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Research article

First records of *Ameles spallanzania* (Rossi, 1792) with new data on the distribution of *Hierodula tenuidentata* Saussure, 1869 in Bulgaria (Insecta: Mantodea: Mantidae)

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Abstract: The praying mantis *Ameles spallanzania* (Rossi, 1792) is reported for the first time from Bulgaria, as well as for the Black Sea Region. New data on the current distribution in Bulgaria of an alien mantis species, *Hierodula tenuidentata* Saussure, 1869, is also presented.

Keywords: alien species, Balkans, Black Sea coast, citizen science, *Hierodula transcaucasica,* praying mantis

Introduction

Five mantis species belonging to five genera and two families were previously known from Bulgaria: *Empusa fasciata* Brullé, 1832 from Empusidae and *Ameles heldreichi* Brunner von Wattenwyl, 1882, *Hierodula tenuidentata* Saussure, 1869, *Iris oratoria* (Linnaeus, 1758) and *Mantis religiosa* (Linnaeus, 1758) from Mantidae (Battiston et al., 2010; Schwarz & Ehrmann, 2018). Of these, *H. tenuidentata* is an alien species, only recently reported for the country, with a native range extending from India and Central Asia to the Caucasus region (Battiston et al., 2018).

Ameles spallanzania (Rossi, 1792) is a small mantis species with a Mediterranean–Maghrebian distribution. It is reported from Albania, Algeria, Croatia, France, Greece, Hungary, Italy, Libya, Malta, Morocco, Portugal, Spain and Tunisia (Agabiti et al., 2010; Battiston et al., 2010; Szinetár, 2020). The species reaches between 18 and 40 mm in body length, with a triangular head and conical compound eyes (Battiston et al., 2010; Szinetár, 2020). The sexual dimorphism is evident, with males being longer and slenderer, with fully developed wings, and the females with shorter body length, large and curled up abdomen, stocky and brachypterous (Battiston, 2011). The species is thermophilic and inhabits arid meadows and environments open with sparse herbaceous vegetation and sclerophyllous bushes (Fontana et al., 2002).

Hierodula tenuidentata is a large mantis species (up to 70–80 mm in body length) with a short and wide pronotum, three darker bands on the ventral side of the thorax and four to five prominent yellowish spines on the front coxae. Hyaline wings generally exceed the length of the abdomen and have whitish stigma on the tegmina (Battiston et al., 2019). The *H. tenuidentata*

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oothecae are variable in size, rounded, with proximal and distal edges almost straight in lateral view. The residual process is situated in the upper part of the distal end, the colour of the ootheca is dark brown with the emergence area whitish after laying but turning dirty yellow in time (Pintilioaie et al., 2021). Previously described as *H. transcaucasica* Brunner von Wattenwyl, 1878, now it is considered by some authors as a synonym of *H. tenuidentata* Saussure, 1869 (Ehrmann, 2011; Battiston et al., 2018). The first record of the presence of *H. tenuidentata* in the Bulgarian fauna was published by Schwarz & Ehrmann (2018), where two juvenile specimens were observed in southern Bulgaria in the year of publication. An earlier finding of two females in 2017 was subsequently reported by Romanowski et al. (2019). Since then, the species has expanded its range throughout the country (Zlatkov et al., 2020; Langourov et al., 2022; present paper).

In this paper we provide a comprehensive review of the current distribution of *H. tenuidentata,* discuss its expansion in Bulgaria and report the first observations of *A. spallanzania* for the country.

Materials and methods

Ameles spallanzania in Bulgaria was discovered in posts on a citizen science group on the social network Facebook, where photos of four specimens from four locations were independently published for identification. The determination of the species was done by examining the original photos in detail and from the field description provided by the authors of the observations. One specimen was collected and kept in captivity for identification purposes.

The distribution of *H. tenuidentata* in Bulgaria was determined by reviewing the already existing literature regarding the species. The new locations were a result of the combination of purposeful investigation, citizen science and fortuitous observations. The specimens were either observed and photographed or collected and preserved in 70% ethanol and stored in the private collections of the authors.

During this investigation, the species was registered with 307 separate observations, falling into 113 10x10 km UTM squares. The alignment of the observations according to the source of information is as follows: 49 of the observations, falling into 37 UTM squares were made by visual observation from the authors of this study; 9 observations in 5 UTM squares were from already published records; 249 observations, falling into 71 UTM squares, were examined from social media (Facebook.com) and public database (iNaturalist.org) reports.

All observations of *H. tenuidentata* between 21.VII.2016 and 10.XII.2022 (6 years and 4 months) were included in the study.

The photos of *A. spallanzania* specimens were edited with Adobe Photoshop 24.0 2023. To present the distribution of *H. tenuidentata,* a 10x10 km UTM grid map was prepared, using the open-source software QGIS 3.24.1 (QGIS.org., 2022).

Results

Mantidae

Ameles Burmeister, 1838

Ameles spallanzania (Rossi, 1792)

Material examined: 1 adult ♀ (Fig. 1), LG89, Stara Zagora (42.4401°N, 25.6274°E), 258 m a.s.l., 24.IX.2021, N. Kolev obs. & photo; 1 adult ♀ (Fig. 2), NH30, Burgas (42.5134°N, 27.4495°E), 9 m a.s.l., 17.X.2022, R. Tavitiyan obs. & photo; 1 adult ♀ (Fig. 3), NH78, Varna (43.2165°N, 27.8701°E), 20 m a.s.l., 25.X.2022, D. Borisov obs. & photo; 1 adult ♀ (Fig. 4), FN92, Sofia (42.6139°N, 23.3998°E), 594 m a.s.l., 10.XII.2022, I. Teofilova leg.

Hierodula Burmeister, 1838

Hierodula tenuidentata Saussure, 1869

According to our results, *Hierodula tenuidentata* appears to be widespread throughout the country, being more common in South Bulgaria (Thracian Lowland, along Struma River, Eastern Rhodopes Mts), along the Black Sea Coast and in North-east Bulgaria (Fig. 5). It appears to be distributed mainly in locations with low altitude – between 0 m (Pomorie) and 1013 m (Koprivshtitsa). Approximately 60% of the observations were below 200 m, 30% between 200 and 500 m and 10% between 500 and 1000 m a.s.l.

Almost all of the sightings (about 97%) were from urban or semi-urban environments (towns, villages, gardens, yards). The species was registered only nine

Figs 1–4. *Ameles spallanzania,* observed in Bulgaria, adult females – in Stara Zagora, photo by N. Kolev (1), in Burgas, photo by R. Tavitiyan (2), in Varna, photo by D. Borisov (3), and in Sofia, photo by I. Teofilova (4).

times in non-urban areas, which are the protected areas "Besaparski Hills", "Chaya River", "Shablenska Tuzla", "Durankulak Lake" and North "Atanasovsko Lake", and in the vicinity of Yagodovo Village near Plovdiv, Momchilovo Village, Taushan Tepe and Frangensko Plateau.

The number of observations per year is as follows: 2016 – 1; 2017 – 3; 2018 – 20; 2019 – 33; 2020 – 40; 2021 – 94; 2022 (as of 10.XII.2022) – 116.

The known distribution of *Hierodula tenuidentata* is visualised on Fig. 5. The species (specimens or oothecae) was registered in the following localities (only the first unpublished observation from every UTM square is presented).

Published records

Schwarz & Ehrmann, 2018: FL89, Kozhuh Hill, VII.2018; FL89, Ribnik, 13.VII.2018; Romanovski et al., 2019: KG77, Pazardzhik, 14.XI.2017; Zlatkov et al., 2020: GP34, Oryahovo, 9.VI.2019; FL99, Novo Konomladi, 8.IX.2020; FL89, Rupite, 12.X.2020; Langourov et al., 2022: FM72, Kresna Gorge – Kresna Inn and near Oshtava crossroad, 8.VII.2022.

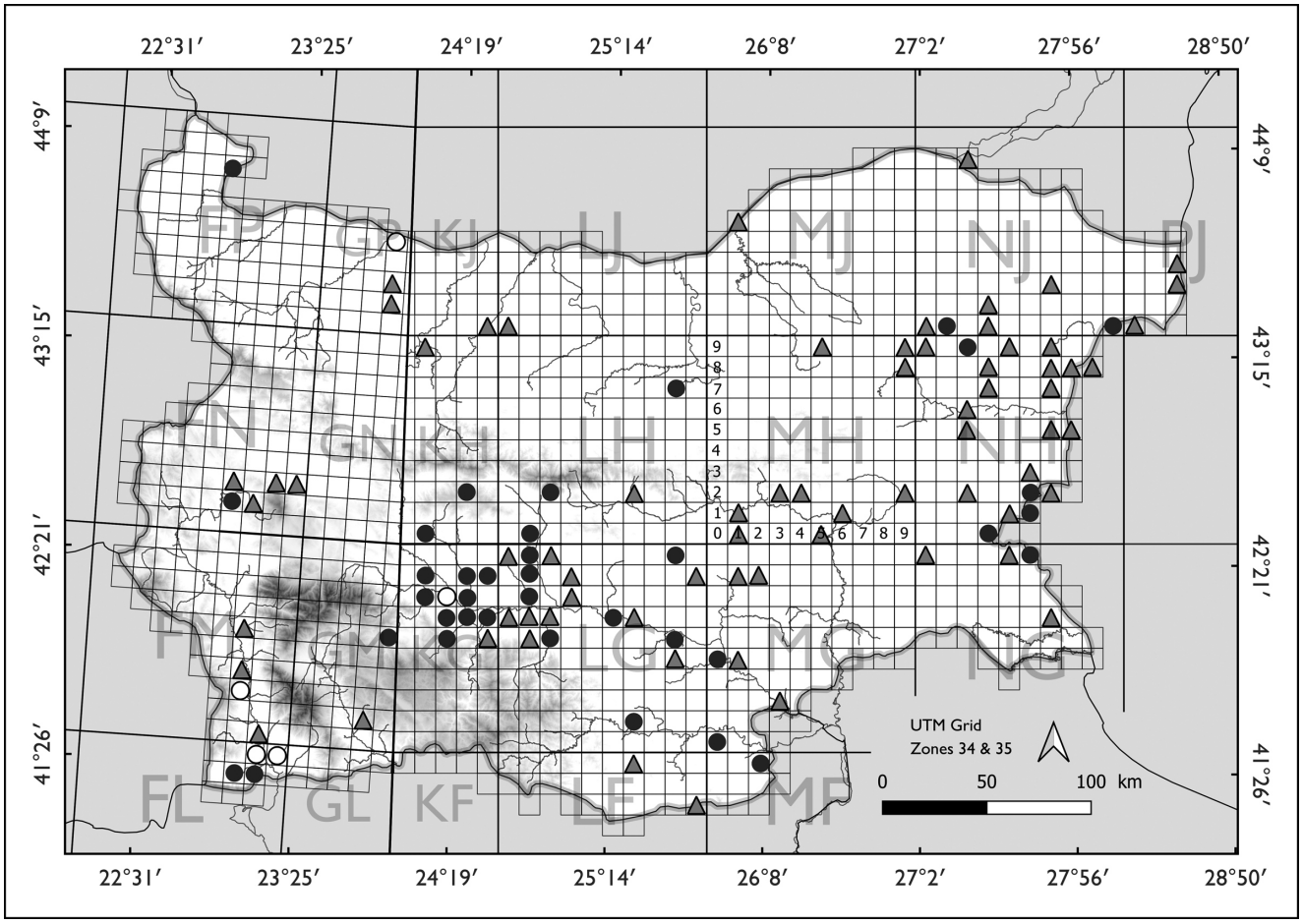

Fig. 5. Distribution of *Hierodula tenuidentata* in Bulgaria from the published records (white circles), personal observations (black circles) and social media/open database reports (grey triangles).

Unpublished data

2016: LG15, Palm Center – Plovdiv Nursery, 42.0638°N, 24.8195°E, 21.VII.2016.

2017: LG16, Plovdiv, 30.VII.2017.

2018: NH30, Burgas, 10.VII.2018; MG00, Madzharovo, 14.VII.2018; MG04, Harmanli, 14.VII.2018; MF29, Ivaylovgrad, 16.VII.2018; NH52, Nesebar, 11.VIII.2018; NH65, Rudnik, 30.VIII.2018; NH67, Zdravets, 3.IX.2018; FM72, Kresna, 16.IX.2018; PJ00, Kavarna, 27.IX.2018; NH26, Dalgopol, 1.X.2018; MH32, Gavrailovo, 13.X.2018; LG26, Yagodovo, 14.X.2018; NJ90; Balchik, 23.X.2018; FL88, Petrich, 31.X.2018.

2019: FM80, Sandanski, 24.III.2019 (ootheca); LG19, Kaloyanovo, 28.IV.2019; KG75, Peshtera, 5.V.2019; KG86, Ognyanovo, 11.V.2019; KG67, Septemvri, 30.V.2019; KG68, Kalugerovo, 2.VI.2019; NH51, Pomorie, 30.VI.2019; LG61, Kardzhali, 4.VII.2019; LG89, Stara Zagora, 10.VII.2019; GM45, Velingrad, 18.VII.2019; NJ31, Stefan Karadzha, 24.VII.2019; NH78, Varna, 29.VIII.2019; LG25, Asenovgrad, 17.IX.2019; LH10, Hisarya, 20.IX.2019; NH46, Dobroplodno, 20.IX.2019; MG18, Radnevo, 23.IX.2019; LG56, Parvomay, 24.IX.2019; KH60, Panagyurishte, 3.X.2019; KH82, Koprivshtitsa, 19.X.2019; NJ00, Pliska, 6.XI.2019; KG98, Stamboliyski, 12.XI.2019; LG18, Graf Ignatievo, 14.XI.2019.

2020: NH38, Provadiya, 15.VI.2020; FN62, Meshtitsa, 4.VII.2020; FN92, Sofia, 20.VII.2020; KH69, Cherven Bryag, 2.VIII.2020; MH10, Nova Zagora, 20.VIII.2020; MH96, Divdyadovo, 8.IX.2020; LJ00, Pleven, 15.IX.2020; NH68, Ezerovo, 25.IX.2020; LG36, Rakovski, 30.IX.2020; FN71, Rudartsi, 1.X.2020; MH99, Shumen, 1.XI.2020; PJ23.

2021: PJ23, Krapets, 5.II.2021 (ootheca); NH75, Shkorpilovtsi, 11.IV.2021 (ootheca); NH25, Dobromir, 3.VI.2021; LG84, Haskovo, 4.VII.2021; NH49, Suvorovo, 18.VII.2021; MG32, Svilengrad, 19.VII.2021; NG59, Sozopol, 23.VII.2021; LG85, Dimitrovgrad, 25.VII.2021; MH42, Sliven, 25.VII.2021; LH62, Kazanlak, 26.VII.2021; KG95, Krichim, 29.VII.2021; NG66, Tsarevo, 12.VIII.2021; NJ62, Dobrich, 12.VIII.2021; LH87, Veliko Tarnovo, 16.VIII.2021; NH88, Sveti Konstantin i Elena, 25.VIII.2021; NJ28, Silistra, 5.IX.2021; NH22, Aytos, 9.IX.2021; NH37, Tutrakantsi, 9.IX.2021; PJ22, Shablenska Tuzla, 11.IX.2021; NH09, Madara, 13.IX.2021; MH92, Karnobat, 19.IX.2021; MJ15, Ruse, 21.IX.2021; FM75, Blagoevgrad, 25.IX.2021; FN61, Radomir, 2.X.2021; LF69, Momchilgrad, 11.X.2021; FP57, Vidin, 14.X.2021; FM73, Polena, 23.X.2021; NH69, Aksakovo, 18.XI.2021 (ootheca).

2022: LG29, Borets, 25.IV.2022 (ootheca); MH50, Yambol, NH29, Taushan Tepe, 2.VI.2022; 4.VI.2022; NG49, Atiya, 20.VI.2022; NJ30, West of Momchilovo, 28.VIII.2022; KG88, Chernogorovo, 23.VI.2022; KG76, Besaparski Hills, 14.VII.2022; LG98, Yastrebovo, FL78, Samuilovo, 15.VII.2022; 30.VII.2022; MH11, Korten, 2.VIII.2022; NH62, Sveti Vlas, 11.VIII.2022, MG14, Dositeevo, 3.IX.2022; LG66, Dobri Dol, 7.IX.2022; NH53, Kosharitsa, 24.IX.2022; FN82, Sofia, 25.IX.2022; MH61, Zavoy, 25.IX.2022; LG09, Nedelevo, 25.IX.2022; LH22, Karlovo, 28.IX.2022; NG09, Suhodol, 2.X.2022; GP32, Galiche, 2.X.2022 (ootheca); LG37, Belozem, 10.X.2022; KJ90, Dolni Dabnik, 14.X.2022; NJ22, Pet Mogili, 20.X.2022; NJ10, Pliska, 20.X.2022; LG06, Brestovitsa, 25.X.2022; KG89, Malo Konare, 27.X.2022; NH41, Sarafovo, 29.X.2022; GM31, Marchevo, 21.11.2022.

Discussion

Our paper presents the first documented observations of *Ameles spallanzania* from Bulgaria and for the Black Sea Region and outlines the northeasternmost limit of the known range of the species. The presence of *A. spallanzania* in the Bulgarian fauna is likely an example of accidental transportation. The number of alien and allochthonous mantis species has increased in Europe in the last two decades. There are several ways of invasion, but the major two are: 1) the natural expansion of their native ranges, and 2) an introduction due to human transportation activities (Schwarz, 2018). Most observations of *A. spallanzania* in Bulgaria were from large airport and harbour cities, with Burgas and Varna situated on the Black Sea coast and Sofia in the central part of western Bulgaria. The female observed in Stara Zagora was found in a garden centre with decorative plants imported from Italy. The absence of records in the southern parts of Bulgaria seems to exclude a natural expansion of its native range. The specimen from Varna was recorded at the same location for a period of 43 days after its first discovery (between 25.X.2022 and 7.XII.2022). On 7.XII.2022 it was observed laying an ootheca. The specimen from Sofia laid an ootheca while in captivity the day after its discovery. It is possible that the females were brought to their respective locations already fertilised or that the fertilisation occurred in the area of the observation from a male transported together with the female. Another possibility is that the eggs have been laid unfertilised. Accidentally introduced fertilised females or oothecae could potentially establish populations in favourable habitats, which are similar to the ones preferred by the commonly spread *Mantis religiosa*. The oothecae can resist snow, ice and temperatures as low as -9°C (Battiston & Galliani, 2011).

Hierodula tenuidentata is a mantis species which is rapidly spreading in the Balkan Peninsula and South and Southeast Europe (Cianferoni et al., 2018; Van der Heyden, 2018; Romanowski et al., 2019; Pintilioaie et al., 2021; Vujić et al., 2021; Kulijer et al., 2022; Martinović et al., 2022). The first published records of the species in Bulgaria were from the Thracian Lowland in 2017 (Romanowski et al., 2019) and from the Struma Valley in 2018 (Schwarz & Ehrmann, 2018). Two nymphs (one of them being eaten by the other), photographed in a nursery near Plovdiv (Thracian Lowland), were later identified in a social media post from 2016 and this seems to be the earliest observation of this species in Bulgaria. Plovdiv is an import hub for Mediterranean decorative plants, thus it is quite possible that these specimens (or oothecae) have been transported to the locality accidentally with imported plants.

The early presence of *H. tenuidentata* along Struma River and Eastern Rhodopes Mts in 2018 might be due to natural expansion from the South, where the species was already established. However, it is more likely that the rapid invasion in Bulgaria is due to a few independent accidental introductions, rather than

natural spreading, especially considering the great number of records from urban and sub-urban areas compared to those from natural habitats.

The impact of *H. tenuidentata* on the native fauna, particularly other mantises, is still unknown. Further surveys are needed in order to monitor the species expansion and possible negative influence on the local fauna.

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References

Agabiti B., Salvatrice I., Lombardo F. 2010 The Mediterranean species of the genus *Ameles* Burmeister, 1838 (Insecta, Mantodea: Amelinae), with a biogeographic and phylogenetic evaluation. Boletín de la Sociedad Entomológica Aragonesa (S.E.A.) 47: 1–20.

Battiston R., Picciau L., Fontana P., Marshall J. 2010 Mantids of the Euro-Mediterranean Area. WBA Handbooks 2. World Biodiversity Association, Verona, 239 pp.

Battiston R., Galliani C. 2011 On the life-cycle of *Ameles spallanzania* (Rossi, 1792) (Insecta, Mantodea). Atti Società italiana di Scienze naturali Museo civico di Storia naturale di Milano 152 (1): 25–35. https://doi.org/10.4081/nhs.2011.25

Battiston R., Leandri F., Di Pietro W., Andria S. 2018 The Giant Asian Mantis *Hierodula tenuidentata* Saussure,1869 spreads in Italy: a new invasive alien species for the European fauna? (Insecta Mantodea). Biodiversity Journal 9 (4): 399–404. https://doi.org/10.31396/Biodiv.Jour.2018.9.4.399.404

Battiston R., Leandri F., Di Pietro W., Andria S. 2019 *Mantis, Hierodula* e *Sphodromantis:* aggiornamento su conoscenze e identificazione delle mantidi (Mantodea: Mantinae) native ed aliene presenti in Italia. Pianura – Scienze e storia dell'ambiente padano 38: 86–96.

Cianferoni F., Mochi O., Ceccolini F. 2018 New records of *Hierodula* Burmeister, 1838 (Mantodea: Mantidae) in Europe. Revista gaditana de Entomología 9 (1): 299–308.

Ehrmann R. 2011 Mantodea from Turkey and Cyprus (Dictyoptera: Mantodea). Articulata 26 (1): 1–42.

Fontana P., Buzzetti F.M., Cogo A., Odé B. 2002 Guida al riconoscimento e allo studio di Cavallette, Grilli, Mantidi e Insetti affini del Veneto. Blattaria, Mantodea, Isoptera, Orthoptera, Phasmodea, Dermaptera, Embiidina. Museo Naturalistico Archeologico di Vicenza, Vicenza. 592 pp.

iNaturalist.org 2018 iNaturalist Research-grade Observations. Occurrence dataset. https://doi.org/10.15468/ab3s5x (accessed via GBIF.org on 14 November 2022)

Kulijer D., Kahrić A., Vinko D. 2022 *Hierodula tenuidentata* Saussure, 1869 (Mantodea: Mantidae) has settled down in Bosnia and Herzegovina. Entomologia Croatica 21 (1): 10–16. https://doi.org/10.17971/ec.21.1.2

Langourov M., Simov N., Abadjiev S. 2022 The invasion continues: *Hierodula tenuidentata* (Mantodea), *Leptoglossus occidentalis* (Hemiptera) and *Pelopidas thrax* (Lepidoptera) already on the island of Alonnisos. Historia naturalis bulgarica 44: 137–144. https://doi.org/10.48027/hnb.44.112

Martinović M., Ćato S., Lengar M., Skejo J. 2022 First records of three exotic giant mantid species on the Croatian coast. Journal of Orthoptera Research 31 (1): 55–61. https://doi.org/10.3897/jor.31.76075

Pintilioaie A.-M., Spaseni P., Jurjescu A., Rădac I. 2021 First record of the alien mantid *Hierodula tenuidentata* (Insecta: Mantodea) in Romania.

Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa" 64: 37–49. https://doi.org/10.3897/travaux.64.e65489

QGIS.org 2022 QGIS Geographic Information System. QGIS Association. http://www.qgis.org

Romanowski J., Battiston R., Hristov G. 2019 First Records of *Hierodula transcaucasica* Brunner von Wattenwyl, 1878 (Mantodea Mantidae) in the Balkan Peninsula. Acta Zoologica Bulgarica 72: 297–300.

Schwarz C.J., Ehrmann R. 2018 Invasive Mantodea species in Europe. Articulata 33: 73–90.

Szinetár C., Kenyeres Z. 2020 Introducing of *Ameles spallanzania* (Rossi, 1792) (Insecta, Mantodea) to Hungary raising questions of fauna-changes. Natura Somogyiensis 35: 133–138.

Van der Heyden T. 2018 First record of *Hierodula transcaucasica* Brunner von Wattenwyl (Mantodea: Mantidae: Mantinae: Paramantini) in Albania. Revista Chilena de Entomología 44 (4): 407–409.

Vujić M., Ivković S., Rekecki T., Krstić D., Stanković V., Đurić M., Tot I. 2021 A first record of the alien mantis species *Hierodula tenuidentata* (Mantodea: Mantidae) in Serbia. Acta entomologica serbica 26 (1): 1–7.

Zlatkov B., Stefanov S., Gashtarov V. Vergilov V. 2020 New records of *Hierodula transcaucasica* Brunner von Wattenwyl, 1878 (Mantodea) from Bulgaria. Historia naturalis bulgarica 41: 99–101. https://doi.org/10.48027/hnb.41.12003

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Research article

First record of the flying fox bat fly *Cyclopodia horsfieldi* de Meijere, 1899 (Diptera: Hippoboscoidea: Nycteribiidae) on Ursula Island, Philippines

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Abstract: *Cyclopodia horsfieldi* de Meijere, 1899 is an Old World nycteribiid bat fly primarily ectoparasitic to flying foxes (Pteropodidae). This is the first record of *C. horsfieldi* on Ursula Island, Philippines. This represents the first report of an ectoparasitic arthropod on bats in this protected area.

Keywords: ectoparasite, flying fox, Palawan, Pteropodidae

Introduction

Ursula Island Game Refuge and Bird Sanctuary is a small island in Southern Palawan that lies 20 km from the municipality of Bataraza (Fig. 1). The island is declared as one of the Key Biodiversity Areas (KBA) in the Philippines (Key Biodiversity Areas Partnership, 2022). As a protected sanctuary, Ursula Island is home to a variety of vertebrate species including *Ducula pickeringii* (Cassin, 1854) (grey imperial pigeon), *Hypotaenidia torquata* (Linnaeus, 1766) (barred rail), *Megapodius cumingii* Dillwyn, 1853 (Tabon scrubfowl or Philippine Megapode), and *Otus mantananensis* (Sharpe, 1892) (Mantanani scops owl) (Saulog, 1997; Matillano et al., 2008; Birdlife International, 2022). Also, Ursula Island serves as home to fruit bat species (Saulog, 1997) including the endemic *Acerodon leucotis* (Sanborn, 1950) (Palawan flying fox) and *Pteropus hypomelanus* Temmick, 1853 (island flying fox) (Tsang, 2020; Key Biodiversity Areas Partnership, 2022).

P. hypomelanus is one of the five species of flying foxes belonging to the genus *Pteropus* reported in the Philippines (Heaney et al., 2010). This species occupies a wide geographic range spanning from archipelagos near the Indian subcontinent (Andaman, Nicobar, and Maldives islands) to Southeast Asia extending to Papua New Guinea and the Solomon Islands (Tsang, 2020). *Pteropus hypomelanus* is known to establish roosts on small islands and commonly on forested areas of nearby coastline (Heaney et al., 2010). Furthermore, *P. hypomelanus* is an important pollinator and seed disperser of tropical tree species such as *Ficus* spp. and *Durio zibethinus* Murray (Heaney et al., 2010; Aziz et al., 2017; Oo et al., 2017).

Prior to this paper, no published account of ectoparasitic arthropods have been reported from bats in the Ursula Island Game Refuge and Bird Sanctuary. This note presents the first documentation of a nycteribiid bat fly parasitic on the island flying fox (*P. hypomelanus*) from Ursula Island.

Material and methods

During a rapid biodiversity assessment conducted on Ursula Island in June 2019, an adult island flying fox (*P. hypomelanus*) was caught in the mist nets

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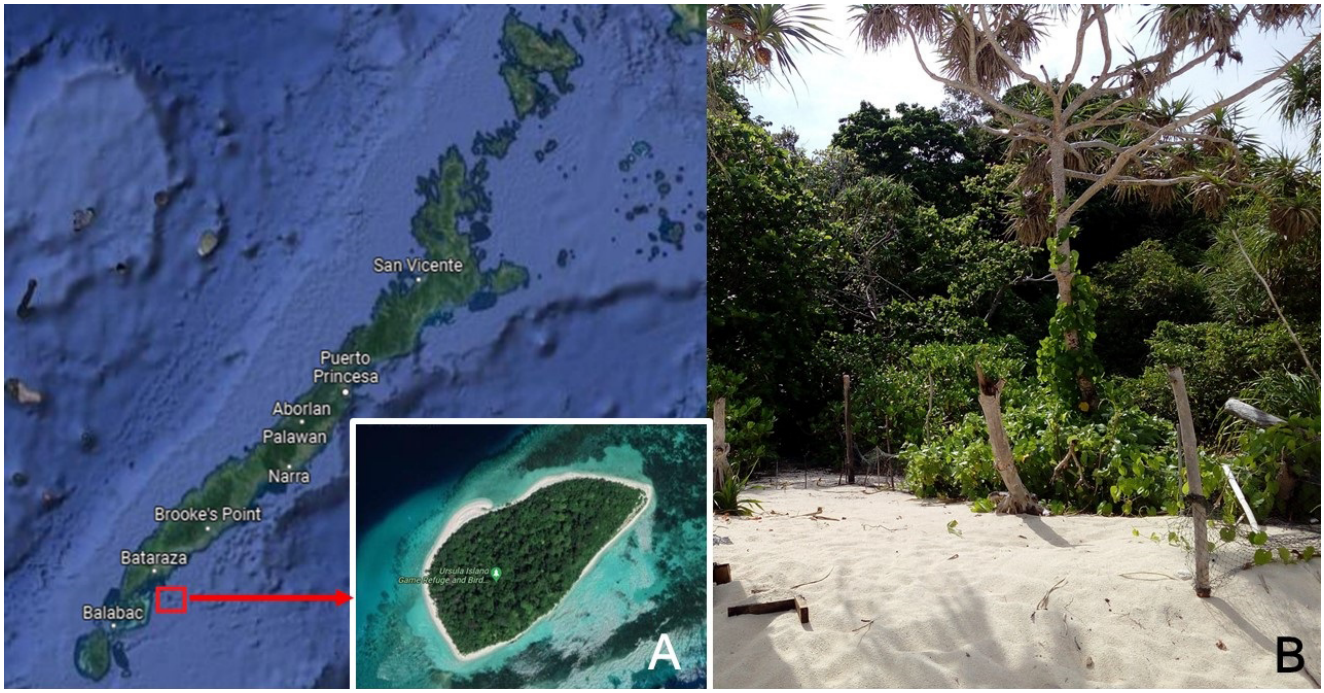

Fig. 1. Location of Ursula Island in the southern region of Palawan, Philippines (A) and its beach forest vegetation (B).

Fig. 2. Island flying fox (*Pteropus hypomelanus*) collected on Ursula Island (A) and its associated nycteribiid bat fly, *Cyclopodia horsfieldi,* foraging on the chest area near mammary gland (B).

established at the edge of a beach forest (Fig. 1). Upon close examination, an adult female bat fly was observed foraging on its pelage (Fig. 2). The bat fly was collected using fine-tipped forceps and preserved in 95% ethanol prior to identification. The specimen was examined under Leica S9D dissecting microscope and identified following taxonomic descriptions provided by Theodor (1963).

Results and discussion

Cyclopodia horsfieldi de Meijere, 1899 (Figs 3–5)

Cyclopodia horsfieldi de Meijere, 1899. Tijds. Ent. 42: 153. Type locality: Java (Indonesia). Repository: Zoologisch Museum Amsterdam (The Netherlands).

Material examined: On *Pteropus hypomelanus:* 1 ♀, Ursula Island, Palawan, Philippines, 27.VI.2019, leg. R. Giganto & A. Santillan.

Distribution: Cambodia (Olival et al., 2013), Indonesia (Maa, 1962, Theodor, 1967), Malaysia (Theodor, 1967; Olival et al., 2013), Philippines (Theodor, 1963; Theodor, 1967; Cuy, 1980), Singapore (Maa, 1962), Thailand (Maa, 1962; Theodor, 1967;

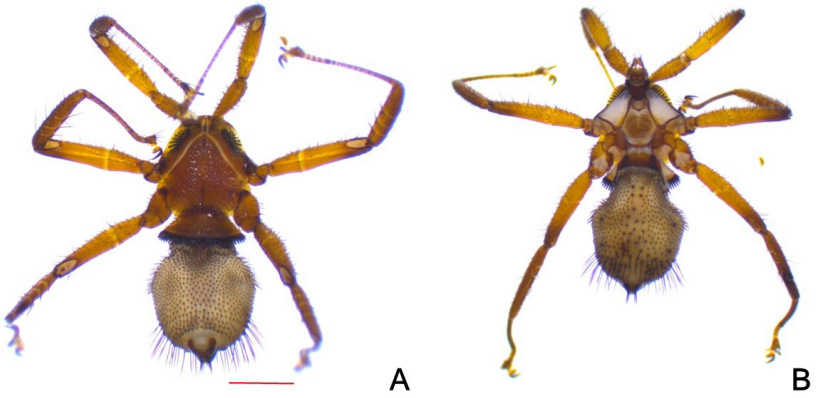

Fig. 3. Ventral (A) and dorsal (B) profile of female *Cyclopodia horsfieldi* parasitising *Pteropus hypomelanus* from Ursula Island, Philippines (scale bar = 1mm).

Fig. 4. Lateral profile of female *Cyclopodia horsfieldi*.

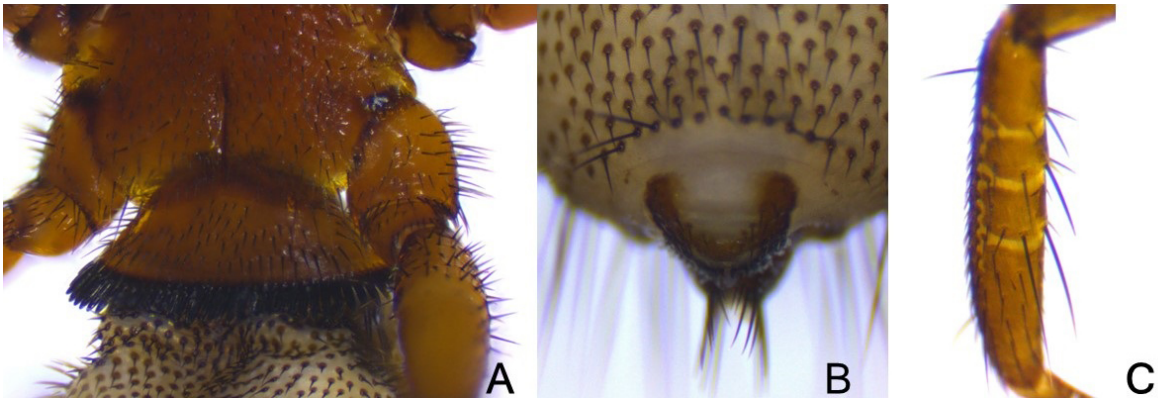

Fig. 5. Some ventral features in *C. horsfieldi:* pronounced abdominal ctenidia (A); anal segment showing sclerotised region (genital plate) (B); tibia showing three middle bands and ventral setae (C).

Olival et al., 2013), Timor Leste (Maa, 1962), Vietnam (Olival et al., 2013).

Philippine host records: *Acerodon jubatus* (Eschscholtz, 1831), *Pteropus hypomelanus* Temminck, *P. vampyrus* (Linnaeus, 1758), *P. speciosus* Andersen, 1908, *Rousettus amplexicaudatus* (Geoffroy, 1810) (Theodor, 1963; Cuy, 1980).

The genus *Cyclopodia* is currently represented by 24 species and eight subspecies distributed across the Old World (Graciolli & Dick, 2018). In the Philippines, the genus *Cyclopodia* is represented by two species: *C. garrula* Maa, 1968 and *C. horsfieldi,* both of which are ectoparasitic on Pteropodidae (Cuy, 1980). The former is an endemic species parasitic on *Harpyionycteris*

whiteheadi Thomas (harpy fruit bat) (Maa, 1968) while the latter is primarily ectoparasitic on flying foxes (Theodor, 1959). *C. horsfieldi* has a wide distribution range spanning across mainland and maritime Southeast Asia and has been recorded in several countries.

Bat flies have been known to harbour various blood- associated microbiota and can transmit these microbes via blood feeding. Among these is the genus *Bartonella,* a group of intracellular parasites and the sole member of the family Bartonellaceae. Morse et al. (2012) reported genotypes of *Bartonella* from *C. horsfieldi* parasitic on *P. vampyrus* from Malaysia. The certainty of how many bat-associated *Bartonella* genotypes occur in Southeast Asia is still unknown and requires further research.

Acknowledgments

The author would like to thank the Palawan Center for Sustainable Development (PCSD) for providing collection and transport permit (through D. Celadiña), CBNC environmental researchers for the aid during fieldwork, Prof. D. Celadiña for allowing the author to join fieldwork, R. Giganto for donating the bat fly specimen, P.G. Jakosalem (Philippine Biodiversity Conservation Foundation, Inc.) for confirming the identity of the bat host, and Dr H.-Y. Tseng (National Taiwan University) for providing working space to the first author.

References

Aziz S.A., Clements G.R., McConkey K.R., Sritongchuay T., Pathil S., Yazid M.N.H.A., Campos-Arceiz A., Forget P.-M., Bumrungsri S. 2017 Pollination by the locally endangered Island flying fox (*Pteropus hypomelanus*) enhances fruit production of the economically important durian (*Durio zibethinus*). Ecology and Evolution 7 (21): 8670–8684.

BirdLife International 2022 Important Bird Areas factsheet. http://www.birdlife.org (accessed 27 March 2022)

Cuy L.S. 1980 Nycteribiidae (Diptera) of the Philippines. Kalikasan, Philippine Journal of Biology 9 (2–3): 145–168.

Graciolli G., Dick C.W. 2018 Checklist of World Nycteribiidae (Diptera: Hippoboscoidea). 10 pp.

Heaney L.R., Dolar M.L., Balete D.S., Esselstyn J.A., Rickart E.A., Sedlock J.L. 2010 Synopsis of Philippine Mammals. Field Museum of Natural History, USA. https://www.fieldmuseum.org/synopsis-philippine-mammals (accessed 27 March 2022)

Key Biodiversity Areas Partnership 2022 Key Biodiversity Areas factsheet: Ursula Island. Extracted from the World Database of Key Biodiversity Areas Developed by the Key Biodiversity Areas Partnership. https://www.keybiodiversityareas.org/ (accessed 27 March 2022)

Maa T.C. 1962 Records and descriptions of Nycteribiidae and Streblidae (Diptera). Pacific Insects 4 (2): 417–436.

Maa T.C. 1968 Additions to the Cyclopodiinae. Part I (Diptera: Nycteribiidae). Pacific Insects 10 (1): 1–23.

Matillano J.D., Espinosa A.F., Gonzales B.J. 2008 The birds of Pandan Island, Honda Bay, Palawan. The Legend Hotels International Corporation Technical Report, 18 pp.

Morse S.F., Olival K.J., Kosoy M., Billeter S., Patterson B.D., Dick C.W., Dittmar K. 2012 Global distribution and genetic diversity of *Bartonella* in bat flies (Hippoboscoidea, Streblidae, Nycteribiidae). Infection, Genetics, and Evolution 12: 1717–1723.

Olival K.J., Dick C.W., Simmons N.B., Morales J.C., Melnick D.J., Dittmar K., Perkins S.L., Daszak P., DeSalle R. 2013 Lack of population genetic structure and host specificity in the bat fly, *Cyclopodia horsfieldi,* across species of *Pteropus* bats in Southeast Asia. Parasites & Vectors 6: 231.

Oo K.S., Win H.L., Bates P.J.J.,Pearch M.J. 2017 The ecology and distribution of flying foxes (Chiroptera: Pteropodidae: *Pteropus*) in Tanintharyi Region, Myanmar with the first mainland record of *Pteropus hypomelanus geminorum* from Myeik. Journal of Threatened Taxa 9 (8): 10528–10537.

Saulog F. 1997 Status assessment for conservation and development of Ursula Island Game Refuge and Bird Sanctuary. Philippine Council of Agriculture, Forestry and Natural Resources Research and Development, Laguna, pp. 100–101.

Theodor O. 1959 A revision of the genus *Cyclopodia* (Nycteribiidae, Diptera). Parasitology 49 (1–2): 242–308.

Theodor O. 1963 Philippine batflies of the family Nycteribiidae (Diptera, Pupipara). Fieldiana (Zoology) 42 (11): 151–192.

Theodor O. 1967 An illustrated catalogue of the Rothschild collection of Nycteribiidae (Diptera) in the British Museum (Natural History); with keys and short descriptions for the identification of subfamilies, genera, species and subspecies. Trustees of the British Museum(Natural History), Publication number 655, London, 506 pp. + 5 plates.

Tsang S.M. 2020 *Pteropus hypomelanus*. The IUCN Red List of Threatened Species 2020: e. T18729A22081642. https://doi.org/10.2305/iucn.uk.2020-2.rlts.t18729a22081642.en (accessed 27 March 2022)

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Research article

On the *Rhyopsocus* Hagen, 1876 (Insecta: Psocoptera) of East Africa with a description of two new species

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Abstract: Finds of four *Rhyopsocus* species in East Africa were reported, two of which from Uganda were described as new to science. Other two were *R. afer* from Tanzania, and *R. pandanicola* from coastal Kenya. Information on the colouration, morphology and somatometrics was provided. An identification key for all known African species was proposed.

Keywords: Africa, biodiversity, invertebrates, tropical

Introduction

The genus *Rhyopsocus* Hagen, 1876 consists of 24 known species spread in the warm parts of Africa, North and South America, and some oceanic islands (Lienhard 2016). Some of the species occupy typical psocid microhabitats like living or dry plants and leaf litter, and some are possibly more specialised tending to inhabit nests of birds or rodents (Badonnel, 1948; Baz, 1990; Mockford, 2016). These insects are easily spread by humans and often found in stored fruit products (Pearman, 1931; New, 1974). However, very little is known on the ecology of the *Rhyopsocus* and the species diversity of the genus is far from well known (Mockford, 2016). In this paper I report in detail all of mine *Rhyopsocus* finds in Africa till now, two of which represent new species to science.

Material and methods

Psocoptera were collected by the author from East Africa – Kenya, Tanzania (Zanzibar) and Uganda by beating the vegetation. The specimens were stored in 96% ethanol. The photos (specimens in glycerin) were taken by a camera Canon PowerShot SX500IS through the eyepiece of a light microscope Optika and Carl Zeiss-Jena. Type material was deposited at the National Museum of Natural History, Sofia, Bulgaria (NMNH), Natural History Museum of Geneva, Switzerland (NHMG) and the particular collection of the author. The species discussed in the paper were identified according to original descriptions, redescriptions, and published identification keys. Measurements followed Lienhard (1998). Species diversity and distributions is according Lienhard (2016).

Measurements abbreviations (all in mm in the text): LC = body length; A = antenna length, P4: fourth segment of maxillary palp, F+tr = hind femur and trochanter length; T = hind tibia length; t1, t2, t3 = tarsomeres of hindtarsus (lengths measured from condyle to condyle), FW = forewing, HW = hindwing, D = anteroposterior diameter of the compound eye, IO = shortest distance between compound eyes.

Results and discussion

Family Psoquillidae Lienhard & Smithers, 2002

Rhyopsocus ugandanus **n. sp.**

Holotype ♀ (in 96% ethanol), Uganda, Buvi Village area, a small peninsula at Lake Viktoria NW of

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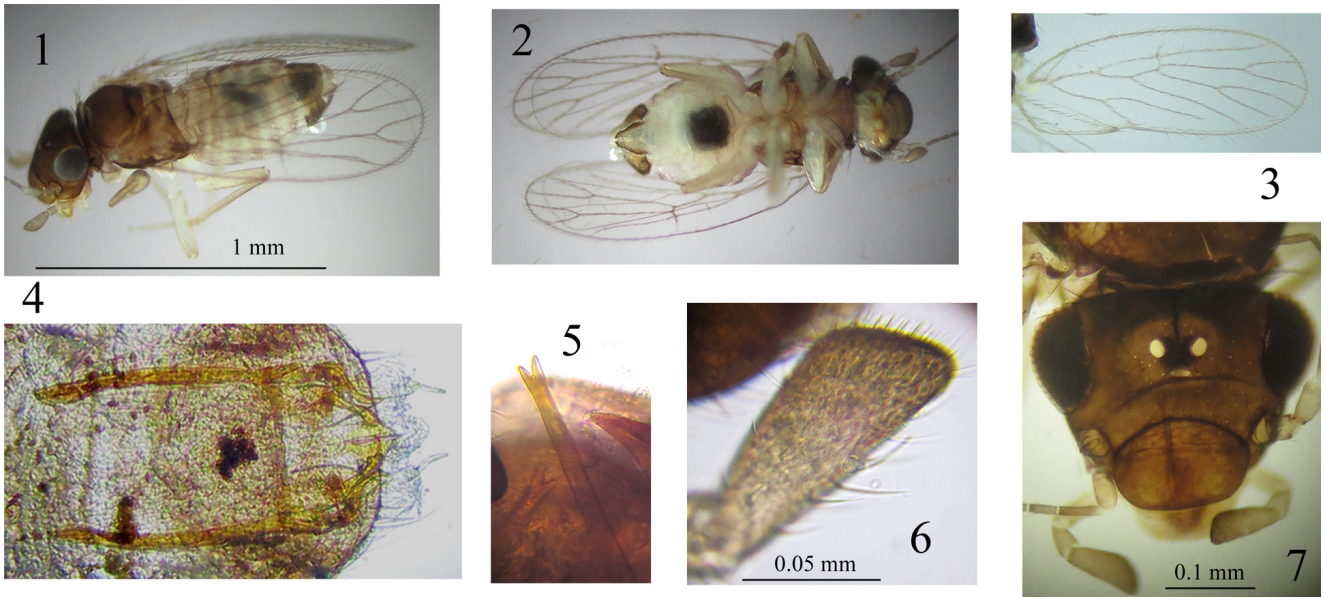


Figs 1–7. *Rhyopsocus ugandanus* n. sp., (1) lateral view, paratype ♀, (2) ventral view of same specimen, (3) forewing, holotype ♀, (4) phalosome, hypandrium, epiproct and paraprocts, paratype ♂, (5) lacinia of same specimen, (6) P4, paratype ♀, (7) head, paratype ♀ (scale of Fig. 1 valid for 2 and 3; Figs 4–5 not to scale).

Entebbe Town, N0.12306° E32.45378°, 1133 m a.s.l., 25.07.2022; NMNH; paratypes: 1 ♂ (in 96% ethanol), same locality and date; NMNH; 1 ♂, 1 ♀ (in 96% ethanol), same locality and date; NHMG. Additional material: 1 ♂ (different body parts on microscope slides, in glycerin), same locality and date; D. Georgiev coll.

Diagnosis: The phalosome and P4 (4th segment of the palpus) morphology of the new species is similar with these ones of *R. ocotensis*. But together with its body colouration, *R. ugandanus* n. sp. differs and by its reduced and flat middle ocellus, paraprocts and hypandrium morphology. By its forewing venation and brown head and thorax *R. ugandanus* n. sp. is similar and to *R. peregrinus* (Pearman, 1929). This species was shortly described by a single specimen in stored bananas in Great Britain with unknown origin by a single specimen with unknown sex. However, in *R. peregrinus* the hind wings are considerably smaller than the forewings (New, 1974), while in *R. ugandanus* n. sp. they are just a little bit shorter, prolonging to about 90% of the forewing length even in the brachypterous specimens.

There are three species of macropterous *Rhyopsocus* having banded abdomen (Banks 1930, Mockford, 2016; Thornton et al., 1972). From *R. texanus* (Banks, 1930) (known form USA and Mexico) and *R. celtis* Mockford, 2016 (USA) it differs by its darker head and thorax, and from *R. pandanicola* Thornton, Lee & Chui, 1972 (Micronesia, Christmas Island, Tonga) by its not pigmented wings and paler abdomen.

Etymology: The species is named after Uganda – the country where it was found.

Description (after two months in 96% ethanol): Colouration. In both sexes identical. Head and thorax dark blackish-brown, lighter ventrally. Compound eyes black with greyish tinge. Ocelli yellowish (Fig. 7). Legs, antennae and palpi brown, lighter proximally. Abdomen white-yellowish, tergites with brown transverse stripes interrupted ventrally. Terminal sclerites dark brown. Wings hyaline (Figs 1–3).

Morphology. Female: The distance between the compound eyes is twice as their anteroposterior diameter. Lateral ocelli round, the middle ocellus elongate, flattened, and somehow reduced (Fig. 7). Flagellum of the antenna with 20 flagellomeres. P4 broad distally with long setae at its major external surface and rather short at its apical part (Fig. 6), resembling this one of *R. ocotensis* García-Aldrete, 1999 (see García-Aldrete, 1999: p. 228). Lacinia slim, with two cusps from which the lateral one is slightly longer (Fig. 5). Tibia and femur + trochanter almost equal in length. In flying forms the wing is almost as long as the body length, and wings are passing over the abdominal tip. Wing veins well defined. Forewings

with moderately short setae (Figs 1–3). Forewing venation variable even in one and a same individual mainly considering the length of cells m1 and r3, and the shape and length of the central cell. Gonapophyses elongate, with long sclerotised band at its dorsal edge, more membranous ventrally. With two very long setae apically, a few little bit shorter and many which are half their size (Fig. 23). Epiproct and paraprocts with scattered short setae, epiproct with additional row of longer setae. Paraproctal spur short and could be straight or slightly curved outwards (there is no any difference between the male and female) (Fig. 4).

Male: Smaller than the female (LC<1.0 mm). Antennae longer compared to body length than these in female (♀ A/LC = 0.83, ♂ A/LC = 0.92). P4 narrower than this in female, more rounded and having longer setae at its apical area. In two of the males forewings longer than body length, shorter in the third (see measurements). Eyes are insignificantly larger than those in female compared to the shortest distance between them. Hypandrium simple, rounded with flattened apex, setose, having two pairs of closely situated, curved and very long setae at its lateral edge (Fig. 26). Phallosome with two slender parallel projections (anterior endophallic sclerites) and two triangular sclerites (Edeagal arch + Posterior endophallic sclerites), one at each side of longitudinal midline (Fig. 4). Epiproct and paraprocts scarcely setose with shorter setae than those in female. Other characters as in female.

Dimensions: Holotype ♀: LC = 1.04, P4 = 0.12, F+tr = 0.44, T = 0.45, t1 = 0.18, t2 = 0.04, t3 = 0.03, FW = 1.02, HW = 0.88, D = 0.15, IO = 0.30, IO/D = 2.0; paratype ♀: LC = 1.04, P4 = 0.12, A = 0.86, FW = 1.0, D = 0.10, IO = 0.22, IO/D = 2.2; paratype ♂: LC = 0.96, A = 0.88, F+tr = 0.35, T = 0.40, t1 = 0.16, t2 = 0.05, t3 = 0.05, FW = 1.0, HW = 0.88, D = 0.16, IO = 0.30, IO/D = 1.88; paratype ♂ (with not well developed wings): LC = 1.1, FW = 0.78, HW = 0.66.

Distribution: Known only from the type locality.

Type locality: Uganda, Buvi Village area, a small peninsula at Lake Viktoria NW of Entebbe Town, banana (*Musa* sp.) plantation, NE of Buvi Lodge, from fallen village weaver *Ploceus cucullatus* (Müller, 1776) nests beneath a date palm (*Phoenix* sp.), N0.12306° E32.45378°, 1133 m a.s.l.

Habitat: The species was found during the dry season at agricultural lands – banana (*Musa* sp.) plantation, from fallen village weaver *Ploceus cucullatus* (Müller, 1776) nests beneath a date palm (*Phoenix* sp.). The fallen nests were found among tall grass vegetation, lianas and dry date palm leaves.

Rhyopsocus weingardti **n. sp.**

Holotype ♂ (with detached abdomen and a hind wing; in 96% ethanol), N0.12306° E32.45378°, 1133 m a.s.l., 25.07.2022; NMNH.

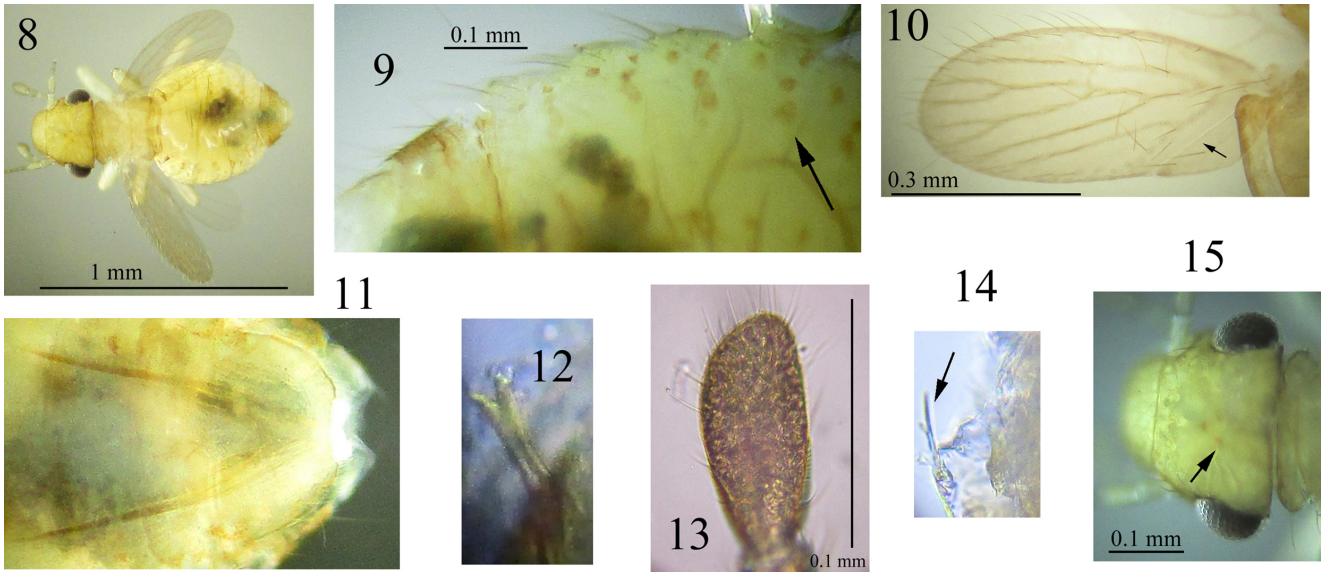
Diagnosis: The specific Y-shape pattern of spots on each dorso-lateral side of the abdominal tergites is unique for this species.

There are three yellowish-brown *Rhyopsocus* species known so far. *R. calakmulensis* García-Aldrete, 1999 (Mexico) has no ocelli (even vestigial) and wings with shorter setae and not well defined veins (García-Aldrete, 1999); *R. disparilis* (Pearman, 1931) has no ocelli (even vestigial) too, and more elongate wings with different venation (Pearman, 1931); *R. plesiafer* Turner & Cheke, 1983 (Togo) has pale terminalia and maxillary palps, not pigmented forewings, and the paraproctal spur is curved outwards (Turner & Cheke, 1983).

Etymology: Named after my colleague, the psocidologist Michael Weingardt (Friedrich Schiller University, Jena, Germany).

Description (after two months in 96% ethanol): Colouration. The whole animal is yellowish-brown (Fig. 8). The head, thorax and terminal sclerites a little bit darker, more brownish. Compound eyes black with greyish tinge. Vestigial ocelli reddish-brown (Fig. 15). Each dorsolateral side of the preclunial abdominal tergite with four brown spots forming Y-shape pattern (Fig. 9). Wings greyish-brown, transparent (Fig. 10). Forewings darker. Both forewing and hindwing with a narrow hyaline band along cu2 (Fig. 10). Veins dark, brown and well visible.

Morphology. Male: The distance between the compound eyes is twice as their anteroposterior diameter. Ocelli not well developed, only three vestigial rounded ocelli present. P4 narrow proximally, elongate-rounded distally and has both long and short setae at its apical area (Fig. 13). Lacinia bifurcated having two cusps of almost equal length (Fig. 12). The forewings are short and do not pass over the abdominal tip. Venation well defined as shown on Fig. 10. Forewing with long setae. Epiproct and paraprocts with scattered setae. Paraproctal spur distinctly curved inwards (Fig. 14). Hypandrium simple, with concave apex, setose, having two groups of four setae at its



Figs 8–15. *Rhyopsocus weingardti* n. sp. (♂ holotype), (8) dorsal view, (9) specific for this species Y-shape pattern of the dorso-lateral side of the abdominal tergites, (10) forewing, (11) phalosome, (12) lacinia, (13) P4, (14) paraproctal spur, (15) head, vestigial ocelli pointed by an arrow (Figs 11, 12, 14 not to scale).

lateral edges arranged in rows (Fig. 27). Phalosome with thin arms arranged at an acute angle (Fig. 11).

Female: Unknown.

Dimensions: Holotype ♂: LC = 1.0, P4 = 0.09, F+tr = 0.30, T = 0.35, t1 = 0.10, t2 = 0.05, t3 = 0.04, FW = 0.59, HW = 0.47, D = 0.12, IO = 0.25, IO/D = 2.08.

Distribution: Known only from the type locality.

Type locality: Uganda, Buvi Village area, a small peninsula at Lake Viktoria NW of Entebbe Town, banana (*Musa* sp.) plantation, NE of Buvi Lodge, from fallen village weaver *Ploceus cucullatus* (Müller, 1776) nests beneath a date palm (*Phoenix* sp.), N0.12306° E32.45378°, 1133 m a.s.l.

Habitat: Same as in *R. ugandanus* n. sp.

Rhyopsocus afer (Badonnel, 1948)

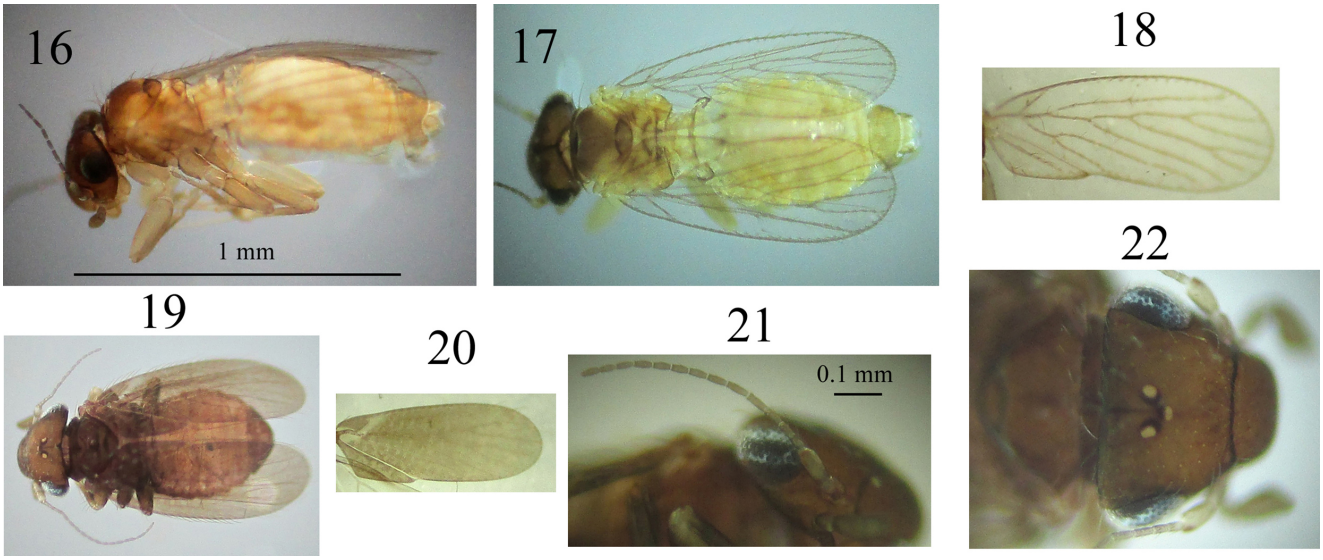
Material examined: The specimen reported by Georgiev (2021) was reexamined, photographed and measured: 1 ♀, 28.02.2021, Tanzania, Zanzibar, Unguja Island, Michamwi Peninsula, yard of a hotel, among *Cocos nucifera* and *Pandanus* sp., from fallen nest of golden weaver, *Ploceus subaureus* (Smith, 1839), S6.14181° E39.48986°, 5 m a.s.l.; NMNH.

Description of the specimen: Colouration (after 19 months in 96% ethanol). Head, thorax, antennae and palpi dark brown (Fig. 16). Compound eyes black. Ocelli pale. Abdomen and legs yellowish-white. Terminal sclerites a little bit darker (Fig. 17). Wings hyaline, veins brownish (Fig. 18).

Morphology. Compound eyes relatively big (IO/D < 2). Flagellum of the antenna with 21 flagellomeres. P4 moderately broad and rounded distally, with relatively short setae at its apical part. Lacinia bifurcated having slightly longer lateral cusp and thickened stem. Forewings slightly bent above the abdomen, with variable venation (Fig. 18). Most noticeable is that in left wing cell m1 is much shorter than r3, and in the right they are almost equal in length. Gonapophyses elongate, with long sclerotised band at its dorsal edge, more membranous ventrally. With one very long seta apically and two shorter in close proximity (Fig. 25).

Dimensions: LC = 1.2, P4 = 0.10, F+tr = 0.33, T = 0.39, t1 = 0.17, t2 = 0.04, t3 = 0.05, FW = 0.84, HW = 0.80, D = 0.15, IO = 0.28, IO/D = 1.87.

Remark: The differences from the original description of Badonnel (1948)from Congo which was observed in the Zanzibar specimen was that the antennae were brown (versus pale), the paraproctal spur was slightly curved inwards (versus straight), and the gonapophyses had only one very long seta apically (versus two). Further studies of more samples are needed to clarify if it is an individual or local variation



Figs 16–22. *Rhyopsocus afer* ♀ from Zanzibar, (16) lateral view, (17) dorsal view, (18) forewing, *Rhyopsocus pandanicola* ♀ from Kenya, (19) dorsal view, (20) forewing, (21) head, lateral view, (22) head, dorsal view (scale of Fig. 1 valid and for 17–20, scale of Fig. 21 valid and for 22).

of *R. afer,* or the Unguja population belongs to a separate species.

Rhyopsocus pandanicola Thornton, Lee & Chui, 1972

Material examined: 1 ♀, 4.03.2022, Kenya, South of Mombasa, at the coast of the Indian Ocean, along the estuary of Congo River, mangrove scrubs, S4.25842° E39.59481°, 6 m a.s.l., from various bushes and trees, collected by beating the vegetation. Reported by Georgiev (2022) as *Rhyopsocus* sp.

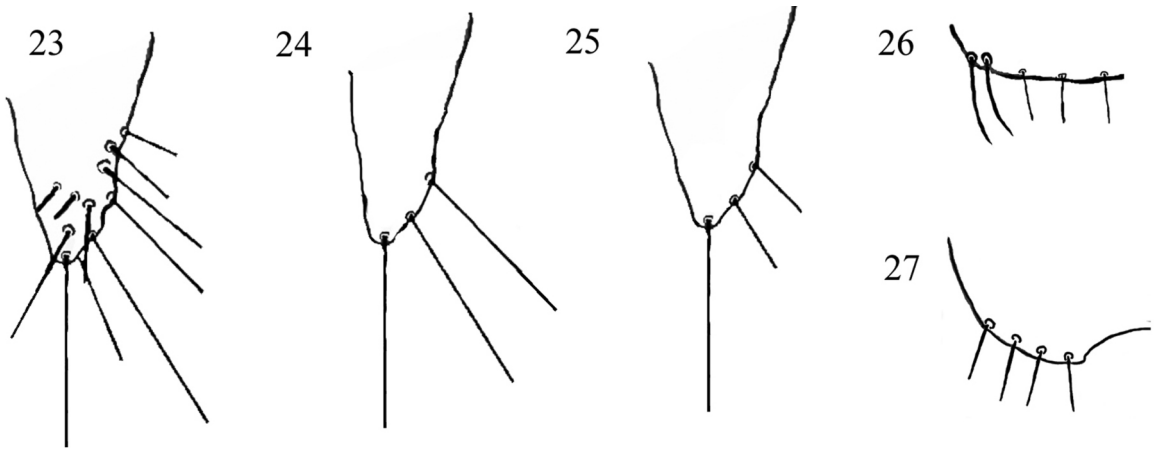
Description of the specimen: Colouration (after seven months in 96% ethanol). The whole animal is dark brown (Fig. 19). Compound eyes black with two parallel longitudinal greyish-blue stripes (Fig. 21). Ocelli pale, with darker pigment at their inner sides (Fig. 22). Tibia light at its most distal part. Tarsi light. Forewings blackish-brown having a translucent-whitish band at the base and narrow hyaline band along cu2 (Fig. 20). Hindwing a little lighter, with blackish-brown hue and narrow hyaline band along cu2 too.

Morphology. Flagellum of the antenna with 19 flagellomeres. Ocelli rounded, middle ocellus smaller (Fig. 22). Forewings longer than body length, passing a lot over the abdominal tip, with long setae and a lot of tiny ones all over the wing surface (Fig. 19). Hindwings also long, almost as long as body length. Gonapophyses slim, with three very long setae at the apical area (Fig. 24).

Dimensions: LC = 0.78, P4 = 0.09, F+tr = 0.24, T = 0.32, t1 = 0.10, t2 = 0.04, t3 = 0.05, FW = 0.81, HW = 0.76, D = 0.11, IO = 0.23, IO/D = 2.09.

Habitat: The species was found on mangrove bushes at a river estuary of the tidal zone of the Indian Ocean.

Remark: *R. pandanicola* was known from Micronesia, Christmas Island and Tonga (Lienhard, 2016). The find on coastal Kenya is a new record of the species for the African continent. The specimen recorded fits well with the description of Thornton et al. (1972). The slight colour differences pointed by Georgiev (2022) could due to long time of preservation of 20 years of the specimens according which the species was described. As an additional different character from the original description of *R. pandanicola* can be added the presence of two grey-blue stripes on the compound eye of the African specimen. Of course the possibility that they are closely related separate species cannot be excluded. However some psocid species considered to have Oriental distribution were recently found and at the shores of East Africa as *Lepidopsocus pretiosus* (Banks, 1942), *Belaphopsocus murphyi* Lienhard, 1991 and *Peritroctes cochinensis* Menon, 1938, and a record of *R. pandanicola* is not surprising (Georgiev,



Figs 23–27. (23) *R. ugandanus* n. sp. ♀, gonapophysis; (24) *R. pandanicola* from Kenya, ♀, main setae on the apical area of gonapophysis; (25) *R. afer* from Zanzibar, ♀, main setae on the apical area of gonapophysis; (26) *R. ugandanus* n. sp. ♂, lateral area of the hypandrium; (27) *R. weingardti* n. sp., ♂, lateral area of the hypandrium.

2021, 2022). Many species are probably distributed along the Indian Ocean coast, probably due to both natural processes of passive dispersal and human introductions.

Identification key to the known African *Rhyopsocus* species

As the forewing venation tends to vary (even in a single specimen as was noticed in this study) it was not used as an important character in building of the identification key. Mostly the criteria of Mockford (2016) were applied.

1. Head and thorax brown, abdomen pale 2
– Body relatively unicoloured 3
2. Abdomen unicoloured, yellowish-white . . . . . *R. afer* (Badonnel, 1948) (Angola, Congo, Equatorial Guinea, India, Ivory Coast, South Africa, Tanzania, Zanzibar)
– Abdomen striped . . . . . *R. ugandanus* n. sp.
3. Body pale 4
– Body dark brown 5
4. Ocelli absent . . . *R. disparilis* (Pearman, 1931) (Great Britain, USA, Angola, Congo, Ghana)
– Ocelli present 6
5. Anal margin of forewing angulated, veins well visible . . . . . *R. pandanicola* Thornton, Lee & Chui, 1972 (Micronesia, Christmas Island, Tonga)
– Anal margin of forewing smoothly rounded, veins hardly visible . . . . . *R. nidicola* Baz, 1990 (Equatorial Guinea)
6. Body yellowish-brown, dorsolateral margin of abdominal tergites with Y-shape pattern . . . . . *R. weingardti* n. sp.
– Whole body unicoloured pale brown . . . . . *R. plesiafer* Turner & Cheke, 1983 (Togo)

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References

Badonnel A. 1948 Psocopteres du Congo belge (2‘ note). Revue de Zoologie et de Botanique Africaines, Bruxells 40 (4): 266–322.

Banks N. 1930 New neuropteroid Insects from the United States. Psyche 37: 223–232.

Baz A. 1990 Psocoptera from weaver bird nests (Aves: Ploceidae) in Equatorial Guinea (West-Africa). Annales de la Société entomologique de France (Nouvelle Série) 26 (1): 33–38.

García-Aldrete A. 1999 New species of *Rhyopsocus* from Mexico. Senckenbergiana biologica 79 (2): 225–229.

Georgiev D. 2021 On the fauna of Psocoptera of Unguja (Zanzibar) Island (Tanzania, East Africa). Historia naturalis bulgarica 42: 35–42. https://doi.org/10.48027/hnb.42.061

Georgiev D. 2022 New records of Psocoptera from East Sub-Saharan Africa. ZooNotes, Supplement 12: 1–36.

Lienhard C. 1998 Psocoptères euro-méditerranées. Faune de France 83: 1–517.

Lienhard C. 2016 Country checklists of the Psocoptera species of the World, extracted from Lienhard C., Smithers, C. 2002 "Psocoptera (Insecta) – World catalogue and bibliography". Psocid News Special Issue I: 1–123.

Mockford E. 2016 The Brachypterous Ground-Litter-Inhabiting Species of *Rhyopsocus* Hagen (Psocodea: 'Psocoptera': Trogiomorpha: Psoquillidae) from Southwestern United States, Mexico, and Guatemala, with Descriptions of Two New Species. Transactions of the American Entomological Society (Philadelphia) 142 (2): 215–235.

New T. 1974 Psocoptera. Handbooks for the Identification of British Insects 1 (7): 1–102.

Pearman J. 1931 More Psocoptera from warehouses. Entomologist's Monthly Magazine 67: 95–98.

Thornton I., Lee S., Chui, V. 1972 Insects of Micronesia: Psocoptera. Insects of Micronesia 8 (4): 45–144.

Turner B., Cheke R. 1983 Psocoptera of the Togo-Benin Gap, West Africa. Journal of Natural History 17: 379–404.

Historia naturalis bulgarica 45 (2): 39–42
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Research article

New data about the distribution of *Plectophloeus fischeri* (Aubé, 1833) and *Dicentrius biroi* Besuchet, 1999 (Coleoptera: Staphylinidae: Pselaphinae) in Bulgaria

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Abstract: New data for the rare and poorly known species *Plectophloeus fischeri* (Aubé, 1833) and *Dicentrius biroi* Besuchet, 1999 in Bulgaria are presented.

Keywords: distribution, endemic, new records, rare species, saproxylic

Introduction

Plectophloeus fischeri (Aubé, 1833) is a widespread species in Europe, distributed from Great Britain, through Central Europe and Italy to the Balkans (Löbl & Löbl, 2015). It is a typical saproxylic beetle inhabiting dead wood, often found under the bark of various trees. It is one of the first representatives of the subfamily Pselaphinae reported from Bulgaria, from Rila Mts and Chamkoria (Borovets) (Rambousek, 1909). Later, Karaman added another record from the vicinity of Varna (Karaman, 1969). In the last decade, a few more findings were accumulated, some of them already published, they are from Vitosha, Belasitsa, Western Rhodopes, and Pirin (Bekchiev, 2008, 2011; Bekchiev & Kostova, 2022; Bekchiev & Shishiniova, 2007). Despite the increasing information of its distribution, the species is rare and reported in relatively low number of localities at least on the territory of Bulgaria. Nevertheless, it remains the most widespread and most common compared to the others species of the genus *Plectophloeus* Reitter, 1891 (*Plectophloeus nitidus* (Fairmaire, 1858), *Plectophloeus nubigena* (Reitter, 1877), *Plectophloeus rhenanus* (Reitter, 1882)) in our country (Bekchiev, 2016).

The genus *Dicentrius* (Reitter, 1882) was considered monospecific until 1999, when Besuchet (1999) described 8 new species from the Balkans (mainly from Bulgaria, Albania and Northern Macedonia) and one new species from Serbia was added later (Bekchiev & Hlaváč, 2008). Most species of the genus are characterised by narrow distribution ranges, as they have a low dispersal ability, restricted to mountainous regions. The species of the genus are microphthalmous, they are very similar morphologically and they identification is only possible when male aedeagus is studied. All representatives of the genus are litter dwellers, most abundant in forest habitats, but could also be met in high altitude in the subalpine belt (2000–2500 m). The genus, as well as the closely related genus *Pselaphogenius* Reitter, 1910 most likely speciated relatively recently, possibly during the Pleistocene glaciations (Sabella et al., 2019). In accordance with the framework outlined above, it can be assumed that the alternation during the Pleistocene of cold glacial periods and hot and dry interglacial periods played a fundamental role in the specific differentiation between species in this group, which is reflected in the different affinity levels between them and in their current geographic distribution. In this regard, the finding of

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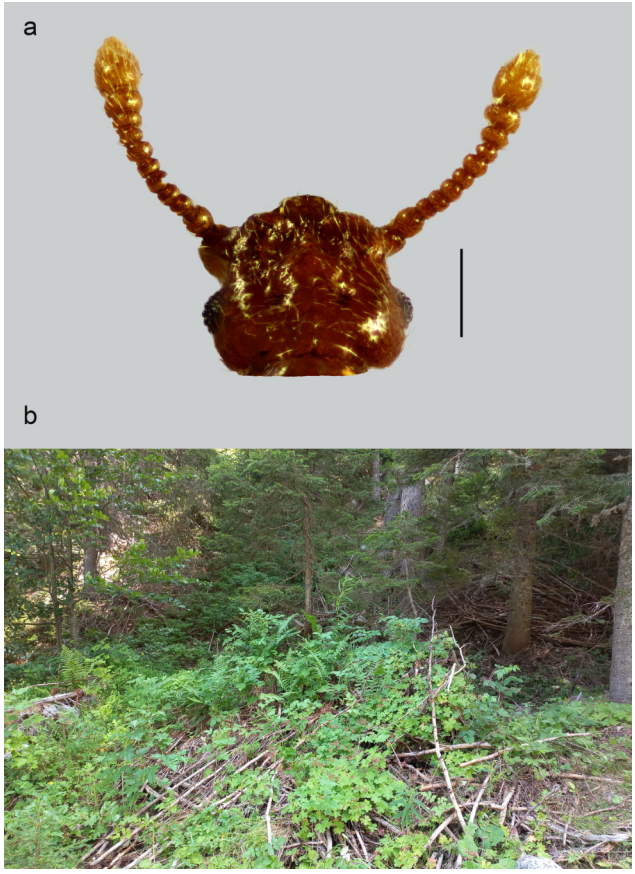
Fig. 1. Habitat of *Plectophloeus fischeri* at Banderitsa Hut, Pirin Mts, Bulgaria.



← Fig. 2. (a) Head of *Plectophloeus fischeri* – male (scale: 0.1 mm); (b) microhabitat where the specimens were collected.

Dicentius biroi Besuchet, 1999 in Rila Mountains, known before only from Osogovo and Stara Planina Mountains (Bekchiev, 2008), raises many interesting questions about the phylogenetic relationships within the genus.

The material is preserved in the collection of the National Museum of Natural History-Sofia (NMNHS). Additional data from the collection of Muséum d'histoire naturelle, Genève – Switzerland (MHNG) are also provided.

Results

Plectophloeus fischeri (Aubé, 1833)
Figs 1; 2a, b)

Pirin Mts, Banderitsa River Valley, near Banderitsa Hut, 27.07.2022, N41.7680°, E23.4239°, 1 ♂, 4 ♀♀, leg. R. Bekchiev, R. Kostova (NMNHS); Stara Planina

Fig. 3. Microhabitat of *Dicentrius biroi* in Rila Mts, Treshtenik.

Mts, Kalofer Town env., 10.07.1928, 1 ♂, leg. J. Fodor; Sopot Town env., 1 ♀ (MHNG).

Note: The material from Pirin Mts was collected in 2022, during the field expeditions in Pirin Mts, in the valley Banderishka River (Fig. 1), near Bansko Town, in mixed *Pinus heldreichii* and *Picea abies* forest. Adult specimens (Fig. 2a) were caught by sifting rotten wood, death branches and litter (Fig. 2b). This is the second known locality from the mountain.

The species is new for Stara Planina Mts.

Dicentrius biroi Besuchet, 1999
(Fig. 3)

Rila Mts, Treshtenik Hut, 30.06.2021, N42.0821° E23.6179°, 4 ♂♂, 2 ♀♀ leg. R. Bekchiev, R. Kostova (NMNHS).

Note: For the first time the species *Dicentrius biroi,* known until now only from Stara Planina Mts and Osogovo Mts, was found in the forest of *Pinus peuce* Griseb., 1846 by sifting litter and rotten wood near Treshtenik Hut in the Rila Mountains.

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References

Bekchiev R. 2008 The subfamily Pselaphinae (Coleoptera: Staphylinidae) of southwestern Bulgaria. I. Historia naturalis bulgarica 19: 51–71.

Bekchiev R. 2011 A study of the Pselaphinae (Coleoptera, Staphylinidae) in the Rhodope Mountains (Bulgaria). In: Beron P. (ed.) Biodiversity of Bulgaria 4. Biodiversity of Western Rhodopes (Bulgaria and Greece) II. Pensoft Publishers et National Museum of Natural History, Bulgarian Academy of Sciences, Sofia, pp. 267–278.

Bekchiev R. 2016 The Pselaphinae (Coleoptera: Staphylinidae) of Bulgaria, version 1.2. National Museum of Natural History-Sofia, Bulgaria. http://pselaphinae-bg.myspecies.info/

Bekchiev R., Hlaváč P. 2008 A new species of the genus *Dicentrius* Reitter, 1882 (Coleoptera: Staphylinidae, Pselaphinae) from western Serbia, pp. 241–243. In: Pavicevic D., Perreau M. (eds) Advances in the studies of the fauna of the Balkan Peninsula. Papers dedicated to Guilldo Nonveiller. Institute for Nature Conservation of Serbia, Belgrade, p. 564.

Bekchiev R., Kostova R. 2022 The Subfamily Pselaphinae (Coleoptera: Staphylinidae) of Southwestern Bulgaria: Rila and Pirin Mountains. Acta Zoologica Bulgarica 74: 169–174.

Bekchiev R., Shishiniova M. 2007 A contribution to the Pselaphinae fauna (Coleoptera: Staphylinidae) of the Vitosha Mountain. Acta Zoologica Bulgarica 59: 33–39.

Besuchet C. 1999 Le genre *Dicentrius* Reitter (Coleoptera Staphylinidae Pselaphinae). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 72: 221–233.

Karaman Z. 1969 Über einige neue und interessante Pselaphiden Vertreter der Balkanhalbinsel. Fragmenta Balcanica, Musei Macedonici Scientiarum Naturalium 7: 9–20.

Löbl I., Löbl D. 2015 Catalogue of Palaearctic Coleoptera. Hydrophiloidea – Staphylinoidea (2 vols). Revised and Updated Edition. (Vol. 2/1). Brill, Leiden, Boston.

Rambousek F.J. 1909 Příspěvek k poznání bulharských Pselaphidů a Scydmaenidů. Časopis České Společnosti Entomologické: 6: 16–24.

Sabella G., Viglianisi F.M., Bekchiev R. 2019 A new species of *Pselaphogenius* Reitter, 1910 of the *fiorii* species group from southern Italy (Coleoptera, Staphylinidae, Pselaphinae). Zootaxa 4585: 387–394.