

- KOMPOSCH, Ch. 1997. The arachnid fauna of different stages of succession in the Schütt rockslip area, Dobratsch, southern Austria (Arachnida...Araneae) (pp. 139-149). In: ŽABKA, M. (ed.). *Proceedings of the 16<sup>th</sup> European Colloquium of Arachnology Siedlce*, Poland, 334 pp.
- KOMPOSCH, Ch. & STEINBERGER, K.-H. 1999. Rote Liste der Spinnen Kärntens (Arachnida: Araneae). *Naturschutz in Kärnten (Klagenfurt)* 15: 567-618.
- KORGE, H. 1977. Beiträge zur Kenntnis der Fauna des Wimbachgriestales im Naturschutzgebiet Königssee bei Berchtesgaden. *Verhandlungen des Botanischen Vereins der Provinz Brandenburg* 112: 131-159.
- KROPF, C. & HORAK, P. 1996. Die Spinnen der Steiermark (Arachnida, Araneae). *Mitteilungen des Naturwissenschaftlichen Vereins für Steiermark, Sonderheft*: 1-112.
- KULCZYNSKI, V. 1887. [Symbola ad faunam arachnoidarum Tirolensem]. *Rozprawy i sprawozdania z posiedzen wydziału matematyczno przyrodniczego Akademji umiejtnosci (Krakow)* 16: 243-356, pl. 5-8.
- KULCZYNSKI, V. 1915. Fragmenta arachnologica. 10. Araneorum species nonnullae novae aut minus cognitae. Descriptiones et adnotationes. *Bulletin international de l'Académie des sciences de Cracovie (Classe des sciences mathématiques et naturelles)* B 1914: 897-942, pl. 66.
- KŮRKA A. 1994. Přehled druhů pavouků (Araneida) ve sbírce prof. F. Millera (zoologické Přírodovědeckého muzea - Národního muzea), část I. *Časopis Národního Muzea (Praha), Řada přírodovědná* 163: 43-54.
- LOHMANDER, H. 1944. Vorläufige Spinnennotizen. *Arkiv för Zoologi (Stockholm)* 35 (A,16): 1-21.
- MALICKY, H. 1972. Spinnenfunde aus dem Burgenland und aus Niederösterreich (Araneae). *Wissenschaftliche Arbeiten aus dem Burgenland* 48: 101-108.
- MILLER, F. 1967. Studien über die Kopulationsorgane der Spinnengattungen *Zelotes*, *Micaria*, *Robertus* und *Dipoena* nebst Beschreibung einiger neuen oder unvollkommen bekannten Spinnenarten. *Acta scientiarum naturalium Academiae bohemoslovacae Brno* 1: 251-296, Tab. 1-14.
- MILLER, F. & SVATON, J. 1978. Einige seltene und bisher unbekannte Spinnenarten aus der Slowakei. *Annotationes Zoologicae et Botanicae (Bratislava)* 126: 1-19.
- MURPHY, J. & MURPHY, F. 1984. An English collection of Tyrolean spiders (Arachnida: Aranei). *Berichte des naturwissenschaftlich-medizinischen Vereins in Innsbruck* 71: 83-96.
- NOFLATSCHER, M. T. 1988. Ein Beitrag zur Spinnenfauna Südtirols: Epigäische Spinnen an Xerotherm- und Kulturstandorten bei Albeins (Arachnida: Aranei). *Berichte des naturwissenschaftlich-medizinischen Vereins in Innsbruck* 75: 147-170.
- NOFLATSCHER, M. T. 1991. Beiträge zur Spinnenfauna Südtirols. 3: Epigäische Spinnen an Xerotherm-Standorten am Mitterberg, bei Neustift und Sterzing (Arachnida: Aranei). *Berichte des naturwissenschaftlich-medizinischen Vereins in Innsbruck* 78: 79-92.
- OVTSHARENKO, V. I., PLATNICK, N. I. & SONG, D. X. 1992. A review of the North Asian ground spiders of the genus *Gnaphosa* (Araneae, Gnaphosidae). *Bulletin of the American Museum of Natural History* 212: 1-88.
- PFEIFFER, A. 1901: [Oberösterreichische Spinnentiere]. *Programm des k. k. Obergymnasiums der Benediktiner zu Kremsmünster* 1901: 17-18.
- PLATNICK, N. I. 1989. Advances in spider taxonomy 1981-1987. A supplement to Brignolis A catalogue of the Araneae described between 1940 and 1981. *Manchester University Press, Manchester, New York*, 673 pp.
- PLATNICK, N. I. 1993. Advances in spider taxonomy 1988-1991. With synonymies and transfers 1940-1980. *New York Entomological Society and American Museum of Natural History, New York*, 846 pp.

- PLATNICK, N. I. & SHADAB, M. U. 1983. A revision of the American spiders of the genus *Zelotes* (Araneae, Gnaphosidae). *Bulletin of the American Museum of Natural History* 174: 97-191.
- PUNTSCHER, S. 1980. Ökologische Untersuchungen an Wirbellosen des zentralalpiner Hochgebirges (Obergurgl, Tirol). 5. Verteilung und Jahresrhythmik von Spinnen. *Veröffentlichungen der Universität Innsbruck* 129 (*Alpin-Biologische Studien* 14): 1-106.
- RELYS, V. 1996. Eine vergleichende Untersuchung der Struktur und Lebensraumbindung epigäischer Spinnengemeinschaften (Arachnida, Araneae) des Gasteinertales (Hohe Tauern, Salzburg, Österreich). *Dissertation, Salzburg*, 282 pp.
- SCHENKEL, E. 1925. Beitrag zur Kenntnis der Schweizerischen Spinnenfauna. *Revue suisse de Zoologie* 32: 253-318.
- STEINBERGER, K.-H. 1988. Epigäische Spinnen an "xerothermen" Standorten in Kärnten (Arachnida: Aranei). *Carinthia* II 178/98: 503-514.
- STEINBERGER, K.-H. 1990. Phenology and Habitat-selection of "xerothermic" spiders in Austria (Lycosidae, Gnaphosidae). *Bulletin de la Société européenne d'Arachnologie (Paris)*, Vol. h. s. 1: 325-333.
- THALER, K. 1989a. Das Männchen von *Zelotes devotus* Grimm (Arachnida: Araneae, Gnaphosidae). *Mitteilungen der schweizerischen entomologischen Gesellschaft* 62: 363-366.
- THALER, K. 1989b. Epigäische Spinnen und Weberknechte (Arachnida: Aranei, Opiliones) im Bereich des Höhentransektes Glocknerstrasse-Südabschnitt (Kärnten, Österreich). *Veröffentlichungen des österreichischen MaB-Programms* 13: 201-215.
- THALER, K. 1995. Spinnen (Araneida) mit Anhang über Weberknechte (Opiliones). Ökologische Untersuchungen im Unterengadin. *Ergebnisse der wissenschaftlichen Untersuchungen im Schweizerischen Nationalpark* 12: 473-538.
- THALER, K. 1997. Beiträge zur Spinnenfauna von Nordtirol. 3: "Lycosaeformia" (Agelenidae, Hahniidae, Argyronetidae, Pisauridae, Oxyopidae, Lycosidae) und Gnaphosidae (Arachnida: Araneae). *Veröffentlichungen des Tiroler Landesmuseums Ferdinandeum (Innsbruck)* 75/76: 97-146.
- WIEHLE, H. & FRANZ, H. 1954. 20. Ordnung: Araneae (pp. 473-557). In: FRANZ, H. Die Nordostalpen im Spiegel ihrer Landtierwelt. Bd. 1. *Wagner, Innsbruck*, 664 pp.



## Note sur les musaraignes (Soricidae, Mammalia) du Parc National du Souss-Massa, Maroc

Peter VOGEL<sup>1</sup>, Mark LAWRENCE<sup>2</sup> & Ali AGHNAJ<sup>3</sup>

<sup>1</sup> Institut d'écologie, Université de Lausanne, CH-1015 Lausanne, Suisse.

<sup>2</sup> International Foundation for Conservation and Development of Wildlife, B.P. 116, Inezgane, Maroc (current address: National Avian Research Center, P.O. Box 45553, Abu Dhabi, UAE).

<sup>3</sup> Direction du Parc National Souss-Massa, B.P. 107, Inezgane, Maroc.

**Shrews (Soricidae, Mammalia) of the National Park Souss-Massa, Morocco.** - With 420 trap-nights we sampled shrews in different habitats of the Souss-Massa National Park. *Crocidura viaria* (n=11) was found in 5 habitats (cultivated land, wetland, beach dunes with *Chenopodia*, sand dunes with patchy vegetation and also in the *Euphorbia* association). No shrews were captured in *Eucalyptus* forest with undergrowth. Southward from Essaouira, *C. viaria* is obviously the most frequent species in dense or patchy lowland vegetation. Two other species (*C. whitakeri* and *C. tarfayaensis*) which occur in sympatry in the Agadir region were not captured. They live probably not in syntopy with *C. viaria* and their ecological requirements remain to be studied.

**Key-words:** Soricidae - *Crocidura viaria* - shrews - Souss-Massa National Park.

### INTRODUCTION

Le Parc National du Souss-Massa (PNSM), fondé en 1991, a pour but principal de protéger la plus grande population d'Ibis chauve (*Geronticus eremita*). Elle compte entre 250 et 300 individus, représentant plus des deux tiers de la population mondiale (Brindley *et al.*, 1995). Au vu d'une espèce aussi menacée, la protection de cette région se justifie largement. Compte tenu de la richesse ornithologique rencontrée aux embouchures des rivières Souss et Massa, de la diversité des milieux rencontrés dans ce parc (Anonyme, rapport des Eaux et Forêts) et la diversité faunistique due à la rencontre d'éléments paléarctiques et afrotropicaux (Benhamza, 1995), cette région mérite d'être mieux connue sur le plan scientifique.

Concernant les mammifères, Aulagnier & Thévenot (1986a) ont publié un aperçu basé sur une collection étendue de données diverses. Une étude plus ciblée sur les musaraignes de la région du Oued Massa par Aulagnier & Hermas (1989) a été basée essentiellement sur l'analyse de pelotes de déjection de rapaces nocturnes.

mettant en évidence la présence de trois espèces à fréquence pratiquement égale (*Crocidura viaria*, *C. whitakeri* et *C. tarfayaensis*) et d'une espèce très rare (*Crocidura lusitania*). Plus récemment, Benhamza (1995) a repris le sujet de la faune mammalienne du PNSM, réunissant une vaste base de données par observations directes, analyse de traces, de fèces, de parties squelettiques et en ce qui concerne les micromammifères, par piégeages effectués sur une période de deux ans. Si ce travail a permis de mieux cerner les exigences écologiques de certaines espèces (Carnivores, Ongulés, Rongeurs), le résultat concernant les Soricidae est étonnant: sur 58 micromammifères capturés par trappes, aucune musaraigne n'y a été prise. Ces données divergentes obtenues par des méthodes peu comparables nous ont incité à rechercher une explication.

En 1986, l'un de nous a eu l'occasion de faire un essai de piégeage dans un champ cultivé de Sidi R'bat ayant comme résultat la capture de 5 musaraignes (Vogel *et al.*, 1988). Ceci a donné l'idée d'appliquer la même technique pour vérifier l'hypothèse d'une régression éventuelle, évaluer la situation actuelle de ces insectivores et comparer les peuplements des musaraignes des différents milieux du parc.

## MATÉRIEL ET MÉTHODES

Les milieux typiques du parc sont, selon Benhamza (1995), au nombre de 7, soit les dunes fixées (I), dunes non fixées (II), milieu steppique (III), reboisement à *Eucalyptus* (IV), formation à Euphorbes cactoïdes (V), cultures (VI), zones humides à végétation spécialisées (VII). Tous ces milieux ont été prospectés, sauf le milieu steppique, la végétations semblait trop faible pour convenir aux musaraignes. En ce qui concerne le milieu cultivé, nous nous référons à Vogel *et al.* (1988).

Après l'inspection d'un milieu, une ou deux lignes de 30 trappes Longworth® (Penlon, Abingdon, GB) ont été posées, explorant ainsi des sous-unités du même biotope. L'espacement moyen des trappes était d'environ 7 m (3 à 15 m), l'emplacement ayant été si possible choisi sous un strate de végétation dense pour maximiser la capture des musaraignes. Les piégeages, totalisant 420 pièges-nuits, ont eu lieu en juillet/août 1998.

Les trappes, dont la boîte de nid est garnie de foin pour absorber l'urine, ont été appâtées de viande ou de sardines, de flocons d'avoine, de graines de tournesol et d'un raisin.

Les individus capturés ont été pesés et mesurés sans anesthésie et relâchés sur place. Une analyse plus poussée était prévue en cas de problème de détermination. Celle-ci s'est basée sur les travaux d'Aulagner & Thévenot (1986b), Benhamza (1995) et l'expérience personnelle (Vogel & Maddalena, 1987; Vogel *et al.*, 1988).

## RÉSULTATS

Au total, 19 micromammifères ont été capturés, soit 11 musaraignes et 8 rongeurs. Ceci suggère que dans les milieux prospectés, la faune des micromammifères semble être dominée par les musaraignes et non pas par les rongeurs. Toutes les musaraignes appartenaient à la même espèce *Crociura viaria* (Fig. 1).

TABLEAU I

Répartition des 19 micromammifères capturés dans le Parc National Souss- Massa en fonction du milieu, avec indication du nombre de trappes-nuits (T-N). \* = captures de 1986.

Habitat	T-N	<i>Crocidura viaria</i>	<i>Mus spretus</i>	<i>Mastomys erythroleucus</i>	<i>Gerbillus campestris</i>	<i>Gerbillus hoogstraali</i>
Dunes à végétation (I)	120	1			1	
Dunes à Chenop. (II)	120	2				5
Steppe (II)	-					
Forêt à Eucalyptus (IV)	30					
Euphorbes cactoïdes (V)	60	2				
Champs cultivés* (VI)	60	5	2			
Zone humide (VII)	90	6	1	1		

Les captures, regroupées en fonction du milieu, sont résumées au Tableau 1. Il s'en suit que le milieu le plus riche en musaraignes (6 individus sur 90 trappes-nuits) correspond à la végétation du lit du ruisseau (Fig. 2), dominé par les plantes halophiles (*Salicornia* sp.), des juncs (*Juncus acutus*) et des Tamarisques (*Tamarix gallica*). Dans les autres milieux, le taux de captures était plus faible avec environ 2 musaraignes sur 60 trappes. En ce qui concerne les dunes, tout dépend de la couverture du sol: dans les dunes les plus proches de la mer et isolées, avec couverture de *Chenopodium murale*, aucune musaraigne n'a été capturée. C'est en fait l'habitat typique de *Gerbillus hoogstraali*. Ceci n'est pas seulement démontré par les captures assez nombreuses de cette espèce, mais encore par les quantités importantes de traces en forme de cercle autour de la dune et rayonnant entre les dunes. Néanmoins, dans une parcelle de *Chenopodium* très étendue d'environ 30 m de long en bordure des dunes fixes (Fig. 3), un couple de *C. viaria* a été capturé. Dans les dunes partiellement boisées (*Acacia cyanophylla*), cette musaraigne était également présente. Mais dans ce type de milieu, elle n'a jamais été prise dans les reboisements à *Eucalyptus*. Dans des dunes stabilisées et une forêt d'*Eucalyptus* avec sous-bois longeant l'embouchure de l'Oued Souss, aucun micromammifère n'a été pris. Finalement, les lignes posées dans un milieu à Euphorbes cactoïdes sur un sol rocheux au-dessus de Sidi R'bat (Fig. 4) ont mis en évidence la présence de *C. viaria* (2 individus sur 60 trappes). Rappelons que les cultures ont permis en juillet 1986 un taux de captures élevé.



FIG. 1

*Crocidura viaria*, mâle adulte. La queue de cette espèce est visiblement un lieu de stockage de graisse.



FIG. 2

Milieu humide, occasionnellement inondé, vers l'embouchure de la rivière Massa. Il s'agit d'un biotope particulièrement riche.





FIG. 3

Dunes à *Chenopodium murale* à Sidi R'bat, lieu de capture d'un couple de *C. viaria*.



FIG. 4

Milieu à Euphorbes cactoïdes.

## DISCUSSION

La systématique des musaraignes du Maroc a posé quelques problèmes, notamment à la suite du travail de Vesmanis & Vesmanis (1979). Celui-ci, basé sur le matériel de la Smithsonian Institution, faisait miroiter l'existence de 13 espèces du genre *Crocidura*. Hutterer (1986) ne retenait que 5 espèces valides, interprétation confirmée par Aulagnier & Thévenot (1986b). Quatre de ces espèces vivent dans la région d'Agadir (Aulagnier & Hermas, 1989). La plus grande espèce, décrite à l'origine sous le nom de *Crocidura bolivari* Morales Agacino, 1934, présente une formule chromosomique qui les rapproche aux crocidures géantes (*Crocidura olivieri*) d'Afrique tropicale (Vogel *et al.*, 1988). Selon l'analyse morphologique de Hutterer (1986), *C. bolivari* est synonyme de *C. viaria* (I. Geoffroy Saint-Hilaire, 1834). Cette interprétation a été confirmée par Maddalena (1990) qui n'a pas trouvé des différences alléliques importantes par rapport à des populations de *C. viaria* situées au sud du Sahara (Burkina Faso).

Si les unités spécifiques sont actuellement établies avec une assez grande certitude, deux problèmes importants restent à résoudre. Le premier concerne l'origine phylogénétique de deux espèces mal connues: *C. whitakeri* et *C. tarfayaensis*. Le deuxième concerne les connaissances écologiques de toutes ces espèces. Nos résultats aident à mieux comprendre l'écologie de *C. viaria*, seule espèce capturée.

Un point intéressant concerne le rapport numérique entre musaraignes et rongeurs. Notre première tentative de capture en 1986 a révélé la présence de *C. viaria* dans des terrains cultivés du village Sidi R'bat (Vogel *et al.*, 1988). L'absence de captures de musaraignes par Benhamza (1995) dans le périmètre du parc laissait penser soit à un recul de ce groupe dû à l'utilisation de pesticides dans les terrains cultivés, soit à un effet provoqué par des changements climatiques. Les résultats présentés ici suggèrent une autre explication, soit celle d'un biais dû aux trappes utilisées. Les trappes Longworth sont connues pour leur efficacité pour capturer les micromammifères de petite taille. L'entrée de 4,5 x 4 cm du tunnel d'accès est attirant pour les musaraignes et le système de déclenchement est très sensible s'il est muni d'une rampe. Même *Suncus etruscus* avec 1,8 g peut déclencher le mécanisme, mais une fois prise, cette musaraigne minuscule arrive à s'échapper par le trou de passage du ressort. En revanche, ce système avec boîte de nid métallique totalement fermée est moins attrayant pour les rongeurs désertiques et ne permet pas de capturer d'animaux dépassant 80 g. Les trappes-cages grillagées de Manufrance utilisées par Benhamza (1995) semblent plus attractives pour les grands rongeurs, mais inefficaces pour les plus petites espèces: le déclenchement se fait par traction sur l'appât et le grillage d'une maille de 2 x 1 cm laisse passer toutes les espèces de musaraignes, expliquant le résultat négatif avec ce type de trappe.

Concernant les exigences écologiques de *C. viaria*, cette espèce se trouve dans la région du parc dans presque tous les milieux, à condition que la végétation soit assez dense pour lui procurer une protection contre les prédateurs. Le milieu à végétation d'halophytes semble être son terrain de prédilection, mais des terres agricoles à couverture dense comme un champ de luzerne conviennent également. La couverture à elle

seule n'est pas suffisante puisque dans la forêt d'*Eucalyptus* avec sous-bois, aucune prise n'a été faite. Ce milieu particulier semble inhospitalier, étant donné qu'il n'héberge pas une riche faune d'invertébrés. Il n'est pas étonnant que les musaraignes soient quasiment absentes des dunes dont la couverture est très clairsemée. Ce milieu peut se présenter plus favorablement lors d'une année de pullulation de rongeurs; leurs galeries nombreuses peuvent alors être exploitées par les musaraignes. La présence de *C. viaria* dans le milieu à Euphorbes cactéoïdes était plutôt inattendue, puisque la végétation se présente sous forme de touffes discontinues. Mais ce même milieu héberge selon Benhamza (1995) une population d'*Elephantulus rozeti*, un autre micro-mammifère à régime insectivore. Ce dernier étant caractérisé par un rythme d'activité diurne (Seguignes, 1983), il éviterait une éventuelle compétition avec *C. viaria* qui est strictement nocturne (Tettamanti, 1997).

La question se pose sur la valeur d'un sondage sur une période si courte. Malgré un taux de capture relativement faible (4.5% des trappes occupées), le total de nos captures correspond à un tiers des prises effectuées par Benhamza (1995) en deux ans. La représentativité relativement bonne de notre campagne est confirmée par l'échantillon des rongeurs. Malgré le petit nombre d'individus, il correspond assez bien aux résultats de Benhamza (1995) pour les espèces de petite taille (présence de *Gerbillus hoogstraali*, *G. campestris*, *Mastomys erythroleucus* et *Mus spretus*), qui ont été trouvés dans les milieux correspondant à leur préférence écologique (Tab. 1).

Face à la richesse spécifique des rongeurs sur un échantillon de seulement huit individus, l'uniformité monospécifique pour les musaraignes est étonnante. Les données obtenues par l'analyse de pelotes de la région (Aulagnier & Hermas, 1989) ne montrent qu'une légère dominance de *C. viaria*. Or, ce travail n'a pas séparée les données selon leur origine. Une comparaison du nombre minimal d'individus provenant des deux villages de l'embouchure de l'Oued Massa (Sidi R'bat et Sidi Ouassay) avec les individus provenant du barrage Youssef ben Tachine, localité à 30 km en amont du PNSM et située dans les montagnes, est très intéressante (S. Aulagnier, comm. pers.) : sur les 19 Crocidures provenant de la côte *C. viaria* domine avec 63%, suivie de *C. tarfayaensis* avec 21% et *C. whitakeri* avec 16%. Au barrage en revanche, sur les 26 Crocidures (non incluses deux *C. lusitania*), *C. tarfayaensis* dominait avec 43%, suivie de *C. viaria* avec 31% et *C. whitakeri* avec 27%. Les deux petites espèces semblent dès lors plutôt exploiter des régions plus sèches et rocailleuses. Si les données bibliographiques s'accordent pour définir l'exigence écologique de *C. tarfayaensis* en l'associant à un milieu rocheux (Aulagnier & Thévenot, 1986; Hutterer, 1986), la situation est moins claire pour *C. whitakeri*. Selon Heim de Balsac (1968) et Rzebik-Kowalska (1988), elle vivrait aussi en milieu rocheux, mais selon d'autres, elle serait associée aux dunes, comme le suggère l'échantillon retiré de pelotes analysées par Hutterer (1986) en provenance de Moulay Bousseham (93 *C. whitakeri*, 48 *C. russula*). Concernant l'oued Massa, cette espèce a été en effet capturée une fois dans les mêmes dunes fixées où notre effort est resté infructueux. Il s'agit d'une femelle portante (Fig. 5), capturée le 4.10.1989 (M. Ruedi, comm. pers.).

En guise de conclusion, dans la région du sud marocain, y compris d'Essaouira à Sidi Ifni (P. Vogel obs. pers.), *C. viaria*, dont l'origine est afrotropicale, est une musa-



FIG. 5

Musaraigne capturée, photographiée et déterminée comme *C. whittakeri* par M. Ruedi. Il s'agit d'une femelle capturée à Sidi R'bat qui a donné naissance à deux petits, avant de s'évader. Il semble que ce soit le seul individu vivant photographié. Le blanc du ventre et du dessus des pattes ainsi que le pelage grivelé sont des critères distinctifs (Aulagnier & Thévenot, 1986a). En revanche, la queue en réalité courte (27 à 39 mm pour une longueur de tête et corps de 53 à 64 mm) apparaît sur cette photo plutôt longue.

raigne omniprésente dans tous les milieux à végétation dense (oueds et milieux cultivés). Toutefois, sa répartition est limitée aux basses altitudes. Plus au nord, en tous cas de Casablanca à Tanger, elle est remplacée par *C. russula*, d'origine paléarctique. Cette dernière supporte mieux le froid (Sparti, 1990). Comme montré ailleurs (Vogel & Maddalena, 1987), *C. russula* vit depuis les milieux halophiles en bordure d'estuaires (Mulay Bousseham) jusqu'à 2'800 m dans le Haut Atlas (Oukaimeden).

Remarquons que ce sondage n'a pas permis de préciser l'écologie de *C. whittakeri* et de *C. tarfayaensis* qui, selon les analyses de pelotes, existent dans le périmètre du PNSM. Malheureusement, la chouette chevêche (*Athene noctua*) que nous avons rencontrée à plusieurs reprises semble spécialisée dans la chasse aux insectes et aux reptiles (obs. pers.), les micromammifères ne jouant qu'un rôle secondaire dans leur régime. La chouette effraie (*Tyto alba*) a en revanche un régime alimentaire représentant mieux la faune des petits mammifères. Selon le faible nombre de pelotes à disposition de Benhamza (1995), ce rapace nocturne semble très rare. L'installation de nichoirs pour la chouette effraie à des endroits bien protégés de toute perturbation pourrait fournir un matériel d'étude à long terme. Ceci serait non seulement intéressant sur un plan scientifique, mais également sur un plan didactique, soit pour l'instruction des élèves, étudiants et touristes qui visitent le nouveau centre d'accueil placé au cœur du parc.

## REMERCIEMENTS

Nous remercions M. Mohamed Ribi, Directeur du Parc, pour nous avoir associé au programme de recherche du PNSM, ainsi que M. Paul McCormick, Directeur de la IFCDW, pour le soutien concernant cette étude. S. Aulagnier a mis à disposition des données non publiées et M. Ruedi sa prise de vue unique de *C. whitakeri*.

## BIBLIOGRAPHIE

- Anonyme. Parc National de Souss-Massa, Plan d'aménagement et de gestion. Administration des Eaux et Forêts et de la conservation des sols. Pp. 11-22.
- AULAGNIER, S. & THÉVENOT, M. 1986a. Note sur les Mammifères de la région de l'embouchure de l'Oued Massa. *Bulletin de l'Institut Scientifique, Université Mohammed V, Rabat* 10: 193-199.
- AULAGNIER, S. & THÉVENOT, M. 1986b. Catalogue des Mammifères sauvages du Maroc.- *Travaux de l'Institut scientifique chérifien publiés par la Société des Sciences naturelles du Maroc, Série zoologie* 41: 1-164.
- AULAGNIER, S. & HERMAS, J. 1989. Etude biométrique des Crocidures (Soricidae, Insectivora) de la région de Massa (Souss, Maroc). *Doñana, Acta Vertebrata* 16: 89-104.
- BENHAMZA, J. 1995. Mammifères du Parc National du Souss-Massa (Agadir) : Composition et répartition cartographiée. *Thèse, Université Ibnou Zohr, Agadir*, 144 pp.
- BRINDLEY, E., DIMMICK, C., BOXDEN, C., RIBI, M., HOFFMANN, D. & DEL NEVO, A. 1995. The bald Ibis: a species on the brink? *RSPB Conservation Review* 9: 76-79.
- HEIM DE BALSAC, H. 1968. Les Soricidae dans le milieu désertique saharien. *Bonner Zoologische Beiträge* 3/4: 181-188.
- HUTTERER, R. 1986. The species of *Crociodura* (Soricidae) in Morocco. *Mammalia* 50: 521-534.
- MADDALENA, T. 1990. Systématique, évolution et biogéographie des Musaraignes Afrotropicales et Paléarctiques de la sous-famille des Crocidurinae: une approche génétique. *Thèse de doctorat, Université de Lausanne*, 172 pp.
- RZEBIK-KOWALSKA, B. 1988. Studies on the genus *Crociodura* (Insectivora, Mammalia) in Algeria. *Acta Zoologica Cracoviensia* 31: 167-192.
- SEGUIGNES, M. 1983. La torpeur chez *Elephantulus rozeti* (Insectivora, Macroscelididae). *Mammalia* 47: 87-91.
- SPARTI, A. 1990. Comparative temperature regulation of African and European shrews. *Comparative Biochemistry and Physiology, Part A, Comparative physiology* 97: 391-397.
- TETTAMANTI, C. 1997. Etude de la température corporelle chez trois musaraignes du genre *Crociodura* (Insectivora, Mammalia). *Travail de diplôme, Université de Lausanne*.
- VESMANIS, I.E. & VESMANIS, A. 1979. Beitrag zur Kenntnis der Crociduren-Fauna Marokkos (Mammalia Insectivora, Soricidae). 1. Die Wimperspitzmäuse aus der Sammlung der Smithsonian Institution. *Zoologische Abhandlungen* 36/23: 11-80.
- VOGEL, P. & MADDALENA, T. 1987. Note sur la répartition altitudinale et la fréquence de la Musaraigne musette (*Crociodura russula yebalensis*) au Maroc. *Mammalia* 51: 465-467.
- VOGEL, P., MADDALENA, T. & AULAGNIER, S. 1988. Le caryotype de *Crociodura bolivari* Morales Agacino, 1934 (Mammalia, Soricidae). *Revue suisse de Zoologie* 95: 779-783.



## A review of the Scaphidiinae (Coleoptera: Staphylinidae) of the People's Republic of China, II

Ivan LÖBL

Muséum d'histoire naturelle, case postale 6434, CH-1211 Genève 6, Switzerland.

**A review of the Scaphidiinae (Coleoptera: Staphylinidae) of the People's Republic of China, II.** - The present paper is the second part of a review of the scaphidiines of the People's Republic of China. It treats the members of *Scaphisoma* Leach, which is the most speciose genus of the subfamily. Within the collections examined 54 species are recognized, from which the following 30 are described as new: *S. inversum*, *S. emeicum*, *S. serosum*, *S. subtile*, *S. aciculare*, *S. latro*, *S. signum*, *S. wolong*, *S. styloides*, *S. apertum*, *S. pseudantennatum*, *S. oppositum*, *S. acclivum*, *S. linum*, *S. serpens*, *S. parasolutum*, *S. pseudosolutum*, *S. vexator*, *S. pseudovarium*, *S. heishuense*, *S. paravarium*, *S. fibrosun*, *S. incisum*, *S. migrator*, *S. mutator*, *S. suspiciosum*, *S. irruptum*, *S. volitatum*, *S. vestigator*, and *S. dumosum*. *Scaphisoma lautum* Löbl and *Scaphisoma sinense* Pic are placed in synonymy of *Scaphisoma haemorrhoidale* Reitter. A key to the species of *Scaphisoma* of the People's Republic of China is provided.

**Key-words:** Coleoptera - Staphylinidae - Scaphidiinae - China - systematics.

### INTRODUCTION

Scaphidiinae are mycophagous beetles feeding on a variety of fungi (e. g., Nuss, 1975; Lawrence & Newton, 1980; Newton, 1984). They are common on Polyporaceae, but also feed and develop on Hydnaceae, Clavariaceae, Agaricales, Heterobasidiomycetes, and slime moulds. They tunnel in carps and gills of the gilled and other mushrooms, build characteristic retreats and produce silk-lined pupal chambers (Ashe, 1984; Leschen, 1988 and 1994; Hanley, 1996). Scaphidiines are usually associated with dead wood or other decaying vegetational matter. Many species are cryptic but may be easily found in sieved forest litter. Their highest diversity is in moist, warm temperate, subtropical, and tropical forested areas. Such habitats have been largely destroyed in mainland China (see Jäch & Li, 1995), or are difficult to survey. Nevertheless, substantial new collections of scaphidiines were gathered in the course of the past decade. I have recorded 78 species in 12 genera in the first part of my review of the scaphidiines of the People's Republic of China (Löbl, 1999). Most of these species were recorded for the first time from China, and

18 were new to science. The present study treats *Scaphisoma* Leach which is the most speciose genus of the subfamily. At present 54 species are recognized, 30 of which are new and described below. The total number of scaphidiines is raised from 31 species described or recorded from mainland China prior to my 1999 paper, to 122 species. Yet it is difficult to estimate how far this number is representative and to extrapolate data pertaining to species diversity of scaphidiines of China. While members of almost all genera likely to occur in the country have been found, numerous additional species in most genera may be expected. The poor knowledge of the Chinese scaphidiines may be illustrated by the two records (each for one species) from the Northeastern Region of China, whereas from the neighboring Russian Far East 19 species are known (Löbl, 1993). No scaphidiines are recorded from Inner Mongolia, Tibet, and the Northwestern areas of China although at least two common species may be expected to occur there: *Scaphisoma inopinatum* Löbl which is distributed throughout large parts of the Eurasian continent and known from Mongolia and the Russian Far East (Löbl, 1970), and *Scaphium quadraticolle* Solsky, widely distributed in Central Asia, northern Pakistan and Kashmir included. Curiously, scaphidiines are unknown from Hainan and only two are from Guangdong, while at least 11 species occur in Hong Kong. Most material comes from Yunnan (72 species in total, 32 of them *Scaphisoma*) and Sichuan (with 33 species, 13 of them *Scaphisoma*), where the highest number of presumed narrow endemics also occur. Seven species are known from Fujian, all from a collection made in 1946 at «Kuatun» (= Guadun Village, Wuyi Shan, North Fujian; see Smetana, 1996); from other provinces usually less than 5 species are represented in the material studied. An other notable feature of the Chinese *Scaphisoma* is the relatively high number of species of the Palaearctic *S. subalpinum* and the Oriental *S. rouyeri* groups, and the low number of species of the Oriental *S. unicolor* group.

#### MATERIAL AND METHODS

Reference is made only to material coming from the People's Republic of China, referred below as to China. Most is from recent collections and housed in the Muséum d'histoire naturelle, Geneva (MHNG). Other collections which include specimens used in the present study are:

MNHN	Muséum National d'Histoire Naturelle, Paris
MMUE	The Manchester Museum, Manchester
NHMB	Naturhistorisches Museum, Basel
NMPC	National Museum, Praha
PCAP	Private collection A. Pütz, Eisenhüttenstadt
PCMS	Private collection M. Schülke, Berlin
SMNS	Staatliches Museum für Naturkunde, Stuttgart
SNMB	Slovak National Museum, Bratislava
ZMB	Zoologisches Museum, Berlin

The methods are as given in my preceding publications: the length of the body is measured from the anterior pronotal margin to the inner apical angle of the elytra;



the lateral keels of the pronotum and elytra, and the plane of the inner and outer apical angles of the elytra is observed in dorsal view. The presence, but not the absence, of the antecoxal puncture row of the metasternum is quoted. The length ratio of the antennal segments is measured from dry specimens, at high (100 to 200x) magnification. This ratio is not given in species of the *S. haemorrhoidale* group in which it does not provide diagnostic characters. The genitalia of all males were dissected and mounted in Canada balsam on slides. The length of the aedeagi is taken from genitalia mounted on slides.

The previously described species are listed alphabetically, the new species are ranged according to their relationships.

Nevertheless, some males and numerous females from various collections could not be assigned to any defined species.

#### KEY TO THE SCAPHISOMA OF CHINA

- 1 Elytra each with sutural stria extended along base to form basal stria . . . . . 2
- Elytra without basal striae . . . . . 18
- 2 Elytra with basal striae entire, joined to lateral striae . . . . . 3
- Elytra with basal striae extending to midwidth of base, or to humeral area, not joined to lateral striae . . . . . 5
- 3 Elytra each with dark discal spot . . . . . *notatum* Löbl
- Elytra lacking discal spot . . . . . 4
- 4 Antennal segment 5 much shorter than segments 3 and 4 combined . . . . . *styloides* sp. n.
- Antennal segment 5 about as long as segments 3 and 4 combined. *serpens* sp. n.
- 5 Antennal segment 5 much longer than segments 3 and 4 combined . . . . . 6
- Antennal segment 5 about as long as, or distinctly shorter than, segments 3 and 4 combined . . . . . 7
- 6 Antennal segment 5 about 3 times as long as segment 4 . . . *pseudorufum* Löbl
- Antennal segment 5 twice as long as segment 4 . . . . . *serosum* sp. n.
- 7 Metacoxal line parallel . . . . . 8
- Metacoxal line arcuate or subangulate . . . . . 9
- 8 Antennal segments 5 and 6 equally long . . . . . *aciculare* sp. n.
- Antennal segment 5 much shorter than segment 6 . . . . . *uniforme* Löbl
- 9 Antennal segment 6 longer than segments 4 and 5 combined . . . . . 10
- Antennal segment 6 shorter than segments 4 and 5 combined . . . . . 12
- 10 Aedeagus gradually narrowed apically, basal bulb much shorter than distal process; flagellum robust, angulate in basal portion (Fig. 27) . . . . . *oppositum* sp.n.
- Aedeagus abruptly narrowed apically, basal bulb much longer than distal process; flagellum not angulate . . . . . 11
- 11 Aedeagal apex truncate, flagellum very thin (Fig. 25) . *pseudantennatum* sp. n.
- Aedeagal apex hook-like, flagellum robust (Figs 29, 30) . . . . . *acclivum* sp. n.
- 12 Abdomen with microsculpture consisting of transverse striae . . . *latro* sp. n.

- Abdomen lacking microsculpture, or with punctulate microsculpture . . . . . 13
- 13 Mesocoxal line subparallel . . . . . 14
- Mesocoxal line arcuate or subangulate . . . . . 15
- 14 Punctuation on mediobasal portion of first abdominal sternite much more coarse and dense than that on apical or lateral portions of same sternite. Internal sac of aedeagus lacking spinose or squamose structures . *subtile* sp. n.
- Punctuation of first abdominal sternite entirely very fine and sparse. Internal sac of aedeagus with spinose structures (Fig. 23) . . . . . *apertum* sp. n.
- 15 Large species, body 2.1 to 2.3 mm long. Internal sac of aedeagus with flagellum . . . . . *linum* sp. n.
- Small species, body 1.2 to 1.7 mm long. Internal sac of aedeagus with or without flagellum . . . . . 16
- 16 Mesocoxal line subangulate, mesocoxal area as long as, or longer than, metacoxal area. Aedeagus asymmetrical . . . . . *brunneonotatum* Pic
- Mesocoxal line arcuate, mesocoxal area shorter than metacoxal area. Aedeagus symmetrical . . . . . 17
- 17 Internal sac of aedeagus with sclerotized flagellum . . . . . *wolong* sp. n.
- Internal sac of aedeagus without flagellum or rods . . . . . *portevini* Pic
- 18 Minute species, body length below 1 mm . . . . . *minutissimum* Champion
- Larger species, body length exceeding 1 mm . . . . . 19
- 19 Antennal segment 6 as long as, or longer than, segments 4 and 5 combined . . . . . 20
- Antennal segment 6 shorter than segments 4 and 5 combined . . . . . 21
- 20 Abdomen with punctulate microsculpture. Aedeagus asymmetrical . . . . . *falciferum* Löbl
- Abdomen with microsculpture consisting of striae. Aedeagus symmetrical . . . . . *japonicum* Löbl
- 21 Elytra with sutural striae short, starting posterior level of tip of pronotal lobe, distant from basal margin . . . . . 22
- Elytra with sutural striae longer, starting at each side of pronotal lobe, close to . . . . . elytral margin 23
- 22 Abdomen with microsculpture consisting of striae. Body large, length 1.9 mm . . . . . *pseudosolutum* sp. n.
- Abdomen lacking microsculpture. Body smaller, length 1.3-1.5 mm . . . . . *laevigatum* Löbl
- 23 Elytra with adsutural areas conspicuously widened toward base, sutural striae angulate . . . . . *dohertyi* Pic
- Elytra with adsutural areas not particularly widened anteriorly, sutural striae not angulate anteriorly . . . . . 24
- 24 Prohypomera distinctly microsculptured . . . . . 25
- Prohypomera lacking microsculpture . . . . . 26
- 25 Anterior two thirds of elytra coarsely punctate, posterior third of elytra very finely punctate, appearing impunctate . . . . . *rufescens* (Pic)

- Entire elytra with fairly coarse punctation . . . . . *pseudodelictum* Löbl
- 26 Antennal segment 3 conspicuously long, about as long as two thirds of  
segment 4 . . . . . *parasolutum* sp. n.
- Antennal segment 3 short, usually about as long as one third, not longer  
than half, of segment 4 . . . . . 27
- 27 Exposed abdominal segments lacking microsculpture, or with punctate  
microsculpture . . . . . 28
- All exposed abdominal segments with microsculpture consisting of  
transverse striae, or first sternite lacking microsculpture, remainder  
of abdomen with distinct striate microsculpture . . . . . 31
- 28 Mesocoxal line subtriangular, mesocoxal area longer than metacoxal  
area . . . . . *maindroni* Achard
- Mesocoxal line arcuate, mesocoxal area as long as or shorter than  
metacoxal area . . . . . 29
- 29 Elytra each with dark, transverse, central and apical fasciae . . . *invertum* sp. n.
- Elytra lacking dark fasciae . . . . . 30
- 30 Aedeagus asymmetrical, with parameres extremely narrow  
. . . . . *unicolor* Achard
- Aedeagus symmetrical, with parameres normally wide . . . . . *segne* Löbl
- 31 Pronotum light, with dark median fascia extended from base to anterior  
margin . . . . . *vexator* sp. n.
- Pronotum without dark median fascia . . . . . 32
- 32 Pronotum dark brown or black on large central part of disc, light  
ochreous along lateral margins; elytra each with black basal area and  
very dark brown or black subapical spot . . . . . *paravarium* sp. n.
- Colour pattern different . . . . . 33
- 33 Elytra and pronotum uniformly ochreous or dark brown, or elytra  
slightly darkened subapically . . . . . 34
- Elytra bicolorous, often with distinctive colour patten, not darkened  
subapically . . . . . 38
- 34 Aedeagus with basal bulb partly overlapping distal process . . . . . 35
- Aedeagus with basal bulb not overlapping distal process . . . . . 36
- 35 Parameres with distinct membranous lobe in middle portion . . . *pressum* Löbl
- Parameres without distinct membranous lobe (Fig. 61) . . . . . *incisum* sp. n.
- 36 Parameres expanded proximally to form large basal lobes entirely  
exposed in dorsal view; apical portion of parameres widened in dorsal  
view (Fig. 7) . . . . . *signum* sp. n.
- Parameres not expanded proximally to form lobes and usually not  
widened apically . . . . . 37
- 37 Antennal segment 6 wider than segment 5. Body dark reddish-brown.  
Adsutural areas of elytra distinctly raised . . . . . *emeicum* sp. n.
- Antennal segments 5 and 6 equally wide. Body light ochreous or light  
reddish-brown. Adsutural areas of elytra flat . . . . . *nakanei* Löbl

- 38 Elytra each with darkened basal area usually forming triangular pattern, and often with additional dark central or subapical spot . . . . . 39
- Elytra each with apical sixth to apical third light, remainder of surface uniformly reddish-brown to black, as pronotum . . . . . 42
- 39 Elytra usually with darkened central area, prothorax light ochreous. Parameres of aedeagus arcuate, each with large, wide membranous lobe . . . . . *atronotatum* Pic
- Elytral not darkened in center; prothorax dark. Parameres usually with narrow, small lobes . . . . . 40
- 40 Elytra with inner apical angles prominent and acute. Elytral punctation conspicuously coarse . . . . . *fibrosum* sp. n.
- Elytra with apical angles rounded, not prominent. Elytral punctation not conspicuously coarse . . . . . 41
- 41 Parameres of aedeagus lobed in middle, arcuate in apical half (Fig. 46) . . . . . *pseudovarium* sp. n.
- Parameres of aedeagus lacking lobes, arcuate in apical fourth (Fig. 49) . . . . . *heishuiense* sp. n.
- 42 Aedeagus with distal process completely overlapped by basal bulb . . . . . 43
- Aedeagus with distal process not, or partly overlapped by basal bulb . . . . . 45
- 43 Aedeagus with parameres arcuate in dorsal view . . . . . 44
- Aedeagus with parameres sinuate in dorsal view (Fig. 71) . . . . . *suspiciosum* sp. n.
- 44 Aedeagus with parameres widened posterior middle, with wide apical portion; internal sac with subapical narrow rod, lacking central rod (Fig. 75) . . . . . *irruptum* sp. n.
- Aedeagus with parameres equally wide in apical half; internal sac with long, narrow, central rod (Figs 83, 85) . . . . . *vestigator* sp. n.
- 45 Internal sac of aedeagus with one or two sclerotized rod/s . . . . . 46
- Internal sac of aedeagus lacking rods . . . . . 47
- 46 Parameres of aedeagus curved, wide, in apical portion much wider than at narrowest point near middle (Fig. 82) . . . . . *volitatum* sp. n.
- Parameres of aedeagus with parameres narrow, almost straight, in apical portion as wide as in middle . . . . . *cederholmi* Löbl
- 47 Internal sac of aedeagus with several, long, strongly sclerotized, straight or slightly oblique, apical denticles . . . . . 48
- Internal sac of aedeagus without apical denticles, or with cluster of numerous, short, curved, apical denticles . . . . . 50
- 48 Internal sac of aedeagus with subapical, triangular, sclerotized plate (Fig. 88) . . . . . *dumosum* sp. n.
- Internal sac of aedeagus lacking subapical, sclerotized plate . . . . . 49
- 49 Denticles present throughout entire width of apical portion of internal sac . . . . . *migrator* sp. n.
- Denticles present in medio-apical portion of internal sac only . . . . . *morosum* Löbl
- 50 Internal sac of aedeagus with two subapical clusters of strongly sclerotized, curved denticles . . . . . *geminatum* Löbl

- Internal sac of aedeagus without subapical clusters of strongly sclerotized denticles . . . . . 51
- 51 Basal portion of internal sac of aedeagus lacking median row of denticles . 52
- Basal portion of internal sac of aedeagus with long, median row of strongly sclerotized denticles . . . . . 53
- 52 Punctuation on large basal portion of elytra very fine, contrasting with punctuation on elytral center. Internal sac without basal spicules . *innotatum* Pic
- Punctuation on most of basal area of elytra about as coarse as that on elytral center. Internal sac with proximal spicules . . . . . *fortipatum* Champion
- 53 Internal sac of aedeagus with pair of lateral lobes; paramers weakly arcuate. Elytra often with reddish, humeral spot . . . . . *haemorrhoidale* Reitter
- Internal sac of aedeagus lacking lateral lobes; parameres strongly arcuate (Fig. 68). Elytra without humeral spot . . . . . *mutator* sp. n.

#### NEW RECORDS AND COMMENTS

##### *Scaphisoma atronotatum* Pic, 1920

Redescription, aedeagus: Löbl, 1970: 152, Figs 5, 6; Löbl, 1990b: Figs 67, 68.

Material examined. China, Yunnan, Xishuangbanna, 24.i.1993, G. de Rougemont, 2 (MHNG); Gaoligong Mts, 2200-2500m, 24°57'N, 98°45'E, 8-16.v.1995, O. Semela, 1 (NHMB) and same data but 1500-2500m, 17-24.v. 1995, 4 (NHMB, MHNG); Yunnan, Hengduan Mts, Meili, 2700m, 28°06'N 98°54'E, 5-8.vii.1996, O. Semela, 1 (MHNG); Yunnan, Kuming, western hills, 9.vii.1990, L. & M. Bocák, 1 (NHMB); Yunnan, Yipinglang, 1800m, 25°05'N, 101°53'E, 8-10.vi.1993, Bolm, 1 (NHMB); same but 1800-2000m, 25°04', 17-20.vi.1994, V. Kubán, 2 (NHMB).

Distribution. Nepal; Burma; Thailand; China: Yunnan.

##### *Scaphisoma brunneonotatum* Pic, 1923

Aedeagus: Löbl, 1980, Figs 27, 28; diagnostic characters: Löbl, 1982: 105.

Material examined. China, Hong Kong, Aberdeen, 10.viii.1996, J. Fellowes, 16 (MHNG); Hong Kong, Saikung, Tai Mong Tsai, 1.viii.1996, J. Fellowes, 24 (MHNG); Hong Kong, iii, v, ix-xii. 1996, G. de Rougemont, 36 (MHNG); Hong Kong, N.T., Tai Po Kau, iv.1992, G. de Rougemont, 11 (MHNG); Guangxi, Guilin, 22.ix.1995, G. de Rougemont, 12 (MHNG).

Distribution. Japan: Ryukyu's; Taiwan; Thailand; Vietnam; China: Guangxi, Hong Kong.

##### *Scaphisoma cederholmi* Löbl, 1971

Diagnostic characters, aedeagus: Löbl, 1986a: 193, Fig. 74.

Material examined. China, Hong Kong, v.1996, G. de Rougemont, 2 (MHNG).

Distribution. Sri Lanka; India; Thailand; China: Hong Kong.

##### *Scaphisoma dohertyi* Pic, 1915

Diagnostic characters, aedeagus: Löbl, 1981b: 107, Fig. 5.

Material examined. China, Yunnan, Xishuangbanna, 24.i.1993, G. de Rougemont, 2 (MHNG); Yunnan, Mengyang Nat. Res., ca 500m, 9.ix.1994, S. A. Kurbatov, 3 (MHNG).

Distribution. India; Indonesia; Thailand; Malaysia; Vietnam; China: Yunnan.

*Scaphisoma falciferum* Löbl, 1986

Description, aedeagus: Löbl, 1986b: 359, Figs 14, 15.

Material examined. China, Yunnan, Gaoligong Mts, 25°22'N, 98°49'E, 17-24.v.1995, O. Semela, 1 (MHNG).

Distribution. Pakistan; India; Nepal; China: Yunnan.

*Scaphisoma forcipatum* Champion, 1927

Diagnostic characters, aedeagus: Löbl, 1986a: 198, Figs 88-91.

Material examined. China, Yunnan, 25°22'N, 98°49'E, Gaoligong Mts, 1500-1800m, 17-24.v.1995, O. Semela, 1 (NHMB).

Distribution. Pakistan; India; Nepal; China: Yunnan.

*Scaphisoma geminatum* Löbl, 1986

Description, aedeagus: Löbl, 1986a: 212, Figs 112-114.

Material examined. China, Guangdong, Qi Mu Zhang, 5.iv.1997, leaf litter, J. Fellowes, 1 (MHNG).

Distribution. India; China: Guangdong.

Comments. This specimen has the two central clusters of robust denticles in the internal sac of the aedeagus oriented apically, and notably longer and those in the specimens from India. Besides, it differs slightly in the shape of the apical portion of the parameres and in the structure of the basal portion of the internal sac.

*Scaphisoma haemorrhoidale* Reitter, 1877

Redescription, aedeagus: Löbl, 1970: 791, Figs 76, 77.

Type material examined. *Scaphisoma sinense* Pic, 1920: 5; lectotype ♂ (MNHM), paralectotype ♀ (SNMB), from Nankin - **syn. n.** *Scaphisoma lautum* Löbl, 1965b: 30; holotype ♂ from Fujian, Kuantun (MNHM) - **syn. n.**

Additional material examined. China, Beijing, Xiaolongmen, 1200m, 1.vii.1993, G. de Rougemont, 1 (MHNG); Beijing, airport, 50m, 17.v.1997, M. Schülke, 1 (PCMS); Jiangsu, Nanjing, 17.viii.1994, G. de Rougemont, 2 (MHNG); Jiangsu, Nanjing Agric. Univ., vii.1991, R.J.Cooter, 1 (MMUE); "Nankin", 1 (MHNG); Hubei, Chengde, 15.ix.1995, G. de Rougemont, 1 (MHNG); Luoyang, viii.1982, G. de Rougemont, 4 (MHNG).

Distribution. Japan; Korea; Russian Far East; China: "Manchuria", Beijing, Hubei, Jiangsu, Liaoning, Fujian, Yunnan.

Comments. The variability of some characters was underestimated by Löbl (1965b). In addition, the lectotype of *S. sinense* and the holotype of *S. lautum* have the internal sacs of the aedeagi extruded, making observation of the diagnostic structures difficult. It is notable that almost all specimens from China have the subhumeral area of the elytra reddish, in addition to the light apical area. A similar colour pattern is rarely present in specimens from Japan.

*Scaphisoma innotatum* Pic, 1926

Diagnostic characters, aedeagus: Löbl, 1881b: 110, Fig.8; redescription. aedeagus: Löbl, 1986a: 2201, Figs 92-94.

Material examined. China, Yunnan, Ruili, 4.ii.1993, G. de Rougemont, 4 (MHNG).

Distribution. India; Nepal; Thailand; Vietnam; China: Yunnan.

*Scaphisoma japonicum* Löbl, 1965

Redescription, aedeagus: Löbl, 1970: 779, Figs 62, 63.

Material examined. China, Liaoning, Mt. Shi Fang Ding, Dandong City, 25.viii.1996, J. Li, 9 (MHNG).

Distribution. Far East Russia; Japan; China: Liaoning.

*Scaphisoma laevigatum* Löbl, 1970

Description: Löbl, 1970: 755, Figs 29, 30; diagnostic characters, aedeagus: Löbl, 1980: 103, Fig. 15.

Material examined. China, North Yunnan, 30km N of Lijiang, 3000m, 3.vii.1990, L. & M. Bocák, 2 (MHNG NHMB); Yunnan, Jizushan, 2500-3100m, 25°58'N, 100°21'E, 30.v.-3.vi.1993, V. Kubán, 1 (MHNG) and Bolm, 1 (NHMB).

Distribution. Far East Russia; Japan; Taiwan; China: Yunnan.

*Scaphisoma maidroni* Achard, 1920

Diagnostic characters, aedeagus: Löbl, 1979: 102, Fig. 24.

Material examined. China, Hong Kong, iii-iv. 1996, G. de Rougemont, 4 (MHNG); Guizhou, Huaxi, x.1986, G. de Rougemont, 4 (MHNG); Yunnan, Shi Lin, 8.x.1985, G. de Rougemont, 1 (MHNG).

Distribution. Pakistan; India; Nepal; Thailand; Vietnam; China: Guizhou, Hong Kong, Yunnan.

*Scaphisoma minutissimum* Champion, 1927

Redescription, aedeagus: Löbl, 1992: 538, Fig. 126.

Material examined. China, South Yunnan, Mengyang Nat. Res., ca 500m, 10.ix.94, litter and 12.ix.1994, rotten wood, S. A. Kurbatov, 2 (MHNG).

Comments. Both specimens are females very similar in external characters to specimens of *S. minutissimum* from North India. Their identification is tentative in absence of male.

*Scaphisoma morosum* Löbl, 1990

Description, aedeagus: Löbl, 1990b: 589, Figs 129-131.

Material examined. China, Yunnan, Ruili, 4.ii.1993, G. de Rougemont, 1 (MHNG).

Distribution. Burma; Thailand; China: Yunnan.

*Scaphisoma nakanei* Löbl, 1980

Description, aedeagus: Löbl, 1980: 107, Figs 22, 23.

Material examined. China, Jiangsu, Nanjing, 17.viii.1994, G. de Rougemont, 4 (MHNG); Jiangsu, Nanjing, Zijishan, 8.v.1996, J. Cooter, 2 (MHNG); Hong Kong, iii, x-xii.1996, G. de Rougemont, 7 (MHNG).

Distribution. Taiwan; China: Jiangsu, Hong Kong.

*Scaphisoma notatum* Löbl, 1986

Description, aedeagus: Löbl, 1986a: 154, Figs 16, 17.

Material examined. China, Yunnan, Gaoligong Mts, 2200-2500m, 24°57'N, 98°45'E, 8-16.v.1995, O. Semela, 2 (NHMB, MHNG); West Sichuan, Ganzi Tibet Aut. Pref., Luding Co. W Erlangshan-Pass, 2600m, 7km SSE Luding, 29°51'N, 102°15'E, 20.vi.1999, M. Schülke, 2 (PCMS); West Sichuan, Ya'an Pref., Shimian Co., Shimian-Ganluo, 27km south Shimian, 2450m, 29°02'N 102°31'48"E, springfedswamp, 8.vii.1999, A. Pütz, 2 (PCAP).

Distribution. Pakistan; North India; Nepal; China: Sichuan, Yunnan.

*Scaphisoma portevini* Pic, 1920

Redescription, aedeagus: Löbl, 1965b: 29, Figs 2a,b.

Material examined. China, Yunnan, Lijiang, 26°53'N, 100°18'E, 1800m, 23.vi.-21.vii.1992, S. Becvár, 8 (MHNG); Yunnan, Dali, 1600-2000m, 5-8.vii.1990, L. & M. Bocák, 1 (NHMB); Yunnan, Jizu Shan, 2500-2700m, 25°58'N, 100°21'E, 6-10.vii.1994, V. Kubán, 13 (NHMB, MHNG); Yunnan, Yipinglang, 1800-2000m, 25°04'N, 101°53'E, 17-20.vi.1994, V. Kubán, 3 (NHMB, MHNG); (NHMB, MHNG); Yunnan, Shi Lin, 8.x.1985, G. de Rougemont, 2 (MHNG); Yunnan, Ruili, iii.1993, G. de Rougemont, 1 (MHNG); Sichuan, Mt. Emei, 1700m, 22.ix.1994, S. A. Kurbatov, 1 (MHNG); South Sichuan, nr. Xichang, 1600m, 28.vii.1996, litter, S. A. Kurbatov, 1 (MHNG); NE Guangxi, 10km south Longsheng, ca 1000m, 15.vi.1995, S. A. Kurbatov, 1 (MHNG).

Distribution. Korea; Japan; China: Guangxi, Sichuan, Yunnan.

Comments. This species is very similar to *S. rufum* Achard for which it was mistaken a few times (see comments in Löbl, 1986a). As the shape of the internal sac of *S. portevini* is diagnostic only dissected males are recorded above.

*Scaphisoma pressum* Löbl, 1990

Description, aedeagus: Löbl, 1990: 571, Figs. 92-95.

Material examined. China, South Yunnan, Mengyang Nat. Res., ca 500m, 11.ix.1994, S. A. Kurbatov, 4 (MHNG).

Distribution. Thailand; China: Yunnan.

*Scaphisoma pseudodelictum* Löbl, 1986

Description, aedeagus: Löbl, 1986a: 180, Figs 54, 55.

Material examined. China, Yunnan, Ruili, 4.ii.1993, G. de Rougemont, 1 (MHNG); Xishuangbanna, 24.i.1993, G. de Rougemont, 2 (MHNG); Yunnan, Mengyang Nat. Res., ca 500m, 9.ix.1994, S. A. Kurbatov, 4 (MHNG).

Distribution. India; Thailand; China: Yunnan.



*Scaphisoma pseudorufum* Löbl, 1986

Description, aedeagus: Löbl, 1986a: 143, Fig. 3.

Material examined. China, South Yunnan, Mengyang Nat. Res., ca 500m, 9-14.ix.1994, S. A. Kurbatov, 7 (MHNG); Yunnan, Gaoligong, 1500-2500m, 25°22'N, 98°49'E, 17-24.v.1995, O. Semela, 3 (NHMB, MHNG); Northeast Guangxi, 10km south Longsheng, ca 1000m, 15.vi.1995, S. A. Kurbatov, 1 (MHNG).

Distribution. North India; Nepal; China: Guangxi, Yunnan.

*Scaphisoma rufescens* (Pic, 1920)

Redescription, aedeagus: Löbl, 1981a: 157, Fig. 4.

Material examined. China, Yunnan, Ruili, 4.ii.1993, G. de Rougemont, 1 (MHNG); Xishuangbanna, 24.i.1993, G. de Rougemont, 2 (MHNG); Mengyang Nat. Res., ca 500m, 9.ix.1994, S. A. Kurbatov, 3 (MHNG).

Distribution. East Malaysia; Singapore; Thailand; Vietnam; China: Yunnan.

*Scaphisoma segne* Löbl, 1990

Description, aedeagus: Löbl, 1990b: 568, Figs 87-89.

Material examined. China, Sichuan, Mt. Emei, 1500 and 1800m, 21 and 24.ix.1994, S. A. Kurbatov, 4 (MHNG); Sichuan, Mt. Emei, Wannian, 1050m, 19-30.iii.1999, W. Schawaller, 1 (SMNS); Zhejiang, Lin'an County, W Tianmu Shan N.R., ca 500m, 16.v.1996, J. Cooter, 1 (MHNG); Yunnan, Yipinglang, 25°04'N, 101°55'E, 1800-2000m, 17-20.vi.1996, V. Kuban, 6 (NHMB, MHNG).

Distribution. Thailand; China: Sichuan, Yunnan, Zhejiang.

Comment. Four males are present in the collections examined, and all were dissected. Their aedeagi are very similar to that of holotype but they lack the large sclerified denticles in the internal sac.

*Scaphisoma unicolor* Achard, 1923

Redescription, aedeagus: Löbl, 1970: 772, Figs 50, 51; aedeagus: Löbl, 1980: Fig. 26.

Material examined. China, South Yunnan, Mengyang Nat. Res., ca 500m, 11.ix.1994, S. A. Kurbatov, 1 (MHNG).

Distribution. India; Nepal; Thailand; Japan; Russian Far East; Taiwan; China: Yunnan.

*Scaphisoma uniforme* Löbl, 1986

Description, aedeagus: Löbl, 1986a: 157, Fig. 20.

Material examined. China, Yunnan, Weibaoshan, 25°12'N 100°24'E, 2000-3000m, 29-30.vi.1992, V. Kuban, 1♂ (MHNG).

Distribution. North India; Nepal; China: Yunnan.

Comments. This species is variable in the colour of the body and elytral punctuation. The shape of the basal portion of the flagellum is diagnostic.

## DESCRIPTIONS OF NEW SPECIES

*Scaphisoma invertum* sp. n.

Figs 1, 2

Holotype ♂: China, Northeast Guangxi, 10km south Longsheng, ca 1000m, 15.vi.1995, forest litter, S. A. Kurbatov (MHNG).

Paratypes: same data as holotype, 2 ♂, 7 ♀; South Yunnan, Mengyang Nat. Res., ca 500m, 14.ix.1994, in rotten wood, S. A. Kurbatov, 2 ♂ (MHNG); Yunnan, Maguan, 23°04'N, 104° 25'E, 1500-1600m, 25-26.vi.1994, V. Kubán, 1 ♂ (NHMB).

*Description.* Length 1.3-1.5 mm. Body ochreous. Elytra usually dark along base, in middle and near apices. Central and subapical dark area usually distinct and forming transverse fasciae. Surface between dark areas lighter than pronotum. Apical abdominal segments and appendages light ochreous or yellowish. Length ratio of antennal segments 3 to 11 as follows: 3: 9: 11: 12: 16: 13: 15: 15: 17 (holotype); segment 4 narrow, 4 times as long as wide; segments 5 and 6 almost equally wide, distinctly wider than segment 4, each about 4 times as long as wide; segments 7 and 8 each about 4 times as long as wide; segment 11 about 3 times as long as wide. Pronotum with lateral margins almost evenly rounded; lateral keels entirely concealed or exposed in basal half; punctation sparse and extremely fine. Tip of scutellum exposed. Elytra each with lateral margin slightly arcuate near base and apices, oblique in middle; apical margin slightly rounded; inner apical angles at same level as outer apical angles; sutural margin not or slightly raised; adsutural areas flat; sutural striae almost parallel, near base slightly curved, not extended along basal margin; discal punctation fairly dense and very fine, more distinct than that on pronotum. Prohypomera smooth. Mesepimeral ridge slightly longer than interval to mesocoxa. Metasternum flat in middle portion, very finely and sparsely punctate, lacking median impressions and without microsculpture. Mesocoxal linea arcuate, finely punctate; mesocoxal area 0.05 mm long. Metepisternum in same plane as metasternum, flat, moderately narrowed anteriorly, with suture straight, rounded only at angles. Abdominal punctation even, very fine and sparse. First exposed sternite lacking microsculpture. Metacoxal lines arcuate, rather coarsely punctate; metacoxal areas 0.08 mm long. Apical abdominal tergites and sternites with punctulate microsculpture.

Male sexual characters. Segments 1 to 3 of protarsi widened. Aedeagus (Figs 1, 2) 0.42-46 mm long. Median lobe symmetrical, weakly sclerotized, with large basal bulb. Ventral tubercles large, prominent. Distal process of median lobe short, obliquely inflexed, gradually narrowed, with apex wide in dorsal view, abruptly narrowed and with acute tip in lateral view. Internal sac tubular, long, widened apically, looped basally, lacking sclerites, covered by dense, minute, squamose or denticular structures. Parameres moderately bent in dorsal and lateral views, almost evenly wide.

*Comments.* This species has the aedeagus structurally similar to that in *S. invisum* Löbl, *S. discretum* Löbl, and *S. binaluanum* Pic. As the aedeagi in these species lack obvious derived characters, their relationships remain uncertain. *Scaphisoma inversum* may be readily distinguished from *S. discretum* and *S. invisum* by the colour pattern of the elytra. In addition, *S. invisum* is characterized by the antennal

segment 5 longer than segment 6, the mesocoxal areas relatively very large, longer than the metacoxal areas and the first abdominal sternite microsculptured. The new species differs notably from *S. discretum* by the antennal segment 4 much longer and the antennal segment 6 much shorter, compared with segment 5, and by the abdominal segments lacking striate microsculpture. It may be distinguished readily from *S. binaluanum* by the lack of striate microsculpture on abdominal segments.

*Scaphisoma emeicum* sp. n.

Figs 3, 4

Holotype ♂: China, Sichuan, Mt. Emei, 1700m, 22.ix.1994, S. A. Kurbatov (MHNG).

Paratypes: same data as holotype, 1♂, 2♀; same data but 23.ix., 1♂; same data but 1500m, 21.IX, 2♂; same data but 1800m, 24.ix., 1♂ (all MHNG).

*Description.* Length 1.4-1.5 mm. Body uniformly very dark brown or almost blackish. Apex of abdomen and appendages ochreous, tarsi and antennae lighter than tibiae and femora. Length ratio of antennal segments 3 to 11 as follows: 3: 9: 11: 11: 15: 12: 14: 14: 16 (holotype); segments 4 and 5 each about 4 times as long as wide; segments 6, 7, 8 and 11 each about 3 times as long as wide. Pronotum with lateral margins evenly arcuate; lateral keels not visible; punctation dense and very fine, consisting of minute, very shallow and not well delimited punctures. Scutellum completely covered by pronotal lobe, or minute point of scutellum exposed. Elytra each with slightly arcuate lateral margin; lateral keel not visible; apical margin truncate; inner apical angle lying at, or somewhat posterior to level of outer angle; sutural margin not raised; adsutural area flat near base, raised in posterior two thirds; sutural striae diverging in posterior third, parallel from apical third to level of pronotal lobe, slightly curved along pronotal lobe, not extended along basal margin. Prohypomera smooth. Mesepimeral ridge longer than interval to mesocoxa. Metasternum without microsculpture, flat in middle and without medio-apical impressions. Metasternal punctation fine and fairly dense, very fine on latero-anterior area. Mesocoxal line arcuate, finely punctate; mesocoxal area 0.05 mm long. Metepisternum flat, in same plane as metasternum, strongly narrowed anteriorly, with suture straight. Abdomen with microsculpture consisting of transverse striae and/or short waves. Punctation on pygidium extremely fine. First exposed sternite with punctation dense and fairly coarse in middle, sparse and very fine on lateral portions. Punctation on following sternites obsolete. Metacoxal line strongly arcuate, finely punctate; metacoxal area 0.07 mm long.

Sexual characters of male. Segments 1 to 3 of protarsi widened. Aedeagus (Figs 3, 4) 0.43-0.47 mm long. Median lobe symmetrical, with basal bulb fairly large and moderately sclerotized. Ventral tubercles large, slightly prominent. Distal process of median lobe slightly shorter than basal bulb, inflexed, curved, gradually narrowed apically, with tip obtuse in dorsal view, acute in lateral view. Dorsal valve single, membranous. Parameres moderately inflexed, wide, gradually narrowed toward apical third, slightly sinuate in dorsal view, straight in lateral view. Internal sac with denticulate and spinose structures. Rows of large and stronger sclerotized denticles distinct in lateral view, in ventro-apical part of internal sac.

*Comments.* This species is likely related to *S. vagans* Löbl and *S. iriomotense* Löbl, with which it shares most of the aedeagal characters. The new species may be easily distinguished from *S. sagans* by the metepisternal suture which is convex, and the elytral punctation which is notably coarser in the latter species. *Scaphisoma iriomotense* may be easily distinguished by the antennae with segments 3 to 5 about as long as segment 6.

*Scaphisoma serosum* sp. n.

Figs 5, 6

Holotype ♂: China, Central Sichuan, Wolong Nat. Res., 1000m, 24.v.1994, rotten wood, S. A. Kurbatov (MHNG).

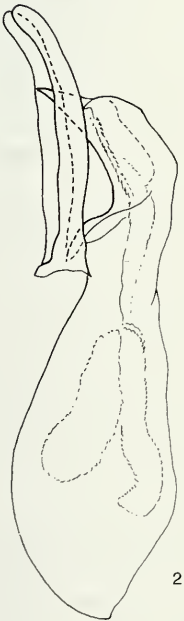
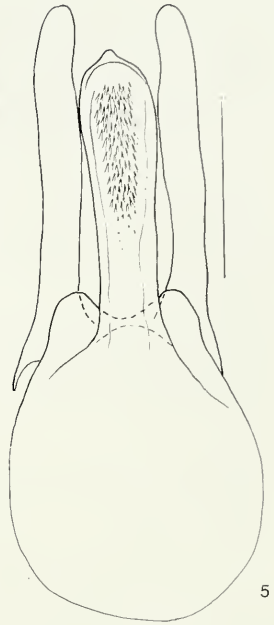
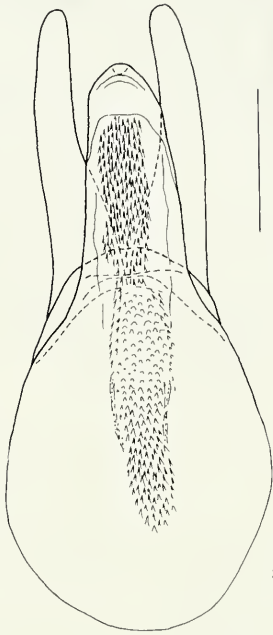
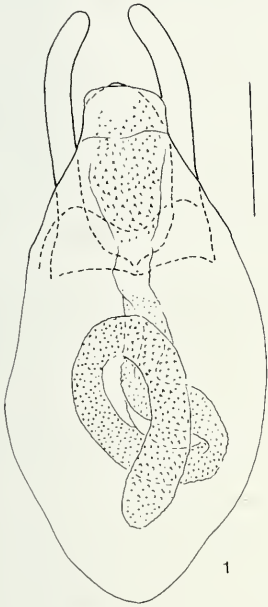
Paratypes: same data as the holotype, 1 ♂ (MHNG); same data but 1700m, 19.v.1994, litter, 1 ♂ (MHNG).

*Description.* Length 1.7 mm. Body dark reddish-brown. Elytra each with wide, light ochreous, subapical fascia. Femora and tibiae reddish, lighter than thorax. Apical abdominal segments, tarsi and antennae light, ochreous. Length ratio of antennal segments 3 to 11 as: 5: 10: 20: 19: 25: 20: 25: 25: 27 (holotype); segments 4 and 5 each about 4 times as long as wide; segments 6, 7 and 8 each about 3 times as long as wide; segment 11 about 3.5 times as long as wide. Pronotum with evenly arcuate lateral margins; lateral keels concealed; punctation dense and fine, punctures much smaller than puncture intervals. Tip of scutellum exposed. Elytra each with moderately rounded lateral margins; lateral keel hardly visible near base and near apex, not visible in middle portion (dorsal view); apical margin slightly arcuate; inner apical angle rounded, not prominent, situated at same level as outer apical angles; sutural margin not raised; adsutural area flat; sutural stria parallel to suture, curved near base and extended laterally to reach outer fourth of basal width, not joined to lateral stria; discal punctation fine and dense, slightly less fine than that on pronotum, with puncture intervals 2 to 5 times larger than puncture diameters. Pygidium with microsculpture consisting of very short striae. Prohypomera smooth, impunctate and lacking microsculpture. Mesepimeral ridge longer than interval to mesocoxa. Metasternum without microsculpture; medio-apical portion flattened, with fine and dense punctation, lateral and medio-anterior portions of metasternum with punctation very fine and scattered. Metepisternum narrowed anteriorly, flat, lying on slightly lower plane than metasternum, suture slightly sinuate. Mesocoxal line arcuate, finely punctate; mesocoxal area 0.04 mm long. Exposed abdominal sternites with microsculpture consisting of short striae, partly forming meshes. Abdominal punctation very fine and sparse on most surface, relatively coarse on median portion of first sternite. Metacoxal line arcuate, rather coarsely punctate; metacoxal area 0.09-0.10 mm long.

Male sexual characters. Segments 1 to 3 of protarsi widened. Aedeagus (Figs 5, 6) 0.32-0.33 mm long, symmetrical. Median lobe with basal bulb fairly small, moderately sclerotized, ventral tubercles large, prominent. Distal process of median

FIGS 1 to 6

Aedeagi in *Scaphisoma*, dorsal and lateral views; 1 and 2, *S. invertum* sp. n.; 3 and 4, *S. emecum* sp. n.; 5 and 6, *S. serosum* sp. n. Scale bars = 0.1 mm.



lobe narrow near bulb, strongly arcuate and inflexed in lateral view, slightly widened toward tip in dorsal view, with tip acute. Parameres almost evenly wide, slightly sinuate in dorsal view, slightly arcuate in lateral view. Internal sac simple, tubular, with apical spinose structures.

*Comments.* This species resembles *S. flavofasciatum* Löbl in the conspicuous colour pattern but it may be easily distinguished by the relative length of the antennal segments 5 and 6, the length of the metacoxal area, and the abdominal microsculpture. *Scaphisoma flavofasciatum* has the segment 6 significantly longer than the segment 5, the first exposed abdominal sternite lacks microsculpture, and the metacoxal areas are much shorter than in *S. serosum*. The male characters are unknown from *S. flavofasciatum*. Although the aedeagus of *S. serosum* is similar to that of *S. curtipenne* (Pic), these species are probably not closely related. These two species differ drastically in exoskeletal characters (for *S. curtipenne* see Löbl, 1973), and their aedeagi lack obvious derived characters.

*Scaphisoma signum* sp. n.

Figs 7, 8

Holotype ♂: China, Central Sichuan, Wolong Nat. Res., 1500m, 22.v.1994, S. A. Kurbatov (MHNG).

*Description.* Length 1.5 mm. Body reddish-brown, subapical portion of elytra darkened, apices of elytra, abdominal apex, femora and tibiae lighter than thorax, antennae and tarsi yellowish. Length ratio of antennal segments 3 to 11 as follows: 5: 11: 15: 15: 20: 15: 20: 20: 25; segment 4, 5 and 11 each about 4 times as long as wide; segments 6, 7 and 8 each about 3 times as long as wide. Pronotum with lateral margins evenly arcuate; lateral keels not visible; punctation sparse and very fine, consisting of minute but well delimited punctures. Tip of scutellum exposed. Elytra each with lateral margin rounded in basal third, oblique in apical two thirds; lateral keel entirely exposed in dorsal view; apical margin arcuate; inner apical angle rounded, not prominent, on same level as outer apical angles; sutural margin not raised; adsutural area flat; sutural stria parallel to suture, curved along pronotal lobe, not extended along basal margin; punctation near base as fine as that on pronotum, on most surface less fine, consisting of fine, not well delimited punctures. Prohypomera and mesepisterna smooth. Mesepimeral ridge as long as interval to mesocoxa. Metasternum flattened medio-apically, with punctation sparse and very fine on most of surface, dense near inner margin of metacoxae. Mesocoxal line arcuate, finely punctate; mesocoxal area 0.03 mm long. Metepisternum flat, moderately narrowed anteriorly, lying in same plane as metasternum, suture straight except near angles. Abdominal tergites and sternites with microsculpture consisting of transverse striae, punctation sparse and very fine. Metacoxal line arcuate, finely punctate; metacoxal area 0.09 mm long.

Male sexual characters. Segment 1 to 3 of protarsi slightly widened. Aedeagus (Figs 7, 8) 0.44 mm long. Median lobe fairly sclerotized, symmetrical. Basal bulb large, with robust, not prominent ventral tubercle. Distal process of median lobe gradually narrowed, with tip acute, strongly inflexed and curved, and dorsal valve single, sclerotized. Parameres with base very wide, narrowed toward curved apical portion, bearing large membranous lobe. Internal sac complex, with two median rows

of large denticles and group of large, subapical denticles; membranes very finely denticulate apically, and finely spinose and incurved proximally.

*Comments.* This new species is very similar to *S. taiwanum* Löbl in both exoskeletal and genital characters. It may be distinguished from the latter species by its aedeagus with parameres bearing large lobes and by the internal sac with rows of large denticles.

*Scaphisoma aciculare* sp. n.

Figs 9 to 11

Holotype ♂: China, Yunnan, Gaoligong Mts, 2200-2500m, 24°57'N, 98°45'E, 8-16.v.1995, S. Bečvář (MHNG).

*Description.* Length 2.10 mm. Body uniformly very dark reddish-brown, apex of abdomen, antennae and tarsi lighter. Length ratio of antennal segments 3 to 11 as follows: 7: 15: 19: 19: 25: 20: 23: 24: 28; segments 4, 5 and 8 each about 4 times as long as wide; segments 6, 7 and 11 each 3 times as long as wide. Pronotum with evenly arcuate lateral margins; lateral keels concealed; discal punctation extremely fine, fairly dense. Tip of scutellum exposed. Elytra each with lateral margin slightly rounded; lateral keel visible near base only; apical margin truncate, inner apical angle rounded, not prominent, at same level as outer apical angles; adsutural area flat anteriorly, slightly raised in apical two thirds; sutural stria curved near base and extended to outer third of basal width, forming basal stria not joined to lateral stria; discal punctation fairly dense and fine, consisting of punctures not well delimited, mostly much smaller than puncture intervals; punctation near base finer than that on discal center, similar to that on pronotum. Prohypomera smooth. Mesepimeral ridge about as long as interval to mesocoxa. Metasternum without microsculpture, very finely and sparsely punctate, convex in middle, with two medio-apical impressions. Mesocoxal line arcuate, distinctly punctate; mesocoxal areas 0.06 mm long. Metepisterna flat, moderately narrowed anteriorly, lying on lower plane than metasternum; suture straight. Abdominal punctation sparse and very fine. First exposed sternite without microsculpture, following sternites with punctulate microsculpture. Metacoxal line parallel to coxa, finely punctate; metacoxal area 0.03 mm long.

Male sexual characters. Segments 1 to 3 of protibiae and segments 1 and 2 of mesotibiae moderately widened. Aedeagus (Figs 9 to 11) 0.69 mm long. Median lobe symmetrical. Basal bulb rather strongly sclerotized, relatively small. Ventral tubercles large, prominent. Distal process of median lobe about as long as basal bulb, gradually narrowed apically, with subapical denticle on dorsal side; tip acute in lateral view. Parameres with subbasal notch, expanded base, abruptly curved subapically in dorsal view. Inner side of parameres weakly sclerotized in apical half, sinuate in lateral view. Internal sac with long rod overlapped by rows of spines.

*Comments.* This species possesses an aedeagus similar to that of *S. simplicipenis* Löbl, and is likely closely related to that species. However it may be easily distinguished from *S. simplicipenis* by the much large basal bulb, the less prominent ventral tubercles, and the presence of conspicuous, sclerotized spines in the internal sac. In external characters *S. aciculare* differs notably from *S. simplicipenis* by the sutural striae of elytra extended to form basal striae.

*Scaphisoma latro* sp. n.

Figs 12, 13

Holotype ♂: China, Western Hubei, Shennonglia Nat. Res., 2000-2200m, 3-8.vi.1995, S. A. Kurbatov (MHNG).

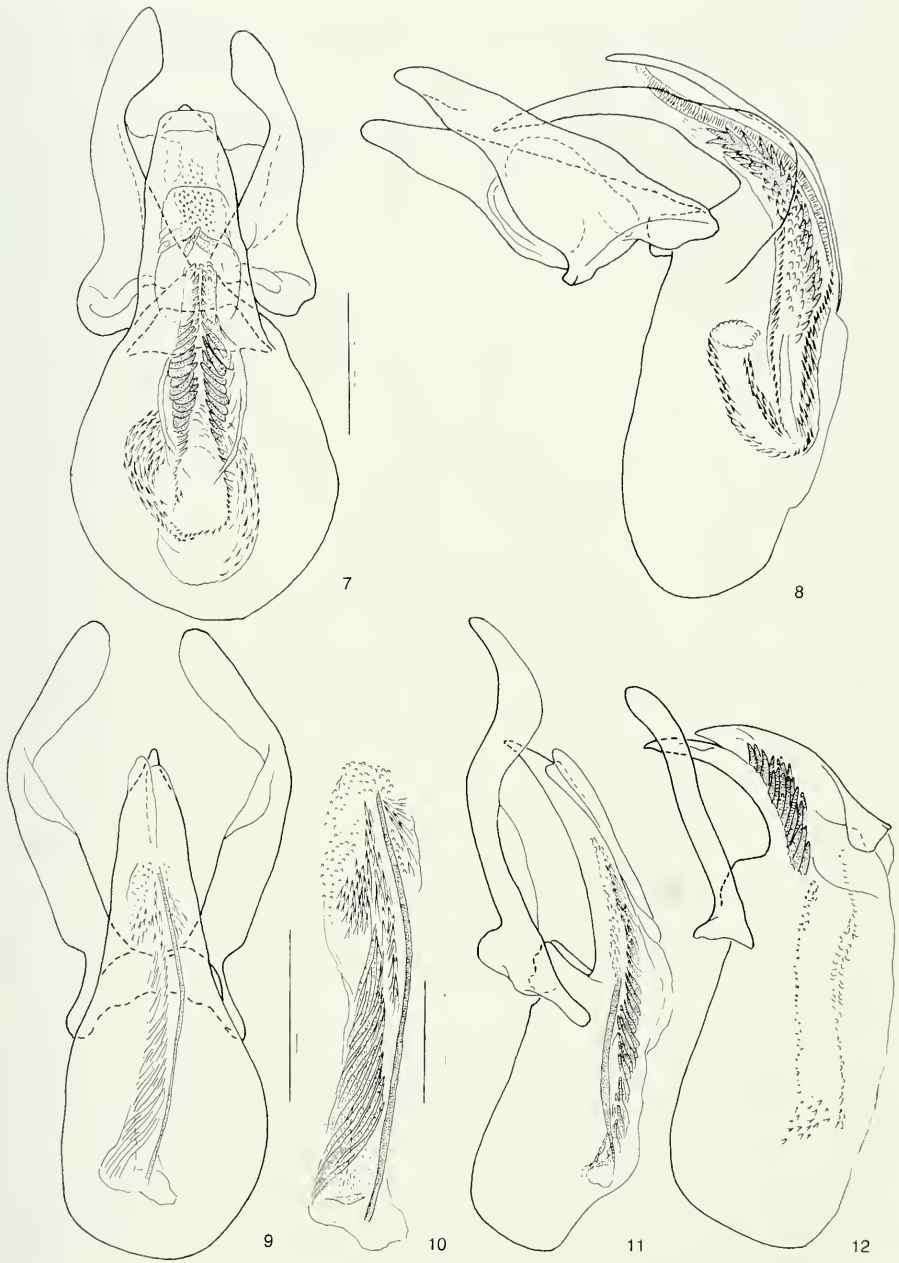
Paratypes: same data as holotype, 1♂, 2♀ (MHNG).

*Description.* Length 1.70-1.75 mm. Body dark reddish-brown to black, apical third of elytra yellowish, apex of abdomen ochreous. Femora and tibiae reddish-brown, lighter than thorax, antennae and tarsi yellowish. Length ratio of antennal segments 3 to 11 as follows: 6: 10: 16: 16: 22: 16: 20: 21: 25 (holotype); segment 4 about 3 times as long as wide; segment 5 about 4 times as long as wide; segment 6 about 3.5 times as long as wide; segment 7 about 3 times as long as wide; segment 8 about 2.5 times as long as wide; segment 11 almost 3.5 times as long as wide. Pronotum evenly arcuate laterally; lateral keels concealed; discal punctation very fine and fairly sparse, diameters of punctures much smaller than puncture intervals. Tip of scutellum exposed. Elytra each with lateral margin arcuate in basal third, straight in posterior two thirds; apical margin slightly rounded; inner apical angle rounded, not prominent, at same level as outer apical angle; sutural margin not raised; adsutural area flat in anterior half, slightly raised in posterior half; sutural striae parallel in anterior half, converging toward apex, curved along base to form basal striae reaching outer third of basal width; discal punctation fine, fairly dense, less fine than that of pronotum but near elytral base about as fine as on pronotum. Prohypomera smooth. Mesepimeral ridge twice as long as interval to mesocoxa. Metasternum without microsculpture, with very fine and sparse punctation, flattened in middle, and with very shallow, medio-apical impressions; midline impunctate. Mesocoxal line arcuate, very finely punctate; mesocoxal area 0.06 mm long. Metepisterna flat, gradually narrowed anteriorly, lying at same plane as metasternum, with suture almost straight. Exposed abdominal segments with microsculpture consisting of transverse striae; abdominal punctation very fine and sparse, on mediobasal portion of first sternite more distinct than on remainder of sternal surface; microsculpture absent from latero-basal portion of first sternite. Metacoxal line strongly arcuate and very finely punctate; metacoxal area 0.10 mm long.

Sexual characters of male. Segments 1 to 3 of protarsi widened. Aedeagus (Figs 12, 13) 0.59-0.61mm long. Median lobe symmetrical. Basal bulb large, moderately sclerotized. Ventral tubercles large, somewhat prominent. Distal process of median lobe short, curved and inflexed, with tip wide in dorsal view, acute in lateral view. Parameres almost evenly narrow, slightly curved in dorsal view, slightly sinuate in lateral view. Internal sac with long membranous vesicle covered by squamose structures and with rows of strongly sclerotized, apical denticles.

*Comments.* This species possesses the aedeagus similar to that of *S. hiekei* Löbl although the latter species has the apical portion of the median lobe more strongly inflexed, and the parameres evenly narrow. *Scaphisoma hiekei* may be easily distinguished from *S. latro* by the elytra lacking basal striae and the antennal segments 3 and 4 equally short.





FIGS 7 to 12

Aedeagi in *Scaphisoma*, dorsal and lateral views; 7 and 8, *S. signum* sp. n., scale bar = 0.1 mm; 9 to 11, *S. aciculare* sp. n.: 9 and 11, aedeagus, scale bar = 0.2 mm; 10, internal sac, scale bar = 0.1 mm; 12, *S. latro* sp. n., lateral view.

*Scaphisoma subtile* sp. n.

Figs 14, 15

Holotype ♂: China, South Sichuan, south Xichang, Lunji, 2300-2500m, 16-24.vii.1996, S. A. Kurbatov (MHNG).

*Description.* Length 2.15 mm. Body blackish-brown, elytra lighter toward apex. Abdomen dark reddish-brown, with apex lighter. Femora blackish, tibiae reddish-brown, antennae and tarsi lighter than tibiae. Length ratio of antennal segments 3 to 11 as follows: 7: 12: 17: 20: 23: 19: 23: 22: 30; segments 4, 8 and 11 each about 3 times as long as wide; segment 5 about 3.5 times as long as wide; segment 6 about 4 times as long as wide; segment 7 about 2.5 times as long as wide. Pronotum with lateral margins evenly arcuate; lateral keels entirely visible; punctuation dense and fairly fine, most puncture intervals distinctly larger than puncture diameters. Exposed point of scutellum minute. Elytra each with lateral margin strongly arcuate in basal half, slightly rounded in apical half; lateral keel exposed posterior middle area; apical margin truncate; inner apical angle rounded, not prominent, lying slightly posterior level of outer apical angles; sutural margin not raised; adsutural area flat in basal third, slightly raised in posterior basal third; sutural stria parallel to suture, curved near base and extended along basal margin to outer third of basal width, not joined to lateral stria; discal punctuation fine and fairly sparse, punctures not well delimited, mostly as large as, or smaller than, pronotal punctures, much smaller than puncture intervals. Pygidium with distinct punctulate microsculpture; punctuation fine near base, becoming very fine toward apex. Propygidium with punctuation fairly coarse and dense. Prohypomera smooth, lacking microsculpture, with few extremely fine punctures. Mesepimeral ridge as long as interval to mesocoxa. Metasternum without microsculpture; medio-apical area flattened and with dense and fairly coarse punctuation; medio-anterior and lateral areas of metasternum with very fine and sparse punctuation. Mesocoxal line almost parallel to mesocoxa, finely punctate; mesocoxal area 0.04 mm long. Metepisternum flat, narrowed anteriorly, with almost straight suture, almost in same plane as metasternum. First exposed abdominal sternite lacking microsculpture; with punctuation fairly coarse and dense on mediobasal area, very fine and sparse on medio-apical and lateral areas. Metacoxal line arcuate, finely punctate; metacoxal area 0.08 mm long. Following sternites with punctuation very fine and sparse, and with distinct punctulate microsculpture.

Male sexual characters. Segments 1 to 3 of protarsi slightly widened. Aedeagus (Figs 14, 15) 0.70 mm long. Median lobe symmetrical, with relatively small and weakly sclerotized basal bulb. Ventral tubercles large, prominent. Distal process of median lobe slender, longer than basal bulb, moderately inflexed, narrowed in apical portion; tip obtuse in dorsal view, slightly curved and acute in lateral view. Parameres almost evenly wide in apical two thirds, widened toward base, with margins sinuate in dorsal view, arcuate in lateral view. Internal sac with long, strongly sclerotized, almost straight rod; membranes lacking squamose or spinose structures.

*Comments.* This species exhibits an aedeagus structurally similar to that of *S. punctaticolle* Löbl, although the ventral tubercles of the median lobe are much larger and prominent. *Scaphisoma punctaticolle* may be distinguished easily from *S. subtile* by the relatively coarsely punctate metasternum and the conspicuously microsculptured first abdominal sternite.

*Scaphisoma wolong* sp. n.

Figs 16, 17

Holotype ♂: China, Sichuan, Wolong Nat. Res. 1700m, 19.v.1994, S. A. Kurbatov (MHNG).

Paratype ♀: same data as holotype (MHNG).

*Description.* Length 1.65 mm. Body uniformly very dark reddish-brown. Femora and tibiae slightly lighter than body. Antennae and tarsi ochreous or yellowish. Length ratio of antennal segments 3 to 11 as follows: 3: 6: 8: 11: 14: 10: 15: 14: 20 (holotype); segment 4 narrow, less than twice as long as wide, segment 5 wider than segment 4, almost 3 times as long as wide; segment 6 much wider than segment 5, about twice as long as wide; segments 7 and 11 each about 2.5 times as long as wide; segment 8 about twice as long as wide. Pronotum evenly arcuate laterally; lateral keels completely concealed; punctation very fine and dense, punctures relatively well delimited, much smaller than puncture intervals. Tip of scutellum exposed. Elytra each with lateral margin strongly arcuate anteriorly, oblique in apical portion; lateral keel not visible; apical margin distinctly rounded; inner apical angle rounded, not prominent, lying posterior to level of outer angle; sutural margin flat anteriorly, slightly raised in posterior half; adsutural area mostly flat, not or hardly oblique in posterior half; sutural striae parallel, curved along base and extended to humeral areas, forming basal striae not joined to lateral striae; discal punctation sparse and very fine on basal half, similar to that on pronotum, slightly less fine on apical half. Pygidium with punctation extremely fine and with punctulate microsculpture. Prohypomera smooth, impunctate. Mesepimeral ridge as long as interval to mesocoxa. Metasternum convex in middle, without medio-apical impressions and without microsculpture, with punctation very fine and sparse laterally and on center, dense and fairly coarse on medio-apical area. Mesocoxal line arcuate, rather coarsely punctate, mesocoxal area 0.06 mm long. Metepisternum flat, in same plane as metasternum, narrowed anteriorly, with straight suture. First abdominal sternite with punctation sparse and very fine laterally, dense and rather coarse medially. Metacoxal line arcuate, rather coarsely punctate; metacoxal area 0.06 mm long. Apical sternites with punctulate microsculpture.

Male sexual characters. Protarsi not widened. Aedeagus (Figs 16, 17) 0.35 mm long. Median lobe fairly sclerotized, symmetrical. Basal bulb relatively small, with ventral tubercles distinct, not prominent. Distal process curved and moderately inflexed ventrally, gradually narrowed in dorsal view, with blunt tip. Dorsal valves membranous. Parameres slightly bent apically in dorsal view, slightly arcuate in lateral view. Internal sac bearing simple long flagellum; membranose very finely spinose. Flagellar base widened and bifid.

*Comments.* This species is a member of the *S. subalpinum* group. It is similar to *S. inquietum* Löbl, from which it differs in having the elytral and pronotal punctation more dense, the antennal segment 4 longer, and the internal sac bearing a simple rod, lacking denticulate and or quamoso structures on membranes. The latter feature separates *S. wolong* from all other members of the *S. subalpinum* group.

*Scaphisoma styloides* sp. n.

Figs 18 to 20

Holotype ♂: China, West Hubei, Shennongjia Nat. Res., 2000-2200m, 3-8.vi.1995, S. A. Kurbatov (MHNG).

Paratype ♀: sama data as holotype (MHNG).

*Description.* Length 1.95-2.30 mm. Body uniformly dark reddish-brown, apex of abdomen, tarsi and antennae lighter. Length ratio of antennal segments 3 to 11 as follows: 6: 10: 12: 15: 22: 16: 19: 18: 20 (holotype); segment 4 narrow, about 3 times as long as wide; segment 5 about 2.5 times as long as wide; segment 6 slightly more than 2 times as long as wide; segment 7 almost 3 times as long as wide; segment 8 and 11 each about 2 times as long as wide. Pronotum evenly arcuate laterally; lateral keels concealed; punctation very fine and sparse, puncture diameters much smaller than intervals. Tip of scutellum exposed. Elytra each with lateral margin arcuate in basal half, oblique in apical half; lateral keel not visible in dorsal view; apical margin truncate; inner apical angle rounded, not prominent, on same level as outer apical angle; sutural margin not raised; adsutural area flat; sutural stria parallel to suture, curved at base and extended to form basal stria joined to lateral stria; discal punctation fine, fairly dense, intervals between punctures mostly 2 to 4 times as large as puncture diameters. Pygidium very finely punctate, with punctulate microsculpture. Prohypomera smooth. Mesepisterna, lateral portions of metasternum, metepisterna and lateral portions of first exposed sternite with very fine and sparse punctation. Mesepimeral ridge about 1.5 times as long as interval to mesocoxa. Metasternum without microsculpture, convex in middle, with two medio-apical impressions densely punctate. Mesocoxal line arcuate, finely punctate; mesocoxal area 0.06 mm long. Metepisterna flat, strongly narrowed anteriorly, in same plane as metasternum, with straight suture. Lateral portions of first exposed sternite and entire following sternites covered by punctulate microsculpture (conspicuous in holotype, hardly visible in paratype). Metacoxal line arcuate, finely punctate; metacoxal area 0.07 mm long.

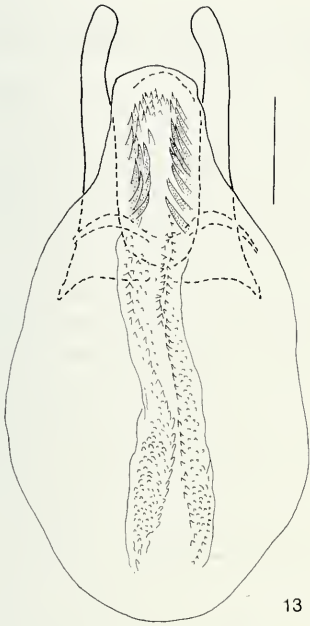
Sexual characters of male. Segments 1 to 3 of protarsi distinctly widened. Aedeagus (Figs 18 to 20) 0.55 mm long. Median lobe symmetrical, with basal bulb large, moderately sclerotized. Ventral tubercles small, slightly prominent. Distal process of median lobe much shorter than basal bulb, inflexed ventrally, gradually narrowed apically. Internal sac with flagellum simple, slender, gradually narrowed apically, slightly curved, and with large basal vesicular area covered by squamose structures. Parameres almost evenly wide in apical two third, straight in middle, curved in apical portion.

*Comments.* This species is a membre of the *S. subalpinum* group. It is likely closely related to *S. uniforme* Löbl with which it shares most aedeagal characters. It differs from the latter species by the shape of the flagellum of the internal sac which is widened and hook-like in *S. uniforme*, the curved apices of parameres, and by the elytra with entire basal stria.

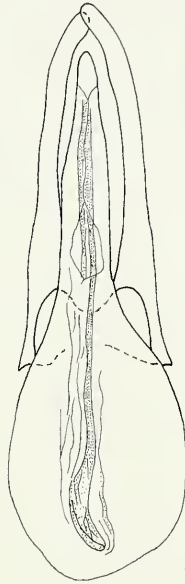
---

FIGS 13 to 18

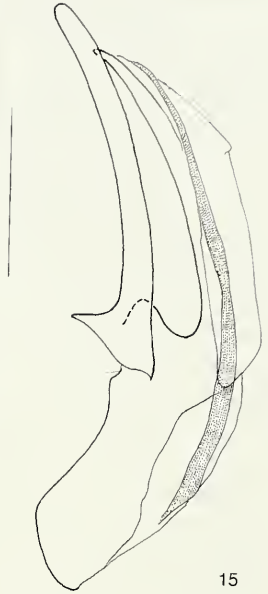
Aedeagi in *Scaphisoma*, dorsal and lateral views; 13, *S. latro* sp. n., dorsal view, scale bar = 0.1 mm; 14 and 15, *S. subtile* sp. n., scale bar = 0.2 mm; 16 and 17, *S. wolong* sp. n., scale bar = 0.1 mm; 18, *S. styloides* sp. n., scale bar = 0.1 mm.



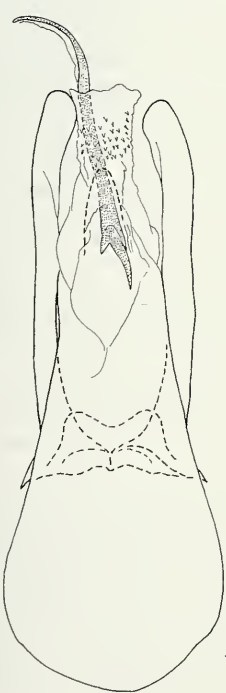
13



14



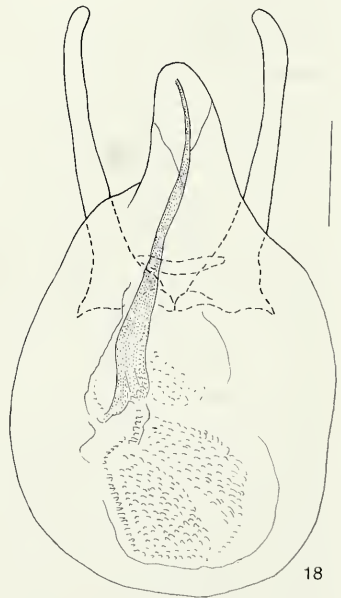
15



16



17



18

*Scaphisoma apertum* sp. n.

Figs 21 to 23

Holotype ♂: China, Yunnan, Jizu Shan, 2500-2700m, 25°58' N 100°21' E, 6-10.vii.1994, V. Kubán (MHNG).

Paratypes: Yunnan, Gaoligong Mts, 2200-2500m, 25°57' N 98°45' E, 8-16.v.1995, O. Semela, 1♂, 2♀ (NHMB, MHNG).

*Description.* Length 2.1-2.2 mm. Body uniformly black, femora and tibiae dark reddish-brown, tarsi and antennae ochreous. Length ratio of antennal segments 3 to 11 as follows: 6: 14: 15: 21: 27: 23: 28: 26: 32 (holotype); segment 4 narrow, 3.5 times as long as wide; segments 5 to 8 each about 3 times as long as wide; segment 11 about 4 times as long as wide. Pronotum with lateral margins rounded in anterior half, oblique in basal half; lateral keels not visible; punctuation dense and coarse, punctures not well delimited, mostly smaller than puncture intervals. Tip of scutellum exposed. Elytra each with lateral margin distinctly arcuate in basal third, slightly arcuate in apical two thirds; lateral keel visible near base and in apical third; apical margin arcuate; inner apical angle rounded, not prominent, on same level as outer apical angle; sutural margin not raised; adsutural area flat in basal third, slightly raised posterior basal third; sutural striae parallel, curved along base to form basal striae extended to outer third of basal width; discal punctuation finer and less dense than pronotal punctuation, puncture intervals mostly 2 to 4 times as large as puncture diameters. Pygidium and propygidium very finely punctate and with almost obsolete, punctulate microsculpture. Prohypomera smooth. Mesepimeral ridge slightly shorter than interval to mesocoxa. Metasternum without microsculpture, very finely and sparsely punctate, but with dense punctuation on flattened medio-apical portion. Mesocoxal line subparallel, with coarse and very dense punctures; mesocoxal area 0.05 mm long. Mesepisterna flat, strongly narrowed anteriorly, lying below plan of metasternum; suture slightly sinuate. Abdominal sternites extremely finely punctate. First exposed sternite without microsculpture, following sternites with almost obsolete punctulate microsculpture. Metaxocal line arcuate, with dense and coarse punctures; metacoxal area 0.06 mm long.

Sexual characters of male. Segments 1 - 3 of protarsi widened. Aedeagus (Figs 21 to 23) 0.72-0.73 mm long. Median lobe symmetrical, with basal bulb large, weakly sclerotized. Ventral tubercles well developed, slightly prominent. Distal process of median lobe shorter than basal bulb, inflexed, tapering. Dorsal valves membranous. Inner sac with flagellum long, strongly sclerotized, almost evenly thin, hook-like basally. Membranes with denticular and squamose structures, denticles partly arranged in rows.

*Comments.* This is an additional member of the *S. subalpinum* group. It shares with *S. castaneipenne* Reitter, *S. galloisi* Achard and *S. adnexum* Löbl an aedeagus with long, thin flagellum, the internal sac with rows of denticular structures, and the parameres almost evenly narrow. *Scaphisoma apertum* may be distinguished from these species by the hook-like basis of the flagellum. In addition, it may be easily separated from *S. castaneipenne* and *S. galloisi* by the finer elytral punctuation and finer abdominal microsculpture, and from *S. adnexum* by the larger size of the body and the more coarse pronotal punctuation.

The two examined males have the internal sac extruded. The flagellum is as illustrated, strongly bent in the holotype, stretched apically in the paratype.

*Scaphisoma pseudantennatum* sp. n.

Figs 24 to 26

Holotype ♂: China, Central Sichuan, Wolong Nat. Res., 1500m, 21.v.1994, S. A. Kurbatov (MHNG).

Paratypes: same data as holotype, 4♂, 4♀ (MHNG); Sichuan, Liziping env. near Shimian, 200km south west Xa'an, 27.iv.-3.vii.1991, Z. Kejval, 1♀ (NHMB).

*Description.* Length 2.6-2.7 mm. Body black, apex of abdomen very dark brown, tibiae reddish-brown, tarsi and antennae lighter than tibiae, ochreous or light brown. Length ratio of antennal segments 3 to 11 as follows: 8: 12: 15: 32: 35: 28: 30: 31: 38 (holotype); segments 4 and 5 each 3 times as long as wide; segment 6 conspicuously subparallel, wider than segment 5, almost 5 times as long as wide; segment 7 about 3.5 times as long as wide; segment 8 and 11 each about 4 times as long as wide (holotype). Thorax lacking microsculpture. Pronotum with almost evenly arcuate lateral margins, lateral keels not or barely visible; discal punctation distinct, punctures well delimited, puncture diameters smaller than puncture intervals. Tip of scutellum exposed. Elytra each with lateral margin arcuate anteriorly, oblique in middle portion; lateral keel partly visible in dorsal view; apical margin straight; inner apical angle rounded, not prominent, about on same level as outer apical angle; sutural margin not raised; adsutural area flat; sutural stria shallow, parallel to sutural margin, curved anteriorly and extended laterally along basal margin to humeral area, not joined with lateral stria; discal punctation even, similar to that on pronotum, as coarse as, or slightly coarser than, pronotal punctation. Mesepimeral ridge about as long as interval to mesocoxa. Metasternum flattened medio-apically; metasternal punctation very fine and very sparse on lateral and mediobasal areas, fairly dense and coarse on medio-apical area. Mesocoxal line arcuate, coarsely punctate; mesocoxal area 0.07-0.08 mm long. Metepisterna flat, strongly narrowed anteriorly, on same plane as metasternum; suture slightly sinuate. Exposed tergites with microsculpture consisting of punctures. Punctation on propygidium finer, that on pygidium much finer than elytral punctation. First exposed abdominal sternite lacking microsculpture; with punctation fairly dense and distinct on mediobasal area, very fine and very sparse on medio-apical and lateral surfaces. Following sternites with distinct punctulate microsculpture, normal punctation obsolete. Metacoxal line arcuate, coarsely punctate; metacoxal area 0.09-0.10 long.

Male sexual characters. Segments 1 to 3 of protarsi distinctly widened. Aedeagus (Figs 24 to 26) 1.15-1.20 mm long. Median lobe and parameres symmetrical, fairly strongly sclerotized. Basal bulb large. Ventral tubercles not prominent. Distal process of median lobe gradually inflexed and tapering; dorsal valves overlapping, weakly sclerotized. Internal sac with long flagellum curved basally and joined to short, hook-like sclerite. Membranes bearing complex squamose structures. Parameres slightly narrowed apically and slightly curved in lateral view, sinuate or distinctly curved and narrowed apically in dorsal view.

*Comments.* This new species is a member of the *S. subalpinum* group. It is similar to *S. antennatum* (Achard) with which it shares the antennal segment 6 long compared with segments 4 and 5. It may be distinguished readily from *S. antennatum* by the shorter antenal segment 11 and by the aedeagal characters. The aedeagus is smaller in *S. antennatum*, with the distal process of the median lobe shorter and not inflexed, the parameres slightly sinuate and the shape of the flagellum distinctive.

*Scaphisoma oppositum* sp. n.

Figs 27, 28

Holotype ♂: China, Yunnan prov., Gaoligongshan, 90 km west Baoshan, 26-26.v.1995, S. Bečvář (MHNG).

Paratype ♀: same data as holotype (MHNG).

*Description.* Length 2.55 mm. Very similar to *S. pseudantennatum* in most diagnostic characters. Antennae slightly distinctive, length ratio of antennal segments 3 to 11 as follows: 7: 10: 15: 31: 34: 28: 30: 30: 40 (holotype); segment 4 about 2.5 times as long as wide; segment 5 about 3 times as long as wide; segment 6 about 5 times as long as wide; segments 7 and 11 each 4 times as long as wide. Elytra with discal punctation finer and more sparse than that on pronotum or in *S. pseudantennatum*. Microsculpture on propygidium and on lateral portions of first exposed abdominal sternite absent or hardly visible. Mesocoxal area 0.09 mm long. Metacoxal area 0.10 mm long.

Male sexual characters. Segments 1 to 3 of protarsi widened. Aedeagus (Figs 27, 28) 1.10 mm long. Median lobe and parameres symmetrical, strongly sclerotized. Median lobe gradually narrowed apically, with basal bulb relatively small, shorter than distal process. Tip of median lobe acute and strongly curved. Ventral tubercles not prominent. Parameres arcuate, narrowed from base to middle third, almost evenly wide in posterior two thirds. Internal sac with flagellum sinuate and bifid proximally, and with additional, straight, subbasal rod. Basal portion of flagellum fairly thick, left flagellar rod narrow. Membranes of internal sac with squamose structures in middle.

*Comments.* This species is an other member of the *S. subalpinum* group and is similar to *S. antennatum* and *S. pseudantennatum*. It differs from them notably by the more finely punctate elytra, the narrower aedeagus, and the very distinctive, bifid flagellum bearing an additional rod.

*Scaphisoma acclivum* sp. n.

Figs 29, 30

Holotype ♂: China, South Sichuan, Ya'an Prefecture, Shimian Co., Xiaoxiang Ling, lateral valley above Nanya Cun near Caluo, 11 km south Shimian, ca 1250m. 7.vii.1999, litter, bark, fungi, M. Schülke (ZMB).

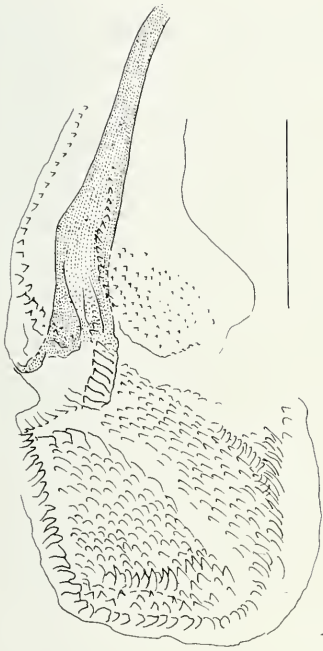
Paratypes: same data as holotype, 2 ♀ (MHNG, PCMS).

*Description.* Length 2.6-2.9 mm. In external characters very similar to *S. antennatum*, *S. pseudantennatum* and *S. oppositum*. It differs by following characters.

FIGS 19 to 24

Aedeagi in *Scaphisoma*, dorsal and lateral view; 19 and 20, *S. styloides* sp. n.; 21 to 23, *S. apertum* sp. n., apical portion of median lobe with partly extruded internal sac; 24, *S. pseudantennatum* sp. n., internal sac. Scale bars = 0.1 mm.

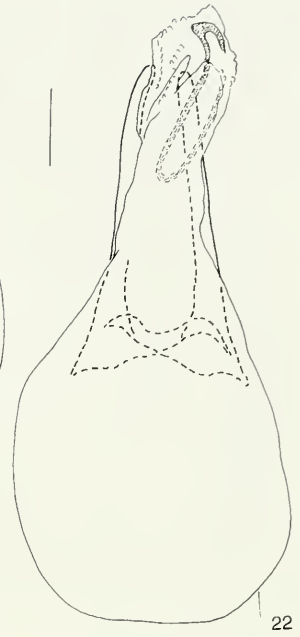




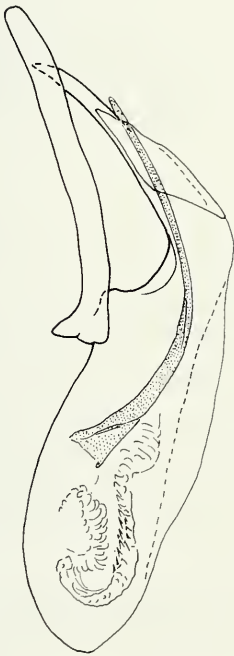
19



21



22



20



24



23

Length ratio of antennal segments 3 to 11 as follows: 6: 10: 15: 28: 30: 24: 29: 25: 34 (holotype); segment 4 about 2.5 times as long as wide; segments 5 about 3 times as long as wide; segment 6 about 5 times as long as wide, parallel-sided; segment 7 almost 4 times as long as wide; segments 8 and 11 each 4 times as long as wide. Pronotal punctation dense and coarse, punctures well delimited, slightly smaller or as large as intervals. Elytral punctation less dense, near base finer, on center of disc slightly coarser than pronotal punctation. Metepisternum lying below plane of metasternum. Mesocoxal area 0.09 mm long, metacoxal area 0.10 mm long. Microsculpture on lateral portions of first exposed abdominal sternite distinct.

Male sexual characters. Segments 1 to 3 of the protarsi and mesotarsi strongly widened. Aedeagus (Figs 29, 30) 1.55 mm. Median lobe strongly sclerotized, symmetrical, except for asymmetrical apex. Basal bulb fairly large, about as long as distal process, with ventral tubercles distinct, not prominent. Distal process moderately inflexed, rather oblique, asymmetrically narrowed toward apex; tip blunt in dorsal view; apex expanded ventrally and hook-like in lateral view. Parameres with large base, narrowed toward middle, with apical half almost equally wide and arcuate in dorsal view; sinuate in lateral view. Internal sac with flagellum robust, widened and curved in basal portion, almost straight in posterior basal portion, becoming gradually thinner toward apex. Proximal end of flagellum bearing small, oblique apophysis. Additional basal rod short, curved. Membranes very densely spinose in middle part of internal sac.

*Comments.* This species may be readily distinguished from other members of the *S. subalpinum* group by the shape of the distal process of the median lobe, in particular by its hook-like apex. It is also characterized by the shape of the flagellum. The aedeagal characters of *S. acclivum* indicate close relationships to *S. oppositum* which possesses also a flagellum bearing a proximal apophysis and an additional basal rod. However, the shape of the median lobe, parameres and flagellum are distinct these two species.

### *Scaphisoma linum* sp. n.

Figs 31, 32

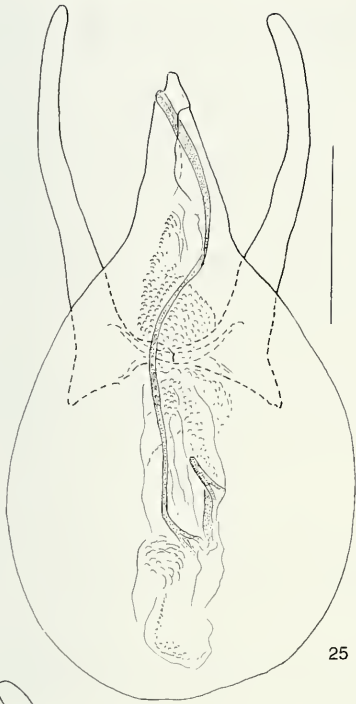
Holotype ♂: China, Sichuan, Liziping env. near Shimien, 200 km southwest Ya'an, 27.vi.-3.vii.1991, Z. Kejval (MHNG).

Paratypes: same data as holotype, 1 ♂, 2 ♀ (MHNG); Sichuan, Daxue Shan, Gongga Shan, 102°04'E 29°36'N, Hailuoguo Glacier Park, river valley about 1km above Camp I, 2100m, 28-31.v.1997, A. Pütz, 3 ♂, 1 ♀ (MHNG, PCAP); same data but env. Camp II, 2650m, sifted, 30.v.1997, 1 ♂ (MHNG); same data but above Camp III, 3000m, 1 ♂ (MHNG).

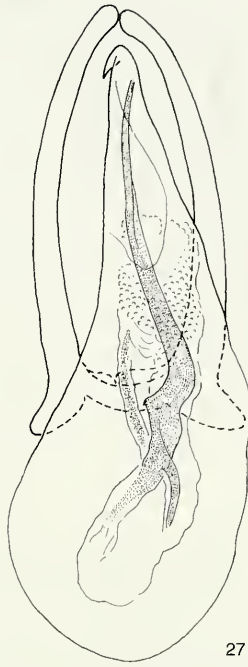
*Description.* Length 2.15-2.30 mm. In external characters very similar to *S. pseudantennatum*, differs from the latter by: length ratio of antennal segments 3 to 11 as follows: 6: 10: 16: 18: 23: 17: 22: 21: 26 (holotype); antennal segment 4 about 3 times as long as wide; segments 5 and 6 each 4 times as long as wide; segments 7, 8

Figs 25 to 30

Aedeagi in *Scaphisoma*, dorsal and lateral views: 25 and 26, *S. pseudantennatum* sp. n., scale bar = 0.3 mm; 27 and 28, *S. oppositum* sp. n., scale bar = 0.3 mm; 29 and 30, *S. acclivum* sp. n., scale bar = 0.4 mm.



25



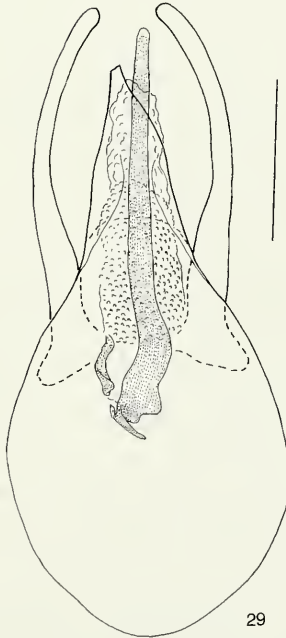
27



28



26



29



30

and 11 each about 3 times as long as wide; pronotum and elytra with almost even, fine punctation; inner apical angle of elytra lying posteriorly to outer apical angles; mesocoxal and metacoxal lines finely punctate; exposed abdominal tergites very finely punctate.

Sexual characters of male. Segments 1 to 3 of protarsi widened. Aedeagus (Figs 31, 32) 0.65 - 0.70 mm long, symmetrical. Basal bulb moderately sclerotized, fairly large. Ventral tubercles large, prominent. Distal process of median lobe about as long as basal bulb, tapering, curved and inflexed ventrally. Parameres slightly curved, with large base, gradually narrowed toward middle, evenly wide in apical half (dorsal and ventral views). Internal sac with flagellum very long, almost evenly narrow, strongly curved basally and joined to long, membranous, basal vesicle. Squamose structures absent from internal sac.

*Comments.* This species is also member of the *S. subalpinum* group. It may easily be distinguished by the distinctive shape of the flagellum. It has the ventral tubercles of the median lobe prominent, as in *S. adjacens* Löbl and *S. serpens* sp.n.

*Scaphisoma serpens* sp. n.

Figs 33, 34

Holotype ♂: China, Shaanxi, Qin Lin Shan, 10756'E, 33°45'N, route km 93 south of Zhouzhi, 108 km southwest of Xian, 1650m, mountain forest, sifted, 1-2.ix.1995, M. Schülke (ZMB).

*Description.* Length 1.9 mm. Body very dark reddish-brown, apex of abdomen lighter. Femora and tibiae ochreous. Tarsi and antennae light brown to yellowish. Length ratio of antennal segments 3 to 11 as follows: 5: 7: 13: 15: 20: 15: 19: 19: 23; segment 4 short, about 1.5 times as long as wide; segments 5 and 6 each about 2.5 times as long as wide; segments 7, 8 and 11 each about twice as long as wide. Pronotum with arcuate lateral margins; lateral keels concealed; punctation fine and dense, punctures not well delimited, very shallow, partly about as large as puncture intervals but mostly much smaller than latter. Tip of scutellum exposed. Elytra each with lateral margin slightly arcuate, lateral keel visible only near base; apical margin truncate; inner apical angle rounded, not prominent, lying posteriorly to outer angle; sutural margin not raised; sutural striae parallel, curved near base and extended laterally to form basal striae, approximate to base laterally and joined with lateral striae; discal punctation irregular, very fine to fairly coarse, dense; punctures usually larger than those on pronotum, smaller or about as large as puncture intervals. Exposed abdominal segments with punctulate microsculpture. Pygidium very finely and sparsely punctate, propygidium more coarsely punctate near base. Prohypomera impunctate, with punctulate microsculpture. Mesepimeral ridge about as long as interval to mesocoxa. Metasternum slightly convex in middle, impressed medio-apically; microsculpture absent, punctation very fine and sparse on most of surface, coarse and dense medio-apically. Mesocoxal line arcuate and finely punctate; mesocoxal area 0.05 mm long. Metepisternum flat, strongly narrowed anteriorly, with almost straight suture, almost on same level as metasternum. Exposed abdominal sternites extremely finely punctate. Metacoxal line arcuate, finely punctate; metacoxal area 0.07 mm long.

Sexual characters of male. Segments 1 to 3 of protarsi widened. Aedeagus (Figs 33, 34) 0.75 mm long. Median lobe symmetrical, basal bulb large, weakly sclerotized. Ventral tubercles large, slightly produced. Distal process of median lobe gradually narrowed toward tip (dorsal view), inflexed obliquely and curved at apex; tip acute in lateral view. Parameres slender, slightly sinuate, curved in apical portion. Internal sac with flagellum wide, flat and almost straight in basal portion, bearing small but distinct, acute denticle on right side. Flagellum narrowed and strongly arcuate posteriorly to level of denticle and evenly narrow in apical half; membranes with fine squamose and, in apical portion, spinose structures.

*Comments.* This species is an additional member of the *S. subalpinum* group. It has the aedeagus similar to that of *S. adjacens* Löbl to which it is obviously closely related. It may be distinguished from *S. adjacens* by the prohypomera and distinctly microsculptured first exposed abdominal sternite, and by the distinctive shape of the flagellum.

*Scaphisoma parasolutum* sp. n.

Figs 35, 36

Holotype ♂: China, South Yunnan, Mengyang Nat. Res., ca 500m, 14.ix.1994. S. A. Kurbatov (MHNG).

*Description.* Length 1.55 mm. Body dark reddish-brown, elytra slightly darker than pronotum. Ventral side of body and appendages ochreous. Length ratio of antennal segments 3 to 11 as follows: 10: 14: 23: 19: 25: 20: 25: 25: 26; segment 3 conspicuously elongate; segment 4 very narrow, about 5 times as long as wide; segment 5 slightly wider than segment 4, about 6 times as long as wide; segments 6, 7, 8 and 11 each about 5 times as long as wide. Pronotum with lateral margins almost oblique in basal half, convex in apical half; lateral keels visible; discal punctation dense and fine, punctures well delimited. Apical portion of scutellum exposed. Elytra each with lateral margin evenly arcuate; lateral keel entirely visible in dorsal view; apical margin rounded; inner apical angle rounded, not prominent, on same level as outer apical angle; sutural margin not raised; adsutural area flat; sutural striae parallel to suture in anterior half, slightly converging from middle to apex, reaching level of scutellum, not curved externally; discal punctation dense and coarse, punctures mostly well delimited and smaller than intervals. Prohypomera smooth. Mesepisterna very finely punctate. Mesepimeral ridge 1.5 times as long as interval to mesocoxa. Metasternum flattened medio-apically; area between coxae with microsculpture consisting of transverse striae, lateral portions of metasternum without microsculpture; metasternal punctation sparse and very fine; antecoxal puncture row dense, fairly coarse. Mesocoxal line arcuate, coarsely punctate; mesocoxal area 0.04 mm long. Metepisterna slightly convex, strongly narrowed anteriorly, in same plane as metasternum, with arcuate suture. Abdominal tergites and sternites with microsculpture consisting of transverse striae; punctation sparse and very fine. Metacoxal line arcuate, coarsely punctate; metacoxal area 0.08 mm long.

Sexual characters of male. Protarsi with segments 1 to 3 moderately widened. Aedeagus (Figs 35, 36) 0.88 mm long. Median lobe symmetrical. Basal bulb large, weakly sclerotized. Ventral tubercles small, somewhat produced. Distal process of

median lobe tapering, slightly inflexed. Parameres asymmetrical, in same plane as median lobe, each bearing oblique, membranous lobe. Internal sac with sclerotized rod gradually narrowed apically and membranes covered by squamose structures.

*Comments.* This species is certainly closely related with *S. solutum* Löbl which shares the conspicuously elongate 3rd antennal segment and the structurally very similar aedeagus. *Scaphisoma parasolutum* may be distinguished from *S. solutum* by the presence of the metasternal antecoxal puncture row and by the internal sac of the aedeagus bearing a rod gradually narrowed.

*Scaphisoma pseudosolutum* sp. n.

Figs 37 to 39, 41

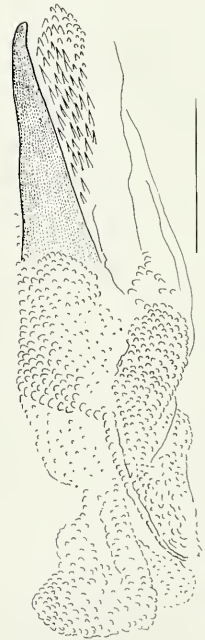
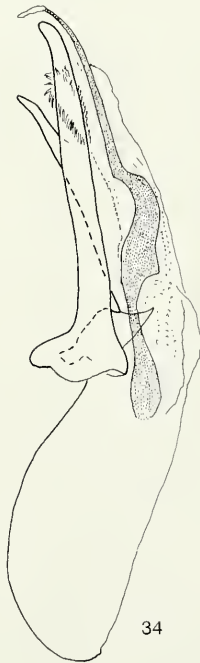
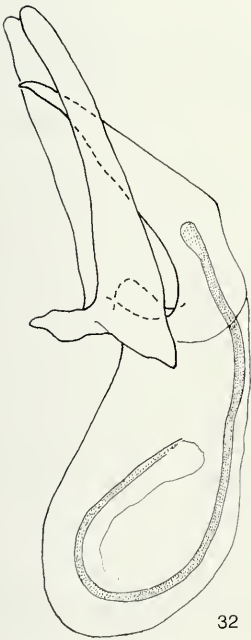
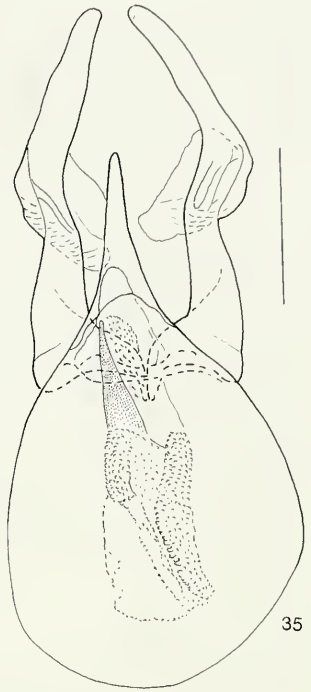
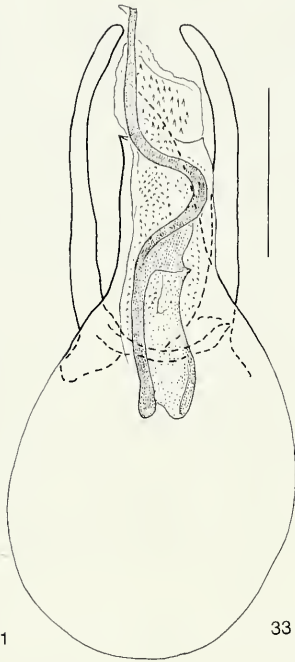
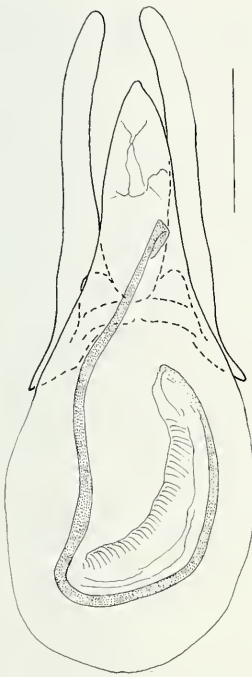
Holotype ♂: China, West Hubei, Shennongjia Nat. Res., 2000-2200m, 5.vi.1995, S. A. Kurbatov (MHNG)

*Description.* Length 1.9 mm. Body very dark reddish-brown, apex of elytra, apical abdominal segments and legs lighter, antennae yellowish. Length ratio of antennal segments 3 to 11 as follows: 5: 12: 20: 17: 21: 15: 21: 20: 24; segments 4 and 5 about 4 times as long as wide; segments 6, 7, 8 and 11 each about 3 times as long as wide. Pronotum with lateral margins evenly arcuate; lateral keels visible in dorsal view; discal punctation dense and fine, consisting of well delimited punctures. Apex of scutellum exposed. Elytra each with lateral margin almost straight, rounded only near base and apex; apical margin truncate; inner apical angle on same level as outer apical angles, not prominent; adsutural area flat in basal fifth, raised between basal fifth and apex; sutural stria gradually, weakly diverging from apex to base, ending behind pronotal lobe, not curved externally; discal punctation dense and fairly fine, coarser than that on pronotum, consisting of punctures well delimited, smaller than puncture intervals. Prohypomera smooth. Mesepisterna extremely finely punctate, without microsculpture. Mesepimeral ridge almost twice as long as interval to mesocoxa. Metasternum with very fine microsculpture consisting of very short waves and striae. Medio-apical portion of metasternum impressed. Metasternal punctation fine and dense in middle, becoming very sparse laterally; antecoxal puncture row very dense, consisting of small punctures. Mesocoxal line subtriangular, distinctly punctate; mesocoxal area 0.05 mm long. Metepisterna flat, strongly narrowed anteriorly, on same plane as metasternum; suture slightly sinuate. Abdominal tergites and sternites with distinct microsculpture consisting of transverse striae; punctation very fine and sparse. Metacoxal line strongly convex, finely punctate; metacoxal area 0.09 mm long.

Male sexual characters. Protarsi with segments 1 and 2 strongly widened, segment 3 slightly widened. Mesotarsi with segment 1 strongly widened, segment 2 slightly widened. Aedeagus (Figs 37 to 39, 41) 0.98 mm long. Median lobe symmetrical, with basal bulb weakly sclerotized. Ventral tubercles small, not produced.

FIGS 31 to 36

Aedeagi in *Scaphisoma*, dorsal and lateral views; 31 and 32, *S. linum* sp. n., scale bar = 0.3 mm; 33 and 34, *S. serpens* sp. n., scale bar = 0.2 mm; 35 and 36, *S. parasolutum* sp. n., aedeagus in dorsal view, scale bar = 0.2 mm (35); internal sac, scale bar = 0.1 mm (36).



Distal process tapering and moderately inflexed, slightly sinuate near tip in lateral view. Dorsal valve simple, lamellar, weakly sclerotized. Parameres wide, hardly inflexed, bent apically, with large, subbasal, membranous lobe. Internal sac narrow in middle, widened apically, bulbous basally; bearing spinose and squamose structures in basal portion, squamose structures in middle and apical portions.

*Comments.* This species appears to be allied to *S. gentile* Löbl, *S. flexuosum* Löbl, *S. nigrum* Löbl, *S. solutum* Löbl, and *S. parasolutum* sp. n. which share aedeagal characters, in particular the shape of the median lobe and parameres. *Scaphisoma pseudosolutum* differs notably from *S. gentile* by the narrow apical portion of the parameres and much smaller squamose structures of the internal sac, from *S. flexuosum* by the wide middle portion of the internal sac, from *S. nigrum* and *S. solutum* by the parameral lobe situated subbasally, and from the latter species also by the internal sac lacking a sclerotized rod. These species may be easily distinguished from *S. pseudosolutum* by their smaller size (the body length in *S. flexuosum* is 1.35 mm, in *S. nigrum* and *S. parasolutum* 1.50 - 1.55 mm, and in *S. solutum* 1.3 mm). They may be readily separated also by the length ratio of the antennal segments, especially by the short segment 4 in *S. nigrum*, the relatively long segment 3 in *S. solutum* and *S. parasolutum*, and the segment 5 much longer than the segment 6 in *S. flexuosum*.

*Scaphisoma vexator* sp. n.

Figs 40, 42

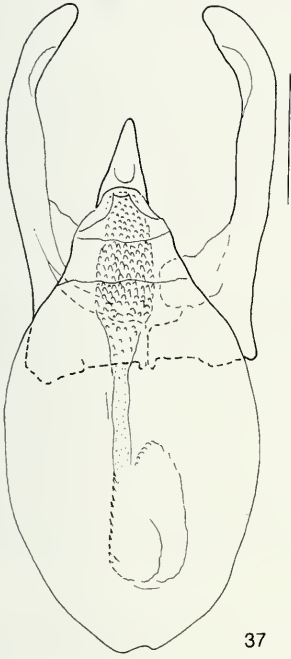
Holotype ♂: China, Yunnan, Gaoligong Mts, 1500-2500m, 25°22'N, 98°49'E, 17-24.v.1995, S. Bečvář (MHNG).

*Description.* Length 2.0 mm. Most of body, and appendages ochreous. Pronotum dark brown to black in mesal and basal portions. Elytra each with entire lateral portion, apex and base dark brown to black; subapical, transverse stripe lighter than remaining ochreous surface. Dark lateral area extended to elytral center, and dark basal area extended along suture to form triangle reaching to mid-length of suture. Mesosternum, metasternum and episterna brown. Length ratio of antennal segments 3 to 11 as follows: 4: 13: 22: 24: 26: 21: 24: 23: 26; segments 4 to 8 and 11 each about 4 times as long as wide. Pronotum with lateral margins arcuate; lateral keels entirely distinct; punctation fine and dense, well delimited and visible on dark areas, rather indistinct on ochreous areas. Elytra each with lateral margin arcuate; lateral keel entirely visible; apical margin rounded; inner apical angle lying posteriorly to level of outer apical angle, not prominent; sutural margin not raised; adsutural area flat; sutural stria parallel in anterior half, converging apically, curved near pronotal lobe, not extended along basal margin; discal punctation fairly fine and dense, punctures not well delimited, mostly larger than those on pronotum, and mostly distinctly

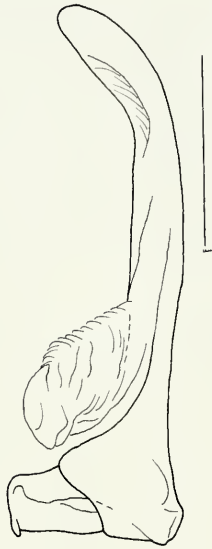
Figs 37 to 42

Aedeagi in *Scaphisoma*: 37 to 39 and 41, *S. pseudosolutum* sp. n., dorsal and lateral views, scale bar = 0.2 mm (37, 38), paramere in ventral view, scale bar = 0.2 mm (39), internal sac in dorsal view, scale bar = 0.1 (41); 40 and 42, *S. vexator* sp. n., aedeagus in dorsal view, scale bar = 0.3 mm (40), paramere in ventral view, scale bar = 0.2 mm (42).

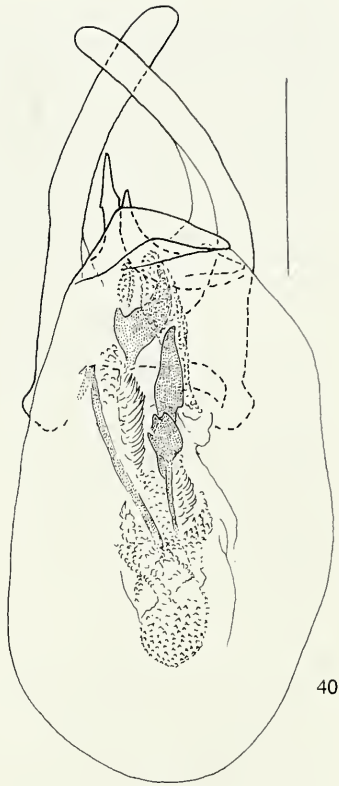




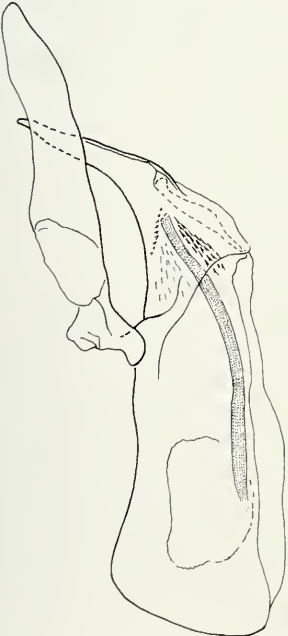
37



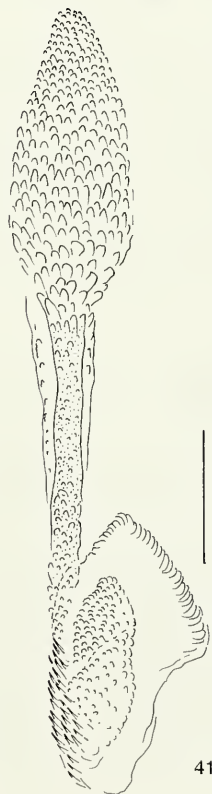
39



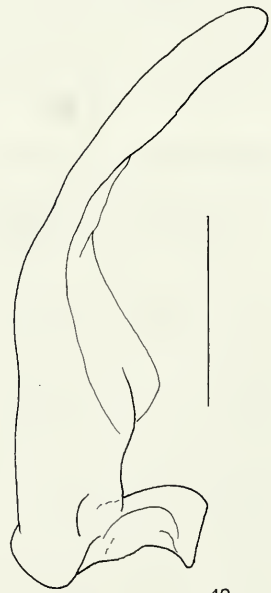
40



38



41



42

smaller than puncture intervals but some punctures about as large as puncture intervals. Prohypomera smooth. Mesepimeral ridge longer than interval to mesocoxa. Metasternum slightly convex in middle, lacking impressions; with microsculpture consisting of transverse striae becoming obsolete laterally, punctation sparse and very fine; antecoxal puncture row present but relatively inconspicuous. Mesocoxal line arcuate, very finely punctate; mesocoxal area 0.08 mm long. Metepisterna flat, moderately narrowed anteriorly, lying on lower plane than metasternum; suture straight. Abdomen very finely and sparsely punctate, with microsculpture consisting of transverse striae. Metacoxal line arcuate, finely punctate; metacoxal area 0.10 mm long.

Sexual characters of male. Segments 1 and 2 of protarsi and segment 1 of mesotarsi strongly widened, about as wide as apex of tibiae. Segment 3 of protarsi and segments 2 and 3 of mesotarsi widened, narrower than preceding segment. Aedeagus (Figs 40, 42) 1.12 mm long. Median lobe asymmetrical. Basal bulb large, weakly sclerotized. Ventral tubercles small, not prominent. Distal process of median lobe consisting of strongly sclerotized dorsal and ventral arms. Dorsal arm partly overlapped by basal bulb, curved, tapering and inflexed. Ventral arm longer than dorsal arm, straight, parallel-sided in anterior middle, tapering in posterior middle. Parameres wide, curved, with weakly sclerotized inner lobes. Internal sac complex, with two large, strongly sclerotized teeth, one narrow, long rod, and bearing squamose and denticulate membranous structures.

*Comments.* This species is closely related with *S. velox* Löbl. The aedeagi in both species are very similar (the length of the aedeagus of *S. velox* is not 0.55 mm as given by lapsus in the description, but 1.10 mm). *Scaphisoma velox* has the dorsal arm of the median lobe inconspicuous, the teeth-like sclerites of the internal sac longer, and the internal sac bearing an apical groups of denticles and a long basal rod which is absent from *S. vexator*. These two species may be easily distinguished by their colour pattern (the body is almost uniformly ochreous in *S. velox*).

*Scaphisoma pseudovarium* sp. n.

Figs 43 to 46

Holotype ♂: China, Yunnan, Gaoligong Mts, 2200-2500m, 24°57'N, 98°45'E, 8-16.v.1995, S. Bečvář (MHNG).

Paratypes: same data as holotype, 3 ♂, 5 ♀ (MHNG).

*Description.* Length 1.9-2.0 mm. Body with distinctive although variable colour pattern. Head and pronotum reddish-brown to blackish, lateral portions of pronotum sometimes lighter than pronotal center. Elytra ochreous or yellowish, with entire base and small subapical spot dark brown to black. Dark basal zone expanded apically along suture to cover at least anterior half of adsutural area, sometimes expanded to form large, triangular zone joined to subapical spots. Prohypomera ochreous. Mesosternum, metasternum, episterna and metepimera, and basal two or three exposed abdominal sternites dark brown to black. Following sternites and exposed abdominal tergites ochreous to yellowish. Appendages ochreous. Length ratio of antennal segments 3 to 11 as follows: 5: 15: 20: 20: 21: 19: 21: 20: 25 (holotype); segment 4 about 6 times as long as wide; segments 5 and 6 each about 7 times as long as wide; segment

7 almost 4 times as long as wide; segments 8 and 11 each almost 5 times as long as wide. Pronotum with evenly arcuate lateral margins; lateral keels visible near base; punctation dense and fine or very fine, less fine near base than at center, punctures not well delimited, usually smaller than puncture intervals. Apex of scutellum exposed. Elytra each with lateral margin arcuate in basal half, oblique in apical half; lateral keel entirely visible in dorsal view; apical margin truncate; inner apical angle lying posteriorly to level of outer apical angle, not prominent; sutural margin not raised; adsutural area flat; sutural stria converging to apex, parallel to suture in anterior half, curved along basal lobe of pronotum, not extended laterally along basal margin; discal punctation dense and coarse, puncture intervals mostly about as large as, or up to twice as large as puncture diameters. Propyopomera smooth. Mesepimeral ridge about 1.5 times as long as interval to mesocoxa. Metasternum lacking microsculpture, flattened in middle, without medio-apical impressions; punctation fine, dense on center, sparse laterally; antecoxal puncture row indicated by irregular row of punctures slightly larger than other metasternal punctures. Mesocoxal line arcuate, finely punctate; mesocoxal area 0.05-0.06 mm long. Metepisterna flat, moderately narrowed anteriorly, lying below plane of metasternum, with suture rounded near angles, straight in middle. Exposed abdominal segments very finely punctate, with microsculpture consisting of transverse striae. Metacoxal line strongly arcuate, finely punctate, metacoxal area 0.11-0.13 mm long.

Sexual characters of male. Segments 1 to 3 of protarsi and 1 and 2 of mesotarsi distinctly widened. Aedeagus (Figs 43 to 46) 1.02-1.04 mm long. Median lobe symmetrical. Basal bulb weakly sclerotized, slightly expanded apically, overlapping base of distal process. Ventral tubercles prominent. Distal process of median lobe inflexed, with ventral arm tapering and acute at apex, denticulate on dorsal side, bearing single denticle in middle of ventral side. Dorsal process partly fissured to form two joined rods strongly sclerotized along fissure. Parameres symmetrical, sinuate, with wide base, lobed and membranous at middle. Internal sac with two central tooth-like sclerites and membranes bearing squamose and spinose structures.

*Comments.* This species is very similar to *S. varium* Löbl with which it shares the colour pattern and most of the diagnostic characters. It may easily be distinguished from *S. varium* by the ventrally denticulate distal process of the median lobe, the irregular inner lobes of the parameres and the internal sac bearing two fairly long, central, sclerotized teeth. The aedeagus of *S. pseudovarium* is structurally very similar to that of *S. sasagoense* Löbl and *S. pinnigerum* Löbl. *Scaphisoma sasagoense* has the parameres narrowed subapically, and distinctly widened in apical portion, lacking a membranous lobe, and the internal sac with clusters of strongly sclerotized basal and apical denticles. In addition, *S. sasagoense* may be distinguished by the uniformly reddish-brown body. In *S. pinnigerum*, the metasternal antecoxal puncture row is distinct, the parameral lobe lies more apically, and the internal sac of the aedeagus bears a proximal striate structure which is absent from *S. pseudovarium* and *S. sasagoense*.

**Scaphisoma heishuiense** sp. n.

Figs 47 to 50

Holotype ♂: China, Yunnan, Heishui, 35km north Lijiang, 27°13'N, 100°19'E, 18.vi.-4.vii.1993, S. Bečvář (MHNG).

*Description.* Length 1.9 mm. In external characters very similar to *S. pseudovarium*, including the colour pattern. Body ochreous, with pronotum dark brown except near lateral margins and on anterior third, elytra with dark brown basal area expanded along suture to form not well delimited triangular spot, and with slightly darkened subapical spot, the latter not reaching to sutural stria. Mesosternum and metasternum with episterna and epimera dark brown. Appendages ochreous. Antennae almost as in *S. pseudovarium*: length ratio of antennal segments 3 to 11 as follows: 5: 12: 19: 17: 20: 16: 20: 19: 24. Pronotal punctation more sparse, with punctures mostly much smaller than puncture intervals. Metasternum with antecoxal puncture row obsolete. Mesocoxal area 0.05 mm long. Metepisterna slightly narrowed anteriorly, with straight suture. Metacoxal area 0.11 mm long. Punctation on mediobasal area of first exposed sternite relatively coarse. Aedeagus (Figs 47 to 50) 0.90 mm long. Vento-apical process of median lobe narrower than in *S. pseudovarium*, sinuate, more densely denticulate on dorsal surface, lacking ventral denticle. Parameres barely sinuate, bent apically, with inner lobe narrow. Spinose structures of internal sac long and strongly sclerotized, teeth-like sclerites larger than those in *S. pseudovarium*.

**Scaphisoma paravarium** sp. n.

Figs 51 to 55

Holotype ♂: China, Yunnan, Gaoligong Mts, 2200-2500m, 24°57'N, 98°45'E, 8-16.v.1995, S. Bečvář (MHNG).

Paratypes: same data as holotype, 2 ♀ (NHMB, MHNG)

*Description.* Length 1.75-1.95 mm. In external characters very similar to *S. pseudovarium*, with almost the same colour pattern. Antennae similar to those in preceding species; length ratio of antennal segments 3 to 11 as follows: 5: 12: 18: 18: 21: 18: 20: 19: 24 (holotype). Pronotum broadly lighter laterally and anteriorly; elytra with dark apical spot not reaching to sutural stria. Lateral keels of pronotum concealed in dorsal view, those of elytra entirely visible or concealed in middle. Elytra each with sutural margin raised; punctation very fine near base, consisting of fairly large but very shallow and not clearly delimited punctures on posterior two thirds of disc.

Sexual characters of male. Protarsi with segments 1 and 2 strongly widened, segment 3 slightly widened. Mesotarsi with segments 1 and 2 slightly widened. Aedeagus (Figs. 51 to 55) 0.90 mm long. Median lobe symmetrical, with basal bulb weakly sclerotized, slightly expanded apically, lacking ventral tubercles. Distal process of

## FIGS 43 to 50

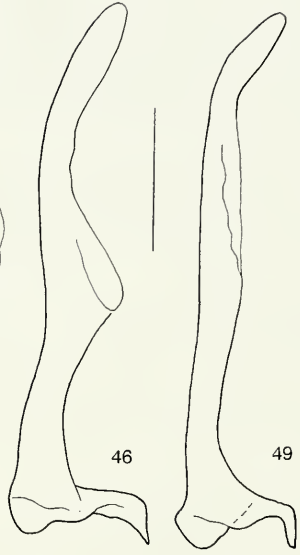
Aedeagi in *Scaphisoma*: 43 to 46. *S. pseudovarium* sp. n., aedeagus in dorsal and lateral views, scale bar = 0.2 mm (43, 44), apical portion of median lobe, in lateral view, scale bar = 0.1 mm (45), paramere in ventral view, scale bar = 0.2 mm (46); 47 to 50, *S. heishuiense* sp. n., aedeagus in dorsal and lateral views, scale bar = 0.2 mm (47, 48), paramere in ventral view, scale bar = 0.2 mm (49), apical portion of median lobe, in lateral view, scale bar = 0.1 mm (50).



43

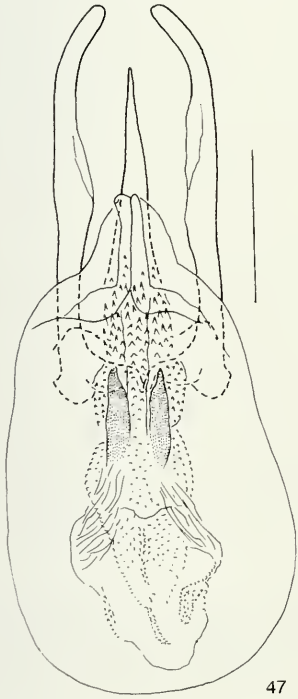


44



46

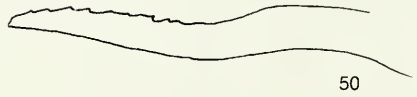
49



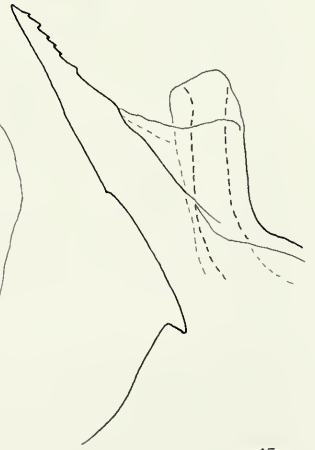
47



48



50



45

median lobe almost in same plane as basal bulb, tapering, denticulate dorso-apically. Dorsal valves apparently joined medianly, strongly sclerotized along inner margin. Parameres sinuate, almost evenly narrow, enlarged base excepted, with short, narrow, membranous lobe in posterior half. Internal sac lacking rods or robust teeth-like sclerites. Membranes of basal half of internal sac bearing denticulate structures overlapped laterally by squamose structures forming oblique, irregular rows. Denticular structures in apical portion of internal sac variable in size, more distinct than those in basal portion.

*Comments.* This species may be distinguished from the very similar *S. varium*, *S. pseudovarium* and *S. heishuiense* by the finer elytral punctation. It is well characterized by the shape of the parameres and the structures of the internal sac.

***Scaphisoma fibrosum* sp. n.**

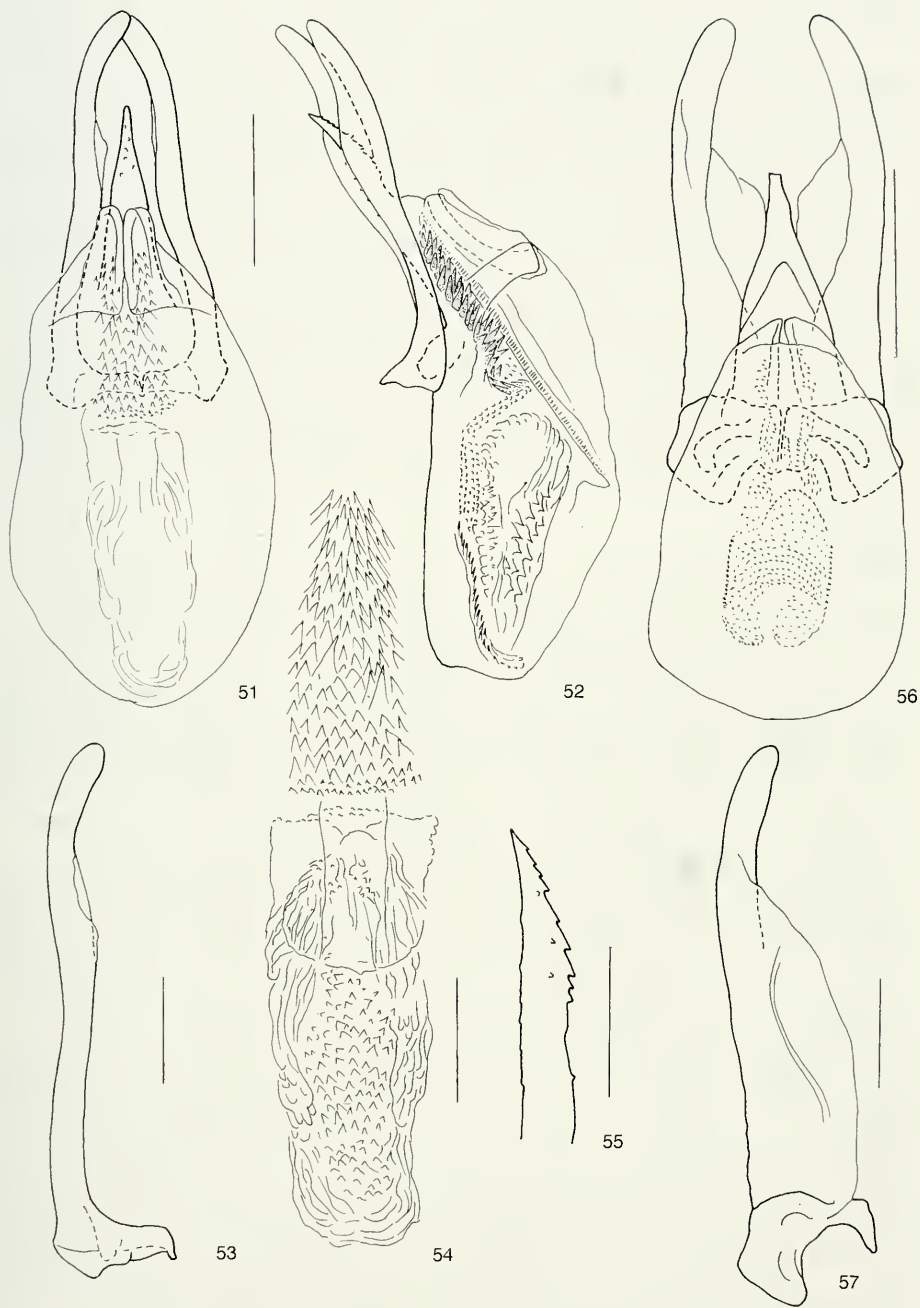
Figs 56, 57

Holotype ♂: China, Yunnan, Xishuangbanna, 24.i.1993, G. de Rougemont (MHNG).

*Description.* Length 1.7 mm. Head, thorax and basal two thirds of first exposed abdominal sternite dark brown. Elytra ochreous, with base dark brown to black; basal dark area expanded along suture to form triangular spot. Appendages, elytral apices and most of abdomen light ochreous. Antennae similar to those of preceding species; length ratio of antennal segments 3 to 11 as follows: 5: 12: 20: 19: 23: 19: 24: 23: 28. Pronotum with lateral margins oblique in dorsal view; lateral keels exposed; punctation fine and dense near base, becoming very fine and more sparse anteriorly; punctures not well delimited, slightly smaller than puncture interval near base. Apex of scutellum exposed. Elytra each with lateral margins arcuate anteriorly and posteriorly, oblique in middle; lateral keel distinct in dorsal view; apical margin slightly concave, dentate at and near inner angle; inner apical angle prominent, lying posterior to level of outer angle; sutural margin not raised; adsutural area flat; sutural stria straight, not curved near base, gradually, very slightly converging to suture apically; punctation coarse and dense, punctures not well delimited, partly about as large as puncture intervals. Prohypomera smooth. Mesepimeral ridge slightly longer than interval to mesocoxa. Metasternum slightly convex in middle, flattened medio-apically, covered by microsculpture consisting of transverse striae; metasternal punctation very fine and sparse, but dense and coarse on medio-apical area; antecoxal puncture row distinct, lying in impressed line. Mesocoxal line arcuate, coarsely punctate, mesocoxal area 0.04 mm long. Metepisterna convex, moderately narrowed anteriorly, lying below plane of metasternum; suture slightly arcuate anteriorly and posteriorly, straight in middle. Abdominal segments with microsculpture consisting of transverse striae but punctulate on laterobasal area of first sternite. Abdominal punc-

FIGS 51 to 57

Aedeagi in *Scaphisoma*; 51 to 55. *S. paravarium* sp. n., aedeagus in dorsal and lateral view, scale bar = 0.2 mm (51, 52), paramere in ventral view, scale bar = 0.1 mm (53), internal sac, dorsal view, scale bar = 0.1 mm (54), apical portion of median lobe, in lateral view, scale bar = 0.1 mm (55); 56 and 57. *S. fibrosum* sp. n., aedeagus in dorsal view, scale bar = 0.2 mm (56), paramere in ventral view, scale bar = 0.1 mm (57).



tation extremely fine. Metacoxal line arcuate, coarsely punctate; metacoxal area 0.05 mm long.

Sexual characters of male. Segments 1 and 2 of protarsi strongly widened. Segment 3 of protarsi and segments 1 and 2 of mesotarsi slightly widened. Aedeagus (Figs 56, 57) 0.78 mm long. Median lobe symmetrical. Basal bulb weakly sclerotized, expanded over proximal part of distal process of median lobe, lacking ventral tubercles. Distal process inflexed, gradually narrowed, with tip truncate in dorsal view. Dorsal valves incompletely separated by fissure. Parameres wide, moderately curved, with outer margin almost straight up to apical portion, with wide, inner, membranous lobe; parameral basis strongly enlarged. Internal sac with membranes bearing very small squamose or denticulate structures, lacking sclerotized rods or teeth.

*Comments.* This species is obviously closely related to *S. varium*, *S. pinnigerum*, *S. pseudovarium*, *S. heishuiense*, and *S. paravarium* with which it shares the structurally similar aedeagus. *Scaphisoma fibrosum* may be easily separated from these species by the coarse elytral punctation, the antecoxal puncture row lying in an impressed line, the broad parameres, and the absence from sclerotized structures in the internal sac.

***Scaphisoma incisum* sp. n.**

Figs 58 to 61

Holotype ♂: China, Yunnan, Lijiang, 1800m. 26°53' N, 100°18' E, 21.vii.1992, S. Bečvář (MHNG).

Paratypes: same data as holotype, 4 ♀ (MHNG).

*Description.* Length 1.70-1.75 mm. Head and most of pronotum very dark, almost blackish, with or without reddish lustre. Elytra as pronotum, or with large portion of disc somewhat lighter and reddish; elytral apices ochreous. Femora and tibiae ochreous. tarsi and abdominal apex yellowish. Length ratio of antennal segments 3 to 11 as follows: 6: 10: 15: 15: 17: 13: 17: 15: 19 (holotype). Pronotum with lateral margins evenly arcuate; lateral keels visible; punctation very fine, sparse, most punctures very shallow and not well delimited, but punctures near base appear slightly deeper and better delimited. Apex of scutellum exposed. Elytra each with lateral margin almost evenly arcuate; lateral keel visible in dorsal view; apical margin truncate, inner apical angle posterior to level of outer angle. not prominent; sutural stria slightly diverging from apex to mid-length of elytron, parallel from mid-length to level of pronotal lobe, slightly curved and ending near pronotal lobe; discal punctation fine and rather sparse, consisting of well delimited punctures, much larger than those on pronotum, puncture intervals mostly 3 to 5 times as large as puncture diameters. Pygidium conspicuously notched medio-apically, very finely punctate, with microsculpture consisting of transverse striae. Prohypomera smooth. Mesepimeral ridge about 1.5 times as long as interval to mesocoxa. Metasternum slightly convex in middle, lacking impressions, without microsculpture. Metasternal punctation very fine and sparse on lateral and on medio-anterior portions, more dense and less fine medio-apically and on areas between mesocoxae and metacoxae; antecoxal puncture row barely indicated. Mesocoxal lines arcuate, finely punctate, mesocoxal area 0.05 mm long. Metepisternum flat, lying below plane of metasternum, moderately narrowed



anteriorly, with almost straight suture. Abdominal sternites with microsculpture consisting of transverse striae; punctation very fine and sparse. Metacoxal line arcuate, fairly coarsely punctate; metacoxal area 0.08 mm long. Tibiae straight.

Male sexual characters. Segment 1 of protarsi strongly widened, about as wide as apex of tibia. Segment 2 of protarsi slightly widened, segment 3 of protarsi and segments 1 and 2 of mesotarsi barely widened. Aedeagus (Figs 58 to 61) 0.82 mm long. Median lobe almost as in *S. pseudovarium*, but with distal process oblique, not sinuate ventrally, bearing numerous dorsal denticles and single ventral denticle, as in the latter species. Parameres less curved apically, with inner lobe very narrow, inconspicuous. Internal sac with two proximal, rather large, teeth-like sclerites, lacking any particular structures in middle, denticulate in apical portion.

*Comments.* This species has the aedeagus similar to that of *S. varium* and the three species described above. It is obviously closely related to these four species but may be readily distinguished by the colour pattern and incised pygidium. The presence of a pair of teeth-like sclerites in the internal sac may indicate relationships to *S. pseudovarium* and *S. heishuiense*.

*Scaphisoma migrator* sp. n.

Figs 62 to 65

Holotype ♂: China, Shaanxi, east of Xian, Mt. Huashan, 500m, 12.v.1994, S. A. Kurbatov (MHNG).

Paratypes: same data as holotype, 2 ♂ (MHNG); Sichuan, Mt. Emei, 1700m, 22.ix.1994, S. A. Kurbatov, 3 ♂ and with same data but 1500, 21.ix., 1 ♂ (MHNG); Sichuan, Wolong Nat. Res., 24.v.1994, S. A. Kurbatov, 1 ♂ and with same data but 1700m, 19.v., 2 ♂ (MHNG); Shaanxi, On Ling Shan [=An Ling Shan], 110°06'E 34°27'N, Hua Shan, 118km east xian, N valley, 1200-1400m, 12-20.viii.1995, D. W. Wrase, 1 ♂ (PCMS); Shaanxi, On Lin Shan, 107°56'E 32°45'N, autoroute 93km south Zhouzhi, 108km southwest Xian, 1650m, mountaine forest, 2.ix.1995, D. W. Wrase, 1 ♂ (PCMS); Shaanxi, Taibai Shan above Houshenzi, 130-1700m, 9.vi.-3.vii.1998, P. Jäger & J. Martens, 1 ♂ (SMNS).

*Description.* This species is very similar to, and possesses most diagnostic features of *S. morosum* Löbl, *S. khao* Löbl, *S. karen* Löbl, *S. prehensor* Champion, and *S. tortile* Löbl. The colour pattern of the elytra is fairly variable, the apical fifth to third of the disc is light. The metasternal antecoxal puncture row is irregular and usually less distinct than in similar species. This new species is characterized by the male genitalia.

Aedeagus (Figs 62 to 65) 0.76-0.87 mm long. Median lobe symmetrical, fairly strongly sclerotized. Basal bulb very large, partly overlapping basal bulb. Ventral tubercles small, not prominent. Distal process of median lobe inflexed and arcuate, fairly long in lateral view, appearing short and straight in dorsal view, with small subapical denticle on dorsal side and tip acute. Dorsal valves completely separated, short, parallel. Internal sac complex, with large, sclerotized, apicolateral denticles joined to long, straight, tubular portion consisting of spinose structures. Parameres gradually narrowed from base to subapical portion, widened and slightly curved in apical portion, with small, inner, membranous lobe.

*Comments.* This species appears closely allied to *S. morosum* with which it shares structural characters of the aedeagus, in particular the presence of a small,

subapical parameral lobe, and similar internal sac. *Scaphisoma migrator* may be distinguished from *S. morosum* by the teeth-like apical sclerites joined by complex membranous structures, the absence of dorso-apical plate of the internal sac, and wider apical portion of the parameres.

In the absence of non sexual specific characters I have tentatively associated 14 females with the males listed above. The females were obviously collected together with the males.

*Scaphisoma mutator* sp. n.

Figs 66 to 69

Holotype ♂: China, Sichuan, Wolong Nat. Res., 1500m, 21.v.1994, S. A. Kurbatov (MHNG).

Paratypes: China, Sichuan, Wolong Nat. Res., 1000m, 24.v.1994, litter, S. A. Kurbatov, 2 ♂ (MHNG), same data but ca 500m, 15-16.v.94, 1 ♂ (MHNG); Mt. Emei, 1500m, 21.ix. 1994, litter, S. A. Kurbatov, 1 ♂ (MHNG); same data but 1700m, 22.ix., 4 ♂ (MHNG); same data but 1800m, 1 ♂ (MHNG); Sichuan, Quingchen-Shan, 650-700m, 30°53'56''N, 103°33'01''E, 18.v.1997, M. Schülke, 2 ♂ (PCMS); same but Qiencheng Shan NW Chengdu, 30°54'N, 103°33'E, D. Wrase, 3 ♂ (PCMS, MHNG); same but 65km NW Chengdu, 8km W Taiping, 800-1000m, A. Pütz, 3 ♂ (PCAP, MHNG); Shaanxi, Qin Lin Shan 110°06'E, 34°27'N, N Hua Shan 118km east Xian, N valley, 1200-1400m, leafy wd., 18-20.viii.1995, D. Wrase, 1 ♂ (PCMS); same but sifted, M. Schülke, 4 ♂ (PCMS, MHNG); Shaanxi, east Xian, Huashan, 700m, 9-12.v.1994, S. A. Kurbatov, 17 ♂ (MHNG).

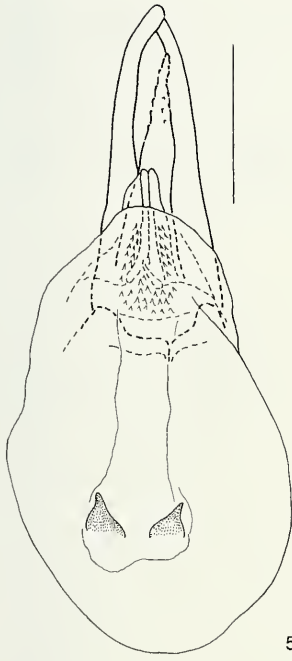
*Description.* Length 1.70-1.85 mm. Body dark reddish-brown, in some specimens almost blackish, apices of elytra usually distinctly lighter; tarsi, antennae and apex of abdomen light brown to yellowish. In external characters very similar to *S. tortile* Löbl but elytra with lateral keels usually concealed in dorsal view and sutural striae slightly diverging up to base; medio-apical portion of metasternum slightly impressed. This new species may be distinguished by the aedeagal characters.

Aedeagus (Figs 66 to 69) 0.86 - 0.95 mm long. Median lobe fairly strongly sclerotized, symmetrical. Basal bulb very large. Ventral tubercles small, not prominent. Distal process of median lobe short, inflexed ventrally and oblique, very narrow in lateral view, with single, fairly large apicodorsal denticle. Dorsal valves short, completely separated, gradually narrowed apically. Internal sac complex, with long, central row of oblique or transverse teeth-like sclerites pointed ventrally, short subapical denticles, and two groups of apical denticles pointed toward apex. Parameres sinuate, wide in middle, with very narrow inner lobe, slightly widened in apical portion (dorsal view), gradually narrowed from middle toward apex in lateral view.

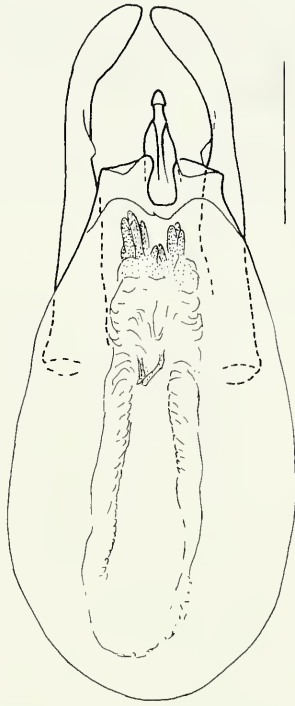
*Comments.* This species is a member of the *S. haemorrhoidalis* group and appears to be closely related to *S. tortile* Löbl and *S. prehensor* Champion. It shares with these two species, in addition to an overall similarity, the internal sac of the

Figs 58 to 64

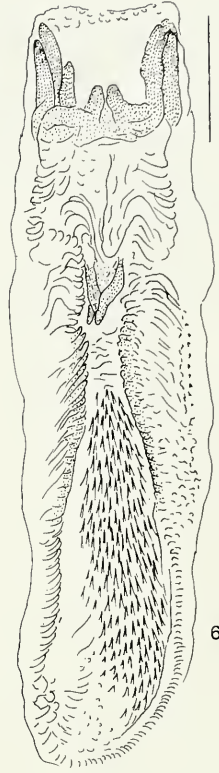
Aedeagi in *Scaphisoma*; 58 to 61, *S. incisum* sp. n., aedeagus in dorsal and lateral views, scale bar 0.2 mm (58, 59), apical portion of median lobe, in lateral view, scale bar = 0.1 mm (60), paramere in ventral view, scale bar = 0.1 mm (61); 62 to 64, *S. migrator* sp. n., aedeagus in dorsal view, scale bar = 0.2 mm (62); internal sac, scale bar = 0.1 mm (63), paramere in ventral view, scale bar = 0.1 mm (64).



58



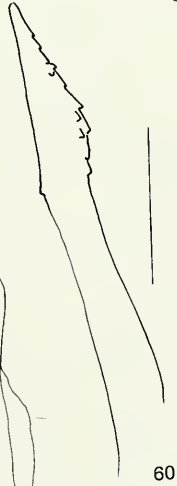
62



63



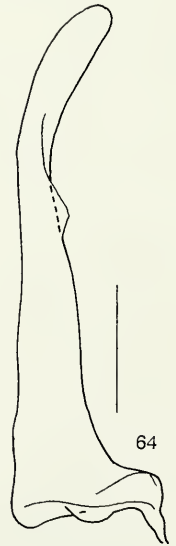
59



60



61



64

aedeagus bearing a long row of teeth-like sclerites, and the apical denticles pointed toward apex. *Scaphisoma mutator* may be distinguished from *S. tortile* and *S. prehensor* by the absence of a large sclerotized plate or tooth in central part of the internal sac, by the apical denticles grouped to form two clusters, and the parameres sinuate and widened apically.

An additional 32 females from Huashan are likely conspecific but are not included in the type series because this species can be recognized only by the male characters.

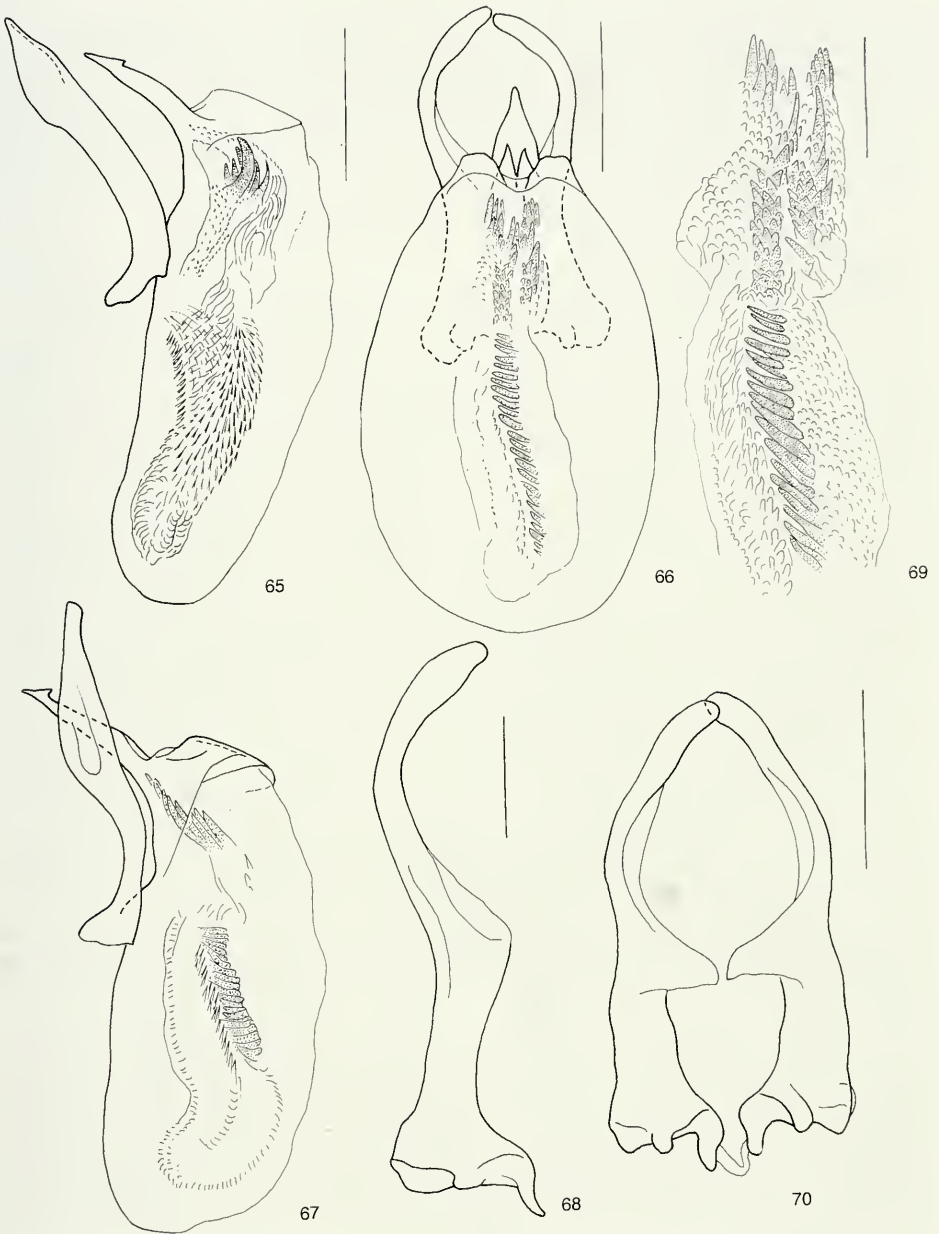
*Scaphisoma suspiciosum* sp. n.

Figs 70 to 73

Holotype ♂: China, Yunnan, Xishuangbanna, 24.i.1993, G. de Rougemont (MHNG).

*Description.* Length 1.7 mm. Body, femora and tibiae light reddish-brown, apical third of elytra and apical abdominal segments lighter, ochreous. Antennae and tarsi yellowish. Pronotum with slightly arcuate lateral margins; lateral keels exposed; discal punctation sparse and very fine, punctures particularly shallow and not clearly delimited. Tip of scutellum exposed. Elytra each with lateral margin rounded near base, straight in posterior two thirds; apical margin truncate, inner apical angle lying posterior to level of outer apical angle, not prominent; sutural margin not raised, adsutural area flat; sutural stria slightly diverging from apex to mid-length, parallel to suture in anterior half, slightly curved near base; punctation dense and fairly fine, puncture intervals mostly as large as to 3 times larger than puncture diameters. Exposed abdominal tergites extremely finely punctate. Prohypomera smooth. Mesepimeral ridge longer than interval to mesocoxa. Metasternum without microsculpture and with very fine and sparse punctation on lateral portions, lacking antecoxal puncture row. Middle portion of metasternum flattened, with shallow impression in center, fine and dense punctation, and very finely microsculptured. Mesocoxal line arcuate, finely punctate; mesocoxal area 0.08 mm long. Metepisterna flat, moderately narrowed anteriorly, lying below plane of metasternum, with slightly sinuate suture. Abdomen with microsculpture consisting of transverse striae; sternites very finely punctate. Metacoxal line arcuate, fairly coarsely punctate; metacoxal area 0.07 mm long.

Sexual characters of male. Segments 1 and 2 of protarsi and 1 of mesotarsi strongly widened, about as wide as tibia, segment 2 of mesotarsi moderately widened. Aedeagus (Figs 70 to 73) 0.93 mm long. Median lobe symmetrical, fairly strongly sclerotized. Basal bulb large, in dorsal view completely overlapping distal process and dorsal valves. Ventral tubercle robust, not prominent. Distal process strongly inflexed, almost perpendicular to axis of median lobe, gradually narrowed, with minute sub-apical denticle (tip broken off). Dorsal valves very short, completely separated, slightly curved. Parameres sinuate, with wide, relatively short lobe in posterior basal third, equally wide posterior lobe in dorsal view, gradually narrowed from lobe to apex in lateral view. Internal sac complex, with very dense spinose structures in basal half, followed by oblique, widened, central portion bearing large and strongly sclerotized teeth-like sclerites and apical portion consisting of small teeth and squamose structures.



FIGS 65 TO 70

Aedeagi in *Scaphisoma*; 65, *S. migrator* sp. n., lateral view, scale bar = 0.2 mm; 66 to 69, *S. mutator* sp. n., aedeagus in dorsal and lateral views, scale bar = 0.2 mm (66, 67), paramere in ventral view, scale bar = 0.1 mm (68), internal sac in dorsal view, scale bar 0.1 mm (69); 70, *S. suspiciosum* sp. n., parameres in ventral view, scale bar = 0.2 mm.

*Comments.* This species is a member of the *S. haemorrhoidale* group. It appears to be closely related to *S. insulanum* Löbl, which possesses a long median lobe, with very short dorsal valves, similar shape of parameres and structurally similar internal sac. Both species differ notably in the shape of the distal process of the median lobe which in *S. suspiciosum* is much more inflexed and overlapped by the basal bulb in dorsal view.

The holotype has the segments 3 - 11 of both antennae broken off.

*Scaphisoma irruptum* sp. n.

Figs 74 to 76, 81

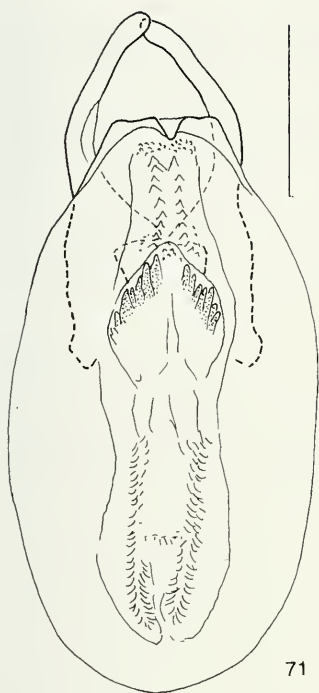
Holotype ♂: China, Yunnan, Xishuangbanna, 24.i.1993, G. de Rougemont (MHNG).

*Description.* Length 1.6 mm. Body and femora dark reddish-brown, apical third of elytra and apex of abdomen light ochreous. Tibiae and tarsi ochreous. Pronotum with lateral margins evenly arcuate; lateral keels visible in dorsal view; discal punctation very fine and sparse, consisting of minute and not well delimited punctures. Tip of scutellum exposed. Elytra each with lateral margin slightly arcuate near base and in apical third, oblique in middle; lateral keel entirely exposed; apical margin slightly rounded, inner apical angle posterior to level outer apical angle, not prominent; sutural margin not raised, adsutural area flat; sutural striae diverging from middle to apex, parallel to anterior middle, curved along pronotal lobe, not extended laterally; punctation fine and dense in apical half, puncture intervals mostly as large as, to 3 times larger than, puncture diameters in apical half, 3 to 5 times larger than puncture diameters near base. Prohypomera smooth. Mesepimeral ridge longer than interval to mesocoxa. Middle and lateroposterior portions of metasternum with microsculpture consisting of transverse striae, most of lateral portions of metasternum without microsculpture. Metasternum flattened in middle, lacking impression, with very fine and dense punctation. Lateral portions of metasternum with punctation sparse and very fine; antecoxal puncture row distinct. Mesocoxal line arcuate, finely punctate; mesocoxal area 0.08 mm long. Metepisterna flat, narrowed anteriorly, lying below plane of metasternum; suture oblique, rounded near angles. Exposed abdominal segments with sparse and very fine punctation, and with distinct microsculpture consisting of transverse striae. Metacoxal line arcuate, finely punctate; metacoxal area 0.07 mm long.

Sexual characters of male. Segments 1 and 2 of protarsi strongly widened, about as wide as tibiae. Segment 3 of protarsi moderately widened. Aedeagus (Figs 74 to 76, 81) 0.72 mm long. Median lobe symmetrical, with basal bulb large, moderately sclerotized, overlapping distal process in dorsal view. Ventral tubercles distinct, not prominent. Distal process strongly inflexed ventrally, thick basally, abruptly angulate

FIGS 71 to 76

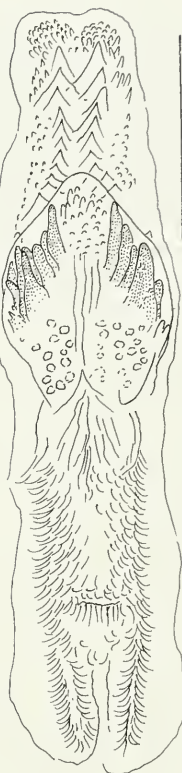
Aedeagi in *Scaphisoma*: 71 to 73. *S. suspiciosum* sp. n., aedeagus in dorsal and lateral views, scale bar = 0.2 mm (71, 72), internal sac in dorsal view, scale bar = 0.2 mm (73); 74 to 76. *S. irruptum* sp. n., aedeagus in dorsal and lateral views, scale bar = 0.2 mm (74, 76), internal sac in dorsal view, scale bar = 0.1 mm (75).



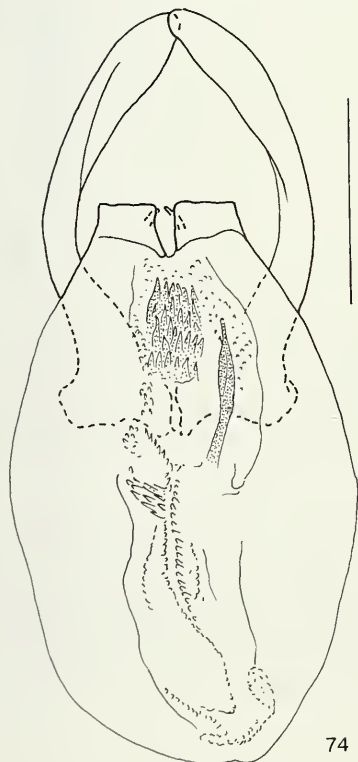
71



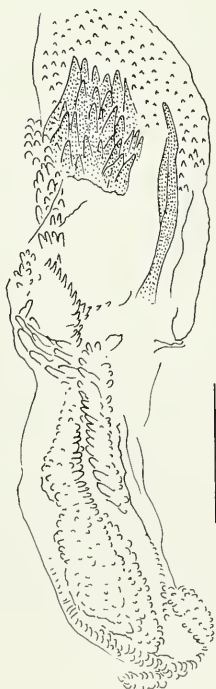
72



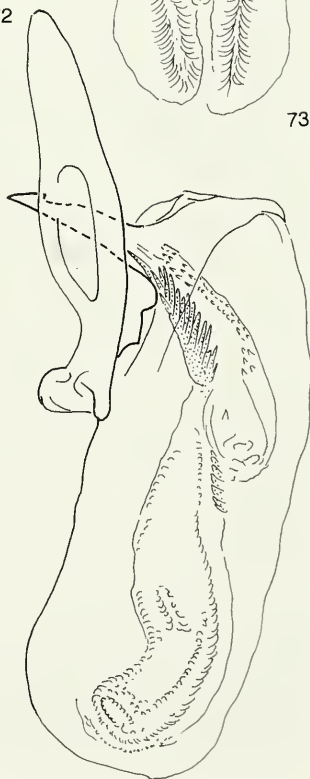
73



74



75



76

posterior to ventral process (lateral view), gradually narrowed toward tip in lateral view and bearing small, subapical tooth on dorsal side; tip acute. Dorsal valves short, completely separated, slightly curved. Internal sac complex, with long, straight basal portion consisting of spinose structures, central plate covering two rows of robust teeth, followed by rows of denticles becoming larger apically, and by fine squamose structures. Parameres sinuate, large in basal portion, abruptly widened in anterior mid-length, forming large inner lobe.

*Comments.* This species is another member of the *S. haemorrhoidale* group. It is characterized by the aedeagus with angulate ventral side of the median lobe, internal sac bearing long, narrow rod, and wide parameres.

*Scaphisoma volitatum* sp. n.

Figs 77 to 80

Holotype ♂: China, Yunnan, Xishuangbanna, 24.i.1993, G. de Rougemont (MHNG).

*Description.* Length 1.6 mm. Body and femora dark reddish-brown, apical third of elytra, apex of abdomen, tibiae, tarsi and antennae light ochreous to yellowish. Basal half of elytra slightly lighter than narrow dark area delimiting apical ochreous third of elytra, and lighter than pronotum. Pronotum with lateral margins evenly arcuate; lateral keels entirely, but hardly, visible; discal punctation fairly dense, very fine, particularly shallow and not clearly delimited. Tip of scutellum exposed. Elytra each with lateral margin slightly arcuate; lateral keel entirely distinct; apical margin truncate; inner apical angle lying posterior to level of outer apical angle, not prominent; sutural margin not raised, adsutural area flat; sutural stria parallel to suture in anterior mid-length, converging to suture from middle to apex, curved near base, ending near pronotal lobe; discal punctation fairly sparse and fine, punctures mostly well delimited, puncture intervals mostly 2 to 3 times as large as puncture diameters in middle of disc, becoming larger anteriorly. Prohypomera smooth. Mesepisterna very finely punctate. Mesepimeral ridge about twice as long as interval to mesosternum. Metasternum with microsculpture consisting of transverse striae, covering large middle portion and extending to level of lateral edges of mesocoxae; surface lateral of mesocoxae lacking microsculpture. Medio-apical area of metasternum flattened, without microsculpture, with punctation dense and rather fine. Lateral portions of metasternum very finely punctate, with antecoxal puncture row distinct, dense, coarse and irregular. Mesocoxal line arcuate, finely punctate; mesocoxal area 0.07 mm long. Metepisterna flat, strongly narrowed anteriorly, lying below plane of metasternum, with suture oblique in middle, curved near angles. Exposed abdominal segment with microsculpture consisting of transverse striae, except laterobasal portions of first sternite which lacks microsculpture. Punctation of first sternite sparse and very fine. Metacoxal line arcuate, finely punctate, metacoxal area 0.07 mm long.

Sexual characters of male. Segments 1 to 3 of protarsi strongly widened. Segments 1 and 2 of mesotarsi moderately widened, segment 3 of mesotarsi hardly widened. Aedeagus (Figs 77 to 80) 0.86 mm long. Median lobe large, symmetrical. Basal bulb partly overlapping distal process, moderately sclerotized. Distal process inflexed, gradually narrowed, with acute tip in dorsal view; narrowed subapically,



with tip dorsoventrally expanded and obliquely truncate in lateral view. Dorsal valves slightly curved, tapering apically. Ventral tubercles small, not prominent. Internal sac complex, with lateral row of strongly sclerotized, blunt basal teeth, numerous sub-apical denticles, one large, long rod curved and pointed apically, and membranes bearing spinose and squamose structures. Parameres wide, curved posterior of mid-length, with fairly large inner lobe in middle, apical portion distinctly widened and weakly sclerotized.

*Comments.* This species is another member of the *S. haemorrhoidale* group. It may be distinguished from related species possessing a similar colour pattern only by the aedeagal characters, in particular by the shape of the rod of the internal sac, in combination with the presence of a row of blunt teeth and wide parameres. The aedeagal characters indicate close relationships to *S. tortile* Löbl and *S. prehensor* Champion. The latter species differs drastically by the presence of a flat sclerite in the middle portion of the internal sac. *Scaphisoma tortile* may be distinguished from *S. volitatum* by the shape of the rod and the subapical denticulate and spinose area of the internal sac being distinctly delimited.

*Scaphisoma vestigator* sp. n.

Figs 82 to 85

Holotype ♂: China, Sichuan, Mt. Emei, 1700m, 22.ix.1994, litter, S. A. Kurbatov (MHNG).

Paratype ♂: same data as holotype (MHNG).

*Description.* Length 1.65 - 1.80 mm. Body very dark reddish brown to blackish-brown. Apical sixth to fifth of elytra, apical abdominal segments, femora and tibiae ochreous, tarsi and antennae lighter, yellowish. Ochreous apical band of elytra extending more anteriorly, and about as long as one fourth of elytral length, near lateral margins. Pronotum with lateral margins evenly arcuate; lateral keels visible only near base; discal punctation dense and very fine, consisting of shallow, not well delimited punctures. Point of scutellum exposed. Elytra each with lateral margin slightly arcuate anteriorly and in apical third, oblique in middle; lateral keel entirely visible; apical margin truncate; inner apical angle lying posterior level of outer apical angle, not prominent; sutural margin not raised; adsutural area flat; sutural striae diverging from apex to mid-length, parallel from middle to level of pronotal lobe, curved along pronotal lobe to reach base near pronotal lobe; punctation similar to that on pronotal disc near base, along sutural stria and lateral margin, becoming gradually coarser and more dense posteriorly; punctures in middle and on most of posterior half not well delimited, puncture intervals about 2 to 5 times as large as puncture diameters. Prohypomera smooth. Mesepisterna extremely finely punctate. Mesepimeral ridge about as long as interval to mesocoxa. Metasternum with shallow medio-apical impression; finely punctate and with microsculpture consisting of transverse striae in middle. Lateral portions of metasternum lacking microsculpture, with punctation very fine and sparse; antecoxal puncture row inconspicuous, consisting of few, fine punctures. Mesocoxal line arcuate, coarsely punctate; mesocoxal area 0.05 mm long. Metepisterna flat, moderately narrowed anteriorly, lying below plane of metasternum, with suture straight except near angles. Exposed abdominal segments with microsculpture consisting of transverse striae, laterobasal portions of first sternite lacking

microsculpture. Abdominal punctation very fine and sparse. Metacoxal line arcuate, coarsely punctate; metacoxal area 0.10 mm long.

Sexual characters of male. Segments 1 to 3 of protarsi strongly widened, segments 1 and 2 of mesotarsi slightly widened. Aedeagus (Figs 82 to 85) 0.88-0.92 mm long. Median lobe large, symmetrical. Basal bulb weakly sclerotized, almost completely overlapping apical process (dorsal view). Ventral tubercles small, not prominent. Distal process short, obliquely inflexed, with subapical denticle on dorsal side. Dorsal valves slightly curved, blunt. Internal sac complex, with basal portion strongly incurved, bearing dense spinose and squamose structures. Central portion of internal sac narrow, with one long, slender rod. Apical portion of internal sac straight, formed by two lobes joined apically, bearing dense, fine, squamose structures, and larger, strongly sclerotized, subapical denticles. Parameres wide and straight at base, narrowed in middle portion, arcuate in apical half (dorsal view), with long, narrow, inner lobe; slightly sinuate and widest anterior middle in lateral view.

*Comments.* This new species is also a member of the *S. haemorrhoidale* group. It is unique in having the aedeagus with short distal process overlapped by basal bulb in combination with the internal sac curved basally and bearing a median rod. The aedeagal characters indicate close relationships to *S. irruptum*. It may be distinguished from *S. irruptum* by the apical half of the parameres being narrower and the median lobe lacking an angulate area posterior to ventral tubercles.

*Scaphisoma dumosum* sp. n.

Figs 85 to 89

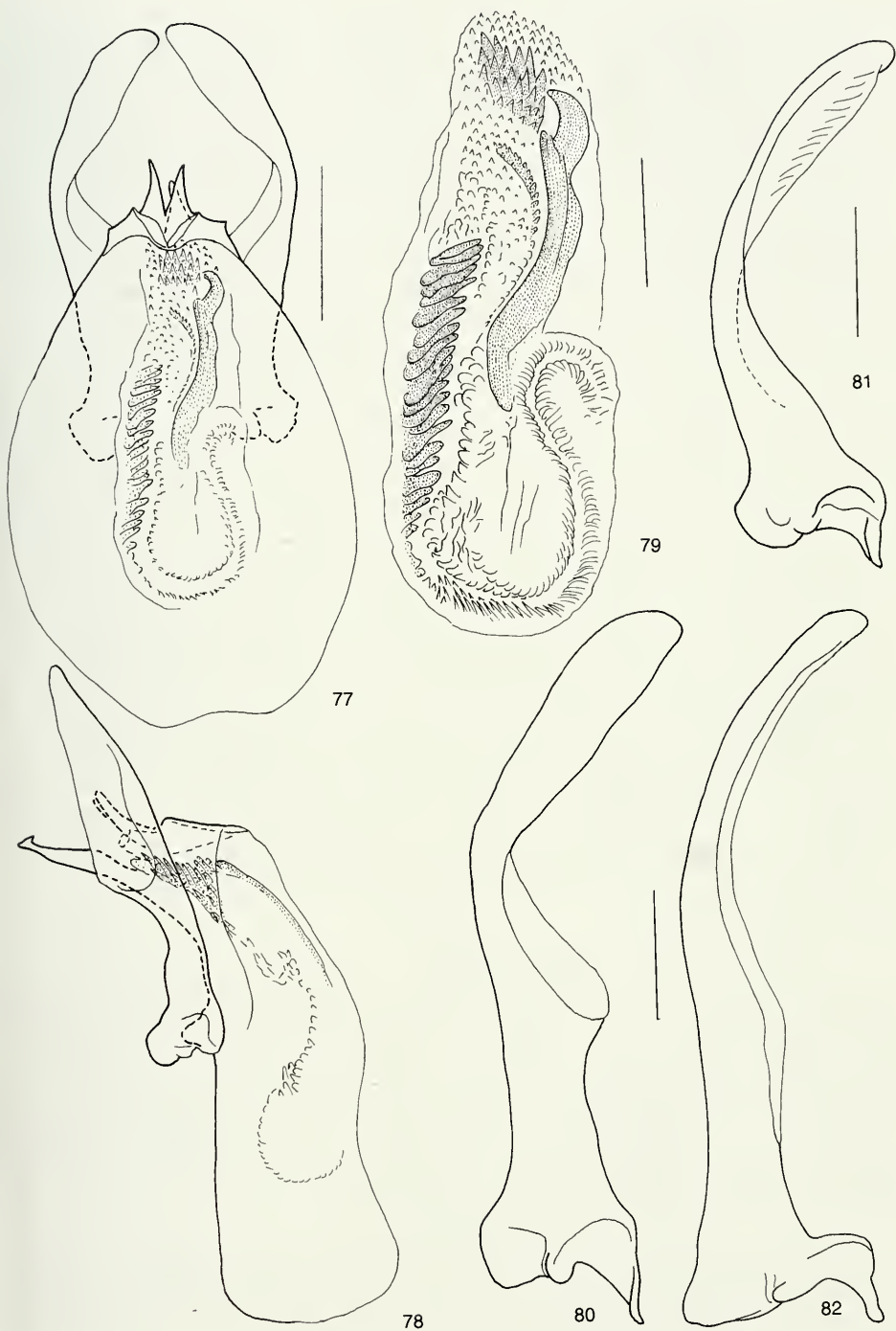
Holotype ♂: China, Yunnan, above Dali, 2000-2200m, 4.-17.iv.1999, W. Schawaller (SMNS).

Paratypes: same data as holotype, 1 ♂ (MHNG); Yunnan, Gongga Shan, Moxi, 1300m, 11.vii.1996, 20°13'N 102°10'E, A. Smetana, J. Farkač and P. Kabátek, 2 ♂ (MHNG).

*Description.* Length 1.65-1.75 mm. Body dark brown to black, apical fourth of elytra, apical abdominal segments, tarsi and antennae light ochreous, femora and tibiae reddish-brown. Pronotum with evenly arcuate lateral margins; lateral keel not exposed; discal punctation extremely fine, sparse, consisting of very shallow and not clearly delimited punctures. Point of scutellum exposed. Elytra each with lateral margin slightly arcuate; lateral keel entirely visible; apical margin truncate; inner apical angle posterior to level of outer apical angle, not prominent; sutural margin not raised; adsutural area flat; sutural striae diverging from apex to mid-length, parallel from middle to level of pronotal lobe, curved along pronotal lobe to reach base near pronotal lobe; punctation similar to that on pronotal disc, near base, along sutural stria and lateral margin, becoming gradually coarser and denser posteriorly; punctures in middle and on most of posterior half not well delimited, puncture intervals about 2 to 5 times as large as puncture diameters. Prohypomera and mesepisterna extremely

FIGS 77 to 82

Aedeagi in *Scaphisoma*; 77 to 80, *S. volitatum* sp. n., aedeagus in dorsal and lateral views, scale bar = 0.2 mm (77, 78), internal sac in dorsal view, scale bar 0.1 mm (79), paramere in ventral view, scale bar = 0.1 mm (80); 81, *S. irruptum* sp. n., paramere in ventral view, scale bar = 0.1 mm; 82, *S. vestigatum* sp. n., paramere in ventral view, scale bar = 0.1 mm.



finely punctate. Mesepimeral ridge about twice as long as interval to mesocoxa. Metasternum without median impressions, flattened medio-apically; with microsculpture consisting of transverse striae present only on narrow medio-apical area, most of surface lacking microsculpture. Punctuation sparse and very fine on lateral portions of metasternum, less fine on center of metasternum. Mesocoxal line subtriangular, coarsely punctate; mesocoxal area 0.07-0.08 mm long. Antecoxal puncture row absent. Metepisterna flat, hardly narrowed anteriorly, lying below plane of metasternum, with straight suture between rounded angles. Exposed abdominal segments with microsculpture consisting of transverse striae. First abdominal sternite sparsely and coarsely punctate, lacking microsculpture on basolateral area. Metacoxal line arcuate, very finely punctate; metacoxal area 0.08-0.10 mm long.

Sexual characters of male. Segments 1 to 3 of protarsi strongly widened, segments 1 and 2 of mesotarsi moderately widened. Aedeagus (Figs 85 to 89) 0.69 - 0.72 mm long. Median lobe symmetrical, moderately sclerotized. Basal bulb large, partly overlapping distal process. Distal process strongly inflexed, almost straight, gradually narrowed, with subapical denticle; tip acute. Dorsal valves slightly curved, acute. Ventral tubercles small, inconspicuous. Internal sac complex, with straight, wide and long basal portion consisting of rows of fairly strongly sclerotized central denticles covered by fine spicules, and lateral, weakly sclerotized, irregularly structured areas. Subapical portion of internal sac with moderately sclerotized, triangular plate rising apically and curved (lateral view); apical portion with six blunt, strongly sclerotized, robust denticles joined to finely denticulate membranous area. Parameres almost on same plane as basal bulb, arcuate in apical half (dorsal view), fairly wide, with narrow inner lobe; widest in middle and slightly narrowed toward apex in lateral view.

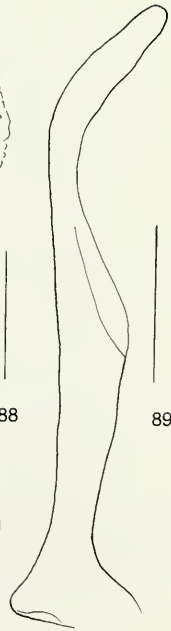
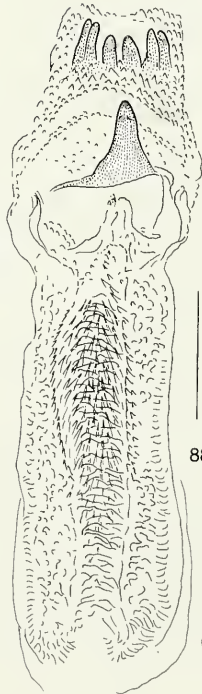
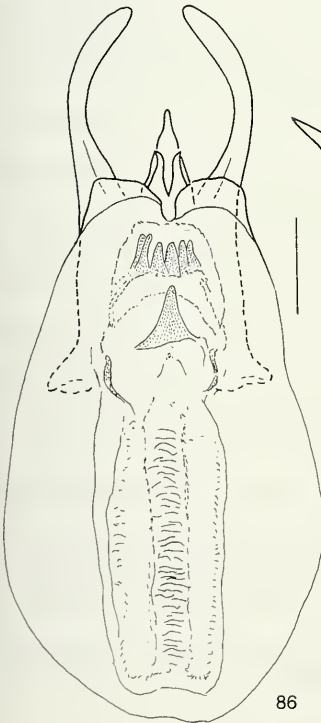
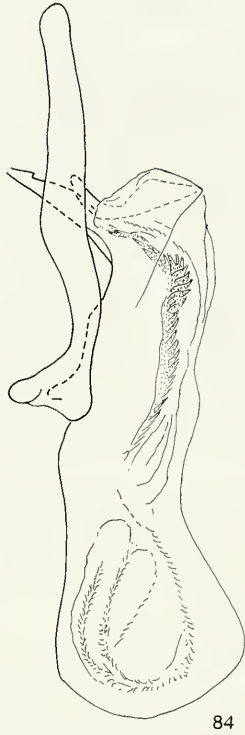
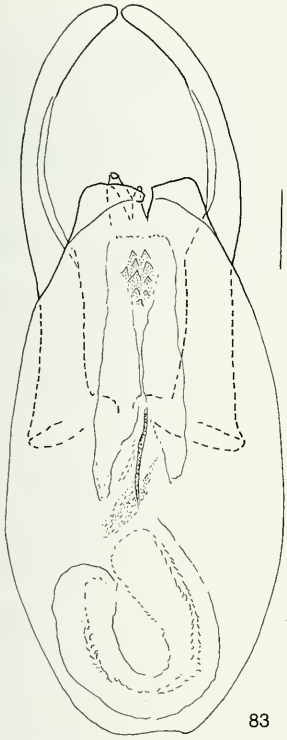
*Comments.* This species exhibits on internal sac of the aedeagus similar to that of *S. migrator*. Both species have robust apical denticles and basal portion of the internal sac straight, bearing fine spicules. *Scaphisoma dumosum* may be separated from *S. migrator* by the parameres being more curved and lacking a subapical lobe, and by the presence of a plate in the subapical part of the internal sac.

#### ACKNOWLEDGEMENTS

My thanks are due to following colleagues and friends who provides material, either as loan from collections of which they are in charge, or as donation: S. Bečvář (České Budějovice), N. Berti (Paris), D. Burckhardt (Basel), J. Cooter (Hereford), Z. Kejval (Domažlice), D. Král (Praha), V. Kubán (Brno), S. A. Kurbatov (Moscow), J. Jelínek (Prague), C. Johnson (Manchester), A. Pütz (Eisenhüttenstadt), G. de Rougemont (London), W. Schawaller (Stuttgart), M. Schülke (Berlin), A. Smetana (Ottawa), and E. Sprecher (Basel). I thank also G. de Rougemont (London) for comments on the manuscript which improved the study.

#### FIGS 83 to 89

Aedeagi in *Scaphisoma*: 83 to 85, *S. vestigatum* sp. n., aedeagus in dorsal and lateral views (83, 84), internal sac in dorsal view (85); 86 to 89, *S. dumosum* sp. n., aedeagus in dorsal and lateral views (86, 87), internal sac in dorsal view (88), paramere in ventral view (89). Scale bars = 0.1 mm.



## REFERENCES

- ASHE, J. S. 1984. Description of the larva and pupa of *Scaphisoma terninata* Melsh. and the larva of *Scaphium castanipes* Kirby with notes on their natural history (Coleoptera: Scaphidiidae). *The Coleopterists Bulletin* 38: 361-373.
- HANLEY, R. S. 1996. Immature stages of *Scaphisoma castaneum* Motschulsky (Coleoptera: Staphylinidae: Scaphidiinae), with observation of natural history, fungal hosts and development. *Proceedings of the Entomological Society of Washington* 98: 36-43.
- JÄCH, M. A. & JI, L. 1995. Introduction. In: Water beetles of China. Vienna, 410 pp.
- LAWRENCE, J. F. & NEWTON, A. F. 1980. Coleoptera associated with the fruiting bodies of slime molds (Myxomycetes). *The Coleopterists Bulletin* 34: 129-143.
- LESCHEN, R. A. B. 1988. The natural history and immatures of *Scaphisoma impunctatum* (Coleoptera: Scaphidiidae). *Entomological News* 99: 225-232.
- LESCHEN, R. A. B. 1994. Retreat-building by larval Scaphidiinae (Staphylinidae). *Mola* 4: 3-5.
- LÖBL, I. 1965a. Beitrag zur Kenntnis der japanischen Arten der Gattung *Scaphosoma* Leach (Scaphidiidae). *Entomologische Blätter* 61: 44-58.
- LÖBL, I. 1965b. Beitrag zur Kenntnis der Scaphosoma-Arten Chinas (Coleoptera, Scaphidiidae). *Reichenbachia* 6: 25-31.
- LÖBL, I. 1970. Revision der Gattungen *Scaphisoma* Leach und *Caryoscaptha* Ganglbauer der Tribus Scaphisomini (Col. Scaphidiidae). *Revue suisse de Zoologie* 77: 727-799.
- LÖBL, I. 1973. Über einige orientalische Scaphidiidae (Coleoptera) aus dem Museo Civico di Storia Naturale di Genova und Muséum National d'Histoire Naturelle de Paris. *Nouvelle Revue d'Entomologie* 3: 149-160.
- LÖBL, I. 1979. Die Scaphidiidae (Coleoptera) Südindiens. *Revue suisse de Zoologie* 86: 77-129.
- LÖBL, I. 1980. Beitrag zur Kenntnis der Scaphidiidae (Coleoptera) Taiwans. *Revue suisse de Zoologie* 87: 91-123.
- LÖBL, I. 1981a. Über die Arten-Gruppe Rouyeri der Gattung *Scaphisoma* Leach (Coleoptera Scaphidiidae). *Archives des sciences (Genève)* 34: 153-168.
- LÖBL, I. 1981b. Über einige Arten der Gattung *Scaphisoma* Leach (Coleoptera, Scaphidiidae) aus Vietnam und Laos. *Annales historico-naturales musei nationalis Hungarici* 73: 105-112.
- LÖBL, I. 1982. Über die Scaphidiidae (Coleoptera) der japanischen Ryukyu-Inseln. *Mitteilungen der Schweizerischen entomologischen Gesellschaft* 55: 101-105.
- LÖBL, I. 1986a. Les Scaphidiidae (Coleoptera) du nord-est de l'Inde et du Bhoutan II. *Revue suisse de Zoologie* 93: 133-212.
- LÖBL, I. 1986b. Contribution à la connaissance des Scaphidiidae (Coleoptera) du nord-ouest de l'Inde et du Pakistan. *Revue suisse de Zoologie* 93: 341-367.
- LÖBL, I. 1990a. Contribution à la connaissance des *Scaphisoma* (Coleoptera, Scaphidiidae) de l'Himachal Pradesh, Inde. *Archives des sciences (Genève)* 43: 117-123.
- LÖBL, I. 1990b. Review of the Scaphidiidae (Coleoptera) of Thailand. *Revue suisse de Zoologie* 97: 505-621.
- LÖBL, I. 1992. The Scaphidiidae (Coleoptera) of the Nepal Himalaya. *Revue suisse de Zoologie* 99: 471-627.
- LÖBL, I. 1993. Contribution to the knowledge of the Scaphidiinae (Coleoptera) of the Far East Region of Russia. *Russian Entomological Journal* 2: 35-40.
- LÖBL, I. 1997. Catalogue of the Scaphidiinae (Coleoptera: Staphylinidae). *Instrumenta biodiversitatis* I: XII + 190 pp.
- LÖBL, I. 1999. A review of the Scaphidiinae (Coleoptera: Staphylinidae) of the People's Republic of China. I. *Revue suisse de Zoologie* 106: 691-744.
- NUSS, I. 1975. Zur Ökologie der Porlinge. Untersuchungen über die Sporulation einiger Porlinge und die an ihnen gefundenen Käferarten. *Bibliotheca Mycologica (Vaduz)* 45: 1-258.
- PIC, M. 1954. Coléoptères nouveaux der Chine. *Bulletin de la Société entomologique de Mulhouse* 1954: 53-59.
- SMETANA, A. 1996. Two new species of *Deinopteroloma* from China (Coleoptera: Staphylinidae: Omaliinae). *Koleopterologische Rundschau* 66: 77-81.

REVUE SUISSE DE ZOOLOGIE

Tome 107 — Fascicule 3

Pages

PUTHZ, Volker. The genus <i>Dianous</i> Leach in China (Coleoptera, Staphylinidae). 261. Contribution to the knowledge of Steninae. . . . .	419-559
GATTOLLIAT, J.-L. & M. SARTORI. Contribution to the systematics of the genus <i>Dabulamanzia</i> (Ephemeroptera: Baetidae) in Madagascar. . . .	561-577
MUSTER, Christoph & Konrad THALER. Das Männchen von <i>Zelotes zellensis</i> Grimm (Araneae: Gnaphosidae). . . . .	579-589
VOGEL, Peter, Mark LAWRENCE & Ali AGHNAJ. Note sur les musaraignes (Soricidae, Mammalia) du Parc National du Souss-Massa, Maroc. . . .	591-599
LÖBL, Ivan. A review of the Scaphidiinae (Coleoptera: Staphylinidae) of the People's Republic of China, II. . . . .	601-656

REVUE SUISSE DE ZOOLOGIE

Volume 107 — Number 3

	Pages
PUTHZ, Volker. The genus <i>Dianous</i> Leach in China (Coleoptera, Staphylinidae). 261. Contribution to the knowledge of Steninae. . . . .	419-559
GATTOLIAT, J.-L. & M. SARTORI. Contribution to the systematics of the genus <i>Dabulamanzia</i> (Ephemeroptera: Baetidae) in Madagascar. . . . .	561-577
MUSTER, Christoph & Konrad THALER. The male of <i>Zelotes zellensis</i> Grimm (Araneae: Gnaphosidae). . . . .	579-589
VOGEL, Peter, Mark LAWRENCE & Ali AGHNAJ. Shrews (Soricidae, Mammalia) of the National Park Souss-Massa, Morocco. . . . .	591-599
LÖBL, Ivan. A review of the Scaphidiinae (Coleoptera: Staphylinidae) of the People's Republic of China, II. . . . .	601-656

**Indexed in** CURRENT CONTENTS, SCIENCE CITATION INDEX



PUBLICATIONS DU MUSÉUM D'HISTOIRE NATURELLE DE GENÈVE

CATALOGUE DES INVERTÉBRÉS DE LA SUISSE, N <sup>OS</sup> 1-17 (1908-1926) . . . . .	série Fr. 285.—
(prix des fascicules sur demande)	
REVUE DE PALÉOBIOLOGIE . . . . .	Echange ou par fascicule Fr. 35.—
LE RHINOLOPHE (Bulletin du centre d'étude des chauves-souris) . . . . .	par fascicule Fr. 35.—
COLLEMBOLENFAUNA EUROPAS von H. GISIN, 312 Seiten, 554 Abbildungen, 1960 (Nachdruck, 1984) . . . . .	Fr. 30.—
THE EUROPEAN PROTURA THEIR TAXONOMY, ECOLOGY AND DISTRIBUTION WITH KEYS FOR DETERMINATION by J. NOSEK, 346 pages, 111 figures in text, 1973 . . . . .	Fr. 30.—
CLASSIFICATION OF THE DIPLOPODA par Richard L. HOFFMAN, 237 pages, 1979 . . . . .	Fr. 30.—
LES OISEAUX NICHEURS DU CANTON DE GENÈVE par P. GÉROUDET, C. GUËX et M. MAIRE 351 pages, nombreuses cartes et figures, 1983 . . . . .	Fr. 45.—
CATALOGUE COMMENTÉ DES TYPES D'ECHINODERMES ACTUELS CONSERVÉS DANS LES COLLECTIONS NATIONALES SUISSES, SUIVI D'UNE NOTICE SUR LA CONTRIBUTION DE LOUIS AGASSIZ À LA CONNAISSANCE DES ECHINODERMES ACTUELS par Michel JANGOUX, 67 pages, 11 planches, 1985 . . . . .	Fr. 15.—
RADULAS DE GASTÉROPODES LITTORAUX DE LA MANCHE (COTENTIN-BAIE DE SEINE, FRANCE) par Y. FINET, J. WÜEST et K. MAREDA, 62 pages, 1991 . . . . .	Fr. 10.—
GASTROPODS OF THE CHANNEL AND ATLANTIC OCEAN; SHELLS AND RADULAS by Y. FINET, J. WÜEST and K. MAREDA, 1992 . . . . .	Fr. 30.—
O. SCHMIDT SPONGE CATALOGUE par R. DESQUEYROUX-FAUNDEZ & S.M. STONE, 190 pages, 49 plates, 1992 . . . . .	Fr. 40.—
ATLAS DE RÉPARTITION DES AMPHIBIENS ET REPTILES DU CANTON DE GENÈVE par A. KELLER, V. AELLEN et V. MAHNERT, 48 pages, 1993 . . . . .	Fr. 15.—
THE MARINE MOLLUSKS OF THE GALAPAGOS ISLANDS: A DOCUMENTED FAUNAL LIST par Yves FINET, 180 pages, 1995 . . . . .	Fr. 30.—
NOTICE SUR LES COLLECTIONS MALACOLOGIQUES DU MUSEUM D'HISTOIRE NATURELLE DE GENEVE par Jean-Claude CAILLIEZ, 49 pages, 1995 . . . . .	Fr. 22.—
PROCEEDINGS OF THE XIIIth INTERNATIONAL CONGRESS OF ARACHNOLOGY, Geneva 1995 (ed. Volker MAHNERT), 720 pages, 1996 . . . . .	Fr. 160.—
CATALOGUE OF THE SCAPHIDIINAE (COLEOPTERA: STAPHYLINIDAE) ( <i>Instrumenta Biodiversitatis</i> I) par Ivan LÖBL, 192 pages, 1997 . . . . .	Fr. 50.—
CATALOGUE SYNONYMIQUE ET GÉOGRAPHIQUE DES SYRPHIDAE (DIPTERA) DE LA RÉGION AFROTROPICALE ( <i>Instrumenta Biodiversitatis</i> II) par Henri G. DIRICKX, 188 pages, 1998 . . . . .	Fr. 50.—
A REVISION OF THE CORYLOPHIDAE (COLEOPTERA) OF THE WEST PALAEARCTIC REGION ( <i>Instrumenta Biodiversitatis</i> III) par Stanley BOWESTEAD, 204 pages, 1999 . . . . .	Fr. 60.—
THE HERPETOFAUNA OF SOUTHERN YEMEN AND THE SOKOTRA ARCHIPELAGO ( <i>Instrumenta Biodiversitatis</i> IV) par Beat SCHÄTTI & Alain DESVOIGNES, 178 pages, 1999 . . . . .	Fr. 70.—



## **Revue suisse de Zoologie: Instructions to Authors**

The *Revue suisse de Zoologie* publishes papers by members of the Swiss Zoological Society and scientific results based on the collections of the Muséum d'histoire naturelle, Geneva. Submission of a manuscript implies that it has been approved by all named authors, that it reports their unpublished work and that it is not being considered for publication elsewhere. A financial contribution may be asked from the authors for the impression of colour plates and large manuscripts. All papers are refereed by experts.

In order to facilitate publication and avoid delays authors should follow the *Instructions to Authors* and refer to a current number of R.S.Z. for acceptable style and format. Manuscripts not conforming with these directives are liable to be returned to the authors. Papers may be written in French, German, Italian and English. Authors should aim to communicate ideas and information clearly and concisely. Authors not writing in their native language should pay particular attention to the linguistic quality of the text.

Manuscripts must be typed, or printed (high quality printing, if possible by a laser-printer), on one side only and double-spaced, on A4 (210 x 297 mm) or equivalent paper and all pages should be numbered. All margins must be at least 25 mm wide. Authors must submit one original and two copies, including tables and figures, in final fully corrected form, and are expected to retain another copy.

We encourage authors to submit the text on a diskette (3.5", Macintosh or IBM compatible, with "Microsoft Word" or similar programmes). The text should be in roman (standard) type face throughout, including headings, except genus and species names which should be formatted in italics (or underlined with pencil); bold, small capitals, large capitals and other type faces should not be used. Footnotes and cross-references by page should be avoided.

Papers should conform to the following general layout:

**Title page.** A concise but informative full title plus a running title of not more than 40 letters and spaces, name(s) in full and surname(s) of author(s), and full address(es).

**Abstract.** The abstract is in English, composed of the title and a short text of up to 200 words. It should summarise the contents and conclusions of the paper. The abstract is followed by less than 10 key-words, separated by hyphens, which are suitable for indexing.

**Introduction.** A short introduction to the background and the reasons for the work.

**Materials and methods.** Sufficient experimental details must be given to enable other workers to repeat the work. The full binominal name should be given for all organisms. The International Code of Zoological Nomenclature must be strictly followed. Cite the authors of species on their first mention.

**Results.** These should be concise and should not include methods or discussion. Text, tables and figures should not duplicate the same information. New taxa must be distinguished from related taxa. The abbreviations gen. n., sp. n., syn. n. and comb. n. should be used to distinguish all new taxa, synonyms or combinations. Primary types must be deposited in a museum or similar institution. In taxonomic papers the species heading should be followed by synonyms, material examined and distribution, description and comments. All material examined should be listed in similar, compact and easily intelligible format; the information should be in the same language as the text. Sex symbols should be used rather than "male" and "female".

**Discussion.** This should not be excessive and should not repeat results nor contain new information, but should emphasize the significance and relevance of the results reported.

**References.** The *Harvard System* must be used for the citation of references in the text, e.g. White & Green (1995) or (White & Green, 1995). For references with three and more authors the form Brown *et al.* should be used. Authors' names should not be written in capitals. The list of references must include all publications cited in the text but only these. References must be listed in alphabetical order of authors, and both the title and name of the journal must be given in full in the following style (italics can be formatted by the author):

Penard, E. 1888. Recherches sur le *Ceraïum macroceros*. *Thèse, Genève*, 43 pp.

Penard, E. 1889. Etudes sur quelques Héliozoaires d'eau douce. *Archives de Biologie* 9: 1-61.

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.

References should not be interspaced and, in the case of several papers by the same author, the name has to be repeated for each reference.

**Tables.** These should be self-explanatory, with the title at the top organised to fit 122 x 180 mm. Each table should be typed, double spaced, on a separate page and numbered consecutively and its position indicated in the text.

**Figures.** These may be line drawings or half tones and all should be numbered consecutively, and their position indicated in the text. Figures should be arranged in plates which can be reduced to 122 x 160 mm. Drawings and lettering should be prepared to withstand reduction. Magnification should be indicated with scale lines. Authors should refrain from mixing the drawings and half tones. Original drawings will not be returned automatically. The *Revue suisse de Zoologie* declines responsibility for lost or damaged slides or other documents. If electronically scanned figures are submitted on diskettes, this should be clearly indicated on the print-out enclosed with the manuscript.

**Legends to figures.** These should be typed in numerical order on a separate sheet.

**Proofs.** Page proofs only are supplied, and authors may be charged for alterations (other than printer's errors) if they are numerous.

**Offprints.** The authors receive totally 25 offprints free of charge; more copies may be ordered at current prices when proofs are returned.

**Correspondence.** All correspondence should be addressed to

Revue suisse de Zoologie  
Muséum d'histoire naturelle  
CP 6434  
CH-1211 Genève 6  
Switzerland.

Phone: +41 22 418 63 33 - Fax +41 22 418 63 01

e-mail: [volker.mahnert@mh.ville-ge.ch](mailto:volker.mahnert@mh.ville-ge.ch)

Home page RSZ: <http://www.ville-ge.ch/musinfo/mhng/page/rsz.htm>



451  
H

ANNALES

de la  
SOCIÉTÉ SUISSE DE ZOOLOGIE  
et du  
MUSÉUM D'HISTOIRE NATURELLE  
de la Ville de Genève

tome 107  
fascicule 4  
2000

SWISS JOURNAL OF ZOOLOGY

REVUE SUISSE DE ZOOLOGIE



GENÈVE DÉCEMBRE 2000 ISSN 0035 - 418 X

# REVUE SUISSE DE ZOOLOGIE

TOME 107 — FASCICULE 4

Publication subventionnée par:  
ACADÉMIE SUISSE DES SCIENCES NATURELLES ASSN  
VILLE DE GENÈVE  
SOCIÉTÉ SUISSE DE ZOOLOGIE

VOLKER MAHNERT  
Directeur du Muséum d'histoire naturelle de Genève

MANUEL RUEDI  
Chargé de recherche au Muséum d'histoire naturelle de Genève

CHARLES LIENHARD  
Chargé de recherche au Muséum d'histoire naturelle de Genève

## *Comité de lecture*

Il est constitué en outre du président de la Société suisse de Zoologie, du directeur du Muséum de Genève et de représentants des Instituts de zoologie des universités suisses.

Les manuscrits sont soumis à des experts d'institutions suisses ou étrangères selon le sujet étudié.

La préférence sera donnée aux travaux concernant les domaines suivants: biogéographie, systématique, évolution, écologie, éthologie, morphologie et anatomie comparée, physiologie.

## *Administration*

MUSÉUM D'HISTOIRE NATURELLE  
1211 GENÈVE 6

Internet: <http://www.ville-ge.ch/musinfo/mhng/page/rsz.htm>

### PRIX DE L'ABONNEMENT:

SUISSE Fr. 225.—

UNION POSTALE Fr. 230.—

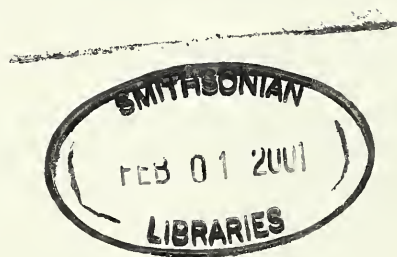
(en francs suisses)

Les demandes d'abonnement doivent être adressées  
à la rédaction de la *Revue suisse de Zoologie*,  
Muséum d'histoire naturelle, C.P. 6434, CH-1211 Genève 6, Suisse

ANNALES

de la  
SOCIÉTÉ SUISSE DE ZOOLOGIE  
et du  
MUSÉUM D'HISTOIRE NATURELLE  
de la Ville de Genève

tome 107  
fascicule 4  
2000



SWISS JOURNAL OF ZOOLOGY

REVUE SUISSE DE ZOOLOGIE



GENÈVE DÉCEMBRE 2000 ISSN 0035 - 418 X

# REVUE SUISSE DE ZOOLOGIE

TOME 107 — FASCICULE 4

Publication subventionnée par:  
ACADÉMIE SUISSE DES SCIENCES NATURELLES ASSN  
VILLE DE GENÈVE  
SOCIÉTÉ SUISSE DE ZOOLOGIE

---

VOLKER MAHNERT  
Directeur du Muséum d'histoire naturelle de Genève

MANUEL RUEDI  
Chargé de recherche au Muséum d'histoire naturelle de Genève

CHARLES LIENHARD  
Chargé de recherche au Muséum d'histoire naturelle de Genève

## Comité de lecture

Il est constitué en outre du président de la Société suisse de Zoologie, du directeur du Muséum de Genève et de représentants des Instituts de zoologie des universités suisses.

Les manuscrits sont soumis à des experts d'institutions suisses ou étrangères selon le sujet étudié.

La préférence sera donnée aux travaux concernant les domaines suivants: biogéographie, systématique, évolution, écologie, éthologie, morphologie et anatomie comparée, physiologie.

## Administration

MUSÉUM D'HISTOIRE NATURELLE  
1211 GENÈVE 6

Internet: <http://www.ville-ge.ch/musinfo/mhng/page/rsz.htm>

## PRIX DE L'ABONNEMENT:

SUISSE Fr. 225.—

UNION POSTALE Fr. 230.—  
(en francs suisses)

Les demandes d'abonnement doivent être adressées  
à la rédaction de la *Revue suisse de Zoologie*,  
Muséum d'histoire naturelle, C.P. 6434. CH-1211 Genève 6, Suisse



**Redescription of *Hymenaphorura alticola* (Bagnall, 1935) from the Alps and description of a new related species from the Sudetes, *Hymenaphorura improvisa* sp. n. (Collembola: Onychiuridae)**

Romuald J. POMORSKI & Dariusz SKARZYNSKI

Zoological Institute, Wrocław University, Sienkiewicza 21,  
PL-50-335 Wrocław, Poland.

E-mail: onychus@biol.uni.wroc.pl, hypogast@biol.uni.wroc.pl

**Redescription of *Hymenaphorura alticola* (Bagnall, 1935) from the Alps and description of a new related species from the Sudetes, *Hymenaphorura improvisa* sp. n. (Collembola: Onychiuridae).** - *Hymenaphorura alticola* (Bagnall, 1935) is redescribed based on material from Switzerland, France, Austria and Italy. A neotype is designated. *Hymenaphorura improvisa* sp. n. from Poland is described and figured.

**Key-words:** Collembola - Onychiuridae - *Hymenaphorura* – taxonomy - Europe.

## INTRODUCTION

During faunistic studies in the Sudetes (SW Poland) some specimens, which fit Bagnall's (1935) description and Gisin's redescription (1953, 1960) of *H. alticola* (Bagnall, 1935), were found. A detailed comparison with Gisin's material which we have obtained thanks to the kindness of Dr. Charles Lienhard from the Muséum d'histoire naturelle (Genève) made it possible to ascertain that the Polish specimens represented a new species and *H. alticola* needed a modern redescription.

### *Hymenaphorura alticola* (Bagnall, 1935)

*Material.* Neotype – female on slide, by present designation; (CZ 44) Schweiz (Kanton Bern), Berner Jura. Höhle Gitzloch bei Court, 12. IX. 1954, leg. P. Strinati (in collection of the Muséum d'histoire naturelle in Geneva).

Other material examined - 2 females, 1 male juv.; (Fn 7) Suisse (Neuchâtel), Jura neuchâtois, Val de Travers, grotte de Môtiers, 21. VIII. 1952. leg. P. Strinati, 3 males, 3 females; (Jb Rr 1/4 and 1/5) Österreich, Tirol, Zillertaler Alpen, Gegend um Schönbichler Horn, Rossrucken, unterhalb Rossruckspitz, nivale Pionier-Polster, 3100 m, Sommer 1946, leg. H. Janetschek. 3 females; (Jb Rr 4/1) Österreich, Tirol, Zillertaler Alpen, Gegend um Schönbichler Horn, Rossrucken, Schneeboeden, *Polytrichetum sexangularis*, 2620 m, Sommer 1946, leg. H. Janetschek. 5 females; (Kg 191) France (Jura), St. Claude, grotte de la Grusse B. 40 m sous terre. II. 1963, leg. J. Colin. 4 juv.; (Ma 2a) Italie (Dolomites), Marmolada, 2000 m, prairie sur alluvions, 1956, leg. G. Marcuzzi. 2 females, 2 males, 4 juv.; (Ma 5a) Italie (Dolomites), Marmolada, 2100 m, prairie alpine sur roche, 1956, leg. G. Marcuzzi. 1 male, 2 juv.; (Ma 16a) Italie (Dolomites), Marmolada, 2400 m, prairie alpine sur roche, 1956, leg. G. Marcuzzi (the material is preserved in the collection of the Muséum d'histoire naturelle in Geneva).

*Diagnosis.* *H. alticola* is closely related to *Hymenaphorura creatricis* Pomorski, 1990. Both species have  $p_3$  setae longer than  $p_2$  on abdominal terga I-II, a similar chaetotaxy of abdominal tergum V, the same localisation of microsensillum on antennomere IV and a similar shape and proportions of tibiotarsi and claws. *H. alticola* distinctly differs from *H. creatricis* in its pseudocellar formula (20/111/11112 - *H. alticola*, 10/011/11112 - *H. creatricis*) and finer granulation of terga.

*Redescription.* Colour in alcohol white. Size, without antennae, 1.6-2.0 mm (neotype female - 2.0 mm). Shape of body cylindrical, as in Fig. 1. Antennae as long as head. Trace of reduced furca in shape of 2 symmetrical small patches of fine granulation with 2 small setae posteriorly. Granulation of dorsal side of the body very fine - usually 12-13 grains around each pseudocellus. Granular areas almost invisible.

Antennal III sense organ consists of 5 relatively long papillae; 2 sensory rods; 2 finely granulated, ovoid sensory clubs; 4 guard setae. Antennal segment IV with subapical organite and microsensillum at level of first row of setae. On antennal segment III microsensillum localised laterally, slightly below antennal III sense organ (Fig. 3).

Postantennal organ in a long cuticular groove, with 11 (9-16) simple vesicles (Fig. 2). Labium without lateral papilla E.

Pseudocellar formula 20/111/11112, ventral pso absent. Parapseudocellar formula typical for the genus - dorsally 01/111/1111, ventrally 1/000/11111. Parapseudocelli on subcoxa and femora invisible.

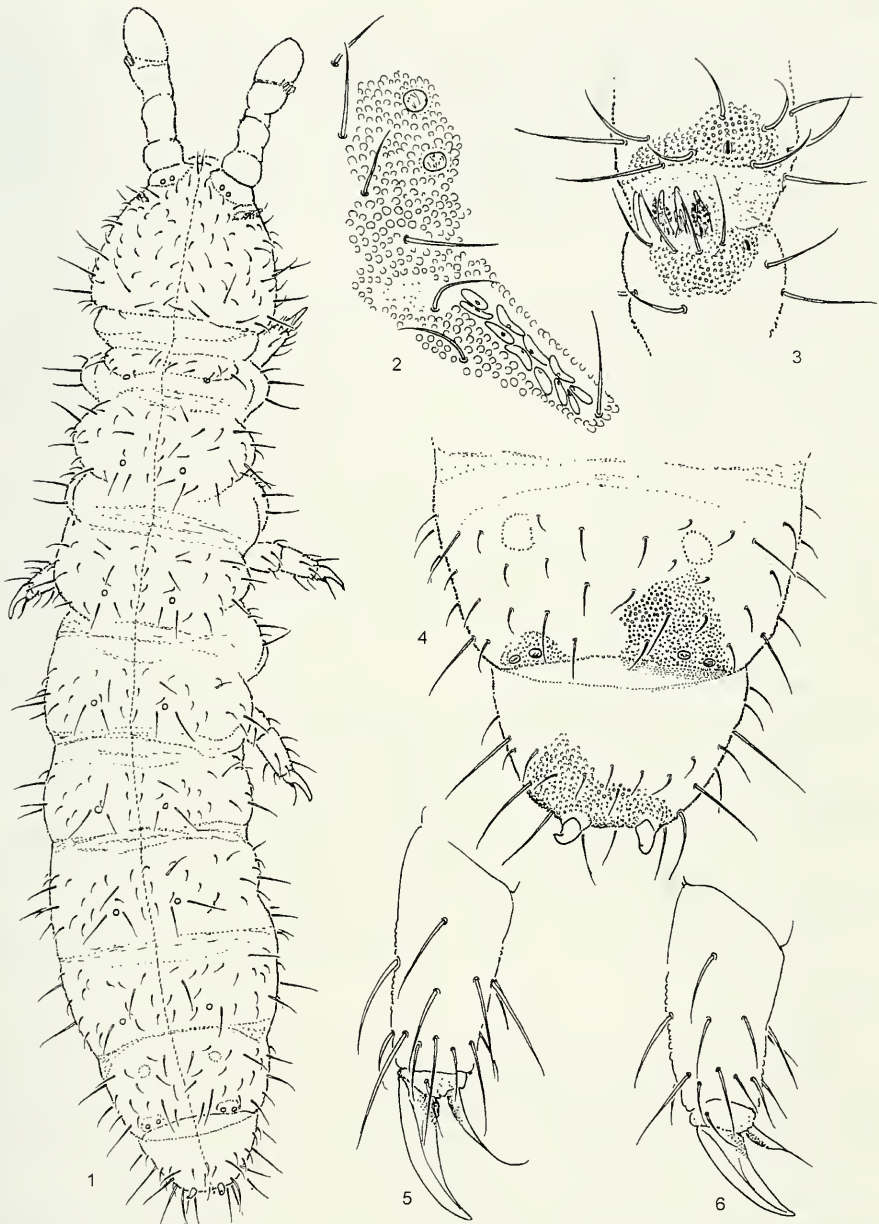
Dorsal chaetotaxy symmetrical, well differentiated into macrochaetae and microchaetae, as in Fig. 1. Thorax II-III with lateral microsensilla. On I-IV abdominal terga, setae  $p_2$  shorter than  $p_3$ . Granular area on abdominal tergum V with 4+4 more or less distinct macrochaetae. Subcoxae with 3, 5 (4), 5 (4) setae, between legs on meso- and metathorax 1+1 setae, tubus ventralis usually with 9+9 setae. Male ventral organ absent.

Claw without denticle. Empodial appendage long with narrow basal lamella, appendage length equal to that of inner edge of claw (Fig. 5) (specimens from Italian Dolomites have a shorter appendage and a slightly broader basal lamella, as in Fig. 6). Distal whorl of setae on tibiotarsi symmetrical, with 11 setae.

Anal spines strong, weakly curved, pointed, with relatively small basal papillae, as long as the claw.

*Remarks.* Handschin (1920) summarised the knowledge about the fauna of Swiss Onychiuridae and briefly described individuals with 2+2 pseudocelli at the base of antenna as *Onychiurus sibiricus* Tullberg, 1876. Bagnall (1935) pointed out, that "true" *O. sibiricus* had 1+1 pseudocellus at the base of antenna and proposed to classify the individuals examined by Handschin as a new species *Onychiurus alticola*. Later, Gisin (1953, 1960), on the basis of new materials from Austria, France, Switzerland and Italy, redescribed this species.

Examination of Gisin's material allowed us to redescribe this species using a set of modern, diagnostic characters (Pomorski, 1990, 1998). Moreover, we decided to designate of neotype, since Handschin's syntypes could not be located [Dr. Charles Lienhard - Muséum d'histoire naturelle (Genève) and Dr. Daniel H. Burckhardt - Naturhistorisches Museum (Basel); personal communication].



FIGS 1-6. *Hymenaphorura alticola*: 1 - habitus and dorsal chaetotaxy; 2 - postantennal organ and pseudocelli at base of antenna; 3 - antennal III sense organ; 4 - chaetotaxy of abdominal terga V-VI; 5 - tibiotsarsus and claw of legs III (specimen from French Jura); 6 - tibiotsarsus and claw of legs III (specimen from Italian Dolomites).

*Hymenaphorura improvisa* sp. n.

*Type material.* Holotype, male on slide; Poland, Sudetes, Karkonosze Mts., neighbourhood of Szklarska Poreba, 17. X. 1999; flood debris of the river Kamienna, leg. D. Skarzynski. Paratypes 1 male and 3 females on 2 slides, same locality, 10. V. 1999, leg. D. Skarzynski; 4 females on slide, same locality, 15 V 2000, leg. D. Skarzynski; 33 specimens in alcohol, same locality, 15 V 2000, leg. D. Skarzynski (type material preserved in the collection of the Department of Systematic Zoology and Zoogeography, Wrocław University, Poland; one paratype female housed in the collection of the Muséum d'histoire naturelle in Geneva).

*Etymology.* The species name is derived from Latin word "improvisus" – unexpected.

*Diagnosis.* Four guard setae in antennal III sense organ, labial lateral papilla E absent, the shape of remnant of furca and the presence of dorso-internal pseudocelli indicate that the new species belongs to the genus *Hymenaphorura*. The new species resembles *H. alticola* only in its pseudocellar formula, but two important characters: 9 setae in the distal whorl of tibiotarsi and the presence of median seta  $m_0$  on abdominal tergum V, place this species in an isolated position within the genus.

*Description.* Size, without antennae, 1.4-1.5 mm males, 1.5-1.7 mm females (holotype male – 1.5 mm). Colour in alcohol white. Shape of body cylindrical, elongated as in Fig. 7. Antennae as long as head. Trace of reduced furca in shape of small patches of fine granulation with 2 small setae posteriorly. Granulation of the dorsal body side distinct, with very well visible granular areas - usually 10-11 grains around each pseudocellus.

Antennal III sense organ consists of 5 simple papillae; 2 sensory rods; 2 granulated, spherical sensory clubs of which internal is bent; 4 guard setae (Fig. 8).

Antennal segment IV with subapical organite and microsensillum in latero-external position, at level of second row of setae. On antennal segment III microsensillum localised laterally, slightly below antennal III sense organ (Fig. 8).

Postantennal organ in short cuticular groove, with two border setae, composed of 10-11 simple and bilobed vesicles (Fig. 9). Labium without lateral papilla E and usually with thickened and blunt-tipped sensilla on papilla C.

Pseudocellar formula (pso) 20/111/11112, ventral pso absent. Parapseudocelli poorly visible (we are sure of the presence of 1+1 parapseudocelli on abdominal sternum V).

Dorsal chaetotaxy symmetrical, well differentiated into macrochaetae and microchaetae, as in Fig. 7. On abdominal terga I-III, setae  $p_2$  distinctly longer than  $p_3$ . Granular area on abdominal tergum V with 3+3 distinct macrochaetae and median seta  $m_0$  (Fig. 10). Subcoxae with 3, 4, 4 setae. Between legs on meso- and metathorax 1+1 setae. Tubus ventralis with 7+7 (6+6) setae. Male ventral organ absent.

Claws relatively short, always without denticle. Empodial appendages with narrow basal lamella, appendage length equal to that of the inner edge of claw. Distal whorl of setae on tibiotarsi symmetrical, with 9 setae (Figs. 11-13).

Anal spines strong, weakly curved, pointed, with distinct basal papillae, as long as the claw.

*Ecological remarks.* *H. improvisa* was collected singly in flood debris and numerous under stones on gravel bed of the river Kamienna.



FIGS 7-13. *Hymenaphorura improvisa* sp. n.: 7 - habitus and dorsal chaetotaxy (holotype); 8 - antennal III sense organ; 9 - postantennal organ and pseudocelli at base of antenna; 10 - chaetotaxy of abdominal terga IV-VI; 11 - tibiotarsus and claw of legs III (dorsal side); 12 - tibiotarsus and claw of legs III (ventral side); 13 - claw of legs III.

*Discussion.* Within the genus *Hymenaphorura* Bagnall, 1948 three species with 2+2 pseudocelli at the base of antenna are known - *Hymenaphorura alticola* (Bagnall, 1935) which lives in Swiss, French, Italian and Austrian Alps (Gisin, 1960), *Hymenaphorura rafalskii* Weiner & Szeptycki, 1997 from Korea and *Hymenaphorura improvisa* sp. n. from Poland. However, they do not constitute a natural group of related species. Besides the common character mentioned above, they differ in some essential, exceptional characters. *H. improvisa* sp. n. is easy to identify based on the presence of 9 setae in the distal whorl of tibiotarsi (in the remaining species 11 setae), the Korean species has 3+3 pseudocelli on abdominal tergum V (in the remaining species 2+2 pseudocelli) and *H. alticola* has  $p_3$  setae longer than  $p_2$  on abdominal terga I-II (in *H. improvisa*  $p_3$  is distinctly shorter than  $p_2$ , in *H. rafalskii* these setae are subequal).

#### ACKNOWLEDGEMENTS

We wish to express our sincere thanks to: Dr. Charles Lienhard from Geneva for loans of Gisin's material of *H. alticola*; Prof. Erhard Christian from Vienna for kind information and search for *H. alticola* in Austria; Dr. Daniel Burckhardt from Basel for kind information and search for *H. alticola* in Handschin's collection. The study was sponsored by the Wrocław University - grant No. 2020/W/IZ/99.

#### REFERENCES

- BAGNALL, R. S. 1935. Notes on British Collembola. *Entomologist's Monthly Magazine* 75: 61-63.
- GISIN, H. 1953. Notes sur les Collemboles, avec description de cinq espèces nouvelles, découvertes dans le canton de Genève. *Mitteilungen der Schweizerischen entomologischen Gesellschaft* 26: 56-62.
- GISIN, H. 1960. Collembolenfauna Europas. *Muséum d'histoire naturelle, Genève*, 312 pp.
- HANDSCHIN, E. 1920. Die Onychiurinen der Schweiz. *Verhandlungen der Naturforschenden Gesellschaft in Basel* 32: 1-37.
- POMORSKI, R. J. 1990. New data on the genus *Hymenaphorura* (Collembola, Onychiuridae) from Europe. *Mitteilungen der Schweizerischen entomologischen Gesellschaft* 63: 209-225.
- POMORSKI, R. J. 1998. Onychiurinae of Poland (Collembola: Onychiuridae). *Genus*, supplement: 1-201.

## Allozyme discrimination of three species of *Loricariichthys* (Siluriformes: Loricariidae) from Southern Brazil<sup>1</sup>

Cláudio H. ZAWADZKI<sup>1</sup>, Roberto E. REIS<sup>2</sup> & Erasmo RENESTO<sup>1</sup>

<sup>1</sup> Universidade Estadual de Maringá, Núcleo de Pesquisas em Limnologia, Ictiologia e Aqüicultura G-90, Av. Colombo, 5790, 87020-900 – Maringá, PR, Brasil.

E-mail: chzawadzki@nupelia.uem.br or e-mail: renesto@nupelia.uem.br

<sup>2</sup> Pontifícia Universidade Católica do Rio Grande do Sul, Museu de Ciências e Tecnologia, Caixa Postal 1429, Av. Ipiranga, 6681, 90619-900 – Porto Alegre, RS, Brasil.

E-mail: reis @puers.br

### Allozyme discrimination of three species of *Loricariichthys* (Siluriformes: Loricariidae) from Southern Brazil. - Three species of armored catfish of the genus *Loricariichthys* were clearly discriminated by starch gel isozyme electrophoresis on heart, liver and muscle tissues. We scored 21 enzyme loci from 14 isozyme systems (ACP, ADH, AAT, EST, GCDH, G3PDH, G6PDH, GPI, ICDH, LDH, MDH, MDHP, PGM and SOD). Expected mean heterozygosity ( $H_e$ ) ranged from 0.023 in *Loricariichthys anus* to 0.050 in *L. platymetopon* and 0.035 in *Loricariichthys* sp. The percentage of polymorphic loci ( $P_{0.99}$ ) was 14.3% for the three analyzed species. Nei's genetic identity (I) was found to be 0.663 between *Loricariichthys anus* and *Loricariichthys* sp., 0.329 between *L. anus* and *L. platymetopon*, and 0.478 between *L. platymetopon* and *Loricariichthys* sp. Genetic variability, tissue specific differences, as well as applicability of isozyme electrophoresis as a tool for neotropical fish systematists are discussed.

Genetic variability, tissue specific differences, as well as applicability of isozyme electrophoresis as a tool for neotropical fish systematists are discussed.

**Key-words:** Genetic diversity - isozymes - polymorphism - Siluriformes - taxonomy - systematics - fish - *Loricariichthys*.

## INTRODUCTION

The freshwater fish fauna of South America is the richest of all the continents and rivals in diversity with the coral reef fishes. In a recent estimate of the diversity of neotropical ichthyofauna Schaefer (1998) suggested that the total number of species of fish in this region may reach about eight thousands. The gaps in the systematic knowledge of neotropical fishes are as great as the number of species, and can be sustained principally by the lack of overall representation in scientific collections. One of the many difficulties from dealing with neotropical fishes is related to the great

<sup>1</sup> This paper is a part of the Ph.D thesis of Cláudio Henrique Zawadzki, at the State University of Maringá, granted by CAPES.

number of forms in each taxonomic group and to the great similarity found among species of the same genus. The family Loricariidae is the largest among the Siluriformes, with many species difficult to identify in several genera. In *Loricariichthys* Bleeker, 1862 as is usually the case for fish systematics and taxonomy, morphological characters forms the bulk of data used in descriptions as well as in species diagnoses (Reis & Pereira, in press). The genus *Loricariichthys* comprises 16 valid species (Isbrücker, 1980) and do not diverge from other neotropical taxa of fishes in regard to the gaps in the systematic knowledge. Thus, we search auxiliary tools for the morphological criteria. Different cytogenetic, biochemical and molecular techniques have been developed and used to assist in the diagnosis and species identification. As suggested by Thorpe & Solé-Cava (1994), isozyme electrophoresis can become an extremely useful tool when combined with morphological methods for the discrimination of closely related species. In this work we examine the level of genetic identity and variability among three species of *Loricariichthys* through allozyme electrophoresis, assaying loci and tissue expression. These are first and partial results from an attempt of the first author to form a bulk of allozyme data of some Loricariidae catfishes from southern Brazil, with the objective of finding genetic markers that could help to resolve questions on the systematics of this family. We also aim to corroborate the use of allozyme electrophoresis as a tool for the discrimination of morphologically similar species of Loricariidae.

## MATERIALS AND METHODS

After withdraw the tissues, the specimens were fixed in 10% formalin and they are alcohol preserved in the synoptic collection of Nupélia at the State University of Maringá, Brazil. Voucher specimens are deposited at the Museu de Zoologia da PUC, Porto Alegre, Brazil. *L. platymetopon* MCP25476 and MCP25749; *Loricariichthys* sp. MCP25747 and MCP25748, and also at the Muséum d'Histoire Naturelle, Geneva (Switzerland). A list of specimens was arranged in the text as follow: locality, town, collecting date, number of specimens (if there are more than one) between parenthesis and the standard length in centimeters (the smallest and biggest if there are more than one in the lot).

### LIST OF SPECIMENS STUDIED

Brazil, Paraná State:

*Loricariichthys platymetopon*: Vila Ipiranga (25°14'12"S/54°14'02"W), rio Ocoí, rio Paraná basin, São Miguel do Iguaçu, 10.ix.1998, 27.8; 16-17.ix.1998, (4) 22.7-26.4; Passo Côe (25°21'64"S/54°24'50"W), Itaipu lake reservoir, Foz do Iguaçu, 15.ix.1998, (2) 23.7-26.3; São Vicente (25°01'20"S/54°23'57"W), Itaipu lake reservoir (25°01'20"S/54°23'57"W), rio Paraná basin, Santa Helena, 13.ix.1998, 30.1; Ponto do Chico Barbudo (25°22'32"S/54°26'05"W) Itaipu lake reservoir, rio Paraná basin, Santa Terezinha do Itaipu, 14.ix.1998, (4) 22.9-27.8; Esquina Gaucha (25°17'42"S/54°19'20"W), Itaipu lake reservoir, rio Paraná basin, Itaipulândia, 15.ix.1998, 28.9; Itaipu lake reservoir (24°28'19"S/54°18'49"W), rio Paraná basin, Marechal Cândido Rondon, 18.ix.1998, (3) 24.6-31.6.

*Loricariichthys* sp.: Vila Ipiranga (25°14'12"S/54°14'02"W), rio Ocoí, rio Paraná basin, São Miguel do Iguaçu, 10.ix.1998, (5) 25.3-28.2; 17.ix.1998, (3) 22.3-25.4 Rio São Francisco Verdadeiro (24°40'32"S/54°13'92"W), rio Paraná basin, Pato Bragado, 11.ix.1998, (2) 19.5-25.3;



Ponto do Chico Barbudo (25°22'32"S/54°26'05"W), Itaipu lake reservoir, rio Paraná basin, Santa Terezinha do Itaipu, 14.ix.1998, (2) 22.7-26.3; Esquina Gaucha (25°17'42"S/54°19'20"W), Itaipu lake reservoir, rio Paraná basin, Itaipulândia, 15.ix.1998, 27.9 .

Brazil, Rio Grande do Sul State:

*Loricariichthys anus*: Fortaleza lagoon (30°09'02"S/50°14'30"W), Cidreira, 20.iii.1999, (8) 25.7-26.4.

Samples of white skeletal muscle, liver and heart tissues were collected. The tissues were stored in liquid nitrogen until analysis. Samples of tissues were homogenized with plastic sticks, in microcentrifuge tubes with Tris/HCl 0.02 M, pH 7.5 buffer in 1:1 concentration.

When homogenizing liver samples, 0.5 ml of CCl<sub>4</sub> was added to precipitate the great amount of fat present in such tissue (Pasteur *et al.*, 1988). The homogenized samples were centrifugated at 25,000 rpm (44,720 x g) for 30 min. at temperatures between 1° C and 5° C. The supernatant fractions were applied to starch gel using straps of Whatman paper 3 MM<sup>®</sup>. Gels were prepared with corn starch (Penetrose<sup>®</sup>) 13% in a buffer solution. Two buffer systems were used for the electrophoresis: Tris-citrate, pH 7.0 (Shaw & Prasad, 1970) and Tris-borate-EDTA pH 8.3 (Boyer *et al.*, 1963). The electrophoresis was run during six hours at 5° C with 250 V for Tris-citrate gel and 450 V for Tris-borate-EDTA gel. Gels were then cut horizontally and each slice was incubated with a solution of appropriate staining for each enzyme. The staining procedures were those described by Aebersold *et al.* (1987), with the exception of the AAT which followed the procedures of Morizot & Schmidt (1990). The nomenclature used was that proposed by the International Union of Biochemistry and Molecular Biology (1992). The data were analyzed using Biosys 1 software (Swofford & Selander, 1981). The genetic interpretation of the enzymatic patterns was based on the quaternary structure of enzymes described by Ward *et al.* (1992).

## RESULTS

Fourteen enzymatic systems of eight *Loricariichthys anus*, 16 *L. platymetopon* and 13 *Loricariichthys* sp. were analyzed, allowing the detection of 21 loci (Table 1). Electrophoretic patterns of enzymes in each tissue and their genetic interpretation for the three species analyzed are shown in Figure 1. Only the most common alleles for each species are represented.

The enzymes ACP, ADH, GCDH and G6PDH present a single band only in liver samples. Esterases are more active in the liver, but they are also expressed in other tissues, though less intensely. AAT, PGM and SOD zymograms show that these enzymes have the same activity in the three tissues and exhibit only one band.

The enzyme G3PDH presents three bands in white muscle, probably due to presence of two loci and the formation of a heterodimer interloci. Locus G3pdh-A also presents strong activity in heart and liver, while locus G3pdh-B has a weak expression in liver and is practically absent in heart tissues of the three species.

The enzyme GPI presents three regions of activity in the three species, as a result of expression of two loci Gpi-A and Gpi-B, and the intermediate region as corresponding to the formation of heterodimer interloci. In heart tissues the two loci

TABLE 1. Names, Number of Enzyme Commission (E.C.n°), tissues, buffers, interpreted quaternary structure (Q.S) and number of loci expressed in *Loricariichthys anus*, *L. platymetopon* and *Loricariichthys* sp. L = liver; M = muscle; H = Heart; TBE = Tris/borate/EDTA; TC = Tris/citrate.

Enzyme (Abbreviation)	E.C. n°	Tissue	Buffer	Q. S.	Loci
Acid phosphatase (ACP)	3.1.3.2	L	TC	Dimeric	1
Alcohol dehydrogenase (ADH)	1.1.1.1	L	TBE	Dimeric	1
Aspartate aminotransferase (AAT)	2.6.1.1	L, H, M	TBE	Dimeric	1
Esterase (EST)	3.1.1.1	L, H, M	TBE	Monomeric	1
Glucose 1-dehydrogenase - NAD+ (GCDH)	1.1.1.118	L	TBE	Dimeric	1
Glycerol-3-phosphate dehydrogenase (G3PDH)	1.1.1.8	L, H, M	TC	Dimeric	2
Glucose-6-phosphate dehydrogenase (G6PDH)	1.1.1.49	L	TBE	Tetrameric	1
Glucose-6-phosphate isomerase (GPI)	5.3.1.9	L, H, M	TC	Dimeric	2
Isocitrate dehydrogenase - NADP+ (ICDH)	1.1.1.42	L, H, M	TC	Dimeric	2
L-Lactate dehydrogenase (LDH)	1.1.1.27	H, M	TC	Tetrameric	2
Malate dehydrogenase (MDH)	1.1.1.37	L, H, M	TC	Dimeric	3
Malate dehydrogenase - NADP+ (MDHP)	1.1.1.40	L, H, M	TC	Tetrameric	2
Phosphoglucomutase (PGM)	5.4.2.2	L, H, M	TC	Monomeric	1
Superoxide dismutase (SOD)	1.15.1.1	L, H, M	TBE	Dimeric	1

present an equally intense activity. In liver, Gpi-A expresses itself with more intensity than that of Gpi-B, while the reverse is true for muscle tissues.

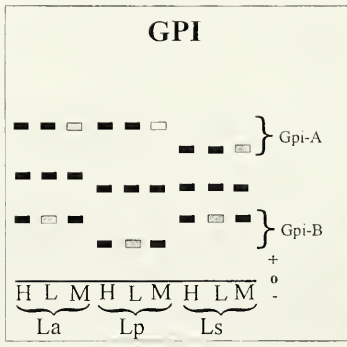
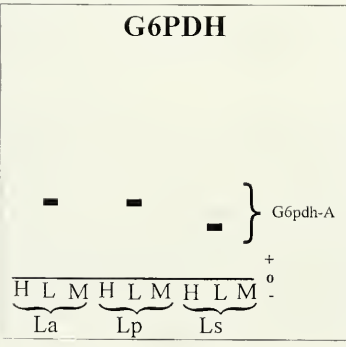
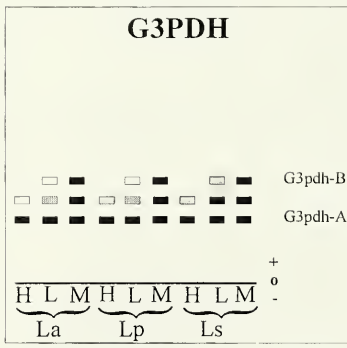
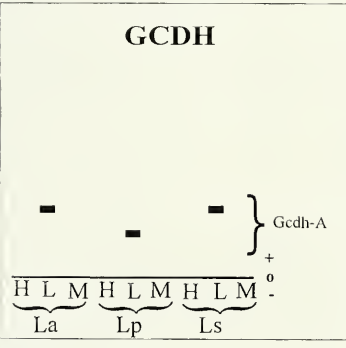
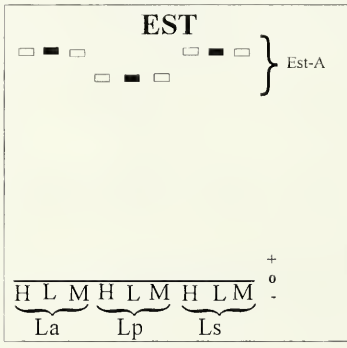
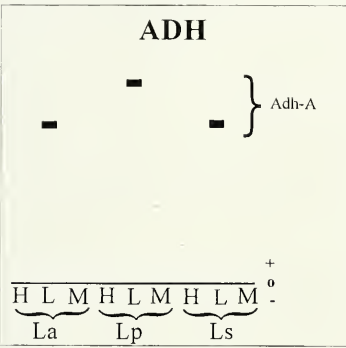
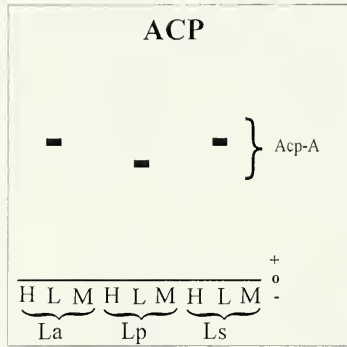
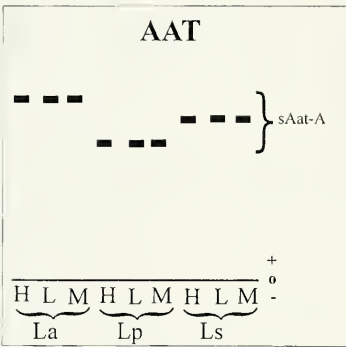
The tetrameric enzyme LDH presented five bands in muscle tissues, due to the expression of two loci, Ldh-A and Ldh-B, and three interloci heterotetramers. In heart only one band occurs, apparently corresponding to the A<sub>1</sub>B<sub>3</sub> heterotetramer. A weak expression of heterotetramers and the absence of homotetramers in the three species studied were observed in liver tissues. In *L. anus* three weak bands (A<sub>3</sub>B<sub>1</sub>, A<sub>2</sub>B<sub>2</sub> and A<sub>1</sub>B<sub>3</sub>), were observed in liver, while in *L. platymetopon* and *Loricariichthys* sp. a two banded pattern (A<sub>2</sub>B<sub>2</sub> and A<sub>1</sub>B<sub>3</sub>) was observed.

The dimeric enzyme ICDH presented two loci with different tissue-expression for the three species. Locus mIcdh-A expressed itself in heart and muscle and was absent in liver tissues. Locus sIcdh-A presents bands in liver tissues only.

The dimeric enzyme MDH presents three loci for *Loricariichthys*. Locus sMdh-A has a greater intensity of expression in heart, and weaker intensity in liver and muscle tissues. mMdh-A locus expresses itself only in liver of *L. anus* and *Loricariichthys* sp. In *L. platymetopon*, despite a better resolution of the bands in liver, weak bands are also observed in heart and muscle tissues. sMdh-B locus expresses itself with greater intensity in heart and muscle tissues than in the liver.

Table 2 shows allelic frequencies of the three analyzed species. *Loricariichthys anus* is polymorphic at loci Adh-A, G3pdh-A, and Gpi-B; *L. platymetopon* is polymorphic at Gpi-A, Gpi-B, and sMdh-A, and *Loricariichthys* sp. is polymorphic at Gcdh-A, Gpi-A, and Pgm-A. Of the enzymes studied, eleven loci were diagnostic for

FIG. 1a. Schematic representation of enzymatic systems AAT, ACP, ADH, EST, GCDH, G3PDH, G6PDH and GPI of *L. anus* (La), *L. platymetopon* (Lp) and *Loricariichthys* sp. (Ls), and their genetic interpretation.



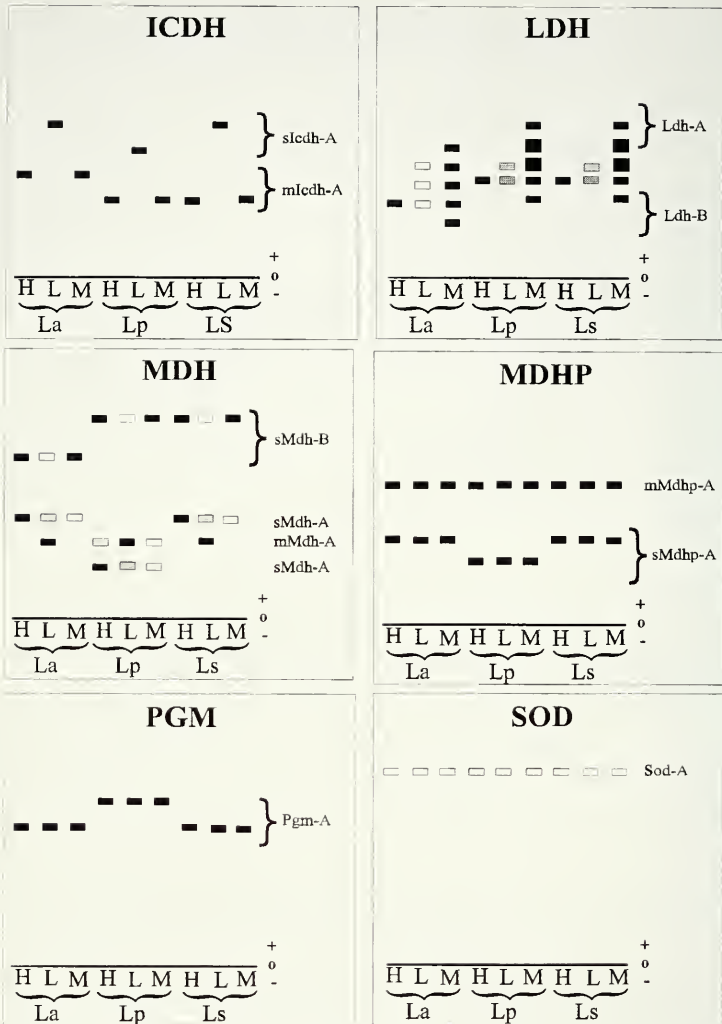


FIG. 1b. Schematic representation of enzymatic systems ICDH, LDH, MDH, MDHP, PGM and SOD of *L. anus* (La), *L. platymetopon* (Lp) and *Loricariichthys sp.* (Ls), and their genetic interpretation.

one or another of the three species. Loci sAat-A, Acp-A, Est-A, sIcdh-A, sMdh-A, and sMdhp-A are diagnostic for *L. platymetopon*, that is, they are fixed for different alleles. Loci sAat-A, mIcdh-A, Ldh-A, Ldh-B, and sMdh-B are diagnostic for *L. anus* and the loci sAat-A and G6pdh-A are diagnostic for *Loricariichthys sp.*

The genetic variability for the three species of *Loricariichthys* is presented in Table 3. All the polymorphic loci analyzed were in Hardy-Weinberg equilibrium. Unbiased genetic identity (I) and genetic distance (D) of Nei (1978) among the three species is represented in Table 4.

TABLE 2. Allelic frequencies observed for 21 loci in *L. anus*, *L. platymetopon* and *Loricariichthys* sp.

LOCUS	ALLELE	<i>L. anus</i> (n = 8)	<i>L. platymetopon</i> (n = 16)	<i>Loricariichthys</i> sp. (n = 13)
sAat-A	a	----	1,000	----
	b	----	----	1,000
	c	1,000	----	----
Acp-A	a	----	1,000	----
	b	1,000	----	1,000
Adh-A	a	0,875	----	1,000
	b	0,125	1,000	----
Est-A	a	----	1,000	----
	b	1,000	----	1,000
Gcdh-A	a	----	1,000	0,308
	b	1,000	----	0,692
G3pdh-A	a	0,063	----	----
	b	0,938	1,000	1,000
G3pdh-B	a	1,000	1,000	1,000
G6pdh-A	a	----	----	1,000
	b	1,000	1,000	----
Gpi-B	a	----	0,906	----
	b	0,938	0,094	1,000
	c	0,063	----	----
Gpi-A	a	----	0,125	0,885
	b	1,000	0,500	0,115
	c	----	0,375	----
mIcdh-A	a	----	1,000	1,000
	b	1,000	----	----
sIcdh-A	a	----	1,000	----
	b	1,000	----	1,000
Ldh-B	a	1,000	----	----
	b	----	1,000	1,000
Ldh-A	a	1,000	----	----
	b	----	1,000	1,000
sMdh-A	a	----	0,156	----
	b	----	0,844	----
	c	1,000	----	1,000
mMdh-A	a	1,000	1,000	1,000
sMdh-B	a	1,000	----	----
	b	----	1,000	1,000
sMdhp-A	a	----	1,000	----
	b	1,000	----	1,000
mMdhp-B	a	1,000	1,000	1,000
Pgm-A	a	1,000	----	0,962
	b	----	1,000	0,038
Sod-A	a	1,000	1,000	1,000

## DISCUSSION

The usefulness of this technique as a tool for discrimination of similar species is confirmed, especially for fish systematists, whose morphological criteria are, not always, fully efficient to discriminate taxa. Isozyme electrophoresis constitutes a practical tool, given the easiness of its application, relative little need of specialized equipment, reduced cost, and the ability of obtaining data in a relatively short time (Buth & Murphy, 1999).

TABLE 3. Genetic variability measures for 21 loci of three *Loricariichthys* species. Number in parentheses are standard deviation. N = number of analyzed specimens; K = mean number of alleles per locus;  $P_{0.99}$  = frequency of polymorphic loci;  $H_o$  = mean observed heterozygosity;  $H_e$  = mean expected heterozygosity.

Species	n	k	$P_{0.99}$	$H_o$	$H_e$
<i>L. anus</i>	8	1.1 (0.1)	14.3	0.024 (0.014)	0.023 (0.013)
<i>L. platymetopon</i>	16	1.2 (0.1)	14.3	0.039 (0.028)	0.050 (0.032)
<i>Loricariichthys</i> sp.	13	1.1 (0.1)	14.3	0.015 (0.009)	0.035 (0.023)

TABLE 4. Nei's unbiased genetic identity  $I$  is shown above the diagonal and genetic distance  $D$  is shown below the diagonal.

Species	<i>L. anus</i>	<i>L. platymetopon</i>	<i>Loricariichthys</i> sp.
<i>L. anus</i>	*****	0.329	0.663
<i>L. platymetopon</i>	1.112	*****	0.478
<i>Loricariichthys</i> sp.	0.411	0.738	*****

Various authors have demonstrated the value of data obtained through electrophoresis of enzymes for systematics and taxonomy of fish (Avisé, 1974, 1994; Buth, 1984; Buth & Murphy, 1999; Ward & Grewe, 1995 and references therein). Besides the use of allozyme data as diagnostic characters, Buth & Murphy (1999) emphasize the importance of other electrophoretic characteristics such as tissue activity, heteropolymer formation, differences in ontogenetic expression and post-translational modifications.

According to Kettler *et al.* (1986) differences in the expression of a given enzyme in different tissues (differential tissue-specific expression, different tissular ontogenetic changes or heteropolymer formation...) can be treated, as a set of characters for taxonomical studies, independently of the analysis of different enzymes in a given tissue (loci polymorphism, heterozygosity, presence/absence of diagnostic loci...).

The patterns of tissue-specific isozyme distribution is an indirect evidence of functional divergence (Basaglia, 1991a) and interspecific differences in these patterns can reveal informative evolutionary aspects of the gene-expression divergence in phylogenetic studies (Whitt, 1983; Basaglia, 1991b). For constructing a robust data set of tissue-expression one must get information about the activity of a given enzyme through the greatest possible number of tissues, and principally, in many species within a taxon. Since the data obtained here forms a part of a broader investigation on the family Loricariidae, containing many other species (Zawadzki, in preparation), the three tissues presented were found to be the most informative in regard to the number of loci, within the limits of time and money of the whole research.

Recent allozyme studies have been developed at population and species levels for neotropical fishes for example Fenerich-Verani *et al.* (1990a, 1990b); Almeida Val *et al.* (1990, 1992); D'Avila Ferreira *et al.* (1991); Monteiro *et al.* (1991); Renesto & Zawadzki (1997); Revaldaves *et al.* (1997); Almeida & Sodr  (1998); Chiari & Sodr  (1999); Lapenta *et al.* (1999); Zawadzki *et al.* (1999a, 1999b). Nevertheless, to the

present, no studies was conducted on the genus *Loricariichthys* preventing detailed comparison.

Here, two systems, MDH and LDH, present differences among the three species of *Loricariichthys* in relation to the patterns of tissue activity. Locus mMdh-A is expressed as an intense band in the liver of the three species and weak bands in the heart and muscle of *L. platymetopou*; while in the other two species its expression is limited to the liver. The LDH isozyme in liver tissue shows differences in relation to the heterotetramer interloci formation in these species of *Loricariichthys*, with a three banded pattern in *L. anus* and a two banded pattern in the other two species. In muscle tissue, all three species show a strongly expressed five banded pattern. Zawadzki *et al.* (in press) found in species of *Hypostomus* a single banded pattern in muscle and heart tissues corresponding to the homotetramer A<sub>4</sub> for *H. aff. coumersonii* and *H. myersi* and to homotetramer B<sub>4</sub> for *H. derbyi*. Buth & Murphy (1999) state that multimeric and multiloci enzymatic systems can vary with regard to the production of interlocus heteropolymers and that this variation when established among the species can have systematic value. Murphy (1988) states that for fishes, there is a "general" trend in the LDH heteropolymer restriction, from the primitive five banded pattern to the advanced two banded A<sub>4</sub>B<sub>4</sub> pattern condition. Thus, the LDH patterns observed for these species seem to corroborate the more basal position of Loricariinae relative to Hypostominae, or at a least to *Hypostomus* species, shown in recent phylogenetic analysis of the family (Schaefer, 1986, 1987; Montoya-Burgos *et al.*, 1997, 1998). Although, these enzymatic findings are not conclusive, it shows an open branch to one questioning the applicability of LDH isozymes in assaying Loricariidae phylogeny.

The presence of a single Esterase locus in these three species of *Loricariichthys* contrasts markedly with the six loci found by Lapenta *et al.* (1999) in *Hypostomus albopunctatus*. Duplication or silencing loci events in this enzymatic system can have occurred in the Loricariidae family and are also to be further investigated.

The heterozygosity found in the three species of *Loricariichthys* agree with the average 0.051, calculated by Ward *et al.* (1992) for freshwater fishes. The values are 0.023 for *L. anus*, 0.050 for *L. platymetopou*, and 0.035 for *Loricariichthys* sp. The greater values for the last two species could be explained by a more heterogeneous area sampled. However, Zawadzki *et al.* (1999b), studying sympatric loricariid catfish species of the genus *Hypostomus* in the Itaipu Hydroelectric Reservoir, found low heterozygosity for *H. albopunctatus* (0.015) and *H. microstomus* (0.016) and high heterozygosity for *H. regani* (0.103) and *H. ternetzi* (0.091), suggesting the predominance of historical factors rather than sampling artifacts in the determination of the genetic variability in some species of the family Loricariidae.

The unbiased genetic identity (*I*) (Nei, 1978), among the three species, is low. According to Thorpe (1982) and Thorpe & Solé-Cava (1994) 85% of *I* values between pairs of congeneric species exceed 0.35, and 76% of the values are above 0.4, while 77% of the values of *I* between different genera are below 0.35. Thus, the genetic identity between *L. platymetopou* and *L. anus* is as small as that between two distinct genera.

The allozyme discrimination among the three species of *Loricariichthys* was more efficient, in number of diagnostic characters, than the morphologic discrimination

of the same three species, as presented by Reis & Pereira (in press). Those authors found three morphological characters to discriminate between *L. platymetopon* and the new species, and two additional characters to separate the new species from the other two.

From these allozymatic diagnostic characters and from that obtained by Zawadzki *et al.* (1999a) which found allozyme genetic markers for three species of *Hypostomus* from the rio Iguaçú basin, we suggest the continuous use of allozyme electrophoresis as an auxiliary tool for the taxonomy of the family Loricariidae. It is worthwhile to point out that by enlarging the number of loci assayed as well as by screening and comparing several other loricariid species, the systematists could take profits from a still underexploited source of biological characters for taxonomic and phylogenetic analysis of this family.

#### ACKNOWLEDGEMENTS

The authors would like to thank ITAIPU BINACIONAL and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for financial support. Edson K. Okada and Vanderlei P. da Silva for their help in collecting the samples. Maria de Fátima P. S. Machado and Sandro L. Bonatto for revising the manuscript. We also thank Núcleo de Pesquisas em Limnologia ictiologia e Aquicultura (Nupelia) for the logistical support. Roberto E. Reis is thankful to Conselho Nacional do Desenvolvimento Científico e Tecnológico (CNPq) for its financial support.

#### REFERENCES

- AEBERSOLD, P.B., WINANS, G.A., TEEL, D.J., MILNER, G.B. & UTTER, F.M. 1987. Manual for starch gel electrophoresis: a method for detection of genetic variation. *NOAA Technical Report NMFS* 61:1-17.
- ALMEIDA, F.S. & SODRÉ, L.M.K. 1998. Analysis of genetic variability in three species of Pimelodidae (Ostariophysi - Siluriformes). *Genetics and Molecular Biology* 21(4): 487-492.
- ALMEIDA VAL, V.M.F., SCHWANTES, M.L.B. & VAL, A.L. 1990. LDH isozymes in amazon fish – I. Electrophoretic studies on two species from Serrasalmidae family: *Mylossoma dmiventris* and *Colossoma macropomum*. *Comparative Biochemical and Physiology* 95B(1): 74-84.
- ALMEIDA VAL, V.M.F., DA SILVA, M.N.P., CARACIOLO, M.C.M., MESQUITA, L.S.B., FARIAS, I.P. & VAL, A.L. 1992. LDH isozymes in amazon fish – III. Distribution patterns and functional properties in Serrasalmidae (Teleostei: Ostariophysi). *Comparative Biochemical and Physiology* 103B(1): 119-125.
- AVISE, J.C. 1974. Systematic value of electrophoretic data. *Systematic Zoology* 23: 465-481.
- AVISE, J.C. 1994. Molecular markers, natural history and evolution. *Chapman & Hall, New York*.
- BASAGLIA, F. 1991a. Malate dehydrogenase isozymes in fifteen Sparidae species (Perciformes, Teleostei). *Comparative Biochemical and Physiology* 98B: 9-19.
- BASAGLIA, F. 1991b. Interspecific gene differences and phylogeny of the Sparidae family (Perciformes, Teleostei), estimated from electrophoretic data on enzymatic tissue-expression. *Comparative Biochemical and Physiology* 99B(3): 495-508.
- BOYER, S.H., FAJNER, D.C. & NAUGHTON, M.A. 1963. Myoglobin inherited structural variation in man. *Science* 140: 1228-1231.
- BUTH, D.G. 1984. The application of electrophoretic data in systematic studies. *Annual Review of Ecology and Systematics* 15: 501-522.



- BUTH, D.G. & MURPHY, R.W. 1999. The use of isozyme characters in systematic studies. *Biochemical Systematics and Ecology* 27: 117-129.
- CHIARI, L. & SODRÉ, L.M.K. 1999. Genetic variability in five species of Anostomidae (Ostariophysii - Characiformes). *Genetics and Molecular Biology* 22(4): 517-523.
- D'AVILA FERREIRA, N.C., ALMEIDA VAL, V.M.F. & SCHWANTES, M.L.B. 1991. Lactate dehydrogenase (LDH) in 27 species of amazon fish: adaptative and evolutive aspects. *Comparative Biochemical and Physiology* 100B(2): 391-398.
- FENERICH-VERANI, N., SCHWANTES, M.L.B. & SCHWANTES, A.R. 1990a. Patterns of gene expression during *Prochilodus scrofa* (Characiformes: Prochilodontidae) embryogenesis – II. Soluble Malate dehydrogenase. *Comparative Biochemical and Physiology* 97B(2): 247-255.
- FENERICH-VERANI, N., SCHWANTES, M.L.B. & SCHWANTES, A.R. 1990b. Patterns of gene expression during *Prochilodus scrofa* (Characiformes: Prochilodontidae) embryogenesis – III. Glucose-6-phosphate isomerase. *Comparative Biochemical and Physiology* 97B(3): 579-590.
- HILLIS, D.H. 1987. Molecular versus morphological approaches to systematics. *Annual Review of Ecology and Systematics* 18: 23-42.
- International Union of Biochemistry and Molecular Biology. Nomenclature Committee. 1992. Enzyme Nomenclature 1992. *Academic press, San Diego, CA*.
- ISBRÜCKER, I.J.H. 1980. Classification and catalogue of the mailed Loricariidae (Pisces, Siluriformes). *Verslagen en Technische Gegevens, Universiteit Amsterdam* 22: 1-181.
- KETTLER, M.K., GHENT, A.W. & WHITT, G.S. 1986. A comparison of phylogenies based on structural and tissue-expression differences of enzymes in a family of teleost fishes (Salmoniformes: Umbridae). *Molecular Biology and Evolution* 3: 485-498.
- LAPENTA, A.S., ZAWADZKI, C.H., RENESTO, E., OKADA, E.K. & SUZUKI, H.I. 1999. Padrão eletroforético das esterasas em *Hypostomus albopunctatus* (Regan, 1908) da bacia do rio Paraná e *H. aff. albopunctatus* (Pisces: Siluriformes: Loricariidae) da bacia do rio Iguaçú. *Genetics and Molecular Biology* 22(3), Supplement: p. 600.
- MONTEIRO, M.C., SCHWANTES, M.L.B. & SCHWANTES, A.R. 1991. Malate dehydrogenase in subtropical fish belonging to the orders Characiformes, Siluriformes and Perciformes. – I. Duplicate gene expression and polymorphism. *Comparative Biochemical and Physiology* 100B(2): 381-389.
- MONTOYA-BURGOS, J., MULLER, S., WEBER, C. & PAWLOWSKI, J. 1997. Phylogenetic relationship between Hypostominae and Ancistrinae (Siluroidei: Loricariidae): first results from mitochondrial 12S and 16S rRNA gene sequences. *Revue suisse de Zoologie* 104(1): 185-198.
- MONTOYA-BURGOS, J., MULLER, S., WEBER, C. & PAWLOWSKI, J. 1998. Phylogenetic relationship of the Loricariidae (Siluriformes) based on mitochondrial rRNA gene sequences (pp. 363-374). In: MALABARBA, L.R., REIS, R.E., VARI, R.P., LUCENA, Z.M. & LUCENA, C.A. [Eds]. Phylogeny and classification of neotropical fishes. *Edipucers, Porto Alegre*, 603 pp.
- MORIZOT, D.C. & SCHMIDT, M.E. 1990. Starch gel electrophoresis and histochemical visualization of proteins. pp. 23-80. In: WHITMORE, D.H. (Ed.). Electrophoretic and isoelectric focusing techniques in fisheries management. *CRC Press, Boca Raton, FL*.
- MURPHY, R.W. 1988. The problematic phylogenetic analysis of interlocus heteropolymer isozyme characters: a case study from sea snakes and cobras. *Canadian Journal of Zoology* 66: 2628-2633.
- NEI, M. 1978. Estimation of average heterozygosity and genetic distance from a small number of individuals. *Genetics* 89: 583-590.
- PASTEUR, N., PASTEUR, G., BONHOMME, F., CATALAN, J. & BRITTON-DAVIDIAN, J. 1988. Practical isozyme genetics. *Ellis Horwood Limited, Chichester*, 215 pp.
- REIS, R.E. & PEREIRA, E.H.L. (in press). Three new species of the loricariid catfish genus *Loricariichthys* (Teleostei: Siluriformes) from southern South America. *Copeia*.

- RENESTO, E. & ZAWADZKI, C.H. 1997. Taxonomia bioquímica de *Astyanax* do reservatório de Segredo (pp. 85-96). In: AGOSTINHO A.A. & GOMES, L.C. (eds.) Reservatório de Segredo - bases ecológicas para o manejo. *EDUEM, Maringá-PR*.
- REVALDAVES, E., RENESTO, E. & MACHADO, M.F.P.S. 1997. Genetic variability of *Prochilodus lineatus* (Characiformes: Prochilodontidae) in the upper Paraná River. *Revista Brasileira de Genética* 20: 381-388.
- SCHAEFER, S. A. 1986. Historical biology of the loricariid catfishes: phylogenetics and functional morphology. *Unpublished Ph.D. Dissertation, University of Chicago, Illinois*, 198 pp.
- SCHAEFER, S. A. 1987. Osteology of *Hypostomus plecostomus* (Linnaeus), with a phylogenetic analysis of the loricariid subfamilies (Pisces: Siluroidei). *Contribution in Science* 394: 1-31.
- SCHAEFER, S.A. 1998. Conflict and resolution: impact of new taxa on phylogenetic studies of the neotropical cascudinhos (Siluroidei: Loricariidae) (pp. 375-400). In: MALABARBA, L.R., REIS, R.E., VARI, R.P., LUCENA, Z.M. & LUCENA, C.A. [Eds.]. Phylogeny and classification of neotropical fishes. *Porto Alegre, Edipucrs*, 603 pp.
- SHAW, C.R. & PRASAD, R. 1970. Starch gel electrophoresis - a compilation of recipes. *Biochemical Genetics* 4: 297-320.
- SWOFFORD, D.L. & SELANDER, R.B. 1981. BIOSYS-1: A FORTRAN program for the comprehensive analysis of electrophoretic data in population genetics and systematics. *Journal of Heredity* 72: 281-283.
- THORPE, J.P. 1982. The molecular clock hypothesis: biochemical evolution, genetic differentiation and systematics. *Annual Review of Ecology and Systematics* 13: 139-168.
- THORPE, J.P. & SOLÉ-CAVA, A.M. 1994. The use of allozyme electrophoresis in invertebrate systematics. *Zoological Scripta* 23(1): 3-18.
- WARD R.D. & GREWE, P.M. 1995. Appraisal of molecular genetic techniques in fisheries (pp. 29-54). In: CARVALHO, G.R. & PITCHER, T.J. [eds.] Molecular genetics in fisheries. *Chapman & Hall, London*.
- WARD, R.D., SKIBINSKI, D.O.F. & WOODWARD, M. 1992. Protein heterozygosity, protein structure, and taxonomic differentiation. *Evolutionary Biology* 26: 73-157.
- WHITMORE, D.H. 1990. Electrophoretic and isoelectric focusing techniques in fisheries management. *CRC Press, Boca Raton, Florida*, 350 pp.
- WHITT, G. S. 1983. Isozymes as probes and participants in developmental and evolutionary genetics (pp. 1-40). In: RATAZZI, M.C., SCANDALIOS, J.G. & WHITT, G.S. [eds.]. Isozymes: Current topics in biological and medical research. Vol. 10. *Alan R. Liss, New York*.
- ZAWADZKI, C.H., RENESTO, E. & BINI, L.M. 1999a. Genetic and morphometric analysis of three species of the genus *Hypostomus* Lacépède, 1803 (Osteichthyes: Loricariidae) from the Rio Iguazu basin (Brasil). *Revue suisse de Zoologie* 106(1): 91-105.
- ZAWADZKI, C.H., RENESTO, E., OKADA, E.K. & BRANDÃO, M. 1999b. Análise isoenzimática de quatro espécies do gênero *Hypostomus* Lacépède, 1803 (Pisces: Osteichthyes: Loricariidae) do reservatório de Itaipu, no município de Guaíra-PR, Brasil. *Genetics and Molecular Biology* 22(3), Supplement: p. 587.
- ZAWADZKI, C.H., MACHADO, M.F.P.S. & RENESTO, E. (in press). Differential expression for tissue-specific isozymes in three species of *Hypostomus* Lacépède, 1803 (Teleostei: Loricariidae). *Biochemical Systematics and Ecology*.

**Oribatids from Sabah (East Malaysia) VIII  
(Acari: Oribatida: Dampfiellidae and Otocephidae).  
(*Acarologica Genavensia* LXXXVI)**

Sándor MAHUNKA

Zoological Department, Hungarian Natural History Museum, Baross utca 13,  
H-1088 Budapest, Hungary.

**Oribatids from Sabah (East Malaysia) VIII (Acari: Oribatida: Dampfiellidae and Otocephidae). (*Acarologica Genavensia* LXXXVI).** - Thirty-two species belonging to the superfamily Otocephoidea Balogh, 1972 are identified and listed, twenty-one of them are described as new to science: three new species belong to the family Dampfiellidae Balogh 1961, eighteen new species to the family Otocephidae Balogh, 1961.

**Key-words:** Acari - Oribatida: Otocephoidea - taxonomy - new species - Malaysia: Sabah.

INTRODUCTION

The Oribatid fauna of Sabah, formerly North Borneo, has been discussed in previous papers (Mahunka, 1987a, 1987b, 1988, 1990, 1991, 1995a, 1996a, 1996b). In most of my earlier papers I described various species phylogenetically far distant from each other. Later I realized that on this basis no regional zoogeographical evaluation could be made. So I decided to study larger taxonomic units. In a recent contribution I discussed the taxa belonging to the family Galumnidae (Mahunka, 1995a). Herein I propose a survey of the Sabah species belonging to the superfamily Otocephoidea Balogh, 1972 which was earlier excellently elaborated in different ways by Grandjean (1964), Aoki (1965, 1967), Hammer (1971, 1979) and Wallwork (1962a, 1962b). The material examined yielded 32 species, of which 21 are new to science.

After the present studies, I am not sure if the present classification of Otocephidae Balogh, 1961 is correct or if further studies are necessary to improve it. Some genera of Otocephinae (e.g. *Acrotocephus* Aoki, 1965, *Megalotocephus* Aoki, 1965 and *Otocephus* Berlese, 1916) are only distinguishable by the presence or absence of prodorsal or notogastral condyles. The other main diagnostic features, such as length, size and position (in relation to the rostral setae) of the lateral lamelliform expansion and the tutorium, are very variable. Therefore all Otocephinae species mentioned in this paper are provisionally placed in the genus *Otocephus* Berlese, 1904.

Details about the origin of the material examined have already been given and the general goal of my work has also been outlined in my earlier publications (e.g. Mahunka, 1995b). Descriptions and the terminology in this contribution follow those adopted in my previous papers.

#### LIST OF LOCALITIES

- Sab-82/4: MALAISIE: **Sabah** (Sandakan Residency): 15 milles (24 km) W de Sandakan: Sepilok: "Kabili-Sepilok Forest Reserve", forêt près "Orang-Utan Rehabilitation Station", prélèvement de sol dans les angles formés par les contreforts ailés de grands arbres (Dipterocarpaceae), 30m; 23.IV.1982; leg. B. Hauser – (appareil Berlese à Sepilok).
- Sab-82/5: MALAISIE: **Sabah** (Sandakan Residency): 15 milles (24 km) W de Sandakan: Sepilok: "Kabili-Sepilok Forest Reserve", forêt près "Orang-Utan Rehabilitation Station", prélèvement de bois pourri. Lowland Dipterocarp Forest. 30m; 23.IV.1982; leg. B. Hauser – (appareil Berlese à Sepilok).
- Sab-82/15: MALAISIE: **Sabah** (West Coast Residency): Mt Kinabalu: "Bukit Ular Trail" (sentier reliant "Kambarangan Road" à "Power Station"), tamisage de feuilles mortes et de bois pourri, forêt de *Lithocarpus-Castanopsis*; 1790m; 28.IV.1982; leg. B. Hauser – (appareil Winkler-Moczarski à Sepilok).
- Sab-82/16: MALAISIE: **Sabah** (West Coast Residency): Mt Kinabalu: "Bukit Ular Trail" (sentier reliant "Kambarangan Road" à "Power Station"), prélèvement de feuilles mortes, forêt de *Lithocarpus-Castanopsis*; 1850m; 28.IV.1982; leg. B. Hauser – (appareil Berlese à Sepilok).
- Sab-82/23: MALAISIE: **Sabah** (West Coast Residency): Mt Kinabalu: "Summit Trail" (sentier reliant "Power Station" au sommet), forêt brumeuse, prélèvement de sol au pied de plusieurs arbres, 2480m; 30.IV.1982; leg. B. Hauser – (appareil Berlese à Sepilok).
- Sab-82/27: MALAISIE: **Sabah** (Sandakan Residency): 15 milles (24 km) W de Sandakan: Sepilok: "Kabili-Sepilok Forest Reserve", forêt près "Orang-Utan Rehabilitation Station", tamisage de feuilles mortes et de bois pourri prélevés dans les angles formés par les contreforts ailés de grands arbres, Lowland Dipterocarp Forest, 30m; 3.V.1982; leg. B. Hauser – (appareil Winkler-Moczarski à Sepilok).
- Sab-82/34: MALAISIE: **Sabah** (Sandakan Residency): 15 milles (24 km) W de Sandakan: Sepilok: "Kabili-Sepilok Forest Reserve", forêt près "Orang-Utan Rehabilitation Station", sentier menant vers la mangrove, prélèvement de sol dans le pré autour du "Cottage" (ancienne plantation d'hévéas); 7.V.1982; leg. B. Hauser – (appareil Berlese à Sepilok).
- Sab-82/41: MALAISIE: **Sabah** (Sandakan Residency): 15 milles (24 km) W de Sandakan: Sepilok: "Kabili-Sepilok Forest Reserve", forêt près du "Pond" (étang formant la réserve d'eau pour Sepilok), prélèvement de feuilles mortes, Secondary Lowland Forest; 10.V.1982; leg. B. Hauser – (appareil Berlese à Sepilok).
- Sab-82/45: MALAISIE: **Sabah** (Interior Residency): route de Kimanis, à 16 milles de Keningau: hélicoptère, prélèvement de feuilles mortes, forêt brumeuse, 1380m; 12.V.1982; leg. B. Hauser – (appareil Berlese à Genève, Suisse).
- Sab-82/50: MALAISIE: **Sabah** (Interior Residency): route de Kimanis, à 10 milles de Keningau: prélèvement de sol dans les angles formés par les contreforts ailés d'un arbre mort, 1170m; 13.V.1982; leg. B. Hauser – (appareil Berlese à Genève, Suisse).

#### LIST OF IDENTIFIED SPECIES

**Dampfiellidae** Balogh, 1961

*Dampfiella kinabalu* sp. n.

Locality: Sab-82/15.

- Dampfiella nebulosa* sp. n.  
Locality: Sab-82/23.
- Dampfiella sepilok* sp. n.  
Locality: Sab-82/41.

### Otocepheidae Balogh, 1961

- Archegotocephens singularis* Mahunka, 1988  
Localities: Sab-82/27: 7 specimens; Sab-82/41: 5 specimens.  
Distribution: Sabah (known from the type localities only); second record.
- Borneremaens hauseri* Mahunka, 1991  
Locality: Sab-82/15: 16 specimens.  
Distribution: Sabah (known from the type locality only); second record.
- Bulbocephens hanserorum* Mahunka, 1988  
Locality: Sab-82/43: 15 specimens.  
Distribution: Sabah (known from the type locality only); second record.
- Dolicheremaens brmeiensis* Aoki, 1967  
Localities: Sab-82/4: 5 specimens; Sab-82/5: 2 specimens; Sab-82/41: 2 specimens.  
Distribution: Brunei (Aoki, 1967), Sabah (Mahunka, 1991); second record for Sabah.
- Dolicheremaens cicatrinosus* Mahunka, 1991  
Localities: Sab-82/27: 4 specimens; Sab-82/43: 3 specimens.  
Distribution: Sabah (known from the type locality only); second record.
- Dolicheremaens claviger* sp. n.  
Locality: Sab-82/15.
- Dolicheremaens fujikawae* sp. n.  
Localities: Sab-82/15; Sab-82/16; Sab-82/27.
- Dolicheremaens krantzi* sp. n.  
Localities: Sab-82/4; Sab-82/15; Sab-82/16; Sab-82/43; Sab-82/45; Sab-82/50.
- Dolicheremaens luxtoni* sp. n.  
Locality: Sab-82/50.
- Dolicheremaens punctatus* sp. n.  
Locality: Sab-82/15.
- Dolicheremaens sabahinus* Mahunka, 1988  
Localities: Sab-82/27: 8 specimens; Sab-82/41: 3 specimens; Sab-82/50: 1 specimen.  
Distribution: Sabah (known from the type localities only); second record.
- Dolicheremaens sulcatus* sp. n.  
Locality: Sab-82/4.
- Dolicheremaens yoshii* sp. n.  
Locality: Sab-82/4.
- Ikarotocephus alatus* Mahunka, 1988  
Localities: Sab-82/43: 2 specimens.  
Distribution: Sabah (known from the type locality only); second record.
- Leptotocephus orientalis* Mahunka, 1988  
Localities: Sab-82/4: 7 specimens; Sab-82/5: 1 specimen; Sab-82/27: 5 specimens; Sab-82/34: 2 specimens; Sab-82/41: 17 specimens; Sab-82/43: 21 specimens; Sab-82/45: 2 specimens.  
Distribution: Sabah (known from the type locality only); second record.
- Otocephus bajau* sp. n.  
Locality: Sab-82/4: 6 specimens.
- Otocephus berndhauseri* sp. n.  
Locality: Sab-82/15.

*Otocephus burckhardti* (Mahunka, 1987a)

Localities: Sab-82/27: 3 specimens; Sab-82/41: 8 specimens.

Distribution: Sabah (known from the type locality only); second record.

*Otocephus heterosetiger* (Aoki, 1965)

Localities: Sab-82/27: 1 specimen; Sab-82/41: 1 specimen.

Distribution: Thailand; first record for Sabah.

*Otocephus kadazan* sp. n.

Locality: Sab-82/15.

*Otocephus kenangan* sp. n.

Locality: Sab-82/43.

*Otocephus lienhardorum* sp. n.

Localities: Sab-82/15; Sab-82/16.

*Otocephus nepenthes* sp. n.

Locality: Sab-82/34.

*Otocephus orangutan* sp. n.

Locality: Sab-82/27.

*Otocephus philippinensis* Aoki, 1965

Localities: Sab-82/27: 2 specimens; Sab-82/50: 4 specimens.

Distribution: Philippines; first record for Sabah.

*Otocephus rafflesiae* sp. n.

Locality: Sab-82/27.

*Otocephus reniformis* sp. n.

Locality: Sab-82/15.

*Otocephus spatulatus* sp. n.

Locality: Sab-82/50.

*Otocephus verrucosus* sp. n.

Locality: Sab-82/15.

## DESCRIPTIONS AND REMARKS

*Dampfiella kinabalu* sp. n.

Figs 1-10

*Material examined:* Sabah: Holotype: Sab-82/15, 50 paratypes from the same sample. Holotype and 30 paratypes: MHNG<sup>1</sup>; 20 paratypes (1498-PO-94): HNHM<sup>2</sup>.

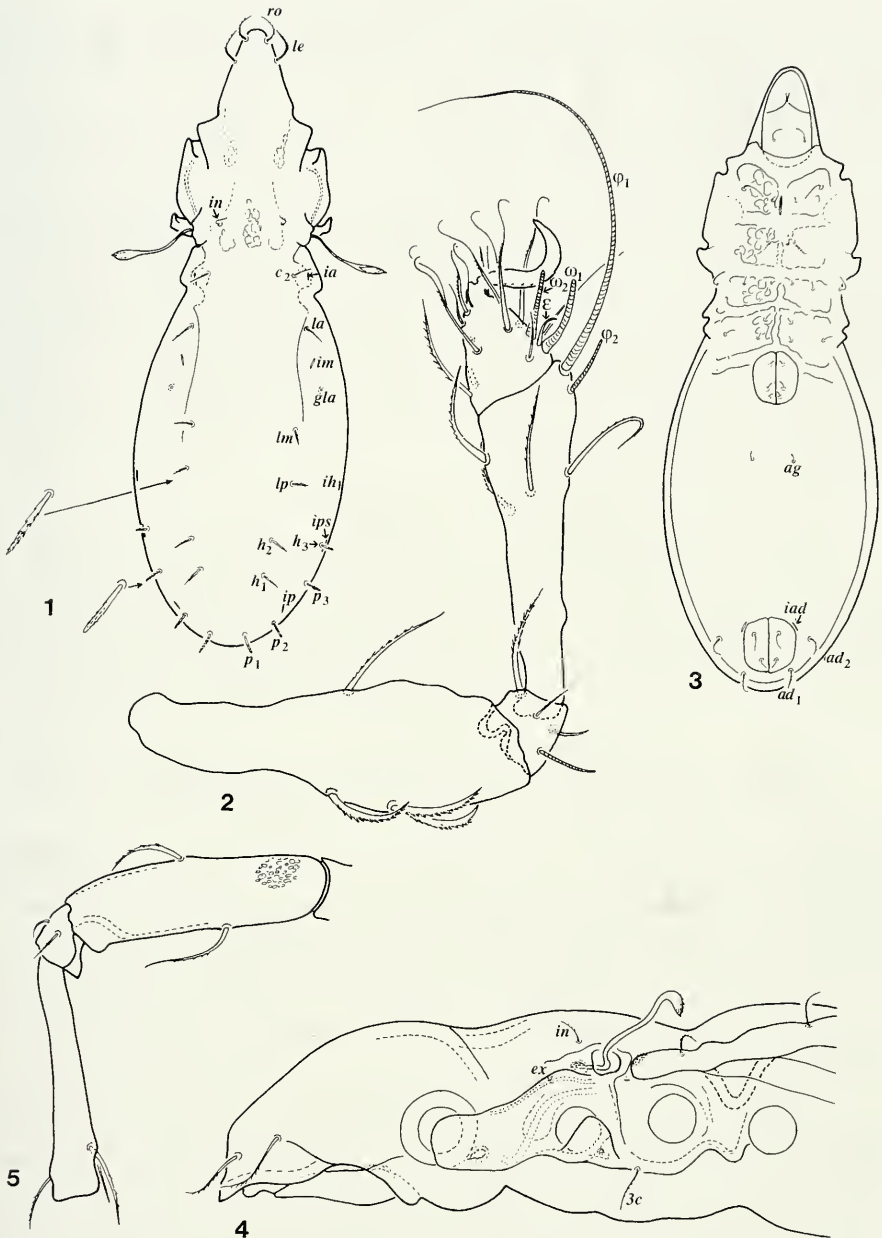
*Measurements:* Length of body: 458-667  $\mu\text{m}$ ; width of body: 180-250  $\mu\text{m}$ .

*Prodorsum:* Rostrum wide, rostral setae simply arched, shorter than the geniculate lamellar ones, all finely ciliate. Interlamellar setae shorter, exobothridial setae minute or represented only by their alveoli, arising very close to the bothridium. Sensillus (Fig. 9) comparatively long, with a well developed apex (often broken) and some small spicules on its surface. The median spots and other irregular sculptures of the prodorsum - typical for this genus - conspicuous (Fig. 6). Taenidia also clearly visible.

*Notogaster:* Narrow, humeral apophysis well developed, with cerotegument granules. Anterolateral "cuvette" very deep. Ten pairs of short notogastral setae. 5

<sup>1</sup> MHNG: deposited in the Muséum d'histoire naturelle, Geneva.

<sup>2</sup> HNHM: deposited in the Hungarian Natural History Museum, Budapest, with identification-number of the specimens in the Collection of Arachnida.



FIGS 1-5

*Dampfiella kinabalu* sp. n. — 1: body in dorsal aspect, 2: leg I, 3: body in ventral aspect, 4: podosoma in lateral aspect, 5: femur, genu and tibia of leg IV.

pairs of lyrifissures and the glandular opening visible. All notogastral setae nearly equal in size, distinctly spiculate (Fig. 1), the anterior and median setae sharply pointed, 4 pairs in posteromarginal position being as long as the others but blunt at the tip and bacilliform.

*Lateral part of podosoma:* Pedotecta I very large, pedotecta II-III triangular, discidium rounded, as shown in Fig. 4.

*Ventral region* (Fig. 3): Coxisternal region well sculptured, and the epimeral borders clearly developed. Epimeral setal formula: 2(3) - 1 - 3 - 3. Excepting the setae *1b*, all setae short. or minute. Setae *1c* completely reduced or represented only by their alveoli. Setae *4c* standing conspicuously far from the discidium, distance between setae *3a* only slightly shorter than that between setae *3b*. Anogenital setal formula : 3 - 1 - 2 - 2. Aggenital setae very short, anterior anal setae (*an*<sub>2</sub>) somewhat longer than the posterior ones (*an*<sub>1</sub>) and arising further from each other than the posterior ones. Setae *ad*<sub>3</sub> absent. Lyrifissures *iad* hardly discernible, located near to the anterior corner of the anal aperture.

*Gnathosoma:* Labiogenal articulation conspicuous, mentum long (Fig. 7). Chelicera (Fig. 8) normal, both digits well developed.

*Legs:* All femora ornamented by foveolae, one of the crests on their distal end clearly visible. All femora broadly, and all genua narrowly excavated basally, the inner pointed apices on genua III and IV sharply pointed (Fig. 4), the lateral ones rounded. All claws with 6-7 small dorsal teeth, on tarsi I-II absent. On tarsus I setae *p'*, *p''* and *s* eupathidial, the others of normal type (Fig. 2). Leg setal formulae are:

I: 1 - 4 - 3+1 - 4+2 - 16+2 - 1

IV: 1 - 1 - 2 - 3 - 12 - 1

*Remarks:* See the remarks after the following *Dampfiella* species.

*Derivatio nominis:* Named after the Mt Kinabalu National Park.

### *Dampfiella nebulosa* sp. n.

Figs 11-13

*Material examined:* Sabah: Holotype: Sab-82/23, 3 paratypes from the same sample. Holotype and 2 paratypes: MHNG; 1 paratype (1949-PO-94): HNHM.

*Measurements:* Length of body: 556-667 µm; width of body: 208-278 µm.

*Prodorsum:* Very similar to the preceding species, but the sensillus (Fig. 12) slightly thicker, without a sharply pointed apex, bearing some small spines of equal size on its distal margin.

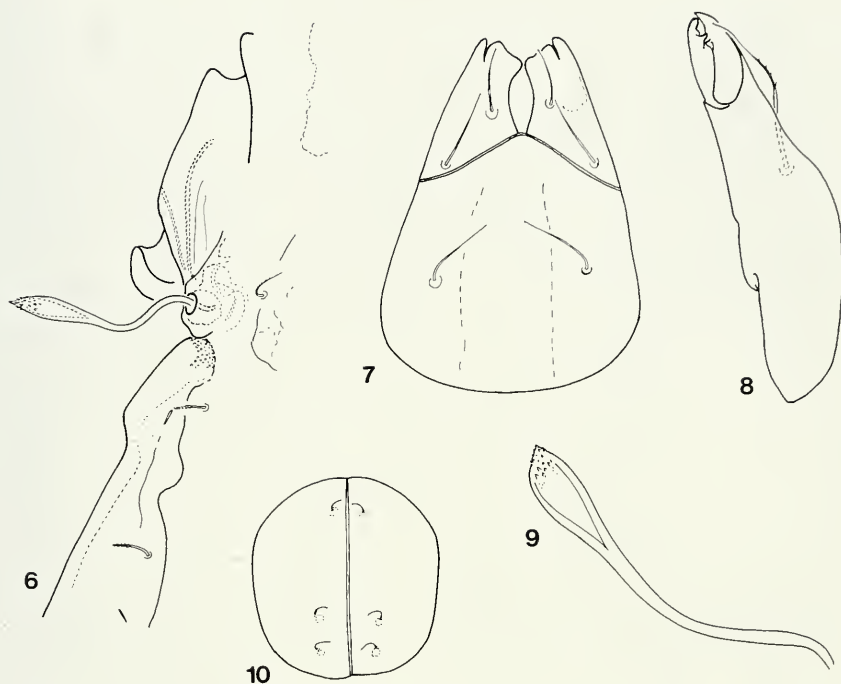
*Notogaster:* Broader than in the preceding species, but the position of the setae is quite similar. Ten pairs of notogastral setae well developed, six of them thicker and longer than the four other bacilliform ones which are present in the posteromarginal position (Fig. 11).

*Ventral region* (Fig 13): Coxisternal region well sculptured, epimeral borders conspicuous. Epimeral setal formula: 2 - 1 - 3 - 3, the insertions of setae *1c* were not discernible. Setae *1b* longest of all, but some setae (e.g. *4a* and *4b*) much longer than in the preceding species.

*Legs:* Similar to those of the preceding species.

*Remarks:* The family Dampfiellidae Balogh, 1961, with its two genera *Dampfiella* Sellnick, 1931 and *Beckiella* Grandjean, 1964, is rather inadequately known, as





FIGS 6-10

*Dampfiella kinabalu* sp. n. – 6: lateral part of body in dorsal aspect, 7: gnathosoma, 8: chelicera, 9: sensillus, 10: genital plates.

has been pointed out by Hammer (1979) and also by Pérez-Iñigo & Baggio (1986). The two new species (*D. kinabalu* and *D. nebulosa*) readily distinguishable by the shape of their notogastral setae should be grouped with *D. angusta*. In this respect *D. angusta* is closer to *D. kinabalu*, though its sensillus is smooth and much longer and narrower than that of the two new species. Furthermore, its rostrum is more angular in dorsal view.

*Derivatio nominis*: An allusion to the cloud-forest of Mt. Kinabalu, where the type material was collected.

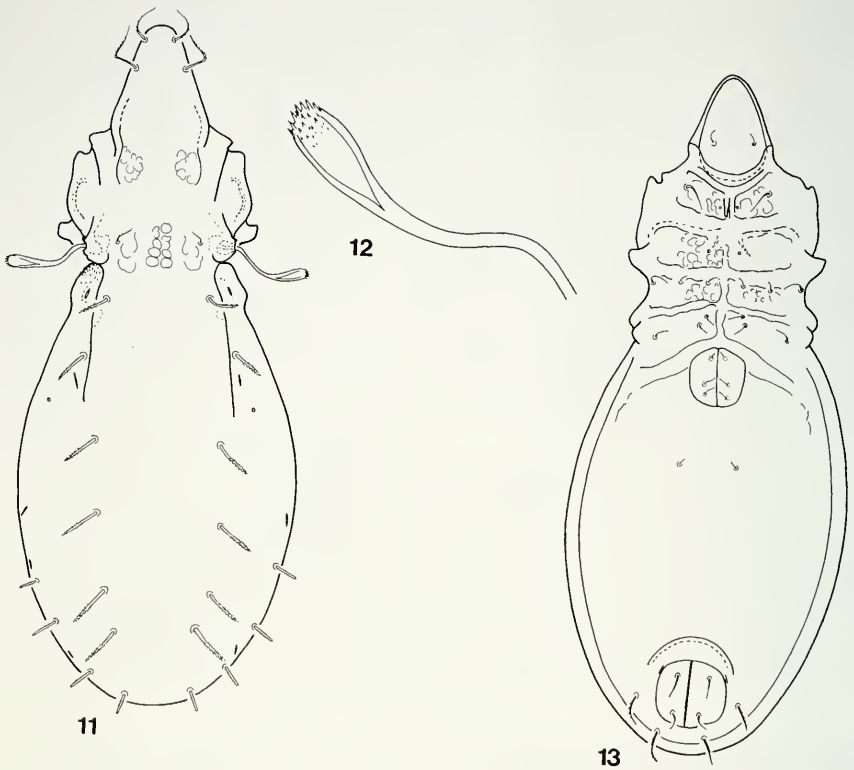
***Dampfiella sepilok* sp. n.**

Figs 14-17

*Material examined*: Sabah: Holotype: Sab-82/41, 3 paratypes from the same sample. Holotype and 2 paratypes: MHNG; 1 paratype (1950-PO-94): HNHM.

*Measurements*: Length of body: 501-610  $\mu\text{m}$ ; width of body: 138-207  $\mu\text{m}$ .

*Prodorsum*: Similar to the preceding species, but slightly longer. Rostral apex weakly foveolate. Rostral and lamellar setae simply arched, unilaterally ciliate. Interlamellar setae short, setiform, exobothridial setae reduced, represented only by their alveoli. Sensillus long, its head clavate, wide, with a small apex and some spicules on its distal end.



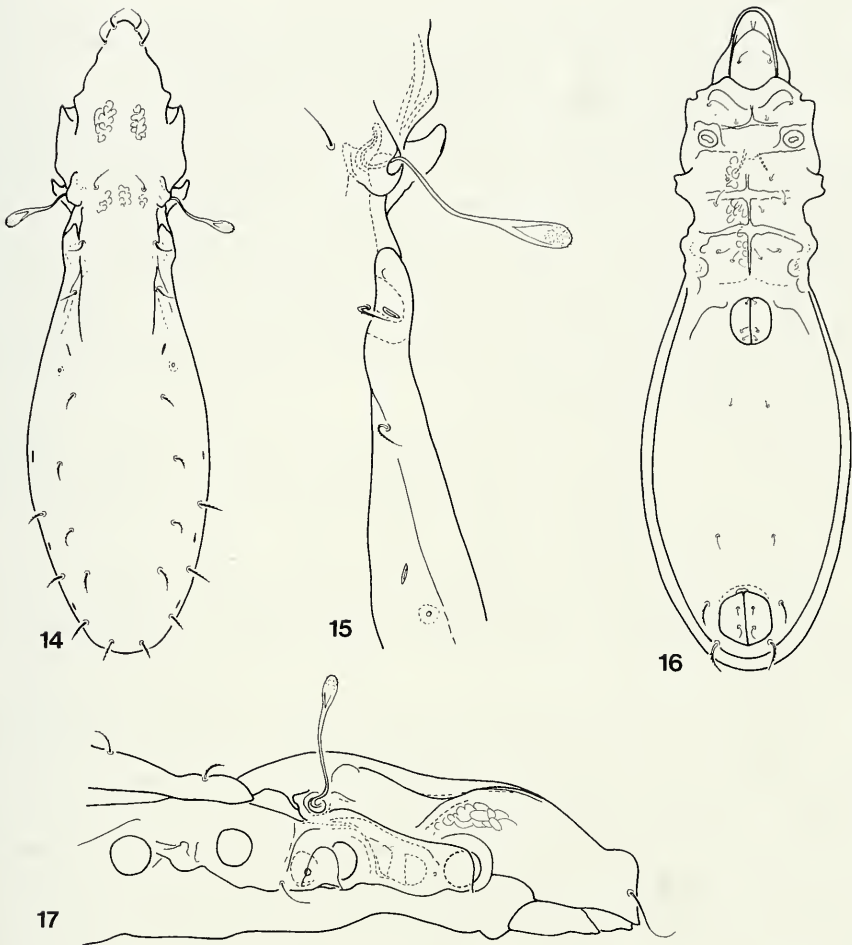
FIGS 11-13

*Dampfiella nebulosa* sp. n. — 11: body in dorsal aspect, 12: sensillus, 13: body in ventral aspect.

*Notogaster*: Extremely long and narrow. A well defined neck-region observable (Fig. 14). Between the bothridial and the lateral condyles of the notogaster an intercondylar band visible (Fig. 15). Anterolateral cuvette small and not deep. Ten pairs of notogastral setae present, all blunt at tip and distinctly spiculate unilaterally. The distance between setae  $c_2$  and  $la$  much smaller than that between  $la$  and  $lm$ . The median notogastral setae gradually becoming longer posteriorly, setae  $h_1$  being the longest of all. All four pairs of setae in posteromarginal position are of equal length.

*Lateral part of podosoma*: Pedotecta I very large (Fig. 17). The extreme length of the body also reflected in the neck-region.

*Ventral region* (Fig. 16): Ventral cuvette very large, strongly bordered, epimeres I and II larger than normal. Behind the discidium a pair of deep hollows present. Epimeral setal formula: 3 - 1 - 2 - 2 (setae  $4c$  near the discidium not discernible). Epimeral setae, excepting setae  $1b$ , very short, sometimes hardly observable. Genital and aggenital setae also very short, anal setae normal and adanal ones conspicuously long, setae  $ad_1$  being the longest of all notogastral and ventral setae, thickened and spiculate like the posterior notogastral setae.



FIGS 14-17

*Dampfiella sepilok* sp. n. – 14: body in dorsal aspect, 15: lateral part of body in ventral aspect, 16: body in ventral aspect, 17: podosoma in lateral aspect.

*Legs:* All femora strongly foveolate, appearing to be polygonate. The protruding plates on genua II-IV are rounded.

*Remarks:* On the basis of the 3 pairs of adanal setae, this species belongs to another species group than the two preceding ones. It is well characterised by the shape of the notogastral and ventral setae and primarily by the extremely elongated body with a narrow neck-part. On this basis this species may easily be distinguished from all heretofore known taxa.

*Derivatio nominis:* The species is named after the region of Sepilok, where its type locality is situated.

*Dolicheremaeus claviger* sp. n.

Figs 18-22

*Material examined:* Sabah: Holotype: Sab-82/15, 2 paratypes from the same sample. Holotype and 1 paratype: MHNG; 1 paratype (1953-PO-94): HNHM.

*Measurements:* Length of body: 820-876  $\mu\text{m}$ ; width of body: 319-362  $\mu\text{m}$ .

*Prodorsum:* Rostrum wide, foveolate. Lamellae narrow, long, medially arching outwards (Fig. 18). Interlamellar region with strong sculpture consisting of foveolae of different sizes. Both pairs of prodorsal condyles well developed, rounded and slightly larger than the lateral ones. Tutorium sinuate and arched, not directed toward the insertion of rostral setae. Lateral lamelliform expansions straight, not touching each other. Rostral and lamellar setae setiform, lamellar setae clearly longest (Fig. 18). Interlamellar setae ensiform, straight, the much shorter and thinner exobothridial setae erect, all setae ciliate or spiculate. Sensillus (Fig. 21) short, its head clavate, with some minor spicules on its distal end.

*Notogaster:* Its surface characteristically foveolate, ornamented by larger foveolae anteriorly and by smaller ones posteriorly (Fig. 18). Ten pairs of ensiform (needle-like), mostly straight notogastral setae present, they are spiculate or finely roughened. No great differences among them, but setae  $p_1$  clearly shorter than  $p_2$ , setae  $c_2$  shorter than interlamellar setae.

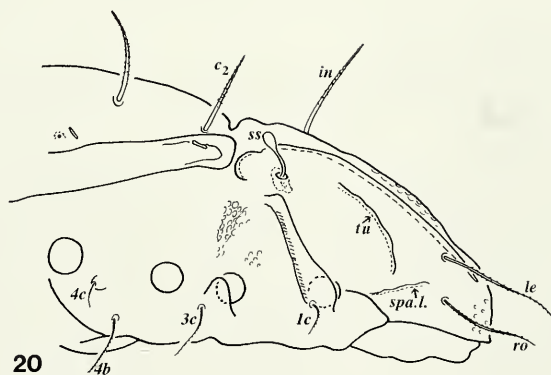
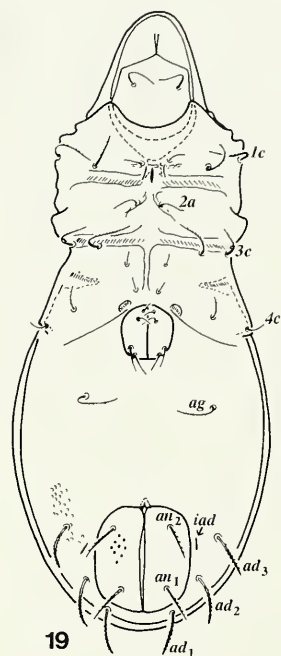
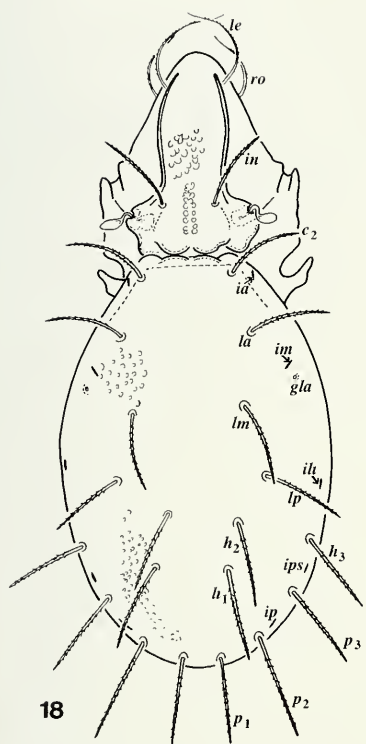
*Lateral part of podosoma:* Pedotecta I narrow, pedotecta II-III small, their shape typical for the genus. Sejugal region stronger, surface between the pedotecta I and II-III slightly foveolate. Discidium small. Setae  $1c$  arising at the basis of pedotecta I (Fig. 20).

*Ventral region:* The shape of the apodemes and the epimeral borders typical for the genus, with a weak sculpture. The posterior border of this region (*bo.* 4) thin, like a tectum, but conspicuous. Great differences exist among the epimeral setae, they are longer on epimeres I and II than on epimeres III and IV. Setae  $1b$ ,  $1c$ ,  $3b$  long, setae  $4c$  particularly short, their size and ratio are shown in Fig. 19. All setae strongly pilose. Ventral plate rarely foveolate. A pair of well sclerotized short laths observable at the anterior corner of the genital aperture. Anterior two pairs of genital setae short, posterior two pairs long. These and the aggenital setae are fine, setiform, adanal ones blunt at tip, similar to notogastral ones. Setae  $ad_3$  located closer to the anal aperture than to the lateral margin of the ventral plate. Lyrifissures *iad* in inverse apoaanal position.

*Legs:* All tarsi with dorsal teeth, claws are spiculate dorsally. Type of ultimate setae: L - ? - ? - S. Setae *v*"of tibia and *pv*"of tarsus plumose.

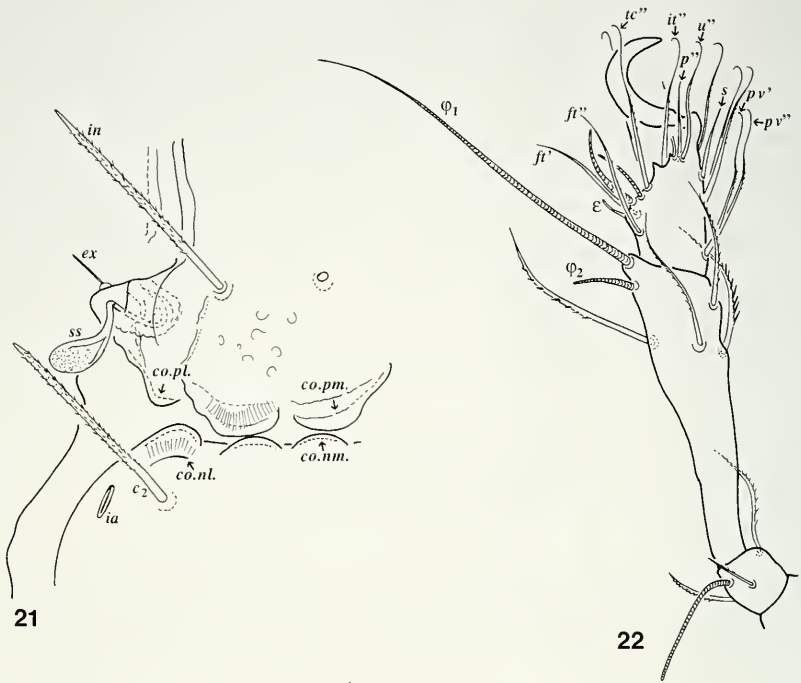
*Remarks:* The new species is characterised by the great differences among the genital setae and the form of the very short, clavate sensillus, by its characteristic notogastral sculpture, the form of its lateral condyles and the form of its notogastral setae. On this basis it may be distinguished from all the heretofore known *Dolicheremaeus* species.

*Derivatio nominis:* The species is named after the form of its sensillus.



FIGS 18-20

*Dolicheremaeus claviger* sp. n. – 18: body in dorsal aspect, 19: body in ventral aspect, 20: podosoma in lateral aspect.



FIGS 21-22

*Dolicheremaeus claviger* sp. n. – 21: sensillus and the lateral condyles, 22: leg I.

*Dolicheremaeus fujikawae* sp. n.

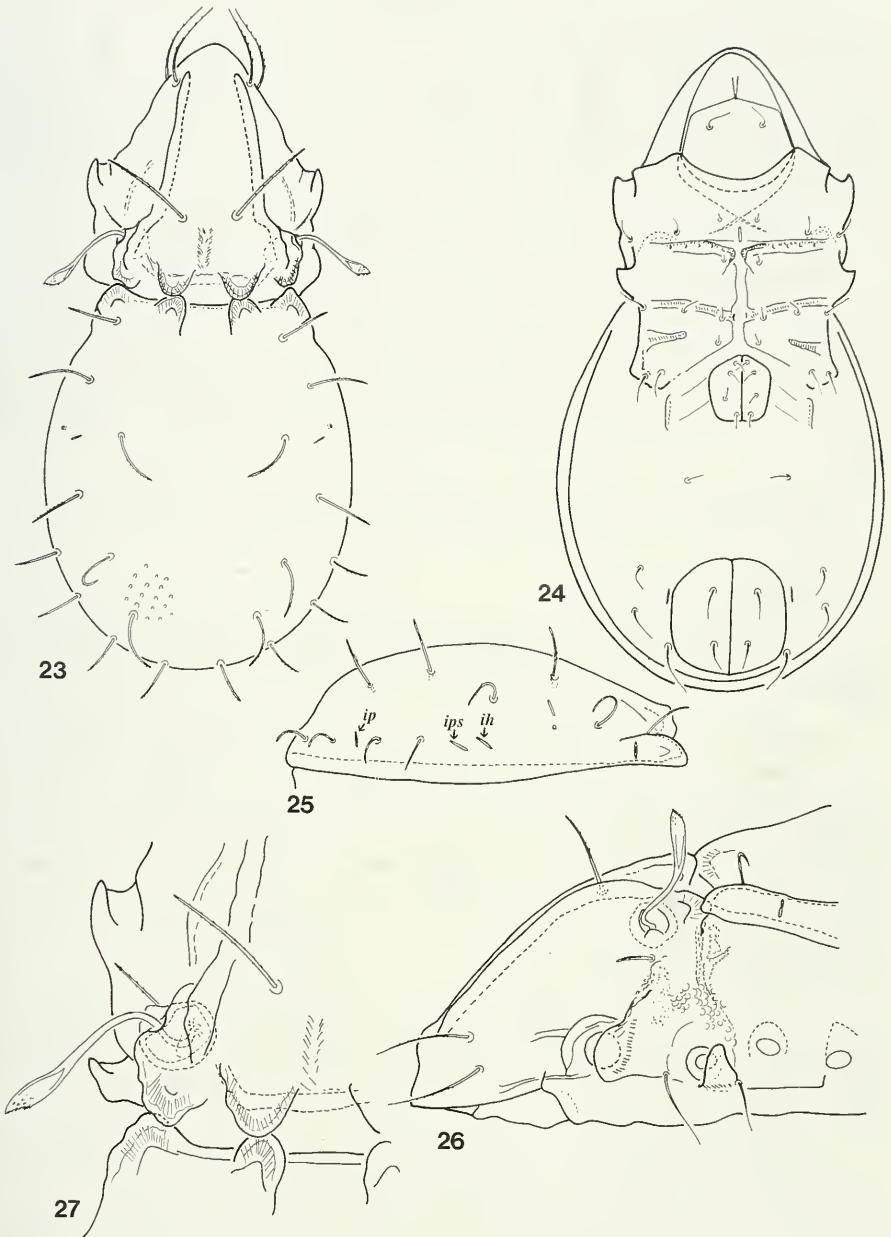
FIGS 23-27

*Material examined:* Sabah: Holotype: Sab-82/15, 1 paratype from the same sample; 1 paratype: Sab-82/16; 2 paratypes: Sab-82/27. Holotype and 2 paratypes: MHNG; 2 paratypes (1960-PO-94); HNHM.

*Measurements:* Length of body: 331  $\mu$ m; width of body: 180  $\mu$ m.

*Prodorsum:* Lamellae long, gradually converging anteriorly, reaching beyond the insertion of the lamellar setae but not touching them. Surface weakly ornamented, but covered by cerotegument granules. Tutorium hardly discernible, lateral lamelli-form expansion short, straight. Both pairs of median condyles very large, median one more rounded, lateral one slightly angulate (Fig. 27). Under the median condyles a transversal band observable in a deeper layer. Rostral and lamellar setae long, setiform, weakly ciliate. Interbothridial and exobothridial setae bacilliform, blunt at tip, their surface only slightly roughened. Head of sensillus asymmetrically dilated, with short spines or spicules on its distal end.

*Notogaster:* Surface rarely foveolate. Both pairs of notogastral condyles conspicuously large. Ten pairs of short and mostly bacilliform notogastral setae present, they are nearly equal in size and length (Fig. 23), their surface slightly roughened. Five pairs of conspicuous lyrifissures, *ih* and *ips* located anteriorly to seta  $h_3$  (Fig. 25).



FIGS 23-27

*Dolicheremaeus fujikawae* sp. n. – 23: body in dorsal aspect, 24: body in ventral aspect, 25: notogaster in lateral aspect, 26: podosoma in lateral aspect, 27: lateral part of the dorsosejugal region.

*Lateral part of podosoma:* Pedotecta II-III well, discidium hardly developed. Sejugal region distinctly pustulate (Fig. 26).

*Ventral region:* Coxisternal and ventral plates somewhat sculptured, the apodema and the epimeral borders mostly observable. *Bo.* 4 only partly visible, interrupted. A well-developed longitudinal lath parallel with the genital aperture present. All setae in the ventral regions short and simple (Fig. 24), anal setae longer than the longest epimeral ones. Lyrifissures *iad* in paraanal position.

*Legs:* Tarsus of leg I without triangular teeth. Type of ultimate setae: L - L - L - L, but these setae (*u*) very short and fine. No dilated setae on tibia IV and tarsus IV.

*Remarks:* The new species is well characterised by the form of its sensillus, the position of the notogastral lyrifissures (*ih* and *ips*) and the short notogastral setae of equal length. On this basis it belongs to the species group of *D. variolatus* Mahunka, 1989. The new species may be distinguished from the latter by its peculiarly large condyles on the prodorsum and on the notogaster, and by the much shorter adanal setae.

*Derivatio nominis:* I dedicate the new species to Dr. T. Fujikawa, the renowned Oribatidologist, for her excellent studies on the Japanese oribatids.

### *Dolicheremaeus krantzi* sp. n.

Figs 28-31

*Material examined:* Sabah: Holotype: Sab-82/15, 10 paratypes from the same sample; 3 paratypes: Sab-82/4; 2 paratypes: Sab-82/16; 9 paratypes: Sab-82/43; 1 paratype: Sab-82/45; 3 paratypes: Sab-82/50. Holotype and 17 paratypes: MHNG; 11 paratypes (1952-PO-94): HHNM.

*Measurements:* Length of body: 457-512  $\mu\text{m}$ ; width of body: 226-294  $\mu\text{m}$ .

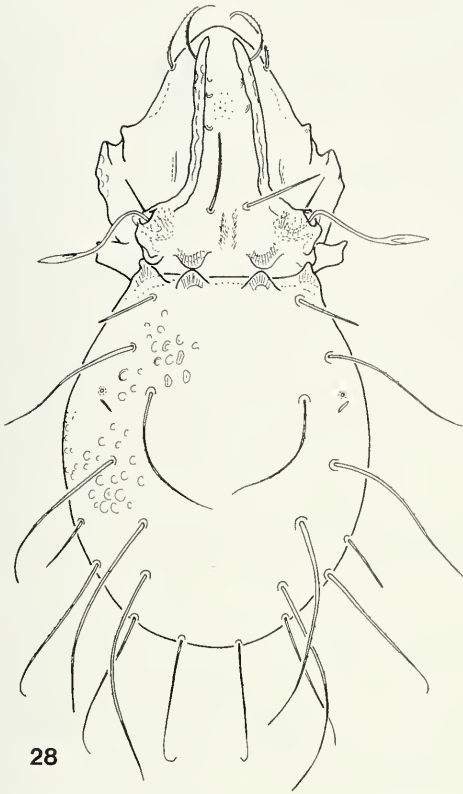
*Prodorsum:* Rostrum widely rounded, lamellae long, slightly and gradually converging anteriorly. Prodorsal surface mostly smooth, with some large foveolae and wrinkles along the lamellae in the interlamellar region. Median prodorsal condyles distinct, the lateral ones weakly developed (Fig. 30). Rostral and lamellar setae setiform, both distinctly ciliated. Interlamellar setae ensiform and exobothridial setae needle-shaped, surface of the former smooth, the latter strongly spiculate. Sensillus long, with slightly lanceolate head.

*Notogaster:* Whole surface covered by large, partly rounded, partly elongated pustules with a medial split. Notogastral condyles well developed, median pair rounded, lateral ones triangular. Great differences in length among notogastral setae. Setae  $c_2$  and  $h_3$  short, bacilliform, all others setiform or filiform, much longer than the preceding two pairs (Fig. 28).

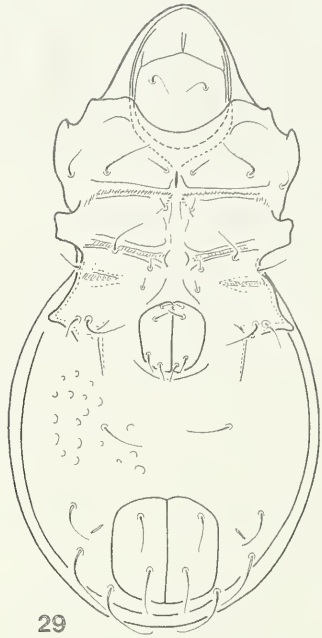
*Lateral part of podosoma:* Pedotecta I normal, pedotecta II-III well developed. Discidium with a conspicuously protruding posterior corner (Fig. 31).

*Ventral region* (Fig. 29): Among the apodemes *ap.* 2, *ap. sej.* and *ap.* 3 distinct, *ap.* 4 weakly developed, *bo.* 4 only partly observable. Far laterally along the genital aperture a longitudinal crest present. Epimeral setal formula normal (3 - 1 - 3 - 3), setae *1b*, *3b* and *4b* longer than the others. Ventral plate foveolate. Aggenital, anal and adanal setae fine, shorter than most of the notogastral ones. Lyrifissures *iad* in inverse apoanal position.





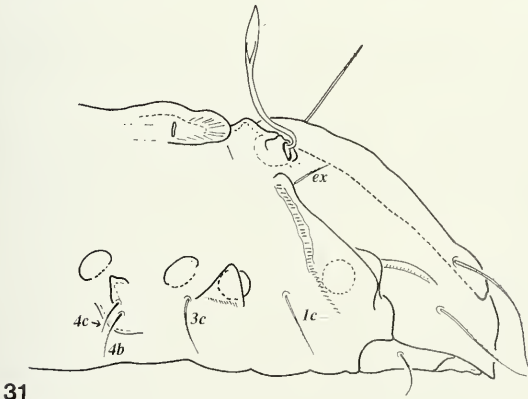
28



29



30



31

FIGS 28-31

*Dolicheremaeus krantzi* sp. n. – 28: body in dorsal aspect, 29: body in ventral aspect, 30: lateral part of the dorsosejugal region, 31: podosoma in lateral aspect.

*Legs:* Tarsus of leg I without triangular teeth. Type of ultimate setae: L - L - L - L. Setae *pv*" of tibia and *v*" of tarsus plumose.

*Remarks:* The new species is well characterised and well distinguished from all heretofore known *Dolicheremaeus* species by its characteristic sculpture on the notogaster and the form of its notogastral setae.

*Derivatio nominis:* I dedicate the new species to Prof. Dr. W. Krantz (Corvallis, USA), an acarologist of great renown.

***Dolicheremaeus luxtoni* sp. n.**

Figs 32-35

*Material examined:* Sabah: Holotype: Sab-82/50. 8 paratypes from the same sample. Holotype and 5 paratypes: MHNG; 3 paratypes (1966-PO-94): HHNM.

*Measurements:* Length of body: 583-738  $\mu\text{m}$ ; width of body: 264-390  $\mu\text{m}$ .

*Prodorsum:* Rostrum smooth. Lamellae very long and narrow, running parallel to each other. Only one pair of notogastral condyles present; the median one completely lacking, whereas the lateral one enlarged and very wide (Fig. 34). Tutorium hardly developed, the lateral lamelliform expansion clearly developed, directed toward the insertion of rostral setae but not reaching it (Fig. 35). Rostral and lamellar setae setiform, strongly ciliate. Interlamellar setae ensiform. Sensillus with asymmetrically dilated head, its distal end bearing some spicules. Exobothridial setae straight, short.

*Notogaster:* Its surface ornamented mostly by foveolae, but posterior part clearly pustulate. Two pairs of large notogastral condyles present, *co. ul.* and *co. um.* located conspicuously near to each other (Fig. 32), the median one is elongated. All ten pairs of notogastral setae ensiform, no great differences in length and size among them. Lyrifissures *ips* open between setae *p*<sub>3</sub> and *h*<sub>3</sub>.

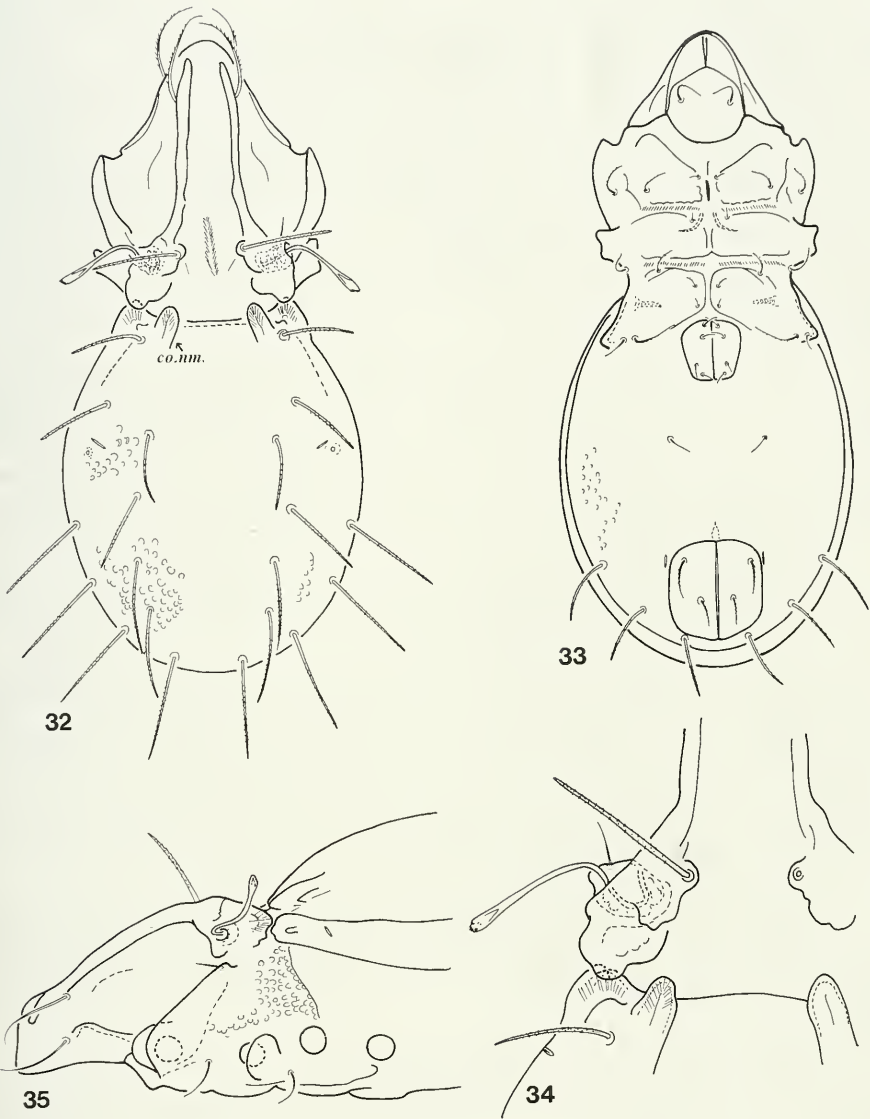
*Lateral part of podosoma:* All pedotecta normal in shape, as shown in Fig. 35. Sejugal region well pustulate.

*Ventral region* (Fig. 33): Epimeral borders and the usual apodemes conspicuous. Epimeral setae short, no obvious differences among setae *1b*, *1c*, *3b*, *3c*. Setae *4b* the longest of all, setae *1a*, *2a*, *3a* and *4a* very short. Ventral plate foveolate, surface of genital and anal plates smooth. Genital and aggenital setae short and simple, anal ones and especially adanal ones much longer and stronger. Setae *ad*<sub>3</sub> arising far laterally, near to the margin of ventral plate. All setae slightly aciculate. Lyrifissures *iad* in adanal position.

*Legs:* Type of ultimate setae: L - S - S - S. No triangular teeth on tarsi I-IV. Seta *v*" on tibia and *pv*" on tarsus plumose.

*Remarks:* Owing to the absence of the median prodorsal condyles and the position of adanal setae and lyrifissures, the new species strongly resembles *D. baloghi* Aoki, 1967. However, the latter is well distinguished from the new species by the sculpture of the notogaster (the posterior part also foveolate) and by the length of the interlamellar setae (short in *D. baloghi*). The form of the notogastral condyles also differs.

*Derivatio nominis:* I dedicate the new species to Dr. M. Luxton, the renowned specialist of the world oribatids, as a grateful acknowledgement of his valuable help in the revision of my manuscripts.



FIGS 32-35

*Dolicheremaeus luxtoni* sp. n. — 32: body in dorsal aspect, 33: body in ventral aspect, 34: dorsosejugal region, 35: podosoma in lateral aspect.

*Dolicheremaeus punctatus* sp. n.

Figs 36-39

*Material examined:* Sabah: Holotype: Sab-82/15, 23 paratypes from the same sample. Holotype and 14 paratypes: MHNG; 9 paratypes (1954-PO-94): HNHM.

*Measurements:* Length of body: 847-1279  $\mu\text{m}$ ; width of body: 389-667  $\mu\text{m}$ .

*Prodorsum:* Rostrum slightly foveolate, prodorsal surface simple, only the exobothridial and sejugal region strongly pustulate laterally. Lamellae long and narrow, slightly bent inwards distally. Two pairs of prodorsal condyles present, median one regularly rounded and much larger than the slightly angulate lateral pair (Fig. 37). Rostral and lamellar setae arising relatively near to each other, both pairs setiform and strongly ciliate, with filiform distal end. Interlamellar setae ensiform, straight, slightly spiculate. Exobothridial setae short, sensillus with a slightly dilated lanceolate head.

*Notogaster:* Ornamented with small but deep, well-framed foveolae (nearly punctate). Two pairs of notogastral condyles present, but the median pairs weakly developed, not reaching beyond the dorsosejugal suture (Fig. 36). The lateral condyles triangular in shape. Ten pairs of notogastral setae present, all ensiform, similar to the interlamellar ones, without essential difference between them. Lyri-fissures *ih* and *ips* located in front of setae *h*<sub>3</sub>.

*Lateral part of podosoma:* Pedotecta I and II-III normal, discidium small (Fig. 39). Tutorium long, well arched, undulate dorsally, not connected with the also long and reversed S-shaped lateral lamelliform expansion.

*Ventral region* (Fig. 38): Epimeral surface rarely, ventral plate distinctly foveolate, similar to the notogastral surface. Epimeral setae relatively long, setae *1c* arising anteriorly, setae *4b* and *4c* located far from each other. All setae, excepting the adanal ones, in the anogenital region (e.g. genital ones) unusually long, setiform. Adanal setae ensiform like the notogastral setae, shorter than the anal setae. Setae *ad*<sub>1</sub> slightly longer than *ad*<sub>3</sub>, the former arising closer to the anal aperture than to the lateral margin. Lyri-fissures *iad* in inverse apoanal position.

*Legs:* Tarsi of all legs bearing sharp teeth. Type of ultimate setae: L - S - S - S.

*Remarks:* The new species is well characterised by the strong (deep) punctation resembling a foveolate sculpture, by the equal length and size of the notogastral setae and primarily by the ratio of the anogenital setae (i.e. anal setae longer than the adanal ones).

*Derivatio nominis:* The species is named after the punctate surface of the notogaster.

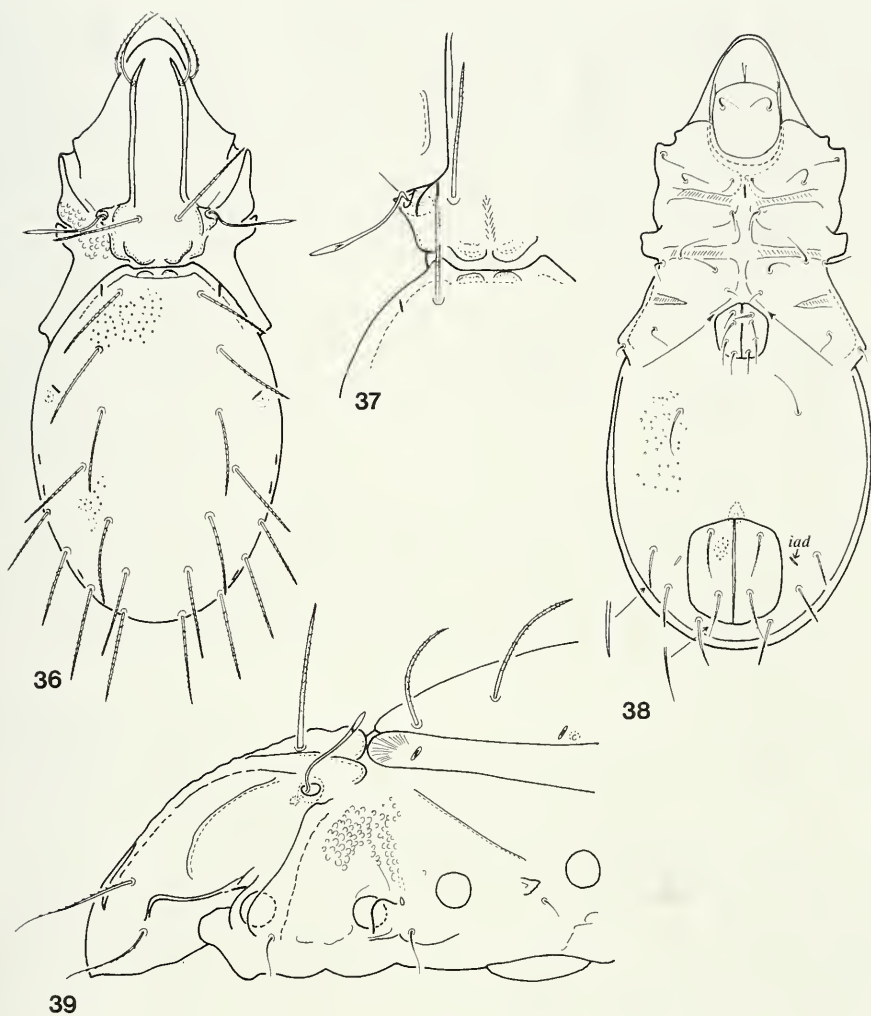
*Dolicheremaeus sulcatus* sp. n.

Figs 40-47

*Material examined:* Sabah: Holotype: Sab-82/4, 5 paratypes from the same sample. Holotype and 3 paratypes: MHNG; 2 paratypes (1951-PO-94): HNHM.

*Measurements:* Length of body: 556-602  $\mu\text{m}$ ; width of body: 272-300  $\mu\text{m}$ .

*Prodorsum:* Surface smooth, only the surface of pedotecta weakly foveolate and the sejugal region pustulate (Fig. 40). Some very fine interlamellar spots visible, arranged in longitudinal rows. Lamellae very long, with well separated distal part, like



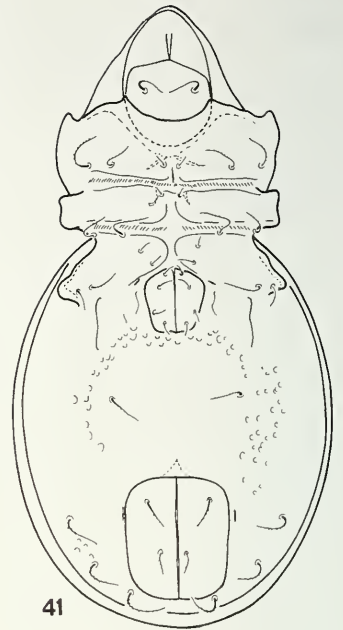
FIGS 36-39

*Dolicheremaeus punctatus* sp. n. — 36: body in dorsal aspect, 37: dorsosejugal region. 38: body in ventral aspect, 39: podosoma in lateral aspect.

cusps, running parallel to each other. The median prodorsal condyles connected with them, both pairs of condyles very large, the outer ones rectangular, the inner ones triangular (Fig. 42). Lamellar and rostral setae setiform, strongly ciliated. Interlamellar setae ensiform, exobothridial setae arising at the basis of pedotecta I. Tutorium absent, lateral lamelliform expansion well developed.



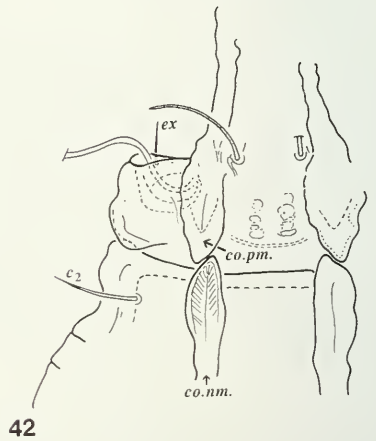
40



41



43



42

FIGS 40-43

*Dolicheremaeus sulcatus* sp. n. — 40: body in dorsal aspect. 41: body in ventral aspect. 42: dorsosejugal region. 43: podosoma in lateral aspect.

*Notogaster*: Sejugal region wide, two pairs of well-developed condyles present, median pairs conspicuously long (Fig. 40), directed backwards. Anterior and median surface sulcate, alternating with irregular alveoli, behind them is a blister-like structure, and the posterior margin again foveolate and alveolate. Ten pairs of thin and mostly long or very long notogastral setae present, some of them with filiform and flagelliform distal ends. Lyrifissures *im* located far anteriorly, the glandular opening placed rather anteriorly. Lyrifissures *ips* present between setae  $p_3$  and  $h_3$  (Fig 44).

*Lateral part of podosoma*: Pedotecta I wide, pedotecta II-III rectangular, discidium normal, setae *4b* and *4c* arising close to each other on the apex of the discidium (Fig. 43).

*Ventral region* (Fig. 41): Transversal apodemes well developed, the two *ap.* 2 and the two *ap. sej.* connected medially. Epimeral setae (3 - 1 - 3 - 3) mostly clearly ciliate. Ventral plate foveolate laterally, a pair of longitudinal wrinkles observable along the genital aperture. Aggenital, anal and adanal setae similar to the notogastral ones, with filiform end.

*Legs*: Type of ultimate setae: L - L - L - L. No triangular teeth on tarsi I-IV (Figs 45-46). Seta *v*" on tibia and *pv*" on the tarsus plumose.

*Remarks*: The new species is distinguished from all others hitherto known from the family Otocephidae Balogh, 1961 by the blister-like structure of the body and by the sculpture of the notogaster.

*Derivatio nominis*: The species is named after the sulcate surface of the notogaster.

### *Dolicheremaeus yoshii* sp. n.

Figs 48-51

*Material examined*: Sabah: Holotype: Sab-82/27, 20 paratypes from the same sample. Holotype and 12 paratypes: MHNG; 8 paratypes (1955-PO-94): HNHM.

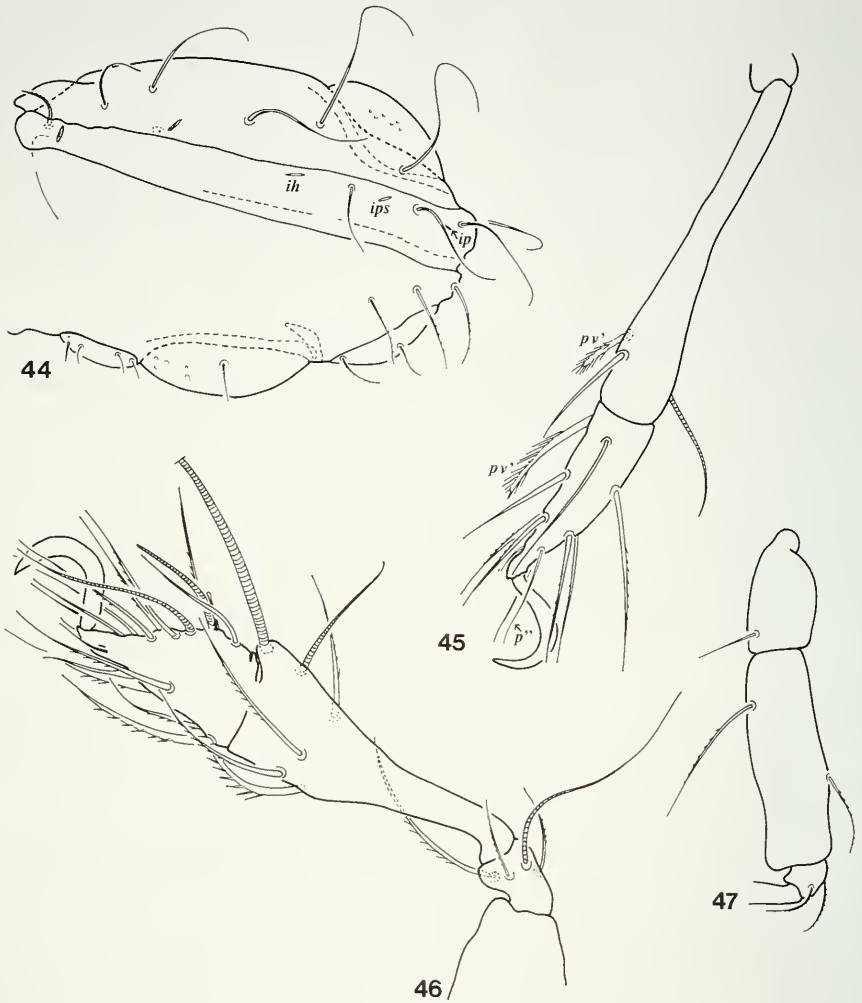
*Measurements*: Length of body: 792-1070  $\mu\text{m}$ ; width of body: 264-459  $\mu\text{m}$ .

*Prodorsum*: Rostral apex smooth, slightly excavate medially. Lamellae long, running parallel to each other, their surface foveolate. Basal part of the interlamellar region with some wrinkles. Both pairs of prodorsal condyles large, nearly triangular. Bothridium with a small dorsal, and a very large ventral squama (Fig. 48). Tutorium weak, straight, lateral lamelliform expansion very long, arching upwards, directed rather to the lamellar than the rostral setae and ending between them. Head of sensillus dilate, with a blunt distal end, the latter with some spicules.

*Notogaster*: Sejugal region wide, with two pairs of notogastral condyles. Lateral ones triangular, median ones asymmetrical, conspicuously long (Fig. 50). Notogastral surface ornamented with very large and irregular foveolae and with some sinuate wrinkles around the median part. Only nine pairs of notogastral setae present (setae  $c_2$  absent), all ensiform, finely ciliate.

*Lateral part of podosoma*: Pedotecta I normal, pedotecta II-III and the discidium weakly developed. Pedotecta and the sejugal region ornamented with smaller foveolae and a field over the acetabula III-IV with larger ones (Fig. 51).

*Ventral region* (Fig. 49): Epimeral surface lacking sculpture, apodemes and epimeral borders well developed, typical for the genus. Epimeres well framed

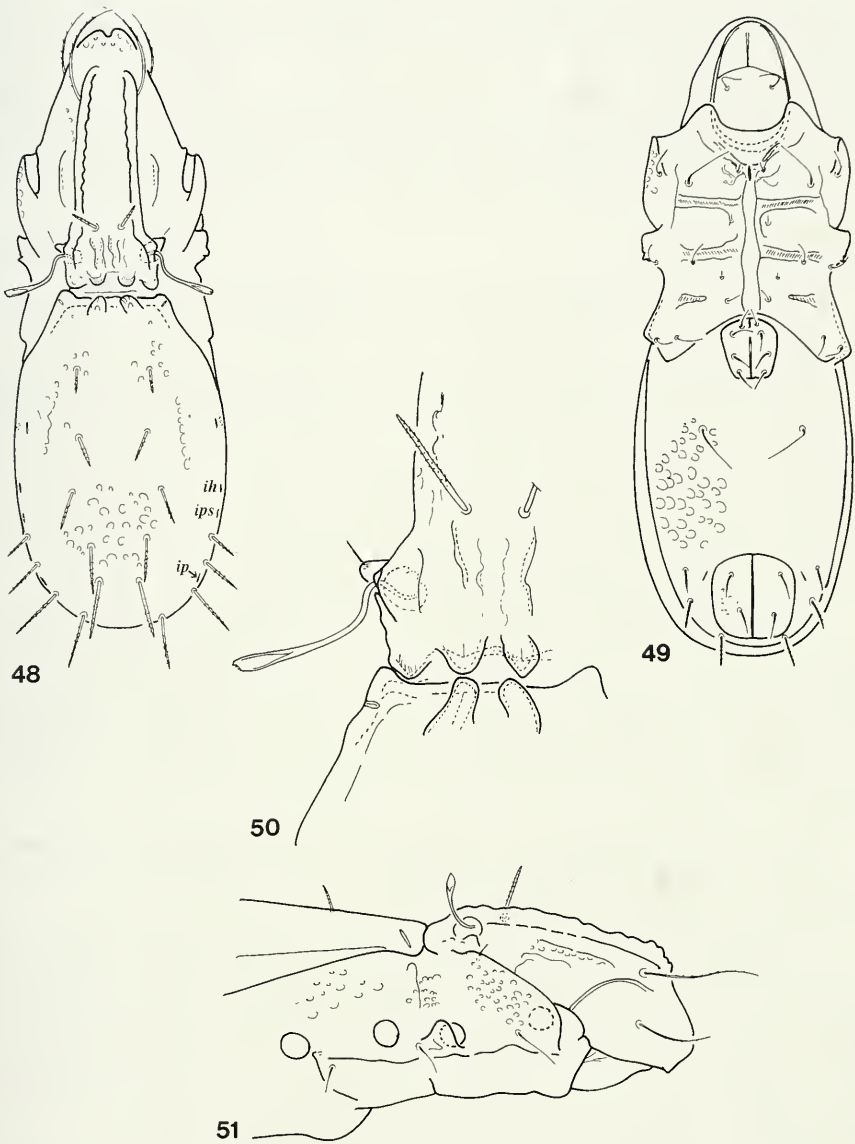


Figs 44-47

*Dolicheremaeus sulcatus* sp. n. – 44: posterior part of notogaster in lateral aspect, 45: tarsus and tibia of leg IV, 46: leg I, 47: trochanter, femur and genu of leg IV.

medially, between them a well-defined median field visible. Among the epimeral setae (3 - 1 - 3 - 3) great differences in length, setae *Ib* the longest of all. Ventral plate with large foveolae, as on the notogastral surface. Genital setae strong, setiform, aggenital setae longer than adanal ones. Anal setae thin, setiform, adanal ones ensiform, slightly dilated. Setae *ad*<sub>3</sub> arising closer to the lateral margin of the ventral plate than to the anal aperture. Lyrifissures *iad* in inverse apoanal position.





FIGS 48-51

*Dolicheremaeus yoshii* sp. n. — 48: body in dorsal aspect, 49: body in ventral aspect, 50: dorsosejugal region, 51: podosoma in lateral aspect.

*Legs:* Type of ultimate setae: L - S - S - S. Tarsi I-III with triangular teeth dorsally, they are absent on tarsus IV. Leg IV with two dilated plumose ventral setae ( $v''$  and  $pv''$ ).

*Remarks:* The new species is readily distinguished from all the heretofore described species of the genus on the basis of the missing setae  $c_2$ .

*Derivatio nominis:* I dedicate the new species to the late Prof. Dr. R. Yoshii for his help in the realization of this collecting trip.

*Otocephalus bajau* sp. n.

Figs 52-55

*Material examined:* Sabah: Holotype: Sab-82/4, 6 paratypes from the same sample. Holotype and 4 paratypes: MHNG; 2 paratypes (1963-PO-94): HNHM.

*Measurements:* Length of body: 1265-1501  $\mu\text{m}$ ; width of body: 556-657  $\mu\text{m}$ .

*Prodorsum:* Rostral apex and surface of lamellae weakly foveolate. Lamellae long, narrow, slightly bent medially and convergent anteriorly. Two pairs of well developed prodorsal condyles of nearly equal size, lateral one widely rounded, median one slightly triangular (Fig. 54). Bothridium with a rounded ventral plate. Rostral and lamellar setae setiform, finely ciliate, with a filiform distal end. Interlamellar setae ensiform, exobothridial one simple and short. Sensillus small, with a lanceolate head sometimes bearing some scattered spicules.

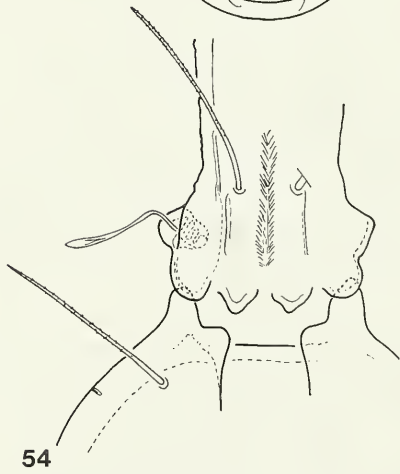
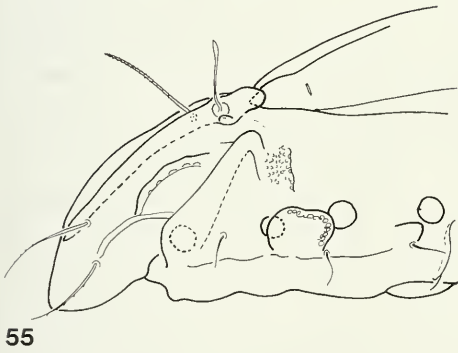
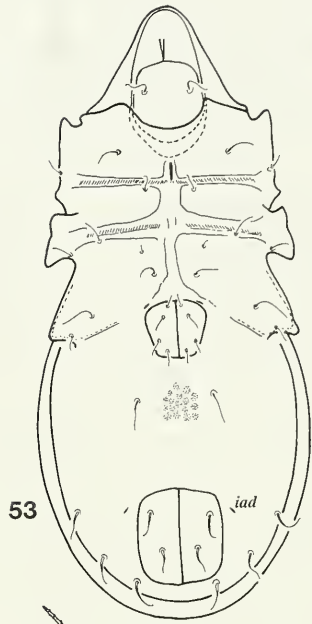
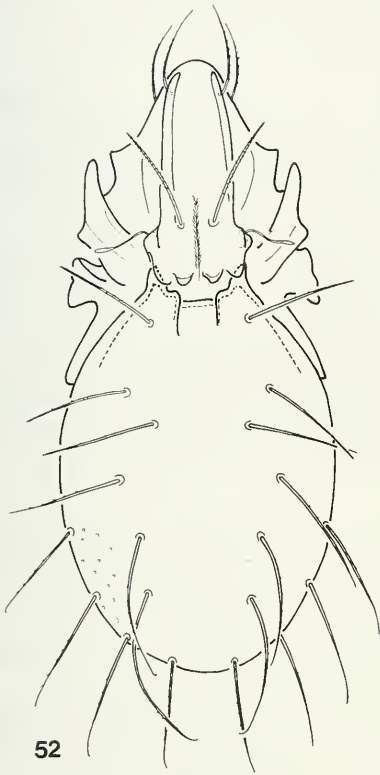
*Notogaster:* Surface ornamented by a weak polygonal sculpture consisting of small granules. One pair of very large notogastral condyles present, with a very long outer apex, covering the rounded prodorsal one (Fig. 52). Ten pairs of long notogastral setae present, setae  $c_2$  and  $la$  ensiform, all the others setiform. Their length gradually increasing toward the posterior part of notogaster. Setae  $p_1 = h_1$  the longest of all. Only one lyrifissure ( $ih$ ) located in front of  $h_3$ ,  $ips$  visible between setae  $p_3$  and  $p_2$ .

*Lateral part of podosoma:* Pedotecta I and II-III very large, posterior part of the latter larger than the anterior part, its margin foveolate (Fig. 55). Discidium with a large posterior corner, carrying only one pair of setae ( $4c$ ).

*Ventral region* (Figs 53): Completely covered by cerotegument granules, on the third and fourth epimeres they compose polygonal fields, a similar formation also on the notogaster and on the ventral plate. Epimeral borders and apodemes of usual shape, epimeral setae simple. Among them setae  $1b$ ,  $3b$  and  $4b$  longer than their corresponding outer pairs ( $1c$ ,  $3c$  and  $4c$ ). Genital setae short, simple: the aggenital, anal and adanal setae nearly equal in length, all slightly thickened basally, their ends filiform, slightly flagellate. Lyrifissures  $iad$  in inverse apoanal position.

*Legs:* All segments of legs very long and narrow. Tarsus I with triangular teeth, latter absent from tarsi II-IV. Type of ultimate setae: L - S - S - S. Seta  $v''$  on tibia IV and  $pv''$  on tarsus IV plumose.

*Remarks:* The new species is related to *O. holtmanni* Aoki, 1965. However, it is distinguished from *O. holtmanni* by the ratio of the epimeral setae ( $3c$  longer than  $3b$  in *O. holtmanni*) and the prodorsal sculpture (lateral part of prodorsum foveolate in *O. holtmanni*, smooth in the new species).



Figs 52-55

*Otocepheus bajau* sp. n. – 52: body in dorsal aspect, 53: body in ventral aspect, 54: dorso-sejugal region. 55: podosoma in lateral aspect.

*Derivatio nominis*: This species is named after the Bajau people inhabiting mainly the coastal area of Sabah.

*Otocephus berndhauseri* sp. n.

Figs 56-59

Material examined: Sabah: Holotype: Sab-82/15, 2 paratypes from the same sample; 1 paratype Sab-82/23. Holotype and two paratypes: MHNG; 1 paratype (1958-PO-94): HNHM.

*Measurements*: Length of body: 986-1098  $\mu\text{m}$ ; width of body: 472-556  $\mu\text{m}$ .

*Prodorsum*: Rostrum strongly foveolate, some foveolae visible also in the interlamellar region. A transversal band is present in front of the lamellar cusps. Lamellae long, rather wide, running parallel to each other, ending far from the rostral apex. Both pairs of prodorsal condyles well developed and rounded, the median ones not connected with each other (Fig. 58). Rostral setae comparatively short, setiform, exobothridial setae minute, hardly discernible, lamellar and interlamellar ones very long, filiform, much resembling the other notogastral setae. All setae finely and sparsely ciliate. Sensillus comparatively small, twisted backwards, its head smooth, slightly asymmetrical in lateral aspect (Fig. 59).

*Notogaster*: Lateral notogastral condyles very large, hardly narrower than the distance between them. Ten pairs of extremely long and filiform notogastral setae present, no essential difference between them (Fig. 56). Five pairs of lyrifissures also present, their position normal (*ips* located between setae  $h_3$  and  $p_3$ ).

*Lateral part of podosoma*: Pedotecta I long, pedotecta II-III large, fishtail-shaped, ornamented by foveolae or spots (Fig. 59). Discidium very large.

*Ventral region*: In the coxisternal region only two pairs of apodemes conspicuous, the epimeral borders and the other apodemes poorly developed. Epimeral setae short, the short setae *1b* being unusual. All setae on epimere I arising in the posterior part of this field. Both setae *3a - 3b* and also setae *4b - 4c* arising conspicuously near to each other (Fig. 57). All epimeral setae finely ciliate or roughened. Ventral plate foveolate. Genital, aggenital and anal setae normal, setiform, adanal setae very long, filiform and flagellate at their distal end. Setae *ad*<sub>3</sub> arising far from the anal aperture, near to the lateral margin of the ventral plate. Lyrifissures *iad* in paraanal position.

*Legs*: Type of ultimate setae: L - S - S - S. All joints of legs conspicuously long and narrow. Femur IV with very large genual lamellae. Seta *l''* on genua II-IV long, spiniform, setae *v* on femora II-III also conspicuously long. Setae *v''* on tibia IV and *pv'* on tarsus IV dilated and plumose.

*Remarks*: The new species has a unique body chaetotaxy within this genus. On this basis it is readily distinguished from all related species.

*Derivatio nominis*: I dedicate the new species to my friend Dr. B. Hauser (Geneva), the organizer of this expedition and collector of this very rich material.

*Otocephus kadazan* sp. n.

Figs 60-63

Material examined: Sabah: Holotype: Sab-82/15, 1 paratype from the same sample. Holotype: MHNG; paratype (1961-PO-94): HNHM.

*Measurements*: Length of body: 1014-1029  $\mu\text{m}$ ; width of body: 403-417  $\mu\text{m}$ .

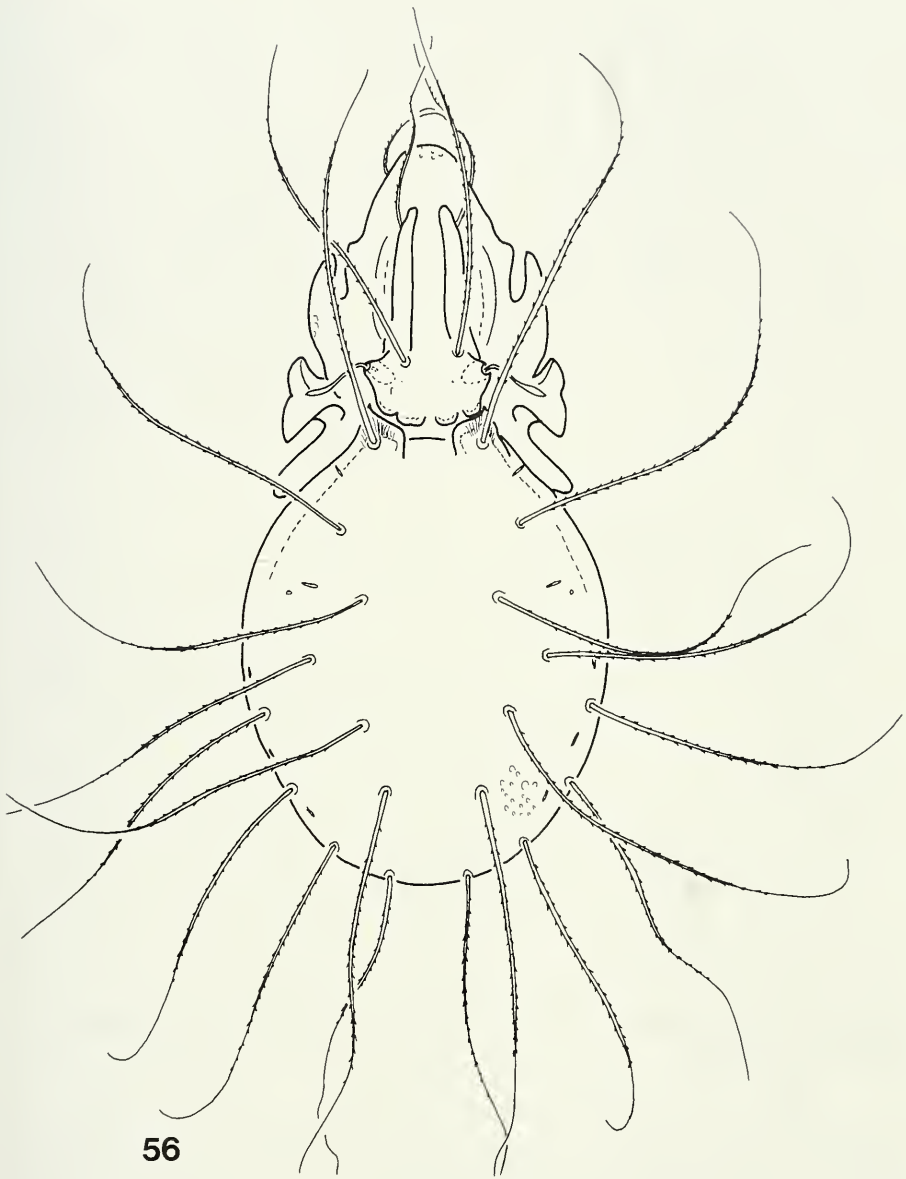
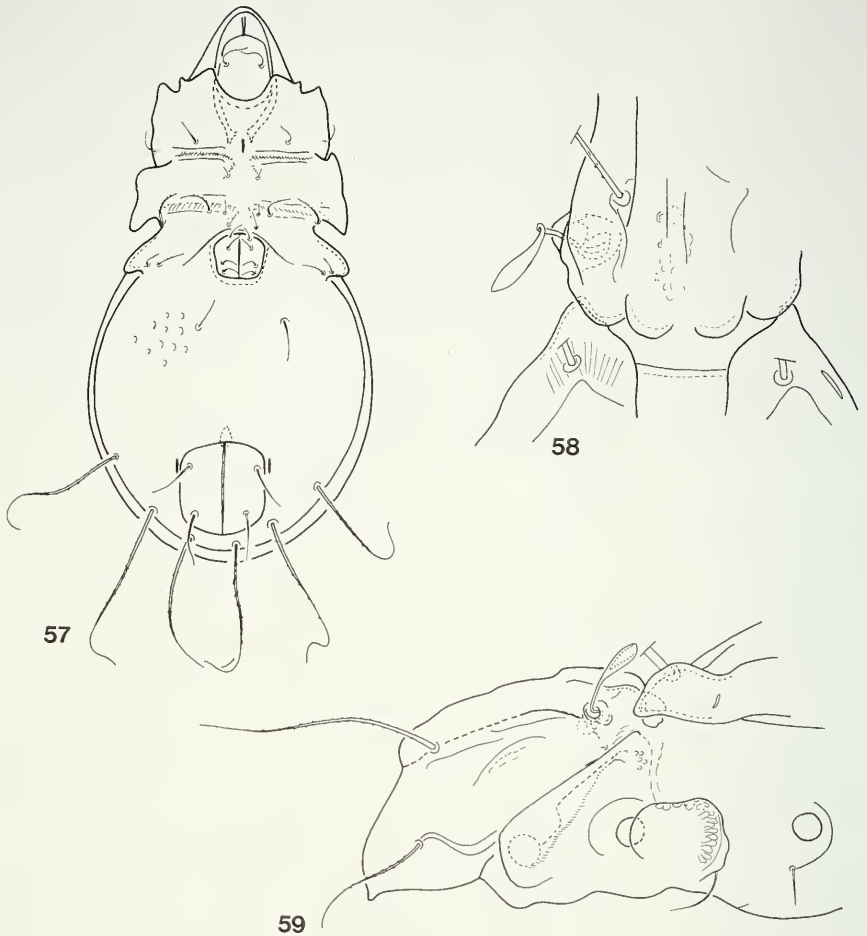


FIG. 56

*Otocephalus berndhauseri* sp. n. — 56: body in dorsal aspect.



FIGS 57-59

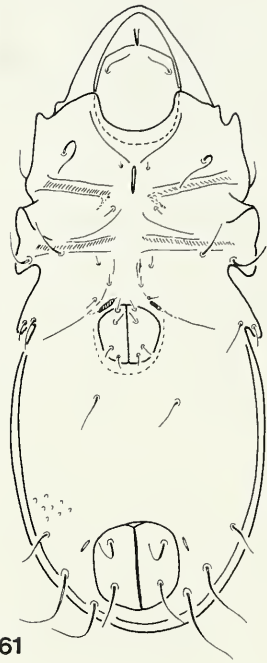
*Otocephalus berndhauseri* sp. n. – 57: body in ventral aspect, 58: dorsosejugal region, 59: podosoma in lateral aspect.

*Prodorsum*: Rostrum weakly foveolate, interlamellar region with some longitudinal crests. Lamellae very long, coming close to the rostrum, bent outwards medially, inwards distally (Fig. 60). Both pairs of prodorsal condyles well developed, both rounded (Fig. 62). Rostral and lamellar setae long, simply setiform, pilose, interlamellar ones ensiform, finely spiculate. Exobothridial setae short, fine, straight. Sensillus with a small lanceolate head, without any spiculae or cilia.

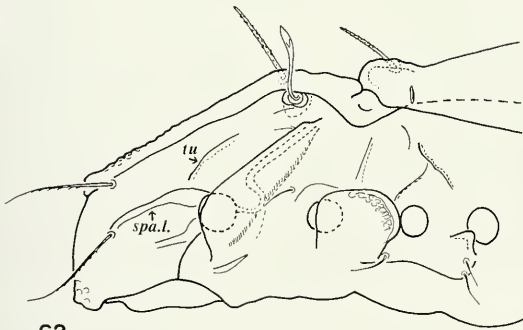
*Notogaster*: Its surface well foveolate, the foveolae are arched, small and partly connected laterally. Ten pairs of notogastral setae present, six pairs ensiform, like the interlamellar ones, 4 pairs in posteromarginal position setiform, but mostly



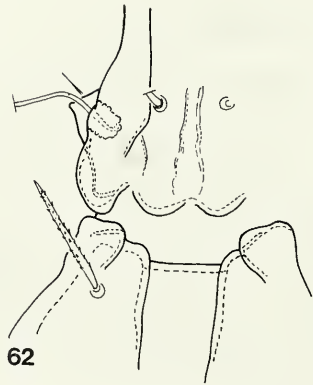
60



61



63



62

FIGS 60-63

*Otocepheus kadazan* sp. n. – 60: body in dorsal aspect, 61: body in ventral aspect. 62: dorso-sejugal region, 63: podosoma in lateral aspect.

straight, only their distal end curved. Anterior setae arising nearly in one longitudinal row. Setae  $h_3$  much shorter than setae  $p_1 - p_2$ ,  $h_3$  inserted much farther from  $p_3$  than the latter one from  $p_2$ .

*Lateral part of podosoma*: All pedotecta and discidium well developed, posterior margin of pedotecta II-III ornamented by foveolae (Fig. 63). Lateral lamelliform expansion double arched between the acetabulum and the insertion of rostral setae.

*Ventral region*: Surface of coxisternal region without any characteristic features, apodemes and epimeral borders also typical for the genus. *Bo.* 4 absent, close to the anterior corner of the genital aperture a short, weakly sclerotized lath observable. Epimeral setal formula: 3 - 1 - 3 - 3. Among these setae *1b*, *3b* and *4b* longer than the others, setae *1c* arising far laterally and posteriorly. Ventral plate foveolate. Genital setae simple and short. No setae in postanal position and setae  $ad_3$  arising far from the anal apertures, laterally (Fig. 61). All adanal setae relatively long, with a filiform distal part. Lyrifissures *iad* in inverse apoanal position.

*Legs*: Type of ultimate setae: L - S - S - S. Tarsus I with triangular teeth, latter absent on the other tarsi.

*Remarks*: The new species may be clearly characterised by the form and position of the notogastral setae and the notogastral condyles. It stands nearest to *O. duplicornutus* (Aoki, 1965). However, its posteromarginally placed notogastral setae are much longer than in *O. duplicornutus*.

*Derivatio nominis*: This species is named after the Kadazan people which lives in the Mt. Kinabalu area.

### *Otocephalus keningau* sp. n.

Figs 64-67

Material examined: Sabah: Holotype: Sab-82/43, 2 paratypes from the same sample. Holotype and 1 paratype: MHNG; 1 paratype (19-PO-94): HNHM.

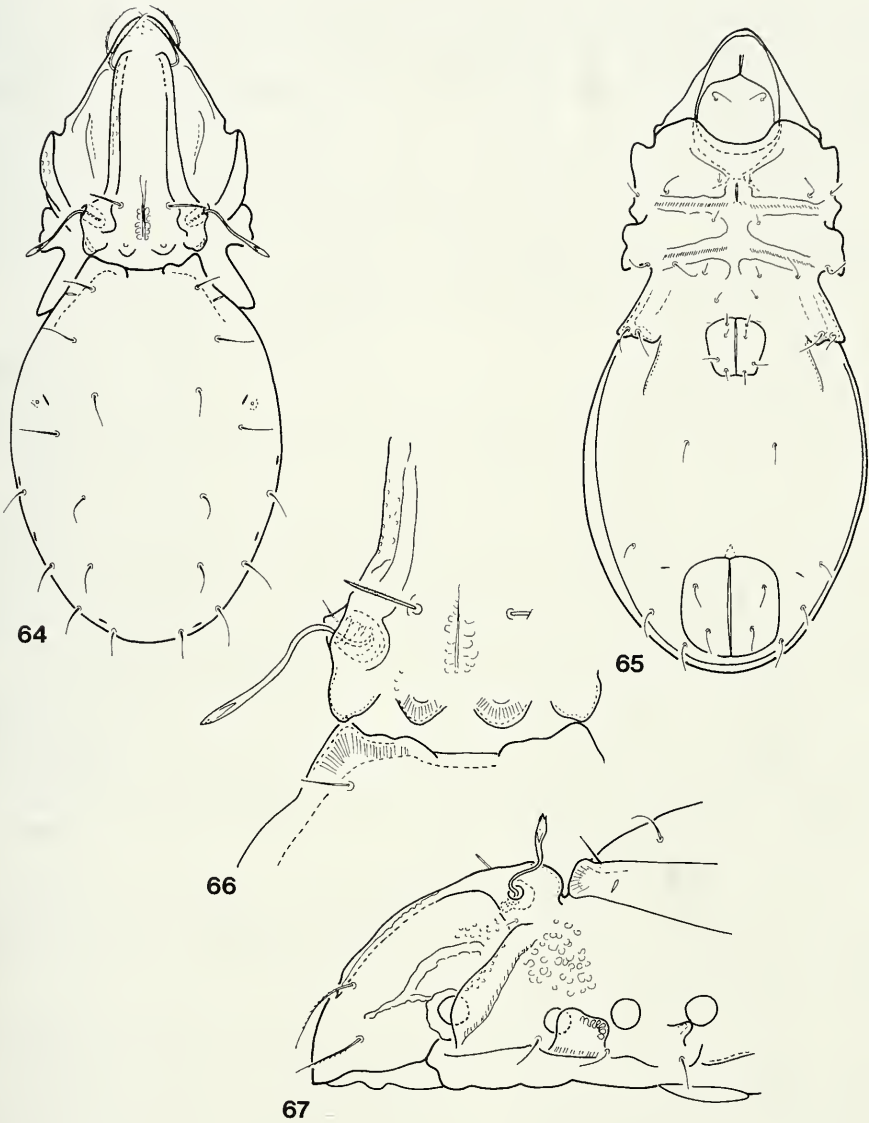
*Measurements*: Length of body: 792-1057  $\mu\text{m}$ ; width of body: 326-487  $\mu\text{m}$ .

*Prodorsum*: Rostrum and surface of lamellae with some foveolae. Tutorium and lateral lamelliform expansion well developed. Two pairs of prodorsal condyles present, lateral pair slightly bigger than the median ones, with some very weak light spots. Median part of the interlamellar region: Fig. 66. Rostral and lamellar setae setiform, strongly ciliate unilaterally, lamellar setae geniculate, the rostrals simply arched. Interlamellar setae ensiform, short; exobothridial setae minute. Sensillus long, its head narrowly lanceolate but thin, bearing some minute spicules on its distal end (Fig. 66).

*Notogaster*: Its surface smooth or finely punctulate. Only one pair of lateral notogastral condyles present, not highly protruding, but with a much extending margin medially. Ten pairs of very short and fine notogastral setae present, they are setiform with flagellate ends. Lyrifissures *ips* located between setae  $p_3$  and  $h_3$ .

*Lateral part of podosoma*: Tutorium and lateral lamelliform expansion connected with each other, a small field near the basal part of the tutorium weakly foveolate. Sejugal region also ornamented by foveolae. Pedotecta I and II-III large, discidium also well developed, with a large corner posteriorly (Fig. 67).





FIGS 64-67

*Otocephalus keningau* sp. n. — 64: body in dorsal aspect, 65: body in ventral aspect, 66: dorsosejugal region, 67: podosoma in lateral aspect.

*Ventral region* (Fig. 65): Coxisternal and ventral plates lacking sculpture. Epimeral border and apodemes conspicuous. Epimeral setal formula: 3 - 1 - 3 - 3. All setae in these two regions short and simple. Setae *1c* placed posteriorly and laterally, *4b* and *4c* arising near to each other. Setae *ad*<sub>3</sub> situated laterally, near to margin of the ventral plate.

*Legs*: Type of ultimate setae: L - S - S - S. Seta *v*" on tibia IV and *pv*" on tarsus IV plumose.

*Remarks*: The new species is characterised by the fine and short notogastral setae and the flat notogastral condyles. On this basis it is readily distinguished from all heretofore described otocephoid species.

*Derivatio nominis*: This species is named after the city of Keningau.

***Otocephus lienhardorum* sp. n.**

Figs 68-71

Material examined: Sabah: Holotype: Sab-82/15, 1 paratype from the same sample; 1 paratype Sab-82/16. Holotype and 1 paratype: MHNG; 1 paratype (1960-PO-94): HNHM.

*Measurements*: Length of body: 847-1004  $\mu\text{m}$ ; width of body: 336-459  $\mu\text{m}$ .

*Prodorsum*: The whole body is conspicuously wide. Rostral apex foveolate, other surfaces smooth or finely punctate. Lamellae long, running clearly parallel to each other. Prodorsal condyles nearly equal in size, both pairs well rounded (Fig. 70). Rostral setae setiform, with fine distal ends, lamellar ones also setiform, but their distal end blunter (Fig. 68), all distinctly ciliate. Interlamellar setae ensiform, straight, exobothridial setae minute. Sensillus simple, with a smooth lanceolate head.

*Notogaster*: Lateral margin smooth, its inner surface distinctly pustulate (Fig. 68). The shape and the density of pustules varying. A pair of very large notogastral condyles present, their anterolateral corner conspicuously long. Ten pairs of notogastral setae present all, excepting the 4 pairs in posteromarginal position, of nearly equal length and size, all ensiform and finely roughened or spiculate. Setae *p*<sub>1</sub> - *p*<sub>3</sub> and *h*<sub>3</sub> long, simple, filiform.

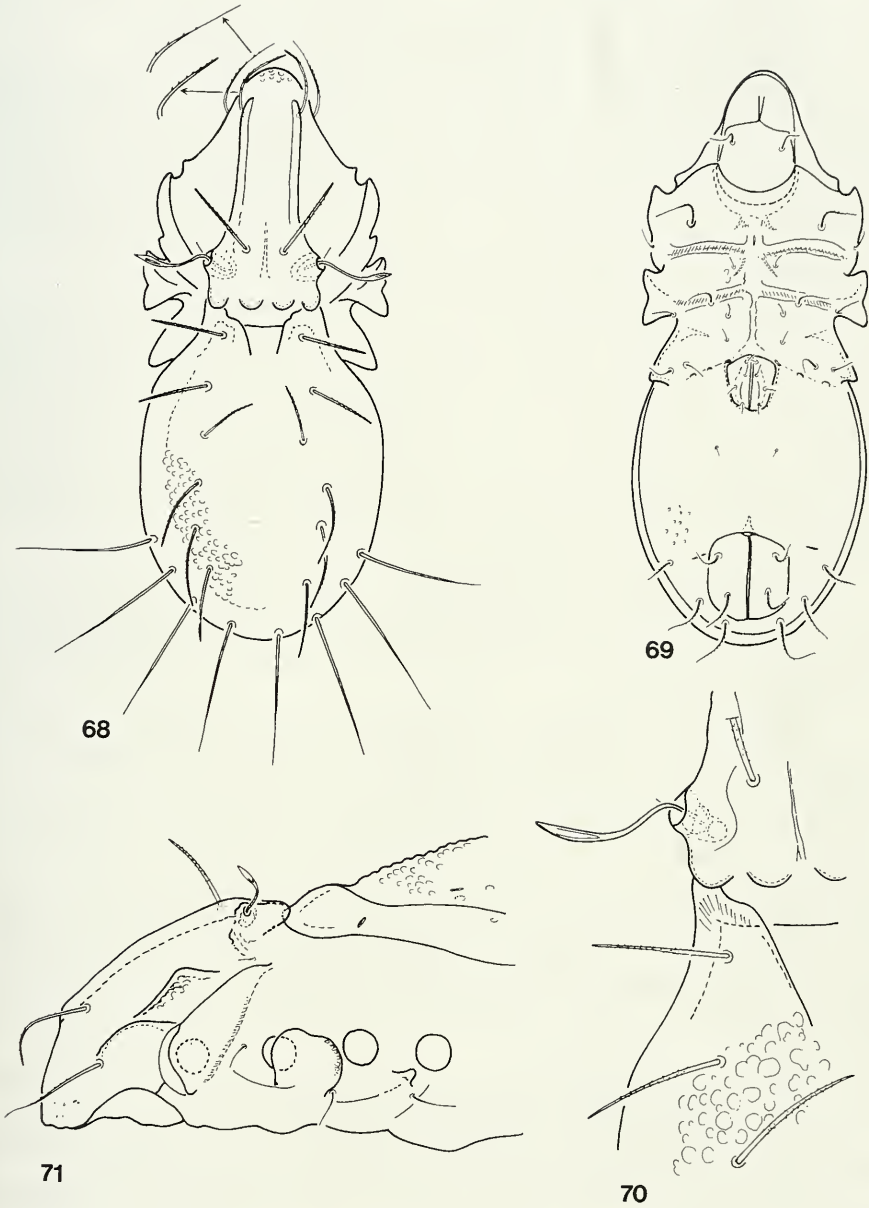
*Lateral part of podosoma*: Lateral lamelliform expansion arched, turtorium long, reaching close to the preceding one (Fig. 71). All pedotecta and the discidium well developed, the fishtail-shaped pedotecta II-III ornamented by some foveolae on their posterior margin.

*Ventral region*: Surface of epimeres without any particular sculpture. Epimeral setae normally developed but seta *1a* minute or absent, setae *1b* and *2b* longer than the rest. At the anterior corner of the genital plates a minute, well sclerotized structure observable. Ventral plate foveolate. Setae in the anogenital region short, setae *ad*<sub>3</sub> arising laterally, slightly farther from *ad*<sub>2</sub> than the latter from *ad*<sub>1</sub>. Lyrifissure *iad* in inverse apoanal position (Fig. 69).

*Legs*: Type of ultimate setae: L - S - S - S. Two small teeth visible on tarsus I, they are absent from the other legs.

*Remarks*: The new species is well characterised by its notogastral surface, thus easily distinguishable from all related taxa.

*Derivatio nominis*: I dedicate the new species to my friends, Dr. C. Lienhard's family (Geneva).



FIGS 68-71

*Otocepeus lienhardorum* sp. n. – 68: body in dorsal aspect, 69: body in ventral aspect, 70: dorsosejugal region, 71: podosoma in lateral aspect.

*Otocephus nepenthes* sp. n.

Figs 72-75

*Material examined:* Sabah: Holotype: Sab-82/34. Holotype: MHNG.

*Measurements:* Length of body: 959  $\mu\text{m}$ ; width of body: 383  $\mu\text{m}$ .

*Prodorsum:* Rostrum slightly convex medially. Surface foveolate and/or alveolate. Lamellar surface also foveolate, interlamellar region strongly foveolate basally, with a broad border around the foveolae. Lamellae long and wide. Two pairs of prodorsal condyles present, lateral ones well rounded and fitting into the opposite notogastral condyles. Median prodorsal condyles much smaller, slightly triangulate. Rostral and lamellar setae setiform, strongly pilose, interlamellar ones ensiform, exobothridial ones comparatively long. Sensillus lanceolate (Fig. 72).

*Notogaster:* The whole body surface covered by a thick cerotegument layer of larger or smaller granules or tubercles, giving the surface a pustulate appearance. This ornamentation is absent from the sejugal region, including a narrow band behind the notogastral condyles. One pair of very large notogastral condyles present, with an unusually excavated anterolateral part accepting the lateral prodorsal condyles (Fig. 74). Their median part well separated and projecting forwards, giving the impression of two condyles. Ten pairs of notogastral setae present,  $c_2$  and  $la$  fusiform, the others setiform with a slightly dilated basal part. Their length gradually increasing posteriorly (Fig. 72),  $h_1$  and  $p_1$  being the longest setae of all.

*Lateral part of podosoma:* Pedotecta I normal, pedotecta II-III smaller than usual, the fishtail-shaped formation hardly discernible (Fig. 75). Discidium with a very large posterior corner bearing two epimeral setae ( $4b$ ,  $4c$ ). Epimeral foramen conspicuous, well bordered.

*Ventral region:* Mentum and the epimeral surface alveolate-reticulate. The cerotegument layer thick, but not so typically granulate as the notogaster or the ventral plate. Epimeral setae comparatively long, setae  $2a$  long and arising far from each other. Setae  $4b$  and  $4c$  placed very close to each other, both arising on the posterior margin of the discidium. Posteromarginal ridges (postpodosomal ornamentation *opp* in Aoki, 1965) continuing in longitudinal crests on the ventral plate (Fig. 73) and a small node (the genital fissure *iag* in Aoki 1965) conspicuous. Genital plates with a well sclerotised longitudinal ridge. Surface of anal plates also with cerotegumental tubercles. All setae in the anogenital region simply setiform. Setae  $ad_3$  placed far laterally. Lyrifissures *iad* in adanal position, near to the anal aperture.

*Legs:* Type of ultimate setae: L - S - S - S. Seta  $l''$  of genua I-II very strong, long, spiniform. Seta  $v''$  on tibia IV and  $pv''$  on tarsus IV plumose.

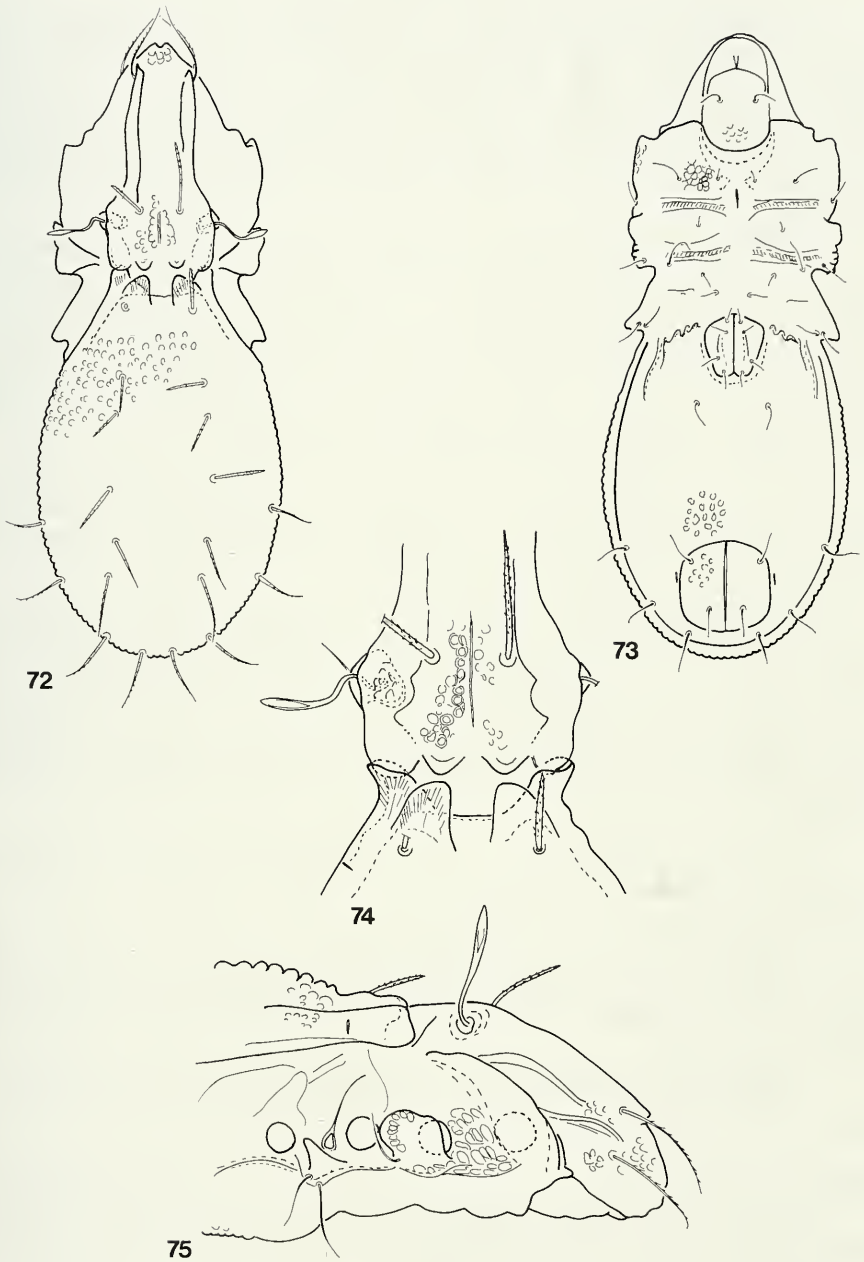
*Remarks:* On the basis of its unique ornamentation the new species is readily distinguishable from all the heretofore described otocephoid taxa.

*Derivatio nominis:* Reference to the pitcher plants, which have many endemic species on Mt. Kinabalu.

*Otocephus orangutan* sp. n.

Figs 76-79

*Material examined:* Sabah: Holotype: Sab-82/27, 7 paratypes from the same sample. Holotype and 4 paratypes: MHNG; 2 paratypes (1962-PO-94): HNHM.



FIGS 72-75

*Otocephalus nephenthes* sp. n. – 72: body in dorsal aspect, 73: body in ventral aspect, 74: dorsosejugal region, 75: podosoma in lateral aspect.

*Measurements:* Length of body: 708-861  $\mu\text{m}$ ; width of body: 250-390  $\mu\text{m}$ .

*Prodorsum:* Rostral apex wide, its surface foveolate. Lamellae wide and long, running parallel to each other, their surface irregularly foveolate. Interlamellar region with some crests. Two pairs of well developed, slightly angular prodorsal condyles of nearly equal size present (Fig. 78). Rostral and lamellar setae fine, setiform, unilaterally pilose. Interlamellar ones ensiform, slightly roughened. Exobothridial setae very short. Head of sensillus wide, with a stout distal end, surface distally bearing some spicules.

*Notogaster:* One pair of large notogastral condyles with an excavate anterior margin. Notogastral surface strongly foveolate. Among notogastral setae great differences exist in length and size. Setae  $c_2$  ensiform, setae  $la$  and  $lm$  reduced, only short, arched, bacilliform setae observable (Fig. 76). Setae  $p_3$  and  $h_3$  also very short, but fine and setiform. The remaining setae longer than the preceding ones, all straight and ensiform. The surface of the ensiform setae roughened or ornamented with minute spicules. Lyrifissure *ips* located between setae  $p_3$  and  $r_3$ .

*Lateral part of podosoma:* Pedotecta I normal, pedotecta II-III typically fish-tail-shaped, the margin of the latter strongly foveolate. Lateral lamelliform expansion mostly straight, directed toward the insertion of rostral setae and touching them (Fig. 79).

*Ventral region:* Epimeral surface lacking conspicuous sculpture, apodemes and epimeral borders conspicuous. Ventral plate foveolate, but only laterally. Epimeral setal formula: 3 - 1 - 3 - 3. Among the epimeral setae great differences exist, three pairs ( $1b$ ,  $3b$ ,  $4b$ ) much longer than the others, all filiform. Setae  $1c$ ,  $3c$  and  $4c$  conspicuously short,  $1a$  and  $2a$  minute or very short. Genital, aggenital and adanal setae fine, short and setiform. Anal setae different in length and size:  $an_1$  long but fine, clearly blunt at tip,  $an_2$  resembling adanal setae (Fig 77). Lyrifissures *iad* in adanal position.

*Legs:* Type of ultimate setae: L - S - S - S. Triangular projection on tarsi I and II present, on tarsi III and IV absent. Seta  $v''$  on tibia IV and  $pv''$  on tarsus IV broadened, the latter twice as large as the former.

*Remarks:* On the basis of the fine and short notogastral and the adanal setae, the new species is related to *Otocephus heterosetiger* Aoki, 1965. However, the new species is distinguished from it by lacking median prodorsal condyles and the reduced  $la$  and  $lm$  setae.

*Derivatio nominis:* The species is named after the orang-utan, the most characteristic mammal of Borneo.

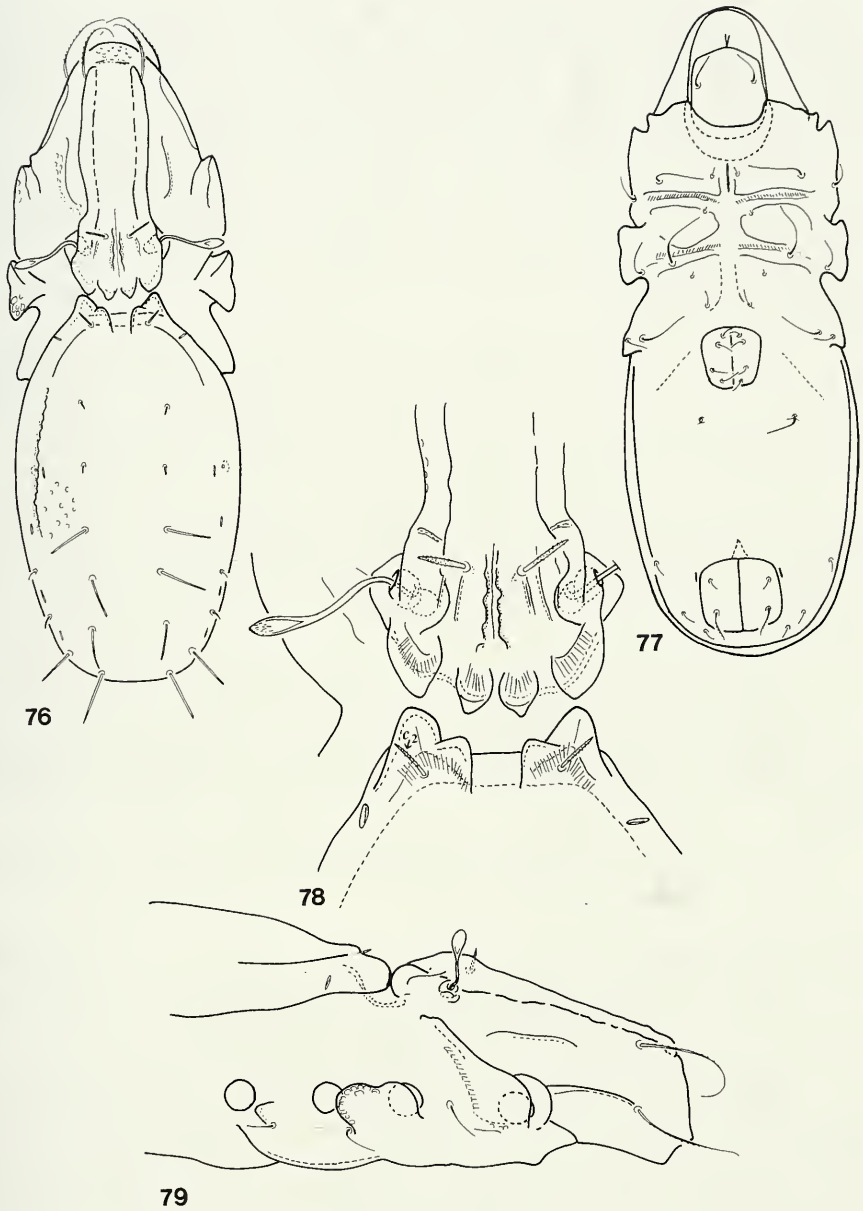
*Otocephus rafflesiae* sp. n.

Figs 80-83

*Material examined:* Sabah: Holotype: Sab-82/27, 1 paratype from the same sample. Holotype: MHNG; paratype (1965-PO-94): HNHM.

*Measurements:* Length of body: 1292-1515  $\mu\text{m}$ ; width of body: 542-640  $\mu\text{m}$ .

*Prodorsum:* Rostral apex and lateral part of prodorsum well foveolate. Lamellae long and wide, running mostly parallel, their surfaces also foveolate.



FIGS 76-79

*Otocephalus orangutan* sp. n. – 76: body in dorsal aspect, 77: body in ventral aspect, 78: dorsosejugal region, 79: podosoma in lateral aspect.

Tutorium conspicuous in dorsal aspect, long, reaching to the lateral lamelliform expansion. Two pairs of prodorsal condyles present, outer pairs (*co.pl.*) angulate, median ones very small (Fig. 82). Rostral and lamellar setae setiform, with strongly ciliate filiform distal ends. Interlamellar setae ensiform, sparsely pilose, exobothridial setae minute. Sensillus very small, its head rounded, well barbed (Fig. 80).

*Notogaster*: Form of notogaster characteristic; the anterior third being its widest part. Surface ornamented by indistinct foveolae. Marginal ridges well developed. Notogaster with only one pair of large condyles, situated laterally and removed far from each other. This distance is longer than their diameter. Ten pairs of ensiform notogastral setae present, all finely spiculate. Lyrifissures *ips* located between setae  $p_3$  and  $h_3$ .

*Lateral part of podosoma*: Pedotecta I long and narrow, pedotecta II-III very large, with foveolae on its posterolateral margin and some pustules anteriorly (Fig. 82). Sejugal region also pustulate. Tutorium long, connected with the arched lateral lamelliform expansion. The latter reaching to the insertions of the rostral setae.

*Ventral region* (Fig. 81): Epimeral surface smooth, apodemes normal. The posterior margin of the epimeral region with a characteristic, catenate structure (*opp*). Epimeral setae comparatively long, well ciliate. Ventral plate rarely foveolate, genital and anal plates smooth. Genital setae strong, not smaller than the aggenital ones, but all setae in the anal region longer than the preceding ones. They are of equal length, excepting setae  $ad_3$ .

*Legs*: Type of ultimate setae: L - S - S - S. Lateral setae ( $l''$ ) of genua I-II long, strong, spiniform. Seta  $v''$  on tibia IV and  $pv''$  on tarsus IV plumose.

*Remarks*: The new species is readily distinguished by the shape of the notogaster, the very small and rounded sensillus and the subequal anal and adanal setae. This combination of characters is unknown among the heretofore described species.

*Derivatio nominis*: This species is named after the largest flower of the world, which occurs in Sabah.

### *Otocephalus reniformis* sp. n.

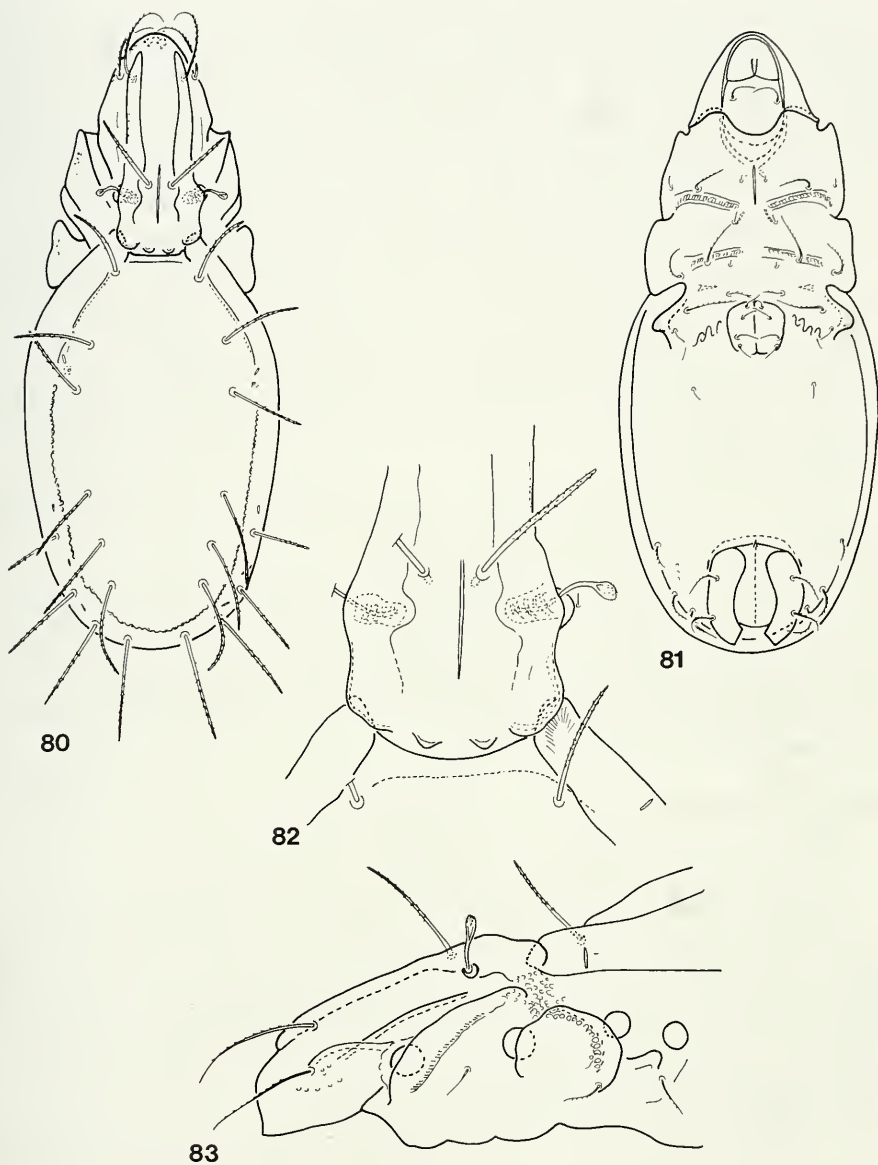
Figs 84-87

*Material examined*: Sabah: Holotype: Sab-82/15, 36 paratypes from the same sample. Holotype and 19 paratypes: MHNG; 12 paratypes (1957-PO-94): HNHM.

*Measurements*: Length of body: 657-862  $\mu\text{m}$ ; width of body: 278-403  $\mu\text{m}$ .

*Prodorsum*: Finely granulated cerotegument covering nearly the whole body surface. Prodorsum rarely foveolate. Rostrum rounded, lamellae slightly convergent anteriorly, overlapping the insertion of the lamellar setae. Interlamellar region with some longitudinal wrinkles. Tutoria long, reaching to the lateral lamelliform expansions (Fig. 87). The latter directed toward the insertion of the rostral setae and touching them. Very large prodorsal condyles present (Fig. 86), lateral ones rounded, larger than the median ones. The latter condyles connected with each other, but this connection is indistinct medially. Lamellar and rostral setae setiform, distinctly pilose, interlamellar setae blunter at tip, sparsely pilose. Sensillus simple, its head lanceolate, smooth.





FIGS 80-83

*Otocephus rafflesiae* sp. n. — 80: body in dorsal aspect, 81: body in ventral aspect, 82: dorsosejugal region, 83: podosoma in lateral aspect.

*Notogaster*: One pair of large notogastral condyles present, opposite to both prodorsal ones. The size of the 10 pairs of notogastral setae characteristic, setae  $c_2$  ensiform and acuminate, setae *da* clearly dilated medially, fusiform. All other setae nearly setiform, conspicuously long, excepting setae  $h_3$  being only half as long as seta  $p_1$  (Fig. 84), primarily on the posterior part of the notogaster. Setae  $r_3$  also much shorter than  $p_1$ . Five pairs of lyrifissures well discernible, in normal position.

*Lateral part of podosoma*: Pedotecta I large, normal, pedotecta II-III fishtail-shaped, also large and ornamented by some spots or wrinkles. Discidium normal.

*Ventral region*: Surface weakly sculptured. Apodemes 2 and *ap. sej.* distinctly developed, *ap. 3*, *ap. 4* absent or hardly discernible. Epimeral borders also only partly visible (Fig. 85). All epimeral setae short, setae *1b* and *3b* longer than the others. Setae *4b* and *4c* arising close to each other. Epimeral setal formula: 3 - 1 - 3 - 3. Anogenital setal formula: 4 - 1 - 2 - 3, typical for the genus. Setae  $ad_3$  only half as long as  $ad_1$ . Anal and adanal setae with filiform distal ends. Lyrifissures *iad* in inverse apoanal position.

*Legs*: Type of ultimate setae: L - S - S - S. Seta *v* on genu II conspicuously long, setiform, on genu III much shorter and spiniform. Setae *v''* on tibia IV and *pv''* on tarsus IV plumose. Legs setal formulae normal.

*Remarks*: The new species is readily classified in the genus *Otocepheus* Aoki, 1965, on the basis of the position of lyrifissures *iad* it is related to *O. duplicornutus* Aoki, 1965. However, the new species is readily distinguished from all its congeners by the fusiform seta *da* and the ratio (very short  $h_3$ ) of the notogastral setae.

*Derivatio nominis*: The species is named after the kidney-shaped condyle of the prodorsum.

### *Otocepheus spatulatus* sp. n.

Figs 88-91

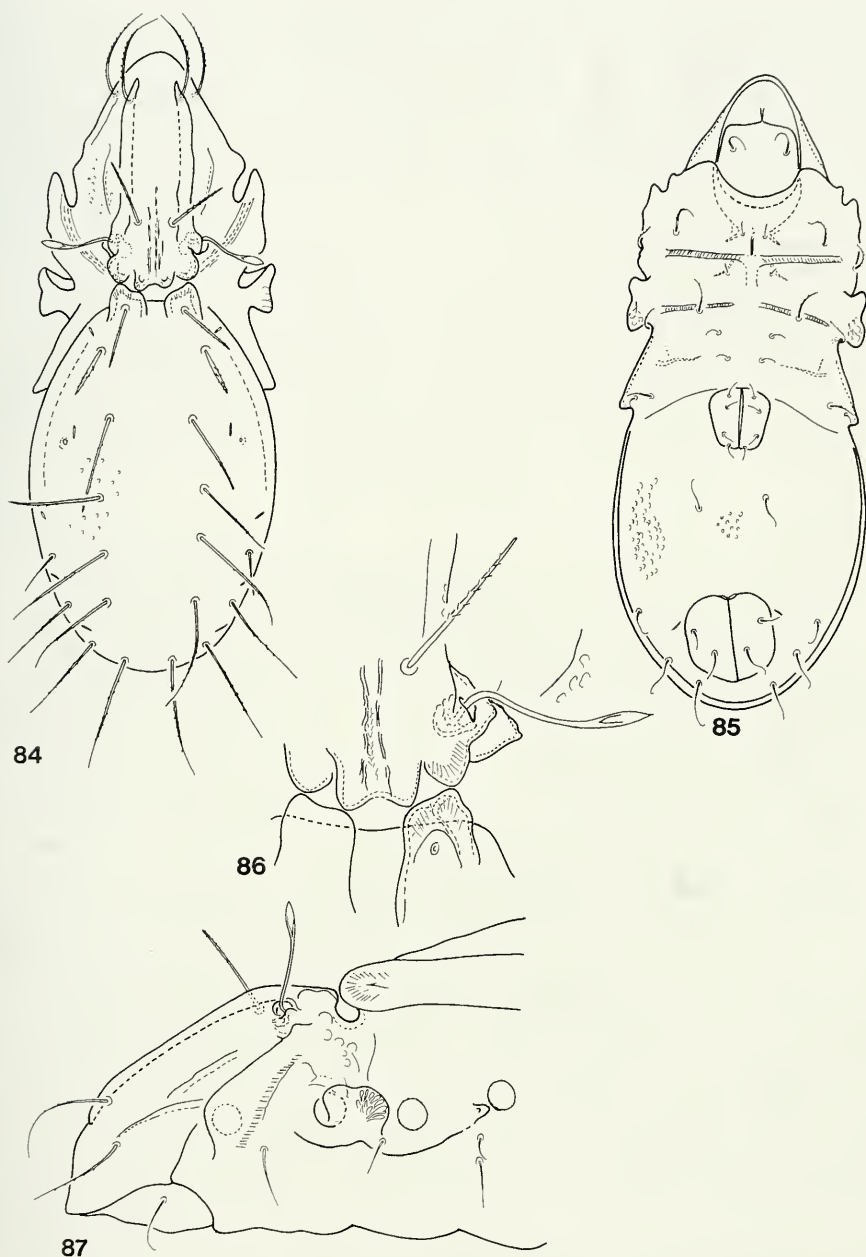
*Material examined*: Sabah: Holotype: Sab-82/50. Holotypus: MHNG.

*Measurements*: Length of body: 1035  $\mu\text{m}$ ; width of body: 340  $\mu\text{m}$ .

*Prodorsum*: Very wide in dorsal view, rostral apex, lateral part of prodorsum and surface of the long and wide lamellae with some weak foveolae. Tutorium strong, lateral lamelliform expansion well developed. One pair of rounded prodorsal condyles present, connected by a short transversal line. Rostral and lamellar setae setiform, well ciliate, interlamellar ones very short, but ensiform, exobothridial setae minute or reduced, hardly observable. Sensillus lanceolate, but very short, ending far from the lateral margin of prodorsum (in dorsal aspect).

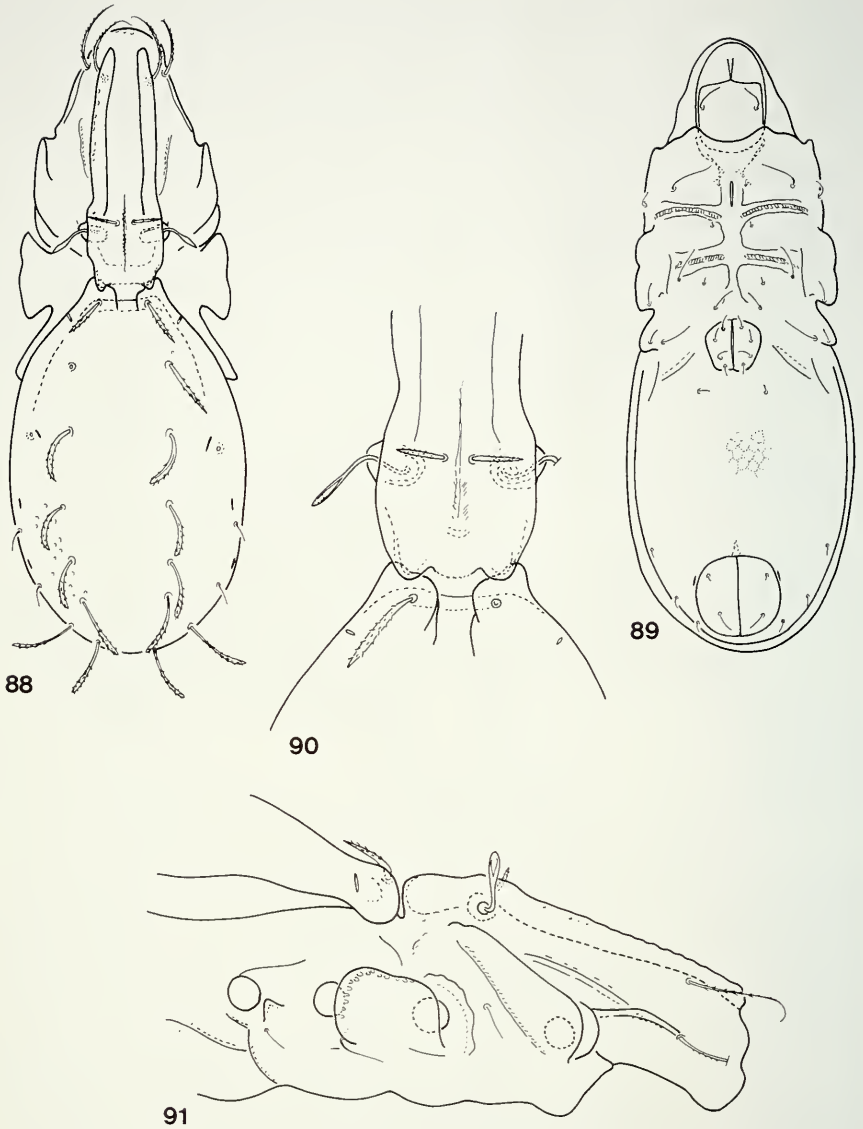
*Notogaster*: One pair of large notogastral condyles laterally, the distance between them smaller than the transversal diameter of one condyle. Surface of notogaster sparsely foveolate marginally. Ten pairs of notogastral setae present, two anterior pairs simple, fusiform, six other median pairs widened distally, slightly spatulate. Two pairs (setae  $p_3$  and  $h_3$ ) short, fine and simply setiform (Fig. 88). Lyrifissures *ips* situated between these two setae.

*Lateral part of podosoma*: Tutorium and the lateral lamelliform expansion arched, fused with each other and clearly extending to the insertion of the rostral setae (Fig. 91).



FIGS 84-87

*Otocepeus reniformis* sp. n. — 84: body in dorsal aspect, 85: body in ventral aspect, 86: dorsosejugal region, 87: podosoma in lateral aspect.



FIGS 88-91

*Otocephalus spatulaus* sp. n. — 88: body in dorsal aspect. 89: body in ventral aspect, 90: dorsosejugal region, 91: podosoma in lateral aspect.

*Ventral region:* Coxisternal region simple and unornamented, ventral plate with very fine polygonal reticulation. Apodemes, primarily *ap.* 2 and *ap. sej.*, characteristically arched (Fig. 89). Epimeral setae simple, setae *1b*, *3b* and *4b* longer than the others. Genital setae normal, aggenital setae very short. All three pairs of adanal setae short, simple and setiform, *ad*<sub>3</sub> arising far anteriorly and laterally, the distance between them and setae *ad*<sub>2</sub> much greater than between setae *ad*<sub>1</sub> and *ad*<sub>2</sub>. Anterior anal setae (*an*<sub>1</sub>) minute, the posterior ones much longer (Fig. 89). Lyrifissure *iad* in adanal position.

*Legs:* Type of ultimate setae: L - S - S - S. Seta *l*" of genua I-II very strong, long spiniform. Seta *v*" on tibia IV and *pv*" on tarsus IV plumose.

*Remarks:* The lack of median condyles of the prodorsum readily places the new species into the genus *Otocephus* sensu Aoki (1965). The peculiar form of the notogastral setae distinguishes the new species not only from the hitherto known species of this genus, but from all the species of the subfamily Otocephinae.

*Derivatio nominis:* The species name refers to the form of the notogastral setae.

### *Otocephus verrucosus* sp. n.

Figs 92-95

*Material examined:* Sabah: Holotype: Sab-82/15. 3 paratypes from the same sample. Holotype and 2 paratypes: MHNG; 1 paratype (1959-PO-94): HNHM.

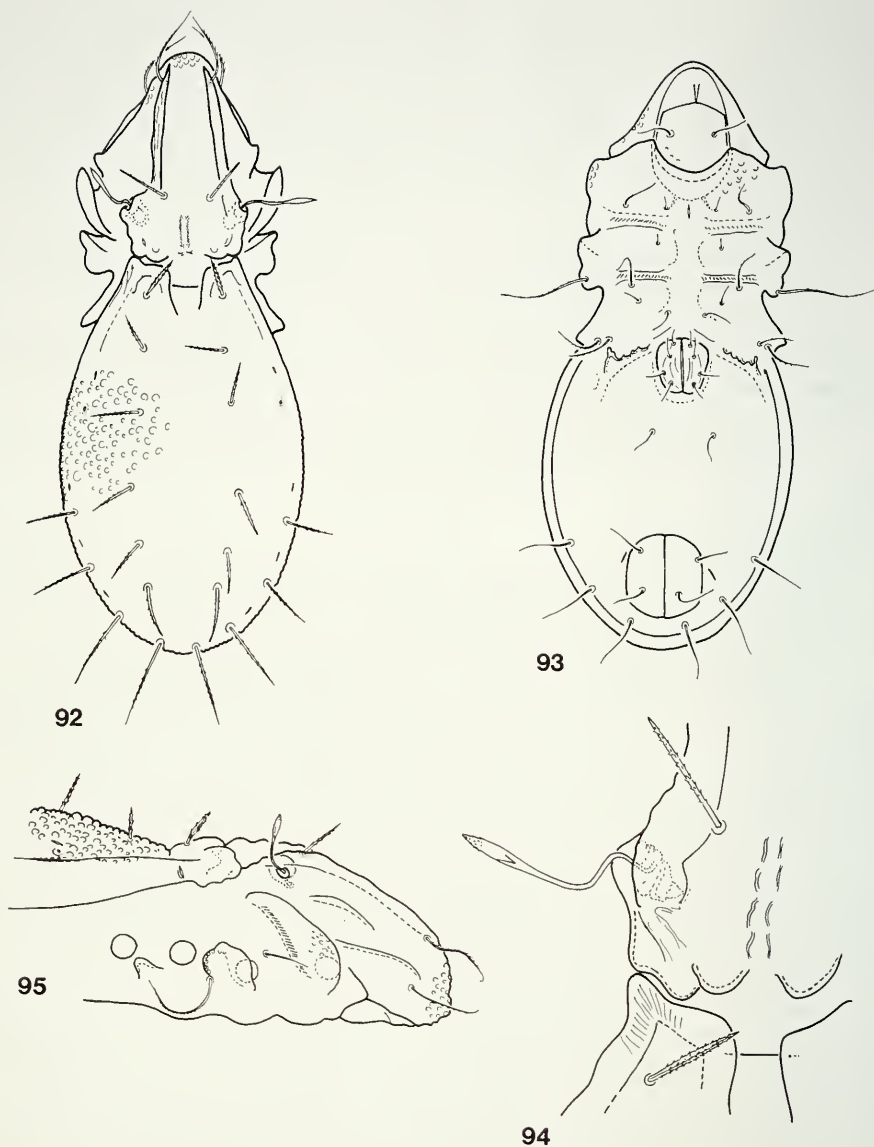
*Measurements:* Length of body: 931-960  $\mu\text{m}$ ; width of body: 375  $\mu\text{m}$ .

*Prodorsum:* Rostrum very wide, well foveolate. Lamellae long, running parallel to each other. Both pairs of prodorsal condyles present, no remarkable difference between them. Lateral condyles angulate, the median ones rounded. Some characteristic, small, longitudinal crests present in interlamellar position (Fig. 92). Tutorium short, directed towards the lateral lamelliform expansion but not touching it; the latter long and reaching beyond the insertion of the rostral setae. Rostral and lamellar setae long, simple, setiform, slightly ciliate. Interlamellar setae bacilliform, longer than the notogastral ones, but shorter than the rostral setae. Exobothridial setae completely reduced (I was unable to find their alveoli). Sensillus simple, its head weakly fusiform, with some minute spicules on its distal end.

*Notogaster:* Lateral notogastral condyles very large, the distance between them much smaller than their transversal diameter (Fig. 94). Ten pairs of comparatively short notogastral setae present, setae *c*<sub>2</sub> slightly fusiform, all the others simple but erect and mostly straight. All setae slightly ciliate. Lyrifissures in normal position.

*Lateral part of podosoma:* Pedotecta I large, distinctly foveolate, as is the surface between the acetabula of legs II and III. Both corners of pedotecta II-III rounded, the posterior part also ornamented (Fig. 95). Posterior part of discidium distinctly protruding.

*Ventral region* (Fig. 93): Epimeral region typical for the genus, its surface weakly foveolate anteriorly and very roughly foveolate posteriorly. Epimeral setal formula: 3 - 1 - 3 - 3, setae *1c* arising very far laterally, observable only in lateral aspect. Setae *1b*, *3b*, *4b* and *4c* long, setae *3c* conspicuously long and unusually



FIGS 92-95

*Otocepheus verrucosus* sp. n. — 92: body in dorsal aspect, 93: body in ventral aspect, 94: dorsosejugal region, 95: podosoma in lateral aspect.

directed laterally. Along border IV a characteristic ornamentation of rugae observable (*opp*). Surface of ventral plate pustulate like the notogastral one, surface of genital plates with 2-3 longitudinal crests. All setae in the anogenital region long, partly filiform, setae  $ad_3$  arising in marginal position very far from the anal aperture. Lyrifissures *iad* located near to the anal openings, but clearly in inverse apoanal position.

*Legs*: Surface of femora without any characteristic sculpture. Setae *l*" of genua II and III spiniform. Type of ultimate setae: L - S - S- S.

*Remarks*: The attribution of the new species to the genus *Otocepheus* is rather problematic, because the shape of pedotecta II-III is atypical and the posterior corner of the fishtail-shaped part of the body absent. However, the habitus, primarily the form of the notogaster, and the absence of the median notogastral condyles indicate the true relationship of this species. It is readily distinguished by the conspicuously long setae *3c*, which are unknown elsewhere in the family.

*Derivatio nominis*: The species name refers to the tubercled sculpture of the notogaster.

#### ACKNOWLEDGEMENTS

I want to thank most cordially Dr. B. Hauser, former Head of the Arthropod Department of the Museum d'histoire naturelle, Geneva, for allowing me to study this valuable material and for his efforts in editing this paper. I am also very grateful to Dr. Malcolm Luxton (National Museum of Wales, Cardiff) for his critical reading of the manuscript and his many useful suggestions.

This research programme was partly sponsored by the Hungarian Scientific Research Fund (OTKA 16 729).

#### REFERENCES

- AOKI, J. 1965. A preliminary revision of the family Otocepheidae (Acari, Cryptostigmata) I. Subfamily Otocepheinae. *Bulletin of the National Science Museum, Tokyo* 8: 259-341.
- AOKI, J. 1967. A preliminary revision of the family Otocepheidae (Acari, Cryptostigmata) II. Subfamily Tetracondylinae. *Bulletin of the National Science Museum, Tokyo* 10: 297-359.
- GRANDJEAN, F. 1964. Oribates mexicains (Ire série) *Dampfiella* Selln. et *Beckiella* n. g. *Acarologia* 6: 694-711.
- HAMMER, M. 1971. On some Oribatids from Viti Levu, the Fiji Islands. *Biologiske Skrifter. Kongelige Danske Videnskabernes Selskab* 16: 1-60.
- HAMMER, M. 1979. Investigations on the Oribatid Fauna of Java. *Biologiske Skrifter. Kongelige Danske Videnskabernes Selskab* 22: 1-79 (1979).
- MAHUNKA, S. 1987a. Neue und interessante Milben aus dem Genfer Museum LV. Oribatids from Sabah (East Malaysia) I (Acari: Oribatida). *Archives des Sciences* 40: 293-305.
- MAHUNKA, S. 1987b. Neue und interessante Milben aus dem Genfer Museum LX. Oribatids from Sabah (East Malaysia) II. (Acari: Oribatida). *Revue Suisse de Zoologie* 94: 765-817.
- MAHUNKA, S. 1988. New and interesting mites from the Geneva Museum LXI. Oribatids from Sabah (East Malaysia) III (Acari: Oribatida). *Revue Suisse de Zoologie* 95: 817-888.

- MAHUNKA, S. 1990. A survey of the superfamily Euphthiracaroida Jacot, 1930 (Acari: Oribatida). *Folia Entomologica Hungarica* 51: 37-80.
- MAHUNKA, S. 1991. New and interesting mites from the Geneva Museum LXXVIII. Oribatids from Sabah (East Malaysia) IV (Acari: Oribatida). *Revue Suisse de Zoologie* 98: 185-206.
- MAHUNKA, S. 1995a. Oribatids from Sabah, East Malaysia (Acari Oribatida, Parakalummoidea n. stat. and Galumnoidea). *Tropical Zoology* 8: 269-308.
- MAHUNKA, S. 1995b. Oribatids from Brunei I (Acari: Oribatida). New and interesting mites from the Geneva Museum LXXV. *Revue Suisse de Zoologie* 102: 913-942.
- MAHUNKA, S. 1996a. Oribatids from Sabah (East Malaysia) VI (Acari: Oribatida). (Acarologica Genavensia LXXXIV). *Archives des Sciences* 49: 99-104.
- MAHUNKA, S. 1996b. Oribatids from Sabah (East Malaysia) VII (Acari: Oribatida). (Acarologica Genavensia LXXXV). *Archives des Sciences* 49: 205-212.
- PÉREZ-ÍÑIGO, C. & BAGGIO, D. 1986. Oribates édaphiques du Brésil (III). Oribates de l'île du "Cardoso" (deuxième partie). *Acarologia* 27: 163-179.
- WALLWORK, J. A. 1962a. Some Oribatei from Ghana VIII. The genus *Tetracondyla* Newell 1956 (1st. series). *Acarologia* 4: 274-291.
- WALLWORK, J. A. 1962b. Some Oribatei from Ghana. IX. The genus *Tetracondyla* Newell 1956 (2nd. series). *Acarologia* 4: 440-456.



## More about the Buthoidea of Madagascar, with special references to the genus *Tityobuthus* Pocock (Scorpiones, Buthidae)

Wilson R. LOURENÇO

Laboratoire de Zoologie (Arthropodes), Muséum National d'Histoire Naturelle,  
61 rue de Buffon, F-75005 Paris, France.

E-mail. arachne@mnhn.fr

**More about the Buthoidea of Madagascar, with special references to the genus *Tityobuthus* Pocock (Scorpiones, Buthidae).** - A revised diagnosis of the genus *Tityobuthus* Pocock is given and three new species, i.e. *T. manonae* sp. n., *T. griswoldi* sp. n. and *T. monodi* sp. n., are described. For two species previously associated with *Tityobuthus*, two new genera are established, i.e. *Troglotityobuthus* gen. n. for *Tityobuthus gracilis* (Fage) (described under *Babycurus gracilis*) and *Palaeogrosplus* gen. n. for *Tityobuthus copalensis* Lourenço. Phylogenetic relationships between Madagascan scorpions and those in Africa, South America and Asia are discussed. Revised keys are given for the genera of Buthoidea present in Madagascar and for the species of the genus *Tityobuthus*.

**Key-words:** Scorpiones - Buthidae - Microcharmidae - taxonomy - Madagascar.

### INTRODUCTION

The genus *Tityobuthus* was established by Pocock (1893) for *Tityobuthus baroni* (Pocock, 1890) previously included in the genus *Rhoptrurus* Karsch, 1886, because this name was already preoccupied by that of a snake genus, *Rhoptrura* Peters, 1858 (Vachon, 1979). Confusion existed about the genera *Tityobuthus* Pocock, *Pseudobuthus* Pocock and *Odonturus* Karsch until they were revised by Vachon (1979), who finally included only two species in the genus *Tityobuthus*, i.e. *Tityobuthus baroni* (Pocock, 1890) and *Tityobuthus gracilis* (Fage, 1946). The latter was originally described in the genus *Babycurus* Karsch, 1886.

In the last few years, and in particular since the scorpion fauna of Madagascar was summarised by Lourenço (1996a), increasing numbers of new species have been described in the genus *Tityobuthus*. These are: *T. guillaumeti* Lourenço, *T. pococki* Lourenço, *T. lucileae* Lourenço, *T. copalensis* Lourenço, *T. petrae* Lourenço, *T. parrilloi* Lourenço, *T. judsoni* Lourenço, *T. dastychi* Lourenço and *T. ivohibe* Lourenço & Goodman. This shows that this genus of micro-scorpions is very rich in species (Lourenço, 1995, 1996a,b,c, 1997a; Lourenço & Goodman, 1999). The same phenomenon has already been observed in other micro-scorpion genera including

*Ananteris* Thorell. The number of species known in that genus increased from 3 to 23 within twenty years (Lourenço, 1993, 1994, 1997b, 1999a, b; Lourenço & Monod, 1999). The recent discovery of three additional new species of the genus *Tityobuthus* pointed out the necessity for a revision of this genus. A reanalysis of characters showed that two species previously associated with *Tityobuthus*, i.e. *T. gracilis* (Fage) and *T. copalensis* Lourenço, deserve a separate taxonomic position.

Revised keys to the genera of Buthoidea present in Madagascar, and to the known species of the genus *Tityobuthus* are also provided in the following. Possible phylogenetic links and associations between Madagascan lineages and those present in Africa, South America and Asia are pointed out.

## TAXONOMY OF *TITYOBUTHUS*

### *Tityobuthus* Pocock, 1893

*Type species: Rhoptrurus baroni* Pocock, 1890; described from Madagascar.

*Revised diagnosis:* Scorpions of small size, 20-25 mm in total length. Carapace with a moderate to strong concavity; median ocular tubercule markedly anterior to the center of the carapace; three pairs of lateral eyes. Chelicerae with dentition according to the buthid pattern (Vachon, 1963). Pedipalps slender and moderately long; movable fingers with 7 or 8 slightly oblique, almost straight rows of granules. Tibial spurs present in some species, reduced in others and absent in a few. Sternum sub-triangular. Pectines with 11-25 teeth; fulcra present or absent according to species; basal middle lamellae of female never dilated. Sternites with very short linear stigmata. Telson with a very slender vesicle; aculeus long and moderately curved, with a spinoid subaculear tooth of variable size. Trichobothrial pattern of type A- $\alpha$  - orthobothriotaxic.

*Remarks:* The presence or absence of tibial spurs is a particularity of this genus since this character has always been considered to be invariable within a given genus. The fact that in *Tityobuthus* species certain characters are present in different states had already lead Vachon (pers. comm.) to consider a division of the genus into two or more genera. I have, however, some hesitations about taking this step. *Tityobuthus*, like other buthid genera, may belong to archaic lineages in which some characters are not precisely differentiated (Lourenço, 1995, 1996a).

*Distribution:* Madagascar.

## DESCRIPTION OF THREE NEW SPECIES

### *Tityobuthus manonae* sp. n.

Figs 12-16

*Type:* MADAGASCAR, Mandena, Fort Dauphin (littoral forest 10 km north of Fort Dauphin), holotype male, 6-12/1/1999 (J.-B. Ramanamanjato leg.)<sup>1</sup>; deposited in the Muséum d'histoire naturelle, Genève (MHNG).

*Etymology:* Patronym in honor of Dr Manon Vincelette of QIT Minerals-Madagascar, Montreal, Canada.

<sup>1</sup> Collected with 11 specimens of *Grosphus hirtus* Kraepelin, also deposited in MHNG.

*Description* (based on male holotype): Measurements in Table I.

*Coloration.* Ground colour yellowish, symmetrically marbled with a dark reddish brown, giving an overall spotted appearance. Prosoma: carapace yellowish, moderately spotted; eyes surrounded by black pigment. Mesosoma: yellowish, with four longitudinal brown stripes, i.e. two central and two lateral ones. Metasoma: segments I to IV yellowish; V yellowish to reddish yellow. Vesicle as segment V. Venter yellowish, with a number of spots on sternites VI and VII. Chelicerae yellowish, with dark spots on the lateral edges; fingers reddish. Pedipalps: yellowish, with several dark spots on femur and tibia; chela less densely spotted; hands yellowish; fingers much darker, reddish-brown, with the extremities yellowish. Legs yellowish, with diffuse fuscous spots.

TABLE I  
Measurements (in mm) of male holotypes of the described species

	<i>T. manonae</i>	<i>T. griswoldi</i>	<i>T. monodi</i>
Carapace:			
- length	2.6	2.6	1.9
- anterior width	1.8	2.1	1.5
- posterior width	2.7	2.8	2.0
Metasomal segment I:			
- length	1.6	1.5	1.1
- width	1.7	1.5	1.2
Metasomal segment V:			
- length	3.3	3.4	2.5
- width	1.3	1.4	1.0
- depth	1.2	1.3	0.9
Vesicle:			
- width	0.8	1.0	0.7
- depth	0.9	1.1	0.7
Pedipalp:			
- Femur length	2.2	2.6	1.8
- Femur width	0.7	0.7	0.5
- Tibia length	2.9	3.2	2.6
- Tibia width	1.2	1.3	0.8
- Chela length	4.1	5.0	3.4
- Chela width	0.9	1.2	0.6
- Chela depth	0.8	1.0	0.6
Movable finger length	2.7	3.3	2.4

*Morphology.* Carapace moderately to weakly granular; anterior margin with a weakly to moderately pronounced median concavity. Anterior median superciliary, posterior median keels and all furrows moderate to feeble. Median ocular tubercle distinctly anterior to the center of the carapace; median eyes separated by one ocular diameter. Three pairs of lateral eyes. Sternum subtriangular. Mesosoma: tergites moderately granular. Median keel moderate to strong on all tergites; confluent vesti-

gial keels present. Tergite VII pentacarinat. Venter: genital operculum longitudinally divided. Pectines: pectinal tooth count 19/20; basal middle lamellae not dilated; fulcra present. Sternites smooth or with very weak granulations and small, elongate stigmata; VII with two keels. Sternite V with a large smooth, bright zone on posterior edge. Metasoma: segments I to III with 10 keels, crenulate. Segment IV with 8 keels, crenulate. Intercarinal spaces weakly to moderately granular. Segment V smooth and rounded. Telson smooth, without punctuations, with a long but moderately curved aculeus; subaculear tooth very small and slightly rhomboid. Cheliceral dentition characteristic of the family Buthidae (see Vachon, 1963); basal teeth of movable fingers reduced and almost fused; ventral surfaces of finger and manus almost without setae. Pedipalps: femur pentacarinat; tibia and chelae with some keels, moderately crenulate; internal face of tibia with six spinoid granules; all faces moderately granular; movable fingers with 8/9 oblique rows of granules. Trichobothriotaxy; orthobothriotaxy A- $\alpha$  (cf. Vachon, 1973, 1975). Legs: tarsus with numerous fine median setae ventrally. Pedal and tibial spurs present but reduced.

*Relationships:* From general morphology *T. manonae* sp. n. appears to be most closed related to *T. petrae* Lourenço, 1996. The two can be readily distinguished by the following features: (i) the new species is much larger (see Table I, Lourenço, 1996a), (ii) the presence of a single conspicuous white smooth and bright central zone on sternite V of the new species, whereas in *T. petrae* this zone is reduced and there are two small rounded white patches laterally.

***Tityobuthus griswoldi* sp. n.**

Figs 17-21

*Types:* MADAGASCAR, Prov. Fianarantsoa, P.N. Ranomafana, Talatakely (21°15,3' S - 47°25,9' E), holotype male 9-26-IV-1998 (pitfall traps; C.E. Griswold, D.H. Kavanaugh, N.D. Penny & M.J. Raheirilalao leg.); deposited in the California Academy of Sciences, San Francisco (CAS). Paratypes: Same data as for the holotype. 1 male, 19-30/IV/1998, deposited in MHNG; 1 juvenile; 3 juveniles, 19-30/IV/1998 (21°14,9 S - 47°25,6 E), deposited at the CAS.

*Etymology:* Patronym in honor of Dr Charles E. Griswold of the California Academy of Sciences.

*Description* (based on male holotype): Measurement in Table I.

*Coloration.* Colour yellow, symmetrically marbled with dark brown, giving an overall spotted appearance. Prosoma: carapace yellowish, densely spotted; eyes surrounded by black pigment. Mesosoma: yellowish with three longitudinal brown stripes, the median one indistinctly divided. Metasoma: segments I to V yellowish; vesicle as is segment V. Venter yellowish, with a number of dark spots on all sternites. Sternite V with a large bright white zone in the posterior region and with two small rounded white bright zones laterally. Chelicerae yellow, with dark spots in median zone; fingers reddish. Pedipalps yellowish, with several dark spots on femur and tibia; chela less densely spotted; hands yellowish, fingers much darker, reddish-brown. Legs yellowish, with diffuse fuscous spots.

*Morphology.* Carapace moderately to weakly granular; anterior margin with moderate median concavity. Anterior median superciliary, posterior median keels and

all furrows moderate to weak. Median ocular tubercle distinctly anterior to center of carapace; median eyes separated by one ocular diameter. Three pairs of lateral eyes. Sternum subtriangular to pentagonal. Mesosoma: tergites weakly granular. Median keel moderate in all tergites. Tergite VII pentacarinat. Venter: genital operculum longitudinally divided. Pectines: pectinal tooth count 14/14; basal middle lamellae not dilated; fulcra present. Sternites weakly granular with small and moderately elongate stigmata; VII without keels. Sternite V with smooth, bright white zone in posterior region and two similar small rounded zones laterally. Metasoma: segments I and II with 10 keels, crenulate. Segments III and IV with 8 keels, crenulate. Intercarinal spaces weakly to moderately granular. Segment V smooth and rounded. Telson smooth without punctuations, with fairly short, moderately curved aculeus; subaculear tooth strong, slightly spinoid. Cheliceral dentition characteristic of the family Buthidae (cf. Vachon, 1963); basal teeth of movable fingers small; ventral surface of finger and manus with setae. Pedipalps: femur pentacarinat; tibia and chela with some keels but moderately crenulate; internal face of tibia with four spinoid granules; all faces feebly granular; movable fingers with 8/9 oblique rows of granules. Trichobothriotaxy; orthobothriotaxy A- $\alpha$  (cf. Vachon, 1973, 1975). Legs: tarsus with numerous fine median setae ventrally. Pedal and tibial spurs present but reduced.

*Variation:* the pectinal tooth count in the paratypes is: 13-13, 14-13, 12-14, 14-14 (x2).

*Relationships:* From general morphology *T. griswoldi* sp. n. appears to be most closely related to *T. dastychi* Lourenço. The two species can, however, be readily distinguished by the following features: (i) a different shape of the pectines and a different number of teeth, 12 to 14 in the new species and 18 in *T. dastychi*. (ii) the presence of a single conspicuous smooth bright white zone on sternite V of *T. dastychi*, while in the new species this central zone is reduced and associated with two small rounded smooth bright white zones laterally.

*Tityobuthus monodi* sp. n.

Figs 22-26

*Type:* MADAGASCAR, Prov. Toamasina, F.C. Andriantantely (18°41,7' S - 48°48,8' E), 530 m, holotype male, 7-10-XII-1998 (H. J. Ratsirarson leg.); deposited in MHNG.

*Etymology:* Patronym in honor of M. Lionel Monod of the Muséum d'histoire naturelle de Genève.

*Description* (based on male holotype): Measurement in Table I.

*Coloration.* Ground colour yellow, symmetrically marbled with dark brown, giving an overall spotted appearance. Prosoma: carapace yellowish, densely spotted; eyes surrounded by black pigment. Mesosoma: yellowish, with three longitudinal brown stripes more or less inter-linked by confluent stripes. Metasoma: segments I to V yellowish; vesicle yellowish but lighter than segment V. Venter yellowish, with all sternites densely spotted. Sternite V with only a vestigial bright white zone in posterior region. Chelicerae yellowish, densely spotted in central zone; fingers reddish. Pedipalps yellowish, with several dark spots on femur and tibia; chela less densely spotted; hands light yellow; fingers much darker, reddish, with the extremity more yellow. Legs yellowish, with diffuse fuscous spots.

Morphology. Carapace moderately to weakly granular; anterior margin with weak to moderate median concavity. Anterior median superciliary, posterior median keels and all furrows moderate to weak. Median ocular tubercle distinctly anterior to center of carapace; median eyes separated by more than one ocular diameter. Three pairs of lateral eyes. Sternum subtriangular to pentagonal. Mesosoma: tergites weakly granular. Median keel very weak in all tergites. Tergite VII pentacarinat. Venter: genital operculum longitudinally divided. Pectines: pectinal tooth count 16/16; basal middle lamellae not dilated; fulcra very reduced, almost vestigial. Sternites smooth, with small elongate stigmata; VII without keels. Metasoma: segments I and II with 10 keels, crenulate. Segments III and IV with 8 keels crenulate. Intercarinal spaces weakly granular. Segment V smooth and rounded. Telson smooth, without punctuations, with moderately long, curved aculeus; subaculear tooth strong and spinoid. Cheliceral dentition characteristic of the family Buthidae (cf. Vachon, 1963); basal teeth on movable fingers small; ventral surface of finger and manus with some setae. Pedipalps: femur pentacarinat; tibia and chela with some keels but moderately crenulate; internal face of tibia with four/five granules but not spinoid; all faces weakly granular, almost smooth. Movable fingers with 8/9 oblique rows of granules. Trichobothriotaxy; orthobothriotaxy A- $\alpha$  (cf. Vachon, 1973, 1975). Legs: tarsus with numerous fine median setae ventrally. Pedal and tibial spurs present but very reduced.

*Relationships:* *Tityobuthus monodi* appears to be most closed related to *T. guillaumeti* Lourenço. The two species can be readily distinguished by the following features: (i) a different pattern of pigmentation, i.e. the new species is heavily spotted, whereas *T. guillaumeti* is uniformly yellowish, (ii) the different shape of the pectines; in the new species these are small and have vestigial fulcra, whereas in *T. guillaumeti* they are large and the fulcra is completely absent.

#### DESCRIPTION OF TWO NEW GENERA

##### *Troglotityobuthus* gen. n.

Figs 1-7

*Type species:* *Babycurus gracilis* Fage, 1946; described from Madagascar, Ambilobe, Ankarana, «grotte des Fanihys».

*Diagnosis:* Scorpions of medium size, 45 mm in total length. Pigmentation almost absent. The whole body flattened dorsally, all appendices long and slender. Carapace with a moderate concavity; very flat dorsally. Median ocular tubercle anterior to center of carapace; three pairs of lateral eyes. Chelicerae with dentition according to the buthid pattern (Vachon, 1963). Pedipalps long and slender; movable fingers very long, with 9/10 slightly oblique, almost straight rows of granules. Tibial spurs present. Sternum triangular. Pectines with 20/20 teeth; fulcra strongly marked; basal middle lamellae not dilated. Sternites with short linear stigmata. Telson with a very slender vesicle; aculeus long and moderately curved, with a spinoid subaculear tooth. Trichobothrial pattern of type A- $\alpha$  - orthobothriotaxic.

*Distribution:* Madagascar.

*Palaeogrosphus* gen. n.

Figs 8-11

*Type species: Tityobuthus copalensis* Lourenço, 1996; described from Madagascar, Diégo-Suarez, region of Antseranana (in copal).

*Diagnosis:* Scorpions of small size, 20-25 mm in total length. Carapace with a moderate concavity; median ocular tubercle anterior to the center of the carapace; three pairs of lateral eyes. Cheliceral dentition apparently (with some uncertainty) in accordance with the buthid pattern (Vachon, 1963). Pedipalps slender but not long; movable fingers with 10 only slightly oblique, almost straight rows of granules. Tibial spurs not easily discernible, apparently reduced. Sternum sub-pentagonal. Pectines without fulcra; basal middle lamellae moderately dilated. Sternites with short linear stigmata. Telson with a moderately incrassate vesicle; aculeus moderately curved, with a short and slightly rhomboidal subaculear tooth. Trichobothrial pattern of type A- $\alpha$ , probably orthobothriotaxic but not all trichobothria discernible.

*Distribution:* Madagascar (in recent palaeogeological periods; late Cenozoic-early Pleistocene).

*Remark:* The character basal middle lamellae moderately dilated, suggests that the new genus is related to the genus *Grosphus*.

## BIOGEOGRAPHY

As noted by previous authors (Fage, 1929; Millot, 1948; Vachon, 1979), there are significant affinities between the scorpion faunas of Madagascar and Africa. The following arguments can be given in support of this view. (i) *Grosphus* Simon, one of the most species-rich Madagascan genera, and *Neogrosphus* Lourenço, a genus which probably evolved more recently from *Grosphus*, undoubtedly have close affinities with the African genus *Uroplectes* Peters. These three genera share a very remarkable sexual dimorphism of the pectines (Fage, 1929). The new genus *Palaeogrosphus* gen. n. may represent a primitive element, older than *Grosphus* and *Neogrosphus*, but more data on this sub-fossil genus are needed before a decision can be made (Lourenço, 1995, 1996a), (ii) The recently discovered genus *Pseudouroplectes* Lourenço may also have some affinities with the genus *Uroplectes*. However, the morphology of *Pseudouroplectes* suggests a much more primitive lineage when compared with *Uroplectes* and *Grosphus*, which certainly evolved later (Lourenço, 1995, 1996a). *Pseudouroplectes* corresponds to primitive lineages, which have probably vanished in other regions of the world but are still present in Madagascar. This genus has distant affinities with the microcharm mid genus *Microcharmus* Lourenço, but some intermediate elements still have to be identified in the Madagascan Buthoidea. (iii) The genus *Tityobuthus* was phylogenetically poorly defined until recently, but the discovery of several new species has improved our knowledge of this group. Affinities possibly exist with the Gondwanan genus *Ananteris* Thorell, today present in West Africa and South America. *Ananteris* seems to have had its center of origin in the western part of Gondwanaland, which corresponds with present-day South America. More recently, affinities have also been shown between *Ananteris*, *Tityobuthus* and the Himalayan genus *Himalayotityobuthus* Lourenço (Lourenço, 1997c). These three

genera show several primitive characteristics, including small size and the absence of fulcra in the pectines (the absence of fulcra is observed in at least one species of *Tityobuthus*).

The new genus *Troglotityobuthus* gen. n. represents a troglobitic element, which probably derived from epigeal species close to *Tityobuthus*. However, our knowledge of this genus remains extremely incomplete. The discovery of the genus *Microcharmus*, in the north-eastern region of Madagascar, provided the first indication of possible affinities with *Charmus* Karsch in India and Sri Lanka. Both *Microcharmus* and *Charmus* represent primitive lineages whose characteristics (see Lourenço, 1995, 1996a) show that they belong to the most early-derived extant Buthoidea. The descriptions of several other species of *Microcharmus* and the study of the African genus *Akentrobuthus* Lamoral have lead (in a preliminary decision) to the transfer of these two genera to a separate buthoid family, the Microcharmidae (Lourenço, 1998). In a more recent decision, the genus *Akentrobuthus* was replaced in the family Buthidae (Lourenço, 2000) and the Microcharmidae returned again to be represented by relictual elements, present only in Madagascar. At the moment there are no further indications to suggest affinities between Madagascar, Indo-Malayan region and Australia.

## CONCLUSIONS

Although this study is only preliminary, the following findings on the Buthoidea of Madagascar can be presented: 1. The majority of the buthoid taxa in Madagascar correspond with primitive lineages which no longer exist in most other regions of the world. 2. Several genera appear to be poor in species. It is, however, reasonable to expect future discoveries of several new species in certain genera of micro-scorpions such as *Tityobuthus*, *Microcharmus* and *Pseudouroplectes*. 3. The number of recorded species is still small, but the faunistic inventories so far carried out are extremely incomplete. 4. Nevertheless the number of genera is significant, even when compared with other well-studied regions of the world. 5. The most remarkable characteristic of the buthoids of Madagascar is the impressive level of endemism, both in species and in genera. This supports the hypothesis of a very early isolation of the island from other land masses.

## KEY TO THE GENERA OF BUTHOIDEA PRESENT IN MADAGASCAR

- |     |   |                                      |
|-----|---|--------------------------------------|
| 1   | Sternum with a triangular shape: Buthidae . . . . .   | 2                                    |
| (1) | Sternum with a sub-pentagonal to pentagonal shape<br>. . . . .                                    | Microcharmidae - <i>Microcharmus</i> |
| 2   | Chelae: movable fingers with 10 to 14 oblique rows of granules . . . . .                          | 3                                    |
| (2) | Chelae: movable fingers with 7 or 8 oblique rows of granules . . . . .                            | 5                                    |
| 3   | Carapace distinctly flattened; length of movable finger 3-4 times the<br>length of hand . . . . . | <i>Troglotityobuthus</i> gen. n.     |
| (3) | Carapace not flattened; movable finger 1.5 times longer than hand . . . . .                       | 4                                    |



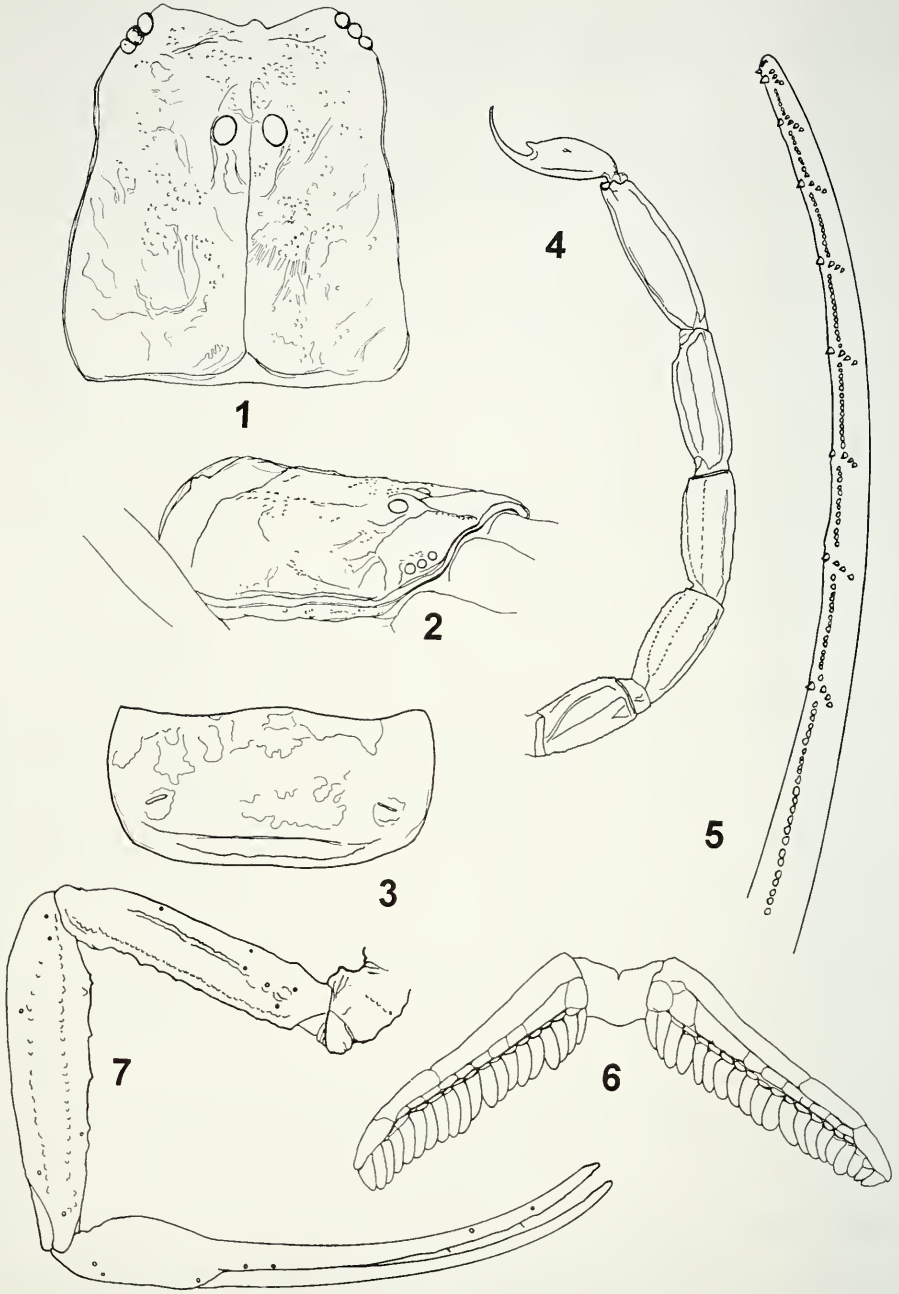
- 4 Telson without subaculear tooth; pectines with fulcra . . . . . *Grosphus*  
 (4) Telson with small subaculear tooth; pectines without fulcra  
 . . . . . *Palaeogrosphus* gen. n.  
 5 Telson with moderate to strong subaculear tooth . . . . . *Tityobuthus*  
 (5) Telson without subaculear tooth . . . . . 6  
 6 Pectines of female with basal middle lamellae moderately dilated *Neogrosphus*  
 (6) Pectines of female with basal middle lamellae not dilated . . . *Pseudouroplectes*

KEY TO THE SPECIES OF *TITYOBUTHUS*

- 1 Pectines with fulcra vestigial or absent . . . . . 2  
 (1) Pectines with well developed fulcra . . . . . 3  
 2 Fulcra vestigial . . . . . *monodi* sp. n.  
 (2) Fulcra absent . . . . . *T. guillaumeti*  
 3 Tibial spurs absent . . . . . *T. baroni*  
 (3) Tibial spurs present . . . . . 4  
 4 Chelicerae without spots or pigmentation . . . . . *T. judsoni*  
 (4) Chelicerae with dark spots and pigmentation . . . . . 5  
 5 Pectines with 20 or more teeth . . . . . 6  
 (5) Pectines with less than 20 teeth . . . . . 8  
 6 A conspicuous smooth, white and bright central zone on sternite V  
 . . . . . *T. manonae* sp. n.  
 (6) No such zone on sternite V . . . . . 7  
 7 Body, pedipalps and legs heavily spotted; pedipalpal chelae short and  
 robust; internal face of tibia with four spinoid granules . . . . . *T. lucileae*  
 (7) Body, pedipalps and legs with only vestigial spots; pedipalpal chelae  
 long and slender; internal face of tibia with 5 or 6 spinoid granules . *T. pococki*  
 8 Pectines with 11 teeth . . . . . *T. ivohibe*  
 (8) Pectines with 12 to 19 teeth . . . . . 9  
 9 Pectines with 12 to 14 teeth . . . . . 10  
 (9) Pectines with 15 to 19 teeth . . . . . 11  
 10 A smooth white central zone on sternite V and two small rounded  
 smooth white zones laterally . . . . . *T. griswoldi* sp. n.  
 (10) Sternite V without smooth white zone . . . . . *T. parrilloi*  
 11 Sternite V centrally with a single conspicuous smooth white zone . *T. dastychi*  
 (11) Sternite V with a reduced smooth white central zone associated with  
 two small rounded smooth white zones laterally . . . . . *T. petrae*

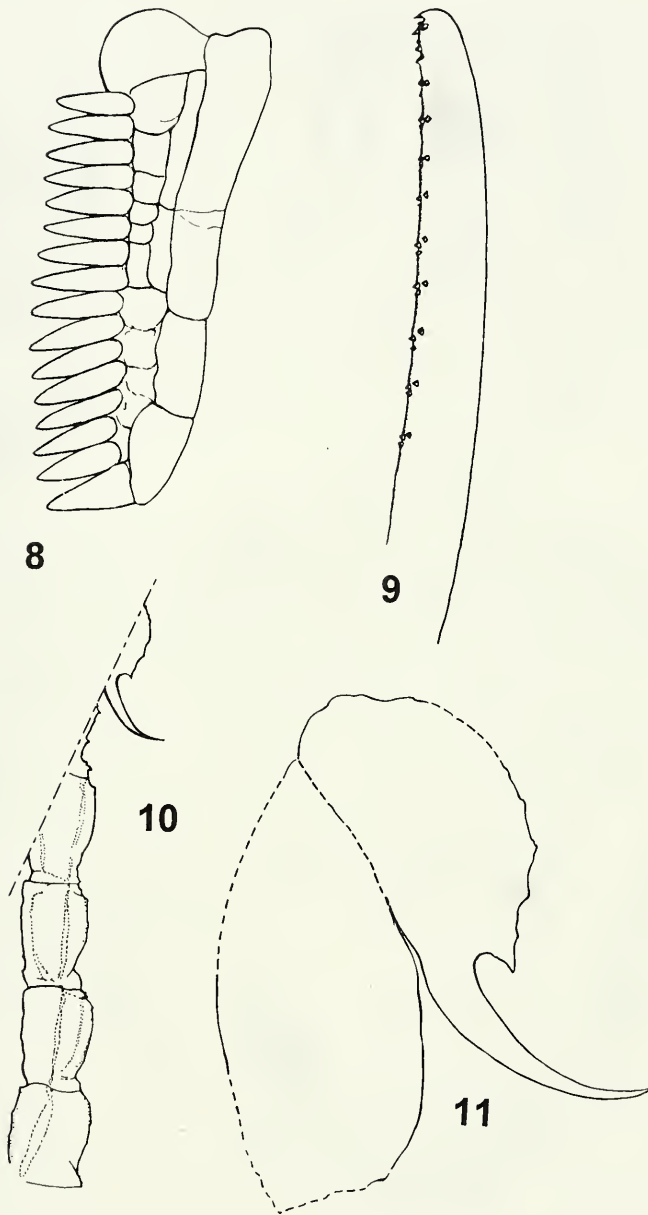
## ACKNOWLEDGEMENTS

I am very grateful to Didier Geffard and Philippe Bouchard, Laboratoire de Zoologie Arthropodes, for preparing several illustrations. Prof. John L. Cloudsley-Thompson, London and Dr. Peter Schwendinger, Geneva are acknowledged for reviewing the manuscript.



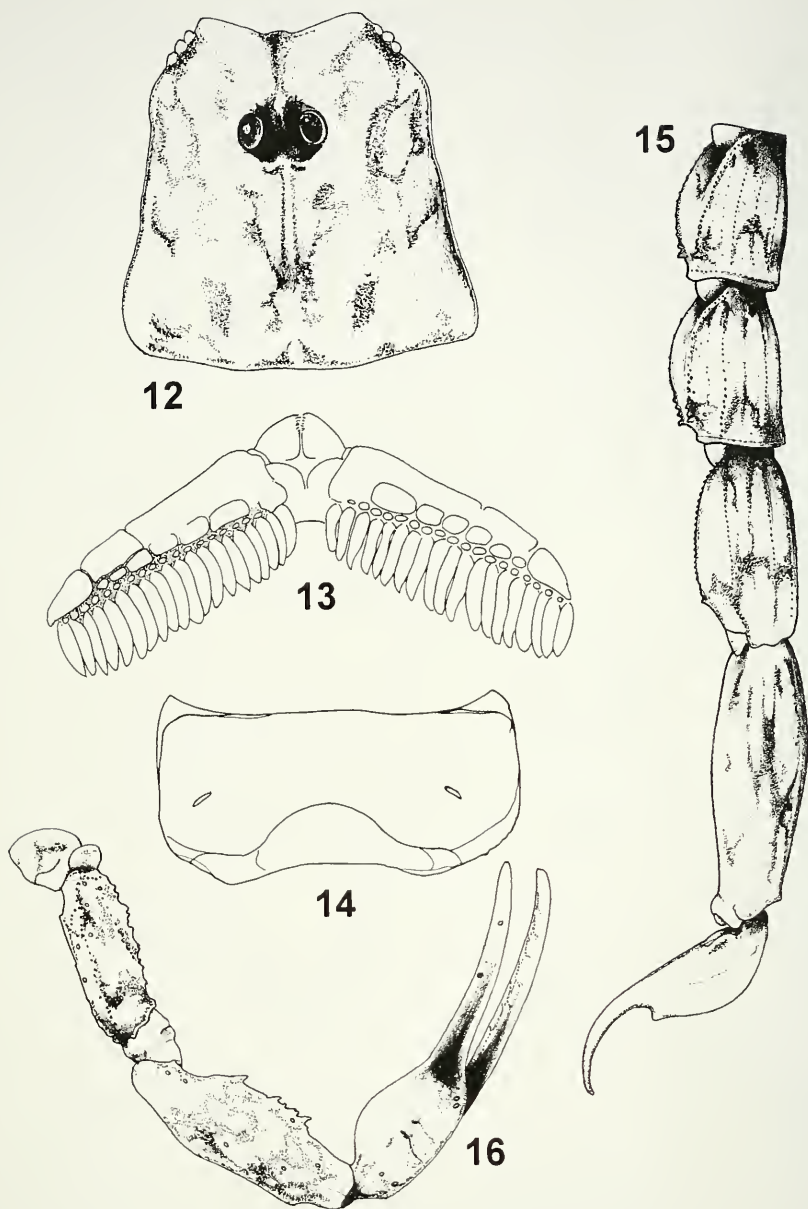
FIGS 1-7

Male holotype of *Troglotityobuthus gracilis*. 1. Carapace, dorsal view. 2. The same, lateral view. 3. Sternite V. 4. Metasoma and telson, lateral view. 5. Movable finger of pedipalpal chela. 6. Pectines. 7. Pedipalp, dorsal view with trichobothrial pattern.



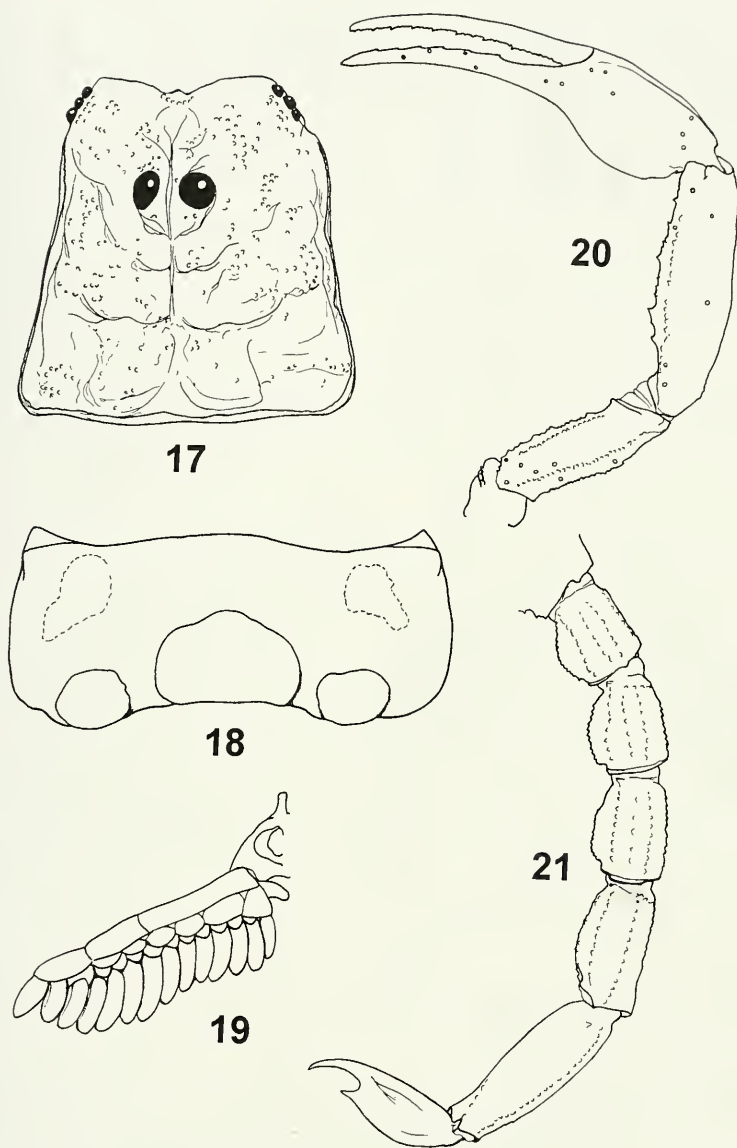
FIGS 8-11

Male holotype of *Palaeogrosphus copalensis*. 8. Left pecten. 9. Movable finger of pedipalpal chela. 10. Metasoma and telson, lateral view. 11. Metasomal segment V and telson in detail, lateral view.



FIGS 12-16

Male holotype of *Tityobuthus manonae* sp. n. 12. Carapace. 13. Pectines. 14. Sternite V. 15. Metasoma and telson, lateral view. 16. Pedipalp, dorsal view with the trichobothrial pattern.



FIGS 17-21

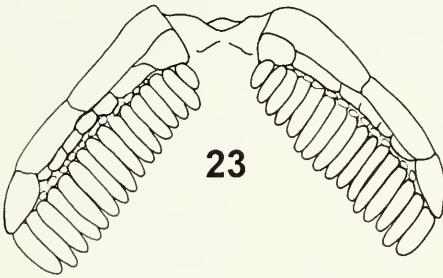
Male holotype of *Tityobuthus griswoldi* sp. n. 17. Carapace. 18. Sternite V. 19. Pecten. 20. Pedipalp, dorsal view with trichobothrial pattern. 21. Metasoma and telson, lateral view.



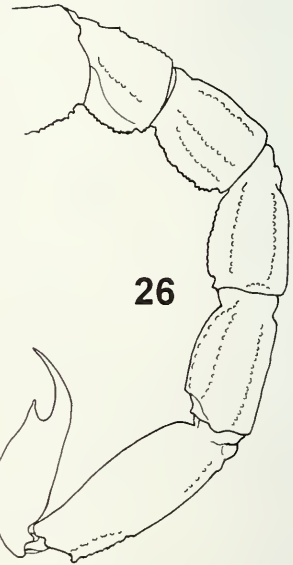
22



25



23



26



24

FIGS 22-26

Male holotype of *Tityobuthus monodi* sp. n. 22. Carapace. 23. Pectines. 24. Sternite V. 25. Pedipalp, dorsal view with trichobothrial pattern. 26. Metasoma and telson, lateral view.

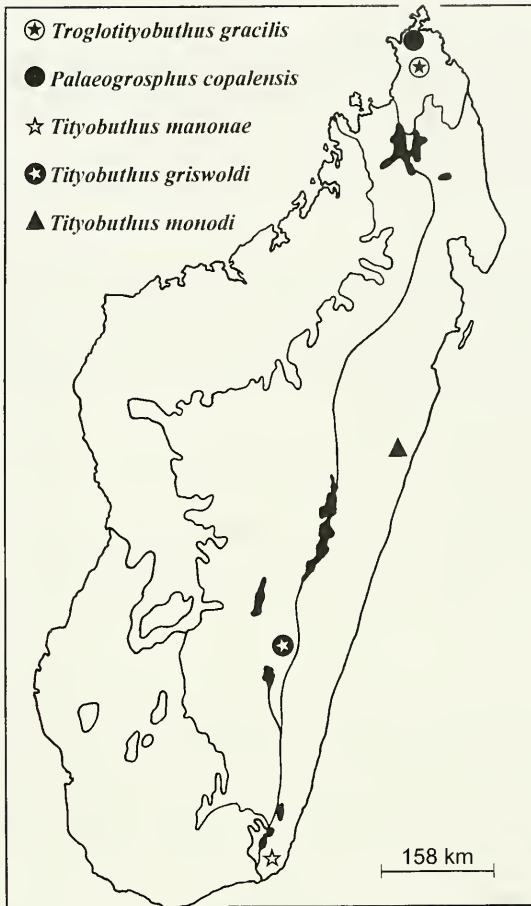


FIG. 27

Map of Madagascar showing the type localities of the new genera and species described in this paper.

## REFERENCES

- FAGE, L. 1929. Les Scorpions de Madagascar. Faune des Colonies françaises 3. *Société d'Éditions Géographiques, Maritimes et Coloniales, Paris*: 637-694.
- LOURENÇO, W. R. 1993. A review of the geographical distribution of the genus *Anameris* Thorell (Scorpiones: Buthidae), with description of a new species. *Revista de Biologia Tropical* 41 (3): 697-701.
- LOURENÇO, W. R. 1994. Scorpions (Chelicerata) de Colombie. VI. Quatre nouvelles espèces de Buthidae des régions amazonienne, sud-pacifique et de la cordillère orientale. *Revista de la Academia Colombiana de Ciencias Exatas, Físicas y Naturales* 19 (73): 387-392.
- LOURENÇO, W. R. 1995. Description de trois nouveaux genres et de quatre nouvelles espèces de scorpions Buthidae de Madagascar. *Bulletin du Muséum National d'Histoire Naturelle, Paris*, 4<sup>e</sup> sér. 17 (1-2): 95-106.

- LOURENÇO, W. R. 1996a. Scorpions. In: *Faune de Madagascar*. N° 87. Muséum National d'Histoire Naturelle, Paris: 102 pp.
- LOURENÇO, W. R. 1996b. A new species of *Tityobuthus* from Madagascar (Scorpiones, Buthidae). *Bolletino del Museo Regionale di Scienze Naturali, Torino* 14 (1): 267-273.
- LOURENÇO, W. R. 1996c. Premier cas connu d'un sub-fossile de scorpion dans le copal de Madagascar. *Comptes Rendus de l'Académie des Sciences, Paris*, Sér. IIA, t. 323: 889-891.
- LOURENÇO, W. R. 1997a. Another new species of *Tityobuthus* from Madagascar (Scorpiones, Buthidae). *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg* 12 (155): 147-151.
- LOURENÇO, W. R. 1997b. A reappraisal of the geographical distribution of the genus *Ananteris* Thorell (Scorpiones: Buthidae). *Biogeographica* 73 (2): 81-85.
- LOURENÇO, W. R. 1997c. Description of a new genus and new species of Buthidae scorpion from the Himalayas of India and Nepal, with some new biogeographic implications. *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg* 12 (156): 183-188.
- LOURENÇO, W. R. 1998. Une nouvelle famille est nécessaire pour des microscorpions humicoles de Madagascar et d'Afrique. *Comptes Rendus de l'Académie des Sciences, Paris, Sciences de la vie* 321: 845-848.
- LOURENÇO, W. R. 1999a. A new species of *Ananteris* Thorell from the coastal region of Ecuador (Scorpiones, Buthidae). *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg* 13 (160): 95-100.
- LOURENÇO, W. R. 1999b. New species of *Ananteris* from the north of Chocó, Colombia (Scorpiones, Buthidae). *Anales del Instituto de Biología, Universidad Nacional Autónoma de México, ser. Zool.* 70 (2): 93-98.
- LOURENÇO, W. R. 2000. Panbiogéographie, les familles des scorpions et leur répartition géographique. *Biogeographica* 76 (1): 21-39.
- LOURENÇO, W. R. & GOODMAN, S. M. 1999. Taxonomic and ecological observations on the scorpions collected in the Forest of Ankazomivady-Ambositra and on the «RS d'Ivohibe», Madagascar. *Revista de Biología Tropical* 47 (3): 475-482.
- LOURENÇO, W. R. & MONOD, L. 1999. A new species of *Ananteris* Thorell from French Guyana (Scorpiones, Buthidae). *Revue suisse de Zoologie* 106 (2): 301-306.
- MILLOT, J. 1948. Revue générale des Arachnides de Madagascar. *Mém. Inst. Sci. Madagascar, Sér. A* 1(2). In: *Mémoires de la Société de Biogéographie* (1953): 127-145.
- POCOCK, R. I. 1893. Notes on the classification of scorpions followed by some observations upon synonymy, with descriptions of genera and species. *Annals and Magazine of Natural History* (6) 12: 303-330.
- VACHON, M. 1963. De l'utilité, en systématique, d'une nomenclature des dents des chélicères chez les Scorpions. *Bulletin du Muséum National d'Histoire Naturelle, Paris*. 2<sup>e</sup> sér. 35 (2): 161-166.
- VACHON, M. 1973. Etude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bulletin du Muséum National d'Histoire Naturelle, Paris*. 3<sup>e</sup> sér., n° 140. Zool., 104: 857-958.
- VACHON, M. 1975. Sur l'utilisation de la trichobothriotaxie du bras des pédipalpes des Scorpions (Arachnides) dans le classement des genres de la famille des Buthidae Simon. *Comptes Rendus de l'Académie des Sciences, Paris*, sér. D. 281: 1597-1599.
- VACHON, M. 1979. Remarques biogéographiques sur la faune des Scorpions de Madagascar à propos de l'utilisation de caractères trichobothriotaxiques permettant la distinction des genres *Odonturus* Karsch. 1879 et *Tityobuthus* Pocock. 1893. *Comptes-Rendus du V<sup>e</sup> Colloque d'Arachnologie d'Expression Française, Barcelona*: 217-224.



## Japygidés (Diplura) du Sud-Est asiatique n° 9 *Dicellurata Genavensia* XXIV

Jean PAGÉS<sup>1</sup>

51, rue du Faubourg Saint-Martin, F-21121 Fontaine-lès-Dijon, France.

**Japygidae (Diplura) from South-East Asia n° 9. - *Dicellurata Genavensia* XXIV.** - This note is devoted to the descriptions or citations of 5 species belonging to 3 genera. *Psalidojapyx* gen. n. is proposed for *Japyx murudensis* Silv., 1930 described from Sarawak, here recorded from Brunei, and *Psalidojapyx edentulus* sp. n. from Sarawak. *Burmjapyx* Silv. is represented by two new species: *Burmjapyx lienhardi* sp. n. from Sumatra and *Burmjapyx murphyi* sp. n. from Singapore. The generic position of *Burmjapyx huashanensis* Chou, 1983 is discussed. New specimens of *Pauperojapyx (Paucijapyx) kajan* Pgs are recorded from Sarawak and Brunei.

**Key-words:** Diplura Japygidae - Indonesia - Singapore - Malaysia - Brunei - new genus and new species.

### INTRODUCTION

Dans cette note sont étudiés des Japygidés provenant de trois des missions (1985, 1987 et 1988) organisées dans le Sud-Est asiatique par le Dr B. Hauser, ancien Conservateur du Département des Arthropodes et d'Entomologie I du Muséum d'histoire naturelle de la Ville de Genève, en collaboration avec le Dr C. Lienhard, Chargé de Recherche dans le même Département; ils n'appartiennent pas aux omniprésents *Indjapyx*, mais représentent trois genres dont un nouveau pour la Science.

I.- *Psalidojapyx* gen. n. est proposé pour le *Japyx murudensis* Silv., 1930 du Mont Murud (2438 m ) au Sarawak (Malaisie) et dont je décris un ♂<sub>1</sub> du Brunei présentant des caractéristiques particulières permettant de mieux comprendre la variabilité des espèces dans ce genre; *Psalidojapyx edentulus* sp. n. est une nouvelle espèce du Sarawak.

II.- *Burmjapyx lienhardi* sp. n. de Sumatra et *Burmjapyx nurphyi* sp. n. de Singapour portent à 6 le nombre d'espèces de ce genre propre à l'Asie du Sud-Est asiatique, tel qu'il a été défini par Silvestri (1930). La position générique du *Burmjapyx huashanensis* Chou (Chou & Chen, 1983) me paraît inappropriée et j'apporte quelques éléments de discussion.

III.- *Pauperojapyx (Paucijapyx) kajan* Pagés est signalé de 2 nouvelles stations, l'une au Brunei, l'autre au Sarawak.

<sup>1</sup> Professeur émérite de l'Université de Bourgogne.

Manuscrit accepté le 17.07.2000

Tous les spécimens étudiés dans ce travail sont conservés dans les collections du Muséum d'histoire naturelle de la Ville de Genève.

## ETUDE TAXONOMIQUE<sup>2</sup>

### I.— *Psalidojapyx* gen. n.

Appartient à la famille des Japygidae. Le premier stade à forceps est un st.III B.  
*Espèce type*: *Japyx murudensis* Silvestri, 1930.

#### TÊTE

*Antennes*: de 43 articles chez l'espèce type, les 13 trichobothries typiques, *a* proximale, mais non subbasale; 6 ou 8 sensilles placoïdes en position typique sur l'article apical.

*Pièces buccales*: typiques de la famille; les 5 lames du lobe interne des maxilles pectinées.

#### THORAX

*Chétotaxie*: les 5+5 *M* en position typique sur les 3 notums.

*Pattes*: peu allongées, très pileuses; les soies spiniformes des tarsi très développées, peu nombreuses; prétarse typique.

#### ABDOMEN

*Tergite 1*: avec les seuls *ma* = *M* sur le scutum.

*Tergites 2 à 7*: à chétotaxie typique.

*Tergite 10*: sans carènes.

*Sternites*: à chétotaxie normale.

*Organes subcoxaux latéraux*: larges, peu saillants; soies glandulaires et soies sensorielles normales.

*Organe glandulaire médian*: saillant, de nombreuses minuscules sensilles sétiformes (= "pseudopori") sur l'opercule.

*Papilles génitales*: typiques de la famille, Silvestri (1930) n'ayant rien signalé de particulier chez la ♀ qu'il a décrit: je n'ai pu étudier que deux st.III B et un individu présentant des caractères de st.III B, mais avec une papille génitale ♂ sans phanère.

#### CERQUES

Un peu moins longs que la partie normalement découverte du tergite 10.

*Cerque droit*: marge interne rectiligne, sans dent, mais avec des denticules unisériés proximaux.

*Cerque gauche*: régulièrement concave, avec 2 carènes sur la marge interne; 2-3 denticules basaux nets, le reste des carènes avec des ondulations disparaissant vers l'apex des cerques.

<sup>2</sup> On trouvera la liste des abréviations et des rapports utilisés dans Pagés (1954, 1984) et Pagés & Schowing (1958).

## AFFINITÉS

Ce genre est bien caractérisé par ses antennes, la chétotaxie abdominale tergale, les organes glandulaires du premier urosternite, le tergite 10 et les cerques. Ces derniers se rapprochent de ceux de *Rossjapyx* Smith (Smith, 1962) et d'*Hapljapyx* Silv., celui-ci réuni aux *Austrjapyx* Silv. par Smith & Gonzalez (1964), tous les trois d'Amérique du Sud, mais l'armature des marges internes est nettement différente, ce qui joint aux autres caractéristiques détaillées ci-dessus permet de distinguer ces genres les uns des autres.

## DERIVATIO NOMINIS:

ψαλις- ιδος = ciseaux, par illusion aux cerques qui rappellent les deux lames tranchantes des anciens ciseaux connus sous le nom de "forces", dont on se servait, par exemple, pour tondre les moutons.

*Psalidojapyx murudensis* (Silv.) comb. n.

Figs 1-12

*Matériel étudié*: 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; 21XI.1988; leg. B. Hauser; extraction par Berlese; 1 ♂<sub>1</sub> de 6, 25 mm.

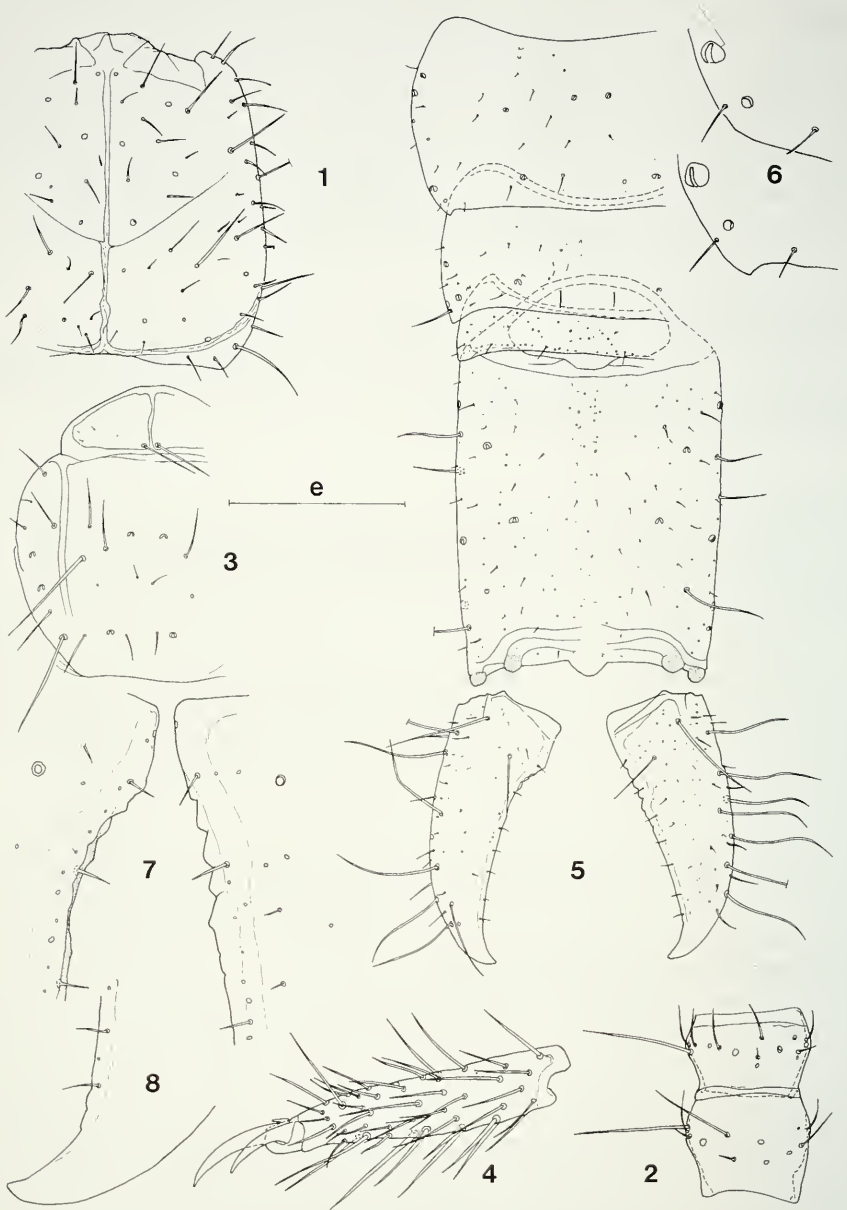
Je crois utile de décrire cet exemplaire très jeune collecté à moins de 140 km à vol d'oiseau du Mont Murud (ca. 2438 m), station où a été capturée la ♀ décrite par Silvestri (1930); on devrait pouvoir ainsi apprécier la variabilité des caractères au cours du développement postembryonnaire et apporter quelques compléments à la description originale.

## TÊTE

*Vertex*: Chétotaxie simplifiée; seuls les grands phanères A1-A4, S2, S4, S5 et S6, V2 et V4, M3 et M5, I2, I4 et I5, L1 et L4, P1 et P2 sont différenciés, longs ou assez longs; seules les s6 à s9 sont reconnaissables; les autres grands phanères ou s sont soit absents, soit courts ou très courts.

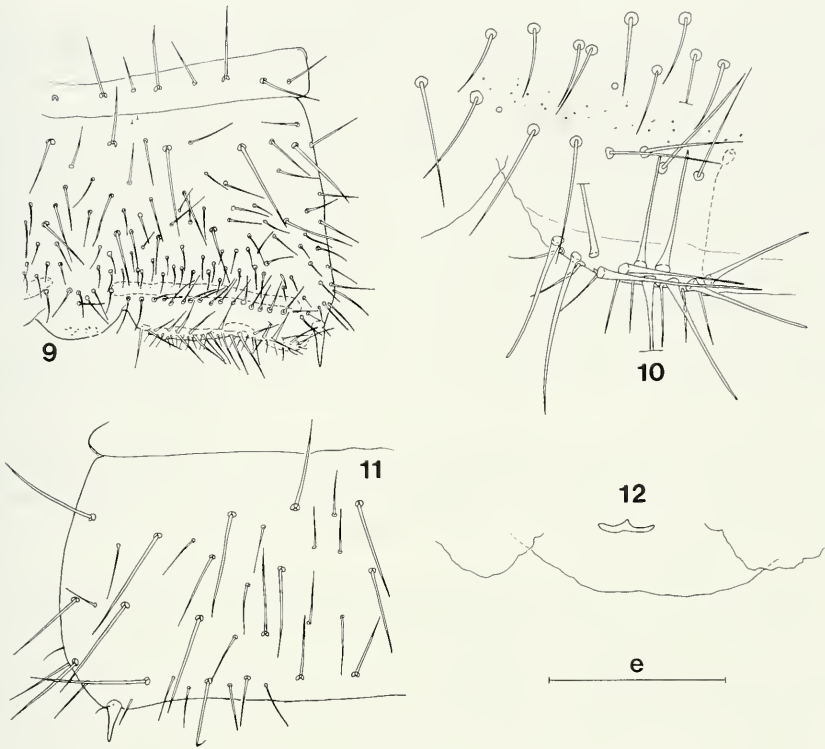
*Antennes*: la droite de 43 articles peu pileux; la gauche cassée, de 15 articles; aires pileuses sur les articles 14 à 21; 13 trichobothries typiques, *a* proximale. *p* = 0,44, du même type que celle d'un st.III B dont les autres caractéristiques se retrouvent pratiquement inchangées chez le ♂<sub>1</sub> (Pagés, 1952, 1955); 6 sensilles placoides en position typique sur l'article apical; on note une sensille placœide sternale sur les articles 39 à 42; l'article apical étant de forme normale, conique, aussi long que large, je ne crois pas qu'il s'agisse d'une antenne en régénération, mais peut-être d'un caractère propre à *murudensis* (cf. Pagés, 1952).

*Pièces buccales*: typiques de la famille; les cinq lames du lobe interne des maxilles pectinées, la première pourvue d'une dizaine de dents; palpes labiaux environ 2 fois aussi longs que large à la base, les soies subapicales sont en moyenne 1, 50 fois (v. ex. = 1,42 - 1,56) aussi longues que le palpe qui les porte.



FIGS 1-8

*Psalidojapyx murudensis* (Silv.), ♂<sub>1</sub>. - 1. Vertex, e = 361 μm. - 2. Antenne gauche, articles 3 et 4 face tergale, e = 211 μm. - 3. Mésonotum, e = 361 μm. - 4. Tarse et prétarse de la PII droite, face antérieure, e = 158 μm. - 5. Tergites 7 à 10 et les cerques, e = 361 μm. - 6. Angles postérieurs gauches des tergites 6 et 7, e = 105 μm. - 7. Détail de la base des marges internes des cerques, face tergale, e = 126 μm. - 8. Détail de l'apex du cerque droit, e = 126 μm.



FIGS 9-12

*Psalidojapyx murudensis* (Silv.), ♂<sub>1</sub>. – 9. Urosternite 1, les pointillés représentent les aires sur lesquelles débouchent les glandes cuticulaires, e = 211 µm. – 10. Détail de l'angle interne de l'organe subcoxal gauche, e = 63 µm. – 11. Urosternite 3, e = 211 µm. – 12. Papille génitale de ce ♂<sub>1</sub>, e = 63 µm.

THORAX

*Pronotum*: les 5+5 *M* en position typique; le *M*<sub>1</sub> gauche est dédoublé; les 1+1 *M*<sub>1</sub> typiques sont tombés, cependant compte tenu de la taille des embases on peut estimer que le rapport *M*<sub>1</sub>/*e* est compris entre 1,5 et 2.

*Mésonotum*. Préscutum: 1+1 *M*. Scutum: 6+6 *M*, les 5+5 *M* typiques et 1+1 *M* supplémentaires latéraux, insérés au-dessus des *M*<sub>3</sub>; les 5+5 soies assez longues habituelles.

*Métanotum*: ne diffère du précédent que par la présence des seuls 5+5 *M* typiques.

*Pattes*: longues, les PIII atteignent la limite des urosternites 4 et 5; peu pileuses, sauf les tarsi; ces derniers présentent 4 paires de soies spiniformes très fortes et très longues; aux PIII la longueur du tarse égale 0,65 fois celle du tibia; la griffe postérieure égale les 4/10 du tarse, 1,4 fois la griffe antérieure et plus de 6,5 fois celle de l'unguiculus.

## ABDOMEN

*Tergite 1:* Préscutum: 1+1  $M$  assez longs. Scutum: 1+1  $M$  ( $ma = M$ ) longs,  $msa$ ,  $m_3$ ,  $mp$  seuls décelables.

*Tergite 2:* 4+4  $M$  ( $ma = M$ ,  $M_1$ ,  $M_{4-5}$ ) longs,  $msa$  et  $m_1$  courts,  $m_2$  assez courts,  $m_3$  et  $mp$ , ainsi qu'un  $sm$  entre  $M_4$  et  $M_5$ , longs.

*Tergites 3 à 7:* 6+6  $M$  ( $ma = M$ ,  $M_{1-5}$ ) longs;  $msa$  et  $m_1$  courts;  $m_2$ ,  $m_3$  et  $mp$  assez longs.

*Tergite 8:* 2 fois aussi large que long ( $l/L = 2, 04$ ); 4+4  $M$  longs, 3+3 homologables aux  $M_{3-5}$  et 1+1 latéraux postérieurs substernaux; 1+1 soies homologables aux  $m_3$ , assez longues;  $m_1$ ,  $m_2$  très courts,  $mp$  assez courts.

*Tergite 9:* près de 3,5 fois aussi large que long ( $l/L = 3,41$ ); pas de  $M$ , mais une rangée postérieure de 4+4 soies très courtes entre lesquelles s'intercalent de minuscules sensilles.

*Tergite 10:* à bords subparallèles, 1,5 fois aussi long que large; sans carène; 5+5  $M$ , tous tombés, à grandes embases, dont 2+2 discaux et 3+3 latéraux antérieurs, intermédiaires et subpostérieurs; 2+2 longues soies, sublatérales subpostérieures et latérales postérieures; en outre 2+2 soies latérales assez longues entre les  $M$  latéraux antérieurs et intermédiaires.

*Angles latéraux postérieurs des tergites:* nuls aux tergites 1 à 6 et 9; en pointe aiguë, petite, peu saillante au tergite 7; en pointe plus forte, obtuse au tergite 8.

*Acropyge:* saillant, en demi-cercle.

*Longueurs relatives des segments 7 à 10:* 43-36-19-100.

*Sternite 1:* Préscutum: 4+4  $M$  longs et 3+3 soies assez longues. Scutum: 11+11  $M$  typiques,  $A_4$  et  $C_3$  indifférenciés,  $A_2$ ,  $A_3$  et  $A_5$  très longs, les autres longs ou assez longs;  $B_3$  et  $B_5$  les plus courts de tous: 1+1  $M$  supplémentaires entre  $C_1$  et  $C_2$ ; de nombreuses soies assez longues ou assez courtes, localisées surtout sur les bords latéraux du sternite; les soies à embase circulaire caractéristique localisées en arrière des  $B$ , relativement nombreuses, sont de 2 tailles; les plus postérieures sont assez longues, dessinant une rangée régulière en avant des organes subcoxaux latéraux; elles sont séparées des autres, nettement plus courtes, par un espace assez important sur lequel s'ouvrent les orifices de très nombreuses glandes cuticulaires dont le diamètre du réservoir est d'environ 5  $\mu\text{m}$ ; chez toutes les espèces de Japygidés, on en rencontre toujours quelques unes, très éparées, mais je n'avais encore jamais observé une telle concentration de ces glandes sur une aire aussi bien délimitée.

*Organes subcoxaux latéraux:* occupant un peu plus de 1/3 de la largeur interstyliaire, saillants, les soies glandulaires nettement éloignées de la rangée postérieure de soies à embase circulaire caractéristique; 32 soies glandulaires à droite, 37 à gauche, de taille inégales, irrégulièrement bisériées,  $SG / st_1 = 0,96$  en moyenne (v. ex. 0,75-1,15), canal glandulaire un peu plus long que la soie glandulaire correspondante, à réservoir ovoïde terminé par un petit goulot saillant; 26-27 soies sensorielles,  $SS / st_1 = 0,40$ ;  $SG / SS = 2,42$  en moyenne (v. ex. = 1,9-2,9).

*Organe glandulaire médian:* saillant, occupant environ le 1/6 de la largeur interstyliaire: 11 minuscules sensilles sétiformes (= "pseudopori") sur l'opercule.

*Sternites 2 à 6*: 16+16 *M* typiques,  $A_6$ ,  $B_4$  et les *C* de rang pair (sauf  $C_6$ ) indifférenciés; les *A*, ainsi que les  $B_{1-3}$  et  $C_6$  très longs ou assez longs; en général 5+5+5 soies assez courtes.

*Sternites 8*: avec 7+7 *M* longs, répartis en 3 rangées longitudinales de 2, 2 et 3 *M* en partant de l'extérieur vers la ligne médiane; on note que les phanères situés entre les *M* postérieurs des rangées intermédiaire et médiale sont différenciés en *M* assez longs dont la taille de l'embase est à peine égale à la moitié de celle d'une des 7 *M* normaux; il en est de même pour 2 phanères insérés entre les *M* intermédiaires de la rangée médiale; ces 6 phanères sont donc des *sm* (cf. Pagés, 1951).

*Paratergites 8*: avec 1 *M* subpostérieur long, 1 soie postérieure assez longue.

*Sternopleurites 9*: largement réunis par une courbe régulière; 1 *M* latéral postérieur assez long, 1 assez longue soie sublatérale postérieure et une rangée postérieure de 3-4 soies très courtes.

*Vésicules exsertiles*: typiques aux urites 1 à 7.

*Styles*: typiques; cône secondaire obsolète, simple renflement à la base du style, pore énigmatique bien net aux  $st_7$  et devenant de moins en moins différencié, pour être à peine discernable aux  $st_1$ ;  $s_1/st_1 = 0,34$ ;  $st_1/st_7 = 0,86$ ;  $s_1/s_7 = 0,94$ ;  $s_1/st_7 = 0,30$ .

*Papille génitale* ♂: par rapport à ce que j'ai défini comme caractéristique de la papille génitale du ♂<sub>1</sub> (Pagés, 1955, 1967) celle de cet exemplaire s'en distingue par l'absence totale de phanères; compte tenu de la difficulté d'observer ce qui existe sur la membrane reliant les urites 8 et 9 lorsque l'individu n'est pas en extension parfaite et sans élevages, il est impossible d'affirmer qu'il peut y avoir un stade particulier entre un st.III et un ♂<sub>1</sub> tels que je les ai définis.

## CERQUES

Un peu plus courts que la partie normalement découverte du tergite 10.  $L_{cd}/L_{10dec} = 0,82$ ; assez élancés,  $L/l = 2,4$ ; recourbés à l'extrémité distale qui est aiguë; sans dent différenciée.

*Cerque droit*: marge interne rectiligne avec sur le quart proximal 5 denticules asymétriques, à sommet arrondi dirigé vers l'apex du cerque; le reste de la marge est pratiquement lisse, sauf tout à fait à son extrémité où s'observent 2 ondulations peu élevées.

*Cerque gauche*: marge interne légèrement concave à la base, puis rectiligne; 2 carènes, l'inférieure présentant 2 denticules basaux peu saillants, puis à une certaine distance un troisième denticule très faible; le reste de la marge est intègre; la carène supérieure montre 6 denticules dont seuls les 2 premiers sont assez saillants, les autres s'estompant graduellement; le reste de la carène est intègre, sauf à son extrémité distale où s'observent 2 ondulations peu élevées, comme au cerque droit.

*Chétotaxie*: une assez longue soie subantérieure, au niveau des premiers denticules; 8 longues soies le long du bord externe des cerques; je n'ai pas observé de *M* latéral antérieur.

## REMARQUES

Dans l'ensemble, les caractéristiques de ce  $\delta_1$  sont parfaitement comparables à celles de la ♀ décrite par Silvestri; la seule discordance importante concerne le nombre de *M* présents sur les notums thoraciques. D'après Silvestri (l.c.) on aurait la chétotaxie suivante en admettant que ses "setis longis" soient des *M*: pronotum: 5+5; mésonotum: 5+5; métanotum: 3+3; d'après nos observations le  $\delta_1$  présente 5+5 *M* au pronotum, 6+6 *M* au mésonotum et 5+5 *M* au métanotum. Sans un réexamen du type et l'étude d'un plus abondant matériel il n'est pas possible de savoir, soit qu'il s'agit d'une divergence réelle, d'une évolution chétotaxique au cours du développement postembryonnaire, les individus les plus "âgés" ayant moins de *M* que les plus jeunes soit, plus vraisemblablement, que Silvestri qui, à l'époque, ne s'occupait pas de la forme des embases pour différencier les divers types de phanères, mais uniquement de leur taille, n'a pas pris en compte aux méso- et métanotum des *M* trop "courts" pour être comptés avec les "setis longis" et les a inclus dans ses "setis sat longis".

*Psaldidjapyx edentulus* sp. n.

Figs 13-20

*Matériel étudié*: Sar-87/82: MALAISIE: SARAWAK: Bau, environs de "Fairy-Cave I", prélèvement de sol dans les angles formés par les contreforts de grands arbres, 20 m; 13.XII.1987; leg. B. Hauser; extraction par Berlese: 2 st.III B de 6.64 (holotype) et 6,44 mm (paratype); l'holotype s'est cassé, lors du démontage de la préparation, en plusieurs fragments, conservés dans un tube d'alcool.

## TÊTE

*Vertex*: les 4 grands phanères A1-4 assez longs; S2, S4, S6, M2-M3, M5, I3-I5, L4 et P1-P2 longs; les autres assez courts ou absents; seules s6 et s9 présentes.

*Antennes*: de 38 articles peu pileux; aires pileuses sur les articles 15 à 19; les 13 trichobothries typiques, *a* est une sensille sétiforme très courte, submédiane, *p* = 0,90; 8 sensilles placoides en position typique sur l'article apical, il n'en existe aucun sur les articles précédents.

*Pièces buccales*: typiques de la famille; les 5 lames du lobe interne des maxilles pectinées; palpes labiaux 3 fois aussi longs que larges à la base, les soies subapicales sont en moyenne 1,42 fois aussi longues que le palpe qui les porte.

## THORAX

*Pronotum*: les 5+5 *M* typiques, les *M*<sub>3</sub> les plus longs, *M*<sub>1</sub> et *M*<sub>4</sub> les plus courts; la longueur des *M*<sub>1</sub> égale un peu plus de 1 fois un tiers l'écartement de leurs embases.

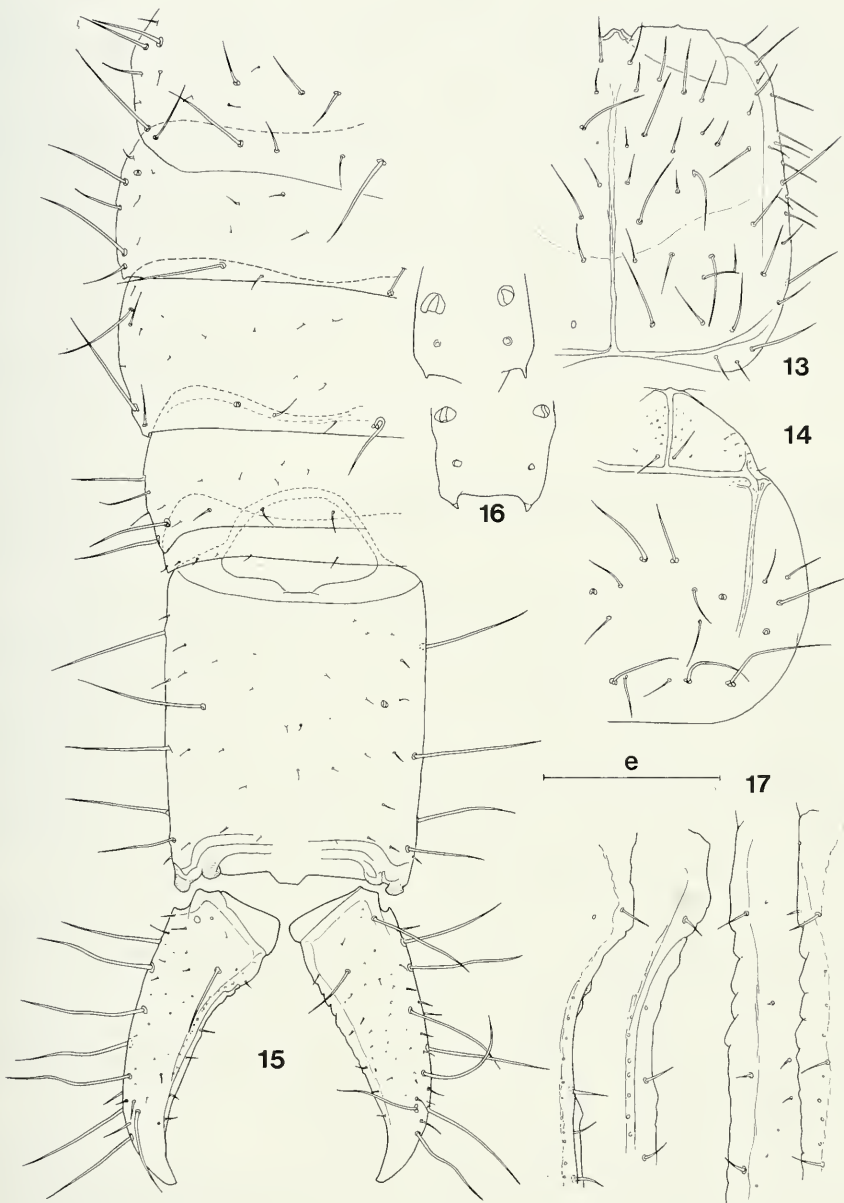
*Méso- et métanotum*: identiques à ceux du  $\delta_1$  de *P. murudensis*.

*Pattes*: assez longues, les PIII atteignant la limite des sternites 3 et 4; 4-5 paires de soies spiniformes très développées; le tarse des PIII égale les 2/3 de la longueur du tibia correspondant; la griffe postérieure mesure environ la moitié de la longueur du tarse, 1.4 fois celle de la griffe antérieure et 5 fois celle de l'unguiculus qui est peu aigu.

## ABDOMEN

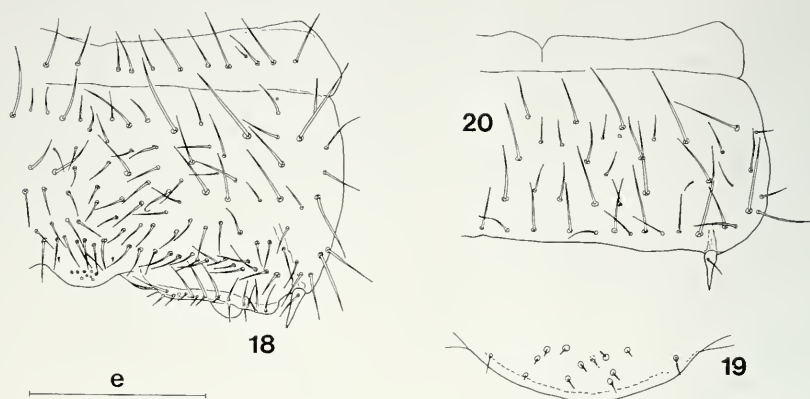
*Tergite 1*. Préscutum: 1+1 *M*. Scutum: 1+1 *M* (*ma* = *M*); seuls les *mp*, assez longs, sont présents.





FIGS 13-17

*Psalidojapyx edentulus* sp. n., holotype. - 13. Vertex, e = 316  $\mu$ m. - 14. Mésonotum, e = 316  $\mu$ m. - 15. Tergites 5 à 10 et les cerques, e = 316  $\mu$ m. - 16. Angles postérieurs des tergites 6 et 7, e = 105  $\mu$ m. - 17. Détail de la base des marges internes des cerques, face tergale, au centre ceux de l'holotype, de part et d'autre ceux du paratype, e = 126  $\mu$ m.



FIGS 18-20

*Psalidojapyx edentulus* sp. n., paratype. — 18. Urosternite 1, e = 253  $\mu$ m. — 19. Organe glandulaire médian, e = 63  $\mu$ m. — 20. Urosternite 3, e = 253  $\mu$ m.

*Tergite 2*: 3+3 *M* ( $ma = M, M_{4-5}$ ); *msa* très courts;  $m_3$  et *mp* assez longs.

*Tergites 3 à 5*: 6+6 *M* ( $ma = M, M_{1-5}$ ),  $M_4$  et  $M_5$  les plus longs;  $M_3$  assez longs;  $m_1$  et *mp* très courts;  $m_2$  assez courts.

*Tergites 6 et 7*: 4+4 *M* ( $M_1$  nuls); *msa*,  $m_1$ , *mp* très courts;  $m_2$  et  $m_3$  assez courts.

*Tergite 8*: un peu plus de 2 fois (2,15) aussi large que long; 3+3 *M* homologables aux  $M_3, M_4$  et  $m_3 = M$ ;  $m_2$  assez longs, *mp* courts.

*Tergite 9*: environ 4 fois 1/5 aussi large que long; pas de *M*, mais 5+5 soies très courtes le long du bord postérieur.

*Tergite 10*: à bords parallèles; près de 1 fois 1/2 aussi long que large; pas de carènes; 4+4 *M* longs dont 1+1 discaux antérieurs et 3+3 latéraux antérieurs, intermédiaires et subpostérieurs, 1+1 assez longues soies latérales postérieures; 10-12+3-4+10-12 très courtes soies.

*Angles latéraux postérieurs des tergites*: nuls aux tergites 1 à 5; en pointe aiguë, large, peu saillante aux tergites 6 et 7; saillants, larges, aigus au tergite 8 et à un moindre degré au 9ème.

*Longueur relative des segments 7 à 10*: 36-38-17-100.

*Acropyge*: saillant, trapézoïdal à angles arrondis.

*Sternite 1*: Préscutum: 6+6 *M* longs et 4+4 soies assez longues. Scutum: 12+12 *M* typiques ( $B_5$  nuls), très longs à longs; de nombreuses soies assez longues, pratiquement une entre chaque paire de *M*, plus nombreuses entre les  $A_1$  et  $B_1$ ; soies à embase circulaire caractéristiques localisées en arrière d'une ligne joignant  $C_3$ - $B_1$ - $B_1$ - $C_3$ ; elles forment une rangée régulière en avant des organes glandulaires postérieurs.

*Organes subcoxaux latéraux*: saillants, occupant environ le tiers de la largeur interstylière; 9 à 11 soies glandulaires, les médianes plus longues que les latérales,

SG/st<sub>1</sub> = 0,94 en moyenne (v. ex. = 0,7-1,20); 19-21 soies sensorielles assez courtes, SS/st<sub>1</sub> = 0,44 en moyenne (v. ex. = 0,39-0,49); SG/SS = 2,14 en moyenne (v. ex. = 1,72-2,41).

*Organe glandulaire médian*: peu saillant; occupant environ le 1/5 de la largeur interstyliare; 10-12 minuscules sensilles sétiformes sur l'opercule.

*Sternites 2 à 7*: 16+16 *M* (A<sub>6</sub>, B<sub>4</sub>, C<sub>2</sub>, C<sub>5</sub>, C<sub>8</sub> et C<sub>10</sub> indifférenciés) longs, A<sub>3</sub>, A<sub>5</sub>, C<sub>4</sub> et C<sub>9</sub> les plus longs de tous; de nombreuses soies courtes ou très courtes.

*Sternite 8*: les 7+7 *M* typiques longs, en position normale.

*Paratergites 8 et sternopleurites 9*: identiques à ceux de *murudensis*.

*Vésicules exsertiles*: typiques aux sternites 1 à 7.

*Styles*: typiques, identiques à ceux de *murudensis*; s<sub>1</sub>/st<sub>1</sub> = 0,50; s<sub>1</sub>/s<sub>7</sub> = 0,96; st<sub>1</sub>/st<sub>7</sub> = 0,85; s<sub>1</sub>/st<sub>7</sub> = 0,43.

*Papille génitale*: aucune trace n'a pu en être décelée.

#### CERQUES

Un peu moins longs que la partie normalement découverte du tergite 10, L<sub>cd</sub>/L<sub>10dec</sub> = 0,90; assez élancés, L/L = 2,69 en moyenne (v. ex. = 2,50-2,92); apex peu arqué, aigu.

*Cerque droit*: marge interne sans dent, rectiligne; près de la base 5 denticules asymétriques peu saillants, arrondis, le reste de la marge avec de très faibles ondulations à peine indiquées.

*Cerque gauche*: marge interne avec 2 carènes s'étendant pratiquement de la base à l'apex du cerque; la carène inférieure présente sur son tiers proximal un léger sinus ayant 2 denticules arrondis à sa base et 1 autre à sommet aigu à son extrémité distale; la largeur du cerque au niveau de ce denticule égale les 2/3 de la largeur à la base, le reste de la carène est intègre; la carène supérieure est absolument lisse à l'exception de 2-3 denticules arrondis à son début.

*Chétotaxie*: identique à celle de *P. murudensis*.

#### AFFINITÉS

Cette espèce est proche du ♂<sub>1</sub> de *P. murudensis*. Elle s'en écarte par ses antennes, la chétotaxie des tergites abdominaux et ses cerques.

#### DERIVATIO NOMINIS

D'après *edentulus* = édenté, allusion à l'absence de dent différenciée aux 2 cerques.

#### II. – *Burmjapyx* Silv., 1930

Parona (1892) signale deux espèces de Japygidés: 9 spécimens sont rapportés au *Japyx indicus* Oudemans, 1890 et deux autres à une espèce nouvelle, *Japyx oudemansi* Parona. Ces deux derniers spécimens ont été revus par Silvestri (1930) qui constate qu'il s'agit d'un ♂ et d'une ♀; il les répartit entre deux espèces pour lesquelles il crée le genre *Burmjapyx* caractérisé surtout par la structure très particulière des organes subcoxaux latéraux: *B. oudemansi* (Parona) pour le ♂ à 28 articles

antennaires, nombre retenu par Parona dans sa description, et *B. paronae* Silvestri<sup>3</sup> pour la ♀ qui possède 32 articles antennaires. En 1948 Silvestri décrit *B. megurus* d'Indochine (le Vietnam actuel). Enfin, Pagés (1977) redécrit *B. inferus* (Carpenter, 1932) d'après un ♂ et une ♀.

Avec *B. lienhardi* sp. n. et *B. murphyi* sp. n., décrits plus loin, le genre *Burmjapyx* compte donc 6 espèces; pour les différencier, outre l'armature des cerques, qui est très utile, surtout celle du droit, la chétotaxie des tergites abdominaux 1 à 7 a aussi une grande importance; sur le tableau 1 sont indiqués les *M* et les *sm* différenciés en *M* chez chacune de ces espèces; les chétotaxies de *megurus*, *paronae* et *oudemansi* sont données d'après les descriptions et figures de Silvestri (1930) et peuvent être sujettes à caution, surtout pour les deux dernières.

En 1957, Paclt met 8 autres genres en synonymie avec *Burmjapyx*; j'ai dit à plusieurs reprises (Pagés, 1961, 1977, 1994) ce que je pensais de ce système qui, pour moi, est la négation de la systématique évolutive et qui ne fait que compliquer la recherche des affinités réelles entre les diverses lignées de Japygidés; je crois que nous ne connaissons même pas le dixième des taxons existants; je pense que la biogéographie, entre autre, doit être considérée comme ayant une importance primordiale sur l'évolution des différentes lignées et la diversification des genres, surtout chez des Insectes dont l'hybridation ou l'interfécondité entre espèces paraît invérifiable pour le moment, les élevages d'assez longue durée, étant, pour l'instant, impossibles.

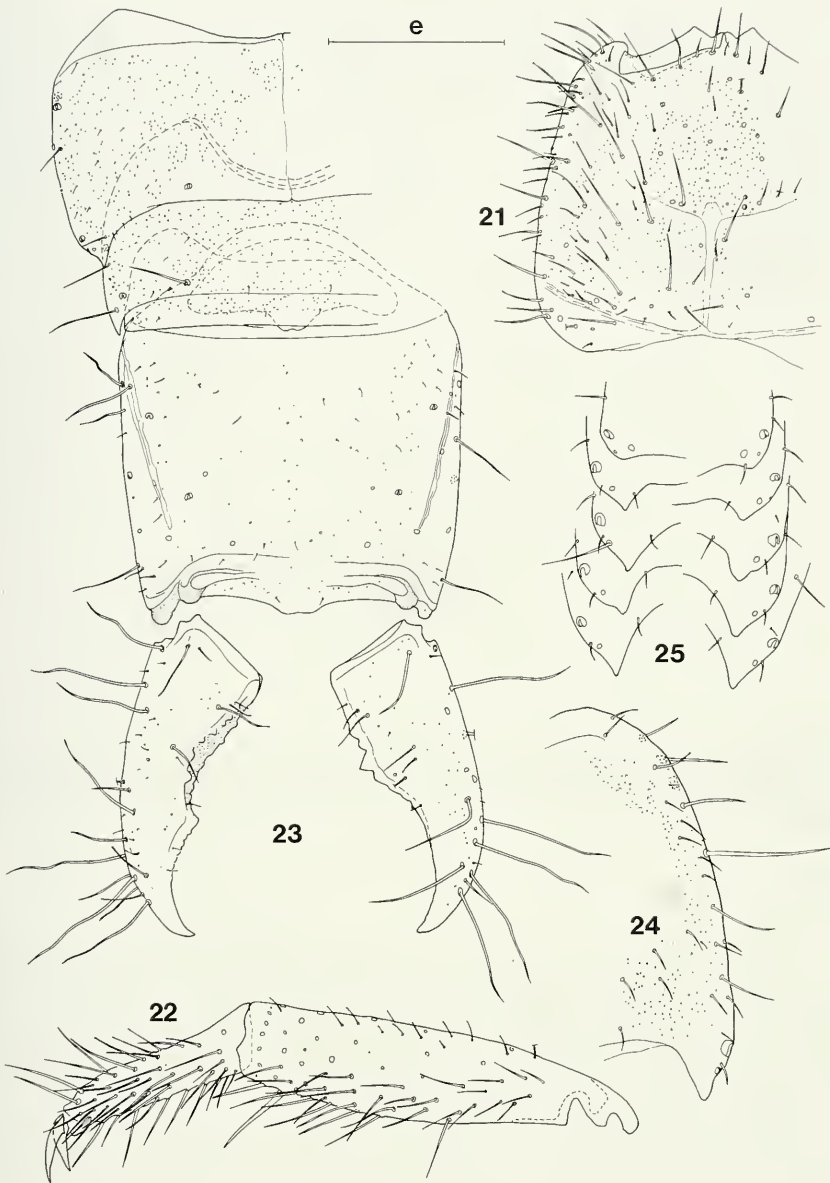
De plus l'utilisation de la clef dichotomique des différents genres qu'il retient, aussi simplifiée qu'elle soit, ne semble pas permettre d'aboutir à une détermination correcte d'un de ses genres. Pour ne prendre qu'un exemple voici le cas du *Burmjapyx huashanensis* Chou, décrit du Shaanxi par Chou & Chen (1983). En tenant compte du très court résumé en espéranto et des figures 1-23 de la planche I, très peu précises et difficiles à exploiter, on arrive en utilisant la clef de Paclt, non pas à un *Burmjapyx*, sensu Paclt dont le cerque droit a des tubercules unisériés, mais, puisque les 2 cerques de *B. huashanensis* sont à tubercules bisériés (fig. 23), à un *Teljapyx*, sensu Paclt; ce serait plus correct en faisant abstraction de l'absence d'une dent basale au cerque gauche, caractère bien spécifié par Silvestri (1948) dans la définition du genre. En fait, *B. huashanensis*, compte tenu des données de Chou & Chen, devrait à mon avis se rapprocher des *Sinjapyx* Silvestri (1948) (considéré comme un synonyme de *Teljapyx* par Paclt), et plus particulièrement de *Sinjapyx davidoffi* Silv. de l'Annam. Seule une révision des types de ces espèces permettrait de pouvoir tenter de les classer génériquement.

### *Burmjapyx lienhardi* sp. n.

Figs 21-34, 44

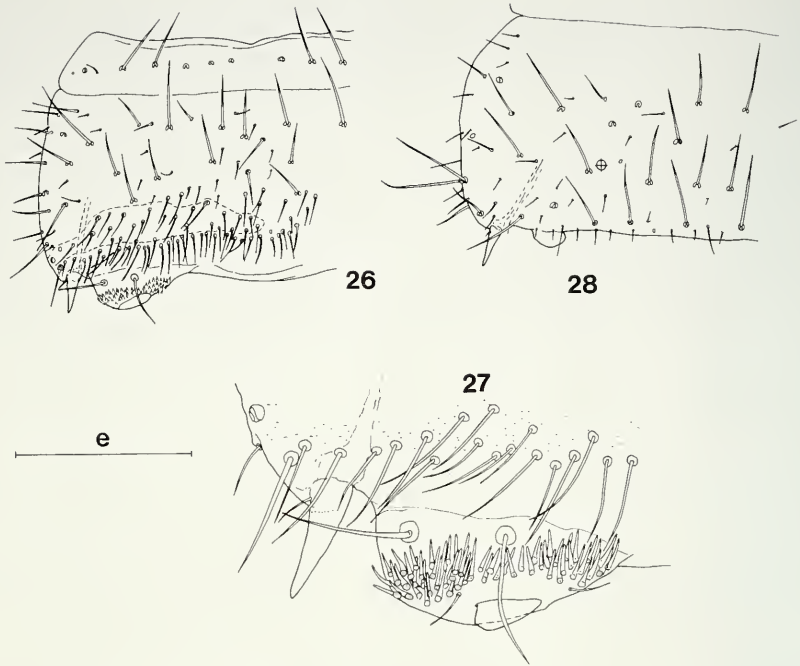
*Matériel étudié:* Sum-85/49: INDONÉSIE: SUMATRA (Sumatra Utara: Langkat): Réserve naturelle de Bukit Lawang, près de Bohorok, forêt primaire le long de la rivière, 180 m, prélèvement de sol dans les angles formés par les contreforts d'un grand arbre; 20.XI.1985, leg. B. Hauser: extraction par Berlese; 1 ♂ de 9.9 mm (holotype), 1 st.III B de 4,9 mm (paratype).

<sup>3</sup> Il décrit aussi un *Indjapyx indicus* var. *birmana* nov., récoltés par L. Fea à Bahmo, sans indiquer s'il s'agit des spécimens étudiés par Parona et provenant de la même localité.



FIGS 21-25

*Burmjapyx lienhardi* sp. n., ♂ holotype. - 21. Vertex, e = 549  $\mu$ m. - 22. PII droite, face tergale, e = 316  $\mu$ m. - 23. Tergites 7 à 10 et les cerques, e = 592  $\mu$ m. - 24. Détail de la marge droite du tergite 7, à noter la taille du m2, e = 316  $\mu$ m. - 25. Angles latéraux postérieurs des tergites 3 à 7, e = 316  $\mu$ m.



FIGS 26-28

*Burmjapyx lienhardi* sp. n., ♂ holotype. – 26. Urosternite 1, sur la surface délimitée par des tirets s'ouvrent les très nombreuses glandes cuticulaires, e = 421  $\mu$ m. – 27. Organe subcoxal droit, les point représentent l'ouverture des glandes cuticulaires, e = 140  $\mu$ m. – 28. Urosternite 3, e = 421  $\mu$ m.

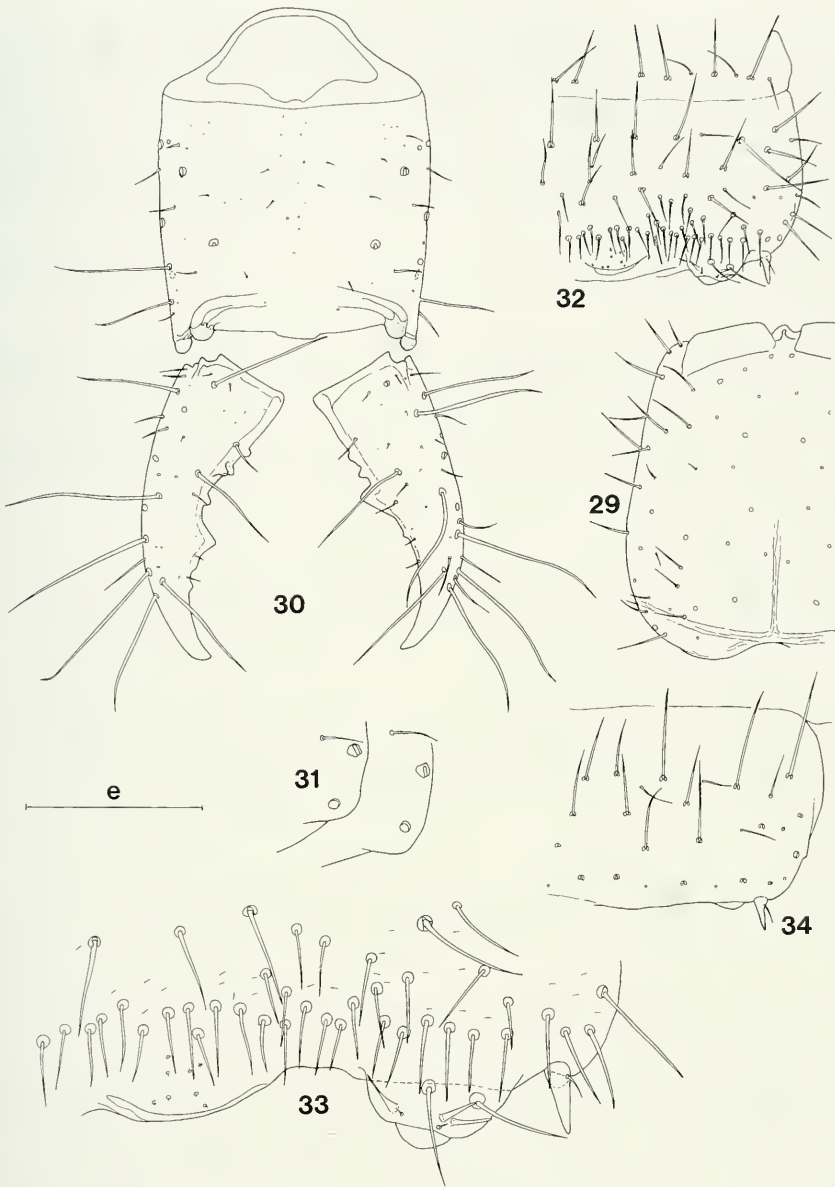
## DESCRIPTION DU ♂

## TÊTE

*Vertex*: tous les grands phanères sont présents; en outre de nombreuses soies de toutes tailles, longues à courtes parsèment les quarts latéraux du vertex; enfin une multitude de minuscules sensilles criblent toute la surface, plus densément en avant des branches latérales de la suture en Y, sur le territoire en-dessous duquel se trouve le cerveau; chez de très nombreuses espèces de Japygoidea cette zone est plus fortement colorée que le reste de la capsule céphalique.

*Antennes*: de 32 articles, la gauche du ♂ est un régénérat de 31 articles; la chétotaxie est typique, chaque article portant deux verticilles de soies longues, voire assez longues et des sensilles recourbées assez longues; aires pileuses sur les articles 14 à 19; les 13 trichobothries typiques, *a* assez proximale, *p* = 0,46; 6 sensilles placoides en position typique sur l'article apical.

*Pièces buccales*: typiques de la famille; les 5 lames du lobe interne des maxilles pectinées; palpes labiaux environ 4 fois aussi longs que large à la base, les soies subapicales sont en moyenne 1.5 fois aussi longues que le palpe qui les porte.



FIGS 29-34

*Burmjapyx lienhardi* sp. n., paratype (st.III B). – 29. Vertex, e = 303  $\mu$ m. – 30. Tergite 10 et les cerques, e = 253  $\mu$ m. – 31. Angles latéraux postérieurs droits des tergites 6 et 7, e = 105  $\mu$ m. – 32. Urosternite 1, e = 211  $\mu$ m. – 33. Détail de l'organe subcoxal latéral gauche et de l'organe glandulaire médian, les tirets représentent les glandes cuticulaires, e = 84  $\mu$ m. – 34. Urosternite 6, e = 211  $\mu$ m.

## THORAX

*Pronotum*: les 5+5  $M$  typiques,  $M_3$  et  $M_4$  les plus longs; les  $M_1$  sont tombés, mais en tenant compte de la taille de leurs embases et de leur écartement on peut admettre que  $e$  est au moins égal à 2.

*Mésnotum*: Préscutum: 1+1  $M$  assez longs et 2+2 soies assez courtes. Scutum: 6+6  $M$  dont les 5+5  $M$  typiques et 1+1  $M$  supplémentaires situés au même niveau que les  $M_2$ , mais latéraux, insérés au-dessus des  $M_3$ ; 6-8+6-8 soies assez longues ou courtes.

*Métanotum*: comparable au mésnotum, mais sans la paire de  $M$  supplémentaires.

*Pattes*: assez longues, les PIII atteignant le milieu de l'urosternite 4; très pileuses; 6-8 paires de soies spiniformes, on notera que la soie spiniforme postérieure de chacune de 3 ou 4 paires distales est nettement plus forte et colorée que les autres; calcars bien développés, le postérieur le plus fort; la longueur du tarse égale un peu plus de la moitié de celle du tibia (53/100); la longueur de la griffe postérieure égale environ de 1/3 de celle du tarse, 1 fois 1/5 celle de la griffe antérieure et près de 5 fois celle de l'unguiculus.

*Tergite 1*: Préscutum: 1+1  $M$  assez longs. Scutum: 2+2  $M$ , ( $ma = M$  et  $M_5$ ), les  $M_1$  sont indifférenciés et de même taille que les autres  $sm$ , assez longs à assez courts.

*Tergite 2*: 3+3  $M$  ( $ma = M$ ,  $M_{4-5}$ ) longs; les  $M_1$  sont des  $sm$  identiques aux  $m_2$  et  $m_3$ , les seuls décelables, assez longs.

*Tergite 3*: 6+6  $M$  ( $ma = M$ ,  $M_{1-5}$ ) longs;  $msa$  assez courts.

*Tergites 4 et 5*: 6+6  $M$  ( $ma = M$ ,  $M_{2-5}$ ,  $m_1 = M$ ); les  $m_2$  sont au moins aussi longs que  $M_2$  ou  $M_3$ , mais indifférenciés; les  $msa$  sont présents et assez courts.

*Tergite 6*: 5+5  $M$  ( $M_{2-5}$ ,  $m_1 = M$ ); les  $msa$  indiscernables.

*Tergite 7*: 4+4  $M$  ( $M_{2-5}$ );  $ma$ ,  $msa$ ,  $M_1$  et  $mp$  totalement absents;  $m_1$  minuscules,  $m_2$  et  $m_3$  assez courts.

*Tergite 8*: environ 2,23 fois aussi large que long; 4+4  $M$  longs, dont 3+3 homologables aux  $M_3$ ,  $M_4$  et  $M_5$  et 1+1 latéraux postérieurs substernaux; 2+2 soies assimilables aux  $m_2$  et  $m_3$ , ces dernières longues; 2+2 soies courtes ou très courtes représentent les  $m_1$  et  $mp$ .

*Tergite 9*: à peu près 3,40 fois aussi large que long; pas de  $M$ ; 4-5 + 4-5 soies très courtes le long du bord postérieur; ce tergite comme ceux des urites 6 à 8, est criblé de minuscules soies ou sensilles.

*Tergite 10*: à bords subparallèles, 1 fois 1/4 aussi long que large; carènes bien développées, fortement colorées; 4+4  $M$  longs dont 1+1 latéraux antérieurs, 1+1 latéraux intermédiaires et 2+2 discaux subantérieurs et subpostérieurs; 2+2 longues soies carénales, subantérieures et subpostérieures; 3+3 soies latérales longues ou assez longues, subantérieures, intermédiaires et postérieures; 1+1 autres aux extrémités postérieures des carènes et 1+1 plus courtes correspondant au  $mp$ ; de nombreuses soies très courtes.

*Angles latéraux postérieurs des tergites*: nuls aux tergites 1 et 2; arrondis et saillants au tergite 3; en pointe progressivement plus saillante du tergite 4 au 8ème, nuls au 9ème.



*Acropyge*: typique, peu saillant, à angles arrondis.

*Longueurs relatives des segments 7 à 10*: 44-45-16-100.

*Sternite 1*: Préscutum: 6+5 *M* longs; 3-4+3-4 soies assez longues. Scutum: 12+12 *M* typiques,  $C_1$  apparemment absents; 2-3+4+2-3 *M* supplémentaires, dont 1+1 latéraux à hauteur des  $B_5$ , 1-2+1-2 latéraux au-dessus des  $C_3$ ; environ 10+10 soies assez longues, presque toutes le long des bords latéraux et 15+15 autres courtes ou très courtes; les soies à embase circulaire caractéristique occupent un territoire situé en arrière d'une ligne joignant  $C_3$ ,  $B_4$ ,  $B_2$ ,  $C_1$ ; elles sont assez longues et forment une rangée assez régulière en avant des organes glandulaires postérieurs du sternite. Sur tout le territoire occupé par ces soies à embase circulaire caractéristique on observe, comme chez le ♂<sub>1</sub> de *Psalidojapyx murudensis* (Silv.) au même emplacement, une multitude de minuscules glandes cuticulaires, mais plus petites, de 3 µm en moyenne.

*Organes subcoxaux latéraux*: caractéristiques du genre; très saillants, ils occupent environ le 1/4 de la largeur interstylière. Les soies à très grande embase circulaire caractéristique du genre sont au nombre de 2, l'une latérale externe, l'autre insérée au-dessus de la vésicule exsertile, elles sont égales et à peine plus longues que le  $st_1$  (1,05-1,08); chaque organe compte environ 60 soies glandulaires réparties en 2 groupes, interne et externe, où elles sont quadrisériées, réunis par un pont composé de soies bisériées, elles sont courtes,  $SG/st_1 = 0,22$ , à sommet obtus, semblables à celles que j'ai décrites chez *Kinabalu japyx* Pgs et *Pauperojapyx* Pgs, dont elles présentent aussi le même canal glandulaire et réservoir; 2 soies sensorielles courtes,  $SS/st_1 = 0,33$ ;  $SG/SS = 0,67$ .

*Organe glandulaire médian*: très saillant, occupant environ le quart de la largeur interstylière, à opercule en demi-cercle bien net sur lequel s'observent 22 minuscules sensilles sétiformes (= "pseudopori" de Silvestri), dont 2+2 près de la ligne d'articulation de l'opercule, les 18 autres sur 2-3 rangées transversales près du bord de l'opercule.

*Sternites 2 à 7*: 18+18 *M* typiques longs;  $C_4$ ,  $C_6$  différenciés en *M*, les autres *C* de rang pair et les  $B_4$  indifférenciés; un *M* supplémentaire peut s'observer entre  $B_2$  et  $B_3$ ; d'assez nombreuses soies courtes disposées plus ou moins par paire et dont une vingtaine forment une rangée continue le long du bord postérieur du sternite.

*Sternite 8*: 7+7 *M* répartis en 3 rangées longitudinales de 2, 2 et 3 *M* en partant de l'extérieur vers la ligne médiane; le *M* intermédiaire de la rangée interne est nettement moins développé que les autres qui sont longs; on note aussi que les 3 *M* de cette rangée sont parfaitement alignés alors que typiquement le *M* intermédiaire est plus ou moins décalé vers l'extérieur.

*Paratergites 8*: 1 *M* long près de l'angle postérieur et 5-6 soies courtes ou très courtes.

*Sternopleurites 9*: se raccordant par une large courbe régulière; 1 *M* postérieur assez long et quelques soies insérées le long du bord libre, assez longues à courtes.

*Vésicules exsertiles*: typiques aux urites 1 à 7.

*Styles*: assez élancés, peu aigus, à cône secondaire petit, obtus, pore énigmatique parfaitement différencié;  $s_1/st_1 = 0,31$ ;  $s_1/s_7 = 0,72$ ;  $st_1/st_7 = 0,78$ ;  $s_1/st_7 = 0,26$ .

*Papille génitale* ♂: typique; restée invaginée sous le sternite 8 je n'ai pu l'étudier correctement; elle est beaucoup plus pileuse que celle que j'ai représentée chez *Burmjapyx inferus* (Carpenter) (Pagés, 1977), en particulier les aires antérieure et postérieure au gonopore; les soies sans embase bordant la lèvre antérieure du gonopore sont bisériées, tout au moins vers les angles latéraux de l'orifice génital; appendices génitaux bien développés, coniques, près de 2 fois aussi longs que larges à la base, très pileux.

*Papille génitale* ♀: inconnue.

*Fossettes glandulaires sternales des* ♂ : inexistantes.

#### CERQUES

Aussi longs que la partie normalement découverte du tergite 10, assez élancés,  $L/l = 2,44$ ; par rapport à la largeur à la base, celle au niveau de la dent est égale à 1 au cerque droit et aux 3/4 au gauche; nettement arqués et à apex aigu.

*Cerque droit*: à dent en triangle isocèle, obtuse, nettement prémédiane,  $r_d = 0,58$ ; marge prédentale rectiligne avec 2 tubercules, le proximal très peu saillant, le second arrondi; marge postdentale montrant à la suite de la dent 2-3 ondulations peu marquées, le reste de la marge intègre.

*Cerque gauche*: à dent en triangle isocèle obtus, nettement distale,  $r_g = 1,38$ ; marge prédentale concave avec 7/8 tubercules arrondis; les 5 premiers supérieurs ont leurs bases pratiquement contiguës, les 2 autres sont largement séparés; les 4ème et 8ème inférieurs sont très petits et aigus.

*Chétotaxie*: typique; le phanère latéral antérieur de chacun des cerques étant tombé il ne m'a pas été possible d'examiner correctement l'embase pour savoir s'il s'agissait d'un *M* ou non.

#### DESCRIPTION DU ST.III B

Le st.III B présente un certain nombre de caractéristiques qui me paraissent très importantes à décrire pour mieux appréhender la variabilité des espèces de *Burmjapyx*.

#### TÊTE

*Vertex*: chétotaxie très simplifiée, de nombreux grands phanères sont absents, mais la série A est complète.

*Antennes*: de 32 articles; *a* proximale,  $p = 0,50$ , valeur très voisine de celle des adultes; aires pileuses sur les articles 15-19; 6 sensilles placoides.

*Pièces buccales*: identiques à celles des adultes; palpes labiaux 2,6 fois aussi longs que large à la base, les soies subapicales sont en moyenne 1,25 fois aussi longues que le palpe qui les porte.

#### THORAX

*Pronotum*: les 5+5 *M* typiques; les  $M_1$  sont aussi longs que l'écartement de leurs embases.

*Méso- et métanotum*: présutum et scutum typiques.

*Pattes*: les PIII atteignent à peine le sternite 3; elles sont moins pileuses que chez les adultes, mais tout les phanères principaux sont présents y compris les soies spiniformes des tarse; la longueur du tarse égale les trois quarts de celle du tibia.

#### ABDOMEN

*Tergites 1 et 2*: identiques à ceux des adultes.

*Tergites 3 à 7*: identiques à ceux des adultes; on note cependant que seul le  $ma = M$  droit existe au tergite 5 et que le tergite 6, normalement sans  $ma = M$ , présente aussi ce  $M$  à droite.

*Tergites 8 et 9*: identiques à ceux des adultes.

*Tergite 10*: à bords subparallèles, 1,28 fois aussi long que large; sans carène; 4+4  $M$  identiques à ceux des adultes; peu de soies très courtes.

*Angles latéraux postérieurs des tergites*: nuls aux tergites 1 à 5; en lobes arrondis dirigés vers l'arrière aux tergites 6 à 9.

*Acropyge*: typique, très peu saillant.

*Longueurs relatives des segments 7 à 10*: 41-44-19-100.

*Sternite 1*: Préscutum: 4+4  $M$  longs et 3+3 soies assez longues. Scutum: les 13+13  $M$  typiques, pas de  $M$  supplémentaires; toutes les soies à embase circulaire caractéristique sont localisées en arrière des  $C$ , elles forment une rangée assez régulière en avant des organes glandulaires postérieurs; un petit nombre de minuscules glandes cuticulaires en arrière des  $C$ .

*Organes subcoxaux latéraux*: caractéristiques du genre; très saillants ils occupent à peine le 1/5 de la largeur interstylière; 2 soies à très grande embase circulaire d'égale longueur, mesurant 1 fois 1/3 la longueur du  $st_1$ ; 3 soies glandulaires, typiques du genre;  $SG/st_1 = 0,5-0,6$ ; 2 soies sensorielles très courtes,  $SS/st_1 = 0,15$ ;  $SG/SS = 3,6$ .

*Organe glandulaire médian*: typique du genre, occupant un peu plus du cinquième de la largeur interstylière; 8 minuscules sensilles sétiformes disposées sur 2 rangées longitudinales.

*Sternites 2 à 7*: 14+14  $M$  typiques,  $A_6$ ,  $B_4$  et les  $C$  de rangs pairs (sauf  $C_6$ ) indifférenciés.

*Sternite 8*: 7+7  $M$  répartis en 3 rangées comme chez les adultes.

*Paratergites 8*: identiques à ceux des adultes.

*Sternopleurites 9*: se raccordant par une large courbe régulière; pas de  $M$ ; 3-4 soies courtes ou très courtes.

*Vésicules exsertiles*: typiques.

*Styles*: peu allongées, à apex arrondi; cône secondaire et pore énigmatique peu différenciés;  $s_1/st_7 = 0,42$ ;  $st_1/st_7 = 0,90$ ;  $s_1/st_7 = 0,38$ ;  $s_1/s_7 = 0,83$ .

#### CERQUES

Un peu plus longs que la partie normalement découverte du tergite 10,  $L_{cq}/10_{dec} = 1,14$  (v. ex. = 1,12-1,6); assez élancés,  $L/l = 2,50$ ; la largeur au niveau de la dent par rapport à celle à la base égale 0,89 au cerque droit et 0,68 au gauche; peu arqués, à apex peu aigu.

*Cerque droit*: à dent triangulaire très saillante à sommet obtus, prémédiane,  $r_d = 0,72$ ; marge prédentale rectiligne avec 2 forts tubercules arrondis; marge postdentale concave avec 1 seul denticule triangulaire sur son tiers proximal.

*Cerque gauche*: à forte dent triangulaire isocèle, à sommet assez aigu, post-médiane,  $r_g = 1,43$ ; marge prédentale avec 1/3 forts tubercules triangulaires, les inférieurs largement espacés; marge postdentale ne montrant que 2 ondulations sur sa moitié proximale, le reste de la marge intègre.

*Chétotaxie*: typique; le *M* latéral antérieur présent.

#### AFFINITÉS

Cette espèce appartient au même groupe que *paronae* Silv.; elle est bien caractérisée par la chétotaxie des urotergites et les organes subcoxaux.

#### DERIVATIO NOMINIS

Le Dr. C. Lienhard collabore depuis 1983 aux missions de recherche et de récolte d'Arthropodes en Asie du Sud-Est. Spécialiste mondialement reconnu des Psocoptères il a mis au point une technique de montage en préparation dont il a eu la gentillesse de me faire profiter, ce qui m'a été d'une aide fondamentale dans l'étude de certains Diploures délicats. C'est pour l'en remercier que je lui dédie cette espèce.

#### *Burmjapyx murphyi* sp. n.

Figs 35-43, 45

*Matériel étudié*: Bru-88/67: SINGAPOUR: Botanic Gardens, prélèvement de sol dans les angles formés par les contreforts d'un très grand arbre, au fond de la partie "Jungle", env. 20 m; 5.XII.1988; leg. B. Hauser; extraction par Berlese; 1 ♂ de 10,30 mm (holotype). 1 ♂ de 9,50 mm (paratype).

#### TÊTE

*Vertex*: on notera l'absence de plusieurs grands phanères et le faible développement de certains autres, en particulier ceux de la série L; de nombreuses soies assez courtes ou courtes et une multitude de minuscules sensilles criblent, mais en plus faible densité que chez *B. lienhardi* sp. n., la surface du vertex.

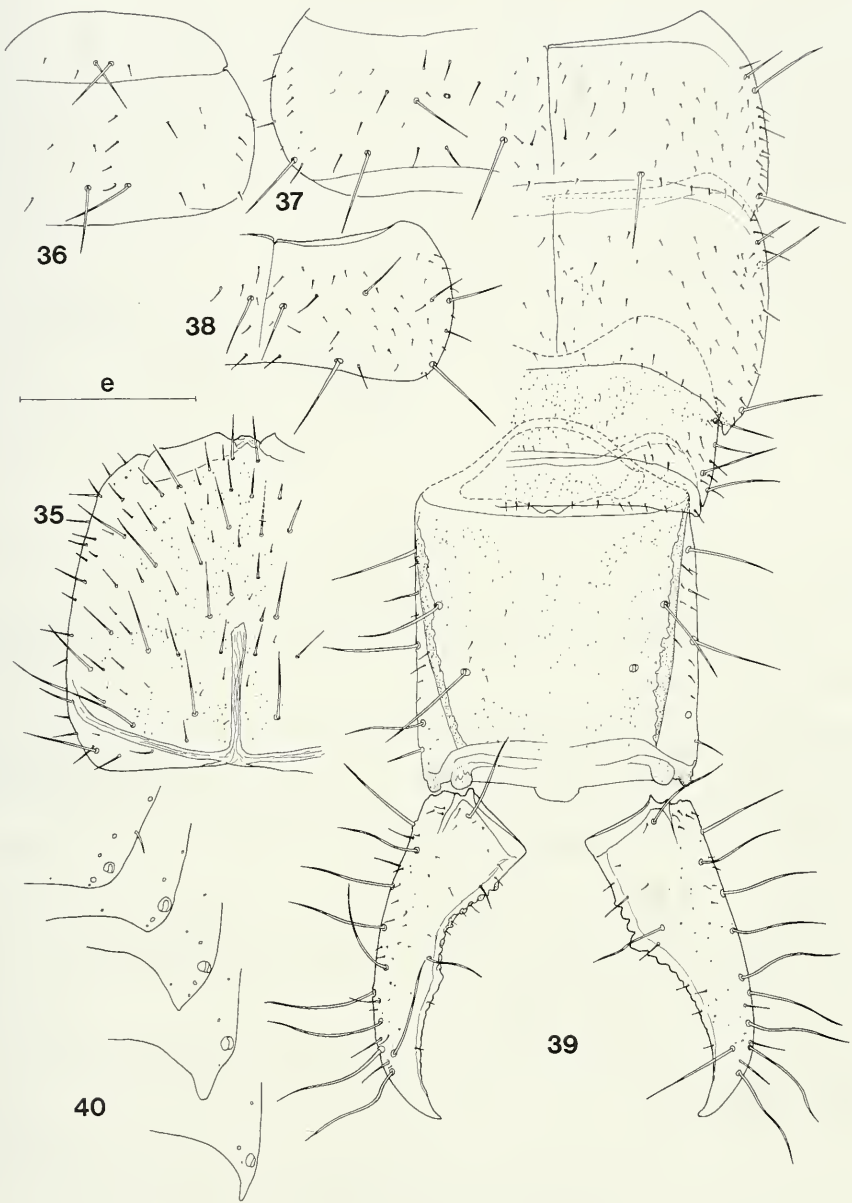
*Antennes*: de 32 articles à chétotaxie typique; aires pileuses sur les articles 12 à 18; les 13 trichobothries typiques, *a* proximale,  $p = 0,52$ ; 6 sensilles placoides sur l'article apical.

*Pièce buccales*: typiques de la famille; les 5 lames du lobe interne des maxilles pectinées; palpes labiaux 2,6 fois aussi longs que larges à la base, les soies subapicales sont en moyenne égales à 1,3 fois la longueur du palpe qui les porte.

#### THORAX

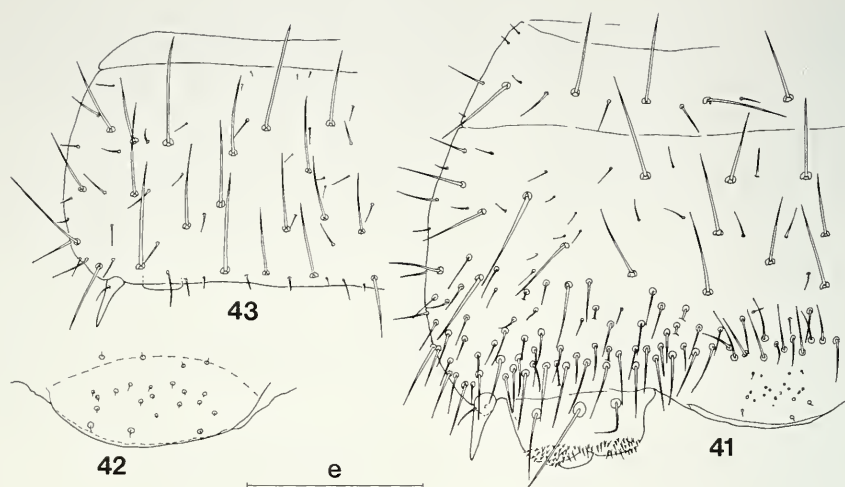
*Pronotum*: les 5+5 *M* typiques,  $M_3$  les plus longs; la longueur des  $M_1$  égale 1,8 fois l'écartement de leurs embases; 4+4 soies assez longues et 5-6+5-6 autres assez courtes ou courtes.

*Mésonotum*: Préscutum: 1+1 *M* assez longs; 2-3+2-3 soies très courtes et une douzaine de minuscules sensilles sétiformes. Scutum: les 5+5 *M* typiques,  $M_3$  les plus longs,  $M_5$  les plus courts; 4-5+4-5 soies assez longues ou assez courtes.



FIGS 35-40

*Burmjapyx murphyi* sp. n., ♂ holotype. – 35. Vertex, e = 515  $\mu$ m. – 36. Tergite 1, e = 632  $\mu$ m. – 37. Tergite 2, e = 632  $\mu$ m. – 38. Tergite 3, e = 632  $\mu$ m. – 39. Tergites 6 à 10 et les cerques, e = 632  $\mu$ m. – 40. Angles latéraux postérieurs droits des tergites 4 à 8, e = 316  $\mu$ m.



Figs 41-43

*Burnjapyx murphyi* sp. n., ♂ paratype. – 41. Urosternite 1, e = 253  $\mu$ m. – 42. ♂ holotype, organe glandulaire médian, e = 158  $\mu$ m. – 43. ♂ paratype, urosternite 3, e = 355  $\mu$ m.

*Métanotum*: identique au mésonotum, sauf qu'il n'y a que 2+2 soies courtes et quelques soies très courtes.

*Pattes*: assez longues, PIII atteignant le milieu de l'urosternite 4; chétotaxie très fournie, semblable à celle de *lienhardi* en ce qui concerne les calcars et les soies spiniformes; la longueur du tarse est égale à 1,75 fois celle du tibia; la longueur de la griffe postérieure égale environ les 2/5 de celle du tarse, 1,29 fois celle de la griffe antérieure et plus de 6 fois celle de l'unguiculus.

#### ABDOMEN

*Tergite 1*: Présutum: 1+1  $M$  longs; 1+1 soies très courtes de part et d'autre des  $M$ . Scutum: 1+1  $M$  ( $M_5$ ) un peu plus longs que ceux du présutum;  $M_1 = sm$  courts; environ 6+6 soies courtes ou très courtes.

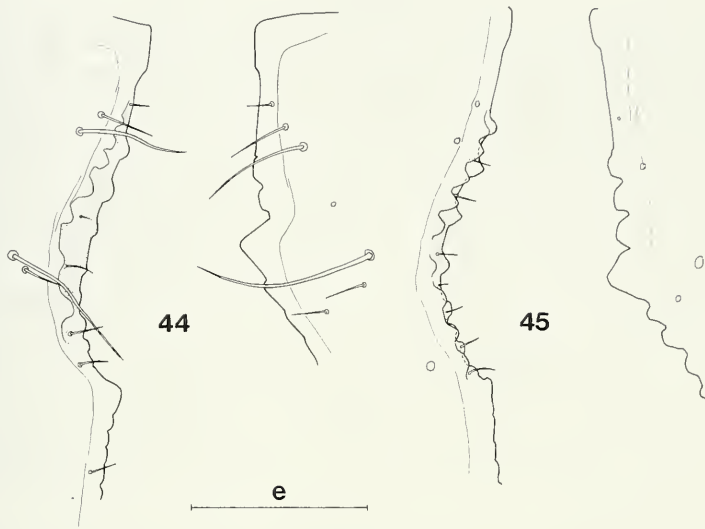
*Tergite 2*: 3+3  $M$  longs ( $ma = M, M_{4-5}$ ),  $M_5$  les plus longs;  $msa$  assez courts,  $m_1, m_2, m_3$  et  $mp$  assez courts ou courts; une dizaine de soies très courtes sur chaque moitié du tergite.

*Tergite 3*: 6+6  $M$  ( $ma = M, M_{1-5}$ ).  $M_2$  assez courts;  $msa, m_2, m_3$  et  $mp$  courts,  $m_1$  indiscernables de la vingtaine de soies très courtes recouvrant chaque demi-tergite.

*Tergites 4 à 6*: 4+4  $M$  ( $M_1$  nuls),  $M_2$  assez longs, les autres longs;  $msa, m_1$  et  $m_2$  courts. à peine plus développés que les très nombreuses soies très courtes.

*Tergite 7*: 3+3  $M$  ( $M_2, M_3, M_4$ ), l'absence de  $M_5$  est peu courante chez les Japygides;  $m_1$  et  $m_2$  seuls  $sm$  reconnaissables; de très nombreuses soies très courtes.

*Tergite 8*: environ 2,40 fois aussi large que long; 3+3  $M$  longs homologables à  $M_3, M_4$  et  $m_3 = M$ ;  $m_2$ , les seuls  $sm$  reconnaissables, assez courts; de nombreuses soies très courtes et une multitude de minuscules sensilles.



Figs 44-45

*Burmjapyx lienhardi* sp. n., ♂ holotype. – 44. Détails des marges internes des cerques, e = 253  $\mu$ m. – *Burmjapyx murphyi* sp. n., ♂ holotype. – 45. Détails des marges internes des cerques, e = 253  $\mu$ m.

*Tergite 9*: à peu près 5 fois  $3/4$  aussi large que long; pas de *M*; une rangée d'une vingtaine de soies très courtes le long du bord postérieur; de nombreuses sensilles minuscules.

*Tergite 10*: à côtés subparallèles, 1 fois  $1/3$  aussi long que large; carènes très développées, fortement colorées; 4+4 *M* dont 1+1 latéraux antérieurs, 1+1 latéraux intermédiaires et 2+2 discaux, subantérieurs et subpostérieurs; 1+1 soies latérales postérieures assez longues; 1+1 soies sublatérales subantérieures et 1+1 latérales sublatérales postérieures courtes; d'assez nombreuses soies très courtes dont 2 (subantérieure et intermédiaire) sur chacune des carènes; les très nombreuses minuscules sensilles habituelles.

*Angles latéraux postérieurs des tergites*: nuls aux tergites 1 à 3; peu saillants et arrondis au tergite 4; obtus, dirigés vers l'arrière au tergite 5; très saillants, aigus au tergite 6, en pointe arrondie assez longue au 7ème, en pointe très étroite au 8ème, droits au 9ème.

*Acropyge*: typique, saillant, à angles arrondis.

*Longueurs relatives des segments 7 à 10*: 45-36-15-100.

*Sternite 1*: Préscutum: 4-5+4-5 *M* longs; 4+1+4 soies courtes. Scutum: 12+12 *M*, *C*<sub>2</sub> apparemment nuls chez le ♂ de 9, 50 mm; un *M* supplémentaire peut être présent entre *A*<sub>3</sub> et *B*<sub>3</sub>; les soies à embase circulaire caractéristique occupent un territoire situé en arrière d'une ligne joignant *B*<sub>5</sub>, *B*<sub>2</sub> et *C*<sub>1</sub>; elles sont plus ou moins nettement bisériées en avant des organes subcoxaux latéraux; sur l'aire située en

arrière de la série des *B*, occupée par les soies à embase circulaire caractéristique, on observe de très nombreuses glandes cuticulaires comme chez *lienhardi*.

*Organes subcoxaux latéraux*: très saillants; ils occupent environ le quart de la largeur interstylière. Les soies à très large embase sont au nombre de 3 par organe, sauf chez le ♂ de 9,5 mm chez lequel il n'y en a que 2 à droite, correspondant aux soies externe et médiane normales; leur taille par rapport au  $st_1$  est très variable et ne semble pas être un caractère spécifique très important; chez le ♂ de 10, 30 mm la soie externe égale 1,70 fois la longueur du  $st_1$  à gauche et 1,46 à droite, la soie médiane égale à gauche 1,45 fois et à droite 1,32 fois celle du  $st_1$ , quant à l'interne elle en égale 0,83 à gauche et à droite; chez le ♂ de 9,5 mm, à l'organe droit, la soie externe égale 0,83, la médiane 1,29 et l'interne 0,56 fois celle du  $st_1$ , à l'organe gauche l'externe égale 1,66 et l'interne 1,39 fois la longueur du  $st_1$ ; environ 70 soies glandulaires par organe réparties en 2 groupes, où elles sont tri- ou quadrisériées, reliés par un pont de 4-5 soies uni- ou bisériées; en moyenne  $SG/st_1 = 0,22$  (v. ex. = 0,18-0,25); 6 soies sensorielles par organe,  $SS/st_1 = 0,28$  (v. ex. = 0,26-0,30);  $SG/SS = 0,82$  en moyenne.

*Organe glandulaire médian*: saillant, occupant environ le tiers de la largeur interstylière, à opercule net sur lequel on observe 22 à 23 minuscules sensilles sétiformes dont les 2+2 plus antérieures sont légèrement plus longues que les autres.

*Sternites 2 à 7*: 19+19 *M* typiques longs,  $B_4$ ,  $C_5$ ,  $C_8$ ,  $C_{10}$  généralement indifférenciés assez courts ou courts; 2 *M* supplémentaires médians, le plus constant étant inséré entre les  $B_1$ , 1 autre *M* supplémentaire entre  $B_1$  et  $B_3$ ; une vingtaine de soies courtes ou très courtes sur chaque moitié du sternite.

*Sternite 8*: 7+7 *M* répartis en 3 rangées longitudinales de 2, 2 et 3 *M* en partant de l'extérieur vers la ligne médiane; dans la rangée de 3 *M*, le médian est moins long que les autres et décalé vers l'extérieur par rapport aux 2 autres.

*Paratergites 8*: 1 *M* long subpostérieur et 5-6 soies courtes ou très courtes dont la plus postérieure est la plus développée.

*Sternopleurites 9*: se raccordant par une large courbe régulière; 1 *M* long postérieur sublatéral et quelques soies courtes ou très courtes le long du bord libre.

*Vésicules exsériles*: typiques aux urites 1 à 7.

*Styles*: assez élancés, peu aigus, à cône secondaire peu développé à apex aigu, pore énigmatique peu différencié, petit;  $s_1/st_1 = 0,40$ ;  $s_1/s_7 = 0,89$ ;  $st_1/st_7 = 0,84$  (v. ex. = 0,81-0,87);  $s_1/st_7 = 0,33$ .

Papille génitale ♂: restée invaginée sous le sternite 8 elle paraît identique au point de vue de la chétotaxie à celle de *lienhardi*; les soies sans embase bordant le bord antérieur du gonopore n'ont pu être observées; appendices génitaux coniques, près de 2,5 fois aussi longs que larges à la base, très pileux.

Papille génitale ♀: inconnue.

*Fossettes glandulaires sternales des ♂*: inexistantes.

## CERQUES

Pratiquement aussi longs que la partie normalement découverte du tergite 10; assez élancés, environ 2,5 fois aussi longs que larges à la base; par rapport à la largeur



TABLEAU I

Chétotaxie des tergites 3 à 7 des *Burmjapyx* connus (sous toutes réserves pour *paronae* et *oudemansi*)

		MA	MSA	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	M <sub>4</sub>	M <sub>5</sub>	m <sub>1</sub> = M	m <sub>2</sub> = M
<i>inferus</i>	Tg 3	X		X	X	X	X	X	X	
	Tg 4	X		X	X	X	X	X	X	
	Tg 5	X		X	X	X	X	X	X	
	Tg 6	X			X	X	X	X	X	
	Tg 7				X	X	X	X	X	
<i>lienhardi</i>	Tg 3	X		X	X	X	X	X		
	Tg 4	X			X	X	X	X	X	
	Tg 5	X			X	X	X	X	X	
	Tg 6				X	X	X	X	X	
	Tg 7				X	X	X	X		
<i>murphyi</i>	Tg 3	X		X	X	X	X	X		
	Tg 4				X	X	X	X		
	Tg 5				X	X	X	X		
	Tg 6				X	X	X	X		
	Tg 7				X	X	X			
<i>megurus</i>	Tg 3		X		X	X	X	X	X	
	Tg 4		X		X	X	X	X	X	
	Tg 5		X		X	X	X	X	X	
	Tg 6				X	X	X		X	
	Tg 7				X					
<i>paronae</i>	Tg 3						X			X
	Tg 4						X	X		X
	Tg 5				X		X	X		X
	Tg 6				X		X	X		
	Tg 7				X		X	X		
<i>oudemansi</i>	Tg 3						X		X	X
	Tg 4						X			X
	Tg 5						X			X
	Tg 6						X			X
	Tg 7						X			X

à la base, celle au niveau de la dent est égale à 0,95 au cerque droit et aux 2/3 au gauche; relativement peu arqués, à apex aigu.

*Cerque droit*: à dent en triangle isocèle, à sommet mousse, prémédiane,  $r_d = 0,63$ ; marge prédentale rectiligne avec 3 tubercules saillants arrondis sans intervalles entre-eux; marge postdentale pourvue de denticules arrondis, les 2-3 premiers les plus développés, les suivants décroissant graduellement de taille.

*Cerque gauche*: à dent peu saillante, à sommet dirigé vers la base du cerque, distale,  $r_g = 1,16$ ; marge prédentale concave avec 9/8 tubercules régulièrement espacés chez l'holotype, 8/11 chez le paratype; chez les 2 ♂ les 3-5 tubercules les plus proximaux de chaque rangée ont tendance à être aigus, les autres arrondis; marge postdentale subintègre présentant de faibles ondulations peu élevées.

*Chétotaxie*: typique; 1 *M* latéral antérieur long.

#### AFFINITÉS

Cette espèce appartient au groupe *paronae*, mais se rapproche de *B. inferus* dont elle se distingue par la présence de 3 tubercules au lieu de 2, la chétotaxie des tergites abdominaux et les organes subcoxaux latéraux.

#### DERIVATIO NOMINIS

Je dédie avec plaisir cette espèce au Prof. Dr. D.H. Murphy de la National University de Singapour, pionnier de l'étude des Microarthropodes du sol à Singapour dont il a offert d'intéressants échantillons au Muséum de Genève. Une raison supplémentaire est qu'il cite le genre *Burmjapyx* dans son ouvrage (Murphy, 1973) sur la Vie animale des forêts à Singapour.

#### III.— *Pauperojapyx (Paucijapyx) kajan* Pagés

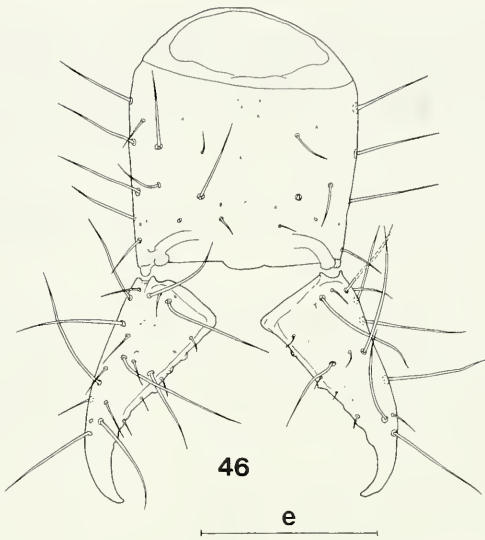
Fig. 46

*Matériel étudié*: Sar-87/86: MALAISIE: SARAWAK: route Kuching-Serian, près du Kampong Kuap (à 18 km de Kuching), forêt secondaire, prélèvement de sol dans les angles formés par les contreforts d'un grand arbre. 30 m: 13.XII.1987; leg. B. Hauser; extraction par Berlese (1 st.III B de 2,6 mm, 1 ♀ de 3,68 mm, 3 ♂ de 3,32 mm, 3,92 mm et 4,60 mm). Bru-88/41: BRUNEI (Belaït 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" (= *Kompassia malaccensis* Maing. & Benth. (Fabaceae)), 20 m; 25.XI.1988; leg. B. Hauser; extraction par Berlese (1 st.III B de 1,84 mm, 1 ♀ de 3,04 mm, 3 ♂ de 3,28 mm, 3,56 mm et 3,60 mm).

Ces exemplaires correspondent parfaitement à la description originale de l'espèce connue d'une seule station du Sarawak.

Les st.III B possèdent déjà la chétotaxie abdominale typique des adultes, seul le nombre de soies courtes ou très courtes est réduit.

Les organes subcoxaux montrent 1-2 soies glandulaires et 2-3 soies sensorielles. Les cerques, aussi longs ou à peine plus longs que la partie normalement découverte du tergite 10 sont élancés,  $L/I = 2,98-3,00$ , leurs marges internes montrent une faible dent triangulaire proximale,  $r_d = r_g = 0,80$  en moyenne, précédée de 1-2 minuscules tubercules et suivie de 3 faibles ondulations.



FIGS 46

*Pauperojapyx (Paucijapyx) kajan* Pgs, st.III B de Sar-87/86. – 46. Tergite 10 et les cerques, e = 126  $\mu$ m.

Chez les ♀, en particulier chez celle de 3,68 mm, on note que les *sm* des tergites sont sensiblement plus longs que chez les individus déjà connus; l'armature des marges prédentales des cerques est plus variable, en effet, si celle de la ♀ de 3,68  $\mu$ m est identique à celle de la ♀ paratypique, celle de la ♀ de 3,04 mm présente au cerque droit 2 tubercules arrondis, peu saillants, très rapprochés l'un de l'autre et 2 tubercules largement espacés, le proximal beaucoup plus développé, au cerque gauche.

Les ♂ conformes à la description originale; on notera cependant que le ♂ de 4,6 mm est pourvu de 9 soies glandulaires, et celui de 3,56 mm de 8 de ces soies à chaque organe subcoxal, alors que l'holotype (4,5 mm) n'en possède que 6 ou 7; 3 soies sensorielles comme chez le type; aux cerques les marges prédentales montrent 1-2 tubercules, le ♂ de 3,56 mm en possède 3 rapprochés.

#### REMERCIEMENTS

Je tiens à remercier Mlle F. Marteau qui a reporté avec précision mes dessins sur calque et à Mme I. Juriens-Cottet qui a dû établir les frappes de mon manuscrit.

#### BIBLIOGRAPHIE

- CHOU, I. & CHEN, T. 1983. Studo de Japigedoj (V) (Dipluroj: Japigedoj). *Entomotaxonomia* 5: 327-341.
- MURPHY, D. H. 1973. Animals in the Forest Ecosystem, pp. 53-73. In: S. H. CHUANG (ed.). *Animal Life and Nature in Singapore*. Singapore University Press, 302 pp.

- PACLT, J. 1957. Diplura. *Genera Insectorum* 212: 123 pp.
- PAGÉS, J. 1952. Japygidae (Insecta, Diplura) du Congo Belge. (Première note). *Revue de Zoologie et de Botanique africaines* 46: 345-372.
- PAGÉS, J. 1954. Japyginae (Japygidae, Insecta Diplura) de la Yougoslavie et des régions limitrophes. *Glasnik Prirodnja Ckog Muzeja Srpske Zemlje* (= *Bulletin du Muséum d'Histoire naturelle du Pays Serbe*) 5-6: 235-264.
- PAGÉS, J. 1955. Biospeologica LXXV. Mission Henri Coiffait au Liban (1951). 5. Diploures Japygides. *Archives de Zoologie expérimentale et générale* 91: 413-421.
- PAGÉS, J. 1961. Japygidae (Insecta, Diplura) de l'Afghanistan II. (Contribution à l'étude de la faune de l'Afghanistan. 58.). *Comptes Rendus du 86<sup>e</sup> Congrès des Sociétés savantes, Montpellier*, 1961: 735-750.
- PAGÉS, J. 1967. Données sur la biologie de *Dipljaxyx humberti* (Grassi). *Revue d'Ecologie et de Biologie du Sol* 4: 187-281.
- PAGÉS, J. 1977. *Dicellurata Genavensia* III. Japygides du Sud-Est asiatique. N°1. *Revue suisse de Zoologie* 84: 687-698.
- PAGÉS, J. 1984. *Dicellurata Genavensia* XIII. Japygides du Sud-Est asiatique. N°4. *Revue suisse de Zoologie* 91: 425-436.
- PAGÉS, J. 1994. Japygides du Sud-Est asiatique n°6: Malaysia (Sabah). *Dicellurata Genavensia* XIX. *Revue suisse de Zoologie* 100: 413-434.
- PAGÉS, J. & SCHOWING, J. 1958. Diploures Japygides du Kivu et de l'Urundi (Congo belge). *Revue de Zoologie et de Botanique africaines* 57: 193-240.
- PARONA, C. 1892. Di alcuni Tisanuri e Collembola delle Birmania, raccolti da Leonardo Fea. *Atti della Società Italiana di Scienza naturali* 34: 123-135.
- SILVESTRI, F. 1930. Contributions to a knowledge of the Indo-Malayan Japygidae (Thysanura). *Records of the Indian Museum* 32: 439-489.
- SILVESTRI, F. 1948. Contributo alla conoscenza degli Japygidae (Insecta Diplura). *Rendiconti. Società Italiana delle Scienze della Accademia dei Quaranta* (ser. III) 27: 3-115.
- SMITH, L. M. 1962. Japygidae of South America. 3: Japygidae of Chile. *Proceedings of the Biological Society of Washington* 75: 273-292.
- SMITH, L. M. & GONZALEZ, R. H. 1964. Japygidae of South America 4: The Genus *Austrjapyx* and descriptions of new species. *Annals of the Entomological Society of America* 57: 159-164.

## Notes sur les Psélaphines néotropicaux (Coleoptera, Staphylinidae, Pselaphinae) – 11. Un nouveau genre et sept espèces nouvelles de la tribu des Metopiasini

André COMELLINI

Muséum d'histoire naturelle, case postale 6434, CH-1211 Genève 6, Suisse.

**Notes on Neotropical Pselaphines (Coleoptera, Staphylinidae, Pselaphinae) 11. A new genus and seven new species of the tribe Metopiasini.** - The genus *Metopiasoides* is described to accommodate nine species, all described and/or redescribed: *Metopiasoides brasiliensis* sp. n., *M. elongatus* (Schaufuss) from Brasil, *M. carinipes* (Raffray) from Bolivia, *M. costaricensis* sp. n., *M. weneri* sp. n. from Costa-Rica, *M. decoratus* sp. n., *M. grandior* sp. n., *M. minusculus* sp. n. from Panama and *M. pecki* sp. n. from Ecuador. A lectotype is designated for *M. carinipes* (Raffray).

**Key-words:** Coleoptera - Staphylinidae - Pselaphinae - Metopiasini - taxonomy - Neotropics.

### INTRODUCTION

La tribu des Metopiasini est constituée actuellement de huit genres, y compris ce nouveau, répartis dans la région néotropicale. Elle est caractérisée par la forme de la tête et par les antennes coudées, avec un scape particulièrement long (Sharp, 1887; Raffray, 1908; Park, 1942). Les espèces décrites ou redécrites ci-après forment un groupe homogène; elles sont réunies dans un genre nouveau.

Les dessins des mêmes structures sont à la même échelle. Les abréviations suivantes ont été utilisées: CNCI = Canadian National Collection of Insects, Ottawa; DENH = University of New Hampshire Insect Collection, Durham; FMNH = Field Museum of Natural History, Chicago; MNHN = Muséum National d'Histoire Naturelle, Paris; MHNG = Muséum d'histoire naturelle, Genève.

### SYSTÉMATIQUE

*Metopiasoides* gen. n.

Espèce type: *Metopiasoides weneri* sp. n.

Ce genre est reconnaissable en premier lieu à ses antennes (fig. 1). L'article 3 de celles-ci est très grand et les articles 2 et 4, bien plus courts, sont à peu près de même longueur; de plus, tous ces articles sont de même largeur. Les trois premiers segments abdominaux apparents ont de larges rebords latéraux soulignés, à l'ex-

térieur, d'une petite carène assombrie. La pilosité est longue, fine, claire et légèrement courbe. Le tégument est lisse et brillant. Les tibias des pattes antérieures possèdent, sur leur face avant, une longue carène longitudinale sombre très en relief; celle-ci est située dans la partie supérieure concave de la patte. Les sternites 5, 6 et 7 forment chez les ♂ une structure caractéristique très différente pour chaque espèce.

Ce nouveau genre est proche de *Metopias* Gory, 1832 (cf. Comellini, 1993: 921-927). Il en diffère surtout par la base des fémurs grêle, très nettement pédonculée (chez *Metopias*, fémurs élargis dès la base, non pédonculés), par les fossettes du vertex plus ou moins rapprochées, réunies dans une dépression commune ou reliées par un sillon transversal (largement séparées, reliées par un sillon transversal en arrière duquel se trouve une bosse arrondie assez grande) et par la moitié antérieure de l'abdomen subparallèle, les trois premiers tergites apparents subégaux, leur base nettement déclive (abdomen relativement court chez les *Metopias*, atténué dès la base du 2<sup>ème</sup> segment apparent; 1<sup>er</sup> tergite un peu plus grand, sa base nettement déclive).

On peut distinguer deux groupes d'espèces dans ce genre *Metopiasoides*. Le premier, formé des grandes espèces (*M. brasiliensis* sp. n., *carinipes* (Raffray), *elongatus* (Schaufuss), *grandior* sp. n. et *M. pecki* sp. n.), se caractérise par les fémurs postérieurs moins longuement pédonculés (moins de la moitié de la longueur du fémur), par l'apex des tibias postérieurs peu élargi, droit, par les tarsi avec le 3<sup>ème</sup> article presque aussi long que le 2<sup>ème</sup>, par la pubescence des élytres très longue, par les fossettes du vertex bien séparées, reliées par un sillon transversal, par les yeux formés de petites ommatidies, par l'article 9 des antennes soit un peu plus long que large (*brasiliensis* sp. n., *carinipes* (Raffray) et *pecki* sp. n.), soit presque deux fois plus long que large (*elongatus* (Schaufuss), *grandior* sp. n.). Le deuxième groupe, formé des petites espèces (*costaricensis* sp. n., *decoratus* sp. n., *minusculus* sp. n. et *werneri* sp. n.), est bien caractérisé par les fémurs postérieurs très longuement pédonculés, par la partie apicale des tibias postérieurs élargie et un peu courbée, par les tarsi avec le 3<sup>ème</sup> article nettement plus court que le 2<sup>ème</sup>, par la pubescence des élytres moins longue, par les fossettes du vertex très rapprochées, réunies dans une dépression commune, par les yeux formés de grosses ommatidies, enfin par l'article 9 des antennes au moins deux fois plus long que large.

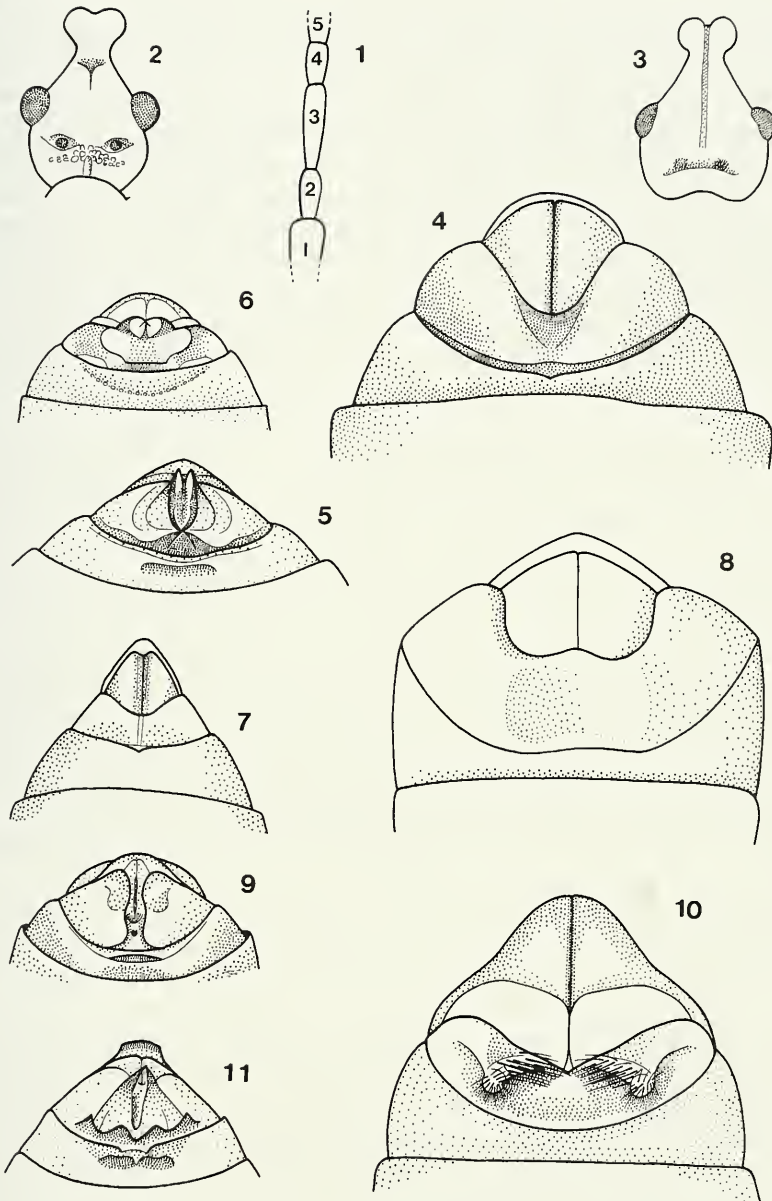
### *Metopiasoides brasiliensis* sp. n.

Figs 4, 12

Holotype ♂: Brésil, province de Sao Paulo, Station biologique Boracea (leg. J. M. et B. A. Campbell) (CNCI). Paratypes: 4 ♂, 1 ♀, même provenance (CNCI et MHNG).

Tête avec deux fossettes profondes sur le vertex impressionnant celui-ci transversalement. Un sillon longitudinal net partage le dessus de la tête de l'avant de la saillie antennaire au vertex. Yeux du ♂ gros et saillants. Tégument ponctué, un peu granuleux sur l'avant et sur les côtés de la saillie antennaire. Pilosité plus dense et plus épaisse sur les côtés de la tête.

Pronotum aussi long que large, cordiforme, avec un large sillon transversal au tiers postérieur, s'étendant sur toute la largeur, avec une fossette plus profonde au centre; une faible dépression longitudinale médiane part de l'avant du pronotum et se



FIGS 1-11

1, *Metopiasoides elongatus* (Schaufuss), antenne. Dessus de la tête: 2, *Metopiasoides carinipes* (Raffray); 3, *M. elongatus* (Schaufuss). Derniers sternites des ♂: 4, *M. brasiliensis* sp. n.; 5, *M. costaricensis* sp. n.; 6, *M. decoratus* sp. n.; 7, *M. elongatus* (Schaufuss); 8, *M. grandior* sp. n.; 9, *M. minusculus* sp. n.; 10, *M. pecki* sp. n.; 11, *M. wernerii* sp. n.

termine dans cette fossette. Tégument assez finement ponctué; une zone granuleuse transversale à l'avant et à l'apex. Pilosité comme celle de la tête, plus dense et un peu plus épaisse sur les côtés.

Elytres réunis nettement plus larges que longs. La suture des élytres est très saillante, plus en avant qu'en arrière. Deux petites fossettes basales sur chaque élytre; l'une près de la suture, dans une dépression de la base de l'élytre, l'autre plus petite à l'intérieur de la bosse humérale. Angles huméraux soulignés par une bosse allongée arrondie. Tégument finement et éparsément ponctué. Pilosité assez dense dirigée un peu obliquement vers l'arrière; cette pilosité est plus dense sur les côtés et à l'apex.

Abdomen. Chaque tergite est fortement déprimé à la base sur toute la largeur de la partie centrale. Tégument finement et régulièrement ponctué. Pilosité plus dense et plus épaisse sur les côtés et à l'apex de chaque tergite. Derniers sternites des ♂ (fig. 4).

Longueur: ♂: 3, 25 à 3, 5 mm; l'unique ♀: 3, 30 mm.

Edéage: longueur 0, 73 à 0, 89 mm. (fig. 12).

Cette espèce ressemble au *M. carinipes* par ses caractères généraux, en diffère nettement par la structure de l'édéage.

*Metopiasoides carinipes* (Raffray) comb. n.

Figs 2, 13

*Metopias carinipes* Raffray, 1904

Lectotype ♂: Bolivie, Yuracaris. L'étiquette porte comme indications: Yucaris / Germain / ex. Fauvel. Coll. Raffray (MNHN).

Tête (fig. 2) avec un léger bourrelet transversal à l'arrière, fortement granuleux; ce bourrelet est précédé de deux profondes fossettes réunies par un sillon. Yeux moyens, en cônes arrondis avec l'extrémité dirigée vers l'arrière. Tégument finement, irrégulièrement et peu densément granuleux-ponctué. Pilosité dense, recourbée vers l'avant, sur les côtés de la tête. Tégument des antennes finement et assez éparsément granuleux. Pilosité de l'antenne assez longue, dirigée vers l'avant.

Pronotum un peu plus large que long, cordiforme, partagé au tiers postérieur, sur toute sa largeur, par un profond sillon transversal. Tégument comme celui de la tête. Pilosité assez dense sur les côtés du pronotum, mais moins longue que celle de la tête.

Elytres réunis un plus larges que longs avec deux fossettes basales profondes sur chacun. Un sillon longitudinal, plus profond en avant, partant d'une fossette basale, longe la suture sur toute sa longueur; un large dépression longitudinale partant de la seconde fossette basale, située plus près de la bosse humérale que de la suture, s'efface vers le milieu de l'élytre. Angles huméraux arrondis mais très marqués. Tégument très finement, irrégulièrement et éparsément ponctué. Pilosité assez dense sur les côtés, longue comme celle de la tête.

Abdomen. Tergites avec les rebords latéraux relevés, garnis d'une longue pilosité recourbée vers l'arrière. Derniers tergites à forte pilosité dirigée vers l'apex. Tégument finement et éparsément ponctué.

Longueur de l'unique exemplaire: 2, 8 mm.

Edéage: longueur 0, 49 mm (fig. 13).



*Metopiasoides costaricensis* sp. n.

Figs 5, 14, 15

Holotype ♂: Costa-Rica, Turrialba, Catie (alt. 600 m) (Leg. J.M. et B.A. Campbell) (CNCI). Paratype: 1 ♂, réserve de Montevarde (alt. 1500 m.) Costa-Rica (Leg. J.M. et B.A. Campbell) (MHNG).

Tête avec une grande dépression sur le vertex à fond lisse, atténuée en avant et ornée en arrière de deux fossettes. Saillie antennaire avec, à la base, deux mamelons séparés par un sillon lisse, longitudinal, prolongé en avant presque jusqu'à l'extrémité. Yeux des ♂ gros et saillants. Tégument finement ponctué. Pilosité peu dense, dirigée vers l'extérieur. Antennes du ♂ avec l'article 9 trois fois plus long que large.

Pronotum plus long que large avec une dépression transversale bien marquée au tiers postérieur, s'étendant sur toute sa largeur et une faible dépression médiane longitudinale. Tégument avec une faible ponctuation irrégulière; une bande transversale plus ponctuée et granuleuse à l'avant et une autre à l'arrière du pronotum. Pilosité comme celle de la tête, un peu plus dense sur les côtés.

Elytres réunis nettement plus longs que larges. Sur chaque élytre, à la base, une fossette près de la suture et une autre vers le milieu de l'avant; ces fossettes marquent le départ de larges sillons longitudinaux, arrondis, s'effaçant avant le milieu. Angles huméraux assez effacés. Tégument finement et irrégulièrement ponctué-granuleux. Pilosité comme celles de la tête et du thorax mais un peu épaisse, surtout sur les côtés et à l'apex.

Abdomen. Rebords latéraux de chaque tergite saillants fortement à l'arrière sur le suivant. Pilosité dirigée vers l'apex. Derniers sternites des ♂ (fig. 5).

Tibias postérieurs du ♂ nettement élargis et un peu coudés un peu avant l'apex. Longueur des ♂: 2, 60 et 2, 75 mm.

Edéage: longueur 0, 40 mm. (figs 14 et 15).

Cette espèce peut être distinguée de *M. brasiliensis* et de *M. carinipes* par sa taille plus petite et ses antennes bien plus allongées.

*Metopiasoides decoratus* sp. n.

Figs 6, 16

Holotype ♂: Panama, Bocas del Toro (leg. H. Wolda) (FMNH). Paratypes: 5 ♂, même provenance (DENH et MHNG).

Tête avec une dépression sur le vertex. Un faible sillon longitudinal au milieu de la saillie antennaire. Yeux des ♂ gros. Tégument finement et irrégulièrement ponctué. Pilosité plus dense sur les côtés. Antennes du ♂ avec l'article 9 deux fois plus long que large.

Pronotum aussi long que large, cordiforme, avec un profond sillon transversal après le tiers postérieur, s'étendant sur toute sa largeur. Tégument et pilosité comme la tête; la pilosité est dirigée vers l'extérieur et est plus dense sur les côtés.

Elytres réunis à peine plus longs que larges. Deux petites fossettes basales sur chaque élytre; l'une près de la suture au départ d'une faible dépression longeant celle-ci et s'étendant, en s'affaiblissant, jusqu'à l'apex; l'autre près de l'épaule au départ d'une faible dépression longitudinale s'effaçant déjà au tiers de la longueur de l'élytre. Angles huméraux assez effacés. Tégument finement ponctué. Pilosité un peu

plus épaisse que sur la tête et le pronotum, assez dense, régulière, dirigée vers l'arrière.

Abdomen. Rebords latéraux des tergites un peu bombés, plus larges en arrière qu'en avant. Tégument comme les élytres. Pilosité comme les élytres, dirigée aussi vers l'arrière, mais plus dense et plus épaisse sur les rebords latéraux et à l'apex de chaque tergite où elle forme une frange très nette. Derniers sternites des ♂ (fig. 6).

Longueur des ♂: 2, 12 à 2, 25 mm.

Édéage: longueur 0, 36 mm (fig. 16).

Cette espèce ressemble à *M. costaricensis*, en diffère par la forme de l'édéage et par les tibias postérieurs à peine élargis dans la partie apicale.

***Metopiasoides elongatus* (Schaufuss) comb. n.**

Figs 1, 3, 7, 17, 18

*Metopias elongatus* Schaufuss, 1872

Holotype ♂: Brésil, Amazone. Coll. Raffray (MNHN); 1 ♂, Bolivie, Yucaris, Coll. Raffray (MNHN).

Tête (fig. 3) avec une dépression transversale à l'arrière. Yeux des ♂ gros, en cônes arrondis, leur sommet dirigé vers l'arrière. Tégument très finement et éparément ponctué. Pilosité plus épaisse sur les côtés. Antenne (fig. 1). Tégument des antennes finement granuleux. Pilosité des antennes dense, orientée vers l'extrémité.

Pronotum un peu plus large que long, cordiforme. Au tiers postérieur, un profond sillon transversal s'étendant sur toute sa largeur; une dépression longitudinale, plus ou moins marquée, part du milieu de l'avant et se termine au sillon transversal. Tégument comme celui de la tête. Pilosité dense.

Elytres réunis plus larges que longs. Deux fossettes basales peu profondes sur chaque élytre. Un sillon longitudinal partant de la fossette centrale longe la suture sur toute sa longueur; une légère dépression longitudinale part de la deuxième fossette et s'efface déjà vers le tiers antérieur de l'élytre. Angles huméraux arrondis, assez marqués. Tégument finement, irrégulièrement et éparément ponctué. Pilosité plus dense sur les côtés et à l'apex, dirigée vers l'arrière.

Abdomen. Rebords latéraux des trois premiers tergites apparents terminés à l'angle postérieur extérieur en une dent obtuse plus ou moins forte. Bord postérieur de chaque tergite formé d'une large bande de très petites alvéoles rectangulaires alignées et étagées sur plusieurs rangs; cette bande alvéolaire est plus large au centre. Tégument finement et irrégulièrement ponctué. Pilosité latérale et apicale dense, plus épaisse et plus courte que celle des élytres; pilosité du dessus fine et éparse. Derniers sternites des ♂ (fig. 7).

Longueur des deux exemplaires ♂: 4 mm.

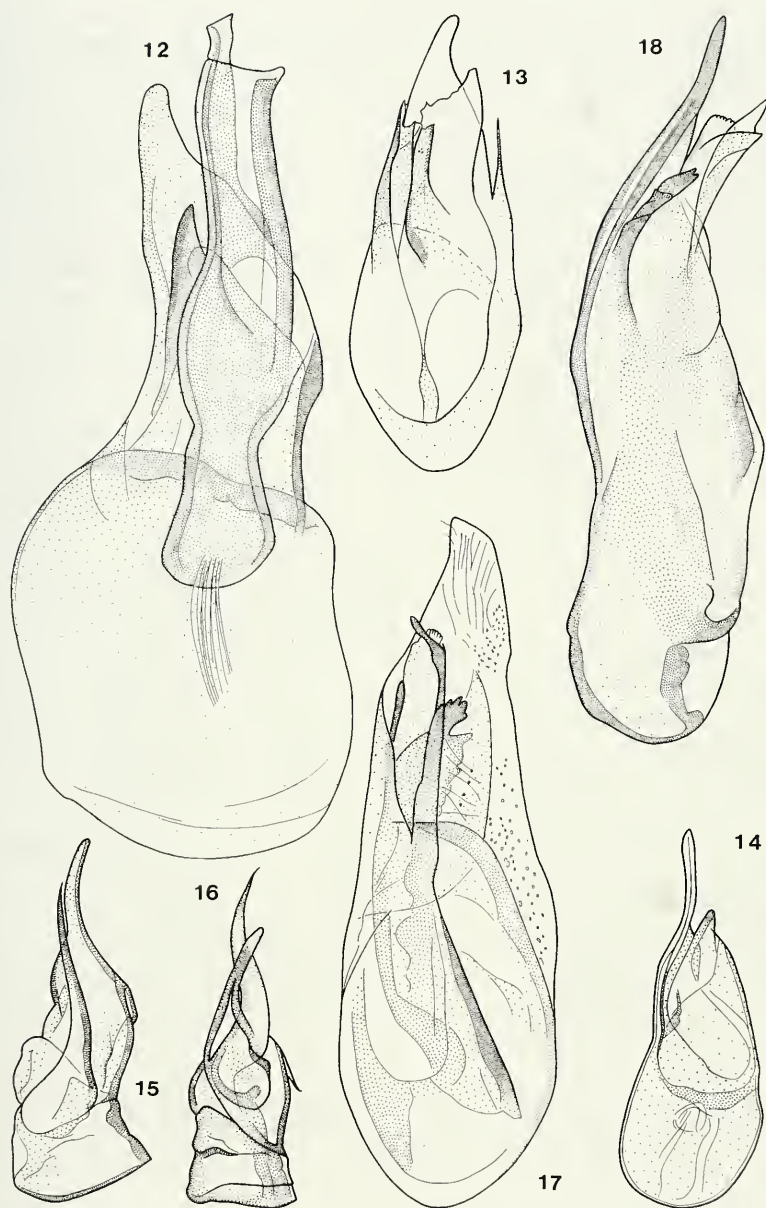
Édéage: longueur 0, 75 mm (figs 17 et 18).

Les édéages des deux seuls spécimens connus ne sont pas indentiques; je ne suis pas sûr qu'ils soient de la même espèce.

***Metopiasoides grandior* sp. n.**

Figs 8, 19

Holotype ♂: Panama, province de Chiriqui, Cerro Colorado alt. 1475 m (leg. W. Suter) (FMNH).



FIGS 12-18

Edéages: *Metopiasoides brasiliensis* sp. n., 12, face; *M. carinipes* (Raffray), 13 face; *M. costaricensis* sp. n., 14, face, 15, profil; *M. decoratus* sp. n., 16, profil; *M. elongatus* (Schau-fuss), 17, face, 18, profil.

Tête triangulaire avec un faible rebord en arrière du vertex. Angles postérieurs en angles aigus. Yeux moyens, saillants. Deux petites fossettes arrondies sur le vertex. Tégument finement et assez densément ponctué, finement granuleux sur la saillie antennaire et sur la zone médiane du dessus de la tête. Pilosité dirigée vers l'avant, plus dense sur les côtés.

Pronotum un peu plus long que large, en quadrilatère plus large en avant; les côtés sont arrondis et les angles sont saillants, les antérieurs plus fortement que les postérieurs; un profond sillon transversal sur toute la largeur au tiers postérieur; une faible dépression longitudinale médiane dans la partie antérieure. Tégument finement ponctué avec, par place, de fines granulations. Pilosité comme celle de la tête, mais dirigée vers le centre du pronotum.

Élytres réunis un peu plus larges que longs. Sur chaque élytre, deux petites fossettes basales peu apparentes, l'une près de la suture, l'autre près de la bosse humérale. Angles huméraux soulignés par une forte bosse allongée arrondie. Tégument finement ponctué, irrégulièrement granuleux à la base. Pilosité comme celles de la tête et du pronotum, mais un peu plus longue et dirigée vers l'arrière; plus dense sur les côtés et à l'apex.

Abdomen. Tergites avec les rebords latéraux épais et obliques. A l'apex de chaque tergite, une forte bande transversale alvéolée. Tégument finement ponctué. Pilosité comme celle des élytres, dirigée en arrière, plus dense sur les rebords latéraux et à l'apex de chaque tergite. Derniers sternites du ♂ (fig. 8).

Longueur de l'unique ♂ : 4, 20 mm.

Edéage: longueur 0, 69 mm, mais l'extrémité est cassée (fig. 19).

L'espèce peut être facilement distinguée de ses congénères par la tête aux tempes anguleuses et par le pronotum aux angles antérieurs saillants.

*Metopiasoides minusculus* sp. n.

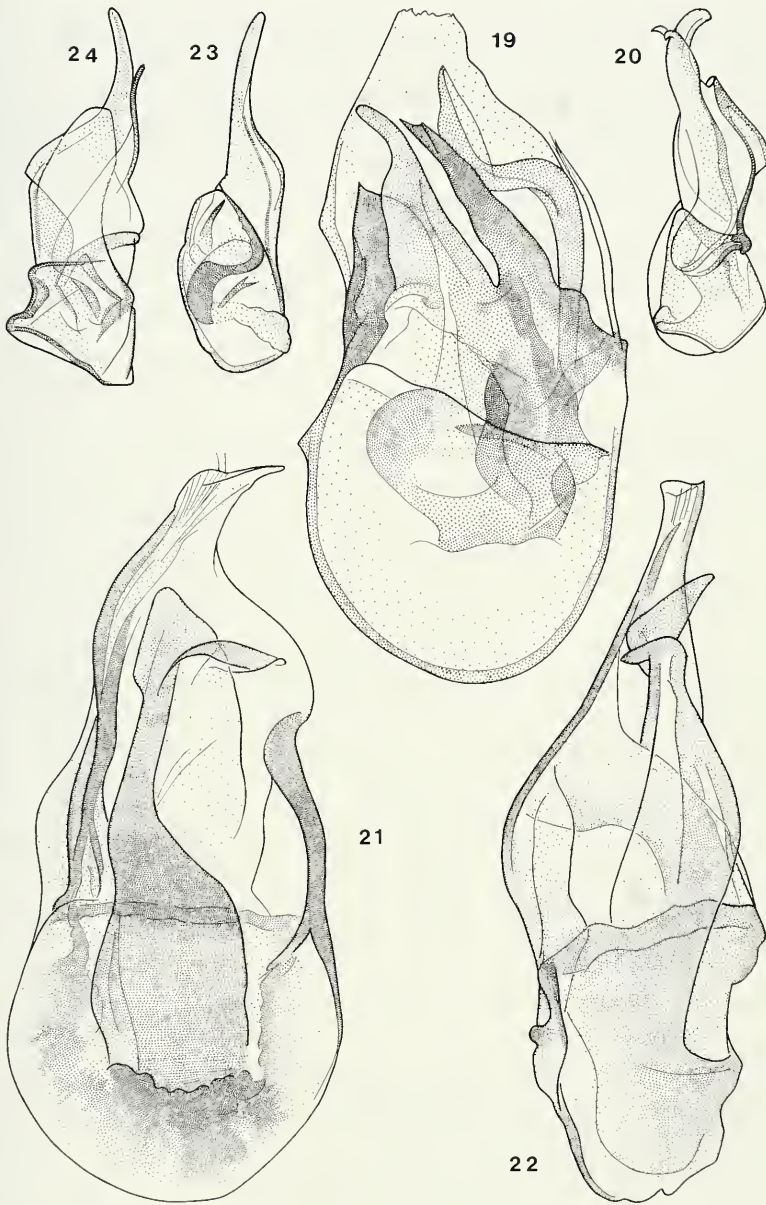
Figs 9, 20

Holotype ♂ : Panama, Bocas del Toro (leg. H. Wolda) (DENH). Paratypes: 16 ♂, même provenance (DENH et MHNG).

Tête avec une dépression triangulaire sur le vertex, la pointe dirigée en avant, avec deux petites fossettes à l'arrière. Un sillon longitudinal au milieu de la saillie antennaire qui est soulignée à la base par un sillon oblique transversal. Yeux des ♂ gros. Tégument finement et éparsément ponctué. Arrière de la tête plus foncé que le reste.

Pronotum à peine plus long que large, cordiforme, avec un sillon transversal s'étendant sur toute sa largeur, après le tiers postérieur. Tégument et pilosité comme la tête; cette dernière plus dense sur les côtés. Avant et arrière du pronotum plus foncés que le reste.

Élytres réunis plus longs que larges avec la base, l'apex, les côtés et la suture plus foncés que le dessus. Deux petites fossettes basales sur chaque élytre; l'une près de la suture, au départ d'une dépression longitudinale s'étendant jusqu'à l'apex de l'élytre, l'autre plus petite, au milieu de la base. Angles huméraux en bosses longitudinales arrondies. Tégument et pilosité comme la tête et le pronotum: la pilosité est plus dense sur les côtés et à l'apex et est dirigée vers l'arrière.



FIGS 19-24

Edéages: *Metopiasoides grandior* sp. n., 19, face; *M. minusculus* sp. n., 20, profil; *M. pecki* sp. n., 21, face, 22, profil; *M. weneri* sp. n., 23, face, 24, profil.

Abdomen. Les rebords latéraux sont un peu bombés. Tégument et pilosité comme le reste du corps, mais cette dernière est beaucoup plus dense et un peu plus épaisse à l'apex de chaque tergite. Derniers sternites des ♂ (fig. 9).

Tibias postérieurs du ♂ particulièrement robustes, élargis peu après la base, ornés un peu avant l'apex de deux dépressions allongées profondes, l'une sur la face externe du tibia, l'autre sur la face interne; ces deux dépressions déterminent en leur centre une petite fenêtre transparente.

Longueur des ♂: 2 à 2,2 mm.

Édage: longueur 0,36 et 0,38 mm (fig. 20).

Espèce proche de *M. decoratus*, bien caractérisée par les tibias postérieurs du ♂ et par l'édage.

*Metopiasoides pecki* sp. n.

Figs 10, 21, 22

Holotype ♂: Equateur, Pastaza (alt. 1000 m.) à 25 km. au N. de Puyo (leg. S. et J. Peck) (CNCI). Paratypes: 1 ♂, 3 ♀, même provenance (CNCI et MHNG).

Tête avec une dépression transversale sur le vertex terminée de chaque côté par une fossette. Un sillon longitudinal bien marqué au milieu de la saillie antennaire. Yeux des ♂ gros, en cônes arrondis, leur sommet dirigé vers l'arrière. Tégument assez densément granuleux-punctué. Pilosité assez dense, dirigée vers le centre de la tête.

Pronotum bien plus large que long, en parallépipède plus large en avant qu'en arrière. Un profond et large sillon transversal au tiers postérieur. Tégument assez finement et éparsément punctué; à la base, une mince bande transversale densément guillochée. Pilosité comme celle de la tête, mais dense, dirigée vers l'extérieur et vers l'arrière.

Elytes réunis un peu plus longs que larges. Sur chaque élytre, une fossette bien marquée près de la suture. au départ d'un profond sillon s'étendant jusqu'à l'apex, une autre fossette, au milieu de la base, prolongée par une courte dépression longitudinale très rapidement effacée. Angles huméraux soulignés par une forte bosse allongée. Tégument très finement et très éparsément punctué. Pilosité comme celles de la tête et du pronotum, mais plus longue et dirigée vers l'extérieur et vers l'arrière.

Abdomen. Tergites relevés de chaque côtés, dépassant latéralement les suivants. Apex de chaque tergite souligné d'une forte bande plus claire très finement alvéolée. Le tégument est très finement et éparsément punctué. Pilosité comme celle des élytres, encore un peu plus longue, dirigée vers l'arrière, plus dense à l'apex de chaque tergite. Derniers sternites des ♂ (fig. 10).

Longueur des ♂: 3,38 et 3,75 mm.

Édage: longueur 0,76 et 0,77 mm (figs 21 et 22)

L'espèce ressemble au *M. elongatus*, en diffère par la pubescence plus longue et par la forme de l'édage.

Étymologie: Espèce dédiée au Dr Stuart Peck de l'Université Carlton d'Ottawa, Canada.

*Metopiasoides werneri* sp. n.

Figs 11, 23, 24

Holotype ♂: Costa-Rica, volcan Poas (alt. 1500 m) (leg. P. Werner) (MHNG).  
Paratypes: 1 ♂, 2 ♀, même provenance (MHNG).

Tête avec une dépression triangulaire sur le vertex, la pointe dirigé en avant. Un sillon longitudinal au milieu de la saillie antennaire, effacé vers l'arrière. Yeux gros chez le ♂, très petits chez la ♀. Tégument très finement et éparsément ponctué. Pilosité assez serrée, surtout sur les côtés de la tête. Antennes du ♂ et de la ♀ avec l'article 9 deux fois et demie plus long que large.

Pronotum plus long que large, en ovale court, avec un profond sillon transversal au tiers postérieur s'étendant sur toute sa largeur et une faible ponctuation irrégulière; une bande transversale plus ponctuée et granuleuse à l'avant et une autre bande transversale identique à l'arrière. Pilosité assez dense, dirigée du centre vers les côtés, moins dense dans la zone longitudinale médiane.

Élytres réunis aussi longs que larges. Deux fossettes basales sur chaque élytre, au départ d'un large sillon arrondi disparaissant déjà après le premier tiers de la longueur de celui-ci. Angles huméraux bien marqués chez le ♂, complètement effacés chez la ♀. Tégument finement et densément ponctué-granulé. Pilosité comme celle du pronotum, mais un peu plus longue; plus dense sur les côtés et à l'apex.

Abdomen. Chaque tergite est bordé à l'apex d'une large bande transversale légèrement bombée plus ponctuée et granulée que le reste du segment, soulignée en avant et en arrière d'une mince ligne sombre. Pilosité comme celles du pronotum et des élytres, mais dirigée en arrière, plus dense à l'apex de chaque tergite et sur les côtés. Derniers sternites du ♂ (fig. 11).

Tibias postérieurs du ♂ élargis dans la moitié apicale, ornés sur la face externe, un peu avant l'apex, d'une dépression allongée assez profonde.

Longueur: ♂: 2, 50 à 2, 75 mm; ♀: 2, 40 à 2, 55 mm.

Édage: longueur 0, 38 et 0, 40 mm (figs 23 et 24).

Cette espèce ressemble au *M. costaricensis*, elle en diffère par la forme de l'édage.

Étymologie: espèce dédiée au Dr Philippe Werner, Ollon s/ Sierre, Valais, Suisse.

## REMERCIEMENTS

Madame N. Berti, Paris et Messieurs J.M. Campbell, Ottawa, D.S. Chandler, Durham et J.A. Wagner, Chicago m'ont communiqués le matériel étudié. Monsieur G. Roth, Genève a mis au net les dessins et M. C. Besuchet, Genève, a pris la peine d'apporter quelques corrections et compléments à mon manuscrit.

## BIBLIOGRAPHIE

- COMELLINI, A. 1993. Notes sur les Psélaphides néotropicaux (Coleoptera). 8. Le genre *Metopias* Gory de la tribu des *Metopiasini*. *Revue suisse de Zoologie* 100: 921-927.  
PARK, O. 1942. A study in Neotropical Pselaphidae. *Northwestern University Studies in Biological Sciences and Medicine*, Number 1: 403 p., 21 pls.

- RAFFRAY, A. 1904. Genera et catalogue des Psélaphides. *Annales de la Société entomologique de France*: 1-400.
- RAFFRAY, A. 1908. Coleoptera. Fam. Pselaphidae. *Genera Insectorum* 64: 487 p., 9 pls.
- SCHAUFUSS, L. W. 1872. Beschreibung einiger Pselaphiden. *Numquam Otiosus* 2: 259-279.
- SHARP, D. 1887. Fam. Pselaphidae. *Biologia Centrali-Americana. Insecta. Coleoptera*, vol. 2 (1): 1-46, pl. 1.



**A review of the West African skink genus *Cophoscincopus* Mertens (Reptilia: Scincidae: Lygosominae): resurrection of *C. simulans* (Vaillant, 1884) and description of a new species**

Wolfgang BÖHME, Andreas SCHMITZ & Thomas ZIEGLER<sup>1</sup>  
Zoologisches Forschungsinstitut und Museum A. Koenig,  
Adenauerallee 160, D-53113 Bonn, Germany.

**A review of the West African skink genus *Cophoscincopus* Mertens (Reptilia: Scincidae: Lygosominae): resurrection of *C. simulans* (Vaillant, 1884) and description of a new species.** - The taxonomy of the West African scincid genus *Cophoscincopus* is reviewed. Based on external and genital morphology the so far monotypic genus can be partitioned into three very similar species. Besides *Cophoscincopus durus* (Cope, 1862) the name *Cophoscincopus simulans* (Vaillant, 1884) is available for one of these forms. The third, up to now, unnamed form is herein described as *Cophoscincopus greeri* sp. n. A key to the species is provided and informations about ecology and distribution are given. We revealed the presence of large, multicellular integumentary glands (located post-cloacally), which are described for the first time in the genus.

**Key-words:** Reptilia - Scincidae - Lygosominae - *Cophoscincopus* - *C. durus* - *C. simulans* - *C. greeri* sp. n. - taxonomy - postcloacal glands - West Africa.

## INTRODUCTION

The genus *Cophoscincopus* consists of small, semi-aquatic skinks which are known to inhabit the closed forests of Africa north of the Gulf of Guinea, from Sierra Leone and southern Guinea east to Togo (Müller, 1910; Mertens, 1933).

Until recently the genus *Cophoscincopus* was considered to be monotypic. The single species *C. durus* was originally described as *Tiliqua dura* by Cope (1862) and was based upon a single West African specimen. Cope (l. c.) characterised this species, among other traits, by the presence of supranasals, a very tiny outer ear opening and strongly tricarinate scales on the back.

A second West African lizard of similar habitus was described by Vaillant (1884) in his new genus *Cophoscincus* as *C. simulans*. According to the original description, this species is in part characterised by the absence of either supranasals or an outer ear opening and by tricarinate scales on the back, in which the middle keel is dominating in size.

<sup>1</sup> Present address: Staatliche Naturhistorische Sammlungen Dresden, Museum für Tierkunde, A.B.-Meyer-Bau, Königsbrücker Straße 159, D-01109 Dresden, Germany.

Despite these seemingly clear differences Boulenger (1887) indicated that he thought *Cophoscincus simulans* to be a synonym of *Tiliqua dura*, but without further discussing this issue. Boulenger (l.c.) also transferred both forms to the genus *Lygosoma*, as the genus *Tiliqua* had been restricted to Australasian forms.

In contrast to this point of view, Tornier (1901) considered *Cophoscincus simulans* and *C. durus* to be two distinct species within the genus *Lygosoma*. He argued that *Lygosoma simulans* differed in part from *L. durum* in the following characters: no supranasals, rostral in contact with the frontonasal, the latter not touching the frontal, no enlarged nuchals, no ear opening, three keels on the back scales, the middle one the largest.

Müller (1910), after having received a larger series of new specimens from Liberia, discovered that a tiny ear opening was always present in both *L. durum* and *L. simulans*, though it can be often hidden by overlapping scales. Furthermore he found one specimen in which the internasal was divided by an azygous scale, which otherwise exactly fitted the description of *Tiliqua dura* Cope, 1862. He concluded that Cope had misidentified the divided internasal as two supranasals, and the azygous scale as an internasal. Also as Cope did not specifically describe the exact status of the keels on the dorsal scales, he considered the different descriptions of the middle keel as being within the limits of variability. Having discarded the principal differences between the two species, he concluded that *Lygosoma simulans* is a junior synonym of *Lygosoma durum*.

Mertens (1933) reviewed *Lygosoma durum* and principally agreed with the arguments of Müller (l. c.). He nonetheless found the species to be distinct enough from the other known species of *Lygosoma* to put it in a genus of its own. As *Tiliqua* was still restricted to Australasian species, the next available name was *Cophoscincus* Vaillant, 1884. But Mertens also noted that this name was preoccupied by *Cophoscincus* Peters, 1867 (type species *Lygosoma quadrivittatum* Peters, 1867). Therefore he erected the new name *Cophoscincopus*, with the single species *Cophoscincopus durus*. This arrangement has been followed by all subsequent authors (e.g. Mittleman, 1952; Hoogmoed, 1973; Greer, 1974; Joger, 1981). The history of nomenclatural changes is summarized in the following list:

- 1862 *Tiliqua dura* Cope. Proc. Acad. Philadelphia 1862: 190. Type specimen: USNM 5996; western Africa.
- 1884 *Cophoscincus simulans* Vaillant. Bull. Soc. Philomath. 8 (7): 170. Type specimen: MNHN 6457; Crouacrou, Ghana.
- 1884 *Cophoscincus simulans* – Vaillant. Bull. Soc. Zool. France 1884: 349.
- 1887 *Lygosoma durum* – Boulenger. Cat. Lizards III: 304.
- 1893 *Cophoscincus simulans* – Matschie. Mitteil. deutsch. Schutzgeb. 6 (3): 4.
- 1901 *Lygosoma simulans* – Tornier. Arch. F. Naturgesch. 1901, Beiheft: 86.
- 1910 *Lygosoma durum* – Müller. Zool. Anz. 35 (9/10): 266-269.
- 1921 *Lygosoma simulans* – Chabanaud. Bull. Comité d'Etudes Hist. Sci. l'Afrique Occidentale Française: 445-472.
- 1933 *Cophoscincopus durus* – Mertens. Zool. Anz. 102: 188-190.
- 1938 *Cophoscincopus durus* – Loveridge. Proc. New England Zool. Club 17: 49-74.
- 1952 *Cophoscincopus durus* – Mittleman, Smithson. misc. Coll. 117: 1-35.

- 1973 *Cophoscincopus durus* –Hoogmoed, Die Aquarien- u. Terr.-Zeitschr. 5: 174-178; 7: 217-222, 8: 282-283.  
1974 *Cophoscincopus durus* – Greer, Aust. J. Zool., Suppl. Ser. No 31; 67 pp.  
1979 *Cophoscincopus (durus)* – Greer, Rec. Aust. Mus. 32: 339-371.  
1981 *Cophoscincopus durus* – Joger, Bonn. zool. Beitr. 32: 297-340.

Based on unpublished data kindly provided to us by Allen Greer, further investigations based on morphological and hemipenial data confirmed that the genus *Cophoscincopus* actually consists of three, though very similar, species. Whereas names are available for two of these forms, the third yet unnamed species is described below.

## MATERIAL AND METHODS

Specimens included in the present study are kept in the following museums: BMNH - Natural History Museum, London; FMNH - Field Museum of Natural History, Chicago; HLMD - Hessisches Landesmuseum Darmstadt; MCZ - Museum of Comparative Zoology, Cambridge/Mass.; MHNG - Muséum d'histoire naturelle, Genève; MNHN - Muséum National d'Histoire Naturelle, Paris; RMNH - Natuurhistorisch Nationaal museum, Leiden; ZFMK - Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn; ZMB - Zoologisches Museum Berlin.

Measurements were taken as follows: *External morphology*: Snout-vent length (SVL) from tip of snout to vent and tail length (TL) from vent to tail tip were measured with a ruler to the nearest 1.0 mm; other measurements were done with dial callipers and recorded to the nearest 0.1 mm. *Genital morphology*: Whereas the hemipenes of the holotype of *Cophoscincopus greeri* sp. n. were available to us in a completely everted condition, the available hemipenes of *C. durus* (ZFMK 36127-8, 36137-8, 36142-3, 36146, 36153) were only partially everted. Due to a new technique (Pesantes 1994, Ziegler & Böhme 1997) which allows to evert and study the hemipenes not only of fresh material, but also of specimens previously preserved in alcohol, it was possible to reconstruct the shape of completely everted hemipenes in *Cophoscincopus durus* of ZFMK 36128 (SVL: 4.8; TL: 4.5; HPL: 0.5 cm). Hemipenes of *C. simulans* were not available in the framework of the present study. Terminology of genital morphology follows Böhme (1988) and Ziegler & Böhme (l.c.). HPL - Hemipenis length, from cloacal base-point to apex.

## RESULTS

### RESURRECTION OF *COPHOSCINCOPUS SIMULANS*

As explained above, the description of *Cophoscincopus simulans* as a distinct species was the direct consequence of Cope's misinterpretation of the head scales in his original description of *C. durus* and the fact that some of the used diagnostic characters are highly variable in the genus. Therefore it seemed justifiable to keep *C. simulans* as a synonym to *C. durus* until today. Our analysis of the new material, which was collected since the last revision of the genus by Mertens (1933), clearly

demonstrates *C. simulans* not to be conspecific with *C. durus*. However, we are basing its diagnosis on additional key characters and the two species can consequently be differentiated as follows:

***Cophoscincopus durus* (Cope, 1862)**

*Tiliqua dura* Cope, 1862: 190; type specimen: USNM 5996; western Africa.

*Diagnosis.* Differs from *C. simulans* in the following combination of characters: frontonasal longitudinally divided (comp. Fig. 1); prefrontals either usually separated by a medial azygous scale or, less frequently, in direct contact vs. usually separated or, less frequently, in direct contact in *C. simulans* (see Figs. 1-3 in Müller 1910; Table 1, this paper); anterior loreal double; posterior loreal and ventral preocular distinct; size slightly smaller (max. SVL = 55 mm vs 61 mm for *C. simulans*).

***Cophoscincopus simulans* (Vaillant, 1884)**

*Cophoscincopus simulans* Vaillant, 1884: 349; type specimen: MNHN 6457; Crouacrou, Ghana.

*Diagnosis.* Differs from *C. durus* in the following two characters: frontonasal entire; posterior loreal fused to lower preocular; Furthermore it is characterised by: paravertebral scales 39-48; external ear opening small but generally evident in lateral view (comp. Fig. 2).

*Remarks.* Our new careful examination of the specimens also revealed for the first time the presence of post-cloacal glands in the genus *Cophoscincopus*. The openings of these glands are located along the central part of the first row of scales posterior to the soft scaleless lining of the cloaca. They lie either between the cloacal lining and a scale of the first row or between two scales. This area is normally covered by the pre-anal flap and this flap must be reflected and the area cleaned in order to see the gland openings to full advantage. They are identified most easily by their semi-solid, yellowish-brown exudate. The glands occur only in males and their openings are first identifiable grossly only in males approaching sexual maturity (on gross gonadal criteria).

The post-cloacal glands can furthermore be used to differentiate between *Cophoscincopus durus* and *Cophoscincopus simulans*: In *C. durus* the gland openings occur between the scales of the first row and hence are rather obliquely elongate whereas in *C. simulans* they open anterior to the scales and are circular. In all three species the openings are largest medially and diminish in size laterally.

DESCRIPTION OF A THIRD SPECIES

Furthermore we found a third form which seems to be closely related to *C. simulans*, but being at the same time clearly distinct from it. For this species, there is no name available and it is described here as:

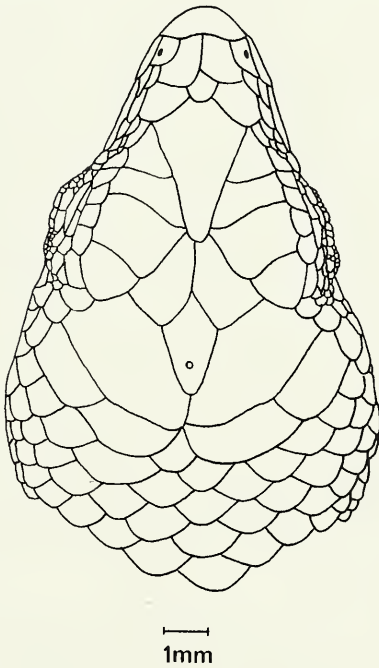
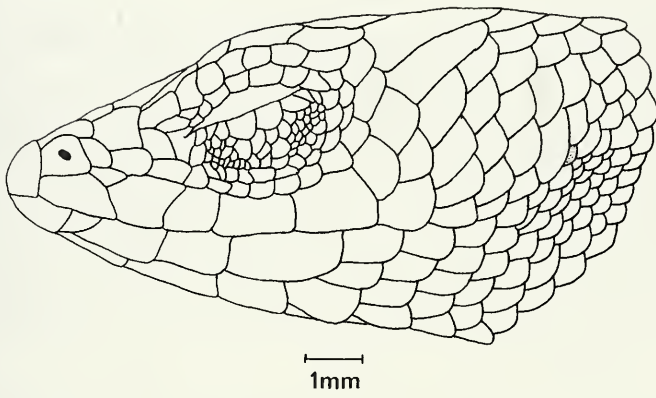


FIG. 1  
Head portrait of *Cophoscincopus durus* (ZFMK 36141)

*Cophoscincopus greeri* sp. n.

*Holotype*: ZFMK 57599, ♂, Mt. Nimba, 1800 m a.s.l., SE-Guinea, coll. Wolfgang Böhme, Fig. 3. SVL: 5.9; TL: 7.7; HPL: 0.6 cm.

*Paratypes*. BMNH 1903.4.24.1-3: Abuasi, Ghana; BMNH 1930.6.9.14: Okurom River, Begoro, Akim, Ghana; BMNH 1921.11.12.6-7: N'Zebela, French Guinea; BMNH 1960.1.3.60: Tingi Hills, Sierra Leone; BMNH 1962.9.12: W.A.C.R.I., Tafua, Ghana; FMNH 190998: 48 km N of Koforidua, Tafo, Ghana. MNHN 20.128-130, MNHN 20.132 (two specimens), MNHN 20.135 (four specimens), MNHN 20.134 (one of two specimens): N'Zebela, SE Guinea; MNHN 1943.53-54: Yalenzou, SE Guinea; MNHN 1943.56-57: Kéoulenta, SE Guinea; MNHN 1951.118: Crête de Nion, 1500 m, Massif du Nimba, SE Guinea; MNHN 1951.124-126, MNHN 1951.142: Ziéla, SE Guinea; MNHN 1951.134-137: Zougue, 1050 m, SE Guinea; MNHN 1963.404-405: Macenta, SE Guinea; MNHN 1963.412-416: Mt. Nimba, 1580 m, SE Guinea; RMNH 17242, RMNH 18806, RMNH 18809: Amedzofe, Togo; MCZ 51512: Bintumane Mts., Sierra Leone; ZFMK 20208-9: Mt. Tonkoui, Ivory Coast; ZMB 11251: Togo; ZMB 16061: Misahöhe, Togo.

*Other material*: The following series was recently discovered far from the known area of the species (and genus!) and has therefore not been included in the type series: HLMD 2515-19, S Niokolo Koba NP, SE Senegal.

*Diagnosis*: A large species of *Cophoscincopus* (for definition of the genus see Mertens, 1933 and below) with a total maximum length of 165 mm. It differs from all other species of *Cophoscincopus* in the following combination of characters: frontonasal entire; posterior loreal fused to lower preocular (vgl. Fig 3); size slightly larger (max. SVL = 66 mm vs. 61 mm for next largest species); paravertebral scales 45-57, but only one specimen below 48 vs. 39-48 for other species; external ear opening very small and almost always hidden by overlapping scales.

Body elongated, habitus ± mabuiform with well developed extremities. Tail round, slightly flattened laterally. Head relatively pointed. Prefrontal in contact or widely divided by the frontal. A tiny outer ear opening is present but generally hidden by overlapping scales. Anterior loreal undivided. Dorsal head scales with weak longitudinal ridges or smooth. Dorsal neckscales weakly keeled. As in *C. durus* the gland openings occur between the scales of the first row and hence are rather obliquely elongate. Colour of dorsum dark brown, ventral colour whitish. The hemipenes of *C. greeri* sp. n. (Fig. 4a) differ from those of *C. durus* (Fig. 4b) mainly in lacking (1) well developed terminal lobes (the uniformly unpaired apex which Böhme [1988] stated for the hemipenes of *C. durus* was based on terminally not completely everted hemipenes), (2) a terminally distinctly divided sperm groove, and (3) a well defined collar-like ornamentation ("kragenartiger Ringsaum" sensu Böhme, 1988) at the upper trunk of the organ.

*Description of holotype*: Snout-vent length: 59 mm, tail length: 77 mm. Body slender, elongated, tail round, slightly flattened laterally; degree of lateral flattening increases towards tail tip. Limbs well developed, long, pentadactyl; if adpressed to the body, slightly overlapping. Head relatively pointed, its width smaller than that of the back, only marginally set off from the latter. Distance of tip of snout from anterior edge of eye two-thirds of the distance from the posterior edge of the eye to ear opening. Latter tiny, generally hidden, about twice as wide as high. Frontonasal undivided, about one-third as wide as deep. Two undivided loreal scales. Anterior loreal small, triangular. Posterior loreal more or less quadrangular, about three times

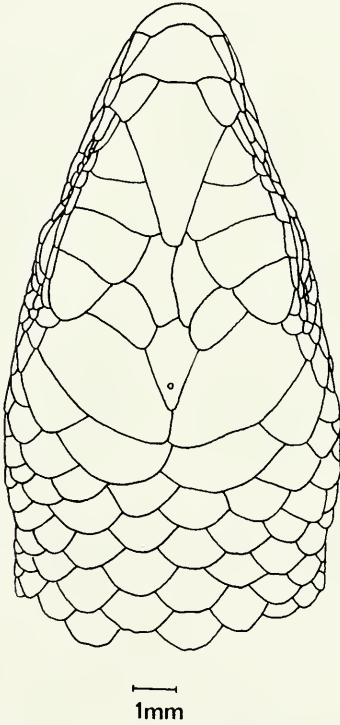
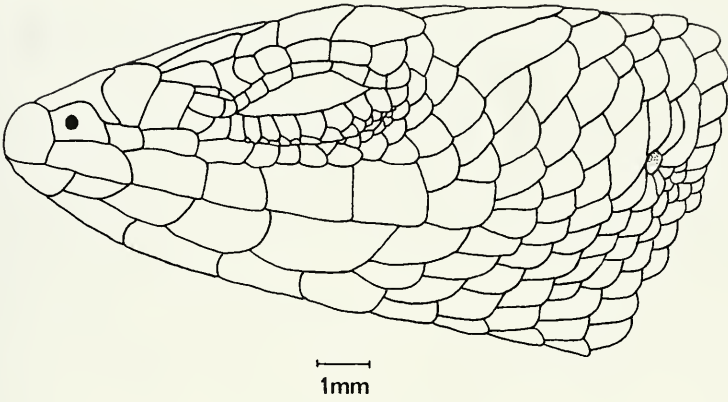
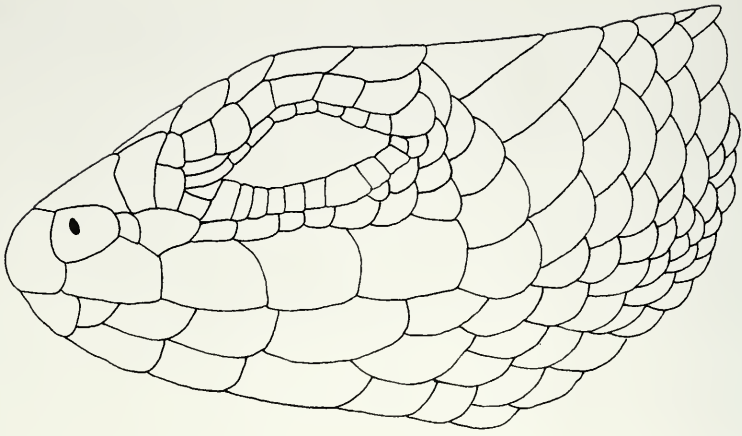
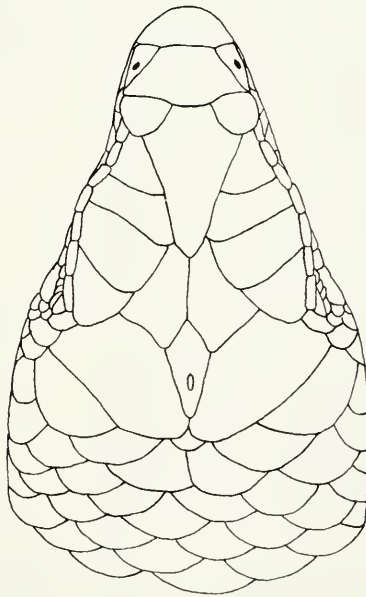


FIG. 2

Head portrait of *Cophoscincopus simulans* (MNHN 1967.187) (The subdivided frontoparietals of *C. simulans* are a unique variant).



1mm



1mm

FIG. 3  
Head portrait of the holotype of *Cophoscincopus greeri* sp. n. (ZFMK 57599)



as long as high, four times as large as the anterior loreal, slightly narrowing towards the latter. Prefrontals widely separated from each other by the frontal, subtriangular, about as large as the nasal. Frontal longer than its distance from the tip of snout, narrowing to a tip posteriorly, about as large as the parietals. Frontoparietals half the size of the frontal, equally long but twice as large as the interparietal. Latter narrowing to a tip posteriorly. Parietals about twice as long as large, touching each other only in a small suture. A tiny round occipital scale present. 5-6 supralabials, the fourth bordering the eye. 51 paravertebral scales. Nearly no ridges on the head scales. Dorsal neck scales slightly keeled. Ventrals slightly enlarged. 67 subcaudals, number of subcaudal scale rows decreasing from 5 at the anal opening to 1 at the tailtip. Dorsal and lateral scales on tail strongly keeled.

Dorsal colour (in preservative) dark brown, brightening laterally. On the lateral sides four rows of round white spots, which run from the neck to about the middle of the tail. Throat grey, slowly merging into the light colour of the ventral scales. Ventral side whitish, unspotted (in life, it was bright salmon-red: see Fig. 26 in Böhme, 1994). Dorsally, above the vertebral column two very weak rows of white spots, slowly disappearing from the neck to the anal region.

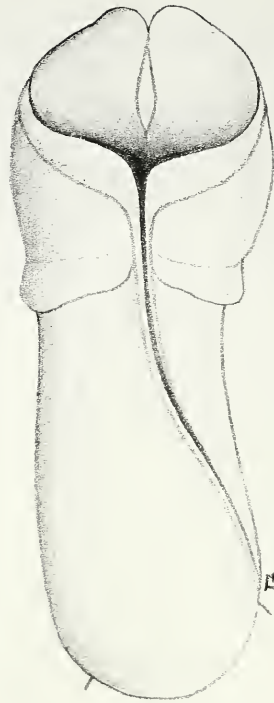
Hemipenes slender, longish, partially transparent and apically slightly widened. At the upper truncus an inconspicuous, hardly recognizable collar-like ring (purposely slightly accentuated in Fig. 4a), which is closed around the truncus except for the sulcus spermaticus. The sulcus is surrounded by inconspicuous sulcal lips and widens laterally at the lower apex. Terminally the apex is medially slightly divided but is lacking well-defined lobes. At the sulcal side the terminal division of the apex turns into a longish flap nearly reaching the forking point of the sperm groove. No remarkable structures were discernible at the asulcal surface of the apex. Besides the whole apical area is densely covered with delicate pustules, not discernible from Fig. 4a.

Variation of paratypes: The paratypes agree generally well with the above description. Only in about 5% of the specimens examined the prefrontals are in contact with each other (see Tab. 1). In the living female paratypes, the colouration of the belly is distinctly sexually dimorphic: light yellowish instead of salmon-red in the male.

*Etymology:* We dedicate the new skink to Dr. Allen Greer to acknowledge his valuable help, which was indispensable for the completion of this paper.

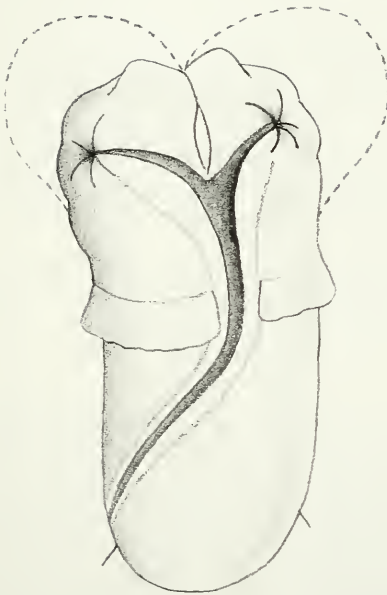
#### REDEFINITION OF THE GENUS

A new, generalized definition of the genus *Cophoscincopus* can be given as follows: It belongs to the beta subgroup of the *Eugongylus* group sensu Greer (1974). It differs from all other members of this subgroup in the following combination of derived characters: the supranasals are absent; the upper preocular and prefrontal are in contact (they thereby separate the first supraciliary and posterior loreal); the external ear opening is small; there are usually six supralabials, the fourth lies usually below centre of eye; the dorsal scales are densely shagreened. - Type species: *C. durus* (Cope, 1862); Species included: *C. simulans* (Vaillant, 1884); *C. greeri* sp. n.



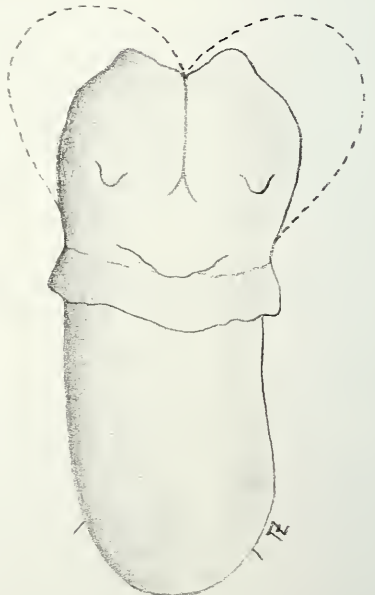
a

1 mm



b

1 mm



KEY TO THE SPECIES OF *COPHOSCINCOPUS*

- 1 Frontonasal longitudinally divided; prefrontals either separated by an azygous median scale or in contact; anterior loreal double; posterior loreal and lower preocular distinct; 38-48 paravertebral scales . . . . . *durus*
- Frontonasal entire; prefrontals either separated by frontonasal-frontal or in contact; anterior loreal single; posterior loreal and lower preocular fused . . . . . 2
- 2 Size slightly larger (max. SVL = 66 mm); paravertebral scales 45-57 (but only one specimen with fewer than 48); external ear opening minute and generally hidden by overlapping scales; on neck, dark colour of dorsum grades gradually into light ventral colour; dorsal head scales with only weak longitudinal ridges or none at all; dorsal neck scales weakly keeled . . . . . *greeri*
- Size slightly smaller (max. SVL = 61 mm); paravertebral scales 39-48; external ear opening small and generally evident; on neck, usually a black mid-lateral stripe slightly distinct from brown of dorsum and sharply distinct from brownish yellow of venter; head scales with moderately strong longitudinal ridges; dorsal neck scales moderately to strongly keeled . . . . . *simulans*

DISTRIBUTION OF *COPHOSCINCOPUS*

The genus *Cophoscincopus* is restricted to West Africa and is distributed from Senegal, Sierra Leone and southern Guinea east to Togo (Chabanaud, 1921; Barbour & Loveridge, 1930; Loveridge, 1938; Hoogmoed, 1973; Joger, 1981) (see Fig. 6).

*C. durus* is known only from Sierra Leone, Liberia and southern Guinea. It is recorded herein for the first time from the Ivory Coast (Voucher specimen: ZFMK 68759, Tai National Park).

*C. simulans* occurs from Sierra Leone, Liberia and southern Guinea east through the Ivory Coast and Ghana to Togo.

*C. greeri* sp. n. is the most widespread of the three species: It is currently known from Senegal and Sierra Leone as well as from the extreme SE of Guinea eastwards through Ivory Coast and Ghana to Togo. It has not yet been recorded from Liberia.

FIG. 4

a) Sulcal view of the right hemipenis of the holotype of *Cophoscincopus greeri* (ZFMK 57599),  
 b) Left sulcal, right asulcal view of the left hemipenis of *C. durus* (ZFMK 36127) from Liberia (SVL: 4.9; HPL: 0.4 cm).

The mode of completely everted lobes in the hemipenis of *C. durus* is indicated by the broken lines (in the case of completely everted lobes the lateral branches of the sulcus spermaticus are ending laterally of each lobe); not discernible from the hemipenis drawings is a delicate and dense pustular apical surface.

TABLE 1

Comparison between the three species of *Cophoscincopus* in certain interspecifically variable characters.

	<i>durus</i>	<i>simulans</i>	<i>greeri</i>
Prefrontals (% of NB)			
Meet	13	25	5
Separated by azygous scale	87	-	-
Separated	-	75	95
N	179	79	20
Paravertebral Scales			
Range	38-48	39-48	(45) 48-57
Mean	43.7	43.0	51.4
S.D.	1.62	1.89	2.24
N	100	45	48
Snout-vent Length (mm)			
Range	23-55	24-61	27-66
N	196	118	47
Tail Length (% SVL)			
Range	1.12-1.45	1.29-1.61	1.31-1.50
N	83	20	8
Size of gravid ♀♀			
Range	43-54	47-58	48-63
N	28	19	7
Clutch Size			
1	1	-	-
2	25	16	5
3	1	3	2
4	-	-	2

There are several localities where the species occur in sympatry: All three species have been recorded from Kéoulenta and Ziéla, Guinea; *durus* and *simulans* from Macenta, Mt. Nimba and Yalenzou, Guinea, and *simulans* and *greeri* from Amedzofe, Ghana. No doubt more thorough collecting would reveal additional cases.

#### HABITATS, ECOLOGY AND REPRODUCTION OF *COPHOSCINCOPUS*

Up to now, there is only little information available regarding the habitats and the autecology of *Cophoscincopus*. All species are mainly found in the vicinity of small creeks and pools in forested areas. The animals are active on the surface by day. If disturbed, they flee either into earth holes, under various rotten logs etc. or mostly into water. They swim under the water surface by lateral undulations with limbs adpressed to body and tail (Scherer in Müller, 1910; Chabanaud, 1921; Bequaert in Barbour & Loveridge, 1930; Harley in Loveridge, 1938; Hoogmoed, 1973 and Joger, 1981). Their prey comprises, in part, termites and spiders (Loveridge, 1938). All species are oviparous with clutch sizes of 1-4 eggs (Loveridge, 1938; Hoogmoed, 1973 and Table 1, this paper).



FIG. 5

*Cophoscincopus greeri* sp. n., holotype in life.

The holotype of the new species was collected at the Guinean side of Mt. Nimba at an altitude of ca. 1200 m a.s.l., in a fast-running, cold mountain creek within the submontane forest zone (among else characterised by the tree fern *Cyathea manniana*). Next to the specimen itself (Fig. 5), also its habitat has been figured by Böhme (1994), however, still using the name *C. simulans*. The same name was used for the two female paratypes from a partly cleared lowland forest site at Malweta river (Forêt de Ziama, SE Guinea), with interspersed cocoa (*Theobroma cacao*) trees.

Joger (1981: 329), who collected two ZFMK paratypes of *C. greeri* sp. n., reports that they "were collected in a cool, shallow creek, where they dived like newts, and hid themselves under stones". MNHN 1951.126 was collected in or on the edge of a "marigot": MNHN 1951.142 has the word "swamp" associated with it in the registers, and MNHN 1951.134-137 the words "gallery forest".

In view of the habitual, external overall similarity, it is surprising how many cases of broad sympatry have already been found (cf. Fig. 6). Clearly it would be interesting to learn more about the niche segregation of these highly specialized lizards.

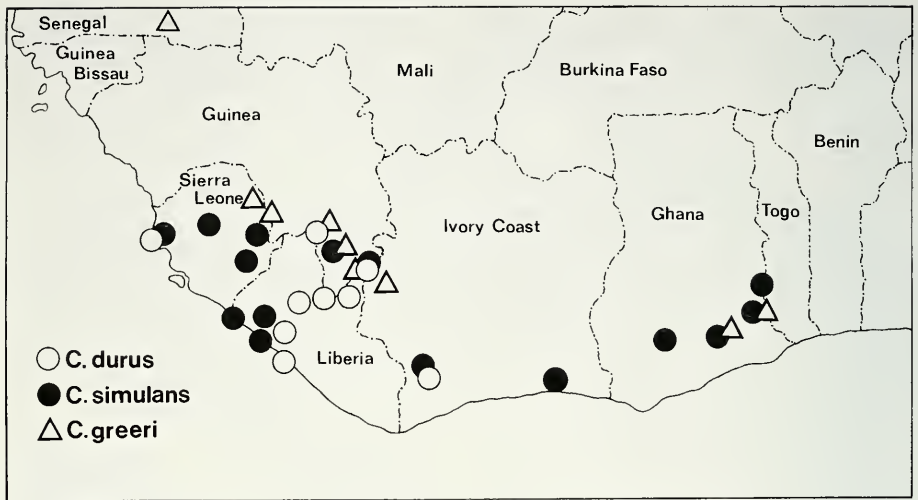


FIG. 6

West Africa north of the Gulf of Guinea showing the distribution of the three species of *Cophoscincopus*.

#### ACKNOWLEDGEMENTS

First of all we wish to thank Dr. Allen Greer, Sydney for his indispensable help with an earlier draft of this paper. Furthermore, we thank Phyllis Koshland for providing us with drawings of the heads of the 3 species. Drs. E. N. Arnold, London, E. R. Brygoo, Paris, R. Günther, Berlin, M. S. Hoogmoed, Leiden, R. F. Inger, Chicago, U. Joger, Darmstadt, and J. P. Rosado, Cambridge/Mass. made specimens of their respective collections available to us. M.-O. Rödel kindly donated some voucher specimens to the ZFMK collection. To all of them, we extend our deep gratitude.

#### LITERATURE CITED

- BARBOUR, T. & LOVERIDGE, A. 1930. Reptiles and amphibians from Liberia (pp. 769-786). In: Strong's report of the Harvard-African Expedition upon the African Republic of Liberia and the Belgian Congo. *Cambridge, Mass.*, Vol. 2. [Not seen by us.]
- BÖHME, W. 1994. Frösche und Skinke aus dem Regenwaldgebiet Südost-Guineas, Westafrika. II. Ranidae, Hyperoliidae, Scincidae: faunistisch-ökologische Bewertung. *Herpetofauna Weinstadt* 16(93): 6-16.
- BÖHME, W. 1988. Zur Genitalmorphologie der Sauria: funktionelle und stammesgeschichtliche Aspekte. *Bonner zoologische Monographien* 27: 1-176.
- BOULENGER, G.A. (1887): Catalogue of the Lizards in the British Museum London 3: 575 pp.
- CHABANAUD, P. 1921. Contribution à l'étude de la faune herpétologique de l'Afrique occidentale. Deuxième note. *Bulletin du Comité d'Etudes Historiques et Scientifiques de l'Afrique Occidentale Française*: 445-472.
- COPE, E. D. 1862. On *Lacerta echinata* and *Tiliqua dura*. *Proceedings of the Academy of Natural Science Philadelphia* 1862: 189-191.

- Greer, A.E. 1974. The generic relationships of the scincid lizard genus *Leiopisma* and its relatives. *Australian Journal of Zoology, Suppl. Ser.* 31, 67 pp.
- GREER, A. E. 1979. A phylogenetic subdivision of Australian skinks. *Records of the Australian Museum* 32: 339-371.
- HOOGMOED, M. S. 1973. Herpetologische Beobachtungen in Ghana. *Die Aquarien- u. Terrarien-Zeitschrift* 5: 174-178; 7: 217-222, 8: 282-283.
- JÖGER, U. 1981. Zur Herpetofaunistik Westafrikas. *Bonner zoologische Beiträge* 32: 297-340.
- LOVERIDGE, A. 1938. On a collection of reptiles and amphibians from Liberia. *Proceedings of the New England Zoological Club* 17: 49-74.
- MERTENS, R. 1933. Die Scincidengattung *Cophoscincus* Vaillant. *Zoologischer Anzeiger* 102: 188-190.
- MITTLEMAN, M. B. 1952. A generic synopsis of the Lizards of the subfamily Lygosominae. *Smithsonian miscellaneous Collections* 117: 1-35.
- MÜLLER (or MUELLER), L. 1910. Über *Lygosoma durum* (Cope). *Zoologischer Anzeiger* 35 (9/10): 266-269.
- PESANTES, O. S. 1994. A method for preparing the hemipenis of preserved snakes. *Journal of Herpetology* 28(1): 93-95.
- PETERS, W. 1867. Herpetologische Notizen. *Monatsberichte der Königlichen Akademie der Wissenschaften Berlin*: 13-37.
- VAILLANT, L. 1884. Catalogue raisonné des reptiles et batraciens d'Assinie donnés par M. Chaper au Muséum d'Histoire Naturelle. *Bulletin de la Société Zoologique de France* 1884: 343-354.
- ZIEGLER, T. & BÖHME, W. 1997. Genitalstrukturen und Paarungsbiologie bei squamaten Reptilien, speziell den Platynta, mit Bemerkungen zur Systematik. *Mertensiella, Rheinbach* 8: 1-207.





## **Review of the *Lithoscirtus* genus group (Orthoptera, Acrididae, Proctolabinae) with description of new species**

C. H. F. ROWELL

Zoologisches Institut der Universität Basel, Rheinsprung 9,  
CH-4051 Basel, Switzerland.

**Review of the *Lithoscirtus* genus group (Orthoptera, Acrididae, Proctolabinae) with description of new species.** - The genera *Lithoscirtus* Bruner, 1908, *Drymophilacris* Descamps, 1976, and *Drymacris* Descamps & Rowell, 1978, occurring in Costa Rica and Panama, are reviewed and in part redescribed. Five species are described as new: *Lithoscirtus tessellatus* sp. n., *Drymophilacris glyphocerca* sp. n., *Drymophilacris nigrescens* sp. n., *Drymophilacris veraguensis* sp. n., and *Drymophilacris melanopsis* sp. n. The previously unknown female of *Drymacris panamae* (Descamps) is described, and the species restored to *Drymophilacris* on the basis of female characters, giving the reinstated combination *Drymophilacris panamae* Descamps; *Drymacris* is thereby left monospecific, and is redescribed. New data on the distribution and coloration in life of previously described species are presented. Keys to the three genera and to the species of *Lithoscirtus* and *Drymophilacris* are given.

**Key-words:** taxonomy - Neotropics - Central America - Orthoptera - Acrididae - Proctolabinae.

### INTRODUCTION

The term "*Lithoscirtus* genus group" is used here for three closely related genera, *Lithoscirtus* Bruner, 1908, *Drymophilacris* Descamps, 1976 and *Drymacris* Descamps & Rowell, 1978, belonging to the subtribe Lithoscirtae of the tribe Proctolabini. Phylogenetic analysis of mitochondrial ribosomal DNA genes (Flook and Rowell, in preparation) confirm that the three genera are a clade and each others' nearest relatives. The first species to be described (Rehn, 1905) were erroneously placed by the author in the genus *Dellia*, which is not a proctolabine but possibly a primitive ommatolampine, and is restricted to the Greater Antilles. Later Rehn (1929) combined these and other newly described species with the genus name *Lithoscirtus* and characterised that genus for the first time, the name having been created by Bruner (1908) without documentation. The genus *Drymophilacris* was split from *Lithoscirtus* by Descamps (1976), based on the shape of the male cerci and of the anterior margin of the endophallic sclerites. Subsequently, Descamps & Rowell

(1978) further split off from *Drymophilacris* the genus *Drymacris*, on the basis of differences in the male and female cerci, the female subgenital plate, the ovipositor and the elytra.

To date there are 3 described species of *Lithoscirtus*, two of *Drymacris* and three of *Drymophilacris*, and the combined range of all three genera extends from northern Costa Rica to western Panama. Six of these are montane, but *D. bimaculata* and *L. viceitas* extend into the Caribbean lowlands. Early larvae of all three genera have a characteristic black coloration with an orange head and dorsal yellow stripe (Descamps & Rowell, 1978). The adult males are notable for the species-specific coloured patches, usually yellow or pale blue, on the subgenital and supraanal plates, which appear to serve in intraspecific communication (Rowell, 1983). All these species are small, flightless, brilliantly coloured grasshoppers of neotropical wet forest, especially of tree-fall clearings and forest edges, and all are foodplant specialists, eating a few species of Solanaceae and in a few cases (*Lithoscirtus minutulus*, *Drymophilacris nigrescens* sp. n.) some Asteraceae as well. The spatulate dorsal ovipositor valves are associated with the habit of laying eggs in foam sandwiched between leaves of the foodplant, and not in the ground.

In this paper I describe one new species of *Lithoscirtus* from Costa Rica and four new species of *Drymophilacris*, one from Costa Rica and three from Panama. All the new species are from montane forest of the Caribbean slope. Keys to these genera are given; their range is extended to Central Panama. The previously unknown female of *Drymacris panamae* Descamps is also described, and the species reassigned to *Drymophilacris*. Additional distributional and natural history records for the previously described species of the three genera are given.

Abbreviations of depositories: ANSP, Academy of Natural Sciences, Philadelphia, USA; INBio, Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica; MHNP, Museum National d'Histoire Naturelle, Paris, France; RC, the author's collection; UMMZ, University of Michigan Museum of Zoology, Ann Arbor, USA; UP, Museo de Invertebrados G.B. Fairchild, Universidad de Panamá, Panama.

## CHARACTERS OF THE GENUS GROUP

The Lithoscirtae were recognized as a subtribe of the tribe Proctolabini by Amédégnato (1974, 1977), and this usage was continued by Descamps in his 1976 revision. Within the subtribe the *Lithoscirtus* genus group is separated from other genera by the incurved posterior edge to the pronotum and by its microptery (except for *Drymacris nebulicola* (Descamps, 1976)); also by the fact that the upper ovipositor valves are to a greater or lesser extent dorsoventrally flattened into spatula-like organs (e.g. Figs. 3A, 7A), which diverge distally (unlike the situation in *Tela* and *Paratela*, where the valves are also spatulate, but parallel). The fastigium is more or less produced, subtriangular in dorsal view, ending in a low ridge separating it from the flattened frontal ridge. The prosternal process is wide and low. The male supra-anal plate and the posterior rim of the 10th. abdominal tergite anterior to it are usually covered with long vertical white hairs with bent-over horizontal tips (e.g. Figs 1C, 4B).

The male internal genitalia were first described and figured by Descamps (1976). All the Lithoscirtae have a flat, shield-shaped epiphallus (rather than disc-shaped, the term used by Descamps), devoid of ancorae and with small lophi (e.g. Fig. 2A). In the entire subfamily the ventrolateral sclerites are elongate and fused together at both ends, and posterior to the cingulum are united dorsally by a more or less sclerotised membrane. The resultant structure resembles the soleless upper of a shoe (e.g., Figs 2B, 5B); the cingular apodemes and endophallic processes project from the opening for the "ankle", the "heel" encloses the endophallus anteriorly, and the "toe" overhangs the aedeagal valves. Amédégnato (1977) pointed out that in the Lithoscirtae and most other proctolabines the anterior apodemes of the endophallus are lost, and replaced by very similar-looking structures derived from flattened projections of the central zone of the endophallus. For this reason the term "processes" rather than "apodemes" is used here). The cingulum is rather small and weak; paired lobes of thin, densely ornamented membrane run posteriorly from the rami, sheathing the lower aedeagal valves ventrolaterally midway to their tip (e.g. Figs 2B; 5B & D). The anterior processes of the endophallus are large, compressed laterally and provided with wide semimembranous margins (e.g. Figs 2B, 5B). The dorsal aedeagal sclerites are thin and bound by the sheathing membrane into a single medial dorsal aedeagal valve (e.g. Figs 2D, 5B & D), lying between the lower valves. In the Lithoscirtus genus group (as in the genera *Tela* and *Paratela*) the ventral sclerites of the aedeagus have a laterally directed hook (or hooks) at the tip (e.g. Figs 2B, D & E; 5B & D).

KEY TO GENERA (external characters)

MALES

- 1 Cerci long, only slightly incurved, with an abrupt embayment in the ventral edge at 2/3 of the length, tip laterally flattened and symmetrically rounded. Elytra cycloid, extending into 2nd abdominal segment and partially covering tympana . . . . . *Drymacris* Descamps & Rowell
- Cerci of various forms, but not as above. Elytra squamiform, extending maximally into metanotum . . . . . 2
- 2 Cerci abruptly flexed inwards by some 70° at about half length, completely or almost completely melanized; furcula absent (Fig. 1B-D) . . . . . *Lithoscirtus* Bruner
- Cerci curved smoothly inwards, forceps-like, usually only the distal region melanized; furcula absent or present (Figs. 4, 8,11,14 & 16, B-D in all cases) . . . . . *Drymphilacris* Descamps

FEMALES

- 1 Elytra cycloid, extending into 2nd abdominal segment and partially covering tympana. Cerci short, with blunt rounded tips (Fig. 19A, D). Dorsal ovipositor valves slightly excavated on dorsal surface, with raised internal edge (Fig. 19A, D). Subgenital plate flat (Fig. 19C) . . . . . *Drymacris* Descamps & Rowell

- Elytra squamiform, extending maximally into metanotum. Dorsal ovipositor valves flattened, spatulate. Cerci long and straight, with fine sharp points (Figs 3A, 7A, 10A, 13A, 18A). Subgenital plate domed or with paired swellings at anterior margin . . . . . 2
- 2 Subgenital plate smoothly domed in anterior region (Fig. 3C).  
 . . . . . *Lithoscirtus* Bruner
- Subgenital plate with paired ventral or ventrolateral swellings near anterior margin (Figs 7B & C, 10B & C, 13B & C, 18B & C)  
 . . . . . *Drymophilacris* Descamps

***Lithoscirtus* Bruner, 1908**

Bruner, 1908: 273. Type species: *Dellia miniatula* Rehn, 1905: 423. Rehn, 1929: 14. Amédégno, 1974: 200. Descamps, 1976: 68, 77-80 (revision of genus). Amédégno, 1977: 256. Amédégno & Poulain, 1987: 400.

Medium-small grasshoppers (>9.9, <20 mm in length); body size 14-17 mm (males), 17-19 mm (females). Hind femur 3.8-3.9X as long as pronotum, 0.20-0.23X as deep as long. Hind foot 0.39-0.46X as long as femur, second tarsal joint makes up 0.22-0.24 of foot. Interocular space narrow, 0.36-0.48X (males), 0.58-0.64X (females) as wide as antennal pedicel. Antennae long and filiform, 4.5-4.9 (males), 3.3-3.7X (females) as long as pronotum. Micropterous: elytra extend maximally to the anterior part of the metanotum. The thickened transverse ridge typically separating the fastigium from the frontal ridge in the Proctolabinae is obsolete in this genus (Descamps, 1976).

*Male characters.* Male cerci short, thick, inwardly flexed at their tip, typically heavily melanized throughout (that of *L. tessellatus* sp. n. has however a green outer face proximally). Epiphallus (Fig. 2A) subrectangular, as long or longer than its greatest width, widening posteriorly towards the lophi, which are more erect than in *Drymophilacris*. The anterior processes of the endophallic sclerites are remarkable and diagnostic of the genus, being large thin irregular crumpled sheets of chitin, resembling miniature cabbage leaves (see Figs 2B-D). Ventral sclerites of the aedeagus rather short, dorsoventrally flattened, wide proximally in ventral view, tapering to the tip, ending in recurved hooks (Fig. 2B-E).

*Female characters* (Fig. 3). Cerci straight, tapering to a fine point (as in *Drymophilacris*). Subgenital plate simple, triangular, but with concave posterior edges; the anterior region smooth and domed, without paired swellings. Posterior extremity of subgenital plate ("egg-guide") short, straight, laterally compressed and bluntly pointed in lateral view, about half as long as the visible portion of the ventral valves of ovipositor. Bursa copulatrix rather short and thin-walled relative to the other two genera. Lateral diverticulum of spermatheca with an initial wide chamber followed by a thinner, rather simply convoluted appendage without secondary diverticula.

KEY TO SPECIES OF *LITHOSCIRTUS* (males)

Males of this genus are traditionally separated on the complex shapes of the cerci (see Figs in Rehn, 1929 & Descamps, 1976, and Fig. 1 of this paper), which is undoubtedly the best method when dealing with museum specimens, but requires a microscope. The key given below is based on the colour differences of living animals, which are unambiguous for all except the two very similar species *miniatus* and *viceitas*. These latter however are nowhere sympatric and when alive differ markedly in ground colour (though not when dried). Females are best identified by association with their males, to which they are similarly coloured; all females and no males have white-tipped antennae. A rarer bronze-coloured female morph exists in all species.

- 1 Apex of subgenital plate entirely black without other markings. Body generally black, but with dark green iridescence in life; paired dorsoventral spots at posterior margin of pronotum whitish yellow (not green, as in other spp.). All legs green. Cercus in side view vertically truncate at tip. . . . . *L. daedalus* Rehn, 1929, southern (nominate) race.
- Not as above. . . . . 2
- 2 Apex of subgenital plate with paired coloured spots. Elytron extends into metanotum. . . . . 3
- Apex of subgenital plate with an undivided pale blue medial patch (or a pair of medially confluent ones); femora of mesothoracic legs red, other legs green. Elytron does not reach posterior border of mesonotum. . . . . 4
- 3 Apex of subgenital plate with paired pale blue patches. Fastigium and vertex markings, metallic blue green; femora of mesothoracic legs, red. Cercus in side view vertically truncate at tip. . . . . *L. daedalus* Rehn, 1929, northern race (cf. Descamps & Rowell, 1984).
- Apex of subgenital plate with paired dull green patches (Fig. 1B). Legs all green. Cercus in side view (Fig. 1C) tapering to a blunt, upwardly inflected tip, with a grey-green area near the base. Antennae black proximally and in distal half, but pale green in segments 2-7 (Fig. 1A). . . . . *L. tessellatus* sp. n.
- 4 Colour in life principally metallic green. Cercus in side view obliquely truncate at tip (N.E. Costa Rica). . . . . *L. miniatus* (Rehn, 1905)
- Colour in life principally metallic blue. Cercus in side view tapering to a point (S.E. Costa Rica, N. Panama). . . . . *L. viceitas* Rehn, 1929

**1. *Lithoscirtus miniatus* (Rehn, 1905)**

*Dellia miniatula* Rehn, 1905: 423. Bruner, 1908: 273. Kirby, 1910: 423.

*Lithoscirtus miniatus* Rehn, 1929: 19. Descamps, 1976: 77. Amédégnato, 1977: Figs 364-366.

Holotype male: COSTA RICA: Prov. S. José: Carrillo, June 1903 (J.A.G. Rehn) (ANSP).

Dimensions: see Table 1.

Distribution: NE Caribbean slope of Costa Rica from at least 1700 m down to about 300 m altitude. The species is typical of montane forest and does not occur in true lowland rain forest, where it is replaced ecologically by *Drymophilacris bimaculata*. As noted by Rehn (1929), Bruner's locality of Pozo Azul (on the Pacific slope) is almost certainly false. Rehn listed specimens from Carrillo, Juan Viñas, and Guápiles. Other specimens have now been taken from the Sarapiquí valley at Cinchona, La Virgen del Socorro and Chilamate (Provinces of Heredia and Alajuela); from the ridge between the Río Peje and the Río Sardinalito (Prov. Heredia); from Cerro Zurquí through the entire P.N. Braulio-Carrillo to Carrillo itself, and from the region around S. Jerónimo, Alto la Palma and Bajo la Hondura (Prov. S. José); along the upper reaches of the Río Toro Amarillo (Prov. S. José) down to Guápiles, and from near Tucurrique (Prov. Limón); and from Turrialba and Chitaria (Prov. Cartago).

This species is usually found on selected species of *Solanum* and *Witheringia*, but also occurs on *Datura* and (more rarely) on *Verbesina* and *Vernonia* spp. (Asteraceae).

## 2. *Lithoscirtus viceitas* Rehn, 1929

Rehn, 1929: 20. Descamps, 1976: 78.

Holotype male: COSTA RICA: Prov. Limón: Suretka trail, between the Sixaola and Estrella Valleys, 19 May 1924 (Bradley JC) (ANSP).

Dimensions: see Table 1. Apart from the ground colour when alive (see Key) and the form of the male cerci, almost indistinguishable from *L. miniatulus*. The pregenicular part of the hind femur is thicker in *viceitas*, as noted by Rehn (1929), but the difference is only 0.05 mm and requires simultaneous comparison of the two species to be seen.

Distribution: mid-elevation and lowland forest of the Caribbean slope, from the city of Limón (Costa Rica) south and east at least to Colón in Panama. The most widely distributed species of the genus, in many areas sympatric with one of several species of *Drymophilacris*.

Rehn's (1929) localities were from the Suretka trail (Prov. Limón) and the Ujarrás de Terraba (Prov. Cartago), both in montane forest in SE Costa Rica. It has since been found along the valley of the Río Pacuare down to near Turrialba (Prov. Cartago), and throughout the valleys of the Río Bananito, of the rivers of the Valle de la Estrella and of the Río Sixaola almost to sea level (Prov. Limón). In Panama it has been recorded from Prov. Bocas del Toro (Changuinola, Guabita, and above Chiriquí Grande), Prov. Coclé (Cerro Copé; El Valle de Antón, Cerro Gaitál), Prov. Panama (Cerro Campana) and Prov. Colón (Colón; Gatún; Porto Bello). The Panamanian localities range from 1100 to 20 m altitude.

A strict specialist on a few species of Solanaceae.

TABLE 1. Dimensions of *Lithoscirtus* spp. and *Drymacris*

	<i>Lithoscirtus daedalus</i>		<i>L. miniatulus</i>		<i>L. vicellus</i>		<i>L. tessellatus</i>		<i>Drymacris nebulicola</i>	
MALES	MEAN		MEAN		MEAN		MEAN		MEAN	
Dimensions in millimetres:	N = 5		N = 3		N = 3		N = 3		N = 3	
F: Hind femur, length	8.90 - 9.15	( 9.06)	10.30 - 9.33	( 9.74)	8.07 - 10.20	( 9.49)	10.03 - 10.58	(10.31)	10.40 - 11.44	(10.84)
FD: Hind femur, depth	1.93 - 2.08	( 2.00)	2.13 - 1.98	( 2.04)	1.72 - 2.15	( 1.98)	1.96 - 2.16	( 2.07)	1.97 - 2.07	( 2.02)
L: Rostrum-subgen. plate	14.64 - 14.72	(14.68)	15.79 - 14.94	(15.26)	12.32 - 16.98	(14.74)	16.14 - 18.04	(16.91)	15.06 - 15.78	(15.47)
P: Pronotum (midline)	2.36 - 2.45	( 2.39)	2.61 - 2.49	( 2.55)	2.05 - 2.72	( 2.47)	2.59 - 2.72	( 2.65)	3.01 - 3.23	( 3.13)
Interocular space	0.15 - 0.17	( 0.16)	0.16 - 0.14	( 0.15)	0.16 - 0.16	( 0.16)	0.18 - 0.21	( 0.20)	0.15 - 0.19	( 0.17)
EE: (eye-eye)	3.13 - 3.24	( 3.18)	3.23 - 3.13	( 3.19)	2.84 - 3.36	( 3.17)	3.19 - 3.36	( 3.28)	3.40 - 3.43	( 3.42)
Fastigium	0.38 - 0.52	( 0.44)	0.49 - 0.34	( 0.42)	0.38 - 0.40	( 0.39)	0.40 - 0.51	( 0.44)	0.51 - 0.56	( 0.54)
Antennal pedicel (width)	0.39 - 0.44	( 0.41)	0.41 - 0.40	( 0.41)	0.37 - 0.41	( 0.39)	0.39 - 0.42	( 0.41)	0.46 - 0.50	( 0.48)
Antenna	10.14 - 11.43	(10.84)	13.37 - 11.61	(12.47)	10.30 - 13.40	(12.12)	11.16 - 12.65	(12.11)	11.60 - 13.07	(12.38)
T1: hind tarsus 1	1.09 - 1.17	( 1.13)	1.41 - 1.13	( 1.26)	1.00 - 1.28	( 1.16)	1.33 - 1.34	( 1.33)	1.57 - 1.74	( 1.64)
T2: hind tarsus 2	0.86 - 0.92	( 0.89)	0.93 - 0.87	( 0.91)	0.76 - 0.84	( 0.80)	1.09 - 12.15	( 1.12)	1.35 - 1.47	( 1.43)
T3: hind tarsus 3	1.56 - 1.73	( 1.64)	2.12 - 1.86	( 1.96)	1.49 - 1.82	( 1.69)	2.26 - 2.32	( 2.29)	2.18 - 2.47	( 2.33)
<b>Ratios</b>										
FD/F	0.21 - 0.23	( 0.22)	0.22 - 0.21	( 0.21)	0.20 - 0.21	( 0.21)	0.20 - 0.21	( 0.20)	0.18 - 0.19	( 0.19)
F/P	3.73 - 3.88	( 3.79)	3.95 - 3.75	( 3.82)	3.75 - 3.94	( 3.85)	3.69 - 4.01	( 3.89)	3.31 - 3.54	( 3.47)
L/P	5.98 - 6.24	( 6.14)	6.19 - 5.76	( 5.98)	5.66 - 6.24	( 5.97)	6.11 - 6.63	( 6.38)	4.80 - 5.24	( 4.95)
Interoc./P	0.06 - 0.07	( 0.07)	0.06 - 0.05	( 0.06)	0.06 - 0.08	( 0.07)	0.07 - 0.08	( 0.07)	0.05 - 0.06	( 0.05)
Interocular/pedicel	0.38 - 0.43	( 0.40)	0.39 - 0.34	( 0.36)	0.39 - 0.43	( 0.41)	0.43 - 0.54	( 0.48)	0.30 - 0.41	( 0.36)
Fast/EE	0.12 - 0.17	( 0.14)	0.15 - 0.11	( 0.13)	0.12 - 0.14	( 0.13)	0.12 - 0.15	( 0.13)	0.15 - 0.16	( 0.16)
(T1 + T2 + T3)/F	0.40 - 0.42	( 0.40)	0.43 - 0.42	( 0.42)	0.37 - 0.40	( 0.39)	0.45 - 0.47	( 0.46)	0.49 - 0.50	( 0.50)
T2/ (T1+T2+ T3)	0.24 - 0.25	( 0.24)	0.43 - 0.42	( 0.22)	0.21 - 0.23	( 0.22)	0.23 - 0.24	( 0.24)	0.26 - 0.27	( 0.27)
Ant/Pronotum	4.28 - 4.67	( 4.53)	0.23 - 0.21	( 4.89)	4.80 - 5.02	( 4.92)	4.10 - 4.83	( 4.57)	3.59 - 4.34	( 3.97)
EE/F	0.34 - 0.36	( 0.35)	5.12 - 4.55	( 0.33)	0.32 - 0.35	( 0.33)	0.32 - 0.32	( 0.32)	0.30 - 0.33	( 0.32)
<b>FEMALES</b>										
Dimensions in millimetres:	MEAN		MEAN		MEAN		MEAN		MEAN	
	N = 3		N = 3		N = 3		N = 2		N = 3	
F: Hind femur, length	10.73 - 10.93	(10.83)	11.03 - 10.20	(10.75)	8.56 - 10.82	( 9.88)	11.10 - 12.11	(11.61)	11.59 - 12.36	(12.00)
FD: Hind femur, depth	2.27 - 2.47	( 2.39)	2.35 - 2.21	( 2.27)	1.97 - 2.42	( 2.25)	2.26 - 2.40	( 2.33)	2.41 - 2.46	( 2.43)
L: Rostrumsubgen. plate	16.74 - 18.58	(17.38)	17.38 - 18.28	(18.69)	14.30 - 18.63	(16.81)	17.86 - 19.39	(18.63)	19.46 - 19.27	(18.86)
P: Pronotum (midline)	2.81 - 2.90	( 2.85)	2.88 - 2.84	( 2.86)	2.44 - 3.07	( 2.74)	2.74 - 3.14	( 2.94)	3.61 - 3.78	( 3.68)
Interocular space	0.21 - 0.23	( 0.22)	0.24 - 0.21	( 0.23)	0.21 - 0.25	( 0.24)	0.29 - 0.32	( 0.31)	0.26 - 0.28	( 0.27)
EE: (eye-eye)	3.51 - 3.54	( 3.52)	3.50 - 3.34	( 3.40)	2.97 - 3.47	( 3.28)	3.55 - 3.57	( 3.56)	3.41 - 3.61	( 3.54)
Fastigium	0.43 - 0.56	( 0.50)	0.46 - 0.40	( 0.42)	0.41 - 0.52	( 0.45)	0.46 - 0.48	( 0.47)	0.54 - 0.65	( 0.60)
Antennal pedicel (width)	0.37 - 0.39	( 0.38)	0.40 - 0.36	( 0.38)	0.32 - 0.36	( 0.34)	0.35 - 0.40	( 0.38)	0.39 - 0.46	( 0.42)
Antenna	9.43 - 9.47	( 9.45)	10.00 - 9.67	( 9.83)	7.89 - 12.40	(10.01)	10.15 - 10.27	(10.21)	11 - 11.87	(11.40)
T1: hind tarsus 1	1.42 - 1.51	( 1.47)	1.38 - 1.33	( 1.35)	1.04 - 1.46	( 1.30)	1.49 - 1.54	( 1.52)	1.69 - 1.79	( 1.75)
T2: hind tarsus 2	0.98 - 1.01	( 1.00)	1.10 - 0.97	( 1.04)	0.71 - 1.00	( 0.87)	1.20 - 1.30	( 1.25)	1.42 - 1.56	( 1.50)
T3: hind tarsus 3	2.07 - 2.13	( 2.10)	2.26 - 1.85	( 2.10)	1.56 - 1.94	( 1.80)	2.41 - 2.60	( 2.51)	2.31 - 2.63	( 2.49)
<b>Ratios</b>										
FD/F	0.21 - 0.23	( 0.22)	0.22 - 0.20	( 0.21)	0.22 - 0.23	( 0.23)	0.20 - 0.20	( 0.20)	0.19 - 0.21	( 0.20)
F/P	3.77 - 3.85	( 3.80)	3.86 - 3.59	( 3.76)	3.51 - 3.80	( 3.61)	3.86 - 4.05	( 3.95)	3.19 - 3.38	( 3.26)
L/P	5.80 - 6.54	( 6.10)	6.03 - 5.69	( 5.83)	5.86 - 6.48	( 6.14)	6.18 - 6.52	( 6.35)	4.88 - 5.27	( 5.12)
Interoc./P	0.07 - 0.08	( 0.08)	0.08 - 0.07	( 0.08)	0.08 - 0.09	( 0.09)	0.09 - 0.12	( 0.10)	0.07 - 0.08	( 0.07)
Interocular/pedicel	0.54 - 0.61	( 0.58)	0.67 - 0.53	( 0.59)	0.66 - 0.76	( 0.70)	0.73 - 0.01	( 0.82)	0.61 - 0.72	( 0.65)
Fast/EE	0.12 - 0.16	( 0.14)	0.14 - 0.12	( 0.12)	0.12 - 0.15	( 0.14)	0.13 - 0.13	( 0.13)	0.15 - 0.18	( 0.17)
(T1+T2+T3)/F	0.42 - 0.43	( 0.42)	0.43 - 0.41	( 0.42)	0.38 - 0.41	( 0.40)	0.76 - 0.83	( 0.80)	0.47 - 0.50	( 0.48)
T2/ (T1+T2+T3)	0.21 - 0.22	( 0.22)	0.23 - 0.23	( 0.23)	0.21 - 0.23	( 0.22)	0.24 - 0.24	( 0.24)	0.26 - 0.26	( 0.26)
Ant/Pronotum	3.26 - 3.37	( 3.32)	3.47 - 3.38	( 3.44)	3.23 - 4.04	( 3.63)	3.23 - 3.75	( 3.49)	3.04 - 3.14	( 3.09)
EE/F	0.32 - 0.33	( 0.33)	0.33 - 0.30	( 0.32)	0.32 - 0.35	( 0.33)	0.29 - 0.32	( 0.31)	0.28 - 0.31	( 0.30)

### 3. *Lithoscirtus daedalus* Rehn, 1929

Rehn, 1929: 22. Descamps & Rowell, 1984: 155.

Holotype male: COSTA RICA: Prov. Cartago: Navarro, 3800-3950 m, 24. July 1927 (Lankester CH. Rehn JAG) (ANSP).

Dimensions: see Table 1.

This Costa Rican species occurs in two distinct colour forms which are geographically separated (Descamps & Rowell, 1984). It is apparently confined to the upper reaches (above 1000 m altitude) of the Río Reventazón and its tributaries.

A strict specialist on a few species of Solanaceae.

The ranges of the three preceding species adjoin each other in the neighbourhood of Turrialba. Nowhere are they known to be sympatric.

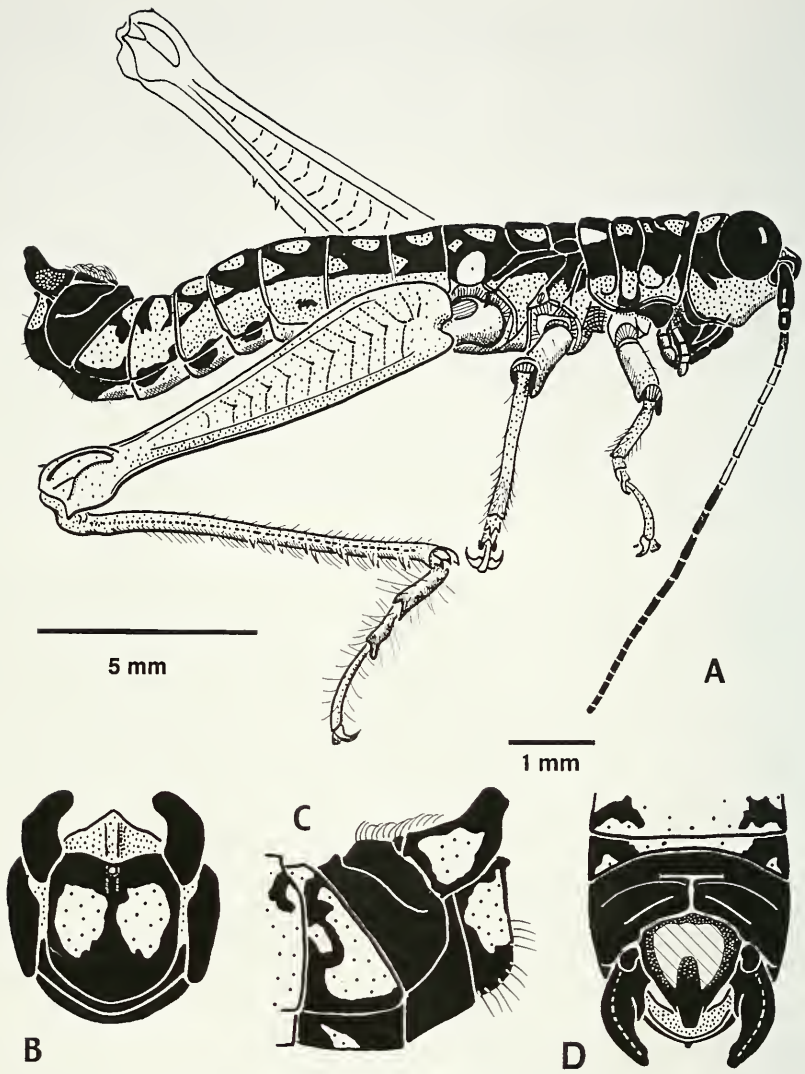


FIG. 1

*Lithoscirtus tessellatus* sp. n., male. A, Habitus. B-C, external genital region, in axial, lateral and dorsal views.



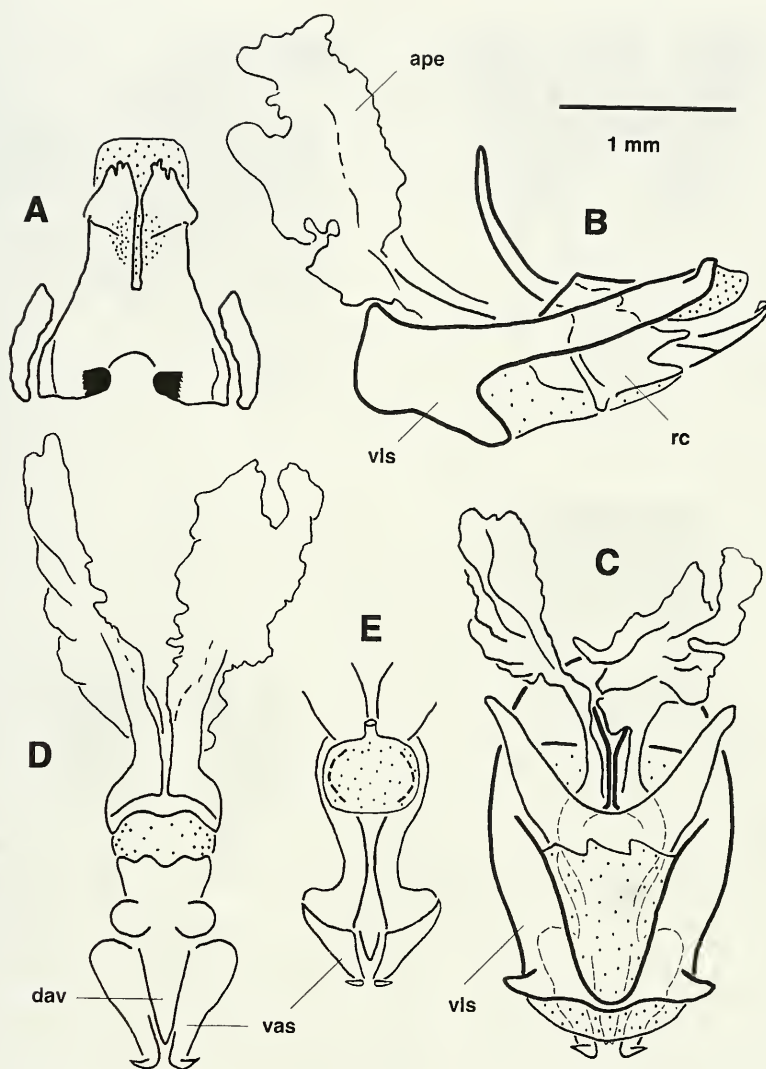


FIG. 2

*Lithoscirtus tessellatus* sp. n., male. Internal genitalia. A, epiphallus. B, C, phallic complex in lateral and dorsal views. D, E, endophallus in dorsal and ventral views. Abbreviations: ape, anterior process of endophallus; dav, dorsal aedeagal valve; rc, rami of cingulum and associated membranes; vas, ventral aedeagal sclerite; vls, ventrolateral sclerite.

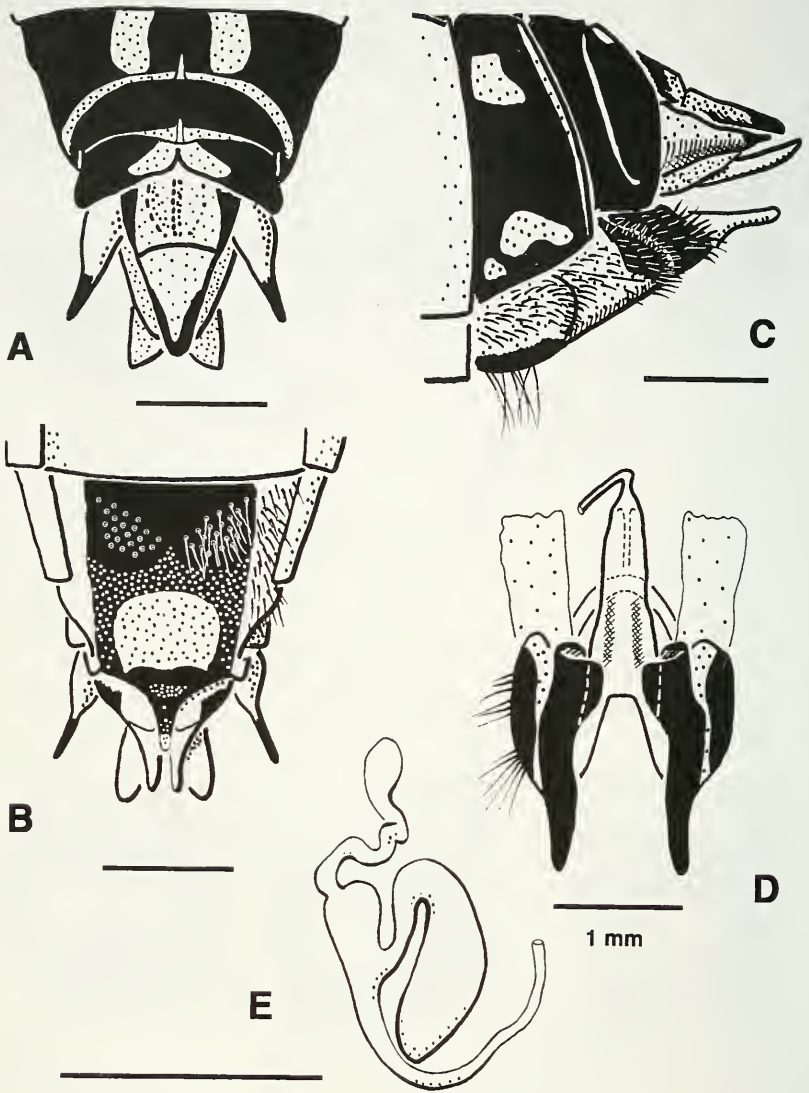


FIG. 3.

*Lithoscirtus tessellatus* sp. n., female. A-C, external genital region in dorsal, ventral and lateral views. D, ventral ovipositor valves and bursa copulatrix. E, spermatheca.

#### 4. *Lithoscirtus tesselatus* sp. n.

Holotype male: COSTA RICA: Guanacaste Prov.: Volcan Tenorio: nr. summit of rd. from Tierras Morenas to Bajo Los Cartagos. 1040 m, LN287250\_426500, 21 July 1991 (Rowell CHF & Elsner N), specimen no. 91108. Allotype female: same data as holotype, specimen no. 91109 (both ANSP). Paratypes: As holotype, male, specimen no. 91107 (RC). Guanacaste Prov.: Tilarán, Zona Protectora Tenorio A.C.A., Río San Lorenzo. 1050 m, LN287800\_427600, May 1994 (G. Rodriguez), specimen nos. CRI001 873901 (male), CRI001 873902 (female); (INBio).

Etymology: Latin *tesselatus*, inlaid with square mosaic stones, referring to the pattern of green and black markings.

MALE (Fig. 1). Elytron squamiform, large for the genus, reaching to anterior margin of metanotum. Wing absent. Cerci (Fig. 1B-D) short, bent abruptly inwards halfway to tip at 45°, tip rounded, concavely excavated on ventral edge. Subgenital plate (Fig. 1B-D) with a short round tubercle medially and apically, at the junction of the plate and the pallium. Furcula absent. Supra-anal plate (Fig. 1D) longer than wide, ending in a blunt-tipped medial process.

Internal genitalia (Fig. 2) generally typical of the genus. The hooks at the tips of the ventral valves are more robust and less curved than in the other species.

Coloration: Antennae: scape, pedicel and first flagellar segment, glossy black; flagellar segments 2-7, pale green, 8 to 21 (tip), dull black. Eyes black (brown when dried). Palps green; mandibles, labrum and clypeus, glossy black. Rest of head basically green; inverted V on vertex, post-ocular stripe, ventral rim of frons, ventral and posterior rim of genae, antennal sockets, rostrum, and an hourglass-shaped mark on frontal ridge, with narrowest point ventral to the medial ocellus: glossy black.

Disc of pronotum, glossy black. A pair of dorsolateral green spots in front of each sulcus, and a pair of yellow spots behind the third sulcus, reaching the hind margin. Lateral lobes glossy black, blotched with green ventrally, proepimeron black. Mesonotum black. Elytron, black, dorsal margin green-brown. Mesonotum black with central green blotch and paired yellow spots dorsolaterally at hind margin. Meso- and metepimera and episterna black dorsally, green ventrally.

Front and middle legs yellow proximally, shading to green by the middle of the femur, each with 4 brown tibial spines. Claws and pulvilli black. Hind femur green, hind tarsus green proximally, blue-green distally, tibial spines (7 externally, 8 internally) and spurs brown, tipped black. Tarsi green, claws and pulvillus brown, tipped black.

Abdominal segments with same pattern as metanotum, but with paired medial green marks, increasing in relative size towards the distal segments. Underside black, with a pale posterior rim to each segment. Genital region black. Supraanal plate (Fig. 1D) lemon yellow, bordered black, covered thinly with long white hairs. Cerci (Fig. 1B-D) mostly black but greenish proximally on outer surface. Subgenital plate (Fig. 1B, C) black, with paired green spots.

FEMALE. Elytron squamiform, overlapping anterior margin of metanotum. Supra-anal plate (Fig. 3A) triangular, longer than wide, tip rounded, almost as long as

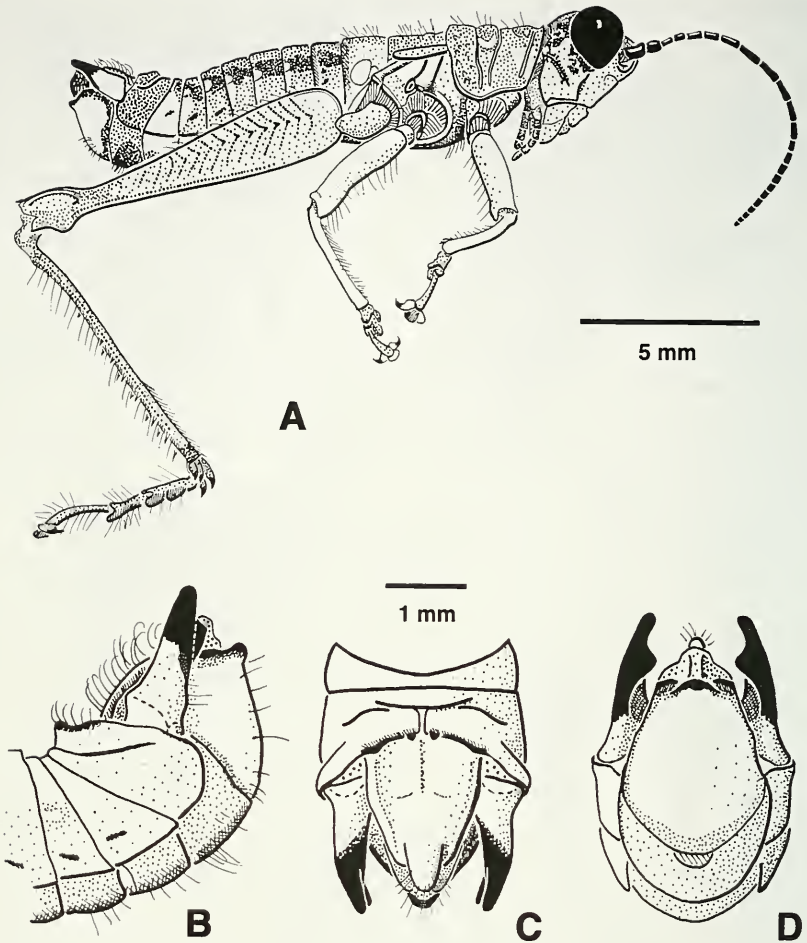


FIG. 4

*Drymophilacris panamae* Descamps, male. A. habitus. B-D. external genitalia in lateral, dorsal and ventral views.

dorsal ovipositor valves, transversely divided, with a shallow medial depression proximally. Subgenital plate (Fig. 3B, C) melanized in medial region, smoothly domed anteriorly, with paired patches of long hairs (in the position of the swellings of *Drymophilacris*), flat posteriorly, with a central semi-membranous area, posterior edges concave, apex ("egg-guide") short, not more than half the length of the ventral valves in ventral view; lateral lobes densely hairy.

Internal genitalia (Fig. 3D, E). Typical of genus (see above). Basal external shoulder of ventral ovipositor valves sclerotized and provided with long lateral hairs.

Coloration other than in antennal and genital regions as in male, but markings somewhat less clearly defined and colours less brilliant. Antennae black, terminal 2 segments white, the preceding one reddish brown. Supraanal plate olive green, shading to olive brown, blackish at tip. Ovipositor valves, brown-black; dorsal face of upper valves, green. Subgenital plate blackish-brown, lateral lobes green.

Dimensions: see Table 1. *L. tessellatus* is the largest species of the genus to date; its proportions, however, are normal.

This species appears to be more closely related to *L. daedalus* than to the *miniatus/viceitas* complex. The former has a trace of the protuberance at the apex of the dorsal edge of the male subgenital plate, seen in *tessellatus*, as well as the longer elytra.

Natural History. On Solanaceae in clearings and at edges of mid-altitude montane forest in the Tilarán area. At first sight looks like a small example of *Dryophilacris montevertensis*, which has a very similar coloration and is geographically close. Males are however readily distinguished by the subgenital plate with its twin small green spots, that of *D. uonteverdensis* is entirely pale turquoise blue. The pale proximal third of the male antenna is also distinctive; those of *D. uonteverdensis* are entirely black.

### *Dryophilacris* Descamps, 1976

Descamps, 1976: 80. Type species: *Dellia bimaculata* Rehn, 1905: 426. Amédégnato, 1977: 256. Descamps & Rowell, 1978: 358. Amédégnato & Poulain, 1987: 400.

Medium-small (>10, <20 mm) to medium (>20, <30 mm) sized grasshoppers: body length 14-19 mm (males), 17-22 mm (females). Hind femur 3.5-4.0X as long as pronotum, 0.20-0.24X as deep as long. Hind foot 0.42-0.48X as long as femur, second tarsal joint makes up 0.21-0.25 of foot. Interocular space narrow but somewhat wider than that of *Lithoscirtus*, 0.48-0.52X (males), 0.69-0.82X (females) as wide as antennal pedicel. Antennae 3.7-4.8X (males), 2.5-3.5X (females) as long as pronotum, thus tending to be slightly shorter than those of *Lithoscirtus*. Micropterous, elytra do not exceed posterior border of metanotum (*D. panamae*), and are still smaller in the remaining spp.

*Male characters.* Cerci long, gradually curving inwards, forceps-like, nearly straight or somewhat sigmoid in lateral view, with tips of variable shape. Rim of subgenital plate pinched together at apex and prolonged medially, like the lip of a jug. Endophallus has large regularly oval anterior processes, with doubly flanged margins, sharply differentiating the genus from *Lithoscirtus*. Ventral aedeagal sclerites thin and tapering in both lateral and ventral view, ending in one or more sets of recurved hooks. Epiphallus usually relatively broader than that of *Lithoscirtus*, nearer square than rectangular in dorsal view, less narrowed anteriorly, lophi less erect.

*Female characters.* Cerci long and slender at tip, acutely pointed, similar to those of *Lithoscirtus*. Upper ovipositor valve flattened dorsoventrally, upper face flat (as in *Lithoscirtus*). Subgenital plate simple, triangular, posterior edges almost

straight, with 2 more or less prominent swellings near anterior margin; in some species these form large laterally projecting bulges visible from above. Apex of subgenital plate ("egg-guide") of variable length, from short in *D. bimaculata* to equalling the ventral ovipositor valves in *D. rubripes* and *D. nigrescens*; tip upturned, straight or downturned in lateral view. Spermatheca similar to *Lithoscirtus*, but with a more complex appendage of the lateral diverticulum, usually provided with pouches and small diverticula (but simple in *D. bimaculata*).

KEY TO SPECIES OF *DRYMOPHILACRIS* (adult males)

- 1 Subgenital plate black with a pair of yellow spots. Hind knees wholly or partly reddish brown. . . . . 2
- Subgenital plate not as above. . . . . 4
- 2 Clypeus, labrum, frontal ridge, frons, genae: yellow, lightly mottled with small black markings. Antenna in dorsal view black, minutely ringed with white at joints, terminal segment white. Furcula absent (Caribbean Costa Rica). . . . . *D. bimaculata* (Rehn, 1905)
- Face not as above; at least clypeus, labrum and antennal sockets black. Furcula present. . . . . 3
- 3 Frontal ridge, frons and ventral part of genae entirely black; terminal two segments of antennae white; furcula well-developed (Fig. 16) (Coclé Prov., Panama). . . . . *D. melanopsis* sp. n.
- Frontal ridge black only in dorsal region; remainder of frons and genae, yellow; spots of subgenital plate relatively small, covering only about half of total area; furcula small (Fig. 14) (Veraguas Prov., Panama). . . . . *D. veraguensis* sp. n.
- 4 Cercus with ventral distal extremity angled obliquely inwards and shorter than dorsal extremity (Figs 4 & 8). . . . . 5
- Cercus not as above. . . . . 6
- 5 Subgenital plate black with broadly confluent green spots; supra-anal plate yellow-green; hind knees red; antennae black with indistinct pale annulations proximally; furcula absent (Fig. 8) (highlands of Central Costa Rica). . . . . *D. glyphocerca* sp. n.
- Subgenital plate entirely pale blue, supra-anal plate yellow brown; all femora light reddish brown; furcula present but minute (Fig. 4) (highlands of SW Costa Rica and SW Panama). . . . . *D. panamae* Descamps, 1976
- 6 Cercus long and nearly parallel-sided in lateral view, almost completely black; subgenital plate entirely turquoise, supra-anal plate emerald green in life, yellow green when dried; furcula absent (Cordillera del Norte, Costa Rica). . . . . *D. monteverdensis* Desc. & Rowell, 1978
- Cercus not as above; subgenital plate with confluent or narrowly separated blue-grey spots; furcula small but present. . . . . 7
- 7 Supra-anal plate blue-grey; femora of middle legs red basally, blue distally; pronotum mostly green (lowlands, Bocas del Toro, Panama). . . . . *D. rubripes* Desc. & Rowell, 1984

- Supra-anal plate yellow; femora of middle legs yellow basally, green distally; pronotum mostly black (Fig. 11) (highlands, Bocas del Toro, Panama). . . . . *D. nigrescens* sp. n.

### 5. *Drymphilacris bimaculata* (Rehn, 1905)

*Dellia bimaculata* Rehn, 1905: 426. Bruner, 1908: 272.

*Lithoscirtus bimaculatus* Rehn, 1929: 26.

*Drymphilacris bimaculata* Descamps, 1976: 81. Amédégnato, 1977: 256, Fig. 346. Descamps & Rowell, 1978: 359. Rowell, 1983: 714.

Holotype male: COSTA RICA: Prov. S. José: Carrillo, June 1903 (ANSP).

The species differs from all others in the noticeably upturned tip to the dorsal aedeagal valve, as illustrated in Descamps (1976). The recurved tips of the ventral valves are also proportionately longer than in other species.

Dimensions, see Table 2.

A specialist on species of *Solanum* and *Witheringia*.

Distribution. As indicated by Descamps & Rowell (1978), the species is widely distributed on the Caribbean slope of Costa Rica, from sea level to over 1000 m. It does not however seem to extend south of the Valle de la Estrella; though recorded from Puerto Viejo on the coast, it is absent from the valley of the R. Sixaola and in the adjoining area of Panama is replaced by *D. rubripes*. Its possible occurrence in the lowlands of Nicaragua is undocumented.

### 6. *Drymphilacris monteverdensis* Descamps & Rowell, 1978

Descamps & Rowell, 1978: 358.

Holotype male: COSTA RICA: Prov. Puntarenas: Monteverde, 1400 m, LN 253500\_448400, 10. Sept. 1975 (Rowell CHF) (MHNP).

New material examined: COSTA RICA: Prov. Guanacaste: W side of Volcán Cacao, Estac. Mengo, 1400 m, LN 323700\_376700, 11 July 1988 (Janzen D, Hallwachs W). specimen no. CRI001 013274, and other later specimens from same locality (INBio).

Dimensions, see Table 2.

A specialist on species of *Solanum* and *Lycium*.

Previously recorded only from the region around the type locality, this species is now also known in a particularly large and robust form from Volcán Cacao, some 95 km to the NW.

### 7. *Drymphilacris rubripes* Descamps & Rowell, 1984

Descamps & Rowell, 1984: 154.

Holotype male: PANAMA: Prov. Bocas del Toro; Changuinola District, United Fruit Co. Plantation, 3. Oct. 1925 (Walker FW) (UMMZ).

New material examined: PANAMA: Prov. Bocas del Toro; Parque Internacional La Amistad, WEKSO-Region Teribé, 20.10.99 (DeGrazia L & Santos A), specimen nos. 99502 & 99503 (UP).

Dimensions, see Table 2.

TABLE 2. Dimensions of

	<i>Dr. bimaculata</i>		<i>Dr. montevidensis</i>		<i>Dr. rubripes</i>		<i>Dr. panamae</i>	
MALES	MEAN		MEAN		MEAN		MEAN	
Dimensions in millimetres:	N = 3		N = 3		N = 2		N = 5	
F: Hind femur, length	9.29 - 10.23 ( 9.88)		12.18 - 11.95 (12.05)		9.11 - 9.66 ( 9.39)		9.07 - 9.93 ( 9.50)	
FD: Hind femur, depth	2.15 - 2.27 ( 2.21)		2.51 - 2.45 ( 2.48)		1.99 - 2.04 ( 2.02)		1.90 - 2.06 ( 1.97)	
L: Rostrum-subgen. plate	15.05 - 16.91 (15.88)		19.70 - 18.61 (19.26)		15.00 - 15.81 (15.41)		14.06 - 15.82 (14.82)	
P: Pronotum (midline)	2.46 - 2.67 ( 2.59)		3.45 - 3.13 ( 3.32)		2.55 - 2.70 ( 2.63)		2.70 - 2.93 ( 2.77)	
Interocular space	0.18 - 0.19 ( 0.19)		0.27 - 0.21 ( 0.24)		0.18 - 0.20 ( 0.19)		0.19 - 0.22 ( 0.20)	
EE: (eye-eye)	3.16 - 3.48 ( 3.30)		3.82 - 3.65 ( 3.71)		3.14 - 3.35 ( 3.25)		3.16 - 3.28 ( 3.23)	
Fastigium	0.38 - 0.41 ( 0.40)		0.50 - 0.47 ( 0.48)		0.19 - 0.31 ( 0.25)		0.33 - 0.59 ( 0.46)	
Antennal pedicel (width)	0.38 - 0.40 ( 0.39)		0.55 - 0.46 ( 0.49)		0.38 - 0.41 ( 0.40)		0.41 - 0.43 ( 0.42)	
Antenna	11.19 - 12.26 (11.66)		13.39 - 12.76 (13.07)		11.57 - 11.57 (11.57)		9.37 - 10.22 ( 9.61)	
T1: hind tarsus 1	1.27 - 1.53 ( 1.39)		1.77 - 1.70 ( 1.73)		1.13 - 1.27 ( 1.20)		1.24 - 1.50 ( 1.33)	
T2: hind tarsus 2	0.80 - 1.16 ( 0.98)		1.45 - 1.40 ( 1.43)		0.92 - 0.92 ( 0.92)		1.04 - 1.20 ( 1.12)	
T3: hind tarsus 3	1.87 - 2.18 ( 2.05)		2.55 - 2.52 ( 2.53)		1.76 - 1.94 ( 1.85)		1.80 - 2.00 ( 1.88)	
<b>Ratios</b>								
FD/F	0.21 - 0.24 ( 0.22)		0.21 - 0.20 ( 0.21)		0.21 - 0.22 ( 0.21)		0.20 - 0.22 ( 0.21)	
F/P	3.78 - 3.88 ( 3.82)		3.82 - 3.53 ( 3.64)		3.57 - 3.58 ( 3.58)		3.25 - 3.66 ( 3.44)	
L/P	5.94 - 6.33 ( 6.13)		6.22 - 5.52 ( 5.82)		5.56 - 6.20 ( 5.88)		5.20 - 5.57 ( 5.36)	
Interoc./P	0.07 - 0.08 ( 0.07)		0.08 - 0.06 ( 0.07)		0.07 - 0.07 ( 0.07)		0.06 - 0.08 ( 0.07)	
Interocular/pedicel	0.45 - 0.50 ( 0.48)		0.51 - 0.46 ( 0.49)		0.47 - 0.49 ( 0.48)		0.44 - 0.54 ( 0.48)	
Fast/EE	0.11 - 0.13 ( 0.12)		0.14 - 0.12 ( 0.13)		0.06 - 0.09 ( 0.08)		0.10 - 0.18 ( 0.14)	
(T1+T2+T3)/F	0.42 - 0.46 ( 0.46)		0.48 - 0.46 ( 0.47)		0.42 - 0.43 ( 0.42)		0.43 - 0.48 ( 0.46)	
T2/(T1+T2+T3)	0.20 - 0.25 ( 0.22)		0.25 - 0.25 ( 0.25)		0.22 - 0.24 ( 0.23)		0.25 - 0.27 ( 0.26)	
Ant/Pronotum	4.24 - 4.69 ( 4.51)		4.28 - 3.78 ( 3.95)		4.54 - 4.54 ( 4.54)		3.30 - 3.77 ( 3.48)	
EE/F	0.32 - 0.34 ( 0.33)		0.31 - 0.30 ( 0.31)		0.34 - 0.35 ( 0.35)		0.33 - 0.35 ( 0.34)	
<b>FEMALES</b>								
Dimensions in millimetres:	N = 3		N = 3		N = 2		N = 4	
F: Hind femur, length	10.57 - 11.82 (11.12)		13.18 - 12.71 (13.01)		10.26 - 10.76 (10.51)		10.13 - 10.67 (10.40)	
FD: Hind femur, depth	2.54 - 2.60 ( 2.56)		2.70 - 2.69 ( 2.73)		2.26 - 2.47 ( 2.37)		2.09 - 2.24 ( 2.14)	
L: Rostrum-ovip.	17.11 - 19.36 (18.41)		22.18 - 21.76 (21.91)		17.28 - 17.43 (17.36)		18.06 - 16.89 (16.37)	
P: Pronotum (midline)	3.00 - 3.07 ( 3.04)		3.84 - 3.72 ( 3.77)		2.86 - 2.86 ( 2.86)		2.84 - 3.05 ( 2.92)	
Interocular space	0.28 - 0.31 ( 0.29)		0.33 - 0.32 ( 0.32)		0.24 - 0.25 ( 0.25)		0.26 - 0.33 ( 0.31)	
EE: (eye-eye)	3.44 - 3.54 ( 3.48)		4.09 - 3.94 ( 4.01)		3.36 - 3.52 ( 3.44)		3.33 - 3.54 ( 3.43)	
Fastigium	0.46 - 0.56 ( 0.51)		0.64 - 0.55 ( 0.59)		0.35 - 0.38 ( 0.37)		0.51 - 0.59 ( 0.54)	
Antennal pedicel (width)	0.37 - 0.41 ( 0.38)		0.45 - 0.44 ( 0.44)		0.36 - 0.37 ( 0.37)		0.34 - 0.38 ( 0.36)	
Antenna	9.37 - 10.79 (10.17)		11.40 - 10.00 (10.50)		no data		7.45 - 8.25 ( 7.98)	
T1: hind tarsus 1	1.41 - 1.54 ( 1.49)		1.90 - 1.74 ( 1.83)		1.20 - 1.47 ( 1.34)		1.44 - 1.55 ( 1.50)	
T2: hind tarsus 2	0.99 - 1.11 ( 1.03)		1.69 - 1.49 ( 1.57)		0.95 - 1.03 ( 0.99)		0.28 - 1.21 ( 0.96)	
T3: hind tarsus 3	2.14 - 2.41 ( 2.24)		2.85 - 2.68 ( 2.79)		2.10 - 2.13 ( 2.12)		1.97 - 2.16 ( 2.10)	
<b>Ratios</b>								
FD/F	0.22 - 0.24 ( 0.23)		0.21 - 0.20 ( 0.21)		0.22 - 0.23 ( 0.22)		0.20 - 0.21 ( 0.21)	
F/P	3.52 - 3.85 ( 3.65)		3.53 - 3.38 ( 3.45)		3.59 - 3.76 ( 3.67)		3.32 - 3.72 ( 3.57)	
L/P	5.70 - 6.31 ( 6.05)		5.85 - 5.78 ( 5.81)		6.04 - 6.09 ( 6.07)		0.00 - 5.89 ( 4.27)	
Interoc./P	0.09 - 0.10 ( 0.10)		0.09 - 0.08 ( 0.09)		0.08 - 0.09 ( 0.09)		0.09 - 0.11 ( 0.11)	
Interocular/pedicel	0.71 - 0.84 ( 0.77)		0.75 - 0.71 ( 0.73)		0.65 - 0.69 ( 0.67)		0.76 - 0.94 ( 0.87)	
Fast/EE	0.13 - 0.16 ( 0.15)		0.16 - 0.14 ( 0.15)		0.10 - 0.11 ( 0.11)		0.11 - 0.15 ( 0.14)	
(T1+T2+T3)/F	0.43 - 0.43 ( 0.43)		0.49 - 0.46 ( 0.48)		0.21 - 0.24 ( 0.22)		0.38 - 0.47 ( 0.44)	
T2/(T1+T2+T3)	0.21 - 0.22 ( 0.22)		0.26 - 0.25 ( 0.25)		0.42 - 0.42 ( 0.42)		0.07 - 0.25 ( 0.21)	
Ant/Pronotum	3.12 - 3.51 ( 3.34)		3.06 - 2.63 ( 2.78)		no data		2.60 - 2.84 ( 2.73)	
EE/F	0.29 - 0.33 ( 0.31)		0.03 - 0.02 ( 0.02)		0.33 - 0.33 ( 0.33)		0.31 - 0.35 ( 0.33)	

The original description was based on a 60-year old museum series. Fresh new specimens from a nearby region (some 20 km higher up the Río Teribé) show that the types are badly discoloured. The description of the coloration must be amended as below.

MALE. General colour, dark green. Antennae, black; 21 flagellar segments. Eyes, black (brown when dried). Frons and genae blueish-white, with a black band running from eyes through antennal sockets and including the rostrum; lower edge of frons and genae edged black. Mouthparts black, palps white. Postocular stripe and vertex, black. Fastigium and inverted V marking on vertex, blue grey. Pronotum green, with black postocular stripe produced over lateral lobes to posterior border,



*Drymophilacris* spp.

<i>Dr. glyphocerca</i> n. sp.	<i>Dr. metanopsis</i> n. sp.	<i>Dr. nigrescens</i> n. sp.	<i>Dr. veraguensis</i> n. sp.
MEAN N = 5	MEAN N = 3	MEAN N = 5	MEAN N = 2
9.45 - 9.97 ( 9.68)	10.42 - 11.00 (10.74)	9.92 - 10.41 (10.09)	9.11 - 9.69 ( 9.40)
2.10 - 2.24 ( 2.18)	2.30 - 2.32 ( 2.31)	1.98 - 2.16 ( 2.10)	1.90 - 2.06 ( 1.98)
14.01 - 15.31 (14.64)	16.44 - 18.30 (17.27)	15.75 - 16.30 (16.01)	13.80 - 14.84 (14.32)
2.55 - 2.89 ( 2.75)	2.83 - 3.02 ( 2.94)	2.53 - 2.75 ( 2.67)	2.50 - 2.64 ( 2.57)
0.20 - 0.26 ( 0.22)	0.20 - 0.22 ( 0.21)	0.17 - 0.23 ( 0.19)	0.14 - 0.23 ( 0.19)
3.33 - 3.39 ( 3.36)	3.39 - 3.58 ( 3.48)	3.23 - 3.37 ( 3.29)	3.09 - 3.21 ( 3.15)
0.42 - 0.53 ( 0.48)	0.39 - 0.45 ( 0.42)	0.33 - 0.49 ( 0.39)	0.27 - 0.29 ( 0.28)
0.39 - 0.47 ( 0.43)	0.41 - 0.43 ( 0.42)	0.38 - 0.47 ( 0.42)	0.37 - 0.37 ( 0.37)
9.09 - 10.80 (10.11)	12.91 - 13.42 (13.21)	12.04 - 13.39 (12.47)	8.28 - 8.28 ( 8.28)
1.31 - 1.39 ( 1.36)	1.41 - 1.56 ( 1.47)	1.22 - 1.41 ( 1.33)	1.13 - 1.23 ( 1.18)
0.86 - 0.98 ( 0.94)	1.13 - 1.22 ( 1.19)	1.07 - 1.25 ( 1.13)	0.96 - 1.07 ( 1.02)
1.89 - 2.05 ( 1.98)	2.21 - 2.42 ( 2.30)	2.06 - 2.18 ( 2.11)	1.89 - 1.92 ( 1.91)
0.22 - 0.23 ( 0.23)	0.21 - 0.22 ( 0.22)	0.20 - 0.21 ( 0.21)	0.21 - 0.21 ( 0.21)
3.34 - 3.82 ( 3.52)	3.45 - 3.82 ( 3.66)	3.66 - 3.93 ( 3.78)	3.64 - 3.67 ( 3.66)
5.17 - 5.74 ( 5.33)	5.55 - 6.47 ( 5.89)	5.75 - 6.40 ( 6.00)	5.52 - 5.62 ( 5.57)
0.07 - 0.10 ( 0.08)	0.07 - 0.08 ( 0.07)	0.06 - 0.09 ( 0.07)	0.05 - 0.09 ( 0.07)
0.45 - 0.57 ( 0.52)	0.48 - 0.51 ( 0.50)	0.40 - 0.56 ( 0.47)	0.38 - 0.62 ( 0.50)
0.13 - 0.16 ( 0.14)	0.11 - 0.13 ( 0.12)	0.10 - 0.15 ( 0.12)	0.09 - 0.09 ( 0.09)
0.43 - 0.46 ( 0.44)	0.44 - 0.47 ( 0.46)	0.44 - 0.46 ( 0.45)	0.43 - 0.44 ( 0.44)
0.21 - 0.23 ( 0.22)	0.23 - 0.25 ( 0.24)	0.24 - 0.26 ( 0.25)	0.24 - 0.26 ( 0.25)
3.35 - 4.24 ( 3.68)	4.27 - 4.70 ( 4.50)	4.39 - 5.29 ( 4.68)	3.14 - 3.14 ( 3.14)
0.34 - 0.35 ( 0.35)	0.32 - 0.33 ( 0.32)	0.32 - 0.34 ( 0.33)	0.33 - 0.34 ( 0.34)
N = 5	N = 2	N = 5	
9.93 - 10.65 (10.38)	12.23 - 12.66 (12.45)	10.96 - 11.63 (11.33)	
2.38 - 2.56 ( 2.46)	2.68 - 2.77 ( 2.73)	2.29 - 2.41 ( 2.36)	
17.22 - 18.27 (17.79)	20.66 - 21.07 (20.87)	17.57 - 20.38 (18.58)	
3.16 - 3.30 ( 3.25)	3.47 - 3.63 ( 3.55)	2.83 - 3.30 ( 3.04)	
0.31 - 0.34 ( 0.32)	0.29 - 0.31 ( 0.30)	0.29 - 0.36 ( 0.32)	
3.42 - 3.61 ( 3.50)	3.74 - 3.79 ( 3.77)	3.55 - 3.68 ( 3.61)	
0.50 - 0.60 ( 0.53)	0.53 - 0.57 ( 0.55)	0.45 - 0.52 ( 0.49)	
0.39 - 0.41 ( 0.40)	0.43 - 0.44 ( 0.44)	0.37 - 0.40 ( 0.39)	
7.79 - 8.72 ( 8.31)	9.92 - 11.60 (10.76)	9.59 - 10.46 ( 9.92)	
1.32 - 1.50 ( 1.37)	1.67 - 1.73 ( 1.70)	1.36 - 1.54 ( 1.45)	
0.97 - 1.06 ( 1.01)	1.27 - 1.44 ( 1.36)	1.18 - 1.31 ( 1.23)	
1.84 - 2.07 ( 2.00)	2.71 - 2.71 ( 2.71)	2.20 - 2.39 ( 2.30)	
0.23 - 0.25 ( 0.24)	0.21 - 0.23 ( 0.22)	0.20 - 0.21 ( 0.21)	
3.01 - 3.29 ( 3.19)	3.49 - 3.52 ( 3.51)	3.48 - 3.87 ( 3.73)	
5.22 - 5.66 ( 5.48)	5.69 - 6.07 ( 5.88)	5.61 - 6.70 ( 6.12)	
0.09 - 0.10 ( 0.10)	0.08 - 0.09 ( 0.08)	0.10 - 0.11 ( 0.10)	
0.76 - 0.87 ( 0.81)	0.66 - 0.72 ( 0.69)	0.69 - 0.84 ( 0.77)	
0.14 - 0.18 ( 0.15)	0.14 - 0.15 ( 0.15)	0.12 - 0.14 ( 0.13)	
0.41 - 0.44 ( 0.42)	0.46 - 0.47 ( 0.46)	0.42 - 0.45 ( 0.44)	
0.23 - 0.24 ( 0.23)	0.22 - 0.25 ( 0.23)	0.24 - 0.26 ( 0.25)	
2.36 - 2.67 ( 2.56)	2.86 - 3.20 ( 3.03)	3.15 - 3.47 ( 3.27)	
0.33 - 0.34 ( 0.34)	0.30 - 0.31 ( 0.30)	0.31 - 0.33 ( 0.32)	

where the black band is punctuated by a single green spot; sulci black. Pterothorax and abdomen, green. Preterminal abdominal segments pale yellow ventrolaterally, genital region black. Spots on subgenital plate, supraanal plate and outer face of cerci, blue-grey. Fore and middle legs distal to midfemur, blue; proximal femur red, coxa yellow. Hind femora dark green, hind knee and hind tibia darker, suffused with blueish; hind feet brownish.

**FEMALE.** Generally similar to male. Metathoracic and abdominal segments 1-7 with an interrupted lateral yellow stripe, flanked dorsally and ventrally with diffuse black. Black stripes on pronotum bordered dorsally by a thin yellow stripe. Supranal plate yellow green. Hind femora paler green proximally.

### 8. *Dryomphilacris panamae* Descamps, 1976: reinstated combination

Descamps, 1976: 82.

*Dryomphilacris panamae* Descamps & Rowell, 1978: 357, 361.

Holotype male: PANAMA: Prov. Chiriquí: El Volcán: Cerro Punta, 5600 feet. Feb. 1937 (D.W. Bishop) (ANSP). Type examined. Note that Descamps omitted the true locality, Cerro Punta, from his original description; there is both a village and a mountain of that name, and they lie some 10 km NE of the town of El Volcán.

New records: PANAMA: Prov. Chiriquí: Volcán Barú, eastern slope, 1800 m, 26 Sept. 1999 (Rowell CHF, Bentos-Pereira A), 1 male, 1 allotype female, specimen nos. 99248 & 99246 (ANSP); 1 male, 1 female, specimen nos. 99247 & 99251 (UP); 4 males, 3 females, specimen nos. 99245, 99249-50, 99252-55 (RC). COSTA RICA: Prov. Puntarenas: Cerro Cruces, 6 km. S. of San Vito de Jaba, 5000'. 16 Mar 1969 (Rentz DC), specimen no. 69001 (RC). (This locality appears to be Cruces in the Cerro Zapote, 1476 m, LS 300600\_575100, now completely deforested).

The holotype male is discoloured (possibly pinned from alcohol?) and the female has not been described previously.

#### REDESCRIPTION

Small for genus, and with relatively short antennae. Measurements: see Table 2.

MALE (Fig. 4). Elytra squamiform, reaching posterior edge of metathoracic notum. Furcula present, in form of two minute melanized projections. Supra-anal plate (Fig. 4C) 1.48X as long as broad, with a medial proximal depression; having a somewhat up-rolled, thickened margin, and ending in a bluntly pointed cylindrical process. Apical lip of subgenital rim rather long. Cercus (Fig. 4B-D) longer than supraanal plate, curving gently inwards, tapering smoothly to a rounded tip; lower edge bearing a ventrally and inwardly directed lobe 3/4 of the way to the tip.

Internal genitalia (Fig. 5). Phallic complex of same form as that of other members of the genus, but elongated along anterior-posterior axis until relatively nearly twice as long as that of e.g. *D. bimaculata*; epiphallus correspondingly unusually long for genus, only 0.62X as broad as long. Dorsal aedeagal valve straight, slightly shorter than ventral valves, symmetrically rounded at tip. Ventral valves project beyond posterior edge of capsule, ending in single recurved hooks, barbed on the inner surface (Fig. 5D).

Coloration. Antennae, black. Eyes, black (brown when dried). Mandibles blackish distally. Postocular stripe, marks on genae and V-mark on vertex dark green. Remainder of head metallic pale green with golden sheen (drying to dull light green).

Nota of pterothorax and disc of pronotum olive green, pronotal lobes shading to olive brown. Metallic green marks dorsolaterally at anterior rim of pronotum and anterior to each pronotal sulcus (vanish in dried specimens). Elytra olive green.

Front and middle legs pale reddish brown proximally shading to olive green at knee. Tibia and tarsi olive green. Tarsal spines and tarsal claws tipped black, pulvillus blackish. Basal 3/4 of hind femur, reddish brown, distally green, upper part of knee tinged brown. Hind tibia blue-green, shading to reddish brown distally, spurs brown; tarsal spines (6/7) blue-green, tipped brown. Hind tarsi pink, claws brown.

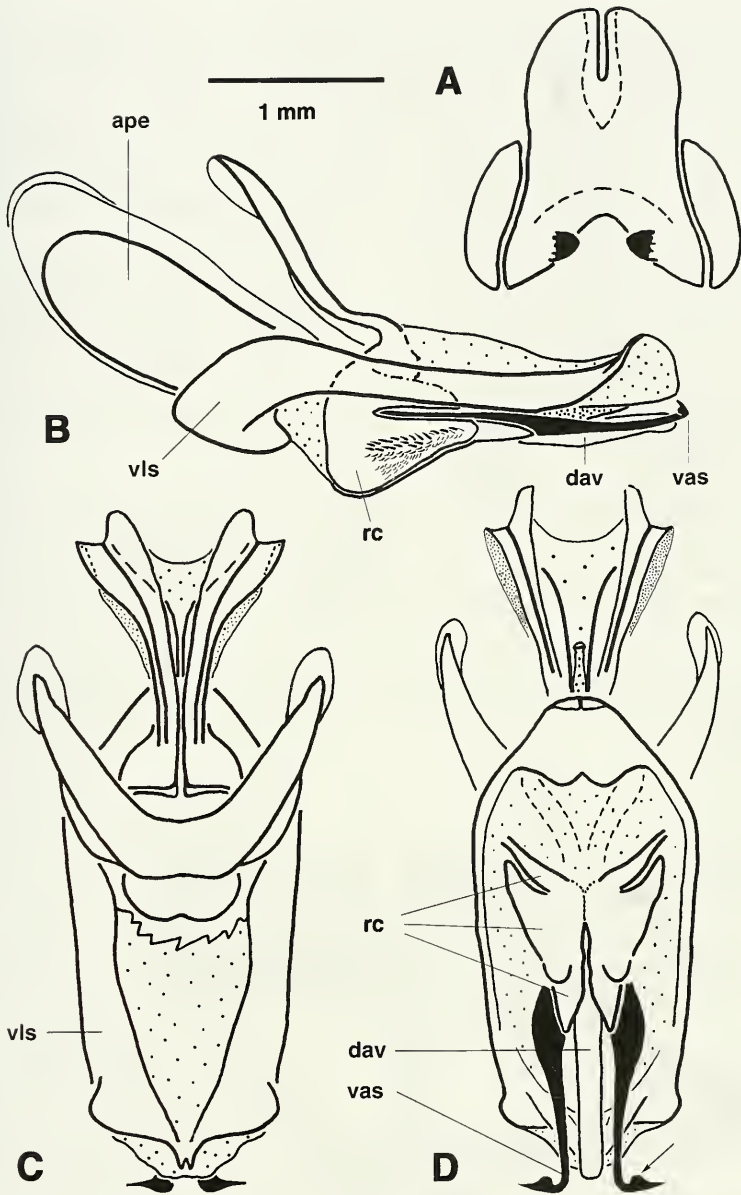


FIG. 5

*Dryophilacris panamae* Descamps, male. Internal genitalia. A, epiphallus. B-D, phallic complex in lateral, dorsal and ventral view. The ventral aedeagal valves are here coloured black for clarity, they are not heavily melanized in life. Arrow in D shows the "barb" on the appendage of the ventral valve. Abbreviations: ape, anterior process of endophallus; dav, dorsal aedeagal valve; rc, rami of cingulum and associated membranes; vas, ventral aedeagal sclerite; vls, ventrolateral sclerite.

First 8 abdominal segments olive green, paired darker green blotches dorso-laterally on each tergum. Segment 8 with metallic iridescence in life, lost at death. Segments 9-10 reddish brown, furcula and rim of 10th. tergum blackish. Cerci pale blue-green basally, black distally. Supraanal plate pale yellow-brown proximally, dark brown distally; it lacks the striking colours seen in other species of the genus. Subgenital plate a conspicuous light blue in life, medium dark grey-blue when dried, undivided by black medially; rim and pallium blackish. Underside purplish grey, darker medially. Sternum of 9th abdominal segment blackish.

FEMALE (Figs 6, 7). Elytron squamoid, extending to posterior margin of metanotum. Cerci (Figs. 7A-C) short, but abruptly narrowed to thin points. Subgenital plate (Fig. 7B) flat posteriorly, somewhat concave medially; proximally two paired swellings, easily visible in profile in side view of the abdomen (Fig. 7C); distal margin subtriangular, ending in an thick straight "egg guide" nearly equal in length to the ventral ovipositor valves; outer lobes densely haired.

Internal genitalia. Bursa copulatrix (Fig. 7D) long, thin, thick-walled, with two prominent dorsal thickenings at the base; the lumen is mostly as narrow as the duct and is only expanded over a short length near the entrance. Spermatheca (Fig. 7E); terminal ampulla rather long and thin, preapical diverticulum with a long narrow initial chamber, and a convoluted appendage bearing three small angular accessory diverticula.

Coloration. All adult and late larval females seen were of the bronze morph frequently found in this genus group; if there is a form coloured like the males, it is not common.

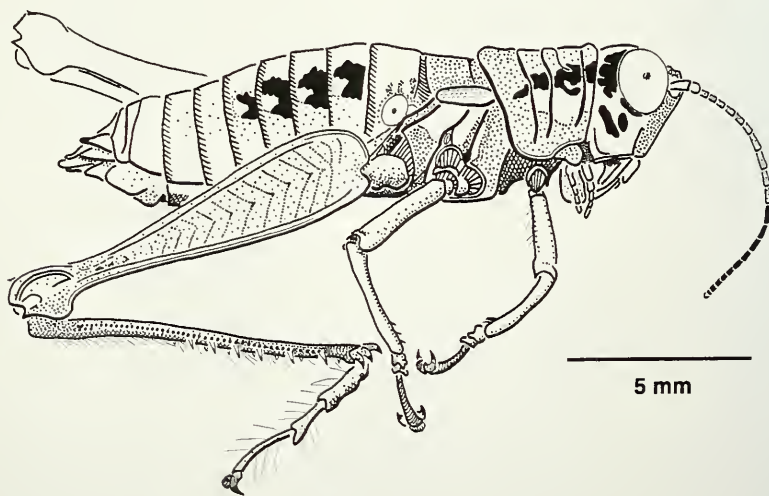


FIG. 6

*Dryophilacris panamae* Descamps, female. Habitus.

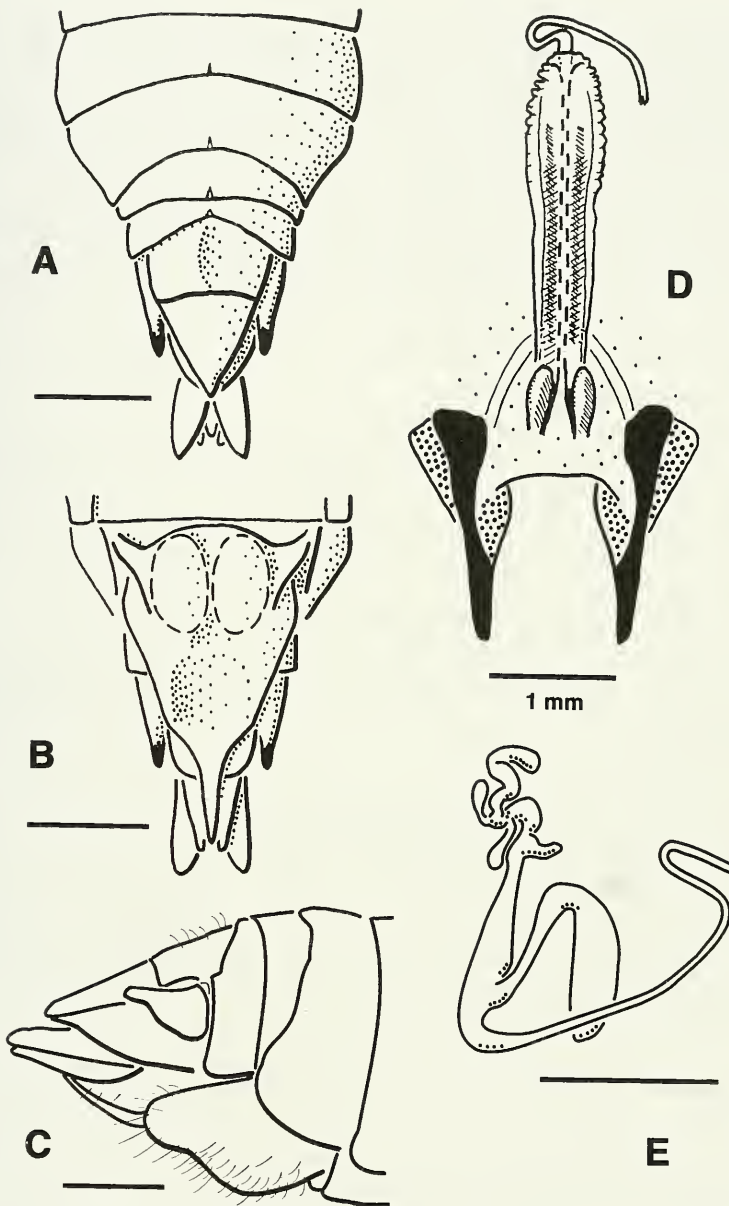


FIG. 7

*Drymophilacris panamae* Descamps, female. Genitalia. A-C, external genitalia in dorsal, ventral and lateral views. D, ventral ovipositor valves and bursa copulatrix. E, spermatheca.

Antennae: scape and pedicel yellow, flagellar segments 1-10 red, 11-20 black, 21 white. Eyes light purple-grey, with black pseudopupil (brown when dried). Labrum and clypeus, yellow brown. Palps greenish, blackish at base. Frons and anterior portion of genae, pinkish bronze. Posterior genae iridescent green (dries pale yellow brown) with a few black spots. Postocular stripe black. Vertex and fastigium brown, V-shaped mark on vertex green.

Dorsal surface of thorax, pinkish bronze. Postocular stripe continued onto upper lobe of pronotum as an irregular black stripe, bordered ventrally with iridescent green. Metathoracic epimeron and episternum metallic blue-green dorsally, shading to olive green ventrally. Elytron blackish brown.

Front and middle legs green; tibiae blackish distally, tarsi and pulvilli blackish brown. Hind femur and tibia green, upper part of knee tinged brown. Tarsi pink. Spines and spurs minutely tipped black.

Dorsal surface of abdomen, including supranal plate, pinkish bronze; all segments with grayish posterior border. Conspicuous black spot on the side of each notum of abdominal segments 2-4, each containing an ill-defined yellow blotch posteriorly. Abdomen widest at level of segment 7, thereafter narrowing abruptly to genital region. Tips of cerci, dorsal surface of superior ovipositor valves and tips of ventral valves blackish brown.

Underside of abdomen and thorax dark green laterally, in each segment shading to dark blue medially and posteriorly.

Dried specimens lose almost all the colour described above and become a uniform pale rufous brown with green legs and some black markings. The antennae retain their colours.

Natural History. The type locality, Cerro Punta, is now a centre of intensive vegetable horticulture with very heavy insecticide application, little natural vegetation and few living insects. It is reassuring that the species occurs in suitable localities on Volcán Barú, which is a National Park. It lives there on *Solanum* bushes at the forest edge, sharing them with a very large population of *Ampelophilus olivaceus* (Giglio-Tos), another lithoscirtan. In September, when we made our collection, the majority of individuals of *D. panamae* were still larvae; adults, especially females, were scarce, but the species is not uncommon in this locality.

Comment. At the time of our transfer of this species to *Drymacris* only the holotype male was available. The rather large squamiform elytra suggest this attribution, and the male cercus has a weak resemblance to that of *Drymacris nebulicola*. The diagnostic structures of the female subgenital plate and ovipositor, however, leave no doubt that the real genus is *Drymophilacris*.

The specimen from Puntarenas Province, Costa Rica, is a fifth instar female larva, and precise determination is not easy. Its antennal coloration indicates either *Drymacris nebulicola* or *Drymophilacris panamae*, which are also the geographically closest members of the genus group. The shorter antennae, small wing rudiment, long thin pointed cerci and flattened upper ovipositor valves confirm the latter identification. This is the first record of the species from Costa Rica; the locality lies some 50 km W of Volcán Barú.

### 9. *Dryophilacris glyphocerca* sp. n.

Holotype male: COSTA RICA: Prov. Cartago: P.N. Tapantí: Rancho Negro, 1735 m, LN 186300\_560000, 7. Oct 1999 (Rowell CHF), specimen no. 99382. Allotype female: same data, specimen no. 99380 (both ANSP). Paratypes: As holotype, but specimen nos. 99364, 99372, 99378, 99379, 99383, 99384, 99387, 99388, 99389, 99395 and 99396 (all ANSP). Same, but specimen no. 99367 (f); COSTA RICA: Prov. Cartago: P.N. Tapantí: 0-1 km past entrance to reserve, LN 194000\_559800, 8. Oct 1999 (Rowell CHF), specimen nos. 99403 & 99404 (2 m) (all MHNP). As holotype, but specimen nos. 99365, 99366, 99368, 99370, 99371, 99375, 99381 & 99416 (RC). COSTA RICA: Cartago: P.N. Tapantí: Sector La Represa: Rancho Negro, LN 186300\_560000, 15. Aug 1997 (Delgado R), specimen nos. CRI002 592428 & 592429 (INBio). COSTA RICA: Cartago: P.N. Tapantí: R. Dos Amigos, 1480 m, LN 189500\_560200, 15. Mar 1994 (Mora G), specimen no. CRI001 964083 (larva) (INBio).

Etymology: (Gr. *glyphis*, penknife, and *kerkos*, tail), referring to the form of the male cercus.

MALE (Fig. 8). Elytra rounded, squamiform, reaching to first 1/3 of metathoracic notum. Furcula barely perceptible. Supra-anal plate 1.33X as long as broad, in form like that of *D. panamae*. Lip of rim of subgenital plate shorter than in *D. panamae*. Sheathed aedeagus very large, projects above and beyond cerci. Cerci (Figs 8B-D) very similar to those of *D. panamae*, ventral lobe somewhat smaller and more angular at extremity. Antennal flagellum with 20 segments.

Internal genitalia (Fig. 9). Rather elongate phallic complex, similar to but less extreme than that of *D. panamae*. Epiphallus (Fig. 9A) approximately square in dorsal view, about equally long as broad. Superior valve of aedeagus (Fig. 9B, D) short, straight and very slender in both lateral and ventral view. Ventral valves of same form as in *D. panamae*, but project further and are less obviously barbed (Fig. 9C, D).

Coloration. Antennae black, proximally annulated in grey. Eyes black (brown when dried). Frons, clypeus, entire frontal ridge, genae, blue green. Labrum and mandibles, black distally, brownish proximally. Palps dark at base, tipped green. Fastigium green-gold; vertex greenish blue. Postocular stripe and some pitting on adjacent parts of gena, black.

Pronotum blue-green, its margins, sulci and continuations of post-ocular stripe, black. Meso- and metathoracic epimera and episterna, blue-green, sutures black. Elytron brown, central area green. Thoracic and abdominal nota blue-green with paired black chevrons, each bearing a gold mark. The black area diminishes in the later abdominal segments. Underside blueish green, medial area black.

Legs pale olive green, pulvilli and claws black. All feet red-brown. Hind knees, red brown. Hind tibiae green proximally, shading to red-brown distally; spines red-brown.

Genital area, black. Supra-anal plate metallic green-gold. Cerci black at tip, yellow-grey on outer face proximally. Subgenital plate gold-green, undivided in adult, medially divided into two spots in late larva.

In dried specimens the blue, gold and some black elements fade, leaving predominantly shades of green. The black of the antennae, mouthparts and genital area is however unaffected.

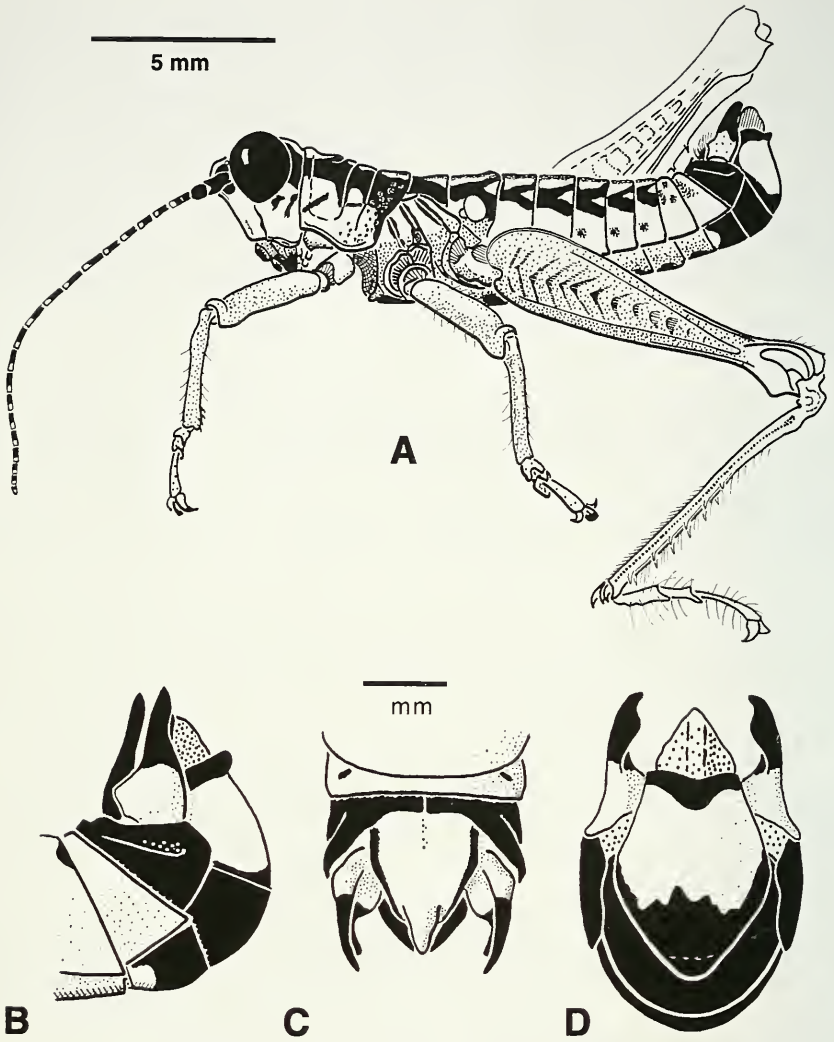


FIG. 8

*Drymophilacris glyphocerca* sp. n., male. A, habitus. B-D, external genitalia in lateral, dorsal and ventral views.



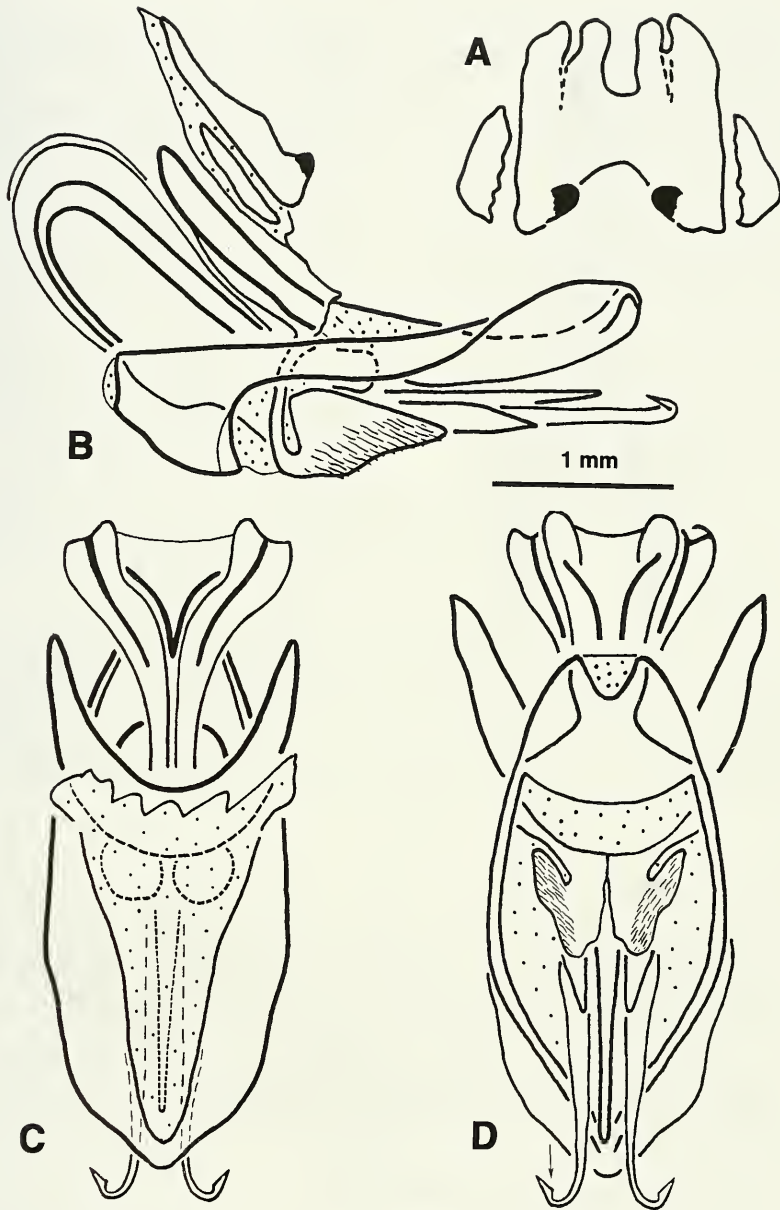


FIG. 9

*Drymphilacris glyphocerca* sp. n. male. Internal genitalia. A, epiphallus, dorsal view. B, phallic complex, lateral view. C, D, as B, but dorsal and ventral views respectively. Arrow in D shows the "barb" on the appendage of the ventral valve - compare with Fig. 5D.

FEMALE. Elytra rounded, squamiform, reaching to middle of metathoracic notum. Cerci (Fig. 10A-C) abruptly narrowed to long thin points. Subgenital plate (Fig. 10B) flat or slightly concave posteriorly; proximally two paired swellings, which are produced anteriorly onto the next abdominal sternum; distal margin subtriangular, ending in an "egg guide" equal to  $2/3$  the length of the ventral ovipositor valves and markedly curved upwards at the tip; outer lobes densely haired. Antennal flagellum with 19-20 segments, median 20.

Internal genitalia. Bursa copulatrix (Fig. 10D) as in *D. panamae*. Spermatheca (Fig. 10E): preapical diverticulum with a short initial chamber and an appendage with 2 rounded accessory diverticula.

Coloration. Highly polymorphic in colour, with at least 4 variants - green like male, though with less black on pronotum; bronze; dull brown; and almost black. The first two forms can additionally have either red or green legs.

Antennae always red proximally, blue-black distally, with white tip separated from the blue area by a thin red band.

Relationships. The species seems close both ecologically and morphologically to *D. panamae*; both are alpine, small, have shorter antennae than usual in the genus, similar flanged male cerci, minute furculae, and barbed hooks on the tips of the ventral aedeagal valves.

Natural history. Occurs commonly above 1600 m on *Solanum* spp. in wet montane forest in the upper drainage of the Río Grande de Orosi and its tributary, the Río Macho, both draining the north-eastern Talamanca mountains. At high altitude (>2000 m) it is sympatric with *Drymacris nebulicola*, below 1600 m it is replaced by *Lithoscirtus daedalus*. Of the 28 specimens of the type series, three were parasitised by mermithid nematodes.

#### 10. *Drymophilacris nigrescens* sp. n.

Holotype male: PANAMA: Prov. Bocas del Toro: 1-3 km past watershed on road Fortuna-Chiriquí Grande, 1035-850 m, 24. Sept. 1997 (Rowell CHF Bentos A), specimen no. 97488. Allotype female: same data but 23. Sept 1997, specimen no. 97477 (both ANSP). Paratypes: same data as holotype, but dates between 18. and 27. Sept. 1997: specimen nos. 97452, 97453, 97462, 97480, 97486, 97487 & 97569 (all ANSP). As above, but specimen nos. 97472 & 97473 (2 males); as above, but 18.09.99, specimen no. 99126 (female) (all MHNP). As above, but specimen nos. 97451 (female) & 97461 (male) (UP). As above, but specimen no. 97509 (female) (RC). PANAMA: Prov. Bocas del Toro: Quebrada Felix, 2 km NW of summit of rd. to Chiriquí Grande, 900 m, 26. Sept. 1997 (Rowell CHF Bentos A), specimen nos. 97535 & 97536 (2 males) (ANSP).

Etymology: Latin *nigresceus*, dusky, blackish.

MALE (Fig. 11). Elytron extending over 50% to 90% of mesonotum, not reaching the posterior margin of the tergum. Furcula small but distinct. Tip of cercus with rounded obtuse upper and angular acute ventral corners. Supra-anal plate 1.18X as long as broad, tapering to a rounded tip, largely without the appendage seen in *panamae* and *glyphocerca*. Subgenital plate with a short medial lip.

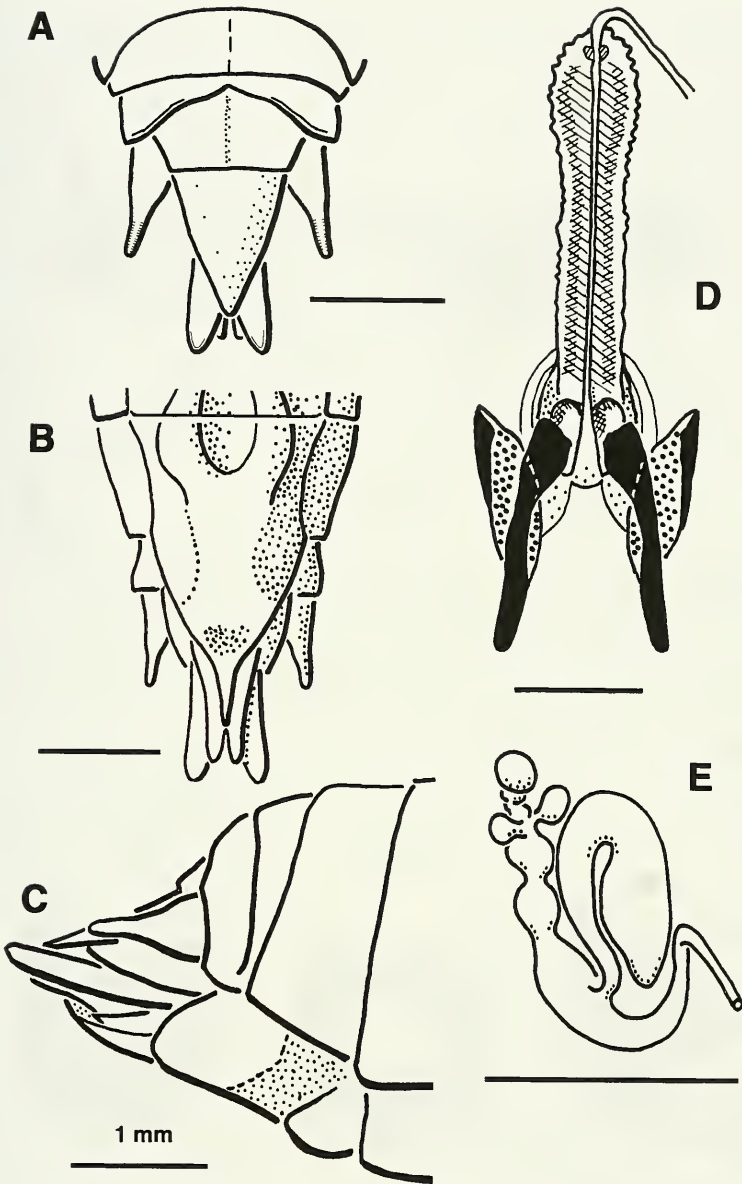


FIG. 10

*Drymphilacris glyphocerca* sp. n., female. Genitalia. A-C, external genitalia in dorsal, ventral and lateral views. D, ventral ovipositor valves and bursa copulatrix. E, spermatheca.

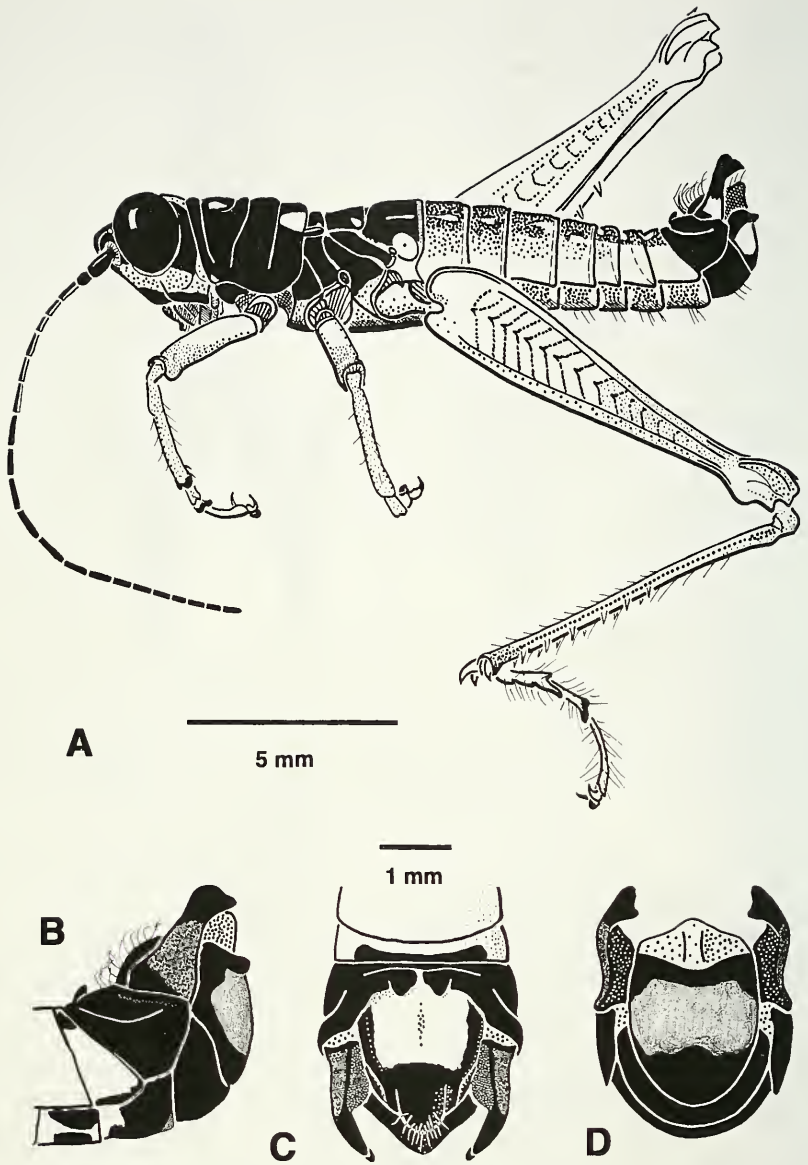


FIG. 11

*Dryophilacris nigrescens* sp. n. Male. A. habitus. B-D, external genitalia in lateral, dorsal and ventral views.

Internal genitalia (Fig. 12). Upper aedeagal valve slightly shorter than lower valves, laterally compressed, rather pointed, straight. Terminal appendages of lower valves a simple straight hook, unbarbed.

Coloration: Antennae black. Eyes black (red-brown when dried). Lateral ocelli, yellow. Palps black basally, green at tip. Mandibles, labrum, clypeus, ventral rim of genae, black. Antennal socket, black. Postocular stripe and most of genae, black. Frons and anterior central part of genae, grey-green or grey-blue, variably suffused with black. Frontal ridge in upper part always black, below medial ocellus variably so. Fastigium and vertex, dull yellow-green or blue-grey; V-marking on vertex black.

Pronotum mainly black. Anterior ventral angle green, a pair of green marks dorsolaterally at posterior margin, just anterior to elytra. In some individuals a variable amount of dark green marking medially on pronotal disc. Meso- and metathorax, black laterally and ventrally, dark green dorsally and medially, variously suffused black; a pair of poorly defined yellow dots dorsolaterally and posteriorly, in the black area of each segment. Elytra brown, traces of wings visible in some individuals.

Front and middle legs yellow proximally, dark green in distal femur and from thence distally. Pulvilli and claws blackish. Hind femur pale green proximally, dark green or blue-green distally, ventral surface light blue. Ventral lobes of knee light blue. Tibiae mainly blue, but green proximally and black distally; spines 6/7, blue, tipped red brown, spurs brown. Tarsi pinkish brown, claws and pulvilli blackish.

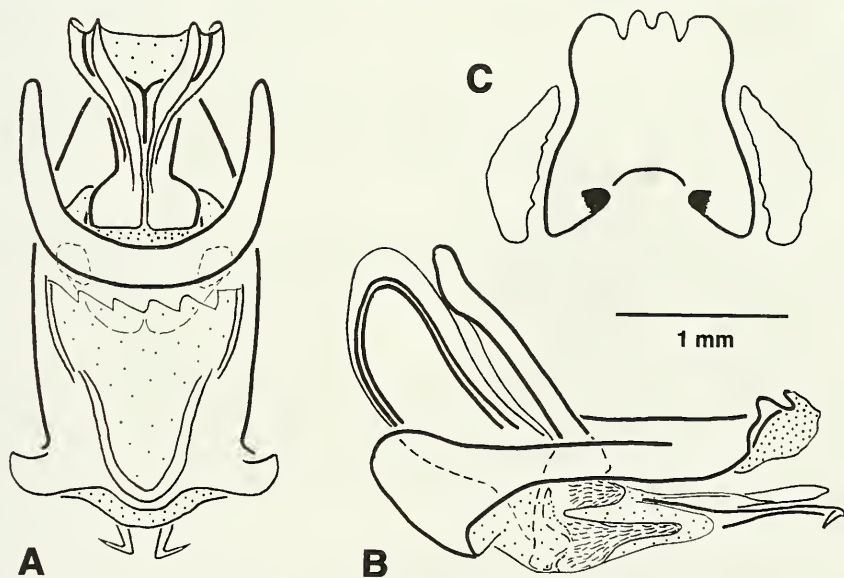


FIG. 12

*Drymophilacris nigrescens* sp. n., male. Internal genitalia. A, phallic complex, dorsal view. B, the same, lateral view. C, epiphallus, dorsal view.

Terga of abdominal segments 1-6 repeat pattern of meso- and metathorax; segments 7-9 are lighter. Sides of segments yellow, underside blackish, with blue posterior margins and yellow-brown anterior margins. Genital area (Figs 11B-D) mostly black. Furcula black. Tip of cercus with rounded dorsal and angular ventral corners, black, proximal part of outer face grey-blue or grey-green. Paired confluent spots of subgenital plate grey-blue. Supraanal plate with black rim and distal half, proximal central part yellow; distal half with long dense hairs.

FEMALE (Fig. 13). Elytra extend to posterior margin of mesonotum. Cerci typical of genus, but slightly downturned at tip in lateral view (Fig. 13C). Subgenital plate flat or concave distally, ending in an egg guide (Fig. 13D) that equals or exceeds the length of the ventral valves, downwardly hooked at the tip; anteriorly provided with two large laterally directed melanized swellings, clearly visible as lateral projections from above or below (Figs 13A, B).

Internal genitalia (Figs 13E, F) typical of the genus.

Coloration. Females are dimorphic in coloration.

Green form: coloration as male, except for antennae (distal 2 segments white), hind tarsi (grey) and genital area. Elytron greenish yellow, brown basally, reaching posterior edge of mesothoracic tergum. Sides of last three abdominal tergites black, forming a pair of conspicuous dark spots. Cerci yellow-green basally, black distally. Proximal half of supraanal plate green, terminal half blackish. Ovipositor valves light brown, blackish on dorsal face of superior valve. Subgenital plate brown laterally, blue grey medially; basal swellings, blackish.

Bronze form: entire body except legs reddish brown, with metallic sheen in life, lost after death; distal half of antenna black with white tip, postocular stripe darker brown. Yellow spots of the green form represented by light brown flecks. Front and middle legs green, tarsi and tibiae tinged brown. Hind femur green, knee area reddish brown, underside blue. Hind tibia red-brown, ventral surface blue, blackish at distal extremity. Tarsi light brown. Claws, spurs and pulvillus dark brown.

Relationships. Morphologically similar to the geographically adjacent *D. rubripes*, especially in the form of the female subgenital plate, but differing in the ventrally hooked egg guide. It also differs in its larger size and slightly longer fastigium, and markedly in coloration.

Natural history. On *Solanaceae* (mostly *Solanum* spp., esp. *S. ochraceo-ferrugineum*, but also *Witheringia solanacea*) and sometimes on *Vernonia* (Asteraceae) in clearings in montane forest, up to 1200 m (the highest available point). Not recorded below 550 m. Found to date solely on the Caribbean side of the watershed. Adults and all stages of larvae present in September. Mature females contain 2-6 eggs.

Comment. The species is remarkably similar in general coloration to a large undescribed *Hylopedetes* sp. (Rowell in prep.) with which it is sympatric. Especially green females of *D. nigrescens*, lacking the characteristic markings of the male genital region, can readily be confused with this rhytidochrotine; the best field

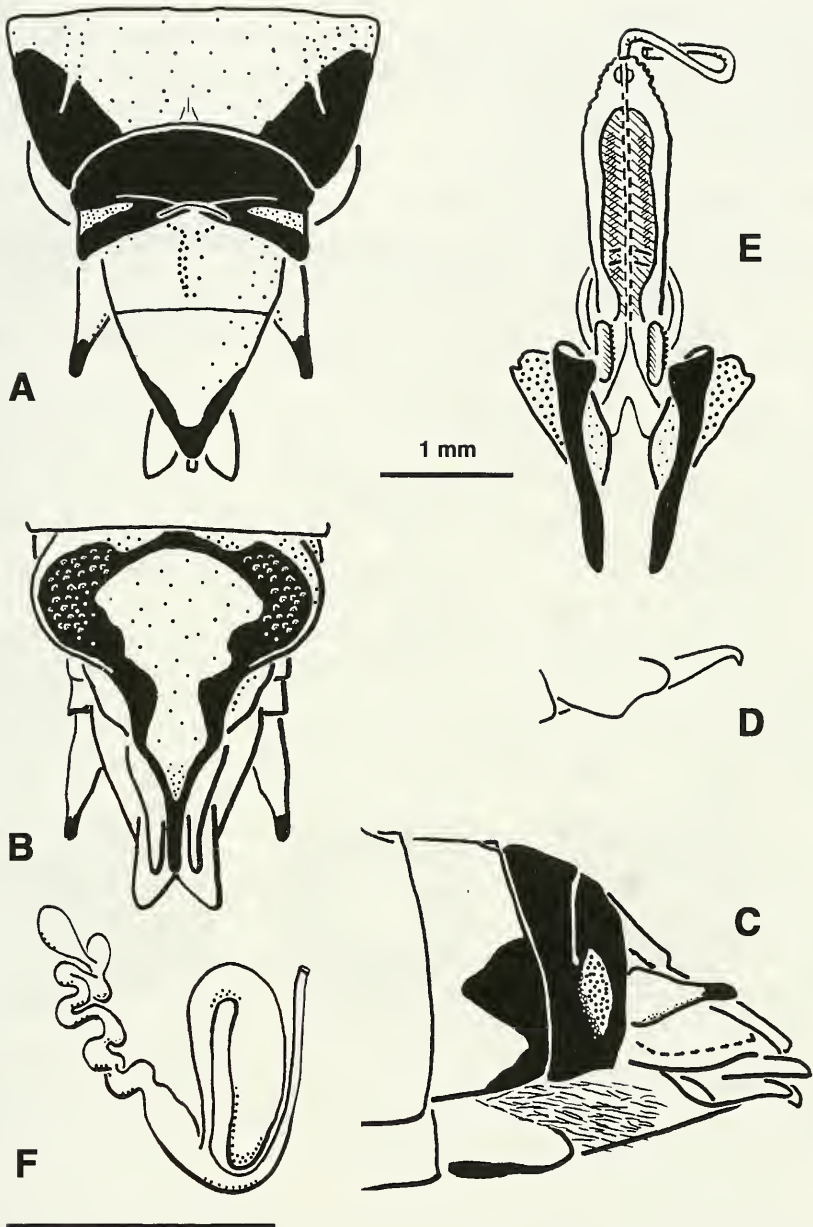


FIG. 13

*Drymophilacris nigrescens* sp. n., female. Genitalia. A-C, external genitalia in dorsal, ventral and lateral views. D, ventral ovipositor valves and bursa copulatrix. E, spermatheca.

character under these circumstances is the length of the antennae, which in *Hylopedetes* are much shorter. The black and green males with twin yellow patches on the posterior edge of the pronotum are strongly reminiscent of *Lithoscirtus daedalus*, but differ in the bright yellow supraanal plate and the blue spots of the subgenital plate.

### 11. *Dryophilacris veraguensis* sp. n.

Holotype male: PANAMA: Veraguas Prov.: Santa Fé: Alto la Piedra, 900 m, 16. Sept 1999 (Rowell CHF, Bentos A), specimen no. 99096 (ANSP). Paratype male: same data, but 16. Nov 1999 (De Gracia L, Santos A, Gonzalez P), specimen no. 99520 (UP).

Etymology: coming from Veraguas, the province in which the type locality is located.

MALE (Fig. 14). Elytron minute, falling well short of posterior margin of the mesonotum; wing absent. Furcula quite well developed. Cerci incurving, rounded at the dorsal tip, angular at the ventral tip, similar to those of *D. nigrescens*. Supraanal plate 1.23X as long as wide, and tip blunter and more rounded, most similar to that of *D. nigrescens*.

Internal genitalia (Fig. 15). Very similar to those *D. nigrescens*, but dorsal aedeagal valve equal in length to ventral valves, truncate at tip.

Coloration. Antennae black (but flagellar segments distal to no. 16 missing in both specimens). Eyes black (brown when dried). Clypeus, labrum and mandibles black, palps yellow. Remainder of head yellow, except for black antennal sockets, black mark on upper part of frontal ridge between the two antennal sockets, black postocular stripe, small black fleck in centre of fastigium, and inverted black V on vertex.

Pronotum yellow, with one medial and two lateral black stripes continuing the markings of the vertex and the post-ocular stripe posteriorly; these stripes continue as far as the first abdominal segment. Pronotal epimeron black. Elytron brown. Meso- and metathoracic epimera and episterna yellow with longitudinal black marks. Fore and mid legs, yellow. Hind femora green, upper lobe of knee tinged red-brown. Hind tibia green; 6 external and 7 internal tibial spines, tipped red-brown, tarsal spurs tipped black. Tarsi yellow, claws tipped black.

Abdominal segments greenish-yellow. Dorsa of segments 6-8 bright yellow medially. Genital region (see Fig. 14B-D) mostly black; central area of suprananal plate, spots on subgenital plate, bright yellow. Cerci black, with a grey-green region on the central part of the outer surface of the shaft.

FEMALE unknown.

Relationships. As far as can be judged from the male alone, this species is most closely related to *nigrescens* and *rubripes*, which are also the closest geographically.

Natural history. Found on *Solanum* plants at forest edges.



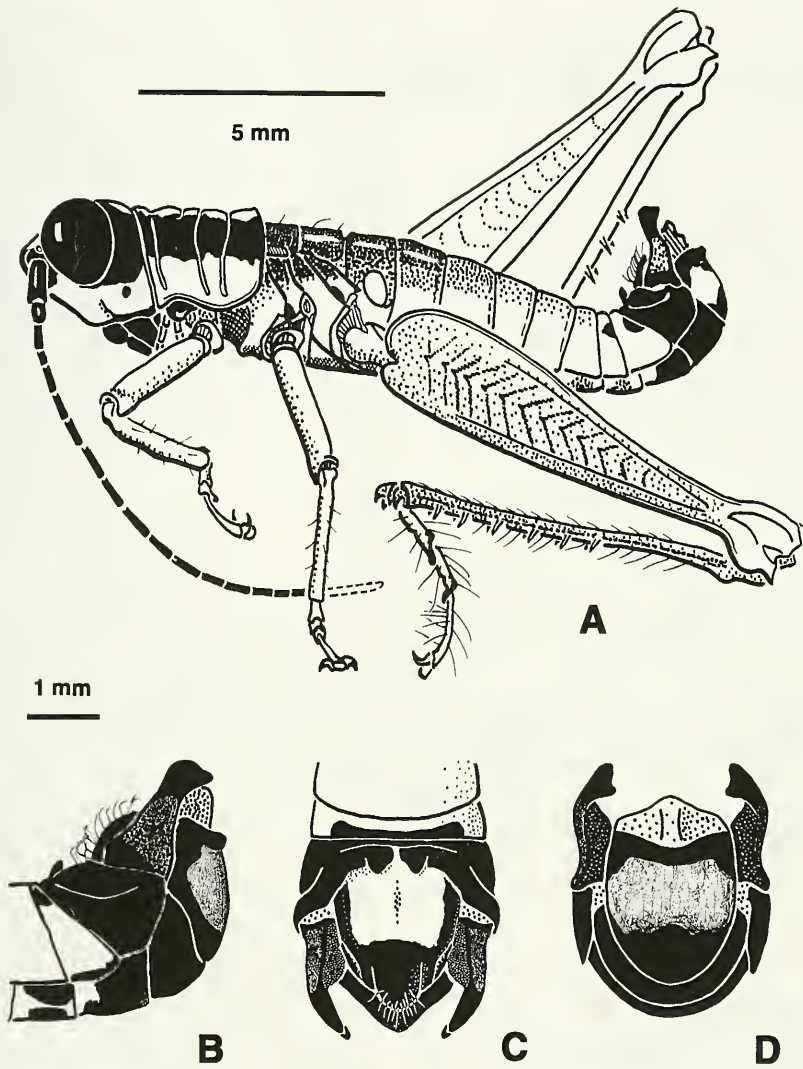


FIG. 14

*Dryophilacris veraguensis* sp. n., male. A, habitus. B-D, external genitalia in lateral, dorsal and ventral views.

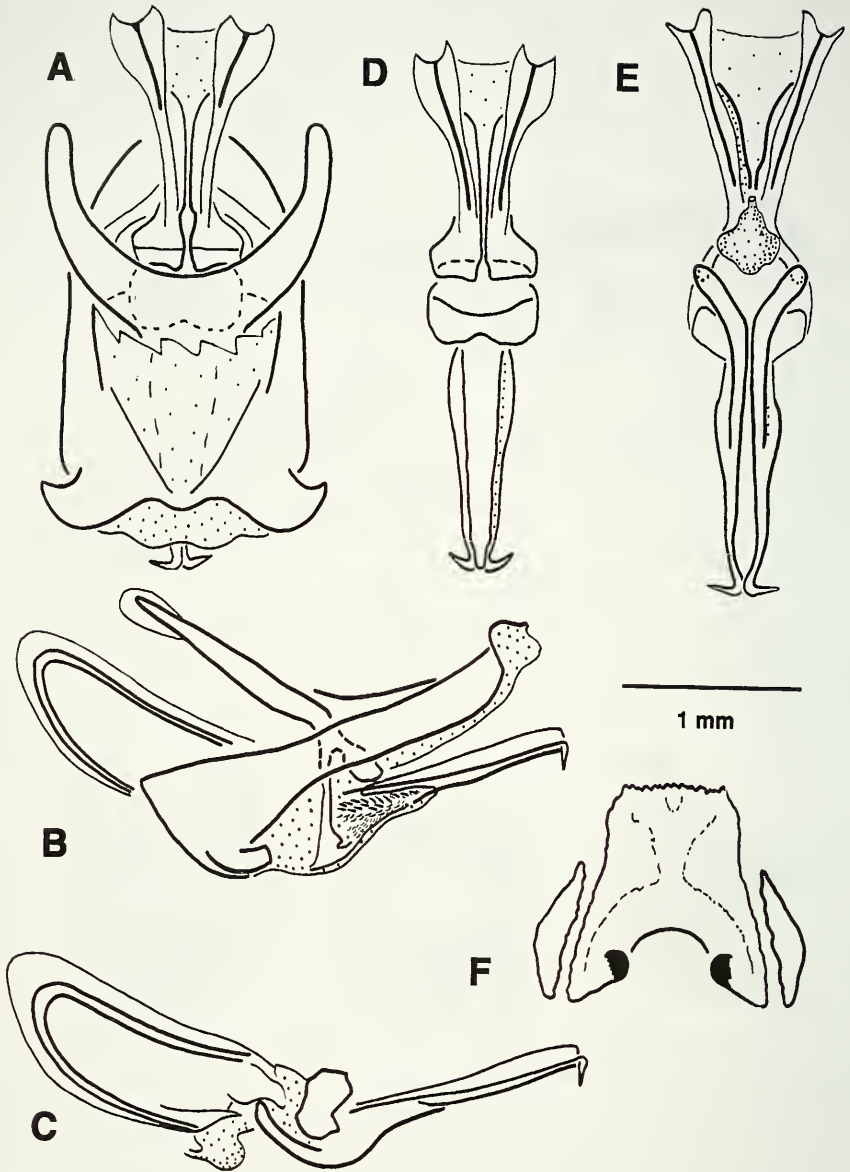


FIG. 15

*Drymphilacris veraguensis* sp. n., male. Internal genitalia. A, phallic complex, dorsal view. B, the same, lateral view. C, epiphallus, dorsal view.

## 12. *Dryomphilacris melanopsis* sp. n.

Holotype male: PANAMA: Prov. Coclé: Cerro Copé: 830 m, 20 Sept 1997 (Rowell CHF, Bentos A), specimen no. 97400 (ANSP). Paratypes: as above, but 13-15 Sept 1999: one male, specimen no. 99084, one female, specimen no. 99076 (ANSP); one male, specimen no. 99094, one female, specimen no. 99085 (RC).

*Etymology*: *melanopsis* Gr., black face, noun in apposition.

**MALE** (Fig. 16). Elytron rather large for the genus, reaching clearly into the metathoracic notum. Furcula well developed, with widely separated points directed obliquely upwards. Supraanal plate almost glabrous anteriorly, entirely yellow with a thin black/red-brown rim, 1.37X as long as broad, with a prominent appendage terminally; cerci somewhat sigmoid and narrowly waisted behind tip in lateral view, tip broad and spatulate, dorsal corner rounded, ventral corner more acute.

Internal genitalia (Fig. 17). Epiphallus (Fig. 17C) longer than broad, deeply notched on anterior edge, and wider anteriorly than posteriorly, unlike other species of the genus; oval sclerites small. Phallic complex rather short and wide, relative to other species, and unique in having double recurved hooks at the tip of the ventral aedeagal valves (Fig. 17 A, B, D).

**Coloration**. Antennae black, terminal 2 segments white (uniquely for males of the genus); 21 flagellar segments. Eyes black (red-brown when dried). Palps green. Mandibles, labrum, clypeus, frons, antennal sockets, postocular stripe, lower edge of genae, glossy black. Upper part of genae, lemon yellow. Fastigium and vertex, lemon yellow; inverted V-marking on vertex, black.

Pronotum green dorsally, with darker dorsolateral stripes continuing line of post-ocular stripes. Ventral half of lateral lobes lemon-yellow, continuing line of genae. Two short yellow stripes dorsolaterally posterior to hind sulcus, continuing the line of the elytra. Pronotal epimeron, green. Meso- and metasternal interspace, blackish. Elytron, yellow.

Fore and middle legs green, pulvilli black. Hind femur green, knee reddish brown. Hind tarsus green, blackish-brown distally, spurs and tibial spines (6/7) blackish brown. Tarsi blackish brown, pale olive dorsally, claws and pulvilli tipped black.

Abdominal segments green dorsally, blackish brown ventrally. A pair of longitudinal yellow lines run dorsolaterally from the metathoracic notum to the genital region. Genital region (see Fig. 16B-D). Tergum 9 black, tergum 10 (with furcula) brown anteriorly, black posteriorly. Supraanal plate entirely yellow with a thin black/red-brown rim. Cerci green proximally, black distally. Paired spots of subgenital plate lemon yellow.

**FEMALE** (Fig. 18). Elytron extends on to metathoracic notum. Cerci typical of genus. Subgenital plate (Fig. 18B) flat, with low, laterally spreading, paired swellings with rugose cuticle anteriorly, triangular posteriorly, terminating in a straight, pointed, upward slanting egg guide (Fig. 18F), 0.7X as long as the ventral ovipositor valves.

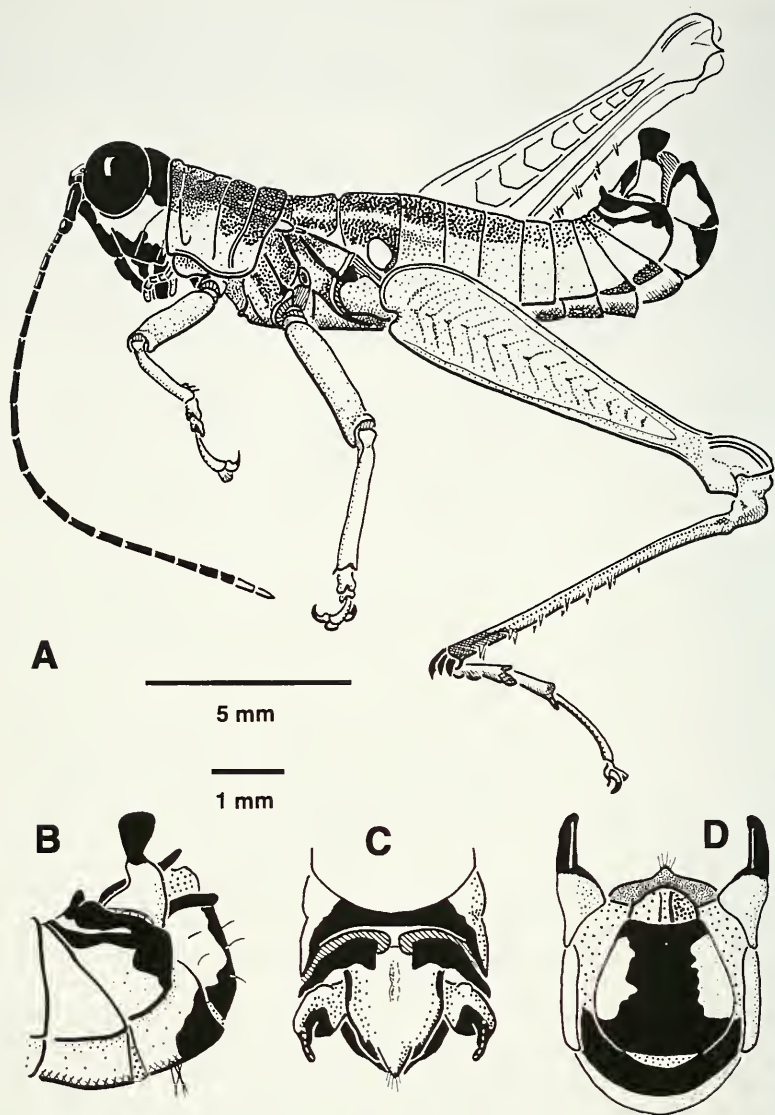


FIG. 16

*Dryophilacris melanopsis* sp. n., male. A. habitus. B-D. external genitalia in lateral, dorsal and ventral views.

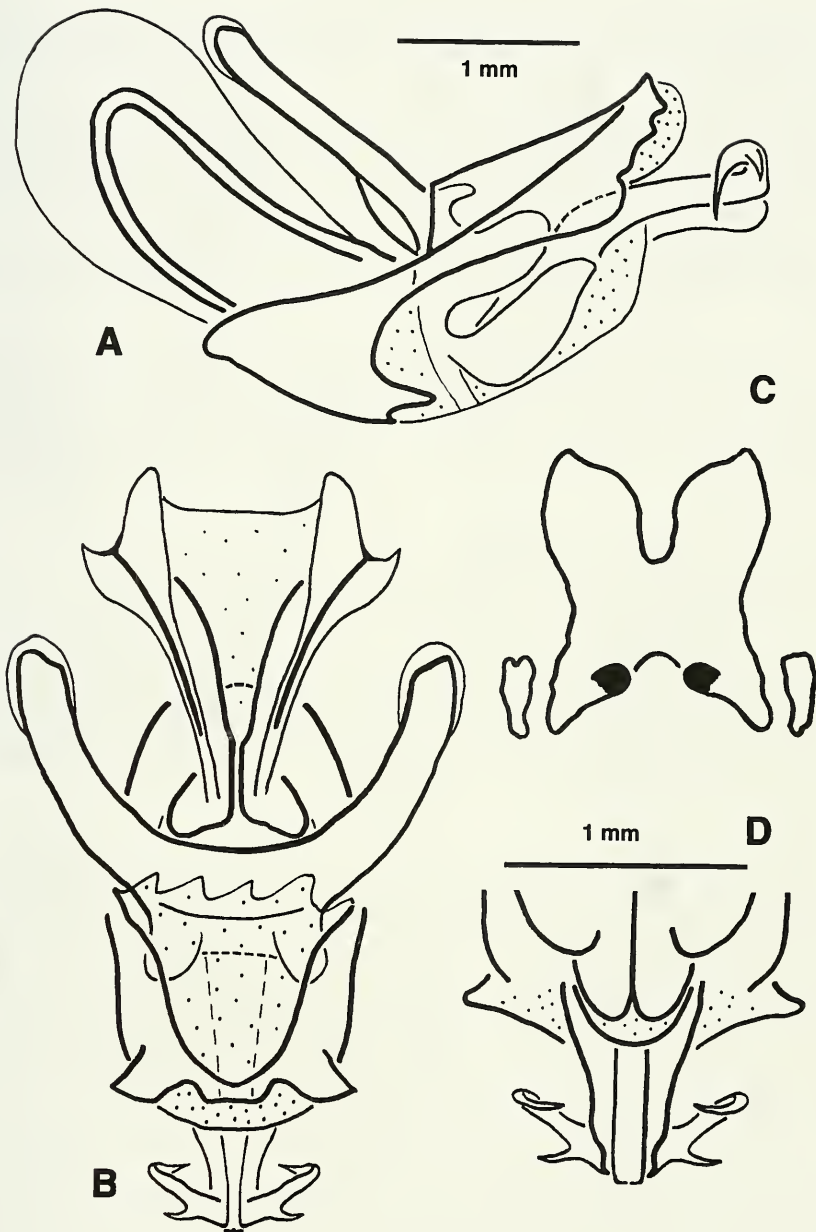


FIG. 17

*Drymphilaris melanopsis* sp. n., male. Internal genitalia. A, phallic complex, lateral view. B, the same, dorsal view. C, epiphallus, dorsal view. D, tip of aedeagus, ventral view.

Internal genitalia. Bursa copulatrix long and wide (Fig. 18D). Spermatheca (Fig. 18E) with a long convoluted appendage to the lateral diverticulum, bearing 3 or 4 accessory diverticula.

Coloration: as in male, except white tip of antenna includes the 3 terminal segments, and except for genital region. Supraanal plate, mottled olive green, tip tinged brown. Cerci olive brown, darker at tips. Ovipositor valves brown, dorsal valves black distally. Subgenital plate predominantly blackish in colour.

Relationships. A morphologically distinctive species, which does not seem to be closely related to any other member of the genus, and the second largest described to date.

Natural history. The insect is found on species of *Solanum* and *Witheringia* along paths and in treefall clearings in montane forest, on both sides of the Pacific/Caribbean watershed. One male (99084) contained a mermithid nematode and undeveloped testes. The remaining specimens were sexually mature, the females each containing 6 eggs.

#### *Drymacris* Descamps & Rowell, 1978

Descamps & Rowell, 1978: 358. 361. Type species: *Lithoscirtus nebulicola* Rehn, 1929: 26. Amédégnato & Poulain, 1987: 400.

The genus originally contained three species: *nebulicola* (Rehn, 1929), *panamae* Descamps, 1976, then known only from the male holotype and here transferred to *Drymophilacris*, and *ovatipennis* (Rehn, 1905), then known only from the female holotype and transferred to *Paratela* by Descamps & Rowell (1984) following discovery of the male. The genus is now monospecific.

#### REDESCRIPTION

Medium-small grasshoppers (>9.9, <20 mm in length); body length 15 (males) - 19 (females) mm. Pronotum relatively longer than in *Lithoscirtus* and *Drymophilacris*. Hind femur 3.2 (females) - 3.5X (males) as long as pronotum, rather slender, 0.19 - 0.20X as deep as long. Hind foot longer than in the other genera, 0.48X (females), 0.50X (males) as long as femur, second tarsal joint makes up 0.27 of foot. Interocular space narrow, 0.36X (males), 0.65X (females) as wide as antennal pedicel. Antennae 4.0X (males), 3.1X (females) as long as pronotum. Fastigium slightly longer than in the other genera.

Elytra much larger than in the other two genera, cycloid and extending beyond the posterior margin of the metanotum.

Male cerci abruptly notched on the ventral margin towards the tip. Internal genitalia very similar to those of *Drymophilacris*, but rather shorter and wider than usual in that genus; epiphallus 1.6X as wide as long.

Female cerci (Fig. 19A, C) short, bluntly rounded at the tip, unlike the other two genera. Upper ovipositor valves (Fig. 19A, C) relatively unmodified, less flattened dorsoventrally than in the other genera, slightly excavated dorsally, with a raised, minutely toothed, internal edge. Subgenital plate (Fig. 19B, C) flat, neither

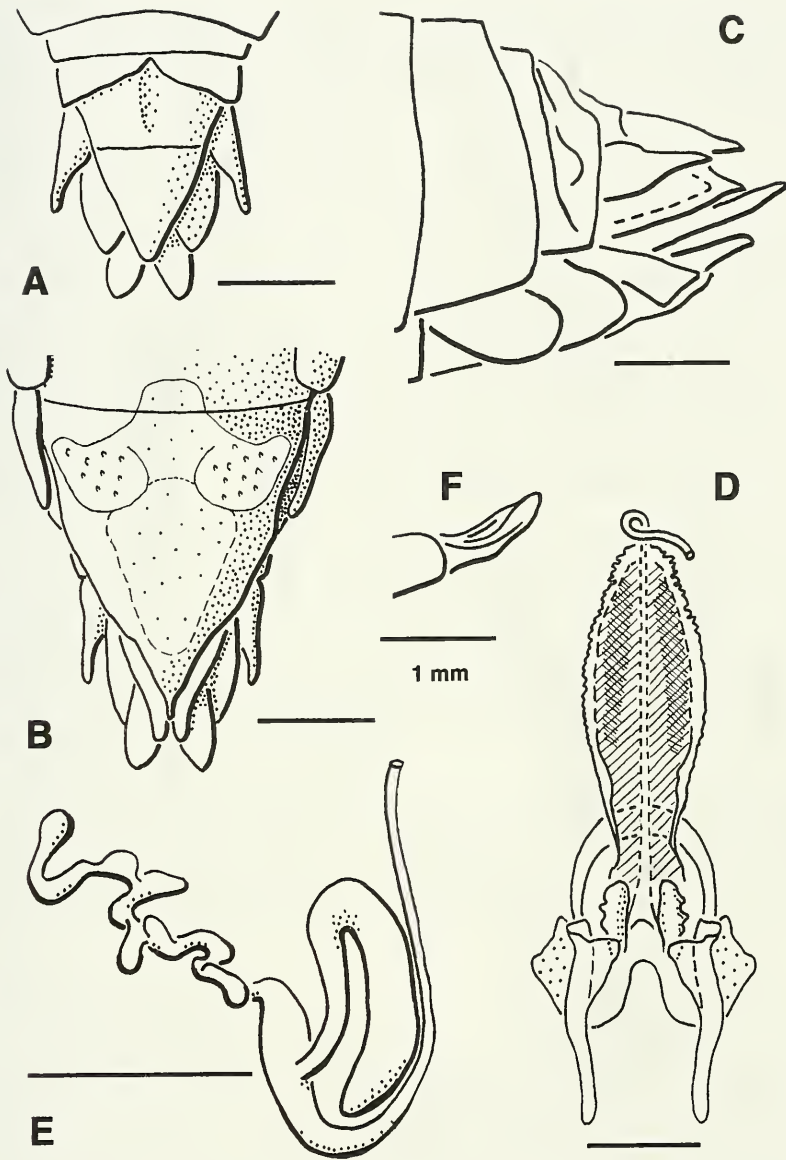


FIG. 18

*Drymphilacris melanopsis* sp. n., female. Genitalia. A-C, external genitalia in dorsal, ventral and lateral views. D, ventral ovipositor valves and bursa copulatrix. E, spermatheca; F, extremity of subgenital plate ("egg-guide") in lateral view.

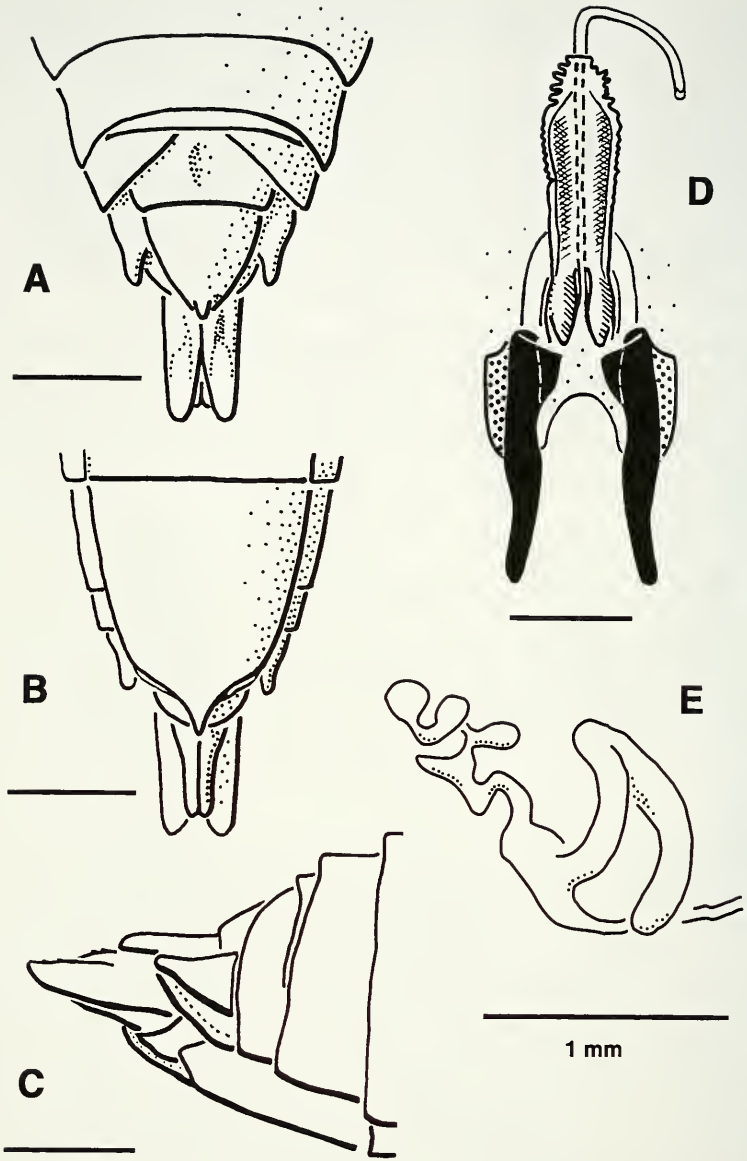


FIG. 19

*Drymacris nebulicola* (Rehn, 1929), female. A-C, external genitalia in dorsal, ventral and lateral views. D, bursa copulatrix. E, spermatheca.



domed (*Lithoscirtus*) nor provided with paired anterior swellings (*Drymophilacris*); terminal process ("egg-guide") very short. Terminal ampulla of spermatheca (Fig. 19E) rather long and narrow relative to the other two genera; appendage of lateral diverticulum with several small diverticula.

### 13. *Drymacris nebulicola* (Rehn, 1929)

*Lithoscirtus nebulicola* Rehn, 1929: 26. Transferred to *Drymophilacris*, Descamps, 1976: 81. Transferred to *Drymacris*, Descamps & Rowell, 1978: 361.

Holotype male and allotype female: COSTA RICA: La Palma, between Volcan Barba & Volcan Irazú, 4960-5100 feet, 1 Sept. 1923 (J.F. Tristán & J.A.G. Rehn) (ANSP).

New records: COSTA RICA: Prov. Cartago: Reserva Forestal Río Macho, Alto Roble, 2200 m, LN 190000\_552300, 12 Oct. 1999 (Marshall S), specimen no. 99471 (RC). Tres Ríos: Cerro la Carpintera, 1700-1800 m, LN 207600\_538600 21 Sept 1993 (Rowell CHF), specimen nos. 93310 & 93311 (RC). Below pass between Volcán Irazú and Volcán Turrialba, S. side, 1900-2000m, LN 217000\_562500, 6 July 1980 (Rowell CHF, Rowell-Rahier M, Hyde C).

Prov. Heredia: 5 km. S of Los Cartagos (crossing of Rta 9 & R. Tabor), 1750 m, LN 232730\_518480, 8 Sept 1993 (Rowell CHF), specimen no. 93203 (RC). San Rafael de Vara Blanca, 1800-2000 m, LN 239800\_524200, 13 April 1986 (Rowell CHF, Braker HE), specimen nos. 86019-86022 (RC).

Prov. Puntarenas: Potrero Grande: Tres Colinas, 1945-2150 m, LS 342100\_565600, 12 Sept 1995 (Rowell CHF, Meier V), specimen nos. 95540-95542 (RC). Monteverde: Sendero Nuboso, 1480-1520 m, LN 253500\_449400, 14 July 1980 (Rowell CHF, Rowell-Rahier M, Hyde C, Braker HE).

Prov. S. José: Between Cascajal and Tierras Morenas, 1600-1700 m, LN 224000\_543400, 18 Sept 1993 (Rowell CHF). S. Gerardo de Dota, 2000-2500 m, LS 387400\_482700, 24 Feb 1992 (Curso Tachinidae y Syrphidae), specimen no. CRI000 407614 (INBio).

Fig. 19 shows the previously unillustrated female subgenital plate (19B, C) and internal genitalia (Figs 19D, E).

Dimensions, Table 1.

Distribution. The species is now known to be widely distributed in the higher montane forest zone of Costa Rica on both Atlantic and Pacific watersheds. Descamps & Rowell (1978) noted occurrences in Chompipe (near the type locality in the Cordillera Central) and in Monteverde (Cordillera del Norte). Further new records see above.

### ACKNOWLEDGEMENTS

I thank A. Solís (INBio, Costa Rica), Prof. D. Quintero (Universidad de Panamá), D. Azuma (Academy of Natural Sciences, Philadelphia, USA) and Dr. M. O'Brien (University of Michigan, USA) for access to their collections and the loan of specimens, Drs. D. Rentz (Canberra, Australia) and S. Marshall (Guelph, Canada) for the gift of specimens, the authorities of Costa Rica and Panama for permission to collect in their National Parks and elsewhere, and Profs. A. Bentos (Montevideo) and N. Elsner (Göttingen) for help and companionship in the field.

## REFERENCES

- AMÉDÉGNATO, C. 1974. Les genres d'Acridiens neotropicaux, leur classification par familles, sous-familles et tribus. *Acrida* 3: 193-204.
- AMÉDÉGNATO, C. 1977. Etude des Acridoidea Centre et Sud Américains (Catantopinae sensu lato): Anatomie des genitalia, classification, repartition, phylogénie. *Thèse, Université Pierre et Marie Curie*, Paris, 385 pp. (mimeo.).
- AMÉDÉGNATO, C. & POULAIN, S. 1987. Les acridiens néotropicaux I: Proctolabinae Amazoniens (Orthoptera, Acrididae). *Annales de la Société Entomologique de France* (NS) 23(4): 399-434.
- BRUNER, L. 1908. Acrididae. *Biologia Centrali Americana. Insecta, Orthoptera* 2: 1-342, plates 1-4 (1900-1909).
- DESCAMPS, M. & ROWELL, C. H. F. 1978. Acridiens des clairières de Costa Rica. Diagnoses, signalisations, notes biologiques, polymorphisme (Acridomorpha, Acrididae). *Annales de la Société Entomologique de France* (N.S.) 14(3): 351-367.
- DESCAMPS, M. 1976. La faune dendrophile néotropicale. I. Revue des Proctolabinae (Orth. Acrididae). *Acrida* 5: 63-167.
- KIRBY, W. F. 1910 A synonymic catalogue of Orthoptera. Vol. 3. Orthoptera Saltatoria. Part. 2. (Locustidae vel Acrididae). *British Museum, London*, 674 pp.
- REHN, J. A. G. 1905. A contribution to the knowledge of the Acrididae (Orthoptera) of Costa Rica. *Proceedings of the Academy of Natural Sciences of Philadelphia* 57: 400-454.
- REHN, J. A. G. 1929. Studies in Costa Rican Dermaptera and Orthoptera. II. New genera and species of Acrididae. *Transactions of the American Entomological Society* 55: 9-77.
- ROWELL, C. H. F. 1983 *Dryomophilaeris bimaculata* (pp. 714-716). In: JANZEN, D. H. (ed.). Costa Rican natural history. *University of Chicago Press, Chicago and London*, 816 pp.

## **A new species of the genus *Stumpffia* (Amphibia: Anura: Microhylidae) from a small forest remnant of the central high plateau of Madagascar**

Denis VALLAN

Universität Bern, Zoologisches Institut, Baltzerstrasse 3, CH-3012 Bern, Switzerland.

E-mail: denis.vallan@zos.unibe.ch

**A new species of the genus *Stumpffia* (Amphibia: Anura: Microhylidae) from a small forest remnant of the central high plateau of Madagascar.** - A new frog species of the terrestrial and leaf litter dwelling genus *Stumpffia* is described. *Stumpffia helenae* sp. n. has enlarged finger tips and partially reduced fingers and toes. It is the first record of the genus from the central high plateau of Madagascar. Since this frog was discovered in small forest fragments, this record shows how important small forest remnants could be for nature conservation.

**Key-words:** Amphibia - Anura - Microhylidae - *Stumpffia* - new species - Madagascar - high plateau - forest fragment - nature conservation.

### INTRODUCTION

In Madagascar the family of Microhylidae is represented by ten endemic genera distributed in three subfamilies: Scaphiophryninae, Dyscophinae and Cophylinae (Glaw & Vences, 1994). *Stumpffia*, a genus containing small to very small species that often have reduced fingers and toes, belongs to the latter subfamily. At present, the genus *Stumpffia* contains seven species: *Stumpffia psologlossa* Boettger, 1881, *S. tridactyla* Guibé, 1975, *S. pygmaea* Vences & Glaw, 1991, *S. tetradactyla* Vences & Glaw, 1991, *S. grandis* Guibé, 1974, *S. roseifemoralis* Guibé, 1974, and *S. gimmeli* Glaw & Vences, 1992. In this paper a new species of *Stumpffia* is described. It was found in a forest remnant of the nature reserve of Ambohitantely and is the first record of this genus in the central high plateau of Madagascar.

### MATERIALS AND METHODS

Animals were collected during a survey for ecological research. After anaesthesia with ether specimens were fixed in 90% ethanol and stored in 70% ethanol. All measurements were taken with dial callipers to a precision of 0.1 mm. Unless otherwise stated the following parameters were measured according to Duellman (1970): snout-vent length; head width; forearm length; hand length (from the tubercle

at the base of finger I to the tip of the longest digit); tibia length; foot length including tarsus (from the joint between the tibiofibula and ankle to the tip of toe IV); foot length (from the base of the metatarsal tubercle to the tip of toe IV); horizontal tympanum diameter; horizontal eye diameter; distance from eye to nostril; distance from nostril to snout tip. All measurements are in millimetres. Photos were taken to document the colour of the living animals.

The following abbreviations are used: NMBE = Naturhistorisches Museum Bern; SMF = Senckenberg Museum Frankfurt; ZFMK = Zoologisches Forschungsinstitut und Museum Alexander Koenig.

The following specimens were used for comparison: *Stumpffia psologlossa* (SMF 7337; holotype), *S. grandis* (NMBE 1034195), *S. gimmeli* (ZFMK 52536; paratype). For the other species data were taken from literature (Vences & Glaw, 1991; Glaw & Vences, 1994).

## RESULTS

### *Stumpffia helenae* sp. n.

Holotype: NMBE 1044802 (Figs 1a, 1c, 2a and 2c) Adult ♂ from the "Reserve Spéciale" (RS) d'Ambositantely, central high plateau of Madagascar, Ankazobe Fivondronana, Antananarivo Province, 18° 09' S, 47° 15' E, 1500 m a. s. l., 25 March 1997, D. Vallan leg.

Paratype: NMBE 1044801 (Figs 1b, 1d, 2b and 2d) Adult ♀, same locality and collector as the holotype, 23 March 1997.

*Diagnosis:* Due to its general features (small size, partially reduced fingers, connected lateral metatarsals, inner metatarsal tubercle present, outer metatarsal tubercle absent, webbing between fingers and toes absent, no signs of external vocal sac are visible, terrestrial habits and slow motion moving) I include this species to the genus *Stumpffia*. Differentiation from other *Stumpffia* species: The most similar species are *S. gimmeli* and *S. psologlossa*. Both species have a similar size and can be similarly coloured. In all three species (*S. gimmeli*, *S. psologlossa* and *S. helenae* sp. n.) fingers and toes are clearly recognisable but *S. gimmeli*, *S. psologlossa* differ in having less reduced fingers and toes. They also lack the enlarged fingertip. As shown in Tab. 1 *S. helenae* sp. n. differs from all other *Stumpffia* species by the combination of size, digital reduction and the enlarged fingertips. Enlarged fingertips are usual in species of several genera (*Anodonthyla*, *Plethodontohyla*, *Cophyla* and *Platypelis*) of the microhylid family but not known from species of the genus *Stumpffia*. I presume that *Stumpffia helenae* sp. n. belongs to the genus *Stumpffia* due its enlarged finger tips mainly because of its reduced finger and toes and the slow motion moving. In Malagasy anurans these two characteristics are only known in species of the genus *Stumpffia*.

*Description of the holotype:* A ♂ of 13.8 mm length. Also if the animal was not found calling, the presence of nuptial pads indicate that the holotype is an adult ♂. Four fingers and five toes present. Finger II is slightly and finger I is more reduced. Toe I is also reduced (Figs 2a and 2c). Tip of finger III is slightly enlarged and triangular (due to the small size of the only known holotype and paratype, further

TABLE 1. Comparison of the characteristics between *Stumpfia helenae* n. sp. and other species of the genus. In the column "number of fingers" and "number of toes" the first number refers to the number of not reduced fingers and toes, the second to the number of reduced but present fingers and toes and the third number refers to the number of completely reduced fingers and toes.

Species	Sex	length (mm)	Tibiotarsal articulation reaches the ...	Tympanum/eye ratio	number of fingers	number of toes	enlarged 3. finger tip
<i>Stumpfia helenae</i> sp. n. <sup>1</sup>	♂	13.8	... eye	1/2	2/2/0	4/1/0	yes
<i>S. psologlossa</i> <sup>2</sup>	?	14.5	... eye	1/4	4/0/0	5/0/0	no
<i>S. tridactyla</i> <sup>5</sup>	♂	10 - 11	... tympanum	2/5 - 3/4	0/3/1	2/2/1	no
<i>S. pygmaea</i> <sup>5</sup>	♂	10 - 12	... tympanum	1/2 - 2/5	3/1/0	4/1/0	no
<i>S. tetradactyla</i> <sup>5</sup>	♂	13 - 15	... eye	1/3 - 1/2	3/1/0	4/0/1	no
<i>S. grandis</i> <sup>3</sup>	♂	18.0	... eye	3/4	3/1/0	4/1/0	no
<i>S. roseifenorialis</i> <sup>5</sup>	♂	22	... eye	3/5	3/1/0	4/1/0	no
<i>S. gimmeti</i> <sup>4</sup>	?	12.9	... eye	1/3	4/0/0	5/0/0	no

<sup>1</sup> NMBE 1044801, <sup>2</sup> SMF 7337, <sup>3</sup> NMBE 1034195, <sup>4</sup> ZFMK 52536, <sup>5</sup> Data from Vences & Glaw, 1991 and Glaw & Vences, 1994

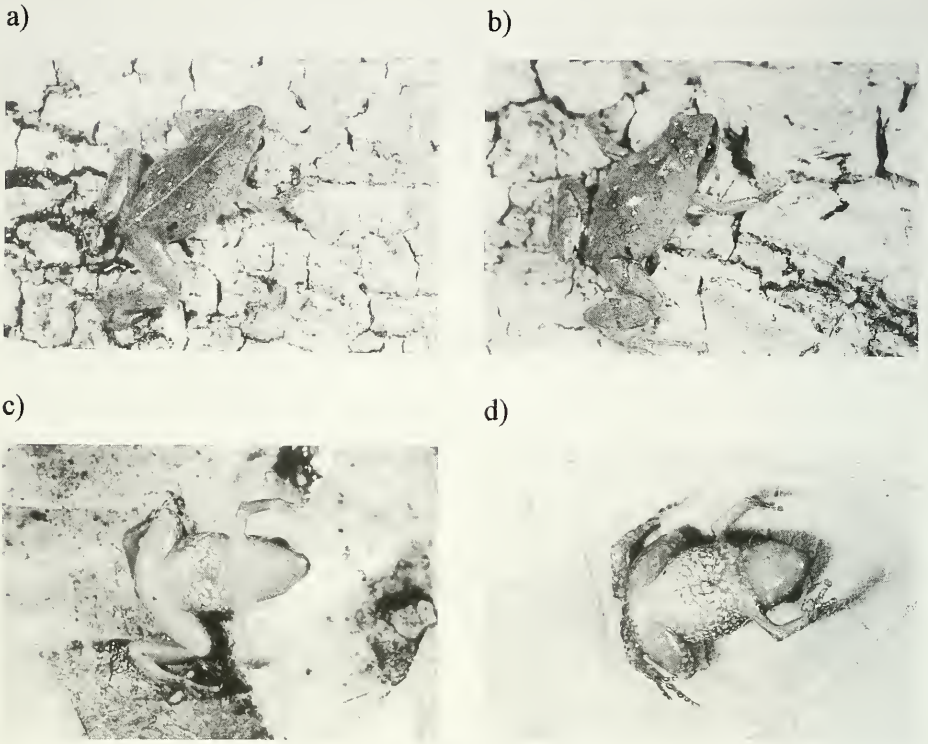


FIG. 1

Dorsal (a) and ventral (c) view of ♂ *Stumpffia helenae* sp. n. (holotype: NMBE 1044802). Dorsal (b) and ventral (d) view of ♀ *Stumpffia helenae* sp. n. (paratype: NMBE 1044801).

osteological analyses - e.g. enlarged end of the phalanx - were impossible without damage them). Dorsal skin slightly granular. Tibiotarsal articulation reaches the posterior edge of the eye. Measurements of the holotype: head width: 4.5; forearm length: 3.0; hand length: 2.1; tibia length: 6.6; foot length including tarsus: 9.3; foot length: 5.4; tympanum diameter: 0.7; eye diameter: 1.3; distance from eye to nostril: 0.9; distance from nostril to snout tip: 0.6. The left forearm is broken.

*Description of the paratype:* A ♀ of 15.0 mm length (since the size of the paratype is similar to that of the holotype (adult ♂) and nuptial pads are absent, it can be assumed that the paratype is an adult ♀). Similar to the holotype except fingertip less enlarged (Figs 2a and 2b), and the skin on the back smoother than in the holotype. Measurements of the paratype: head width: 5.1; forearm length: 3.5; hand length: 3.1; tibia length: 7.2; foot length including tarsus: 10.7; foot length: 6.2; tympanum diameter: 1.0; eye diameter: 1.6; distance from eye to nostril: 0.9; distance from nostril to snout tip: 0.7.

*Colour in life:* The ♂ had a dark grey, marbled colour on the back (Fig. 1a). In the inguinal region two black spots were present (probably an imitation of eyes). An

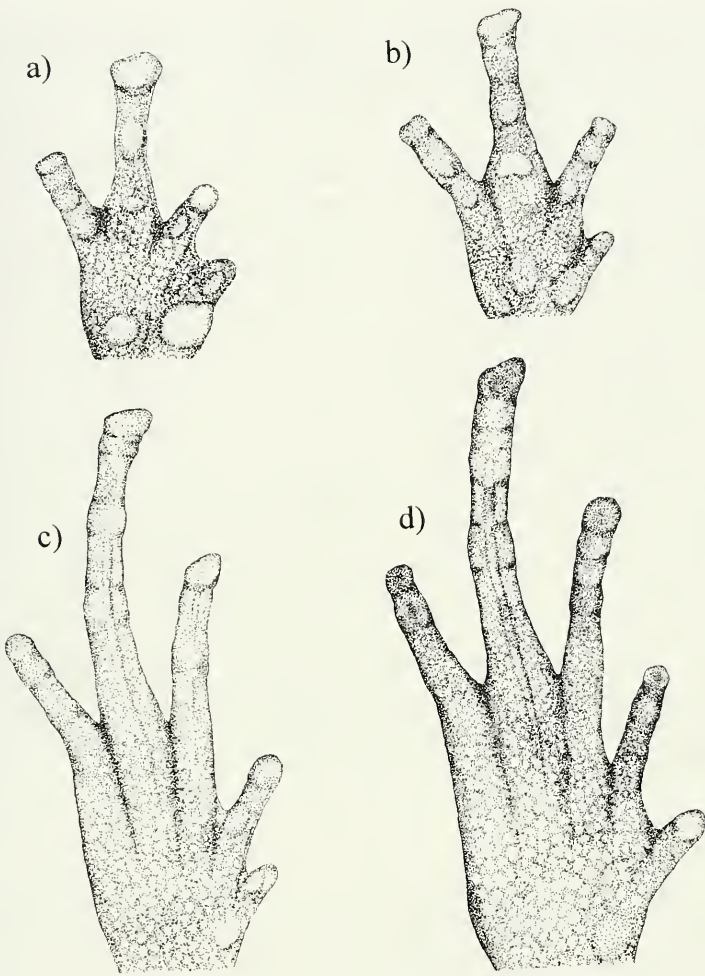


FIG. 2

Hand (a) and foot (c) of ♂ *Stumpffia helenae* sp. n. (holotype: NMBE 1044802). Hand (b) and foot (d) of ♀ *Stumpffia helenae* sp. n. (paratype: NMBE 1044801).

orange line was present on the middle of the back, extending from the middle of the head to the posterior end of the body. On both sides of the dorsal line two lines of small weakly elevated light spots were visible. A thin creamy and golden line extended from the humeral joint of the arm passing above the eye to its posterior edge. The sides of the head were dark grey but not marbled. The dark grey colour of the flanks (same colour as the sides of the head) was covered by lighter spots. The colour of the dorsal side of arms and legs was similar to the colour of the back but a

bit lighter. The throat, the belly and the ventral sides of the extremities were light grey with a few indistinct lighter spots (Fig. 1c). The chest was also light grey but covered by irregular white patches, giving to the chest a netlike impression. No distinct border present between the coloration of the dorsal and ventral side. The oval (horizontally flattened) pupil is surrounded by a golden iris. Compared to the coloration of the ♂, the coloration of the ♀ shows the following differences (Fig. 1b and 1d): the colour of the back was rather brown than grey, the orange line present in the ♂ was nearly not visible in the ♀ and the primary colour of the chest was not light grey but pink.

*Colour in preservative:* After 22 month in preservative the colour has changed little. The brown colour of the back of the ♀ and the orange line on the back of the ♂ changed into grey and light grey respectively. The pink colour of the ♀ chest faded out. On the ventral side of the legs the indistinct white spots became visible.

*Etymology:* I wish to dedicate this new species to my wife and friend Helena Bigler for her support of my research and her enthusiasm for Madagascar.

*Distribution:* *Stumpffia helenae* sp. n. is just known from the type locality.

*Habitat and habits:* Both known animals were found in the high plateau rain forest of the RS d'Ambohitantely, which was described by Koechlin (1972) as "high-altitude lichen forest". This forest contains wetter (riparian) and dryer (on slopes, plateau and ridges) forest types as described by Razakanirina (1993). The ♀ was active during the day in the leaf litter of the riparian forest 1 m from a brook. The ♂ also was active during the day in the leaf litter but far from brooks in the dryer slope forest. The riparian forest is characterised by trees to a canopy height of 20 m and a relatively sparse undergrowth vegetation, whereas the slope forest is characterised by a lower canopy and a denser undergrowth vegetation.

## DISCUSSION

It was surprising to find a *Stumpffia* in Ambohitantely since this genus was mainly known from middle or lower altitudes. *S. gimmeli* is known from the Montagne d'Ambre, *S. roseifemoralis* from the Marojezy massive and *S. grandis* from both mountains, but they do not reach altitudes much higher than 1000 m a.s.l.. Raxworthy & Nussbaum (1996) mentioned a not specified *Stumpffia* species from the Tsaratanana mountains in 2050 m a.s.l.. *Stumpffia helenae* sp. n. is one of the few records of this genus from higher altitudes (1500 m a. s. l.) and the first record in the central high plateau of Madagascar.

The forests of the high plateau of Madagascar are among the most threatened forests of Madagascar. The "Réserve Spéciale" of Ambohitantely is a nature reserve containing one of the last forests. It consists of hundreds of islands of forest, their sizes ranging from 0.16 to 1250 ha making up a total of 2737 ha about half the total reserve area (Langrand and Wilmé, 1997). The paratype was found in the 1250 ha fragment, whereas the holotype lived in a 30 ha fragment. The fragmentation of the forest started centuries ago. Small forest fragments may maintain stable amphibian populations since outside the forest, in the almost completely cleared landscape, the



conditions for the survival of this species are not favourable (high temperature and low air and soil humidity). The discovery of this new species shows the importance of even small forest remnants for conservation.

#### ACKNOWLEDGMENTS

I am very thankful to Monica Biondo for drawings and to John E. Cadle, Frank Glaw, and an anonymous reviewer for the review of the manuscript. I thank Wolfgang Nentwig and Walter Hödl for their support, Solofo and Armand for the help in the field, Wolfgang Böhme (Museum Koenig, Bonn) and Gunther Köhler (Senckenbergmuseum, Frankfurt) for the loan of comparative specimens. Claudio Vallan kindly reviewed an early draft of this paper. The research in Madagascar was made possible by scientific co-operation with the University of Antananarivo, the financial support of the Swiss Academy of Natural Sciences (SANS) and the Natural History Museum of Bern. The research was also supported by Air Madagascar, Photo-Wyss (Zürich) and Tramp Store (Trimbach) and authorized by the Direction des Eaux et Forêts (DEF), Association Nationale pour la Gestion des Aires Protégées (ANGAP), and the Commission Tripartite.

#### REFERENCES

- DUELLMAN, W. E. 1970. The Hyloid frogs of Middle America. *Monographs of the University of Kansas Natural History Museum* 1: 1-753.
- GLAW, F. & VENCES, M. 1994. A fieldguide to the amphibians and reptiles of Madagascar. 2nd edition, including mammals and freshwater fish. *Vences and Glaw, Köln*.
- KOECHLIN, J. 1972. Flore and vegetation of Madagascar (pp. 144-190). In: BATTISTINI, R. & RICHARD-VINDARD, G. (eds). Biogeography and ecology of Madagascar. *Dr. W. Junk B. V., Publishers, The Hague*.
- LANGRAND, O. & WILMÉ, L. 1997. Effects of forest fragmentation on extinction patterns of the endemic avifauna on the Central High Plateau of Madagascar (pp. 280-305). In: GOODMAN, S. M. & PATTERSON, B. D. (eds). Natural change and human impact in Madagascar. *Smithsonian Institution Press, Washington D.C.*
- RAZAKANIRINA, D. 1993. Le jardin botanique de la réserve speciale d'Ambohitantely. *Akon'ny Ala* 11: 50-52.
- RAXWORTHY, C. J. & NUSSBAUM, R. A. 1996. Montane Amphibian and Reptile Communities in Madagascar. *Conservation Biology* 10: 750-756.
- VENCES, M. & GLAW, F. 1991. Revision der Gattung *Stumpffia* Boettger 1881 aus Madagaskar mit Beschreibung von zwei neuen Arten (Amphibia, Anura, Microhylidae). *Acta biologica Benrodis* 3: 203-219.



**Nuclear and mitochondrial markers reveal the existence of two parapatric scorpion species in the Alps: *Euscorpium germanus* (C. L. Koch, 1837) and *E. alpha* Caporiacco, 1950, stat. nov. (Euscorpiidae)**

Benjamin GANTENBEIN<sup>1</sup>, Victor FET<sup>2</sup>, Mark BARKER<sup>2</sup> & Adolf SCHOLL<sup>1</sup>

<sup>1</sup> Institute of Zoology, Division of Population Biology, University of Berne, Baltzerstrasse 3, CH-3012 Berne, Switzerland.

E-mail: gantenbein@zoo.unibe.ch

<sup>2</sup> Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755-2510, USA.

E-mail: fet@marshall.edu

**Nuclear and mitochondrial markers reveal the existence of two parapatric scorpion species in the Alps: *Euscorpium germanus* (C. L. Koch, 1837) and *E. alpha* Caporiacco, 1950, stat. nov. (Euscorpiidae).** - A molecular (mtDNA and allozyme) data set reveals a clear divergent phylogeny within the Alpine scorpion species *Euscorpium* (*Alpiscorpium*) *germanus* (C. L. Koch, 1837). Two distinct (ca. 7 % DNA sequence divergence), monophyletic clades exist which are geographically separated by the Adige (Etsch) River in northern Italy. At the allozyme level, these population groups are fixed for alternative alleles at eight out of 18 gene loci and correspond roughly to the morphological subspecies *E. g. germanus* and *E. g. alpha*. No evidence of introgressive hybridization between the two groups is shown by the allozyme data. The branching points of the two population groups are found at unusually high distances compared with the outgroup taxa *E. gamma* Caporiacco, 1950 and *E. flavicaudis* (De Geer, 1778). The subspecies *E. g. alpha* is therefore elevated to species level: *Euscorpium alpha* Caporiacco, 1950, stat. nov. A neotype for *E. germanus* (C. L. Koch, 1837) and lectotypes for *E. alpha* stat. nov., *E. germanus beta* syn. nov. of *E. alpha*, and *E. germanus croaticus* are designated. Phylogenetic and biogeographic implications are discussed.

**Key-words:** Scorpions - trichobothria - allozymes - 16S mtDNA - biogeography - parapatric species - Alps - phylogeny.

## INTRODUCTION

Several species of the scorpion genus *Euscorpium* Thorell, 1876 (Euscorpiidae) are common in the circum-Mediterranean region and in southern Europe. Taxonomy of this genus is not well resolved; there are currently seven “good” species, and 40 (!) formally valid subspecies in *Euscorpium* (Fet & Sissom, 2000; Scherabon *et al.*,

2000). Recently, we began to apply molecular data to solve complicated taxonomic problems in this genus (Gantenbein & Scholl, 1998; Gantenbein *et al.*, 1998, 1999a; Fet *et al.*, 1999; Scherabon *et al.*, in press). This paper reports new phylogenetic data, based on the analyses of mtDNA sequences and allozymes, from the Alpine populations, which have been traditionally placed in *Euscorpius germanus* (C. L. Koch, 1837).

*E. germanus* is a mountainous species, recorded from the western Balkans, Austria, northern Italy and southern Switzerland (Capra, 1939; Caporiacco, 1950; Valle *et al.*, 1971; Bonacina, 1980; Scherabon, 1987; Crucitti, 1993; Fet & Braunwalder, 1997; Gantenbein *et al.*, 1998). Scorpion taxa are traditionally classified using morphological characters such as variation in the trichobothrial numbers and patterns ('trichobothriotaxy') (Birula, 1900, 1917; Hadzi 1931; Vachon 1962, 1981). However, molecular markers have recently become a powerful tool for evaluating the taxonomic status of populations and subspecies/species. The combination of nuclear and mitochondrial markers has been efficiently applied to detect introgression between taxa (Barton & Hewitt, 1989; Harrison, 1990; Bernatchez *et al.*, 1995). The subspecies *Euscorpius germanus gamma* Caporiacco 1950 was recently elevated to species rank (Scherabon *et al.*, in press) after using allozyme and mtDNA data. Gantenbein *et al.* (1998) and Gantenbein & Scholl (1998) demonstrated that the Swiss *E. germanus* populations probably have originated from two different refuges during the glaciations, forming two genetically highly divergent population groups. In order to further clarify the taxonomic status of the two subspecies *E. g. germanus* and *E. g. alpha* and to confirm the hybrid zone between these taxa assumed by Bonacina (1980), we initiated a molecular survey applying previously established nuclear (allozymes) and mitochondrial (16S mtDNA sequences) gene markers.

## METHODS AND MATERIALS

### SPECIMENS ANALYSED

A map of Switzerland, northern Italy, Austria and Slovenia from where *E. germanus* samples were collected is given in Fig. 1. Two outgroup species were collected, *Euscorpius gamma* Caporiacco, 1950 (see Scherabon *et al.*, 2000) from Koschuta (Carinthia, Austria) and *Euscorpius flavicaudis* (DeGeer, 1778) from Lauris (Vaucluse, France). The animals were caught in a sampling area of about 100-300 m<sup>2</sup> and were brought alive to the laboratory where they were killed by deep-freezing and stored in -80°C prior to biochemical analyses. In general, only few animals were taken from one site because small sample sizes (N < 10) are already expected to result in relatively good estimates of gene frequencies at allozyme loci. Previous studies reported a low genetic variability within *E. germanus* populations (Gantenbein *et al.*, 1998, 1999a). Sample sizes are given in appendix I. After biochemical analyses, the animals were transferred to 70 - 80% ethanol for morphological analysis.

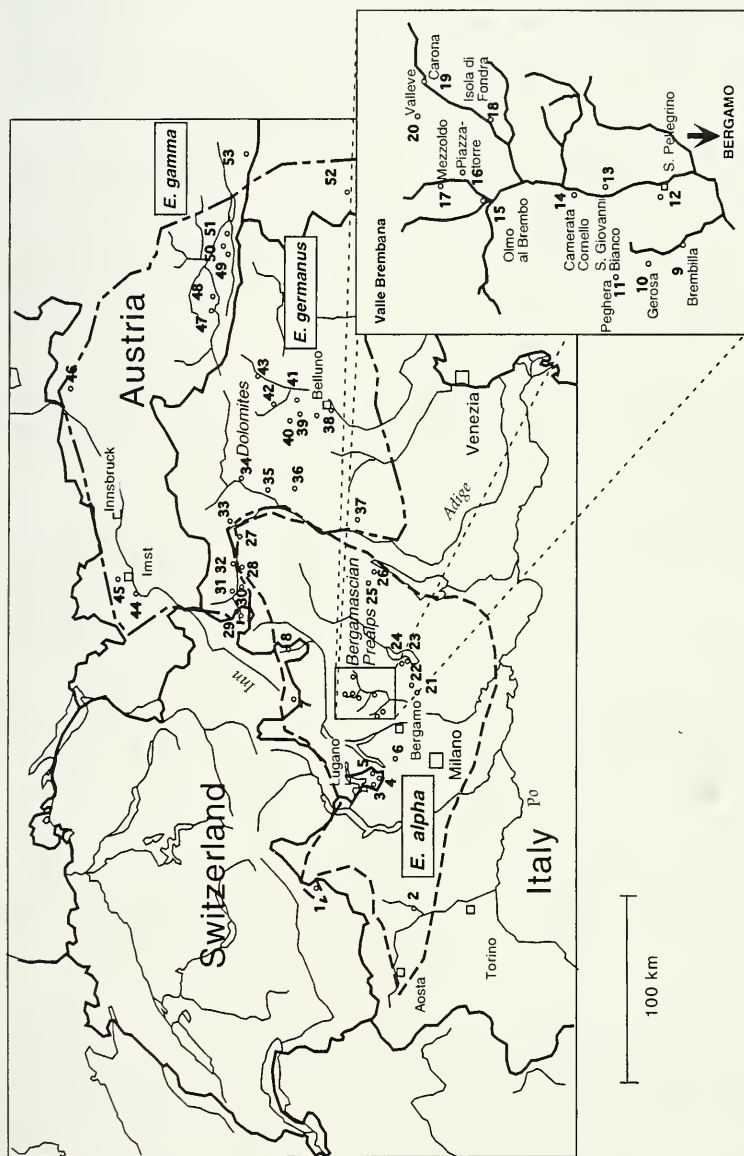


FIG. 1

Sampling sites. Western clade (*E. alpha*): samples 1-28; 1 Gondo, 2 Fontainemore, 3 Rancate, 4 Monte, 5 Fornace, 6 Pontide, 7 Sottoponte, 8 San Carlo, 9 Brembilla, 10 Gerosa, 11 Peghera, 12 San Pellegrino, 13 San Giovanni Bianco, 14 Camerata Cornello, 15 Olmo al Brembo, 16 Piazzatorre, 17 Mezzoldo, 18 Isola di Fondra, 19 Carona, 20 Valleve, 21 Selvino, 22 Nembro, 23 Tavernola, 24 Vigolo, 25 Bezzecca, 26 Molina di Ledro, 27 Marling, 28 Bad Salz. Eastern clade (*E. germanus*): samples 29-52; 29 Sta Maria, 30 Lichtenberg, 31 Schluderns, 32 Schluderns, 33 Verdins, 34 Brixen, 35 Völs, 36 Bremer, 37 Vetriolo, 38 Belluno, 39 Voltago, 40 San Tomaso, 41 Mezzocanale, 42 Borca di Cadore, 43 Auronzo di Cadore, 44 Starkenbach, 45 Tarrenz, 46 Kranzsch, 47 Dellach, 48 Oberdrauburg, 49 Dobratsch, 50 Schütt, 51 Federaun, 52 Crnice (near Nova Gorica). Outgroup *E. gamma*: 53 Koschuta.

## DNA ANALYSIS

*DNA extraction and sequencing techniques:* A comparative analysis of the mitochondrial 16S ribosomal RNA and allozymes has been recently used for resolving species-level phylogeny of *Euscorpium* (Gantenbein *et al.*, 1999a); this contribution should be consulted for the technical details and protocols. Total DNA was extracted from fresh or preserved (95% ethanol) muscle tissue using a standard extraction method. An approximately 400 bp long fragment of the mitochondrial (mt) 16S rRNA gene was amplified by the polymerase chain reaction (PCR) using the primers 16Sbr (= LR-J-12887), (Simon *et al.* 1994; CGATTTGAACTCAGATCA; forward, 18-mer) and a scorpion-specific reverse primer (GTGCAAAGGTAGCA-TAATCA, 20-mer). A total of 25 mtDNA sequences was used for the analysis (Table 1). For further analysis, all ambiguities and indels were excluded, as suggested by Swofford *et al.* (1996), with 357 characters remaining.

*Haplotype diversity:* We calculated the haplotype (gene) diversity (Nei, 1987), the nucleotide diversity  $\pi$  (Nei & Li, 1979) and the number of segregating (polymorphic) sites (S) among sequences of *E. germanus*. Neutrality of mutations within each species was examined by using Tajima's D test (1989). The genetic variability estimates and the neutrality tests were calculated using the computer program DnaSP (Rozas & Rozas, 1999).

*Phylogenetic analyses:* We applied character-matrix-based methods (maximum parsimony (MP) and maximum likelihood (ML)) methods (Felsenstein, 1981a) as well as distance-based methods (neighbour-joining (NJ) cluster algorithm) (Saitou & Nei, 1987). The beta-version of the computer program PAUP\* 4.0 (Swofford, 1998) was used for all phylogenetic DNA analyses. We calculated hierarchical likelihood ratio tests, in order to find the most appropriate model of DNA substitution, using the program MODELTEST 2.0 (Posada & Crandall, 1998). This program calculates the likelihood ratio statistic  $\delta = -2 \log \Lambda$  where  $\Lambda$  is defined as

$$\Lambda = \frac{\max [L_0(\text{NullModel} \setminus \text{Data})]}{\max [L_1(\text{AlternativeModel} \setminus \text{Data})]}$$

with  $L_0$  being the likelihood under the null hypothesis (simple model) and  $L_1$  being the likelihood under the alternative hypothesis (more complex, parameter rich, model). When the models compared are nested (the null hypothesis is a special case of the alternative hypothesis) and the null hypothesis is correct, the  $\delta$  statistic is asymptotically distributed as  $\chi^2$  with  $q$  degrees of freedom ( $q$  is the difference in number of free parameters between the two models). In the next step, a test for the molecular clock hypothesis (i. e. rate constancy among lineages) was calculated ( $\chi^2$  distributed,  $df = N - 2$  OTUs). Details on model testing using maximum likelihood ratios are given in Huelsenbeck & Rannala (1997) and in Huelsenbeck & Crandall (1997). The likelihood ratio tests suggested the Tamura & Nei (1993) model with rate heterogeneity (TrN93 +  $\Gamma$ ), which is a submodel of the general-time-reversible (GTR) substitution model (Rodríguez *et al.*, 1990, Yang *et al.*, 1994). All parameters (base frequencies, rate matrix) were estimated via maximum likelihood. The rate

heterogeneity among sites was assumed to follow a gamma distribution (shape parameter  $\alpha$  was ML-estimated) with four categories, each represented by its mean (Yang, 1994). Phylogenetic analysis is facilitated when rates are equal among lineages. However, the test for the molecular clock was rejected at the 0.01 level, therefore, the tree search was carried out without enforcing the clock.

For ML analyses the tree space was explored using the heuristic search option implemented in PAUP\* with random addition of sequences (100 replicates, tree bisection-reconnection (TBR) branch-swapping algorithm). For the MP analysis the transitions (ti) were weighted twice over transversions (tv) according to the ML estimated ti / tv ratio using the HKY85 (Hasegawa *et al.*, 1985) model, and the tree search was done using the branch-and-bound search option. To save computing time, identical haplotypes were eliminated. The consistency index (CI) and the retention index (RI) (Kitching *et al.*, 1998) were calculated as measures for tree stability with PAUP\*.

Alternatively, pairwise ML-distances were estimated using the TrN93 +  $\Gamma$  model. Estimating distances via ML has the advantage of constant parameters over all pairwise comparisons and consequently the variance of distances is reduced. These distances were used as a matrix for neighbour-joining (NJ) clustering (Saitou & Nei, 1987). NJ is assumed to be a good heuristic approach for estimating the minimum evolution tree (Page & Holmes, 1998). The trees were rooted using two outgroup species: *E. gamma* and *E. flavicaudis*. The trees were bootstrapped resampling 1,000 data sets with 357 characters.

#### DNA SEQUENCE AVAILABILITY

All sequences were deposited in the EMBL Nucleotide Sequence Database with the following accession numbers: *E. alpha* stat. nov.: *EalGO* (= *EalFO*) = AJ389379; *EalRA* = AJ271886; *EalSP* = AJ286751; *EalSG* = AJ286752; *EalCA* = AJ286753; *EalOL* = AJ286754; *EalSO* = AJ286755; *EalTA* = AJ286756; *EalMA* (= *EgeML*) = AJ286757; *E. germanus*: *EgeVO* (= *EgeSH* = *EgeSM* = *EgeTz* = *EgeKR* = *EgeVE*) = AJ389380; *EgeOB* (= *EgeDE* = *EgeST*) = AJ249553; *EgeBO* = AJ286758; *EgeME* = AJ286759; *EgeCR* = AJ249552; *E. gamma*: *EgaKO* = AJ249554; *E. flavicaudis*: *EflLA* = AJ389381. Abbreviations for haplotypes are given in appendix I.

#### ALLOZYME ANALYSIS

Horizontal starch gel electrophoresis of allozymes was carried out according to the protocols described in Harris & Hopkinson (1976) and Murphy *et al.* (1996). We scored the same 18 loci as described in Gantenbein *et al.* (1998): N-(3-Aminopropyl)-morpholine-citrate (AC, pH 6.2, modified from Clayton & Tretiak 1972), Tris-citrate (TC, pH 7.3, Ayala *et al.* 1972) and Tris-borate-EDTA (TBE, pH 9.3, modified from Ayala *et al.*, 1972). The loci scored were: AAT-1 and AAT-2 (aspartate aminotransferase; EC 2.6.1.1), ALPDH (alanopine dehydrogenase; EC 1.5.1.17), ARK (arginine kinase; EC 2.7.3.3), DDH (dihydrolipoamide oxidase; EC 1.8.1.4), GAPDH (glyceraldehyde-3-phosphate dehydrogenase; EC 1.2.1.12), GTDH (glutamate dehy-

drogenase; EC 1.4.1.2), GPI (PGI) (glucose-6-phosphate isomerase; EC 5.3.1.9), HK (hexokinase; EC 2.7.1.1), IDH-1 and IDH-2 (isocitrate dehydrogenase; EC 1.1.1.42), MDH-1 and MDH-2 (malate dehydrogenase; EC 1.1.1.37), MPI (mannose-6-phosphate isomerase; EC 5.3.1.8), PEP (pepdidase; EC 3.4.-.-), PGM (phosphoglucomutase; EC 5.4.2.2), 6-PGD (6-phosphogluconate dehydrogenase; EC 1.1.1.44), and PK (pyruvate kinase; EC 2.7.1.40). We refer to the observed electromorphs as alleles which are identified by their electrophoretic mobility relative to the most common mobility in the *E. flavicaudis* population from Lauris, France (assigned mobility=100) as described in Gantenbein *et al.* (1998). To assess the genetic variability within each population, the mean number of alleles per locus, the percentage of polymorphic loci and the mean heterozygosity were calculated by the direct count method and by Nei's (1978) unbiased estimate. Calculations were done using BIOSYS-1 (Swofford & Selander, 1989). Cavalli-Sforza & Edwards' (1967) chord distance was calculated from pairwise comparisons of populations using the program GENDIST from the PHYLIP 3.5 package (Felsenstein, 1995). Using Nei's pairwise distances as an input matrix, an additive tree was created by the neighbour-joining algorithm (NJ). Alternatively, an unrooted maximum likelihood tree was calculated using the computer program CONTML. This estimates phylogenies by the restricted maximum likelihood (REML) method, based on the Brownian motion model (Cavalli-Sforza & Edwards, 1967). The REML algorithm was described in Felsenstein (1973, 1981b). It uses less parameters than the full ML analysis and is therefore considered to be more consistent. Additionally, the program calculates branch lengths and rough confidence intervals for the branches. Bootstrap values were obtained from 1,000 pseudo-replicates of allele frequencies using the SEQBOOT routine in PHYLIP.

#### MORPHOLOGICAL ANALYSIS

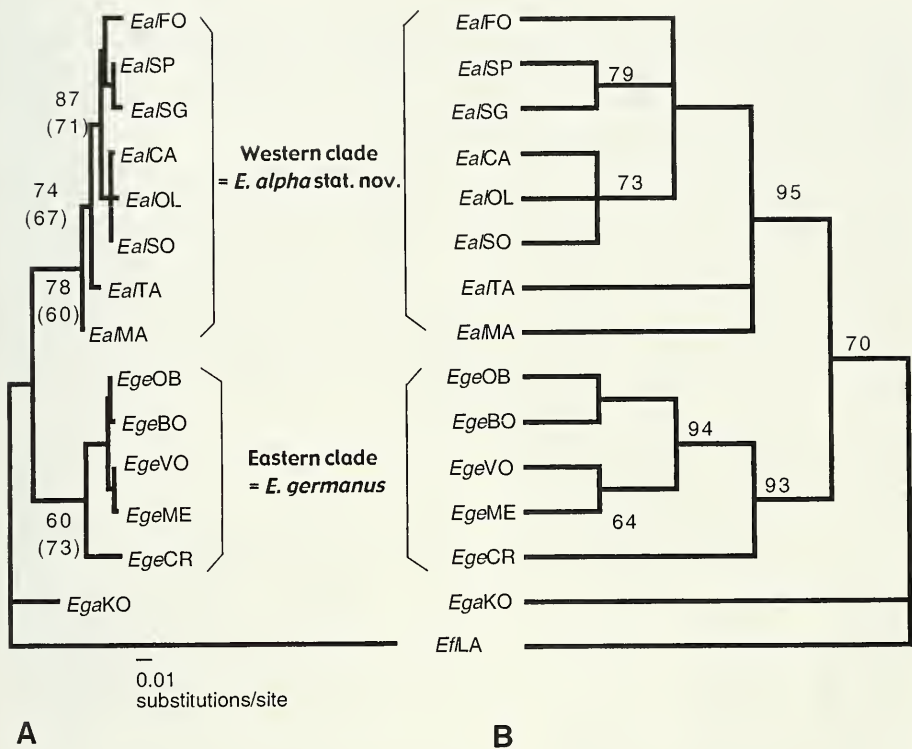
We scored the number of pectinal teeth ( $D_p$ ) and the numbers of trichobothria on the ventral ( $P_v$ ) and external ( $P_e$ ) aspects of the palpal patella (called tibia by some authors; see Hjelle, 1990). ♂♂ have higher numbers of pectinal teeth. We tested the differences between two discovered clades using a one-sided *t*-test.

#### RESULTS

##### MOLECULAR ANALYSES

*mtDNA data:* We analysed 25 mtDNA sequences representing 17 different haplotypes. The heuristic tree search (100 replicates) using maximum likelihood (ML) revealed a single tree with a ln likelihood of -904.57 (Fig. 2A). The nucleotide frequencies within the 16S mtDNA were estimated via ML to A = 0.332, C = 0.13, G = 0.12, and T = 0.41, respectively. The substitution rate matrix (R) was estimated via ML to A <-> C = 1, A <-> G = 19.0, A <-> T = 1, C <-> G = 1, C <-> T = 3.82, and G <-> T = 1. The shape parameter  $\alpha$  of the gamma distribution was estimated via ML to 0.085. The relatively low estimate of  $\alpha$  indicates a high rate of heterogeneity among nucleotide sites. The tree topology of the ML tree was identical to that





(A) Maximum likelihood (ML) phylogeny based on the 16S mtDNA gene sequences in the “western” clade (*Euscorpius alpha stat. nov.*, *Eal*) and in the “eastern” clade (*E. germanus*, *Ege*). The  $-\ln$  Likelihood was 904.57 using the model by Tamura & Nei (1993) with rate heterogeneity (TrN93 +  $\Gamma$ ). (B) Strict consensus tree of six equally parsimonious trees (91 steps, CI = 0.80, RI = 0.85) calculated by weighted maximum parsimony (MP). Numbers at nodes refer to bootstrap values calculated from 1,000 pseudoreplicates. Bootstrap values in parentheses (in A) are from neighbour-joining (NJ) analysis, which resulted in the same tree topology showing a deep split between both clades (species). Abbreviations for haplotypes are explained in appendix I.

of a NJ tree (tree not shown) which was built using TrN93 +  $\Gamma$  distances. The bootstrap values for the ML tree and the NJ analysis (in parentheses) are given in Fig. 2A. This phylogeny splits all analysed mtDNA sequences of *E. germanus* into two clearly distinct clades (“western” and “eastern”), both supported by relatively high bootstrap values.

The analysis using weighted maximum parsimony (MP) revealed six equally parsimonious trees with a tree score of 91 steps. 297 characters were constant, 27 characters were parsimony-informative. The consistency index (CI) for all eight trees was 0.80 and the retention index (RI) was 0.85, respectively. Both indices indicate a high tree stability. The strict consensus tree is shown in Fig. 2B. The deep splitting of

two population groups in the MP analysis is consistent with the ML tree and the NJ tree. However, the sequence from Crnice (EgeCR) showed an ambiguous grouping in ML and NJ analysis. Therefore, the bootstrap values for the two clades were moderate (about 70%) in ML and NJ analyses. This was not the case in MP analysis where both clades were supported by high values (about 90%).

The DNA polymorphism of the 16S data is listed in Table 1 and in Appendix II. The analysis of DNA variation revealed that 16 sites out of 357 characters were polymorphic (segregating) among the eleven "western clade" sequences whereas 14 sites out of 364 were polymorphic among the twelve "eastern clade" sequences. The probability that two randomly chosen haplotypes are different (= gene diversity) was 0.94 and 0.72, respectively (Table 1). Within the "western clade", the average nucleotide diversity  $\pi$  was  $0.03 \pm 0.00$ , whereas in the "eastern clade" it was close to zero. Tajima's D test statistics were not significant for both species.

TABLE 1: mtDNA diversity measures within the "western" and "eastern" clades (*E. alpha* stat. nov. and *E. germanus*, respectively).

	Sample size n	Number of haplotypes	haplotype (gene) diversity	Polymorphic sites S	Total Number of sites*	Average number of nucleotide differences	Nucleotide diversity $\pi$	$\theta (= 2 Ne \mu)$ per site	Tajima's D**
Western clade = <i>E. alpha</i> stat. nov.	11	8	0.95	16	357	5.78	0.0322	0.016	0.26
Eastern clade = <i>E. germanus</i>	12	5	0.72	8	364	3.12	0.009	0.008	-1.39

\* excluding indels and ambiguities.

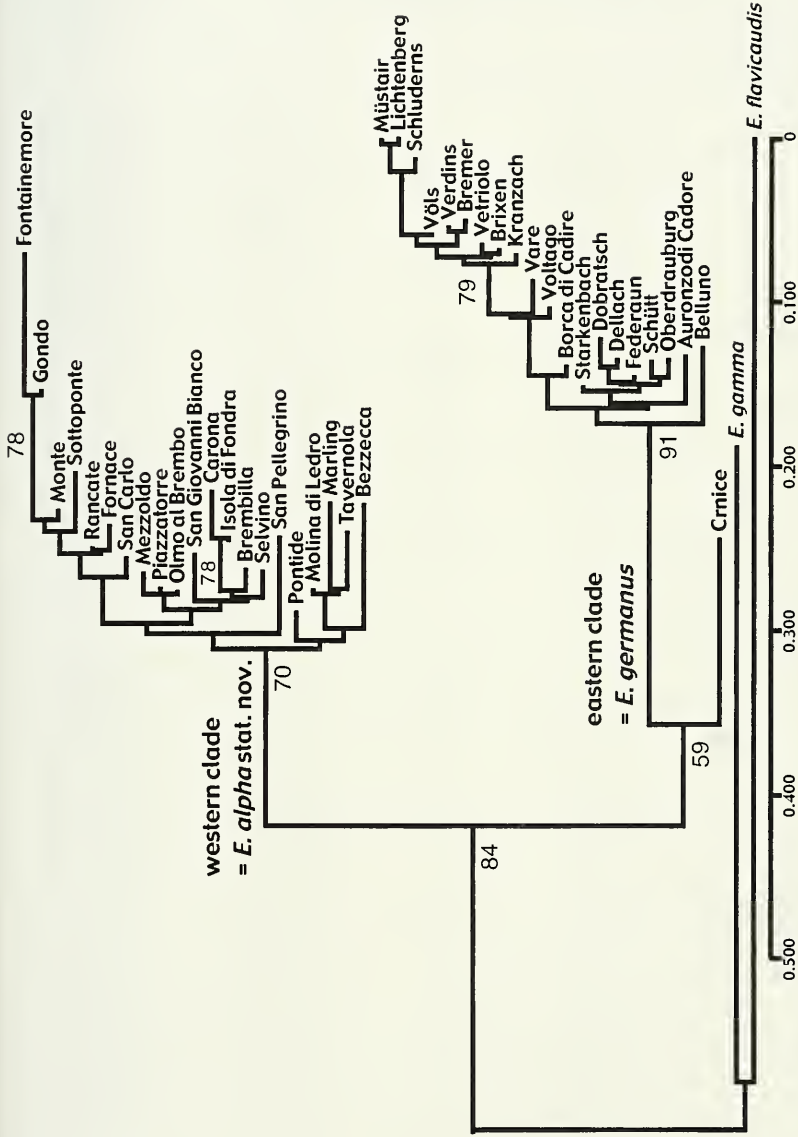
\*\*  $P > 0.10$

*Allozyme data:* The NJ tree based on allozyme gene frequency data at 18 loci (appendix I) independently revealed a tree topology comparable to those obtained by 16S mtDNA sequence analysis. It splits all populations of *E. germanus* examined into two highly divergent groups, a "western" and an "eastern" one (Fig. 3). However, bootstrap values of these two groups were not as high as in DNA analysis. This is caused by the Crnice population, which in some cases exhibited ambiguous clade groupings. The ln Likelihood of the best tree (tree not shown) using the Restricted ML (REM) criterion by Felsenstein (1981b) was -3647.51970 (14,688 trees explored) and the topology was identical to that revealed by NJ analysis.

The genetic variation estimates within both clades are given for samples  $N \geq 4$  in Table 2. The populations were fixed at many gene loci, therefore, the mean number of alleles was approximatively one. Low genetic variability estimates were found for the mean number of loci polymorphic (16%) and for the average heterozygosity ( $0.03 \pm 0.02$ ) (Table 2).

#### MORPHOLOGICAL ANALYSIS

We measured the number of pectinal teeth ( $D_p$ ) in ♂♂ and ♀♀ from each of the two major clades recognized by molecular analyses (Figs. 2-3). ♀♀ of the "eastern clade" had significantly higher number ( $t = 2.29, P = 0.011$ ) of pectinal teeth ( $(D_{p_{left}} + D_{p_{right}}) / 2$ ) (mean = 6.05,  $s^2 = 1.10, N = 83$ ) than the ♀♀ of the "western



Cavalli-Sforza (1967) chord distance

Fig. 3. Neighbour-joining (NJ) analysis of samples ( $N \leq 4$ ) of the two clades (species) using Cavalli-Sforza chord distance (Cavalli-Sforza & Edwards, 1967) as an input matrix. Distances are based on 18 allozyme loci. Numbers at the nodes refer to bootstrap values calculated over 1,000 pseudoreplicates.

TABLE 2: Genetic variability estimates between the "western" and "eastern" clades (*E. alpha* stat. nov. and *E. germanus*, respectively) based on 18 allozyme loci (see appendix I) (N ≥ 4).

Nr	Population	Mean no. of alleles per locus	Percentage of polymorphic loci*	Mean heterozygosity	
				Direct count	Hardy-Weinberg expected
<b>Western clade = <i>E. alpha</i> stat. nov.</b>					
1	Gondo	1.2 ± 0.1	11.1	0.01 ± 0.00	0.03 ± 0.02
2	Fontainemore	1.0 ± 0.0	0	0.00 ± 0.00	0.00 ± 0.00
3	Rancate	1.2 ± 0.2	11.1	0.03 ± 0.03	0.06 ± 0.04
4	Monte	1.2 ± 0.1	11.1	0.03 ± 0.02	0.05 ± 0.03
5	Fornace	1.2 ± 0.1	16.7	0.03 ± 0.02	0.06 ± 0.04
6	Pontide	1.4 ± 0.2	33.3	0.09 ± 0.04	0.14 ± 0.06
7	Sottoponte	1.2 ± 0.1	16.7	0.04 ± 0.03	0.04 ± 0.03
8	San Carlo	1.2 ± 0.1	22.2	0.04 ± 0.02	0.07 ± 0.04
9	Brembilla	1.4 ± 0.2	27.8	0.10 ± 0.05	0.11 ± 0.06
12	San Pellegrino	1.6 ± 0.2	33.3	0.11 ± 0.05	0.19 ± 0.07
13	San Giovanni Bianco	1.6 ± 0.2	33.3	0.09 ± 0.04	0.11 ± 0.05
15	Olmo al Brembo	1.3 ± 0.2	22.2	0.04 ± 0.02	0.08 ± 0.04
16	Piazzatorre	1.4 ± 0.2	22.2	0.05 ± 0.03	0.09 ± 0.05
17	Mezzoldo	1.3 ± 0.2	16.7	0.06 ± 0.03	0.07 ± 0.04
18	Isola di Fondra	1.6 ± 0.2	38.9	0.09 ± 0.04	0.10 ± 0.04
19	Carona	1.2 ± 0.1	11.1	0.04 ± 0.03	0.04 ± 0.03
21	Selvino	1.3 ± 0.2	22.2	0.07 ± 0.04	0.09 ± 0.04
23	Tavernola	1.2 ± 0.1	16.7	0.03 ± 0.02	0.08 ± 0.05
25	Bezzecca	1.4 ± 0.2	27.8	0.08 ± 0.03	0.12 ± 0.05
26	Molina di Ledro	1.4 ± 0.2	22.2	0.05 ± 0.03	0.11 ± 0.06
27	Marling	1.4 ± 0.2	27.8	0.06 ± 0.03	0.11 ± 0.05
	Mean	1.3 ± 0.2	21.16	0.05 ± 0.03	0.08 ± 0.04
<b>Eastern clade = <i>E. germanus</i></b>					
29	Sta Maria	1.1 ± 0.1	5.6	0.01 ± 0.01	0.02 ± 0.02
30	Lichtenberg	1.1 ± 0.1	5.6	0.00 ± 0.00	0.03 ± 0.03
31	Schluderns	1.2 ± 0.1	11.1	0.02 ± 0.01	0.04 ± 0.03
33	Verdins	1.1 ± 0.1	5.6	0.00 ± 0.00	0.00 ± 0.00
34	Brixen	1.1 ± 0.1	5.6	0.01 ± 0.01	0.03 ± 0.03
35	Völs	1.2 ± 0.1	16.7	0.02 ± 0.01	0.06 ± 0.04
36	Bremer	1.1 ± 0.1	11.1	0.02 ± 0.02	0.04 ± 0.02
37	Vetriolo	1.1 ± 0.1	11.1	0.02 ± 0.01	0.02 ± 0.01
38	Belluno	1.1 ± 0.1	5.6	0.02 ± 0.02	0.03 ± 0.03
39	Voltago	1.2 ± 0.1	16.7	0.08 ± 0.04	0.09 ± 0.05
40	San Tomaso	1.1 ± 0.1	11.1	0.06 ± 0.04	0.05 ± 0.03
42	Borca di Cadore	1.3 ± 0.2	22.2	0.06 ± 0.03	0.10 ± 0.05
43	Auronzo di Cadore	1.2 ± 0.1	16.7	0.07 ± 0.04	0.05 ± 0.03
44	Starkenbach	1.1 ± 0.1	11.1	0.04 ± 0.03	0.05 ± 0.04
45	Tarrenz	1.0 ± 0.0	0	0.00 ± 0.00	0.00 ± 0.00
46	Kranzsch	1.1 ± 0.1	5.6	0.00 ± 0.00	0.03 ± 0.03
47	Dellach	1.1 ± 0.1	11.1	0.01 ± 0.01	0.03 ± 0.03
48	Oberdrauburg	1.2 ± 0.2	11.1	0.01 ± 0.01	0.06 ± 0.05
49	Dobratsch	1.2 ± 0.1	16.7	0.06 ± 0.03	0.05 ± 0.03
50	Schütt	1.2 ± 0.1	11.1	0.04 ± 0.03	0.07 ± 0.05
51	Federaun	1.1 ± 0.1	11.1	0.03 ± 0.03	0.05 ± 0.03
52	Crnice	1.2 ± 0.1	16.7	0.04 ± 0.02	0.07 ± 0.04
	Mean	1.1 ± 0.1	10.87	0.03 ± 0.02	0.04 ± 0.03
	Overall Mean	1.2 ± 0.1	16.02	0.03 ± 0.02	0.06 ± 0.04

\* A locus is considered polymorphic if the frequency of the most common allele does not exceed 0.99

\*\* Unbiased estimate (Nei, 1978)

TABLE 3: Distance matrix of the sequence divergence (uncorrected p) (upper right) and of TrN93 +  $\Gamma$  (lower left) calculated from pairwise comparisons of 16S mtDNA sequences.

	EalFO	EalSP	EalSC	EalCA	EatOL	EalSO	EalTA	EalMA	EgeOB	EgeBO	EgeVO	EgeME	EgeCR	EgaKO	EfilA
EalFO	-	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.06	0.06	0.06	0.06	0.07	0.06	0.10
EalSP	0.02	-	0.00	0.02	0.02	0.01	0.02	0.02	0.06	0.06	0.06	0.07	0.07	0.06	0.12
EalSC	0.03	0.00	-	0.02	0.02	0.02	0.02	0.02	0.07	0.06	0.07	0.07	0.07	0.06	0.12
EalCA	0.02	0.03	0.04	-	0.00	0.00	0.02	0.02	0.07	0.07	0.07	0.07	0.07	0.06	0.11
EatOL	0.03	0.02	0.03	0.00	-	0.00	0.02	0.02	0.07	0.07	0.07	0.07	0.07	0.06	0.12
EalSO	0.03	0.02	0.03	0.00	0.00	-	0.02	0.02	0.06	0.06	0.06	0.07	0.07	0.06	0.11
EalTA	0.05	0.05	0.05	0.05	0.03	0.03	-	0.01	0.06	0.06	0.06	0.06	0.06	0.05	0.11
EalMA	0.04	0.04	0.04	0.04	0.03	0.03	0.01	-	0.06	0.05	0.06	0.06	0.06	0.05	0.10
EgeOB	0.41	0.49	0.54	0.64	0.56	0.49	0.31	0.31	-	0.00	0.00	0.00	0.03	0.06	0.11
EgeBO	0.39	0.47	0.52	0.62	0.54	0.47	0.30	0.30	0.00	-	0.00	0.01	0.03	0.06	0.11
EgeVO	0.41	0.49	0.54	0.64	0.56	0.49	0.31	0.31	0.00	0.00	-	0.00	0.03	0.06	0.11
EgeME	0.51	0.62	0.69	0.81	0.70	0.61	0.39	0.39	0.00	0.01	0.00	-	0.04	0.06	0.11
EgeCR	0.38	0.46	0.50	0.36	0.40	0.45	0.19	0.18	0.06	0.07	0.07	0.08	-	0.06	0.12
EgaKO	0.25	0.20	0.22	0.25	0.19	0.20	0.10	0.09	0.43	0.36	0.43	0.54	0.22	-	0.10
EfilA	0.45	0.79	0.86	0.65	0.62	0.65	0.48	0.45	0.65	0.59	0.62	0.52	0.65	0.46	-

clade" (mean = 5.68,  $s^2 = 1.41$ ,  $N = 111$ ). This corresponded to a unimodal distribution of this character in the "eastern clade" (common Dp = 6) versus bimodal in the "western clade" (Dp = 5 or 6). ♂♂ of the "eastern clade" also had significantly higher number ( $t = 1.73$ ,  $P = 0.045$ ) of pectinal teeth (mean = 7.58,  $s^2 = 2.1$ ,  $N = 24$ ) than ♂♂ of the "western clade" (mean = 6.98,  $s^2 = 1.97$ ,  $N = 60$ ). This corresponded to a bimodal distribution of this character in the "eastern clade" (Dp = 7 or 8) versus unimodal in the "western clade" (common Dp = 7).

The average number of trichobothria on the ventral aspect of the pedipalp patella ( $(Pv_{\text{left}} + Pv_{\text{right}}) / 2$ ) showed more variation. Among populations belonging to the "eastern clade", the number of ventral trichobothria ( $(Pv_{\text{left}} + Pv_{\text{right}}) / 2$ ) was more constant (mean = 4.96,  $s^2 = 0.24$ ,  $N = 126$ ) and no geographic pattern was detectable. Within the "western clade" the mean Pv was higher and more variable (mean = 5.60,  $s^2 = 0.34$ ,  $N = 146$ ) and also exhibited a considerable geographic variation. In the center of its geographical range (Bergamascan Alps) the Pv character was fixed around 6. However, in the marginal populations of the "western clade", this character was fixed at ca. 5. This holds true for both, the westernmost (Fontainemore and Gondo), as well as the easternmost populations (Tavernola, Molina di Ledro, Bezzecca, Marling and Bad Salz).

## DISCUSSION

### TAXONOMIC SUBDIVISION OF *EUSCORPIUS GERMANUS* (C. L. KOCH)

Before the advent of chaetotaxy (trichobothrial pattern) analysis, taxonomy of *Euscorpius* species was extremely confusing and was based mainly on morpho-sculpture and coloration characters. Large and conspicuous trichobothria of *Euscorpius* as taxonomic characters were first studied in detail by Hadzi (1929, 1931) and Caporiacco (1950), who used overall trichobothrial counts of pedipalp chela and patella for identification of species and subspecies.

*Euscorpius germanus* (C. L. Koch, 1837) has been originally described from "southern Tirol [i.e. today's Trentino - Alto Adige in Italy] and northern Italy"; see Fet & Braunwalder (1997) for the detailed taxonomic history and authorship discussion. This species traditionally included several subspecies with rather unclear diagnostics (Caporiacco, 1950).

Although Birula (1900) already clearly demonstrated species-level differences between *E. germanus* and the Caucasian *E. mingrelicus* (Kessler, 1876), several authors later often confused these two species. Until 1980, *E. germanus* was treated as a widely distributing species (from Italy to Caucasus) with a number of subspecies (Hadzi, 1929; Caporiacco 1950; Curcic, 1971; Kinzelbach, 1975). Bonacina (1980) limited *E. germanus* (C. L. Koch) to the Alpine regions of Italy (from Piemonte in the West to Goriziano in the East), Switzerland, and Austria, plus some Balkan populations; and reestablished as a "good" species *E. mingrelicus* (western Balkans and Anatolia to Caucasus, with notable absence in Greece) (Bonacina, 1980; Fet, 1993; Fet & Sissom, 2000). Most recently, we (Scherabon *et al.*, 2000) demonstrated

presence of more than one species within the "*E. mingrelicus* complex", including *E. gamma* Caporiacco, 1950.

Hadzi (1929) was the first to establish subspecies of *E. germanus*; however, his names (*polytrichus*, *mesotrichus* and *oligotrichus*) are invalid since they are homonyms, and therefore replacement names are necessary. Moreover, they were not sufficiently defined to allow identification of these taxa (Fet, 1997). Besides, most populations of "*E. germanus*" from ex-Yugoslavia treated by Hadzi (1929) and by Curcic (1971) do not belong to this species as it is currently defined (Bonacina, 1980; Fet & Sissom, 2000; Scherabon et al., in press).

Capra (1939) separated *E. germanus* from Italy into four forms (A, B and C, as well as a "typical form") based on the number of pectinal teeth (Dp) and the number of trichobothria on the ventral aspect of the pedipalp patella (Pv). Within Italy, the "typical form" of *E. germanus* (Pv = 5) was limited by Capra to the region of Trentino, Alto-Adige and Cadore; the 'A-form' (Pv = 6) to the Lombardian Alps; the 'B-form' (Pv = 5) was assigned to the Piemontese Alps and the 'C-form' (Pv = 5 or 6) to the Goriziano and the Karawanken Alps. Caporiacco (1950) confirmed all of Capra's forms and formally described three new subspecies (*E. g. alpha*, *E. g. beta*, *E. g. gamma*) in addition to the nominotypical *E. g. germanus*. Caporiacco (1950) also described *E. g. croaticus* from Croatia. Finally, Valle et al. (1971) described *E. g. marcuzzii* from the Dolomites and Slovenia.

Bonacina (1980) in his revision restricted *E. germanus* to four subspecies: *E. g. germanus* (= *E. g. beta*), *E. g. alpha*, *E. g. marcuzzii* and *E. g. croaticus*. *E. g. gamma* was treated as a subspecies of *E. mingrelicus* (see Scherabon et al. (in press) for a detailed taxonomic history). Bonacina (1980) synonymized the disjunct western (Piemonte) *E. g. beta* with the eastern *E. g. germanus* since both taxa shared character of Pv = 5. Furthermore, he suggested hybridization between the taxa *E. g. alpha* and *E. g. germanus*. Bonacina (1980) also carried out a thorough statistical study of trichobothrial numbers (on ventral and external surfaces of the pedipalp patella) for numerous populations in Piemonte and Lombardy, Italy. He postulated that the number of ventral patellar trichobothria is Pv = 5 for *E. g. germanus* and Pv = 6 in *E. g. alpha*. He also suggested a hybridogenic origin for populations in the Bergamascan Alps (Valle Brembana, north of Bergamo), because of intermediate forms (5-5 or 6-6) and a high number of asymmetric (5-6 or 6-5) individuals. However, our allozyme and DNA data do not confirm any assumptions of hybridogenic origin by Bonacina (1980), or by Kinzelbach (1975); see also Gantenbein et al. (1999a).

Applying methods based on models of evolutionary change (pairwise distance methods / maximum likelihood) and the maximum parsimony criterion, in our study, two independent systems of molecular markers (allozymes and 16S mtDNA sequences) revealed an almost identical phylogenetic pattern. The phylogeny based on both mtDNA and allozyme data suggests a clear, distinct topology of two major clades (Figs 2-3). These clades are well supported statistically. They include parapatric population groups which are geographically separated by the river Adige (Etsch). The genetic distance which is found between these two groups is comparable to the genetic distance found between each of these clades and the outgroup species

*E. gamma*. Therefore, we propose to treat these two population groups as two species: *Euscorpius germanus* (C. L. Koch, 1837) sensu stricto ("eastern" clade) and *Euscorpius alpha* Caporiacco, 1950 **stat. nov.** ("western" clade).

The deep divergence and parapatry of the "eastern" and "western" clades inferred by using independent genetic markers is not entirely consistent with geographical ranges of the subspecies *E. germanus germanus* and *E. g. alpha* as shown by Caporiacco (1950) and Bonacina (1980). Nevertheless, type localities of these two taxa (as designated below) would fall well inside the ranges of two papapatric clades, thus making the existing taxonomic names applicable to the monophyletic clades.

THE STATUS OF *EUSCORPIUS GERMANUS BETA* CAPORIIACCO, *E. G. CROATICUS* CAPORIIACCO, AND *E. G. MARCUZZII* VALLE ET AL.

(a) *Euscorpius germanus beta* Caporiacco, 1950. Originally delineated by Capra (1939) as "Form B" from Val d'Aosta, including the marginal, westernmost populations of "*E. germanus*" (sensu lato). It was formally described as a subspecies by Caporiacco (1950) and also limited to Piemonte populations. Bonacina (1980) synonymized *E. g. beta* with eastern *E. g. germanus* since both taxa shared the character Pv = 5. Other diagnostic characters listed by Caporiacco (1950) (i.e. metasomal granulation and carination of chela) were considered too variable to be diagnostic. This synonymy, however, created a disjunct distribution for *E. g. germanus* sensu Bonacina (1980).

Our molecular analysis shows that "*E. g. beta*" populations from Italy (Fontainemore) and bordering Switzerland (Gondo, Zwischbergental) occupy the most derived position in the "western clade", or *E. alpha*. Both populations from this area for which allozyme and DNA data were available (i.e. Fontainemore and Gondo) grouped together and were supported by bootstrap values in all analyses (Figs 2-3). Thus, we cannot confirm Bonacina's synonymy *E. g. beta* = *E. g. germanus*. On the other hand, assigning a separate taxonomic status to these two populations would create a paraphyletic subspecies "*E. alpha beta*". Subsequently we would be required to treat other *E. alpha* subclades as monophyletic assemblages as well and assign at least three other new "subspecies" names. Thus, it seems reasonable not to retain *E. g. beta* as a valid taxon, but to place it into synonymy: *Euscorpius alpha* **stat. nov.**, elevated from *Euscorpius g. alpha* Caporiacco, 1950 = *Euscorpius g. beta* Caporiacco, 1950 **syn. nov.**

(b) *Euscorpius germanus croaticus* Caporiacco, 1950. This taxon remained enigmatic since its description. It was mentioned but not revised by Bonacina (1980). We analysed the morphology of the only existing type specimen of this taxon (MZUF 5580, a male from Mali Haram, Velebit Mountains, Croatia; here designated as lectotype, see below). Its trichobothrial pattern on the pedipalps, i.e. number of ventral trichobothria on patella (Pv = 6) and position of trichobothria on the fixed finger, is identical with that of many populations of *E. alpha* (but not of *E. germanus* s. str.). The external face of the pedipalp patella in *E. g. croaticus* bears 22 trichobothria (Pe = 22) in the following serial arrangement: *et* = 5, *est* = 4, *em* = 3, *esb* = 2.



$eb_a = 4$ ,  $eb = 4$ ). However, the number  $et = 5$  is not found in other populations of *E. germanus* or *E. alpha*, which have  $et = 4$  or even  $et = 3$ . A number of other morphological characters, first of all the very clear presence of carinae on the metasomal segments, shape of pedipalps and spination of legs, indicate that this form is not close to *E. germanus* and falls into the "species complex" of *E. carpathicus* (L., 1767). Similar forms have been observed by one of us (V.F.) from the Rhodope Mountains in Bulgaria.

Reduction of trichobothrial numbers is not uncommon in *E. carpathicus*. In fact, reduction of the trichobothria in the series em from 4 to 3 in *E. c. banaticus* from Romania has been the reason for confusion (Vachon & Jaques, 1977) since this single character was considered to be diagnostic for *E. germanus* (sensu lato, including *E. alpha*, *E. gamma* and *E. mingrelicus*). A detailed study of *E. carpathicus* and related taxa is now being carried out by us (V. Fet, M. Soleglad, B. Gantenbein, in preparation). Pending the completion of this study, we treat *E. germanus croaticus* Caporiacco, 1950 as a form belonging to "*E. carpathicus* complex", but not to *E. germanus* C. L. Koch. Its exact taxonomic status has to be determined.

(c) *Euscorpius germanus marcuzzii* Valle, Berizzi, Bonino, Gorio, Gimigliaro-Negri & Percassi, 1971. Marcuzzi & Fabris (1957) first recorded a form of *E. germanus* from the Dolomites (Italy) with 20 trichobothria (in contrast to the common 21) on the external face of the pedipalp patella ( $Pe = 20$ ). Valle *et al.* (1971, p. 95-96) very briefly (one line!) described this subspecies from the "refugial massifs of the Venetian Pre-Alps (Italy) and from northern Slovenia", without designating any type specimens (Valle's syntypes of this subspecies are in the Museo Civico di Scienze Naturali "Enrico Caffi", Bergamo). The sole morphological character distinguishing this taxon from other subspecies is the presence of 3 trichobothria instead of 4, in the accessory basal series ( $eb_a = 3$ ) on the external face of the pedipalp. This character is unique and indeed accords with the general trend of trichobothrial number reduction in the subgenus *Alpiscorpius* (see Gantenbein *et al.* 1999a). Bonacina (1980) mentions a number of populations from northeastern Italy and Slovenia, some "pure" *E. g. marcuzzii* and others mixed (and "hybrid", i.e. asymmetric  $eb_a = 3-4$  or  $4-3$ ) with *E. g. germanus*.

Our molecular analysis of *E. alpha* from Italy presently includes asymmetrical specimens ( $eba = 3-4$  or  $4-3$ ) which were found to be rare at Bezzeca (only one find) but are much more common at Auronzo di Cadore, Belluno, Schluderns, Voltago, Vetriolo, Völs, and Crnice. None of the populations mentioned corresponds with a monophyletic, clearly divergent clade. The only Slovenian locality studied (Crnice) includes both symmetric "*E. g. marcuzzii*" ( $eb_a = 3-3$ ) and regular *E. germanus* specimens. However, further molecular analysis of all populations with  $eb_a = 3$  and a thorough analysis of the syntype series and of additional material are necessary to clarify the status of *E. g. marcuzzii*, which currently appears to be a taxon of dubious validity.

## DESIGNATION OF TYPE SPECIMENS

None of the taxa treated in here have a holotype or lectotype specimen. Types designated by C. L. Koch (1837) are lost. For the taxon described by Caporiacco (1950) only syntypes were designated; they are deposited in the collection of the Museo Zoologico "La Specola" dell'Università de Firenze, Florence, Italy (MZUF) (Bartolozzi *et al.*, 1988). Here we designate the necessary type specimens for the following taxa:

*Euscorpius germanus* (C. L. Koch, 1837)

Originally described as *Scorpius germanus* C. L. Koch, 1837 (pp. 110-112, plate 108, figs 250-252) from "southern Tyrol (now Trentino-Alto Adige, Italy) and upper (= northern) Italy".

Neotype: ♂, Brixen (Bressanone), Trentino - Alto Adige, Italy, 9. 10. 98, coll. B. Gantenbein & I. Gantenbein, sample No. BG-109-07, deposited in Naturhistorisches Museum Bern, Switzerland, accession number Sc1. Trichobothrial formula: Pv = 5, Pe = 21 (*et* = 4, *est* = 4, *em* = 3, *esb* = 2, *eb<sub>a</sub>* = 4, *eb* = 4).

*Euscorpius alpha* Caporiacco, 1950 **stat. nov.**

Originally described as *Euscorpius germanus alpha* Caporiacco, 1950: 211.

Lectotype: ♀ (MZUF 5569), Lago di Como near Varenna, Lombardy, Italy (August 1879, coll. Cantoni). Trichobothrial formula: Pv = 6, Pe = 21 (*et* = 4, *est* = 4, *em* = 3, *esb* = 2, *eba* = 4, *eb* = 4).

Paralectotypes: 1 ♂ (MZUF 5571), 5 ♀♀ (MZUF 5568, 5570-5574), from the type locality; 6 ♂♂, 5 ♀♀ (MZUF 5575-5579), Varese, Lombardy, Italy (1879, coll. Cantoni); 1 ♀ (MZUF 5567). Monte Stelvio, Trentino - Alto Adige, Italy (August 1877, coll. P. Magretti).

*Euscorpius germanus beta* Caporiacco, 1950: 211

Here considered as **syn. nov.** of *Euscorpius alpha* Caporiacco, 1950.

Lectotype: ♂ (MZUF 5588), Monte Massone (Cesara, Novara), Piemonte, Italy (12 August 1879, coll. C. Parona). Trichobothrial formula: Pv = 5, Pe = 21 (*et* = 4, *est* = 4, *em* = 3, *esb* = 2, *eb<sub>a</sub>* = 4, *eb* = 4).

Paralectotypes: 5 ♂♂ and 5 ♀♀ (MZUF 5589, 5590-5593), type locality; 1 ♂, 1 ♀ (MZUF 5584, 5585). Colle della Piccola Mologna, 2000 m, (Biella, Vercelli), Piemonte, Italy; 2 ♀♀ (MZUF), Lamorano, 1879, Piemonte, Italy.

*Euscorpius germanus croaticus* Caporiacco, 1950: 215

Lectotype: ♂ (MZUF 5580), Mali Halam, Velebit Mountains, Croatia (other specimens were listed in the original description but are absent in the MZUF collection). Probably belongs to *Euscorpius carpathicus* (L., 1767) "complex" (see above). Trichobothrial formula: Pv = 6, Pe = 22 (*et* = 5, *est* = 4, *em* = 3, *esb* = 2, *eb<sub>a</sub>* = 4, *eb* = 4).

## MORPHOLOGICAL VERSUS MOLECULAR DATA

The classical morphological characters in the species of *Euscorpius*, such as the number of pectinal teeth and the number of trichobothria, are quantitative threshold characters similar the number of bristles in *Drosophila* (Futuyma, 1986). Such traits are expressed discontinuously at the phenotypic level, but are affected by a continuous distribution of some underlying trait. Capra (1939), Caporiacco (1950) and Bonacina (1980) have found geographic variation in these characters and also asymmetries which are very common. We confirm their observations that within the *E. alpha* clade the number of the ventral trichobothria of the patella (Pv) is about 6 in the region of the Bergamascan Alps (Valle Brembana) and changes to Pv = 5 in the western populations (Fontainemore and Gondo). The same pattern is found in the eastern populations at Molina di Ledro, Bezzecca (Lago di Garda) and Marling, Bad Salz (Trentino-Alto Adige). Here the subclades detected by using molecular markers (Figs. 2-3) correspond to the observed pattern of the Pv character.

However, no hybridization or gene flow was observed between *E. alpha* and *E. germanus* clades. Bonacina (1980) gave a detailed morphological account of the distribution of Pv = 5-5, 6-6 or 5-6 individuals within the Bergamascan Alps. Analysing the same populations (Fig. 1, box) we found no confirmation of his assumption of hybridisation between two distinct taxa; it appears that the described morphological variation occurs at the phenotypic level within a single genetically coherent species, *E. alpha*. Apparently character states Pv = 5 or 6 alone are not sufficient to define both parapatric species since *E. germanus* usually has Pv = 5 but in *E. alpha* this character varies from 5 to 6 with various degree of fixation. The same is true for the pectinal teeth number, Dp (see Results).

Neither trichobothrial nor pectinal teeth scores give us a clear-cut delineation which would reflect the deep divergence of two clades revealed by molecular data and treated here as species-level taxa. In order to characterize these two clades morphologically, more complex characters should be searched for and analysed. Among these, the morphology of the hemispermaphore could possibly be applied as a species-level character set for *Euscorpius* as suggested by some previous authors (Kinzelbach, 1975; Bonacina, 1980; Scherabon 1987).

## PHYLOGENETIC IMPLICATIONS ON BIOGEOGRAPHY

In their analysis of molecular phylogeny and historical biogeography of the genus *Euscorpius*, Gantenbein *et al.* (1999a) noticed the deep split between the endemic Alpine clade (subgenus *Alpiscorpius* Gantenbein, Fet, Largiadèr & Scholl, 1999 which included traditional *E. germanus*) and the major Asia Minor-Trans-Mediterranean lineage (subgenera *Euscorpius* Thorell, 1876 and *Polytrichobothrius* Birula, 1917). This led to the assumption that in the ancestors of modern *E. germanus* (sensu lato) ecological differentiation and adaptation to orophylic and mesophylic habitats (in contrast to xerophylic habitats occupied by *E. carpathicus* and especially *E. italicus*) could have been an ancient event. In other words, modern forms inhabiting the Alpine zone of Europe are not necessarily a result of speciations due to recent (Pleistocene) glacial events (Klicka & Zink, 1997) but these taxa may have

evolved in this area since the beginning of the Alpine orogenesis. This long time scale can explain the high level of genetic divergence observed within the subgenus *Alpiscorpius*, which we separate here into two species, *Euscorpius (Alpiscorpius) germanus* (C. L. Koch, 1837) and *E. (A.) alpha* Caporiacco, 1950.

The period of divergence time between these two parapatric taxa can be estimated by using the genetic distance and by assuming a constant evolutionary rate through time. The calibration of a molecular clock for *Mesobuthus gibbosus* (Brullé, 1832) (Scorpiones, Buthidae) in the mainland Greece and Turkey and on several Aegean islands reveals an average rate of about 3% sequence divergence per Myr for the 16S rRNA gene (our data, unpublished). A comparable rate was reported for another scorpion species, *Buthus occitanus* (Amoreux, 1789) (Buthidae) across the Strait of Gibraltar (Gantenbein *et al.*, 1999b). Applying this "scorpion clock" to the mtDNA sequence divergence between *E. germanus* and *E. alpha* (ca. 7%) reveals a separation time of about 2-3 million years. Such a time scale contradicts the Late Pleistocene Origin model (LPO), which is widely accepted today (see also Klicka & Zink, 1997). The deep split between the evolutionary lineages in *E. germanus* and *E. alpha* remains high even when genetic distances for superimposed substitutions are corrected by using the most appropriate model (TrN93 in this case), as proposed by Arbogast & Slowinski (1998). A similar deep split (> 1.6 Myrs) was uncovered by a recent allozyme survey of Alpine species of *Glomeris* (Diplopoda: Glomeridae) (Hoess & Scholl, 1999) which presumably have similar dispersal rates as *Euscorpius* species.

Taberlet *et al.* (1998) identified several so-called "suture zones" in Europe, including the Alps, where different taxa meet after postglacial isolation. The situation for *Euscorpius* is similar but lacks hybridisation. No gene flow was detected between the two clades, which appear to be true parapatric species separated by the geographic divide of the Adige River valley. Hedin (1997) recently demonstrated for *Nesticus* spiders (Aranae, Nesticidae) in the Appalachian Mountains that mtDNA analysis allows to discover considerable genetic divergence, both between and within recognized morphological species; most of these probably predate the Pleistocene. The divergence between *E. alpha* and *E. germanus* clearly predates the Pleistocene glaciations, as it is the case for a number of other Alpine taxa (Taberlet *et al.*, 1998). This confirms the hypothesis that speciation events mainly occurred during the Pliocene (Zink & Slowinski, 1995).

Possible Pleistocenic refugia for these two species were the Bergamascan Alps for *E. alpha* and the Venetian Prealps for *E. germanus*. Evidence that these regions could have served as refugia for small terrestrial arthropods comes from a palynological analysis (Kral, 1989) which indicates that a relatively mild climate prevailed during the Pleistocene. Other arguments for this interpretation are provided by the genetic data presented in this study. The genetic variability, expressed in the average heterozygosity and the mean number of alleles per locus, in *E. alpha* populations is relatively higher in the region around Bergamo than in regions near the edges of the refuge. Low levels of heterozygosity in *E. germanus* indicate possible genetic bottlenecks in the history of this species. Further investigations are required to test this hypothesis.

## ACKNOWLEDGEMENTS

B. G. thanks his wife Iris for her efforts and enthusiasm when collecting *Euscorpius germanus* and *E. alpha*. Dietmar Huber and Bernhard Scherabon kindly donated additional material of *E. germanus* and *E. gamma* from Austria, and Matjaz Kuntner provided specimens from Slovenia. We are grateful to Carlo Largiadèr for critical discussions and assistance in DNA data analyses. We thank Matt Braunwalder for his enthusiastic help and guidance in the issues related to the natural history of *Euscorpius*. Sarah Whitman Mascherini allowed the loan of Caporiacco's specimens from MZUF. David Sissom and Michael Soleglad advised on taxonomic issues. The Karl-Bretscher Foundation Berne; award to A. S. supported this study. The comments of two anonymous reviewers greatly improved the final version of the manuscript.

## REFERENCES

- ARBOGAST, B. S. & SLOWINSKI, J. B. 1998. Pleistocene speciation and the mitochondrial DNA clock. *Science* 282 (5396): 1955.
- AYALA, F. J., POWELL, J. R., TRACEY, M. L., MOURAO, C. A. & PEREZ-SALAS, S. 1972. Enzyme variability in the *Drosophila willistoni* group. IV. Genic variation in natural populations of *Drosophila willistoni*. *Genetics* 70: 113-139.
- BARTOLOZZI, L., VANNI, S. & MASCHERINI, S. W. 1988. Catalogo del Museo Zoologico "La Specola" (Sezione del Museo di Storia Naturale) dell'Università di Firenze. 5. Arachnida Scorpiones: tipi. *Atti della Società Toscana dei Naturalisti, Memorie*, B, 94: 293-298.
- BARTON, N. H. & HEWITT, G. M. 1989. Adaptation, speciation and hybrid zones. *Nature* 341: 497-503.
- BERNATCHEZ, L., GLÉMET, H., WILSON, C. C. & DANZMANN, R. G. 1995. Introgression and fixation of Arctic char (*Salvelinus alpinus*) mitochondrial genome in an allopatric population of brook trout (*Salvelinus fontinalis*). *Canadian Journal of Fisheries and Aquatic Sciences* 52: 179-185.
- BIRULA, A. A. 1900. Scorpiones mediterranei Musei Zoologici mosquensis. *Izvestiya Imperatorskogo Obshchestva Lyubitelei Prirody, Istorii, Antropologii i Etnografii (Societas Caesarea Anicorum Rerum Naturalium, Anthropologiae Ethnographiae Universitatis Moscoviensis)* 98, 3(1): 8-20 (in Russian).
- BIRULA, A. A. (Byalynitsky-Birula, A. A.) 1917. Arachnoidea Arthrogastra Caucasica. Pars I. Scorpiones. *Mémoires du Musée du Caucase, Tiflis (Imprimerie de la Chancellerie du Comité pour la Transcaucasie)* A(5), 253 pp. (in Russian). English translation: 1964. Arthrogastric Arachnids of Caucasia. 1. Scorpions. *Jerusalem, Israel Program for Scientific Translations*, 170 pp.
- BONACINA, A. 1980. Sistematica specifica e sottospecifica del complesso "*Euscorpius germanus*" (Scorpiones, Chactidae). *Rivista del Museo civico di scienze naturali "Enrico Caffi" (Bergamo)* 2: 47-100.
- CAPORIACCO, L. DI 1950. Le specie e sottospecie del genere "*Euscorpius*" viventi in Italia ed in alcune zone confinanti. *Memorie/Accademia nazionale dei Lincei* (ser. 8) 2: 159-230.
- CAPRA, F. 1939. *L'Euscorpius germanus* (C. L. Koch) in Italia (Arachnida, Scorpiones). *Memorie della Società Entomologica Italiana* 18(2): 199-213.
- CAVALLI-SFORZA, L. L. & EDWARDS, A. W. F. 1967. Phylogenetic analysis: Models and estimation procedures. *Evolution* 32: 550-570.
- CLAYTON, J. W. & TRETIAK, D. N. 1972. Amine-citrate buffers for pH control in starch gel electrophoresis. *Journal of Fisheries Research Board of Canada* 29: 1169-1172.

- CRUCITTI, P. 1993. Distribution and diversity of Italian scorpions. *Redia* 76(2): 281-300.
- CURCIC, B. P. M. 1971. The new finding places of scorpions in Yugoslavia. *Vestnik Československé společnosti zoologické* 35(2): 92-102.
- FELSENSTEIN, J. 1973. Maximum-likelihood estimation of evolutionary trees from continuous characters. *American Journal of Human Genetics* 25: 471-492.
- FELSENSTEIN, J. 1981a. Evolutionary trees from DNA sequences: A maximum likelihood approach. *Journal of Molecular Biology and Evolution* 17: 368-376.
- FELSENSTEIN, J. 1981b. Evolutionary trees from gene frequencies and quantitative characters: Finding maximum likelihood estimates. *Evolution* 35(6): 1229-1242.
- FELSENSTEIN, J. 1995. PHYLIP (Phylogeny Inference Package), Version 3.57c. *Seattle, University of Washington*.
- FET, V. 1993. Notes on *Euscorpis mingrelicus* (Kessler, 1874) from the Caucasus. *Rivista del Museo civico di scienze naturali "Enrico Caffi" (Bergamo)* 16: 1-8.
- FET, V. 1997. Notes on the taxonomy of some Old World scorpions (Scorpiones: Buthidae, Chactidae, Ischnuridae, Scorpionidae). *Journal of Arachnology* 25(3): 245-250.
- FET, V., BARKER, M. & GANTENBEIN, B. 1999. Species-level variation of the mitochondrial 16S rRNA gene sequence: use in molecular systematics and biogeography. *Proceedings of the West Virginia Academy of Science* 71(1): 15.
- FET, V. & BRAUNWALDER, M. E. 1997. On the true authorship and taxonomic history of *Euscorpis germanus* (C. L. Koch, 1837) (nec C. L. Koch, 1836; nec Schaeffer, 1766) (Scorpiones: Chactidae). *Bulletin of the British Arachnological Society* 10(8): 308-310.
- FET, V. & SISSOM, W. D. 2000. Family Euscorpiidae (pp. 355-381). In: FET, V., SISSOM, W. D., LOWE, G. & BRAUNWALDER, M. E. *Catalog of the Scorpions of the World (1758-1998)*. *New York Entomological Society, New York*. 690 pp.
- FUTUYMA, D. J. 1986. *Evolutionary Biology* (2<sup>nd</sup> ed.). *Sinauer Assoc. Inc., Massachusetts*, 600 pp.
- GANTENBEIN, B., BÜCHI, L., BRAUNWALDER, M. E. & SCHOLL, A. 1998. The genetic population structure of *Euscorpis germanus* (C. L. Koch) (Scorpiones: Chactidae) in Switzerland (pp. 33-40). In: SELDEN, P. A. (ed). *Proceedings of the 17th European Colloquium of Arachnology, Edinburgh 1997, 14-18 July, 1997*. 350 pp.
- GANTENBEIN, B., FET, V., LARGIADER, C. R. & SCHOLL, A. 1999a. First DNA phylogeny of *Euscorpis Thorell*, 1876 (Scorpiones: Euscorpiidae) and its bearing on taxonomy and biogeography of this genus. *Biogeographica (Paris)* 75(2): 49-65.
- GANTENBEIN, B., LARGIADER, C. R. & SCHOLL, A. 1999b. Nuclear and mitochondrial gene variation of *Buthus occitanus* (Amoreux, 1789) across the Strait of Gibraltar. *Revue suisse de Zoologie* 106(4): 760.
- GANTENBEIN, B. & SCHOLL, A. 1998. Allozymes show an unusually high differentiation of *Euscorpis germanus* (Scorpiones: Chactidae) populations. *Revue suisse de Zoologie* 105(4): 748-749.
- HADZI, J. 1929. Skorprije Schmidtove zbirke. *Euscorpis italicus polytrichus* n. ssp. i ostale nove rase (Die Skorpione der Schmidt'schen Sammlung: *Euscorpis italicus polytrichus* n. ssp und andere neue Rassen). *Glasnik Muzejskega Drustva za Slovenijo*, (B), 10(1-4): 30-41 (in Serbo-Croatian).
- HADZI, J. 1931. Der Artbildungsprozess in der Gattung *Euscorpis* Thor. *Archivio zoologico italiano* 16(1-2): 356-362 (IX Congrès international de zoologie).
- HARRIS, H. & HOPKINSON, D. A. 1976. *Handbook of enzyme electrophoresis in human genetics*. *Amsterdam, North Holland*.
- HARRISON, R. G. 1990. Hybrid zones: windows on evolutionary process (pp. 69-128). In: FUTUYMA, D. & ANTONOVICS, J. (eds). *Oxford Surveys in Evolutionary Biology*, Vol. 7. *Oxford University Press, Oxford*. 314 pp.

- HASEGAWA, M., KISHINO, K. & YANO, T. 1985. Dating the human-ape splitting by a molecular clock of mitochondrial DNA. *Journal of Molecular Evolution* 22: 160-174.
- HEDIN, M. C. 1997. Molecular phylogenetics at the population/species interface in cave spiders of the Southern Appalachians (Araneae: Nesticidae: *Nesticus*). *Molecular Biology and Evolution* 14: 309-324.
- HJELLE, J. T. 1990. Anatomy and Morphology, chapter 2 (pp. 9-63). In: POLIS, G. A. (ed.). *Biology of Scorpions*. Stanford University Press, Stanford, California, 587 pp.
- HOESS, R. & SCHOLL, A. 1999. The identity of *Glomeris quadrifasciata* C. L. Koch (Diplopoda: Glomeridae). *Revue suisse de Zoologie* 106(4): 1013-1024.
- HUELSENBECK, J. P. & CRANDALL, K. A. 1997. Phylogeny estimation and hypothesis testing using maximum likelihood. *Annual Review of Ecology and Systematics* 28: 437-466.
- HUELSENBECK, J. P. & RANNALA, B. 1997. Phylogenetic methods come of age: testing hypothesis in an evolutionary context. *Science* 276: 227-232.
- KINZELBACH, R. 1975. Die Skorpione der Ägäis. Beiträge zur Systematik, Phylogenie und Biogeographie. *Zoologische Jahrbücher, Abteilung für Systematik* 102(1): 12-50.
- KITCHING, I. J., FOREY, P. L., HUMPHRIES, C. J. & WILLIAMS, D. M. 1998. Cladistics. 2nd edition. *The Systematics Association, Oxford University Press, New York*, 228 pp.
- KLICKA, J. & ZINK, R. M. 1997. The importance of recent ice ages in speciation: A failed paradigm. *Science* 277: 1666-1669.
- KOCH, C. L. 1837. Die Arachniden, 3(6): 105-115. Nürnberg: C. H. Zeh'sche Buchhandlung.
- KRAL, F. 1989. Spät- und postglaziale Waldentwicklung in den italienischen Alpen. *Botanische Jahrbücher der Systematik* 111: 213-229.
- MARCUZZI, C. & FABRIS, F. 1957. Microsistemica dell'*Euscorpius germanus* Koch delle Dolomiti. *Atti della Accademia Padova, Memorie, Classe di Scienze Naturali* 69: 299-307.
- MURPHY, R. W., SITES, J. W., BUTH, D. G. & HAUFLE, C. H. 1996. Proteins: Isozyme electrophoresis, chapter 4 (pp. 51-120). In: HILLIS, D. M., MORITZ, C. & MABLE, B. K. (eds). *Molecular systematics*. 2nd edition. Sinauer Assoc. Inc., Massachusetts, 655 pp.
- NEI, M. 1978. Estimation of average heterozygosity and genetic distance from a small number of individuals. *Genetics* 83:583-590.
- NEI, M. 1987. *Molecular evolutionary genetics*. Columbia University Press, NY.
- NEI, M. & LI, W.-H. 1979. Mathematical model for studying genetic variation in terms of restriction endonucleases. *Proceedings of the National Academy of Sciences USA* 76: 5269-5273.
- PAGE, R. D. M. & HOLMES, E. C. 1998. *Molecular evolution. A phylogenetic approach*. Blackwell Science, London, 347 pp.
- POSADA, D. & CRANDALL, K. A. 1998. Modeltest: testing the model of DNA substitution. *Bioinformatics* 14(9): 817-818.
- RODRIGUEZ, F., OLIVER, J. L., MARÍN, A. & MEDINA, J. R. 1990. The general stochastic model of nucleotide substitution. *Journal of Theoretical Biology* 142: 485-501.
- ROZAS, J. & ROZAS, R. 1999. DnaSP version 3: an integrated program for molecular population genetics and molecular evolution analysis. *Bioinformatics* 15: 174-175.
- SAITOU, N. & NEI, M. 1987. The neighbor-joining method: a new method for reconstructing phylogenetic trees. *Molecular Biology and Evolution* 4: 406-425.
- SCHERABON, B. 1987. Die Skorpione Österreichs in vergleichender Sicht unter besonderer Berücksichtigung Kärntens. *Carinthia II. / Naturwiss. Beiträge zur Heimatkunde Kärntens / Mitteilungen des Naturwissenschaftlichen Vereins für Kärnten* 45: 78-158.
- SCHERABON, B., GANTENBEIN, B., FET, V., BARKER, M., KUNTNER, M., KROPF, C. & HUBER, D. 2000. A new species of scorpions for Austria, Italy, Slovenia and Croatia: *Euscorpius gamma* Caporiacco, 1950, stat. nov. (Scorpiones, Euscorpiidae). *Ekológia (Bratislava)* 19, Supplement 3: 253-262. (Proceedings of the 18th European Colloquium of Arachnology, Slovakia).

- SIMON, C., FRATI, F., BECKENBACH, A., CRESPI, B., LIU, H. & FLOOK, P. 1994. Evolution, weighting, and phylogenetic utility of mitochondrial gene sequences and a compilation of conserved polymerase chain reaction primers. *Annals of the Entomological Society of America* 87(6): 651-701.
- SWOFFORD, D. L. 1998. PAUP\*: Phylogenetic analysis using parsimony (\*and other methods). Version 4. *Sinauer Associates, Sunderland, MA*.
- SWOFFORD, D. L. & SELANDER, R. B. 1989.2000) BIOSYS-1: A computer program for the analysis of allelic variation in population genetics and biochemical systematics. Release 1.7. *Urbana, University of Illinois*.
- SWOFFORD, D. L., OLSEN, G. J., WADDELL, P. J. & HILLIS, D. M. 1996. Phylogenetic inference, chapter 4 (pp. 407-425). *In*: HILLIS, D. M., MORITZ, C. & MABLE, B. K. (eds). *Molecular Systematics*. 2nd edition. *Sinauer Assoc. Inc., Massachusetts*. 655 pp.
- TABERLET, P., FUMAGALLI, L., WUST-SAUCY, A.-G. & COSSON, J.-F. 1998. Comparative phylogeography and postglacial colonization routes in Europe. *Molecular Ecology* 7: 453-464.
- TAJIMA, F. 1989. Statistical method for testing the neutral mutation hypothesis by DNA polymorphism. *Genetics* 123: 585-595.
- TAMURA, K. & NEI, M. 1993. Estimation of the number of nucleotide substitutions in the control region of mitochondrial DNA in humans and chimpanzees. *Molecular Biology and Evolution* 10: 512-526.
- VACHON, M. 1962. Remarques sur l'utilisation en systématique des soies sensorielles (Trichobothries) chez les scorpions du genre *Euscorpium* Thorell (Chactidae). *Bulletin du Muséum national d'histoire naturelle (Paris) série 2*, 34 (5): 345-354.
- VACHON, M. 1981. Remarques sur la classification sous-spécifique des espèces appartenant au genre *Euscorpium* Thorell, 1876 (Scorpionida, Chactidae). *Atti della Società toscana di scienze naturali, Memoria, (B)*, 88 (suppl.): 193-203. (Comptes-rendus 6ème Colloque d'arachnologie d'expression Française (Colloque International Européen), 1981 Modena-Pisa).
- VACHON, M. & JAUQUES, M. 1977. Recherches sur les Scorpions appartenant ou déposés au Muséum d'Histoire naturelle de Genève. 2. Contribution à la connaissance de l'ancienne espèce *Scorpius banaticus* C. L. Koch 1841, actuellement considérée comme synonyme de *Euscorpium carpathicus* (Linné 1767) (Fa. des Chactidae). *Revue suisse de Zoologie* 84(2): 409-436.
- VALLE, A., BERIZZI, M. T., BONINO, M., GORIO, R., GIMMILARO-NEGRI, E. & PERCASSI, A. 1971. Le popolazioni italiane di *Euscorpium germanus* (C. L. Koch) (Scorpiones, Chactidae). *Atti dell'VIII Congresso Nazionale Italiano di Entomologia* (Firenze, 4-7 Settembre 1969): 93-96.
- YANG, Z. 1994. Maximum likelihood phylogenetic estimation from DNA sequences with variable rates over sites: approximate methods. *Journal of Molecular Evolution* 39: 306-314.
- YANG, Z., GOLDMAN, N. & FRIDAY, A. 1994. Comparison of models for nucleotide substitution used in maximum likelihood phylogenetic estimation. *Molecular Biology and Evolution* 11: 316-324.
- ZINK, R. & SLOWINSKI, J. 1995. Evidence from molecular systematics for decreased avian diversification in the Pleistocene Epoch. *Proceedings of the National Academy of Sciences of the USA* 92: 5832-5835.



## APPENDIX I

Allele frequencies at 18 allozyme loci and sample sizes of populations analysed. Also given are the identified 16S rDNA haplotypes.

Nr. Sample	Country	N	Sequence	alpdh			ark			ddh		gapdh		aatI		100	104
				100	95	104	100	98	93	101	100	100	78	88	96		
<b>Western clade =</b>																	
<b><i>E. alpha</i> stat. nov.</b>																	
1	Gondo	CH	(9)	<i>Eal</i> GO	1.00		1.00			1.00		1.00					1.00
2	Fontainemore	CH	(10)	<i>Eal</i> FO	1.00		1.00			1.00		1.00					1.00
3	Rancate	CH	(15)	<i>Eal</i> RA	1.00		1.00			1.00		1.00					1.00
4	Monte	CH	(11)		1.00		1.00			1.00		1.00					1.00
5	Fornace	CH	(10)		1.00	0.05	0.95			1.00		1.00					1.00
6	Pontide	I	(5)		1.00		1.00			1.00		1.00	0.10				0.90
7	Sottoponte	CH	(13)	<i>Eal</i> SO	1.00		1.00			1.00		1.00					1.00
8	San Carlo	CH	(12)		1.00		1.00			1.00		1.00					1.00
9	Brembilla	I	(5)		1.00		1.00			1.00		1.00					1.00
10	Gerosa	I	(2)		1.00		1.00			1.00		1.00					1.00
11	Peghera	I	(2)		1.00		1.00			1.00		1.00					1.00
12	San Pellegrino	I	(4)	<i>Eal</i> SP	1.00		1.00			1.00		1.00		0.25			0.75
13	San Giovanni Bianco	I	(11)	<i>Eal</i> SG	1.00		1.00			1.00		1.00	0.09	0.05			0.82
14	Camerata Comello	I	(1)		1.00		1.00			1.00		1.00					1.00
15	Olmo al Brembo	I	(10)	<i>Eal</i> OL	1.00		1.00			1.00		1.00					1.00
16	Piazzatorre	I	(13)		1.00		1.00			1.00		1.00					1.00
17	Mezzoldo	I	(7)		1.00		1.00			1.00		1.00					1.00
18	Isola di Fondra	I	(13)		1.00		1.00			1.00		1.00					1.00
19	Carona	I	(13)	<i>Eal</i> CA	1.00		1.00			1.00		1.00					1.00
20	Valleve	I	(1)		1.00		1.00			1.00		1.00					1.00
21	Selvino	I	(5)		1.00		1.00			1.00		1.00					1.00
22	Membro	I	(3)		1.00		1.00			1.00		1.00	0.17				0.83
23	Tavemola	I	(4)	<i>Eal</i> Ta	1.00		1.00			1.00		1.00					1.00
24	Vigolo	I	(3)		1.00		1.00			1.00		1.00					1.00
25	Bezzeca	I	(5)		1.00		1.00			1.00		1.00					1.00
26	Molina di Ledro	I	(10)	<i>Eal</i> ML	1.00		1.00			1.00		1.00					0.75
27	Marling	I	(10)	<i>Eal</i> MA	1.00		1.00			1.00		1.00					0.70
28	Bad Salz	I	(1)		1.00		1.00			1.00		1.00					1.00
<b>Eastern clade =</b>																	
<b><i>E. germanus</i></b>																	
29	Sta Maria	CH	(22)	<i>Ege</i> SM	1.00		1.00			1.00		1.00	1.00				
30	Lichtenberg	I	(5)		1.00		1.00			1.00		1.00	1.00				
31	Schluderns	I	(10)	<i>Ege</i> SH	1.00		1.00			1.00		1.00	0.55	0.35			0.10
32	Schlanderns	I	(1)			1.00	1.00			1.00		1.00	1.00				
33	Verdins	I	(10)		0.05	0.95	1.00			1.00		1.00	1.00				
34	Brixen	I	(4)			1.00	1.00			1.00		1.00	1.00				
35	Völs	I	(10)	<i>Ege</i> VO	0.40	0.60	1.00			1.00		1.00	0.95				0.05
36	Bremer	I	(7)		0.21	0.79	1.00			1.00		1.00	1.00				
37	Veltiolo	I	(9)	<i>Ege</i> VE	1.00		0.94	0.06		1.00		1.00	1.00				
38	Belluno	I	(4)		1.00		1.00			1.00		1.00					1.00
39	Voltago	I	(5)		1.00		1.00			1.00		1.00	0.70				0.30
40	San Tomaso	I	(3)		1.00		1.00			1.00		1.00	0.67				0.33
41	Mezzocanale	I	(2)	<i>Ege</i> ME	1.00		1.00			1.00		1.00	0.50				0.50
42	Borca di Cadore	I	(10)	<i>Ege</i> BO	1.00		1.00			1.00		1.00	0.65				0.35
43	Auronzo di Cadore	I	(6)		1.00		1.00			1.00		1.00	1.00				1.00
44	Starkenbach	A	(4)	<i>Ege</i> ST	1.00		1.00			1.00		1.00					1.00
45	Tarrenz	A	(2)	<i>Ege</i> TZ	1.00		1.00			1.00		1.00	1.00				
46	Kranzach	A	(4)	<i>Ege</i> KR	1.00		1.00			1.00		1.00	1.00				
47	Dellach	A	(8)	<i>Ege</i> DE	1.00		1.00			1.00		1.00					1.00
48	Oberdrauburg	A	(5)	<i>Ege</i> OB	1.00		1.00			1.00		1.00					1.00
49	Dobratsch	A	(4)		1.00		1.00			1.00		1.00					1.00
50	Schütt	A	(6)		1.00		1.00			1.00		1.00					1.00
51	Federaun	A	(4)		1.00		1.00			1.00		1.00					1.00
52	Crnice	SLO	(8)		1.00	1.00				1.00		1.00					1.00
<b><i>E. gamma</i></b>																	
53	Koschuta	A	(6)	<i>Ega</i> KO	1.00				1.00	1.00		1.00					1.00
<b><i>E. flavicaudis</i></b>																	
	Lauris	F	(33)	<i>Efl</i> LA	1.00		1.00					1.00	1.00				1.00

## APPENDIX I (2)

Nr. Sample	aat2			gtdh		hk		idh1		idh2		mdh1							
	88	100	107	113	90	95	100	100	107	94	95	100	87	93	100	76	87	89	100
<b>Western clade = <i>E. alpha</i> stat. nov.</b>																			
1				1.00	1.00		1.00		1.00			1.00							1.00
2				1.00	1.00		1.00		1.00			1.00							1.00
3				1.00	1.00		1.00		1.00			1.00							1.00
4				1.00	1.00		1.00		1.00			1.00							1.00
5				1.00	1.00		1.00		1.00			1.00							1.00
6				1.00	1.00		1.00		1.00			1.00						0.80	0.20
7				1.00	1.00		1.00		1.00			1.00							1.00
8				1.00	1.00		1.00		1.00			1.00							1.00
9				1.00	1.00		1.00		1.00			1.00						0.90	0.10
10				1.00	1.00		1.00		1.00			1.00							1.00
11				1.00	1.00		1.00		1.00			1.00							1.00
12		0.25		0.75	1.00		1.00		1.00			1.00							1.00
13				1.00	1.00		1.00		1.00			1.00							1.00
14				1.00	1.00		1.00		1.00			1.00							1.00
15				1.00	1.00		1.00		1.00			1.00							1.00
16				1.00	1.00		1.00		1.00			1.00							1.00
17				1.00	1.00		1.00		1.00			1.00							1.00
18			0.08	0.92	1.00		0.92	0.08	1.00			1.00				0.04		0.92	0.04
19				1.00	1.00		1.00		1.00			1.00							1.00
20				1.00	1.00		1.00		1.00			1.00							1.00
21				1.00	1.00		1.00		1.00			1.00						0.80	0.20
22				1.00	1.00		1.00		1.00			1.00						0.83	0.17
23				1.00	1.00		1.00		1.00			1.00				0.12		0.88	
24		0.33		0.67	1.00		1.00		1.00			1.00							1.00
25				1.00	1.00		1.00		1.00			1.00							1.00
26				1.00	1.00		1.00		1.00			1.00							1.00
27				1.00	1.00		0.95	0.05	1.00			1.00							1.00
28				1.00	1.00		1.00		1.00			1.00							1.00
<b>Eastern clade = <i>E. germanus</i></b>																			
29				1.00	1.00		1.00		1.00			1.00							1.00
30				1.00	1.00		1.00		1.00			1.00							1.00
31				1.00	1.00		1.00		1.00			1.00							1.00
32				1.00	1.00		1.00		1.00			1.00							1.00
33				1.00	1.00		1.00		1.00			1.00							1.00
34				1.00	1.00		1.00		1.00			1.00							1.00
35				1.00	1.00		1.00		1.00			1.00							1.00
36				1.00	1.00		1.00		1.00			1.00							1.00
37				1.00	1.00		1.00		1.00			1.00							1.00
38				1.00	1.00		1.00		1.00			1.00							1.00
39				1.00	1.00		1.00		1.00			1.00							1.00
40				1.00	1.00		1.00		1.00			1.00							1.00
41				1.00	1.00		1.00		1.00			1.00							1.00
42				1.00	1.00		1.00		1.00			1.00					0.20	0.10	0.70
43				1.00	1.00		1.00		1.00			1.00				0.33		0.67	
44				1.00	1.00		1.00		1.00			1.00							1.00
45				1.00	1.00		1.00		1.00			1.00							1.00
46				1.00	1.00		1.00		1.00			1.00							1.00
47				1.00	1.00		1.00		1.00			1.00							1.00
48				1.00	1.00		1.00		1.00			1.00							1.00
49				1.00	1.00		1.00		1.00			1.00							1.00
50				1.00	1.00		1.00		1.00			1.00							1.00
51				1.00	1.00		1.00		1.00			1.00							1.00
52				1.00	1.00		1.00		1.00			1.00							1.00
<b>Outgroup species</b>																			
<b><i>E. gamma</i></b>																			
53				1.00	1.00		1.00	1.00				1.00							1.00
<b><i>E. flavicaudis</i></b>																			
Lauris	0.03	0.97					1.00	1.00		0.09	0.91		1.00						1.00

## APPENDIX I (3)

Nr. Sample	mdh2		mpi												pep					
	100	105	100	101	107	110	112	118	125	130	135	78	87	94	98	100	104	107		
<b>Western clade =</b>																				
<i>E. alpha</i> stat. nov.																				
1 Gondo	1.00		0.17		0.83											1.00				
2 Fontainemore	1.00				1.00											1.00				
3 Rancate	1.00				0.54			0.27		0.12	0.08				1.00					
4 Monte	1.00		0.14		0.77						0.09				1.00					
5 Fornace	1.00				0.30			0.10		0.60					1.00					
6 Pontide	1.00							0.70	0.10		0.20				0.40			0.60		
7 Sottoponte	1.00				0.92			0.08							1.00					
8 San Carlo	1.00				0.14			0.86							0.95			0.05		
9 Brembilla	1.00			0.25			0.50	0.13	0.13						0.90			0.10		
10 Gerosa	1.00							0.75	0.25						1.00					
11 Peghera	1.00			0.25		0.25		0.25	0.25						0.75			0.25		
12 San Pellegrino	1.00			0.13	0.13		0.13	0.64						0.50	0.25			0.25		
13 San Giovanni Bianco	1.00		0.05				0.18	0.59	0.18						0.59			0.41		
14 Camerata Cornello	1.00						1.00						1.00							
15 Olimo al Brembo	1.00				0.05	0.45	0.35	0.15							0.95			0.05		
16 Piazzatorre	1.00				0.12	0.39	0.31	0.12	0.08						0.89			0.12		
17 Mezzoldo	1.00					0.64	0.14	0.14		0.07					0.83			0.17		
18 Isola di Fondra	1.00			0.08			0.58	0.12	0.23						0.92			0.08		
19 Carona	1.00					0.65	0.19	0.15							1.00					
20 Valleve	1.00					1.00									1.00					
21 Selvino	1.00					0.10	0.70	0.20							1.00					
22 Membro	1.00						0.50	0.50							1.00					
23 Tavernola	1.00					0.50	0.50											1.00		
24 Vigolo	1.00					0.50	0.50											1.00		
25 Bezzecca	0.90	0.10		0.10			0.40	0.50							0.20			0.80		
26 Molina di Ledro	1.00				0.10	0.35	0.45	0.10							0.10			0.90		
27 Marling	1.00		0.10	0.30	0.10		0.50											1.00		
28 Bad Salz	1.00									1.00								1.00		
<b>Eastern clade =</b>																				
<i>E. germanus</i>																				
29 Sta Maria	1.00									1.00								1.00		
30 Lichtenberg	1.00									1.00								1.00		
31 Schluderns	1.00									1.00								1.00		
32 Schlanderns	1.00									1.00								1.00		
33 Verdins	1.00									1.00								1.00		
34 Brixen	1.00									1.00								1.00		
35 Völs	1.00									1.00								1.00		
36 Bremer	1.00									1.00								1.00		
37 Vetriolo	1.00									1.00								1.00		
38 Belluno	1.00									1.00				0.50				0.50		
39 Voltago	1.00									1.00				0.60		0.40				
40 San Tomaso	1.00									1.00				0.17		0.83				
41 Mezzocanale	1.00									1.00				0.25		0.75				
42 Borca di Cadore	1.00									1.00				0.05		0.45	0.50			
43 Auronzo di Cadore	1.00									1.00						0.83	0.17			
44 Starkenbach	1.00									1.00						0.38	0.62			
45 Tarrenz	1.00									1.00						1.00				
46 Kranzach	1.00									1.00						1.00				
47 Dellach	1.00									1.00						0.31	0.69			
48 Oberdrauburg	1.00									1.00						0.80	0.20			
49 Dobratsch	1.00									1.00						0.88	0.12			
50 Schütt	1.00									1.00						0.70	0.30			
51 Fereraun	1.00									1.00						0.75	0.25			
52 Crnice	1.00				0.06		0.94									0.42	0.58			
<b>Outgroup species</b>																				
<i>E. gamma</i>																				
53 Koschuta	1.00				1.00						0.17				0.83					
<i>E. flavicaudis</i>																				
Lauris	1.00		0.10											0.13		0.87				

## APPENDIX I (4)

Nr. Sample	6-pgd					pgi				pgm				pk				
	88	93	98	104	107	80	88	93	94	100	80	91	94	98	100	98	100	101
<b>Western clade =</b>																		
<i>E. alpha stat. nov.</i>																		
1 Gondo			1.00					1.00				0.83	0.06	0.11				1.00
2 Fontainemore	1.00							1.00				1.00						1.00
3 Rancate			1.00					1.00				0.57		0.43				1.00
4 Monte			1.00					1.00				0.73		0.27				1.00
5 Fornace			1.00					1.00				0.70		0.30				1.00
6 Pontide			1.00				0.10	0.90				0.40	0.30	0.30				1.00
7 Sottoponte			1.00					0.23	0.77			0.85		0.15				1.00
8 San Carlo			1.00					0.62	0.38			0.75		0.25				1.00
9 Brembilla			1.00				0.10	0.90				0.38	0.13	0.50				1.00
10 Gerosa			1.00				0.25	0.75				0.75		0.25				1.00
11 Peghera			1.00				0.25	0.75				0.50		0.50				1.00
12 San Pellegrino			1.00				0.50	0.50				0.50	0.25	0.25				1.00
13 San Giovanni Bianco			0.91		0.09		0.09	0.91				0.05		0.96				1.00
14 Camerata Cornello			1.00					1.00				1.00						1.00
15 Olmo al Brembo			1.00				0.15	0.85				0.75		0.25				1.00
16 Piazzatorre			1.00				0.08	0.92				0.65		0.35				1.00
17 Mezzoldo			1.00					1.00				0.71		0.29				1.00
18 Isola di Fondra			1.00				0.73	0.27				0.08		0.92				1.00
19 Carona			1.00					1.00				0.13		0.88				1.00
20 Valleve			1.00					1.00										1.00
21 Selvino			1.00				0.10	0.90				0.13	0.13	0.75				1.00
22 Nembro			1.00				0.17	0.83				0.17	0.33	0.50				1.00
23 Tavemola			1.00					1.00				0.50	0.50					1.00
24 Vigolo			1.00					1.00					0.50	0.50				1.00
25 Bezzecca			0.90		0.10			1.00			0.10	0.50	0.20	0.20				1.00
26 Molina di Ledro			1.00					1.00				0.25	0.30	0.45				1.00
27 Marling			1.00				0.05	0.95				0.61	0.22	0.17				1.00
28 Bad Salz			1.00					1.00				1.00						1.00
<b>Eastern clade =</b>																		
<i>E. germanus</i>																		
29 Sta Maria			1.00					1.00				0.80		0.21				1.00
30 Lichtenberg			1.00					1.00				0.40		0.60				1.00
31 Schluderns			1.00					1.00				0.93		0.07				1.00
32 Schlanderns			1.00					1.00				1.00						1.00
33 verdins			1.00					1.00				1.00						1.00
34 Brixen			1.00					1.00				0.75	0.13	0.13				1.00
35 Völs			1.00					1.00				0.70	0.20	0.10				1.00
36 Bremer			1.00					1.00				0.86	0.14					1.00
37 Vetriolo			1.00					1.00				0.89		0.11				1.00
38 Belluno			1.00					1.00						1.00				1.00
39 Voltago			1.00					1.00				0.40		0.60				1.00
40 San Tomaso			1.00					1.00						1.00				1.00
41 Mezzocanale			1.00					1.00				1.00						1.00
42 Borca di Cadore			1.00					1.00				0.85		0.15				1.00
43 Auronzo di Cadore			1.00					1.00				0.08		0.92				1.00
44 Starkenbach			1.00					1.00				0.75		0.25				1.00
45 Tarrenz			1.00					1.00				1.00						1.00
46 Kranzsch			1.00					1.00				0.50		0.50				1.00
47 Dellach			1.00					1.00				0.06		0.94				1.00
48 Oberdrauburg			1.00					1.00				0.10	0.30	0.40	0.20			1.00
49 Dobratsch			1.00				0.13	0.88				0.25	0.75					1.00
50 Schütt			1.00					1.00				0.33		0.42				1.00
51 Federaun			1.00					1.00				0.75		0.25				1.00
52 Crnice			1.00					1.00				0.56		0.44				1.00
<b>Outgroup species</b>																		
<i>E. gamma</i>																		
53 Koschuta			1.00					1.00						1.00				1.00
<i>E. flavicaudis</i>																		
Lauris	0.35			0.65								1.00			1.00			1.00

APPENDIX II

Polymorphic sites (indels, parsimony informative sites, transitions (ti), and transversions (tv)) in the 16S rRNA gene sequences analysed. Abbreviations for the haplotypes are explained in appendix I.

position	111	1111111111	1111111112	2222222222	2222222222	22222333333333
position	33378012	2223344455	5555666890	1111122222	2333346677	778999022233555
position	312352760	2381812923	4569056598	0123723467	9023471901	232246145702029
Indel	===D=====	=====	=====	=====D=====	=====D=====	=====
Informative	===FF=F=	==FFFF==F	F=FFFFFFF	FF==F==F==	==FFFF==F=	FFFF=F=F=====
Ti	N==N>NNNN	=N>NNNN=N	NNNN=N>NNN	NN=NN=N=N	NNNNNN=N=N	NNNNNNNN=N=N=NN
Tv	=VV==V==	V==V=VV==V	V===VV=VV	V=V===VVV=	V=VV==V=V	=====V=V=V=V
EalFO	TTATATTGT	TTACGTGTAG	CCTCATATAG	GGTTA*TGTA	ATAGAAGAAT	AACAAGAGGTTTCGA
EalGO	-----	-----	-----	-----	-----	-----
EalSP	-----	-----	T--T-----	-----	--G----G-	-----A-----G
EalSG	-----	-----	T--T-----	-----	--G----G-	-----A----AT
EalRA	---*-----	-----	T--T---G-	-A-----	--G----G-	-----G-----
EalCA	-----	-----	T--T---G-	-A-----	--G----G-	-----G-----
EalOL	-----	-----	T--T---T-	-A-----	--G----G-	-----G-----A--
EalSO	-----	-----	T--T---G-	-A-----	--G----G-	-----G-----
EalTA	-----A-	-----	T--T-----	AA-----	G-G----G-	G-----
EalML	-----A-	-----	T-----A-	-A-----	--G----G-	G-----
EalMA	-----A-	-----	T-----A-	-A-----	--G----G-	G-----
EgeOB	-----G-A	---AG---C	T-C-G-G-GT	A---G-A-	--GAG----	GGT--A-T-----
EgeDE	-----G-A	---AG---C	T-C-G-G-GT	A---G-A-	--GAG----	GGT--A-T-----
EgeST	-----G-A	---AG---C	T-C-G-G-GT	A---G-A-	--GAG----	GGT--A-T-----
EgeBO	-----A-	---AG---C	T-C-G-G-GT	A---G-A-	--GAG----	GGT--A-T-----
EgeSM	-----G-A	---TAG----	T-C-G-G-GT	A---G-A-	--GAG----	GGT--A-T-----
EgeVE	-----G-A	---TAG----	T-C-G-G-GT	A---G-A-	--GAG----	GGT--A-T-----
EgeSH	-----G-A	---TAG----	T-C-G-G-GT	A---G-A-	--GAG----	GGT--A-T-----
EgeVO	-----G-A	---TAG----	T-C-G-G-GT	A---G-A-	--GAG----	GGT--A-T-----
EgeME	-----G-A	---TAG----	T-C-G-G-GT	A---G-A-	--GAGG----	GGT--A-T-----
EgeKR	-----G-A	---TAG----	T-C-G-G-GT	A---G-A-	--GAG-*----	GGT--A-T-----
EgeTZ	-----G-A	---TAG----	T-C-G-G-GT	A---G-A-	--GAG----	GGT--A-T-----
EgeCR	---GG-A-	---AGG--A	T-C-G--C-T	AA-----A--	-C-AG--G-	GGT--A-T-----
EgaKO	---A-A-	G-GT--A-A	AT--A-C-T	AA-----A--	--G----G-	G-T-GA-T-----
EflLA	CGC-GAC-C	-CGAA--G-	A---AT--T	TAACGTGTAG	T-TT-G-T-A	G-T-A---GCC---



## A new genus of Prionoglarididae from a Namibian cave (Insecta: Psocoptera)

Charles LIENHARD

Muséum d'histoire naturelle, c. p. 6434, CH-1211 Genève 6, Switzerland.

E-mail: charles.lienhard@mhn.ville-ge.ch

**A new genus of Prionoglarididae from a Namibian cave (Insecta: Psocoptera).** - *Sensitibilla strinatii* gen. n., sp. n. is described and illustrated based on three females and several nymphs collected in Arnhem Cave (124 km SE of Windhoek). The new genus is closely related to the North American genus *Speleketor* Gurney. The description of its type species, *Speleketor flocki* Gurney, is complemented and the systematic position of both genera within the family Prionoglarididae is discussed. The presence of trichobothria on legs, unique in Psocoptera, is considered as a striking synapomorphy of *Speleketor* and *Sensitibilla*.

**Key-words:** Psocoptera - Prionoglarididae - new genus - new species - trichobothria - cave fauna - Namibia.

### INTRODUCTION

The family Prionoglarididae (suborder: Trogiomorpha, family-group: Psocathropetae) groups some of the most astonishing psocids currently known. It contains two genera, *Prionoglaris* Enderlein, 1909 and *Speleketor* Gurney, 1943, each comprising 3 species which have been revised by Lienhard (1988) and Mockford (1984) respectively. The Palaearctic genus *Prionoglaris* is characterized by the absence of a bulging postclypeus and the corresponding reduction of hypopharyngeal structures (which are present in all other psocids and implicated in the active uptake of water vapour from the atmosphere, cf. Lienhard, 1988: 104) and by the strong metamorphosis of mouthparts during the last moult, also unique in the order Psocoptera: adults nearly lack laciniae (only a microscopical remnant is visible at high magnification), while nymphs have normal laciniae; adults have strongly modified sickle-shaped mandibles, while these organs are of the normal chewing-type in nymphs (cf. Lienhard, 1988, 1998). In the Nearctic genus *Speleketor* only a slight tendency to such a metamorphosis of mouthparts can be observed (Mockford, 1984), postclypeus and hypopharynx are not modified and exhibit the characters which are typical for the suborder Trogiomorpha. Both genera have very similar wing venation characterized by a strongly developed, arched basal segment of *sc*, joining *r1* close to the base of the pterostigma. The very particular morphology of male genitalia, unique in Psocoptera, can also be interpreted as a synapomorphy of these genera.

In 1999 the Swiss biospeleologist Pierre Strinati discovered the first African prionoglaridid, a very distinct Namibian species which will be described in the following. It is much more closely related to *Speleketor* than to *Prionoglaris*. One of the most striking diagnostic characters is the presence of trichobothria on all tibiae and on hindtarsus, while in *Speleketor* such sensilla are only present on femora and on mid- and hindtrochanter. This feature and the very characteristic development of female genitalia warrant the erection of a new genus for this species, in spite of its close general resemblance to *Speleketor*. It would have been of particular interest to compare also the male genitalia, but unfortunately the male of the new species remains unknown.

Due to the kindness of my colleague Edward Mockford I have been able to examine a paratype female of *Speleketor flocki* Gurney, 1943, the type species of *Speleketor*. In the following comparative discussions some complements to the description of this species are made, enabling a better comparison of these closely related genera.

The following abbreviations are used in the descriptions: P1-P4 = segments of maxillary palp; f1, f2, f3, ... = antennal flagellomeres; t1, t2, t3 = tarsomeres of hindtarsus; c = costal vein; sc = subcostal vein; r1 = first branch of radial vein; rs = radial sector; m = medial vein; pcu = postcubital vein.

### *Sensitibilla* gen. n.

*Diagnosis.* General habitus very similar to *Speleketor* (cf. Gurney, 1943: fig. 3). Differing from *Speleketor* by the following characters. Mandibles with slender incisor region lacking subapical tooth in adults (fig. 9), this region broader and with well developed subapical tooth in nymphs (fig. 13); chewing sculpture on molar region very weakly developed or absent in adults and nymphs. Distal segment of maxillary palp in apical half with a small subglobular sensillum on outer margin (figs 7, 8). Forefemur (fig. 17) lacking the row of articulated spines which is present in *Speleketor* (fig. 22). Legs with the following pattern of trichobothria on dorsal (outer) margin: 2 on foretibia (fig. 17) and midtibia (fig. 18) in adults and nymphs (one of them in proximal half, the other in distal half); 2 also on hind tibia in nymphs (fig. 21), but only the distal one present in adults (fig. 19); 1 on second article of hindtarsus in adults and nymphs (figs 19-21), this article is distinctly thickened at the place where the trichobothrium is located (fig. 20). Female paraproct concave in ventral half, this region densely setose, of about circular shape (fig. 29, the setose ventral part is transversally folded in slide mounted terminalia). Ovipositor valvulae (= third valvulae, fig. 28) with a long distal process, bearing several spinelike setae. Ovipositor valvulae basally articulated to their abdominal tergite on outer side and fused by a sclerified zone to the subgenital plate medially. Apical lobe of subgenital plate free but ventrally almost completely covered by the valvulae. Subgenital plate and main lobe of the ovipositor valvulae sparsely pilose (fig. 28). Spermapore (fig. 25) with a caplike structure and a longitudinal sclerite near the opening of the very long, narrow spermathecal duct. Distal part of the spermathecal duct spirally curled.



Spermatheca (fig. 25) thin-walled, its wall with irregular rows of small circular pores (fig. 26), near origin of duct a slightly sclerified oval region bearing 2 strong denticles directed to the inner side of the spermathecal sac. Spermatophore simple, more or less pear-shaped (fig. 25).

*Type species.* *S. strinatii* sp. n.

*Etymology.* The name is of feminine gender and alludes to the presence of trichobothria on tibiae [sensilis (lat.) = sensible].

*Discussion.* A detailed revised diagnosis of *Prionoglaris* has been published by Lienhard (1988, 1998), the diagnosis of *Speleketor* is given by Mockford (1984, 1993). One of the most striking diagnostic characters mentioned above is the presence of a characteristic pattern of trichobothria on legs. In other Psocoptera, trichobothria only occur on sense cushions of paraprocts. The genera *Speleketor* and *Sensitibilla* are the only psocids, so far as I know, where such sensilla are present on legs. In *Prionoglaris* the general pilosity of legs is short and uniform, similar to that in the two other genera of the family, but trichobothria are lacking. In *Speleketor*, the presence of trichobothria on ventral margin of femora has already been mentioned by Gurney (1943: 198), and Mockford (1984) considers the presence of two trichobothria on forefemur as a generic character. The reexamination of a female paratype of *S. flocki* showed the following pattern of trichobothria, which probably can be considered as diagnostic for the genus *Speleketor* (figs 22-24): 2 on forefemur; 1 on midfemur and 1 on midtrochanter; 1 on hindfemur and 1 on hindtrochanter; all trichobothria are situated on the ventral (inner) margin of the corresponding segment. In *Sensitibilla* the trichobothria are located dorsally on tibiae and hindtarsus.

Female terminalia have been illustrated for *Speleketor* by Gurney (1943: figs 24-26) and Mockford (1984: figs 29-32). The only pair of well developed ovipositor valvulae (= third valvulae) are large rounded flaps bearing numerous slender setae on most of their margin and 2-3 stout setae close together in mediiodistal region. They are not fused to the subgenital plate medially and no distal process is present. In *Speleketor* the paraproct is of normal shape, its ventral half is not concave as in the new genus and the paraproctal setal field is subdivided in a transversal median area and a roughly circular ventral area, both areas are separated by a large zone without hairs (cf. Gurney, 1943: fig. 26). Nothing is known about the spermatheca of *Speleketor flocki*, which is not present in the slide mounted genitalia of the paratype female examined by me. The spermatheca of the allotype female of *Speleketor irviii* Mockford can be characterized as follows (Mockford, *in litt.* 2000): the relatively short, straight duct is wide throughout, with a well-sclerotized cap but with no longitudinal sclerite at the spermapore end; the sac is thin-walled with no ornamentation; within the sac are three vague bodies which are probably spermatophores.

Female genitalia of *Prionoglaris* have been illustrated by Lienhard (1988, 1998). The subgenital plate is simple, with a broadly rounded somewhat sclerified distal margin. The ovipositor valvulae are not fused to the subgenital plate medially and no distal process is present; they are similar in shape to those of *Speleketor* but densely pilose throughout, with some stout setae near apical margin. The paraproct of *Prionoglaris* is simple, pilose and bears some stout setae resembling those on ovi-

positor valvulae. The spermatheca of *Prionoglaris* has a narrow, straight duct of medium length, and there are no ornamentations on the thin-walled sac; spermapore without sclerotized cap but with a longitudinal sclerite; spermatophore not yet observed.

The characters of trichobothrial pattern and female genitalia warrant the separation of *Speleketor* and *Sensitibilla*. Some other useful diagnostic characters are the presence of a row of small spines on anterior face of forefemur in *Speleketor* (fig. 22) (only a row of normal short hairs at the same place in *Sensitibilla*), the presence of a small flattened double sensillum in apical half of P4 in *Speleketor* (fig. 15) (unique subglobular sensillum in *Sensitibilla*) and the presence, on mandibles, of a small but distinct subapical tooth and a weakly but distinctly sculptured chewing plate in *Speleketor* (fig. 16) (no subapical tooth and no chewing sculpture in *Sensitibilla*).

### *Sensitibilla strinatii* sp. n.

#### MATERIAL

Holotype ♀. NAMIBIA: Arnhem Cave (124 km SE of Windhoek), 1550m, 21 October 1999, leg. P. Strinati. Paratypes: 2 ♀ and 7 nymphs (different stages), same collecting data. The specimens were collected at the end of a large gallery going down from the entrance, at about 120 m from the entrance, in a completely dark zone (the gallery being straight, the opening of the entrance is visible from the collecting place), under stones on dusty and sandy soil (the psocids were sitting on the underside of the stones, not on the soil itself). Air temperature at this place: 21°C. At the same place, some pseudoscorpions and beetles were also collected. The cave is inhabited by many bats and guano deposits are important.

The type series is deposited in the Psocoptera collection of the Muséum d'histoire naturelle, Geneva, Switzerland: No. 7435 (♀ holotype, mounted on two slides), 7436 (♀ paratype, in alcohol), 7437 (♀ paratype, head mounted on slide, other parts in alcohol), 7438-7441 (4 nymphs paratypes, each mounted on a slide) and, without collection numbers, 3 nymphs paratypes, in alcohol.

#### ETYMOLOGY

The species is dedicated to its collector, Pierre Strinati, in acknowledgement of his tireless efforts in collecting psocids in caves all over the world.

#### DESCRIPTION (♀, with some indications on nymphal morphology)

*Coloration.* Head (fig. 5) marked with some light brown zones of cuticular pigmentation, a small and sometimes very indistinct crescent-like brown spot on each side near antennal socket. Compound eyes black, ocelli each with a dark brown pigment crescent on the inner side. Antennae and legs grey-brown, thorax brown, abdomen whitish with some red-brown hypodermal pigment on several tergites, arranged in irregular transversal bands. Wings clear, unmarked, pterostigma only very slightly opaque.

*Morphology.* Head shape in frontal view as in *Speleketor flocki* (cf. Gurney, 1943: fig. 1), compound eyes relatively small and very much in lateral position, close to antennal sockets. Vertical suture well visible, frontal suture absent, ocelli well developed (fig. 5). Antennae longer than body, one antenna of holotype damaged, the other apparently intact (i.e. with last flagellomere regularly rounded apically), with 13

articles. All flagellomeres very thin and densely annulated (sculpture), *f1* somewhat curved, *f2-f11* straight. Lacinia with reduced apical denticles in adults (fig. 11), with three apical tines in nymphs (fig. 12). Maxillary palp (fig. 7) very long and slender, *P2-P4* with annulated sculpture, general pilosity relatively dense, consisting of ordinary hairs of about the same length as the diameter of the palpal segments (not figured in fig. 7), 2 short and slightly thickened setae on *P1*, 1 small relatively weakly differentiated spur sensillum subbasally on *P2*, a very characteristic subglobular marginal sensillum in apical half of *P4*, slightly trilobate at apex (fig. 8). Mandibles as described in generic diagnosis (adult: fig. 9, nymph: fig. 13); molar lobe of right mandible subbasally with a well developed and slightly caudally directed fringed lobe. Cibarial sclerite of hypopharynx, epipharyngeal sclerite and oval lingual sclerites well developed, the latter with a distinct hexagonal sculpture, hypopharyngeal filaments separate (fig. 6), hypopharyngeal brush also well developed (not figured in fig. 6). Labial palp 2-segmented (fig. 27), first segment with a short, thickened seta on outer margin, second segment with a slightly sclerified tubercle near distal margin and 3 small thin-walled subapical sensilla. Labrum (fig. 30) with 4 spiniform marginal setae on each side, a row of 6 slender setae in the semicircular hyaline area in the middle of the anterior margin and a row of 5 small setiform marginal sensilla situated in a membranous fold.

Legs with uniform short general pilosity (e.g. fig. 20, these hairs are not figured in figs 17-19). Forefemur with a longitudinal row of normal short hairs on anterior face (at the same place where in *Speleketor* there is a row of articulated spines, cf. fig. 22). Trichobothria pattern of legs as described in generic diagnosis (figs 17-21). Pretarsal claws symmetrical in nymphs and adults, lacking basal process or basal seta, with one preapical tooth in adults (fig. 10), in nymphs with a small additional tooth or short slender process just distally to it (fig. 14). Hindtibia with two ventral marginal spines in distal half and, on apex, 4 large ventral spines and 2 smaller dorsal ones. Hindtarsus with 2 apical spines and 5 plantar spines on *t1* and 1 apical spine on *t2*. Same number of apical and plantar spines on tibia and tarsus of foreleg and midleg, the basal 2 or 3 plantar spines of foretarsus weakly differentiated, no ventral marginal spines in apical half of foretibia and midtibia. All leg spines with broadly rounded apex (fig. 20) (in *Speleketor flocki* the leg spines are pointed apically, cf. fig. 24). Midcoxa with a hyaline tubercle on ventral side. Pearman's organ of hindcoxa only represented by a mirror, coxal rasp not differentiated.

Forewing venation as in fig. 1, distal segment of *sc* nearly perpendicular to *c* (much more inclined towards wing apex in *Speleketor flocki*), in one of the forewings of the holotype only anterior half of the crossvein between base of pterostigma and *rs* developed, wing margin and veins with very loose microscopical pilosity (fig. 2), *pcu* bald. Hindwing relatively small in comparison to forewing. Hindwing venation as in figs 3 and 4, *sc* with basal thickening on lower surface of wing, *rs* and *m* unbranched, *r1* sometimes lacking. Pilosity very sparse or completely lacking on margin and veins of hindwing. Distal segment of *sc*, on lower surface of forewing, with a row of small denticles, diminishing in length towards wing margin (fig. 2) (no such denticles in *Speleketor flocki*), *c* in forewing with scale-like sculpture (fig. 2).

Terminalia of female as described in generic diagnosis (figs 25, 26, 28, 29), with the following complements. Epiproct simple, sense cushion of paraproct with 5-6 trichobothria in normal sockets (no basal rosettes) and 1 shorter ordinary hair. Proximal lobe of ovipositor valvulae with 5-6 long ventral hairs, 3 short hairs on inner margin and a transversal row of 4 short dorsal hairs basally to distal process. Distal process with 7-8 spiniform setae distributed throughout its length: 2 of them on dorsal face, 2-3 on inner margin, 2 on ventral face, 1 on apex. This terminal spine with flattened apex, slightly spoon-shaped (cf. detail of fig. 28). Subgenital plate on each side with a pair of long setae just anterior to the sclerified link with ovipositor valvulae. Basal part of subgenital plate with a characteristic pattern of cuticular pigmentation, apical lobe hyaline (fig. 28). Spermapore, spermatheca and spermatophore (= "sperm packet" of Mockford, 1993) as described in generic diagnosis (figs 25, 26).

*Measurements* (♀ holotype, mm). Body length = 2.5. Forewing length = 2.9. Hindwing length = 1.46. Length of hindfemur = 0.86. Length of hindtibia = 1.45. Length of hindtarsomeres (measured from condyle to condyle):  $t_1 = 0.55$ ;  $t_2 = 0.15$ ;  $t_3 = 0.18$ .

*Remark.* The male is not yet known, but the presence of spermatophores in the spermatheca of the dissected female gives evidence of the bisexuality of the species.

## GENERAL DISCUSSION

### PHYLOGENETICS

Within the family Prionoglarididae the genus *Prionoglaris* is characterized by the autapomorphic characters of head morphology already mentioned in the introduction; another autapomorphy of this genus is the asymmetrical structure of pretarsal claws and their metamorphosis during the last moult (presence of a membraneous vesicle on inner side of anterior claw in adults, no vesicle in nymphs, cf. Lienhard, 1988, 1998).

The clade comprising the remaining two genera, *Speleketor* and *Sensitibilla*, is defined by the synapomorphic presence of trichobothria on legs. Within this group, *Speleketor* is characterized by the presence of a row of articulated spines on forefemur and *Sensitibilla* by the very specialized genitalia of females. The presence of trichobothria on ventral side of femur in all known species of *Speleketor*, mentioned by Mockford (1984), indicates that the trichobothria pattern is of diagnostic value on generic level. The more complex pattern seen in *Sensitibilla* may be interpreted as the apomorphic character state.

### GEOGRAPHICAL DISTRIBUTION

The distribution of the currently known species of Prionoglarididae is the following (cf. Badonnel & Lienhard, 1994; Lienhard, 1988, 1996, 1998; Mockford, 1984, 1993):

Genus *Prionoglaris* (type species: *P. stygia*): *Prionoglaris stygia* Enderlein, 1909: Western Palaearctic, usually in caves, sometimes also under stones and within

rocky débris, recorded from the following countries: Belgium, France (type locality), Germany, Greece, Morocco, Portugal, Switzerland, Turkey, former Yugoslavia. – *Prionoglaris dactyloides* Lienhard, 1988: Greece: Peloponnese (type locality, within rocky débris) and Crete (in cave). – *Prionoglaris lindbergi* Badonnel, 1962: Afghanistan, only one nymph known (holotype), under stone.

Genus *Speleketor* (type species: *S. flocki*): *Speleketor flocki* Gurney, 1943: USA: Southern Arizona (Tucson Mountains, in cave, type locality) and Southeastern Nevada (near Las Vegas, in cave). – *Speleketor irwini* Mockford, 1984: USA: Southern California, on the skirts of dead leaves of the palm *Washingtonia filifera* in native stands. – *Speleketor pictus* Mockford, 1984: USA: Southern California, collected at a light (exact habitat unknown).

Genus *Sensitibilla* gen. n.: *Sensitibilla strinatii* sp. n.: Namibia, Arnhem Cave.

The few populations known are strongly localized, therefore all these species are considered as extremely rare, even the widely distributed *P. stygia* is very rarely collected. Two species, *Sp. flocki* and *S. strinatii* are only known from caves. *P. stygia* and *P. dactyloides* are also regularly found in caves. But probably none of the species is exclusively cave inhabiting; they are all fully winged, well pigmented and have well developed compound eyes and ocelli.

It is interesting to see that all species of *Speleketor* and *Sensitibilla* are known from desert regions only. The strikingly disjunct distribution pattern (SW North America and SW Africa) of these closely related genera may be interpreted as an indication of a relatively old age of this clade.

#### FUNCTIONAL MORPHOLOGY

Some of the morphological characters observed in the new genus reveal several interesting problems of functional morphology which have not been studied in detail but which I would like to point out here very briefly.

The presence of trichobothria on legs in *Sensitibilla* and *Speleketor*, unique in Psocoptera, has been described in detail in the discussion following the description of the new genus. These sensilla are very long and extremely fine smooth filiform hairs, inserted in very large and deep sockets (relative to the diameter of the hairs, cf. fig. 20). Their arrangement is apparently constant within a species and essentially the same in nymphs and adults. The absence, in adults of *Sensitibilla*, of the basal trichobothrium on hindtibia (fig. 19) can be explained by the position of the forewing, which touches and covers the basal half of hindtibia in resting position (cf. figs a and b of pl. 9 in Lienhard, 1998, showing the analogous situation in *Prionoglaris stygia* which has a very similar habitus). The resting position of wings is the same in *Speleketor flocki*, where the forewing covers also most of hindfemur and basal part of hindtibia; this situation is incorrectly figured by Gurney (1943: fig. 3).

These trichobothria are thin but relatively rigid hairs. When preserved specimens of *Sensitibilla strinatii* are moved in alcohol, near to the surface of the liquid, it can be observed that the trichobothria easily deflect at their base, without being bent. No histological investigation has been made but the observations mentioned above confirm the hypothesis that these sensilla are real trichobothria, as they are

known in arachnids, for example (cf. Foelix, 1996: 71-73). In spiders, the trichobothria are stimulated by air currents and low frequency air vibrations (sound). Probably their function could be the same in *Sensitibilla* and *Speleketor* and they may be interpreted as adaptations to cave life, even if only one of the three species of *Speleketor* is known to be cavernicolous. But they could also play an important role in the more general context of a life under the conditions of desert climate (cf. above: "Geographical distribution").

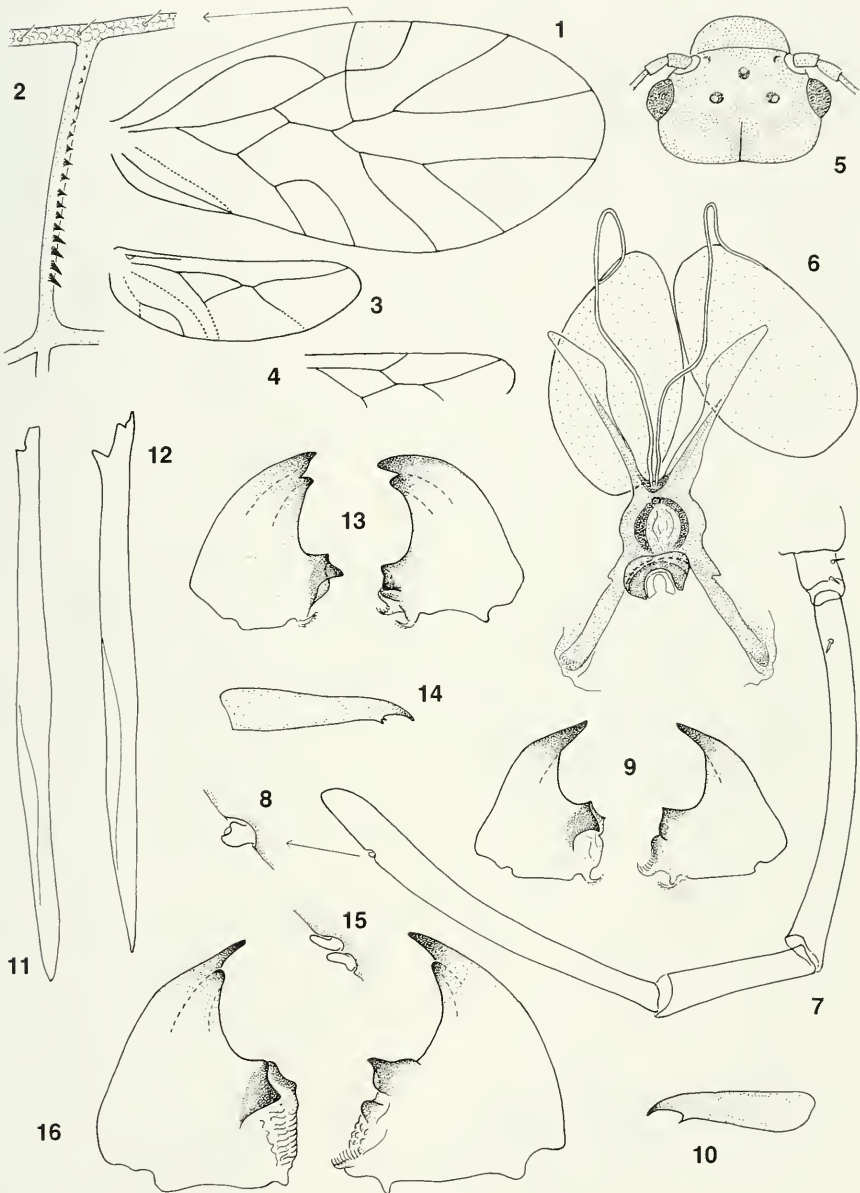
The different position of trichobothria in these genera (ventral side of basal segments of legs in *Speleketor*, dorsal side of apical segments of legs in *Sensitibilla*) may indicate a certain difference in function and therefore in biology of these species. The row of articulated spines on forefemur in *Speleketor* could perhaps also be related to this biological specialization. The row of denticles on distal segment of *sc* in forewing, present in *Sensitibilla* (absent in *Speleketor* and *Prionoglaris*) could eventually be involved in a specialized ethology; it could be interpreted as a sound producing rasp, but there is no evidence of a corresponding frictional structure.

The presence of morphologically different mouthparts (laciniae, mandibles) in adults and nymphs of *Sensitibilla* (and to a somewhat lesser extent in *Speleketor*) indicates a difference in nutritional biology of these life stages. As in *Prionoglaris*, an interpretation is not possible due to the lack of direct observations on animals in captivity (cf. Lienhard, 1988: 103). The reduction of chewing sculpture and the presence of a brush-like fringed basal lobe on right mandible of nymphs and adults could also be related to some nutritional specialization. In this context, it seems interesting to mention the presence of densely fringed mandibles in *Arixenia esau* Jordan (Dermaptera), which lives on bat guano in tropical caves (cf. Strenger, 1977).

The fusion of the ovipositor valvulae with the subgenital plate in *Sensitibilla* results in a unique functional structure which in this configuration is unknown in other psocids. The strong distal process of ovipositor valvulae, bearing several spiniform setae, is reminiscent of the situation in the Namibian desert psocid *Spinatropos philippi* Lienhard, 2000 (Trogomorpha: Atropetae: Trogiidae), where similar spines have been tentatively interpreted as digging organs (Lienhard, 2000). *Sensitibilla strinati* lives under stones on dusty and sandy soils; that is why this interpretation could also be true for this species, which is only very distantly related to *Spinatropos* (same suborder, different family-group). The particular shape and pilosity of the ventral half of the paraproct in *Sensitibilla* could be in functional relation with the unit "ovipositor valvulae-subgenital plate" during oviposition.

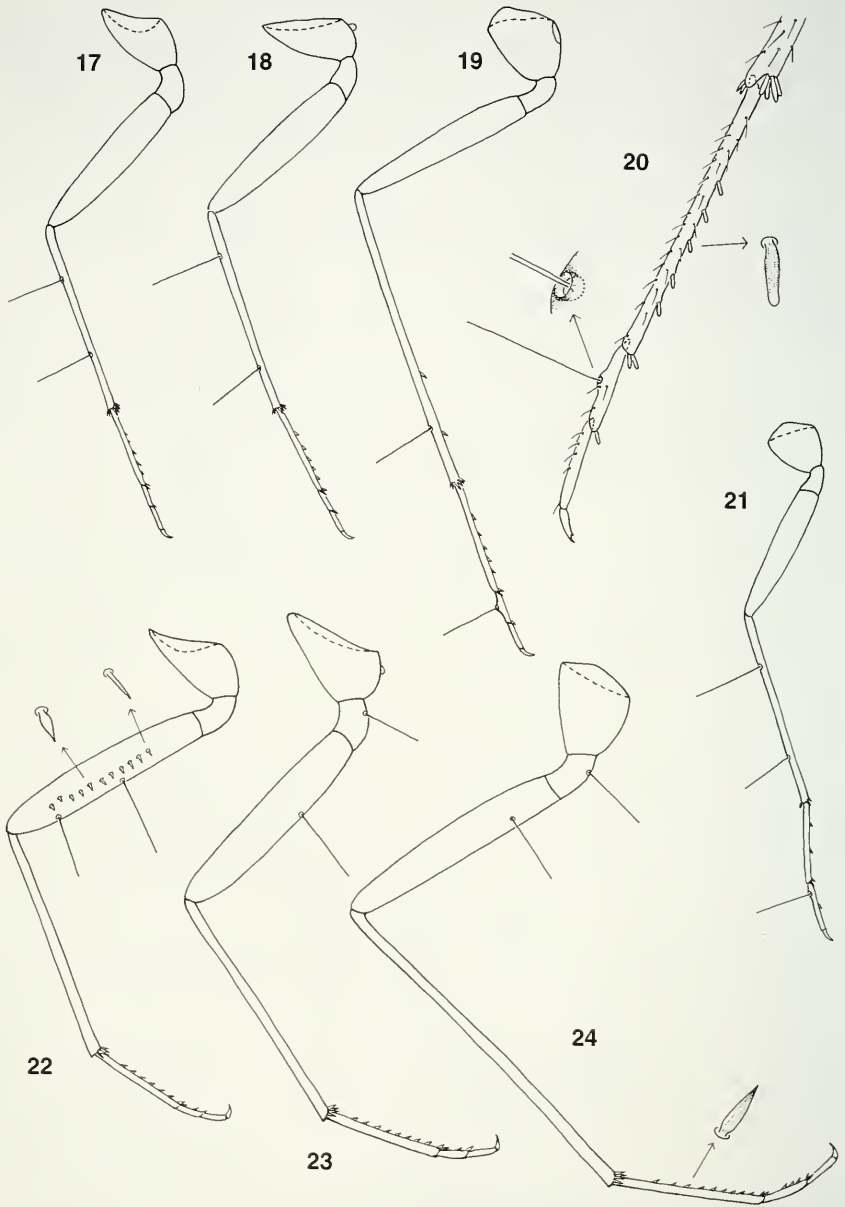
#### ACKNOWLEDGEMENTS

I am very grateful to the renown biospeleologist Dr P. Strinati (Geneva: Cologny) for having made this interesting material available to me. I also thank Dr E. L. Mockford (Normal, Illinois) for the loan of a female paratype of *Speleketor flocki* and for reading the manuscript and making some valuable suggestions. Dr P. Schwendinger (Geneva) kindly indicated to me some literature concerning problems of functional morphology.



FIGS 1-16

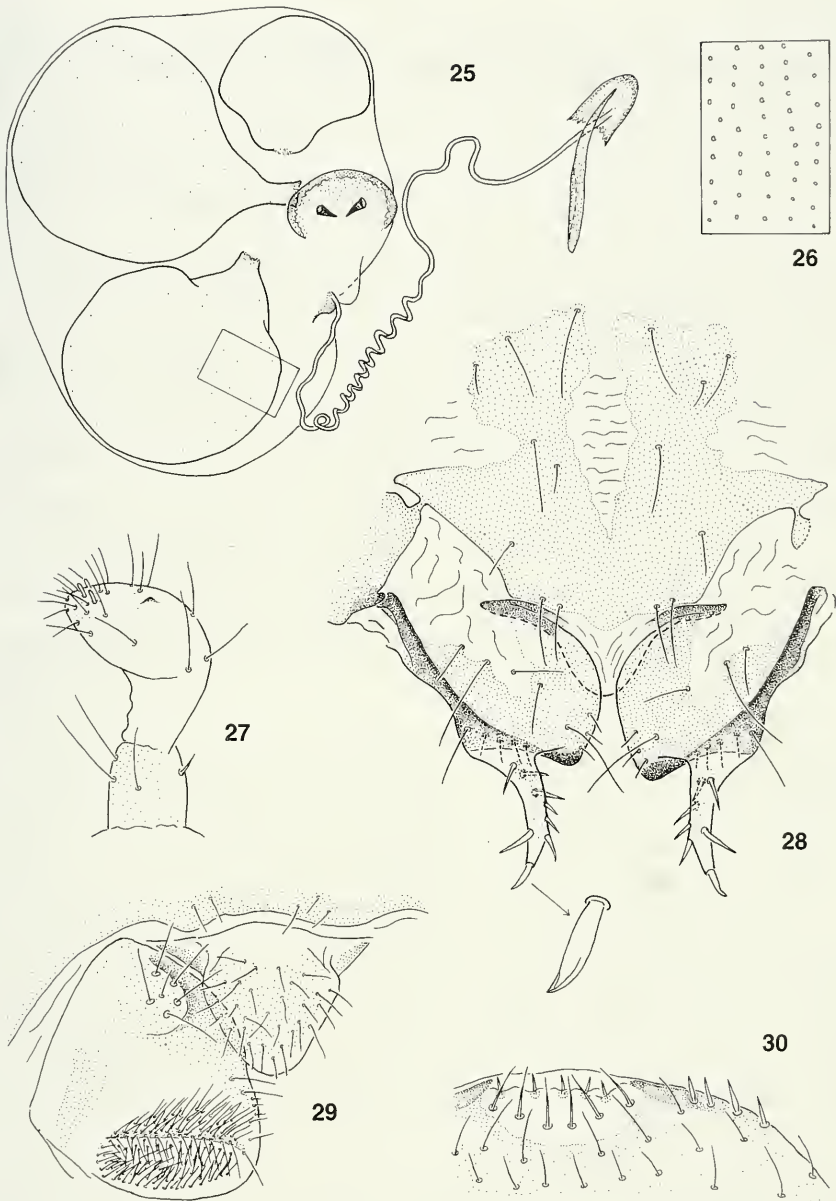
Figs 1-11. *Sensitibilla strinatii*, female: 1, forewing; 2, detail of distal segment of sc in forewing; 3, hindwing (holotype); 4, variant of venation (anteroapical part of hindwing, paratype); 5, head (dorsal view); 6, hypopharyngeal sclerites (dorsal view); 7, maxillary palp (ordinary pilosity not figured); 8, marginal sensillum of P4; 9, mandibles (frontal view); 10, pretarsal claw; 11, lacinia. – Figs 12-14. *Sensitibilla strinatii*, nymph: 12, lacinia; 13, mandibles (frontal view); 14, pretarsal claw. – *Speleketor flocki*, female (paratype): 15, double marginal sensillum on P4; 16, mandibles (frontal view). – N.B. All corresponding figures of laciniae and mandibles at same magnification.



FIGS 17-24

Figs 17-20. *Sensibilla strinatii*, female: 17, foreleg; 18, midleg; 19, hindleg; 20, hindtarsus. — Fig. 21. *Sensibilla strinatii*, nymph: hindleg. — Figs 22-24. *Speleketor flocki*, female (paratype): 22, foreleg; 23, midleg; 24, hindleg. — N.B. Figs 17-19 and 21 at same magnification, figs 22-24 at lower magnification. Ordinary pilosity not represented on these figures (only spinelike setae and trichobothria figured).





FIGS 25-30

*Sensibilla strinatii*, female: 25, spermatheca containing three spermatophores; 26, rows of pores on spermathecal wall (detail to fig. 25); 27, labial palp (ventral view); 28, subgenital plate and ovipositor valvulae (ventral view); 29, epiproct and left paraproct; 30, sensilla on distal margin of labrum (right side and middle).

## REFERENCES

- BADONNEL, A. & LIENHARD, C. 1994. Psocoptera (pp. 301-305). In: JUBERTHIE, C. & DECU, V. (eds). Encyclopaedia Biospeologica, tome I, XII + 834 pp. *Société de Biospéologie, Moulis*.
- FOELIX, R. F. 1996. Biology of spiders (second edition). *Oxford University Press, New York*, 330 pp.
- GURNEY, A. B. 1943. A synopsis of the psocids of the tribe Psyllipsocini, including the description of an unusual new genus from Arizona (Corrodentia: Empheriidae: Empheriinae). *Annals of the entomological Society of America* 36: 195-220.
- LIENHARD, C. 1988. Vorarbeiten zu einer Psocopteren-Fauna der Westpaläarktis. IV. Die Gattung *Prionoglaris* Enderlein (Psocoptera: Prionoglarididae). *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 61: 89-108.
- LIENHARD, C. 1996. Psocoptères nouveaux ou peu connus de quelques îles atlantiques (Canaries, Madère, Açores, Ascension) et de l'Afrique du Nord (Insecta: Psocoptera). *Boletim do Museu municipal do Funchal (Historia Natural)* 48(267): 87-151.
- LIENHARD, C. 1998. Psocoptères euro-méditerranéens. *Faune de France* 83: XX + 517 pp.
- LIENHARD, C. 2000. A new desert psocid from Namibia (Insecta: Psocoptera: Trogiidae). *Revue suisse de Zoologie* 107(2): 277-281.
- MOCKFORD, E. L. 1984. Two new species of *Speleketor* from southern California with comments on the taxonomic position of the genus (Psocoptera: Prionoglaridae). *Southwestern Naturalist* 29(2): 169-179.
- MOCKFORD, E. L. 1993. North American Psocoptera (Insecta). *Flora and Fauna Handbook* 10: XVIII+455 pp. *Sandhill Crane Press, Gainesville, Florida*.
- STRENGER, A. 1977. *Arixenia esau* J., kein Parasit. Eine funktionsmorphologische Studie. *Zoologischer Anzeiger* 199: 95-106.

## Two new Tephritidae (Diptera) from the Western Palaearctic region

Bernhard MERZ

Muséum d'histoire naturelle, c.p. 6434, CH-1211 Genève 6, Switzerland.

E-mail: bernhard.merz@mhn.ville-ge.ch

### Two new Tephritidae (Diptera) from the Western Palaearctic region. -

*Chaetostomella baezi* sp. n. from the Canary Islands (El Hierro, La Palma, Teneriffa), which was reared from flowerheads of *Cheirolophus duranii*, *Ch. junonianns* and *Ch. sventeni gracilis*, is an unusual species. Although having an anterior dorsocentral seta, which is a character of *Chaetorellia*, it is placed in *Chaetostomella* because of the shape of the male terminalia and the strong setae along the vibrissal angle. Its generic position is discussed. *Campiglossa freidbergi* sp. n. is described from high altitude in the Sierra Nevada mountains of Southern Spain. It belongs to the *C. difficilis*-group and differs from *C. difficilis* (Hendel) mainly in the wing pattern and details of the terminalia. Its hostplants are not known.

**Key-words:** Diptera - Tephritidae - new species - Spain - Canary Islands.

### INTRODUCTION

Knowledge of the western Palaearctic Tephritidae is rather good (Norrbon *et al.*, 1998), with about 250 species recorded from this area. Nevertheless, new species may still be found, mostly from areas which harbour a rich endemic flora and fauna. In particular, the Mediterranean region is the least studied. It is therefore not surprising, that two quite large, characteristic species have been found recently in Southern Europe and the Canary Islands which are apparently new to science.

The fauna of the Canary Islands has been studied by several authors during the past 100 years. These studies have been summarized by Merz (1992) who listed 34 species from these islands. Shortly after the publication of that paper the author received independently from B. van Aartsen and M. Baéz specimens of an as yet undescribed and problematic species. It shows an unusual set of characters which make its correct generic position difficult to determine, and it is described here as *Chaetostomella baezi* sp. n.

The Tephritidae of mainland Spain have never been treated in a comprehensive manner. The most important papers are listed in Merz & Blasco-Zumeta (1995) who estimated that about 80 species are known from Spain. However, knowledge of the fauna of the adjacent countries suggested that further species should be found on the Iberian Peninsula. The species described here was found at high altitude in the Sierra Nevada and it belongs to *Campiglossa*. This genus is almost worldwide in distri-

bution, with about 200 described species. It was revised for Europe by Merz (1994) and for the Eastern Palaearctic region by Korneyev (1989). Only *C. producta* (Loew) is widespread throughout the entire Mediterranean region, whereas some other species are found sporadically at higher altitudes. None of these species is known to be endemic in this area.

## MATERIAL

The specimens studied belong to the following institutions and personal collections:

CBVA: private collection Bob van Aartsen, t'Harde, Netherlands

MHNG : Muséum d'histoire naturelle, Genève, Switzerland

TAU : Tel Aviv University, Israel

ZCUL: Zoological collection, University of La Laguna, Tenerife

The terminology follows Merz & Haenni (2000) for external morphology and Korneyev (1985) for structures of male terminalia.

## SYSTEMATIC PART

### *Chaetostomella baezi* sp. n.

Figs 1-11

#### MATERIAL

Holotype ♂. [Canary Islands:] **La Palma**, Fuencaliente, III.1996, leg. R. Mesa / ex larva *Cheirolophus junoniaus* (ZCUL). The specimen is glued laterally on to a card and is in good condition.

Paratypes, Canary Islands: **La Palma**, same data as holotype, 6♂♂, 1♀; Bco [= Barranco] Fagundo, 400m, 9.XII.1994, leg. M. Baéz, 1♀. **El Hierro**, Sabinosa, 14.VIII.1985, leg. M. Baéz, 1♂, 2♀♀; Sabinosa, III.1995, leg. R. Meso, ex larva *Cheirolophus duranii*, 2♂♂; Frontera, 14.VIII.1985, leg. M. Baéz, 1♂. **Tenerife**, El Tablado, IV.1995, leg. R. Meso, ex larva *Cheirolophus sventeni*, 1♂; Buenavista, 2.IV.1968, leg. B. van Aartsen, 1♀. The paratypes are deposited in the following institutions: MHNG, ZCUL and CBVA.

Additional material: **La Palma**, Barranco Fagundo, 400m, 9.XII.1994, leg. M. Baéz, 1 specimen without abdomen (also 1 wing missing); Barranco del Jorao, Tijarafe, 4.IX.1994, leg. R. Mesa Coello, cultivad en *Cheirolophus sventeni gracilis*, *Chaetorellia* n.sp.?, det. M. Baéz, 1♂ (without wings). **El Hierro**, Sabinosa, III.1995, leg. R. Meso, ex larva *Cheirolophus duranii*, 1♂ (without wings). **Tenerife**, Guimar, 17.V.1993, leg. M. Baéz, 1♂ (teneral); Barranco del Río, 21.VII.1996, leg. M. Baéz, 1 without abdomen (also head missing).

Remark: The specimens sent by M. Baéz were badly damaged in the post. Whereas the paratypes show at most some minor damage, all other specimens with heavy damage are excluded from the type series. Nine specimens dropped of their pins and are not listed here because it is impossible to assign them to their locality labels.

#### ETYMOLOGY

Named in honour of Marcos Baéz, La Laguna, in recognition of his long-term investigations of the Diptera of the Canary Islands.

#### DIAGNOSIS

Medium sized species of *Chaetostomella*. Differs from all other species of the genus by the presence of a presutural dorsocentral seta and the arrangement of the

black spots on the mesonotum, with one large black spot in the triangle of the two supraalar setae and the wing base.

#### DESCRIPTION

*Head* (Fig. 1). Entirely yellow, only around ocelli with darker spots; in profile about 1.3 times higher than long; gena and vibrissal angle densely covered with long black and shorter whitish setulae, the anteriormost 2-3 black setulae stronger; frontal plate densely covered with dark setulae; frons bare; scape and pedicel with black setulae; chaetotaxy as usual in the genus: 3 dark frontal setae, 2 dark orbital setae, the posterior pair inclinate; 1 dark ocellar seta, 1 dark medial vertical and 1 dark lateral vertical seta, 1 whitish, upright postocellar seta, between them usually with 1-3 small medial postocellar setulae, all postocular setae dark, but just behind them with several rows of whitish occipital setulae.

*Thorax* (Fig. 2). Brownish-yellow in ground colour, but mesonotum with lyre-like pattern, which may be somewhat more or less developed as in Fig. 2; katepisternum usually pale reddish, but central spot in a few specimens with blackish upper margin; 6 pairs of dark spots visible on the mesonotum: 3 pairs of small dark spots present at the bases of the prescutellar seta and the anterior and posterior dorsocentral setae; 3 pairs of large dark spots present at the base of the presutural seta, in a triangle formed by the anterior and posterior supraalar seta and the base of the wing, and on the lower postalar callus; scutellum with a large apical and two smaller laterobasal dark spots; anepisternum, anepimeron and katepisternum densely covered with predominantly pale, rough setulae; posterior margin of anepisternum with 1-3 black setae; posterodorsal corner of katepisternum with 1 black seta, anepimeron with 1 dark, central seta; legs yellowish.

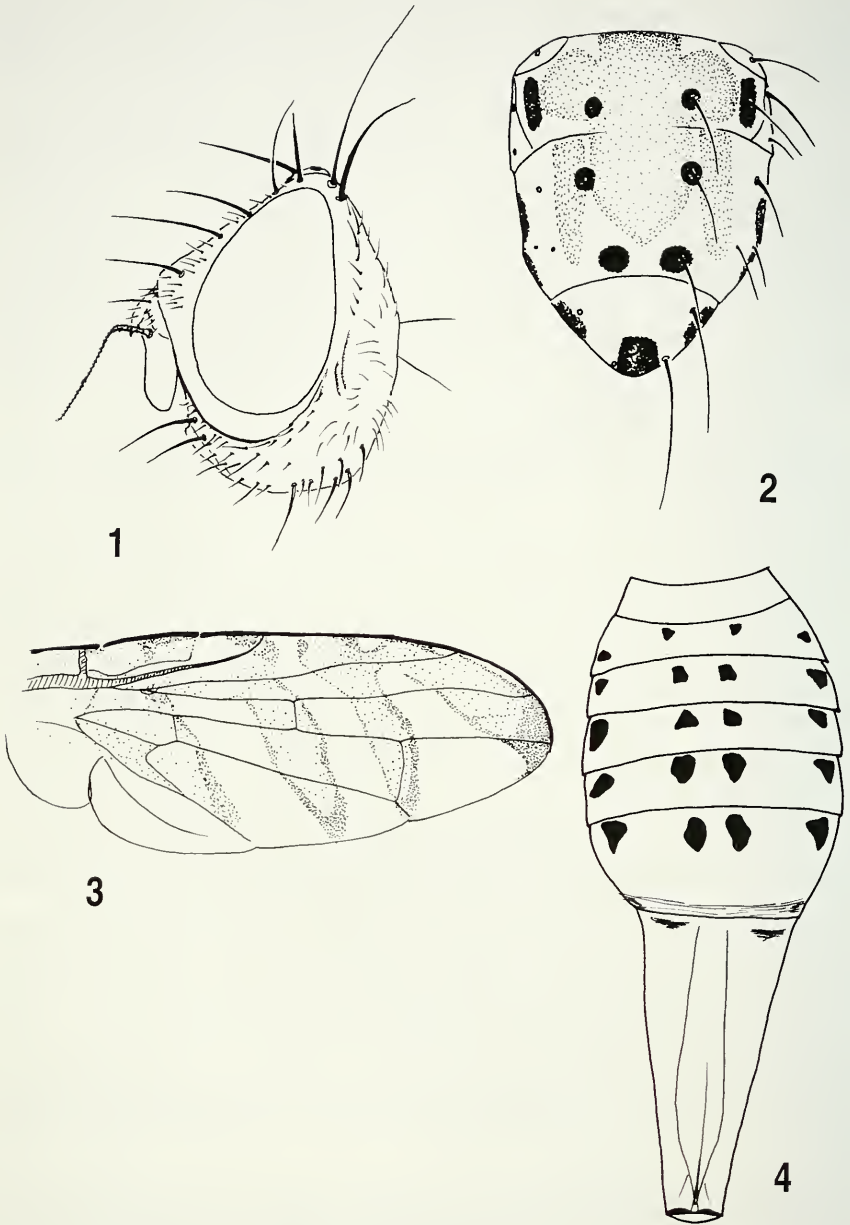
*Wing* (Fig. 3). Pattern as usual in the genus; discal and preapical crossbands always separated; preapical and apical crossbands usually connected, although sometimes only for a short distance; lower extension of posterior cubital cell reaching posteriorly beyond cell bm; halteres yellowish; fringes of upper calypter darkened.

*Abdomen* (Fig. 4). Ground colour brownish-yellow; tergites 2-5 (in ♂) and 2-6 (in ♀) each with 2 pairs of small dark spots; setulae usually entirely dark, only on first tergite mainly pale; last tergite of male slightly shining, other tergites mat.

*Male terminalia* (Figs 5-8). Epandrium, hypandrium and associated structures as usual in the genus; distiphallus without spines or setulae; general structure of glans as in other *Chaetostomella*; ejaculatory ductus evenly curved; at base of glans with an ill-defined serrate sclerite; ligula at least half as long as maximum length of glans, slightly brownish towards tip.

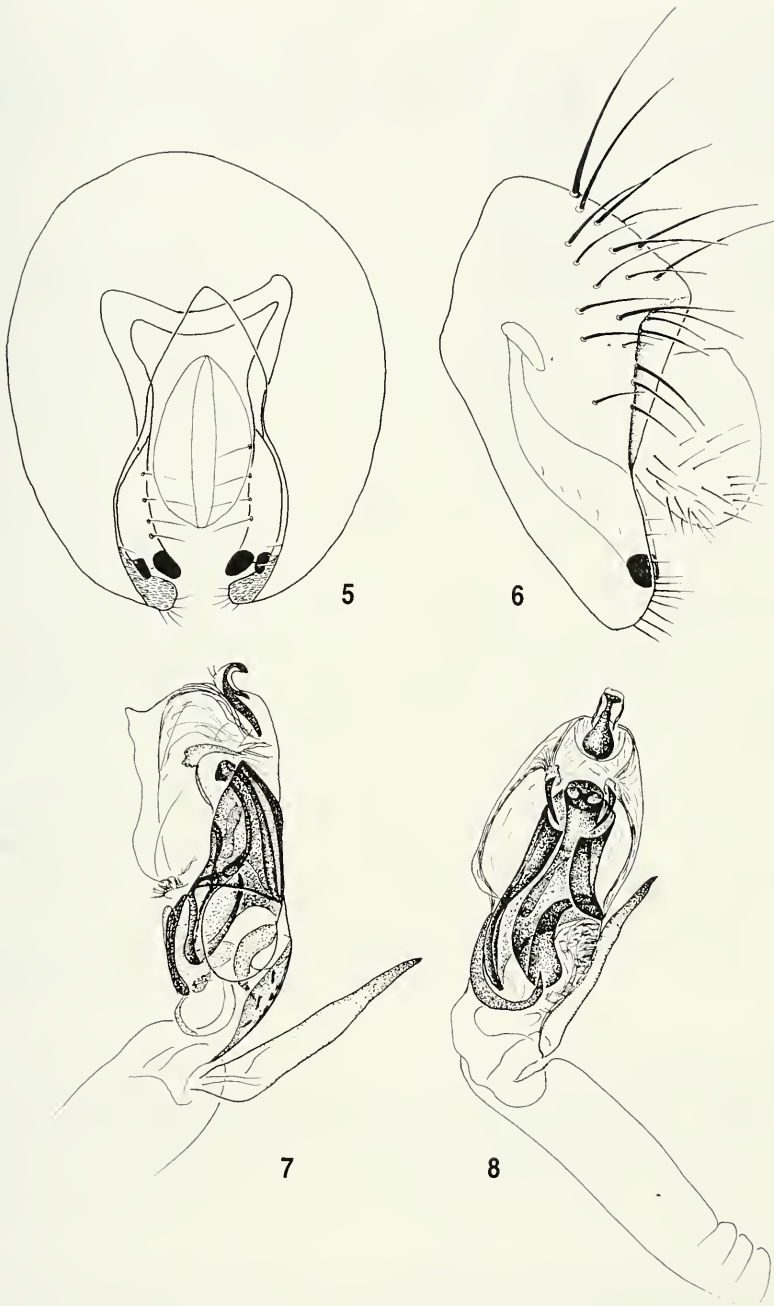
*Female terminalia* (Figs 4, 9-11). Oviscape orange, but at base usually with a pair of small, dark lateral spots; all setulae dark; length about equal to that of the preceding 3 tergites combined; spermathecae rather narrow, cylindrical, densely covered with elongate papillae; aculeus evenly acute, only at tip of sternite 8 with slight shoulder, tip evenly rounded; ratio of length of sternite 8 / total length of aculeus about 0.7.

*Wing length*: 4.9-5.4 mm (male), (4.0-) 4.8-5.5 mm (female).



FIGS 1-4

*Chaetostomella baezi* sp. n.: 1, head, lateral view; 2, mesothorax and scutellum, dorsal view; 3, wing; 4, abdomen of ♀, dorsal view.



FIGS 5-8

*Chaetostomella baezi* sp. n, male: 5, external terminalia, caudal view; 6, external terminalia, lateral view; 7, glans, lateral view; 8, glans, ventral view.

## BIOLOGY

Some specimens were reared from *Cheirtolephus duranii*, *Ch. junonianus* and *Ch. sventeni gracilis*. This genus belongs to the tribe Cardueae within the Asteraceae. Although not stated on the labels, it may be assumed that the larvae live in the flowerheads.

## DISCUSSION

With the well developed presutural dorsocentral seta and the presence of 12 dark spots on the mesonotum this species exhibits the diagnostic characters of *Chaetorellia*. However, the body is more robust than in *Chaetorellia*, the male terminalia are almost identical with other species of *Chaetostomella* (Korneyev, 1985; Freidberg & Kugler, 1989, pers. obs.), the vibrissal angle bears some strong, dark setulae and the lyre-pattern on the mesonotum is very similar to the known species of *Chaetostomella*, so that its placement in the latter genus seems justified. The discovery of this new species with some characters intermediate between *Chaetorellia* and *Chaetostomella* raises the question about the status of the two genera. According to V.A. Korneyev (pers. comm.) also few or most specimens of other species of *Chaetostomella* (*Ch. rossica* Hendel) and *Terellia* (*T. blanda* Richter) may have a presutural dorsocentral seta. Therefore, the number of dorsocentral setae does not seem of generic value and the synonymy of *Chaetostomella* and *Chaetorellia* should probably be proposed. However, this action is premature without the study of the terminalia of all species, which is outside the scope of this paper. The main external differences between the two genera may be summarized as follows:

- |   |   |
|---|---|
| 1 | Vibrissal angle with some well developed dark setae; if presutural dorsocentral seta present, then mesonotum with dark spot laterad of supraalar setae; in general larger, more robust species . <i>Chaetostomella</i> Hendel                     |
| - | Vibrissal angle setulose, but without outstanding dark setae; presutural dorsocentral seta always present and inserted on a black spot; never with dark spot laterad of supraalar setae; more slender species<br>..... <i>Chaetorellia</i> Hendel |

*Campiglossa freidbergi* sp. n.

Figs 12-17

## MATERIAL

Holotype ♂. Spain: Sierra Nevada Veleta, 2500m, 4.X.1985, A. Freidberg (TAU).

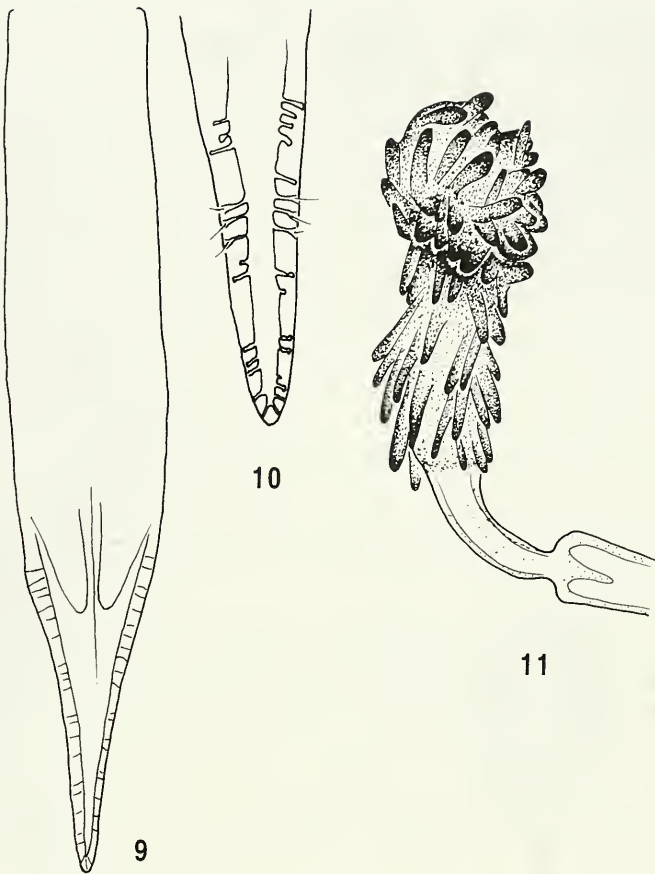
Paratypes: same data as holotype, 6♂♂, 3♀♀. The paratypes are deposited in MHNG and TAU.

The holotype is double mounted with a minutien pin on a polyporus strip and is in excellent condition.

## ETYMOLOGY

Named in honour of Amnon Freidberg, the leading specialist on Tephritidae, the finder of the new species, and an excellent colleague.





FIGS 9-11

*Chaetostomella baezi* sp. n., female: 9, aculeus, ventral view; 10, tip of aculeus, ventral view; 11, spermatheca.

#### DIAGNOSIS

Medium sized species of *Campiglossa*, wing length 3.5-4 mm. It is characterized by the mixed black and whitish postocular setae, the black posterior notopleural seta and in particular by its wing pattern, which shows some quite isolated, much reduced black areas and very large, often fused spots over the entire surface.

#### DESCRIPTION

*Head* (Fig. 12). General colour yellow, with occiput dark and sometimes with a dark band between the two vertical setae; in profile slightly higher than long; frons with indistinct longitudinal vitta; antennae at base separated from each other by half the width of diameter of scape; labellae 1.7-2 times as long as length of 1st flagellomere; scape and pedicel with dark setulae; chaetotaxy: 2 dark frontal setae, 1 dark and

1 white orbital setae; 1 dark ocellar seta; 1 whitish lateral vertical and 1 dark medial vertical seta; 1 pale postocellar seta, 1 pale paraverticilar seta; postocular setae mixed dark and pale.

*Thorax.* General colour black with thick greyish microtrichosity; mesonotum with 5 indistinct darker longitudinal stripes; postpronotal lobe slightly yellowish; setulae on pleura whitish, rough; chaetotaxy as usual in the genus, posterior notopleural seta, anepisternal seta and katepisternal seta black; anepimeral seta whitish; apical scutellar setae inserted on slightly paler ground, about half as long as basal scutellar setae; coxa, trochanter and femur of all legs mostly black, parts of distal half of femur, tibia and tarsus yellow, sometimes hind tibia with dark ring at middle.

*Wing* (Fig. 13). Dark areas rather narrow, hyaline parts of wing large, most spots below vein R4+5 are fused; r2+3 always with a large hyaline spot anterior to R-M; cell cu<sub>1</sub> and anal lobe with only a very indistinct pattern of isolated bars.

*Abdomen.* Of the same greyish microtrichosity as thorax; the paired medial dark spots on tergites 2-5 well developed; all setulae pale.

*Male terminalia* (Fig. 14). Epandrium with a small caudal plate (as in Merz, 1994, Fig. 13y); distal end of distiphallus with two clusters each of 10-15 small setulae; glans elongate, rostrum rather long, distinctly, but weakly sclerotized along entire length; vesica narrow.

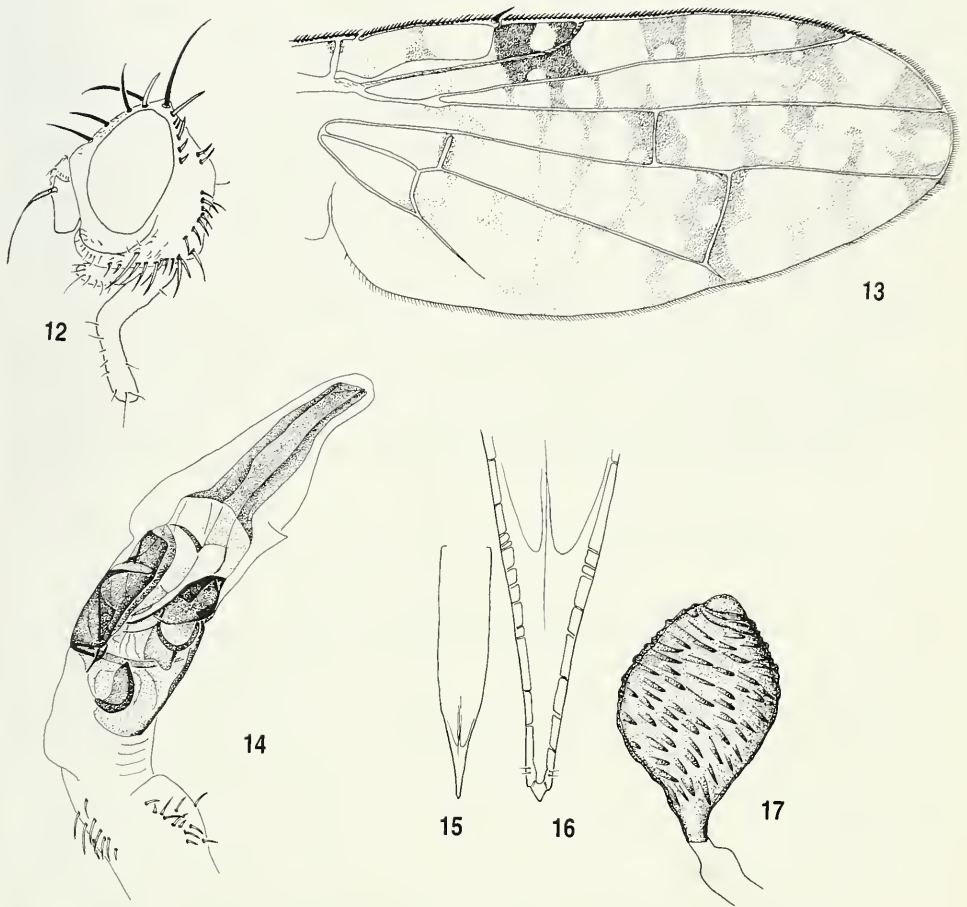
*Female terminalia* (Figs 15-17). Oviscape black, about as long as preceding 2-3 tergites of preabdomen; aculeus evenly narrowed towards tip, but at apex with a distinct step; length of aculeus 1.0 mm (one specimen dissected); spermathecae ovoid, entirely covered by small papillae.

## BIOLOGY

No hostplants are known for this species.

## DISCUSSION

Together with *C. difficilis* (Hendel), this species forms the *C. difficilis*-group of Merz (1994). Both species share the same chaetotaxy and the same type of male terminalia with a cylindrical acrophallus, a narrow vesica, and an elongated rostrum. However, both species differ clearly in the wing pattern and in details of the male terminalia: The preapical lappet of the vesica of *C. difficilis* is absent in *C. freidbergi*. Further, the internal structure of the acrophallus shows some slight differences (see Fig. 15a in Merz, 1994). Another species which may be confused with *C. freidbergi* is *C. cain* (Hering) from Ethiopia and Kenya, which has a very similar wing pattern and head shape. However, the two species differ clearly in the structure of the terminalia in both sexes: The epandrium bears long projections in *C. cain*, as in *C. argentata* (Munro) (see Fig. 79 in Munro, 1957), which are entirely absent in *C. freidbergi*. The rostrum in the glans of *C. cain* is much narrower and bears an apical sclerotized semicircle, which is somewhat similar to *C. anomalina* (Bezzi), as illustrated in Fig. 114 in Munro (1957). The females differ in the tip of the aculeus, which is truncated at the tip and without any step in *C. cain*.



FIGS 12-17

*Campiglossa freidbergi* sp. n: 12, head, lateral view; 13, wing; 14, ♂ glans, ventral view; 15, ♀ aculeus, ventral view; 16, ♀ tip of aculeus, ventral view; 17, ♀ spermatheca.

#### ACKNOWLEDGEMENTS

My sincerest thanks are offered to B. van Aartsen (t'Harde) M. Baéz (La Laguna) and A. Freidberg (Tel-Aviv) for making these flies available for study. Further, I thank V. Korneyev (Kiev) and A. C. Pont (Goring-on-Thames) for checking a first draft of this manuscript.

#### REFERENCES

- FREIDBERG, A. & KUGLER, J. 1989. Diptera: Tephritidae. *Fauna Palaestina - Insecta IV*: 212 pp. & 8 plates.
- KORNEYEV, V. A. 1985. Fruit flies of the Tribe Terelliini Hendel, 1927 (Diptera, Tephritidae) of the fauna of the USSR. *Entomologicheskoe Obozrenie* 49 (4): 626-644. (in Russian; English translation in: *Entomological Review, Washington* 65 (1): 35-55).

- KORNEYEV, V. A. 1989. A review of *Sphenella* and *Paroxyyna* series of genera (Diptera, Tephritidae, Tephritinae). *Insects of Mongolia* 11: 359-470. (in Russian).
- MERZ, B. 1992. The fruit flies of the Canary Islands (Diptera: Tephritidae). *Entomologica Scandinavica* 23 (2): 215-231.
- MERZ, B. 1994. Diptera, Tephritidae. *Insecta Helvetica, Fauna* 10: 1-198.
- MERZ, B. & BLASCO-ZUMETA, J. 1995. The fruit flies (Diptera, Tephritidae) of the Monegros region (Zaragoza, Spain), with the record of the host plant of *Rhagoletis zernyi* Hendel, 1927. *Zapateri, Revista aragonensis de entomologia* 5: 127-134.
- MERZ, B. & HAENNI, J. P. 2000. 1.1. Morphology and terminology of adult Diptera (other than terminalia) (pp. 21-51). In: PAPP, L. & DARVAS, B. (eds). Contributions to a manual of Palaearctic Diptera, Volume 1. *Science Herald, Budapest*, 978 pp.
- MUNRO, H. K. 1957. Trypetidae. *Ruwenzori Expedition* 2 (9): 853-1054.
- NORRBOM, A. L., CARROLL, L. E. & FREIDBERG, A. 1998. Status of knowledge (pp. 9-47). In: THOMPSON, F. C. (ed). Fruit Fly Expert Identification System and Systematic Information Database. *Myia* 9: 1-524.
- WHITE, I. M. & MARCQUART, K. 1989. A revision of the genus *Chaetorellia* Hendel (Diptera: Tephritidae) including a new species associated with spotted knapweed, *Centaurea maculosa* Lam. (Asteraceae). *Bulletin of Entomological Research* 89: 453-487.

POMORSKI, Romuald J. & Dariusz SKARZYNSKI. Redescription of <i>Hymenaphorura alticola</i> (Bagnall, 1935) from the Alps and description of a new related species from the Sudetes, <i>Hymenaphorura improvisa</i> sp. n. (Collembola: Onychiuridae). . . . .	657-662
ZAWADZKI, Cláudio H., Roberto E. REIS & Erasmo RENESTO. Allozyme discrimination of three species of <i>Loricariichthys</i> (Siluriformes: Loricariidae) from Southern Brazil. . . . .	663-674
MAHUNKA, Sándor. Oribatids from Sabah (East Malaysia) VIII (Acari: Oribatida: Dampfiellidae and Otocepheidae). ( <i>Acarologica Genavensia</i> LXXXVI). . . . .	675-720
LOURENÇO, Wilson R. More about the Buthoidea of Madagascar, with special references to the genus <i>Tityobuthus</i> Pocock (Scorpiones, Buthidae). . . . .	721-736
PAGÉS, Jean. Japygidés (Diplura) du Sud-Est asiatique n° 9. - <i>Dicellurata Genavensia</i> XXIV. . . . .	737-764
COMELLINI, André. Notes sur les Psélaphines néotropicaux (Coleoptera, Staphylinidae, Pselaphinae) – II. Un nouveau genre et sept espèces nouvelles de la tribu des Metopiasini. . . . .	765-776
BÖHME, Wolfgang, Andreas SCHMITZ & Thomas ZIEGLER. A review of the West African skink genus <i>Cophoscincopus</i> Mertens (Reptilia: Scincidae: Lygosominae): resurrection of <i>C. simulans</i> (Vaillant, 1884) and description of a new species. . . . .	777-791
ROWELL, C. H. F. Review of the <i>Lithoscirtus</i> genus group (Orthoptera, Acrididae, Proctolabinae) with description of new species. . . . .	793-834
VALLAN, Denis. A new species of the genus <i>Stumpffia</i> (Amphibia: Anura: Microhylidae) from a small forest remnant of the central high plateau of Madagascar. . . . .	835-841
GANTENBEIN, Benjamin, Victor FET, Mark BARKER & Adolf SCHOLL. Nuclear and mitochondrial markers reveal the existence of two parapatric scorpion species in the Alps: <i>Euscorpium germanus</i> (C. L. Koch, 1837) and <i>E. alpha</i> Caporiaacco, 1950, stat. nov. (Euscorpidae). . . . .	843-869
LIENHARD, Charles. A new genus of Prionoglarididae from a Namibian cave (Insecta: Psocoptera). . . . .	871-882
MERZ, Bernhard. Two new Tephritidae (Diptera) from the Western Palaearctic region. . . . .	883-892

POMORSKI, Romuald J. & Dariusz SKARZYNSKI. Redescription of <i>Hymenaphorura alticola</i> (Bagnall, 1935) from the Alps and description of a new related species from the Sudetes, <i>Hymenaphorura inprovvisa</i> sp. n. (Collembola: Onychiuridae). . . . .	657-662
ZAWADZKI, Cláudio H., Roberto E. REIS & Erasmo RENESTO. Allozyme discrimination of three species of <i>Loricariichthys</i> (Siluriformes: Loricariidae) from Southern Brazil. . . . .	663-674
MAHUNKA, Sándor. Oribatids from Sabah (East Malaysia) VIII (Acari: Oribatida: Dampfiellidae and Otocephidae). ( <i>Acarologica Genavensia</i> LXXXVI). . . . .	675-720
LOURENÇO, Wilson R. More about the Buthoidea of Madagascar, with special references to the genus <i>Tityobuthus</i> Pocock (Scorpiones, Buthidae). . . . .	721-736
PAGÉS, Jean. Japygidae (Diplura) from South-East Asia n° 9. - <i>Dicellurata Genavensia</i> XXIV. . . . .	737-764
COMELLINI, André. Notes on Neotropical Pselaphines (Coleoptera, Staphylinidae, Pselaphinae) 11. A new genus and seven new species of the tribe Metopiasini. . . . .	765-776
BÖHME, Wolfgang, Andreas SCHMITZ & Thomas ZIEGLER. A review of the West African skink genus <i>Cophoscincopus</i> Mertens (Reptilia: Scincidae: Lygosominae): resurrection of <i>C. siuulans</i> (Vaillant, 1884) and description of a new species. . . . .	777-791
ROWELL, C. H. F. Review of the <i>Lithoscirtus</i> genus group (Orthoptera, Acrididae, Proctolabinae) with description of new species. . . . .	793-834
VALLAN, Denis. A new species of the genus <i>Stumpffia</i> (Amphibia: Anura: Microhylidae) from a small forest remnant of the central high plateau of Madagascar. . . . .	835-841
GANTENBEIN, Benjamin, Victor FET, Mark BARKER & Adolf SCHOLL. Nuclear and mitochondrial markers reveal the existence of two parapatric scorpion species in the Alps: <i>Euscorpheus germanus</i> (C. L. Koch, 1837) and <i>E. alphi</i> Caporiacco, 1950, stat. nov. (Euscorpidae). . . . .	843-869
LIENHARD, Charles. A new genus of Prionoglarididae from a Namibian cave (Insecta: Psocoptera). . . . .	871-882
MERZ, Bernhard. Two new Tephritidae (Diptera) from the Western Palae-arctic region. . . . .	883-892

PUBLICATIONS DU MUSÉUM D'HISTOIRE NATURELLE DE GENÈVE

CATALOGUE DES INVERTÉBRÉS DE LA SUISSE, N <sup>os</sup> 1-17 (1908-1926) . . . . .	série Fr. 285.—
(prix des fascicules sur demande)	
REVUE DE PALÉOBIOLOGIE . . . . .	Echange ou par fascicule Fr. 35.—
LE RHINOLOPHE (Bulletin du centre d'étude des chauves-souris) . . . . .	par fascicule Fr. 35.—
COLLEMBOLAFAUNA EUROPAS von H. GISIN, 312 Seiten, 554 Abbildungen, 1960 (Nachdruck, 1984) . . . . .	Fr. 30.—
THE EUROPEAN PROTURA THEIR TAXONOMY, ECOLOGY AND DISTRIBUTION WITH KEYS FOR DETERMINATION by J. NOSEK, 346 pages, 111 figures in text, 1973 . . . . .	Fr. 30.—
CLASSIFICATION OF THE DIPLOPODA par Richard L. HOFFMAN, 237 pages, 1979 . . . . .	Fr. 30.—
LES OISEAUX NICHEURS DU CANTON DE GENÈVE par P. GÉROUDET, C. GUEx et M. MAIRE 351 pages, nombreuses cartes et figures, 1983 . . . . .	Fr. 45.—
CATALOGUE COMMENTÉ DES TYPES D'ECHINODERMES ACTUELS CONSERVÉS DANS LES COLLECTIONS NATIONALES SUISSES, SUIVI D'UNE NOTICE SUR LA CONTRIBUTION DE LOUIS AGASSIZ À LA CONNAISSANCE DES ECHINODERMES ACTUELS par Michel JANGOUX, 67 pages, 11 planches, 1985 . . . . .	Fr. 15.—
RADULAS DE GASTÉROPODES LITTORAUX DE LA MANCHE (COTENTIN-BAIE DE SEINE, FRANCE) par Y. FINET, J. WÜEST et K. MAREDA, 62 pages, 1991 . . . . .	Fr. 10.—
GASTROPODS OF THE CHANNEL AND ATLANTIC OCEAN; SHELLS AND RADULAS by Y. FINET, J. WÜEST and K. MAREDA, 1992 . . . . .	Fr. 30.—
O. SCHMIDT SPONGE CATALOGUE par R. DESQUEYROUX-FAUNDEZ & S.M. STONE, 190 pages, 49 plates, 1992 . . . . .	Fr. 40.—
ATLAS DE RÉPARTITION DES AMPHIBIENS ET REPTILES DU CANTON DE GENÈVE par A. KELLER, V. AELLEN et V. MAHNERT, 48 pages, 1993 . . . . .	Fr. 15.—
THE MARINE MOLLUSKS OF THE GALAPAGOS ISLANDS: A DOCUMENTED FAUNAL LIST par Yves FINET, 180 pages, 1995 . . . . .	Fr. 30.—
NOTICE SUR LES COLLECTIONS MALACOLOGIQUES DU MUSEUM D'HISTOIRE NATURELLE DE GENEVE par Jean-Claude CAILLIEZ, 49 pages, 1995 . . . . .	Fr. 22.—
PROCEEDINGS OF THE XIIIth INTERNATIONAL CONGRESS OF ARACHNOLOGY, Geneva 1995 (ed. Volker MAHNERT), 720 pages, 1996 . . . . .	Fr. 160.—
CATALOGUE OF THE SCAPHIDIINAE (COLEOPTERA: STAPHYLINIDAE) ( <i>Instrumenta Biodiversitatis</i> 1) par Ivan LÖBL, 192 pages, 1997 . . . . .	Fr. 50.—
CATALOGUE SYNONYMIQUE ET GÉOGRAPHIQUE DES SYRPHIDAE (DIPTERA) DE LA RÉGION AFROTROPICALE ( <i>Instrumenta Biodiversitatis</i> II) par Henri G. DIRICKX, 188 pages, 1998 . . . . .	Fr. 50.—
A REVISION OF THE CORYLOPHIDAE (COLEOPTERA) OF THE WEST PALAEARCTIC REGION ( <i>Instrumenta Biodiversitatis</i> III) par Stanley BOWESTEAD, 204 pages, 1999 . . . . .	Fr. 60.—
THE HERPETOFAUNA OF SOUTHERN YEMEN AND THE SOKOTRA ARCHIPELAGO ( <i>Instrumenta Biodiversitatis</i> IV) par Beat SCHÄTTI & Alain DESVOIGNES, 178 pages, 1999 . . . . .	Fr. 70.—









## Revue suisse de Zoologie: Instructions to Authors

The *Revue suisse de Zoologie* publishes papers by members of the Swiss Zoological Society and scientific results based on the collections of the Muséum d'histoire naturelle, Geneva. Submission of a manuscript implies that it has been approved by all named authors, that it reports their unpublished work and that it is not being considered for publication elsewhere. A financial contribution may be asked from the authors for the impression of colour plates and large manuscripts. All papers are refereed by experts.

In order to facilitate publication and avoid delays authors should follow the *Instructions to Authors* and refer to a current number of R.S.Z. for acceptable style and format. Manuscripts not conforming with these directives are liable to be returned to the authors. Papers may be written in French, German, Italian and English. Authors should aim to communicate ideas and information clearly and concisely. Authors not writing in their native language should pay particular attention to the linguistic quality of the text.

Manuscripts must be typed, or printed (high quality printing, if possible by a laser-printer), on one side only and double-spaced, on A4 (210 x 297 mm) or equivalent paper and all pages should be numbered. All margins must be at least 25 mm wide. Authors must submit one original and two copies, including tables and figures, in final fully corrected form, and are expected to retain another copy.

We encourage authors to submit the text on a diskette (3.5", Macintosh or IBM compatible, with "Microsoft Word" or similar programmes). The text should be in roman (standard) type face throughout, including headings, except genus and species names which should be formatted in italics (or underlined with pencil); bold, small capitals, large capitals and other type faces should not be used. Footnotes and cross-references by page should be avoided.

Papers should conform to the following general layout:

**Title page.** A concise but informative full title plus a running title of not more than 40 letters and spaces, name(s) in full and surname(s) of author(s), and full address(es).

**Abstract.** The abstract is in English, composed of the title and a short text of up to 200 words. It should summarise the contents and conclusions of the paper. The abstract is followed by less than 10 key-words, separated by hyphens, which are suitable for indexing.

**Introduction.** A short introduction to the background and the reasons for the work.

**Materials and methods.** Sufficient experimental details must be given to enable other workers to repeat the work. The full binominal name should be given for all organisms. The International Code of Zoological Nomenclature must be strictly followed. Cite the authors of species on their first mention.

**Results.** These should be concise and should not include methods or discussion. Text, tables and figures should not duplicate the same information. New taxa must be distinguished from related taxa. The abbreviations gen. n., sp. n., syn. n. and comb. n. should be used to distinguish all new taxa, synonyms or combinations. Primary types must be deposited in a museum or similar institution. In taxonomic papers the species heading should be followed by synonyms, material examined and distribution, description and comments. All material examined should be listed in similar, compact and easily intelligible format; the information should be in the same language as the text. Sex symbols should be used rather than "male" and "female".

**Discussion.** This should not be excessive and should not repeat results nor contain new information, but should emphasize the significance and relevance of the results reported.

**References.** The *Harvard System* must be used for the citation of references in the text, e.g. White & Green (1995) or (White & Green, 1995). For references with three and more authors the form Brown *et al.* should be used. Authors' names should not be written in capitals. The list of references must include all publications cited in the text but only these. References must be listed in alphabetical order of authors, and both the title and name of the journal must be given in full in the following style (italics can be formatted by the author):

Penard, E. 1888. Recherches sur le *Ceratium macroceros*. *Thèse, Genève*, 43 pp.

Penard, E. 1889. Etudes sur quelques Héliozoaires d'eau douce. *Archives de Biologie* 9: 1-61.

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.

References should not be interspaced and, in the case of several papers by the same author, the name has to be repeated for each reference.

**Tables.** These should be self-explanatory, with the title at the top organised to fit 122 x 180 mm. Each table should be typed, double spaced, on a separate page and numbered consecutively and its position indicated in the text.

**Figures.** These may be line drawings or half tones and all should be numbered consecutively, and their position indicated in the text. Figures should be arranged in plates which can be reduced to 122 x 160 mm. Drawings and lettering should be prepared to withstand reduction. Magnification should be indicated with scale lines. Authors should refrain from mixing the drawings and half tones. Original drawings will not be returned automatically. The *Revue suisse de Zoologie* declines responsibility for lost or damaged slides or other documents. If electronically scanned figures are submitted on diskettes, this should be clearly indicated on the print-out enclosed with the manuscript.

**Legends to figures.** These should be typed in numerical order on a separate sheet.

**Proofs.** Page proofs only are supplied, and authors may be charged for alterations (other than printer's errors) if they are numerous.

**Offprints.** The authors receive totally 25 offprints free of charge; more copies may be ordered at current prices when proofs are returned.

**Correspondence.** All correspondence should be addressed to

Revue suisse de Zoologie  
Muséum d'histoire naturelle

CP 6434

CH-1211 Genève 6

Switzerland.

Phone: +41 22 418 63 33 - Fax +41 22 418 63 01

e-mail: [volker.mahnert@mhn.ville-ge.ch](mailto:volker.mahnert@mhn.ville-ge.ch)

Home page RSZ: <http://www.ville-ge.ch/musinfo/mhng/page/rsz.htm>







**HECKMAN**

B I N D E R Y , I N C .  
Bound-To-Pleas<sup>e</sup>\*

**MAY 01**

N. MANCHESTER, INDIANA 46962

SMITHSONIAN INSTITUTION LIBRARIES



3 9088 01260 2033