ZooKeys 251: 1–10 (2012)
doi: 10.3897/zookeys.251.4516
www.zookeys.org

EDITORIAL

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

# Accelerating innovative publishing in taxonomy and systematics: 250 issues of ZooKeys

Terry Erwin[1,†], Lyubomir Penev[2,‡], Pavel Stoev[2,§], Teodor Georgiev[3,§]

**1** *Smithsonian Institution, Washington, DC, USA* **2** *Bulgarian Academy of Sciences & Pensoft Publishers, Sofia, Bulgaria* **3** *Pensoft Publishers, Sofia, Bulgaria*

Corresponding author: *Lyubomir Penev* (info@pensoft.net)

Received 11 December 2012 | Accepted 17 December 2012 | Published @@ December 2012

**Citation:** Erwin T, Penev L, Stoev P, Georgiev T (2012) Accelerating innovative publishing in taxonomy and systematics: 250 issues of ZooKeys. ZooKeys 251: 1–10. doi: 10.3897/zookeys.251.4516

'*Every good product I've ever seen is because a group of people cared deeply about making something wonderful that they and their friends wanted. They wanted to use it themselves*'
Steve Jobs

On 13[th] of December ZooKeys published issue 250, the 76-page monograph "Introduction of the *Exocelina ekari*-group with descriptions of 22 new species from New Guinea (Coleoptera, Dytiscidae, Copelatinae)" by Shaverdo et al. (2012). Likewise, this semiquincentennial issue is a milestone for the editorial team to take a look back and evaluate the journal's progress in the past year.

The year 2012 has been important for the journal and the entire zoological community in many aspects. On the 4th of September, the International Commission on Zoological Nomenclature (ICZN) passed an amendment that considers a publication in a digital scientific journal 'legitimate' if meeting archiving criteria and the publication is registered at the ICZN's official online registry, ZooBank. Pensoft was among the first supporters of the open-access idea, and one of the most active advocates of the e-only publishing of taxonomic data. Taking this into account and as recognition of Pensoft's active role in promotion of taxonomy, the Commission decided to announce the Amendment of the Code in ZooKeys (ICZN 2012). This revolutionary change in ICZN publication rules will undoubtedly speed the process of publishing biodiversity information and improve access to this information.

As a result of a fruitful collaboration, The Encyclopedia of Life (EOL) and ZooKeys on February 10th, 2012 announced a new joint project (EOASP) aimed at increasing the flow of new species descriptions from scientists in developing countries into the Encyclopedia of Life and promoting the open access publishing model in taxonomy. Another goal of this initiative was to support and educate the next generation of taxonomists in open science principles and to motivate publishers to modernize their publishing models and workflows to fit the changing needs of scientists and researchers around the world. Up to now, the EOASP project has supported 22 articles, in which 32 species, 7 genera and 1 family were described as new to sciences, and several more taxa were re-described.

The EOASP project was preceeded by another joint initiative with EOL called "Fabulous New Species collection" launched in January 2012. Its main aim was to bring together and promulgate the scientifically notable new taxa described every year in ZooKeys and other Pensoft's journals and simultaneously registered in EOL. A short annotation written in a popular language explains why the new species is interesting in an attempt to draw the attention of the general public and the world mass media to it.

In 2012, a new pilot project for establishing the Online Identification Key (OIK) as a new type of scientific article that is a derivative of the Data Paper was put forward by ZooKeys. The publication of an online key in the form of a scholarly article is a pragmatic compromise between the dynamic structure of the internet and the static character of scientific articles. The authors of the keys will be able to continuously update their products, to the benefit of users. At the same time, the users will have available a citation mechanism for the online key, identical to that used for any other scientific article, to properly credit its author(s). The model is illustrated by an exemplar paper describing a new software platform for creating online keys, MOSCHweb (Cerretti et al. 2012). The paper describes the main features of an interactive key to the Euro-Asiatic genera of tachinid flies implemented as an original web application and discusses briefly the advantages of these tools for both biologists and general users.

The year 2012 will be remembered also with the ZooKeys special issue "No specimen left behind: mass digitization of natural history collections" initiated by the Natural History Museum in London. The editors Vince Smith and Vladimir Blagoderov brought together 18 papers by 81 authors to look at progress and prospects for mass digitizing of entire natural history collections. The compendium examines recent advances in imaging systems and data gathering techniques, combined with more collaborative approaches to digitization. Examples of research covered by the articles include a description of efforts to digitize 30 million plant, insect and vertebrate specimens at NCB Naturalis in the Netherlands; new scanning and telemicroscopy solutions to digitize the millions of pinned insect specimens held in the Australian National Insect Collection and its European and North American counterparts; and, new data portals providing central access to millions of biological specimens across Europe, etc.

The discovery of any organism in the world matters equally, be it a minute insect or a mammal. Several newly discovered animals published in ZooKeys at the verge of 2011/2012 and in 2012 were of immense interest and attracted the attention of the global society. These include, among others, the world's smallest tetrapode, the largest wasp, and the leggiest animal, as well as a new fanged dinosaur from Africa and new family of cave spiders from the USA. In December 2011, ZooKeys announced the publication of the world's smallest vertebrates – the New Guinean frogs *Paedophryne dekot* and *Paedophryne verrucosa,* which average length rarely exceeds 8–9 mm (Kraus 2011). The press release associated with the publication grabbed the interest of the world's media and shortly reached 44, 000 views – an absolute record for ZooKeys – in Eurekalert! alone. Shortly after the publication even smaller species of the same genus were found in New Guinea and published in PLoS One (Rittmeyer et al. 2012).

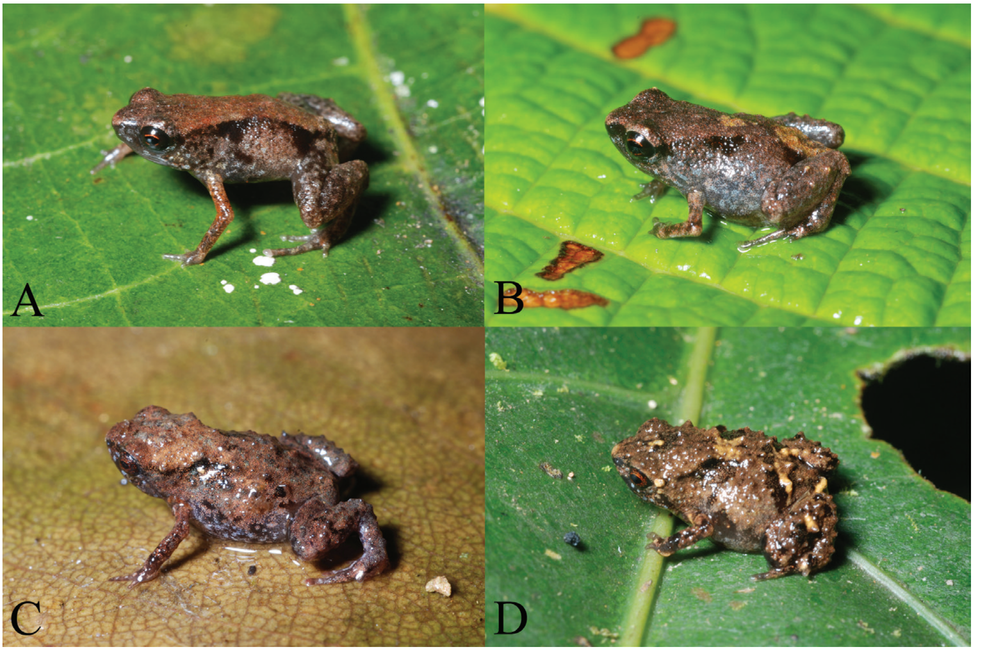



**Figure 1.** Portraits in life of *Paedophryne dekot* (A, B) and *Paedophryne verrucosa* (C, D). Photos: Fred Kraus, 2011. ZooKeys: doi: 10.3897/zookeys.154.1963.

A new species of plant-eating dinosaur, named *Pegomastax africanus*, or "thick jaw from Africa", was described in ZooKeys by Professor Paul Sereno of the University of Chicago in October 2012 (Sereno 2012). The new species had a short, parrot-shaped beak up front, a pair of stabbing canines and tall teeth tucked behind for slicing plants. The dinosaur was of cat size and lived some 200 million years ago in Africa. It was placed by its finder in the heterodontosaurs or "different toothed reptiles," that were among the first dinosaurs to spread across the planet. The discovery was featured by all the world's leading news media, e.g.,: **BBC**: Dwarf 'vampire dinosar was a plant eater, **CNN**: Scientist describes fruit-loving, housecat-sized dino, **National Geographic**: New fanged dwarf dinosaur found, "Would be nice pet", **New York Times**: Bizarre species of miniature dinosaur identified, **The Guardian**: "Fanged vampire parrot" identified as a new species of dinosaur, **Scientific American**: Diminutive dinosaur bore beak, bristles and fangs, **USA Today**: Fanged dinosaur feasted on fruit, **Time**: A parrot-headed, big-fanged, porcupine dinosaur.

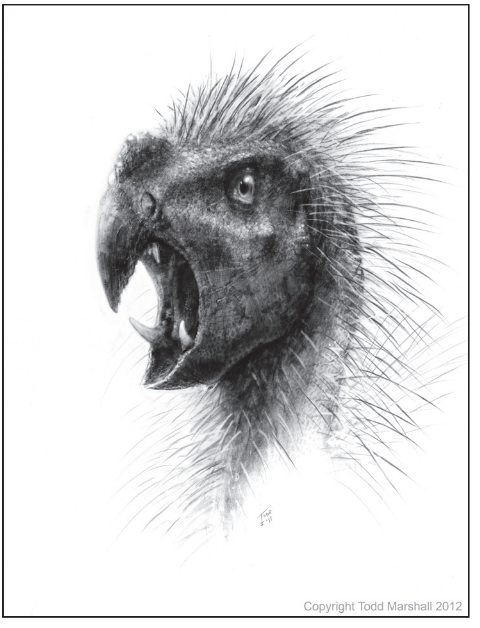



**Figure 2.** The head of *Pegomastax africanus*. Reconstruction by Todd Marshall, 2012.

An unusually large wasp species, named by the authors *Megalara garuda*, was discovered during an expedition to the Indonesian island of Sulawesi (Kimsey and Ohl 2012). With a body size of 32–34 mm and fearful jaws in males, the new species differs from all known related digger wasps, so much so that it was placed in a new genus of its own, *Megalara*.

**Figure 3.** Habitus of *Megalara garuda*. Photo: Kimsey and Ohl, 2012. ZooKeys: doi: 10.3897/zookeys.177.2475

A team of citizen scientists from the Western Cave Conservancy and arachnologists from the California Academy of Sciences found in caves in southwest Oregon, USA, a new, previously unknown family of spiders, named Trogloraptoridae (after the genus *Trogloraptor* or "cave robber") that was published in ZooKeys in August 2012 (Griswold et al. 2012). The discovery has turned into the most visited ZooKeys paper ever, with more than 34,000 at the time of publishing this Editorial. The paper was also featured by CNN, The New York Times, Scientific American and on BBC Today, among many other media. The new species is named for its cave home and spectacular, elongate claws.

International recognition was received also on the discovery of *Kollasmosoma sentum*, a new tiny parasitic braconid wasp with unusual behavior (Gómez Durán and Achterberg 2011). It was selected by the International Institute for Species Exploration and included in their 2011 top 10 list of world's most interesting new species.

**Figure 4.** Habitus of live *Trogloraptor marchingtoni*. Photo: Griswold et al. 2012. ZooKeys: doi: 10.3897/zookeys.215.3547

Marek et al. (2012) re-described the leggiest animal in the world, the millipede *Illacme plenipes*, re-discovered several years ago in California. The females have up to an astounding 750 legs, outclassing the males who only have a maximum leg count of 562. Not only is this species the leggiest animal known on the planet, it also has surprising anatomical features: body hairs that produce silk, a jagged and scaly translucent exoskeleton, and comparatively massive (given its diminutive size) antennae that are used to feel its way through the dark because it lacks eyes. The video associated with the publication enjoyed more than 46,500 views in YouTube within only a month.

**Figure 5.** Habitus of live *Illacme plenipes* ♀ with 170 segments and 662 legs. Photo: Marek et al. 2012. ZooKeys: doi: 10.3897/zookeys.241.3831

## Four and a half years ZooKeys

From the 4th of July 2008 until the 10th of December 2012 the number of published articles and monographs has reached 1,245 or 32,416 pages overall. The number of published pages has grown from 11,344 in 2011 to 12,292 in 2012 (Fig. 6). Based on the analysis of 40 randomly selected papers published in 2012, the average publication time (from submission to publication) is 95 days. The average time from submission to acceptance is 72 days, and from acceptance to publication – 23 day.

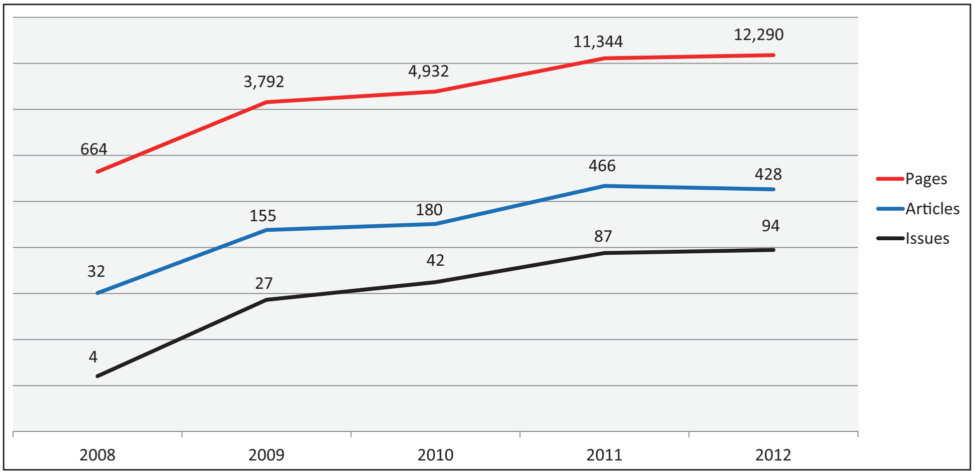



**Figure 6.** Total number of published pages, articles and issues for the period 2008–2012.

Altogether, 2,904 new species-group, 233 new genus-group and 19 new family-group taxa have been published in the journal since its launch. Another 69 are currently in press (being registered in ZooBank) and will probably be published by the end of 2012 or early 2013. This makes 2,973 new taxa in total.

The top 10 most accessed ZooKeys papers through the 10th of December 2012 are listed in Table 1. The remarkable discovery of the new spider family Trogloraptoridae by Griswold et al. (2012) published in August is taking unquestioningly the lead with 33,492 page views, or approximately 20,000 views more than the Bouchard et al.'s monograph (2011) "Family-Group names in Coleoptera (Insecta)" taking a second place. The total number of views of the top 10 most accessed ZooKeys articles exceeds 135,000, which along with the fact that half of them were published in 2012, speaks enough of the continuous importance of the published content and the increasing interest in taxonomic community in the ZooKeys publications as a whole.

In 2012, ZooKeys continued to popularize the published research through press releases, which in most cases were broadly mirrored by the global science media and increased the visibility of the journal on the global scene. A list of the top 10 most accessed posted through EurekAlert! press releases of ZooKeys articles is given in Table 2. Top two places are taken by press releases that were viewed by more than 44,000 science media and individual journalists, third position lying far below that number attracting the attention of 'only' around 16,000 communication experts. The top three

**Table 1.** Top ten most viewed articles of ZooKeys (according to the ZooKeys website counter accessed on the 10th of December 2012).

| Article | Page views |
|---|---|
| Griswold et al. 2012 – An extraordinary new family of spiders from caves in the Pacific Northwest (Araneae, Trogloraptoridae, new family) | 34,003 |
| Bouchard et al. 2011 – Family-Group names in Coleoptera (Insecta) | 13,619 |
| Winterton et al. 2012 – A charismatic new species of green lacewing discovered in Malaysia (Neuroptera, Chrysopidae): the confluence of citizen scientist, online image database and cybertaxonomy | 12,776 |
| Sereno 2012 – Taxonomy, morphology, masticatory function and phylogeny of heterodontosaurid dinosaurs | 12,724 |
| Penev et al. 2009 – Data publication and dissemination of interactive keys under the open access model | 12,307 |
| Kraus 2011 – At the lower size limit for tetrapods, two new species of the miniaturized frog genus *Paedophryne* (Anura, Microhylidae) | 12,139 |
| Hagedorn et al. 2012 – Creative Commons licenses and the non-commercial condition: Implications for the re-use of biodiversity information | 10,885 |
| Kimsey and Ohl 2012 – *Megalara garuda*, a new genus and species of larrine wasps from Indonesia (Larrinae, Crabronidae, Hymenoptera) | 9,698 |
| Sereno and Larsson 2009 – Cretaceous Crocodyliforms from the Sahara | 9,392 |
| Baldwin et al. 2011 – Seven new species within western Atlantic *Starksia atlantica*, *S. lepicoelia*, and *S. sluiteri* (Teleostei, Labrisomidae), with comments on congruence of DNA barcodes and species | 8,087 |
| **Total** | **135,119** |

**Table 2.** Top 10 most accessed press releases of ZooKeys articles posted through EurekAlert! (from the EurekAlert! counter) for the period 1 December 2011 – 10 December 2012. The counter registers only the downloads from EurekAlert! mostly by science media and journalists. The actual number of readers may actually be a much higher than this number.

| Title | Author/s and year of publication of the original article | Date posted | Page views since posted |
|---|---|---|---|
| Megalara garuda: the King of Wasps: A new, giant wasp comes from Indonesia | Kimsey, Ohl 2012 | 23-Mar-2012 | 44,669 |
| World's smallest frogs discovered in New Guinea | Kraus 2011 | 12-Dec-2011 | 44,247 |
| Spider version of Bigfoot emerges from caves in the Pacific Northwest | Griswold et al. 2012 | 17-Aug-2012 | 16,361 |
| The Auburn Tiger trapdoor spider -- a new species discovered from a college town backyard | Bond et al. 2012 | 8-May-2012 | 5,012 |
| Millipede border control better than ours | Mesibov 2011 | 23-Dec-2011 | 4,592 |
| 9 colorful and endangered tree-dwelling tarantulas discovered in Brazil | Bertani 2012 | 30-Oct-2012 | 4,252 |
| DNA barcoding verified the discovery of a highly disconnected crane fly species | Pilipenko et al. 2012 | 18-May-2012 | 4,205 |
| Scorpio rising: An elusive new scorpion species from California lives underground | Webber et al. 2012 | 23-Mar-2012 | 3,247 |
| Italian vineyards invaded from North America by new species of leafminer | Nieukerken et al. 2012 | 23-Feb-2012 | 3,160 |
| A new, beautifully colored lizard discovered in the Peruvian Andes: Named 'mountain dweller', it is the highest-altitude living member of its genus | Chávez, Vásquez 2012 | 17-Feb-2012 | 3,093 |

most accessed press releases logically find place also in the "top 10" list of most viewed papers on the ZooKeys website.

In conclusion, Pensoft Publishers' flagship taxonomic journal ZooKeys continues to experience growth in 2012. Furthermore, ZooKeys continues to evolve its editorial workflow, constantly implementing new and improved publishing and dissemination technologies, thus always being on point for digital biodiversity science. This is backed up by the fact that the Impact Factor of ZooKeys has increased from 0.517 to 0.897 in 2011, and is expected to continue growing due to the high quality and great visibility of the published content. We are deeply indebted to all our authors, reviewers, subject editors, and readers, and journalistic followers without whose support ZooKeys would not have become such a successful journal! We also thank Rich Pyle for providing information on the new taxa registered in ZooBank.

## References


Baldwin CC, Castillo CI, Weigt LA, Victor BC (2011) Seven new species within western Atlantic *Starksia atlantica*, *S. lepicoelia*, and *S. sluiteri* (Teleostei, Labrisomidae), with comments on congruence of DNA barcodes and species. ZooKeys 79: 21–72. doi: 10.3897/zookeys.79.1045

Bertani R (2012) Revision, cladistic analysis and biogeography of *Typhochlaena* C. L. Koch, 1850, *Pachistopelma* Pocock, 1901 and *Iridopelma* Pocock, 1901 (Araneae, Theraphosidae, Aviculariinae). ZooKeys 230: 1–94. doi: 10.3897/zookeys.230.3500

Blagoderov V, Smith VS (2012) Bringing collections out of the dark. In: Blagoderov V, Smith VS (Ed) No specimen left behind: mass digitization of natural history collections. ZooKeys 209: 1–6. doi: 10.3897/zookeys.209.3699

Bond JE, Hamilton CA, Garrison NL, Ray CH (2012) Phylogenetic reconsideration of *Myrmekiaphila* systematics with a description of the new trapdoor spider species *Myrmekiaphila tigris* (Araneae, Mygalomorphae, Cyrtaucheniidae, Euctenizinae) from Auburn, Alabama. ZooKeys 190: 95–109. doi: 10.3897/zookeys.190.3011

Bouchard P, Bousquet Y, Davies AE, Alonso-Zarazaga MA, Lawrence JF, Lyal CHC, Newton AF, Reid CAM, Schmitt M, Ślipiński SA, Smith ABT (2011) Family-group names in Coleoptera (Insecta). ZooKeys 88: 1–972. doi: 10.3897/zookeys.88.807

Cerretti P, Tschorsnig H-P, Lopresti M, Di Giovanni F (2012) MOSCHweb — a matrix-based interactive key to the genera of the Palaearctic Tachinidae (Insecta, Diptera). ZooKeys 205: 5–18. doi: 10.3897/zookeys.205.3409

Chávez G, Vásquez D (2012) A new species of Andean semiaquatic lizard of the genus *Potamites* (Sauria, Gymnophtalmidae) from southern Peru. ZooKeys 168: 31–44. doi: 10.3897/zookeys.168.2048

Gómez Durán J-M, van Achterberg C (2011) Oviposition behaviour of four ant parasitoids (Hymenoptera, Braconidae, Euphorinae, Neoneurini and Ichneumonidae, Hybrizontinae), with the description of three new European species. ZooKeys 125: 59–106. doi: 10.3897/zookeys.125.1754

Griswold CE, Audisio T, Ledford JM (2012) An extraordinary new family of spiders from caves in the Pacific Northwest (Araneae, Trogloraptoridae, new family). ZooKeys 215: 77–102. doi: 10.3897/zookeys.215.3547

Hagedorn G, Mietchen D, Morris RA, Agosti D, Penev L, Berendsohn WG, Hobern D (2011) Creative Commons licenses and the non-commercial condition: Implications for the re-use of biodiversity information. In: Smith V, Penev L (Eds) e-Infrastructures for data publishing in biodiversity science. ZooKeys 150: 127–149. doi: 10.3897/zookeys.150.2189

International Commission on Zoological Nomenclature (2012) Amendment of Articles 8, 9, 10, 21 and 78 of the International Code of Zoological Nomenclature to expand and refine methods of publication. ZooKeys 219: 1–10. doi: 10.3897/zookeys.219.3944

Kimsey LS, Ohl M (2012) *Megalara garuda*, a new genus and species of larrine wasps from Indonesia (Larrinae, Crabronidae, Hymenoptera). ZooKeys 177: 49–57. doi: 10.3897/zookeys.177.2475

Kraus F (2011) At the lower size limit for tetrapods, two new species of the miniaturized frog genus *Paedophryne* (Anura, Microhylidae). ZooKeys 154: 71–88. doi: 10.3897/zookeys.154.1963

Marek PE, Shear WA, Bond JE (2012) A redescription of the leggiest animal, the millipede *Illacme plenipes*, with notes on its natural history and biogeography (Diplopoda, Siphonophorida, Siphonorhinidae). ZooKeys 241: 77–112. doi: 10.3897/zookeys.241.3831

Mesibov R (2011) A remarkable case of mosaic parapatry in millipedes. In: Mesibov R, Short M (Eds) Proceedings of the 15th International Congress of Myriapodology, 18-22 July 2011, Brisbane, Australia. ZooKeys 156: 71–84. doi: 10.3897/zookeys.156.1893

Nieukerken EJ van, Wagner DL, Baldessari M, Mazzon L, Angeli G, Girolami V, Duso C, Doorenweerd C (2012) *Antispila oinophylla* new species (Lepidoptera, Heliozelidae), a new North American grapevine leafminer invading Italian vineyards: taxonomy, DNA barcodes and life cycle. ZooKeys 170: 29–77. doi: 10.3897/zookeys.170.2617

Penev L, Sharkey M, Erwin T, van Noort S, Buffington M, Seltmann K, Johnson N, Taylor M, Thompson FC, Dallwitz MJ (2009) Data publication and dissemination of interactive keys under the open access model: ZooKeys working example. ZooKeys 21: 1–17. doi: 10.3897/zookeys.21.274

Penev L, Cerretti P, Tschorsnig H-P, Lopresti M, Di Giovanni F, Georgiev T, Stoev P (2012) Publishing online identification keys in the form of scholarly papers. ZooKeys 205: 1–3. doi: 10.3897/zookeys.205.3581

Pilipenko VE, Salmela J, Vesterinen EJ (2012) Description and DNA barcoding of *Tipula* (*Pterelachisus*) *recondita* sp. n. from the Palaearctic region (Diptera, Tipulidae). ZooKeys 192: 51–65. doi: 10.3897/zookeys.192.2364

Rittmeyer EN, Allison A, Gründler MC, Thompson DK, Austin CC (2012) Ecological Guild Evolution and the Discovery of the World's Smallest Vertebrate. PLoS ONE 7(1): e29797. doi: 10.1371/journal.pone.0029797

Sereno PC (2012) Taxonomy, morphology, masticatory function and phylogeny of heterodontosaurid dinosaurs. ZooKeys 226: 1–225. doi: 10.3897/zookeys.226.2840

Sereno PC, Larsson HCE (2009) Cretaceous Crocodyliforms from the Sahara. ZooKeys 28: 1–143. doi: 10.3897/zookeys.28.325

Shaverdo HV, Surbakti S, Hendrich L, Balke M (2012) Introduction of the *Exocelina ekari*-group with descriptions of 22 new species from New Guinea (Coleoptera, Dytiscidae, Copelatinae). ZooKeys 250: 1–76. doi: 10.3897/zookeys.250.3715

Webber MM, Graham MR, Jaeger JR (2012) *Wernerius inyoensis*, an elusive new scorpion from the Inyo Mountains of California (Scorpiones, Vaejovidae). ZooKeys 177: 1–13. doi: 10.3897/zookeys.177.2562

Winterton SL, Guek HP, Brooks SJ (2012) A charismatic new species of green lacewing discovered in Malaysia (Neuroptera, Chrysopidae): the confluence of citizen scientist, online image database and cybertaxonomy. ZooKeys 214: 1–11. doi: 10.3897/zookeys.214.3220

ZooKeys 251: 11–19 (2012)
doi: 10.3897/zookeys.251.3616
www.zookeys.org

RESEARCH ARTICLE

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

# On the identity of the type species of the genus *Telema* (Araneae, Telemidae)

Chunxia Wang[1,3], Carles Ribera[2], Shuqiang Li[1]

**1** *Institute of Zoology, Chinese Academy of Sciences, Beijing 100101, China* **2** *Institut de Recerca de la Biodiversitat (IRBio) and Departament de Biologia Animal, Universitat de Barcelona, Avinguda Diagonal 645, 08028 Barcelona, Spain* **3** *University of Chinese Academy of Sciences, Beijing 100049, China*

Corresponding author: *Shuqiang Li* (lisq@ioz.ac.cn)

Academic editor: *Y. Marusik* | Received 3 July 2012 | Accepted 23 November 2012 | Published 18 December 2012

**Citation:** Wang C, Ribera C, Li S (2012) On the identity of the type species of the genus *Telema* (Araneae, Telemidae). ZooKeys 251: 11–19. doi: 10.3897/zookeys.251.3616

### Abstract

*Telema tenella* Simon, 1882, the type species of genus *Telema*, is the only species of family Telemidae reported from Europe and all other 39 congeners occur far from it. However, it has never been properly described. In this paper *T. tenella* is redescribed and illustrated.

### Keywords

Taxonomy, diagnosis, Haplogynae, cave, Eurasia

## Introduction

The genus *Telema* and its type species *T. tenella* were described by Eugene Simon (1882) in the family Leptonetidae. The genus was later treated as a member of the subfamily Teleminae by Fage (1913), which was subsequently elevated to the status of family level, Telemidae Fage, 1913, by Petrunkevitch (1923). The family Telemidae now contains 8 genera and 61 species (Platnick 2012) from tropical Africa, East and Southeast Asia, and North and Central America. Its type genus, *Telema* Simon, 1882, is the largest genus in the family, with 40 species occurring in Guatemala, Southwest Europe, and East and Southeast Asia.

Prior to make global revision of the genus we decided to study the type species, which is insufficiently known, and to redescribe it details. This can allow us and other researches to conduct regional revisions of *Telema*. Although several authors provided descriptions of the type species *T. tenella* (Simon 1893, Fage 1913, Yaginuma 1974, Ribera and Mateos 2000, Le Peru 2011), the morphological characters were not sufficiently detailed. Further, no information existed on the status of type material in Paris (Christine Rollard, personal communication). We made great efforts to find the species at the type locality, but failed. This suggested that *T. tenella* has a restricted distribution. The species is known from six localities in Mount Canigó (Juberthie 1985) in the French Department of the Oriental Pyrenees. All localities were above 900 meters in elevation. More recently, this species has been recorded from la Cova del Far in the province of Girona, Spain, at 1100 meters in elevation (Ribera and Mateos 2000). However, Juberthie (personal communication) indicated that no specimens were recovered in five localities of Mount Canigó, and a recently conducted (2006–2007) survey in Cova del Far (Girona-Spain) also failed to detect specimens.

We had the chance to collect some specimens of Telemidae in a cave near the type locality of *T. tenella* in 2011. The small cave was located next to Highway D115A, approximately 2000 meters from Banys de la Preste on the way to Prats of Molló, France (42°24.43'N, 2°24.37'E, elevation 1097 meters), which is approximately 9000 meters from the type locality. After comparing the specimen with original description, we treat them as *T. tenella*, the type species of *Telema*. Herein, we describe these specimens.

## Materials and methods

Specimens were collected by direct searching, and subsequently were examined and measured using a Leica M205 C stereomicroscope. Further details were studied and measured with an Olympus BX41 compound microscope. The copulatory organs were examined and illustrated after they were dissected from the spiders' bodies. Vulva were removed and treated in lactic acid before illustration. The right palp of male spider was illustrated. The specimens were preserved in an 80% ethanol solution. Photos were taken with an Olympus C7070 wide zoom digital camera (7.1 megapixels) mounted on an Olympus SZX12 stereomicroscope. The images were montaged using Helicon Focus image stacking software. All measurements were given in millimeters. Leg measurements were shown as: total length (femur, patella, tibia, metatarsus, tarsus). Leg segments were measured on their dorsal side.

The studied specimens were deposited in the Institute of Zoology, Chinese Academy of Sciences, Beijing (IZCAS).

## Taxonomy

**Family Telemidae Fage, 1913**
**Genus *Telema* Simon, 1882**

***Telema tenella* Simon, 1882**
http://species-id.net/wiki/Telema_tenella
Figs 1–5

*Telema tenella* Simon 1882: 205 (♂♀); Simon 1893: 284, f. 240, 244 (♂); Fage 1913: 510, pl. 48–49, f. 1–21 (♂♀); Yaginuma 1974: 15, f. 1 (♂); Le Peru 2011: 142, f. 176 (♂♀).

**Type material.** Not examined.

**Material examined.** 1 ♂ and 1 ♀ (IZCAS), unnamed cave, Banys de la Preste to Prats of Molló, France [42°24.43'N, 2°24.37'E, 1097 meters], Carles Ribera leg.

**Diagnosis.** *Telema tenella* differs from other congeners by the distinct shape of male palp and female spermatheca. It is most similar to *T. wunderlichi* Song & Zhu, 1994, a species from Hunan, China, but can be distinguished by the shape of carapace, five tiny denticles on the retromargin of chelicerae (four in *T. wunderlichi*) and bent embolus (straight in *T. wunderlichi*).

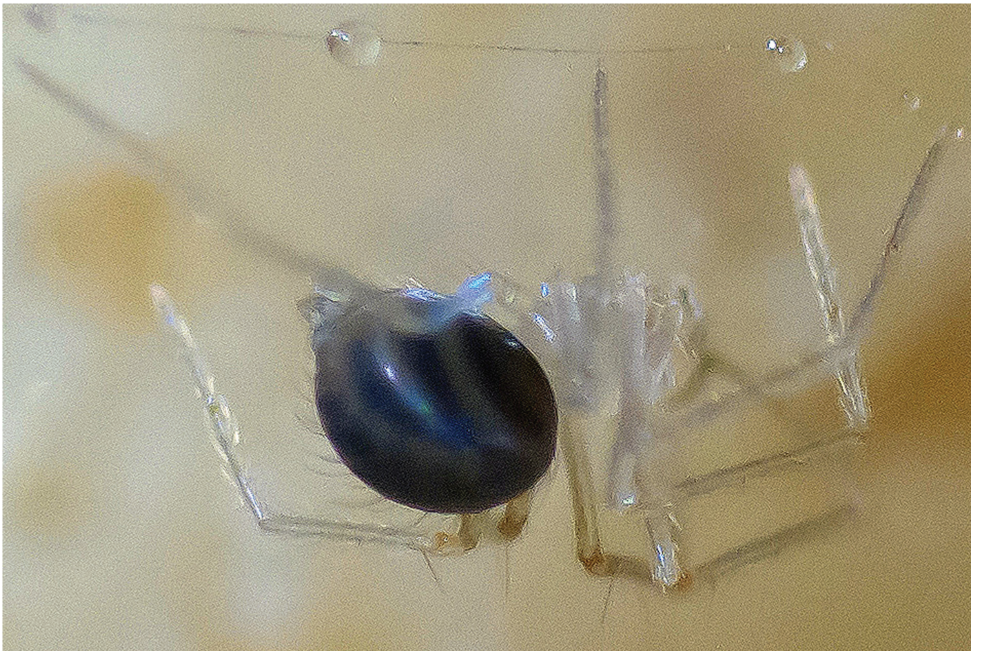


**Figure 1.** Subadult female hanging beneath web. Photo by Enric Planas in an unnamed cave in Banys de la Preste to Prats of Molló, France.

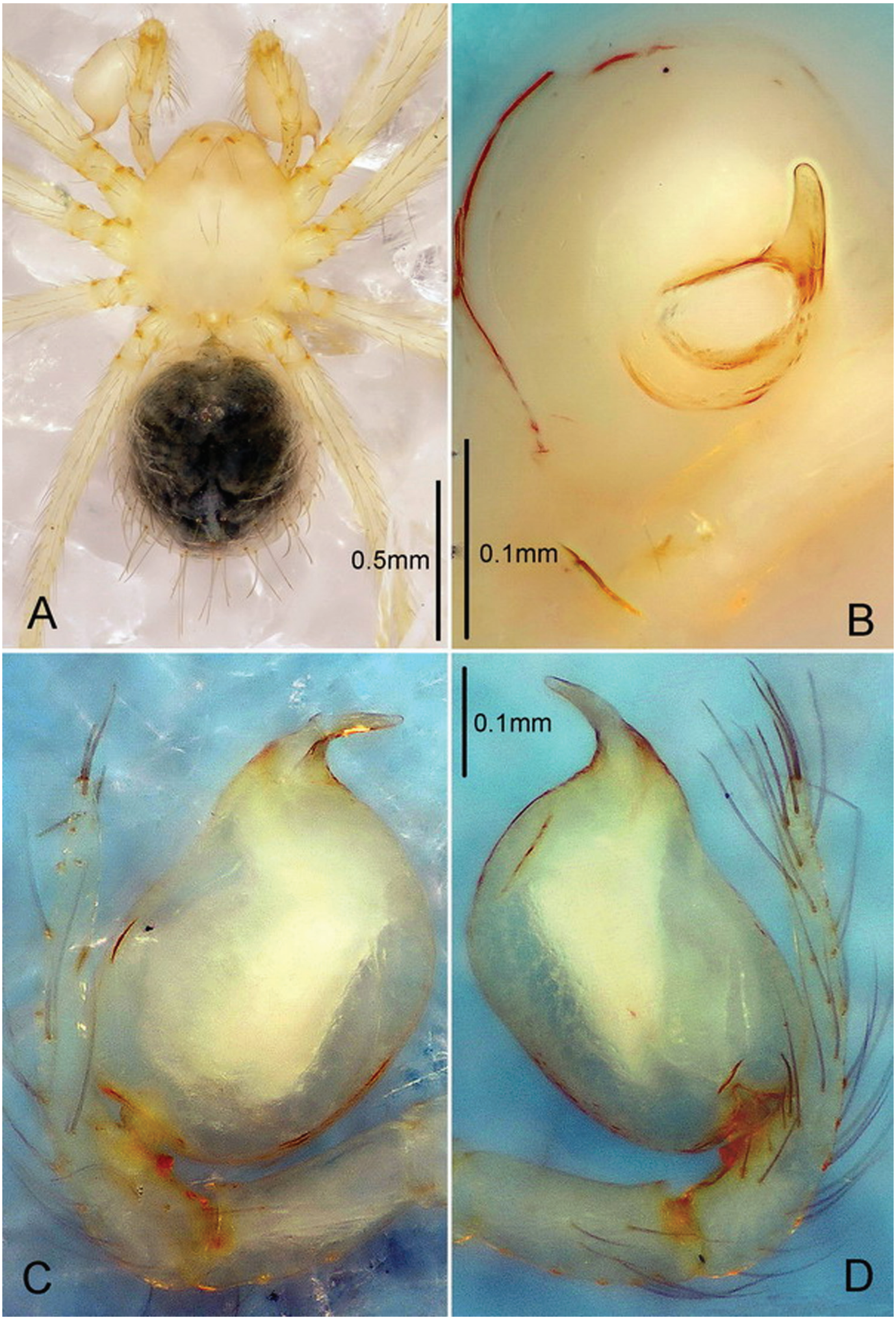



**Figure 2.** *Telema tenella*, male. Based on material from an unnamed cave in Banys de la Preste to Prats of Molló, France. **A** Habitus, dorsal view **B** Embolus tip, apical view **C** Right palp, retrolateral view **D** Right palp, prolateral view.

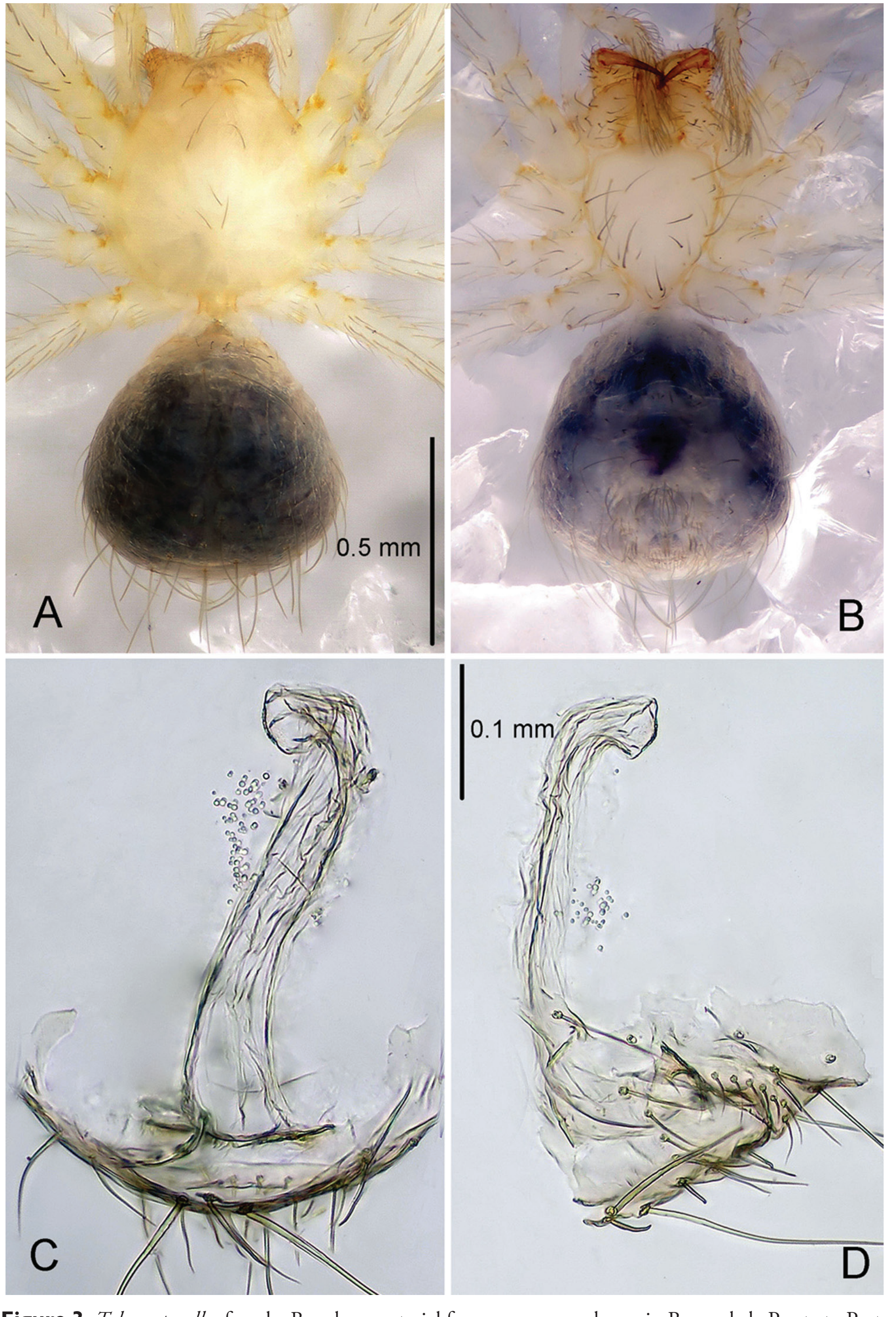



**Figure 3.** *Telema tenella*, female. Based on material from an unnamed cave in Banys de la Preste to Prats of Molló, France. **A**. Habitus, dorsal view **B** Habitus, ventral view **C** Copulatory organ, dorsal view **D** Copulatory organ, lateral view.

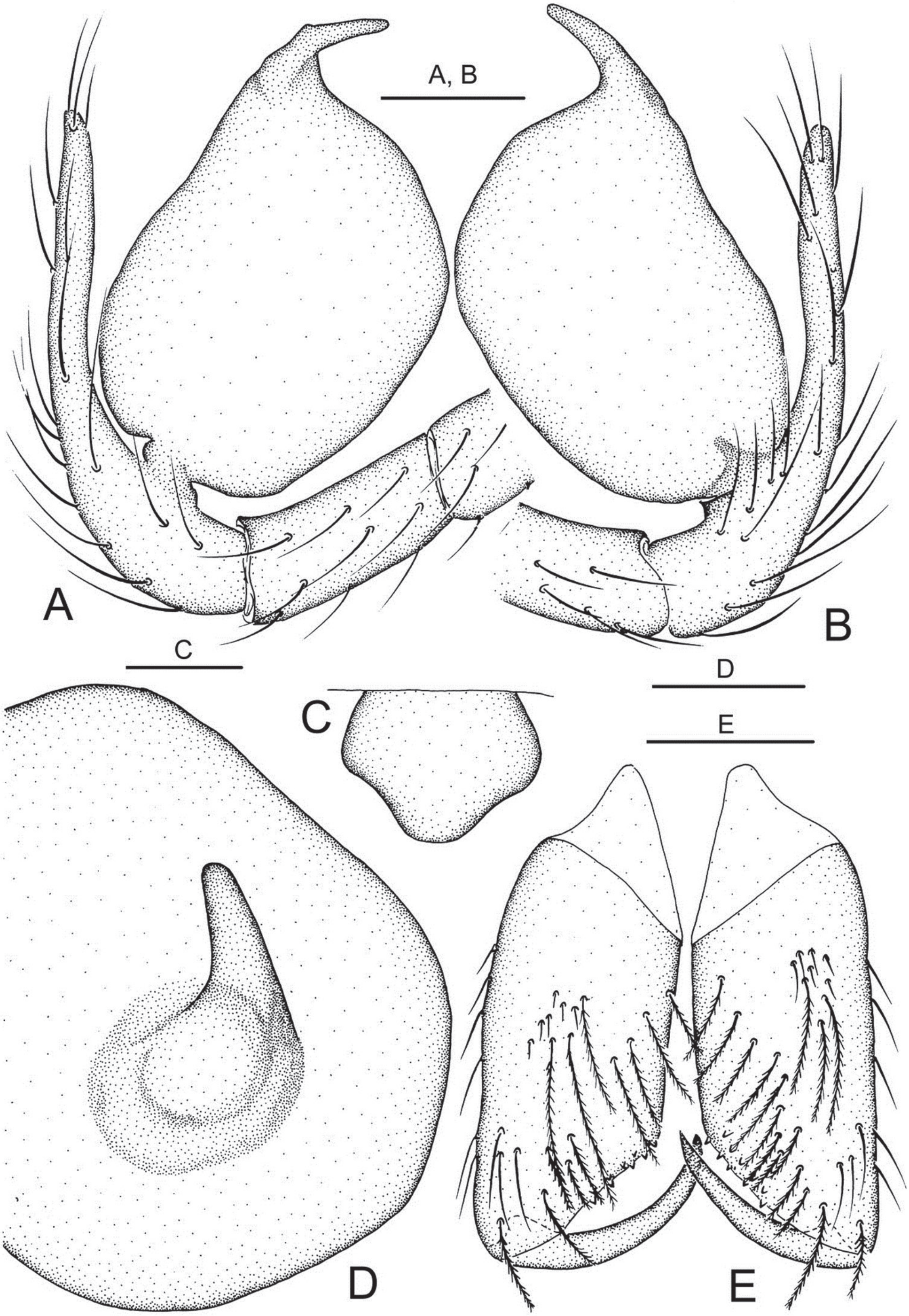



**Figure 4.** *Telema tenella*, male. Based on material from an unnamed cave in Banys de la Preste to Prats of Molló, France. **A** Right palp, retrolateral view B Right palp, prolateral view **C** Colulus, ventral view **D** Embolus tip, apical view **E** Chelicerae, posterior view. Scale bars: **A, B, E** 0.10 mm; **C, D** 0.05 mm.

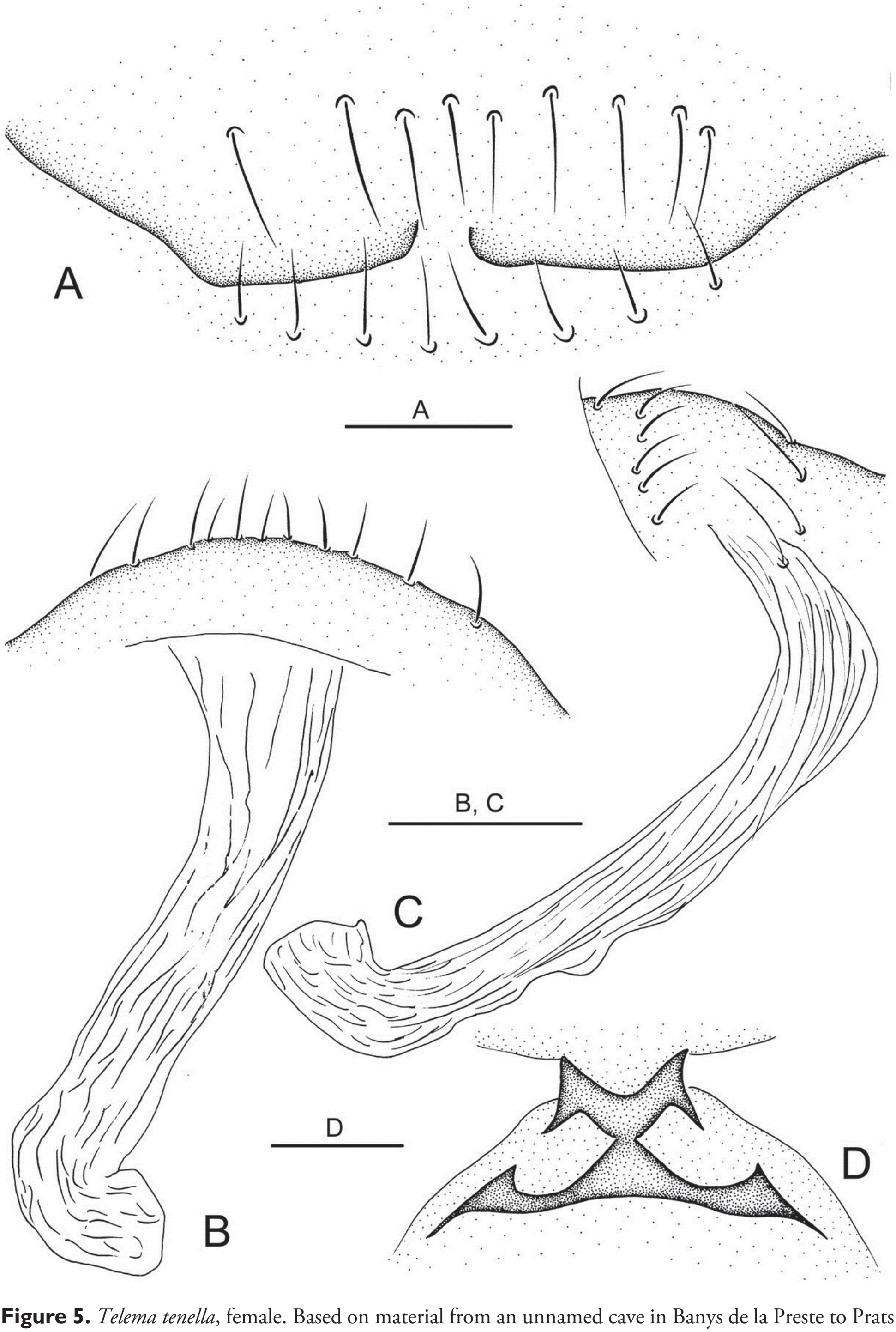



**Figure 5.** *Telema tenella*, female. Based on material from an unnamed cave in Banys de la Preste to Prats of Molló, France. **A** Genital area, ventral view **B** Copulatory organ, dorsal view **C** Copulatory organ, lateral view **D** Pedicel, dorsal view. Scale bars: **A**, 0.05 mm; **B, C, D** 0.10 mm.

**Description. Male** (Fig. 2A). Total length 1.40. Carapace 0.60 long, 0.55 wide. Abdomen 0.70 long, 0.64 wide. Sternum 0.40 long, 0.34 wide. Carapace, chelicerae, endites and labium yellow. Sternum and legs yellowish-white. Carapace with one pair of setae on clypeus, three medially and four on ocular area. Eyeless. Chelicerae (Fig. 4E) with one tooth and four tiny granulous denticles on the promargin, and five tiny granulous denticles on the retromargin of fang furrow. Anterior edge of labium with 4 strong and 8 small bristles. Patella I–IV dorsally with one long seta distally, tibia III IV with one long seta dorsally (position 0.5). Leg measurements: I 4.40 (1.33, 0.23, 1.32, 0.93, 0.59); II 3.91 (1.17, 0.23, 1.09, 0.86, 0.56); III 2.87 (0.87, 0.19, 0.75, 0.62, 0.44); IV 3.54 (1.09, 0.23, 0.94, 0.75, 0.53). Abdomen blue, covered with long setae. Male palp (Figs 2B–D, 4A–B, D). Bulb light yellow, pyriform, with embolus the only projection erected distally; embolus lamellar, curving, short, approximately 1/5 the length of bulb, and weakly sclerotized at the distal part.

**Female** (Figs 3A–B). Similar to male in coloration and general features. Total length 1.30. Carapace 0.60 long, 0.55 wide. Abdomen 0.65 long, 0.65 wide. Sternum 0.40 long, 0.34 wide. Leg measurements: I 4.37 (1.33, 0.23, 1.32, 0.93, 0.56); II 3.92 (1.09, 0.23, 1.25, 0.81, 0.54); III 2.88 (0.71, 0.19, 0.86, 0.59, 0.53); IV 3.58 (0.94, 0.23, 1.09, 0.78, 0.54). Genital area (Fig. 5A) with a row of setae on epigynal area and a row of stout setae posterior to epigastric furrow. Spermatheca (Figs 3C–D, 5B–C) elongate, transparent, and tube-shaped, with the distal part curving ventrally.

**Distribution.** In Pyrenees: France (Pyrénées-Orientales: caves Sainte-Marie and Can Britxot near La Preste; cave Sirach near Ria; caves Can Pey and La Fou near Arles-sur-Tech; copper mine near La Preste), Spain (Gerona, Cueva del Far).

**Discussion.** The genus *Telema* contains 40 species distributed in Spain, France, Guatemala, Japan, Singapore, Borneo, Thailand, Vietnam, and China. Compared with the type species *T. tenella*, some species in the genus have one prolateral apophysis on the cymbium; most species from China have a lager body size, more pigmented bodies, stronger embolus; and the species from Singapore, Borneo, and Thailand have different spermatheca in the female, either thin and strongly spiral or short and swelling. The taxonomic status of the species in *Telema* needs to be studied further as well as distributional limits of the genus.

## Acknowledgments

The manuscript benefited greatly from comments by Y. M. Marusik (Magadan, Russia), Robert W. Murphy (Toronto, Canada) and two anonymous reviewers. This study was supported by project CGL2004-05771/BOS from Spanish Government to Carles Ribera.

## References

Fage L (1913) Etudes sur les Araignées cavernicoles. II. Revision des Leptonetidae. In Biospelogica, XXIX. Archive De Zoologie Expérimentale Et Genéralé 10(5): 479–576.

Juberthie C (1985) Cycle vital de *Telema tenella* dans la grotte-laboratoire de Moulis et strategies de reproduction chez les araignées cavenicoles. Mémoires de Biospéologie 12: 77–89.

Le Peru B (2011) The spiders of Europe, a synthesis of data: Atypidae to Theridiidae. Mémoires de la Société Linnéenne de Lyon 2: 1–522.

Petrunkevitch A (1923) On families of spiders. Annals of the New York Academy of Sciences 29: 145–180. doi: 10.1111/j.1749-6632.1920.tb55355.x

Platnick NI (2012) The world spider catalog, version 13.0. American Museum of Natural History. Available from: http://research.amnh.org/iz/spiders/catalog/ [accessed 10 August 2012]

Ribera C, Mateos E (2000) *Telema tenella* (Simon, 1882) (Telemidae) y *Argyroneta aquatica* (Clerck, 1758) (Argyronetidae), dos nuevas familias de araneidos para la fauna ibérica. Revista Ibérica de Aracnología 1: 61–63.

Simon E (1882) Etudes Arachnologiques. 13e Mémoire. XX. Descriptions d'espèces et de genres nouveaux de la famille des Dysderidae. Annales de la Société entomologique de France 2: 201–240.

Simon E (1893) Histoire naturelle das araignées. Volume 1, Paris, 257–488.

Song DX, Zhu MS (1999) On some species of cave arachnids of China. In: Chen YY (Ed.) Sixtieth Anniversary of the Founding of China Zoological Society: Memorial Volume Dedicated to the Hundredth Anniversary of the Birthday of the Late Prof. Sisan Chen (Z. Chen). Science and Technology Press, Beijing, 35–46.

Yaginuma T (1974) A telemid spider occurs in Japan. Atypus 62: 14–16.

ZooKeys 251: 21–27 (2012)
doi: 10.3897/zookeys.251.3709
www.zookeys.org

RESEARCH ARTICLE

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

# A new species of *Lathrolestes* (Hymenoptera, Ichneumonidae) from Ecuadorian Amazonia, with a key to the Neotropical species of the genus

Alexey Reshchikov[1,†], Anu Veijalainen[2,‡], Ilari E. Sääksjärv[2,§]

**1** *The Insect Growth, Development and Behaviour Regulators Laboratory, Institute of Plant Protection, The Russian Academy of Agricultural Sciences, 3 Podbelsky shosse, Pushkin, St. Petersburg, Russia, 189620* **2** *Zoological Museum, Section of Biodiversity and Environmental Sciences, Department of Biology, FIN-20014, University of Turku, Finland*

**†** *urn:lsid:zoobank.org:author:CB7D7449-FF41-4268-B594-D85D8032A91F*
**‡** *urn:lsid:zoobank.org:author:2A9B042E-9513-4670-B75D-C9BD9F19F90B*
**§** *urn:lsid:zoobank.org:author:2B80E7A4-FEA6-4493-80C1-5B28FB0CDB8F*

Corresponding author: *Alexey Reshchikov* (reshikov@gmail.com)

Academic editor: *G. Broad* | Received 17 July 2012 | Accepted 30 November 2012 | Published 17 December 2012

*urn:lsid:zoobank.org:pub:5F3240F1-0F6A-4F69-9825-9AA7B7AF9C3E*

**Citation:** Reshchikov A, Veijalainen A, Sääksjärvi IE (2012) A new species of *Lathrolestes* (Hymenoptera, Ichneumonidae) from Ecuadorian Amazonia, with a key to the Neotropical species of the genus. ZooKeys 251: 21–27. doi: 10.3897/zookeys.251.3709

## Abstract

Here we describe and illustrate a new parasitoid wasp species, *Lathrolestes gauldi* **sp. n.** from the lowland rainforest of eastern Ecuador and provide a key to the Neotropical species of the genus. This is the first record of the subfamily Ctenopelmatinae from Ecuador.

## Keywords

Amazonia, canopy, Ctenopelmatinae, parasitoid wasp, tropical rainforest, Yasuní

## Introduction

The Ctenopelmatinae is a species-rich subfamily that includes mostly koinobiont endoparasitoids of sawfly larvae (Hymenoptera: Symphyta). The subfamily is expected to be more diverse in temperate than tropical zones as the primary host groups are relatively scarce in tropical rainforest habitats (Gauld et al. 1997, Veijalainen et al. 2012). In the Neotropics, the subfamily's distribution extends across the entire region, but ctenopelmatines are still rarely encountered in Neotropical arthropod samples. The region's ctenopelmatine fauna is very poorly known – there are only 69 described species from South America, Central America and Mexico (Cresson 1874, Townes 1970, Lanfranco 1980, Graf et al. 1991, Barron 1994, Gauld et al. 1997, Reshchikov 2011). In the most recent large study on Neotropical ctenopelmatines, 42 species from Costa Rica belonging to 14 genera were reported (Gauld et al. 1997).

In the present study, we describe a new species of *Lathrolestes* Foerster from Ecuadorian Amazonia. *Lathrolestes* is a large genus of the ctenopelmatine tribe Perilissini with 85 described species including 4 species from Costa Rica (Yu et al. 2012). The new species, *L. gauldi* sp. n., was collected by canopy fogging in the lowland rainforests of Ecuadorian Amazonia. This represents the first record of the subfamily Ctenopelmatinae from Ecuador and the Neotropical rainforest canopy. We also provide a key to four species of *Lathrolestes* occurring in the Neotropical region and six closely related species from the southern United States and Mexico.

## Material and methods

The holotype specimen was collected by Dr. Terry L. Erwin and his research team from the canopy of a lowland *tierra firme* rainforest at Onkone Gare, Department of Orellana, Ecuador, on the 2nd of July, 1995. The site is located near the Yasuní National Park 216 m.a.s.l. in primary rainforest where the vegetation is old and diverse. The annual precipitation exceeds 2500 mm and the temperature always remains above 10 degrees Celsius. For a more specific description of the study site, see Lucky et al. 2002 and Erwin et al. 2005.

The lateral illustration (Fig. 1) of *L. gauldi* shows the habitus and coloration of the species. In addition, we provide more detailed illustrations of the face (Fig. 2), propodeum (Fig. 3), ovipositor (Fig. 4) and areolet of the fore wing (Fig. 5) of the holotype specimen. All digital pictures were taken using an Olympus SZX16 stereomicroscope attached to an Olympus E520 digital camera and combined using the CombineZP program created by Alan Hadley (http://www.hadleyweb.pwp.blueyonder.co.uk/index.htm). The key below is modified from the one presented in Gauld et al. (1997). The morphological terminology follows mainly that of Gauld (1997), wing vein nomenclature is based on Ross (1936).

## Results

### Taxonomy

### Key to the Central and South American species of *Lathrolestes*

1 Metasoma entirely black (Fig. 1). Wings strongly infuscate. Fore wing with resemblance of areolet (Fig. 5). First metasomal tergite short, almost as wide as long. Area superomedia twice as wide as long (Fig. 3). Ecuador....***gauldi* sp. n.**

– Metasoma with yellow coloration or black with base of first tergite yellowish. Wings not infuscate or only slightly infuscate. Fore wing with areolet. First metasomal tergite longer, 1.25–2 times as long as wide. Area superomedia elongate ........................................................................................**2**

2 Mesoscutum with notaulus strongly impressed anteriorly; upper part of head and mesosoma granulate, matt; first tergite of metasoma anteriorly slender with lateromedian longitudinal carinae separated by about the diameter of the spiracle. Costa Rica ............................................***karenae* Gauld, 1997**

– Mesoscutum with notaulus vestigial; upper part of head and mesosoma fairly smooth and polished; first metasomal tergite anteriorly moderately stout with lateromedian longitudinal carinae separated by far more than the diameter of the spiracle........................................................................................**3**

3 Tergites of metasoma uniformly reddish-yellow........................................**4**

– Tergites of metasoma black and yellow or only some tergites reddish-yellow...**7**

4 Fore wing hyaline at apex. First tergite of metasoma short, 1.25 times as long as wide........................................................................................**5**

– Fore wing infuscate at apex. First tergite of metasoma longer, 1.6–1.7 times as long as wide ........................................................................................**6**

5 Area superomedia 1.4 times as long as wide. Costula arises from lateromedian longitudinal carina at the middle of area superomedia. White ring of antenna wide, approximately at flagellomeres 11–27. USA ...***asperatus* Barron, 1994**

– Area superomedia 1.8 times as long as wide. Costula arises from lateromedian longitudinal carina at upper part of area superomedia. White ring of antenna narrower, approximately at flagellomeres 11–18. Mexico............................. ..........................................................***tepeyollotlis* Reshchikov, 2011**

6 Area superomedia twice as long as wide. Costula absent. First tergite of metasoma without lateromedian longitudinal carinae. USA...........***erugatus* Barron, 1994**

– Area superomedia as long as wide. Costula present. First tergite of metasoma with lateromedian longitudinal carinae. Mexico ......................................... ......................................................... ***quetzalcoatlus* Reshchikov, 2011**

7 Antennal flagellum orange-brown basally. Pterostigma translucent golden. Area superomedia 1.5 times as long as wide. Costa Rica..........***haroldi* Gauld, 1997**

– Antennal flagellum black basally. Pterostigma dark brown or black. Area superomedia shorter, 1.1–1.4 times as long as wide or longer, 1.6 times as long as wide........................................................................................**8**

8 Middle of face black. Area superomedia 1.6 times as long as wide. Posterior transverse carina straight. First tergite of metasoma twice as long as wide, with weak lateromedian longitudinal carina. Mexico ........... ***kukulcanis*** **Reshchikov, 2011**

– Face entirely yellow. Area superomedia 1.1–1.4 times as long as wide. Posterior transverse carina curved. First tergite of metasoma 1.6–1.9 times as long as wide with lateromedian longitudinal carina defined ................................ **9**

9 Propodeum with posterior transverse carina formicate (curved towards metasoma). Area superomedia 1.1 times as long as wide. Mexico ........................ ............................................................ ***xochiquetzalis*** **Reshchikov, 2011**

– Propodeum with posterior transverse carina concave or straight ................ **10**

10 Propleuron yellow. First tergite of metasoma with weak lateromedian longitudinal carinae. Propodeum with posterior transverse carina straight. Hind coxa and femur entirely yellow. Costa Rica .................. ***irenea*** **Gauld, 1997**

– Propleuron black. First tergite of metasoma with strong lateromedian longitudinal carinae. Propodeum with posterior transverse carina concave. Hind coxa yellow, ventrally black, hind femur yellow, externally black. Costa Rica ........................................................................... ***jennyae*** **Gauld, 1997**

## Description

***Lathrolestes gauldi*** **sp. n.**
urn:lsid:zoobank.org:act:9887C02B-B24F-415A-9E02-8D8254148620
http://species-id.net/wiki/Lathrolestes_gauldi
Figs 1–5

**Material examined.** Holotype female: **Ecuador**, Department of Orellana, Onkone Gare (00°39'25.7"S, 76°27'10.8"W), 2.vii.1995, T.L. Erwin (NMNH, Smithsonian institution).

**Diagnosis.** This species differs from other species of the genus by the following character states: an entirely black metasoma and hind legs, dark wings, short first metasomal tergite, and short area superomedia (half as long as wide (Fig. 3)).

**Description.** Female. Body length 8.0 mm, pubescent with white hairs. Antenna with 22 flagellomeres. Scape 0.54 times as long as wide. Head narrowed behind eyes, polished. Maximal length of temple equal to transverse eye diameter; minimum length of temple 0.67× transverse eye diameter. Face 1.08× height of eye; convex centrally. Clypeus separated from face by groove; at apex projecting strongly anteriorly; apical margin of clypeus moderately obtuse, with line of deep punctures. Clypeal foveae small, placed in impressions. Malar space 0.7× as long as basal mandible width. Occipital carina dorsally not broadly interrupted. Lower mandible tooth longer and narrower than upper.

Mesosoma smooth, polished, without punctures. Notaulus shallowly impressed at base. Epicnemial carina high. Hind tibia compressed. Claws elongate, not pectinate.


**Figure 1.** *Lathrolestes gauldi* sp. n. ♀, holotype, habitus.

Hind tarsus as long as hind tibia. Vein 3rs-m vestigial (Fig. 5). Second recurrent vein with a single bulla. Nervulus strongly postfurcal. Hind wing with nervellus intercepted below middle. Propodeal carinae complete, strongly raised; area superomedia half as long as wide (Fig. 3).

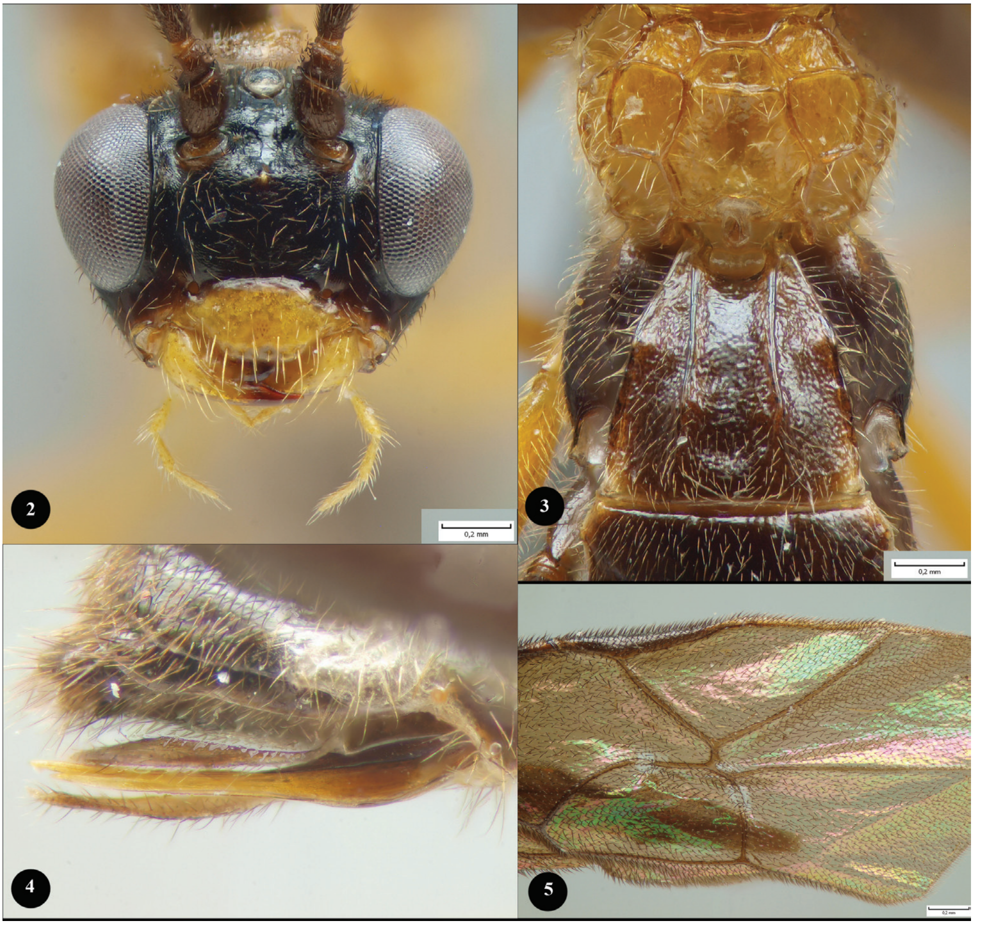
Metasoma compressed apically, polished, sparsely pubescent. First metasomal tergite 0.86× as long as apically wide; without shallow median longitudinal impression; with lateromedian longitudinal carinae, slightly curved at spiracles; with slightly enlarged epipleurae (Fig. 3). Second metasomal tergite transverse. Metasomal sternites small, sclerotized. Subgenital plate slightly notched at apical margin. Ovipositor straight, thin, stout at base, slightly up-curved, approximately as long as metasomal height, without notch (Fig. 4).

Coloration. Female. Head black. Clypeus and mandibles orange (Fig. 2). Mesosoma, fore and middle legs (except of apical part of middle tarsus) orange (Fig. 1). Hind legs and apical part of middle tarsus, metasoma black. Wings infuscate.

**Host.** unknown.

**Distribution.** Ecuador.

**Etymology.** The new species is dedicated to the late Dr. Ian D. Gauld.




**Figures 2–5.** *Lathrolestes gauldi* sp. n. ♀, holotype. **2** face **3** propodeum and first metasomal tergite **4** ovipositor **5** areolet of the fore wing.

## Discussion

Only one specimen of *L. gauldi* sp. n. has been found despite the large sampling effort taking place in many Amazonian study localities (see Veijalainen et al. 2012). However, this is a normal situation with rainforest ichneumonids which are relatively difficult to sample, even by using long-term sampling programs (Sääksjärvi et al. 2004). Thus, *L. gauldi* sp. n. seems to be a rare species, and further sampling is needed to clarify its distribution in the Western Amazonia.

## Acknowledgements

We thank Terry L. Erwin for access to the material, Shelby Stedenfeld for checking the language of the manuscript and Gavin Broad for valuable notes and comments.

## References

Barron JR (1994) A new species of the *Perilissus anatinus* species group and notes on the relationships of the species groups of *Perilissus* (Hymenoptera, Ichneumonidae, Ctenopelmatinae). Canadian Entomologist 126(2): 219–224. doi: 10.4039/Ent126219-2

Cresson ET (1874) Descriptions of Mexican Ichneumonidae. Proceedings of the Academy of Natural Sciences of Philadelphia 1873: 374–413.

Erwin TL, Pimienta MC, Murillo OE, Aschero V (2005) Mapping patterns of ß-diversity for beetles across the Western Amazon Basin: a preliminary case for improving inventory methods and conservation strategies. Proceedings of the California Academy of Sciences 56: 72–85.

Gauld ID, Wahl D, Bradshaw K, Hanson P, Ward S (1997) The Ichneumonidae of Costa Rica, 2. The Ichneumonidae of Costa Rica, 2. Introduction and keys to species of the smaller subfamilies, Anomaloninae, Ctenopelmatinae, Diplazontinae, Lycorininae, Phrudinae, Tryphoninae (excluding *Netelia*) and Xoridinae, with an appendices on the Rhyssinae. Memoirs of the American Entomological Institute 57: 1–485.

Graf V, Kumagai AF, Dutra RRC (1991) Ichneumonidae (Hymenoptera) do sul do Brasil: um novo gênero de Ctenopelmatinae. Acta Biologie Paranaense 20(1/4): 157–166.

Lanfranco LD (1980) Contribución al conocimiento de los Icneumonidos de Chile (Hymenoptera – Ichneumonidae). Revista Chilena de Entomologia 10: 77–84.

Lucky A, Erwin TL, Witman JD (2002) Temporal and spatial diversity and distribution of arboreal Carabidae (Coleoptera) in a Western Amazonian rain forest. Biotropica 34: 376–386.

Reshchikov AV (2011) Mexican species of *Lathrolestes* Förster (Hymenoptera: Ichneumonidae; Ctenopelmatinae), with descriptions of four new species and an identification key. Tijdschrift voor Entomologie 154: 15–24. doi: 10.1163/22119434-900000305

Ross HH (1936) The ancestry and wing venation of the Hymenoptera. Annals of the Entomological Society of America 29: 99–111.

Sääksjärvi IE, Haataja S, Neuvonen S, Gauld ID, Jussila R, Salo J, Marmol Burgos A. (2004) High local species richness of parasitic wasps (Hymenoptera: Ichneumonidae; Pimplinae and Rhyssinae) from the lowland rainforests of Peruvian Amazonia. Ecological Entomology 29: 735–743. doi: 10.1111/j.0307-6946.2004.00656.x

Townes HK (1970) The genera of Ichneumonidae, Part 3. Memoirs of the American Entomological Institute 13: 1–307.

Veijalainen A, Sääksjärvi IE, Erwin TL, Gomez I, Longino JT (2012) Subfamily composition of Ichneumonidae (Hymenoptera) from western Amazonia: Insights into diversity of tropical parasitoid wasps. Insect Conservation and Diversity 2012: 1–10. doi: 10.1111/j.1752-4598.2012.00185.x

Yu DS, van Achterberg K, Horstmann K (2012) World Ichneumonoidea 2011. Taxonomy, Biology, Morphology and Distribution. CD/DVD, Taxapad, Vancouver.

ZooKeys 251: 29–48 (2012)
doi: 10.3897/zookeys.251.3986
www.zookeys.org

RESEARCH ARTICLE

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

# Parasitoids of *Monochamus galloprovincialis* (Coleoptera, Cerambycidae), vector of the pine wood nematode, with identification key for the Palaearctic region

Ricardo Petersen-Silva[1,2], Juli Pujade-Villar[2], Pedro Naves[1], Edmundo Sousa[1], Sergey Belokobylskij[3]

**1** *Instituto Nacional de Investigação Agrária e Veterinária, Quinta do Marquês, 2780–159 Oeiras, Portugal* **2** *Departament de Biologia Animal, Facultat de Biologia, Universitat de Barcelona, Avda. Diagonal 645, 08026, Barcelona, Spain* **3** *Museum and Institute of Zoology, Polish Academy of Sciences, Wilcza 64, Warszawa 00–679, Poland*

Corresponding author: *Ricardo Petersen-Silva* (rnpetersen@netcabo.pt)

Academic editor: *C. van Achterberg* | Received 11 September 2012 | Accepted 3 December 2012 | Published 17 December 2012

**Citation:** Petersen-Silva R, Pujade-Villar J, Naves P, Sousa E,Belokobylskij S (2012) Parasitoids of *Monochamus galloprovincialis* (Coleoptera, Cerambycidae), vector of the pine wood nematode, with identification key for the Palaearctic region. ZooKeys 251: 29–48. doi: 10.3897/zookeys.251.3986

## Abstract

The parasitoid complex associated with *Monochamus galloprovincialis* (Olivier), vector of the pine wood nematode, is discussed. Four species of the family Braconidae and one Ichneumonidae were found associated with *Monochamus galloprovincialis* in Portugal, namely *Atanycolus denigrator* (Linnaeus), *Atanycolus ivanowi* (Kokujev), *Cyanopterus flavator* (Fabricius), *Doryctes striatellus* (Nees) (Braconidae), and *Xorides depressus* (Holmgren) (Ichneumonidae). *Atanycolus ivanowi, Atanycolus denigrator, Doryctes striatellus* and *Xorides depressus* are new species for Portugal fauna, and *Monochamus galloprovincialis* is recorded as a new host of *Xorides depressus*. A key for determination of the ichneumonoid parasitoids of the pine sawyer is provided for the Palaearctic fauna.

## Keywords

Braconinae, Ichneumonidae, parasitoids, *Monochamus galloprovincialis*, Cerambycidae, key to species

## Introduction

Worldwide, beetles of the genus *Monochamus* Dejean (1821) (Coleoptera; Cerambycidae) are the most important vectors of the pine wood nematode *Bursaphelenchus xylophilus* (Steiner and Buhrer 1934) (Nematoda, Tylenchida, Aphelenchoididae) (Linit 1988, 1990, Kishi 1995). This nematode is native to North America, where it's not considered a primary pathogen of indigenous pines, although in countries where it has been introduced it is an important agent of mortality for susceptible pines. In Portugal, where the nematode has been present for over a decade now, the pine sawyer *Monochamus galloprovincialis* (Olivier 1795) is it's sole vector (Sousa et al. 2001).

The pine sawyer *M. galloprovincialis* is widely distributed in Europe (except in the United Kingdom, Ireland and Cyprus), and is also present in Caucasus, Russia, North Africa, China and Mongolia (Hellrigl 1971, Francardi and Pennacchio 1996). The *Monochamus* beetles do not breed on healthy trees, and are attracted only to stressed, dying or recently killed trees and freshly felled timber for egg laying (Linsley 1959, Hellrigl 1971, Linit 1987, Hanks 1999). Before the introduction of *B. xylophilus* in Portugal, *M. galloprovincialis* was considered a secondary forest pest and nothing was known about the most important aspects of its biology and ecology. In the rest of Europe there is also an absence of detailed studies on its biology, with the exception of the classic paper of Hellrigl (1971).

The most efficient way to control wilt disease is to decrease the population levels of the vector *Monochamus* beetles. However, the different methods to control these insects usually have success only in localized, small-dimension areas, but are difficult to implement at low cost and have reduced efficiency over large forested areas. In Portugal, the most important management and control strategy consists in the elimination of symptomatic trees during late autumn, winter and early spring, while the insect vector is inside the host as late-instar larvae or pupae. The vector's populations can also be diminished during the beetle´s flight season with the use of traps baited with attractive lures (Naves et al. 2008).

Specific and efficient natural enemies (bio-control) would be an interesting and environmental-friendly option, but until now there are no adequate species for such control program (Naves et al. 2005). A few studies have already dealt with the parasitoids of this pine pest (Francardi and Pennacchio 1996, Francardi et al. 1998, Naves et al. 2005), although the information is scarce and disperse. In this paper we report on the diversity of parasitoids associated with *M. galloprovincialis* in Portugal, their frequency and revise all previous information on ichneumonoids parasitoids of *M. galloprovincialis* in the Palaearctic Region, resulting in a key for their identification.

## Material and methods

For the parasitoid surveys, two different approaches were employed:

I – Field surveys were made in five main pine regions in Portugal, selected by their different environmental characteristics, between April and October 2011. The areas where the study was made were:

Monção: (Lat: 42.075801, Lon: -8.517426)
Marinha Grande, Leiria: (Lat: 39.751677, Lon: -8.9977)
Comporta: (Lat: 38.35808, Lon: -8.772995)
Vale Feitoso, Idanha-a-Nova: (Lat: 40.064935, Lon: -6.987579)

In each location two dead *Pinus pinaster* Aiton, trees were felled, the wood sections colonized by *M. galloprovincialis* were divided into 60 cm logs, and taken to the INIAV (Instituto Nacional de Investigação Agrária e Veterinária) laboratories in Oeiras to be stored in wood boxes prepared with a wire mesh. The boxes were completely covered with a black plastic, leaving two holes with transparent containers to collect emerged insects. Boxes were analyzed every two days for insects, which were collected and stored in alcohol for posterior identification. Additionally, the boxes were opened frequently for the evaluation of the content and to collect other emerged insects. The logs were kept inside the boxes until no emergences were registered for a period of two months, and then debarked and opened (with a vertical chain saw) to detect the hosts and life stages attacked by the parasitoids.

II – Complementary to the previous approach, artificial trap-trees were also prepared, consisting of living maritime pine trees which were cut into logs and given to adult *M. galloprovincialis* to lay eggs under laboratory controlled conditions. Each log had a medium length of 40 cm and a medium diameter of 10 cm. subsequently, the logs were taken to the terrain to be colonized by parasitoids, and in each log a hole was made to allow passing a rope to hang them in the trees, at the branches height.

A total of 96 logs were divided according to the insect´s life stages (eggs, phloem larvae, xylem larvae and pupae), with 24 replicates each. Trials were made in Monção, Marinha Grande (Leiria), Comporta and Vimeiro, Alcobaça (Lat: 39.477811, Lon: –9.022316). In each location, six trap-trees were taken to the terrain four times during the year (pupae: April; eggs: July; phloem larvae: August; xylem larvae: October), in synchrony with the natural life cycle of the insect, and hanged in a healthy adult pine tree for a period of ten days. Subsequently, the logs were taken to the INIAV laboratory, and kept in wooden boxes (similarly to the previous experiment) to allow for emergencies. All emerged insects were identified and prepared to be photographed in the stereomicroscopy and environmental scanning electron microscopy (Serveis Científico-Tècnics de la Universitat de Barcelona). The field-emission gun environmental scanning electron microscope (FEI Quanta 200 ESEM) was used for high-resolution imaging without gold-coating with the purpose of not damaging the specimens.

All the collected material was stored in INRB Forestry Entomology Collection, Oeiras, Portugal. The insects collected with the trap-tree were labeled "Artificial" and the ones from the dead trees were labeled "Natural". Terminology employed in the key for morphological features, sculpture and measurements as well as wing venation nomenclature follows Belokobylskij and Maeto (2009).

## Results

Besides *M. galloprovincialis*, the following insects emerged from the wood and logs: *Arhopalus* sp. (Coleoptera: Cerambycidae), *Orthotomicus erosus* (Wollaston 1857) (Coleoptera: Scolytidae), *Thanasimus formicarius* (Linnaeus 1758) (Coleoptera: Cleridae), *Sirex noctilio* Fabricius (1793) (Hymenoptera: Siricidae), and some species of the family Anobiidae. Other bark beetles (Scolytidae) were also present in the dead tree material, although they were not analyzed.

No parasitoids emerged from the trap trees with eggs, xylem larvae and pupae of *M. galloprovincialis*. Parasitism was only found in the sub-cortical larvae, corresponding to the host´s first instars. A total of 27 specimens, belonging to five species, were recovered solely from Marinha Grande and Vale Feitoso, seven of which (all *Cyanopterus flavator*) from the trap-trees, while the remaining species were all obtained from the dead trees. *Cyanopterus flavator* (Fabricius) and *Atanycolus ivanowi* (Kokujev) were found in Vale Feitoso, and in Marinha Grande the following ichneumonids and braconids were recovered: *Atanycolus denigrator* (L.); *C. flavator*; *Doryctes striatellus* (Nees) and *Xorides depressus* (Holmgren).

By far, *Cyanopterus flavator* was the most abundant species with a total of 15 specimens from Marinha Grande and Vale Feitoso. Cocoons of this species were found in the xylem galleries of *M. galloprovincialis*, alongside with mandibles of the dead larvae.

The other cocoons found were in the inner bark associated with the larval galleries of the pine sawyer. The number of cocoons found matches exactly the number of parasitoids obtained from this surveys, and no other cocoons were found parasitizing any of the species previously mentioned. The parasitized species emerged between May and September under laboratory conditions and the precise dates are recorded in the labels of each specimen.

The following hymenoptera emerged from the wood, with both Braconidae (4) and Ichneumonidae (1):

## Family Braconidae

### *Atanycolus denigrator* (Linnaeus 1758)

http://species-id.net/wiki/Atanycolus_denigrator
Figures 7a, e

**Material examined.** Portugal: 1 female, "Leiria, 1/6/2011", "Ensaio Pupas Natural", "Col. Estação Florestal Nacional"; 1 male, "Leiria, 1/6/2011", "Ensaio Pupas Natural", "Col. Entomologica, est. Florestal".

**Distribution. Palaearctic**: Austria, Bulgaria, China, Croatia, former Czechoslovakia, Finland, France, Germany, Greece, Hungary, Israel, Italy, Kazakhstan, Korea, Mongolia, Norway, Poland, Russia, Sweden, Switzerland, Turkey, United Kingdom. **Afrotropical**: Niger (Yu et al. 2005, Wang et al. 2009). This species is here recorded for Portugal for the first time.

**Hosts.** *Anthaxia morio* Fabricius, *Chrysobothris chrysostigma* Linnaeus, *Ch. solieri* Laporte & Gory, *Lampra rutilans* (Fabricius), *Poecilonota variolosa* (Paykull) (Buprestidae); *Acanthocinus aedilis* Linnaeus, *A. griseus* (Fabricius), *Arhopalus syriacus* (Reitter), *Monochamus galloprovincialis* (Oliver), *M. sutor* (Linnaeus), *Rhagium indagator* Fabricius, *R. inquisitor* Linnaeus, *R. mordax* (Degeer), *Saperda populnea* (Linnaeus), *Tetropium castaneum* (Linnaeus), *T. fuscum* (Linnaeus), *T. gabrieli* Weise (Cerambycidae); *Ips sexdentatus* (Boerner) (Scolytidae) (Yu et al. 2005, Wang et al. 2009).

**Biology.** *Atanycolus denigrator* is an ectoparasitoid of *M. galloprovincialis* attacking *Pinus pinaster*. The species was found parasitizing the first larval instars under the bark of the tree.

**Remarks.** *Atanycolus denigrator* was already recorded in Italy as parasitoid of *M. galloprovincialis* (Campadelli and Scaramozzino 1994). We additionally studied this reared Italian material in Hungarian Natural History Museum in Budapest (1 female, “Italia, Ravenna, 14.IV.1992, Campadelli”, “Pinus picea”, “ex larva *Monochamus galloprovincialis* Ol., 21.IV.1992”, “*Atanycolus* ♀ *denigrator* L. det. Papp J. 2000”; 1 female, same first label, but “21.IV.1992”, second and third labels are the same ones) and confirmed present determination.

### *Atanycolus ivanowi* (Kokujev 1898)

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

Figures 4c, 5b, 6d

**Material examined.** Portugal: 4 females, “Vale Feitoso II, Maio 2011”, “Col. Entomologica, est. Florestal”; 1 female, same labels, but 12.VI.2011; 1 male, “Vale Feitoso II, Maio 2011”.

**Distribution. Palaearctic**: Armenia, Austria, Azerbaijan, Croatia, Czechia, Finland, France, Germany, Greece, Hungary, Italy, Japan, Kazakhstan, Russia, Slovakia, Switzerland, Tajikistan, Turkmenistan, Ukraine, Uzbekistan (Yu et al. 2005) and Turkey (Bolu et al. 2009). This species is here recorded for Portugal for the first time.

**Hosts.** *Anthaxia aurulenta* (Fabricius), *A. deaurata* (Gmelin), *Chrysobothris solieri* (Laporte & Gory), *Ovalisia mirifica* (Mulsant), *Melanophila picta decastigma* (Fabricius); *Sphenoptera tappesi* Marseul (Buprestidae); *Arhopalus syriacus* (Reitter), *Stictoleptura rubra* (Linnaeus), *Monochamus galloprovincialis* (Olivier), *Tetropium fuscum* (Fabricius), *T. gabrieli* Weise (Cerambycidae) (Yu et al. 2005, Bolu et al. 2009).

**Biology.** *Atanycolus ivanowi* was found to be an ectoparasitoid of first larval stages of *M. galloprovincialis* living under the bark of *P. pinaster*.

**Remark.** *Monochamus galloprovincialis* was already recorded by Campadelli and Scaramozzino (1994) as a host of *A. ivanowi* in Italy.

### *Cyanopterus flavator* (Fabricius 1793)

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

Figures 1d, 7b, d, g

**Material examined.** Portugal: 1 female, “Leiria, 14/6/2011”, “Ensaio Pupas Natural”, “Col. Entomologica, est. Florestal”, “13”; 1 female, same labels, 17.VI.2011, N 12.

"Leiria, Larvas Artificial": 1 female, N 26; 1 female, N 27. "Leiria, Posturas Artificial": 1 female, 31.VIII.2011, N 25; 1 female, N 27. "Leiria, Ensaio, Posturas Artificial": 1 male, 31.VIII.2011, N 21. "Vale Feitoso": 1 female, N 9; 1 female, N 10; 1 male, N 11; 1 female, N 14; 1 female, N 15; 1 female, N 16; 1 female, N 17.

**Distribution. Palaearctic**: Algeria, Croatia, Cyprus, former Czechoslovakia, Finland, France, Germany, Greece, Hungary, Israel, Italy, Japan, Kazakhstan, Korea, Latvia, Morocco, Netherland, Poland, Romania, Russia, Spain, Switzerland, Syria, Tunisia, Ukraine, United Kingdom, former Yugoslavia (Yu et al. 2005) and Portugal (Naves et al. 2005).

**Hosts.** *Bostrichus capucinus* (Linnaeus) (Bostrichidae); *Acanthocinus griseus* (Fabricius), *Acanthoderes clavipes* (Schrank), *Hesperophanes pallidus* (Olivier), *Monochamus galloprovincialis* (Olivier), *M. sartor* (Fabricius), *Morimus asper* (Sulzer), *Phymatodes testaceus* (Linnaeus), *Pogonochaerus fasciculatus* (Degeer), *P. hispidus* (Linnaeus), *Rhagium inquisitor* (Linnaeus), *Saperda scalaris* (Linnaeus) (Cerambycidae) (Yu et al. 2005), and *Monochamus rosenmulleri* (Cederhjelm) (Watanabe 1937).

**Biology.** The biology of this parasitoid is poorly known, but in this study all the specimens emerged from cocoons from the xylemic galleries of *M. galloprovincialis*, which were not completely sealed with frass, as it is normal. Considering the length of the ovipositor of *C. flavator*, it is apparent that only first larval instars of *M. galloprovincialis* (found beneath the bark) are parasitized, which subsequently enter the wood carrying the parasitoid. Only the mandibles of the host larvae were found in galleries with cocoons.

**Remark.** *Monochamus galloprovincialis* as a host of *C. flavator* was already recorded by Campadelli and Scaramozzino (1994) for Italy and Naves et al. (2005) for Portugal.

### ***Doryctes striatellus*** **(Nees 1834)**

http://species-id.net/wiki/Doryctes_striatellus
Figures 1b, 4b, d, 5a

**Material examined.** Portugal: 1 female, "Leiria, 12/8/11", "Ensaio Pupas Natural", 1 male, same labels, but 9.VIII.2011; 1 male, same label, but 29.VII.2011.

**Distribution. Palaearctic**: Austria, Belgium, Bulgaria, China, Czechia, Finland, France, Germany, Hungary, Italy, Japan, Lithuania, Poland, Russia, Slovakia, Sweden, Switzerland, Ukraine, United Kingdom (Yu et al. 2005). This species is here recorded for Portugal for the first time.

**Hosts.** *Ernobius mollis* (Linnaeus), *Dorcatoma dresdensis* Herbst (Anobiidae); *Anthaxia quadripunctata* (Linnaeus), *Phaenops cyanea* (Fabricius), *Ph. guttulata* (Gebler) (Buprestidae); *Acanthocinus aedilis* (Linnaeus), *Agapanthia* sp., *Callidium* sp., *C. violaceum* (Linnaeus), *Clytus* sp., *Exocentrus lusitanus* (Linnaeus), *Mesosa curculionoides* (Linnaeus), *Molorchus minor* (Linnaeus), *Monochamus galloprovincialis* (Olivier), *M. sutor* (Linnaeus), *Phymatodes pusillus* (Fabricius), *Ph. testaceus* (Linnaeus), *Poecilium alni* (Linnaeus), *Pogonocherus* sp., *P. hispidus* (Linnaeus), *Rhagium inquisitor* (Linnaeus), *Semanotus undatus* (Linnaeus), *Stenostola ferrea* (Schrank), *Tetropium castaneum* (Linnaeus), *T. gabrieli* Weise, *T. fuscum* (Fabricius), *T. gracilicorne* Reitter (Cerambycidae); *Pissodes harcyniae* (Herbst), *P. notatus* (Fabricius), *Rhynchaenus fagi* (Linnaeus), *R. pilosus* (Fabricius), *R. quercus* (Linnaeus), *R. testaceus* (Müller), *Magdalis violacea* (Linnaeus), *M. rufa* (Germar), *Tachyerges salicis* (Linnaeus), (Curculionidae); *Hylurgops palliatus* (Gyllenhal), *Ips typographus* (Linnaeus), *I. sexdentatus* (Boerner), *I. subelongatus* Motschulsky, *Pityogenes bidentatus* (Herbst), *Tomicus piniperda* (Linnaeus) (Scolytidae); *Xyphidria prolongata* (Geoffroy) (Xyphidriidae) (Yu et al. 2005).

**Remark.** This species was already recorded in Italy on the name *D. mutillator* (Thunberg) as parasitoid of *M. galloprovincialis* (Campadelli and Scaramozzino 1994).

### Family Ichneumonidae

***Xorides depressus* (Holmgren 1860)**
http://species-id.net/wiki/Xorides_depressus
Figures 1c, 3b, e

**Material examined.** Portugal: 1 female, "Leiria, Pupas Natural", 19.VII.2011; 1 female, "Leiria, 29/7/11, Ensaio Pupas Natural"; 1 female, N 19.

**Distribution. Palaearctic**: Austria, former Czechoslovakia, Finland, France, Germany, Hungary, Latvia, Poland, Romania, Russia, Spain, Sweden (Yu et al. 2005). This species is here recorded for Portugal for the first time.

**Hosts.** *Melanophila cyanea* (Fabricius) (Buprestidae); *Nothorhina punctata* (Fabricius) (Cerambycidae) (Yu et al. 2005). *Monochamus galloprovincialis* (Olivier) is a new host of *X. depressus* from Portugal.

## Discussion

Considering the literature data and information presented in this study, the following key identifies the species of parasitoids attacking this pine sawyer in the Palaearctic Region. Only species that are reliably confirmed as parasitoids of *M. galloprovincialis* were considered for the key. Some species of parasitoids were excluded from this list and discussion about this decision is present in the final section. A key to species of Ichneumonidae and Braconidae parasitoids of *Monochamus galloprovincialis* is presented:

1 Second recurrent vein of fore wing present (Figure 1a). In hind wing, second longitudinal cubital vein always present and arising near middle of nervellus. Second and third metasomal tergites movable, not fused (Figures 1c, 2g) (Fam. Ichneumonidae). – Spiracles of first metasomal tergite placed on or before its middle (Figure 2e–f) .................................................... **2**

– Second recurrent vein of fore wing absent (Figuress 1b, 4e, 5d). In hind wing, second longitudinal cubital vein absent. Second and third metasomal tergites immovable, fused (Figures 1d, 5a–c) (Fam. Braconidae) .......................... **4**

2 First metasomal sternite distinctly separated from tergite, this tergite with glymma (Figure 2e), and/or propodeum without transverse basal carina (Figure 2a). Claws of leg in female with teeth or basal lobe (Figure 2c) (Pimplinae) – Second metasomal tergite with pair of oblique furrows running from almost middle of its base to spiracles (Figure 2g). Lower valva of ovipositor apically with lateral lobes covered partly upper valva; dorsal lobe of lower valva with six–seven furrows. Ovipositor sheath 1.2–1.3 times longer than body. Body entirely black (including corner of pronotum); tegula brownish yellow; pterostigma dark; legs red, hind tibia and tarsus brownish red. Body 10.0–22.0 mm ............................... ***Dolichomitus tuberculatus*** **(Geoffroy)**

– First metasomal sternite fused with tergite, this tergite without glymma (Figure 2f); propodeum always at least with track of transverse basal carina (Figure 2b). Claws of leg in female simple, without teeth or basal lobe (Figure 2d) (Xoridinae) ........................................................................................ **3**

3 Hind femur wide, with strong median ventral tooth (Figure 3a). Temple distinctly punctuate (Figure 3d). – Middle tibia posteriorly without deep oblique groove. Second metasomal tergite transverse and finely punctuate. Ovipositor sheath about as long as body. Body blackish; flagellum of antenna rufous; legs mainly reddish, coxae blackish. Body length 5.0–9.0 mm .......... ........................................................ ***Odontocolon quercinum*** **(Thomson)**

– Hind femur narrow, without ventral tooth (Figure 3b). Temple finely obliquely striate (Figure 3e). – First metasomal tergite beyond middle without dorsal longitudinal carinae, about twice longer than wide (Figure 1c). Ovipositor sheath about as long as body. Antennae brownish, without white band; hind leg brownish, but tarsus rufous; first and second metasomal tergites reddish. Body length 6.0–11.0 mm .....***Xorides depressus*** **(Holmgren)**

4 Hypoclypeal depression absent; middle of ventral margin of clypeus situated close to upper level of mandibles (Figure 4a). Brachial cell of fore wing open in distal posterior part, brachial vein absent. Second radiomedial cell of fore wing short (Figure 4e). (Euphorinae). – Second metasomal tergite striate (Figure 3c). Body mainly black. Body length 6.0–8.0 mm ..........***Meteorus corax*** **Marshall**

– Hypoclypeal depression deep and wide; middle of ventral margin of clypeus situated distinctly above upper level of mandibles (Figure 4b). Brachial cell of fore wing closed by brachial vein in distal posterior part. Second radiomedial cell of fore wing usually long (Figure 1b) .................................................. **5**

5 Occipital and prepectal carinae present (Figure 4d). First tergite with distinct dorsope and without median area delineated by furrows (Figure 5a). Recurrent vein of hind wing present. Submedial cell of hind wing long. (Doryctinae). Body length 3.0–6.5 mm..... ***Doryctes striatellus*** **(Nees) (*D. mutillator*** **auct.)**

– Occipital and prepectal carinae absent (Figure 4c). First tergite without dorsope and with median area delineated by furrows (Figures 1d, 5b, c, 6c, 7a-c). Recurrent vein of hind wing absent. Submedial cell of hind wing short (Figure 5d). (Braconinae)........................................................................**6**

6 Pedicel of antenna almost as long as first flagellar segment. First and second flagellar segments not longer than median segments of flagellum and concave below (Figure 6a). Second metasomal tergite without mediobasal triangle area (Figure 5c). – Ovipositor short, its sheath 1.0–1.3 times as long as metasoma, 0.60–0.65 times as long as fore wing. Second metasomal tergite about as long as third tergite, without or with fine oblique lateral furrows (Figure 5c). Body length 2.5–5.0 mm.................... ***Coeloides sordidator*** **Ratzeburg**

– Pedicel of antenna distinctly shorter than first flagellar segment. First and second flagellar segments longer than median segments of flagellum and not concave below (Figures 6b, 7d). Second metasomal tergite usually with mediobasal triangle area separated by furrows (Figures 5b, 7a, c).....................**7**

7 Second metasomal tergite without mediobasal triangle area separated by furrows (Figure 6c). Upper valva of ovipositor enlarged, distinctly larger than lower valva. Antenna setiform, longer than body. Body crimson-red with black spots. Body length 5.0–12.0 mm.......... ***Iphiaulax impostor*** **(Scopoli)**

– Second metasomal tergite usually (except *Cyanopterus flavator*) with mediobasal triangle area separated by furrows (Figures 5b, 7a, c). Upper valva of ovipositor not enlarged, not larger than lower valva. Antenna more or less filiform, not longer than body. Body never crimson-red, usually black with yellowish brown spots or areas on head and always on most part of metasoma.........................................................................................**8**

8 Scape of antenna with strong basal constriction and with apical collar. Pedicel distinctly projected behind scape (Figures 6d, 7e, f). Furrow between antennal socket and eye present (Figure 7f) ....................................................**9**

– Scape of antenna without basal constriction and without apical collar. Pedicel weakly projected behind scape (Figures 6b, 7d). Furrow between antennal socket and eye absent (Figure 7g)..........................................................**11**

9 Second–fourth metasomal tergites of female coarsely rugose-striate at least medially (Figure 5b). Head often more or less depressed dorso-ventrally (Figure 6d). Body length 5.0–9.0 mm ............... ***Atanycolus ivanowi*** **(Kokujev)**

– Second–fourth metasomal tergites of female smooth (except sculptured furrows) (Figure 7a), rarely second tergite partly with rugosity. Head never depressed dorso-ventrally...................................................................**10**

10 Head mainly brownish yellow or light reddish brown, only dorsally black and usually in large wedge-shaped black spot. Body length 7.0–10.0 mm ........... .................................... ***Atanycolus genalis*** **(Thomson) (*****A. initiator*** **auct.)**

– Head mainly black, sometimes paler only near base of mandible, always with reddish stripes along inner side of eye. Body length 5.0–9.0 mm. ................. ............................................................ ***Atanycolus denigrator*** **(Linnaeus)**

11 Ventral margin of scape (lateral view) not shorter than dorsal margin (Figure 7d). Second tergite without basomedian area delineated by furrow (Figure 7b). Metasoma brownish yellow, behind first tergite entirely smooth. Wings strongly infuscate. Body length 6.0–10.0 mm........................................................................................ ***Cyanopterus* (*Cyanopterus*) *flavator* (Fabricius)**

– Ventral margin of scape (lateral view) shorter than dorsal margin (Figure 6b). Second tergite with distinct basomedian area delineated by sculptured furrow (Figure 7c). Metasoma mainly dark brown or black, behind first tergite sculptured in furrows and suture. Wings faintly infuscate. Body length 4.0–5.0 mm......................................... ***Cyanopterus* (*Ipobracon*) *tricolor* (Ivanov)**

With the exception of *A. ivanowi* collected from Vale Feitoso, all the other species were collected in Marinha Grande. This location is near Portugal´s oldest managed pine forest, in a pine stand with about 1700 square km and which was first planted in the XIII century. This stable and managed environment may have created favorable conditions for the establishment of a diverse entomofauna in the region. In fact, the larger number of parasitoids found in the region, and the low population levels of the vector insect suggest that *M. galloprovincialis* may be locally well controlled by its natural enemies. Further studies in the Leiria pine stand should confirm this hypothesis.

There is no obvious reason for the absence of parasitoids in the other sampled locations, although factors such as the local density of *M. galloprovincialis* (and other insect hosts), and differences in the local edapho-climatic conditions may explain the absence of the natural enemies.

Despite *Atanycolus* genus being the most diverse*, Cyanopterus* is the genus were the most specimens were found. Each parasitoid was reared from one specific location, except *Cyanopterus* specimens which were found in two very distanced sites, which present completely different edapho-climatic conditions.

According to Watanabe (1937), the cocoons of *C. flavator* occurred in the trunk of *Picea jezoensis* Siebold et Zuccarini shut in by a thick corky lid at the end of the tunnel made by the larva of *M. rosenmulleri*, a conclusion which completely supports the suggested hypothesis for the parasitizing activity in Portugal.

Worldwide and including this study, there is now a total of 14 species of parasitoids associated with *M. galloprovincialis*, being six Ichneumonidae and eight Braconidae. Previous reliable records (confirmed rearing from the larvae of *M. galloprovincialis*) in the literature include references from Portugal (Naves et al. 2005), Italy (Campadelli and Scaramozzino 1994), and Siberia (Tobias and Belokobylskij 2000), among other locations (Kenis and Hilszczanski 2004, Tobias et al. 1986; Yu et al. 2005). Although not detected in this study, other groups, such as the braconids of the subfamily Helconinae (namely species of *Helcon* Nees 1812 and *Helconidea* Viereck 1914), will also likely parasitized larvae of *M. galloprovincialis* as they have been found to develop in larvae of other *Monochamus* species (Tobias et al. 1986, Yu et al. 2005).

Other records are more dubious and need further confirmation. Among these, three records of Ichneumonidae are possibly erroneous, namely *Rhyssa persuasoria* (Linnaeus) (Pimplinae), *Perithous divinator* (Rossi) (Pimplinae) and *Stenarella domator* (Poda) (Cryptinae). The first species is a specialized parasitoid of Siricidae larvae (Yu et al. 2005), and its rearing from Cerambycidae is probably inaccurate. Likewise, the other two species are specialized parasitoids of vespoid and sphecoid wasps (Kasparyan 2010), and their associations with Cerambycidae is quite doubtful. Therefore, in the identification key only three ichneumonids were included, namely *Odontocolon quercinum* (Thomson), *Xorides depressus* (Holmgren) and *Dolichomitus tuberculatus* (Geoffroy). On the other hand, as all species of Braconidae were directly reared from *M. galloprovincialis*, they were included in our key.

Despite the relatively high diversity of parasitoids associated with *M. galloprovincialis* worldwide, all species are mainly idiobiont ectoparasitoids (except *M. corax*) and seem to be generalists attacking a vast array of other insects living in dead and dying trees. *Cyanopterus flavator*, which had already been found parasitizing young larval stages (Naves et al. 2005), appears to be the most frequent and promising candidate for studies aiming the biological control of the pine sawyer, despite its generalist habits. As mentioned, the disperse distribution of *Cyanopterus* can be considered as a major adaptation two the diverse edapho-climatic conditions characteristic for Portugal. Other options, such as the introduction of exotic natural enemies would create new parasite-host interactions, which usually offer greater changes of success for biological control than the promotion of already established associations (Hokkanen and Pimentel 1984). Nevertheless, such measures require rigorous pre-release risk assessment of the economic and environmental costs and benefits of the introduction, to evaluate its potential effectiveness, host specificity, acclimatisation and viability for mass-production (van Lenteren et al. 2006).

Detailed studies on the effect of the parasitoid guild found in Portugal on the pine sawyer´s population and the suitability of the species for biological control are being planned, with the final objective of eventually establishing an integrated bio-control program against the vector of the pine wilt disease in Europe.

## Acknowledgement

We are grateful to Mr. Adérito Matos for his assistance both in the field surveys and laboratory handling, to Drª Rita Matos Gomes and to the team from the AFN Marinha Grande for all the conditions and support provided during this study, to Eng. Teixeira and his team from Alcobaça, to Mr. Alfredo and his colleagues from Monção and to Engºs António Moreira and Pedro Serrasqueiro of Herdade da Comporta for allowing the trails to take place in the private estate. We are also very thankful to Dr Dmitri R. Kasparyan (St. Petersburg, Russia) for determination of the ichneumonid parasitoid and valuable consultation.

## Figure plates

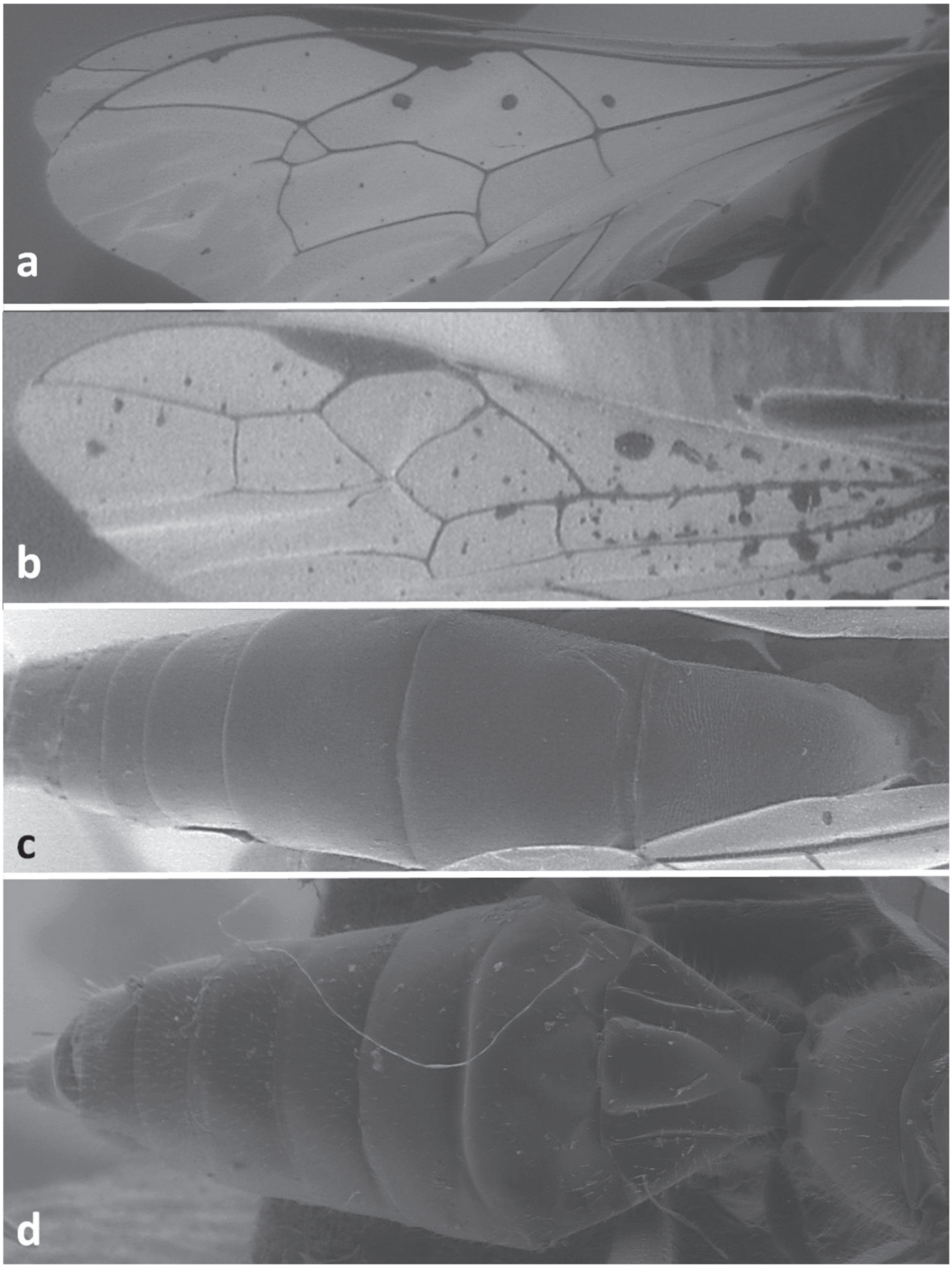



**Figure 1.** Forewing of *Dolichomitus tuberculatus* (**a**) and *Doryctes striatellus* (**b**); metasoma in dorsal view of *Xorides depressus* (**c**) and *Cyanopterus flavator* (**d**).

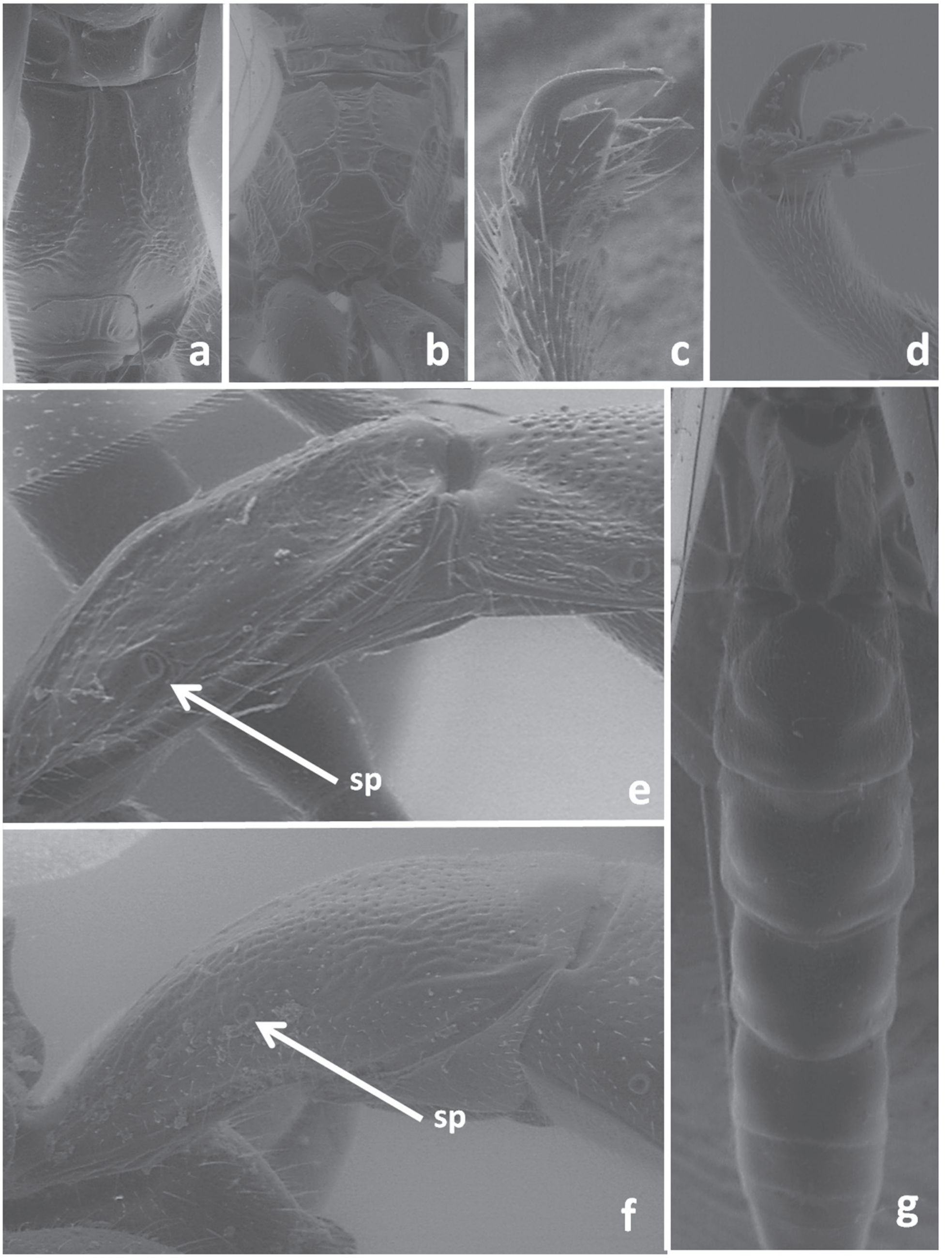



**Figure 2.** Propodeum in dorsal view of *Dolichomitus tuberculatus* (**a**) and *Odontocolon quercinum* (**b**); tarsal claws of *D. tuberculatus* (**c**) and *O. quercinum* (**d**); first metasomal tergite in lateral view of *D. tuberculatus* (**e**) and *O. quercinum* (f); dorsal view of metasoma of *D. tuberculatus* (**e**); sp – spiracle.

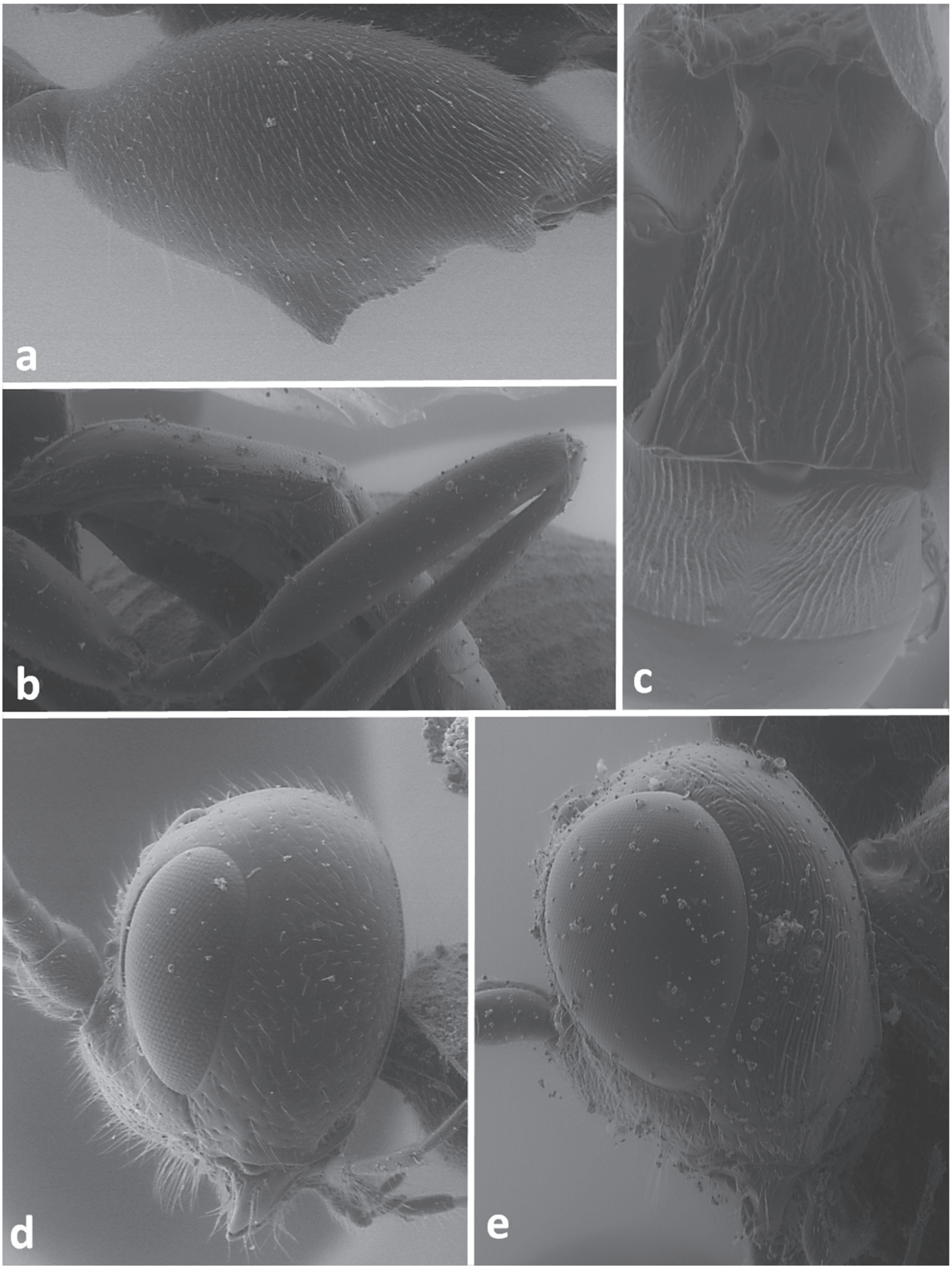



**Figure 3.** Lateral view of hind femur of *Odontocolon quercinum* (**a**) and *Xorides depressus* (**b**); first and second metasomal tergites in dorsal view of *Meteorus corax* (**c**); head in lateral view of *O. quercinum* (**d**) and *X. depressus* (**e**).

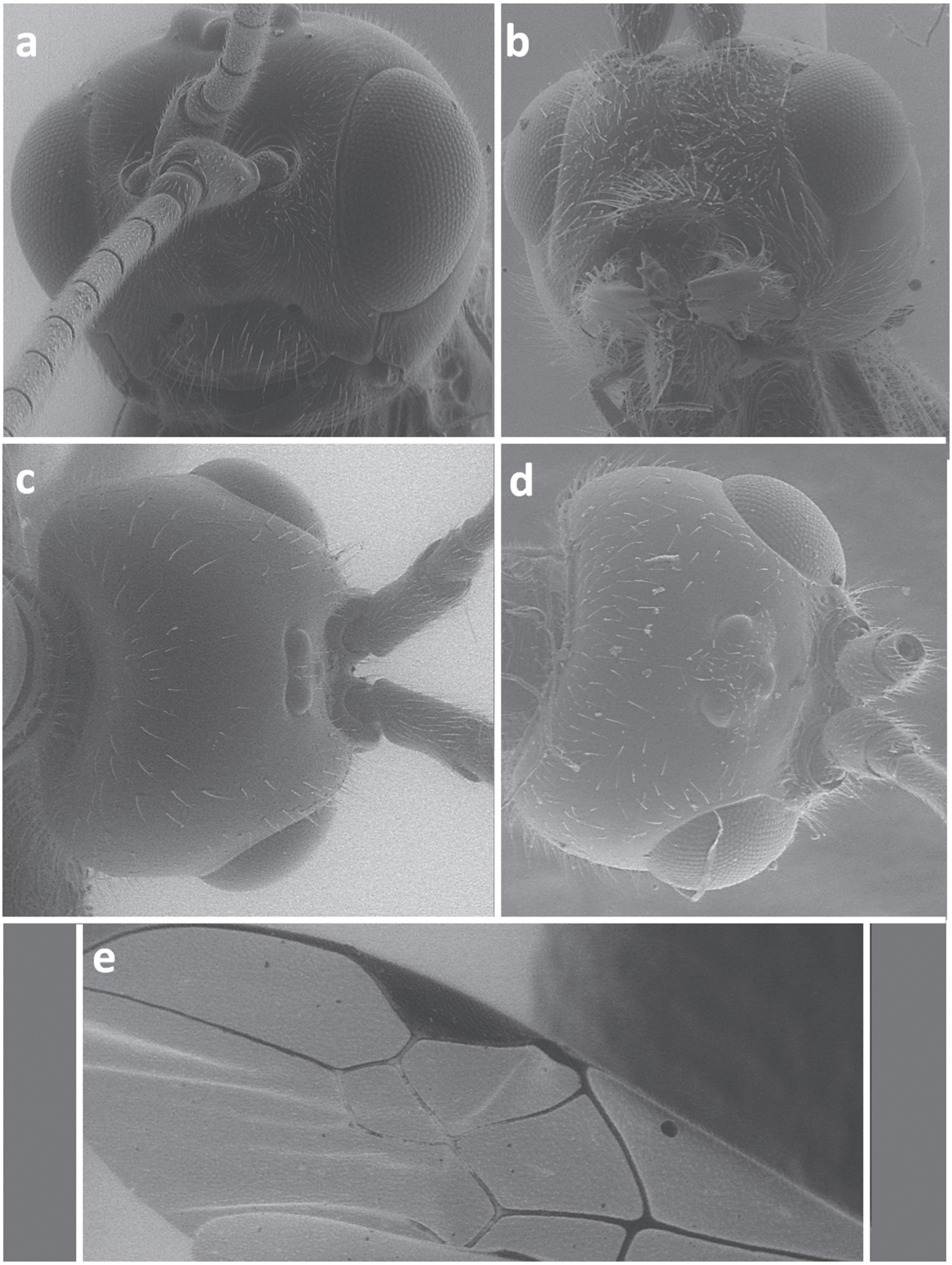



**Figure 4.** Face in frontal view of *Meteorus corax* (**a**) and *Doryctes striatellus* (**b**); head in dorsal view of *Atanycolus ivanowi* (**c**) and *D. striatellus* (**d**); detail of forewing of *M. corax* (**e**).

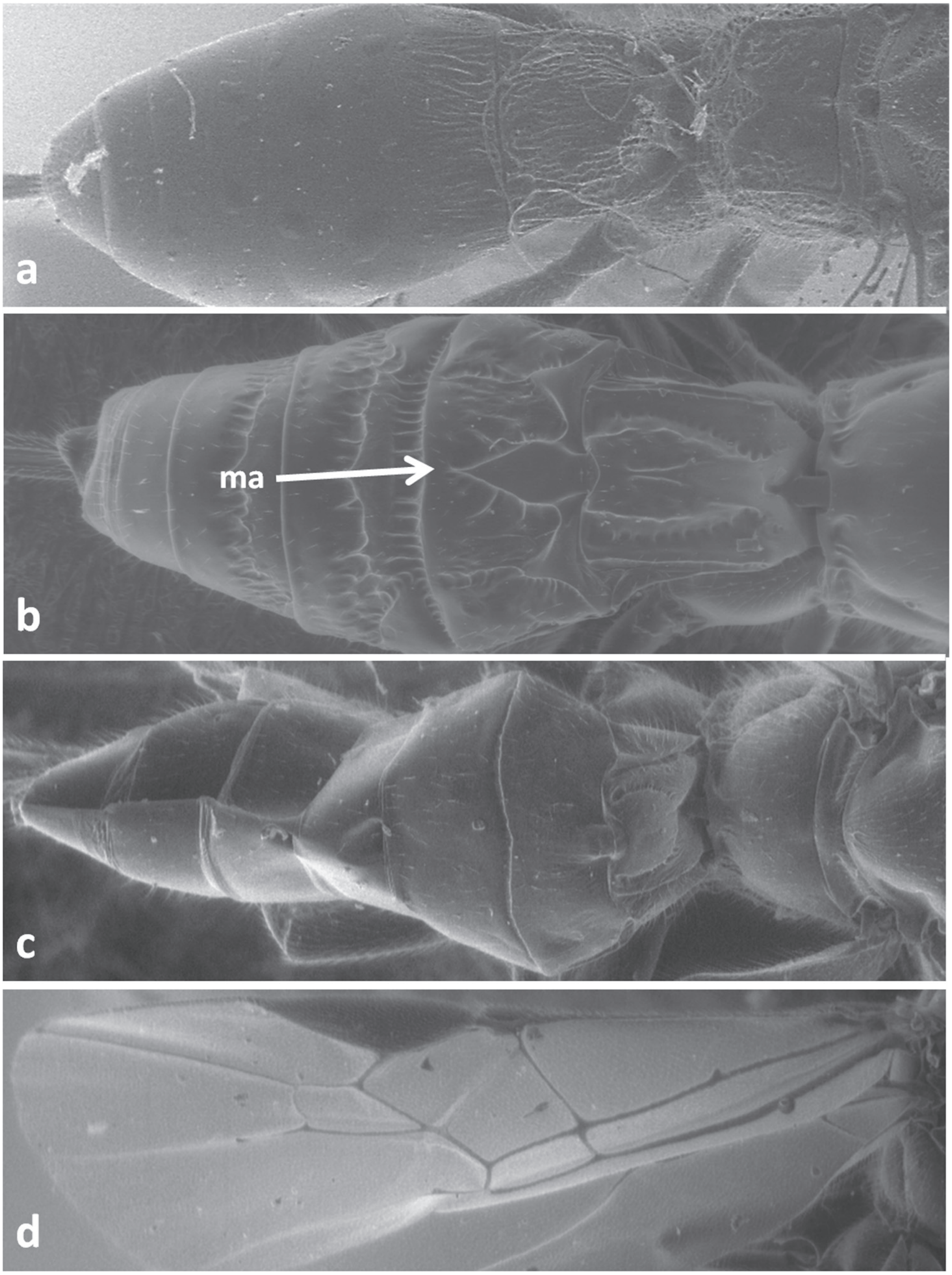



**Figure 5.** Metasoma in dorsal view of *Doryctes striatellus* (**a**), *Atanycolus ivanowi* (**b**) and *Coeloides sordidator* (**c**); forewing of *C. sordidator* (**d**); ma – mediobasal area.

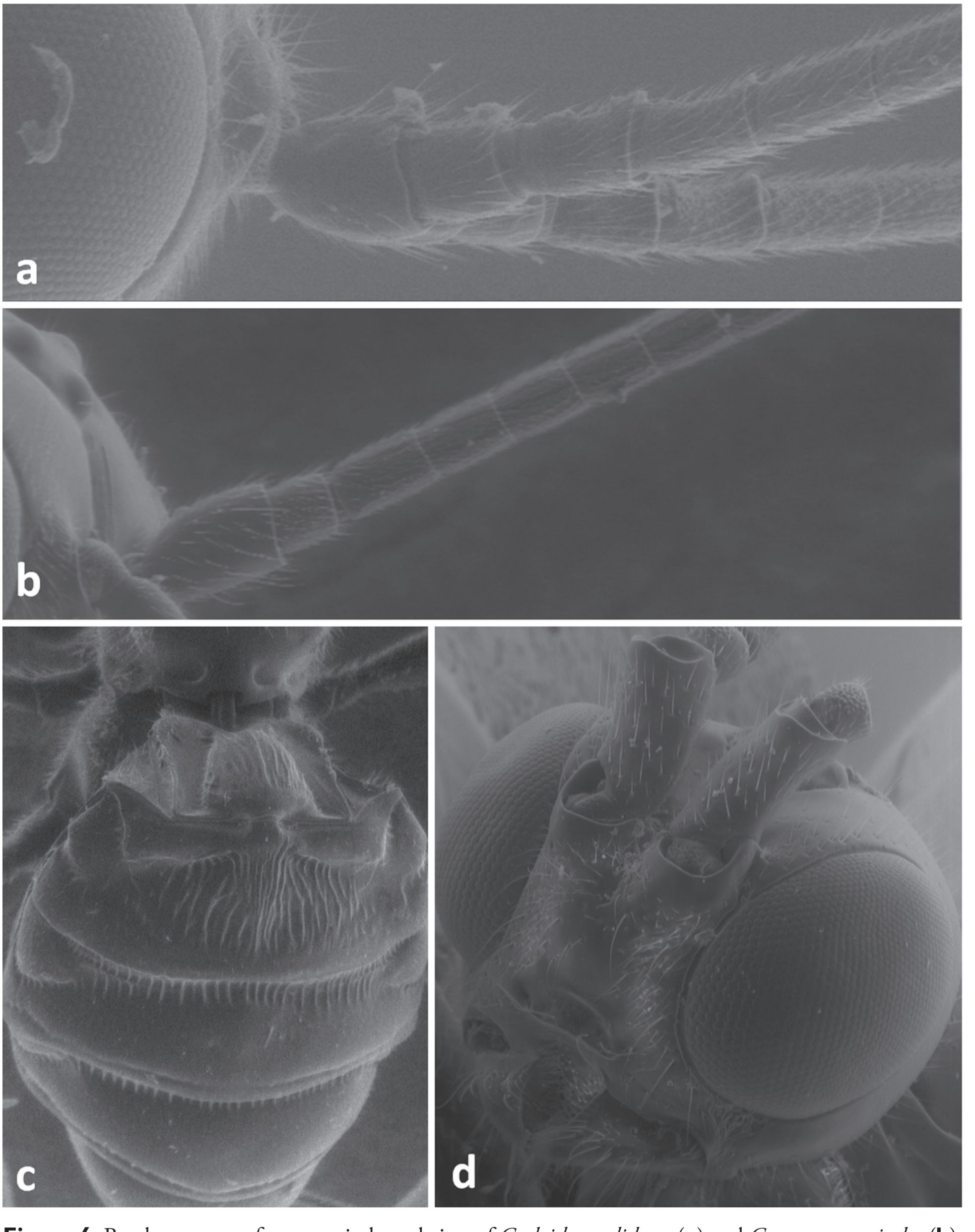



**Figure 6.** Basal segments of antenna in lateral view of *Coeloides sordidator* (**a**) and *Cyanopterus tricolor* (**b**); metasoma in dorsal view of *Iphiaulax impostor* (**c**); face of *Atanycolus ivanowi* (**d**).

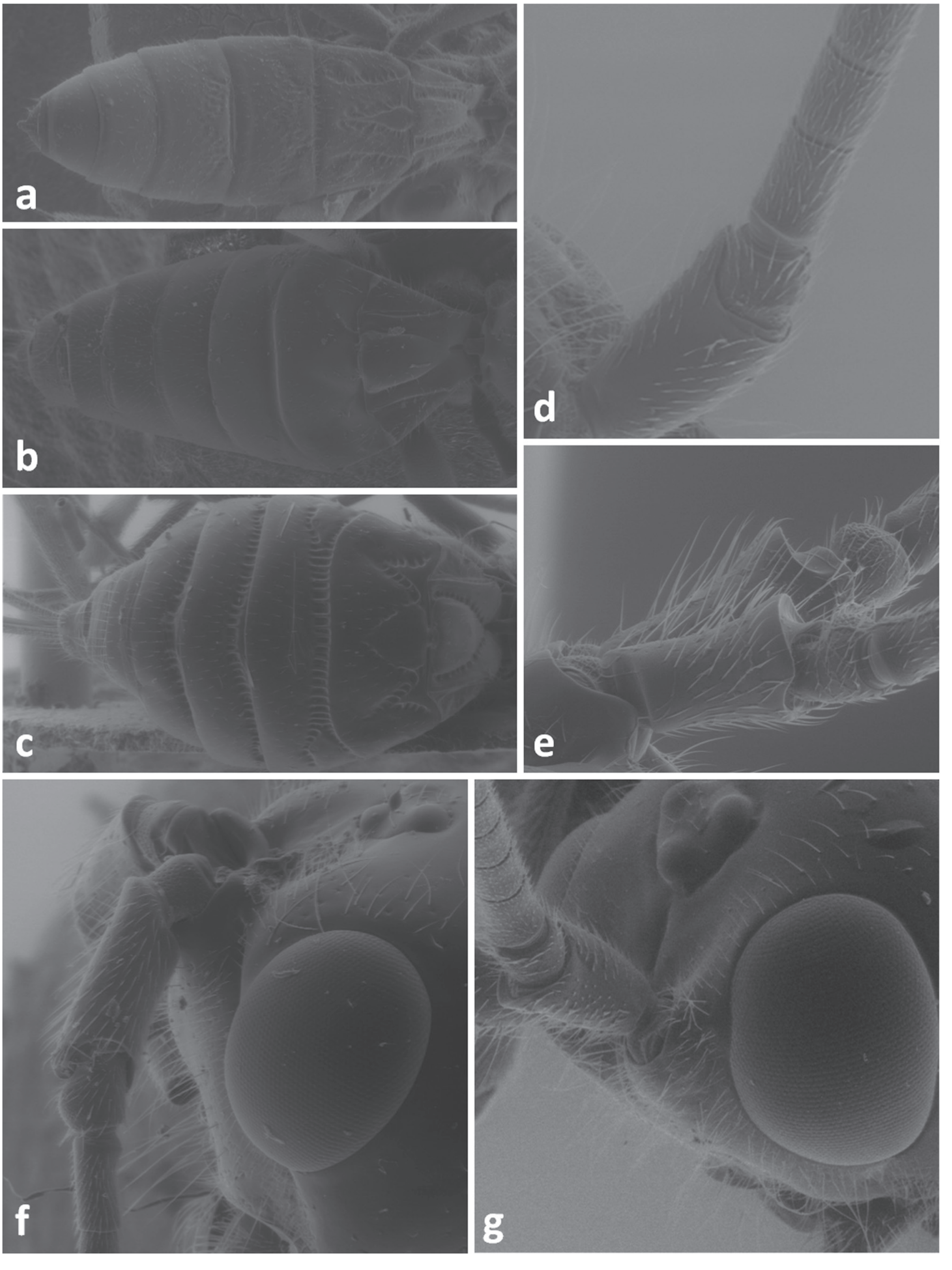



**Figure 7.** Metasoma in dorsal view of *Atanycolus denigrator* (**a**), *Cyanopterus flavator* (**b**) and *Cyanopterus tricolor* (**c**); scape and pedicel in lateral view of C. *flavator* (**d**) and *A. denigrator* (**e**); space of head between antennal socket and eye in laterofrontal view of *Atanycolus genalis* (**f**) and *C. flavator* (**g**).

## References

Belokobylskij SA, Maeto K (2009) Doryctinae (Hymenoptera, Braconidae) of Japan. Fauna Mundi Volume 1. Natura optima dux Foundation, Warsaw, 806 pp.

Bolu H, Beyarslan A, Yildirim H, Aktürk Z (2009) Two new host records of Atanycolus ivanowi (Kokujev, 1898) (Hymenoptera: Braconidae) from Turkey. Türkiye Entomoloji Dergisi 33 (4): 279–287.

Campadelli G, Scaramozzino EPL (1994) Imenotteri parassitoidi di insetti xilofagi in in Romagna. Bollettino dell'Istituto di Entomologia della Universita degli Studi di Bologna 48: 115–121.

Francardi V, Pennacchio F (1996) Note sulla bioecologia di Monochamus galloprovincialis galloprovincialis (Olivier) in Toscana e in Liguria (Coleoptera Cerambycidae). Redia 79: 153–169.

Francardi V, Pennacchio F, de Silva J (1998) Attack distribution on maritime pine bole by longhorn beetles in Tuscany (Coleoptera Cerambycidae). Redia 81: 135–142.

Hanks LM (1999) Influence of the larval host plant on reproductive strategies of cerambycid beetles. Annual Review of Entomology 44: 483–505. doi: 10.1146/annurev.ento.44.1.483

Hellrigl KG (1971) The bionomics of the European genera of Monochamus (Coleoptera, Cerambycidae) and their significance to the forest and lumber economy. Redia 52: 367–509.

Hokkanen HMT, Pimentel D (1984) New approach for selecting biocontrol agents. Canadian Entomologist 116: 1109–1121. doi: 10.4039/Ent1161109-8

Kasparyan DR (2010) Parasitism on aculeates (Hymenoptera: Aculeata) as important direction in the evolution of ichneumon-flies of the tribe Cryptini (Hymenoptera: Ichneumonidae, Cryptinae). Proceedings of the Russian Entomological Society. 81(2): 112–120. [In Russian]

Kenis M, Hilszczanski J (2004) Natural enemies of Cerambycidae and Buprestidae. In: Lieutier F, Day K, Battisti A, Gregoire JC, Evans H (Eds) European bark and wood boring insects in living trees: a synthesis. Kluwer, Amsterdam, 484–498. doi: 10.1007/978-1-4020-2241-8_21

Kishi Y (1995) The pine wood nematode and the Japanese pine sawyer. Thomas Company Limited, Tokyo, 302 pp.

van Lenteren JC, Bale J, Bigler F, Hokkanen HMT, Loomans AJM (2006) Assessing risks of releasing exotic biological control agents of arthropod pests. Annual Review of Entomology 51: 609–634. doi: 10.1146/annurev.ento.51.110104.151129

Linit MJ (1987) The insect component of pine wilt disease in the United States. In Wingfield MJ (ed.), Pathogenicity of the pine wood nematode. American Phytopathological Society Press, St. Paul, 66–73.

Linit MJ (1988) Nematode-vector relationships in the pine wilt disease system. Journal of Nematology 20: 227–235.

Linit MJ (1990) Transmission of pinewood nematode through feeding wounds of Monochamus carolinensis (Coleoptera: Cerambycidae). Journal of Nematology 22: 231–236.

Linsley EG (1959) Ecology of Cerambycidae. Annual Review of Entomology 4: 99–138. doi: 10.1146/annurev.en.04.010159.000531

Naves P, Kenis M, Sousa E (2005) Parasitoids associated with Monochamus galloprovincialis (Olivier) (Coleoptera: Cerambycidae) within the pine wilt nematode-affected zone in Portugal. Journal of Pest Science 78: 57–62. doi: 10.1007/s10340-004-0068-z

Naves P, Sousa E, Rodrigues JM (2008) Biology of Monochamus galloprovincialis (Coleóptera: Cerambycidae) in the pine wilt disease affected zone, Southern Portugal. Silva Lusitana 16: 133–148.

Sousa E, Bravo M, Pires J, Naves P, Penas A, Bonifácio L, Mota M (2001) Bursaphelenchus xylophilus (Nematoda; Aphelenchoididae) associated with Monochamus galloprovincialis (Coleoptera; Cerambycidae) in Portugal. Nematology 3: 89–91. doi: 10.1163/156854101300106937

Tobias VI, Belokobylskij SA, Kotenko AG (1997) Family Braconinae. In: Medvedev GS (Ed.) Key to the insects of the European part of the USSR. Volume 3 Hymenoptera, Part 4, New Dehli, 500 pp. [Translation, original in Russian was published in 1986]

Tobias VI, Belokobylskij SA (2000) Fam. Braconidae. In: Lehr PA (Ed.) Key to insects of the Russian Far East. Neuropteroidea, Mecoptera, Hymenoptera. Dal'nauka, Vladivostok, 4(4): 8–571. [In Russian]

Yu DS, van Achterberg C, Horstmann K (2005) World Ichneumonoidea, Taxonomy, Biology, Morphology and Distribution. Vancouver, Taxapad.

Wang Y, Shi M, Chen X, He J (2009) The genus Atanycolus Foerster (Hymenoptera, Braconidae, Braconinae) in China, with description of one new species. ZooKeys 27: 31–41.

Watanabe C (1937) A contribution to the knowledge of the Braconid fauna of the Empire of Japan (Hymenoptera). Journal of the Faculty of Agriculture Hokkaido Imperial University 42(1): 1–188.

ZooKeys 251: 49–67 (2012)
doi: 10.3897/zookeys.251.3994
www.zookeys.org

RESEARCH ARTICLE

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

# Taxonomy of new relatives of *Onthophagus catenatus* Lansberge, 1883 from New Guinea (Coleoptera, Scarabaeidae, Scarabaeinae)

Jan Krikken[1,†], Johannes Huijbregts[2,‡]

**1** *NCB Naturalis, PO Box 9517, NL-2300 RA, Leiden, The Netherlands* **2** *NCB Naturalis, PO Box 9517, NL-2300 RA, Leiden, The Netherlands*

† *urn:lsid:zoobank.org:author:B5876816-7FB2-4006-8CDC-F58797EFC8DF*
‡ *urn:lsid:zoobank.org:author:903C61B0-8329-4781-9B83-ECD78522FA6C*

Corresponding author: *Jan Krikken* (jan.krikken@naturalis.nl)

Academic editor: *A. Frolov* | Received 17 September 2012 | Accepted 3 December 2012 | Published 17 December 2012

*urn:lsid:zoobank.org:pub:4DFC1300-7CE6-4C1C-B5F7-7AEAE4377442*

**Citation:** Krikken J, Huijbregts J (2012) Taxonomy of new relatives of *Onthophagus catenatus* Lansberge, 1883 from New Guinea (Coleoptera, Scarabaeidae, Scarabaeinae). ZooKeys 251: 49–67. doi: 10.3897/zookeys.251.3994

## Abstract

Four new taxa from New Guinea are proposed in the dung beetle genus *Onthophagus* Latreille, 1802, all in the operational group of *O. catenatus* Lansberge, 1883. The group is discussed, defined, and the five taxa included are listed, keyed, and diagnosed. Three new species are described: *Onthophagus abmisibilus* (from West New Guinea, Indonesia), *O. kokodanus*, *O. kokosquamatus* (both from Papua New Guinea). One new species comprises a lowland and an upland subspecies: *O. kokodanus kokodanus* and *kokodanus hagenaltus* (both in Papua New Guinea).

## Keywords

*Onthophagus*, New Guinea, *catenatus* group, key, list of species, new species

## Introduction

The onthophagine dung beetle fauna of New Guinea and nearby islands has been the subject of various recent papers, including a general discussion with descriptions of a diverse array of new species (Krikken & Huijbregts 2012), and a separate treatment of small, unicolour new species (Krikken & Huijbregts in press), all in the subcosmopolitan mega-genus *Onthophagus* Latreille, 1802. The present paper deals with four new species-group taxa similar to the New Guinea *Onthophagus catenatus* Lansberge, 1883 in features of their vertexal armature, size range, and various other characters. Major males in this operational group have a vertexal pair of long, evenly curved, laterally directed horns, lacking accessory inward lobes and denticles; they differ from the members of the closely related *O. tauroides* Gillet, 1930, group (cf. Krikken & Huijbregts 2012) by the horns at their base being distinctly contiguous, showing a low, variably shaped but relatively simple interconnecting elevation. The pronotum may be slightly modified (depressed, bluntly bifid, etc.), but never with deep concavities and/or strong, sharp protrusions. Note that the material available is limited, particularly from a geographic point of view, and therefore this paper should, after the last overview of Balthasar (1969), be considered just another partial update, attempting to make more taxonomic sense of the morphological diversity now seen in this set of *Onthophagus* species.

This *Onthophagus catenatus* group as here conceived is indeed diverse, and the group concept may even be insufficiently inclusive, as will be clear from the comments below. Formal group delimitation and species identification are, as usual among Scarabaeinae, complicated by intraspecific polymorphism – males, for instance, may look like females, and some species (here excluded) may never have males with long, curved, laterally directed horns. One form (*O. kokodanus kokodanus* subsp. n.) has an isolated conical median tubercle just in front of the base of its broad male vertexal horns, possibly the result of a morphoclinal forward-shifting of the medially angulate interconnecting ridge seen in other group members. Another species (*O. kokosquamatus* sp. n.) has a peculiarly rugulate-squamate pronotal surface and unusual lateral pronotal margins. This species stands apart from the others, and may be related to two much smaller named species here excluded from the *catenatus* group (see Comments under *O. kokosquamatus*). Both sexes of *O. kokosquamatus* have a similar, usually well-developed vertexal armature, contrary to at least two of the other species, in which the vertexal armature of females is reduced to a simple or more complex transverse ridge, its shape apparently different according to species.

The key to the species given below takes all this into account, the first couplet firmly delimiting the *catenatus* group from other Papuasian *Onthophagus* with long horns, in spite of the afore-mentioned complications. *Onthophagus catenatus* Lansberge, 1883, is apparently a widespread species, the label data we have seen indicate a range of altitudes from the Aru Islands to the Mount Hagen highlands and beyond. Although there is some variation, certainly needing further study, our present concept of the species (cf. also Comment in species account) is consistent with van Lansberge's (1883) description, which mentioned the characteristic strengthening of the punctures in the elytral striae, from base to apex.

All four species included in the *Onthophagus catenatus* group are formally placed in the nominotypical subgenus.

## Material and methods

The material used in this work mainly comes from the Canadian Museum of Nature (Ottawa), and comprises 5 species-group taxa, 22 collection records, 166 specimens. The data given in the lists closely follow the information on the specimen labels. Paratypes, where available in sufficient numbers, will in due course be distributed to other collections.

Body part measurements in the descriptions were taken through the microscope with a calibrated ocular scale, and rounded off to 0.1 mm; approximate total body lengths (given for specimens as is) rounded off to ½ mm. For more background, references, and terminological and technical matters, see our companion papers mentioned above. One terminological addition: hemi-punctures are those that have about half of their peripheral rim effaced, usually having a seta more or less decumbent to the effaced side.

### Collection abbreviations

**CMNC** Canadian Museum of Nature, Ottawa, Canada
**IRSNB** Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium
**RMNH** National Museum of Natural History / NCB Naturalis, Leiden, The Netherlands

### List of *Onthophagus* taxa treated in this paper

*O. abmisibilus* sp. n. – Indonesia: West New Guinea (Star Mountains)
*O. catenatus* Lansberge, 1883 – Papua New Guinea, Indonesia: West New Guinea
*O. kokodanus* sp. n. – Papua New Guinea
*O. k. kokodanus* subsp. n. – Papua New Guinea (E of Port Moresby)
*O. k. hagenaltus* subsp. n. – Papua New Guinea (Western Highlands)
*O. kokosquamatus* sp. n. – Papua New Guinea (E of Port Moresby)

### Key to species and subspecies (males)

1 Vertex of major males with pair of laterally divergent, long, evenly, upward curved horns, in various ways connected at base (usually by transverse elevation, medially with or without short angular protrusion); horns complanate, inner edge (axial view) without accessory lobe(s) or denticle(s). Dorsal eye parts distinctly elliptic (width varying according to species, eyes separated by 3–5 times their widths). Clypeofrontal ridge variably distinct (straight or arcuate, angularly connected to clypeogenal suture or ridge). Clypeal apex more or

less reflexed, broadly bisinuate to truncate-rounded. Genal border rounded, clypeogenal transition at most very slightly indented or outwardly angular at border. Basic colour black or (rufous) brown, non-patterned, with or without metallic lustre (but lacking shifting light reflection of satin elytra under different angles of view). Pronotum anteromedially gibbous (at most shortly, bluntly bifid), or more or less broadly depressed; if depressed, surface, at most, posteriorly delimited by blunt protrusion(s) (never with set of sharp forward projections, denticles, or tubercles). Anterolateral section of pronotal edge straight or concave, angle distinct. Parameres with slender, moderately curved, usually tapering tip. Body length usually 8–12 mm..........***catenatus* group, 2**

– Combination of characters different............. **other groups of *Onthophagus***

2 Pronotum largely rugulate-punctate, its broadly rounded anterior gibbosity with scale-like rugulation, anterolaterally with long setae. Lateral border of pronotum distinctly, abruptly angulate (in dorsal view). Ridge connecting base of vertexal horns medially topped with forward angle. Generally black, lacking metallic lustre. Clypeofrontal ridge strongly pronounced, distinctly, evenly arcuate. Males and females similar. Body length over 10 mm .....***kokosquamatus***

– Pronotum more finely punctate, not rugulate, glabrous. Lateral border of pronotum simply rounded at the middle. Frontal disc on either side delimited by ridge extending along gena and eye ................................................**3**

3 Vertexal horns at base with intervening angle or more or less isolated conical protrusion. Pronotum with distinct pair of blunt forward protrusions (rim bisinuate in dorsal view) behind depressed anterior declivity.......................
................................................................... ***kokodanus* (2 subspecies), 4**

– Vertexal horns at base simply connected, intervening elevation not angular. Pronotum with anterior declivity simply gibbous (at most with very slight midline impression), or broadly deplanate with transversely arcuate, blunt, posterior ridge...........................................................................................**5**

4 Vertexal median protrusion shifted forward, in major males more or less isolated, conical; base of horns dilated (plate-like) up to about half of horn length, tip of horns laterally beyond eyes. Elytra distinctly matt, strial punctures all equally fine ..............................................................***k. kokodanus***

– Vertexal median protrusion angulate, situated on basal intervening connection of horns; base of horns broad, gradually narrowing to tapering tip, which does (in axial view) laterally extend over (not beyond) eyes. Elytra shining, strial punctures generally more strongly impressed..................***k. hagenaltus***

5 Anteromedian pronotal declivity gibbous, convex from disc down, surface behind horns shallowly concave. Punctures of elytral striae from base to apex increasingly strong, more broadly impressed and affecting adjacent interstriae. Smaller, body length 8–10 mm................................................***catenatus***

– Anterior declivity of pronotum broadly deplanate, sloping down from generally arcuate, transverse posterior rim. Punctures of elytral striae over entire length all equally impressed. Larger, body length ca 11.5 mm.... ***abmisibilus***

## Descriptions

***Onthophagus abmisibilus* sp. n.**
urn:lsid:zoobank.org:act:F6BBF729-53C1-4DEA-AA33-7912A142A44A
http://species-id.net/wiki/Onthophagus_abmisibilus
Figs 1–2, 12, 17, 22–26

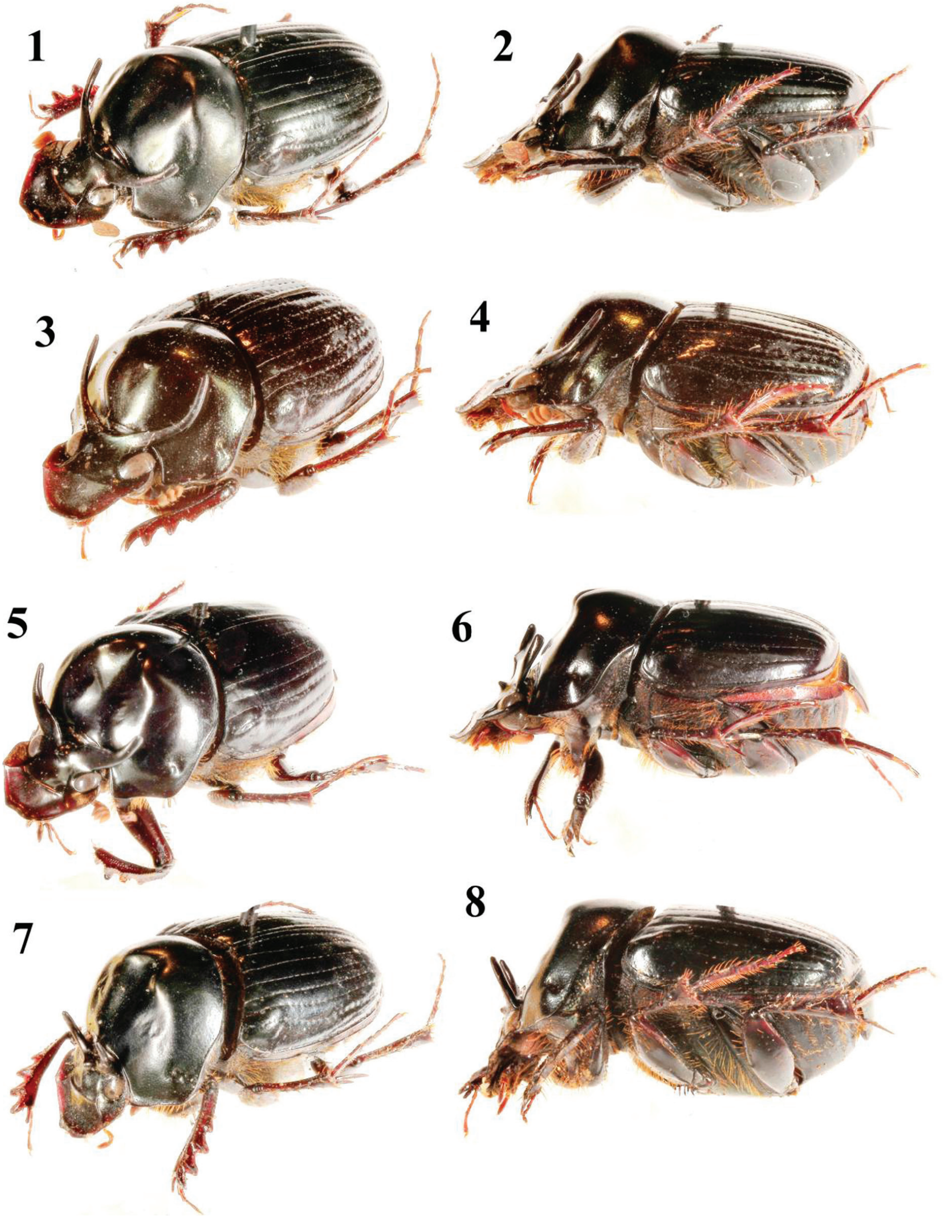
**Type-material. Holotype,** male: (RMNH), Indonesia, : West New Guinea, Papua, Star Mountains, Abmisibil, 1900–2200 m, 4°38'S, 140°33'E, 29.i–09.ii.2005, T. Lackner. Locality description with landscape pictures: http://www.papua-insects.nl/about%20Papua/Starmountains/Star%20Mountains.htm (accessed 30.iii.2012).

**Diagnosis.** Male of this species has two very distinctive features: the concave (in axial view), non-angulate crest of the plate connecting the bases of the vertexal horns, and the rather flat, faintly metallic anterior declivity of the pronotum. Dorsum black-brown, largely matt (particularly elytra). Elytral strial punctures all distinct, fine, equal-sized, and only slightly crenulating interstriae. Lateral border of pronotum distinctly rounded at some distance from anterolateral angle. Pronotum with widely bisinuate, blunt crest behind anterior declivity. Clypeofrontal ridge low, almost straight, on either end angularly connected at clypeogenal ridge. Most of dorsal side finely to minutely, sparsely punctate. Clypeal tip broadly, slightly reflexed, apical border bisinuate. Dorsal eye parts broadly elliptic, separated by slightly over three eye-widths. Pygidium abundantly, finely, distinctly punctate. Body length ca 11.5 mm, *O. catenatus* being smaller, 8–10 mm.

**Description** (holotype, male). Body length ca 11.5 mm. Habitus generally convex, robust. Colour of dorsal side black, generally matt (microreticulate), with slight metallic lustre; ventral parts largely black, partly matt (microreticulate); legs black-brown, shiny. Dorsal side and pygidium virtually glabrous (apart from any inconspicuous micro-stubbles); ventral side and legs with numerous long, light-brown setae.

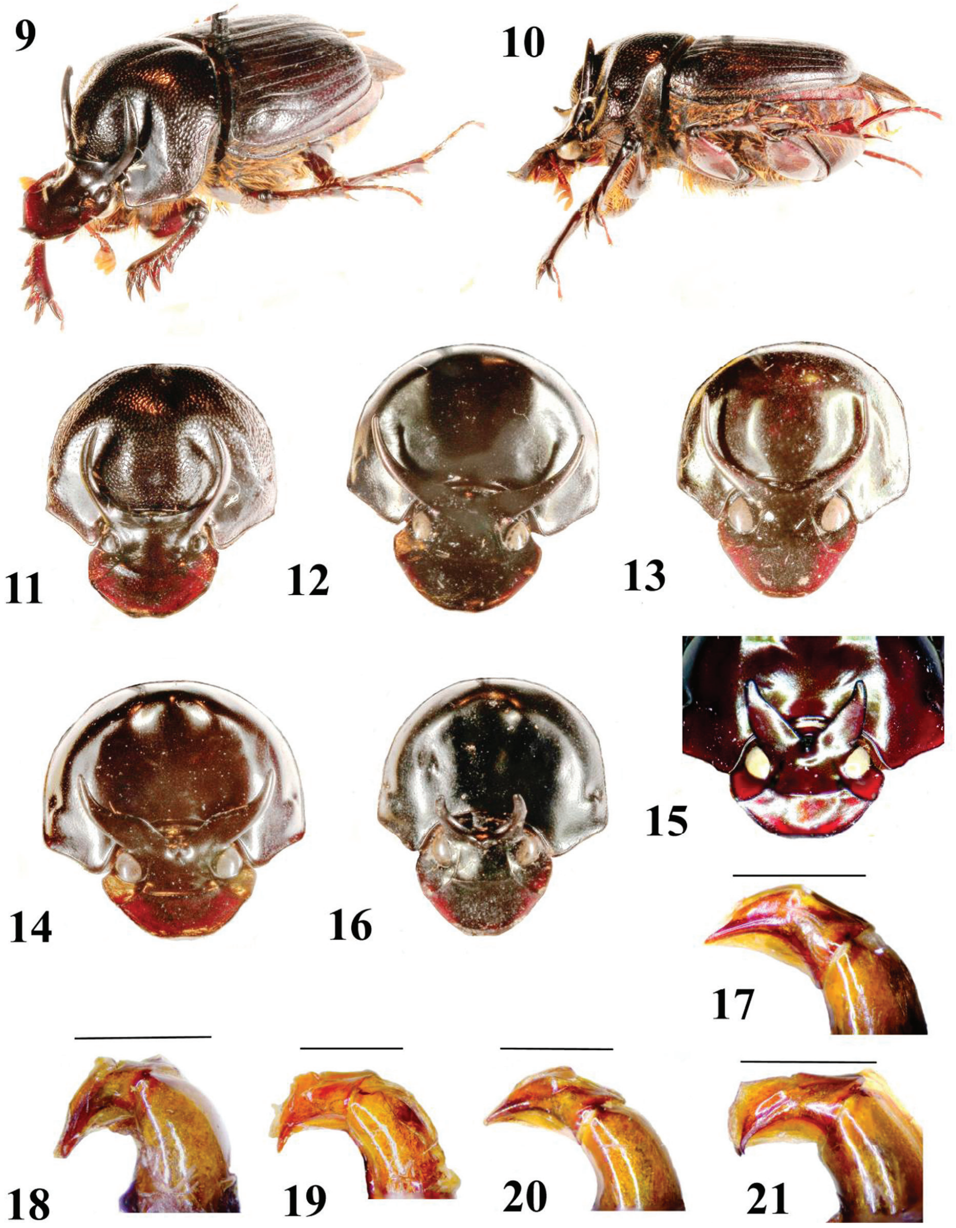
Head shiny, sparsely micropunctate throughout. Clypeal border broadly, distinctly marginate, sides very slightly rounded (almost straight) from genae to apex, the latter bisinuate, slightly reflexed, shortly lobiform; clypeogenal transition at border very obtusely angular, on either side with almost straight ridge extending past end of very weakly curved, distinct clypeofrontal ridge onto frontal side. Genal border evenly, widely rounded. Vertex between posterior end of eyes with pair of long, basally broad horns, connected at base by transverse, slightly concave, laterally sinuate (plate-like) elevation (in axial view); horns widely, evenly arcuate upward, directed laterad, over and beyond eyes (in axial view), evenly tapering to blunt tip; distal section of horn rounded on all sides. Frontal disc limited by fine frontogenal ridge, on either side extending along eye. Dorsal eye parts widely elliptic, with ca 28 facet rows across widest point. Ratio of interocular distance to maximum (transverse) eye width ca 3.3.

Pronotum generally strongly convex, surface matt, with cupreous lustre; disc posteriorly slightly convex (midline impression almost effaced), anterior declivity broadly deplanate, posterior rim slightly transversely arcuate-sinuate, blunt; anterior and lateral borders of pronotum marginate; anterior section of lateral border slightly




**Figures 1–8.** Habitus (oblique and lateral views) of *Onthophagus* males (holotypes, except **3–4**). **1–2** *O. abmisibilus* **3–4** *O. catenatus*, vicinity of Mt Hagen **5–6** *O. k. kokodanus* **7–8** *O. k. hagenaltus*.

concave; anterolateral angle rectangular, shortly rounded; posterior section of lateral border slightly sinuate, posterolateral angle rounded; base finely marginate, with very obtuse basomedian angle. Most of pronotal disc and medial surface in general sparsely micropunctate; lateral declivities with larger, but fine, more abundant punctation (surface microreticulate).




**Figures 9–21.** *Onthophagus* males (holotypes, except **13, 15, 18**) . **9–11, 21** *O. kokosquamatus*; **12, 17** *O. abmisibilus*; **13, 18** *O. catenatus*, vicinity of Mt Hagen **14, 15, 19** *O. k. kokodanus*, **15** minor male E Pt Moresby **16, 20** *O. k hagenaltus*. **9–10** habitus (oblique and lateral views) **11–16** head and pronotum in dorsofrontal view **17–21** parameres in lateral view (scales 1 mm).

Elytra generally black, virtually matt (microreticulate); scutellum indistinct in dorsal view, shape of base and apex unmodified; anterior half of epipleuron distinctly punctate-setose. Elytra broad, with 8 straight to slightly curved, fine, distinct striae; stria 7 slightly sinuate in front, extending onto shining humeral umbone; striae fine, punctures fine but distinct, widely separated (mostly 4–8 puncture diameters), slightly crenulating interstrial edges. Interstrial surfaces virtually flat to slightly convex (from disc to lateral declivity of elytra), with sparse, inconspicuous micropunctation.

Antennal club medium-brown, scapus unmodified. Mentum shallowly emarginate in front. Prothoracic sides with coxal-marginal ridge distinct, curving forward onto lateral border, much of surface annulate-punctate-setose, including large, seta-bearing hemi-punctures. Anterior lobe of metasternum slightly convex, abundantly punctate-setose, disc micropunctate; metasternal sides and adjacent parts matt, abundantly to densely annulate-punctate-setose. Abdominal ventrites matt, each laterally with row of seta-bearing annulate punctures. Pygidium black, matt (microreticulate), with abundant, shallow, fine punctation, without macro-setae; surface slightly convex, base with transverse ridge, apex marginate.

Legs robust. Protibia with 3+1 larger external denticles (distal 3 longer, sub-acuminate), separated by some fine serration; proximal serration consisting of 8 smaller denticles; apico-external denticle oblique to tibial axis; apical edge slightly round, with strong, down-curved, elongate-acuminate spur; protibial underside with low longitudinal crest; protarsus unmodified. Profemur robust, underside finely punctate and with numerous larger seta-bearing hemi-punctures. Meso- and metafemoral undersides also finely punctate, with fewer large seta-bearing hemi-punctures. Meso- and metatibiae strongly dilated distad to transversely subelliptic crest, which is fringed with fine fossorial spines; external side with ca 4 sets of distinct, spine-bearing fossorial protrusions. Tarsi generally slender, with well-developed sickle-shaped claws; meso- and metatarsomeres 1 long, straight, unmodified. Spurs on meso- and metatibiae elongate-acuminate. Relative length proportions of metatibial spur to metatarsomeres 1–5: ca 28, 33, 13, 9, 7, 14.

Parameres narrow (dorsal view), tapering, curved downward (lateral view), Fig. 17.

Measurements (in dorsal view): maximum width of head 3.4 mm, median length of pronotum 3.5 mm, maximum width of pronotum 6.0 mm, sutural length of elytra 5.5 mm, maximum width of combined elytra 6.3 mm.

**Variability and sexual dimorphism.** Only male holotype is known.

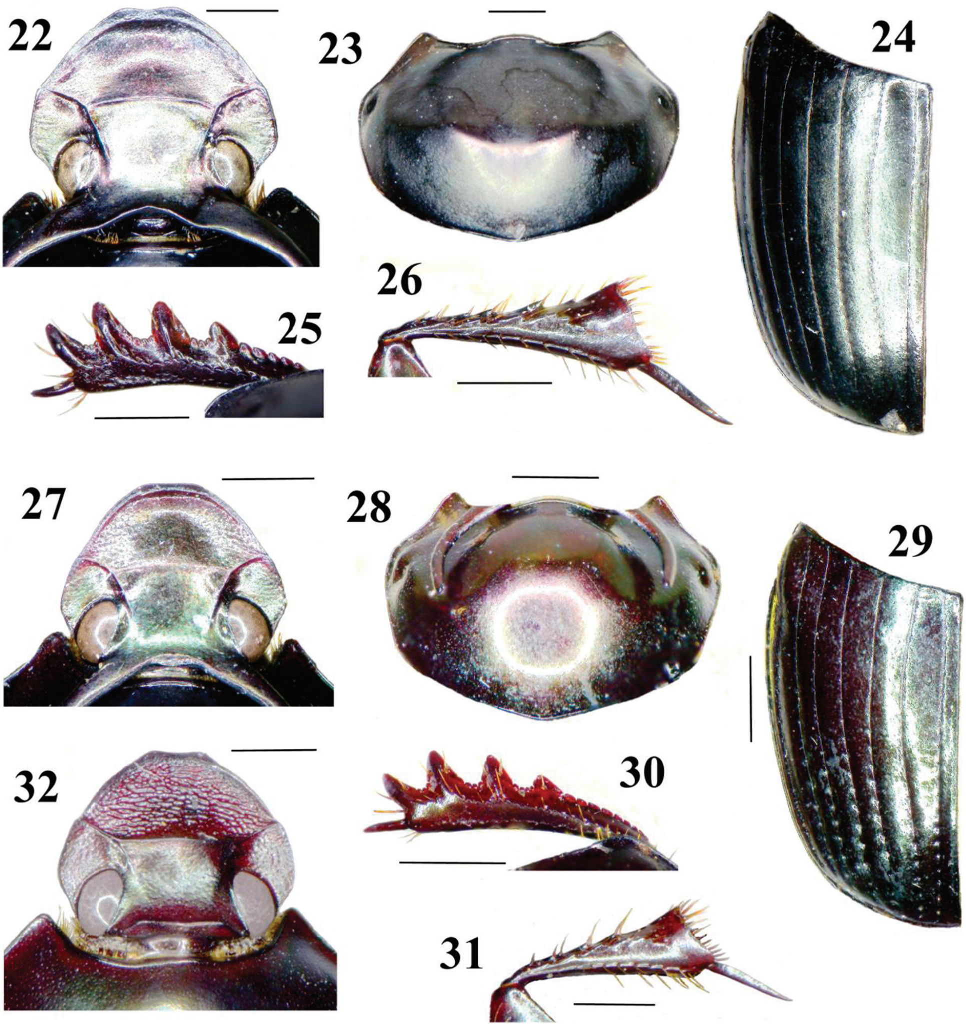
**Etymology.** The name of the new species is derived from the name of the type locality, a village in the central mountain chain, on the Indonesian side of the Indonesian-Papuan New Guinea border; to be treated as masculine noun.

## *Onthophagus catenatus* Lansberge, 1883

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

Figs 3–4, 13, 18, 27–32

**Material examined.** 104 males and females, 11 collection records. Papua New Guinea: 18 mi N Port Moresby, Brown River, 14–15/vii/1974, Peck, 10ft, forest:




**Figures 22–32.** Details of morphology of *Onthophagus*. **22–26** *O. abmisibilus*, holotype **27–32** *O. catenatus*, male, vicinity of Mt Hagen **32** female, N Pt Moresby **22, 27, 32** head in dorsal view **23, 28** pronotum in dorsal view **24, 29** elytron in dorsal view **25, 30** protibia, upper side **26, 31** metatibia, underside. Scales 1 mm.

dung, 32 spm., in CMNC. 30 mi N Port Moresby, Brown River, 15–16/vi/1974, Peck, 3 spm., in CMNC. Kokoda Trail, 20 mi E Port Moresby, 16–18/vii/1974, Peck, 10ft, forest: dung, 35 spm., in CMNC. 15–16/vii/1974, Peck, 10ft, forest: dung, 15 spm., in CMNC. 16–18/vii/1974, Peck, 10ft, forest: dung, 2 spm., in CMNC. Kokoda Trail, 34 mi E Port Moresby, 17–18/vii/1974, Peck, 2200ft, 3 spm., in CMNC. 16–17/vii/1974, Peck, 2200ft, 9 spm., in CMNC. 17–18/vii/1974, Peck, 2200ft, 1 spm., in CMNC. Kuk Exp. Station nr Mt Hagen, 04–12/vii/1974, Howden, 1 spm., in CMNC (pictured, body length ca 9 mm). Madang:

Baitabag, 6°08'19"S – 145°46'34"E, 30/i/2000, Anderson, 100m, rainforest litter, 2 spm., in CMNC. [Indonesia:] "N. Guinea \ Amberbaki", 1 male (syntype?). Additional material seen from both Papua New Guinea and West New Guinea localities, including the Aru Islands.

**Diagnosis.** The following combination of three features should distinguish *O. catenatus* from its close relatives, at least the major males: evenly concave (in axial view), non-angulate crest of the plate connecting the bases of the male vertexal horns; generally convex (gibbous), relatively smooth anterior declivity of the pronotum; and particularly the posteriorly increasing size of the strial punctures of the elytra – normally both males and females should be recognizable from this punctation. Dorsum brown to black (occasionally bicolorous, elytra may be light-brown), shining, usually with distinct metallic lustre (particularly on pronotum). Lateral border of pronotum distinctly rounded (not angular) at some distance from anterolateral angle. Clypeofrontal ridge very low, virtually straight, on either end angularly connected at clypeogenal ridge. Most of dorsal side finely to minutely, sparsely punctate. Clypeal tip slightly reflexed, apical border rounded to truncate. Dorsal eye parts broadly elliptic, separated by 3–3.5 eye widths. Pygidium abundantly, finely, distinctly punctate. Females with transverse vertexal ridge. Body length usually 8–10 mm.

**Comment.** A male in the Gillet drawers of the IRSNB, agreeing with van Lansberge's (1883) description, bears type label and originates from the region mentioned in the original description (northern New Guinea) – it may be one of the syntypes.

## *Onthophagus kokodanus* sp. n.

urn:lsid:zoobank.org:act:F55E685F-8F8A-43A0-A3DF-CEE39BA5A3C0
http://species-id.net/wiki/Onthophagus_kokodanus

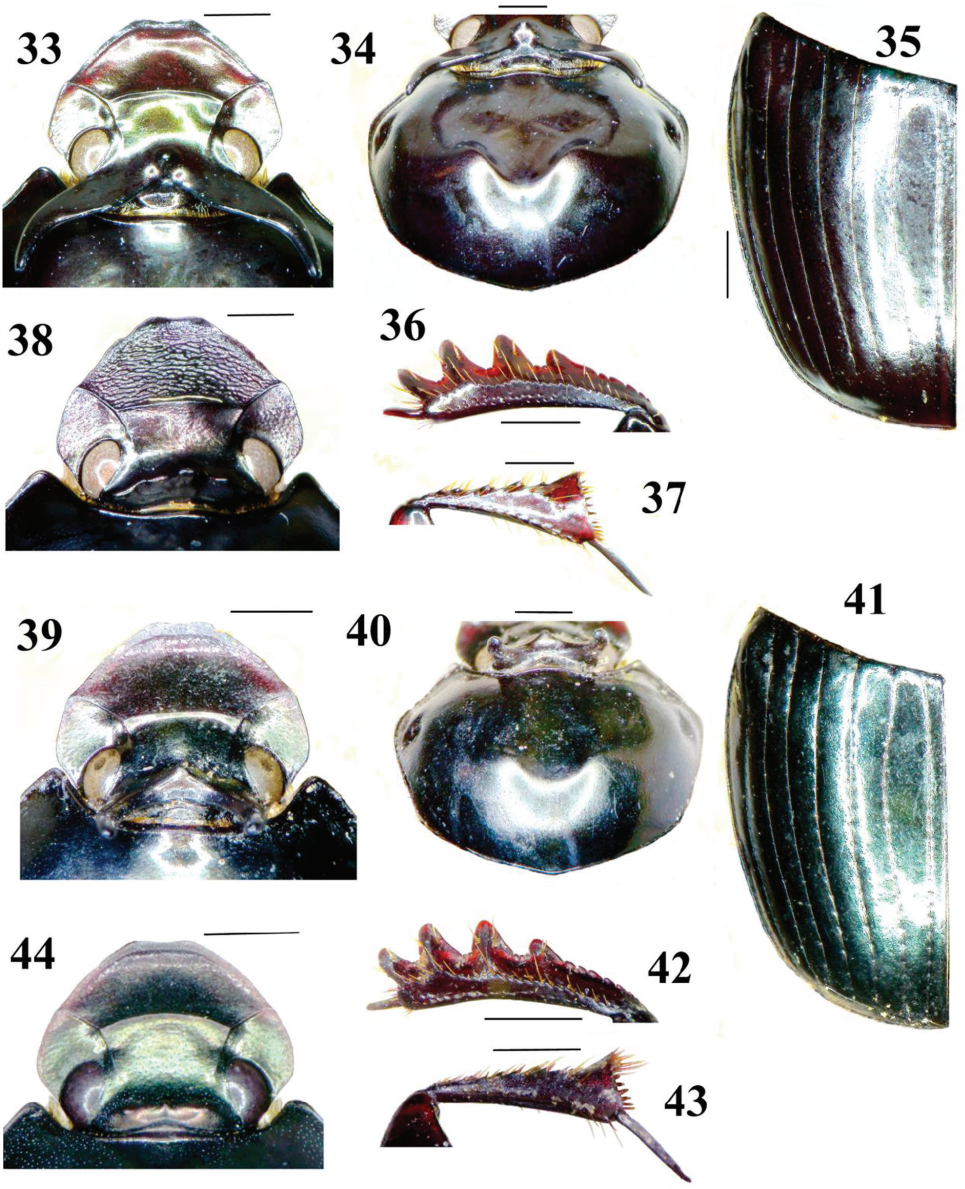
**Comments.** Under this species name two subspecies are characterized, one from the Kokoda Trail region E of Port Moresby, at about 700 m, and one from the Mt Hagen region at about 1800 m. They differ in structural development and in microsculpture, as diagnosed hereafter and in the key above.

## *Onthophagus kokodanus kokodanus* subsp. n.

http://species-id.net/wiki/Onthophagus_kokodanus_kokodanus
Figs 5–6, 14, 19, 33–38

**Type-material.** 41 males and females, 4 collection records. **Holotype** male (CMNC) from Papua New Guinea: 34 mi E Port Moresby, Kokoda Trail, 2000 ft, 17–18. vii.1974, S. Peck, T43–44.

**Paratypes:** Papua New Guinea: Kokoda Trail, 34 mi E Port Moresby, 17–18/ vii/1974, Peck, 2000ft, 6 spm., incl. holotype, in CMNC. Kokoda Trail, 30–34 mi E Port Moresby, 16–17/vii/1974, Peck, 2200ft, 4 spm., in CMNC. Kokoda Trail, 34 mi




**Figures 33–44.** Details of morphology of *Onthophagus* (holotypes, except **38, 44**). **33–38** O. *k. kokodanus*, 38 female paratype, E Pt Moresby **39–44** *O. k. hagenaltus* **44** minor male paratype, Mt Hagen **33, 38, 39, 44** head in dorsal view **34, 40** pronotum and head armature in dorsal view **35, 41** elytron in dorsal view **36, 42** protibia, upper side **37, 43** metatibia, underside. Scales 1 mm.

E Port Moresby, 17–18/vii/1974, Peck, 2200ft, 17 spm., in CMNC. 16–17/vii/1974, Peck, 2200ft, 14 spm., in CMNC.

**Diagnosis.** The pair of interconnected, basally broad (in axial view), plate-like vertexal horns in the major male, with the median conical tubercle just in front, constitutes the primary feature of this subspecies – at least in major males. Lateral border of pronotum distinctly rounded at about 0.4 of length behind anterolateral angle (not angular, in dorsal view, Fig. 34). Pronotum with blunt bisinuate rim behind broadly depressed, more or less concave anterior declivity, all this reduced in minors. Clypeofrontal ridge low, slightly arcuate, ends on either side angularly connected at clypeogenal ridge. Most of dorsal side finely to minutely, sparsely, evenly punctate. Clypeal tip distinctly, broadly reflexed, apical border bisinuate. Dorsal eye parts broadly elliptic, separated by slightly over three eyewidths. Elytra sericeous, virtually matt, sparsely micropunctate; strial punctures very fine, widely separated, all similar, not stronger caudad. Pygidium sparsely to abundantly, very finely punctate. Colour generally black-brown, moderately shiny, without metallic lustre. Body length usually 10–12 mm.

The presence of an isolated conical protrusion right in front of the horns is shared with other New Guinea species, like *O. heurni* Gillet, 1930 and *joliveti* Paulian, 1973, which may be confusing. The males of both these species, however, have on their horns, which are more or less erect, a distinct basal-internal lobe or denticle, and their eyes are narrow.

**Description** (holotype, male). Body length ca 12 mm. Habitus generally convex, robust. Colour of dorsal side (brown-)black, generally moderately shiny, elytra sericeous; ventral parts largely black, matt (microreticulate); legs dark-brown, shiny. Dorsal side and pygidium virtually glabrous (apart from any inconspicuous microstubbles); ventral side and legs with numerous long, light-brown setae.

Clypeal border broadly, distinctly marginate, sides virtually straight from genae to bisinuate, reflexed, shortly lobiform apex; clypeal surface shiny, with sparse, minute punctation; clypeogenal transition at border obtusely angular (anterolateral corner of gena slightly elevated), on either side with straight ridge to slightly arcuate, distinct clypeofrontal ridge. Genal and frontal surface minutely punctate as on clypeus; genal border evenly, widely rounded. Vertex between posterior end of eyes with pair of long, complanate, basally very broad horns, connected at base, with distinct conical tubercle medially on anterior side; horns strongly directed laterad (beyond eyes, in axial view), evenly curving upward to tapering, blunt tip, inner edge of horns sinuate (in axial view); horn surface also minutely, sparsely punctate. Frontal disc limited by fine frontogenal ridge, on either side extending along eye. Dorsal eye parts widely elliptic, with ca 28 facet rows across widest point. Ratio of interocular distance to maximum (transverse) eye width ca 3.2.

Pronotum generally strongly convex, surface shiny; disc posteriorly slightly convex (midline impression virtually effaced), anterior surface broadly depressed, medially shallowly concave up to posterior, strongly bisinuate, transverse protrusion coming from disc forward; anterior and lateral borders of pronotum marginate; anterior section of lateral border slightly concave; anterolateral angle rectangular, shortly rounded; posterior section of lateral border slightly sinuate, posterolateral angle rounded; base medially finely marginate along very obtuse basomedian angle. Most of pronotal surface finely, sparsely punctate, anterior depression minutely, sparsely punctate, this punctation interspersed with vague micropunctation.

Elytra generally weakly shiny to matt (sericeous); scutellum indistinct in dorsal view, shape of base and apex unmodified; anterior half of epipleuron distinctly punctate-setose. Elytra broad, with 8 straight to slightly curved, fine, distinct striae; stria 7 distinctly sinuate in front, extending onto shining humeral umbone; strial punctures very fine, widely separated (ca 10 puncture diameters), hardly crenulating interstrial edges. Interstrial surfaces virtually flat to very slightly convex (from disc to lateral declivity of elytra), with sparse, inconspicuous micropunctation.

Antennal club light-brown, scapus unmodified. Mentum shallowly emarginate in front. Prothoracic sides with coxal-marginal ridge distinct, curving forward onto lateral border, much of surface annulate-punctate-setose, including large, seta-bearing hemi-punctures. Anterior lobe of metasternum slightly convex, abundantly punctate-setose, disc micropunctate; metasternal sides and adjacent parts matt, abundantly to densely annulate-punctate-setose. Abdominal ventrites sericeous, each laterally with strip of seta-bearing annulate punctures. Pygidium black, weakly shiny (sericeous), with sparse to abundant, shallow, very fine punctation, without macro-setae; surface slightly convex, base with transverse ridge, apex marginate.

Legs very robust. Protibia with 3+1 larger external denticles (distal 3 longer, subacuminate), separated by some serration; proximal serration consisting of 5–6 smaller denticles; apico-external denticle oblique to tibial axis; apical edge slightly rounded, with strong, acuminate, down-curved spur; protibial underside with low longitudinal crest; protarsus unmodified. Profemur robust, underside finely punctate, and with numerous larger seta-bearing hemi-punctures. Meso- and metafemoral undersides also finely punctate, with fewer large seta-bearing hemi-punctures. Meso- and metatibiae strongly dilated distad to transversely subelliptic crest, which is fringed with fine fossorial spines and longer setae; external side with ca 4 sets of distinct, spine-bearing fossorial protrusions. Tarsi generally slender, with well-developed sickle-shaped claws; meso- and metatarsomeres 1 straight, unmodified. Spurs on meso- and metatibiae elongate-acuminate. Relative length proportions of metatibial spur to metatarsomeres 1–5: ca 14, 17, 6, 4, 3, 6.

Parameres narrow (dorsal view), tapering, curved downward (lateral view), Fig. 19.

Measurements in dorsal view: maximum width of head 3.7 mm, median length of pronotum 4.4 mm, maximum width 6.4 mm, sutural length of elytra 4.8 mm, maximum width of combined elytra 6.7 mm.

**Variability and sexual dimorphism.** Strongly varying in the development of the vertexal armature. Females have a complex transverse vertexal ridge (Fig. 38), not the variably long horns like in males (note the minor male in Fig. 15, and beware of extremely minor males looking like females, as in the next subspecies). Female vertexal ridge with sides laterally obtusely angulate, thence sloping to eye, medially with robust knob; pronotum with pair of blunt, forward protrusions topping anterior declivity. Body length 9–12 mm.

**Etymology.** Name refers to the Kokoda Trail, the type locality; to be treated as masculine noun.

***Onthophagus kokodanus hagenaltus*** **subsp. n.**
http://species-id.net/wiki/Onthophagus_kokodanus_hagenaltus
Figs 7–8, 16, 20, 39–44

**Type material.** 5 males, 2 collection records. **Holotype** male (CMNC) from Papua New Guinea: 25 mi NE Mount Hagen, 6000 ft, 5.vii.1974, H.F. Howden.

**Paratypes:** Papua New Guinea: 25 mi NE Mount Hagen, 05/vii/1974, Howden, 6000ft, 3 spm., incl. holotype, in CMNC. Western Highlands: Mt. Hagen, 05–08/vii/1974, Peck, 6000ft, oak forest, 2 spm., in CMNC

**Diagnosis.** The vertexal horns of this subspecies are more upright, even in major males, with angular tubercle on top of the interconnecting basal ridge. Dorsum black-brown, largely shining (particularly the elytra), with slight greenish metallic lustre. Elytral strial punctures all equally small, distinct, scatteredly crenulating finely punctate interstriae. Lateral border of pronotum distinctly rounded at about 0.4 of length behind anterolateral angle (not angular, in dorsal view, Fig. 40). Pronotum usually with blunt bisinuate rim behind depressed, medially more or less concave anterior declivity. Clypeofrontal ridge low, very slightly arcuate, ends on either side angularly connected to clypeogenal ridge. Most of dorsal side finely, sparsely punctate. Clypeal tip distinctly, broadly reflexed, apical border bisinuate. Dorsal eye parts broadly elliptic, separated by about three eye widths. Pygidium abundantly, finely, distinctly punctate. Body length usually 10–11 mm. Female unknown.

Apparently a close highland relative of the preceding subspecies.

**Description** (holotype, male). Body length ca 11 mm. Habitus generally convex, robust. Colour of dorsal side black, generally shiny, with slight metallic lustre; ventral parts largely black, partly matt (microreticulate); legs black-brown, shiny. Dorsal side and pygidium virtually glabrous (apart from any inconspicuous micro-stubbles); ventral side and legs with numerous long, light-brown setae.

Clypeal border broadly, distinctly marginate, sides virtually straight from genae to bisinuate, reflexed, shortly lobiform apex; clypeal surface shiny, with sparse to abundant, minute punctation; clypeogenal transition at border obtusely angular, slightly elevated, on either side with straight ridge curving to end of virtually straight, distinct clypeofrontal ridge. Genal and frontal surface sparsely, minutely punctate; genal border evenly, widely rounded. Vertex between posterior end of eyes with pair of long, basally very broad horns, connected at base by angular ridge, with distinct anteromedian angle; horns slightly curved, directed upright behind eyes (not beyond, in axial view), evenly tapering to blunt tip, inner edge of horns evenly concave (in axial view); horn surface with convex anterior surface, minutely, sparsely punctate. Frontal disc limited by fine frontogenal ridge, on either side extending along eye. Dorsal eye parts widely elliptic, with ca 28 facet rows across widest point. Ratio of interocular distance to maximum (transverse) eye width ca 3.0.

Pronotum generally strongly convex, surface shining, with greenish lustre; disc posteriorly slightly convex (midline impression effaced), anterior surface broadly depressed, medially shallowly concave, up to posterior, strongly bisinuate, transverse protrusion coming from disc forward; anterior and lateral borders of pronotum marginate; anterior section of lateral border slightly concave; anterolateral angle rectangular, shortly rounded; posterior section of lateral border slightly sinuate, posterolateral angle rounded; base finely marginate, with very obtuse basomedian angle. Most of pronotal surface finely, sparsely punctate, anterior depression minutely, sparsely punctate, this punctation interspersed with vague micropunctation; lateral declivities more matt (microreticulate).

Elytra generally shiny, with greenish metallic lustre; scutellum indistinct in dorsal view, shape of base and apex unmodified; anterior half of epipleuron distinctly punctate-setose. Elytra broad, with 8 straight to slightly curved, fine, distinct striae; stria 7 slightly sinuate in front, extending onto shining humeral umbone; strial punctures distinct, small, widely separated (mostly 5–8 puncture diameters), distinctly crenulating interstrial edges. Interstrial surfaces virtually flat to very slightly convex (from disc to lateral declivity), with sparse to abundant, fine micropunctation.

Antennal club medium-brown, scapus unmodified. Mentum shallowly emarginate in front. Prothoracic sides with coxal-marginal ridge distinct, curving forward onto lateral border, much of surface annulate-punctate-setose, including large, seta-bearing hemi-punctures. Anterior lobe of metasternum slightly convex, abundantly punctate-setose, disc micropunctate; metasternal sides and adjacent parts matt, abundantly to densely annulate-punctate-setose. Abdominal ventrites matt, each laterally with row of seta-bearing annulate punctures. Pygidium black, weakly shiny (sericeous), with abundant, shallow, fine punctation, without macro-setae; surface slightly convex, base with transverse ridge, apex marginate.

Legs robust. Protibia with 3+1 larger external denticles (distal 3 longer, sub-acuminate), separated by some serration; proximal serration consisting of 7 smaller denticles; apico-external denticle oblique to tibial axis; apical edge slightly rounded, with down-curved spur (tip worn away); protibial underside with low longitudinal crest; protarsus unmodified. Profemur robust, underside finely punctate, and with numerous larger seta-bearing hemi-punctures. Meso- and metafemoral undersides also finely punctate, with fewer large seta-bearing hemi-punctures. Meso- and metatibiae strongly dilated distad to transversely subelliptic crest, which is fringed with fine fossorial spines; external side with ca 4 sets of distinct, spine-bearing fossorial protrusions. Tarsi generally slender, with well-developed sickle-shaped claws; meso- and metatarsomeres 1 straight, unmodified. Spurs on meso- and metatibiae elongate-acuminate. Relative length proportionsof metatibial spur to metatarsomeres 1–5: ca 12, 13, 6, 4, 3, 6.

Parameres narrow (dorsal view), tapering, curved downward (lateral view), Fig. 20.

Measurements in dorsal view: maximum width of head 3.2 mm, median length of pronotum 3.5 mm, maximum width 5.5 mm, sutural length of elytra 4.6 mm, maximum width of combined elytra 5.8 mm.

**Variability and sexual dimorphism.** Female unknown; females probably have a transverse vertexal ridge, not the variably long horns of the males. Strongly varying: there is a minor male looking like a female, having a transverse vertexal ridge (Fig. 44), its aedeagus being similar to that of the holotype. Body length 9.5–11 mm.

**Etymology.** Name refers to the highland nature of the type locality.

***Onthophagus kokosquamatus*** **sp. n.**
urn:lsid:zoobank.org:act:DEDE0A16-B300-4FB8-AC2C-D36556913EB2
http://species-id.net/wiki/Onthophagus_kokosquamatus
Figs 9–11, 21, 45–49

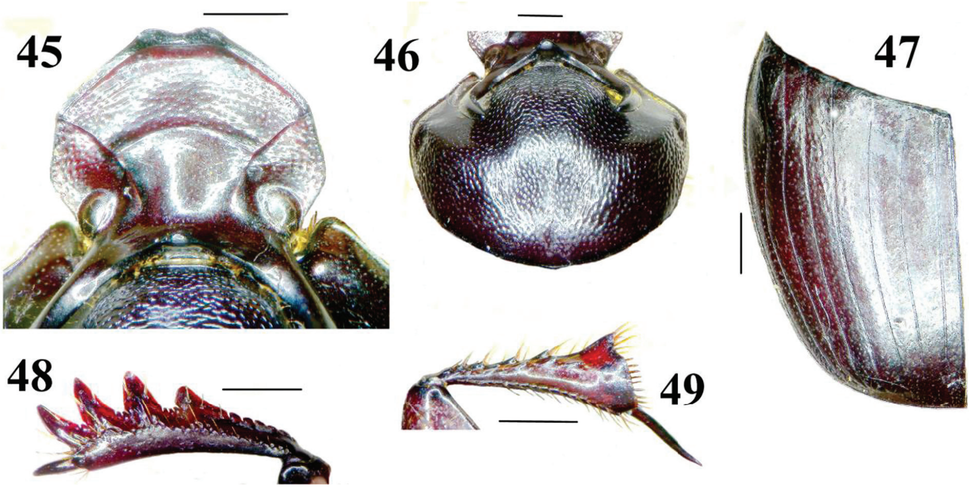
**Type material.** 15 males and females, 4 collection records. **Holotype** male (CMNC) from Papua New Guinea: 34 mi E Port Moresby, Kokoda Trail, 2000 ft, 16–17.vii.1974, S. Peck, T43–45.

**Paratypes:** Papua New Guinea: Kokoda Trail, 30–34 mi E Port Moresby, 16–17/vii/1974, Peck, 2200ft, 2 spm., in CMNC. Kokoda Trail, 34 mi E Port Moresby, 16–17/vii/1974, Peck, 2200ft, 4 spm., incl. holotype, in CMNC. 17–18/vii/1974, Peck, 2200ft, 4 spm., in CMNC. Kokoda Trail, Kauai River, Manari, 12–14/viii/1976, Kukal, 700m, rain forest: dung, 5 spm., in CMNC.

**Diagnosis.** The strongly rugulate-punctate pronotum, with the peculiar squamiform texture on the anterior gibbosity, together with its large size, should distinguish *O. kokosquamatus* from its relatives, or for that matter, any known Papuasian congeners. Bases of both vertexal horns interconnected by robust ridge topped with distinct forward angle. Lateral margin of pronotum distinctly angular at about 0.4 of length behind anterolateral angle (Fig. 46). Pronotal surface behind horns with numerous long setae. Distinctly arcuate clypeofrontal ridge well developed, its ends on either side angularly connected at clypeogenal ridge. Clypeogenal border obtusely angular (full-face view). Clypeal tip distinctly, broadly reflexed, apical crest bisinuate. Dorsal eye parts elliptic, less broad than in the preceding species, separated by about 4.5 eye widths. Most of head surface abundantly, finely punctate; female clypeus transversely rugulate. Elytral interstriae on disc sparsely, indistinctly punctate, lateral interstriae more densely punctate; strial punctures very fine, widely separated, all similar. Pygidium very densely, distinctly punctate. Metasternum superficially prow-shaped in front, behind transverse rim. Colour generally black-brown, without any metallic lustre (elytra lacking reflections shifting in relation to angle of view). Male and female very similar. Body length usually 11–12 mm. For smaller potential relatives, cf. comments below.

**Description** (holotype, male). Body length ca 11.5 mm. Habitus convex, robust. Colour of dorsal side black, generally moderately shiny, forebody heavily (rugulate-) punctate; ventral parts largely black, partly shiny, strongly punctate; legs brown-black, shiny. Dorsal side and pygidium locally with some longer light brown setae (apart from inconspicuous micro-setae); ventral side and legs with numerous long, light-brown setae.

Clypeal border broadly, distinctly marginate, sides virtually straight from genae to apex, the latter bisinuate, reflexed, shortly lobiform; clypeal surface shiny, with abundant, fine punctation; clypeogenal transition at border obtusely angular, on either side with straight ridge to arcuate, very distinct clypeofrontal ridge. Genal surface finely, abundantly punctate as on clypeus, surface, like sides of clypeus, superficially transverse rugulate; genal border evenly, widely rounded. Vertex between posterior end of eyes




**Figures 45–49.** Details of morphology of *Onthophagus kokosquamatus* (male holotype) **45** head in dorsal view **46** pronotum and head armature in dorsal view **47** elytron in dorsal view **48** protibia, upper side **49** metatibia, underside. Scales 1 mm.

with pair of long horns, which are convex in front, basally broad, and are connected at base by high, medially angulate ridge (axial view); horns strongly directed laterad (over eyes), evenly curving upward to tapering (on posterior side thickened) tip, their surface abundantly, very finely punctate. Frontal disc finely, abundantly punctate between slight genal sutures. Dorsal eye parts broadly elliptic, with 13–15 facet rows across widest point. Ratio of interocular distance to maximum (transverse) eye width ca 4.5.

Pronotum generally strongly convex; disc slightly convex (midline impression virtually effaced by heavy punctation); anteromedian surface strongly, evenly bulbous from disc forward; sides, behind horns of head, distinctly concave (with numerous long, decumbent setae), sloping down to anterolateral corner; anterior and lateral borders of pronotum marginate; anterior section posteriorly, at ca 0.4 of total length, with distinct angle, border very slightly concave; anterolateral angle rectangular, rounded; posterior section of lateral border strongly sinuate, posterolateral angle distinct; base medially slightly marginate along very obtuse basomedian angle. Most of pronotal surface densely rugulate-punctate, rugulation on anteromedian bulb squamiform (like reptile skin); anterolateral concavities largely smooth, many punctures on anterolateral surface looking like small horseshoes.

Elytra generally weakly shiny, disc almost matt; scutellum indistinct in dorsal view, shape of base and apex unmodified; epipleuron distinctly punctate-setose. Elytra broad, with 8 straight to slightly curved, fine, distinct striae; stria 7 distinctly sinuate in front, extending onto punctate, shining humeral umbone; strial punctures very fine, widely separated (ca 10 puncture diameters), hardly crenulating interstrial edges. Interstrial surfaces flat to very slightly convex (from disc to lateral declivity), with inconspicuous fine punctation, gradually larger, denser, more distinct, slightly rugulate to lateral interstriae.

Antennal club light-brown, scapus unmodified. Mentum shallowly emarginate in front. Prothoracic sides with coxal-marginal ridge distinct, curving forward onto lateral border, most of surface densely annulate-punctate-setose. Anterior lobe of metasternum slightly convex (very slight median ridge in front), abundantly hemi-punctate-setose; disc abundantly, finely punctate; metasternal sides and adjacent parts matt, densely to crowdedly annulate-punctate-setose. Abdominal ventrites matt, laterally all crowdedly annulate-punctate-setose. Pygidium black, distal part shiny, with dense, distinct, simple punctation, with very few longer macro-setae; surface slightly convex, base with transverse ridge, apex marginate.

Legs very robust. Protibia with 3+1 larger external denticles (distal 3 longer, subacuminate), separated by some serration; proximal serration consisting of 5–6 smaller denticles; apico-external denticle oblique to tibial axis; apical edge protruding, rounded (upper side view), with strong, acuminate, down-curved spur; protibial underside with low longitudinal crest; protarsus unmodified. Profemur robust, underside finely punctate, and with numerous larger seta-bearing hemi-punctures. Meso- and metafemoral undersides also finely punctate, with fewer large seta-bearing hemi-punctures. Meso- and metatibiae strongly dilated distad to transversely sinuate-subelliptic crest, which is fringed with fine fossorial spines and setae; external side with ca 4 sets of distinct, spine-bearing fossorial protrusions. Tarsi generally slender, with well-developed sickle-shaped claws; meso- and metatarsomeres 1 straight, unmodified. Spurs on meso- and metatibiae elongate-acuminate. Relative length proportions of metatibial spur to metatarsomeres 1–5: ca 15, 14, 6, 4, 3, 4.

Parameres narrow, with narrow spatuliform tip (dorsal view), tapering, curved downward (lateral view), Fig. 21.

Measurements in dorsal view: maximum width of head 3.5 mm, median length of pronotum 4.5 mm, maximum width 6.2 mm, sutural length of elytra 4.9 mm, maximum width of combined elytra 6.5 mm.

**Variability and sexual dimorphism.** General body shape of both sexes is very similar. Female clypeus transversely rugulate throughout. Small morphs have less developed horns and obsolescent intervening median angle. Body length 10.5–12 mm.

**Comments.** Some smaller *Onthophagus* (up to ca 8 mm long) with narrow dorsal eye parts and satin-iridescent elytra, from various parts of New Guinea (including the Bismarck Islands), are superficially similar to *O. kokosquamatus*, for instance by their completely rugulate-punctate pronotum and pair of curved vertexal horns (in both sexes). These include *O. irianus* Balthasar, 1969 and *novaeirlandiae* Balthasar, 1969 (cf. his key couplet 78/79). By the shifting light reflections from their elytral disc, absent in *kokosquamatus*, they are reminiscent of species in the Papuasian group of species around *O. iris* Sharp, 1875. A study of this group is under way, and in that context the position of these smaller *kokosquamatus*-like forms and other potential relatives will certainly be reconsidered.

**Etymology.** Specific epithet was derived from geographic origin of the new species and peculiar squamiform pronotal sculpture.

## Acknowledgements

The material of the new taxa described above is housed in CMNC and RMNH. The collaboration of the CMNC and IRSNB staff is gratefully acknowledged: F. Génier and A.B.T. Smith, and A. Drumont, respectively. The implicit support of various other colleagues is also acknowledged – they are listed in companion papers. Helpful suggestions came from the reviewers.

## References

Balthasar V (1969) Neue *Onthophagus*-Arten von Neu-Guinea und den benachbarten Inseln. Acta Entomologica Musei Nationalis Pragae 38: 361–408.

Gillet JJE (1930) Onthophagides de Nouvelle Guinée. Nova Guinea (Zoologie) 15(1929): 411–434.

Krikken J, Huijbregts J (2012) Taxonomy of Papuasian *Onthophagus*: twenty new species and their relatives (Coleoptera: Scarabaeidae: Scarabaeinae). Tijdschrift voor Entomologie 155: 73–131.

Krikken J, Huijbregts J (in press) New Guinea *Onthophagus*: taxonomy of ten new small, unicolour species (Coleoptera: Scarabaeidae: Scarabaeinae). Zootaxa.

van Lansberge JW (1883) Révision des *Onthophagus* de l'archipel Indo-Néerlandais, avec description des espèces nouvelles. Notes from the Leyden Museum 5: 41–82.

Paulian R (1973) Récoltes de M.P. Jolivet en Nouvelle-Guinée. Coléoptères Scarabaeidae Onthophaginae. Bulletin de la Société Entomologique de France 77 (1972): 215–217. [Publication date p. 320]

ZooKeys 251: 69–81 (2012)
doi: 10.3897/zookeys.251.3953
www.zookeys.org

RESEARCH ARTICLE

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

# Five new apterous species of the genus *Lathrobium* Gravenhorst (Coleoptera, Staphylinidae, Paederinae) from the Baishanzu Natural Reserve, East China

Zhong Peng[1,†], Li-Zhen Li[1,‡], Mei-Jun Zhao[1,§]

1 *Department of Biology, College of Life and Environmental Sciences, Shanghai Normal University, Shanghai, 200234, P. R. China*

† *urn:lsid:zoobank.org:author:6CDD4A22-46AC-4DAF-8409-6D1922AE5D81*
‡ *urn:lsid:zoobank.org:author:BBACC7AE-9B70-4536-ABBE-54183D2ABD45*
§ *urn:lsid:zoobank.org:author:FBE4FA1F-5BCF-405E-98C1-4F86894643EA*

Corresponding author: *Mei-Jun Zhao* (mjzhao@shnu.edu.cn)

Academic editor: *V. Assing* | Received 5 September 2012 | Accepted 3 December 2012 | Published 17 December 2012

*urn:lsid:zoobank.org:pub:FA77007C-CDCB-4035-8835-BFBDAC5B37E3*

**Citation:** Peng Z, Li L-Z, Zhao M-J (2012) Five new apterous species of the genus *Lathrobium* Gravenhorst (Coleoptera, Staphylinidae, Paederinae) from the Baishanzu Natural Reserve, East China. ZooKeys 251: 69–81. doi: 10.3897/zookeys.251.3953

### Abstract

Five new apterous species of the genus *Lathrobium* Gravenhorst, 1802 from Baishanzu Natural Reserve, Zhejiang, East China, *L. baishanzuense* **sp. n.**, *L. immanissimum* **sp. n.**, *L. obstipum* **sp. n.**, *L. pilosum* **sp. n.** and *L. tangi* **sp. n.**, are described and illustrated. The *Lathrobium* fauna of the study region is represented by two distinct lineages.

### Keywords

Coleoptera, Staphylinidae, taxonomy, *Lathrobium*, new species, Baishanzu, Zhejiang, China

## Introduction

Up to date, 57 species of the genus *Lathrobium* Gravenhorst have been reported from mainland China, eleven of which are known from Zhejiang Province (Peng et al. 2012a, b; Watanabe 1999a, b; Watanabe and Luo 1992). Baishanzu is a nature reserve situated in Longquan and Qingyuan counties in southwestern Zhejiang province, eastern China. Medium mountain and hill areas constitute the main landform of the nature reserve and the dominant types of vegetation are evergreen broad-leaved forests and mixed coniferous and broad-leaved forests.

In 2004 and 2008, our colleagues conducted two expeditions to Baishanzu and collected numerous *Lathrobium* specimens from the floor of hardwood forest by sifting moist to wet leaf litter and humus (Tang pers. comm.).

Five apterous species were identified. Based on the morphology and chaetotaxy of the male sexual characters, they belong to two different species groups.

## Material and methods

The following abbreviations are used in the text, with all the measurements in millimeters:

**BL** length of body from the anterior margin of the labrum to the apex of the abdomen;
**FL** length of forebody from the anterior margin of the clypeus to the posterior margin of the elytra;
**HL** length of head from the anterior margin of the clypeus to the posterior margin of the head;
**HW** maximum width of head;
**PL** length of pronotum along midline;
**PW** maximum width of pronotum;
**EL** length of elytra from the apex of the scutellum to the posterior margin of the elytra.

The type material is deposited in the Insect Collection of Shanghai Normal University, Shanghai, China (**SNUC**).

## Descriptions

***Lathrobium baishanzuense*** **Peng & Li, sp. n.**
urn:lsid:zoobank.org:act:EB3F420B-E491-45B8-B368-50433453191A
http://species-id.net/wiki/Lathrobium_baishanzuense
Figs 1A, 3

**Type material** (2 ♂♂)**.** Holotype: ♂, labeled '**CHINA:** Zhejiang Prov. / Qingyuan County / Baishanzu N. R. / 27°45'N, 119°13'E / 22–23.ix.2008, alt. 1,500 m / Tang & Zhang leg.'. Paratypes: 1 ♂, same label data as holotype, but '27°45'N, 119°12'E / 6.v.2004, alt. 1,400–1,700 m / Hu, Tang & Zhu leg.'.

**Description.** Measurements and ratios: BL 8.50–9.30, FL 3.00–3.63, HL 1.13–1.15, HW 1.26–1.31, PL 1.48–1.54, PW 1.30–1.35, EL 0.98–1.00, HL/HW 0.88–0.90, HW/PW 0.97, HL/PL 0.75–0.76, PL/PW 1.14, EL/PL 0.65–0.66.

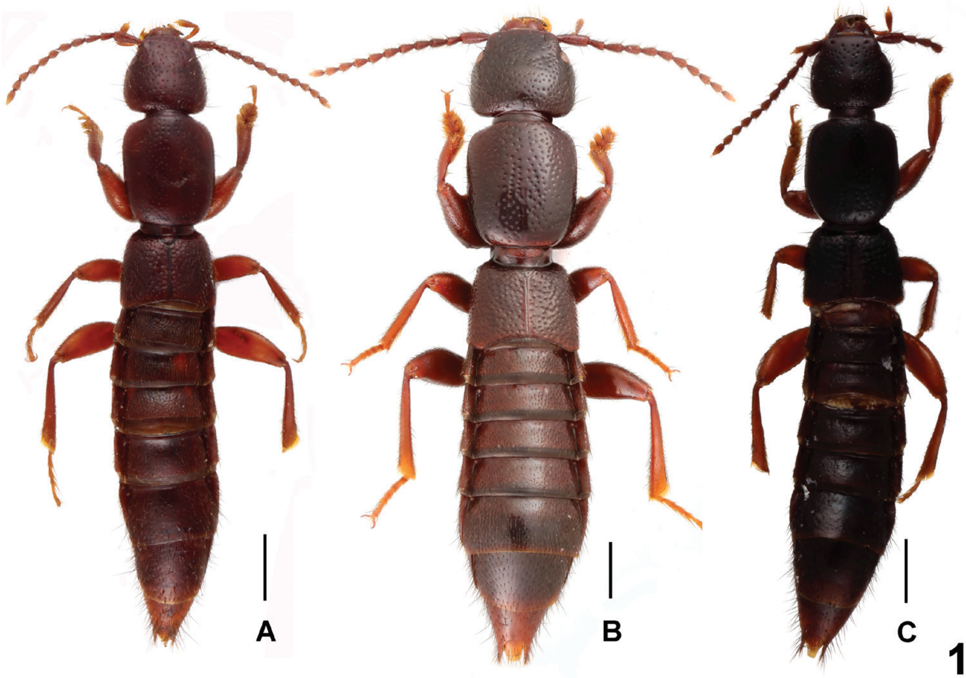



**Figure 1.** Habitus of *Lathrobium* spp., **A** *L. baishanzuense* **B** *L. immanissimum* **C** *L. pilosum*. Scale bars: 1.0 mm.

Habitus as in Fig. 1A. Body brown with paler apex, legs light brown, antennae brown to light brown.

Head subquadrate (HL/HW 0.88–0.90); punctation coarse and sparse; interstices with very shallow microreticulation; eyes small, approximately 1/4–1/3 the length of postocular region in dorsal view.

Pronotum nearly parallel-sided; punctation sparser than that of head; impunctate midline broad; interstices without microsculpture.

Elytra with punctation denser than that of pronotum and well defined; hind wings completely reduced.

Abdomen with dense punctation; interstices with very shallow, transversely striate microsculpture.

Male. Sternite V (Fig. 3A) with dark setae in postero-median impression and posterior margin with several point-like setae; sternite VI (Fig. 3B) with sparse, short setae in postero-median impression and posterior margin with 7–8 peg-like setae; posterior margin of sternite VII (Fig. 3C) weakly concave, pubescence unmodified; sternite VIII (Fig. 3D) with deep asymmetric emargination and blackish setae along both sides of this emargination; sternite IX (Fig. 3E) asymmetric; aedeagus (Fig. 3F, 3G) with asymmetric, apically truncate ventral process, short and moderately sclerotized dorsal plate, and without sclerotized spines in internal sac.

Female. Unknown.

**Distribution.** East China: Donggong mountain range.

**Etymology.** The specific epithet is derived from the type locality "Baishanzu".

**Comparative notes and comments.** Two distinct species groups occur in Baishanzu. One of these groups includes *L. baishanzuense*, the three following species from Baishanzu, and additionally *L. daicongchaoi* Peng & Li, 2012 from Guadun, *L. fujianense* Peng & Li, 2012 from Junzifeng Shan, *L. longwangshanense* Peng, Li & Zhao, 2012 from the Longwangshan, *L. tianmushanense* Watanabe, 1999 from the Tianmushan and the Longwangshan, *L. zhaotiexiongi* Peng & Li, 2012 from Jiulongshan Natural Reserve and Majian, and *L. jiulongshanense* Peng & Li, 2012 from Jiulongshan Natural Reserve. The species group is characterized by a male sternite V with a postero-median impression with dense dark setae and male sternites III–IV with conspicuously modified setae in the posterior or postero-median impression in some species, evident synapomorphies constituting the monophyly of this species group. These characters appear to be unique among Chinese *Lathrobium*.

Among the species of this group, *L. baishanzuense* is characterized particularly by the conspicuous modifications of the male sternite VIII and the morphology of the aedeagus.

## *Lathrobium immanissimum* Peng & Li, sp. n.

urn:lsid:zoobank.org:act:D23235A8-F1C1-447C-8F65-D1B46EDDDA8C
http://species-id.net/wiki/Lathrobium_immanissimum
Figs 1B, 4

**Type material** (5 ♂♂, 5 ♀♀)**.** Holotype: ♂, labeled '**CHINA:** Zhejiang Prov. / Qingyuan County / Baishanzu N. R. / 27°45'N, 119°13'E / 22–23.ix.2008, alt. 1,500 m / Tang & Zhang leg.'. Paratypes: 3 ♂♂, 4 ♀♀, same label data as holotype; 1 ♂, 1 ♀, same label data, but '27°44'N, 119°13'E / 21.viii.2004, alt. 1,250–1,650 m / Hu, Tang & Zhu leg.'.

**Description.** Measurements and ratios: BL 10.57–12.51, FL 5.33–6.17, HL 1.63–1.70, HW 1.88–1.95, PL 2.23–2.30, PW 1.95–2.07, EL 1.40–1.50, HL/HW 0.86–0.88, HW/PW 0.94–0.96, HL/PL 0.73–0.74, PL/PW 1.11–1.14, EL/PL 0.63–0.65.

Habitus as in Fig. 1B. General appearance similar to that of *L. baishanzuense*, except for the much broader and larger body, the narrow impunctate midline on the pronotum and coarser punctation on the head, pronotum and elytra.

Male. Sternite III (Fig. 4H) with dense dark setae in small posterior impression; sternite IV (Fig. 4I) with dense darkish setae in postero-median impression and posterior margin with several peg-like setae; sternite V (Fig. 4K) similar to sternite IV, but with sparser setae in larger impression; sternite VI (Fig. 4J) with long setae in postero-median impression and posterior margin with several peg-like setae; sternite VII (Fig. 4D) with sparse setae in postero-median impression; sternite VIII (Fig. 4G) with shallow symmetric emargination and short dark setae in large impression; sternite IX (Fig. 4C) asymmetric; aedeagus (Fig. 4F, 4L) with very long ventral process

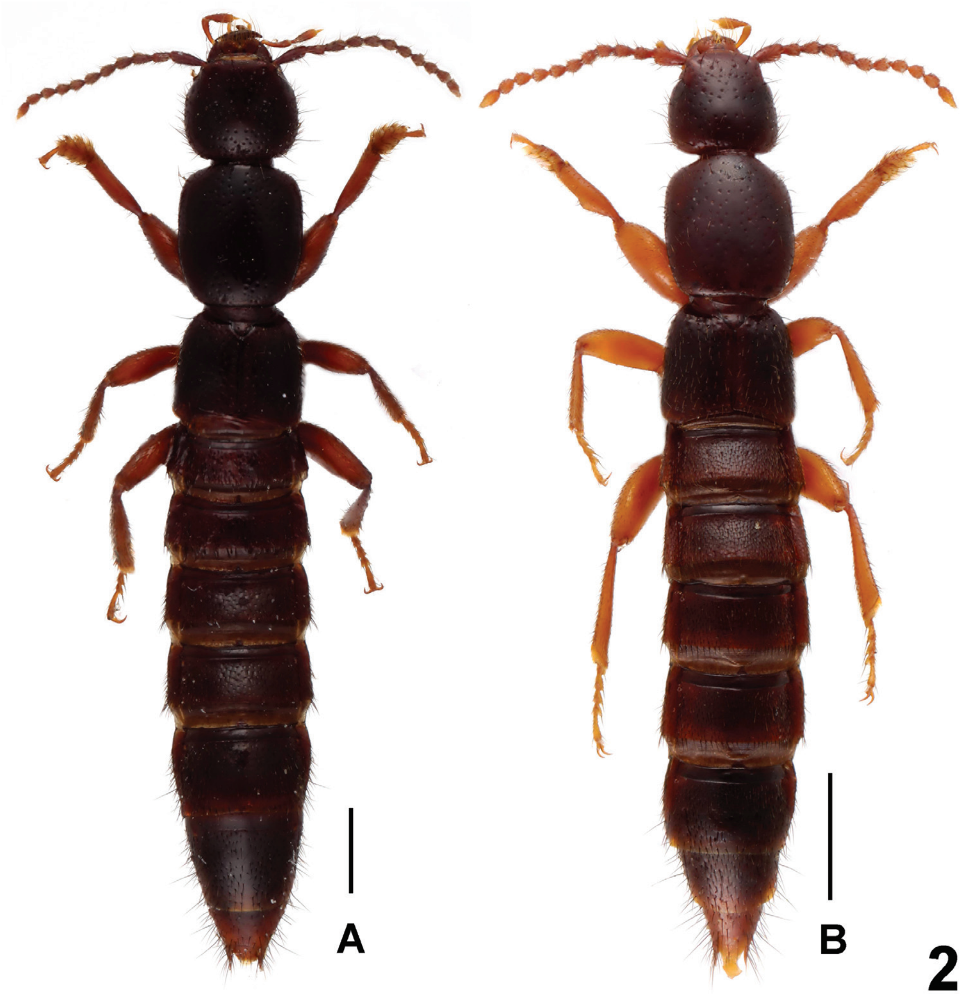



**Figure 2.** Habitus of *Lathrobium* spp., **A** *L. tangi* **B** *L. obstipum.* Scale bars: 1.0 mm.

curved to the left in ventral view, broad dorsal plate and with single sclerotized apical spine in internal sac.

Female. Posterior margin of tergite VIII (Fig. 4A) truncate; sternite VIII (Fig. 4B) longer than that of male, posterior margin strongly convex; tergite X (Fig. 4E) obtuse apically and almost reaching anterior margin of tergite IX (Fig. 4E).

**Distribution.** East China: Donggong mountain range.

**Etymology.** The specific epithet (superlative of the Latin adjective immanis: huge) alludes to the size of the aedeagus.

**Comparative notes.** The new species is readily distinguished from all eastern Chinese *Lathrobium* species by the large size and stout habitus, and by the presence of dense dark setae in the small posterior impression of sternite III.

***Lathrobium pilosum*** **Peng & Li, sp. n.**
urn:lsid:zoobank.org:act:547F958D-8C6F-4729-98A4-02038DE94A53
http://species-id.net/wiki/Lathrobium_pilosum
Figs 1C, 5

**Type material** (2 ♂♂)**.** Holotype: ♂, labeled '**CHINA:** Zhejiang Prov. / Qingyuan County / Baishanzu N. R. / 27°45'N, 119°13'E / 22–23.ix.2008, alt. 1,500 m / Tang & Zhang leg.'. Paratypes: 1 ♂, same label data as holotype, but '27°44'N, 119°13'E / 21.viii.2004, alt. 1,250–1,650 m / Hu, Tang & Zhu leg.'.

**Description.** Measurements and ratios: BL 9.10–10.00, FL 4.11–4.17, HL 1.20–1.26, HW 1.39–1.50, PL 1.75–1.79, PW 1.52–1.57, EL 1.11–1.13, HL/HW 0.84–0.86, HW/PW 0.91–0.96, HL/PL 0.69–0.70, PL/PW 1.14–1.15, EL/PL 0.63.

Habitus as in Fig. 1C. Similar to *L. baishanzuense*, except for the darker coloration of body, the somewhat larger body size, coarser and sparser punctation on the head and pronotum, and weakly convex lateral margins of pronotum in dorsal view.

Male. Sternite IV (Fig. 5A) with cluster of dense dark setae in large postero-median impression, and posterior margin with 7–9 point-like setae; sternite V (Fig. 5B) similar to sternite IV, but with longer setae in smaller impression and posterior margin with numerous point-like setae; tergite VII (Fig. 5D) strongly transverse, posterior margin weakly concave, pubescence unmodified; sternite VIII (Fig. 5H) with triangular, symmetric emargination and short darkish setae in narrow impression; sternite IX (Fig. 5E) nearly symmetric; aedeagus (Fig. 5F, 5G) with narrow ventral process, broad dorsal plate in lateral view and with single sclerotized apical spine in internal sac.

Female. Unknown.

**Distribution.** East China: Donggong mountain range.

**Etymology.** The specific epithet (Latin, adjective: hairy) alludes to the chaetotaxy of the male sternite IV.

**Comparative notes.** This species is close to *L. tangi* sp. n. in sharing a large impression on the male sternite IV and a similar shape of the male sternite VII. In *L. pilosum*, the posterior margin of the male sternite VI has several point-like setae, and male sternite VIII is symmetrically emarginate.

***Lathrobium tangi*** **Peng & Li, sp. n.**
urn:lsid:zoobank.org:act:7AFC7FAB-C5C6-4837-8CE6-17B150F9B9D8
http://species-id.net/wiki/Lathrobium_tangi
Figs 2A, 6

**Type material** (3 ♂♂, 1 ♀)**.** Holotype: ♂, labeled '**CHINA:** Zhejiang Prov. / Qingyuan County / Baishanzu N. R. / 27°45'N, 119°14'E / 7.v.2008, alt. 1,050 m / Hu, Tang & Zhu leg.'. Paratypes: 1 ♂, same label data as holotype, but '22.ix.2008, alt. 1,200 m / Tang Liang leg.'; 1 ♂, same label data, but '28.vi.2004, alt.

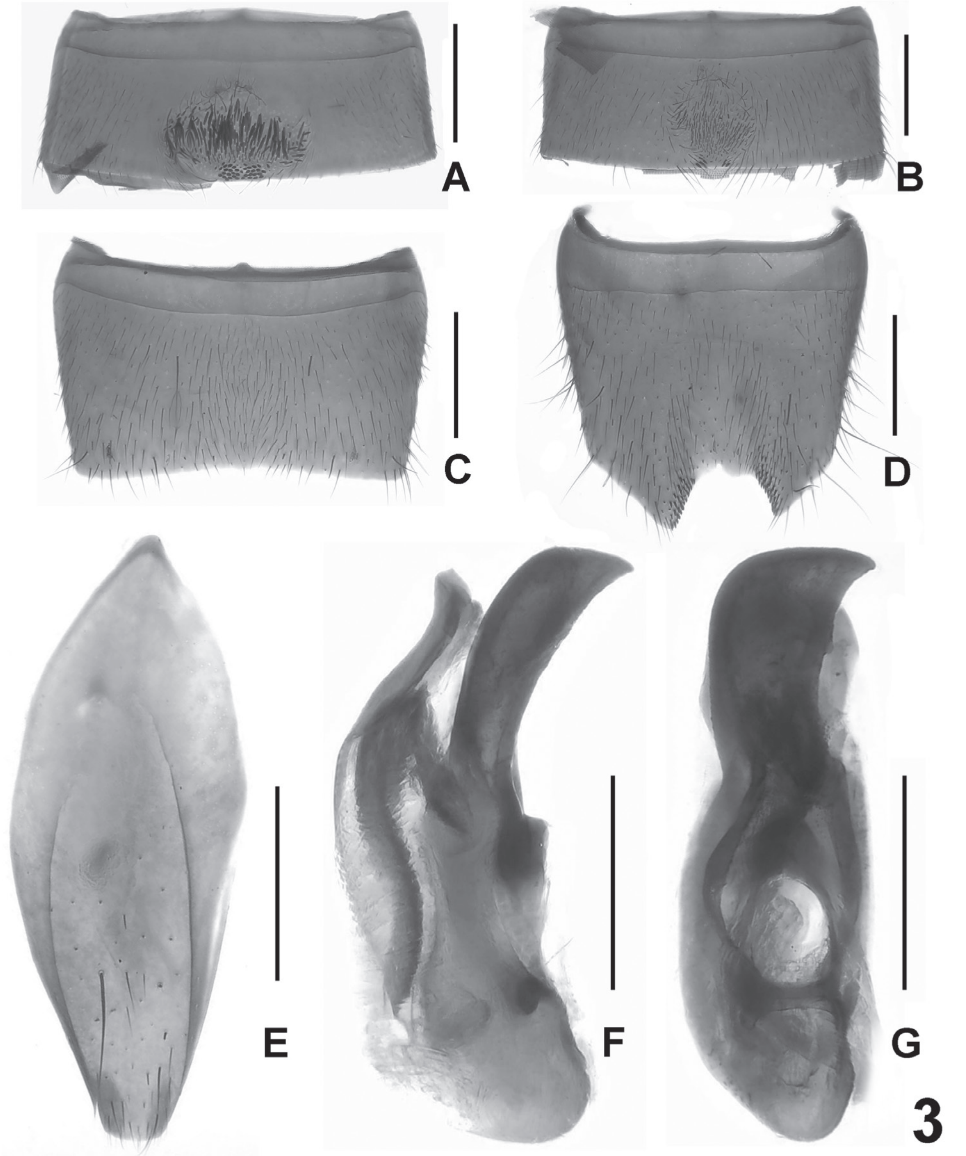



**Figure 3.** *Lathrobium baishanzuense*. **A** male sternite V **B** male sternite VI **C** male sternite VII **D** male sternite VIII **E** male sternite IX **F** aedeagus in lateral view **G** aedeagus in ventral view. Scale bars: 0.5 mm.

1,100 m / Tang & Zhang leg.'; 1 ♀, same label data, but '27°45'N, 119°13'E / 22–23.ix.2008, alt. 1,500 m / Tang & Zhang leg.'.

**Description.** Measurements and ratios: BL 8.62–10.06, FL 4.10–4.14, HL 1.11–1.20, HW 1.23–1.30, PL 1.65–1.70, PW 1.39–1.44, EL 1.04–1.11, HL/HW 0.90–0.92, HW/PW 0.88–0.90, HL/PL 0.67–0.71, PL/PW 1.18–1.19, EL/PL 0.63–0.65.

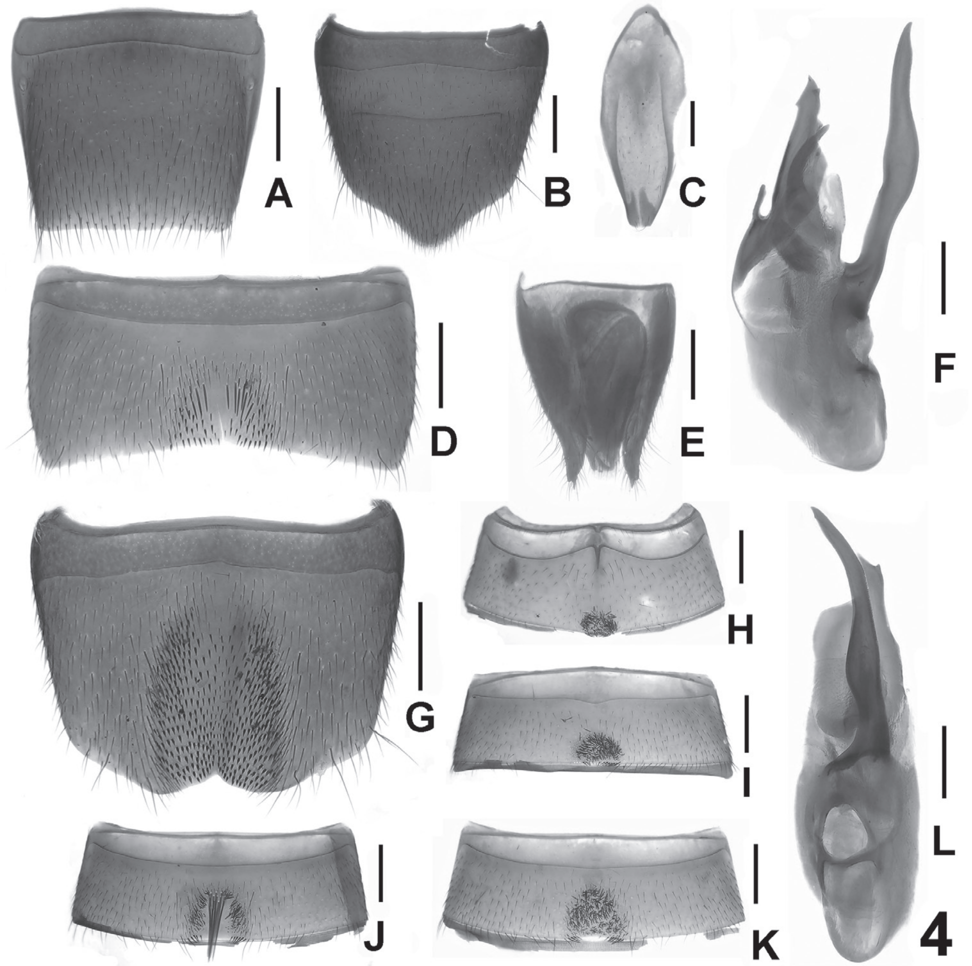



**Figure 4.** *Lathrobium immanissimum*. **A** female tergite VIII **B** female sternite VIII **C** male sternite IX **D** male sternite VII **E** female tergites IX-X **F** aedeagus in lateral view **G** male sternite VIII **H** male sternite III **I** male sternite IV **J** male sternite VI **K** male sternite V **L** aedeagus in ventral view. Scale bars: 0.5 mm.

Habitus as in Fig. 2A. Similar to *L. baishanzuense*, except for the darker coloration of body, the somewhat larger body size, slightly coarser and sparser punctation on the head and pronotum, and weakly convex lateral margins of pronotum in dorsal view.

Male. Sternite IV (Fig. 6C) with dense dark setae in large postero-median impression, and posterior margin with several point-like setae; sternite V (Fig. 6D) similar to sternite IV, but with much smaller impression, and posterior margin with numerous point-like setae; sternite VI (Fig. 6H) unmodified; posterior margin of sternite VII (Fig. 6E) weakly concave; sternite VIII (Fig. 6I) with subtriangular, asymmetric emargination and short dark setae in narrow impression; sternite IX (Fig. 6G) nearly

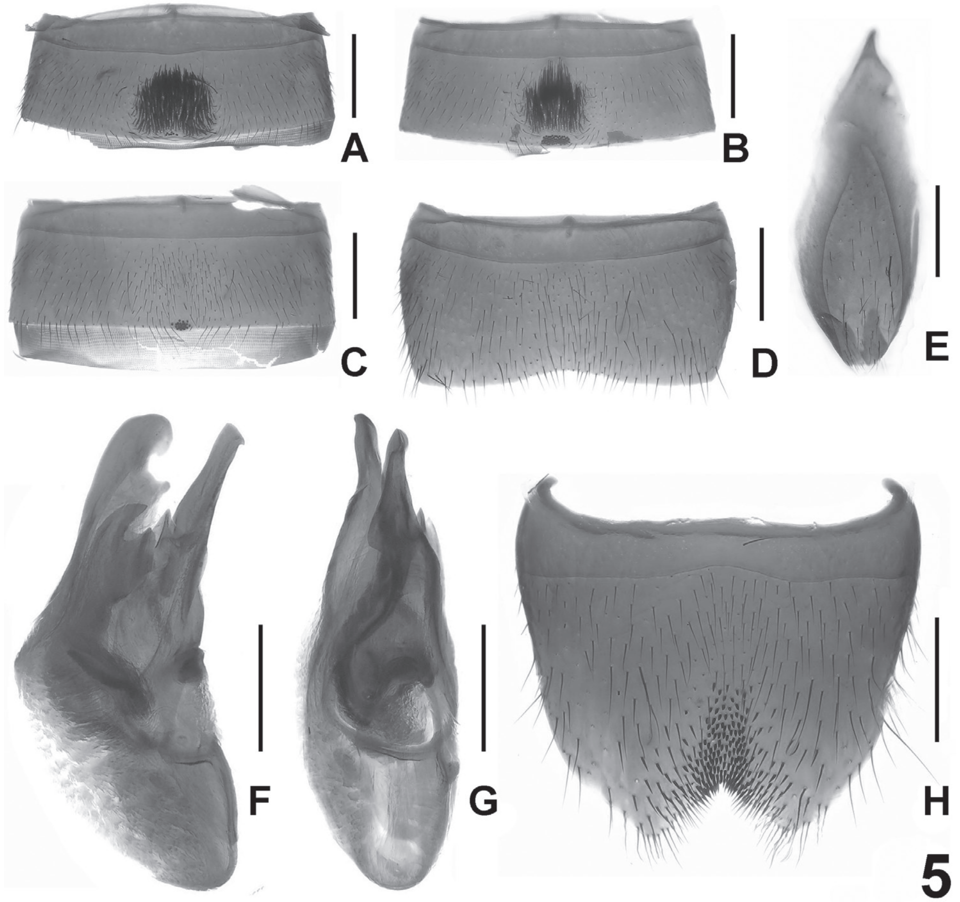



**Figure 5.** *Lathrobium pilosum*. **A** male sternite IV **B** male sternite V **C** male sternite VI **D** male sternite VII **E** male sternite IX **F** aedeagus in lateral view **G** aedeagus in ventral view **H** male sternite VIII. Scale bars: 0.5 mm.

symmetric; aedeagus (Fig. 6J, 6K) weakly asymmetric ventral process, large dorsal plate and with moderately sclerotized apical spine in internal sac.

Female. Posterior margin of tergite VIII (Fig. 6A) convex; sternite VIII (Fig. 6B) longer than that of male, middle of apical margin with apically convex projection; tergite X (Fig. 6F) convex apically, longer than tergite IX in the middle, but not reaching anterior margin of tergite IX (Fig. 6F).

**Distribution.** East China: Donggong mountain range.

**Etymology.** The species is named after Liang Tang, who collected the type seris.

**Comparative notes.** *Lathrobium tangi* is similar to *L. pilosum* large impression on the male sternite IV and a similarlyshaped male sternite VII. In *L. tangi*, the posterior margin of the male sternite VI is unmodified and the male sternite VIII has an asymmetric emargination.

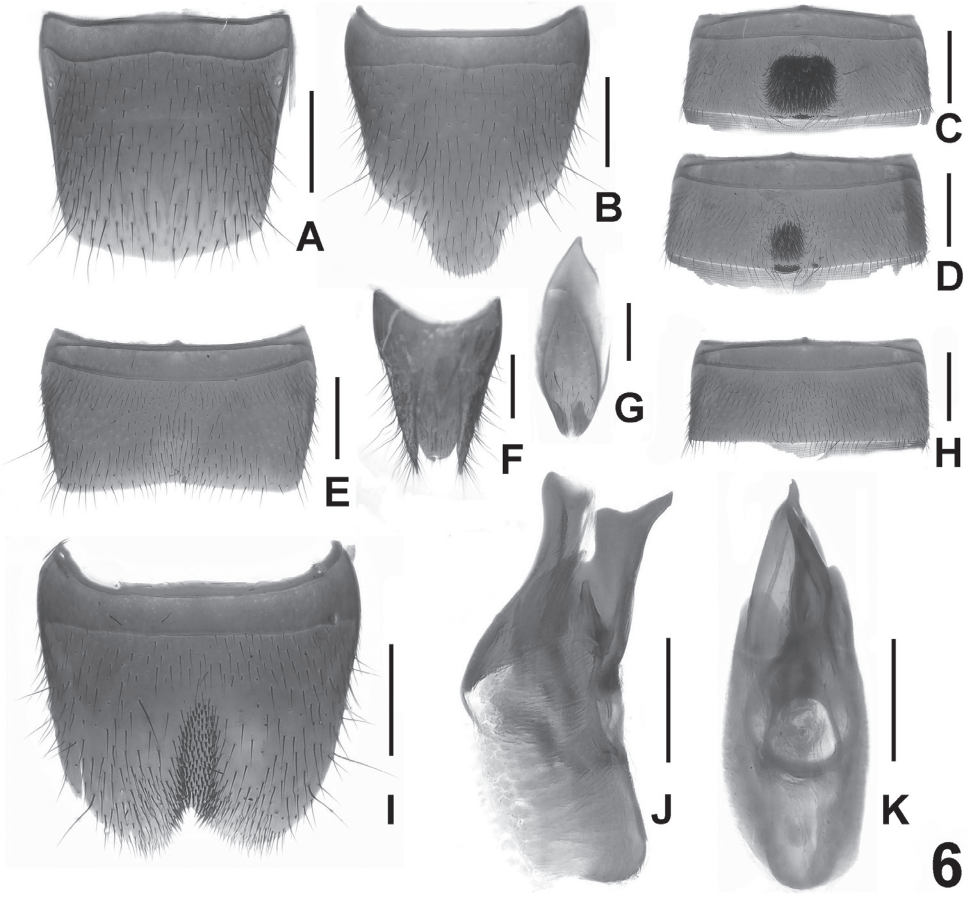



**Figure 6.** *Lathrobium tangi*. **A** female tergite VIII **B** female sternite VIII **C** male sternite IV **D** male sternite V **E** male sternite VII **F** female tergites IX-X **G** male sternite IX **H** male sternite VI **I** male sternite VIII **J** aedeagus in lateral view **K** aedeagus in ventral view. Scale bars: 0.5 mm.

## *Lathrobium obstipum* Peng & Li, sp. n.

urn:lsid:zoobank.org:act:EA820283-AF9C-47BA-AB1F-AF0C34717C8E
http://species-id.net/wiki/Lathrobium_obstipum
Figs 2B, 7

**Type material** (17 ♂♂, 5 ♀♀)**.** Holotype: ♂, labeled '**CHINA:** Zhejiang Prov. / Qingyuan County / Baishanzu N. R. / 27°45'N, 119°13'E / 22–23.ix.2008, alt. 1,500 m / Tang & Zhang leg.'. Paratypes: 10 ♂♂, 5 ♀♀, same label data as holotype; 3 ♂♂, same label data, but '27°45'N, 119°12'E / 6.v.2004, alt. 1,400–1,700 m / Hu, Tang & Zhu leg.'; 3 ♂♂, same label data, but '27°44'N, 119°13'E / 21.viii.2004, alt. 1,250–1,650 m / Hu, Tang & Zhu leg.'.

**Description.** Measurements and ratios: BL 6.34–7.23, FL 2.84–3.12, HL 0.65–0.71, HW 0.87–0.91, PL 1.11–1.19, PW 0.99–1.06, EL 0.76–0.81, HL/

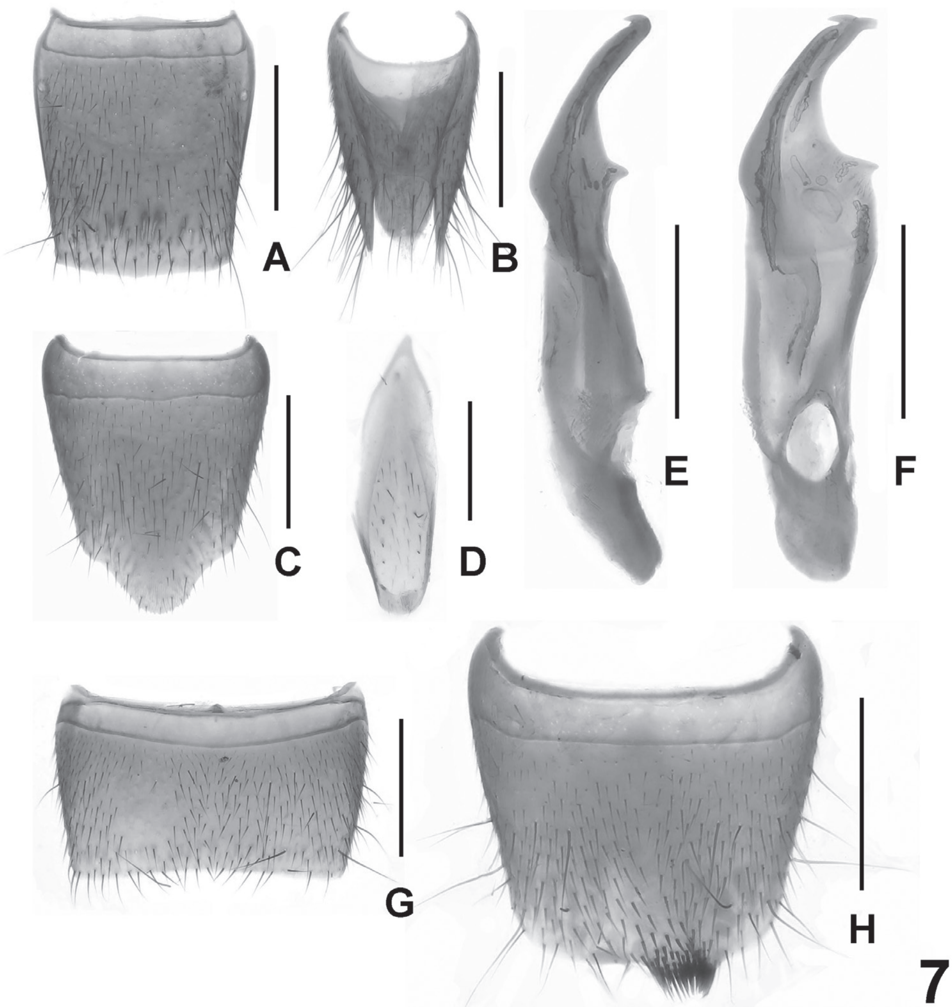



**Figure 7.** *Lathrobium obstipum*. **A** female tergite VIII **B** female tergites IX-X **C** female sternite VIII **D** male sternite IX **E** aedeagus in lateral view **F** aedeagus in ventral view **G** male sternite VII **H** male sternite VIII. Scale bars: 0.5 mm.

HW0.73–0.78, HW/PW 0.86–0.90, HL/PL 0.56–0.62, PL/PW 1.11–1.15, EL/PL 0.67–0.69.

Habitus as in Fig. 2B. Similar to *L. baishanzuense*, except for the lighter coloration of legs and antennae, the smaller body size, sparser punctation on the head and pronotum, and the somewhat broader impunctate midline on pronotum.

Male. Sternites III-VI unmodified; posterior margin of sternite VII (Fig. 7G) nearly truncate; posterior margin of sternite VIII (Fig. 7H) truncate and with tuft of short setae in asymmetric position; sternite IX (Fig. 7D) nearly symmetric; aedeagus (Fig. 7E, 7F) with asymmetric, apically forficate ventral process, without sclerotized dorsal plate, and without sclerotized spines in internal sac.

Female. Posterior margin of tergite VIII (Fig. 7A) weakly convex; sternite VIII (Fig. 7C) longer than that of male, posterior margin strongly convex; tergite X (Fig. 7B) convex apically, not reaching anterior margin of tergite IX (Fig. 7B).

**Distribution.** East China: Donggong mountain range.

**Etymology.** The specific epithet (Latin, adjective: awry) alludes to the chaetotaxy of the male sternite VIII.

**Comparative notes and comments.** The new species is similar to *L. sheni* Peng & Li, 2012 from Jiulongshan in having similarly shaped male sternites VII and IX. The new species can be distinguished from *L. sheni* by a cluster of short setae on the posterior margin of the male sternite VIII and the distinctly flattened aedeagus. In *L. sheni*, the male sternite VIII has two rows of dense setae and the aedeagus is stout.

*Lathrobium obstipum* evidently represents a different lineage than the other species recorded from Baishanzu, since it does not share their derived modifications of the anterior male sternites. It is additionally distinguished from them by the smaller body, yellowish brown legs, the unmodified male sternite III-VI, the nearly truncate posterior margin of the male sternites VII and VIII, and the distinctly flattened aedeagus without a sclerotized dorsal plate.

## Acknowledgements

All the collectors mentioned in the text are acknowledged for their field work. The study is supported by the National Natural Science Foundation of China (No. 31101659 and No. 31172134, 31201734), the Foundation of Shanghai Municipal Education Commission (No. 12YZ077 and No. 13YZ062) and Shanghai Normal University (SK201234 and B–9013–11–003127).

## References

Peng Z, Li LZ, Zhao MJ (2012a) Taxonomic study on *Lathrobium* Gravenhorst (Coleoptera, Staphylinidae, Paederinae) from Longwangshan Mountain, East China. ZooKeys 165: 21–32. doi: 10.3897/zookeys.165.2384

Peng Z, Li LZ, Zhao MJ (2012b) Three new species of the genus *Lathrobium* Gravenhorst (Coleoptera: Staphylinidae: Paederinae) from the Jiulongshan Natural Reserve, East China. ZooKeys 184: 57–66. doi: 10.3897/zookeys.184.2634

Watanabe Y (1999a) Two new subterranean staphylinids (Coleoptera) from East China. Elytra 27(1): 249–257.

Watanabe Y (1999b) Two new species of the group of *Lathrobium pollens / brachypterum* (Coleoptera, Staphylinidae) from Zhejiang Province, East China. Elytra 27(2): 573–580.

Watanabe Y, Luo ZY (1992) New species of genus *Lathrobium* (Coleoptera, Staphylinidae) from the Wu-yan-ling Natural Protective Area in Zhejiang. Elytra 20(1): 47–56.

## Erratum

Peng Z, Li LZ, Zhao MJ (2012) Two new apterous species of *Lathrobium* Gravenhorst (Coleoptera, Staphylinidae, Paederinae) from Fujian, East China. ZooKeys 218: 57–63. doi: 10.3897/zookeys.218.3361

The name *L. daicongchaoi* Peng & Li, 2012 occurs in the text in two different spelling variants: the intended and correct spelling is *L. daicongchaoi* (four times in the text on pages 58, 59, 60 and 61); the incorrect spelling is *L. daocongchaoi* (occurring once in the abstract on page 57).

ZooKeys 251: 83–118 (2012)
doi: 10.3897/zookeys.251.4099
www.zookeys.org

RESEARCH ARTICLE

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

# Notes on Michael Schülke's pselaphine collections from China. – Tyrini. I. genera *Labomimus* Sharp, *Linan* Hlaváč and *Pselaphodes* Westwood (Coleoptera, Staphylinidae, Pselaphinae)

Zi-Wei Yin[1,†], Li-Zhen Li[1,‡]

1 *Department of Biology, College of Life and Environmental Sciences, Shanghai Normal University, Shanghai, 200234, P. R. China*

† *urn:lsid:zoobank.org:author:C515106C-5782-4471-AE11-483B49606A67*
‡ *urn:lsid:zoobank.org:author:BBACC7AE-9B70-4536-ABBE-54183D2ABD45*

Corresponding author: *Li-Zhen Li* (lizhenli@shnu.edu.cn)

Academic editor: *C. Majka* | Received 9 October 2012 | Accepted 20 November 2012 | Published 17 December 2012

*urn:lsid:zoobank.org:pub:93EDBD5F-C9C0-41F5-BC9D-64BABBD28025*

**Citation:** Yin Z-W, Li L-Z (2012) Notes on Michael Schülke's pselaphine collections from China. – Tyrini. I. genera *Labomimus* Sharp, *Linan* Hlaváč and *Pselaphodes* Westwood (Coleoptera, Staphylinidae, Pselaphinae). ZooKeys 251: 83–118. doi: 10.3897/zookeys.251.4099

## Abstract

This paper is the first of a series that deals with Dr. Michael Schülke's collection of Pselaphinae from China. The tyrine genera *Labomimus* Sharp, *Linan* Hlaváč and *Pselaphodes* Westwood are chosen for the first part. The study revealed fourteen new species, all described and illustrated: *Labomimus cognatus* Yin & Li, **sp. n.** (Yunnan), *Labomimus dabashanus* Yin & Li, **sp. n.** (Hubei, Shaanxi), *Labomimus mirus* Yin & Li, **sp. n.** (Yunnan), *Labomimus paratorus* Yin & Li, **sp. n.** (Shaanxi), *Labomimus sarculus* Yin & Li, **sp. n.** (Yunnan), *Labomimus schuelkei* Yin & Li, **sp. n.** (Shaanxi), *Labomimus vespertilio* Yin & Li, **sp. n.** (Yunnan), *Linan tendothorax* Yin & Li, **sp. n.** (Yunnan), *Pselaphodes distincticornis* Yin & Li, **sp. n.** (Yunnan), *Pselaphodes erlangshanus* Yin & Li, **sp. n.** (Sichuan), *Pselaphodes flexus* Yin & Li, **sp. n.** (Yunnan), *Pselaphodes tibialis* Yin & Li, **sp. n.** (Yunnan), *Pselaphodes venustus* Yin & Li, **sp. n.** (Yunnan) and *Pselaphodes zhongdianus* Yin & Li, **sp. n.** (Yunnan). *Pselaphodes jizushanus* Yin, Li & Zhao is recorded from a new locality in Yunnan and its aedeagus is newly illustrated; new province records for *Pselaphodes nomurai* Yin, Li & Zhao is provided. *Labomimus torus* (Yin, Li & Zhao), **comb. n.** is moved from *Pselaphodes* after an examination of the holotype. Species represented only by unassociated females are listed with label data.

**Keywords**
Staphylinidae, Pselaphinae, taxonomy, new species, new combination, China

## Introduction

The Asian species of the *Pselaphodes* complex of genera (sensu Hlaváč 2002) belonging to the tribe Tyrini are most diverse in the east to southeast Oriental region (Hlaváč and Chandler 2005). Despite recent works (Hlaváč 2002; Hlaváč and Nomura 2001; Bekchiev 2010; Yin et al. 2010, 2011a, 2011b, 2011c, 2012a 2012bp; Yin and Li in press) describing a number of new genera and new species from that region, the complex is considered still inadequately studied at both the generic and species levels.

Recent access to the pselaphine collection of M. Schülke, which contains specimens collected during several expeditions by M. Schülke (Berlin, staphylinidologist) and D. W. Wrase (Berlin, carabidologist) to China, provided us an opportunity to work on a large number of yet undescribed tyrine species from that country. In this paper, members of the genera *Labomimus* Sharp, *Linan* Hlaváč and *Pselaphodes* Westwood are treated. The results are fourteen new species, one new record of known species and one new combination; sixteen species are represented only by female specimens, and are listed with their collecting data for future study. This information is reported herein.

## Material and methods

The material referred to in this study is housed in the following public institution and private collection:

**SNUC** Insect Collection of Shanghai Normal University, Shanghai (Z.-W. Yin)
**cSch** private collection M. Schülke, Berlin

The Michael Schülke collection will eventually be moved to Museum für Naturkunde, Berlin (**MNB**).

Labels of the examined material are quoted verbatim if not mentioned otherwise; a slash (/) is used to separate lines on the same label, and a double slash (//) is used to separate different labels.

Holotype bears the following label: 'HOLOTYPE [red] / *xxx xxx* [genus name, species name] / sp. n., Yin & Li / det., 2012, xxx [depository]', and paratype bears a similar label except: 'PARATYPE [yellow]'.

The terminology of the foveal system follows Chandler 2001, except for using 'ventrite' instead of 'sternite' when discussing the meso- and metathoracic structures.

Measurements are in millimeters. The following acronyms are used in the text: **AL**–length of the abdomen along the midline; **AW**–maximum width of the abdomen;

**BL**–length of the body (= HL + PL + EL + AL); **EL**–length of the elytra along the sutural line; **EW**–maximum width of the elytra; **HL**–length of the head from the anterior clypeal margin to the occipital constriction; **HW**–width of the head across eyes; **PL**–length of the pronotum along the midline; **PW**–maximum width of the pronotum.

## Taxonomy

***Labomimus cognatus*** **Yin & Li, sp. n.**
urn:lsid:zoobank.org:act:77BAE919-26BC-4D78-8094-5EED63B6C5BC
http://species-id.net/wiki/Labomimus_cognatus
Figs 1A, 2

**Type material** (3 ♂♂, 3 ♀♀)**.** Holotype: ♂, labeled 'CHINA Yunnan [CH07-11], Baoshan / Pref., Gaoligong Shan, m. Xiaoheishan / N.R., 35 km SE Tengchong, 2110 m, / 24°"50'16"N, 98°"45'43"E, decid forest, / litter, sifted, 30.V.2007, M. Schülke' (cSch). Paratypes, 1 ♂, same label data as holotype (SNUC); 1 ♂, labeled 'CHINA: Yunnan, Baoshan Pref., Gao- / ligong Shan, W pass, 32 km SE / Tengchong, 1600 m, 25°51'11"N, 98°44'27"E, cleft with devast. primary / forest, litter & mushr. sifted, 28.VIII. / 2009, leg. M. Schülke [CH09-14]' (cSch); 1 ♀, same label data except 'D.W. Wrase [14]' (cSch); 1 ♀, same label data, except 'W pass, 35 km / SE Tengchong, 2100 m (devast. prim. / dec. forest, litter, sifted) / 24°50'18"N, 98°45'43"E / 25-28. VIII.2009 D.W. Wrase [06]' (SNUC); 1 ♀, same label data, except 'litter, wood, mushrooms sifted, 25.VIII. / 2009, leg. M. Schülke [CH09-06]' (cSch).

**Diagnosis.** Reddish brown; length 3.18–3.48; postgenae nearly rounded; antennomeres IX–XI enlarged, IX–X modified in the male; pronotum with lateral margins moderately angularly expanded laterally; with short blunt metaventral processes; metacoxae spinose; aedeagus with symmetric median lobe.

**Description.** Male (Fig. 1A). Length 3.18–3.41. Head longer than wide, HL 0.71–0.78, HW 0.65–0.71; eyes each composed of about 40 facets. Antennal clubs as in Fig. 2A. Pronotum (Fig. 2B) slightly longer than wide, PL 0.71–0.75, PW 0.66–0.71, with lateral margins moderately angularly expanded laterally. Elytra wider than long, EL 0.84–0.90, EW 1.12–1.35. Short metaventral processes with rounded apices (Fig. 2C). Protrochanters with small ventral spine, profemora with large ventral spine (Fig. 2D), protibiae with small apical tubercle (Fig. 2E); mesotrochanters (Fig. 2F) with tiny spine at ventral margin; metacoxae (Fig. 2G) with long hook-like protuberance at ventral margin, metatrochanters and metafemora simple. Abdomen broad at base and narrowed apically, AL 0.92–0.98, AW 1.23–1.37. Sternite IX as in Fig. 2H. Aedeagus length 0.50, with symmetric median lobe (Figs 2I–K).

Female. Similar to male in general; BL 3.25–3.48, HL 0.73–0.76, HW 0.65–0.66, PL 0.76–0.77, PW 0.71–0.72, EL 0.80–0.86, EW 1.34–1.41, AL 0.96–1.09, AW 1.41–1.46. Eyes each composed of about 27 facets. Antennae lacking modification; metaventral processes absent.

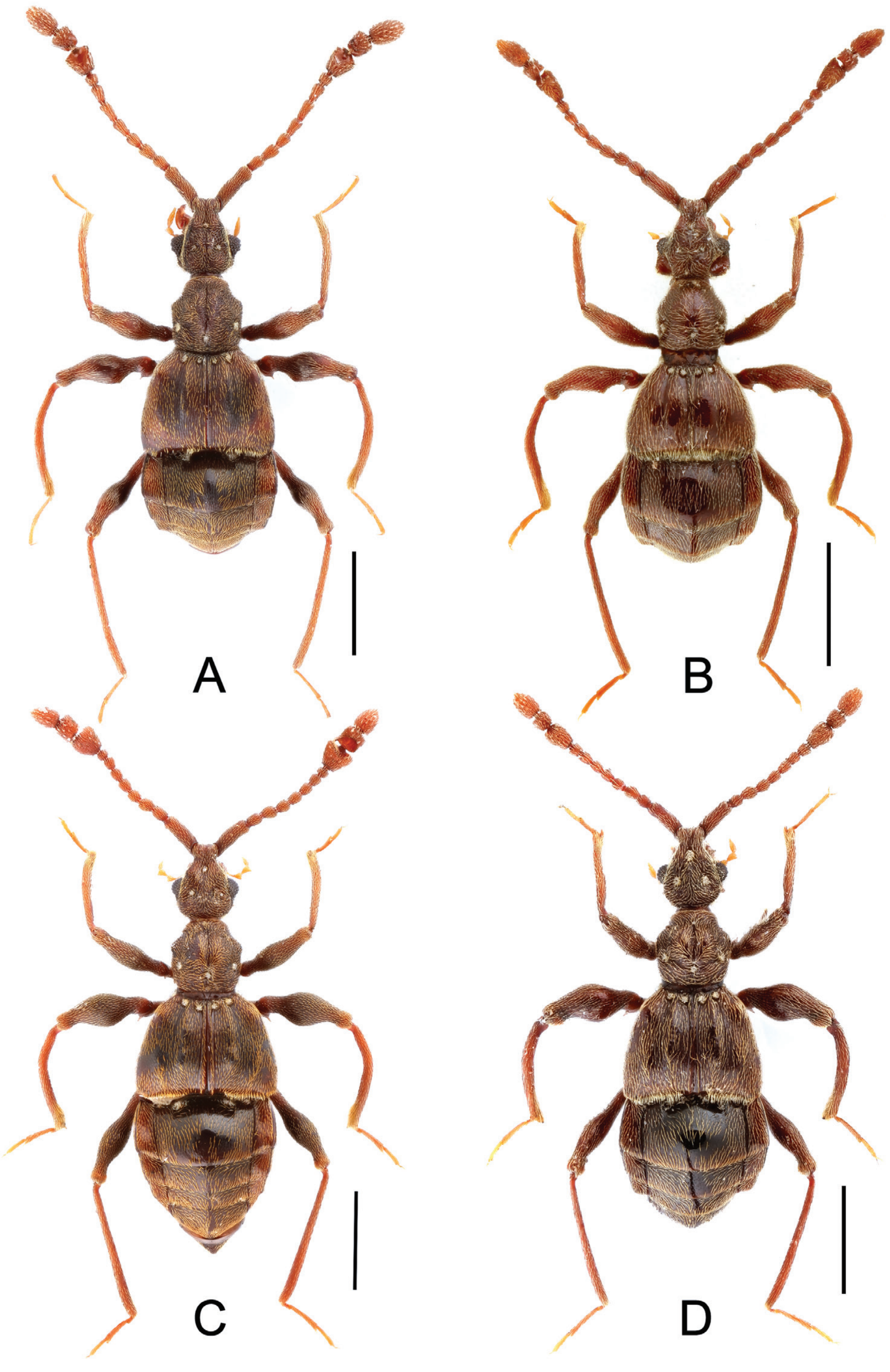



**Figure 1.** Male habitus of *Labomimus* spp. **A** *La. cognatus* **B** *La. dabashanus* **C** *La. mirus* **D** *La. paratorus*. Scales: 1.0 mm.

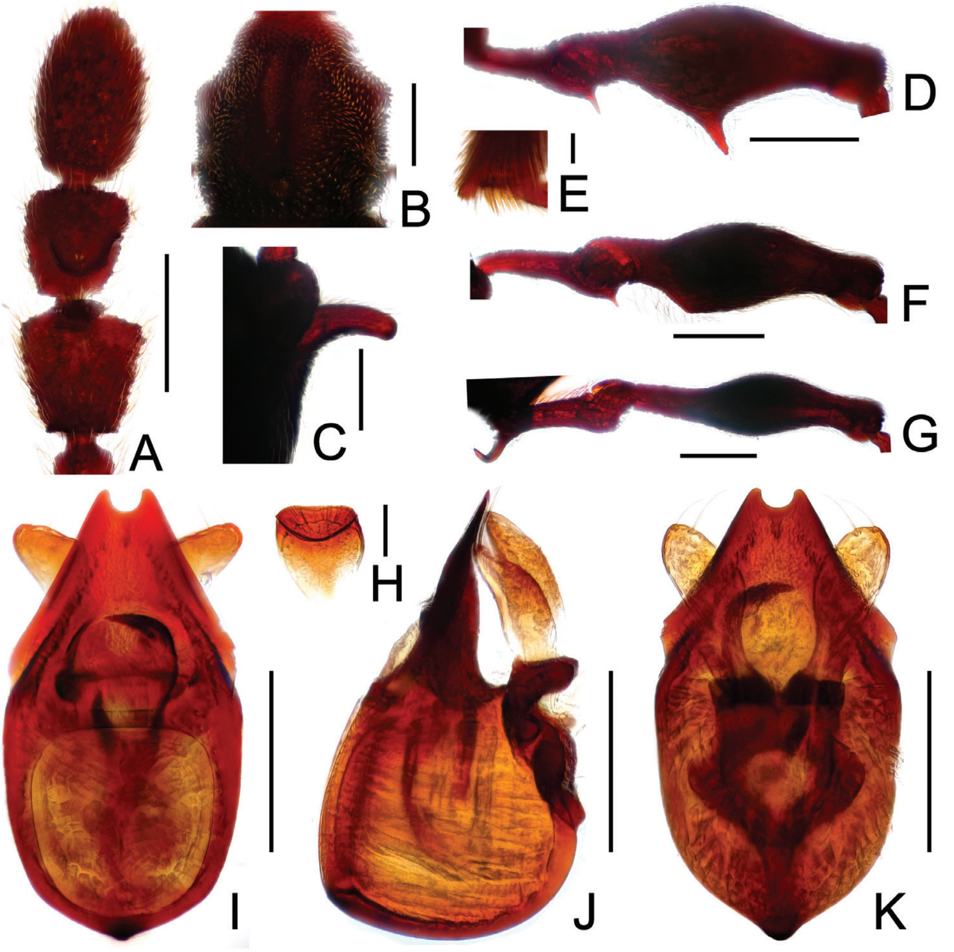



**Figure 2.** Diagnostic features of *La. cognatus*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** metacoxa, metatrochanter and metafemur **H** sternite IX **I** aedeagus, in dorsal view **J** same, in lateral view **K** same, in ventral view. Scales (mm): **A, B, D, F, G** = 0.3; **C, I, J, K** = 0.2; **H** = 0.1; **E** = 0.05.

**Comparative notes.** This is placed as a sister species of *Labomimus vespertilio* sp. n. described below. The two species share a similar general appearance, short metaventral process, similar placement of spines on the legs and a close aedeagal form. The two species can be readily separated by the smaller size, the symmetric antennomeres IX with a disc-like process and the median lobe has a narrower apex in *L. cognatus*, while *L. vespertilio* is larger in size, has strongly asymmetric antennomeres IX and has the aedeagus with median lobe much broader at apex.

**Distribution.** Southwest China: Yunnan.

**Biology.** Individuals were sifted from leaf litter in deciduous forests.

**Etymology.** The Latin word '*cognatus*' means 'related', indicating a close relationship between the new species and *Labomimus vespertilio* described below.

***Labomimus dabashanus* Yin & Li, sp. n.**
urn:lsid:zoobank.org:act:DBDF0116-0E4E-4C38-98E3-3609E077BE82
http://species-id.net/wiki/Labomimus_dabashanus
Figs 1B, 3

**Type material** (4 ♂♂, 5 ♀♀)**.** Holotype: ♂, labeled 'CHINA: W-Hubei (Daba Shan) / pass E of Mt. Da Shengnongjia, / 12 km NW Muyuping, 31°30'N, / 110°21'E, 22.VII.2001, / leg. M. Schülke [C01-13E] // dry creek vaelly, mixed deciduous forest, dead wood, mushrooms, / moss, 1950-2050 m (sifted) / [C01-13E]' (cSch). Paratypes: 2 ♂♂, 3 ♀♀, same label data as holotype (cSch, SNUC); 1 ♂, labeled 'CHINA: S-Shaanxi (Qinling Shan) / pass on rd. Zhouzhi-Foping, / 105 km SW Xi'an, N-slope / 1880 m, 33°44'N, / 107°25'E / leg. M. Schülke [C01-03] // 4.VII.2001, / shady rockwall base, moist / (sifted) [C01-03]' (cSch); 2 ♀♀, labeled 'CHINA: W-Hubei (Daba Shan) / muntain range NE Muyuping, pass 12 km N Muyuping, / 31°32'N, 110°26'E, 2380 m, / leg. M. Schülke [C01-15] // 17.VII 2001, / N pass, N-slope with young deciduous forest, bank of / small creek, moss (sifted) [C01-15]' (cSch). All types also bear the following labels: 'Sammlung / M. Schülke / Berlin // M. SCHÜLKE Coll. / Staphylinidae, Pselaphinae / *Labomimus* sp. 13 / S. Nomura det., 2005'.

**Diagnosis.** Reddish brown; length 2.36–2.96; postgenae broadly expanded laterally; antennomeres IX–XI enlarged, IX–X modified in the male; pronotum with round lateral margins; with long metaventral processes; metacoxae simple; aedeagus with asymmetric median lobe.

**Description.** Male (Fig. 1B). Length 2.85–2.96. Head slightly longer than wide, HL 0.63–0.66, HW 0.60–0.62; eyes each composed of about 25 facets. Antennal clubs as in Fig. 3A. Pronotum (Fig. 3B) as long as wide, PL and PW 0.57–0.59, with round lateral margins. Elytra wider than long, EL 0.69–0.71, EW 1.09–1.10. Metaventral processes long, broadened apically with truncate apices (Fig. 3C). Profemora with short triangular ventral spine (Fig. 3D), protibiae with small apical spur (Fig. 3E); mesotrochanters (Fig. 3F) with small spine and mesofemora angularly protuberant ventrally; metacoxae (Fig. 3G) with short ventral protuberance, metatrochanters and metafemora (Fig. 3H) simple. Abdomen broad at base and narrowed apically, AL 0.96–1.00, AW 1.16–1.20. Sternite IX as in Fig. 3I. Aedeagus length 0.57, with asymmetric median lobe elongate (Figs 3J–L).

Female. Similar to male in general; BL 2.36–2.50, HL 0.56–0.58, HW 0.49–0.50, PL 0.51–0.52, PW 0.50–0.52, EL 0.57–0.60, EW 1.09–1.10, AL 0.72–0.80, AW 1.19–1.22. Eyes each composed of about 20 facets. Antennae lacking modification; metaventral processes absent.

**Comparative notes.** The new species is closest to *L. shibatai* K. Sawada, 1961 by sharing the laterally expanded postgenae and rounded pronotal lateral margins. Apart from the clearly different aedeagal form, the two species can be separated by the much smaller body size, the transverse antennomeres X, and the elongate antennomeres IX

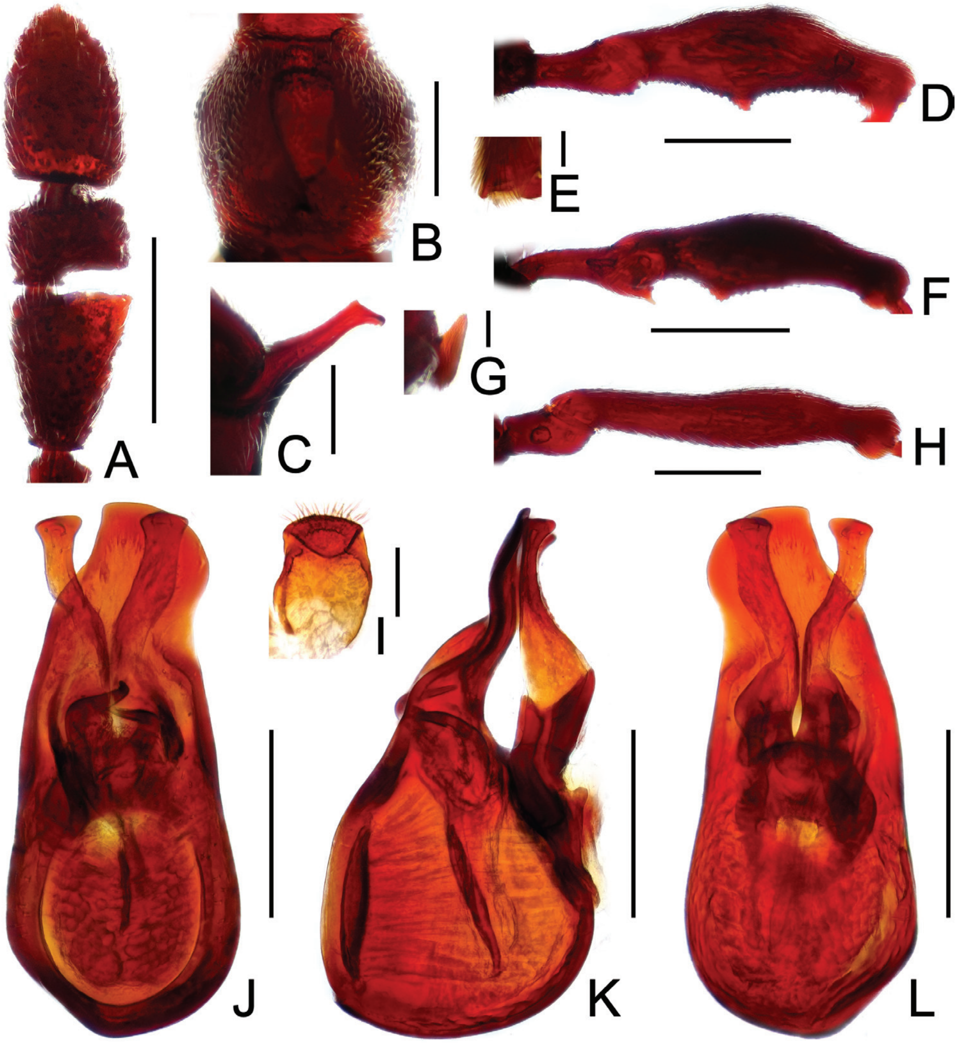



**Figure 3.** Diagnostic features of *La. dabashanus*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** metatrochanter and metafemur **H** metacoxa **I** sternite IX **J** aedeagus, in dorsal view **K** same, in lateral view **L** same, in ventral view. Scales (mm): **A, B, D, F, G** = 0.3; **C, J, K, L** = 0.2; **I** = 0.1; **E, H** = 0.05.

being angularly expanded at anteromedial margin in *L. dabashanus*. *Labomimus shibatai* is much larger in size (3.5–3.8 mm), has elongate antennomeres X and enlarged and unmodified antennomeres IX.

**Distribution.** Central China: Hubei; Norwest China: Shaanxi.

**Biology.** Individuals were sifted from leaf litter and moss in deciduous forests.

**Etymology.** Named after the type locality 'Dabashan Mountain'.

***Labomimus mirus*** **Yin & Li, sp. n.**
urn:lsid:zoobank.org:act:B118D9BC-BFCD-4DFF-B508-39BB3AEEFFC7
http://species-id.net/wiki/Labomimus_mirus
Figs 1C, 4

**Type material** (6 ♂♂, 1 ♀)**.** Holotype: ♂, labeled 'CHINA (N-Yunnan) Dali Bai Nat. / Aut. Pref., Diancang Shan, 3 km / W Dali old town, pine forest at / "cloud road", night upper chair- / list station, 24°41.1''N, 100°06.8'E / 2650-2750 m (needle/leaf litter) / 1.IX.2003 Wrase [19C] // Sammlung / M. Schülke / Berlin // M. SCHÜLKE Coll. / Staphylinidae, Pselaphinae / *Labomimus* sp. 6 / S. Nomura det., 2005' (cSch). Paratypes: 1 ♂, same label data, except with additional label as '[C03-19A] pine needles, moss / (dry) in ditches, mushrooms, / 30.VIII.2003, leg. M. Schülke' (SNUC); 4 ♂♂, labeled 'CHINA: Yunnan [CH07-09], / Dali Bai Auton. Pref., Diancang Shan 45 / km NW Dali, 2730 m, 26°01'20''N, 99°53'17''E, creek valley, pines, ferns, / sifted, 29.V.2007, M. Schülke' (cSch, SNUC); 1 ♀, same label data, except '25°41'09''N, 100°06'32''E, 3000- / 3200 m, cleft in mixed forest, litter, / debirs sifted, 27.V.2007, M. Schülke'(cSch).

**Diagnosis.** Reddish brown; length 3.36–3.75; postgenae rounded; antennomeres IX–XI enlarged, IX–X modified in the male; pronotum with lateral margins moderately angulate laterally; with short sharp metaventral processes; metacoxae simple; aedeagus with median lobe nearly symmetric.

**Description.** Male (Fig. 1C). Length 3.41–3.75. Head slightly longer than wide, HL 0.71–0.72, HW 0.65–0.68; eyes each composed of about 45 facets. Antennal clubs as in Fig. 4A. Pronotum (Fig. 4B) about as long as wide, PL 0.70–0.73, PW 0.65–0.71, with roundly angulate lateral margins. Elytra wider than long, EL 0.87–0.93, EW 1.38–1.40. Metaventral processes short, narrowed from base toward apex (Fig. 4C). Protrochanters with small ventral spine, profemora with large thick ventral spine (Fig. 4D); mesotrochanters (Fig. 4E) with small spine at ventral margin, mesotibiae (Fig. 4F) with short blunt apical tubercle; metatrochanters and metafemora (Fig. 4G) simple. Abdomen broad at base and narrowed apically, AL 1.13–1.37, AW 1.35–1.43. Sternite IX as in Fig. 4H. Aedeagus length 0.67, with broad median lobe elongate nearly symmetric (Figs 3I–K).

Female. Similar to male in general; BL 3.36, HL 0.71, HW 0.64, PL 0.66, PW 0.64, EL 0.74, EW 1.21, AL 1.25, 1.43. Eyes each composed of about 35 facets. Antennae lacking modification; metaventral processes absent.

**Comparative notes.** The postgenae of the head being rounded and not laterally expanded quickly separates this species from *L. sichuanicus* Hlaváč, *L. schuelkei* sp. n. described below, *L. dabashanus* and *L. shibatai*. From the rest of the members of the genus, *L. mirus* can be readily recognized by its characteristic antennal modification and aedeagus.

**Distribution.** Southwest China: Yunnan.

**Biology.** Species were sifted from various kinds of leaf litter and moss in mixed forests.

**Etymology.** Tha Latin word '*mirus*' means 'extraodinary, remarkable', referring to the unique antennal modification and aedeagal form of this species.

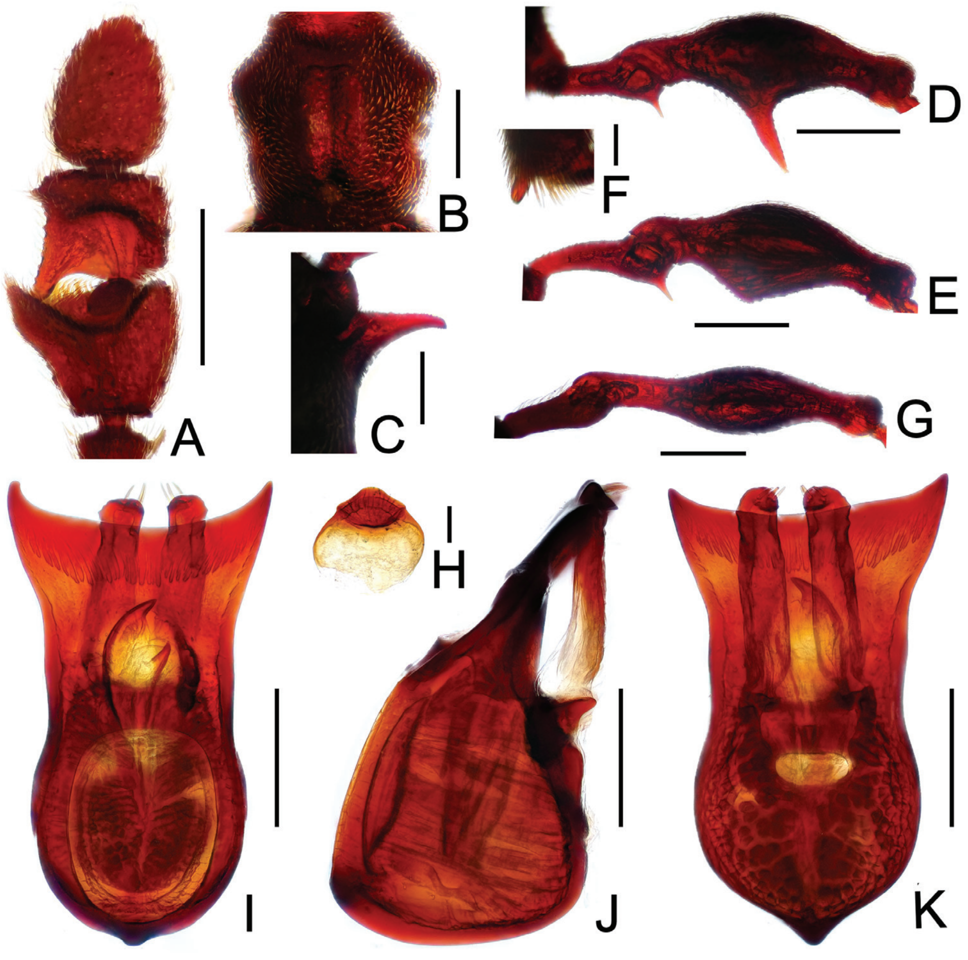



**Figure 4.** Diagnostic features of *La. mirus*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** mesotrochanter and mesofemur **F** apical portion of mesotibia **G** metatrochanter and metafemur **H** sternite IX **I** aedeagus, in dorsal view **J** same, in lateral view **K** same, in ventral view. Scales (mm): **A, B, D, E, G** = 0.3; **C, I, J, K** = 0.2; **H** = 0.1; **F** = 0.05.

***Labomimus paratorus*** **Yin & Li, sp. n.**
urn:lsid:zoobank.org:act:AE6BCF63-0112-4CAE-9D52-FBFE72490A1B
http://species-id.net/wiki/Labomimus_paratorus
Figs 1D, 5

**Type material** (3 ♂♂)**.** Holotype: ♂, labeled 'China: Shaanxi, Qin Ling Shan / 108.47E, 33.51N, Mountain W / pass at Autoroute km 70, 47 km / 2500-2600 m, sifted / 26.-27.08.1995, leg. M. Schülke // Sammlung / M. Schülke / Berlin // M. SCHÜLKE Coll. / Staphylinidae, Pselaphinae / *Labomimus* sp. 5 / S. Nomura det., 2005' (cSch). Paratypes: 1 ♂, same label data as holotype, with additional identification label '*Labomimus* Sharp sp. / det. Brachat 2. 99' (SNUC); 1 ♂, labeled 'CHINA (S-Shaanxi)

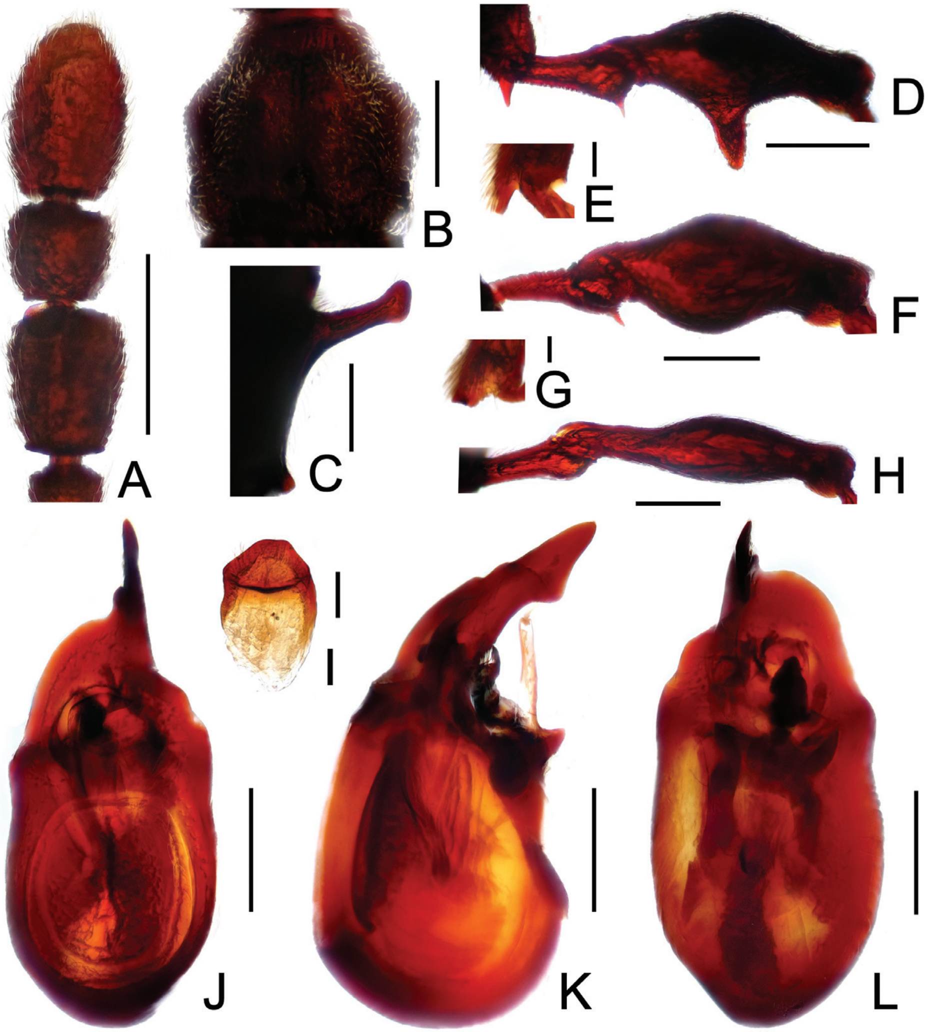



**Figure 5.** Diagnostic features of *La. paratorus*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** procoxa, protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** apical portion of mesotibia **H** metatrochanter and metafemur **I** sternite IX **J** aedeagus, in dorsal view **K** same, in lateral view **L** same, in ventral view. Scales (mm): **A, B, D, F, H** = 0.3; **C, J, K, L** = 0.2; **I** = 0.1; **E, G** = 0.05.

Qingling Shan / mount. range W pass on rd. Xi'an / - Shagoujie, 45 km SSE Xi'an, / 33°52'N, 108°46'E, 2675 m / (N-slope, *Abies*, *Betula*, *Larix*, / subalp. meadows, along road) / 25.VII.2001 Wrase [20] // Sammlung / M. Schülke / Berlin // M. SCHÜLKE Coll. / Staphylinidae, Pselaphinae / *Labomimus* sp. 14 / S. Nomura det., 2005' (cSch).

**Diagnosis.** Reddish brown; length 3.55–3.87; postgenae rounded; antennomeres IX–XI enlarged, IX modified in the male; pronotum with lateral margins slightly angularly expanded laterally; metaventral processes roundly broadened apically; metacoxae simple; aedeagus with asymmetric median lobe.

**Description.** Male (Fig. 1D). Length 3.55–3.87. Head longer than wide, HL 0.74–0.76, HW 0.66–0.69; eyes each composed of about 40 facets. Antennal clubs as in Fig. 5A. Pronotum (Fig. 5B) about as long as wide, PL 0.68–0.70, PW 0.69–0.71, with lateral margins slightly angularly expanded. Elytra wider than long, EL 0.92–0.93, EW 1.25–1.28. Metaventral processes moderately elongate, apically roundly enlarged (Fig. 5C). Procoxae with short thick ventral spine, protrochanters with small ventral spine, profemora with large blunt spine at ventral margin (Fig. 5D), protibiae (Fig. 5E) with small apical tubercle; mesotrochanters (Fig. 5F) with small spine at ventral margin, mesotibiae (Fig. 5G) with short truncate apical tubercle; metatrochanters and metafemora (Fig. 5H) simple. Abdomen broad at base and narrowed apically, AL 1.21–1.48, AW 1.40–1.43. Sternite IX as in Fig. 5I. Aedeagus length 0.81, median lobe elongate, asymmetric (Figs 5J–L).

**Female.** Unknown.

**Comparative notes.** A reexamination of the holotype of *Pselaphodes torus* Yin, Li & Zhao clearly showed the presence of a median metaventral fovea in that species, a character state that is shared by *Labomimus*, *Linan*, and *Indophodes* Hlaváč of the *Pselaphodes*-complex. Combined with the short tarsomeres II not extending to beneath the III, the distinct frontal and vertexal foveae, and the presence of a pronotal median antebasal fovea, *P. torus* is here moved to *Labomimus*, comb. n. *Labomimus paratorus* is placed closest to *L. torus*, they share a similar general appearance, the placement of spines on the legs, and even similar aedeagal form. The two species can be separated only by reddish-brown body coloration and the short apical projections of pro- and mesotibiae in *L. paratorus*, in contrast *Labomimus torus* has black body coloration and much longer apical projections of the first two pairs of tibiae.

**Distribution.** Norwest China: Shaanxi.

**Biology.** Individuals were sifted from leaf litter of mixed forests.

**Etymology.** The species name indicates a close relationship to *Labomimus torus*.

***Labomimus sarculus* Yin & Li, sp. n.**
urn:lsid:zoobank.org:act:88F4D2D6-C9B6-4B74-9CC4-472673FC4EBE
http://species-id.net/wiki/Labomimus_sarculus
Figs 6A, 7

**Type material** (2 ♂♂)**.** Holotype: ♂, labeled 'CHINA: Yunnan, Baoshan Pref., Gao- / ligong Shan, 32 km SE Tengchong,/ 2150-2250 m, 24°51-53'N, 98°45'E, / devast. prim. and second. forest litter, / dead wood, mushrooms sifted, 26.VIII. / 2009, leg. M. Schülke [CH09-08/09]' (cSch). Paratype: 1 ♂, same label data as holotype (cSch).

**Diagnosis.** Reddish brown; length 2.89–3.02; postgenae nearly rounded; antennomeres IX–XI enlarged, IX–X modified in the male; pronotum with lateral margins slightly angularly expanded laterally; metaventral processes short and sharp; metacoxae with large hook-like ventral protuberance; aedeagus with symmetric median lobe.

**Description.** Male (Fig. 6A). Length 2.89–3.02. Head longer than wide, HL 0.70–0.71, HW 0.66–0.69; eyes each composed of about 25 facets. Antennal clubs as in Fig.

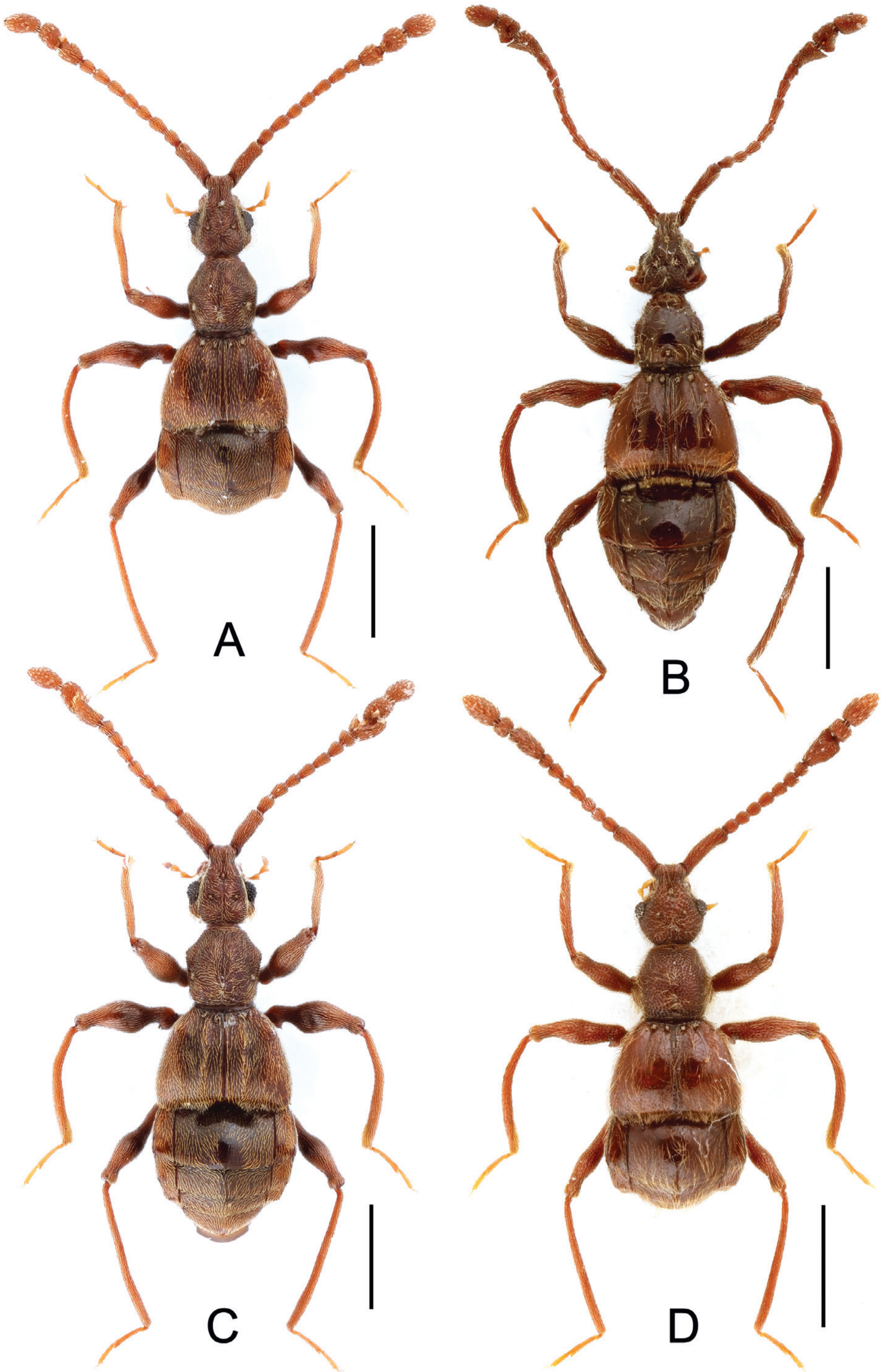



**Figure 6.** Male habitus of *Labomimus* and *Linan* spp. **A** *La. sarculus* **B** *La. schuelkei* **C** *La. vespertilio* **D** *Li. tendothorax*. Scales: 1.0 mm.

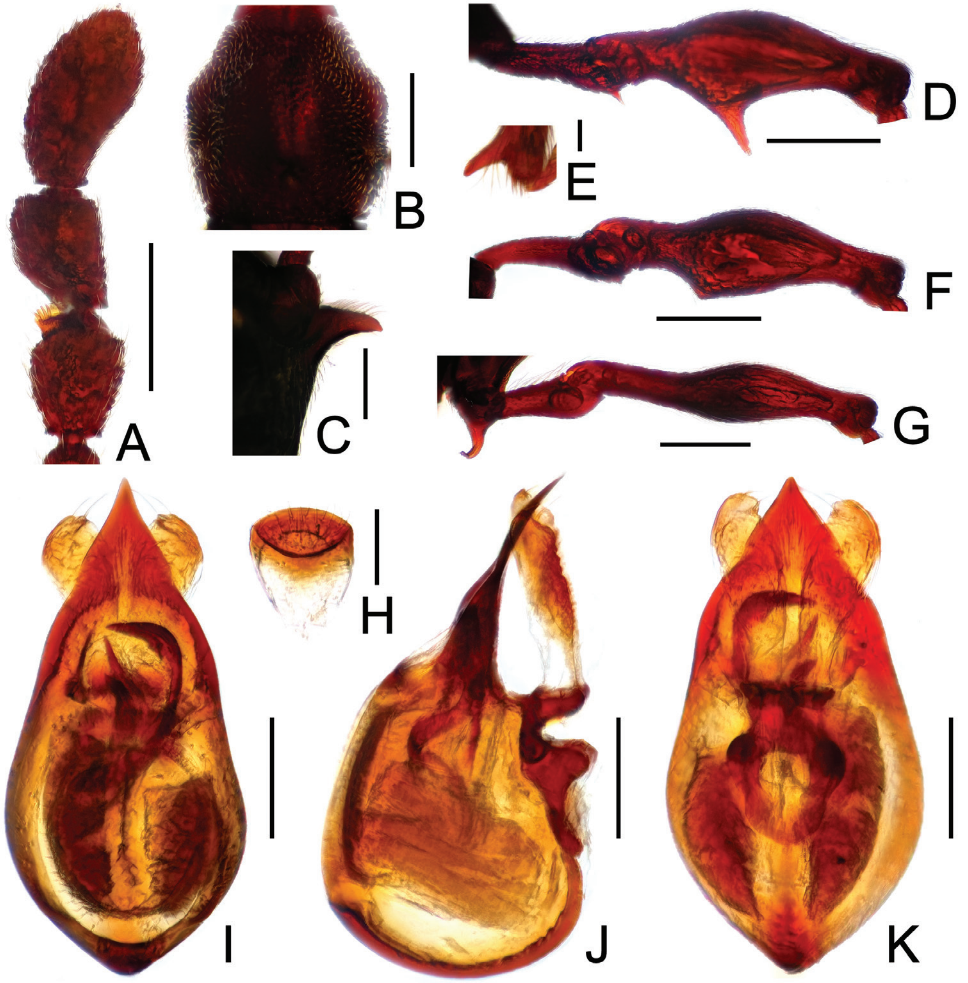



**Figure 7.** Diagnostic features of *La. sarculus*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** metacoxa, metatrochanter and metafemur **H** sternite IX **I** aedeagus, in dorsal view **J** same, in lateral view **K** same, in ventral view. Scales (mm): **A, B, D, F, G** = 0.3; **C, I, J, K** = 0.2; **H** = 0.1; **E** = 0.05.

7A. Pronotum (Fig. 7B) slightly longer than wide, PL 0.68–0.70, PW 0.64–0.65, with lateral margins slightly angularly expanded. Elytra wider than long, EL 0.75–0.76, EW 1.18–1.19. Metaventral processes short, narrowed apically with pointed apices (Fig. 7C). Protrochanters with small ventral spine, profemora with large sharp spine at ventral margin (Fig. 7D), protibiae (Fig. 7E) with distinct preapical apur; mesotrochanters (Fig. 7F) with indistinct tiny spine at ventral margin; metacoxae (Fig. 7G) with big hook-like protuberance at ventral margin, metatrochanters and metafemora simple. Abdomen broad at base and narrowed apically, AL 0.76–0.85, AW 1.23–1.26. Sternite IX as in Fig. 7H. Aedeagus length 0.60, median lobe symmetric, narrowed from base toward apex (Figs 7I–K).

**Female.** Unknown.

**Comparative notes.** This species is placed near *L. cognatus* and *L. vespertilio* described below by sharing a similar habitus, the short median metaventral process and the protuberant metacoxae. *Labomimus sarculus* can be readily separated from both species by the unique modified antennomeres IX, longer apical spur of protibiae and the aedeagus has the median lobe medially straight at the apex, not concave.

**Distribution.** Southwest China: Yunnan.

**Biology.** Individuals were sifted from leaf litter and mixed deadwood and mushrooms in a devastated primary and secondary forest.

**Etymology.** The Latin word '*sarculus*' means 'a hoe', referring to the uniquely modified antennomeres IX.

### *Labomimus schuelkei* Yin & Li, sp. n.

urn:lsid:zoobank.org:act:1616C90A-14ED-4941-A128-5AFA6E28028E
http://species-id.net/wiki/Labomimus_schuelkei
Figs 6B, 8

**Type material** (1 ♂)**.** Holotype: ♂, labeled 'China: Shaanxi, Qin Ling Shan / 110.06E, 34.27N / Hua Shan Mt. N Valley, 1200- / 1400 m, 118 km E Xi'an, sifted / 18.-20.08.1995, leg. M. Schülke // *Eulasinus* Sharp sp. / det. Brachat 2. 99 // Sammlung / M. Schülke / Berlin // M. SCHÜLKE Coll. / Staphylinidae, Pselaphinae / *Labomimus* sp. 4 / S. Nomura det., 2005' (cSch).

**Diagnosis.** Reddish brown; length 3.92; postgenae strongly expanded laterally; antennomeres IX–XI enlarged, IX–X modified in the male; pronotum with lateral margins nearly rounded; metaventral processes short; metacoxae simple; aedeagus with asymmetric median lobe.

**Description.** Male (Fig. 6B). Length 3.92. Head longer than wide, HL 0.89, HW 0.78; eyes each composed of about 20 facets. Antennal clubs as in Fig. 8A. Pronotum (Fig. 8B) slightly longer than wide, PL 0.76, PW 0.70, with lateral margins nearly rounded. Elytra wider than long, EL 0.89, EW 1.34. Metaventral processes short, apically narrowed (Fig. 8C). Protrochanters with tiny ventral spine, profemora simple (Fig. 8D); mesotrochanters (Fig. 8E) with one big spine and one smaller spine at ventral margin; metacoxae with elongate protuberance (Fig. 8F), metatrochanters and metafemora (Fig. 8G) simple. Abdomen broad at base and narrowed apically, AL 1.38, AW 1.37. Sternite IX as in Fig. 8H. Aedeagus length 0.62, asymmetric median lobe narrow (Figs 8I–K).

**Female.** Unknown.

**Comparative notes.** *Labomimus schuelkei* is placed close to *L. sichuanicus* by sharing the postgenae being largely expanded laterally with a thickened posterior margin, and the strongly elongate antennomeres V–VIII. The two species can be readily separated by the large body size, the strongly modified antennomeres IX–X, and the aedeagus with the median lobe narrow dorsal-ventrally in *L. schuelkei*, while *L. sichuanicus* is

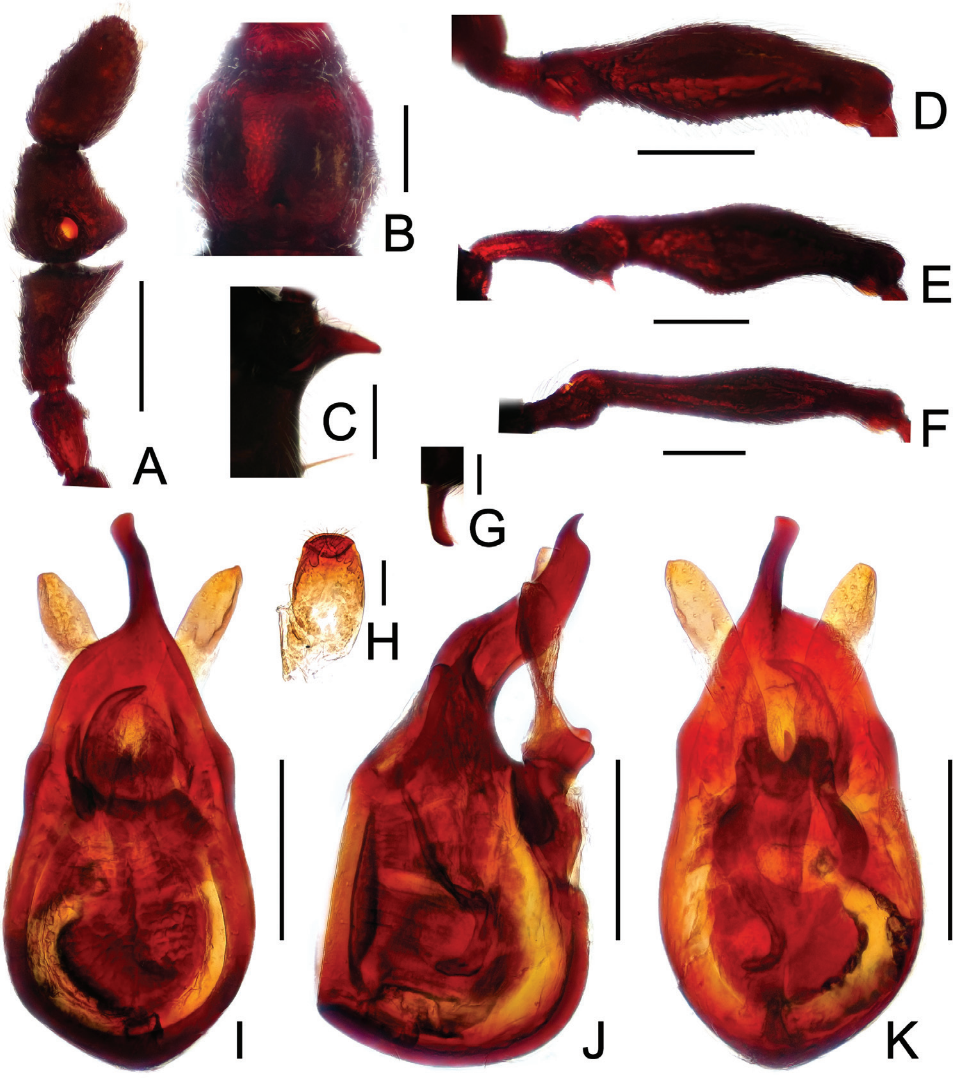



**Figure 8.** Diagnostic features of *La. schuelkei*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** mesotrochanter and mesofemur **F** metatrochanter and metafemur G metacoxa **H** sternite IX **I** aedeagus, in dorsal view **J** same, in lateral view **K** same, in ventral view. Scales (mm): **A, B, D, E, F** = 0.3; **C, I, J,** K = 0.2; **H, G** = 0.1.

much smaller (3.05–3.20 mm), has simple antennomeres IX–X, and has the aedeagus with a much broader median lobe (Hlaváč et al. 2000).

**Distribution.** Northwest China: Shaanxi.

**Biology.** Probably sifted from leaf litter in a forest.

**Etymology.** Named after Michael Schülke, a well-known specialist in Staphylinidae, who kindly provided all the material used in this paper.

***Labomimus vespertilio*** **Yin & Li, sp. n.**
urn:lsid:zoobank.org:act:16AA692E-CA85-4705-A6A7-FB71A99A0C06
http://species-id.net/wiki/Labomimus_vespertilio
Figs 6C, 9

**Type material** (2 ♂♂, 5 ♀♀)**.** Holotype: ♂, labeled 'CHINA: Yunnan, Dali Bai Aut. Pref., / mount. range E Weishan, 12 km NE / Weishan, 25°17'02-15"N, 100°22' / 22-30"E, 2630-2660 m, scrub with / pines and bamboo, litter sifted, 15.IX. / 2009. leg. M. Schülke [CH09-54]' (cSch). Paratypes: 1 ♂, 5 ♀♀, same label data as holotype (cSch, SNUC).

**Diagnosis.** Reddish brown; length 3.34–3.52; postgenae nearly rounded; antennomeres IX–XI enlarged, VIII–X modified in the male; pronotum with lateral margins moderately angularly expanded laterally; with short blunt metaventral processes; metacoxae spinose; aedeagus with symmetric median lobe.

**Description.** Male (Fig. 6C). Length 3.34–3.52. Head longer than wide, HL 0.70–0.75, HW 0.63–0.65; eyes each composed of about 30 facets. Antennal clubs as in Fig. 9A. Pronotum (Fig. 9B) slightly longer than wide, PL 0.71–0.74, PW 0.65–0.70, with lateral margins moderately angularly expanded laterally. Elytra wider than long, EL 0.75–0.81, EW 1.23–1.28. Short metaventral processes with rounded apices (Fig. 9C). Protrochanters with small ventral spine, profemora with large ventral spine (Fig. 9D), protibiae with distinct apical tubercle (Fig. 9E); mesotrochanters (Fig. 9F) with tiny spine at ventral margin; metacoxae (Fig. 9G) with long hook-like protuberance at ventral margin, metatrochanters and metafemora simple. Abdomen broad at base and narrowed apically, AL 1.18–1.22, AW 1.28–1.35. Sternite IX as in Fig. 9H. Aedeagus length 0.56, with symmetric median lobe (Figs 9I–K).

Female. Similar to male in general; BL 3.34–3.40, HL 0.72–0.73, HW 0.61–0.62, PL 0.72–0.73, PW 0.68–0.70, EL 0.73–0.74, EW 1.28–1.29, AL 1.17–1.20, AW 1.38–1.41. Eyes each composed of about 25 facets. Antennae lacking modification; metaventral processes absent.

**Comparative notes.** This is placed as a sister species of *L. cognatus*, sharing with it a number of character states (see comparative notes under *L. cognatus*). The two species can be separated by the larger body size, the strongly asymmetric antennomeres IX, and the aedeagus with much broader apex in *L. vespertilio*, while *L. cognatus* is smaller in body size, has symmetric antennomeres IX with a disc-like process, and has the aedeagus with a much narrower apex. Other than the aforementioned characters, the two species also share with *L. sarculus* the lateral rows of dense setae extending from frontal rostrum base to head base, and the three species seem to form a small species-complex. For separation of *L. sarculus* from *L. cognatus* and *L. vespertilio* see the comparative notes under that species.

**Distribution.** Southwest China: Yunnan.

**Biology.** Adults were from sifted leaf litter in a scrub forest with pines and bamboo.

**Etymology.** The Latin word '*vespertilio*' means 'a bat', referring to the bat-like apical part of the aedeagal median lobe.

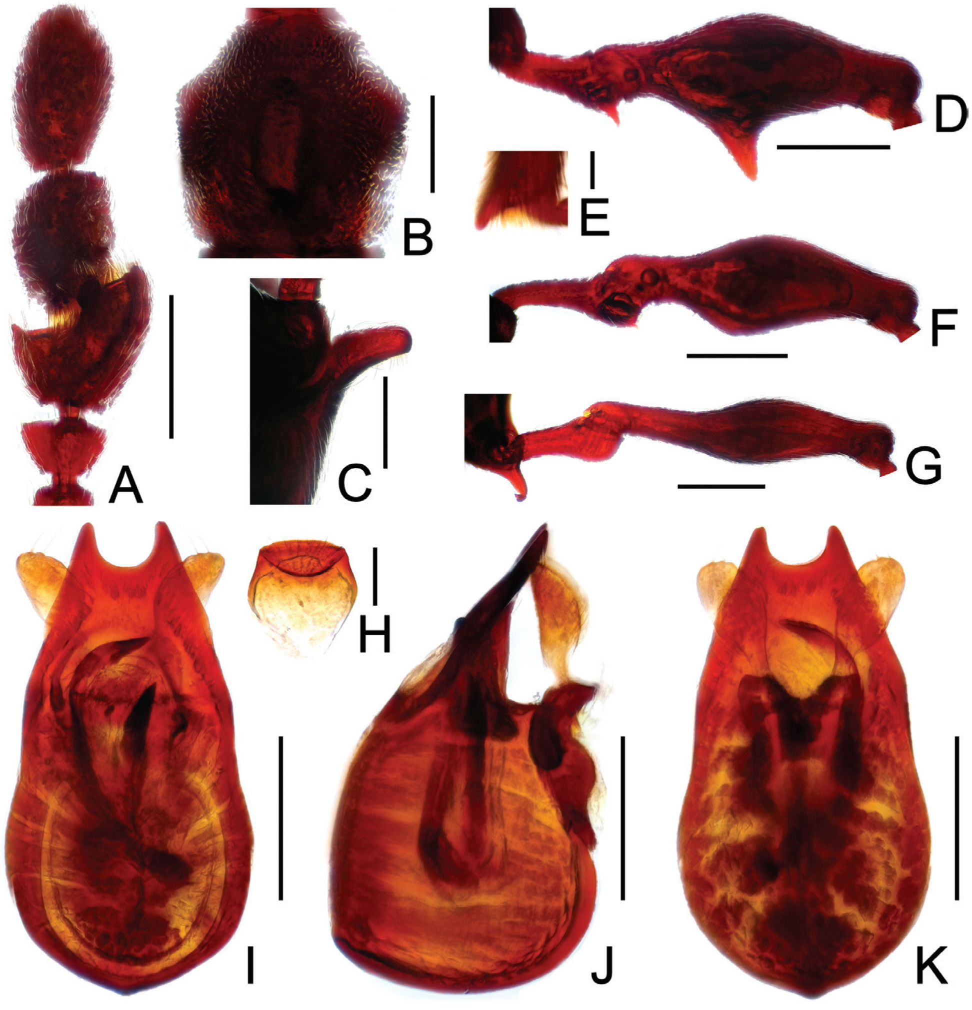



**Figure 9.** Diagnostic features of *La. vespertilio*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** metacoxa, metatrochanter and metafemur **H** sternite IX **I** aedeagus, in dorsal view **J** same, in lateral view **K** same, in ventral view. Scales (mm): **A, B, D, F, G** = 0.3; **C, I, J, K** = 0.2; **H** = 0.1; **E** = 0.05.

***Linan tendothorax*** **Yin & Li, sp. n.**
urn:lsid:zoobank.org:act:3B08AD2E-62ED-4031-96EE-EB853063EA33
http://species-id.net/wiki/Linan_tendothorax
Figs 6D, 10

**Type material** (3 ♂♂, 14 ♀♀)**.** Holotype: ♂, labeled 'CHINA: Yunnan, Lincang Pref., Xue / Shan, 11 km ENE Lincang, 2510 m, / 23°55'01"N, 100°11'17.5"E, second. / pine forest with Rhodod., small cleft with water, litter & mushrooms sifted, / 10.IX.2009, leg. M. Schülke [CH09-39]' (cSch). Paratypes: 1 ♂, 7 ♀♀, same label data as holo-

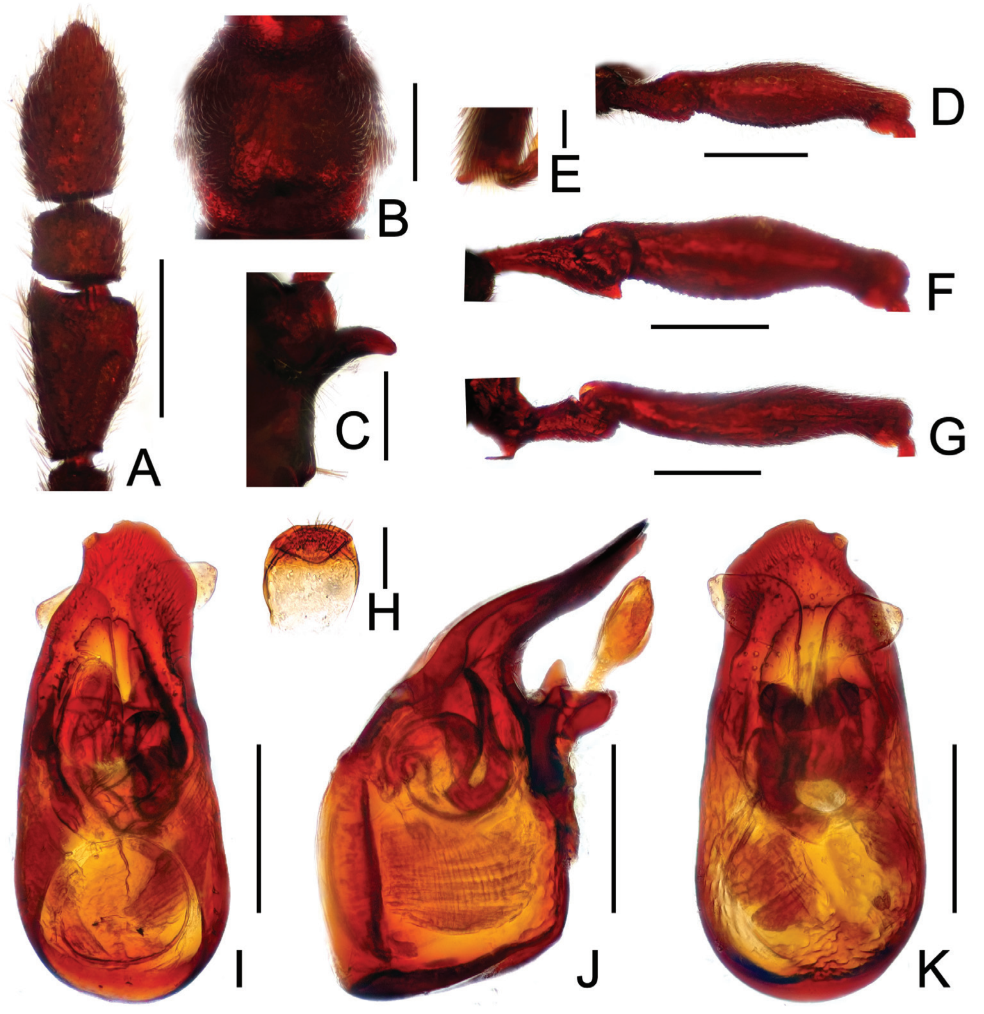



**Figure 10.** Diagnostic features of *Li. tendothorax*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** metacoxa, metatrochanter and metafemur **H** sternite IX **I** aedeagus, in dorsal view **J** same, in lateral view **K** same, in ventral view. Scales (mm): **A, B, D, F, G** = 0.3; **C, I, J, K** = 0.2; **H** = 0.1; **E** = 0.05.

type (cSch, SNUC); 1 ♀, same label data, except 'D.W. Wrase' (cSch); 3 ♀♀, labeled 'CHINA: Yunnan, Lincang Pref., / Laobei Shan, Wei Bo Shan pass, / 24°08'16"N, 99°42'53"E, 2375 m, / creek valley, devastated second. / decid. forest, litter & moss sifted, 8.IX.2009, leg. M. Schülke [CH09-35]' (cSch); 3 ♀♀, labeled 'CHINA (Yunnan) Lincang Pref., / Wuliang Shan, old pass road, W-side, / 2200 m (small creek valley with primary / forest remnant, litter, debris sifted) / 24°42'58.6"N, 100°29'52"E / 12.IX.2009 D.W.Wrase' (cSch); 1 ♂, labeled 'CHINA: Yunnan, Pu'er Pref., / Ailao Shan, 37 km NW Jingdong, / 24°45'12"N, 100°41'24.5"E, 2300 m, / devastated forest remnant, litter & / dead wood sifted, 13.IX.2009, / leg. M. Schülke [CH09-48]' (cSch).

**Diagnosis.** Reddish brown; length 2.80–2.95; postgenae rounded; antennomeres IX–XI enlarged, IX modified in the male; pronotum with lateral margins roundly expanded basolaterally; with short blunt metaventral processes; metacoxae spinose; aedeagus with asymmetric median lobe.

**Description.** Male (Fig. 6D). Length 2.80–2.95. Head longer than wide, HL 0.65–0.66, HW 0.59–0.60; eyes each composed of about 17 facets. Antennal clubs as in Fig. 10A. Pronotum (Fig. 10B) about as long as wide, PL 0.61–0.62, PW 0.59–0.60, with round lateral margins. Elytra wider than long, EL 0.71–0.74, EW 1.08–1.09. Short metaventral processes with rounded apices (Fig. 10C). Protrochanters and profemora simple (Fig. 10D), protibiae with distinct small apical tubercle (Fig. 10E); mesotrochanters (Fig. 10F) with blunt triangular spine at ventral margin; metacoxae (Fig. 10G) with hook-like protuberance at ventral margin, metatrochanters and metafemora simple. Abdomen broad at base and narrowed apically, AL 0.83–0.93, AW 1.14–1.19. Sternite IX as in Fig. 10H. Aedeagus length 0.60, with asymmetric median lobe (Figs 10I–K).

Female. Similar to male in general; BL 2.81–2.92, HL 0.64–0.66, HW 0.58–0.59, PL 0.60–0.62, PW 0.60–0.62, EL 0.70–0.72, EW 1.16–1.19, AL 0.87–0.92, AW 1.22–1.25. Eyes each composed of about 16 facets. Antennae lacking modification; metaventral processes absent.

**Comparative notes.** *Linan tendothorax* is placed as a member of the *L. cardialis* species-group (sensu Yin et al. 2011b) based on its strongly modified antennomeres IX–X. It can be separated from all known *Linan* species by the unique pronotum that is roundly expanded laterally at the basolateral margins.

**Distribution.** Southwest China: Yunnan.

**Biology.** Individuals were sifted from mixed litter, moss, debris and dead wood in primary or secondary deciduous forests.

**Etymology.** The species name is combined from the Latin stem '*tend*' and Greek word '*thorax*', referring to the unique basolaterally extended pronotum of the new species.

### *Pselaphodes distincticornis* Yin & Li, sp. n.

urn:lsid:zoobank.org:act:68CE4309-47C1-40AD-A7B1-2EA84A398A4F
http://species-id.net/wiki/Pselaphodes_distincticornis
Figs 11A, 12

**Type material** (2 ♂♂, 1 ♀)**.** Holotype: ♂, labeled 'CHINA: Yunnan, Dali Bai Aut. Pref. / 36 km N Dali, ruderal pasture wtih / pines and shrubs, 26°01'20"N, / 100°08'14"E, 2158 m, litter sifted / under pines and shrubs, 24.VIII.2009, / leg. M. Schülke [CH09-04]' (cSch). Paratype: 1 ♂, same label data as holotype (SNUC); 1 ♀, same label data sa holotype, except 'D.W. Wrase [04]'.

**Diagnosis.** Reddish brown; length 2.74–2.88; postgenae rounded; antennomeres IX–XI enlarged, IX modified in the male; pronotum with lateral margins roundly expanded laterally; with long thick metaventral processes; metacoxae simple; aedeagus with asymmetric median lobe elongate.

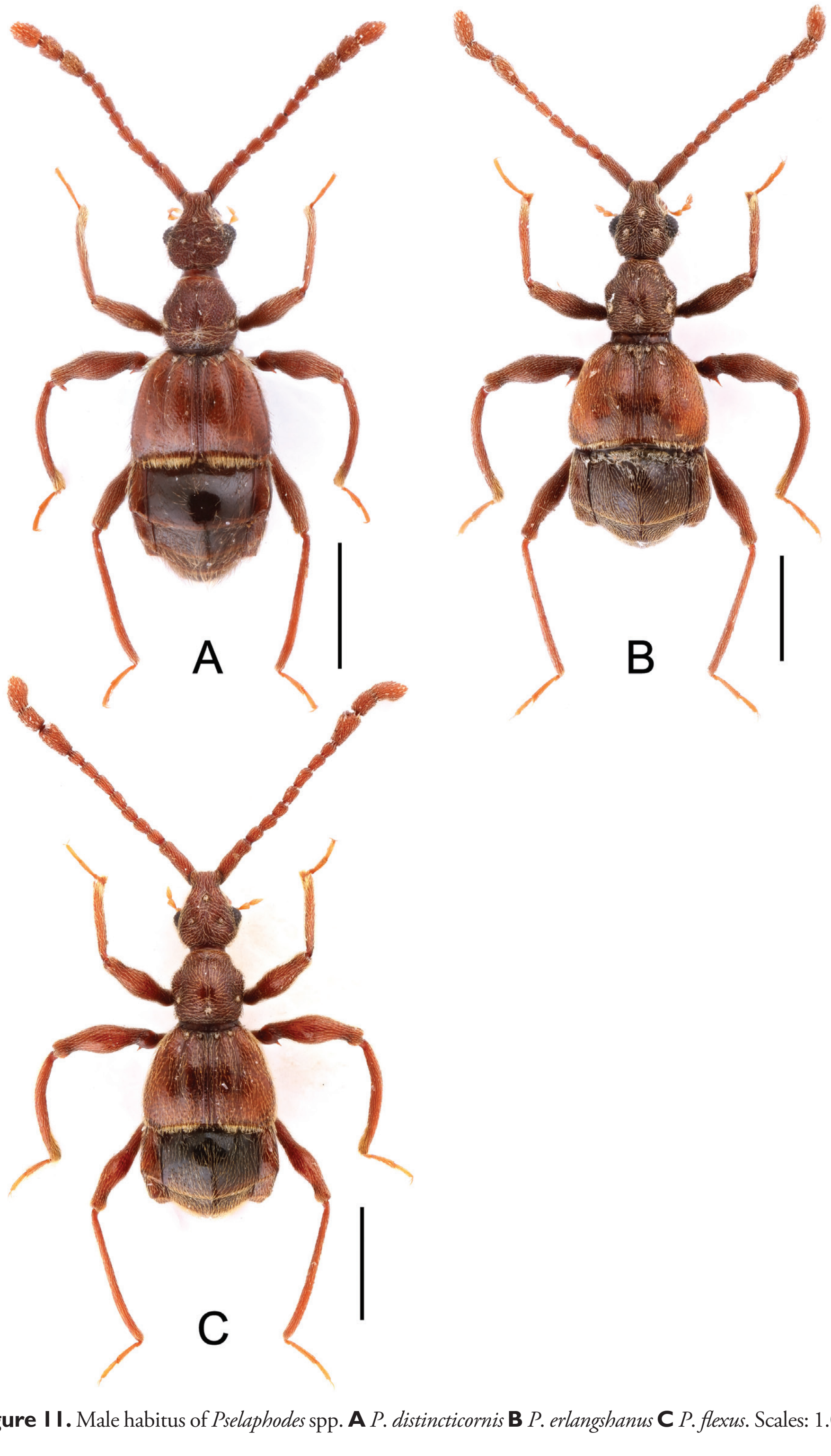



**Figure 11.** Male habitus of *Pselaphodes* spp. **A** *P. distincticornis* **B** *P. erlangshanus* **C** *P. flexus*. Scales: 1.0 mm.

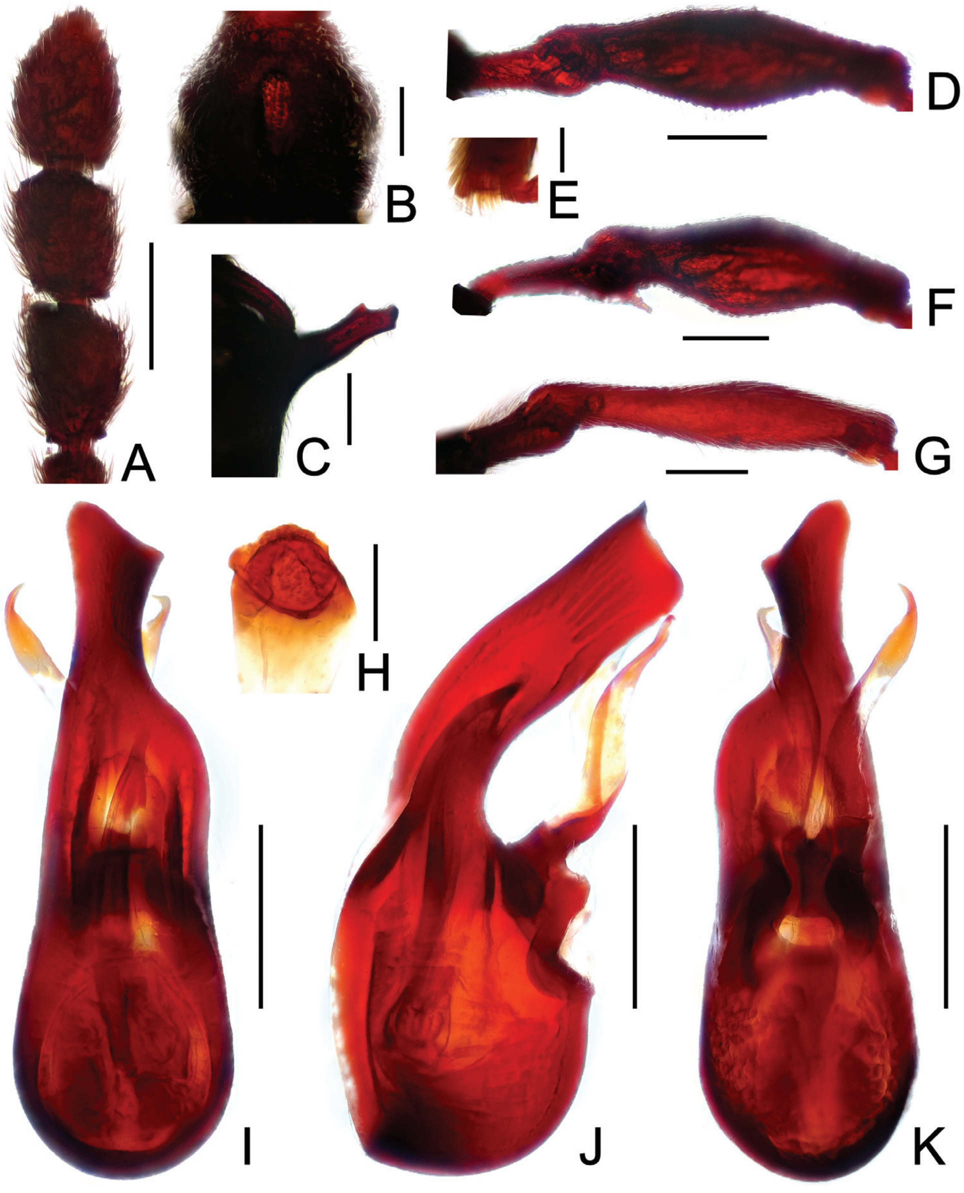



**Figure 12.** Diagnostic features of *P. distincticornis*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** metatrochanter and metafemur **H** sternite IX **I** aedeagus, in dorsal view **J** same, in lateral view **K** same, in ventral view. Scales (mm): **A, B, C, D, F, G, I, J, K** = 0.2; **H** = 0.1; **E** = 0.05.

**Description.** Male (Fig. 11A). Length 2.74–2.88. Head longer than wide, HL 0.59–0.60, HW 0.58–0.59; eyes each composed of about 40 facets. Antennal clubs as in Fig. 12A. Pronotum (Fig. 12B) about as long as wide, PL 0.58–0.59, PW 0.58–0.60, with round lateral margins. Elytra wider than long, EL 0.72–0.73, EW

1.11–1.12. Long metaventral processes with truncate apices (Fig. 12C). Protrochanters and profemora simple (Fig. 12D), protibiae with short apical tubercle (Fig. 12E); mesotrochanters (Fig. 12F) with small spine at ventral margin; metatrochanters and metafemora (Fig. 12G) simple. Abdomen broad at base and narrowed apically, AL 0.85–0.96, AW 1.11–1.14. Sternite IX as in Fig. 12H. Aedeagus length 0.71, with asymmetric median lobe distinctively elongate (Figs 12I–K).

**Female.** Similar to male in general; BL 2.79, HL 0.64, HW 0.58, PL 0.59, PW 0.59, EL 0.62, EW 1.16, AL 0.94, AW 1.22. Eyes each composed of about 30 facets. Metaventral processes absent.

**Comparative notes.** The unmodified antennal clubs are shared in *P. fengtingae* Yin, Li et Zhao (Zhejiang, Jiangxi) and *P. parvus* Yin, Li et Zhao (Guizhou). *Pselaphodes distincticornis* can be separated from both species by the larger size, the simple protrochanters and profemora, and the distinctively asymmetric and elongate median lobe of the aedeagus. Both *P. fengtingae* and *P. parvus* have the protrochanters with a small ventral spine, and the profemora with a larger spine at the ventral margin, and have the aedeagus with an asymmetric but much shorter median lobe.

**Distribution.** Southwest China: Yunnan.

**Biology.** Species were sifted from leaf litter under pines and shrubs in a ruderal pasture.

**Etymology.** Species name combined from Latin stems '*distinct*' and '*corn*', referring to the large median metaventral processes of the new species.

### *Pselaphodes erlangshanus* Yin & Li, sp. n.

urn:lsid:zoobank.org:act:ABAFBD58-6774-4127-A007-652A5C24A7A1
http://species-id.net/wiki/Pselaphodes_erlangshanus
Figs 11B, 13

**Type material** (2 ♂♂)**.** Holotype: ♂, labeled 'CHINA: W-Sichuan 1999 / Ganzi Tibet. Aut. Pref., Luding Co. / W Erlanshan-pass, 2600 m / 7 km SSE Luding, 29°51'N, / 102°15'E, Laub+Nadelstreu, Pilze / 22. VI., leg. M. Schülke // Sammlung / M. Schülke / Berlin // *Labomimus* Sharp sp. / det. Brachat 2.09 // M. SCHÜLKE Coll. / Staphylinidae, Pselaphinae / *Lasinus* sp. 1 / S. Nomura det., 2005' (cSch). Paratype: 1 ♂, same label data as holotype, except 'det. Brachat 4.01' (cSch).

**Diagnosis.** Reddish brown; length 3.29–3.78; postgenae nearly rounded; antennomeres IX–XI enlarged, IX modified in the male; pronotum with lateral margins slightly angularly expanded laterally; with long metaventral processes apically narrowed; metacoxae simple; aedeagus with asymmetric median lobe.

**Description.** Male (Fig. 11B). Length 3.29–3.78. Head longer than wide, HL 0.74–0.78, HW 0.65–0.68; eyes each composed of about 30 facets. Antennal clubs as in Fig. 13A. Pronotum (Fig. 13B) about as long as wide, PL 0.70–0.72, PW 0.68–0.69, with lateral margins slightly angularly expanded laterally. Elytra wider than long, EL 0.87–0.90, EW 1.34–1.37. Long metaventral (Fig. 13C) processes thick at base, narrowed apically. Protrochanters with small ventral spine, profemora with long sharp

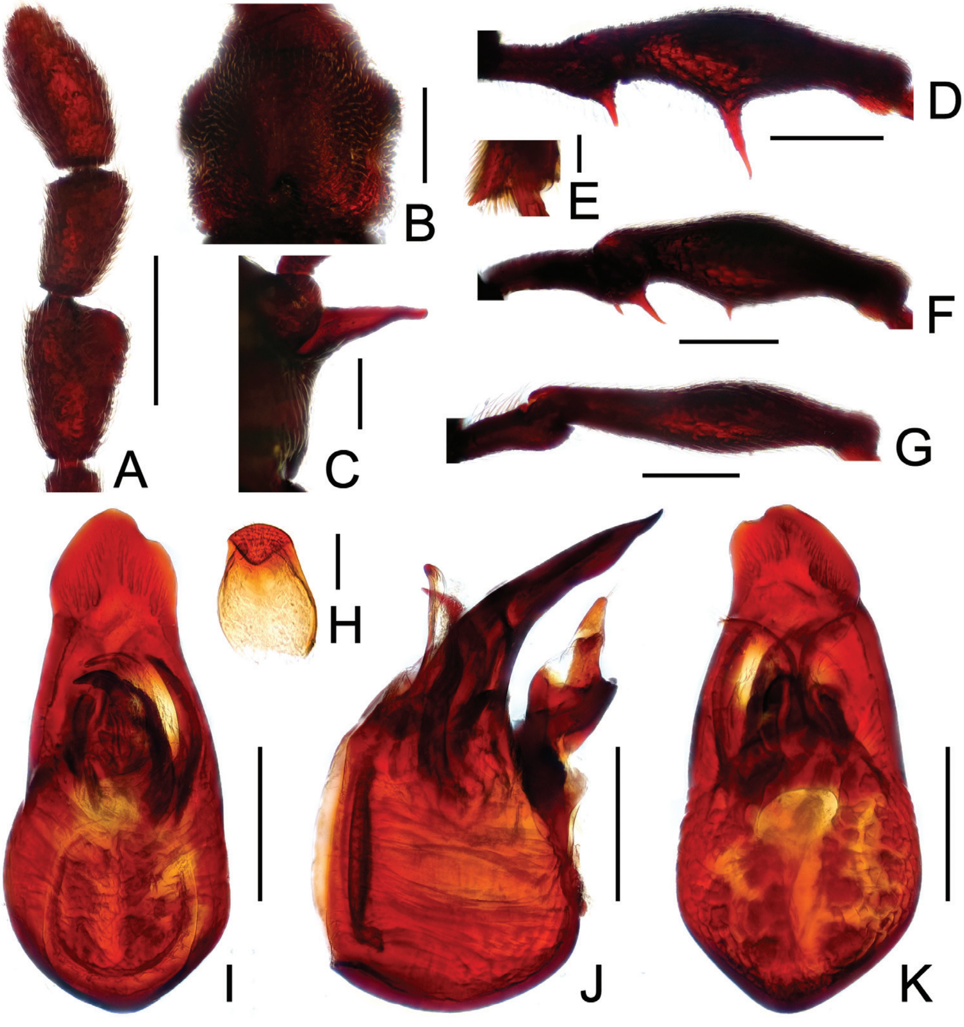



**Figure 13.** Diagnostic features of *P. erlangshanus*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** metatrochanter and metafemur **H** sternite IX **I** aedeagus, in dorsal view **J** same, in lateral view **K** same, in ventral view. Scales (mm): **A, B, D, F, G** = 0.3; **C, I, J, K** = 0.2; **H** = 0.1; **E** = 0.05.

spine at ventral margin (Fig. 13D), protibiae with distinct short apical spur (Fig. 13E); mesotrochanters with large and another much smaller spine at ventral margin, mesofemora with tiny ventral spine (Fig. 13F); metatrochanters and metafemora (Fig. 13G) simple. Abdomen broad at base and narrowed apically, AL 0.98–1.00, AW 1.35–1.38. Sternite IX as in Fig. 13H. Aedeagus length 0.65, with asymmetric median lobe (Figs 13I–K).

**Female.** Unknown.

**Comparative notes.** This species may be related to *P. flexus* and *P. zhongdianus* (both described below) by sharing a similar general habitus, elongate antennomeres

IX–XI, and a somewhat similar aedeagal form. *Pselaphodes erlangshanus* can be readily separated from *P. flexus* by the larger size, the mesotrochanters with two ventral spines, and quite different form of the metaventral processes. The form of the antennomeres IX and aedeagus provide a quick separation of the new species from *P. zhongdianus*.

**Distribution.** Southwest China: Sichuan.

**Biology.** Individuals were sifted from leaf litter in a coniferous forest.

**Etymology.** Named after the type locality.

## *Pselaphodes flexus* Yin & Li, sp. n.

urn:lsid:zoobank.org:act:00C65770-8F24-4C21-A177-070255101FD4
http://species-id.net/wiki/Pselaphodes_flexus
Figs 11C, 14

**Type material** (1 ♂, 7 ♀♀)**.** Holotype: ♂, labeled 'CHINA (N-Yunnan) Lijiang Naxi / Aut. Co., E Yulongxue Shan, / 30 km N Lijiang, 2800-2900 m / 25°09.0'N, 100°14.9'E (creek / valley, secondary mixed forest) / 13.VIII.2003 Wrase [01] // Sammlung / M. Schülke / Berlin // M. SCHÜLKE Coll. / Staphylinidae, Pselaphinae / *Labomimus* sp. 9 / S. Nomura det., 2005' (cSch). Paratypes: 3 ♀♀, same label data as holotype, except '*Labomimus* sp. 7 / S. Nomura det., 2005'; 4 ♀♀, same label data, except '13.VIII.2003, M. Schülke, (cSch, SNUC).

**Diagnosis.** Reddish brown; length 2.87; postgenae rounded; antennomeres IX–XI enlarged, IX modified in the male; pronotum with lateral margins slightly angularly expanded laterally; with long metaventral processes apically narrowed; metacoxae simple; aedeagus with asymmetric median lobe.

**Description.** Male (Fig. 11C). Length 2.87. Head longer than wide, HL 0.66, HW 0.60; eyes each composed of about 25 facets. Antennal clubs as in Fig. 14A. Pronotum (Fig. 14B) about as long as wide, PL 0.65, PW 0.63, with lateral margins slightly angularly expanded laterally. Elytra wider than long, EL 0.81, EW 1.12. Long metaventral (Fig. 14C) processes narrowed apically. Protrochanters with small ventral spine, profemora with big sharp spine at ventral margin (Fig. 14D), protibiae with broad triangular spur (Fig. 14E); mesotrochanters with small spine at ventral margin, mesofemora simple (Fig. 14F); metatrochanters and metafemora (Fig. 14G) simple. Abdomen broad at base and narrowed apically, AL 0.75, AW 1.23. Sternite IX as in Fig. 14H. Aedeagus length 0.60, with asymmetric median lobe (Figs 14I–K).

**Female.** Unknown.

**Comparative notes.** As discussed above, this species may be related to *P. erlangshanus* and *P. zhongdianus* by sharing a similar general habitus, elongate antennomeres IX–XI, and a somewhat similar aedeagal form. *Pselaphodes flexus* can be separated from *P. erlangshanus* by the smaller size, the mesotrochanters with single ventral spine, and much thinner metaventral process. The nearly symmetrically cylindrical antennomeres

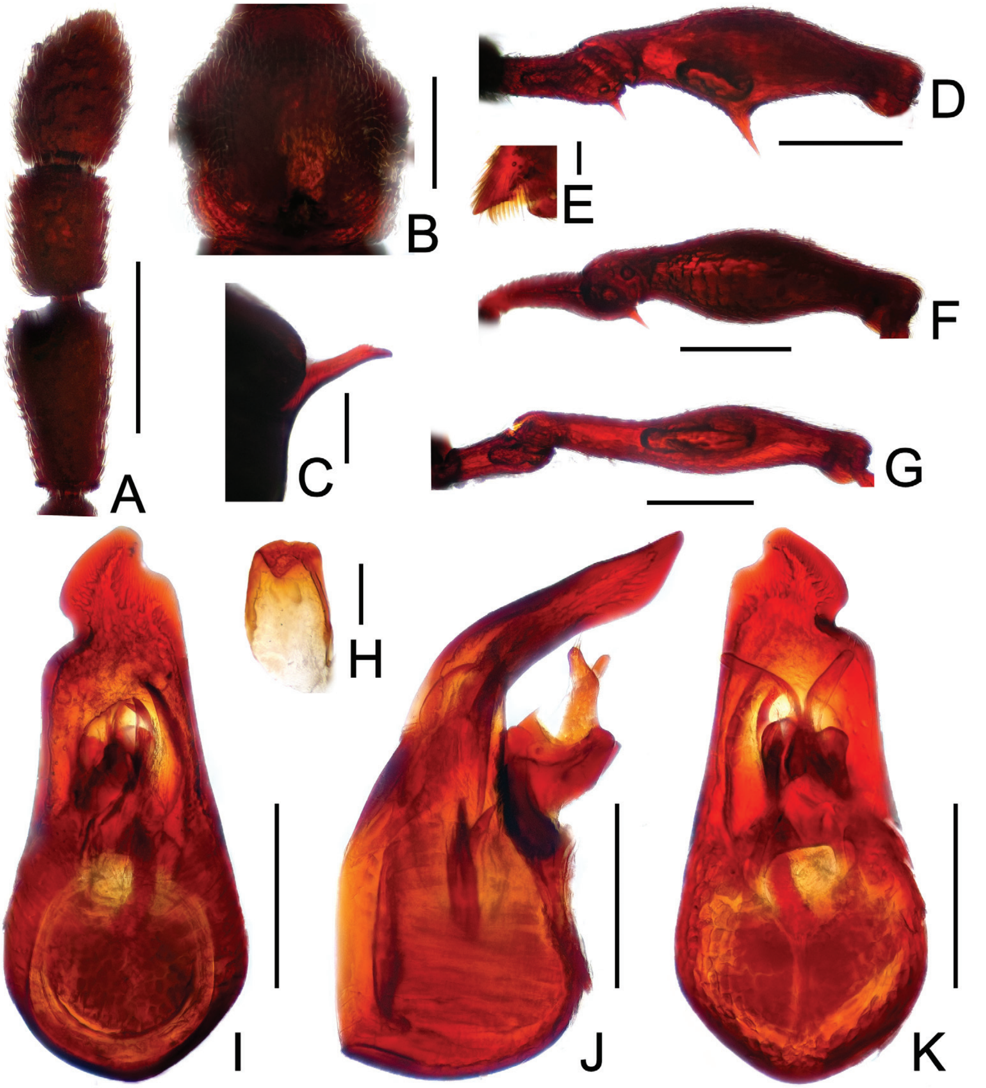



**Figure 14.** Diagnostic features of *P. flexus*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** metatrochanter and metafemur **H** sternite IX **I** aedeagus, in dorsal view **J** same, in lateral view **K** same, in ventral view. Scales (mm): **A, B, D, F, G** = 0.3; **C, I, J, K** = 0.2; **H** = 0.1; **E** = 0.05.

IX of *P. flexus* readily separate it from *P. zhongdianus*, whose antennomeres IX are strongly roundly and projecting anterolaterally.

**Distribution.** Southwest China: Yunnan.

**Biology.** The individual was sifted from a secondary mixed forest in a ravine.

**Etymology.** The Latin word '*flexus*' means 'curved, bent, twisting', referring to the curved terminal antennomere of the new species.

***Pselaphodes jizushanus*** **Yin, Li & Zhao**
http://species-id.net/wiki/Pselaphodes_jizushanus
Figs 15A, 16

*Pselaphodes jizushanus* Yin, Li & Zhao, 2011a: 471.

**Additional material examined.** 1 ♂, labeled 'CHINA: Yunnan [CH07-15], Baoshan / Pref., Gaoligong Shan, 29 km ESE / Tengchong, 24°55'37''N, / 98°45'09''E, / 2350 m, dev. decid. forest, litter, wood, / fungi sifted, 1.VI.2007, M. Schülke' (cSch).

**Diagnosis and description.** Yin et al. 2011: 471; Figs 15A, 16. Measurements: BL 3.10, HL 0.63, HW 0.59, PL 0.63, PW 0.62, EL 0.80, EW 1.14, AL 1.04, AW 1.12; eyes each composed of about 40 facets. Aedeagus length 0.51, with slightly asymmetrical median lobe (Figs 16J–L).

**Distribution.** Southwest China: Yunnan.

**Notes.** This species was originally described based on a single male (Type-locality: Jizushan Mountain, ca. 25°57'37''N, 100°22'44''E, alt. 2400 m). The aedeagus of the holotype was unfortunately lost. Here we record a second male specimen of this species from Tengchong, Gaoligong Mountain, about 200 km southwest from the type locality, and have illustrated its aedeagus.

***Pselaphodes nomurai*** **Yin, Li & Zhao**
http://species-id.net/wiki/Pselaphodes_nomurai

*Pselaphodes nomurai* Yin, Li & Zhao, 2010: 21.

**Additional material examined** (20 ♂♂, 18 ♀♀)**.** 2 ♂♂, labeled 'CHINA: Border Shaanxi - / Sichuan (Daba Shan), pass 20 km / SSE Zhenping, 1700-1800 m, / 31°44'N, 109°35'E, 9.VII.2001, / leg. M. Schülke [C01-07] // young dry mixed forest, / field edge, small creek valley / moss sifted [C01-07]'; 3 ♂♂, 2 ♀♀, same label data, except '12.VII.2001'; 11 ♂♂, 13 ♀♀, same label data, except 'Wrase [07]'; 3 ♂♂, 1 ♀, labeled 'CHINA: S-Shaanxi (Qingling Shan) / pass on rd. Zhouzhi-Foping, / 105 km SW Xi'an, N-slpoe, / 1700 m, 33°46'N, 107°58'E / leg. M. Schülke [C01-02] // 3.VII.2001, / small creek valley, mixed / deciduous forest, moss / (sifted) [C01-02]'; 1 ♂, labeled 'CHINA: S-Shaanxi (Qingling Shan) / river bank above Houzhenzi, / 115 km WSW Xi'an, / 1450 m, 33°50'N, 107°47'E, leg. M. Schülke [C01-06] // 5.VII.2001, / gravel bank (floating), / mixed deciduous forest, moss, / mushrooms (sifted) [C01-06]' (all above specimens bear the following label: 'M. SCHÜLKE Coll. / Staphylinidae, Pselaphinae / *Labomimus* sp. 11 / S. Nomura det., 2005'); 2 ♀♀, labeled 'CHINA: W-Hubei (Daba Shan) / creek valley 8 km NW Muyuping, / 31°29'N, 110°22'E, 1550- / 1650 m, 18.VII.2001, / leg. M. Schülke [C01-16A] // creek valley, deciduous / forest, moss / (sifted) [C01-16A] // M. SCHÜLKE Coll. / Staphylinidae, Pselaphinae / *Labomimus* sp. 12 / S. Nomura det., 2005' (all cSch). All specimens also

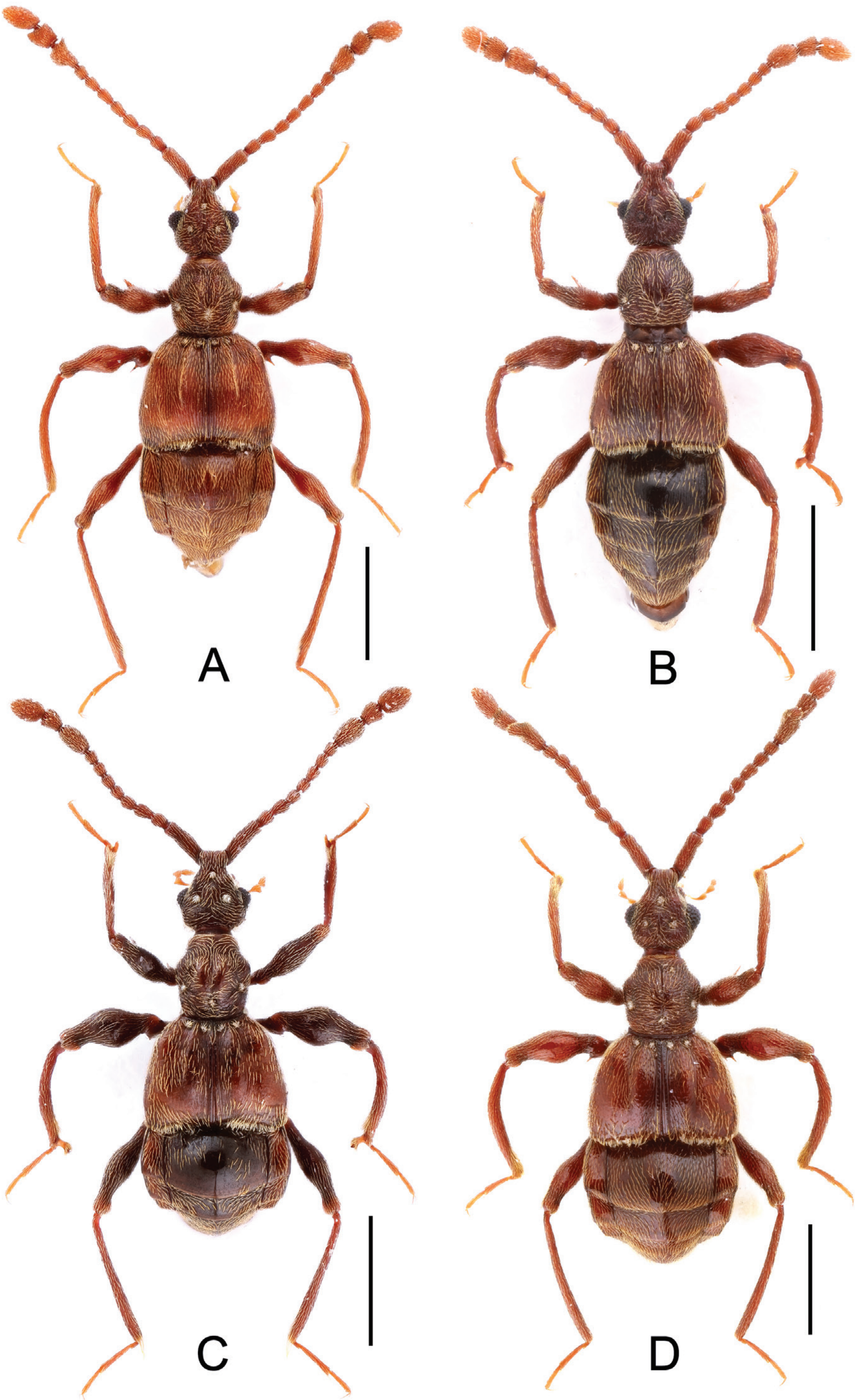



**Figure 15.** Male habitus of *Pselaphodes* spp. **A** *P. jizushanus* **B** *P. tibialis* **C** *P. venustus* **D** *P. zhongdianus*. Scales: 1.0 mm.

bear the following label: 'Sammlung / M. Schülke / Berlin // *Pselaphodes nomurai* / Yin, Li & Zhao, 2010 / det. Yin & Li, 2012'.

**Diagnosis and description.** Yin et al., 2011: 479 (key); Yin et al., 2010: 21.

**Distribution.** Southwest China: Shaanxi; Central China: Henan, Hubei (new provincial record).

### *Pselaphodes tibialis* Yin & Li, sp. n.

urn:lsid:zoobank.org:act:AAEA7BAB-9AB1-45E3-B63F-83E97F51FD79
http://species-id.net/wiki/Pselaphodes_tibialis
Figs 15B, 17

**Type material** (2 ♂♂)**.** Holotype: ♂, labeled 'CHINA: Yunnan [CH07-09], / Dali Bai Aut. Pref., Diancang Shan 45 / km NW Dali, 2730 m, 26°01'20''N, 99°53'17''E, creek valley, pines, ferns, / sifted, 29.V.2007, M. Schülke' (cSch). Paratype: 1 ♂, same label data as holotype (cSch).

**Diagnosis.** Reddish brown; length 2.52–2.58; postgenae slightly angulate posterolaterally; antennomeres IX–XI enlarged, IX modified in the male; pronotum with lateral margins slightly angularly expanded laterally; with metaventral processes apically enlarged; metacoxae simple; aedeagus with asymmetric median lobe.

**Description.** Male (Fig. 15B). Length 2.52–2.58. Head longer than wide, HL 0.58–0.59, HW 0.54–0.55; eyes each composed of about 40 facets. Antennal clubs as in Fig. 17A. Pronotum (Fig. 17B) about as long as wide, PL 0.54–0.55, PW 0.54–0.56, with lateral margins slightly angularly expanded laterally. Elytra wider than long, EL 0.68–0.71, EW 0.99–1.00. Long metaventral (Fig. 17C) processes broadened apically. Procoxae with sharp ventral tooth, protrochanters with short thin ventral spine, profemora with long sharp spine at ventral margin (Fig. 17D), protibiae with distinct apical spur (Fig. 17E); mesotrochanters with small spine at ventral margin, mesofemora simple (Fig. 17F), mesotibiae (Fig. 17G) with big apical projection; metatrochanters and metafemora (Fig. 17H) simple. Abdomen broad at base and narrowed apically, AL 0.72–0.73, AW 1.00–1.02. Sternite IX as in Fig. 17I. Aedeagus length 0.53, with asymmetric median lobe (Figs 17J–L).

**Female.** Unknown.

**Comparative notes.** The resemblance in general habitus, antennal modification, placement of spines on the legs, and the shared modified pro- and mesotibiae place *P. tibialis* closest to *P. venustus* sp. n. described below. The two species can be separated by the smaller body size, the metaventral process being much thinner, and different aedeagal form in *P. tibialis*, while *P. venustus* is larger in size (3.07–3.34) and the metaventral process are much stouter.

**Distribution.** Southwest China: Yunnan.

**Biology.** Individuals were sifted from mixed leaf litter in a ravine.

**Etymology.** The specific name refers to the modifications present on the pro- and mesotibiae.

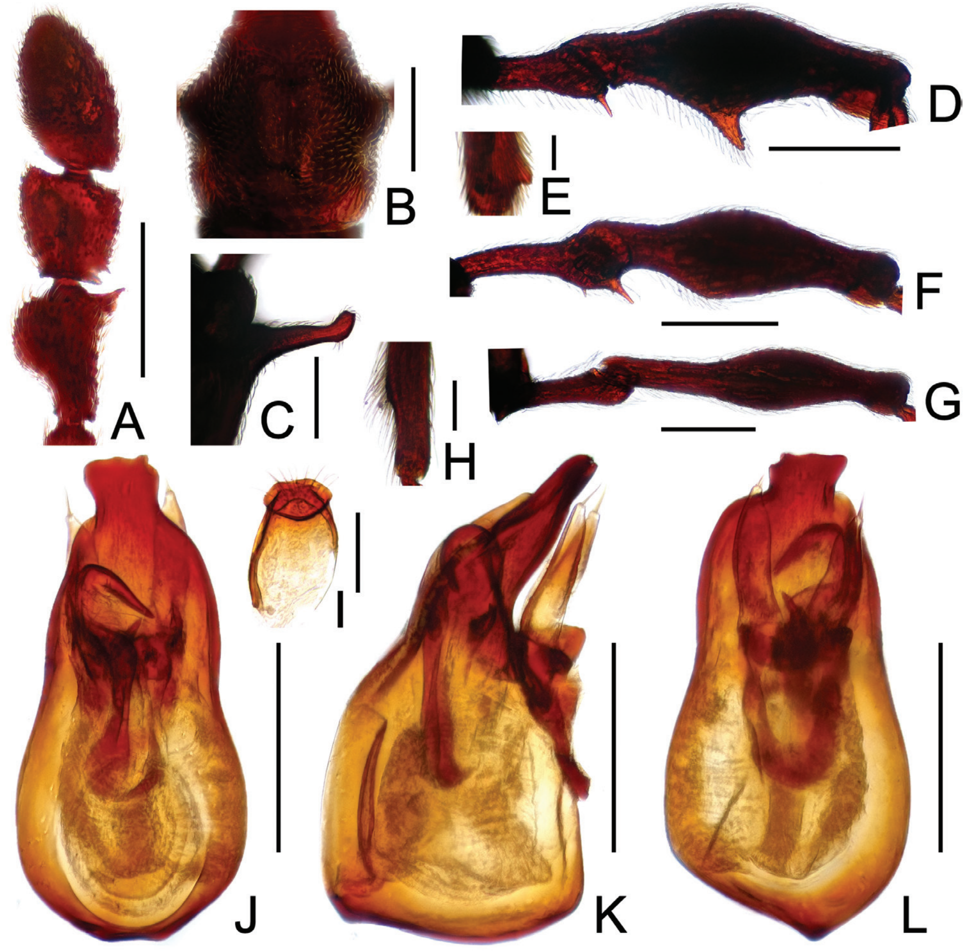



**Figure 16.** Diagnostic features of *P. jizushanus*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** metacoxa, metatrochanter and metafemur **H** apical portion of metatibia **I** sternite IX **J** aedeagus, in dorsal view **K** same, in lateral view **L** same, in ventral view. Scales (mm): **A, B, D, F, G, J, K, L** = 0.3; **C** = 0.2; **H, I** = 0.1; **E** = 0.05.

***Pselaphodes venustus* Yin & Li, sp. n.**
urn:lsid:zoobank.org:act:892D0215-8B5D-4CE0-8CDA-6BE661BC1414
http://species-id.net/wiki/Pselaphodes_venustus
Figs 15C, 18

**Type materia** (1 ♂, 1 ♀)**.** Holotype: ♂, labeled 'CHINA (Yunnan) Dali Bai Aut. Pref., Jizu Shan, summit plateau, / 37 km NE Dali 3150 m, (mixed / forest, sifted from litter, moss) / 25°58'30''N, 100°21'36''E / 5.IX.2009 DW Wrase [28]' (cSch). Paratype: 1 ♀, same label data, except 'leg. M. Schülke [CH09-28]' (cSch).

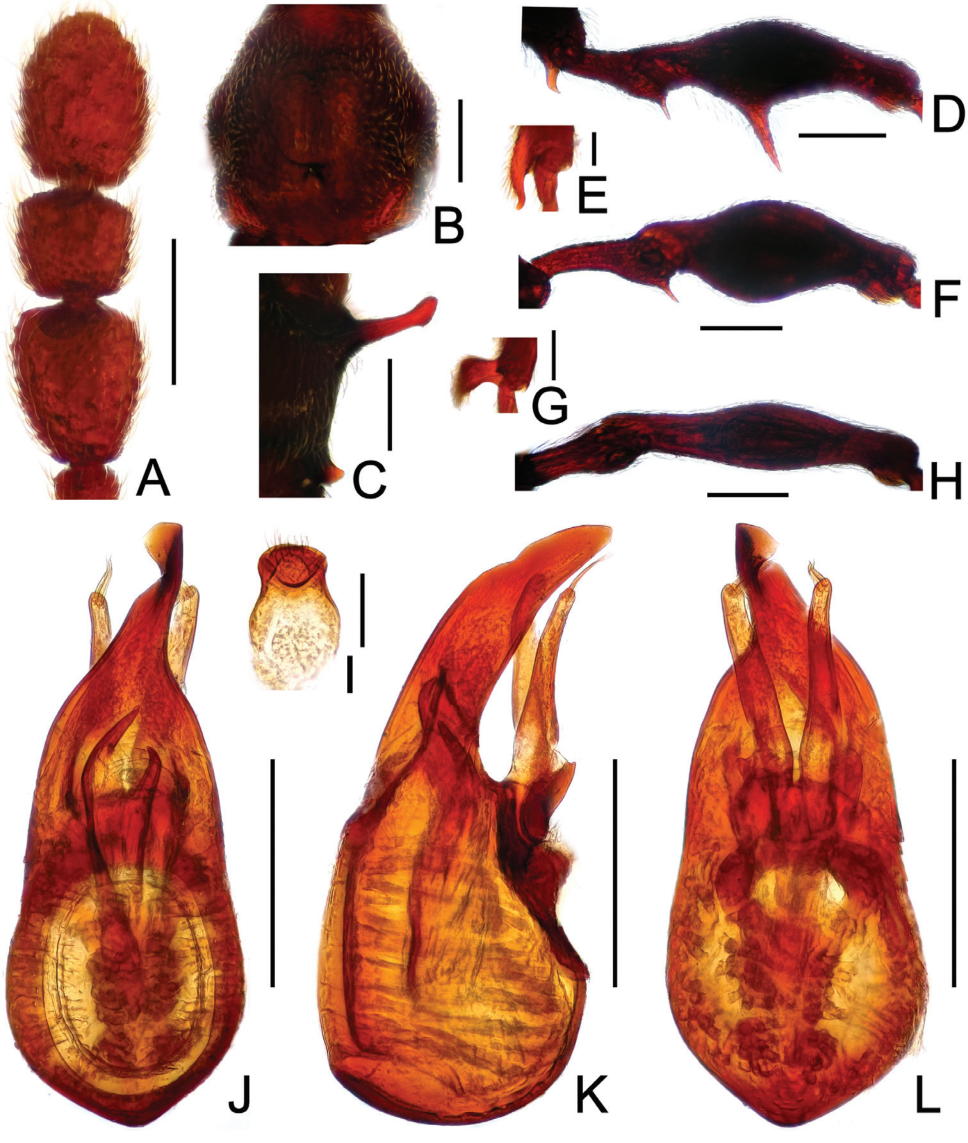



**Figure 17.** Diagnostic features of *P. tibialis*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** procoxa, protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** apical portion of mesotibia **H** metatrochanter and metafemur **I** sternite IX **J** aedeagus, in dorsal view **K** same, in lateral view **L** same, in ventral view. Scales (mm): **A, B, C, D, F, H, J, K, L** = 0.2; **I** = 0.1; **E, G** = 0.05.

**Diagnosis.** Reddish brown; length 3.07–3.34; postgenae rounded; antennomeres IX–XI enlarged, IX modified in the male; pronotum with lateral margins roundly expanded laterally; with stout metaventral processes apically broadened; metacoxae simple; aedeagus with asymmetric median lobe.

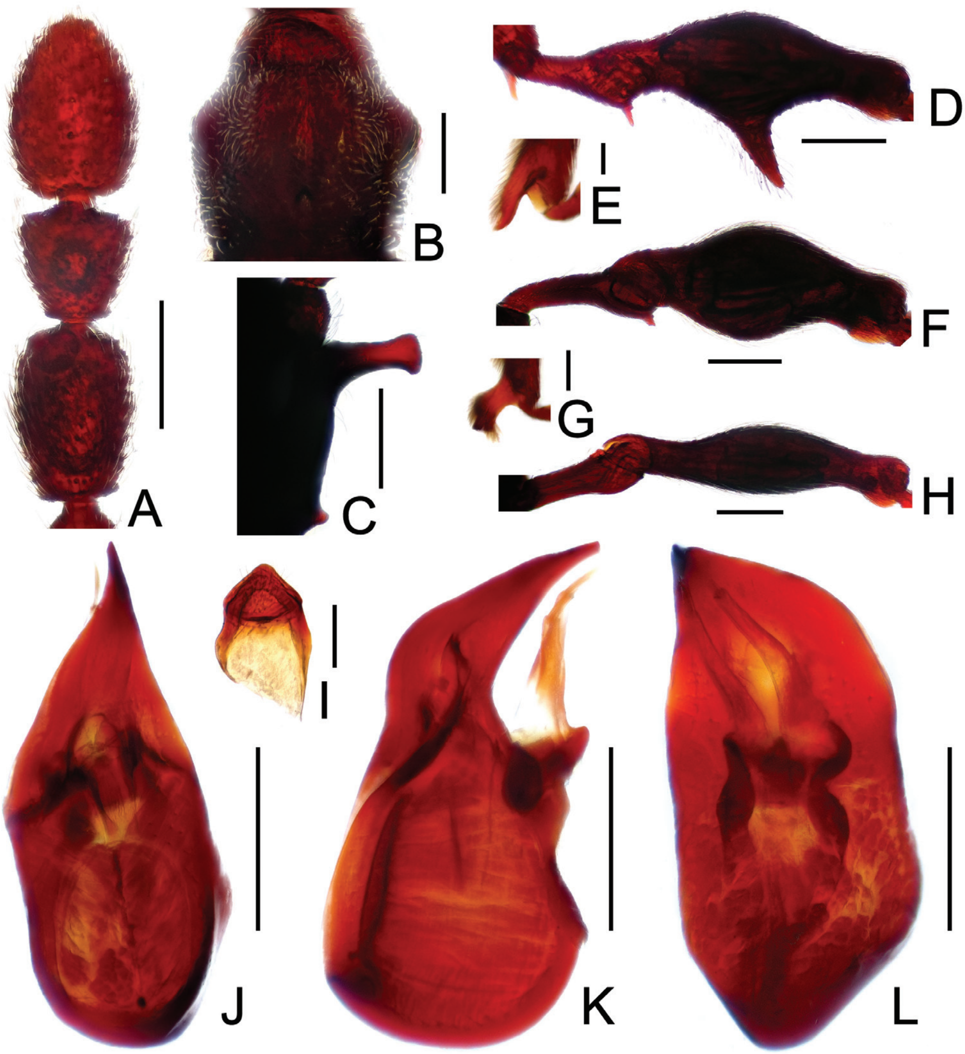



**Figure 18.** Diagnostic features of *P. venustus*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** procoxa, protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** apical portion of mesotibia **H** metatrochanter and metafemur **I** sternite IX **J** aedeagus, in dorsal view **K** same, in lateral view **L** same, in ventral view. Scales (mm): **A, B, C, D, F, H, J, K, L** = 0.2; **I, G** = 0.1; **E** = 0.05.

**Description.** Male (Fig. 17C). Length 3.07. Head slightly longer than wide, HL 0.65, HW 0.60; eyes each composed of about 30 facets. Antennal clubs as in Fig. 18A. Pronotum (Fig. 18B) slightly longer than wide, PL 0.65, PW 0.61, with lateral margins roundly expanded laterally. Elytra wider than long, EL 0.83, EW 1.16. Metaventral processes stout with enlarged apices (Fig. 18C). Procoxae with sharp ventral tooth, protrochanters with short thin ventral spine, profemora with large spine at ventral margin (Fig. 18D), protibiae with distinct apical spur (Fig. 18E); mesotrochanters with small spine at ventral margin, mesofemora simple (Fig. 18F), mesotibiae (Fig. 18G) with big apical projection; metatrochanters and metafemora (Fig. 18H) simple. Abdomen broad at base and narrowed apically, AL 0.94, AW 1.20. Sternite IX as in Fig. 18I. Aedeagus length 0.65, with asymmetric median lobe (Figs 18J–L).

Female. Similar to male in general; BL 3.34, HL 0.68, HW 0.63, PL 0.65, PW 0.60, EL 0.83, EW 1.19, AL 1.18, AW 1.34. Eyes each composed of about 30 facets. Metaventral processes absent.

**Comparative notes.** The differences in body size and forms of the tibial modifications between *P. venustus* and *P. tibialis* were thought to be intraspecific variation before suspicions arose, and dissections of the genital segments of both species were done. Now it is clear that *P. venustus* represents a distinct species. It can be readily separated from *P. tibialis* by the larger size, the much stouter metaventral processes and, primarily, the aedeagal form.

**Distribution.** Southwest China: Yunnan.

**Biology.** Species were sifted from leaf litter and moss in a mixed forest.

**Etymology.** The Latin word '*venustus*' means 'attractive in appearance', with regard to the strong modifications of the pro- and mesotibiae.

***Pselaphodes zhongdianus*** **Yin & Li, sp. n.**
urn:lsid:zoobank.org:act:875C80DE-D055-4A46-8769-F502AA91A5D4
http://species-id.net/wiki/Pselaphodes_zhongdianus
Figs 15D, 19

**Type material** (1 ♂)**.** Holotype: ♂, labeled 'CHINA: N-Yunnan [C03-05] / Zhongdian Co., 46 km SSE / Zhongdian, 27°27.0'N, 99°54.7'E, / 3050-3100 m, creek valley, secondary / mixed forest, bamboo, mushrooms, / 17.VIII.2003, leg. M. Schülke' (cSch).

**Diagnosis.** Reddish brown; length 3.23; postgenae round laterally; antennomeres IX–XI enlarged, IX modified in the male; pronotum with lateral margins slightly angularly expanded laterally; with metaventral processes apically narrowed; metacoxae simple; aedeagus with asymmetric median lobe.

**Description.** Male (Fig. 15D). Length 3.23. Head longer than wide, HL 00.73, HW 0.70; eyes each composed of about 45 facets. Antennal clubs as in Fig. 19A. Pronotum (Fig. 19B) about as long as wide, PL 0.72, PW 0.71, with lateral margins slightly angularly expanded laterally. Elytra wider than long, EL 0.89, EW 1.37. Metaventral (Fig. 19C) processes narrowed apically. Protrochanters with short ventral spine, profemora with long sharp spine at ventral margin (Fig. 19D), protibiae with tiny apical spur (Fig. 19E); mesotrochanters with two small spines at ventral margin, mesofemora simple (Fig. 19F); metatrochanters and metafemora (Fig. 19G) simple. Abdomen broad at base and narrowed apically, AL 0.89, AW 1.44. Sternite IX as in Fig. 19H. Aedeagus length 0.65, with asymmetric median lobe (Figs 19I–K).

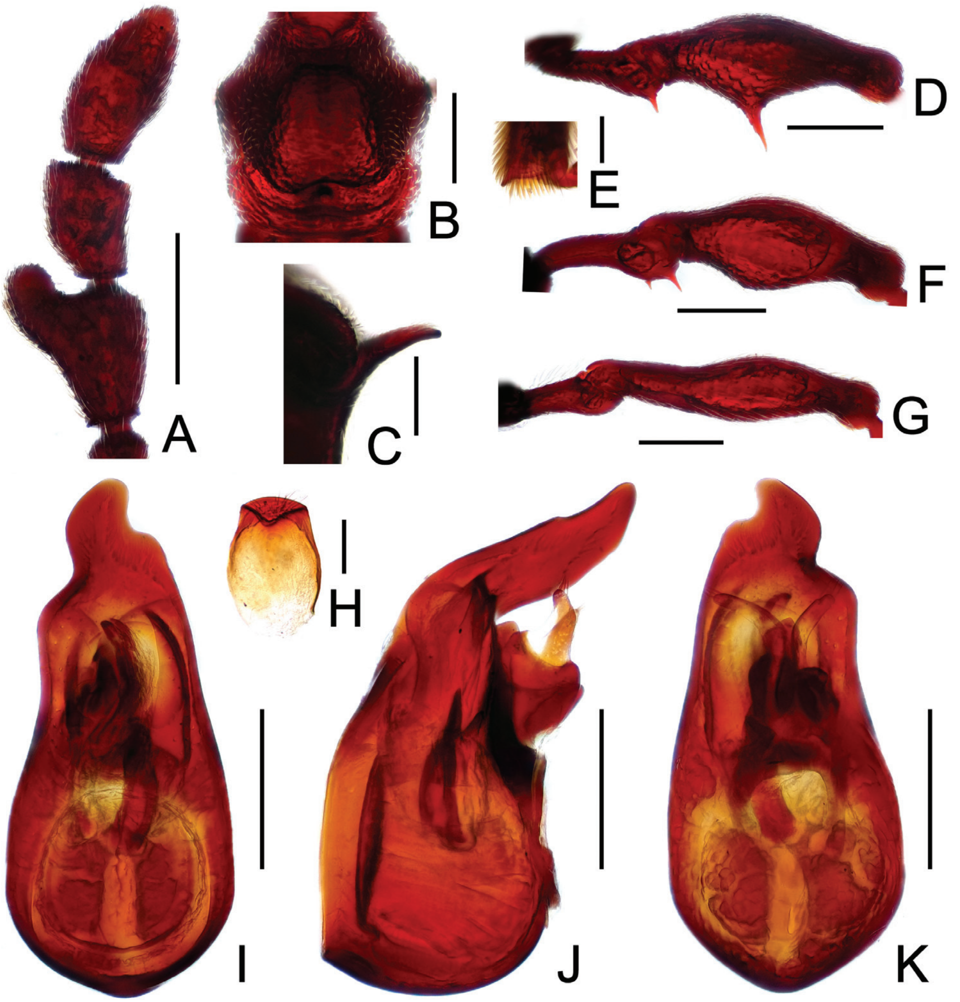



**Figure 19.** Diagnostic features of *P. zhongdianus*. **A** antenna **B** pronotum **C** median meteventral process, in lateral view **D** protrochanter and profemur **E** apical portion of protibia **F** mesotrochanter and mesofemur **G** metatrochanter and metafemur **H** sternite IX **I** aedeagus, in dorsal view **J** same, in lateral view **K** same, in ventral view. Scales (mm): **A, B, D, F, G** = 0.3; **C, I, J, K** = 0.2; **H, E** = 0.1.

**Female.** Unknown.

**Comparative notes.** Placed near *P. erlangshanus* and *P. flexus* as discussed above, readily separated from both species by the unique antennomeres IX being strongly roundly projecting at the anterolateral margin.

**Distribution.** Southwest China: Yunnan.

**Biology.** Individuals was sifted from bamboo leaf litter and mushrooms in a secondary mixed forest**.**

**Etymology.** The new species is named after the type locality, Zhongdian.

## Unassociated female specimens

**Notes.** Only the collecting data are cited here, and all specimens bear an identification label as the following, so that they can be tracked by future workers: 'Unassociated ♀ sp. xx [number] / *xxx* [genus name] sp. / det. Yin & Li, 2012'. Fourteen of the following species are represented by single specimens (all in cSch).

### *Labomimus*

sp. 1. 1 ♀, labeled 'CHINA: W-Sichuan (6) / Daxue Shan, Paoma-Shan / b. kangding, 30.02.56N, / 101.58.05E, 2700-2900 m / 22.05.1997, M. Schülke'.

sp. 2. 1 ♀, labeled 'CHINA:Yunnan, Nujiang Lisu Pref., / Gaoligong Shan, "Cloud pass" 3150 m / 21 km NW Liuku (shrubs, / Vaccinium, bamboo, litter sifted) / 25°58'21''N, / 98°41'01''E / 2.IX.2009 D.W. Wrase [22A]'.

sp. 3. 1 ♀, labeled 'CHINA (Yunnan) / Baoshan Pref., mount. range / 22 km S Tengchong, 1750 m / 24°49'29''N, 98°29'27''E / (loamy banks of fishponds) / 2.VI.2007 D.W. Wrase [18]'.

sp. 4. 1 ♀, labeled 'CHINA W. Sichuan (Aba / Tibet. Aut. Pref., Weizhou Co.) / Quilonglai Shan, Wolong valley / 69 km WSW Dujiangyan, 3500 m / 30°54'N, 102°59'E (mix. forest) / 15.VIII.1999 D.W. Wrase'.

sp. 5. 1 ♀, labeled 'CHINA: W-Sichuan 1999 / Ya'an Prefcture Fulin Co. / Daxiang Ling, Rd., zw. Hanyuanjie u. / Siping. 51 km NNE Shimian, 2000 m / 29°39N, 102°37E, Ufer, Gesiebe / 10. VII., leg. M. Schülke'.

sp. 6. 1 ♀, labeled 'CHINA: S-Shaanxi (Daba Shan) / NW pass 25 km NW Zhenping, / 32°01N, 109°19E, / 2150 m, 11.VII.2001, / leg. M. Schülke [01-09] // creek valley, young coniferous / forest, moss (sifted) [01-09]'.

sp. 7. 1 ♀, labeled 'CHINA: Yunnan, Dali Bai Aut. Pref., / Zhemo Shan, 7 km SW Xiaguan, / 25°32–33'N, 100°10-11'E, 2870–2970 m, / scrub with bamboo, oaks & / Rhododendr., litter sifted, 18. IX. / 2009, leg. M. Schülke [09-60]'.

sp. 8. 1 ♀, labeled 'CHINA: N-Yunnan [C03-15] / Dali Bai Nat. Aut. Pref., Diancang Shan, / 5 km SSW Dali old town, creek valley / above cablecar, 25°38.7'N, 100°08.3'E, / shrub, bamboo, moss, old flood debris, / 2800 m, 26.VIII.2003, M. Schülke'.

sp. 9. 1 ♀, labeled 'CHINA: W-Sichuan 1999 / Ganzi Tibet. Aut. Pref., Luding Co. / W Erlangshan-pass, 2600 m / 7 km SSE Luding, 25°51'N, / 102°15'E, Laubstreu, Pilze / 29.VI., leg. M. Schülke'; 1 ♀, labeled 'CHINA: W-Sichuan 1999 / Ya'an Prefecture, Tianquan Co. / E Erlang Shan Pass, 2900 m, / 9 km SE Luding, 29°52'N, / 102°18'E, Gesiebe / 20.VI., leg. M. Schülke'.

### *Pselaphodes*

sp. 10 1 ♀, labeled 'CHINA: Yunnan, Pu'er Pref., / Ailao Shan, 37 km NW Jingdong, / 24°45'12"N, 100°41'24.5"E, 2300 m, / devastated forest remnant, litter & / dead wood sifted, 13.IX.2009, / leg. M. Schülke [CH09-48]'.

sp. 11. 1 ♀, labeled 'CHINA: Yunnan, Lincang Pref., / Xue Shan, 48 km N Lincang, / 2070 m, 24°16'03"N, 100°07'13"E, / forest remnant, N-slpoe, litter & / mushrooms sifted, 12.IX.2009, leg. M. Schülke [CH09-48]'.

sp. 12. 1 ♀, labeled 'CHINA (N-Yunnan) Lijiang Naxi / Aut. Co., 3 km NW Yongsheng / 53 km WSW Lijiang, 1950-2000 m / 29°41'08"N, 100°43'1"E (SE-slope, / secondary broadleaved forest) / 14.VIII.2003 Wrase [03]'.

sp. 13. 1 ♀, labeled 'CHINA: W-Sichuan 1999 / Ya'an Prefecture, Tianquan Co. / Jiajin Shan, Tal oberh. Labahe / N.R.St., 57 km W Ya'an, 30°06'N, 102°25'E, Streu, Rinde, Pilze, 1800 m / 12.VII., leg. M. Schülke'.

sp. 14. 1 ♀, labeled 'CHINA: Zhejiang [CH07-37], Tianmu / Shan, pass 25 km NNW Linanm 620-820 / m, 30°25'10"N, 119°35'30"E, creek / valley with bamboo and mixed forest, / litter, sifted, 16.VI.2007, M. Schülke'.

sp. 15. 1 ♀, labeled 'CHINA: N-Yunnan [C03-05] / Zhongdian Co., 46 km SSE / Zhongdian, 27°27.0'N, 99°54.7'E, / 3050-3100 m, creek valley, secondary / mixed forest, bamboo, mushrooms, / 17.VIII.2003, leg. M. Schülke'.

sp. 16. 2 ♀♀, labeled 'China: Shaanxi, Qin Ling Shan / 110.06E, 34.27N / Hua Shan Mt. N Valley, 1200- / 1400 m, 118 km E Xi'an, sifted / 18.-20.08.1995, leg. M. Schülke'.

## Acknowledgments

Thanks go to Michael Schülke for making his collection available for our study, as well as for the generous gift of some of the paratypes. Zi-Wei Yin thanks Shûhei Nomura (Tokyo, Japan) for his hospitality and open attitude during Yin's visit at the National Museum of Nature and Science, Tokyo, the notes on several *Labomimus* species were used in this study for comparative purposes. Donald S. Chandler (Derham, U.S.A.) commented on an earlier draft and improved the English. The present study is supported by the National Science Foundation of China (No. 31172134) and Shanghai Normal University (Sk201242).

## References

Chandler DS (2001) Biology, morphology, and systematics of the ant-like litter beetles of Australia (Coleoptera: Staphylinidae: Pselaphinae). Memoirs on Entomology International 15: 1–560.

Bekchiev R (2010) Description of the second species of the genus *Taiwanophodes* Hlaváč, 2002 (Coleoptera: Staphylinidae: Pselaphinae) from Vietnam. Russian Entomological Journal 19: 183–185.

Hlaváč P (2002) A Taxonomic revision of the Tyrini of the Oriental Region. II. - systematic study on the genus *Pselaphodes* and its allied genera (Coleoptera: Staphylinidae: Pselaphinae). Annales de la Société Entomologique de France 38: 283–297.

Hlaváč P, Chandler DS (2005) World catalogue of the species of Tyrini with a key to the genera (Coleoptera: Staphylinidae: Pselaphinae). Folia Heyrovskyana 13: 81–143.

Hlaváč P, Nomura S (2001) A Taxonomic revision of Tyrini of the Oriental Region I. *Paralasinus* (Coleoptera: Staphylinidae: Pselaphinae), a new genus of Tyrina from Indochina. Elytra 29: 163–174.

Hlaváč P, Nomura S, Zhou HZ (2000) Two new species of the genus *Labomimus* from China (Coleoptera: Staphylinidae: Pselaphinae). Species Diversity 5: 149–153.

Sawada K (1961) Neue pselaphinen von Japan (3 Beitrag). Entomological Review of Japan 12: 41–44.

Yin ZW, Li LZ (in press) Five new species of the genera *Labomimus* and *Linan* (Coleoptera, Staphylinidae, Pselaphinae) from Guangxi, South China. Acta Entomologica Musei Nationalis Pragae 52.

Yin ZW, Li LZ, Gu FK (2012a) Taxonomic study on the genus *Pselaphodes* Westwood (Coleoptera, Staphylinidae, Pselaphinae) from China. Part III. Zootaxa 3189: 29–38.

Yin ZW, Li LZ, Zhao MJ (2010) Taxonomical study on the genus *Pselaphodes* Westwood (Coleoptera: Staphylinidae: Pselaphinae) from China. Part I. Zootaxa 2512: 1–25.

Yin ZW, Li LZ, Zhao MJ (2011a) Taxonomic study on the genus *Pselaphodes* Westwood (Coleoptera, Staphylinidae, Pselaphinae) from China. Part II. Annales Zoologici 61: 463–481. doi: 10.3161/000345411X603337

Yin ZW, Li LZ, Zhao MJ (2011b) A review of the genus *Linan* (Coleoptera: Staphylinidae: Pselaphinae). Acta Entomologica Musei Nationalis Pragae 51: 123–135.

Yin ZW, Li LZ, Zhao MJ (2011c) *Dayao* gen. n. of the subtribe Tyrina (Coleoptera, Staphylinidae, Pselaphinae) from South China. Zookeys 141: 45–52. doi: 10.3897/zookeys.141.1948

Yin ZW, Li LZ, Zhao MJ (2012b) Two new species of *Pselaphodes* Westwood and new record of *Taiwanophodes minor* Hlaváč from South China (Coleoptera, Staphylinidae, Pselaphinae). Zookeys 175: 75–86. doi: 10.3897/zookeys.175.2664