

Zeitschrift: Entomologica Basiliensia et Collectionis Frey
Herausgeber: Naturhistorisches Museum Basel, Entomologische Sammlungen
Band: 31 (2009)

Artikel: Flanged Bombardier Beetles from Laos (Carabidae, Paussinae)
Autor: Nagel, Peter
DOI: <https://doi.org/10.5169/seals-981033>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 27.03.2026

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>

Entomologica Basiliensia et Collectionis Frey	31	101–113	2009	ISSN 1661–8041
---	----	---------	------	----------------

Flanged Bombardier Beetles from Laos (Carabidae, Paussinae)

by Peter Nagel

Abstract. The Paussinae of Laos were recently studied based on new material collected by the Natural History Museum Basel. Two species are described as being new to science, *Lebioderus brancuccii* sp.nov., and *Paussus lanxangensis* sp.nov., and two species are new records for Laos. All species are shown in drawings. To date nine species are known from Laos, four of which have been added by the NHMB collecting trips, and a fifth new record is based on other museum collections.

Key words. Laos – Paussinae – *Lebioderus* – *Paussus* – taxonomy– new species – myrmecophiles – distribution records

Introduction

Within the Oriental Region, Indochina is less well explored concerning the insect fauna than the Indian Subcontinent. Within Indochina, Laos is the least explored country, especially when compared to the insect fauna of the adjacent regions of Thailand. In contrast to neighboring countries, Laos still harbour large areas of forest, with relatively little disturbance and the presence of pristine habitats. However, demographic increases combined with forest burning, clearing for cultivation, and logging are major current threats to the Laotian environment. Therefore there are strong concerns for the survival of the high and unique biodiversity of this country which is situated in the centre of the Indo-Burma Hotspot (MITTERMEIER *et al.* 2004).

In order to contribute to the documentation of the Laotian insect fauna as a basis for furthering our understanding and consequentially the conservation efforts, Dr. Michel Brancucci, Natural History Museum Basel, has conducted collecting trips to Laos in 2003, 2004, 2007 and 2009. Dr. Michel Brancucci is continuing his efforts in the coming years. We look forward to his further findings as Laos represents still one of the few “white spots” on the terrestrial biodiversity map.

Paussinae have a predominantly pan-tropical distribution. They comprise about 800 species. Their currently used common name “flanged bombardier beetles” has been introduced by MOORE (2006) and refers to two main characteristics of the group, i.e. the elytral subapical fold (“flange of Coanda”) and the ability of explosive discharge of the defensive liquid. The more derived tribes Protopaussini and Paussini are obligate myrmecophiles while association with ants occurs only exceptionally in the more basal Ozaenini (MOORE 2006, 2008, GEISELHARDT *et al.* 2007).

The Paussinae of Laos have not yet been an object of special faunistic or taxonomic treatment. FOWLER (1912) and ANDREWES (1929) provided keys, descriptions, and distribution data on the “Paussidae” (Protopaussini and Paussini in current nomenclature) and “Ozaeninae” (Ozaenini in current nomenclature) of the Indian subcontinent and Burma. ANDREWES (1930) presented a catalogue of the Carabidae including the Ozaenini of most parts of Southeast Asia, including all Indochina. Scattered new records of Paussini are included in the monograph of LUNA DE CARVALHO (1989). Recently, new species or records of Paussini from South and Southeast Asia have also been published (SAHA *et al.* 1995, MARUYAMA 2005, 2009, MARUYAMA *et al.* 2008).

The aim of this paper is the description of the Paussinae collected in the course of collecting trips of M. Brancucci to Laos. Furthermore, a list is compiled of species reported to occur in Laos based on literature data and unpublished records of the present author.

Material and Methods

The specimens were collected during the collecting trips of M. Brancucci in the years 2003 and 2009. They are dry-mounted and glued to pinned cards. They form part of the collections of NHMB and were provided to me on loan for study. Paussines were only recorded by means of collecting by hand and by means of flight intercept traps.

The identification profited considerably from the comprehensive collections of Paussinae at NHMB and BGUB. The investigation of specimens was mainly done by means of the Leica M205 C stereomicroscope.

All drawings show the specimens with the appendages of the right side shown at their broadest view while the left antenna and legs are shown at a distortion of 90 degrees, i.e., they are shown at their narrowest view. I chose this type of display for flanged bombardier beetles because of their often-flattened legs and three-dimensionally sculptured antennae. With this type of presentation the figures serve as a direct aid for identification (cf. NAGEL 2006).

Abbreviations

BGUB	.....	Coll. Nagel in Biogeographische Sammlung, Universität Basel
MNHN	.....	Muséum National d'Histoire Naturelle, Paris
NHMB	.....	Naturhistorisches Museum Basel
NMPC	.....	National Museum, Prague
ZSM	.....	Zoologische Staatssammlung, München

Paussinae collected by NHMB expeditions in Laos

Lebioderus brancuccii sp.nov.

(Figs 1–2)

Type material. Holotype, male (NHMB); Label 1: Laos-NE, Xieng Khouang prov., 19°38.2'N 103°20.2'E, Ban Na Lam → Phou Sane Mt., 20.–30.v.2009, 1420m, D.Hauck leg.; Label 2: Secondary mountain forest, flight intercept trap, Laos 2009 Expedition, NHMB Basel, NMPC Prague; Paratype female (NHMB); label 1: Laos-NE, Xieng Khouang prov., 19°38.2'N 103°20.2'E, Ban Na Lam → Phou Sane Mt., 20.–30.v.2009, 1420m, M.Brancucci leg.; Label 2 as in holotype specimen.

Description. Holotype, male: Body length 7.9 mm from tip of head to tip of elytra, width across mid-elytra 3.24 mm; body chestnut brown, glossy with head and pronotum slightly more matte; overall appearance glabrous with only the few inconspicuous, thin, long, erect setae of the series umbilicata of the elytra, the tarsal pubescence and the short apical trichomes of the antennal teeth more obvious; elytral disc glabrous with scattered, short, flat lying, brownish setae towards the basal and lateral parts; along the midline of each elytron with one row of hardly discernible three to four long, thin, erect setae similar to the series umbilicata; antennae, head, pronotum and pygidium with

pubescence similar to the basal and lateral parts of the elytra; femora with a similar type of pubescence but more scattered; tibiae and surface of tarsi virtually glabrous.

Head rugose dorsally, much broader than the strongly constricted neck; along the midline with distinct and complete longitudinal groove and shallow pits at both sides of the midline; in dorsal view a slight indentation between temples and eyes.

Mouthparts typical of *Lebioderus* (cf. DESNEUX 1905).

Antennal club (fused antennomeres 3 to 11) with four distinct transverse furrows; fore margin slightly indented between metameres; hind margin with metameres 2 (basal) to 5 (apical) acutely produced and apically equipped with a short trichome; hind margin of basal metamere 1 only slightly and obtusely produced, without trichome; club shining with scattered short setae lying flat against the surface.

Pronotum divided by a transverse furrow, fore and hind margin accompanied by a shallow, narrow groove; longitudinal groove along midline ending at about the middle of the fore part and approaching almost the posterior margin; fore part 1.25 times longer and 1.5 times broader than hind part; lateral lobes of fore part produced in an obtuse angle; dorsal surface slightly rugose by shallow, coarse punctuation.

Elytra about 1.8 times longer than wide with the protruding shoulders characteristic for this genus; laterally not smoothly rounded from dorsal to lateral parts but with obtuse longitudinal edge which ends well before the apico-lateral flange and shortly before the shoulder; hind wings fully developed.

Pygidium with sharp edge, accompanied by a parallel shallow furrow; disc shining with shallow punctures and associated flat-lying, short setae; glandular openings situated proximally at the left and right margin; the longitudinal opening raised above disc level and orientated parallel to the lateral margin.

Tibiae broad, strongly compressed, outer apical angle produced in an acute angle; tarsi slender, tarsomeres 1 to 4 of decreasing length, terminal tarsomere subequal in length to tarsomere 1 plus 2; fore tarsi with tarsomeres 1 (apical part only), 2 and 3 (total length) ventrally with dense brush-like pubescence of obtusely pointed setae; middle tarsi ventrally with tarsomeres 2 (apical part only) and 3 (total length) pubescent with glabrous midline; hind tarsi ventrally with only apex of tarsomere 3 to the left and the right of the glabrous midline each with a small tuft of setae.

Paratype, female: Body length 8.3 mm from tip of head to tip of elytra, width across mid-elytra 3.4 mm; no distinct sexual dimorphism; the temples are slightly more projecting; the lateral lobes of the fore part of the pronotum are slightly more pronounced; on the elytral disc minute scattered, flat-lying setae are discernible, indicating that the almost glabrous disc in the male might be due to abrasion; the pygidium has a more pronounced triangular shape with the glandular openings narrower and longer; the tarsal ventral pubescence is restricted to tarsomeres 2 (apical part only) and 3 of the fore legs, and to the apical part of tarsomere 3 of the middle and hind legs.

Distribution. The species is only known from the type material from Northeastern Laos. It represents the northernmost locality of a species of this genus.

Etymology. This species is named for Dr. Michel Brancucci, Basel, who initiated and conducted the collecting trips to Laos in order to uncover the largely unknown insect diversity.

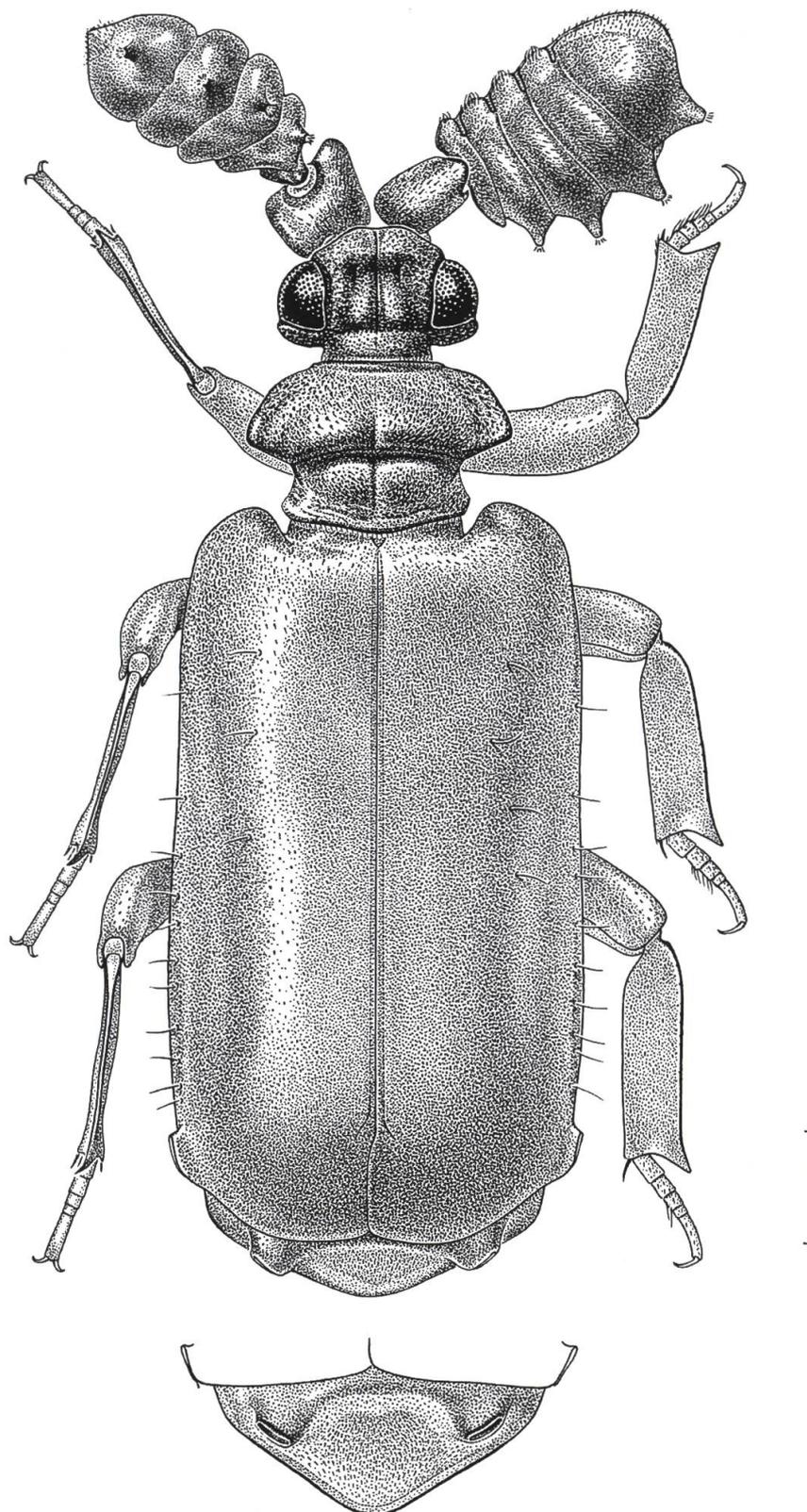


Fig. 1. *Lebioderus brancuccii* sp.nov., holotype, male: habitus and pygidium in plain view. Scale bar 1 mm.

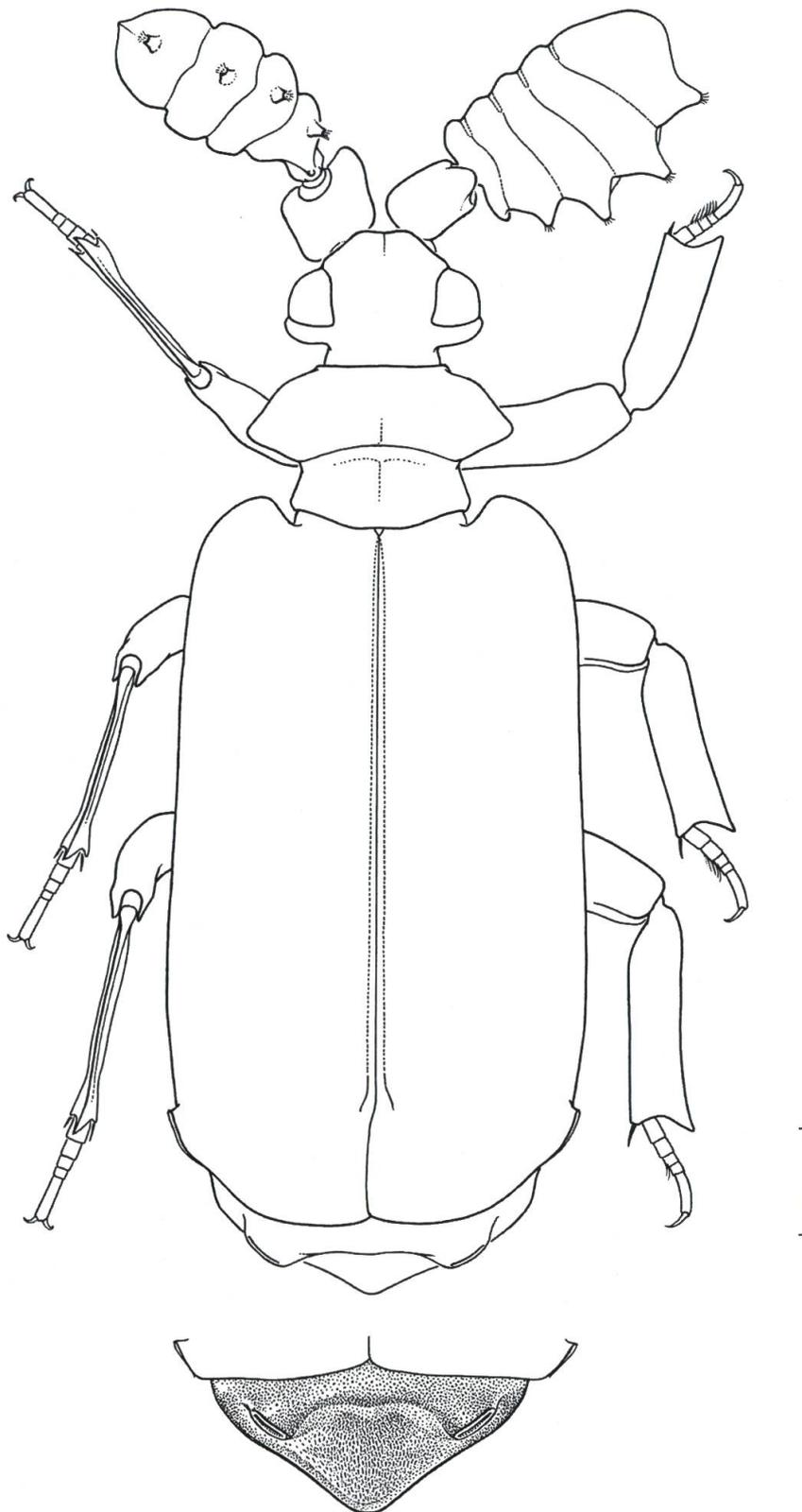


Fig. 2. *Lebioderus brancuccii* sp.nov., paratype, female: sketch of habitus and pygidium in plain view. Scale bar 1 mm.

Differential diagnosis. The species is characterized by the distinct transverse furrows on the surface of the shining antennal club, and distinguished from all other congeners by the strongly compressed, wide tibiae and the elevated pygidial glandular openings.

Natural history. Both specimens have been collected in flight intercept traps that were exposed in secondary mountain forest at 1420m alt. during the hot and humid monsoon period. Virtually nothing is known on the mechanisms of how the two sexes locate themselves. Flying specimens which are attracted to light traps are dominated by males while females are found more regularly in pitfall traps (NAGEL 1987, GEISELHARDT *et al.* 2007). At least males are attracted by their host ants' nest odour and mating probably happens near to or in the ants' nest (NAGEL & MOORE, in preparation). It is therefore interesting to learn that in the case of *L. brancuccii* sp.nov. one male and female each were flying along the same track.

Remarks. This is the second *Lebioderus* species described from the central mainland of Indochina. Recently, *L. thaianus* Maruyama, 2008, has been reported from Thailand, approximately 130 km NE Bangkok (MARUYAMA *et al.* 2008). Further traceable localities of this genus are on Peninsular Malaysia, Sumatra, Java, Borneo, and the Philippines.

***Paussus lanxangensis* sp.nov.**

(Fig. 3)

Type material. Holotype, male (NHMB); Label 1: Laos-NE, Xieng Khouang prov., 19°38.2'N 103°20.2'E, Ban Na Lam → Phou Sane Mt., 20.–30.v.2009, 1420m, D.Hauck leg.; Label 2: Secondary mountain forest, flight intercept trap, Laos 2009 Expedition, NHMB Basel, NMPC Prague.

Description. Male: body length 4.3 mm from tip of head to tip of elytra; body reddish brown with the discs of the antennal club, elytra, ventrites and pygidium, lateral parts of head, pronotum and elytra, and basal two thirds of femora dark brown to black; dorsal surface of head, pronotum and elytra coarsely rugose, resulting in a dull appearance; antennal clubs and legs smooth and shining; all parts of the body equipped with long, mostly sparse pubescence with the exception of the mostly glabrous pygidium and abdomen.

Head at frontal part with a shallow depression, bordered in front at the left and right side by the low but sharply raised anterior margin; vertex with a medial suture from the middle of the head to the posterior margin, cutting a longitudinal slit through a tubercle; the latter might represent an evolutionary remnant of a former gland pore, although no true orifice is discernible; between eyes a pair of ill-defined black colour patches which are located at the sites where tentorial pits or glandular openings are present in other species; hind margin of head slightly indented in the middle; temples broad, rounded, hardly projecting laterally beyond eyes in dorsal view; neck narrow, strongly constricted.

Mouth of the "closed" type, i.e. maxillary and labial palpi cover the mouth opening from beneath; maxillary palpi with third from terminal palpomere large, compressed; terminal palpomere of labial palpi slightly compressed, of oval shape with acute tip.

Antennae with compressed club; fore margin slightly convex, hind margin straight without traces of indentations; basal tooth large, without trichome; hind margin ventrally with a deep furrow from the basal tooth to short distance before apex; dorsal disc with a shallow, longitudinal depression.

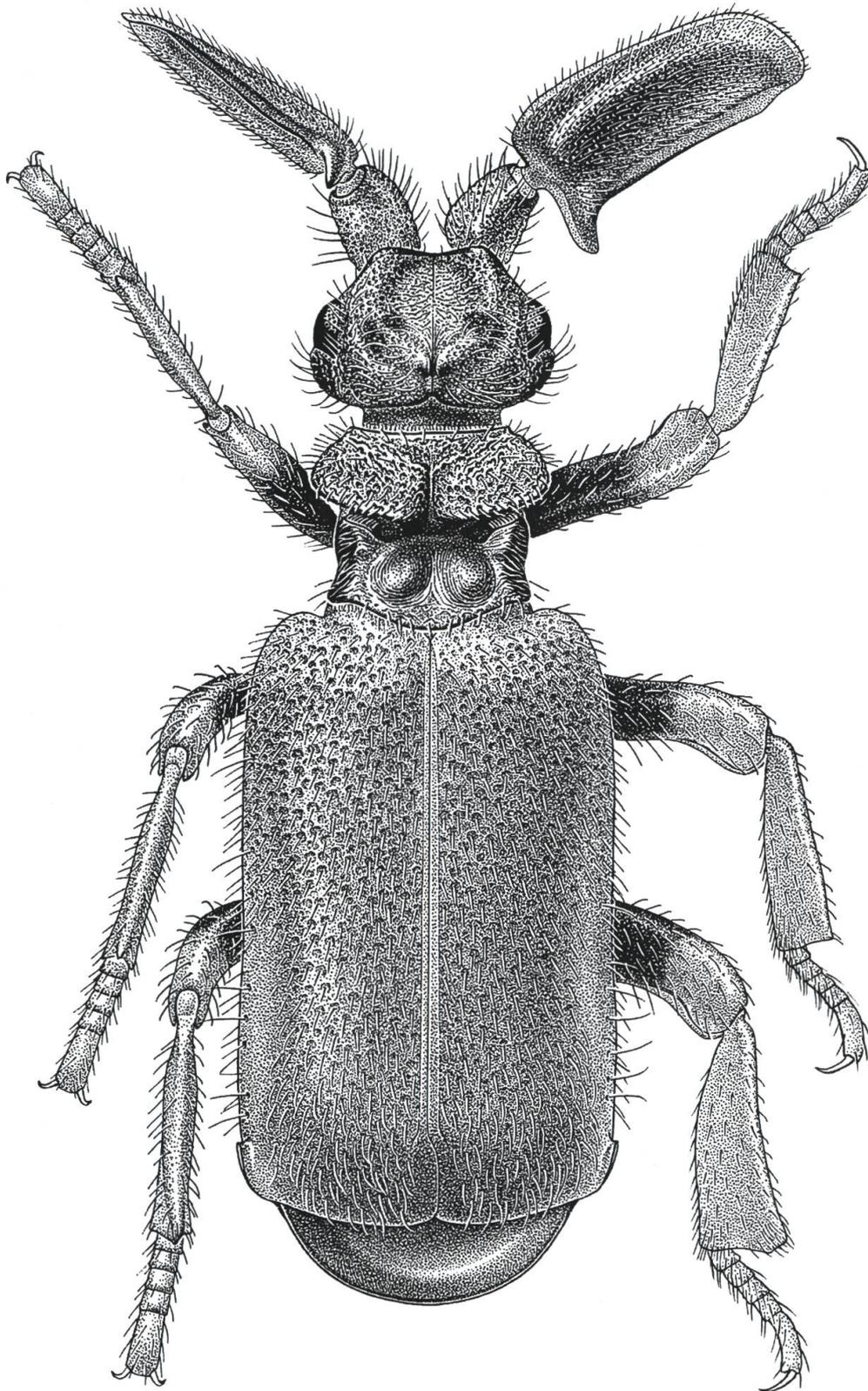


Fig. 3. *Paussus lanxangensis* sp.nov., holotype, male: habitus. Scale bar 1 mm.

Pronotum strongly divided into an anterior and a posterior part by a deep transverse furrow; anterior part 1.2 times wider than posterior part, laterally rounded; strongly divided by a longitudinal groove and thus forming two lobes slantingly projecting backwards over the transverse furrow; transverse furrow with trichome-bearing glandular openings at the furthest lateral ends; posterior part with almost parallel, slightly concave lateral margins; medially with a deep, wide, longitudinal furrow, separating two large round tubercles; surface characterized by a pattern of curved and straight, narrow, adjacent grooves.

Elytral pubescence consisting of whitish, long, solid, erect or slightly slanting setae; near the elytral apex part of these setae is extended into an extremely thin flagellum; elytra with lateral parts and a discal area immediately in front of the apico-lateral flange smooth and shining and the discal part almost glabrous; macropterous.

Pygidium with disc glabrous and shining, bordered apically by high, blade-like, semicircular margin; true marginal trichome (band of setae along the margin) missing, represented only by densely arranged setae lying flat at both proximal corners, usually covered by apex of elytra and not visible.

Legs robust, tibiae slightly compressed with hind tibiae broader than mid and fore tibiae; outer apical angle of hind tibiae obliquely cut; tarsi with tarsomeres 1 to 4 subequal in length; tarsomeres 1 to 4 of all tarsi ventrally setose but without adhesive pubescence.

Female unknown.

Distribution. The species is only known from the type locality in Northeastern Laos.

Etymology. Laos was once known as the “land of a thousand elephants” (Lan Xang or Lane Xang), which is also the name of a kingdom lasting from the 14th to the 18th Century in the area.

Differential diagnosis. The species forms part of the large group of species characterized by their deep transverse pronotal furrow. Within this group the species is unique with regard to the combination of the following characters: head without pores, pronotum strongly sculptured, pygidium without apical trichome. The shape of the antennal club is unique within the genus.

Natural history. See comments above on *Lebioderus brancuccii* sp.nov. of the same locality and collected by the same technique.

Paussus hystrix Westwood, 1850

(Fig. 4)

Material examined. 1 female, body length from tip of head to tip of elytra 6.9 mm, to tip of pygidium 7.3 mm (NHMB); Lao, Phongsaly prov., 21°41–2'N 102°06–8'E, 28.v.–20.vi.2003, Phongsaly env., ~1500m, Brancucci leg.

Collecting details. Collected in the afternoon from the outside of a white house wall (different house and settlement as for *P. waterhousii*) (personal information of M. Brancucci).

Distribution. The species has previously been reported from China (Hongkong and Jiangsu province). This is the first record for Laos and which considerably extends the known distribution of the species.

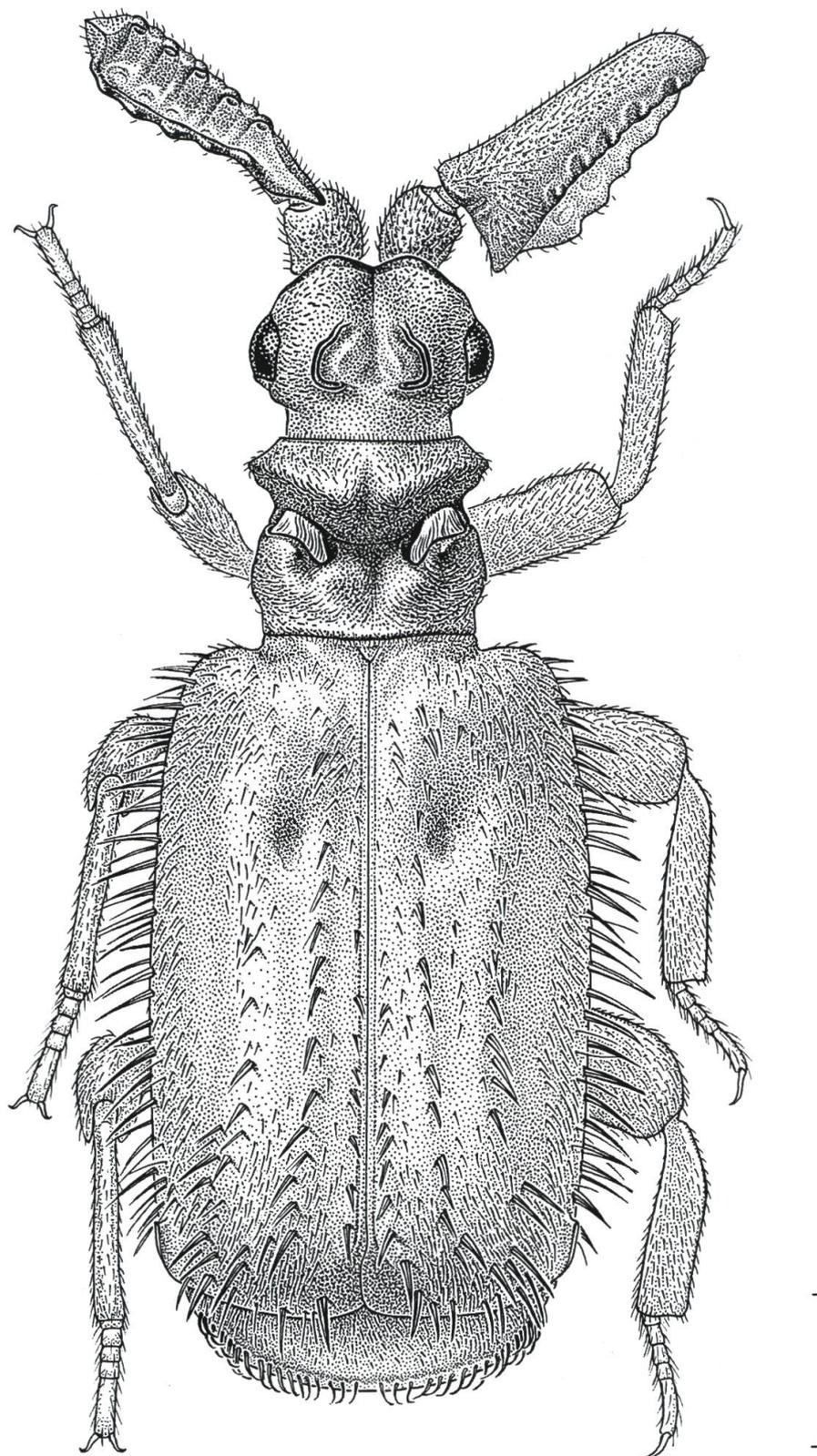


Fig. 4. *Paussus hystrix* Westwood, 1850: female specimen from Laos, Phongsaly prov., leg. Brancucci (see text). Scale bar 1 mm.

***Paussus waterhousii* Westwood, 1874**

(Fig. 5)

Material examined. 1 female, body length from tip of head to tip of elytra 6.5 mm, to tip of pygidium 6.7 mm (NHMB); Lao, Phongsaly prov., 21°41–2'N 102°06–8'E, 28.v.–20.vi.2003, Phongsaly env., ~1500m, Brancucci leg.

Collecting details. Collected in the afternoon from the outside of a white house wall (different house and settlement as for *P. hystrix*) (personal information of M. Brancucci).

Distribution. The species has been known from Sumatra, Peninsula Malaysia, Burma, and China (Kiang-si = Jiangxi). This is the first record for Laos.

Discussion. The present specimen has about the same size as the holotype specimen ("lin. 3.25" = 6.5 mm) but differs from the original description and accompanying figure (WESTWOOD 1874) by its shorter antennal club and the broader hind part of the pronotum combined with the side angles of the anterior part not so much produced. I would have attributed these differences to sexual dimorphism. However, these differences in the shape of the pronotum have already been mentioned by WASMANN (1899) and FOWLER (1912) who most probably observed males and females. Most likely this wide-spread species shows geographical variation in these morphological characters.

Taxonomic arrangement and list of Paussinae recorded from Laos

Apart from a few endemics one may expect in Laos most species reported to occur in "Indochina" or the immediately adjoining countries Thailand, Burma, China, Vietnam, and Cambodia. Currently only nine species are known from the country. Four species have been added by the NHMB collecting trips, and a fifth new record is based on the present author's unpublished records of other museum collections (taxonomic classification according to NAGEL 2003 and GEISELHARDT *et al.* 2007, cf. DI GIULIO *et al.* 2003):

OZAENINI HOPE, 1838*Anentmetus spissicornis* (Fairmaire, 1889)

Literature record: Laos, entre Luang-Prabang et Theng (FAIRMAIRE 1889, LESNE 1904)

Eustra lao Deuve, 2000

Literature record: Laos, entre Vientiane et Louang Prabang, environs de Vang Vieng, grotte de Tham Palusi, 22.xii.1999, leg. Louis Deharveng; Laos, environs de Vang Vieng, grotte de Tham None, 1.i.2000, leg. Anne Bedos & Louis Deharveng (DEUVE 2000).

Itamus castaneus Schmidt-Goebel, 1867

Literature records: Laos, Ban Houei Soui, leg. R. Vitalis de Salvaza; Laos, Xieng Om, leg. R. Vitalis de Salvaza (ANDREWES 1923).

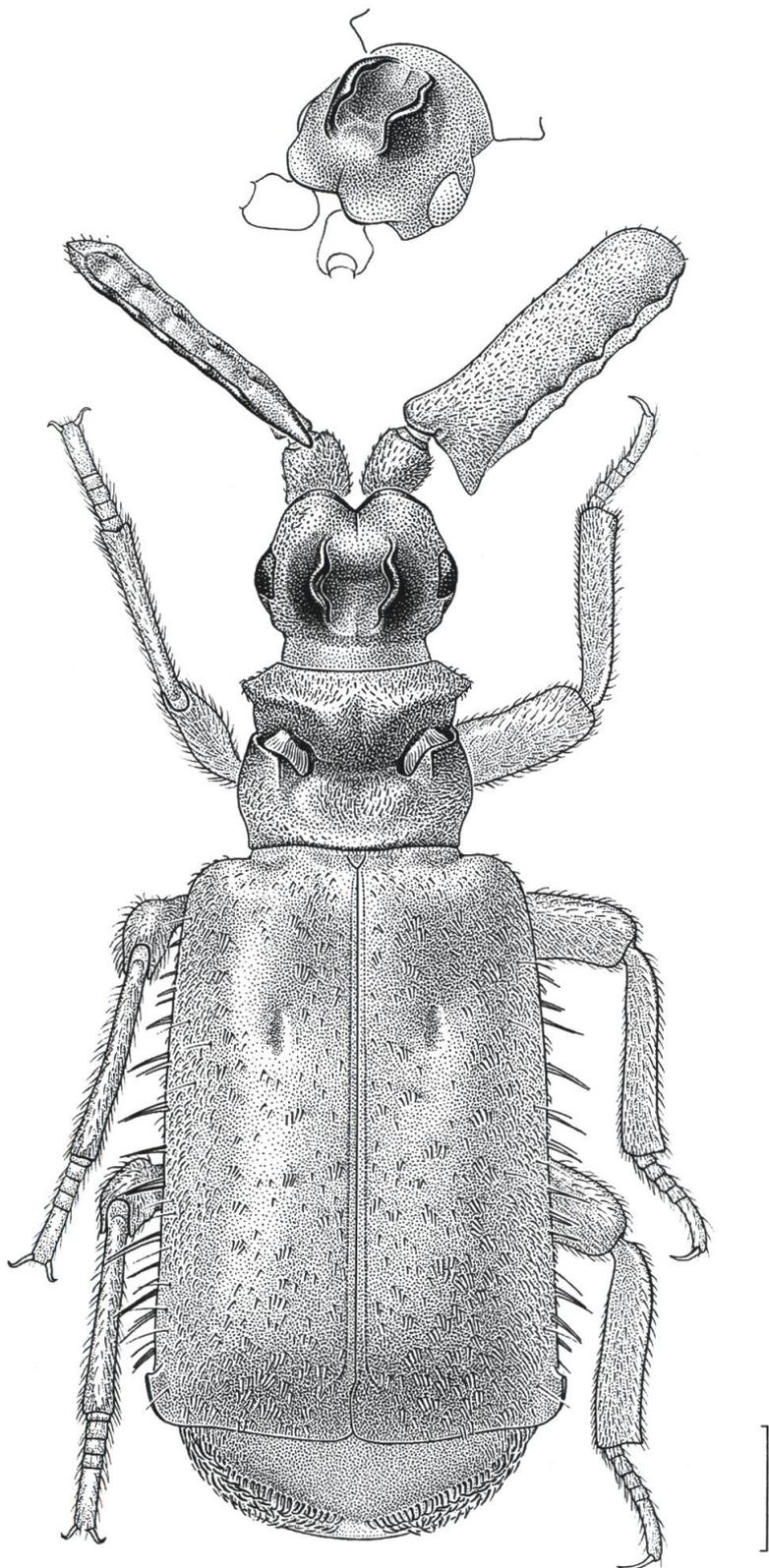


Fig. 5. *Paussus waterhousii* Westwood, 1874: female specimen from Laos, Phongsaly prov., leg. Brancucci (see text). Scale bar 1 mm.

PAUSSINI LATREILLE, 1807**Platyrhopalina Jeannel, 1946***Lebioderus brancuccii* sp.nov.

Present paper: Laos, Xieng Khouang prov., 19°38.2'N 103°20.2'E, Ban Na Lam → Phou Sane Mt., 20.–30.v.2009, 1420m, leg. D.Hauck, M. Brancucci.

Platyrhopalopsis picteti (Westwood, 1874)

Material examined: Laos, 20.x.1968, Ban Khenn, 70 km NW Vientiane, leg. Rondon (MNHN Paris); Laos, Vientiane, Municipal, Phou Khao, Khouay NBKA, Ban Van Hua env., 800–1000m, M.Pejcha lgt. (Coll. Schüle, Nufingen, Germany); Laos, Umgeb. Paksé, 1964 (ZSM).

Ceratoderina Darlington, 1950*Melanospilus yamasakoi* (Maruyama, 2009)

Literature record: Laos, Ban Phu Yang, E. Phu Khun 15 km, Louang Phabang prov., 25.–27.v.2007, J.Yamasako leg. (MARUYAMA 2009).

Paussina Latreille, 1807*Paussus lanxangensis* sp.nov.

Present paper: Laos-NE, Xieng Khouang prov., 19°38.2'N 103°20.2'E, Ban Na Lam → Phou Sane Mt., 20.–30.v.2009, 1420m, D.Hauck leg.

Paussus hystrix Westwood, 1850

Present paper: Lao, Phongsaly prov., 21°41–2'N 102°06–8'E, 28.v.–20.vi.2003, Phongsaly env., ~1500m, Brancucci leg.

Paussus waterhousii, Westwood, 1874

Present paper: Lao, Phongsaly prov., 21°41–2'N 102°06–8'E, 28.v.–20.vi.2003, Phongsaly env., ~1500m, Brancucci leg.

Acknowledgements

I am grateful to Michel Brancucci, Basel, for the provision of the valuable specimens for identification and description. Mrs. Eva Weber, Basel, made all drawings at the usual high level of accuracy. I am very grateful to her. I also gratefully acknowledge the editing of English in the manuscript by Simon Loader, Basel.

References

- ANDREWES H. E. (1923): *On the Types of Carabidae described by Schmidt-Goebel in his Faunula Coleopterorum Birmaniae*. The Transactions of the Entomological Society of London **1923 (Parts I/II)**: 1–63.
- ANDREWES H. E. (1929): *The Fauna of British India, including Ceylon and Burma: Coleoptera. Carabidae. Vol. I. Carabinae*. London, Taylor and Francis, XVIII+431 pp., map, 9 plates.
- ANDREWES H. E. (1930): *Catalogue of Indian Insects. Part 18, Carabidae*. Calcutta, Government of India, XXII+389 pp.
- DESNEUX J. (1905): *Coleoptera Adepaga. Fam. Paussidae*. Genera Insectorum (P. Wytzman ed.) **35**: 1–34, 2 Planches.

- DEUVE T. (2000): *Un nouveau genre de Trechinae aphaenopsien et une nouvelle Eustra microphthalme, cavernicoles dans un karst du Laos (Coleoptera, Trechidae et Paussidae)*. Revue française d'Entomologie, N.S. **22 (1)**: 37–42.
- DI GIULIO A., FATTORINI S., KAUPP A., VIGNA TAGLIANTI A. & NAGEL P. (2003): *Review of competing hypotheses of phylogenetic relationships of Paussinae (Coleoptera: Carabidae) based on larval characters*. Systematic Entomology **28(4)**: 509–537.
- FAIRMAIRE L. (1889): *Descriptions de Coléoptères de l'Indo-Chine*. Annales de la Société entomologique de France, **6e série, 8 (1888)**: 333–378.
- FOWLER W. W. (1912): *The Fauna of British India, including Ceylon and Burma. Coleoptera. General Introduction and Cicindelidae and Paussidae*. London, Taylor and Francis, XX+529 pp.
- GEISELHARDT S. F., PESCHKE K., NAGEL P. (2007): *A review of myrmecophily in ant nest beetles (Coleoptera: Carabidae: Paussinae): linking early observations with recent findings*. Naturwissenschaften **94(11)**: 871–894.
- LESNE P. (1904): *Famille des Carabides*. Pp 62–81. In: PAVIE A. (ed.): *Mission Pavie Indo-Chine 1879–1895. Etudes Diverses. Tome III. Recherches sur l'Histoire Naturelle de l'Indo-Chine Orientale*. Paris, Ernest Leroux.
- LUNA DE CARVALHO E. (1989): *Essai monographique des Coléoptères Protopaussines et Paussines*. Memórias do Instituto de Investigação Científica Tropical, **2a serie, 70 (1987)**: 1–1028.
- MARUYAMA M. (2005): *Some additional or new records of Paussinae (Carabidae) from Asia*. Elytra (Tokyo) **33(2)**: 648.
- MARUYAMA M. (2009): *A New Species of the Genus Merismoderus (Coleoptera, Carabidae, Paussinae) from Laos, with a revised Key of the Genus and a new Combination*. Esakia (Fukuoka) **49**: 107–109.
- MARUYAMA M., KATAYAMA Y., SAKCHOOWONG W. & NOMURA S. (2008): *First Record of Lebioderus (Coleoptera, Carabidae, Paussinae) from the Indochinese Peninsula, with Description of a New Species*. Esakia (Fukuoka) **48**: 47–49.
- MITTERMEIER R. A., ROBLES GIL P., HOFFMAN M., PILGRIM J., BROOKS T., GOETTSCH MITTERMEIER C., LAMOREUX J. & DA FONSECA G. A. B. (2004): *Hotspots Revisited*. Mexico City: Cemex, 392 pp.
- MOORE W. (2006): *Molecular Phylogenetics, Systematics, and Natural History of the Flanged Bombardier Beetles (Coleoptera: Adephaga: Carabidae: Paussinae)*. PhD Thesis, Department of Entomology, The University of Arizona, Tucson, 293 pp.
- MOORE W. (2008): *Phylogeny of the Western Hemisphere Ozaenini (Coleoptera: Carabidae: Paussinae) Based on Sequence Data*. Annals of Carnegie Museum **77(1)**: 79–92.
- NAGEL P. (1987): *Arealsystemanalyse afrikanischer Fühlerkäfer (Coleoptera, Carabidae, Paussinae). Ein Beitrag zur Rekonstruktion der Landschaftsgenese*. Stuttgart, Franz Steiner Verlag Wiesbaden GmbH, 233 pp, 28 Abb., 71 Karten.
- NAGEL P. (2003): *Paussinae*. Pp 208–211. In: LÖBL I. & SMETANA A. (eds.): *Catalogue of Palaearctic Coleoptera. Vol.1*. Stenstrup, Apollo Books.
- NAGEL P. (2006): *Ant Nest Beetles of the Carnegie Museum (Coleoptera: Carabidae: Paussinae: Paussini)*. Annals of Carnegie Museum **75 (3)**: 181–202.
- SAHA S. K., HALDER S. K. & BISWAS S. (1995): *Insecta: Coleoptera: Adephaga: Fam. Rhysodidae, Paussidae and Cicindelidae*. Zoological Survey of India. State Fauna Series 3: Fauna of West Bengal **6(A)**: 1–51.
- WASMANN E. (1899): *Neue Paussiden, mit einem biologischen Nachtrag*. Notes from the Leyden Museum **21(5)**: 33–52, Taf. 3, 4.
- WESTWOOD J. O. (1874): *Order-Coleoptera. Section-Pentamera. Family-Paussidae*. Pp 72–96, pls. 15–19. In: WESTWOOD J. O. (ed.): *Thesaurus Entomologicus Oxoniensis*. Oxford, Clarendon Press.

Author's address:

Prof. Dr. Peter Nagel
 University of Basel
 Department of Environmental Sciences
 Section of Biogeography
 St.Johanns-Vorstadt 10
 CH-4056 Basel
 SWITZERLAND

Homepage: www.biogeography.unibas.ch
 E-mail: peter.nagel@unibas.ch

