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Research article

New data on the status of the jungle cat (*Felis chaus* Schreber, 1777) in Azerbaijan

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Abstract: The article presents new data on the status of the jungle cat (*Felis chaus*) in Azerbaijan, a species from the Red Data Book of Azerbaijan.

Keywords: Azerbaijan, *Felis chaus,* Transcaucasia

The jungle cat *Felis chaus* is an Asian species (Fig. 1), reaching Egypt to the east and the European Caucasian region to the north. In Europe, *F. chaus* is of marginal occurrence: the northern periphery of the species area is related to the European/Asian boundary with small populations in the Cis-Caspian region and the Caucasus along the Caspian Sea. In this region (Caucasus and Transcaucasus), the population has been rapidly declining since the 1960s, mainly with the destruction of the habitats and there were no records of this species in the Astrakhan State Reserve (Russian Federation) since the 1980s (Gray et al., 2016). The estimated numbers were about 100 and ~ 300 animals in Dagestan (Russian Federation) between 2009 and 2013 (Yarovenko, 2014). Little is known about the population status and ecology of the species in Turkey, where this felid is considered threatened by many negative factors (Ogurlu et al., 2010; Ünal & Eryilmaz, 2020). The species is included in the Red Data Books of the Russian Federation, Armenia and Georgia (Gray et al., 2016). It is included also in the Red Data Book of Azerbaijan (Qasimova, 2013). The status of the species in these areas is unclear. The species inhabits mainly reed massifs, dense and prickly bush and forest vegetation near reservoirs, but is also found in foothill and lowland forests and rocky areas (Hajiyev & Rakhmatullina, 2000; Yarovenko, 2014).

Camera traps caught in 2019 and 2020 the presence of the northern subspecies *Felis chaus chaus* in the Korchay (Fig. 2a) and Turyanchay Reserves (Fig. 2b), in the southern and northern part of the Mingachevir Reservoir (Northern Azerbaijan). The camera traps were installed as part of a research carried out between the Institute of Zoology at the Azerbaijan National Academy of Sciences, WWF-Azerbaijan and the National Museum of Natural History, Bulgarian Academy of Sciences. This field study started in 2018. It is related to the study of the status of rare and endangered carnivores in Transcaucasia and includes also the leopard and the striped hyena (Spassov et al., 2020). Our team registered traces of the jungle cat (2018) in the Hyrkan National Park (40 358 ha) of the Talish Moun-

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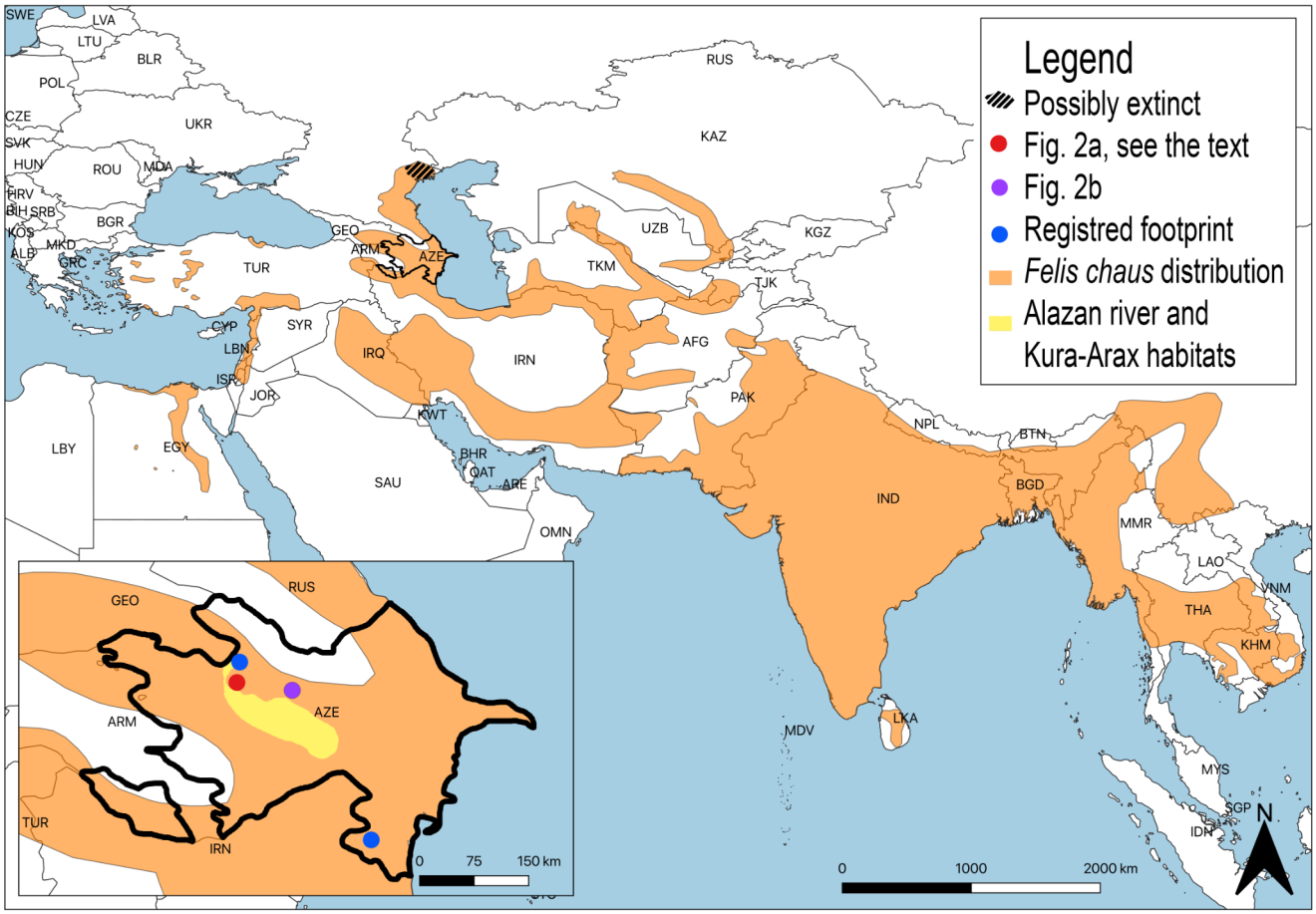

Fig. 1. Area of distribution of *Felis chaus* (after Gray et al., 2016 with additions and modifications).

tains (SW Azerbaijan) at an altitude of 1200 m a.s.l., which is the maximum altitude known for this species in the Caspian region (Yarovenko, 2014). Eighteen camera traps installed in the Hyrkan NP (11 in the southern part and 7 in the northern) at the elevation of 1000–1200 m a.s.l. in southern and 200 m a.s.l. in the northern part during the period March 2018 – December 2019 (3950 camera/days: 2930 in the southern and 1020 in the northern parts of the park) have captured 13 mammalian species. The jungle cat is one of the numerous species of the Hyrkan NP and its population number has been estimated at 194 individuals, with population density of 6.7 animals per 1000 ha, according to recent analyses of WWF-Azerbaijan.

Besides in the Hyrkan forests, the jungle cat is quite common in Kura-Arax Lowland and along the Alazan River Valley in Azerbaijan (Figs 1, 3–4). The road killed jungle cats can be found frequently along the Baku-Tbilisi highway in the same area. The jungle cat was photographed at least three times (2013, WWF Azerbaijan) in these valley regions (Fig. 3).

Northern Azerbaijan is one of the northernmost parts of the species' range, and the Hyrkan NP is an area with a high density of the species, which makes these regions and Azerbaijan as a whole important territories for the protection of this increasingly vulnerable carnivore. The monitoring of the species in the mentioned areas continues and the latest data collected by us can help to assess the status of the species in the country.

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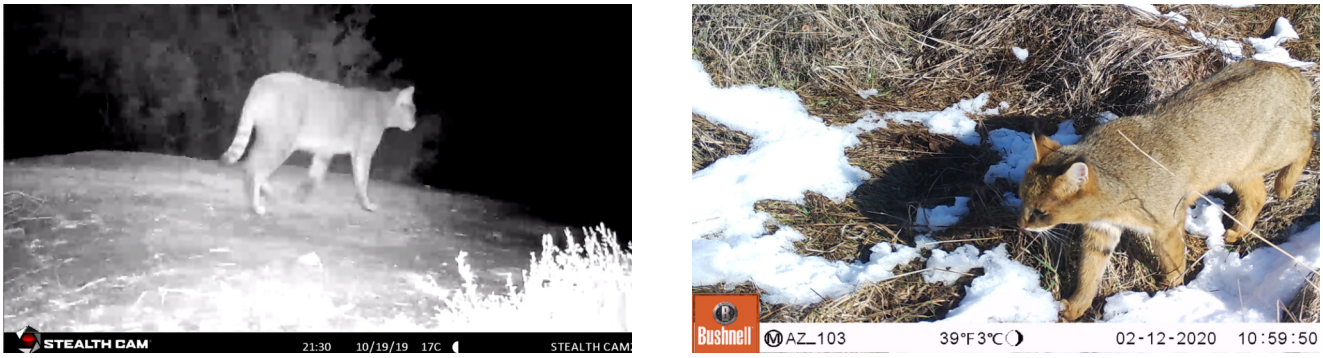

Fig. 2. Camera trap photos of *Felis chaus:* (a) [left] Korchay Reserve, (b) [right] Turyanchay Reserve.

Figs 3–4. *Felis chaus* in Northern Azerbaijan lowlands: (3) [left] with fat dormouse (*Glis glis*) in its mouth, (4) [right] near the Alazan River, not far from the border with Georgia.

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Research article

First record of *Pediacus dermestoides* (Fabricius, 1792) (Coleoptera: Cucujidae) for Bulgaria

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Abstract: The saproxylic species *Pediacus dermestoides* (Fabricius, 1792) is reported from forest habitats located in five mountains in Bulgaria. The adult beetles were found under the bark of several host tree species or captured with flight interception traps. It seems that *P. dermestoides* might be widespread in the mountain forests in Bulgaria.

Keywords: Balkan Peninsula, distribution, forest habitats, saproxylic species

Two genera of the family Cucujidae occur in the Palaearctic: *Cucujus* Fabricius, 1775 and *Pediacus* Shuckard, 1839 (Wegrzynowicz, 2007). In Europe, *C. cinnaberinus* Scopoli, 1763 is a threatened species (Cálix et al., 2018). Recently the species was firstly reported or confirmed for a number of Balkan countries, including Bulgaria (e.g. Guéorguiev et al., 2008; Kulijer & Miljević, 2017; Gjorgjievska et al., 2020). The species of the genus *Pediacus* are less intensively studied by researchers and no records have been available for Bulgaria until now. In the present work the species *P. dermestoides* (Fabricius, 1792) is reported for the first time for the country.

Methods

The material for the present study was collected sporadically in the period of 2005–2020 from five mountain regions in Bulgaria: Maleshevska Planina Mts, Osogovska Planina Mts, Lyulin Mts, Western Rhodopes Mts and Stara Planina Mts (Central Balkan Range). The specimens were obtained by direct examination of suitable microhabitats (under the bark of dead trees), from collected wood samples or using flight interception traps. The abbreviations used in the material description are as follows: ex. – specimen/s; [BFUS] – Zoological Collection of Sofia University "St Kliment Ohridski", Faculty of Biology, Sofia, Bulgaria; [UF] – Entomological collection of University of Forestry, Sofia, Bulgaria.

Results and discussion

Pediacus dermestoides (Fabricius, 1792) (Fig. 1A, B)

Material: Maleshevska Planina Mts, 1.5 km NE of Razdol Vill., 41°37'37.1"N, 23°01'10.8"E, 1170 m a.s.l., 30.v. – 07.vii.2005, 1 ex., from fallen trunk of *Pinus sylvestris* L., with two adults of *Ips acuminatus* (Gyllenhal, 1827), found dead, D. Doychev leg. [UF]; Osogovska Planina Mts, 6.5 km S of Novo Selo Vill., 42°08'11.9"N, 22°40'31.7"E, 1270 m a.s.l.,

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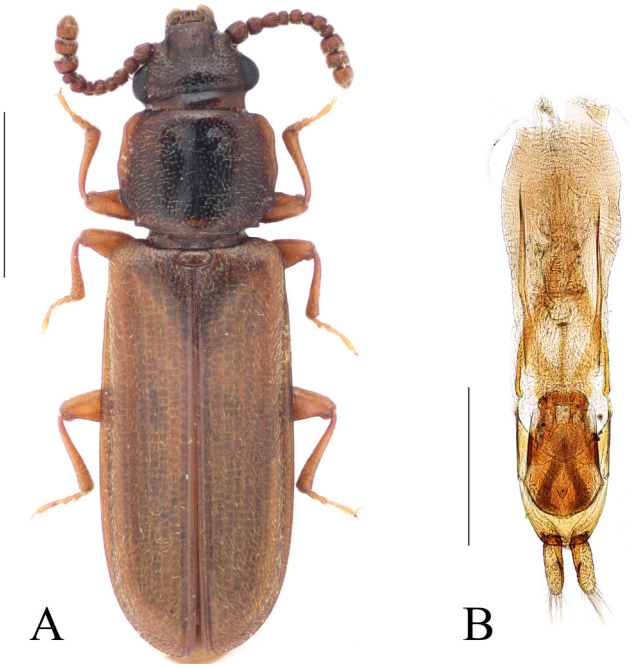

← Fig. 1. *Pediacus dermestoides,* male, Peshtera locality: (A) dorsal view, (B) aedeagus. Scale bars: 1 mm.

08.ix.2016, 1 ex., fallen trunk of *Pseudotsuga menziesii* (Mirb.) Franco, under the bark, D. Doychev leg. [UF]; Lyulin Mts, 700 m N of "Sts Cyril and Methodius" Monastery, 42°39'20.9"N, 23°11'10.3"E, 930 m a.s.l., 23.xi.2017, 2 ex., dead standing trunk of *Sorbus domestica* L. with galleries of *Scolytus mali* (Bechstein, 1805), under the bark, D. Doychev leg. [UF]; Western Rhodopes Mts, SW of Peshtera, near Novomahlenska Reka Riv., 42°00'31.1"N, 24°16'47.3"E, 570 m a.s.l., hornbeam forest, 30.vi.2020 – 26.vii.2020, 1 ♂, 1 ♀, flight interception trap, O. Sivilov & H. Hristova leg. [BFUS] (Fig. 2A); Stara Planina Mts, Central Balkan Range, SW of Chiflik Vill. (Troyan Municipality), near Beli Osam Riv., 42°49'24.4"N, 24°32'27.0"E, 760 m a.s.l., beech forest (*Fagus sylvatica* L.) with solitary trees of *Populus tremula* L., *Abies alba* Mill. and other tree species, 4.vii.2020 –

Fig. 2. Habitats of *Pediacus dermestoides* in Bulgaria: (A) Western Rhodopes Mts, Peshtera locality, (B) Stara Planina Mts, Chiflik locality.

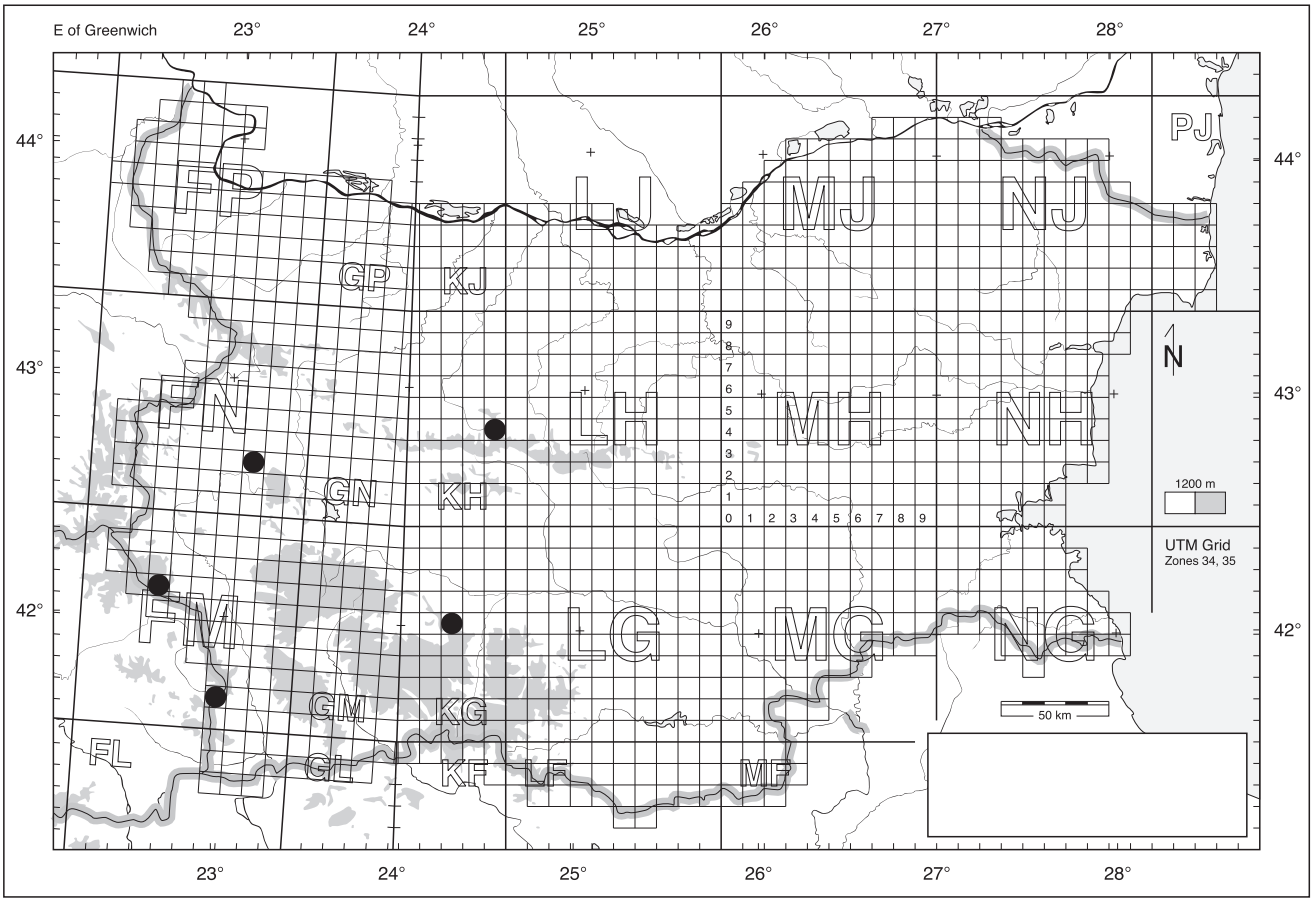

Fig. 3. Localities of *Pediacus dermestoides* in Bulgaria.

30.vii.2020, 1 ♂, flight interception trap, O. Sivilov & H. Hristova leg. [BFUS] (Fig. 2B).

All the specimens examined were collected as adults. The species can be recognised by the shape of the pronotum, shape of the antennomeres and the morphology of the aedeagus (Thomas, 2003). The adults of *Pediacus* can be distinguished from those of *Cucujus* by a number of characters, listed by Guéorguiev et al. (2008).

In Mainland Europe, the genus *Pediacus* is represented by the species *P. depressus* (Herbst, 1797), *P. dermestoides* (Fabricius, 1792) and *P. fuscus* Erichson, 1845 (Wegrzynowicz, 2007; Marris & Ślipiński, 2014). The diagnostic morphological characters of the three species are summarised and illustrated by Thomas (2003). All three species have a relatively wide distributional range (Wegrzynowicz, 2007) but only *P. dermestoides* (Fabricius, 1792) has been recently reported from SE Europe (a single finding from North Macedonia) (Guéorguiev et al., 2010). The present record of the species is the first one for Bulgaria and the second for the Balkan Peninsula.

Biology of the genus *Pediacus* is insufficiently studied (Marris & Ślipiński, 2014). Species of the genus are found under the bark of dead coniferous and deciduous trees (Thomas, 2003; Marris & Ślipiński, 2014). The species *P. dermestoides* is classified as "Data Deficient" in the European Red List of Saproxylic Beetles (Nieto & Alexander, 2010; Cálix et al., 2018). In North Macedonia, the species was collected under the bark of *Platanus orientalis* L. (Guéorguiev et al., 2010). In the present paper, we report the association of *P. dermestoides* with the tree species *Pinus sylvestris, Pseudotsuga menziesii* and *Sorbus domestica*. A number of studies have shown that the flight interception traps are effective for monitoring of *C. cinnaberinus* populations (e.g. Schlaghamerský et al., 2008; Vrezec et al., 2012). We demonstrate that they are also suitable for collecting representatives of the genus *Pediacus* as well.

In two of the reported in the present study five localities, Peshtera and Chiflik Vill. (Fig. 2A, B) another species of the family, *C. cinnaberinus*, was found in previous studies (Bekchiev et al., 2018). Probably *P. dermestoides* is a widespread in the mountain forest habitats with dead wood retention in the country. Its populations appear to exist in low numbers in Bulgaria and it has been overlooked in previous studies. The distributional map, based on reported localities of the species in Bulgaria, is presented in Fig. 3.

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Research article

Type specimens of Zygaenidae in the National Museum of Natural History, Sofia (Lepidoptera)

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Abstract: This paper comprises an annotated list of the type material of Zygaenidae kept in the National Museum of Natural History at the Bulgarian Academy of Sciences in Sofia. The collection contains types of five nominal species group taxa, described by B. Alberti, A. Drenowski and O. Holik.

Keywords: Bulgaria, holotype, nomenclature, paratype, Turkey

Introduction

The National Museum of Natural History at the Bulgarian Academy of Sciences, Sofia (NMNHS) is well known as a depository of important collections of Balkan Lepidoptera, with some taxa represented by types. Currently, the collection of Lepidoptera is housed in a modern Entomology Depot. The list presented here follows ICZN recommendation (1999: 72F.4) and continues the series of catalogues on types of the rich museum holdings.

Material and methods

The collection of Zygaenidae at NMNHS contains type material of five nominal species group taxa (18 specimens), described by Burchard Alberti, Alexander Drenowski and Otto Holik.

The species group taxa names are arranged in alphabetical order. Each entry includes the name, followed by the original combination quoted from the original publication, type locality, type specimens as specified with their labels and comments about the original description, type material and current taxonomic status of the taxon involved. Each line in the label's text is separated by a vertical line "|".

Results and discussion

antitaurica Holik, 1942

"*Zygaena carniolica* var. *antitaurica* m. var. nov." (Holik, 1942: 255). Type locality: Turkey: "Antitaurus in einer Höhe von 3300 m" (Holik, 1942: 255).

Holotype ♂ (Fig. 1) with labels: (1) handwritten (on white paper with double black frame) "Antitaurus | Hochalpin | 3300m. 1912"; (2) handwritten (on white paper with double black frame) "Zyg. carniolica | var. antitaurica | Hol | Ed. W. Siehe, Mersina."; (3) handwritten (on white paper) "det. Holik | 1940."; (3) printed (on red paper with handwritten inscriptions, here italicised) "TYPE | *carniolica* | *antitaurica* | *nova*"; (4) printed (on white paper) "NMNHS-INV-T-0344".

Paratypes 3 ♂♂ with labels: [1] printed (on white paper) "NMNHS-INV-T-0343"; [2] printed (on white paper) "NMNHS-INV-T-01183"; [3] printed (on white paper) "NMNHS-INV-T-01184"; paratypes 1 and 2

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Fig. 1 "*Zygaena carniolica* var. *antitaurica*", holotype ♂ (left: upperside, right: underside).

with additional, handwritten (on white paper) "det. Holik | 1940."; all the paratypes with additional: (1) handwritten (on white paper with double black frame) "Antitaurus | Hochalpin | 3300m. 1912"; (2) handwritten (on white paper with double black frame) "Zyg. carniolica | var. antitaurica | Holik | Ed. W. Siehe, Mersina."; (3) printed (on red paper with handwritten inscriptions, here italicised) "COTYPE | *carniolica* | *antitaurica* | *nova*".

The original type series consisted of 4 ♂♂ "Type und Cotypen" (Holik, 1942: 256). Currently treated as a valid subspecies of *Zygaena carniolica* (Scopoli, 1763) (Hofmann & Tremewan, 1996: 114).

drenowskii Alberti, 1939

"*Procris drenowskii* nov. spec." (Alberti, 1939: 43). Type locality: "Graecia orient. Mont. Athos, Chalcidice" (Alberti, 1939: 46).

Paratypes 3 ♂♂, 2 ♀♀ with labels: [1 ♂, genitalia and abdomen in a micro vial filled with glycerol] (1) printed (on white paper with handwritten inscriptions in Cyrillic, here italicised and transliterated) "Strandja pl 28 V-1-VI | *Vurgari* | D. Iltschew 1923"; (2) handwritten (on white paper) "26"; (3) handwritten (on red paper) "Bulgarien | Strandja pl.", on the back "B. Alberti | 1937"; (4) handwritten (on red paper) "Cotype | ♂", on the back "Procris | drenowskii"; (5) printed (on white paper) "NMNHS-INV-T-0313"; (6) printed (on white paper) "Adscita statices drenowskii | (Alberti, 1939) ♂ | det. A. Nahirnić-Beshkova | 22.02.2021"; [2 ♂] (1) printed (on white paper) "Rhodopy Belovo | A.et J.Milde"; (2) handwritten (on white paper) "20"; (3) handwritten (on red paper) "Cotype | ♂ | Rhodope", on the back "Procris | drenowskii | ♂ | B. Alberti | 1937"; (4) printed (on white paper) "NMNHS-INV-T-0316"; [3 ♂, genitalia mounted on microscopic slide labelled "Procris | drenowskii | (Insecta, Lepi- | doptera). Procris No. Bu. 7"] (1) printed (on white paper with handwrit-

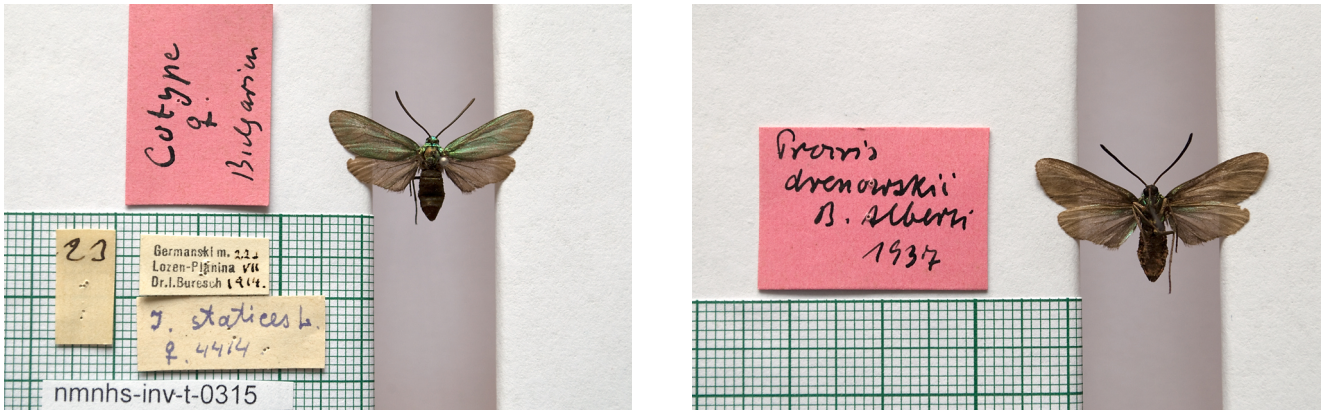

Fig. 2 "*Procris drenowskii*", paratype ♀ (left: upperside, right: underside).

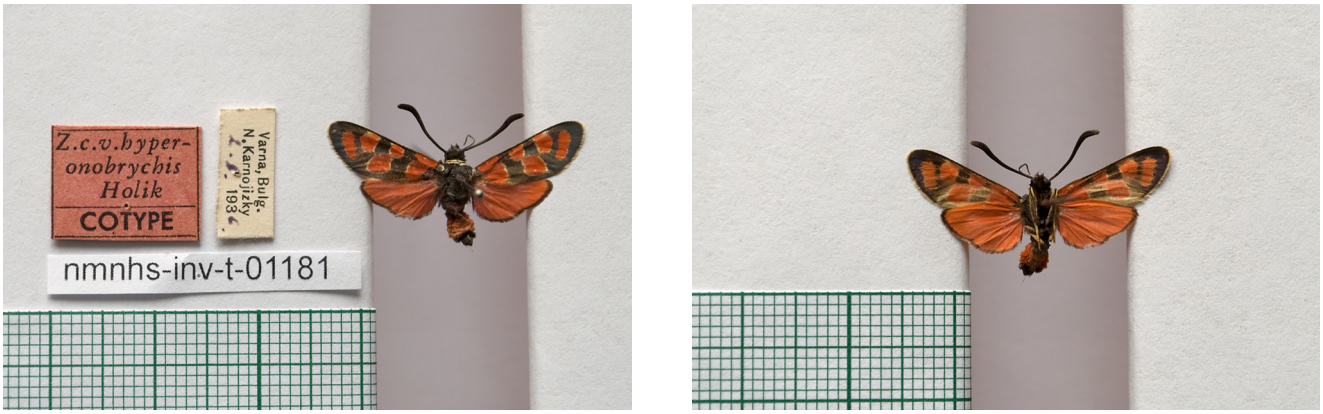

Fig. 3 "*Zygaena carniolica* var. *hyperonobrychis*", paratype ♂ (left: upperside, right: underside).

ten inscriptions, here italicised) "Pirin - Pl. *1600 m.* | Bnderitza [sic] 11-14.VII. | Dr Iw.Buresch. 915."; (2) handwritten (on white paper) "22"; (3) handwritten (on red paper) "Cotype | ♂ | Pirin pl.", on the back "Procris | drenowskii | B. Alberti | 1937"; (4) handwritten (on white paper) "Genital- | Präp. | No. Bu. 7"; (5) printed (on white paper) "NMNHS-INV-T-0317"; [4 ♀] (1) printed (on white paper with handwritten inscriptions, here italicised and transliterated) "Centr, Rodopy | Foten 22VI 924 | D. Iltchew *Selcha*"; (2) handwritten (on white paper) "24"; (3) handwritten (on red paper) "Cotype | ♀ | Rhodope", on the back "Procris | drenowskii | B. Alberti | 1937"; (4) printed (on white paper) "NMNHS-INV-T-0314"; [5 ♀] (Fig. 2) (1) printed (on white paper with handwritten inscriptions, here italicised) "Germanski m. *2.2.* | Lozen-Planina *VII* | Dr.I.Buresch *1914.*"; (2) handwritten (on white paper) "23"; (3) handwritten (on white paper) "J. statices L. | ♀ . 4414"; (4) handwritten (on red paper) "Cotype | ♀ | Bulgarien", on the back "Procris | drenowskii | B. Alberti | 1937"; (5) printed (on white paper) "NMNHS-INV-T-0315".

The original type series consisted of a holotype and numerous paratypes from Greece, Bulgaria, Turkey, Syria, North Macedonia (Alberti, 1939: 46). Currently treated as a different subspecies, *Adscita statices drenowskii* (Alberti, 1939) (Daniel et al., 1951: 18).

hyperonobrychis Holik, 1939

"*Zyg.*[*aena*] (*Argumenia* [sic] Hb.) *carniolica* Scop. var. *hyperonobrychis* m., (var. nov.)" (Holik, 1939: 200). Type locality: Bulgaria: "Varna" (Holik, 1939: 200).

Paratypes 4 ♂♂, 2 ♀♀ with labels: [1 ♂] (Fig. 3) printed (on white paper) "NMNHS-INV-T-01181"; [2 ♂] (1) handwritten (on white paper) "Varna. | 2.VIII.34. | Karnojizky"; (2) printed (on white paper) "NMNHS-INV-T-0338"; [3 ♂] (1) handwritten (on white paper) "Varna. | 2.VIII.1931 | Karnojizky."; (2) printed (on white paper) "NMNHS-INV-T-0339"; [4 ♂] (1) printed (on white paper with handwritten inscriptions, here italicised) "Varna, Bulg. | N. Karnojizky | *23. 7.* 193*4.*"; (2) printed (on white paper) "NMNHS-INV-T-0340"; [5 ♀] printed (on white paper) "NMNHS-INV-T-0337"; [6 ♀] printed (on white paper) "NMNHS-INV-T-01182"; paratypes 1, 5, 6 with additional, printed (on white paper with handwritten inscriptions, here italicised) "Varna, Bulg. | N. Karnojizky | *2. 8.* 193*6*"; all the paratypes with additional, printed (on red paper with black frame) "Z. c. v. hyper- | onobrychis | Holik | [line] | COTYPE".

The number of specimens in the original type series has never been mentioned (Holik, 1939: 200). Currently treated as a junior subjective synonym of *Zygaena carniolica wiedemannii* Ménétries, 1839 (Hofmann & Tremewan, 1996: 113).

rebeli Drenowski, 1928

"*Zygaena purpuralis* (Brünn.) n. var. *rebeli*" (Drenowski, 1928: 211). Type locality: Bulgaria: [Central Rhodopes (higher parts, near Manastirska Mahala and Shiroka Laka Villages and Chepelare Town), at an altitude 1400–1700 m] (Drenowski, 1928: 211).

Paralectotype ♂ (Fig. 4) with labels: (1) printed (on white paper with handwritten inscriptions, here italicised) "Rhodopegebirge | 192*3.VII* | Al. K.

Fig. 4 "*Zygaena purpuralis* var. *rebeli*", paralectotype ♂ (left: upperside, right: underside).

Drenowski", on the back handwritten, in Cyrillic, here transliterated "Nad s. Manastir | 18.VII— 1550 m"; (2) handwritten (on white paper with black frame) "Zygaena | purpuralis Brün | var. Drenowskii Brün"; (3) red paper, blank; (4) printed (on white paper) "NMNHS-INV-T-0336".

The number of specimens in the original type series has not been stated (Drenowski, 1928: 211–213). The lectotype has been designated by Naumann (1982: 379). Currently treated as a junior subjective synonym of *Zygaena purpuralis lathyri* Boisduval, [1828] (Hofmann & Tremewan, 1996: 74).

tonzanica Holik, 1939

"*Zyg.*[*aena*] (*Argumenia* [sic] Hb.) *carniolica* Scop. var. *tonzanica* m. (var. nov.)" (Holik, 1939: 194). Type locality: Bulgaria: "Slivno [Sliven]" (Holik, 1939: 194).

Paratypes 2 ♂♂ with labels: [1] (Fig. 5) (1) printed (on white paper with handwritten inscriptions, here italicised) "Sliven | *12.VI.1912* | P.Tschorbadjiew"; (2) handwritten (on white paper, in Cyrillic, here transliterated) "Cherk kor. | 12.VI.12"; (3) handwritten (on green paper, crossed) "Z. carniolica Z. | var amasina | Stgr."; (4) printed (on red paper with black frame) "Z. carniolica | v. tonzanica | Holik | [line] | COTYPE"; (5) printed (on white paper) "NMNHS-INV-T-0341"; [2] (1) printed (on white paper with handwritten inscriptions, here italicised) "Sliven | *24.VIII.1913* | P.Tschorbadjiew"; (2) handwritten (on white paper with black frame) "Slivno | Ablanovo | 24. VIII.913"; (3) printed (on red paper with black frame) "Z. carniolica | v. tonzanica | Holik | [line] | COTYPE"; (5) printed (on white paper) "NMNHS-INV-T-0342".

The number of specimens in the original type series has never been mentioned (Holik, 1939: 194). Currently treated as a junior subjective synonym of *Zy-*

Fig. 5 "*Zygaena carniolica* var. *tonzanica*", paratype ♂ (left: upperside, right: underside).

gaena carniolica wiedemannii Ménétries, 1839 (Hofmann & Tremewan, 1996: 113).

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Research article

Diversity of long-legged flies (Diptera, Dolichopodidae) of the Balkan Mountains (Bulgaria and Serbia)

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Abstract: The present paper gives information about 61 dolichopodid species distributed in the Balkan Mountains, Bulgaria and Serbia. Twenty-two species, collected from 13 localities, are new to the Balkan Mountains and seven of them (*Dolichopus longicornis, Hercostomus chetifer, Medetera pallipes, M. muralis, Neurigona quadrifasciata, N. pallida* and *Sciapus costea*) are new to the fauna of Bulgaria. *Medetera pallipes* and *Sciapus costea* are also new to the Balkan Peninsula. Thus, the total number of known species of the family Dolichopodidae for Bulgaria increases to 204.

Keywords: Balkan Mountains, Bulgaria, Dolichopodidae, fauna, new records, Serbia

Introduction

The dolichopodid fauna of the Balkan Mountain range (Stara Planina Mts) has not been subject of special study up to now. Some authors gave separate reports from the Balkan Mountains: Beschovski (1964, 1967, 1971 and 2013) listed nine species, Beschovski & Dzhambazhov (2002) reported one species, Olejniček & Barták (1997) listed one species from Dolni Chiflik, Grichanov (2016) recorded 24 species from the Serbian part of the Stara Planina Mts, while Kechev (2017) reported seven dolichopodids collected from the Sinite Kamani Natural Park and Yantra River near Veliko Tarnovo.

The main purpose of this paper is to provide new records of Dolichopodidae for the Stara Planina Mts and to make a review of the known species of the family for the mountain up to now.

Material and methods

The material for the present work was collected by means of sweep net by the author and by means of Malaise traps by M. Langourov, T. Ljubomirov and I. Todorov from 13 localities in the studied area (Fig. 1). After collection, the adults were put in vials containing 75% ethanol. The species were sorted in the laboratory, using a stereo microscope Carl Zeiss. For the determination of dolichopodids were used identification guides by Parent (1938), d'Assis Fonseca (1978), Grichanov (2007) and Negrobov & Stackelberg (1969). The faunistic list includes the following information: name of the species, material (male and female) and site of collection. The material presented in this paper as new to the Balkan Mountains is housed in Mihail Kechev's collection in the Forest Research Institute, Bulgarian Academy of Sciences, Department of Forest Entomology, Phytopathology and Game Fauna, Sofia, Bulgaria.

Sites of collection:

Site 1: Chiprovtsi, 26.VII.2020, 43.365971 N 22.847796 E, 550 m a.s.l., sweeping net, M. Kechev. (Fig. 2).

Site 2: Varshets, 10.V–15.VI.2005, 43.199808 N 23.275018 E, 400 m a.s.l., Malaise trap, M. Langourov.

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Fig. 1. Map of the Balkan Mountains with sites of collection.

Site 3: Gavril Genovo Village, 18.VI–15.VII.2020, 43.370698 N 23.063437 E, 362 m a.s.l., Malaise trap, I. Todorov.

Site 4: Churek Village, 20.VII.2020, 42.790991 N 23.729589 E, 889 m a.s.l., sweeping net, M. Kechev.

Site 5: Divchovoto Village, 28.VIII.2020, 42.821615 N 24.267189 E, 856 m a.s.l., sweeping net, M. Kechev.

Site 6: Shipkovo Village, 20.VII.2020, 42.881828 N 24.573756 E, 657 m a.s.l., sweeping net, M. Kechev.

Fig. 2. River near Chiprovtsi.

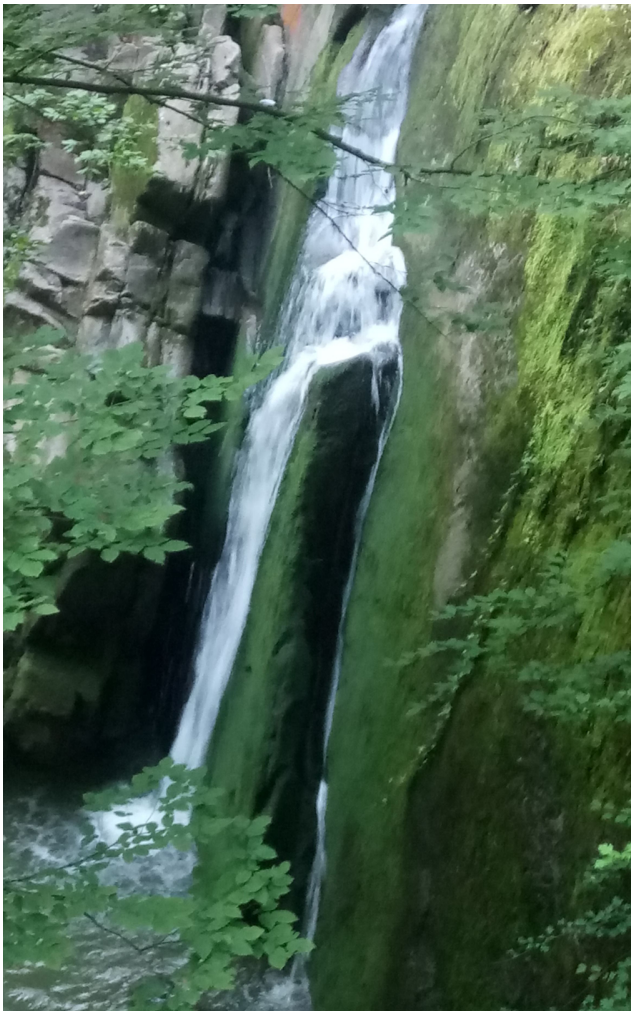

Fig. 3. Waterfall in the Kapincho Park near the Troyan Town.

Site 7: Kapincho Park near town of Troyan, 21.VII.2020, 42.883080 N 24.718593 E, 467 m a.s.l., sweeping net, M. Kechev. (Figs 3 and 4).

Site 8: Kaloferska Planina Mt, 42.641355 N 24.950285 E, 530 m a.s.l., Malaise trap, D. Ganeva & T. Ljubomirov.
8a: 14.V–02.VI.2010.
8b: 20.VII–01.VIII.2010.
8c: 01.VIII–10.VIII.2010.
8d: 20.IX–2.X.2010.

Site 9: Boaza Place, 21.VII.2020, 42.894308 N 24.963426 E, 437 m a.s.l., sweeping net, M. Kechev.

Site 10: Elenska River, near the town of Elena, 21.VII.2020, 42.928457 N 25.711370 E, 443 m a.s.l., sweeping net, M. Kechev.

Site 11: Kotelska River, near the town of Kotel, 29.VII.2020, 42.863379 N 26.480443 E, 444 m a.s.l., sweeping net, M. Kechev. (Fig. 5).

Site 12: Byala River, Zaichar Village, 27.VII.2020, 42.759319 N 27.143086 E, 477 m a.s.l., sweeping net, M. Kechev. (Fig. 6).

Site 13: Planinitsa Village, 27.VII.2020, 42.891613 N 27.172142 E, 242 m a.s.l., sweeping net, M. Kechev.

Balkan Mountains

The Balkan Mountains (Fig. 1) (Galabov, 1966; Glovnya & Blagoeva, 1982; Hubenov, 1997), also called the Balkans, is a mountain range situated in the eastern part of the Balkan Peninsula. The Balkan range runs 557 km from the Vrashka Chuka Peak on the border between Bulgaria and Serbia eastward through

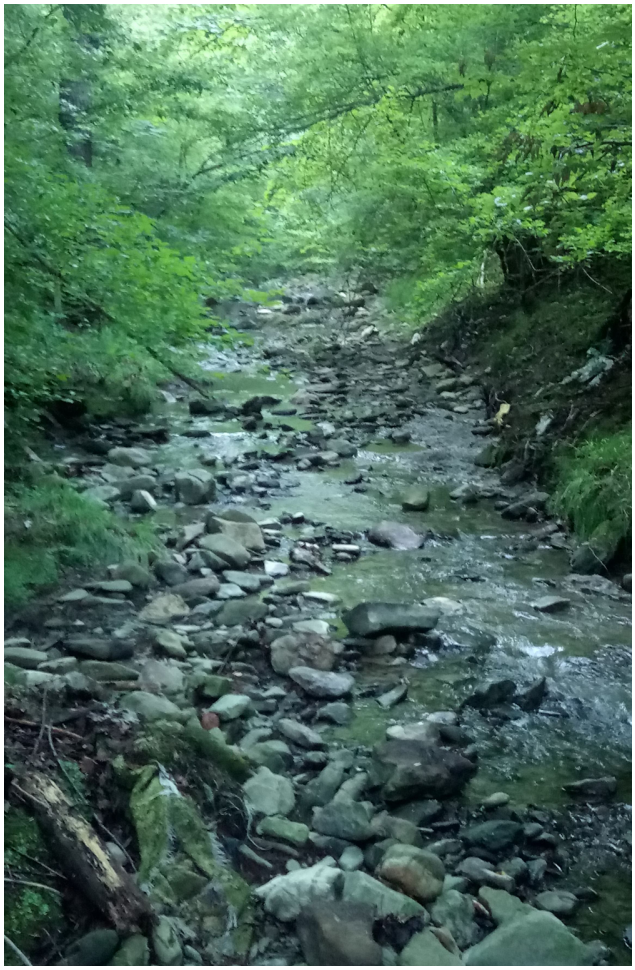

Fig. 4. River in the Kapincho Park near the Troyan Town.

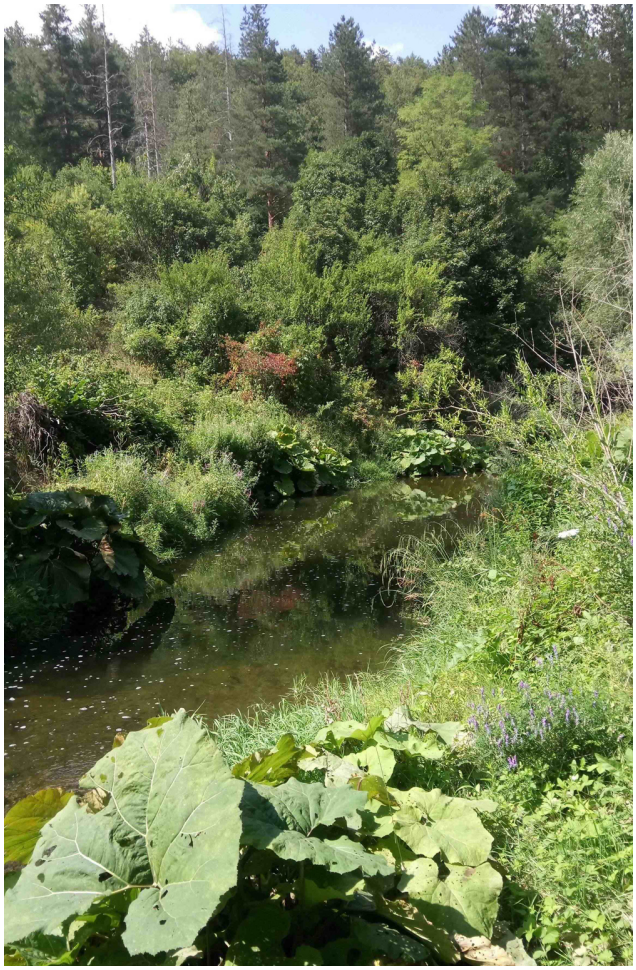

Fig. 5. Kotelska River.

central Bulgaria to Cape Emine on the Black Sea Coast.

Geologically, the Balkan Mountains are a mountain chain of fold mountains, a "young" part of the Alpine-Himalayan chain that stretches across most of Europe and Asia.

The Stara Planina (Balkan) range can be divided into three sections:

The Western Stara Planina extends from Vrashka Chuka to the Botevgrad Pass (Arabakonak) with a total length of 190 kilometres. The highest peak is Midzur (2169 m a.s.l.).

The Central Stara Planina runs from the Botevgrad Pass to the Vratnik Pass with a length of 207 kilometres. Botev Peak, the highest peak of the mountain (2376 m a.s.l.) is situated in this section.

The Eastern Stara Planina extends from the Vratnik Pass to Cape Emine with a length of 160 kilometres. The highest peak is Balgarka (1181 m a.s.l.).

Faunistic results

DIAPHORINAE

Argyra diaphana (Fabricius, 1775) – Serbia: Babin Zub (Grichanov, 2016).

Argyra ilonae Gosseries, 1989 – Serbia: Crni Vrh Village (Grichanov, 2016).

Argyra leucocephala (Meigen, 1824) – Material examined: Site 12: 1 male, 1 female. Note: First record for the Balkan Mountains.

Asyndetus latifrons (Loew, 1857) – Material examined: Site 1: 1 female. Note: First record for the Balkan Mountains.

Chrysotus angulicornis Kowarz, 1874 – Material ex-

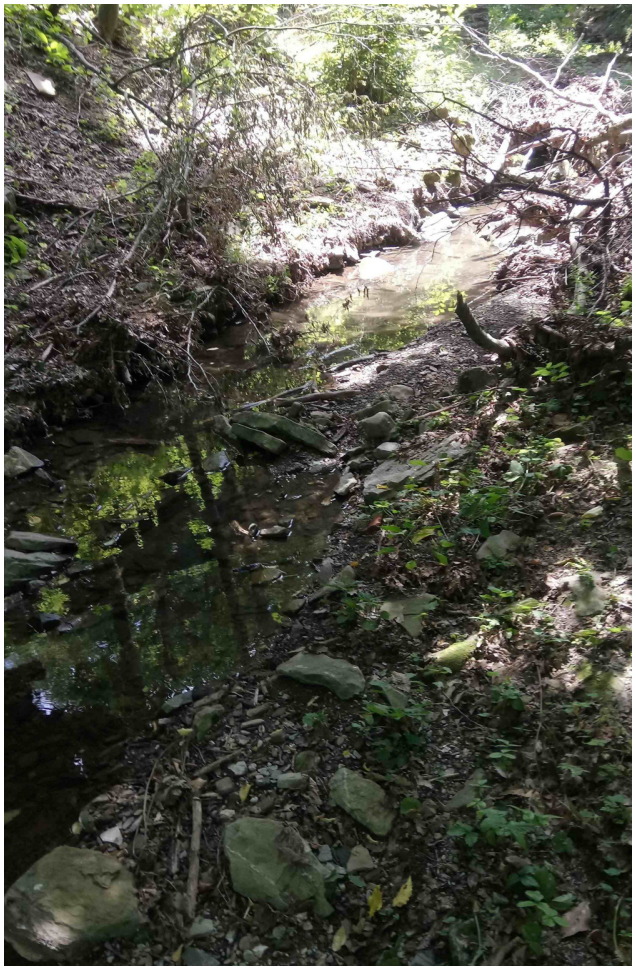

Fig. 6. Byala River near Zaichar Village.

amined: Site 12: 2 males. Note: First record for the Balkan Mountains.

Chrysotus cilipes Meigen, 1824 – Material examined: Site 8b: 1 female. Notes: First record for the Balkan Mountains.

Chrysotus femoratus Zetterstedt, 1843 – Bulgaria: Yantra River, Veliko Tarnovo (Kechev, 2017). New localities: Site 1: 1 male, 1 female; Site 4: 1 male; Site 10: 1 male.

Chrysotus gramineus (Fallén, 1823) – Material examined: Site 11: 1 male, 1 female. Note: First record for the Balkan Mountains.

Chrysotus laesus (Wiedemann, 1817) – Serbia: Babin Zub (Grichanov, 2016). New locality: Site 1: 2 males, 1 female.

Chrysotus obscuripes Zetterstedt, 1838 – Material examined: Site 8b: 1 male. Note: First record for the Balkan Mountains.

Chrysotus pennatus Lichtwardt, 1902 – Bulgaria: Yantra River, Veliko Tarnovo (Kechev, 2017).

Chrysotus suavis Loew, 1857 – Serbia: Kalna Village (Grichanov, 2016).

Diaphorus hoffmannseggi Meigen, 1830 – Serbia: Kalna Village (Grichanov, 2016).

DOLICHOPODINAE

Dolichopus campestris Meigen, 1824 – Bulgaria: Central Stara Planina Mts: Dermenkaja Chalet, 1500 m a.s.l. (Beschovski, 2013).

Dolichopus excisus Loew, 1859 – Bulgaria: East Stara Planina Mts: Sliven (Beschovski, 1967). New locality: Site 13: 1 male, 1 female.

Dolichopus lepidus Staeger, 1842 – Bulgaria: Central Stara Pl. Mts: Dermenkaja Chalet, 1500 m a.s.l. (Beschovski, 2013); Serbia: Babin Zub (Grichanov, 2016).

Dolichopus longicornis Stannius, 1831 (Fig. 7) – Material examined: Site 8c: 1 male. Note: First record for Bulgaria and second for the Balkan Peninsula.

Dolichopus longisetosus Negrobov, 1973 – Bulgaria: Petrohan Village (Beschovski & Dzhambazov, 2002).

Dolichopus picipes (Meigen, 1824) – Bulgaria: Central Stara Planina Mts: Koupena Peak, 1600 m a.s.l. (Beschovski, 2013).

Dolichopus salictorum Loew, 1871 – Material examined: Site 2: 1 male. Note: First record for the Balkan Mountains.

Dolichopus ungulatus (Linnaeus, 1758) – Serbia: Babin Zub (Grichanov, 2016).

Gymnopternus aerosus (Fallén, 1823) – Material examined: Site 1: 1 male, 2 females. Note: First record for the Balkan Mountains.

Fig. 7. *Dolichopus longicornis* Stannius, 1831.

Gymnopternus brevicornis (Staeger, 1842) – Serbia: Crni Vrh Village (Grichanov, 2016).

Gymnopternus celer (Meigen, 1824) – Serbia: Kalna Village (Grichanov, 2016). New locality: Site 6: 1 male, 14 females.

Hercostomus chetifer (Walker, 1849) – Material examined: Site 6: 1 male. Note: First record for Bulgaria.

Hercostomus nanus (Macquart, 1827) – Serbia: Kalna Village (Grichanov, 2016).

Hercostomus rusticus (Meigen, 1824) – Serbia: Babin Zub (Grichanov, 2016).

Poecilobothrus chrysozygos (Wiedemann, 1817) – Serbia: Kalna Village (Grichanov, 2016).

Poecilobothrus nobilitatus (Linnaeus, 1767) – Material examined: Site 8b: 1 male. Note: First record for the Balkan Mountains.

Sybistroma discipes (Germar, 1821) – Material examined: Site 6: 1 male. Note: First record for the Balkan Mountains.

Sybistroma impar (Rondani, 1843) – Bulgaria: Dolni Chiflik (Olejniček & Barták, 1997).

Sybistroma obscurellus (Fallen, 1823) – Material examined: Site 5: 5 males, 1 female. Note: First record for the Balkan Mountains.

Tachytrechus genualis Loew, 1857 – Serbia: Kalna Village (Grichanov, 2016).

HYDROPHORINAE

Hydrophorus balticus (Meigen, 1824) – Bulgaria: Sliven, Sinite Kamani Natural Park (Kechev, 2017); Serbia: Stara Planina (Grichanov, 2016).

Hydrophorus praecox (Lehmann, 1822) – Bulgaria: Kamchiya River (Beschovski, 1964).

Liancalus virens (Scopoli, 1763) – Bulgaria: Sliven, Sinite Kamani Natural Park (Kechev, 2017); Serbia: Babin Zub (Grichanov, 2016). New localities: Site 4: 1 male; Site 6: 1 male.

MEDETERANAE

Medetera jacula (Fallén, 1823) – Serbia: Babin Zub (Grichanov, 2016). New locality: Site 8a: 1 male, 1 female; Site 8b: 2 males, 2 females; Site 8d: 1 male, 1 female.

Medetera muralis Meigen, 1824 – Material examined: Site 8b: 1 male, 1 female. Notes: First record for Bulgaria.

Medetera pallipes (Zetterstedt, 1843) – Material examined: Site 3: 1 male, 1 female. Note: First record for Bulgaria and the Balkan Peninsula.

Medetera truncorum Meigen, 1824 – Serbia: Crni Vrh (Grichanov, 2016).

NEURIGONINAE

Neurigona quadrifasciata (Fabricius, 1781) – Material examined: Site 3: 1 female. Note: First record for Bulgaria.

Neurigona pallida (Fallén, 1823) – Material examined: Site 8a: 1 male, 4 females. Note: First record for Bulgaria and second for the Balkan Peninsula. The species was previously known only from the Olympus Mts (Grichanov, 2009).

Neurigona suturalis (Fallén, 1823) – Material examined: Site 2: 1 male. Note: First record for the Balkan Mountains.

RHAPHIINAE

Rhaphium caliginosum Meigen, 1824 – Bulgaria: Sliven, Sinite Kamani Natural Park (Kechev, 2017); Serbia: Babin Zub and Kalna Village (Grichanov, 2016). New localities: Site 1: 3 females; Site 13: 1 male.

Rhaphium micans (Meigen, 1824) – Serbia: Crni Vrh (Grichanov, 2016).

Rhaphium riparium (Meigen, 1824) – Serbia: Kalna Village (Grichanov, 2016).

PELOROPEODINAE

Chrysotimus molliculus (Fallén, 1823) – Material examined: Site 8b: 1 male, 4 females; Site 8c: 5 females. Note: First record for the Balkan Mountains.

Peloropeodes acuticornis (Oldenberg, 1916) – Material examined: Site 9: 1 male. Note: First record for the Balkan Mountains.

SCIAPODINAE

Sciapus contristans (Wiedemann, 1817) – Bulgaria: Grozdiovo Village (Beschovski, 1967).

Sciapus costae Mik, 1890 (Fig. 8) – Material examined: Site 8b: 5 males, 4 females; Site 8c: 1 female. Note: First record for Bulgaria and the Balkan Peninsula.

Sciapus opacus (Loew, 1866) – Bulgaria: Kamchiya River (Beschovski, 1971).

Sciapus platypterus (Fabricius, 1805) – Bulgaria: Yantra River, Veliko Tarnovo (Kechev, 2017). New localities: Site 8b: 1 mele, 1 female; Site 8c: 2 males; Site 10: 1 female.

SYMPYCNINAE

Campsicnemus curvipes (Fallén, 1823) – Serbia: Stara Planina, Mts Babin Zub (Grichanov, 2016). New localities: Site 5: 2 males, 1 female; Site 12: 1 male.

Campsicnemus scambus (Fallén, 1823) – Bulgaria: Grozdiovo Village (Beschovski, 1967).

Campsicnemus umbripennis Loew, 1856 – Serbia: Babin Zub (Grichanov, 2016).

Sympycnus pulicarius (Fallén, 1823) – Bulgaria: Sliven, Sinite Kamani Natural Park (Kechev, 2017). New locality: Site 2: 1 male.

Syntormon denticulatum (Zetterstedt, 1843) – Serbia: Kalna Village and Crni Vrh (Grichanov, 2016).

Syntormon pallipes (Fabricius, 1794) – Bulgaria: Kamchiya River (Beschovski, 1964); Sliven, Sinite Kamani Natural Park (Kechev, 2017); Serbia: Crni Vrh and Babin Zub (Grichanov, 2016). New locality: Site 5: 1 female; Site 11: 1 male.

Teuchophorus medovoensis Kechev, Negrobov & Grichanov, 2014 – Material examined: Site 6: 1 male; Site 7: 3 male; Site 9: 7 males, 5 females. Note: First record for the Balkan Mountains.

Teuchophorus monacanthus Loew, 1859 – Bulgaria: Yantra River, Veliko Tarnovo (Kechev, 2017).

Teuchophorus simplex Mik, 1880 – Material examined: Site 6: 1 male, 1 female; Site 7: 2 males, 1 female; Site 9: 1 male, 1 female. Note: First record for the Balkan Mountains.

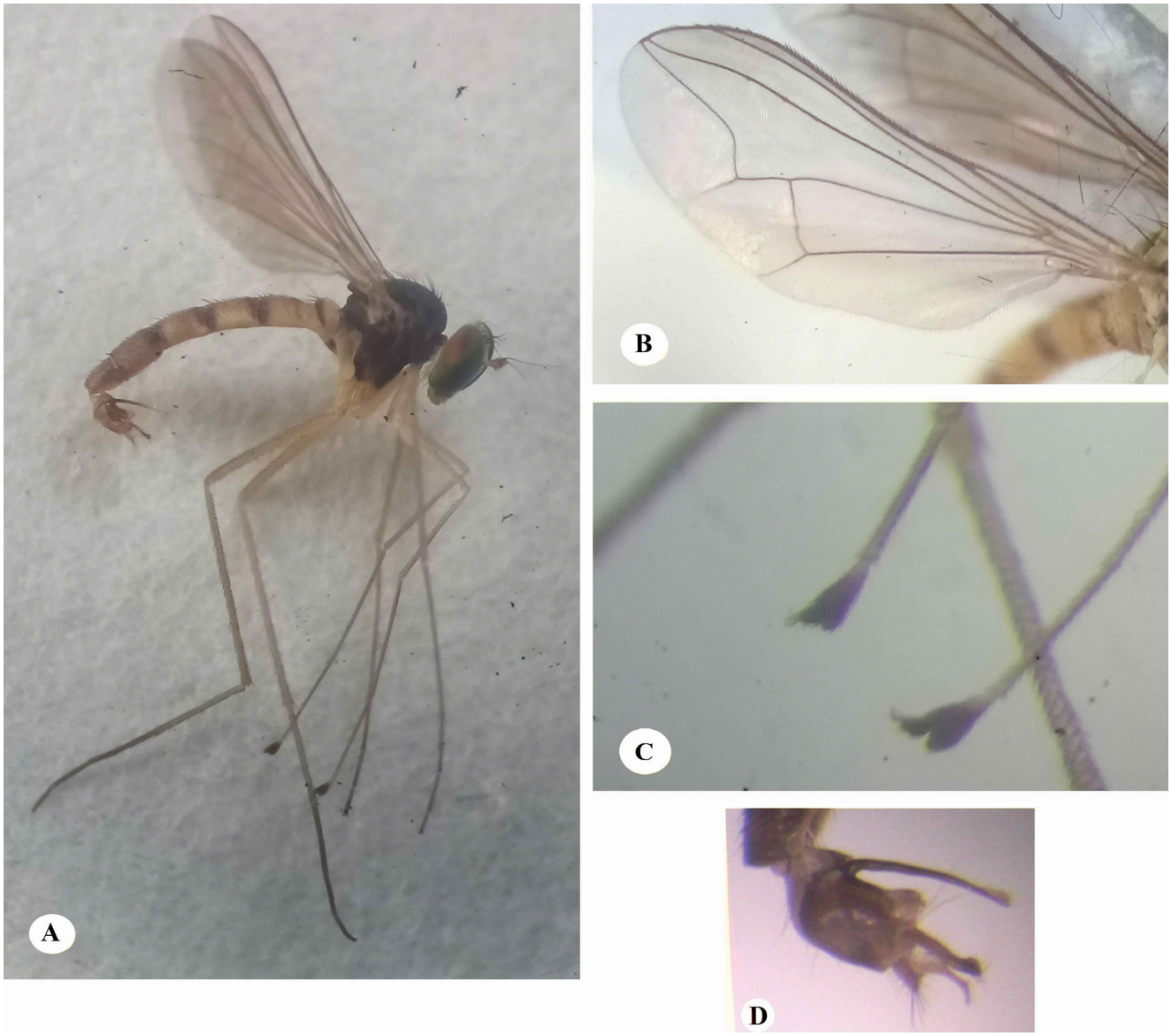

Fig. 8. *Sciapus costae* Mik, 1890: (A) habitus, (B) wing, (C) fore tarsi, (D) hypopygium.

Discussion

This paper presents information about 61 dolichopodid species, belonging to twenty-two genera and nine subfamilies found in the Balkan Mountains. Twenty-two species collected from 13 localities are recorded as new for the studied area, seven of which (*Dolichopus longicornis, Hercostomus chetifer, Medetera pallipes, M. muralis, Neurigona quadrifasciata, N. pallida* and *Sciapus costea*) are new to the fauna of Bulgaria. *Medetera pallipes* and *Sciapus costea* are also new for the Balkan Peninsula. With the new records for Bulgaria, the number of the dolichopodids in the country increases to 204 species. The total number of known species for the Balkan Mountains is 61 so far.

For the species *Chrysotus obscuripes, Medetera jacula, Peloropeodes acuticornis, Teuchophorus simplex* and *T. medovoensis* this study provides the second localities in Bulgaria. *Teuchophorus medovoensis* was described in 2014 from the Sarnena Sredna Gora Mountain with one male specimen (Kechev et al., 2014). Three years later, Kechev (2016) reported another male specimen from the same mountain and locality very close to the first one. This work gives three new localities of this species in the Balkan Mountains, collected at the same altitude as the type locality. The

species *Sciapus costae* is known only from Italy, France, Morocco and Tunisia (Grichanov & Negrobov, 2014). This survey expands the area of distribution of the species and provides the easternmost locality of *S. costae* so far.

The dolichopodids inhabit mostly humid places and all localities of collection in this survey, except Gavril Genovo, are in the vicinity of rivers and streams in the Balkan Mountains. The species found in Gavril Genovo are collected from an oak forest with lower humidity.

The study of predatory flies of the family Dolichopodidae in the Balkan Mountains is still insufficient and new surveys are needed. This work gives base for further investigations and it is probable that the real number of dolichopodids in this region will reach 140–150 species or more.

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Research article

Contribution to the identities and distribution patterns of Zygaenidae (Lepidoptera) from Romania

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Abstract: Zygaenid material collected from 25 localities in ten counties of Romania during 1967–2002 was examined. Fifteen species were found, of which *Jordanita notata* appears to reliably represent the only second population of the species in Romania, while the record of *J. budensis* seems to be the fifth locality for the country. We discuss several misidentifications of species published in previous publications and list their precise collection places and dates.

Keywords: faunistics, Procridinae, Romania, *Zygaena*

Introduction

Zygaenidae are a striking group of moths, whose vivid coloration, mostly diurnal habits and sometimes large population size make them very conspicuous and easily recognisable in the field. However, the complete opposite can be said when it comes to differentiating the various species, especially of subfamily Procridinae (the forester moths). Their similarity among adults has led to various confusions in different geographical distribution lists and has prompted the exclusive reliance on genital structures as specific diagnostic criteria. Such a confusion arose from two recently published papers listing forester moths and *Zygaena purpuralis* (Brünnich, 1763) from Southern Transylvania, Romania (Albu & Albu, 2018) and from the Vlăsia Plain, Muntenia, Romania (Albu & Albu, 2020), based on identifications made using superficial characters. One of the present authors, A. N.-B., dissected the specimens discussed in the above papers and pointed out several inexactitudes. Those data on Procridinae should be ignored as we provide here an updated list with the corrected identities of Zygaenidae in the first author's (V.A.) collection. We, hereby, also expand the distributional list of Romanian Zygaenidae with a series of previously unpublished data.

Material and methods

The sampling was conducted in 25 distinct places, spread out in ten counties. These ranged from an elevation of 50 m above sea level (a.s.l.) at the Hagieni forest and Călugăreni, and 1265, 1105 and 1020 m a.s.l. at the Fundata Village, Domogled Mountain and Poiana Braşov, respectively. We listed these localities in Table 1, providing their elevations and organising them based on their respective counties, along with listing the various species encountered in them. We used the web site "geonames.org" to obtain the correct spelling and elevation for each locality. All material used in this research was obtained through inspecting various flowering plants in diverse habitats during the day. The habitats visited were mountain meadows (Domogled, Poiana Braşov, Tâmpa, Săcele), pastures (Drăuşeni, Drăganu and Teliu Villages, Dealu Monastery), river edges (Pe-

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Table 1. Collecting localities and dates of Zygaenidae.

No.	County	Locality and altitude (m a.s.l.)	Date
1	Argeş	Drăganu Village, 360	03.VII.1998
2	Bistriţa-Năsăud	Mocod Village, 300	19.VI.2002
3a	Braşov	Braşov, Bartolomeu, 530	30.VII.1967
3b			02.VII.1968
4a		Poiana Braşov, 1020	18.VII.1982
4b			17.VII.1991
5a		Tâmpa Mountain, 960	18.VII.1969
5b			25.VII.1981
5c			30.VII.1981
5d			17.VII.1991
5e			14.VII.1998
6a		Drăuşeni Village, 480	20.VI.1981
6b			02.VII.1998
7a		Fundata Village, 1265	19.VII.1982
7b			13.VII.1998
8		Hoghiz, Bogata forest, 464	11.VII.1998
9a		Săcele, Piatra Mare Mountain, 650	18.VII.1969
9b			25.VII.1982
10a		Sânpetru, Lempeş Hill, 528	14.VII.1979
10b			23.VII.1981
11		Teliu, Întorsurii Mountain, 543	02.VII.1978
12		Vlădeni, 542	01.VII.1978
13	Caraş-Severin	Băile Herculane, 168	18.VI.1986
14		Băile Herculane, Crucea Albă, 529	02.VII.1996
15a		Băile Herculane, Domogled Mountain, 1105	03.VII.1981
15b			25.VI.1982
15c			21.IX.1982
16		Băile Herculane, Pecinişca, 134	28.VI.1998
17	Constanţa	Hagieni forest, Mangalia, 50	25.V.1982
18	Covasna	Breţcu Village, 600	23–24.VII.1982
19		Vâlcele Village, 640	19.VI.1981
20a	Dâmboviţa	Târgovişte, Dealu Monastery, 300	16.VI.1981
20b			17.VI.1982
21	Giurgiu	Călugăreni, 50	11.VII.1982
22	Ilfov	Bucureşti, Andronache forest, 80	17.VII.1981
23a		Bucureşti, Pasărea forest, 71	14.VIII.1974
23b			16.VII.1981
24		Chitila Village, 90	15.VII.1978
25	Neamţ	Potoci Village, 577	12.VI.2002

cinişca, Călugăreni), forest clearings and edges (Andronache, Pasărea, Hagieni and Bogata forests, Lempeş Hill), fields, gardens and roadside stretches, especially in villages (Mocod, Potoci and Brețcu Villages) and areas disturbed by anthropogenic activities (livestock grazed fields in Vlădeni, Vâlcele and Fundata Villages, vacant lots in Chitila and Braşov). Capture dates for the specimens in this study stretch from 1967 to 2002.

Preliminary identification based on habitus was done according to Naumann et al. (1999) and de Freina & Witt (2001). Re-determination was done by A. N.-B.

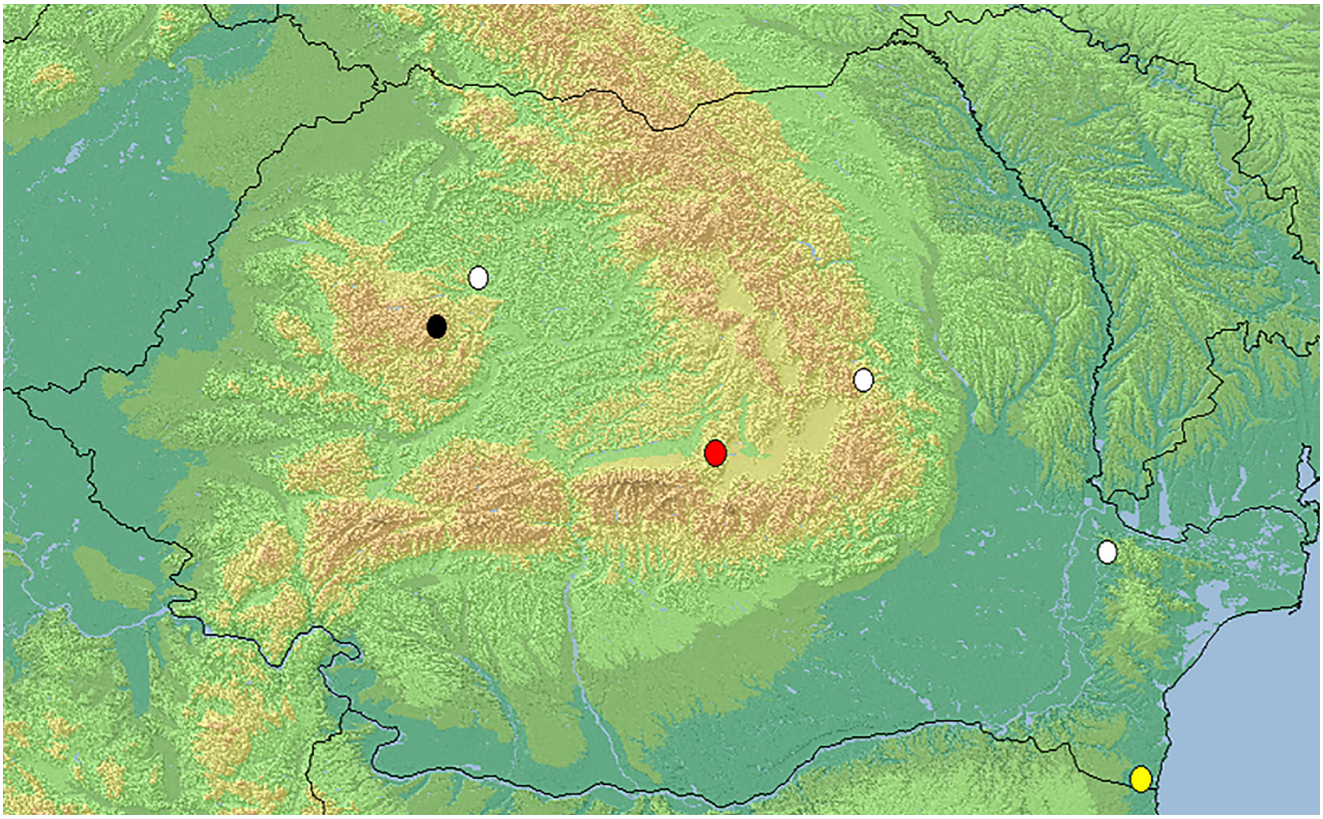

Fig. 1. Map of distribution of *Jordanita notata* (Zeller, 1847) and *J. budensis* (Speyer & Speyer, 1858) in Romania. Black dot – *J. notata* published record, red dot – *J. notata* new record, white dots – *J. budensis* published records, yellow dot – *J. budensis* new record. One white dot covers two very close localities.

on the basis of habitus for several uncertain specimens of *Zygaena,* habitus and genitalia for Procridinae and exclusively by genitalia dissection for *Z. purpuralis*. Genitalia dissections were done according to Robinson (1976). Abdomina and genitalia are preserved in micro vials filled with glycerol.

Results

List of species with the number of locality where they were recorded as presented in Table 1.

Procridinae

Rhagades pruni ([Denis &Schiffermüller], 1775): 2.
Adscita statices statices (Linnaeus, 1758): 1, 2, 12, 19.
Jordanita budensis (Speyer & Speyer, 1858): 17.
J. notata (Zeller, 1847): 12.
J. chloros (Hübner, [1813]): 5b, 15a.
J. globulariae (Hübner, 1793): 2, 6b, 11, 25.

Zygaeninae

Zygaena purpuralis (Brünnich, 1763): 2, 3b, 5a, 5d, 7a, 7b, 9a, 14, 18, 23a.
Z. carniolica (Scopoli, 1763): 10a.
Z. viciae ([Denis &Schiffermüller], 1775): 2, 7b, 25.
Z. loti ([Denis &Schiffermüller], 1775): 2, 3a, 5b, 5d, 5e, 6a, 7b, 10b, 20a, 20b, 21, 23b, 25.
Z. osterodensis Reiss, 1921: 15b.
Z. ephialtes istoki Silbernagel, 1944: 21, 22.
Z. ephialtes retyesati Holik, 1958: 5e.
Z. angelicae Ochsenheimer, 1808: 5c, 5e, 15b.
Z. filipendulae (Linnaeus, 1758): 4a, 4b, 6a, 6b, 7b, 8, 9b, 13, 15a, 15c, 16, 17, 24.
Z. lonicerae (Scheven, 1777): 18.

During this study, we recorded 111 specimens of family Zygaenidae pertaining to 15 species. Of these, 16 individuals of six species were of Procridinae and 95 specimens from ten species were of Zygaeninae. The most abundantly encountered species were *Z. fili-*

pendulae, Z. loti and *Z. purpuralis* (with 29, 25 and 23 specimens, respectively), representing subfamily Zygaeninae. The representatives of Procridinae were much less numerous. The most commonly encountered species of this group, *J. globulariae* and *A. statices* were represented by six and five specimens, respectively. The most frequently collected species were also the most widespread ones. *Z. loti* and *Z. filipendulae* were encountered at ten localities each, while *Z. purpuralis* at eight localities. An ungrazed and unmowed field on the outskirts of the Mocod Village contained the highest number of species, six. This was followed by the undisturbed meadows in the Tâmpa and Domogled Mountains (including Crucea Albă) with five species each. The places with severe anthropogenic disturbance, e.g. urbanisation (Chitila), agriculture (Dealu Monastery) or livestock overgrazing (Drăganu, Teliu, Vâlcele), were the most species-poor localities with only one species being recorded at each of them.

The earliest season record we had was that of a specimen of *J. budensis* from the Hagieni forest on May 25th. In June, we recorded nine species out of 33 specimens. In July, the assemblages were the most diverse and abundant, with 75 specimens representing 13 species. On the other hand, in August and September each one specimen was recorded, *Z. purpuralis* and *Z. filipendulae,* respectively.

Discussion

The last comprehensive catalogue of Romanian Lepidoptera (Rákosy et al., 2003), records 29 species of family Zygaenidae from Romania (12 species of Procridinae and 17 species of Zygaeninae). However, the authors cast doubts in their notes about the correct identities of several of the listed species, especially the ones from the older collections, which have not been dissected. Of those 29 species three should not be considered as members of the Romanian fauna: *Jordanita tenuicornis* (Zeller, 1847), *Zygaena cynarae* (Esper, 1789) and *Z. trifolii* (Esper, 1783). *Adscita obscura* (Zeller, 1847) is the most recent addition for Romania (Guenin, 2019). At present, 27 species of Zygaenidae are confirmed for Romania.

All records from Transylvania presented in our paper were published in Albu & Albu (2018). However, species of Procridinae (with exception of *J. chloros,* which is easy to determine on the basis of its habitus, unless it is very worn) and *Z. purpuralis* should not be considered correct because they were not determined according to genitalia. Moreover, two specimens of *Z. angelicae* from Tâmpa were wrongly reported as *Z. loti* and *Z. viciae,* while *Z. lonicerae* from the Breţcu Village was misidentifies as *Z. angelicae*. All other specimens were correctly determined. In Albu & Albu (2020), several specimens of Zygaenidae were reported only for the counties of the Vlăsia Plain without mentioning the exact localities. In that paper *A. statices* and *Z. purpuralis* were determined on the basis of habitus. In the present study, we provide additional information such as precise locality and date.

J. notata – This species was reported from Ineu (Arad County) by Căpuşe & Kovács (1987) and Bădeni (Cluj County) by Mihuţ (1997), but specimens were not dissected, so their identity remains in doubt (Rákosy et al., 2003). The first specimen of *J. notata* to be confirmed through genital dissection was collected in the Apuseni Mountains, around the village of Băişoara (Cluj County) at an elevation of 1200 m a.s.l. in 2002 (Rákosy et al., 2003). Craioveanu & Rákosy (2011) reported a series *J. notata* from the same locality. Our specimen from Vlădeni (Braşov County), collected in 1978, represents the only reliable record of this species outside the Apuseni Mountains population (Fig. 1).

J. budensis – This is a widely distributed but local species. In Romania it has been reported from Agapia (Neamţ County), Slănic-Moldova (Bacău County) and Fânațele Clujului – Copârșaie (Cluj County) by Popescu-Gorj (1964), Fânațele Clujului (Cluj County) by Popescu-Gorj (1964) and Rákosy (1987) and from Greci (Tulcea County) by Rákosy & Wieser (2000). Further reports of *J. budensis* from Caradja (1895–1896), Caradja (1934) and Czekelius (1934) do not contain information on determination methods; they are from the time when genitalia examination was not a common practice and the authors were not zygaenid specialists, thus we consider records of *J. budensis* mentioned therein as not reliable. The adult is on the wing from April to July. In that respect, the specimen from Agapia (recorded in August) seems very unusual for an elevation of about 500 m. The image of that specimen from the collection of Ostrogovich in Bucharest shows clearly that it belongs to the genus *Adscita* Retzius, 1783. The specimen from Slănic-Moldova is confirmed as *J. budensis*. In the collection of Delvig, there is one more record of this species from Băile Geoagiu (Hunedoara County) published by Ciochia & Barbu (1980). However, according to the report,

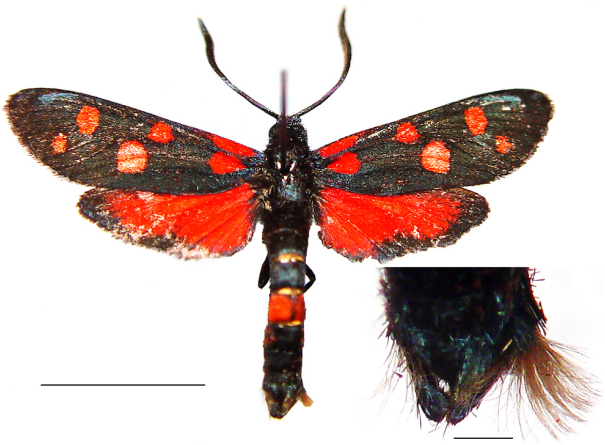

Fig. 2. *Zygaena ephialtes retyesati* Holik, 1948: adult and the tip of the abdomen with coremata. Scales = 1 cm and 1 mm, respectively.

this is a female and females of Procridinae (with rare exceptions) are impossible to identify without genital dissection. A search of the collection of Delvig housed in the Braşov County Museum of History showed that there is not a single specimen of Procridinae currently present in the collection. Some of the species that were difficult to identify were sent out by Alexandru Barbu for identification help, but it is not known to whom (Székely, personal communication). We do not know whether this specimen has been dissected or not. This makes our record from the Hagieni forest the fifth reliable locality for Romania and only the second for Dobrogea, along with the specimen from Greci (Fig. 1).

Z. purpuralis – *Z. purpuralis* complex is a very problematic group, which can be distinguished only by genitalia, larval coloration and larval host-plant (Hofmann & Tremewan, 2017; Nahirnić, 2019). In many papers listing species of this complex, the determination method is not mentioned and so is the case for the majority of papers concerning Romania. In Romania, two cryptic species are reported: *Z. purpuralis* and *Z. minos* ([Denis & Schiffermüller], 1775). *Zygaena purpuralis* is a common species but not all its literature records should be accepted as correct. The only sources known to us that provide appropriate evidence of *Z. minos* in Romania are Naumann et al. (1983), Rákosy & Lüthi (1995) and Rákosy & Wieser (2010). The expectancy of the third species, *Z. diaphana* Staudinger, 1887 should not be underestimated. The nearest known localities of this species are in eastern Serbia and western Bulgaria (Nahirnić, 2019; Nahirnić et al., 2019) and south-eastern Bulgaria (Nahirnić et al., in press). It could possibly inhabit steppe or steppe-like grasslands with abundance of *Eryngium campestre* L., its larval host-plant.

Z. ephialtes – *Z. ephialtes retyesati* is a subspecies restricted to the southern and eastern Carpathian Mountains in Romania (including Apuseni Mountains). Here it has polymorphic populations, mainly red or red to orange-red five-spotted peucedanoid, but also yellow and orange ephialtoid forms, with a broad hind wing border (Hofmann & Tremewan, 2020). Illustrations of this subspecies are given in de Freina & Witt (2001) and Hofmann & Tremewan (2020). We could not find any other images in online scientific literature or in other literature sources on Zygaenidae of Romania; therefore, we provide the photo of our specimen from the Tâmpa Mountain (Fig. 2). From many publications for Romania (as well as for the whole range of the species), it is not clear which subspecies is concerned. We emphasise that sampling of only one or a few specimens in order to prove the presence of the species at a certain locality is not enough for the subspecific determination. On the other hand, we do not encourage the collectiion of large series. It can be very helpful to take photos or release specimens after the wing pattern is noted. Precise information is very important for determining the distributional patterns of this highly polymorphic species and its evolutionary history. We illustrate the coremata of our *Z. ephialtes* from Tâmpa Mountain (Fig. 2) as coremata images of *Zygaena* species have not been found online at the time of the preparation of the manuscript.

Literature records of Procridinae and *Zygaena purpuralis* complex in Romania should be taken with caution and collections should be re-examined, especially through dissection of genitalia. Reliable identifications can show different distribution patterns than those currently published in the literature for the species of Zygaenidae of Romania.

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Research article

First fossil jewel beetle (Insecta: Coleoptera: Buprestidae) from Middle Miocene deposits in Bulgaria

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Abstract: The first fossil jewel beetle discovered in Bulgaria is reported from deposits of the Satovcha Basin dated to the Middle Miocene.

Keywords: Balkans, Buprestidae, Miocene, Rhodopes, Satovcha

Introduction

The present contribution is a continuation of the study of the fossil insects from deposits of the Satovcha Basin dated to the Middle Miocene. Up to now, the fossil dragonflies and March flies were investigated from the region (Nel et al., 2016; Simov et al., 2021).

Here we present the first data of Miocene fossil coleopterans from Bulgaria, which represent also the first record of the fossil representative of the family Buprestidae from the country.

Material and methods

The studied fossil specimens were collected during the palaeobotanical expeditions in the region of Satovcha in the period 1958–1967, and in the beginning of the 1980s (Nel et al., 2016, Simov et al., 2021).

The Satovcha Basin (Satovcha Graben), which is located on the southern slopes of the western Rhodopes (SW Bulgaria), unfolds to the east from the Satovcha Village, Blagoevgrad District. The site corresponds to a large, deep, eutrophic freshwater palaeolake (Vatsev & Pirumova, 1983; Vatsev, 1999). It is filled with Tertiary freshwater sedimentary and volcanic rocks. Two official lithostratigraphic units are recognised in the basin: the Satovcha Formation and the Sivik Formation (Vatsev & Pirumova, 1983). The Sivik Formation covers the Oligocene volcanics and the sediments of the Satovcha Formation. The sedimentary rocks of the Sivik Formation lie discordantly on them and consist of sandstones, aleurolites, sandy clays and diatomites with coal streaks (Vatsev & Pirumova, 1983; Vatsev, 1999; Ivanov, 2013). The fossil insects reported here were discovered in the Sivik Formation. They have been preserved as compression fossils in diatomite clays with only minor relief.

Based on the total content of the macroflora from all layers of the Sivik Formation, Bozukov (2002) has determined its age as Middle Miocene. That dating was also confirmed by the pollen analysis (Ivanov, 2004, 2012, 2013) and accepted in Nel et al. (2016) and Simov et al. (2021). Since the studied fossil insects ori-

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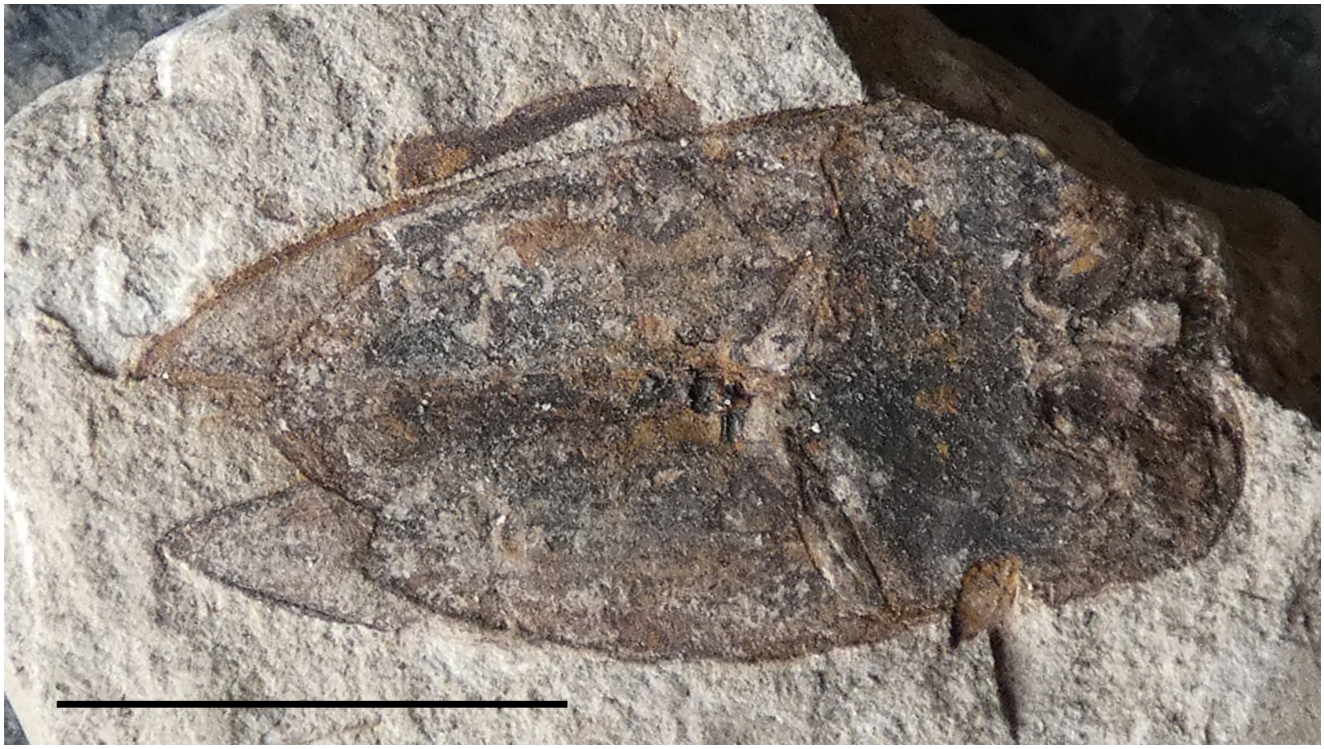

Fig. 1. Dicercini gen. sp. indet. (Coleoptera: Buprestidae): Cat-III-2151, Division of Palaeobotany and Palynology, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia, Bulgaria. Scale = 10 mm.

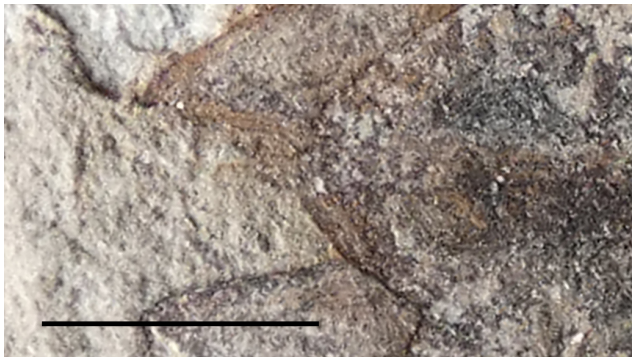

Fig. 2. Same, apical part of the abdomen with visible apical part of the aedeagus. Scale = 4 mm.

ginated from the lower part of Sivik Formation, their age should be considered as Middle Miocene.

Specimens were observed in dry state and photographed with camera Panasonic Lumix FZ82. All structures were measured (in mm) as preserved. The fossil specimens are deposited in the collections of the Division of Palaeobotany and Palynology, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-BAS).

Results and discussion

Systematic palaeontology

Coleoptera Linnaeus, 1758
Buprestidae Leach, 1815
Dicercini Gistel, 1848
gen. sp. indet. (Figs 1–2)

Material: male, Cat-III-2151 (part), Division of Palaeobotany and Palynology, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-BAS), Sofia, Bulgaria.

Description. Cat-III-2151 (part) (Fig. 1). Medium- to big- sized beetle, length 22 mm, width 10.5 mm, 2.1 times as long as wide. Dorsolaterally embedded, strongly compressed. Body brown to dark brown with darker parts of the pronotal disk and medial parts of the first 2/3 of ventral terga. Head not preserved. Pronotum transverse, moderately cordate. Pronotum length 8.6 mm and width 10.5 mm. Elytra obliquely truncate at humeri, sides then subparallel to mid length, arcuate to near apices and regularly arcuate just before apices. Elytra length ca. 15.5 mm, width 5.5 mm, length/width

= 2.82. Rather short and wide and finely punctato-striate. Hind legs with pale brown to brown femurs and darker tibia, robust; hind tibia 5 mm long. Last abdominal segment with broadly and gently arched apex. Partly extruded aedeagus is visible – widened in anterior half, narrowed in apical part (Fig. 2).

Remarks

The combination of the following features shows that the beetle undoubtedly belongs to family Buprestidae: body nearly cylindrical, slightly flattened, elongate-ovoid, cuneiform; pronotum irregularly quadrate, slightly narrowed in front and elytrae apically acuminate (Bellamy & Volkovitsh, 2005). The big size (22 mm), glabrous body, cordate pronotum, small scutellum, and more or less arcuate and finely punctato-striate elytra suggest it could be placed in the tribe Dicercini. Last abdominal segment with broadly and gently arched apex suggests the specimen is not of Chrysochroini. In general habitus the fossil beetle resembles much more representatives of the genera *Lampetis* Dejean, 1833 or *Perotis* Dejean, 1833 or other Dicercini. The incomplete preservation of the specimen does not allow species description or affiliation to exact genus.

The composition of the rich flora (Bozukov, 1998a, 1998b, 1999a, 1999b, 2000) supported the humid, warm-temperate to subtropical climate of this time interval (with temperatures above 15–16°C, and precipitation above 1000 mm) with frostless winters, while the vegetation corresponds to the mixed mesophytic forest (Ivanov, 2012, 2013). In terms of floristic composition, the fossil flora of Satovcha is closest to "evergreen broadleaved forest" and "mixed semi-evergreen forest" of Southeast Asia (Bozukov, 2001, 2002; Ivanov, 2012, 2013). Such conditions correspond well with the climatic requirements of the extant representatives of the above-cited buprestid genera. *Lampetis* and *Perotis* and Dicercini at all were widely distributed in present times in the tropic-subtropic regions of Asia, Africa and both Americas.

The discoveries of first fossil Buprestidae from the Middle Miocene in Bulgaria is of palaeobiogeographical importance. Currently, this is one of the oldest Miocene fossil records of Dicercini in Europe. A few described fossil species, *Perotis bruckmanni* Heer, 1862; *P. lavateri* Heer, 1847; *Capnodis antiqua* Heer, 1847; *C. puncticollis* Heer, 1847 and *C. spectabilis* Heer, 1862, originated from the locality of Öhningen (South Germany) with the age assigned to the Late Miocene (Selmeier, 1990; Lutz, 1997; Fikáček & Schmied, 2013).

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Research article

On the fauna of Psocoptera of Unguja (Zanzibar) Island (Tanzania, East Africa)

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Abstract: A total of 28 species of 13 families were registered. All species recorded were new records to the Zanzibar autonomous region, ten to Tanzania, eight to East Africa and two (*Lepidopsocus pretiosus* (Banks, 1942) and *Belaphopsocus murphyi* Lienhard, 1991) were new to the entire African continent. Original photos of 22 of the found species were provided, some of these species had never been photographed before.

Keywords: Africa, Insecta, new records, Psocoptera, Zanzibar

Introduction

The fauna of Psocoptera of the equatorial and tropical Africa is poorly studied. Some areas, such as Angola, South Africa, Kenya, Tanzania and Madagascar, have been studied and many new species have been described. However, extremely many white spots remain with an unclear species composition of Psocoptera from the region. One such unexplored area is the island of Unguja, part of the Zanzibar autonomous region of Tanzania. The only known psocid record from this area is of *Psocidus zanzibarensis* Pearman, 1934, a species described by a single specimen collected (Pearman, 1934). My aim was to contribute to the knowledge of the fauna of Psocoptera of this area and to the biodiversity in general, providing data for more conservation activities of the unique nature of the island.

Material and methods

All the material was collected from two areas of the east coast of the Unguja Island – north part of the Michamwi Peninsula (many closely situated spots) and at the entrance of the Kuza Cave near the Jambiani Village (Figs 1, 2). Three main habitats were surveyed: mangroves, dry coastal scrubland (Michamwi) and a patch of wet tropical forest (Kuza Cave). The species were identified according to identification keys in monographs or original descriptions (Badonnel, 1955; Broadhead, 1955; Thornton et al., 1972; Broadhead & Richards 1980, 1982; Lienhard, 1991, 1998 and other). Distributional data and taxonomy order followed Lienhard (2016).

Results

A total of 28 species of 13 families were registered. All species recorded were new records to the Zanzibar autonomous region, ten to Tanzania, eight to East Africa and two to the entire African continent. Original pictures of 22 of the found species, some of which had never been photographed before, were provided in Fig. 3.

Lepidopsocidae

Thylacella angustipennis Broadhead & Richards, 1982 (Fig. 3 A)

Material examined: Michamwi Peninsula: 5.3.2021, sandy coastal area with scrubs, from a pile of old palm leaf mats, S06 07 55.5 E39 29 31.2, 6 m a.s.l., 1 ♂, 1 ♀,

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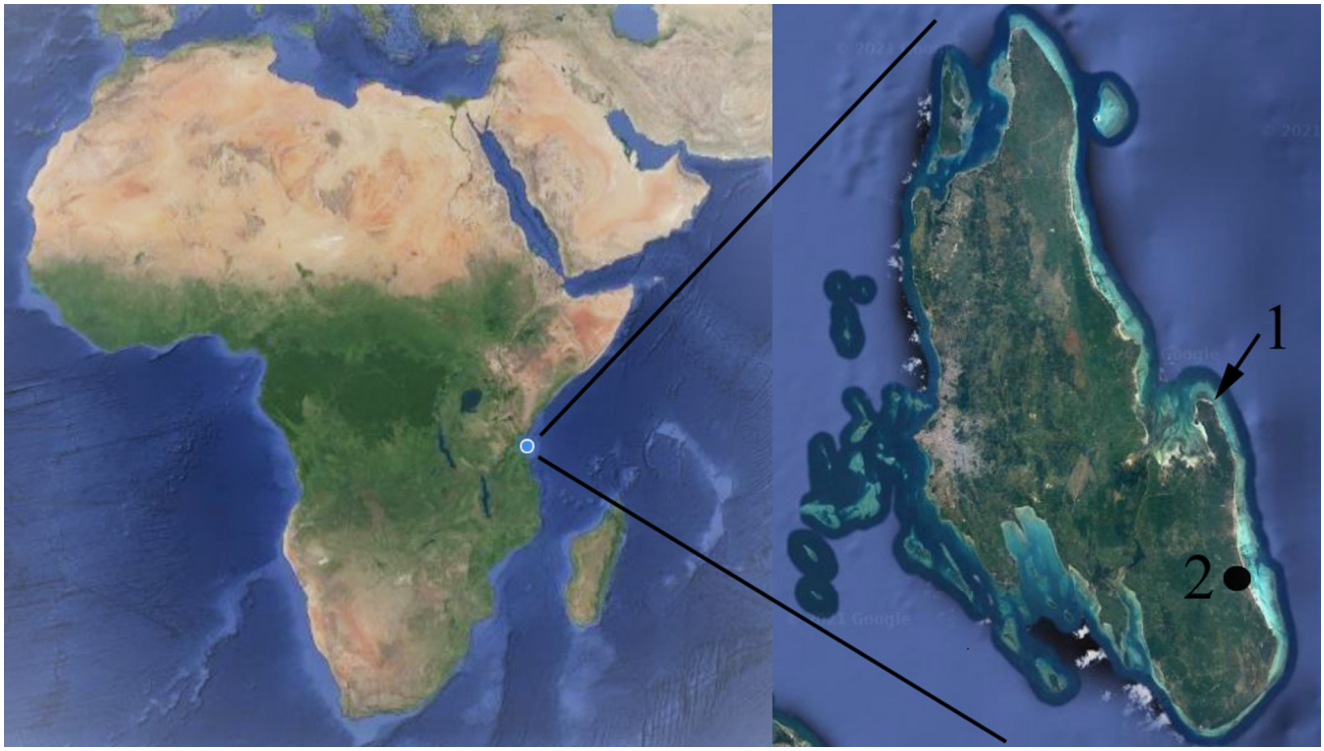

Fig. 1. Location map of the study area: 1 – the north part of the Michamwi Peninsula, 2 – at the entrance of the Kuza Cave, near the Jambiani Village.

collected by beating over white plastic container. Remarks: The species has been previously known only from its type locality in Kenya from a female specimen (Broadhead & Richards, 1982). The male, which has been found during the present study, is similar in colour with the female but its wings are a little bit more pointed and longer in comparison to the body. New record for Tanzania.

Echmepteryx madagascariensis (Kolbe, 1885) (Fig. 3 B)

Material examined: Michamwi Peninsula: 28.2.2021, yard of a hotel, on a trunk of *Panadanus* sp., S06 08 25.9 E39 29 26.4, 3 m a.s.l., 2 ♀♀, collected during night with a head torch by hand and a brush; same date, yard of a hotel, among *Cocos nucifera* and *Panadanus* sp., from fallen nests of *Ploceus subaureus,* S06 08 30.5 E39 29 23.5, 5 m a.s.l., 3 ♀♀, collected by beating over white plastic container; same date, coastal area with bushes and palms, from dry leaves of *Cocos nucifera,* S06 08 44.1 E39 29 21.2, 14 m a.s.l., 3 ♀♀, collected by beating the vegetation; 3.3.2021, bushes near mangroves, from dry leaves of *Cocos nucifera,* S06 08 39.1 E39 29 35.6, 7 m a.s.l., 2 ♀♀, collected by beating the vegetation; 5.3.2021, sandy coastal area with scrubs, from a pile of old palm leaf mats, S06 07 55.5 E39 29 31.2, 6 m a.s.l., 2 ♂♂, 8 ♀♀, collected by beating over white plastic container; 6.3.2021, sandy coastal area with scrubs, from a pile of old palm leaf mats, S06 07 55.5 E39 29 31.2, 6 m a.s.l., 1 ♂, 3 ♀♀, 1 nymph, collected by beating over white plastic container; at the entrance of the Kuza Cave, near the Jambiani Village: 5.3.2021, wet forest at the cave entrance, from dry brunches with dry leaves, S06 18 14.5 E39 32 00.9, 25 m a.s.l., 2 ♀♀, collected by beating the vegetation. Remarks: Widespread species in the Tropics. New record for the Zanzibar autonomous region.

Echmepteryx pallida Smithers, 1965 (Fig. 3 D)

Material examined: At the entrance of the Kuza Cave, near the Jambiani Village: 5.3.2021, wet forest at the cave entrance, from dry brunches with dry leaves, S06 18 14.5 E39 32 00.9, 25 m a.s.l., 3 ♀♀, collected by beating the vegetation. Remarks: The species is known

Fig. 2. Some of the surveyed habitats of Psocoptera: (A) a patch of *Panadanus* sp. (S06 08 28.5 E39 29 35.0), locality of *Echmepteryx lunulata, Pachytroctes* cf. *bicoloripes, Belaphopsocus murphyi*; (B) dry coastal scrubland (S06 08 20.8 E39 29 28.8), locality of *Mepleres maculatus, Peripsocus keniensis, Ectopsocus* spp., *Trichopsocus coloratus, Lepolepis bicolor, B. murphyi* and other; (C) bushes at the tidal zone (S06 07 39.4 E39 29 28.2), locality of *Archipsocus textor* and *P. keniensis*; (D) sandy coastal area with scrubs, a pile of old palm leaf mats (S06 07 55.5 E39 29 31.2), locality of *Thylacella angustipennis, Echmepteryx madagascariensis, Liposcelis albothoracica, L. paetula* and *L. annulata*.

from Australia, Indonesia, Christmas Island, Polynesia and Equatorial Guinea in Africa. New record for East Africa.

Echmepteryx lunulata Thornton, Lee & Chui, 1972 (Fig. 3 C)

Material examined: Michamwi Peninsula: 1.3.2021, scattered bushes and trees, in a patch of *Panadanus* sp., from dry leaves of same plant, S06 08 28.5 E39 29 35.0, 6 m a.s.l., 1 ♂, 1 ♀, 1 nymph, collected by beating the vegetation; at the entrance of the Kuza Cave, near the Jambiani Village: 5.3.2021, wet forest at the cave entrance, from dry brunches with dry leaves, S06 18 14.5 E39 32 00.9, 25 m a.s.l., 2 ♀♀, collected by beating the vegetation. Remarks: The species is known from the Antilles, Equatorial Guinea, Chagos Archipelago, Reunion, Christmas Island, Indonesia, Japan, Galapagos, Hawaii, Melanesia, Micronesia. New record for East Africa.

Lepidopsocus pretiosus (Banks, 1942) (Fig. 3 E)

Material examined: Michamwi Peninsula: 28.2.2021, yard of a hotel, on a trunk of *Panadanus* sp., S06 08 25.9 E39 29 26.4, 3 m a.s.l., 2 ♀♀, collected during

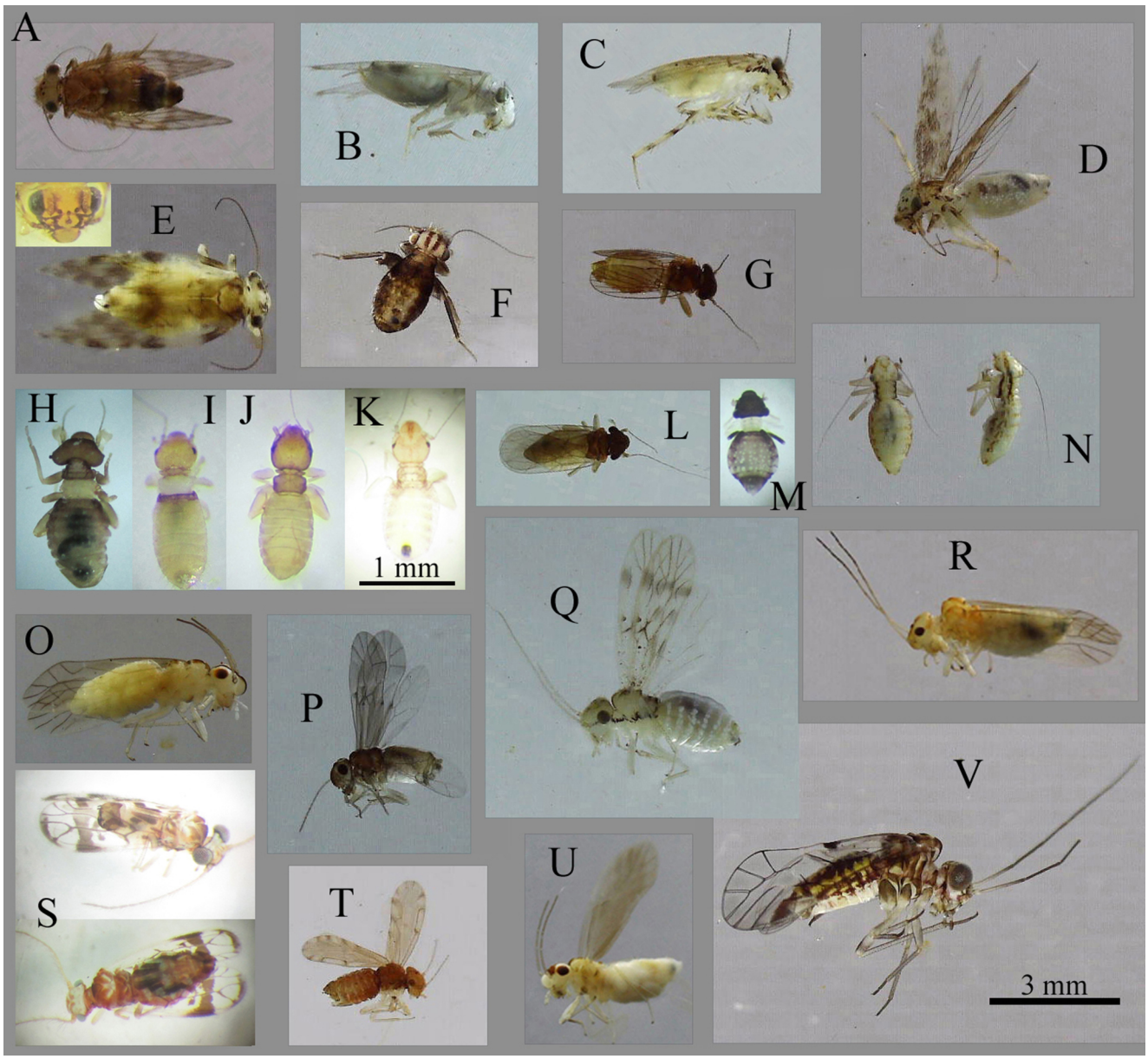

Fig. 3. External views of some of the species recorded: (A) *Thylacella angustipennis* ♀, (B) *Echmepteryx madagascarensis* ♀, (C) *E. lunulata* ♀, (D) *E. pallida* ♀, (E) *Lepidopsocus pretiosus* ♀, (F) *Lepolepis bicolor* ♀, (G) *Rhyopsocus afer* ♀, (H) *Belaphopsocus murphyi* ♀, (I) *Liposcelis albothoracica* ♀, (J) *L. paetula* ♀, (K) *L. annulata* ♀, (L) *Nanopsocus oceanicus* ♂, (M) *Pachytroctes* cf. *bicoloripes* ♀, (N) *Tapinella curvata* ♀, (O) *Stenocaecilius gilvus* ♀, (P) *Peripsocus keniensis* ♀, (Q) *Trichopsocus coloratus* ♀, (R) *Paracaecilius lucidus* ♀, (S) *Mepleres maculatus* ♂ [above] ♀ [below], (T) *Ectopsocus coccophilus* ♀, (U) *V. virgatus* ♀, (V) *Ptycta kiboschoensis* ♂.

night with a head torch by hand and a brush. Remarks: The species is known from Guam, Micronesia, Christmas Island, Indonesia, Melanesia and Polynesia. The morphology of the collected specimens agree with the redescription of Thornton et al. (1972). The specific head pattern of this species is shown in Fig. 3 E. New record for Africa.

Lepolepis bicolor Broadhead, 1955 (Fig. 3 F)

Material examined: Michamwi Peninsula: 27.2.2021, coastal area with bushes and palms, from dry leaves of *Cocos nucifera* on the ground, S06 08 44.3 E39 29 21.1, 4 m a.s.l., 1 ♀, collected by beating over white plastic container; 2.3.2021, scattered bushes and trees, brunches

of bushes and trees, S06 08 20.8 E39 29 28.8, 3 m a.s.l., 1 ♀, collected by beating the vegetation. Remarks: The species is known from Great Britain, Iles Glorieuses, Reunion and India. New record for Tanzania.

Trogiidae

Trogium pulsatorium (Linnaeus, 1758)

Material examined: Michamwi Peninsula: 28.2.2021, coastal area with bushes and palms, from grass of Poaceae, S06 08 44.1 E39 29 21.2, 14 m a.s.l., 8 ♀♀, collected by sweep netting. Remarks: Widespread species. New record for the Zanzibar autonomous region.

Psoquillidae

Rhyopsocus afer (Badonnel, 1948) (Fig. 3 G)

Material examined: Michamwi Peninsula: 28.2.2021, yard of a hotel, among *Cocos nucifera* and *Panadanus* sp., from fallen nest of *Ploceus subaureus,* S06 08 30.5 E39 29 23.5, 5 m a.s.l., 1 ♀, collected by beating over white plastic container. Remarks: The species is known from Congo, Angola, Equatorial Guinea, Ivory Coast, South Africa, Tanzania and India. New record for the Zanzibar autonomous region.

Liposcelididae

Liposcelis albothoracica Broadhead, 1955 (Fig. 3 I)

Material examined: Michamwi Peninsula: 28.2.2021, yard of a hotel, among *Cocos nucifera* and *Panadanus* sp., from a fallen nest of the golden weaver (*Ploceus subaureus*), S06 08 30.5 E39 29 23.5, 5 m a.s.l., 1 ♀, collected by beating over white plastic container; same date, coastal area with bushes and palms, from dry leaves of *Cocos nucifera,* S06 08 44.1 E39 29 21.2, 14 m a.s.l., 1 ♀, collected by beating the vegetation; 2.3.2021, scattered bushes and trees, brunches of bushes and trees, S06 08 20.8 E39 29 28.8, 3 m a.s.l., 1 ♀, collected by beating the vegetation; 4.3.2021, scattered bushes and trees, small nest fallen on the ground, S06 08 18.7 E39 29 38.6, 4 m a.s.l., 1 ♀, collected by beating over white plastic container; 5.3.2021, sandy coastal area with scrubs, from a pile of old palm leaf mats, S06 07 55.5 E39 29 31.2, 6 m a.s.l., 1 ♀, collected by beating over white plastic container. Remarks: The species was described from Great Britain as translocated (in Turkey millet seed in ship's hold). Later, it was found in West Africa (Cape Verde Islands and Senegal) and Mexico. New record for East Africa.

Liposcelis annulata Badonnel, 1955 (Fig. 3 K)

Material examined: Michamwi Peninsula: 5.3.2021, sandy coastal area with scrubs, from a pile of old palm leaf mats, S06 07 55.5 E39 29 31.2, 6 m a.s.l., 5 ♀♀, collected by beating over white plastic container; 6.3.2021, same locality and methods, 1 ♂, 4 ♀♀. Remarks: The species has been previously known from Angola and Kenya. New record for Tanzania.

Liposcelis bostrychophila Badonnel, 1931

Material examined: Michamwi Peninsula: 28.2.2021, yard of a hotel, from a trunk of *Panadanus* sp., S06 08 25.9 E39 29 26.4, 3 m a.s.l., 1 ♀, collected by beating the vegetation; same date, coastal area with bushes and palms, from dry leaves of *Cocos nucifera,* S06 08 44.1 E39 29 21.2, 14 m a.s.l., 1 ♀, collected by beating the vegetation; 6.3.2021, yard of a hotel, among *Cocos nucifera* and *Panadanus* sp., from a fallen nest of the golden weaver, S06 08 30.5 E39 29 23.5, 5 m a.s.l., 1 ♀, collected by beating over white plastic container; same date, sandy coastal area with scrubs, from a pile of old palm leaf mats, S06 07 55.5 E39 29 31.2, 6 m a.s.l., 2 ♀♀, collected by beating over white plastic container. Remarks: Widespread species. New record for Tanzania.

Liposcelis paetula Broadhead, 1950 (Fig. 3 J)

Material examined: Michamwi Peninsula: 27.2.2021, coastal area with bushes and palms, from dry leaves and grasses on the ground, S06 08 44.3 E39 29 21.1, 4 m a.s.l., 2 ♀♀, collected by sieving; 5.3.2021, sandy coastal area with scrubs, from a pile of old palm leaf mats, S06 07 55.5 E39 29 31.2, 6 m a.s.l., 1 ♀, collected by beating over white plastic container. Remarks: The species has been previously known from Great Britain, Italy, Canary and Cape Verde Islands and Madeira. The specimens collected on the Unguja Island are darker in colour as compared to these mentioned by Lienhard (1998) from the Canary Islands. New record for East Africa.

Belaphopsocus murphyi Lienhard, 1991 (Fig. 3 H)

Material examined: Michamwi Peninsula: 1.3.2021, scattered bushes and trees, a patch of *Panadanus* sp., from dry leaves, S06 08 28.5 E39 29 35.0, 6 m a.s.l., 1 ♀, collected by beating over white plastic container; 2.3.2021, scattered bushes and trees, brunches of bushes and trees, S06 08 20.8 E39 29 28.8, 3 m a.s.l., 1 ♀, collected by beating the vegetation. Remarks: This species has been previously known only from its type locality in Singapore. The morphology of the two female specimens collected during the present study fits with the original description of Lienhard (1991) (Fig. 3 H). New record for Africa and second record of this species.

Pachytroctidae

Nanopsocus oceanicus Pearman, 1928 (Fig. 3 L)

Material examined: Michamwi Peninsula: 28.2.2021, yard of a hotel, among *Cocos nucifera* and *Panadanus* sp., from a fallen nest of the golden weaver, S06 08 30.5 E39 29 23.5, 5 m a.s.l., 1 ♂, collected by beating over white plastic container. Remarks: Widespread warm loving species. New record for Tanzania.

Pachytroctes cf. *bicoloripes* Badonnel, 1949 (Fig. 3 M)

Material examined: Michamwi Peninsula: 1.3.2021, scattered bushes and trees, a patch of *Panadanus* sp., from dry leaves, S06 08 28.5 E39 29 35.0, 6 m a.s.l., 1 ♀, collected by beating the vegetation; at the entrance of the Kuza Cave, near the Jambiani Village: 5.3.2021, wet forest at the cave entrance, from dry brunches with dry leaves, S06 18 14.5 E39 32 00.9, 25 m a.s.l., 8 ♀♀, collected by beating the vegetation. Remarks: The morphology of the specimens collected from Unguja has some similarities with that of *P. bicoloripes* mentioned by Badonnel (1955). The species *P. bicoloripes* has been previously known from the Ivory Coast, Angola, Senegal and India. New record of this genus and family for Tanzania.

Tapinella curvata Badonnel, 1949 (Fig. 3 N)

Material examined: Michamwi Peninsula: 1.3.2021, scattered bushes and trees, dry brunches with leaves of a broad leaf tree, S06 08 29.1 E39 29 33.4, 8 m a.s.l., 1 ♀, collected by beating the vegetation. Remarks: Known from West Africa (Congo, Angola, Nigeria and Senegal) and the United Arabian Emirates. New record for East Africa.

Caeciliusidae

Stenocaecilius gilvus (Pearman, 1932) (Fig. 3 O)

Material examined: Michamwi Peninsula: 27.2.2021, coastal area with bushes and palms, from dry leaves of *Cocos nucifera,* S06 08 44.3 E39 29 21.1, 4 m a.s.l., 1 ♀, collected by beating the vegetation. Remarks: The species has been previously known only from its type locality in Kenya. New record for Tanzania.

Valenzuela virgatus (Broadhead & Richards, 1982) (Fig. 3 U)

Material examined: Michamwi Peninsula: 27.2.2021, coastal area with bushes and palms, from dry leaves of *Cocos nucifera,* S06 08 44.3 E39 29 21.1, 4 m a.s.l., 1 ♀, collected by beating the vegetation. Remarks: The species has been previously known from continental Kenya and Tanzania. New record for the Zanzibar autonomous region.

Paracaecilius lucidus Broadhead & Richards, 1982 (Fig. 3 R)

Material examined: Michamwi Peninsula: 28.2.2021, coastal area with bushes and palms, from grass of Poaceae, S06 08 44.1 E39 29 21.2, 14 m a.s.l., 1 ♀, collected by sweep netting. Remarks: The species has been previously known only from its type locality in Kenya. New record for Tanzania.

Peripsocidae

Peripsocus keniensis Broadhead & Richards, 1980 (Fig. 3 P)

Material examined: Michamwi Peninsula: 2.3.2021, scattered bushes and trees, brunches of bushes and trees, S06 08 20.8 E39 29 28.8, 3 m a.s.l., 2 ♀♀, collected by beating the vegetation; same date, bushes at the periphery of the tidal zone, from brunches of bushes,

S06 07 39.4 E39 29 28.2, 2 m a.s.l., 2 ♀♀, collected by beating the vegetation; 3.3.2021, bush area on a limestone hill, from brunches of bushes and trees, S06 08 10.2 E39 29 40.3, 33 m a.s.l., 1 ♀, collected by beating the vegetation; 4.3.2021, bushes and trees at the tidal zone, brunches of bushes and trees, S06 07 58.5 E39 29 34.3, 8 m a.s.l., 1 ♀, collected by beating the vegetation. Remarks: The species has been previously known only from its type locality in Kenya. New record for Tanzania.

Ectopsocidae

Ectopsocopsis spathulata (Ball, 1943)

Material examined: Michamwi Peninsula: 4.3.2021, bushes and trees at the tidal zone, brunches of bushes and trees, S06 07 58.5 E39 29 34.3, 8 m a.s.l., 1 ♀, collected by beating the vegetation. Remarks: The species has been previously known only from its type locality in Congo. New record for East Africa.

Ectopsocus coccophilus Ball, 1943 (Fig. 3 T)

Material examined: Michamwi Peninsula: 2.3.2021, scattered bushes and trees, brunches of bushes and trees, S06 08 20.8 E39 29 28.8, 3 m a.s.l., 7 ♀♀, collected by beating the vegetation; 3.3.2021, bushes near mangroves, brunches of bushes, S06 08 39.1 E39 29 35.6, 7 m a.s.l., 1 ♀, collected by beating the vegetation; 4.3.2021, bushes and trees at the tidal zone, dry brunches with dry leaves, S06 07 58.5 E39 29 34.3, 8 m a.s.l., 1 ♂, 2 ♀♀, collected by beating the vegetation; 6.3.2021, yard of a hotel, among *Cocos nucifera* and *Panadanus* sp., from a fallen nest of *Ploceus subaureus,* S06 08 30.5 E39 29 23.5, 57 m a.s.l., 1 ♀, collected by beating the vegetation; at the entrance of the Kuza Cave, near the Jambiani Village: 5.3.2021, wet forest at the cave entrance, from dry brunches with dry leaves, S06 18 14.5 E39 32 00.9, 25 m a.s.l., 2 ♂♂, 24 ♀♀, collected by beating the vegetation. Remarks: The species has been previously known from Congo and Indonesia only on the base of females. Males were collected for the first time during the present study. Their coloration and size did not differ significantly from these of the females. The little difference was that the males had longer wings compared to the body length. New record for East Africa.

Ectopsocus longisetosus Broadhead & Richards, 1980

Material examined: Michamwi Peninsula: 2.3.2021, scattered bushes and trees, brunches of bushes and trees, S06 08 20.8 E39 29 28.8, 3 m a.s.l., 2 ♀♀, collected by beating the vegetation; 3.3.2021, bush area on a limestone hill, from brunches of bushes and trees, S06 08 10.2 E39 29 40.3, 33 m a.s.l., 1 ♀, collected by beating the vegetation; 4.3.2021, bushes and trees at the tidal zone, brunches of bushes and trees, S06 07 58.5 E39 29 34.3, 8 m a.s.l., 3 ♂♂, 3 ♀♀, collected by beating the vegetation; at the entrance of the Kuza Cave, near the Jambiani Village: 5.3.2021, wet forest at the cave entrance, from dry brunches with dry leaves, S06 18 14.5 E39 32 00.9, 25 m a.s.l., 2, collected by beating the vegetation. Remarks: The species has been previously known only from continental Tanzania. New record for the Zanzibar autonomous region.

Trichopsocidae

Trichopsocus coloratus Lienhard, 1983 (Fig. 3 Q)

Material examined: Michamwi Peninsula: 2.3.2021, scattered bushes and trees, from brunches of bushes and trees, S06 08 20.8 E39 29 28.8, 3 m a.s.l., 6 ♀♀, collected by beating the vegetation; 3.3.2021, bush area on a limestone hill, from brunches of bushes and trees, S06 08 10.2 E39 29 40.3, 33 m a.s.l., 1 ♀, collected by beating the vegetation; 4.3.2021, bushes and trees at the tidal zone, brunches of bushes and trees, S06 07 58.5 E39 29 34.3, 8 m a.s.l., 1 ♀, collected by beating the vegetation. Remarks: Till now the species has been previously known only from its type locality, Madeira Island. New record for East Africa.

Archipsocidae

Archipsocus textor Enderlein, 1911

Material examined: Michamwi Peninsula: 2.3.2021, bushes at the periphery of the tidal zone, from brunches of bushes, S06 07 39.4 E39 29 28.2, 2 m a.s.l., 1 ♀, collected by beating the vegetation. Remarks: The species has been previously known from continental Tanzania and Guinea. New record for the Zanzibar autonomous region.

Elipsocidae

Elipsocidae sp.

Material examined: Michamwi Peninsula: 28.2.2021, coastal area with bushes and palms, from Poaceae grasses, S06 08 44.1 E39 29 21.2, 14 m a.s.l., 1 nymph, collected by sweep netting. Remarks: The specimen collected is entirely brown, resembling the coloration of *Elipsocus ignobilis* Broadhead & Richards, 1982 known from continental Tanzania. The greyish-blue colour of its eyes also resembles the species mentioned. New record of this family for the Zanzibar autonomous region.

Pseudocaeciliidae

Mepleres maculatus (Broadhead & Richards, 1982) (Fig. 3 S)

Material examined: Michamwi Peninsula: 2.3.2021, scattered bushes and trees, from brunches of bushes and trees, S06 08 20.8 E39 29 28.8, 3 m a.s.l., 1 ♂, 3 ♀♀, collected by beating the vegetation Remarks: The species has been previously known only from its type locality in Kenya. It was described by macerated specimens long time preserved in ethanol, so the authors, Broadhead & Richards (1982), did not have the opportunity to describe the head coloration, having specific pattern (Fig. 3 S). New record for Tanzania.

Psocidae

Ptycta kiboschoensis (Enderlein, 1907) (Fig. 3 V)

Material examined: Michamwi Peninsula: 28.2.2021, yard of a hotel, on a trunk of Panadanus sp., S06 08 25.9 E39 29 26.4, 3 m a.s.l., 3 ♂♂ (and some more observed, staying in a cluster on the bark), 3 ♀♀, collected by hand and a brush during night with a head torch. Remarks: The species has been previously known only from its type locality in continental Tanzania. New record for the Zanzibar autonomous region.

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Research article

Records of terrestrial and mangrove snails (Mollusca: Gastropoda) from the Michamwi Peninsula, Unguja (Zanzibar) Island (Tanzania)

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Abstract: During a brief malacological survey, a total of 16 snail species were recorded (four mangrove amphibious, 12 terrestrial). For all the species new localities with GPS coordinates and habitat data are provided. The species *Thapsia insulsa* Preston, 1910 (Urocyclidae) is a new record to the island.

Keywords: Africa, amphibious, Gastropoda, new records, terrestrial

Introduction

Unguja, the main island of the Zanzibar Archipelago, lies about 6° south of the equator and 40 km east of the mainland of Africa and has an area of approximately 1600 km^2 (Pakenham, 1984). Most of the island is covered by high and low scrub forest, also known as a coral rag forest on ground characterised by numerous outcroppings of fossilised coral (Siex, 2011). This vegetation cover is classified as Eastern African Coastal Scrub Forest according to the Clarke's scheme (Burgess & Clarke, 2000).

The East African coastal land mollusc fauna remains poorly explored (Verdcourt, 2006). The territory of Zanzibar autonomous region (Republic of Tanzania) is one of the best studied in terms of species composition of land snails (Rowson, 2007; Rowson et al., 2010; Gittenberger & Bruggen, 2013) but many species have been reported without exact localities or they are problematic to find considering their names (Rowson, 2007). In this short note, I report of some exact species localities at the poorly known Michamwi Peninsula of the Unguja Island and one new record to the island malacofauna.

Material and methods

The study was carried out during the period 27.2.2021 – 6.3.2021. A few closely situated localities were surveyed at the northernmost area of the Michamwi Peninsula, east coast of the Unguja Island (Michamwi is situated on the opposite side of the Chwaka Bay from the Jozani Forest). The specimens (dry shells) were collected by hand or by sieving of soil and detritus. Species names are following Rowson (2007) and Gittenberger & Bruggen (2013).

Results and discussion

There were a total of 16 snail species recorded (four mangrove amphibious, 12 terrestrial). One of the terrestrial species is a new record to the fauna of the Un-

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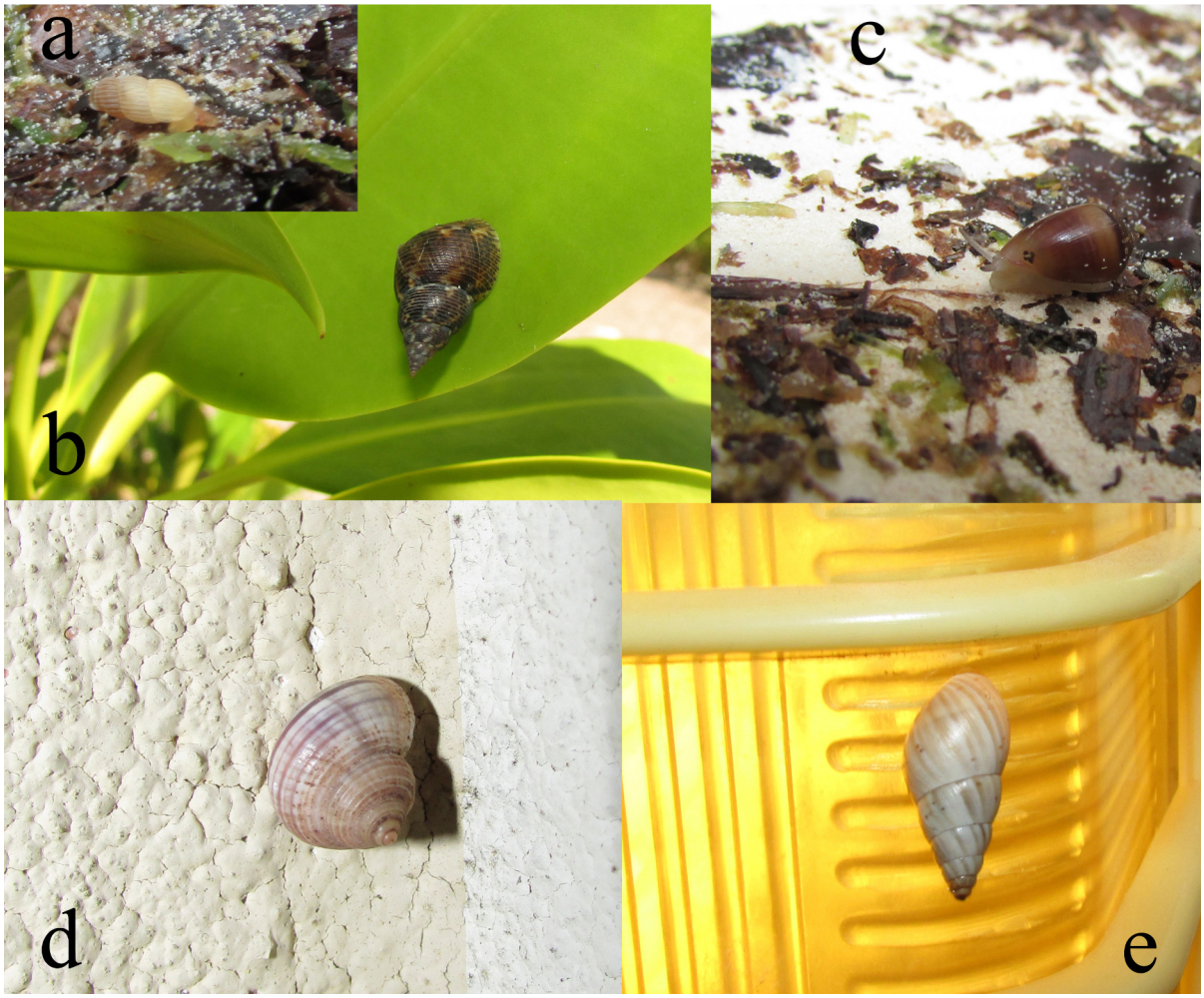

Fig. 1. Some of the living snail species recorded on the Michamwi Peninsula: (a) *Truncatella guerinii* (active specimen among detritus at low tide); (b) *Littoraria intermedia* (inactive, attached to a leaf of *Avicennia marina*); (c) *Melampus luteus* (active specimen among detritus and sand at low tide); (d) *Tropidophora zanguebarica* (inactive, attached to a wall); (e) *Rachis punctata* (inactive, attached to a lamp).

guja Island. For the rest of the species new localities with GPS coordinates and habitat data are provided.

MANGROVE AMPHIBIOUS SPECIES

Littorinidae

Littoraria intermedia (Philippi, 1846)

Material examined: 27.2.2021, mangrove dominated by *Avicennia marina* at a river estuary, south of the Michamwi Village, S06° 08' 45.5" E39° 29' 22.9", 5 m a.s.l., 1 shell and many living individuals observed (Fig. 1b); 2.3.2021, among rocks and various bushes at the periphery of the tidal zone, north-west coast of the peninsula, S06° 07' 39.4" E39° 29' 28.2", 2 m a.s.l., many living individuals observed. This species is widespread in the mangroves of the tropics (Abbott & Dance, 2000). In East Africa, it is rare in the coastal area of the continent but abundant on the nearby Pemba Island (Torres et al., 2008).

Ellobiidae

Melampus luteus (Quoy & Gaimard, 1832)

Material examined: 27.2.2021, mangrove dominated by *Avicennia marina* at a river estuary, south of the

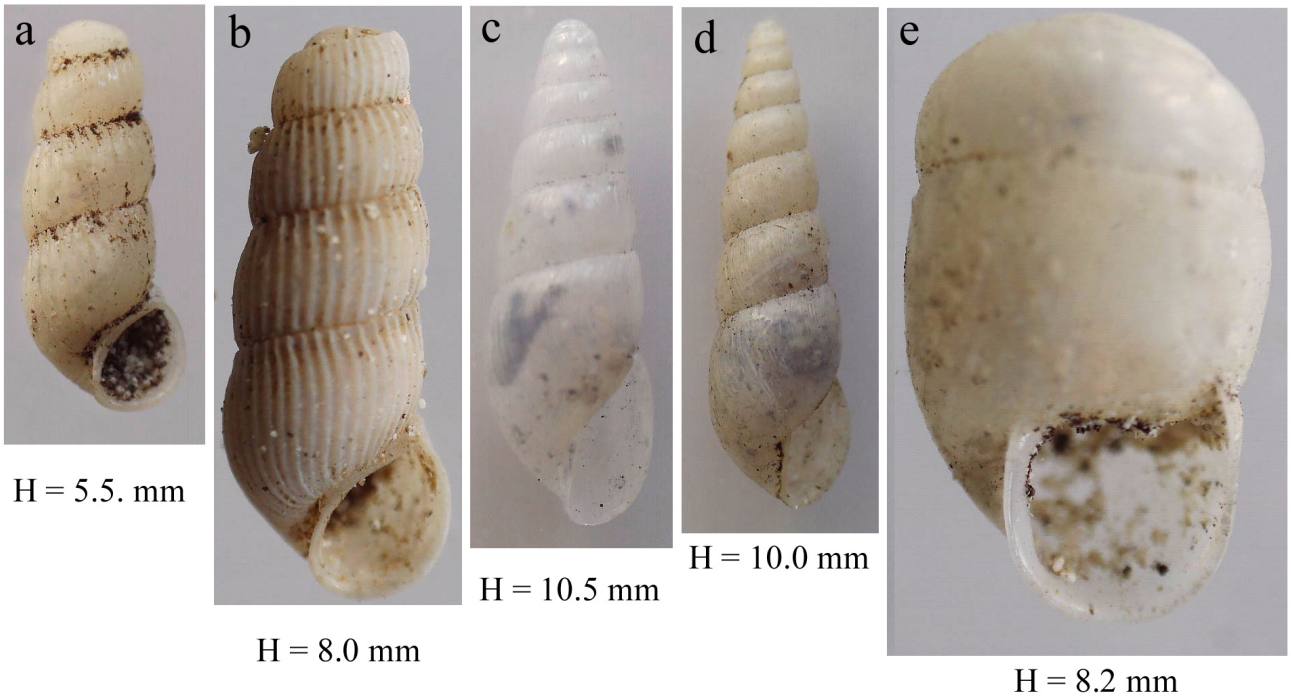

Fig. 2. Shells of some of the species collected: (a) *Truncatella marginata,* (b) *T. guerinii,* (c) *Opeas lamoense,* (d) *Allopeas gracile,* (e) *Gonaxis gibbonsi*.

Michamwi Village, S06° 08' 45.5" E39° 29' 22.9", 5 m a.s.l., 5 shells and many living individuals observed (Fig. 1c). Common estuarine species in the Indo-Pacific Region (Abbott & Dance, 2000).

Truncatellidae

Truncatella guerinii A. & J.B. Villa, 1841

Material examined: 27.2.2021, mangrove dominated by *Avicennia marina* at a river estuary, south of the Michamwi Village, S06° 08' 45.5" E39° 29' 22.9", 5 m a.s.l., 1 shell and many living individuals observed (Fig. 1a, 2b); 4.3.2021, Michamwi Village area, scattered bushes and trees on a sandy terrain, under rocks of a limestone hill, far from the tidal zone, S06° 08' 17.5" E39° 29' 38.8", 5 m a.s.l., 9 shells. Verdcourt (2006) mentioned *T. guerinii* from Zanzibar.

Truncatella marginata Küster, 1855

Material examined: 4.3.2021, Michamwi Village area, scattered bushes and trees on a sandy terrain, under rocks of a limestone hill, S06° 08' 17.5" E39° 29' 38.8", 5 a.s.l., 5 shells (Fig. 2a). The species has a coastal distribution from South Africa to the South Pacific (Muratov, 2010). Verdcourt (2006) mentioned *T. marginata* (as *T. teres* Pfeiffer, 1856, see Gittenberger & Bruggen, 2013) from Zanzibar.

TERRESTRIAL SPECIES

Pomatiasidae

Tropidophora zanguebarica (Petit, 1850)

Material examined: 28.2.2021, Michamwi Village area, yard of a hotel, S06° 08' 25.9" E39° 29' 26.4", 3 m a.s.l., 3 living individuals, attached to a wall (Fig. 1d); 4.3.2021, Michamwi Village area, scattered bushes and trees on a sandy terrain, under rocks of a limestone hill, S06° 08' 17.5" E39° 29' 38.8", 5 m a.s.l., 14 shells and many more observed in the area. The species was known from the coastal regions of continental Africa (Kenya, Tanzania and Mozambique) and the closely situated islands. From the Unguja Island it has been recorded with an exact locality at the Jozani Forest (Rowson, 2007; Rowson et al., 2010; Muratov, 2010; Gittenberger & Bruggen, 2013).

Pupillidae

Pupoides coenopictus (Hutton, 1834)

Material examined: 28.2.2021, Michamwi Village area, yard of a hotel, S06° 08' 25.0" E39° 29' 33.0", 7 m a.s.l., 2 living individuals, attached to a wall. Widespread in sub-Saharan Africa, North Africa and Asia (Seddon, 1994). Reported for Zanzibar with no exact locality mentioned (Verdcourt, 1983). Considering Rowson et al. (2010), it is the first recent precise record of the species on the Zanzibar Archipelago.

Cerastidae

Rachis punctata (Anton, 1839)

Material examined: 28.2.2021, Michamwi Village area, yard of a hotel, S06° 08' 25.0" E39° 29' 33.0", 7 m a.s.l., 5 living individuals, attached to a wall and a lamp (Fig. 1e); 4.3.2021, Michamwi Village area, scattered bushes and trees on a sandy terrain, under rocks of a limestone hill, S06° 08' 17.5" E39° 29' 38.8", 5 m a.s.l., 3 shells. Widespread and common species along the coasts of many countries bordering the tropical Indian Ocean and introduced to some areas of the Atlantic coast (Pilsbry, 1919; Rowson, 2007).

Subulinidae

Allopeas gracile (Hutton, 1834)

Material examined: 4.3.2021, Michamwi Village area, among grasses near a concrete wall, S06° 08' 20.8" E39° 29' 28.8", 3 m a.s.l., 2 shells (Fig. 2d). Verdcourt (1983) recorded it from the Unguja Island without mentioning an exact locality.

Homorus usagarica (E. A. Smith, 1890)

Material examined: 2.3.2021, Michamwi Village area, among grasses near a concrete wall, S06° 08' 20.8" E39° 29' 28.8", 3 m a.s.l., 1 shell; 4.3.2021, Michamwi Village area, scattered bushes and tree on a sandy terrain, under rocks of a limestone hill, S06° 08' 17.5" E39° 29' 38.8", 5 m a.s.l., 5 shells. The species was reported for the island by Germain (1918) as "Zanzibar" (type locality of *insularis* syn. of *usagarica,* see Rowson, 2007). Exact localities of this species on Unguja were not known till now.

Opeas lamoense Melvill & Ponsonby, 1892

Material examined: 4.3.2021, Michamwi Village area, among grasses near a concrete wall, S06° 08' 20.8" E39° 29' 28.8", 3 m a.s.l., 2 shells (Fig. 2c). Verdcourt (1983) recorded it from Unguja Island without mentioning an exact locality. Rowson (2007) reported it from the Jozani Forest.

Pseudoglessula subolivacea (E. A. Smith, 1890)

Material examined: 4.3.2021, Michamwi Village area, scattered bushes and trees on a sandy terrain, under rocks of a limestone hill, S06° 08' 17.5" E39° 29' 38.8", 5 m a.s.l., 7 shells. This species is common on the Unguja and Pemba Islands (Rowson, 2007; Rowson et al., 2010).

Achatinidae

Achatina (*Lissachatina*) *allisa* (L. Reeve, 1849)

Material examined: 4.3.2021, Michamwi Village area, scattered bushes and trees on a sandy terrain, under rocks of a limestone hill, S06° 08' 17.5" E39° 29' 38.8", 5 m a.s.l., 6 shells. Common along the East African coast and in the adjacent areas, including the islands (Mead, 1995). The only exact locality (Jozani Forest) on the Unguja Island was reported by Rowson (2007).

Achatina (*Lissachatina*) *reticulata* (L. Pfeiffer, 1845)

Material examined: 27.02 – 6.3.2021, Michamwi Village area, many shells observed (often broken and at fire sites with traces of possible human consumption or other use). Native to East Africa, mainly coastal species reported from many localities on the Unguja Island (Bequaert, 1950; Rowson, 2007).

Streptaxidae

Gonaxis gibbonsi Taylor, 1877

Material examined: 3.3.2021, Michamwi Village area, scattered bushes and trees on a sandy terrain, under

Fig. 3. Shell of *Thapsia insulsa* from the Michamwi Peninsula, Unguja Island (D = 3.8 mm).

rocks of a limestone hill, S06° 08' 17.5" E39° 29' 38.8", 5 m a.s.l., 2 shells; 4.3.2021, same locality, 3 shells (Fig. 2e). The species was known from continental Tanzania (Usambara Mts) and Kenya (Taita Hills), and from Zanzibar (without an exact locality) (Taylor, 1877; Verdcourt, 1983; Rowson, 2007). It was reported from the Unguja Island at the Chwaka Bay area by Rowson (2007).

Ariophantidae

Sitala jenynsi (L. Pfeiffer, 1845)

Material examined: 4.3.2021, Michamwi Village area, scattered bushes and trees on a sandy terrain, under rocks of a limestone hill, S06° 08' 17.5" E39° 29' 38.8", 5 m a.s.l., 8 shells, and many more observed at the area. Lowland coastal species, known from Kenya, Tanzania and Mozambique and some closely situated islands (Verdcourt, 1963). From the Unguja island it was reported with an exact locality only by Rowson (2007) at the Jozani Forest.

Urocyclidae

Thapsia insulsa Preston, 1910

Material examined: 3.3.2021, Michamwi Village area, scattered bushes and trees on a sandy terrain, under rocks of a limestone hill, S06° 08' 17.5" E39° 29' 38.8", 5 m a.s.l., 2 shells (Fig. 3). The type locality of this species is in Kenya and was recently recorded from the nearby Pemba Island by Rowson et al. (2010). New record for the Unguja Island.

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Research article

Recent expansion of the alien invasive blue crab *Callinectes sapidus* (Rathbun, 1896) (Decapoda, Crustacea) along the Bulgarian coast of the Black Sea

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Abstract: Thirteen new records of the blue crab *Callinectes sapidus* (Rathbun, 1896) have been documented near the Bulgarian Black Sea coast since 2006. This is an evidence for a recent expansion of the species in this part of the Black Sea. This expansion could be explained by the existing of established population in the area and is confirmed by the capturing of an egg-bearing female in the Varna Bay in 2005.

Keywords: allochthonous species, Bulgarian Black Sea coast, *Callinectes sapidus*

The native area of the blue crab *Callinectes sapidus* (Rathbun, 1896) covers the west coast of the Atlantic Ocean from Nova Scotia, Canada to northern Argentina to the south, including some islands in the area like the Bermudas and the Antilles, as well as estuaries and lower reaches of the rivers, flowing directly into the ocean (Shaverdashvili & Ninua, 1975; Meise & Stehlik, 2003; Nehring et al., 2008).

In the last century, the distribution of this species became wider and reached the eastern part of the Atlantic Ocean including the Mediterranean Sea Basin (Pashkov et al., 2012). The first record from European waters is dated back to 1900 when the species was found on the Atlantic coast of France in the estuary of the Gironde River (Shaverdashvili & Ninua, 1975; Nehring et al., 2008). Later it was found also in the Netherlands in 1932, Denmark in 1951, on the North Sea coast of Germany in 1964 and near the coasts of UK in 1975 (Clark, 1984; Nehring, 2011). In Portugal it was recorded in 1979 and in Belgium the first record was from 1981 (Nehring et al., 2008; Jansen, 2010). The species has been found also near the Atlantic coast of Spain in 2002 (Cabal et al., 2006).

In the Mediterranean Sea, it was first recorded in Greece in 1948 and soon after that near Italy in 1949 (Gennaio et al., 2006). Later, it was established near the Mediterranean coast of Israel in 1951 and of Turkey in 1959 (Holthuis, 1961).

The first blue crab found in the Black Sea has been caught in a fishing net during the night of 2 October, 1967 in the western part of the Varna Bay (Bulgurkov, 1968). Few years later, in 1971, the species was found in the eastern part of Black Sea near the coast of Georgia (Shaverdashvili & Ninua, 1975), as well as in the northern part of the sea near the Ukrainian (1975) and Russian (1979) coasts (Pashkov et al., 2012). In 1998, it was found for the first time in Romanian waters (Pashkov et al., 2012). Recently, the blue crab has been recorded in the Sea of Azov in 2006 (Diripasko et al., 2009) and near the Crimean Peninsula in 2007. The first discovery of the species near the Turkish Black Sea coast is from 2014, near Duzce and Zonguldak

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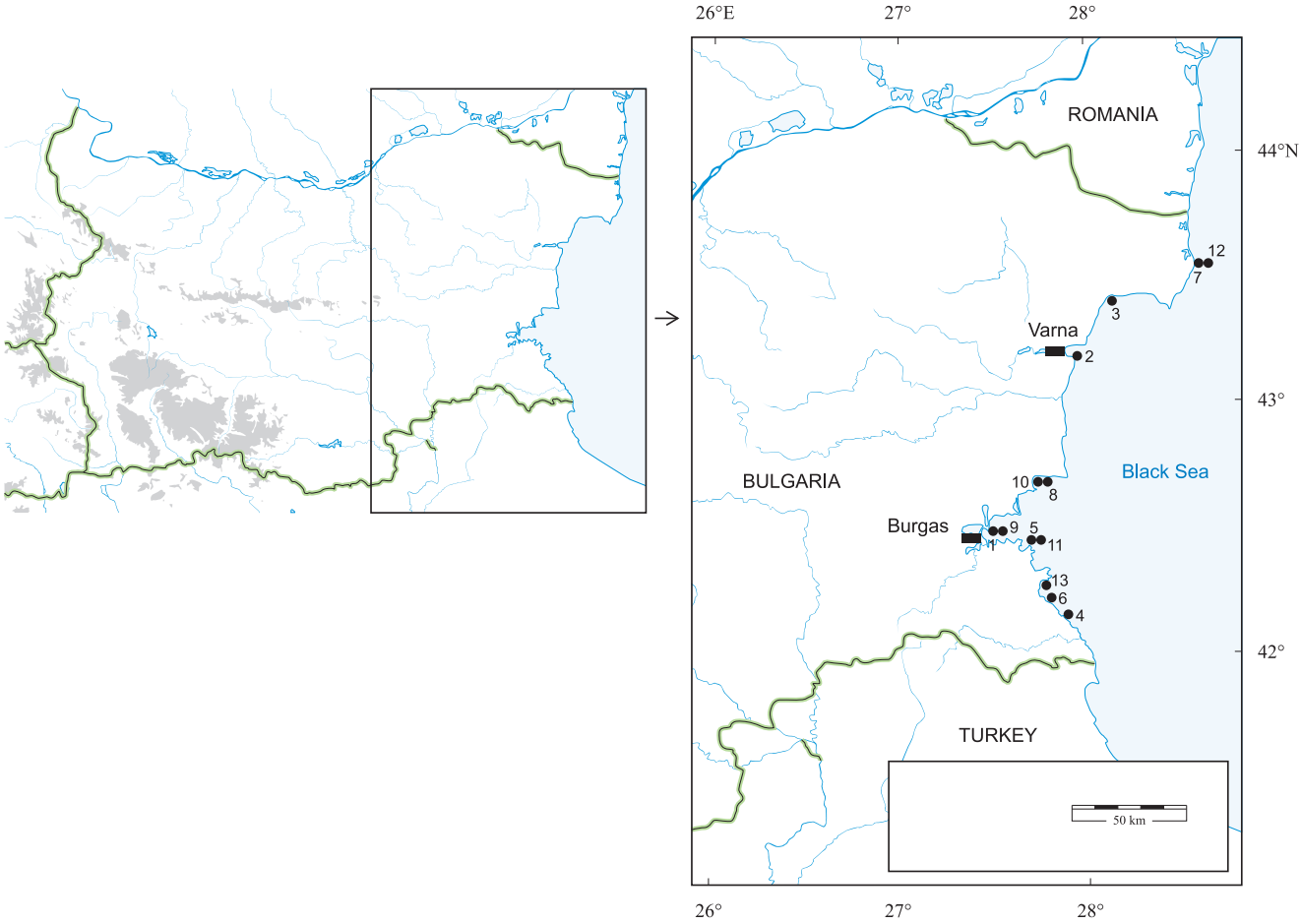

Fig. 1. Map of the localities, where *Callinectes sapidus* was found along the Bulgarian Black Sea coast since 2006. The numbers on the map correspond to the documented records of the species described in the text.

(Yağhoğlu et al., 2014), but soon after that a south-eastward expansion has been recorded, as a female specimen has been found near Trabzon in the southern easternmost part of the Black Sea (Ak et al., 2015).

According to Ak et al. (2015), there are a total of 14 records of *C. sapidus* in different parts of the Black Sea. In his overview paper Hubenov (2015) reported a total of four localities of the species for the Bulgarian sector of the Black Sea (cape Kaliakra, Balchik, Varna and Burgas), but without giving any additional information about dates, number of caught specimens and precise locations. According to Uzunova (2016), in 2005 six blue crabs were caught by fishermen in the Varna Bay, one of which was an egg-bearing female. Apart of all published information, in the last years there are 13 more documented records of the blue crab near the Bulgarian Black Sea coast (Fig. 1). They are as follows:

1 2006. A male blue crab was caught in Burgas Bay in a fishing net by a local fisherman on 22 August. The specimen is deposited in the scientific collections of the Regional History Museum in Burgas.
2 2007. A male crab was collected by a scuba diver in January near Galata Cape (Varna district).
3 2007. One specimen, caught near the town of Balchik was delivered to the aquarium of the Institute of Fisheries Resources, Varna.
4 2008. One specimen was caught in a gill net by a local fisherman in the village of Ahtopol.
5 2009. One blue crab was caught in June in a fish trap near St. Petar Island in the vicinity of the town of Sozopol.
6 2009. Another specimen was caught in a gill net by a local fisherman near the town of Tsarevo.
7 2010. One specimen was caught in November in a gill net by a local fisherman near Shabla Cape.

8 2012. There is unconfirmed information about the capture of one specimen near the Sveti Vlas Village.
9 2013. One blue crab was caught in October and delivered to the Regional History Museum in Burgas.
10 2015. One adult specimen was observed in July on the sand beach of Sunny Beach Resort; there is a video record confirming the observation.
11 2016. One male specimen was caught in October in a gill net by local fishermen near the town of Sozopol.
12 2016. One female specimen was caught in the middle of November in a gill net by a local fisherman near Shabla Cape. The specimen was delivered in the National Museum of Natural History, Sofia (NMNHS) and deposited in the hydrobiological collections of the museum.
13 2017. One male specimen was caught in the Vasiliko District near Kiten Village.

The question how the blue crab penetrates into the Black Sea and the Sea of Azov is still open. The common opinion is that it was introduced with ballast waters of commercial ships helped by the long duration of the larval stages of the species (Zaitsev & Ozturk, 2001; Diripasko et al., 2009; Jensen, 2010). The main evidence is the fact that the blue crabs were often found near big ports, where ballast waters most frequently were discharged (e.g., Varna, Konstanta, Sevastopol, Novorossiysk, Trabzon). However, the recent records of the species along the Bulgarian coast show that the blue crab is spread not only around big ports. Indeed on the contrary, only three of the 13 new founds are near the two biggest Bulgarian ports Varna and Burgas. We assume that the frequency of introductions of this species nowadays is low and it is quite unlikely to detect it directly after its introduction. It is well known that *C. sapidus* is a very good swimmer and capable of distant migrations. For example, few tagged female specimens have been recovered 100 to 540 km from their initial places of release (Hill et al., 1989). Therefore, we think that last years the spreading of the species in the Black Sea is due to natural dispersal rather than ballast water introduction.

In our opinion, there are two stages with different ways of penetration of the blue crab into the Black Sea and the Sea of Azov. In the first stage (approximately till the end of the 20th century), the species was initially introduced in the area with ballast waters and for that reason it was found mainly near big ports – a total of six founds near Varna, Poti, Kerch, Novorossyisk and Constanta (see the map in Pashkov et al., 2012). In the second stage, most of the blue crab founds in the area are due to natural dispersal from the Mediterranean Sea trough the Bosphorus. At that time in the Eastern Mediterranean near the Turkish coasts, a well-established population of this species is known to exist, with 15 known localities in different lagoons some with large well-developed populations (Enzenrob et al., 1997). Yağhoğlu et al. (2014) reported the species for the first time near the Turkish coastal waters of the Black Sea, indicating an eastward migration of the blue crab. However, its further south-eastward expansion near the Trabzon Harbour is most probably due to ballast water transfer, as it has been found close to the harbour and the shipping routes (Ak et al., 2015). In the second stage, *C. sapidus* reached also the Sea of Azov (Diripasko et al., 2009) and according to Pashkov et al. (2012), practically all cases of blue crab findings in the Azov-Black Sea basin in this period could be explained by their migration from the Bosphorus along the gradient of the salinity decrease of the surface waters. The migration of the blue crabs to the eastern part of the Black Sea and the Sea of Azov has been assited also by the Anatolian and Caucasian currents.

In our opinion, the recent expansion of the blue crab near the Bulgarian Black Sea coast is also due to natural dispersal, as suggested by the fewer (only three) founds near the big ports. The other ten founds have been spread all over the Bulgarian coast and concentrated mainly near the biggest fishermen villages, which means that the crabs are found where the fishing activity is higher, because they are often caught in the fishermen gillnets. According to us, nowadays the blue crab is widely spread along the Bulgarian coast and more finds could be expected, especially around the fishermen settlements.

There is still an open question how the blue crabs spread around the Bulgarian coast, because their direct migration from the Mediterranean would have been hindered by the strong Rumelian current, which is directed from North to South towards the Bosphorus. According to the recent founds of the species in the Azov-Black Sea basin, it is most numerous around the Bulgarian coast (13 out of 21 founds since 2006), which makes the migration from other parts of the sea quite improbable. This opens again the question about the level of naturalisation of *C. sapidus* in the area. The natural conditions in the Black Sea, including its temperature regime and low salinity should be quite suit-

able for the blue crab, which is generally an eurybiontic species. It inhabits sites with wide range of chemical and physical environmental conditions and is omnivorous (Hill et al., 1989). The blue crab possesses specific reproductive biology as the mating takes place in relatively low salinity areas of estuaries and after that, females migrate to sites with higher salinity to spawn. Female crab mate only once, but can produce few millions of eggs (Jansen, 2010). Suitable natural conditions are available near the Bulgarian coast and the egg-bearing female found in the Varna Bay in 2005 (Uzunova, 2016) is a direct evidence for the existing of an established population of the species and explains the high number of new founds in the area since 2006. Our study reported only founds of large adult individuals but the recent record of mature female specimen near the Shabla Cape (in 2016), which could had spawned shortly before it was caught, should get special attention. This found could be another evidence for the existing of an established population of *C. sapidus* along the Bulgarian Black Sea coast, which is the reason for the recent expansion of the species.

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Research article

Small red scorpionfish *Scorpaena notata* Rafinesque, 1810 (Actinopterygii: Scorpaenidae) – an unknown species for the Bulgarian Black Sea coast

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Abstract: One adult specimen of small red scorpionfish *Scorpaena notata* Rafinesque, 1810 was found in the ichthyological collections of the National Museum of Natural History in Sofia, Bulgaria. The specimen has been caught on 12 May 1926 in Black Sea near the town of Burgas and labelled as *Scorpaena porcus*. This is the first finding of the species along the Bulgarian Black Sea coast and the oldest record in the Black Sea.

Keywords: Black Sea, Bulgaria, museum collections, *Scorpaena notata,* Scorpaenidae

Introduction

The small red scorpionfish *Scorpaena notata* Rafinesque, 1810, is a small-sized benthic fish from the family Scorpaenidae. It is usually occurred in crevices of rocky coastal habitats on depths between 10–50 meters but rarely could be found up to 700 meters (Muñoz et al., 2005). The species is distributed in the Mediterranean Sea and adjacent areas of the eastern Atlantic, Madeira, Azores, the Canary Islands and the north-western coast of Africa south to Senegal (Eschmayer, 1969). It occurred also in the Aegean Sea and the Sea of Marmara (Bilecenoglu et al., 2002; Fricke et al., 2007). The species was found for the first time in the Black Sea in 1930 near Gelendzhik, Russia (see Svetovidov, 1964) and few years later described as new taxon – *Scorpaena scrofa afimbria* Slastenenko, 1935 (see Svetovidov, 1964; Hureau & Litvinenko, 1986). Although it was described as an infrasubspecific taxon, which makes the name unavailable, the combination *Scorpaena afimbria* was later used by Svetovidov (1964). According to him the species is known in the Black Sea only near Gelendzhik and Novorosiysk on the north-east coast. Nowadays *S. afimbria* is treated as a junior synonym of *S. notata* (Fricke et al., 2021) and it is known that its distribution in the Black Sea covers the coasts of Romania, Russian Federation, Turkey and Ukraine (Bilecenoglu et al., 2002; Fricke et al., 2007; Vasil'eva, 2007; Maximov & Zaharia, 2010; Yankova et al., 2014). The species is still unknown from the Bulgarian sector.

Material and methods

One adult specimens of *S. notata* (132.5 mm Tl) was found in the ichthyological collections of the National Museum of Natural History in Sofia, Bulgaria. The specimen was caught on 12 May 1926 in the Black Sea near the town of Burgas and stored in formaline. It is labelled as *Scorpaena porcus* under Inv. No. NMNHS-F 000110 (old Inv. No. 98/5). The specimen is in very good condition and the body shape and coloration are well preserved and suitable for species determination

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Fig. 1. *S. notata* (132,5 mm Tl) found in the ichthyological collections of the National Museum of Natural History, Sofia (Inv. No. NMNHS-F 000110): lateral view of the body.

(Fig. 1). The specimen was measured with an electronic caliper as all measurements were made point-to-point and recorded to the nearest of 0.1 mm. Method for counting fin rays and scales as well as all methods for measurements generally follow Kottelat & Freyhof (2007).

Results and discussion

The studied specimen had been initially determined and labelled as *S. porcus*. After detailed analysis we found that it does not belong to this species and possesses the following features which are typical for *S. notata* (see Fig. 1): no skin flaps above the eyes (in *S. porcus* there is a large skin flap above each eye), larger scales – a total of 48 between the gill cover and tail base (in *S. porcus* they are usually more than 60), five scales between the last soft ray of the dorsal fin and the lateral line (vs. 6–7 in *S. porcus*), and presence of a black blotch in the middle of the first dorsal fin (vs. no black blotch in *S. porcus*). All these features clearly point that the studied specimen belongs to the species *S. notata*. It possesses small differences in some of the body proportions compared to the studied material of the same species by Akalin et al. (2011) originating from the Aegean Sea near Iznik (see Table 1). It has somehow longer snout – prO in % of Sl is 11.52 vs. 6.38–9.75. The eyes are smaller – do in % of Sl is 9.79 vs. 13.42–15.63 and the distance between them is also slightly smaller – io in % of Sl is 4.51 vs. 4.54–6.29. Postdorsal distance is longer – poD in % of Sl is 13.92 in the studied specimen vs. 7.24–11.11 in the Aegean Sea material. It is difficult to explain the obtained differences in the morphology but they are probably due to some distinctions in the measurement approach rather than taxonomic issue.

Although the ichthyofauna of the Bulgarian Black Sea coast is comparatively well investigated (Drensky, 1923; Guéorguiev et al., 1960; Stoyanov et al., 1963; Prodanov et al., 1998) there is no data about the presence of *S. notata* along it. The species was also not included in the overview works of Drensky (1951), Karapetkova & Zivkov (1995), Zivkov et al. (2006) and Stefanov (2007). The studied specimen is the first and up to now the only record of *S. notata* in the Bulgarian sector of the Black Sea. The fact that the specimen was caught on 12 May 1926 makes it the first record in the Black Sea. As it was mentioned above, the oldest record of this species until now was known from 1930 near Gelendzhik, Russia (see Svetovidov, 1964).

It would be interesting whether the species will be discovered in new areas along the Bulgarian coast of the Black Sea in the future or should be considered "extinct". According to us, it should be rather rare, but constant inhabitant in the area. *S. notata* is obviously a rare

Table 1: Body proportions of *S. notata* from Izmir Bay, Aegean Sea published by Akalin et al. (2011) and the specimen found in the ichthyological collections of NMNHS (values are range and in parentheses is mean).

Acronyms for the measurements used in the table are as follows: Tl – total length, Sl – standard length, lc – head length, pD_1 – predorsal distance, poD – postdorsal distance, pA – preanal distance, lpc – length of caudal peduncle, lD_{1+2} – length of the base of both dorsal fins, lA – length of anal fin base, H – maximum body depth, h – least depth of caudal peduncle, prO – preorbital distance, do – horizontal diameter of eye, poO – postorbital distance, io – interorbital distance.

Locality	Black Sea, near Burgas	Aegean Sea, near Izmir
Source	Our data	Akalin et al. (2011)
n	1 ad.	23 ad.
Tl [mm]	132.5	92–178 (142.74)
Sl [mm]	104.2	70–140 (110.91)
in % of Sl		
lc	43.76	39.04–44.52 (41.16)
pD_1	35.32	–
poD	13.92	7.24–11.11 (9.13)
pA	65.26	–
lpc	24.66	–
lD_{1+2}	63.15	–
lA	14.39	–
H	38.29	35.34–41.74
h	11.42	5.24–11.43 (8.96)
prO	11.52	6.38–9.75 (8.57)
do	9.79	13.42–15.63 (14.91)
poO	23.80	–
io	4.51	4.54–6.29 (5.38)

species in the Black Sea and the Aegean Sea and it is qualified as "Vulnerable for Turkey" by Fricke et al. (2007). According to the authors, the species shows significant decline and should be high priority for conservation action.

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Research article

New data on the rare snail Soosia diodonta (A. Ferussac, 1821) (Gastropoda: Helicodontidae) in Bulgaria

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Abstract: In the present article, we summarised all known information on the species *Soosia diodonta* (A. Ferussac, 1821) from Bulgaria. A new locality in urban environment, photos of live animals and the reproductive system of the species are given. New information on its ecology and biology is provided.

Keywords: biology, Bulgaria, distribution, ecology, *Soosia diodonta*

Introduction

The snail *Soosia diodonta* (A. Ferussac, 1821) was described by Férussac in 1821 from Banat, Romania as *Helix diodonta* (Férussac A. & Deshayes, 1819–1851). Based on the anatomical features Hesse (1918) placed the species in a separate genus, *Soosia* Hesse, 1918. Presently, *S. diodonta* is the only member of the genus (Schileyko, 2006; Bank & Neubert, 2017). *Soosia diodonta* is reported for the first time for Bulgaria, after only one live specimen, by Urbanski (1964) from the Vitosha Mountains, Boyana Waterfall area. Despite the collecting efforts during the last 25 years in the area of the waterfall, the species has not been confirmed again. Georgiev & Stoycheva (2007) reported *S. diodonta* from a new locality in the Eastern Balkan Mountains, western of Kotel Town.

Outside Bulgaria, the species is found in the southern Carpathians, in the Western Balkan Mountains (eastern Serbia) and in the lowlands of the Lower Danube River. There are only a few known locations, summarised by Fehér (2020): Moldova Noua, Baile Herculane, Padurea Caldarusani, Jurilofca; Padurea Prahova, Surdulica; Cerna valley, Motru Sec, Closani, Tismana and Nera gorge near Sasca Montana.

In the present article, new information is given about the distribution and biology of the Bulgarian population of the species, as well as pictures of the reproductive system and live animals in situ.

Material and methods

The snail was collected from two localities in the region of the Balkan Mountains: 1) western of Kotel, road to Zelenich area (Fig. 1); 2) Tryavna, in the town, ruins (Fig. 2). The type of habitats is determined according the Council Directive 92/43/92 and the EUNIS habitat classification. Both literature and new distribution data of the species *S. diodonta* in Bulgaria are summarised in Table 1. The snails were hand collected and photographed in situ. Some species were killed, fixed and stored in 75% ethanol for further analyses. Abbreviation used: Coll. ID = identification number in the

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Fig. 1. The locality of *S. diodonta* after Kotel Town, road to Zelenich area and in situ photos of live animals. A – the habitat of the species and the location of the specimens under log (B); C – live specimens from Zelenich.

Fig. 2. The locality of *S. diodonta* in Tryavna Town and in situ photos of live animal. A – the urban habitat of the species; B – live specimens from Tryavna Town.

Table 1. Localities of *S. diodonta* in Bulgaria.

Geographic Region	**Locality**	**Habitat**	**Date, collectors/ observers/collection**	**GPS coordinates, altitude, remarks**
Vitosha Mountains	Boyana Waterfall	Asperulo-Fagetum beech forests (9130)	Urbanski (1964)	N42.6295° E023.2542°, 1303 m a.s.l. (restored)
Eastern Balkan Mountains	W of Kotel (road to Zelenich area)	Medio-European limestone beech forests of the Cephalanthero Fagion (9150)	Georgiev & Stoycheva (2007)	N42.8866° E026.3943°, 612 m a.s.l. (restored)
ditto	W of Kotel (road to Zelenich area)	Medio-European limestone beech forests of the Cephalanthero Fagion (9150)	12.X.2013, leg. U. Schneppat, F. Knetche, D. Georgiev, I. Dedov, 2adl, 1jvd (IBER, Coll.No.1642)	N42.88248° E026.38868°, 625 m a.s.l. (original)
Central Balkan Mountains	Tryavna, in the town	Urban and suburban derelict spaces – ruderal communities of *Sambucus ebulus, Humulus lupulus, Rubus caesius, Clematis vitalba* etc. (J1.51), under tiles	14.X.2013, leg. U. Schneppat, F. Knetche, I. Dedov, D. Georgiev 12adl, 2jvd (IBER, Coll.No.1645)	N42.872037° E025.497549°, 432 m a.s.l. (original)

molluscs collection of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia.

Results

Distribution in Bulgaria

In Bulgaria, the species is considered to be rare. Presently, the species is known from three localities: one in the Vitosha Mountains (Fig. 3) and two in the region of the Balkan Mountains (Table 1) (Urbanski, 1964; Georgiev & Stoycheva, 2007; present article). Despite the collecting efforts, the species was not found again in the area of the Boyana Waterfall, Vitosha Mountains. The new locality is in the town of Tryavna, in the region of the Central Balkan Mts.

Ecology

In Bulgaria, the species was found in: 1) Asperulo-Fagetum beech forests (9130) (Council Directive 92/43/92), near Boyana Waterfall (Urbanski, 1964), 2) Medio-European limestone beech forests of the Cephalanthero Fagion (9150) (Council Directive 92/43/92), near Kotel (Georgiev & Stoycheva, 2007) and 3)

Fig. 3. The area of Boyana Waterfall, Vitosha Mountains – the first reported locality of *S. diodonta* for Bulgaria by Urbanski (1964).

Fig. 4. *S. diodonta* – eggs (A), offspring (B) and adults from the terrarium of F. K. Glogger – shell (C) and live specimens (D).

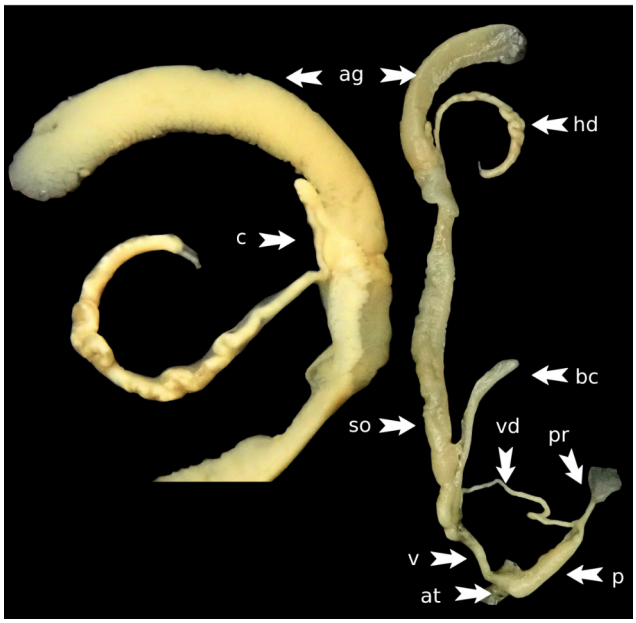

Fig. 5. *S. diodonta,* reproductive system. Abbreviations: ♂♀ at – atrium; ♂: p – penis, pr – penial retractor, vd – vas defferens; ♀: v – vagina, so – sperm-oviduct, ag – albumen gland, c – carrefour, hd – hermaphroditic duct, bc – bursa copulatrix; ad – adult, juv – juvenile, add – adult empty shell, adl – adult collected alive, juvd – juvenile empty shell, juvl – juvenile collected alive.

Urban and suburban derelict spaces – ruderal communities of *Sambucus ebulus, Humulus lupulus, Rubus caesius, Clematis vitalba* etc. (J1.51) (EUNIS habitat classification), in the town of Tryavna, under tiles (Figs 1–3). The species prefers shady places – under bark, in old trunks, under tiles and other materials, which provide it with good humidity.

Biology

The biology of *S. diodonta* was studied keeping specimens in terrarium (for more details about the conditions in the terrarium and the used food see Table 2). Similarly to many other gastropod species, *S. diodonta* is active at night. The pre-copulation habits and copulation activity were not observed. The first eggs were laid about 20 days (D. Georgiev) and 3.5 months (F. K. Glogger) after the collecting of the adult specimens from Tryavna Town (most probably, the specimens grown by D. Georgiev were taken from nature fertilised, while the specimens of F. K. Glogger copulated in the terrarium). The eggs were laid in clutches (3–5 eggs in groups, mostly 3–4 eggs together), adhered to the substrate. The eggs were round-elliptic (about 2.5x1.5 mm), milky-whitish, looking dotted. The period from the eggs-laying to hatching was 15–20 days (F. K. Glogger) and 22 days (D. Georgiev). The freshly hatched offspring were with 2 whorls and a size of about 2 mm. It took about 5 months for the offspring to turn into adults (Fig. 4).

Shells

The investigated shells correspond perfectly with the description of Schileyko (2006) and demonstrated stable characters in shell colour and shape (Grossu, 1983). According to Schileyko (2006), the shell is nearly flat, discoidal, rather thin, of 4.5 scarcely convex whorls. Last whorl distinctly angulate, descending in front, constricted at aperture and impressed above. Colour brownish-corneous. Embryonic whorls smooth, the rest of the surface minutely granularly striate. Aperture narrow, very oblique; margins reflexed, with 1 parietal

Table 2. Biology of *S. diodonta*.

	F. K. Glogger – 5 spm	**D. Georgiev – 2 spm**
Size of terrarium (cm)	60x70x60	10x15x12
Type of substrate	Soil – mixed (brown forest soil, and sort of terrarium soil) with wood (some branches and bark), leaves, moss	Carbonate soil
Temperature regime	Summer 18–19°C, Winter 13–15°C	No observations
Moisture regime	Regularly sprayed rainwater in the terrarium to keep it moist	Keep it moist
Type of food, food preferences	Old leaves, *Cucumis sativus* L., *Cucurbita pepo* L. var. *zucchini, Daucus carota* L., mushrooms. Prefered mushrooms.	*Daucus carota* subsp. *sativus* (Hoffm.) Schübl. & G. Martens, *Brassica oleracea* L., *Capsicum annuum* L., *Cucumis sativus* L.; fruits: *Malus domestica* Borkh., 1803; green leaves of grass species: *Trifolium* sp., *Petunia* sp.; and mushroom fruiting bodies: *Calvatia* sp.
Round-the-clock activity	No detailed observations. Always active in the period 21.00–23.00 h. During the daytime they were most time hidden behind a piece of bark (in group).	5 November 2013: the adult snails are always under the leafs, even in the early morning; 9 November 2013: one adult is on the wall of the terrarium at around 19 h, full darkness; 10 November 2013: eating carrot during the night, T 18.4C.
Pre-copulation and copulation habits	No observations	No observations
Date of material collecting	14 October 2013	14 October 2013
Date of eggs-laying/ Number of eggs/Notes	27 January 2014, 31 January 2014, the laid eggs in 9 clutches (each of them from 3 to 5, mostly 3–4 eggs together). Total number laid eggs – 36, 15 of them hatched. t12–15°C	3 November 2013 / 4 eggs, laid in clutch, sticked on a lief of *Platanus* under a bark/ t18.4°C
Date of hatching/Period from eggs-laying to hatching	15–20 days	25 November 2013/22 days
Period from offsprings to adult	About 5 months (hatched February – adult in July)	No observations

and 1 basal tooth. Umbilicus wide. Height of Bulgarian specimens: 3.3–4.0 mm. Diameter 10–12 mm. Number of whorls 4.5 (Fig. 4).

Anatomy

♂♀ The atrium is relatively short and wide; ♂ penis is cylindric-fusiform, vas-deferens enters the penis apically, penial retractor relatively wide and inserts to vas deference at small distance from penis; ♀ vagina rather short, carrefour well visible. Length of spermatheca a little more than half of sperm oviduct. The investigated reproductive systems from the Balkan Mountains, after the town of Kotel, is typical for the species and match the descriptions of Schileyko (2006) (Fig. 5).

Discussion

According to Grossu (1983), *S. diodonta* occurs in the moist foliage of forests, on the bark of trees in rainy weather, and under the bark of rotten logs. Rarely even

on the rocks. The new locality in the town of Tryavna is the first known finding of the species in an urban environment. This observation is in contrast to the current knowledge on the species' preferable localities – different type of deciduous forest (Urbanski, 1964; Grossu, 1983; Georgiev & Stoycheva, 2007). The abundant population in the town of Tryavna shows good adaptation to the new type of habitat – open terrain with numerous shelters, keeping good shadow and moisture. For Romania, Grossu (1983) considers *S. diodonta* a rare species with limited distribution. According to Fehér (2020), the range of this species is far from being well studied. The new finding in an urban environment may challenge the assumption about the species narrow ecological tolerance. On the other hand, *S. diodonta* is rare in its entire narrow range, which is bounded to well-preserved forests in general. Such type of habitats are diminishing within its potential range (Fehér 2020). Therefore, the species is assessed as Near Threatened by the IUCN. This newly discovered population is very important because it can be a good model to investigate the ecological requirements and the survival potential of this species. A possible reason for the species rarity could be its low reproduction capacity (the small number of eggs), rather than its ecological preferences (the species survives in inappropriate urban environment).

In the sketch given by Grossu (1983), the vagina of the *S. diodonta* is too long and this drawing mistake is corrected in Schileyko (2006). The reproductive system of the Bulgarian specimens of *S. diodonta* is typical for the species – the mucus gland is missing and the vagina is short (Schileyko, 2006).

Acknowledgements

The authors thank Dr Zoltán Fehér for his helpful remarks and the botanist Chavdar Gussev for the help with habitat classification.

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Research article

Five new species of *Dichaetomyia* from the Malagasy Subregion (Diptera: Muscidae)

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http://zoobank.org/AD3AA01D-B070-461A-A1A0-6ED7B06C1564

Abstract: Five new species of the genus *Dichaetomyia* are described from Madagascar. Two species, *Dichaetomyia analama* sp. n. and *D. necoa* sp. n. belong to the subgenus *Panaga*. Three other species, *D. amboha* sp. n., *D. blackia* sp. n. and *D. tantelya* sp. n. are members of the subgenus *Dichaetomyia*. The body colour in normal light conditions of the five species is predominantly yellowish or grey to dark brown or blackish like most of the Afrotropical species of *Dichaetomyia*.

Keywords: descriptions, diagnosis, Phaoniinae, subgenus *Panaga*, subgenus *Dichaetomyia*

Introduction

Among the Madagascan muscids studied since 2015 at the Institute of Biodiversity and Ecosystem Research (IBER) in Sofia, Bulgaria, there were several specimens of the genus *Dichaetomyia* Malloch, 1921.The genus is represented in the Afrotropical Region by two subgenera, *Dichaetomyia* Malloch and *Panaga* Curran, 1928. The latter is restricted to Africa, whereas *Dichaetomyia* s. str. occurs worldwide. The majority of the species of *Dichaetomyia* known from Madagascar belongs to *Dichaetomyia* s. str. The current paper deals with five species new to science. Three species belong to the subgenus *Dichaetomyia* s. str. and two to the subgenus *Panaga*.

Materials and methods

The studied Madagascan Muscidae had mostly been collected in the last 25 years and the specimens for the current study were provided by various entomological institutions. The unidentified muscid specimens originated from the Moravian Museum. The flies were isolated from the stored in ethanol remains of insect traps. Most of the insects that had been left among the remains were in very poor condition, only a small portion of the Muscidae found were suitable for processing and identification. The flies were cleaned and mounted on a pin as recently described (Zielke, 2021b). Several of the selected specimens were rather fragile and despite the careful handling some of them lost body parts during the preparation, these parts were transferred into a gelatine capsule that was then attached to the staging pin.

The vials with the remains contained locality labels, but unfortunately information about the collectors were not found or could not be deciphered. Therefore, the inscriptions of the locality labels are reproduced verbatim but without naming collectors.

The identification key for the Madagascan Muscidae published by Couri et al. (2006) was used to identify the flies. Since this is the only actual key for the identification of species of *Dichaetomyia* from Madagascar, reference is made to the key several times without mentioning the authors and the year of publica-

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tion each time. The new species described in the present contribution are not distinguished by striking blue, green or purple colours as known only from some Madagascan species (Zielke, 1972, 2020; Couri et al., 2006). In normal light conditions they are characterised by yellowish to grey or dark brown body parts, as is typical for most African species of the genus. For this reason, the identification keys of van Emden (1942a, 1942b) for the African species of *Dichaetomyia* and of Pont (1978) for the species of the Comoro Islands were also consulted before a species was described as new to science. In addition, the newly described species were compared with the descriptions of those Afrotropical species of *Dichaetomyia* (Pont, 1969; Zielke, 1971, 1974) which had not been included in the above-mentioned identification tables of van Emden and Pont.

The subgenus *Panaga* is mentioned in brackets as part of the name in the heading of the description below of each species belonging to this subgenus, whereas the subgenus *Dichaetomyia* is not explicitly added to the name of described species.

Morphological terminology follows McAlpine (1981), but postpedicel (Stuckenberg 1999) is used instead of "first flagellomere" as proposed by McAlpine. Moreover, as already suggested earlier (Zielke 2020), the lateral width of the postpedicel of antenna is called "depth" and usually refers to the greatest depth of the postpedicel. Information about the width of frons always refers, if not stated otherwise, to the shortest distance between the margins of the eyes. Only the postsutural intra-alar setae are called intra-alar setae. The intra-alar setae of the presutural part of the mesonotum are referred to as posthumeral and presutural setae as has already been done for example by Gregor et al. (2002, 2016) and Nihei & Carvalho (2009). Body length was measured in millimetres (mm).

The specimens were studied using a Zeiss Stemi SV6 stereomicroscope and images were created by means of combination of a Zeiss Discovery 8 stereomicroscope and an AxioCam ERc5s camera as described previously (Zielke, 2020, 2021a).

The undetermined material and numerous identified specimens of *Dichaetomyia* were examined and compared. The specimens including paratypes and holotypes were kindly loaned for examination to IBER by the entomological departments of: Moravian Museum, Brno, CZ; California Academy of Sciences, San Francisco, CA/USA; Natural History Museum Berlin, D, the Natural History Museum London, UK, the KwaZulu-Natal Museum Pietermaritzburg, SA and Oxford University Museum of Natural History, UK. In addition, during a visit to the Natural History Museum in London in autumn 2019, several specimens of the Madagascan species of *Dichaetomyia* were also compared with corresponding material from the collection of Muscidae kept there.

Unless otherwise stated in the description of the individual species, all specimens will be returned to those collections that loaned the material to IBER.

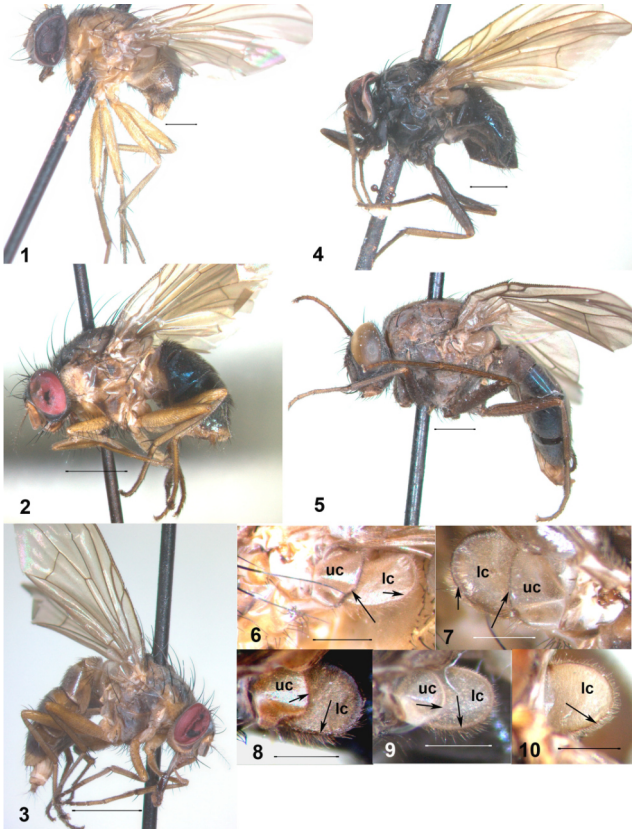
Results

Additions to the descriptions (Applicable to each of the females of the described new species)

The females of the four new species of *Dichaetomyia* from Madagascar described below have several taxonomic features in common, which practically do not differ. Therefore, they have no diagnostic value for distinguishing these species from one another. However, for completeness, these criteria have to be mentioned in the basic characterisation of each of the new species. In order to avoid redundant listings of criteria without diagnostic value, the almost identical taxonomic features are compiled in this chapter, which is therefore to be regarded as an elementary part of the description of each of the four new species of which the female is known. If a characteristic of a species differs significantly from this general characterisation, the difference is mentioned in the individual description. The compilation of taxonomic features below refers to the females of the species: *Dichaetomyia* (*Panaga*) *analama* sp. n., *Dichaetomyia* (*Panaga*) *necoa* sp. n., *Dichaetomyia amboha* sp. n. and *Dichaetomyia tantelya* sp. n.

Head. Dichoptic; eyes with a few, scattered very small hairs, facets of inner and outer side of eye of about equal size. Parafacial bare and distinctly tapering along the entire length. In profile, upper mouth margin about in line with profrons. Arista approximately twice as long as length of postpedicel. Upper half of lateral surface of gena bare, lower margin with black setae and some small setulae. Palpus slender and clavate.

Thorax. Acrostichal setae 0+1, seta not half as long as posterior dorsocentral seta; two postpronotal setae, the outer one somewhat longer; two notopleural setae, notopleuron with few small hairs; two intra-alar setae. Postalar declivity and suprasquamal ridge bare. Prosternum haired; anepimeron with a tuft of setulae above and some scattered seta-like hairs on posterior



Figs 1–5. Lateral view of the five newly described species of *Dichaetomyia*: (1) ♀ holotype, *D. analama* sp. n.; (2) ♀ holotype, *D. amboha* sp. n.; (3) ♀ holotype, *D. necoa* sp. n.; (4) ♂ holotype, *D. blackia* sp. n. (5) ♀ paratype, *D. tantelya* sp. n. Abdomen of *D. amboha* and *D. tantelya* in normal light conditions predominantly brownish to dark brown/blackish, in photographic exposure unusually bluish shiny. (figures 1, 4, 5 bar: 1 mm; figures 2, 3 bar: 2 mm). Figs 6–10. Upper (uc) and lower (lc) calypters of the holotypes of the new species of *Dichaetomyia*: (6) *D. analama* sp. n., upper calypter with dark brown framed margin (long arrow), lower calypter without a framed margin (short arrow); (7) *D. necoa* sp. n., slightly brownish transparent calypters, both with a framed dark margin; (8) *D. blackia* sp. n., lower calypter predominantly brownish transparent with dark brown margin, upper calypter yellowish brown transparent with brown framed margin (short arrow); (9) *D. amboha* sp. n., both calypters whitish transparent with almost whitish margins (short arrow) or in certain light conditions with more or less whitish brownish margin (long arrow); (10) *D. tantelya* sp. n., lower calypter yellowish-white transparent with brown framed margin (arrow), upper calypter hardly visible as it points upwards at right angle to the lower calypter (figures 6–10 bar: 0.5 mm).

surface; proepimeral area, katepimeron and meron bare. Posterior spiracle with black setae at lower margin. Katepisternal setae 1+2, the lower one distinctly closer to the posterior seta than to the anterior one. Scutellum with a pair of strong apical and strong lateral setae; basal and preapical setae much shorter but clearly differentiated from ground hairs.

Wing. Membrane hyaline, cross-veins and surrounding membrane not infuscate. Vein M somewhat diverging from vein R4+5, very slightly curved forward to R4+5 before reaching wing margin. Cross-vein r-m clearly anterior to the point where vein R1 enters costa; distal cross-vein dm-cu sinuous and oblique. Knob and stem of haltere pale yellow.

Legs. Pulvilli and claws distinct but not as long as the corresponding tarsomere. Fore femur with complete rows of posterodorsal, posterior and posteroventral setae, the posterodorsals and posteriors barely as long as depth of femur at point of insertion, posteroventrals somewhat longer than depth of femur. Mid tibia with two strong posterior setae, about twice as long as diameter of tibia. Hind tibia without a long distinct posterodorsal seta.

Abdomen without specific pattern. Sternite 1 laterally with few setulose hairs. Female genitalia were not investigated.

Dichaetomyia (*Panaga*) *analama* n. sp. (Figs 1, 6, 11, 16, 20)

Material examined: ♀ holotype from "Madagascar, Andasibe, Analamazaotra, S. R., Perinet, Circuit Indri, S18.935882°-938042°E48.419051°-419332°, ca. 950 m, screen sweeping, 16.01.2017". The specimen is lacking the fore legs; the left mid tibia with the tarsi fell off during preparation and was transferred into a gelatine capsule, which was then attached to the staging pin. The holotype will be located in the Entomological Department of the Moravian Museum, Brno, CZ.

Etymology: The epithet *analama* of the species' name is an adjective in feminine case and derives (somewhat modified) from the name of the Analamazaotra Reserve, the area where the holotype was found.

Description (female) [see also "Additions to the descriptions" p. 66]: Head (Figs 11, 16). Ground-colour greyish brown. Eyes practically without microscopic hairs. Frons at vertex about 0.26 times as wide as maximum width of head, almost parallel-sided only weakly dilated towards the anterior margin, at level of anterior ocellus about 3.2 times as wide as the distance

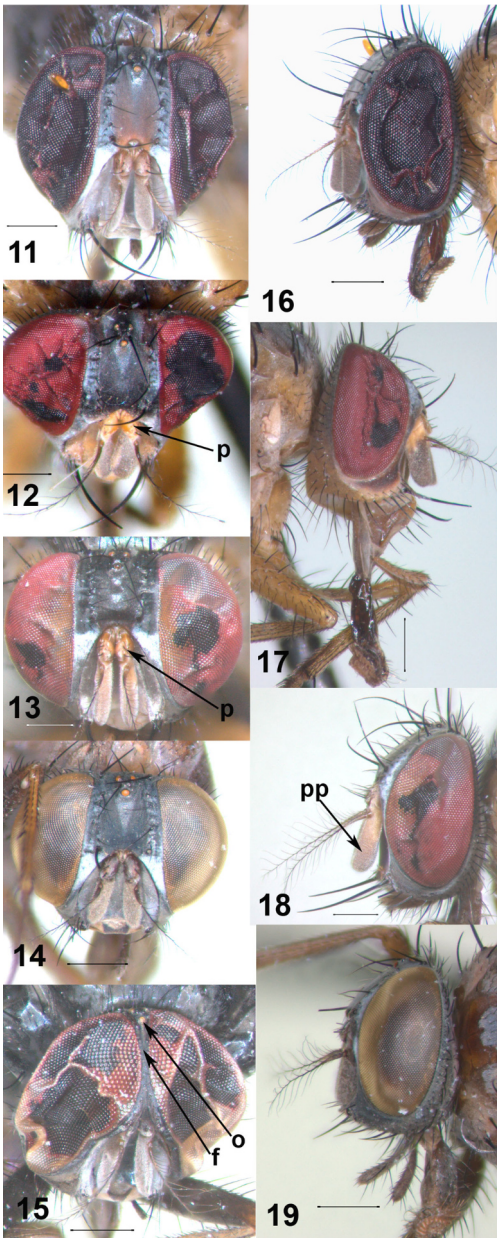
between the outer margins of posterior ocelli and at anterior margin of frontal vitta directly above lunule about 3.7 times as wide. Fronto-orbital plate at narrowest point about twice as wide as anterior ocellus. Frontal triangle slender, not very clearly demarcated, anterior part strongly tapering; from certain viewing angle the anterior tip reaching second pair of anterior frontal setae. Parafacial at level of antenna basis slightly broader than the width of postpedicel and at the lower end barely as broad as anterior ocellus. Genal depth below lowest eye margin (Fig. 16), barely half as broad as depth of postpedicel. When viewed anteriorly (Fig. 11), fronto-orbital plates predominantly black not very densely greyish dusted; frontal vitta dark rust-brown with a reddish tinge and thinly greyish dusted; frontal triangle and ocellar tubercle more blackish and slightly shiny; parafacial, peristomal area and anterior part of gena densely and face somewhat less whitish-greyish dusted. Lateral part of gena dark grey with a reddish-brown shimmer and, at certain angles of viewing, with white dusting; the lower margin dark brown somewhat contrasting to the upper surface. Ground colour of antennae ochre to brown, pedicel somewhat shiny with a yellowish shimmer at certain angles of viewing; postpedicel brownish, in some light conditions more or less grey dusted. Postpedicel about three times as long as broad and about 2.3 times as long as pedicel. Arista not distinctly thickened at base, yellowish-brown to brown, longest hairs of arista twice as long as depth of postpedicel. Anterior part of fronto-orbital plate with three well developed setae and one or two small interstitial hairs; the most anterior seta strong and almost twice as long as the second seta; the third seta somewhat longer than the second, on the upper half at about the level of anterior ocellus a strong long reclinate orbital seta, and another somewhat shorter orbital seta, somewhat below. An irregular row of proclinate setulae between eye margin and frontal and orbital setae, respectively. Facial ridge without visible small setulae. Vibrissal setae strong and approximately twice as long as the longest surrounding peristomal setae. Lower surface of gena and post-occipital surface dark blackish-grey, with dark seta-like hairs. Proboscis not very long and not conspicuously enlarged, prementum not bulbous, glossy brown, length of labella clearly longer than maximal depth of proboscis; palpus brownish, longer than prementum.

Thorax (Figs 1, 20). Ground-colour yellow to dark brown. Mesonotum (Fig. 20) predominantly shiny, the surface extending from anterior presutural margin to scutellar suture and between the posthumeral and intraalar setae of each body side shiny dark brown, at some viewing angles sparsely dusted; when viewed from posterior, presutural part with three broad greyish-white dusted stripes narrowing towards the transverse suture and exceeding the suture slightly. The lateral surface of mesonotum including postpronotal lobe, notopleuron and scutellum and all lateral pleura, shiny yellow (Fig. 1), in certain light conditions sparsely white dusted. Anterior and posterior spiracle strikingly yellow. Prosternum yellow. Dorsocentrals 2+3; anterior notopleural seta longer than posterior seta; prealar seta distinct, as strong as posterior notopleural seta. Greater ampulla with some black setulae. Anepisternals 1+4-5 setae; the setae of posterior row of varying length but distinctly longer than surrounding interstitial hairs. Lateral surface of scutellum with few setulae, limited to the very anterior part, posterior lateral surface and margin to ventral surface bare.

Wing (Figs 1, 6). Membrane with a weak yellowish shimmer. Tegula and basicosta yellow, veins in basal half of wing yellowish and somewhat darker towards distal part of wing. Costal spine small, about twice as long as neighbouring bristles. Radial node and basal part of vein R4+5 dorsally bare, ventrally with a row of long setulae up to midway to cross-vein r-m. Both calypters (Fig. 6) brownish transparent, margin of lower calypter without a dark frame, of upper calypter with a conspicuously dark frame, lower calypter about twice as long as upper calypter.

Legs (Fig. 1). Coxae, trochanters, femora, tibiae and tarsi yellow. Fore legs missing. Mid femur preapically with a short anterodorsal, one almost dorsal and two posterior to posterodorsal setae. Hind femur with complete row of strong anterodorsal setae barely as long as depth of femur at point of insertion; in the apical third, three or four distinct anteroventral setae and in basal third one or two anteroventral and posteroventral seta-like hairs, somewhat longer than the surrounding hairs, preapically two strong posterodorsal to dorsal setae. Hind tibia at middle third with one strong anterodorsal seta, almost twice as long as diameter of tibia and two much weaker anteroventral setae, barely as long as diameter of tibia.

Abdomen. Dorsal surface of tergites shiny brown to dark brown, barely dusted. Anterior part of syntergite 1+2, apical half of tergite five and lateral and ventral parts of tergites yellow. Tergites 3 and 4 with some moderately long marginals; tergite 5 with some discals and a row of marginals. Sternites yellow.



Figs 11–15. Anterior view of the holotypes of the new species of *Dichaetomyia*: (11) *D. analama* sp. n.; (12) *D. necoa* sp. n., p = strikingly yellow pedicel; (13) *D. amboha* sp. n., p = yellowish-orange pedicel; (14) *D. tantelya* sp. n.; (15) *D. blackia* sp. n., f = frons about as wide as diameter of anterior ocellus = o. Figs 16–19. Side view of heads of the female holotypes of *Dichaetomyia*: (16) *D. analama* sp. n.; (17) *D. necoa* sp. n.; (18) *D. amboha* sp. n., pp = yellowish-ochre postpedicel, at least 3.5 times as long as deep; (19) *D. tantelya* sp. n., ♀ paratype. (figures 11–19 bar: 0.5 mm).

Measurements. Length of body about 6 mm; length of wing about 6.3 mm.

Male not known.

Diagnosis: Using the key to the Madagascan species of the genus *Dichaetomyia* (Couri et al. 2006), the new species runs to couplet 4, not matching one of the two options listed. On the one side, *Dichaetomyia analama* sp. n. does not correspond to the description of *Dichaetomyia ovata* (Stein, 1918), which is almost completely matt yellow coloured including the postpedicel. Whereas, the body colour of *D. analama* is predominantly shiny yellow, apart from the shiny dark brown surface of the mesonotum (Figs 1, 20) and the equally brown-coloured dorsal surfaces of the tergites. In addition, the postpedicel of *D. analama* is predominantly brownish (Figs 11, 16). On the other side, the new species differs from the mainly brownish coloured *Dichaetomyia colorata* Couri, Pont & Penny, 2006 by the conspicuously uniformly yellow pleura of the thorax, the completely yellow lateral parts of tergites and the strikingly yellow legs (Fig. 1).

Dichaetomyia (*Panaga*) *necoa* sp. n. (Figs 3, 7, 12, 17, 21)

Material examined: ♀ holotype from "C Madagascar, Ambohitantely Spec. Res., S18°11'43.3"E47°17'17.7", 1630 m, 26.-28.i.2016". 2 ♀♀ paratypes from the same locality and date but with slightly different coordinates and altitude above sea level: S18°11'51.7"E47°17'0.6"; 1604 m a.s.l. The left fore leg and the right fore tarsi of one paratype fell off during preparation and were transferred into a gelatine capsule which was then attached at the staging pin; the mid leg of the other paratype fell off and was preserved in ethanol for determination of DNA sequences (vial no. M6). The holotype will be deposited in the Entomological Department of the Moravian Museum, Brno, CZ and both paratypes are in the entomological collection of IBER.

Etymology: The name of the species *necoa* is a feminine adjective and refers, strongly modified, to the result of the first examination: "ne (= not) colorata" plus the first two and the last letter from *colorata*.

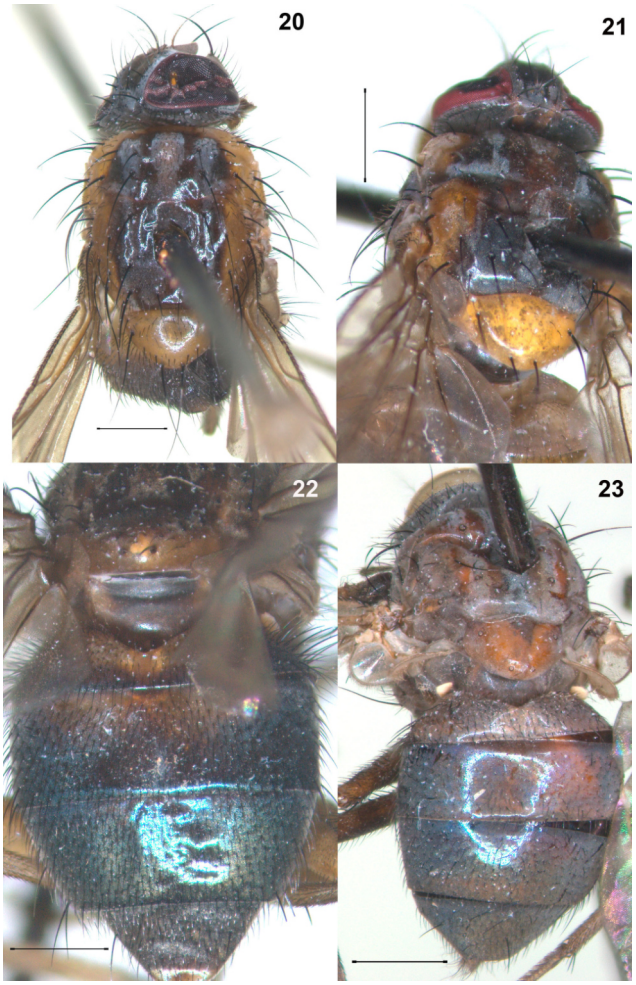
Description (female) [see also "Additions to the descriptions" p. 66]: Head (Figs 12, 17). Ground-colour yellow-orange with more or less dark areas. Frons at vertex about 0.26 times as wide as maximum width of head, slightly dilated towards anterior margin; at level of anterior ocellus about 3.6 times as wide as the distance between the outer margins of posterior ocelli, and at anterior margin above lunule – 4.1 times as wide. Fronto-orbital plate at narrowest point about 1.5

times as wide as anterior ocellus. Frontal triangle slender, anterior tip reaching barely the level of second anterior fronto-orbital seta. Parafacial at level of antenna basis distinctly wider than half depth of postpedicel and at the lower end about as wide as anterior ocellus. Genal depth below lowest eye margin (Fig. 17) about as wide as depth of postpedicel. When viewed anteriorly (Fig. 12), fronto-orbital plate predominantly black with sparse whitish-grey dusting, frontal vitta of the two paratypes contrasting yellowish-orange, more whitish dusted in one female; holotype with a dark frontal vitta slightly greyish-white dusted and concolorous with the fronto-orbital plate, frontal triangle concolorous with frontal vitta, ocellar tubercle blackish. Parafacial and anterior part of gena yellow with some whitish dusting, parafacial and anterior surface of gena of holotype predominantly brownish, densely white dusted; face yellow with greyish-white dusting. Lateral part of gena yellow, the upper half reddish in two females and blackish and white dusted in holotype. Basal antennal segments (Figs 12, 17) and basis of postpedicel up to the insertion of arista conspicuously yellowish, contrasting to the dark brown and greyish dusted apical two thirds of postpedicel. Postpedicel at most three times as long as deep and about 2.5 times as long as pedicel. Arista uniformly dark brown, longest hairs of arista about 1.3 times as long as depth of postpedicel. Anterior half of fronto-orbital plate with two setae, the most anterior seta strong and long, the upper one distinctly smaller, in addition two smaller interstitial seta-like hairs, one of which at about midway of frons. At about the level of anterior ocellus, a strong reclinate orbital seta and another reclinate orbital seta slightly below, at most half as long as the upper seta. An irregular row of proclinate setulae between eye margin and setae. Fascial ridge at basal third with a few very small setulae along the suture to parafacial, no other small setulae visible on facial ridge. Vibrissal seta strong and approximately twice as long as the longest surrounding peristomal setae. Lateral surface of gena and lower occipital part predominantly yellowish. Proboscis (Fig. 17) long, prementum not bulbous, glossy brown, length of labella slightly longer than depth of proboscis; palpus yellow, shorter than prementum.

Thorax (Figs 3, 21). Ground-colour mainly brownish. Mesonotum (Fig. 21) predominantly dark brown, the central part almost blackish with reddish-brown shimmer, depending on viewing angle shiny or whitish dusted. Posteriorly of the brown transverse suture the supra-alar area of mesonotum, bordered by the intra-alar setae, yellow or reddish-brown. When viewed from posteriorly presutural part of scutum with a broad median greyish-white dusted stripe narrowing towards the transverse suture, shortly interrupted at the suture and continued behind the suture as a much narrower, whitish stripe almost reaching the scutellar suture. In addition, a paramedian whitish-greyish stripe (along outside of each row of dorsocentrals) reaching the transverse suture and extending to a greyish-white transverse band along the suture. Scutellum (Fig. 21) uniformly yellow, strikingly contrasting to the dark parts of mesonotum. Postpronotum, anterior part of notopleuron and adjacent part of anepisternum, including the area around anterior spiracle, strikingly yellow. Lateral pleura brown (Fig. 3), at least slightly greyish-white dusted independently of viewing angle. Anterior and posterior spiracle yellow. Prosternum yellow. Dorsocentrals 2+3; the outer postpronotal seta almost twice as long as the inner seta; the anterior notopleural seta longer than the posterior; pre-alar seta distinct, almost as long as posterior notopleural seta. Greater ampulla with some strong setulae. Anepisternal setae 1+4-5; the posterior setae strong and of varying length, surrounded by very few rather short interstitial seta-like hairs. Lateral surface of scutellum, including the margin to the ventral surface, with few setulae.

Wing (Figs 3, 7). Membrane with a brownish shimmer. Tegula and basicosta yellow or ochre, veins brown. Costal spine small, about twice as long as neighbouring bristles. Radial node and basal part of vein R4+5 dorsally at most with one or two setulae and ventrally up to midway to cross-vein r-m with a few rather weak setulae. Both calypters (Fig. 7) transparent with a brownish tinge and contrasting dark brown frames of the margins, lower calypter almost twice as long as upper calypter.

Legs (Fig. 1). Coxae, trochanters, femora, tibiae and tarsi yellow. Fore tibia without a median posterior seta. Mid femur preapically with a short anterodorsal, one almost dorsal and two posterior to posterodorsal setae. Hind femur with a complete row of strong anterodorsal setae and in the basal two thirds with a row of anteroventrals, weak and only somewhat longer than ground hair, followed by four longer anteroventral setae in the apical third, of which the most apical setae are equal in length to the anterodorsal setae; preapically two strong posterodorsal to dorsal setae. Hind tibia in middle third with one strong anterodorsal seta longer than diameter of tibia and one weaker anteroventral seta barely as long as diameter of tibia.



Figs 20–23. Dorsal view of mesonotum and/or abdomen of the female holotypes of the new species of *Dichaetomyia*: (20) *D. analama* sp. n., predominantly shiny brown mesonotum with yellow lateral parts of mesonotum, adjacent pleura and of scutellum; (21) *D. necoa* sp. n., thorax with mesonotum and contrasting yellow scutellum; (22) *D. amboha* sp. n., scutellum with a yellow apical tip; abdomen with yellowish markings on anterior part of syntergite 1+2 and close to the anterior margin of tergite 3, the abdomen is in normal light conditions usually predominantly shiny dark brownish to blackish, when exposed to photographic illumination with a bluish shine; (23) *D. tantelya* sp. n., mesonotum distinctly reddish brown marked and densely dusted at some viewing angles; abdomen in normal light conditions without a distinct pattern, colouration varying between reddish-brown and dark brown and shiny or slightly dusted, depending on the point of viewing, in photographic light conditions the abdomen appears partially shiny bluish. (Figures 20–23 bar: 1 mm).

Abdomen. Shiny brown to dark brown; the abdomen of each of the three females is stretched and the yellowish intersegmental membrane and the anterior parts of the tergites which are usually covered by the posterior margins of the anterior tergites are visible, showing a yellow band between the dorsally brown tergites. Anterior half of syntergite 1+2 dorsally and ventrally predominantly yellow, posterior part dorsally yellowish-brown laterally and ventrally yellow; tergites 3 to 5 dorsally brown, laterally on the upper surface brown changing to predominantly yellow in the ventral parts of tergites. Apical third to half of dorsal surface of tergite 5 yellow. Tergite 4 with a row of moderately long marginals, tergite 5 with some discals and a row of marginals. Colour of sternites varying between yellow to pale brownish, shiny at some points of viewing.

Measurements. Length of body about 7 mm; length of wing about 6.8 mm.

Male not known.

Diagnosis: The specimens of *Dichaetomyia necoa* sp. n. run in the key to *D. colorata* and in updated couplets of the same key (Zielke 2020) to couplet 5a with *D. colorata* and *D. necolorata* Zielke, 2020. The legs of *D. colorata* and of the similar species of *D. necolorata* are light brownish to brown, the antennae are predominantly brown, the postpedicel are at least 3.5 times as long as deep and the palpi are brownish and about as long as or longer than prementum. *Dichaetomyia necoa,* however, is marked by distinctly yellow legs including coxae and trochanters, the basal antennal segments including the basal part of postpedicel are conspicuously yellow, contrasting to the dark apical part of postpedicel. The latter is barely three times as long as deep, the palpi are predominantly yellow and barely as long as prementum.

Dichaetomyia amboha sp. n. (Figs 2, 9, 13, 18, 22)

Material examined: ♀ holotype from "C Madagascar, Ambohitantely Spec. Res., S18°11'51.7"E47°17'0.6', 1604 m, 26.-28.i.2016". 1 ♀ paratype same label as holotype, the left mid leg of the paratype fell off during preparation and was preserved (vial no. M5) for DNA analysis; 6 ♀♀ paratypes from "C Madagascar, Ambohitantely Spec. Res., S18°11'44,5"E47°17'14,9", 1617 m, 26.-28.i.2016, loc. coll." Two of the paratypes lost the left mid and the two fore legs during preparation, the extremities were preserved in ethanol for DNA analysis (vial numbers M18 and M33 respectively). Another ♀ paratype from "C Madagascar, Ambohitantely Spec. Res., S18°11'51"E47°16'59", 1585 m, 5.-8.i.2017, Flight Intercept. Trap." The holotype and

three paratypes will be deposited in the Entomological Department of the Moravian Museum, Brno, CZ and four paratypes remain in the entomological collection of IBER.

Etymology: The name of the species *amboha* is a feminine adjective and derives somewhat modified from the name of the Ambohitantely Reserve on Madagascar, the locality where the specimens of this new species were collected.

Description (female) [see also "Additions to the descriptions" p. 66]: Head (Figs 13, 18). Ground-colour dark, partially densely greyish-white dusted. Eyes of a few specimens with facets close to frons, somewhat larger than the facets of lateral areas. Frons at vertex about 0.33 times as wide as maximum width of head, parallel-sided, at level of anterior ocellus and at anterior margin of frons about 3.8 times as wide as distance between the outer margins of posterior ocelli. Fronto-orbital plate at narrowest point about twice as broad as anterior ocellus. Frontal triangle slender, anterior tip reaching about the level of second anterior pair of fronto-orbital setae. Parafacial at level of antenna basis slightly wider than depth of postpedicel and at the lower end as wide as anterior ocellus. Genal depth below lowest eye margin, 0.7 times as broad as depth of postpedicel (Fig. 18). When viewed from anterior side (Fig. 13) upper half of head blackish, while fronto-orbital plate, frontal vitta with frontal triangle and ocellar tubercle black, depending on viewing angle shiny or somewhat greyish dusted; lower part of head with parafacial, face, peristomal area and anterior part of gena predominantly more or less silver-white dusted. Basal segments of antenna and basal half of postpedicel predominantly yellowish, apical half of postpedicel ochre to brown (Fig. 18). Postpedicel at least 3.5 times as long as deep and as long as pedicel. Arista brownish, longest hairs of arista about twice as long as depth of postpedicel. Anterior half of fronto-orbital plate with three or four setae, the most anterior seta strong and about twice as long as the upper setae, a few smaller interstitial hairs between the setae, at the level of anterior ocellus a strong reclinate orbital seta with another somewhat shorter orbital seta slightly below. An irregular row of small proclinate setulae between eye margin and fronto-orbital and orbital setae along the entire length of frons. Facial ridge with several small setulae, clearly visible when viewed from certain angles. Vibrissal seta strong and at least twice as long as the longest surrounding peristomal setae. Lower surface of gena and post-occipital surface brown to dark, slightly greyish dusted. Proboscis short, conspicuously dilated towards labella, prementum short, ochre to brown, and slightly whitish-grey dusted; labella about as long as prementum, and slightly longer than largest depth of proboscis; palpus yellowish or brown, distinctly longer than prementum.

Thorax (figs 2, 22). Ground-colour mainly brownish to dark brown. The surface of the mesonotum between the rows of dorsocentral setae predominantly dark brown, depending on viewing angle slightly shiny or greyish-white dusted, the postsutural area outside the rows of the dorsocentral setae brown or reddish-brown, varying in intensity and extent in the individual females. From posterior view presutural part of mesonotum with a broad middle grey-white dusted stripe that reaches the transverse suture and continues in the postsutural part of the mesonotum to the scutellar suture, but is abruptly post-sutural reduced to a maximum of one third of its original width; a paramedian grey-white dusted stripe, which is somewhat widened on the anterior presutural part and extends along each row of the dorsocentral setae, shortly behind the transverse suture on the lateral red-brown postsutural surface, the stripe widens to a greyish-white dusted area, which reaches the posterior postsutural dorsocentral seta, in addition a distinct longitudinal dark stripe outside of the postsutural dorsocentral setae extending to the level of the posterior dorsocentral seta. Dorsal surface of scutellum dark brown and slightly shiny, lateral and ventral surface and apical tip contrasting yellow (Fig. 22). Postpronotum and in most specimens also notopleuron conspicuously yellow (Fig. 2), in few paratypes notopleuron more brownish-yellow or only brownish. Lateral pleura pale-brown to brown, depending on viewing angle more or less greyish dusted (Fig. 2). Anterior spiracle strikingly yellow, posterior more yellowish-brown. Prosternum yellow. Dorsocentrals 2+2; the outer postpronotal seta distinctly longer than the inner seta; anterior notopleural seta much longer than the posterior; pre-alar seta distinct, about half as long as posterior notopleural seta; the intra-alar setae relatively short. Greater ampulla without distinct setulae. Anepisternal setae 1+4-5, posterior setae of varying length, surrounded by numerous interstitial seta-like hairs, some of which almost as long as the shortest seta. Basal and preapical setae of scutellum barely longer than the long ground-hair; lower half of lateral surface of scutellum including the margin to the ventral surface bare.

Wing (Figs 2, 9). Membrane with a brownish shimmer. Tegula and basicosta predominantly brownish, veins brown. Costal spine small, about twice as long as neighbouring bristles. Radial node and basal part of vein R4+5 dorsally and ventrally with a few setulae. Both calypters transparent, in general without dark frames (Fig. 9), only in certain light conditions with contrasting dark brown margins, lower calypter about twice as long as upper calypter.

Legs (Fig. 2). Coxae, trochanters, femora, tibiae and tarsi yellow. Fore tibia with a median posterior seta longer than the diameter of tibia. Mid femur preapically with a short anterodorsal and three or four strong posterior to posterodorsal and dorsal setae. Hind femur with complete row of strong anterodorsal setae barely as long as depth of femur at the point of insertion; at the apical third three or four anteroventral setae longer than the anterodorsal setae, preapically two strong posterodorsal to dorsal setae. Hind tibia in middle third with one strong anterodorsal seta longer than diameter of tibia and two or three weaker anteroventral setae, barely as long as diameter of tibia.

Abdomen (Figs 2, 22). When viewed dorsally ground-colour predominantly uniformly dark brown and shiny, in some light conditions tergites 3 to 5 irregularly greyish dusted; anterior half of syntergite 1+2 dorsally and ventrally yellowish coloured, posterior part of syntergite dorsally at middle part somewhat yellowish, dorsolateral and sides shiny dark brown. Anterior dorsal half of tergite 3 with more or less well developed yellowish dorsal areas (Fig. 22). When viewed from posterior, tergites predominantly shiny dark and in certain light conditions with a distinct brownish-blue shimmer. Tergite 5 in some specimens marked by a narrow yellow apical margin (Fig. 22); lateral and ventral parts of tergites about concolorous with dorsal surface (Fig. 2). Tergite 4 laterally with few marginal and discal setae, tergite 5 with some discals and a row of marginals. Sternites varying between yellow to pale brownish.

Measurements. Length of body about 8 mm; length of wing about 8.5 mm.

Male not known.

Diagnosis: The females of *Dichaetomyia amboha* sp. n. are similar to the specimens of *Dichaetomyia tricolorata* Couri, Pont & Penny, 2006. Both species differ, however, in addition to body length (8 mm vs 6-6.4 mm), by the following taxonomic features: The postpedicel of females of *D. tricolorata* is at most three times as long as deep and only the pedicel is yellowish-brown, whereas the postpedices predominantly brown. The abdomen is dull greyish-brown coloured with greyish dusting, tergites 3 to 5 with hints of not clearly defined brown spots. In *D. amboha,* however, the postpedicel is at least 3.5 times as long as deep (Fig. 18). Not only the pedicel, but also the postpedicel is usually predominantly yellowish-orange coloured. The abdomen is predominantly shiny dark brown to blackish without faint brown patches on tergites 3 to 5 (Fig. 22).

Dichaetomyia blackia n. sp. (Figs 4, 8, 15)

Material examined: ♂ holotype from "N Madagascar, Ankarana N. P., S12°57'E49°07', 987 m, 23.-25.i.2016, Flight Intercept. Trap in dark forest". The male's head has shrunk significantly and the specimen is lacking the mid legs and some of the major setae. However, the important taxonomic features of the head and most scars of the lost setae are clearly visible. Due to the distinctive species-specific characteristics, the differentiation and description of the new species was not impaired despite the abovementioned deficiencies. The holotype will be deposited in the Entomological Department of the Moravian Museum, Brno, CZ.

Etymology: The species' name is an adjective in feminine case, modified from "black", the predominant colour of the holotype.

Description (male): Head (Fig. 15). Ground-colour dark brown to black, at some points of viewing sparsely brownish-grey dusted. Eyes large, practically without hairs, facets next to frons distinctly larger than facets on the outer side of eye. Frons at the narrowest point as wide as diameter of anterior ocellus (Fig. 15), fronto-orbital plates at that point half as broad as anterior ocellus and touching along the middle third of frons, separated anteriorly by a short triangular-shaped and in upper part of frons by a line-shaped frontal vitta. Parafacial predominantly parallel-sided, tapering at the lower third, at level of insertion of arista to postpedicel about as broad as anterior ocellus. In profile mouth margin in line with profrons. Genal depth below lowest eye margin as broad as anterior ocellus. When viewed from the anterior side, fronto-orbital plate black, frontal vitta, where available, greyish dusted and parafacial, peristomal area and anterior surface of gena dark with some grey dusting. Antennal segments uniformly dark and at certain viewing angles sparsely greyish dusted. Postpedicel about 3.5 times as long as deep and

also about 3.5 times as long as pedicel. Arista dark brown, approximately twice as long as length of postpedicel, longest dorsal hairs of arista longer than twice the depth of postpedicel. Fronto-orbital plate with scars of three or four distinct setae on anterior quarter and with very few interstitial smaller hairs, at level directly below the ocellar tubercle a distinct scar of a strong orbital seta and shortly below a strong reclinate setula. Parafacial bare. Facial ridge in anterior third with a few setulae along the margin adjacent to gena and lower part of parafacial. Scars of vibrissal setae very strong, the surrounding peristomal setae not very long. Lower surface of gena and post-occipital surface dark with sparse brownish-grey dusting and black seta-like hairs. Proboscis short, dark brown, prementum dark brown not shiny, slightly dusted; labella strikingly large, about twice as long as maximal depth of proboscis; palpus dark brown almost black, slender and longer than prementum.

Thorax (Fig. 4). Ground-colour uniformly deep dark brown to blackish. Mesonotum predominantly shiny. When viewed from the posterior or anterior side, the presutural part of mesonotum with two greyish-white stripes along the dorsocentral setae reaching the suture; from certain viewing angles the presutural part of mesonotum with sparse greyish dusting. Posterior part of mesonotum black and predominantly shiny, scutellum concolorous with mesonotum but somewhat more brownish. Pleura all dark brown to black (Fig. 4), depending on point of viewing uniformly thinly greyish dusted or shiny. Anterior and posterior spiracle dark, posterior one with some black setulae at lower margin. Dorsocentrals 2+2; acrostichals 0 + 1 about half as long as the posterior dorsocentral seta; two postpronotal setae, the outer one distinctly longer and stronger; two notopleural setae, anterior one longer, notopleuron with a few small black hairs in posterior half; pre-alar seta barely half as long as posterior notopleural seta; two intra-alar setae. Greater ampulla without distinct setulae, postalar declivity and suprasquamal ridge bare. Prosternum dark and haired; anepimeron with a tuft of setulae above and some scattered seta-like hairs on the posterior surface. Proepimeral area and katepimeron bare; meron with a few very fine hairs, longer than setulae, predominantly above hind coxa but on the left body side also below the posterior spiracle. Katepisternals 1+2, the lower one distinctly closer to the posterior than to the anterior seta. Anepisternals 1+5, the setae of the posterior row strong and varying in length, about twice as long as the adjacent interstitial seta-like hairs. Scutellum with a pair each of strong apical and strong lateral setae, basal seta and preapical seta distinctly shorter, only upper half of lateral surface with few setulae, lower half and margin to ventral surface bare.

Wing (Figs 4, 8). Membrane hyaline with a distinct yellowish-brown shimmer, cross-veins and surrounding membrane not infuscate. Tegula and basicosta dark, veins yellowish-brown. Costal spine not distinct. Radial node dorsally bare, ventrally with at most three setulae, basal part of vein R4+5 dorsally and ventrally bare. Vein M somewhat diverging from vein R4+5, but slightly curved forward to R4+5 before reaching wing margin. Cross-vein r-m clearly basad of the point where vein R1 enters costa; distal cross-vein dm-cu sinuous and oblique. Both calypters (Fig. 8) brownish transparent, margin of upper calypter brownish, margin of lower calypter conspicuously dark brown; lower calypter almost twice as long as upper calypter. Knob of haltere brown, basis of stem dark yellow.

Legs (Fig. 4). Coxae, trochanters and femora brown, tibiae and tarsi predominantly yellow. Pulvilli and claws well developed, but not as long as the corresponding tarsomeres. Fore femur with rows of posterodorsal, posterior and posteroventral setae, the posterodorsal and posterior setae at least as long as depth of femur at the point of insertion, posteroventral setae clearly longer than depth of femur. Fore tibia with a distinct but not conspicuously long median posterior seta. Mid legs missing. Hind coxa bare on posterior surface. Hind femur with complete row of strong anterodorsal setae, a complete row each of anteroventral and posteroventral setae, the setae of both ventral rows in the basal half about half as long (for anteroventral setae) or about one third as long (posteroventral setae) as the depth of femur at point of insertion and in the apical part, about as long as depth of femur; preapically two strong posterodorsal to dorsal setae. Hind tibia without distinct posterodorsal seta, on middle third one anterodorsal and two or three anteroventral setae, all about as long as diameter of tibia.

Abdomen (Fig. 4). Uniformly glossy dark brown, almost black, without specific pattern; when viewed directly posteriorly, partly sparsely brownish dusted. Tergite 3 with a few strong marginal setae laterally, tergite 4 with several strong marginals and a few strong discals laterally, tergite 5 with some discals and marginals. Sternites brown, margin of sternite 1 haired.

Male genitalia. Hypopygium not pronounced. The species is clearly distinguished from similar species of

the genus by other taxonomic characters, the determination of the species is not based on characters of genitalia. Therefore, it was deemed wiser to refrain from extracting the hypopygium to avoid inflicting damage on the only hitherto available specimen.

Measurements. Length of body about 5.5 mm; length of wing about 6 mm.

Female not known.

Diagnosis: *Dichaetomyia blackia* n. sp. runs in the key to *Dichaetomyia nigra* Couri, Pont & Penny, 2006. However, the mesonotum of *D. nigra* is dark brown-coloured with grey pollinosity, there are two black stripes inside the rows of dorsocentral setae; postpronotum is yellowish-brown; anterior spiracle white; trochanters and femora are brownish-yellow or yellow; abdomen is dark brown with some grey pollinosity. Postpedicel is about 2.6 times as long as pedicel. Meron without fine hairs in lower half; wing vein R4+5 with setulae dorsally on radial node and at base of vein; hind femur with three or four anteroventral setae on apical third. In contrast, the mesonotum and the pleura of *D. blackia* are uniformly shiny dark-brown to blackish, without any yellowish pattern or surfaces; the anterior spiracle is dark; trochanters and femora are brown; abdomen is shiny black. The postpedicel is at least three times as long as pedicel. Distinct fine hairs are present in the lower half of the meron; vein R4+5 is dorsally without setulae and the hind femur is marked by a complete row of anteroventral setae and in apical third with a row of strong posteroventral setae.

Dichaetomyia tantelya n. sp. (Figs 5, 10, 14, 19, 23)

Material examined: ♀ holotype and ♀ paratype from: "Madagascar, Ambohitantely Spec. Res., S18°11'54,9"E47°16'52,6", 1580 m, 20.-25.xi.2011, local coll." Holotype and paratype are lacking some major setae, however the scars of the lost setae are clearly visible. The female paratype is lacking the right mid leg. The holotype will be deposited in the Entomological Department of the Moravian Museum, Brno, CZ and the paratype is deposited in the entomological collection of IBER.

Etymology: The name of the species is an adjective in feminine case and derives from the second half of the name of the area where the specimens were collected.

Description (female) [see also "Additions to the descriptions" p. 66]: Head (Figs 14, 19). Ground-colour dark, partially greyish-white dusted. Frons at vertex about 0.27 times as wide as maximum width of head, somewhat dilated towards the anterior margin, at level of anterior ocellus about 3.2 times and at anterior margin about four times as wide as the distance between the outer margins of posterior ocelli (Fig. 14). Fronto-orbital plate at level of anterior ocellus about 0.7 times as wide as distance between outer margins of posterior ocelli. Ocellar triangle slender, anterior tip almost but not quite reaching anterior margin of frons. Parafacial at level of antenna basis slightly wider than depth of postpedicel and at the lower end not much wider than anterior ocellus. Genal depth below lowest eye margin almost as wide as depth of postpedicel (Fig. 19). When viewed from the anterior side, fronto-orbital plate and parafacial predominantly greyish-white dusted; frontal vitta, frontal triangle and ocellar tubercle black with sparse grey dusting; frontal triangle at some viewing angles somewhat shiny; face greyish dusted, peristomal area and anterior part of gena predominantly dark grey with sparse pale dusting. Antennal segments uniformly brown, postpedicel from some points of viewing greyish-brown dusted. Postpedicel three times as long as deep and about 2.3 times as long as pedicel. Arista at base somewhat bulbous thickened, brown; longest hairs of arista about 1.6 times as long as depth of postpedicel. Anterior half of fronto-orbital plate with three setae and with one or two very small interstitial setulae: the most anterior seta strong and long, the upper setae distinctly shorter, at about midway a small proclinate seta and on the upper half of fronto-orbital plate at the level of anterior ocellus a strong reclinate orbital seta, another, somewhat shorter, orbital seta slightly below; an irregular row of setulae between eye margin and orbital and frontal setae. Facial ridge with few barely recognisable setulae. Vibrissal setae strong and at least twice as long as the longest surrounding peristomal setae. Upper half of lateral surface of gena bare, lower surface and post-occipital surface dark, greyish dusted and with dark seta-like hairs. Proboscis short, prementum rather broad not very deep, brown, dusted, length of labella distinctly longer than depth of proboscis; palpus dark brown, longer than prementum.

Thorax (Figs 5, 23). Ground-colour brownish. Mesonotum brownish-yellow, depending on angle of viewing more shiny or predominantly whitish-grey dusted; when viewed directly from posterior presutural part of mesonotum with a median vitta reaching scutellar suture, densely whitish-grey dusted in the presutural

part and gradually fading to a dark greyish ground-colour at the posterior half of postsutural part; a paramedian whitish-grey stripe along each row of dorsocentrals reaching the scutellar suture, dilated at the anterior presutural part of mesonotum and slightly narrowing before and shortly after the transverse suture; the surface along the white dusted stripes yellowish-brown with sparse dusting only. The raised part of postpronotum predominantly yellow, the lower basal part yellowish-brown or greyish dusted. Scutellum predominantly yellow with sparse dusting and in holotype with a dark brown triangular-shaped patch (Fig. 23), which is not present in the paratype. All pleura (Fig. 5) brownish or grey, depending on viewing angle more or less greyish dusted. Anterior spiracle yellowish-grey, posterior spiracle brownish. Prosternum dark brown. Dorsocentrals 2+2; outer postpronotal seta almost twice as long as the inner seta; anterior notopleural seta much longer than the posterior; pre-alar seta distinct, about half as long as posterior notopleural seta. Greater ampulla without distinct setulae. Anepisternal setae 1+5, posterior setae of varying length, surrounded by several rather short interstitial seta-like hairs. Lateral surface of scutellum including the margin to the ventral surface with a few setulae.

Wing (Figs 5, 10). Membrane with a distinct brownish shimmer. Tegula and basicosta pale brown, veins brown. Costal spine prominent, about three times as long as adjacent bristles. Radial node dorsally and ventrally with few setulae, basal part of vein R4+5 dorsally bare and ventrally with a row of distinct setae reaching at least midway to cross-vein r-m. Cross-vein r-m almost at the same level where vein R1 enters costa; distal cross-vein dm-cu almost straight and at a right angle with vein M. Both calypters yellowish-whitish transparent margin with yellowish-brown frame (Fig. 10), lower calypter about 1.5 times as long as upper calypter.

Legs (Fig. 5). Coxae, trochanters and femora predominantly brown, tibiae and tarsi yellow. Fore tibia with a median posterior seta about 1.5 times as long as diameter of tibia. Mid femur in apical third with a row each of anteroventral and posteroventral setae, about one third as long as depth of femur at point of insertion, preapically with a short anterodorsal, one short dorsal and two distinctly longer posterior to posterodorsal setae. Hind femur with complete row of strong anterodorsal setae, ventral surface of basal half with some hairs almost half as long as depth of femur, in the apical third four anteroventral setae, the two most apical setae distinctly stronger, preapically two strong posterodorsal to dorsal setae. Hind tibia in middle third one strong anterodorsal seta longer than diameter of tibia and one slightly weaker anteroventral seta.

Abdomen (Figs 5, 23). When viewed dorsally syntergite 1+2 and tergite 3 predominantly shiny reddish-brown to dark brown and tergites 4 and 5 mainly dark brown with a diffuse bluish-black shimmer (Fig. 23). However, the colour of the abdomen varies depending on the light conditions, the anterior tergites might be more yellowish and at some angles, lateral and ventral parts of tergites are almost uniformly dark with bluish-black reflections, in certain lighting conditions all tergites are more or less slightly greyish-brown dusted. Tergite 3 is marked by a row of short marginal setae and tergite 4 is marked by a row of long and strong marginals, tergite 5 – by a row of long discals. Sternites brown, somewhat shiny.

Measurements. Length of body about 7.5 mm; length of wing about 7 mm.

Male not known.

Diagnosis: The taxonomic characteristics of the new species lead in the identification key to *D. tricolorata*. In addition, the new species also resembles to some extent *Dichaetomyia amboha,* which is described above as another new species. *Dichaetomyia tantelya* sp. n. differs from both species by the brown coxae, trochanters, femora and evenly-coloured dark brown antennae (Fig. 5, 19), which are more or less conspicuous yellow in the other two species. In addition, the shiny reddish-brown to dark brown abdomen of *D. tantelya* differs distinctly from the matt greyish-brown abdomen of *D. tricolorata,* and it differs from the abdomen of *D. amboha* by lacking defined yellow markings on the dorsal surface of syntergite 1+2 and tergite 3 (Figs 22, 23).

Remarks

The descriptions of four of the five new species are based on female holotypes, as the males of the new species are still unknown. However, the female types differ from related species in several respects, so that their identification as a new species and the differentiation from other species is unambiguous. New species of *Dichaetomyia* have already been described in the past by various authors only on the basis of existing females. The males belonging to the species were sometimes not identified until many years after the species was first de-

scribed. For example, *Dichaetomyia madagascariensis* was originally described by Séguy in 1938, and *Dichaetomyia harlekini* as *Annaria harlekini* in 1972 by Zielke, on the basis of female specimens. It was only in 2006 that males of these two species were mentioned in the literature. Couri et al. (2006) reported, among other identified specimens, one male of each species found during the investigations of the Malagasy material. In addition, during the ongoing studies, two more males of *D. madagascariensis* were identified.

Apart from the five newly described species listed above, one male and five females of another species were identified, which led in the identification key for Malagasy species of *Dichaetomyia* directly to *D. nigra*. However, the specimens did not match most of the taxonomic features listed in the key and in the species description. It was, therefore, checked whether this species, unknown from Madagascar, is listed in the identification keys for *Dichaetomyia* by van Emden (1942) for Africa and von Pont (1978) for the Comoros. The taxonomic characteristics of the species did not lead to any of the members of the genus known from the Comoros Archipelago. In van Emden's key, however, the determination ended in *Dichaetomyia polita polita* Malloch, 1921 in couplet 17 (18). In couplet 18 (17) van Emden (1942) describes *Dichaetomyia polita ugandana* in an extremely short version as a new subspecies, about which he published a few more details nine years later (van Emden, 1951). The two subspecies are very similar and can only be differentiated by the colour of the femora. The specimens from Madagascar seem to agree more with *D. polita polita* than with *D. polita ugandana*. However, the criteria listed in van Emden's identification key are not detailed enough to definitively assign the Malagasy flies to this species. And although *D. polita* described by Malloch in 1921 is also the genotype of the newly described genus *Dichaetomyia* Malloch, 1921, the description of *D. polita* is not sufficiently differentiated. A definite assignment of the Malagasy specimens based on the species description is not possible due to the rudimentary characterisation. It can only be stated that there are no major differences between the few taxonomic features mentioned in the description and the characteristics of the examined flies.

It should also be noted that Pont (1969) renamed *D. polita* to *Dichaetomyia emdeni* Pont, 1969 due to an existing junior homonym, and that the other subspecies has been listed in the catalogue of Afrotropical Muscidae (Pont, 1980) as a distinct species, namely *Dichaetomyia ugandana* van Emden, 1942. *Dichaetomyia emdeni* is so far only known from Kenya. If it would be confirmed that the specimens from Madagascar belong to this species, *D. emdeni* would be the third species of the known Malagasy fauna of *Dichaetomyia,* which – besides *D. ovata* and *Dichaetomyia albivitta* (Stein, 1906) – also exists outside Madagascar.

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Research article

Three species of butterflies new for the North Aegean Island of Lemnos (Greece)

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Abstract: The paper presents results of a brief entomological surveys carried out in the southern parts of Lemnos Island in 2016, 2017 and 2019. It includes a list of 14 recorded species of butterflies, three of which are new for the island.

Keywords: butterfly, distribution, Lepidoptera, Lemnos, new records

Introduction

The first information for the butterflies of the Lemnos [Límnos] Island is found in the earliest works on Greek Lepidoptera fauna by Mathew (1898) and Rebel (1934, 1937). The detailed work of Olivier (1988) includes 31 species, 13 of which are new for the island. Thirteen years later another special article devoted to the island's butterfly fauna has followed. It also includes 31 species, four of which are an addition (Coutsis, 2001). Altogether 33 species of butterflies are known from the island till now, with records of two of these 33 species, *Coenonympha pamphilus* (Linnaeus, 1758) and *Lasiommata maera* (Linnaeus, 1758), being questionable.

Results

During three visits of Lemnos in 2016, 2017 and 2019 some butterfly species has been observed and photographed. Three of them are new for the island's fauna – *Pelopidas thrax* (Hübner, [1821]), *Cacyreus marshalli* Butler, 1898, *Danaus chrysippus* (Linnaeus, 1758). The species are listed in taxonomical order following the nomenclature of Tshikolovets (2011).

The list of localities contains the relevant toponyms, a short description of the habitat, altitude, coordinates and dates of the observations. Localities are arranged from the West to the East (Fig. 1):

[L01] near Myrina; Kastro, 70 m; 39.877844°N, 25.055000°E; 05.ix.2016; pseudosteppe with grasses and annuals.

[L02] Moudros; in the village, 15 m; 39.873381°N, 25.268911°E; 27.viii.2016; gardens and flowerbeds.

[L03] Havouli beach; 5 m; 39.838378°N, 25.264263°E; 30.viii.2016; Aegean phrygana, dune sclerophyllous scrubs, shrubby formations with *Quercus coccifera* L., *Pinus halepensis* Mill.

[L04] near Havouli beach; 34 m; 39.838557°N, 25.273076°E; 04.ix.2019; Aegean phrygana, slacks with reedbeds and *Tamarix* L. (Fig. 2).

[L05] Parthenomitos beach; 3 m; 39.829545°N, 25.284706°E; 09.ix.2017; shifting dunes along

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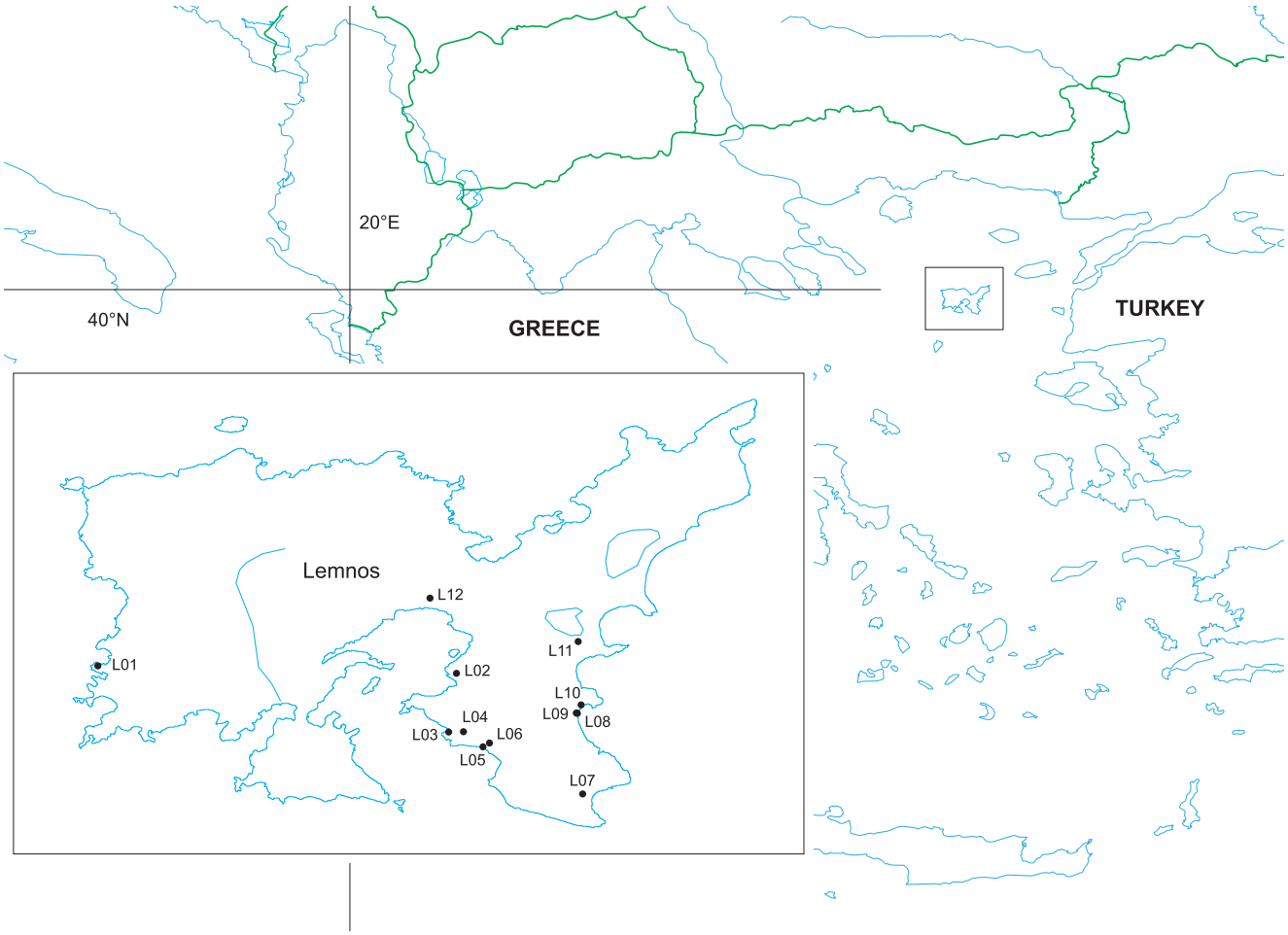

Fig. 1. Map of the localities on the Island of Lemnos, generated with QGIS 3.2 Bonn, Mac OS X version.

the shoreline with *Ammophila arenaria* (L.) Link, intermittently flowing Mediterranean rivers, Aegean phrygana (*Sarcopoterium spinosum* (L.) Spach) (Fig. 3).

[L06] near Parthenomitos beach; 25 m; 39.831814°N, 25.288597°E; 09.ix.2017; Aegean phrygana (*Sarcopoterium spinosum*) (Fig. 4).

[L07] near Skandali; 23 m; 39.801425°N, 25.344184°E; 03.ix.2017; sand dunes with *Ammophila arenaria, Pancratium maritimum* L., *Achillea maritima* (L.) Ehrend.& Y. P. Guo and *Centaurea spinosa* L., dune sclerophyllous scrubs, Aegean phrygana (*Sarcopoterium spinosum*).

[L08] Red Rock Beach; 10 m; 39.849708°N, 25.340398°E; 07.ix.2019; shifting dunes along the shoreline with *Ammophila arenaria,* dune sclerophyllous scrubs, Aegean phrygana (*Sarcopoterium spinosum*).

[L09] Red Rock Beach; 8 m; 39.849538°N, 25.341025°E; 10.ix.2019; Aegean phrygana, shifting dunes along the shoreline with *Ammophila arenaria,* dune sclerophyllous scrubs (Fig. 5).

[L10] Ancient Poliochni; 15 m; 39.854548°N, 25.343265°E; 01.ix.2016; archaeological ruins and garden close to visitors centre of Ancient Poliochni (Fig. 6).

[L11] S shore of Chortarolimni Lake; 5 m; 39.892337°N, 25.341514°E; 01.ix.2016; salt steppes (Limonietalia) and Mediterranean halophilous scrubs (Fig. 7).

[L12] E of Lemnos Airport; 2 m; 39.91769°N, 25.252093°E; 03.ix.2017; Mediterranean halophilous scrubs (Arthrocnemetalia fruticosae).

Fig. 2. [L04] near Havouli beach, habitat of *Pelopidas thrax*.

Fig. 3. [L05] Parthenomitos beach, a place where *Danaus chrysippus* has been observed.

The butterfly species recorded during our visits on the Island of Lemnos are as follows:

Hesperiidae

Carcharodus alceae (Esper, [1780]): near Parthenomitos beach, 09.ix.2017.

Spialia orbifer (Hübner, [1823]): near Parthenomitos beach, 09.ix.2017.

Pelopidas thrax (Hübner, [1821]): near Havouli beach, 04.ix.2019 (Fig. 8). *P. thrax* ranges from the eastern Mediterranean to Africa and across subtropical and tropical Asia to Indonesia. In the eastern part of the Aegean Sea it is previously known only from Dodecanese Islands (Samos, Kos, Rhodes) – Cuvelier (2009), Cuvelier & Mølgaard (2012). The species is also known from the Turkish coast (Hesselbarth et al., 1995). This species is multivoltine – usually from April

Fig. 4. [L06] near Parthenomitos beach, habitat of *Gegenes nostrodamus, Spialia orbifer, Carcharodus alceae, Maniola jurtina*.

Fig. 5. [L09] Red Rock Beach, a place where *Danaus chrysippus* has been observed.

Fig. 6. [L10] Ancient Poliochni, habitat of *Lampides boeticus, Leptotes pirithous, Lycaena phleas, Vanessa atalanta, Argynnis pandora*.

Fig. 7. [L11] South shore of Chortarolimni Lake, habitat of *Pontia edusa*.

Fig. 8. Millet skipper *Pelopidas thrax*, male.

Fig. 9. Mediterranean skipper *Gegenes nostrodamus*, male.

Fig. 10. Female of geranium bronze *Cacyreus marshalli,* ovipositing on *Pelargonium*.

Fig. 11. Plain tiger *Danaus chrysippus,* male.

to November, but all year round in some places, or in the tropics.

Gegenes nostrodamus (Fabricius, 1793): near Parthenomitos beach, 09.ix.2017 (Fig. 9).

Pieridae

Pontia edusa (Fabricius, 1777): S shore of Chortarolimni Lake, 01.ix.2016.

Lycaenidae

Lycaena phleas (Linnaeus, 1761): Ancient Poliochni, 01.ix.2016; near Skandali, 03.ix.2017; E of Lemnos Airport, 03.ix.2017; Parthenomitos, 09.ix.2017.

Lampides boeticus (Linnaeus, 1767): Ancient Poliochni, 01.ix.2016.

Leptotes pirithous (Linnaeus, 1767): Ancient Poliochni, 01.ix.2016.

Cacyreus marshalli Butler, 1898: Moudros, 27.viii.2016 (Fig. 10). It was introduced accidentally from South Africa to the European Mediterranean (initially in Majorca on the Balaeric Islands) in 1988, and in 1993 reached the European mainland, where it spreads further as a pest of cultivated *Pelargonium*. During the past 25 years, the butterfly has colonised much of North Africa and southern Europe and now is widespread in the Mediterranean region. In the eastern part of the Aegean Sea previously known from Dodecanese Islands and some of the North Aegean Islands (Samos, Fournoi, Chios, Lesbos) as well as the Turkish coast – Langourov & Simov (2017). The species is multivoltine – on wing from March/April to November.

Polyommatus icarus (Rottemburg, 1775): near Parthenomitos beach, 09.ix.2017.

Nymphalidae

Danaus chrysippus (Linnaeus, 1758): Parthenomitos beach, 09.ix.2017; Red Rock Beach, 07.ix.2019, 10.ix.2019. All specimens are flying from the sea towards north (Fig. 11). *D. chrysippus* is a polyvoltine, polyphagous wide-ranging migrant species. It is widespread in Asia, Africa and Australia and from the North African coastal regions it has colonised coastal areas of the Canary Islands and after 1970s and 1980s – along the N Mediterranean coast. Tennent (1995, 1996) indicated trends in the movement of the species range to the north, extending to NW Africa (Morocco, Algeria, Tunisia) and that the species uses resident populations to gradually extend its range further north to European countries (Morgun & Ilyina, 2021). In the eastern part of the Aegean Sea, the species is previously known from some of the North Aegean Islands (Imbros [Gökçeada] – Okyar & Aktaç (2006); Chios and Samos – Pamperis (2009); Lesbos – Martin & Russell (2013) and some of the Dodecanese Islands (Astypalaia, Kos, Nisyros, Rhodes, Tilos, Symi) (Cuvelier & Mølgaard, 2012; Galanos, 2017). The species is also known from the Turkish coast (Hesselbarth et al., 1995). The coincidence of this butterfly with *Pelopidas thrax* on some Aegean islands is discussed by Martin & Russell (2013). Most of the observations in regions where the species does not form permanent populations (Cyprus, Greece, Turkey) are from September to November. All observed specimens showed typical migratory behaviour – flying towards north. The same pattern was recorded in Jordan, but earlier in the year (at beginning of April, near Aqaba, personal observations).

Maniola jurtina (Linnaeus, 1758): 30.viii.2016, Havouli beach; 05.ix.2016, near Myrina; near Parthenomitos beach, 09.ix.2017.

Vanessa atalanta (Linnaeus, 1758): Ancient Poliochni, 01.ix.2016.

Argynnis pandora ([Denis & Schiffermüller], 1775): Ancient Poliochni, 01.ix.2016.

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Research article

The new replacement name *Euafricana* nom. nov. for the preoccupied genus *Africana* Ocaña & Brito, 2015 (Cnidaria: Anthozoa: Scleractinia: Caryophylliidae)

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Abstract: The genus name *Euafricana* Ceccolini & Cianferoni **nom. nov.** is proposed to replace the name of the coral *Africana* Ocaña & Brito, preoccupied by the nematode genus *Africana* Travossos, 1920. *Euafricana wirtzi* (Ocaña & Brito, 2015) **comb. nov.** is also established.

Keywords: Cnidaria, Heterakidae, new combination, nomen novum

The genus name *Africana* was used twice in zoological nomenclature. Recently, Ocaña & Brito in Ocaña et al. (2015: 60) established a new genus using this name to allocate the new species *A. wirtzi*. The latter is an anthozoan described through a single colony from Santiago island in Cape Verde archipelago; it is included in Caryophylliidae with a peculiar mix of characters that makes it different from the other genera of the family: the presence of a solid corallum joined to the septal junction arrangement and pali presence (see Cairns & Kitahara, 2012; Ocaña et al., 2015). The name is currently accepted (Rees, 2021; WoRMS Editorial Board, 2021).

Unfortunately, the same name had already been used for a new nematode genus by Travossos (1920: 48) to transfer three species from the genus *Heterakis* Dujardin, 1844. The name *Africana* Travossos, 1920 is currently accepted within Ascaridomorpha Heterakidae, including 10 species parasites of amphibians and reptiles distributed in Africa and the Neotropical region (see Bouamer & Morand, 2008; Ávila & da Silva, 2009). Thus, the genus *Africana* Ocaña & Brito is a junior homonym of the genus name *Africana* Travossos and, according to the ICZN (1999, Article 60), since no synonyms are available (see ICZN, 1999, Art. 60.3), it should be replaced with a new name.

Replacement name

Herein we propose the name *Euafricana* Ceccolini & Cianferoni **nom. nov.** This genus is monotypic and consequently the only species *Africana wirtzi* Ocaña & Brito, 2015 is its type species.

Etymology

The new name follows the original one, adding the prefix *eu-* (from the greek εὖ = true) since this genus really

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includes only African species, while its senior homonym *Africana* Travossos, 1920 currently includes also some American species. The gender of the new name is feminine.

Systematics

Class ANTHOZOA Ehrenberg, 1834
Order SCLERACTINIA Bourne, 1900
Family CARYOPHYLLIIDAE Gray, 1847
Genus *Euafricana* Ceccolini & Cianferoni **nom. nov.**
Species *Euafricana wirtzi* (Ocaña & Brito, 2015) **comb. nov.** = *Africana wirtzi* Ocaña & Brito, 2015 (type species)

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Research article

Vagrant species of birds captured at Durankulak ringing camp, NE Bulgaria, 2019–2020

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Abstract: The area of Coastal Dobrudzha in NE Bulgaria is well known for its richness of vagrants. A long-term research project was started at a location at Durankulak Lake, on the northern Black Sea Coast, aiming to obtain data on the characteristics of autumn migration of passerine birds and on the presence of vagrants there. A total of 20 mist nets with an overall length of 200 meters were set between August and October in two different habitats – reed bed and broad-leaved forest. In 2019, a total of 9344 birds of 84 species were caught and ringed. In 2020, the number of the birds caught increased to 13786 of 93 species. Vagrants such as dusky warbler (*Phylloscopus fuscatus*), yellow-browed warbler (*Phylloscopus inornatus*) and red-flanked bluetail (*Tarsiger cyanurus*) were captured in 2020. Detailed information about these findings is given in the present work.

Keywords: bird migration, Durankulak Lake, dusky warbler, red-flanked bluetail, yellow-browed warbler, vagrants

Introduction

Autumn passerine migration is not systematically studied along the northern part of the Bulgarian Black Sea Coast. The area of maritime Dobrudzha is well known for its richness of vagrants and rare birds of different orders having eastern or northern origin like *Phalaropus fulicarius, Charadrius mongolus, Lanius isabellinus, Serinus pussilus, Phylloscopus proregulus* and many others (Dontschev, 1967; Mitev & Welsch, 2011; Simeonov, 2013; Ignatov et al., 2015; Simeonov, 2015). Along the North Bulgarian Black Sea Coast, records of vagrants are mostly a result of intensive field monitoring. Until 2019, ringing activities had occa-

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sional and sporadic character. There is no functioning ringing station in the coastal part of NE Bulgaria. Until now, occasional short term ringing activities, mostly during summer and autumn, had been carried out at Durankulak Lake and Shabla Tuzla Lake (Dimitrov et al., 2018; own unpublished data).

In Romania, two field ringing stations have operated in recent years on the Black Sea Coast – Chituc (Razelm – Sinoe Lake complex) and Agigea (Marton, 2020; Agigea Ringing Station, Facebook) and a spring ringing camp at the Danube Delta (danubebirdringing). All these studies showed that the area attracts a high number of vagrant species of birds. Captures of species such as yellow-browed warbler (*Phylloscopus inornatus*), greenish warbler (*Phylloscopus trochiloides*), Pallas's leaf warbler (*Phylloscopus proregulus*), dusky warbler (*Phylloscopus fuscatus*), green warbler (*Phylloscopus nitidus*), red-flanked bluetail (*Tarsiger cyanurus*), Asian desert warbler (*Sylvia nana*), rustic bunting (*Emberiza rustica*) and others were recently reported from the Romanian stations (Marton, 2020).

Thus we decided to start a long–term research at a study point at Durankulak Lake, NE Bulgaria, on the Black Sea Coast. The aim was to study the characteristics of autumn migration of passerine birds, and to obtain data about the presence of vagrants on Bulgarian territory. We expected that some of those species recorded in Romania might also be captured in our ringing camp, which would be a valuable contribution to the knowledge of the avifauna of Bulgaria. In August – October of 2019 and 2020, we organised large-scale autumn ringing campaigns at Durankulak Lake ringing camp.

The ringing activities at Durankulak Lake are also valuable for the education of students and volunteers. Across both years, 45 and 80 experts and volunteers, respectively, took part in the ringing camp.

Materials and methods

The ringing camp was situated at the south-eastern part of the Durankulak Lake, Dobrich Province, NE Bulgaria, at coordinates 43°39'38.49N and 28°33'56.81E. A total of 20 mist nets with an overall length of 200 meters were set in two separate lines, covering two different habitats. Nine to ten nets (100 m) were set in a reed bed along a dyke dividing a shallow south-eastern bay of the lake from the main lake. Ten nets (100 m) were set in low mixed broad-leaved forest with bushes, close to the sea shore. The forest was dominated by *Ulmus* sp., *Fraxinus* sp., *Robinia pseudoacacia* and other low trees. The distance between the two lines of nets was approximately 700 m.

Fig. 1. Dusky warbler (*Phylloscopus fuscatus*), 5.10.2020, Durankulak Lake (Photo: Pavel Simeonov)

The period of the study in 2019 was between 24 August and 15 October. In 2020 the study expanded in time covering the period 15 August – 1 November. The position and number of the nets remained the same for both years.

Recordings of bird calls and songs were used to attract birds to the nets at both habitats. For each month collections of sounds of different species were used in the forest and in the reeds. The species were chosen taking into account the prevailing migrant composition for the particular month and habitat according to the available literature sources for other locations from the Balkan Peninsula (Nankinov, 2009; Ivanov, 2011; Marton, 2020) and our own data.

Results and discussion

In 2019, a total of 9344 birds of 84 species (including recaptures) were caught and ringed at Durankulak ringing camp. In 2020, the numbers of birds caught increased to 13786 of 93 species. The following vagrant birds were captured:

Fig. 2. Dusky warbler (*Phylloscopus fuscatus*), 5.10.2020, Durankulak Lake (Photo: Pavel Simeonov)

Fig. 3. Dusky warbler (*Phylloscopus fuscatus*), 5.10.2020, Durankulak Lake (Photo: Pavel Simeonov)

1. Dusky warbler (*Phylloscopus fuscatus*)

One 1st year dusky warbler was caught on the morning of 05.10.2020 in the forest line of nets (Figs 1–3).

Description: Small warbler, generally brown in colour. Obvious dark eye stripe and whitish supercilium. Supercilium quite short, not extending to the nape. Legs dark brown and long. Toes yellowish from below. Breast and belly are greyish-white. Weak, unclear dark throat band. Fine bill, dark with yellowish base of lower mandible. Tail quite long, with great distance between central and outer tail feathers.

Wing formula: First primary very long, much longer than primary coverts. Tip of the wing formed by the fourth primary. Outer emarginations presented on 3, 4, 5, 6 primaries. The line from the tip of the 2nd primary equals the tip of the 8th primary.

Measurements: Wing length – 61.5 mm; bill depth – 2.4 mm; bill width – 3.1 mm; tarsometatarsus – 24.6 mm; tail – 39 mm; weight – 8.9 g; fat score – 1.

Discussion: This species is new for the Bulgarian ornithofauna (Ivanov et al., 2009; Ivanov et al., 2015). Its breeding range is situated in Central and Eastern Siberia, NE Kazakhstan, Northern and Eastern China and North Korea (Cramp et al., 1992). It is a migratory species wintering normally in Southern China, Thailand, Burma, India, Nepal (Cramp et al., 1992). Rare vagrant to Europe – it is observed or captured in Great Britain, Ireland, France, Spain, Poland, Austria, Italy, Estonia, Cyprus, Greece, Albania, etc. (Cramp et al.1992; Handrinos & Akriotis, 1997; Albanian Ornithological Society, Facebook). In Romania, two specimens have been caught and ringed on 2.10.2016 and 14.10.2016 at Chituc ringing station (Marton, 2020) and one more on 29.09.2008 at Sfintu George, Danube Delta (Martin & Pochelon, 2008). Most of the records of the species in Central and Eastern Europe are between September and February (Bozo et al., 2016), and on the British Isles – between mid-October and mid-November (Harrop, 2007).

2. Yellow-browed warbler (*Phylloscopus inornatus*)

One adult yellow-browed warbler was caught on the morning of 06.10.2020 in the reed line of nets (Figs 4–5).

Description: Very small warbler, with short tail and fine bill. Strong yellow supercillium. Long, clear black eye-stripe. It has two clear white wing-bars. Crown and back olive-greenish. Underparts whitish. Legs dark brown.

Wing formula: First primary longer than primary coverts. Tip of the wing formed by the third primary. Outer emarginations presented on 3, 4, 5 primaries. The line from the tip of the 2nd primary equals the tip of the 6th primary.

Measurements: Wing length – 53 mm, tarsometatarsus – 16.99 mm; bill – 7.45 mm, weight – 5.72 g, fat score – 2.

Discussion: The species is a rare vagrant recorded at least five times in Bulgaria until now. According to Ivanov et al. (2021), it has been observed three times in Bulgaria until 2019. One bird was ringed on

Fig. 4. Yellow-browned warbler (*Phylloscopus inornatus*), 6.10.2020, Durankulak Lake (Photo: Pavel Simeonov)

Fig. 5. Yellow-browned warbler (*Phylloscopus inornatus*), 6.10.2020, Durankulak Lake (Photo: Nikola Aleksandrov)

28.09.2005 at Atanasovsko Lake, close to Burgas (Nankinov et al. 2005). Another bird was observed few days later – on 2.10.2005 at Cape Kaliakra, Dobrich District. A third bird was seen and photographed again in October – on 14.10.2013 (locality not mentioned). Another two observations were not included as confirmed by Ivanov et al. (2021). The first observation of the species in Bulgaria was made on 27.09.1987 in Plovdiv (Kyuchukov, 1997). One day earlier to our finding, on 5.10.2020, one yellow-browed warbler was observed and photographed at Gorun Village, Dobrich District (Yanko Yankov, pers.comm.). That locality is situated 18.9 km SW from Durankulak Lake ringing camp.

The species normally breeds from the NE parts of European Russia (including Ural Mts) to the Pacific Ocean Coast and in Mongolia, NE China and Japan. It overwinters in E India, SE China and the Malay Peninsula (Cramp et al., 1992, Keller et al., 2020). It is the most regular Siberian vagrant in Europe (Williamson, 1983). In some European countries (UK, Sweden, Netherlands, France), it is already considered as a "regular migrant" during autumn (Van den Berg & Bosman, 1999; Reeber et al., 2008). In NW Europe, the records of the species are numerous and show a peak in September and October but become much scarcer in SW Europe (De Juana, 2008). The later study suggests the explanation that the majority of these birds reach only as far as NW Europe, do not continue to the Iberian Peninsula and Africa and migrate back directly to Asia. Similarly, records of the yellow-browed warbler are also scarce from the Balkan Peninsula. At Chituc ringing camp, Romania, a total of ten yellow-browed warblers were captured during autumn migration over 6 years, 2014–2019 (Marton, 2020). In NE Europe, a slight shift of breeding range of the species towards the west was recorded (Keller et al., 2020). This can explain the high number of records of the species in W and C Europe during the recent decades.

3. Red-flanked bluetail (*Tarsiger cyanurus*)

One adult female red-flanked bluetail was captured in the forest nets of Durankulak ringing camp, on 24.10.2020 (Figs 6–7).

Description: Typical plumage of a female having blue tail and rump, orange flanks, white belly and breast, greenish-brown back, mantle and head. Bill and legs black, iris – dark brown.

Measurements: Wing length – 76 mm, tarsometatarsus – 22.4 mm, bill (to feathers) – 9.0 mm, bill (to skull) – 13.0 mm, tail – 53 mm, weight – 11.6 g, fat score – 2.

Discussion: Before the observation presented here the species had been recorded in Bulgaria on only in two occasions (Ivanov et al., 2021) and had never been captured or ringed. The first observation was made by Petar Iankov at Cape Emine (Burgas District) on

Fig. 6. Red-flanked bluetail, female (*Tarsiger cyanurus*), 24.10.2020, Durankulak Lake (Photo: Peter Shurulinkov)

Fig. 7. Red-flanked bluetail, female (*Tarsiger cyanurus*), 24.10.2020, Durankulak Lake (Photo: Pavel Simeonov)

3.06.2000. The second observation (documented with photographs) was made by Chris Day in the town of Byala, Varna District, on 28.10.2018. In Romanian Dobrudzha, the species has been caught and ringed at Chituc Station – three specimens, one every autumn in the period 2017–2019 (Marton, 2020). Also one individual was captured at the Agigea Station, on 22.10.2020, only two days before the finding of the species at Durankulak Lake (Agigea Ringing Station, Facebook). During the same month the species was recorded for the first time in Serbia as well – at Bajina Basta, Tara Mt (Medenica I., Facebook). We can conclude that, although very scarce, the red-flanked bluetail passes regularly through the Balkan Peninsula, mostly in October, and especially along the Black Sea Coast.

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Research article

Data on the distribution of Dolichopodidae (Diptera: Empidoidea) in Bulgaria, with first records for the country

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Abstract: The paper presents information about 37 dolichopodid species, collected from 14 localities in Bulgaria. Five species (*Medetera murina, Systenus scholtzi, Neurigona nubifera, Rhaphium antennatum* and *Sciapus bellus*) are recorded for the first time for the fauna of Bulgaria. The species *S. scholtzi* is new to the Balkan Peninsula and the genus *Systenus* is a new genus of the family Dolichopodidae for the Bulgarian fauna.

Keywords: Bulgaria, Dolichopodidae, fauna, new records

Introduction

The family Dolichopodidae encompasses small- to middle-sized species (1 to 10 mm). The flies of the family, also called long-legged flies, are predators and among their food sources are small invertebrates as ticks, insects (imago and larvae), worms and etc. The adults dwell in humid habitats around rivers, ponds, marshes, lakes and sea shores and rocks, and are also found in deciduous and coniferous forests. Their body is most often metallic-green but in some species could be yellow or blue. About 8 000 different species are described worldwide, excluding Antarctica. In Bulgaria, 204 species are known up to now (Kechev et al., 2020; Kechev & Glogov, 2021; Kechev, 2021).

The main purpose of this paper is to provide new records of the family Dolichopodidae for Bulgaria and data on the distribution of the dolichopodids in poorly-studied areas in the country.

Material and methods

The material for the present work was collected from 12 localities in Bulgaria (Fig. 1) using Malaise traps, two types of emergency traps (tree and soil traps) and sweep nets. The species were separated in the laboratory using a Carl Zeiss microscope. For the determination of dolichopodids were used publications by Parent (1938), Negrobov and Stackelberg (1969), d'Assis Fonseca (1978), Grichanov (2007) and Negrobov & Naglis (2016). The species new to Bulgaria are marked with one asterisk (*) and the new one for the Balkan Peninsula with two asterisks (**) in front of the names. The material presented in this paper is housed in Mihail Kechev's collection in the Forest Research Institute, Bulgarian Academy of Sciences, Department of Forest Entomology, Phytopathology and Game Fauna, Sofia, Bulgaria.

Sites of collecting

Site 1: Granichar Village, 43.7230°N 28.4992°E, 48 m, Malaise trap, N. Karaivanov.
1a: 11.VI–8.VII.2011.
1b: 8–28.VII.2011.

Site 2: Povelyanovo Village, 43.2228°N 27.6679°E, 172 m, 28.VII.2020, sweep net, M. Kechev.

Site 3: Trabach Village, 43.3796°N 26.4962°E, 230 m, Malaise trap, K. Ivanov.
3a: 8.VIII–22.IX.1999.
3b: 6–19.IX.1999.

Site 4: Samovodene Village, 43.1469°N 25.6155°E, 108 m, 29.V–27.IV.2011, Malaise trap, E. Sarov.

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Fig. 1. Map of Bulgaria with sites of collection.

Site 5: Banitsa Village, 43.3450°N 23.6913°E, 260 m, Malaise trap, T. Ljubomirov.
5a: 1–15.VII.2013.
5b: 16–31.VIII.2013.
5c: 9–31.VII.2015.

Site 6: Vitosha Mt, Gurgulitsa riverside, 42.5207°N 23.3368°E, 1350 m, 17.VII–4.VIII.2010, Malaise trap, T. Ljubomirov.

Site 7: Rila Mts, Ravnite Mochuri Place, above Dobarsko Village, tree traps, N. Simov.
7a: 15.VI–9.VII.2004.
7b: 9.VII–18.VIII.2004.

Site 8: Banya Village, Glazne River, 41.8875°N 23.5271°E, 780 m, 5.VI.2021, sweep net, M. Kechev.

Site 9: Pirin Mts, Banderitsa River, near Vihren Hut, 2014 m, 9.VII–18.VIII.2004, tree traps, N. Simov.

Site 10: Kamenitsa Village, Struma Valley, 41.6484°N 23.1580°E, 240 m, 3.IV–3.V.2003, tree trap, leg. M. Langourov and S. Lazarov.

Site 11: Kalimantsi Village, Struma Valley, 41.4592°N 23.4795°E, 267 m, 3.IV–03.V.2003, tree trap, leg. M. Langourov and S. Lazarov.

Site 12: above Smolyan (Fig. 7), 41.5612°N 24.6432°E, 1360 m, 10.VI.2021, sweep net, M. Kechev.

Site 13: East Rhodope Mts, Dzherovo Village (Fig. 8), Kazalach River, 41.3187°N 25.3256°E, 354 m, Malaise trap, M. Langourov and N. Simov.
13a: 11–20.V.2021.
13b: 20.V–1.VI.2021.
13c: 1.VI–11.VI.2021.
13d: 11.VI–21.VI.2021.
13e: 21.VI–5.VII.2021.

Site 14: East Rhodope Mts, Kremen Village (Fig. 9), near a small stream right tributary of the river Kazalach, 41.2757°N 25.3396°E, 473 m, Malaise trap, M. Langourov and N. Simov.
14a: 11–20.V.2021.
14b: 20.V–1.VI.2021.
14c: 1.VI–11.VI.2021.
14d: 11.VI–21.VI.2021.
14e: 21.VI–5.VII.2021.

Fig. 2. *Dolichopus picipes* Meigen, 1824, female, habitus.

Results

Diaphorinae

Asyndetus latifrons (Loew, 1857) – Material examined: site 5c: 1 ♂.

Chrysotus gramineus (Fallén, 1823) – Material examined: site 5c: 1 ♂, 9 ♀♀.

Chrysotus laesus (Wiedemann, 1817) – Material examined: site 12: 1 ♂, 1 ♀; site 14a: 8 ♂♂, 2 ♀♀; site 14b: 5 ♂♂, 7 ♀♀.

Chrysotus suavis Loew, 1857 – Material examined: site 5b: 1 ♂, 6 ♀♀.

Dolichopodinae

Dolichopus diadema Haliday, 1832 – Material examined: site 13a: 1 ♂.

Dolichopus griseipennis Stannius, 1831 – Material examined: site 3b: 1 ♂; site 13b: 3 ♂♂, 1 ♀; site 13c: 1 ♂, 2 ♀♀; site 13d: 1 ♂, 2 ♀♀; site 14c: 1 ♂.

Dolichopus longitarsis Stannius, 1831 – Material examined: site 7b: 2 ♂♂, 1 ♀.

Dolichopus picipes Meigen, 1824 (Fig. 2) – Material examined: site 7a: 1 ♀; site 7b: 1 ♂, 5 ♀♀; site 9: 1 ♀; site 12: 1 ♀.

Dolichopus plumipes (Scopoli, 1763) – Material examined: site 8: 1 ♂.

Dolichopus popularis Wiedemann, 1817 (Fig. 3) – Material examined: site 12: 1 ♂.

Dolichopus ungulatus (Linnaeus, 1758) – Material examined: site 7a: 1 ♂; site 12: 3 ♂♂, 4 ♀♀.

Gymnopternus aerosus (Fallén, 1823) – Material examined: site 12: 17 ♂♂, 5 ♀♀.

Gymnopternus brevicornis (Staeger, 1842) – Material examined: site 14b: 1 ♂, 2 ♀♀; site 14c: 5 ♂♂, 4 ♀♀; site 14d: 5 ♂♂, 9 ♀♀.

Gymnopternus celer (Meigen, 1824) – Material examined: site 14d: 1 ♂; site 14c: 1 ♂, 1 ♀.

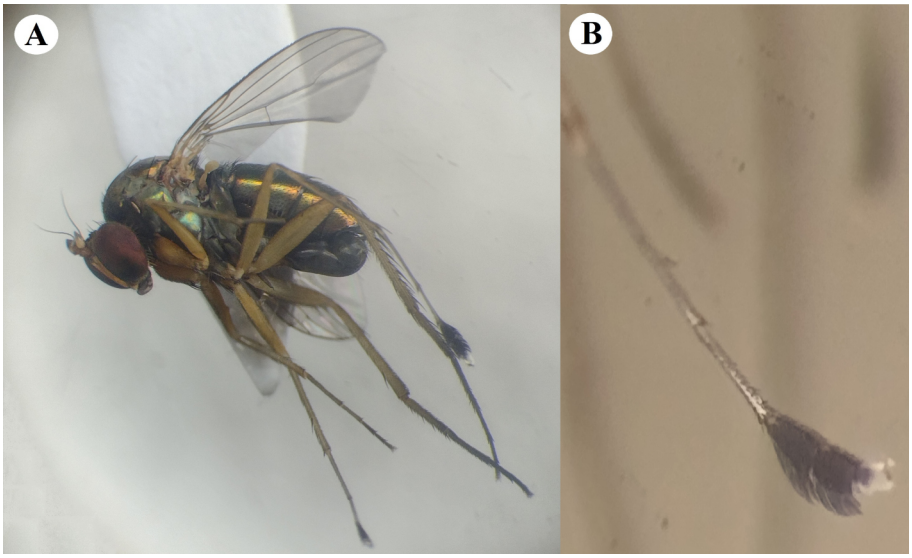

Fig. 3. *Dolichopus popularis* Wiedemann, 1817, male, A: habitus, B: mid tarsi.

Fig. 4. *Systenus scholtzi* (Loew, 1850), male habitus.

Fig. 5. *Neurigona nubifera* (Loew 1869), male habitus.

Hercostomus gracilis (Stannius, 1831) – Material examined: site 2: 6 ♂♂, 2 ♀♀.

Hercostomus rusticus (Meigen, 1824) – Material examined: site 9: 1 ♂.

Poecilobothrus chrysozygos (Wiedemann, 1817) – Material examined: site 14e: 1 ♂.

Poecilobothrus regalis (Meigen, 1824) – Material examined: site 1a: 1 ♀, site 1b: 1 ♂; site 5b: 5 ♂♂, 6 ♀♀.

Tachytrechus consobrinus (Haliday, 1851) – Material examined: site 14a: 1 ♂.

Medeteranae

Medetera jacula (Fallén, 1823) – Material examined: site 3a: 3 ♂♂, 2 ♀♀; site 6: 1 ♂, 1 ♀; site 1a: 2 ♂♂, 1 ♀, site 1b: 1 ♀; site 13d: 1 ♂, 3 ♀♀; site 13e: 3 ♂♂, 1 ♀.

Medetera micacea Loew, 1857 – Material examined: site 3a: 3 ♂♂, 5 ♀♀; site 5a: 3 ♂♂; site 11: 8 ♂♂, 7 ♀♀.

Medetera muralis Meigen, 1824 – Material examined: site 5a: 1 ♂.

* *Medetera murina* Becker, 1917 – Material examined: site 4: 1 ♂.

** *Systenus scholtzi* (Loew, 1850) (Fig. 4) – Material examined: site 11: 1 ♂.

Hydrophorinae

Liancalus virens (Scopoli, 1763) – Material examined: site 14c: 2 ♂♂; site 14d: 1 ♀.

Neurigoninae

Neurigona pallida (Fallén, 1823) – Material examined: site 4: 1 ♂; 1 ♀; site 13a: 2 ♂♂, 1 ♀; site 13b: 2 ♂♂, 2 ♀♀; site 14c: 1 ♀; site 14d: 1 ♀; site 14e: 1 ♀.

* *Neurigona nubifera* (Loew 1869) (Fig. 5) – Material examined: site 13a: 38 ♂♂, 27 ♀♀; site 13b: 2 ♂♂, 21 ♀♀; site 14a: 3 ♂♂, 18 ♀♀.

Neurigona suturalis (Fallén, 1823) – Material examined: site 14a: 1 ♂; site 14b: 1 ♂, 4 ♀♀.

Peloropeodinae

Chrysotimus flaviventris (Roser, 1840) – Material examined: site 6: 1 ♂, 1 ♀.

Rhaphiinae

* *Rhaphium antennatum* (Carlier, 1835) – Material examined: site 14c: 1 ♂; site 14e: 1 ♂.

Rhaphium caliginosum (Meigen, 1824) – Material examined: site 5c: 1 ♂.

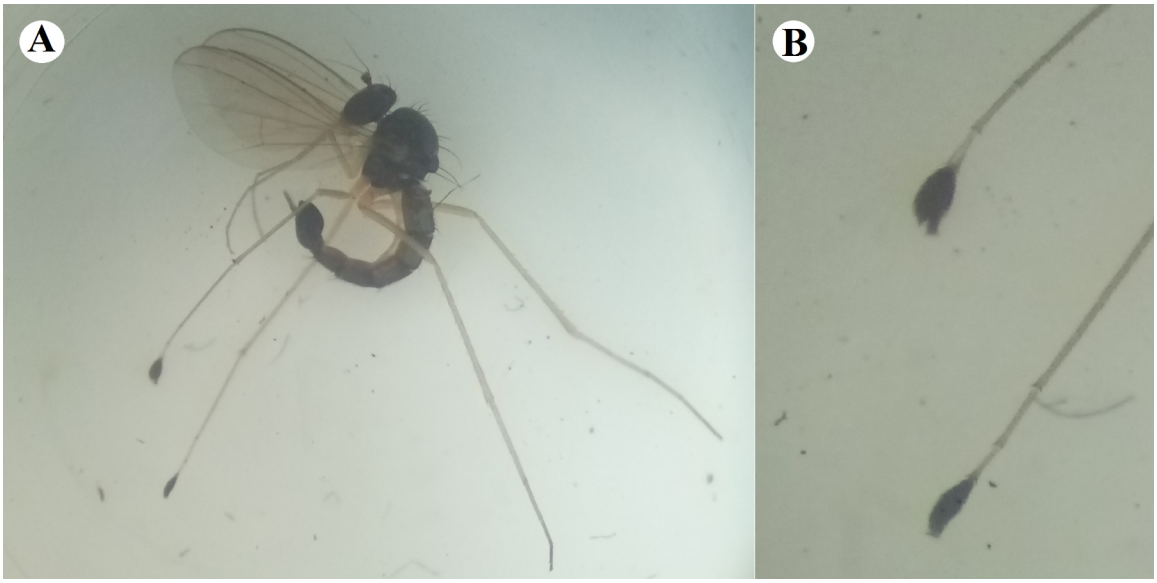

Fig. 6. *Sciapus bellus* Loew, 1873, male, A: habitus, B: mid tarsi.

Rhaphium laticorne (Fallén, 1823) – Material examined: site 5c: 1 ♂.

Sciapodinae

* *Sciapus bellus* Loew, 1873 (Fig. 6) – Material examined: site 6: 1 ♂; site 13a: 10 ♂♂, 3 ♀♀; site 13b: 2 ♂♂, 10 ♀♀; site 14a: 5 ♂♂, 4 ♀♀; site 14b: 5 ♂♂, 8 ♀♀.

Sciapus flavicinctus (Loew, 1857) – Material examined: site 13a: 1 ♂; site 13b: 1 ♂, 2 ♀♀; site 13c: 1 ♀; site 14a: 1 ♂.

Sciapus platypterus (Fabricius, 1805) – Material examined: site 1a: 1 ♀; site 4: 5 ♂♂, 12 ♀♀; site 13c: 7 ♂♂, 9 ♀♀; site 13d: 3 ♂♂, 1 ♂; site 14a: 5 ♂♂, 4 ♀♀; site 14b: 5 ♂♂, 8 ♀♀; site 14c: 6 ♂♂, 4 ♀♀; site 14d: 2 ♂♂, 2 ♀♀; site 14e: 3 ♂♂, 5 ♀♀.

Sympycninae

Sympycnus pulicarius (Fallén, 1823) – Material examined: site 8: 6 ♂♂, 4 ♀♀.

Syntormon pallipes (Fabricius, 1794) – Material examined: site 8: 1 ♂; site 14e: 2 ♀♀, 1 ♀.

Discussion

Sciapus bellus, Neurigona nubifera, Rhaphium antennatum, Medetera murina and *Systenus scholtzi* are recorded for the first time from Bulgaria. With these results the number of dolichopodids known for the Bulgarian fauna is increasing to 209 species. *Systenus scholtzi* is also new for the Balkan Peninsula. *Systenus* is presented with seven European species. Until now, two species have been known for the Balkan Peninsula; they were listed from Croatia: Kechev & Ivanova (2015a), Pollet & Ivković (2018) and Drake (2018) listed *Systenus bipartitus* (Loew, 1850), while Naglis (2017) described *Systenus bartaki* from Gornji Muć Village, near Split.

Three of the species listed in this paper (*Neurigona nubifera, Sciapus bellus* and *S. platypterus*) have been collected with a large number of specimens along riversides (sites 13 and 14, Figs 8 and 9). The single male specimen of *S. bellus,* mentioned above from the Vitosha Mt, has also been found along the riverside. Other reports of *S. platypterus* in Bulgaria are also mainly from river banks. This research suggests higher riparian affinity of these three species.

Dolichopus picipes, D. plumipes, D. popularis, D. ungulatus, Gymnopternus aerosus and *Chrysotus laesus* are found in great abundance in moist meadows surrounded by coniferous forests (Kechev, 2005, 2006 and 2010). Last two years *Ch. laesus* was found at lower altitudes in Bulgaria, along the banks of small brooks and rivers near the deciduous forest (Kechev, 2021).

Poecilobothrus regalis is one of the most common species in the lower parts of Bulgaria, from sea level up

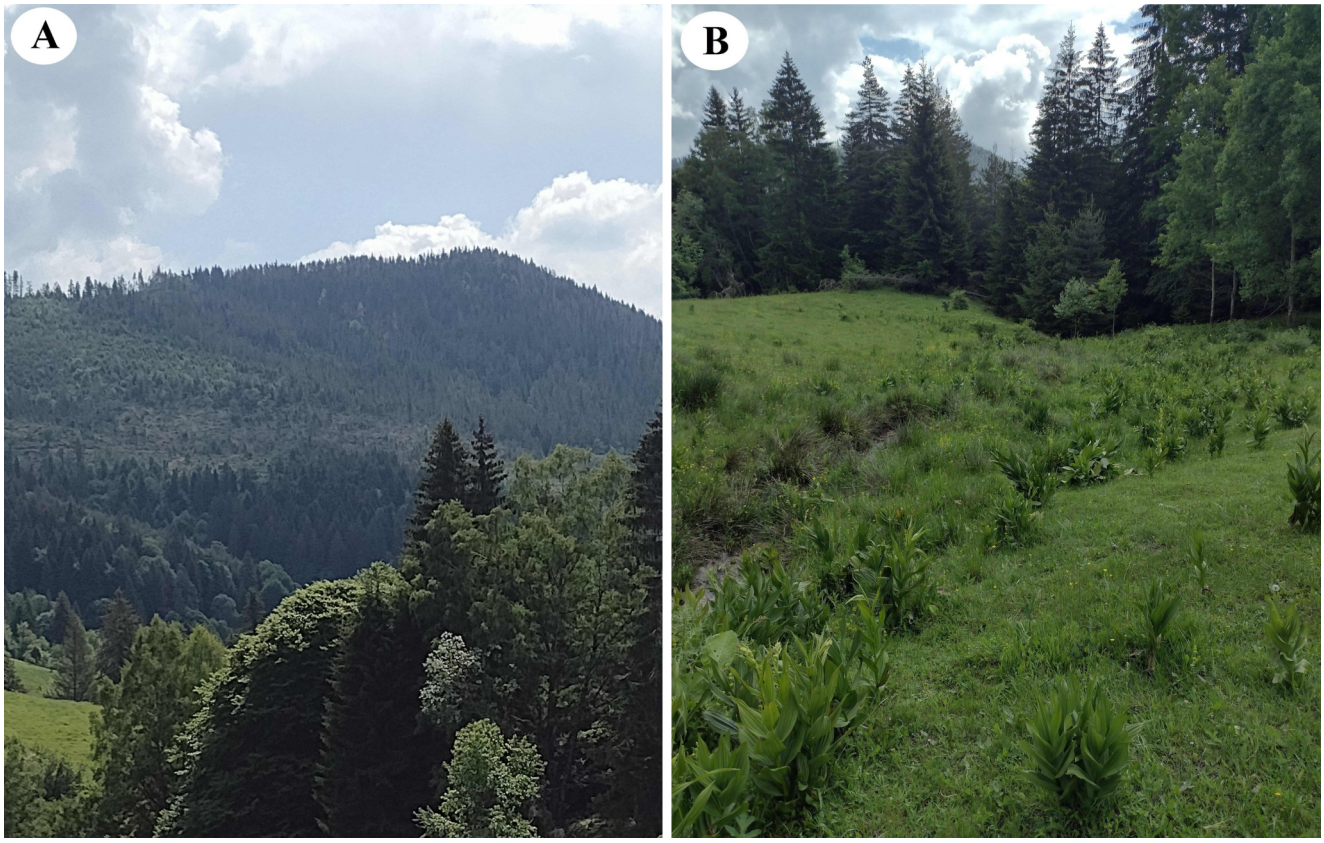

Fig. 7. Wet meadows in coniferous forests above the town of Smolyan, habitat of *Dolichopus picipes, D. ungulatus, D. popularis, Gymnopternus aerosus* and *Chrysotus laesus*.

to about 300 m. It is reported mainly from southern Bulgaria, where it has been found with large numbers of specimens on river banks, ponds and marshes (Kechev & Ivanova, 2015b, Kechev, 2019). Our study lists two new localities in northern Bulgaria.

Some regions in Bulgaria, including the Eastern Rhodope Mts, Pirin Mts, Rila Mts, Struma River Valley, are still not well studied in terms of their dolichopodid fauna. The southern parts of the E Rhodopes and the Struma River Valley are under the Mediterranean climatic influence. Future studies of these areas could results in the discovering of new species for the country and information on habitat preferences, and other ecological data for the family Dolichopodidae.

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Fig. 8. Malaise trap on the bank of Kazalach River, near Dzherovo Village.

Fig. 9. Small stream near Kremen Village.

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