



## A new species of *Chetoneura* Colless from Borneo (Diptera: Keroplatidae)

SVETLOZARA KAZANDZHIEVA<sup>1,2,3\*</sup> & DIMITAR BECHEV<sup>1,4</sup><sup>1</sup>Department of Zoology, University of Plovdiv, 24 Tzar Assen Str., BG4000 Plovdiv, Bulgaria<sup>2</sup>Regional Museum of Natural History – Plovdiv, 34 Hristo G. Danov Str., BG4000 Plovdiv, Bulgaria<sup>3</sup>✉ [svetlozara.k@gmail.com](mailto:svetlozara.k@gmail.com); <https://orcid.org/0000-0001-5018-8951><sup>4</sup>✉ [dbechev@abv.bg](mailto:dbechev@abv.bg); <https://orcid.org/0000-0001-5697-1197>

\*Corresponding author

### Abstract

A new species of Keroplatidae—*Chetoneura lagangensis* **sp. n.** from Lagang cave in Sarawak, Borneo is described and illustrated based on a single male specimen. An identification key to the species of the genus *Chetoneura* Colless is provided. A distribution map of the five known species of *Chetoneura* is presented—*Ch. cavernae* Colless, *Ch. shennonggongensis* Amorim & Niu, *Ch. oligoradiata* (Papp), *Ch. davidi* Ševčík, Hippa & Burdiková and *Ch. lagangensis* Kazandzhieva & Bechev, **sp. n.**

**Key words:** Borneo, identification key, new species, Oriental Region, predaceous fungus gnats

### Introduction

The genus *Chetoneura* Colless, 1962 has a still uncertain position within the subfamily Keroplatinae. According to the original description, the genus would be closer to *Orfelia* than to *Keroplatus* (Colless 1962) and was included by Evenhuis (2006) in the catalogue of the world Keroplatidae in tribe Orfeliini. Subsequently it was moved to Keroplatini by Amorim *et al.* (2008), based on morphological characteristics. Based on nuclear and mitochondrial gene markers, Mantič *et al.* (2020) included *Chetoneura* in Orfeliini, close to *Laurypta* Edwards, 1929, *Monocentrotia* Edwards, 1925, *Platyteridion* Tollet, 1955 and *Proceroplatus* Edwards, 1925.

So far, four species of the genus are known: *Ch. cavernae* Colless, 1962; *Ch. shennonggongensis* Amorim & Niu in Amorim *et al.*, 2008, *Ch. davidi* Ševčík, Hippa & Burdiková 2021 and *Ch. oligoradiata* (Papp, 2006), originally described in *Bisubcosta* Papp, 2006 (Papp *et al.* 2006) and transferred to *Chetoneura* by Ševčík (2012). Here we describe a fifth species of the genus. The known species assigned to *Chetoneura* are known only from the Oriental region (Fig. 14).

### Material and methods

The studied material has been collected by S. Kazandzhieva in Lagang cave (Malaysia: Sarawak) with sweep net and was preserved in ethanol.

The habitus photos (specimen in alcohol) were taken by a digital camera Canon EOS 750D with Canon 100 mm Macro lens. The terminalia of the specimen were removed and subsequently macerated in 10% warm KOH. Dissections and temporary slides were made in glycerol. The slides were photographed with the Canon EOS 750D fit to the compound microscope. The terminalia were afterwards transferred to microvials with glycerine and stored together with the specimen. The habitus and male terminalia photos were combined using the Helicon Focus 5 software from multiple gradually focused images. The morphological terminology follows Söli (1997) and Blagoderov & Ševčík (2017) for the wing venation.

The studied material is deposited in the DBPC—University of Plovdiv, Bulgaria.

## Description of the new species

### *Chetoneura lagangensis* Kazandzhieva & Bechev, sp. n.

Figs 1–6

LSID urn:lsid:zoobank.org:pub:15EF1596-90A5-4237-B73B-C3217D728329

**Diagnosis.** R-M fusion short, tergite IX about twice as long as wide, gonostylus elongate in ventral view, with elongate sharp apical spine. Sc unclear distally. Scutum light yellowish brown, in other species of *Chetoneura* brown, in *Ch. davidi* yellowish, with lateral margins and two submedian longitudinal stripes dark. Coxae light, yellowish, in other species brown, in *Ch. davidi* partly yellowish.

**Type material. HOLOTYPE:** ♂, MALAYSIA: Sarawak: Gunung Mulu National Park, Lagang cave, 14.07.2019, Sweep net, S. Kazandzhieva leg. (in ethanol, in DBPC–University of Plovdiv, Bulgaria).

**Type locality.** Lagang cave, Borneo.

**Male.** Body length 4.3 mm. Wing length 3.15 mm.

**Head.** Vertex and frons light brownish. Occiput light yellowish brown, lighter close to the eyes. Two ocelli, medially on the vertex, distance between them about their diameter. Compound eyes large, covering most of head surface, with ommatidial hairs. Vertex covered with setulae, frons bare. Upper half of face bare, ventral half covered with dark setulae. Clypeus light yellowish brown, small, projected, with parallel edges proximally, rounded triangular distally, bare. Mouthparts reduced. Labellum and labrum rudimentary. Palpus reduced to single small palpifer and a rounded distal segment with setulae. Antenna about 4.5 times as long as head width, with 14 flagellomeres. Scape and pedicel shorter than flagellomeres, width about twice their length. Flagellum laterally compressed, hairy. First flagellomere (F1) about twice as long as second (F2). F2–F5 about as wide as long, F6–F9 slightly longer than wide, F10–F14 about twice as long as wide.



FIGURE 1. *Chetoneura lagangensis* sp. n., habitus, lateral view.

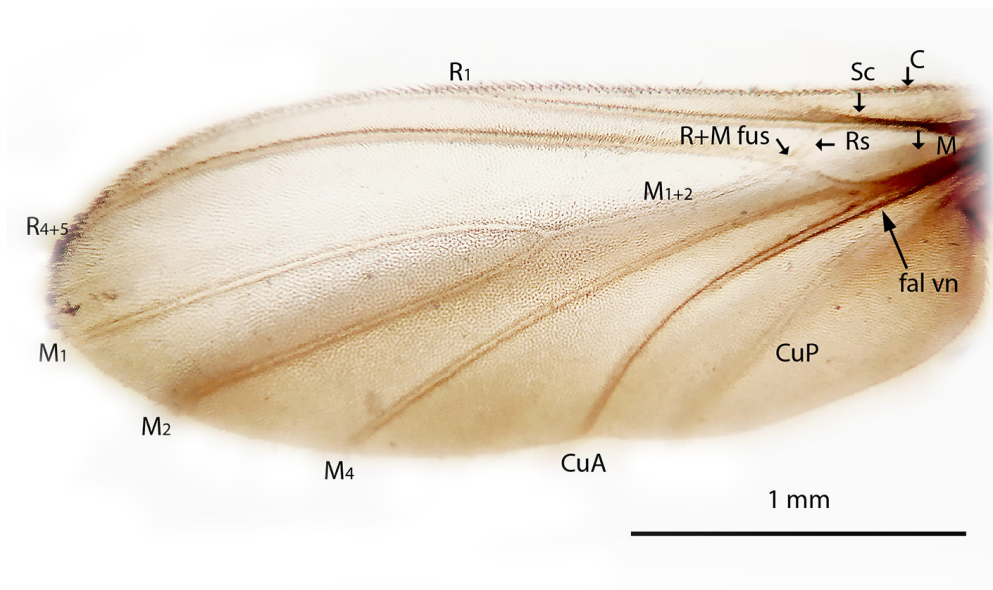


FIGURE 2. *Chetoneura lagangensis* sp. n., wing, view from below.

**Thorax.** Scutum light yellowish brown. Anterior parapsidal suture pronounced. Scutellum darker, almost as wide as long. Scutum and scutellum evenly covered in setae. Mediotergite light brown, with dark brown setae in dorsal part. Laterotergite light yellowish brown, bare. Antepronotum and proepisternum light yellowish brown, setose. Postepisternum with a few setulae at the anterior margin. Anterior spiracle with setulae at margin, except dorsally. Anepisternum pale yellowish brown with whitish shades, other tergites pale and bare. Haltere with light yellowish brown pedicel, two rows of oblique setae beginning from base of pedicel, abundant at base of knob. Knob brown at base, brightening towards tip, tip bare.

**Wing** (Fig. 2). Wing length 3.15 mm, width 1.8 mm. Wing membrane light brown, hyaline, densely covered with microtrichia. Macrotrichia present on C, R<sub>1</sub> and R<sub>4+5</sub>, absent on medial veins, CuA and CuP. Radial veins and CuA strong, other veins weaker and lighter. C extending beyond tip of R<sub>4+5</sub> to about half the distance between tips of R<sub>4+5</sub> and M<sub>1</sub>, ending at wing apex. Sc weak, unclear at distal end near C. R<sub>4</sub> absent. R-M fusion very short. R<sub>4+5</sub> strong, reaching C before wing apex. R<sub>1</sub> long, reaching C beyond level of medial fork. Medial fork weak and relatively long, about twice the length of M<sub>1+2</sub>. M<sub>2</sub> ending at wing margin. M unclear before R-M fusion. CuA strong, distinctly downcurved towards tip. CuP weak, incomplete. A<sub>1</sub> unclear.

**Legs.** Elongate, mostly light brown, darker near joints. Coxae light, yellowish, with distinct lateral rows of dark bristles, upper half almost bare. Femora pale, darker near joints, laterally flattened, evenly covered with fine short dark bristles. Tibial microtrichia arranged in regular rows, tibial macrotrichia present in irregular rows. Fore tibia without apical spur and apical comb. Mid and hind tibiae with a single setose apical spur and apical comb of setae. Mid spur four times tibial width, hind spur five times tibial width. Tarsal claws with basal teeth. Relative length of femur, tibia and tarsus for particular legs: fore leg—1.6: 2.1: 4.7; mid leg—1.5: 2.1: 3.8; hind leg—1.8: 2.3: 3.8.

**Abdomen.** Abdomen yellowish brown, strongly covered with hairs.

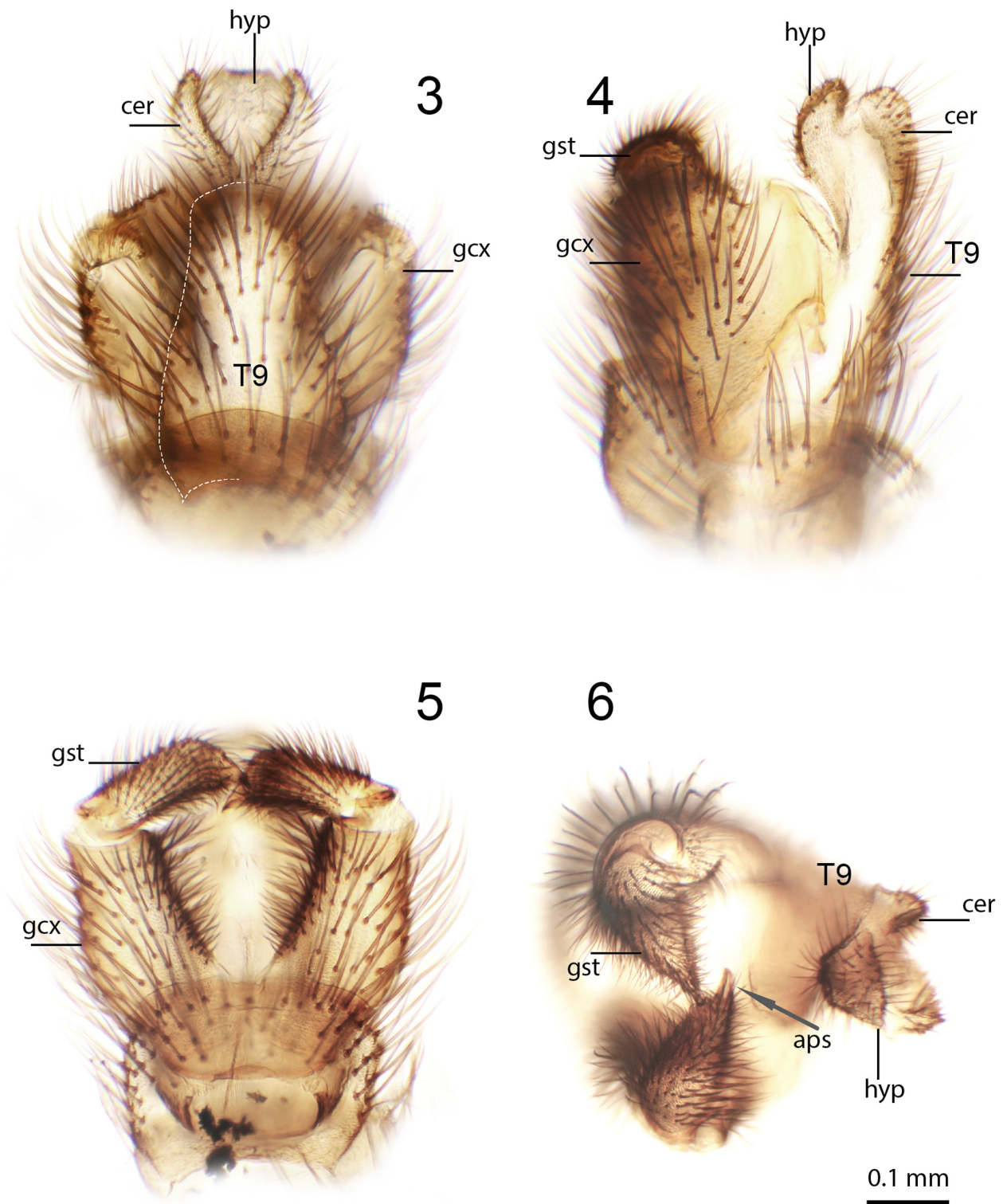
**Terminalia** (Figs 3–6). Brown, densely covered with dark setae. Tergite IX elongated, wider at basal half, narrower at apical (Fig. 3). Cerci long. Hypoproct blunt, covered with setae apically. Gonocoxites ventrobasally fused, forming a broad V-shaped excavation, densely covered with setae (Fig. 5). Gonostylus about twice as long as wide, covered with long dark setae, ending with a sharp apical spine, subtriangular in lateral view (Figs 5–6).

**Female.** Unknown.

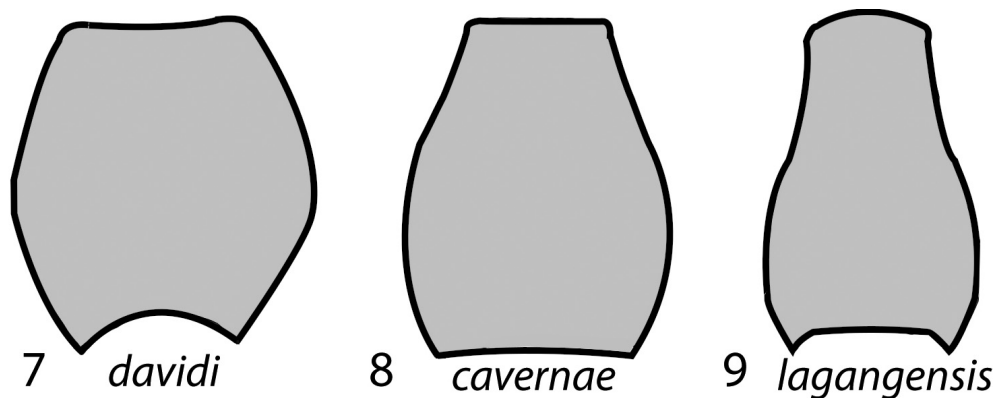
**Larva.** Non-luminescent larvae (probably of the new species) were hanging in the semi-dark cave entrance (Figs 10–12) and deep in the cave as well. Similar larvae were also observed outside the cave (Fig. 13).

**Etymology.** Named after the type locality, the Lagang cave.

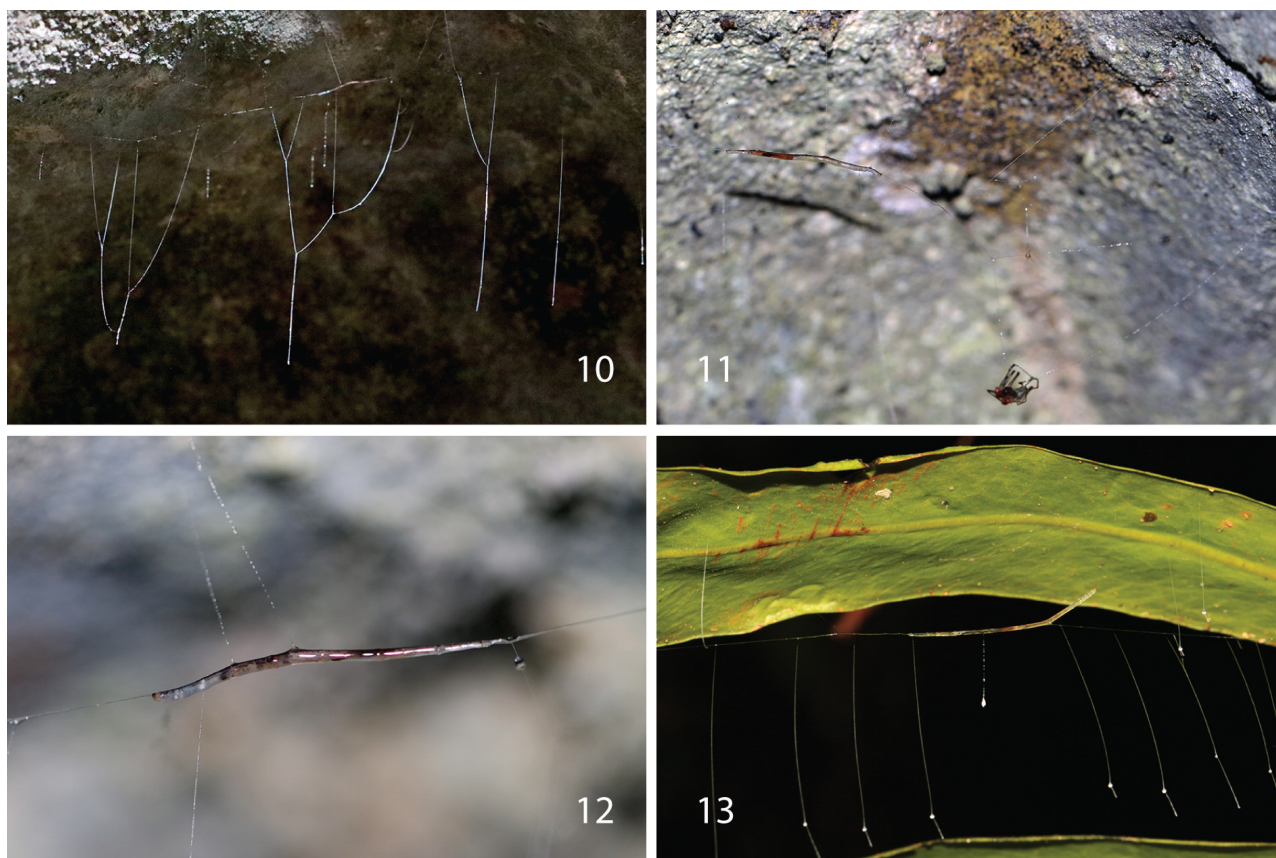




**FIGURES 3–6.** *Chetoneura lagangensis* sp. n., male terminalia: 3—dorsal view, 4—lateral view; 5—ventral view; 6—posterior view. *Abbreviation:* **aps** = apical spine of gonostylus; **cer** = cerci; **gcx** = gonocoxite; **gst** = gonostylus; **hyp** = hypoproct; **T9** = tergite IX.



FIGURES 7–9. Form of tergite IX (not in scale): 7—*Ch. davidi* (by Ševčík *et al.* 2021: Fig. 13C); 8—*Ch. cavernae* (by Colless 1962: Fig. 1c); 9—*Ch. lagangensis* sp. n.



FIGURES 10–13. Larvae, probably of the new species: 10–12—in the entrance, semi-dark part of the cave; 13—outside the cave.

### Key to the species of *Chetoneura*

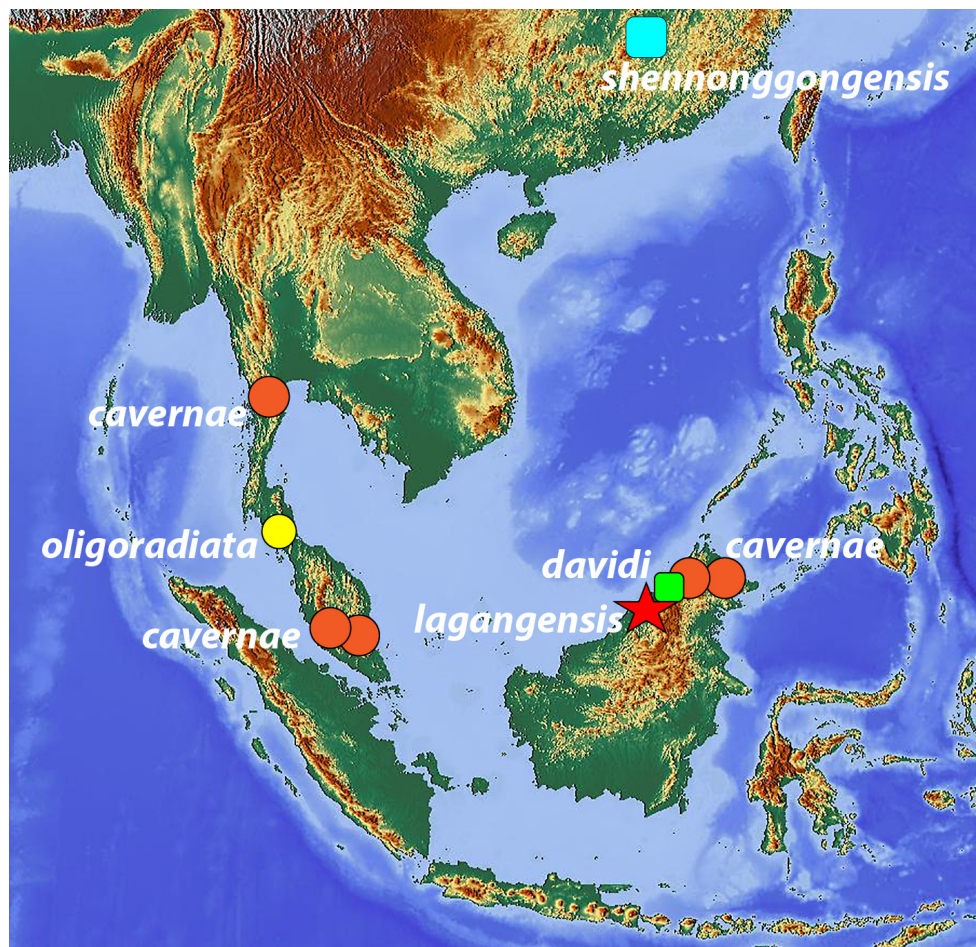
1. R-M fusion very short (Fig. 2). Tergite IX slightly longer than broad or up to about 1.7 as long as wide, not subtriangular. . . . 2
- R-M fusion as long as r-m or more. Tergite IX shorter than broad, subtriangular. . . . . 4
2. Scutum yellowish, with lateral margins and two submedian longitudinal stripes dark. Tergite IX slightly longer than broad, length/width ratio about 1/1. Form of tergite IX—Fig. 7. . . . . *Ch. davidi* Ševčík, Hippa & Burdiková
- Scutum light yellowish brown, without bands or brown, with thin darker brown oblique bands. Tergite IX apparently longer than broad, length/width ratio about 4/3 or more. . . . . 3
3. Tergite IX length/width ratio about 4/3. Form of tergite IX—Fig. 8. Gonostylus stout, with a thorn-like apical spine (Colless 1962: Fig. 1c) . . . . . *Ch. cavernae* Colless
- Tergite IX length/width ratio about 5/3. Form of tergite IX—Fig. 9. Gonostylus not stout, elongated in ventral view, with elon-



- gated sharp apical spine (Figs 5–6) ..... *Ch. lagangensis*, Kazandzhieva & Bechev, **sp. n.**  
 4. Fore tibia without apical spur. .... *Ch. oligoradiata* (Papp)  
 - Fore tibia with very short apical spur. .... *Ch. shennonggongensis* Amorim & Niu

## Discussion

The short R-M fusion and the form of tergite IX of *Ch. lagangensis* **sp. n.** suggests it is closer to *Ch. cavernae* and *Ch. davidi* than to the other two species of the genus. The latter are similar in morphological features and due to the lack of description and illustrations of male terminalia of *Ch. oligoradiata* their reliable distinction is difficult. According to the original descriptions, the anterior tibia of *Ch. oligoradiata* is without apical spur, while in *Ch. shennonggongensis* a small apical spur is present. The existence of non-bioluminescent snare-building larvae in Lagang cave was known for a long time and their relation to *Chetoneura cavernae* was discussed by Merritt & Clarke (2010). However, in the same article, it was suggested that these larvae might belong to a new species of keroplatid. The relationship between the hereby described new species of predacious fungus gnat and the larvae is suggested, but cannot be confirmed without rearing the larva to adulthood. Many tourists and park rangers report that similar larvae (also called “sticky worms”) are found in other caves around Gunung Mulu National Park. We personally observed identical snare-building larvae outside the caves between plant leaves in the jungle (Fig. 13). Such behavior is known in other keroplatids such as *Arachnocampa* Edwards, which inhabit either caves or dark, humid habitats in forests in Australia and New Zealand (Baker *et al.* 2008; Baker 2010). Due to the fact that currently three species of *Chetoneura* occur in northern Borneo (Fig. 14) we thus should be careful in the identification of the larvae. Actually, even more species are possible to occur there, considering the low degree of investigations in the area. So far, only larvae of *Ch. shennonggongensis* have been studied from the type locality (Amorim *et al.* 2008, Li *et al.* 2009).



**FIGURE 14.** Distribution of the known species of *Chetoneura*, map. All species are known only from the type localities, except for *Ch. cavernae* (data from Ševčík 2012).

## Acknowledgements

The authors are grateful to Ognyan Todorov for the photos of the larvae, to Vladimir Blagoderov (Edinburgh, United Kingdom), Peter Chandler (Melksham, United Kingdom), Dalton de Souza Amorim (Ribeirão Preto, Brazil) and Jan Ševčík (Ostrava, Czech Republic) for their valuable comments, suggestions and corrections to the manuscript.

## References

- Amorim, D.S., Niu, C., Li, X.Z., Lei, C.L. & Clarke, A.K. (2008) *Chetoneura shennonggongensis*, a new species of cave-dwelling Keroplatini from China (Diptera: Keroplatidae), with a discussion of the position of *Chetoneura*. *Zootaxa*, 1716 (1), 59–68.  
<https://doi.org/10.11646/zootaxa.1716.1.6>
- Baker, C.H. (2010) A new subgenus and five new species of Australian Glow-worms (Diptera: Keroplatidae: *Arachnocampa*). *Memoirs of the Queensland Museum—Nature*, 55 (1), 11–43.
- Baker, C.H., Graham, G.C., Scott, K.D., Cameron, S.L., Yeates, D.K. & Merritt, D.J. (2008) Distribution and phylogenetic relationships of Australian glow-worms *Arachnocampa* (Diptera, Keroplatidae). *Molecular Phylogenetics and Evolution*, 48, 506–514.  
<https://doi.org/10.1016/j.ympev.2008.04.037>
- Blagoderov, V. & Ševčík, J. (2017) Chapter 18. Keroplatidae (Predaceous Fungus Gnats). In: Kirk-Spriggs, A.H. & Sinclair, B.J. (Eds.), *Manual of Afrotropical Diptera. Vol. 2. Nematocerous Diptera and lower Brachycera. Suricata 5*. South African National Biodiversity Institute, Pretoria, pp. 505–525.
- Colless, D.H. (1962) *Chetoneura cavernae* n. gen., n. sp. from Batu Caves, Malaya (Diptera: Mycetophilidae). *Pacific Insects, Honolulu*, 4 (2), 437–439.
- Edwards, F.W. (1925) British fungus gnats (Diptera, Mycetophilidae). With a revised generic classification of the family. *Transactions of the Entomological Society of London*, 73 (1924), 505–670.
- Edwards, F.W. (1929) Notes on the Ceroplatinae, with descriptions of new Australian species (Diptera, Mycetophilidae). *Proceedings of the Linnean Society of New South Wales*, 54 (3), 162–175.
- Evenhuis, N.L. (2006) Catalog of the Keroplatidae of the World (Insecta: Diptera). *Bishop Museum Bulletins in Entomology*, 13, 1–178.
- Li, X., Niu, C., Huang, Q., Lei, C. & Stanley, D.W. (2009) Life Cycle of *Chetoneura shennonggongensis* (Diptera: Keroplatidae, Keroplatinae) From Jiangxi Province, China. *Insect Science*, 16, 351–359.  
<https://doi.org/10.1111/j.1744-7917.2009.01256.x>
- Mantič, M., Sikora, T., Burdíková, N., Blagoderov, V., Kjærandsen, J., Kurina, O. & Ševčík, J. (2020) Hidden in Plain Sight: Comprehensive Molecular Phylogeny of Keroplatidae and Lygistorrhinidae (Diptera) Reveals Parallel Evolution and Leads to a Revised Family Classification. *Insects*, 11 (348), 1–16.  
<https://doi.org/10.3390/insects11060348>
- Merritt, D., Clarke, A. (2010) Non-glowing sticky worms and glowing centipedes: observations on Gunung Mulu cave fauna. *ACKMA Journal*, 79, 34–35.
- Papp, L., Merz, B. & Földvári, M. (2006) Diptera of Thailand. A summary of the families and genera with references to the species representations. *Acta Zoologica Academiae Scientiarum Hungaricae*, 52 (2), 97–269.
- Ševčík, J. (2012) *Pseudochetoneura* gen. nov., a peculiar new genus from Ecuador, with notes on *Chetoneura* (Diptera: Keroplatidae). *Acta Entomologica Musei Nationalis Pragae*, 52, 281–288.
- Ševčík, J., Hippa, H. & Burdíková, N. (2021) Just a Fragment of Undescribed Diversity: Twenty New Oriental and Palearctic Species of Sciaroidea (Diptera), including DNA Sequence Data and Two New Fossil Genera. *Insects*, 13 (1), 19, 1–35. [published 23 December 2021]  
<https://doi.org/10.3390/insects13010019>
- Søli, G.E.E. (1997) The adult morphology of Mycetophilidae (s. str.), with a tentative phylogeny of the family (Diptera, Sciaroidea). *Entomologica Scandinavica Supplement*, 50, 5–55.
- Tollet, R. (1955) Mycetophilidae (Diptera) nouveaux du Congo Belge. I.—Keroplatinae. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique*, 31 (45), 1–23.