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Earthworm (Clitellata, Megadrili) fauna of Kuttanad wetland, southern part of Vembanad-Kol Ramsar site, India

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Abstract. The earthworm fauna of the wetlands of India is highly undocumented. We have carried out a survey of earthworms in the Kuttanad wetland, an integral part of the Vembanad-Kol Ramsar Site, India's largest wetland of international importance. Current investigation has documented 17 species belonging to 7 families. *Megascolex travancorensis pentagonalis* Stephenson, 1916 and *Glyphidrilus fluviatilis* Rao, 1922 were reported for the first time since their original descriptions. Based on the current study, *M. t. pentagonalis* is raised to species rank as *M. pentagonalis* from the subspecies status. *G. fluviatilis* and *Lennogaster chittagongensis* (Stephenson, 1917) are new records for the state of Kerala. Present results provide a more complete picture of the earthworm fauna of Kuttanad wetland.

Keywords. *Drawida*, Megascolecidae, *Megascolex*, Moniligastridae, Kerala.

INTRODUCTION

The earthworm fauna of India is highly diverse and is well reported as compared to other Asian countries (Julka *et al*. 2009) with around 451 species (Narayanan *et al.* 2020*a*, 2021, Tiwari *et al.* 2021). The Indian state of Kerala is a small and narrow strip of land spreading over an area of 38,863 km along the southwest corner of the Indian subcontinent and the earthworm fauna of the state is very rich and fairly well documented compared to other states of India. Various workers have documented the earthworm fauna of the state since the end of 19th century (Fedarb 1898, Michaelsen 1910, Cognetti 1911, Stephenson 1915, Aiyer 1929 *etc*.). About 80% of the currently known species were recorded in the early part of the last century (Narayanan *et al.* 2016*a*). At present, 120 species of earthworms representing 31 genera in 9 families are recorded from Kerala state (Narayanan *et al.* 2016*a*, *b*, *c*, 2017, 2019*a*, *b*, *c*, 2020b, 2021, 2022, Anuja *et al.* 2020, Lone *et al.* 2022). Wetlands are often termed as 'biological supermarkets' because of the extensive food chains and rich biodiversity they support, providing unique habitats for a wide

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range of flora and fauna (Mitsch & Gosselink 2000). The earthworm fauna of Ramsar wetlands of India is not well documented (Chandra *et al.* 2021), except Renuka wetland, Pong Dam and Chander Lake (Julka & Paliwal 2000, Paliwal & Julka 2009, Paliwal 2018). Kuttanad wetland is one of the best-known backwater ecosystems of India and an integral part of India's largest wetland of international importance, the Vembanad-Kol Ramsar site (Narayanan *et al.* 2011). A recent study by the Zoological Survey of India did not report any earthworm species from this wetland (Anon. 2009). Albeit, eight species of earthworms were randomly reported from the various regions of this wetland (Michaelsen 1910, Aiyer 1929, Narayanan *et al.* 2015, 2016*d*, Anuja *et al.* 2020, 2023). They are *Drawida impertusa* Stephenson, 1920, *Pontoscolex corethrurus* (Müller, 1857), *Argilophilus variabilis* (Aiyer, 1929), *Eukerria kuekenthali* (Michaelsen, 1908), *Lampito mauritii* Kinberg, 1867, *Metaphire houlleti* (Perrier, 1872), *Megascolex insignis* Michaelsen, 1910 and *M. konkanensis* Fedarb, 1898. Among these seven were reported before independence. Here we provide new earthworm records from the Kuttanad wetland, based on collections carried out between 2010 and 2022.

MATERIALS AND METHODS

Kuttanad is a highly complex wetland ecosystem, primarily a deltaic formation of four-river systems, namely, Achencovil, Pamba, Manimala and Meenachil, located in the fertile low-lying areas of Vembanad estuarine system in the Kerala state of southwest India (Fig. 1) (John *et al.* 2009). This region lies between 9°8' – 9°52'N and 76°9' – 76°44'E, with a geographical area of 1,100 km^2 which spreads over Alappuzha, Kottayam and Pathanamthitta districts and separated from the Arabian Sea by a narrow strip of land (Shari & Chitra 2005, John *et al.* 2009, Narayanan *et al.* 2011). Kuttanad wetlands has many characteristic features compared to the other wetlands of the world, one distinct feature is that it lies 0.6 to 2.5 m below mean sea level, receives nearly 3,200 mm of annual rainfall through two monsoon seasons, with uniform high air and water temperature (22–35^{o}C), having humidity ranges between 70–80% throughout the year (John *et al.* 2009).

The area comprises flood plains, coastal alluvial belt, river networks, numerous canals, large paddy fields, lakes, and remains water-logged almost throughout the year, subjected to continued flood submergence during monsoon and saline water ingression during the summer months (John *et al.* 2009, Narayanan *et al.* 2011). Kuttanad wetland has 53,639 ha of paddy fields and is known as the 'rice bowl of Kerala'. Most of these paddy fields remain submerged in water during the non-crop season and water has to be pumped out to the backwaters before the commencement of the cultivating season (Sashikumar & Palot 1996). Based on the soil, pH, geomorphology and salinity intrusion, Kuttanad is subdivided into six agro-ecological zones *viz*., Vaikom Kari, North Kuttanad, Kayal lands, Lower Kuttanad, Upper Kuttanad, and Purakkad Kari (Indo-Dutch Mission 1989).

Earthworms were collected primarily by digging and hand sorting method (Julka 1990) from various habitats, such as dykes, home surroundings, paddy fields, recently reclaimed wetlands by filling the lateritic soils from the midland hills, grassy patches, wooded areas, in detritus and other natural substrates, also handpicked from soils under logs, branches, rocks, stones *etc*. Collected live specimens were placed in small plastic bags along with the substrate. Later collected specimens were washed and preserved in 5% formalin, if possible in the field itself. All anatomical observations were made by dorsal dissection under binocular stereomicroscope (Nikon SMZ800 N). Specimens were identified following standard literatures (Stephenson 1923, Aiyer 1929, Gates 1972, Julka 1988, Blakemore 2012, Chanabun *et al.* 2013). Identified specimens were deposited in the earthworm laboratory of the Advanced Centre of Environmental Studies and Sustainable Development (ACESSD), Mahatma Gandhi University, Kerala, India.

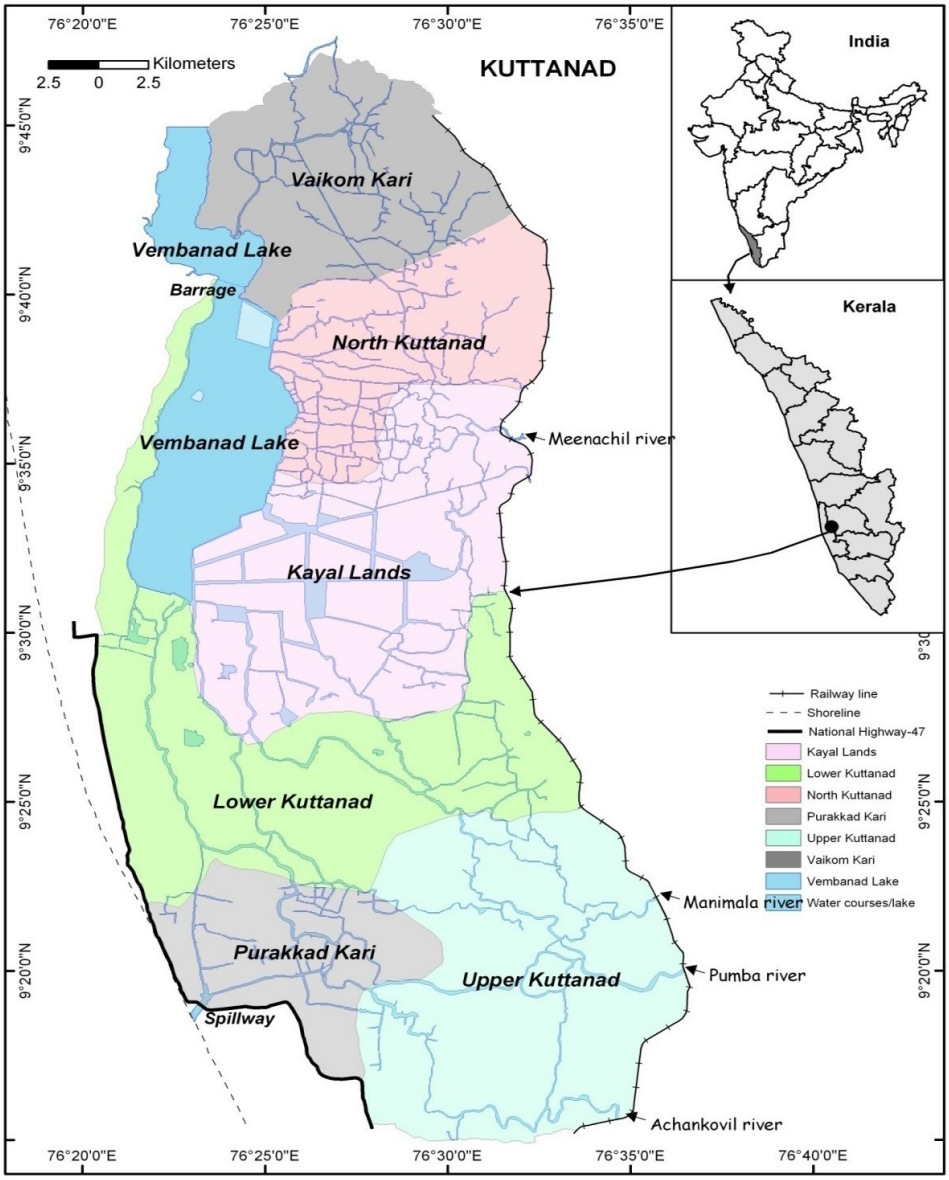

Figure 1. Location of the Kuttanad wetland in southwest India

TAXONOMY

Family Moniligastridae Claus, 1880

Drawida ghatensis Michaelsen, 1910

Drawida ghatensis Michaelsen, 1910: 52.

Material examined. 1 aclitellate (ACESSD/EW/1030), Aymanam, Kottayam Dist., Kerala, home garden, 03.01.2018, leg. G. Sreekumar; 1 aclitellate (ACESSD/EW/1072), Kumarakom (9.6175°N 76.4301°E), Kottayam Dist., Kerala, near pond, 07.03.2019, leg. G. Sreekumar; 2 juveniles, 9 aclitellates, 1 clitellate (ACESSD/EW/1520), Vadayar (9°45'29"N 76°26'50"E), Kottayam Dist., Kerala, edge of paddy field, 12.10.2022, leg. S.P. Narayanan, V.T. Kurien.

Distribution in Kerala. Aymanam, Kumarakom, Vadayar (new records), Anikadu, Aruva-

pulam, Athirampuzha, Bonacaud, Charupara, Kadakkal, Kakkara, Kalleli, Karimbinthodu, Kavalai in Forest Tramway, Kottayam, Kulathupuzha, Kurichi, Maddathoray, Marangatupally, Mukkunni Reserve Forest, Munnilavu, Nedumkunnam, Neyyar Wildlife Sanctuary, Njaloor, Orekar, Pinangathodu, Plassinal, Ponthenpuzha, Ponmudi, Pulpally, Puthuvely, Road to Valiyaparathodu (Silent Valley National Park), Thenmala, Thiruvalla (Michaelsen 1910, 1913, Stephenson 1915, Aiyer 1929, Julka & Chandra 1986, Narayanan *et al.* 2014, 2016*a*, Nair *et al.* 2015, Stahrumithra *et al.* 2018, John *et al*. 2019, Thakur *et al.* 2021, Anuja *et al.* 2023).

Remarks. Endemic to India. Thakur *et al.* (2021), reported *D. ghatensis* from Neyyar Wildlife Sanctuary of Kerala and as per the description provided, prostate is ovoid or thickly pear-shaped, as stated by Stephenson (1923). But later Julka & Chandra (1986) described the prostate as shortly stalked and ovoidal that means 'mushroom-shaped' with a figure. In Thakur *et al.*'s figure (4C) *vas deferens* joins the prostate at its lateral side. But in Stephenson (1915) *vas deferens* joins the prostate at its anterior face. Therefore, this record needs further corroboration. *D. ghatensis* is a species complex, shows great variation with respect to the shape of the spermathecal atrium (Stephenson 1915, 1923; Aiyer, 1929; Julka & Chandra, 1986). But Thakur *et al.* (2021) present initiation of the DNA barcode signatures (COI) of this group will be helpful in future to resolve taxonomical problems in this species complex.

Drawida impertusa **Stephenson, 1920**

Drawida barwelli var. *impertusus* Stephenson, 1920: 200.
Drawida barwelli var. *impertusa*: Stephenson 1923: 134.
Drawida impertusa (Stephenson): Gates 1965: 87.

Material examined. 1 juvenile, 6 clitellates (ACESSD/EW/1094), Perumthuruthu (9°41'22.7"N 76°27'49.5"E), Kottayam Dist., Kerala, paddy field, 21.12.2018, leg. R. Anuja; 2 aclitellates, 2 clitellates (ACESSD/EW/1482), Illichira (9°20' 23"N 76°23'7"E), Alappuzha Dist., Kerala, dyke with grass patch close to *Pandanus* stand, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 2 juveniles, 7 aclitellates (ACESSD/EW/1487), Edathua (9°21'47"N 76°28'52"E), Alappuzha Dist., Kerala, home surrounding, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 1 juvenile, 2 aclitellates, 2 clitellates (ACESSD/EW/1488), Mepral (9°21'47" N 76°28'52" E), Pathanamthitta Dist., Kerala, home surroundings in paddy field, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 7 aclitallates, 10 clitellates (ACESSD/EW/1491), Karumadi (9°22'48"N 76°23'12"E), Alappuzha Dist., Kerala, open grassy (*Axonopus compressus*) area in a dyke, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 2 aclitellates (ACESSD/EW/1502), Chennithala (9°16'43"N 76°30'10" E), Alappuzha Dist., Kerala, home surrounding in a reclaimed land within paddy field, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 3 clitellates (ACESSD/EW/1524), Pattassery near Neelamperoor (9°31'3"N 76°30'32"E), Kottayam Dist., Kerala, home surroundings within paddy field, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien; 2 aclitellates (ACESSD/EW/1526), Kainady (9°30' 4"N 76°28'28"E), Alappuzha Dist., Kerala, bund between paddy field and lake, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien; 2 juveniles, 1 clitellate (ACESSD/EW/1529), Paral (9°26'57"N 76°31'32"E), Kottayam Dist., Kerala, reclaimed land in wetland, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien; 4 aclitellates (ACESSD/EW/1537), Kainakari (9°29'4"N 76°23'3"E), Alappuzha Dist., Kerala, bund with tree near river, 07.12. 2022, leg. S.P. Narayanan, V.T. Kurien; 1 aclitellate, 1 clitellates (ACESSD/EW/1562), Cheepungal (9°38'26.2"N 76°25'16.9"E), Kottayam Dist., Kerala, paddy field, 11.12.2017, leg. R. Anuja, S. Sathrumithra, V.T. Kurien.

Distribution in Kerala. Cheepungal, Chennithala, Edathua, Illichira, Kainady, Kainakari, Karumadi, Mepral, Paral, Pattassery near Neelamperoor, Perumthuruthu (new records), Anikadu, Kanjikode, Kanjirapally, Karimbinthodu, Kerumaadi (Karumady, Karumadi), Marangatupally, Monipally, Munnilavu, Pallikathodu, Peppara Wildlife Sanctuary, Perumthuruthu, Thiruvella (Thiruvalla), Vandiperiyar (Michaelsen 1910,

Aiyer 1929, Gates 1965, Kathireswari *et al.* 2005, Thakur *et al.* 2021, Anuja *et al.* 2023).

Remarks. Native peregrine (Narayanan *et al.* 2016*a*). Thakur *et al.* (2021) records from Peppara Wildlife Sanctuary of Kerala state needs further corroboration. Since, certain key characters given and the figures provided are not matching. Genital markings are very rare in *Drawida* (Gates 1972), Thakur *et al.* (2021) themselves stated same in paper (Thakur *et al.* 2021: 123). Hence, the presence of genital marking is of great importance in species level identification of *Drawida*. In *D. impertusa* genital markings are always present (Gates 1965), as a pair of fairly large, oval whitish papillae on segment 10 in front of the male pores (Stephenson 1923, Aiyer 1929, Gates 1965, Blakemore 2012). Thakur *et al.* mentioned the presence of whitish papillae in front of the male pores, but such papillae are not shown in the figure of the species provided. Thakur *et al.* described the prostate as spherical or sometimes pear-shaped, glandular, duct (*vas deferens*?) joins at the anterior end. But as per Stephenson (1923), Aiyer (1929) and Blakemore (2012) and our personal observations, prostates are glandular, sessile and circular (spheroidal), and the vas deferens joins the prostate at its antereo-median side (Aiyer 1929, Gates 1965).

Drawida travancorensis Michaelsen, 1910

Drawida travancorensis Michaelsen, 1910: 46.

Material examined. 2 aclitellates (ACESSD/EW/1376), Neelamperoor (9°29’48N 76°30’21” E), Alappuzha Dist., Kerala, home surroundings in lateritic soil within Kuttanad, 08.10.2021, leg. Sreehari Mohan.

Distribution in Kerala. Neelamperoor (new record), Anchal, Anikadu, Chadayamangalam, Edamarug, Ezhukone, Illikalkallu, Kanjirapally, Karimbinthodu, Kodanoor, Kolazhy, Kottayam, Marangatupally, Meenadam, Melukavu, Monipally, Munnilavu, near Thangalpara - Vagamon, Nedumkunnam, Pampady, Pangada, Peppara Wildlife Sanctuary, Plassinal, Ponthenpuzha, Poonjar, Puthuvely, Tenmalai, unspecified locality within Wayanad forest, Uzhavoor, Vattiyoorkavu, Vembayam (Michaelsen 1910, Aiyer 1929, Nair *et al*. 2007, 2015, Kushwaha *et al.* 2015, Narayanan *et al.* 2016*a*, Athira *et al.* 2016, Kumari *et al.* 2021*a*, Anuja *et al.* 2023).

Remarks. Endemic to southwest India. Often misspelled as *D. travancorense* (Thakur *et al.* 2021, Reynolds & Wetzel 2023).

Family Acanthodrilidae Claus, 1880

Lennogaster chittagongensis (Stephenson, 1917)

Eudichogaster chittagongensis Stephenson, 1917: 411.
Lennogaster chittagongensis (Stephenson): Gates 1940: 192.

Material examined. 5 clitellates (ACESSD/EW/1076), Ramankary (9°25’27”N, 76°27’55”E), Alappuzha Dist., Kerala, homestead, 11.08.2019, leg. S.P. Narayanan.

Distribution in Kerala. Ramankary (new record for the state).

Remarks. Subendemic species. As of now it is known only from this site in the state.

Family Almidae Duboscq, 1902

Glyphidrilus annandalei Michaelsen, 1910

(Figure 2)

Glyphidrilus annandalei Michaelsen, 1910: 101.
Glyphidrilus achencoili Cognetti, 1911: 506 (*lapsus*).
Glyphidrilus rarus Rao, 1922: 64.
Glyphidrilus safforensis Rao, 1922: 66.

Material examined. 1 juvenile (ACESSD/EW/861), Neendoor (9°41’33.8”N 76°29’29.2”E), Kottayam Dist., Kerala, paddy field, 12.12.2018, leg. R. Anuja, S. Sathrumithra, V. T. Kurien; 1 juvenile, 1 clitellate (Fig. 2) (ACESSD/EW/ 1525), Kainady (9°30’4”N 76°28’28”E), Alappuzha Dist., Kerala, paddy field, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien.

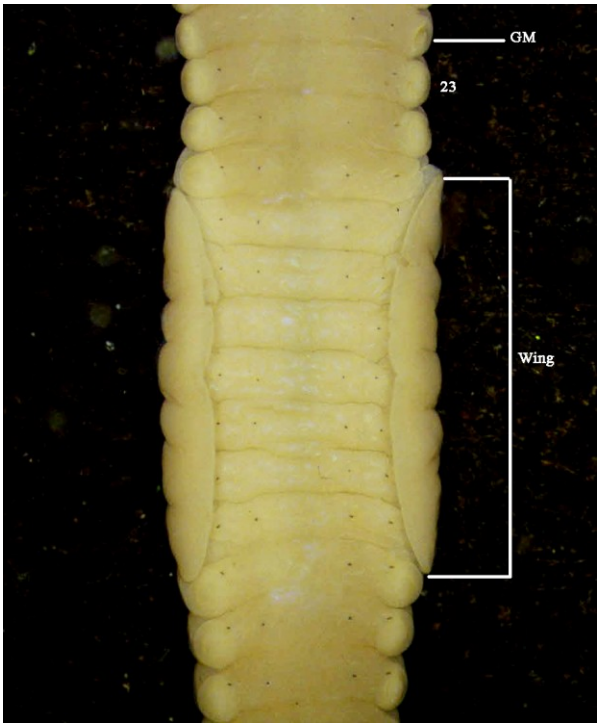

Figure 2. *Glyphidrilus annandalei* Michaelsen, 1910, wings – ventral view. *GM* = genital marking.

Distribution in Kerala. Kainady (new record), Achencoil (Achankovil) River banks, Calicut (Kozhikode), Chathannoor, Chavara, Jaithy Field (Jagathy?), Karunagapally, Kottiyam, Kurichi, Madathoray (Madathara), Malabar, Malapuram (Malappuram), Neendoor, Neyyantinkara, Periya, Quilon (Kollam), Tiruvallur, Trivandrum (Thiruvananthapuram), Vatakara, Vellany (Vellayani) (Michaelsen 1910, 1913, Cognetti 1911, Stephenson 1916, ElAmmari *et al.* 2015; Nair *et al.* 2015, Narayanan *et al*. 2016*a*, Deepthi & Kathireswari 2016, George *et al.* 2017, Sathrumithra *et al.* 2018, Anuja *et al.* 2023).

Remarks. Endemic to India.

Glyphidrilus fluviatilis **Rao, 1922**

(Figure 3)

Glyphidrilus fluviatilis Rao, 1922: 53.
Glyphidrilus annandalei (Rao): Stephenson 1922: 387.
Glyphidrilus fluviatilis: Chanabun *et al.* 2013: 27.

Material examined. 4 juveniles, 1 clitellate (ACESSD/EW/1494), Mukkada (9°20’29”N 76° 25’5”E), Alappuzha Dist., Kerala, paddy field, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien.

Description. Dimension: Clitellate – length 173 mm, width 3.5 mm (at segment 25), segment number 332. Setae lumbricine, body cylindrical in the anterior region, quadrangular behind clitellum. Clitellum annular in segments 13–38; ventro-lateral clitellar wing (Fig. 3A) is in segments 25–31. Dorsal pores absent, male pores, female pores, spermathecal pores invisible. Genital markings present (Fig. 3B), in segments 13–24, 33, 34, 35 paired on *bc* setal lines; median single one on segments 12–22, 37–39 on *aa* setal lines.

Distribution in Kerala. Mukkada (new record).

Remarks. Endemic to India. New addition to the Kerala state, previously it was known only from Madapur (= Madapura), Fraserpett (Kushalnagar), Shimoga (Shivamogga) of Karnataka state and Narayan of Vordevia Dicu (Karnataka state?) (Rao 1922, Chanabun *et al.* 2013).

Family Benhamiidae Michaelsen, 1897

Dichogaster bolaui **(Michaelsen, 1890)**

Benhamia bolavi (corr. *bolaui*) Michaelsen, 1891: 9.
Dichogaster (*Diplothecodrilus*) *bolaui*: Csuzdi 2010: 102 (for complete synonymy).

Material examined. 1 juvenile, 1 aclitellate, 13 clitellates (ACESSD/EW/9), Ramankary (9°25’ 27”N 76°27’55”E), Alappuzha Dist., Kerala, roof top of house, 30.12.2010, leg. S.P. Narayanan; 2 clitellates (ACESSD/EW/9), Ramankary (9°25’ 27”N 76°27’55”E), homestead, 08.06.2016, leg. S.P. Narayanan; 18 clitellates (ACESSD/EW/ 1319), Ramankary (9°25’27”N 76°27’55”E), from decaying leaf litter on roof top, 19.09.2021, leg. S.P. Narayanan.

Distribution in Kerala. Ramankary (new record), Athirampuzha, Ernakulam, Kanjikode, Koottikal, Monipally, Neyyattinkara, Periya, Trivand

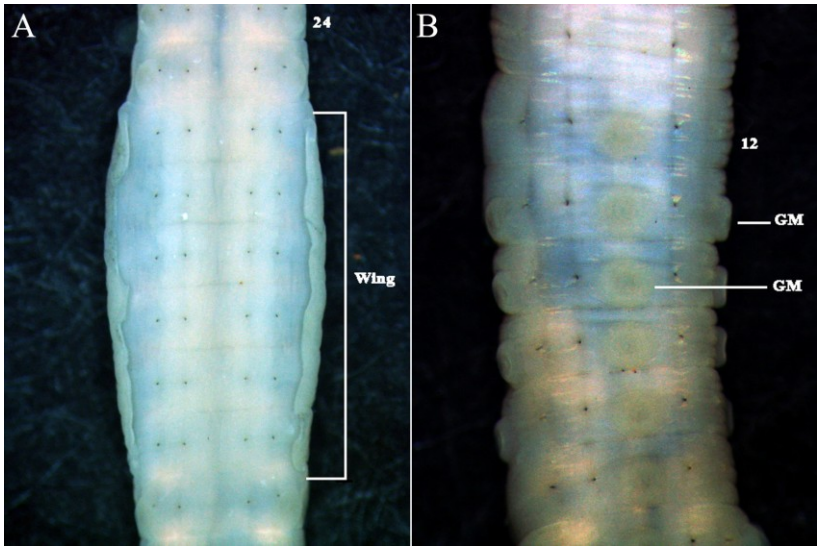

Figure 3. *Glyphidrilus fluviatilis* Rao, 1922: A = Ventral view of wings; B = Ventral view of anterior portion. *GM* = genital marking.

rum (Thiruvananthapuram), Vatakara (Michaelsen 1910; Stephenson 1916; Kathireswari *et al.* 2005b, Narayanan *et al.* 2014*a*, Deepthi & Kathireswari 2016, George *et al.* 2017, Anuja *et al*. 2023).

Remarks. Exotic species. One of the most widespread peregrine earthworm species in the world (Csuzdi *et al.* 2008).

Family Megascolecidae Rosa, 1891

Amynthas alexandri Beddard, 1901

Amyntas alexandri Beddard, 1901: 999.
Amynthas alexandri: Blakemore 2012: 331 (for complete synonymy).

Material examined. 1 juvenile (ACESSD/EW/1122), Ramankary (9°25'27"N 76°27'55" E), Alappuzha Dist., Kerala, road side, 11.08.20 19, leg. S.P. Narayanan; 4 clitellates (ACESSD /EW/1517), Neendoor (9°41'33"N 76°29'29"E), Kottayam Dist., Kerala, roadside in paddy field, 12.10.2022, leg. S.P. Narayanan, V.T. Kurien; 1 clitellate (ACESSD/EW/1533), Veliyanadu (9° 26'43"N 76°27'49"E), Alappuzha Dist., Kerala, reclaimed land in wetland, beneath decaying tree trunk, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien.

Distribution in Kerala. Neendoor, Ramankary, Veliyanadu (new records), Adakasthala, Changuvetty, Chempala, Devi Estate Pettickal (Attappady), Kaniyambatta, Kooriyad, Manjeswaram, Nellikkuzhy, Ponpally, Pulpally, Thazhesambarkode - Attappady, Vallikadavu, Vazhakkulam (Narayanan *et al.* 2016*b*; Sathrumithra *et al.* 2018; John *et al*. 2019)

Remarks. Exotic species, widely distributed in the world (Blakemore 2012). Narayanan *et al.* (2016*b*) reported this species for the first time from the state. Now its range is expanding within the state.

Lampito mauritii Kinberg, 1857

Lampito mauritii Kinberg, 1867: 103; Blakemore 2012: 331 (for complete synonymy).

Material examined. 1 clitellate (ACESSD/EW/866), Neendoor (9°41'33.8"N 76°29'29.2" E), Kottayam dist., Kerala, paddy field, 11.12. 2017, leg. R. Anuja, S. Sathrumithra, V.T. Kurien; 4 aclitellates, 1 clitellate (ACESSD/

EW/870), Perumthuruthu (9°41'22.7"N 76°27' 49.5"E), Kottayam dist., Kerala, paddy field, 11.12.2017, leg. R. Anuja, S. Sathrumithra, V. T. Kurien; 1 juvenile, 6 clitellates (ACESSD/EW/ 1095), Perumthuruthu (9°41'22.7"N 76°27'49.5" E), Kottayam dist., Kerala, paddy field, 21.12. 2018, leg. R. Anuja; 2 clitellate (ACESSD/EW/ 1480), Illichira (9°20'23"N 76°23'7"E), Alappuzha Dist., Kerala, dyke with grass patch close to *Pandanus* stand, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 1 juvenile (ACESSD/EW/ 1492), Karumadi (9°22'48"N 76°23'12"E), Alappuzha Dist., Kerala, open grassy (*Axonopus compressus*) area in a dyke, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 5 clitellates (ACESSD/ EW/1532), Veliyanadu (9°26'43''N 76°27'49'' E), Alappuzha Dist., Kerala, reclaimed land in wetland, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien.

Distribution in Kerala. Illichira, Karumadi, Veliyanadu (new records), Chittur, Ernakulam, Kanjikode, Kerumaadi (Karumady), Killipalam, Kolazhy, Murukunpuzha, Neduvathoor, Neendoor, Oachira, Ollur, Palakkad town, Pallode, Paravoor, Peringandoor, Perumthuruthu, Shasthancottah (Sathamkotta), Shertalay (Cherthala), Trichur (Thrissur), Trivandrum (Thiruvananthapuram), Vanchiyoor, Vatakara, Vazhote, Vazhuthakaud (Michaelsen 1910, 1913, Cognetti 1911; Kathireswari *et al*. 2005, Nair *et al.* 2007, 2015, Manazhy *et al*. 2013, ElAmmari *et al*. 2015, Athira *et al.* 2016, Deepthi & Kathireswari 2016, Jacob *et al.* 2017, Sreelekshmi *et al.* 2017, Anuja *et al.* 2023).

Remarks. Native peregrine species (Narayanan *et al.* 2016*a*). Acquired wide global distribution (Blakemore 2012).

Megascolex konkanensis Fedarb, 1898

Megascolex konkanensis Fedarb, 1898: 434.

Material examined. 1 clitellate (ACESSD/ EW/867), Perumthuruthu (9°41'22.7"N 76°27' 49.5" E), Kottayam dist., Kerala, paddy field, 11.12.2017, leg. R. Anuja, S. Sathrumithra, V.T. Kurien; 3 clitellates (ACESSD/EW/1073), Kumarakom (9.6175°N 76.4301°E), near pond, 07.03. 2019, leg. Sidharth Mohan; 1 juvenile, 1 aclitellate, 1 clitellate (ACESSD/EW/557), Ramankary (9°25'27"N 76°27'55"E), Alappuzha Dist., Kerala, homestead, 18.01.2016, leg. S.P. Narayanan; 3 juveniles (ACESSD/EW/1377), Neelamperoor (9°29'48N 76°30'21"E), home surroundings in lateritic soil within Kuttanad, 08.10.2021, leg. Sreehari Mohan; 1 clitellate (ACESSD/EW/ 1483), Eramathoor (9°18'27"N 76°31'27"E), Alappuzha Dist., Kerala, homestead near paddy field, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 1 juvenile, 1 clitellate (ACESSD/EW/1515), Neendoor (9°41'33"N 76°29'29"E), Kottayam Dist., Kerala, roadside in paddy field, 12.10.2022, leg. S.P. Narayanan, V.T. Kurien; 1 clitellate (ACESSD/EW/1530), Paral (9°26'57"N 76°31' 32"E), Kottayam Dist., Kerala, reclaimed land in wetland, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien.

Distribution. Eramathoor, Kumarakom, Neelamperoor, Neendoor, Paral, Ramankary (new records), Amalagiri, Aryankavu, Athirampuzha, Calicut (Kozhikode), Chempala, Chennithala, Chittur, Elavathur, Engandiyur, Ernakulam, Kadakkal, Kalady, Kalleli, Kaniyambatta, Kanjikode, Karimbinthodu, Kavalai, Kerumaadi (Karumadi), Kokkathodumoozhy, Kottayam, Kulattupuzha (Kulathupuzha), Kummanoor, Maddathoray (Madathara), Manalithara, Maneera, Meenadam, Mlappara in Periyar National Park, Monipally, Muthalamada, Palghat (Palakkad), Pangada, Parambikulam road – Muthalamada, Pathanapuram, Peechi, Perumthuruthu, Pinanganthodu, Pulpally, Puthuvely, Quilon (Kollam), Shasthancottah (Sathamkotta), Thenmala Reservoir – Shendurney Wildlife Sanctuary, Thiruvanjoor, Tirur, Tiruvallur, Travancore, Trivandrum (Thiruvananthapuram), Vettoor (Fedarb 1898, Michaelsen 1910, Stephenson 1916, 1925b, Kathireswari *et al.* 2005, Narayanan *et al.* 2014, 2016*a*, 2019*b*, Balachandran *et al.* 2015, El Ammari *et al.* 2015, Nair *et al.* 2015, Athira *et al.* 2016, Jacob *et al.* 2017, Sreelekshmi *et al.* 2017, Sathrumithra *et al.* 2018, John *et al.* 2019, Chandini *et al.* 2021, Lone *et al.* 2022, Anuja *et al.* 2023).

Remarks. Endemic to India. Intestine origin is of species specific importance in the identification of *Megascolex* species. In this species the intestine begins in segment 16 (Fedarb 1898, Stephenson 1923), whereas in Lone *et al.* (2022) specimens it starts from segment 18. Moreover Lone *et al.* (2022) figures (5a and 5b) depicting the genital region and spermathecae of *M. konkanensis* is not corresponding with the actual description of *M. konkanensis.* The provided genital region figure is matching with the description of *M. cochinensis* Stephenson, 1915 and not with *M. konkanensis*. Hence due to Lone *et al.* (2022) contradicting anatomical features and figures provided, the identity of the species from Parambikulam road – Muthalamada, Thenmala Reservoir – Shendurney Wildlife Sanctuary, Mlappara in Periyar National Park needs further corroboration.

Megascolex pentagonalis Stephenson, 1916 stat. rev.

(Figure 4)

Megascolex pentagonalis Stephenson, 1916: 331.
Megascolex travancorensis var. *pentagonalis* Stephenson: Stephenson 1923: 278.
Megascolex travancorensis pentagonalis Stephenson: Blakemore 2007: 37.

Material examined. 7 clitellates and 2 juveniles, (ACESSD/EW/1501), Chennithala (9°16' 43"N 76°30'10"E), Alappuzha Dist., Kerala, home surrounding in a reclaimed land within paddy field, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 1 juvenile, 1 clitellate (ACESSD/ EW/1504), Eramathoor (9°18'27"N 76°31'27" E), Alappuzha Dist., Kerala, homestead close to paddy field, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien.

Description. Dimension: clitellate – length 274 mm, width 6 mm, segments 331, and juvenile – length 272 mm, width 5.5 mm, segments 417. Colour a uniform medium grey. Secondary annulations present in segments 7–9. Anterior end truncated. Setae enlarged at the anterior portions. Prostomium combined pro-epilobic. First dorsal pore in intersegmental furrow 5/6, indication present in furrow 4/5. Ventral setae in regular longitudinal lines, dorsal setae are not. Clitellum light pinkish cream colour (in life), in segments 14–¼17 (3¼). Male field on segment 18, pentagonal in shape, with the base forwards, the whole occupying the anterior 2/3rd of segment; lateral area to outwards, the whole area surrounded by a groove and marked by an inverted T-shaped depression (Fig. 4A). Spermathecal pores small, in intersegmental furrows 7/8/9, in line with *b* (Fig. 4B). Septa 6/7–10/11 thickened, following septa are moderately thickened, gradually thinner as far as 16/17. Gizzard barrel-shaped, in segment 5. Last heart in segment 13. Holandric, testes and funnels free in segment 10 and 11, seminal vesicles in segments 11, and 12. Intestine begins in segment 16. Prostates racemose, large, elongateed band-like or irregularly rectangular, incised, in segments 17–20; prostatic duct muscular, shiny, ectal end thicker, transversely placed, gradually thinner at ental end, sinuous, with a bent and twisted before entering the gland. Spermathecal ampulla large, sausage-shaped, bent, ental end slightly dilated (Fig. 4C); duct short, half as thick as ampulla; spermathecal diverticulum arising from the ental end of the duct, more than half as long as ampulla, tubular, thin, with a slight dilatation at ental end.

Distribution in Kerala. Chennithala, Eramathoor (new records), Trivandrum (Thiruvananthapuram) (Stephenson 1916).

Remarks. Endemic (Narayanan *et al*. 2016*a*). Earlier it was known only from the type locality. One clitellate and 1 juvenile worms are in full length the rest lost posterior portion while collecting. *M. pentagonalis* initially described at species rank by Stephenson (1916), but later he treated it as a subspecies of *M. travancorensis* Michaelsen, 1910 (Stephenson 1923). There are considerable differences in the male field, dimensions and shape of spermathecae in all the five subspecies of *M. travancorensis*. Due to these facts and based on the present study, *M. t. pentagonalis* is elevated to species rank as *M. pentagonalis* Stephenson, 1916.

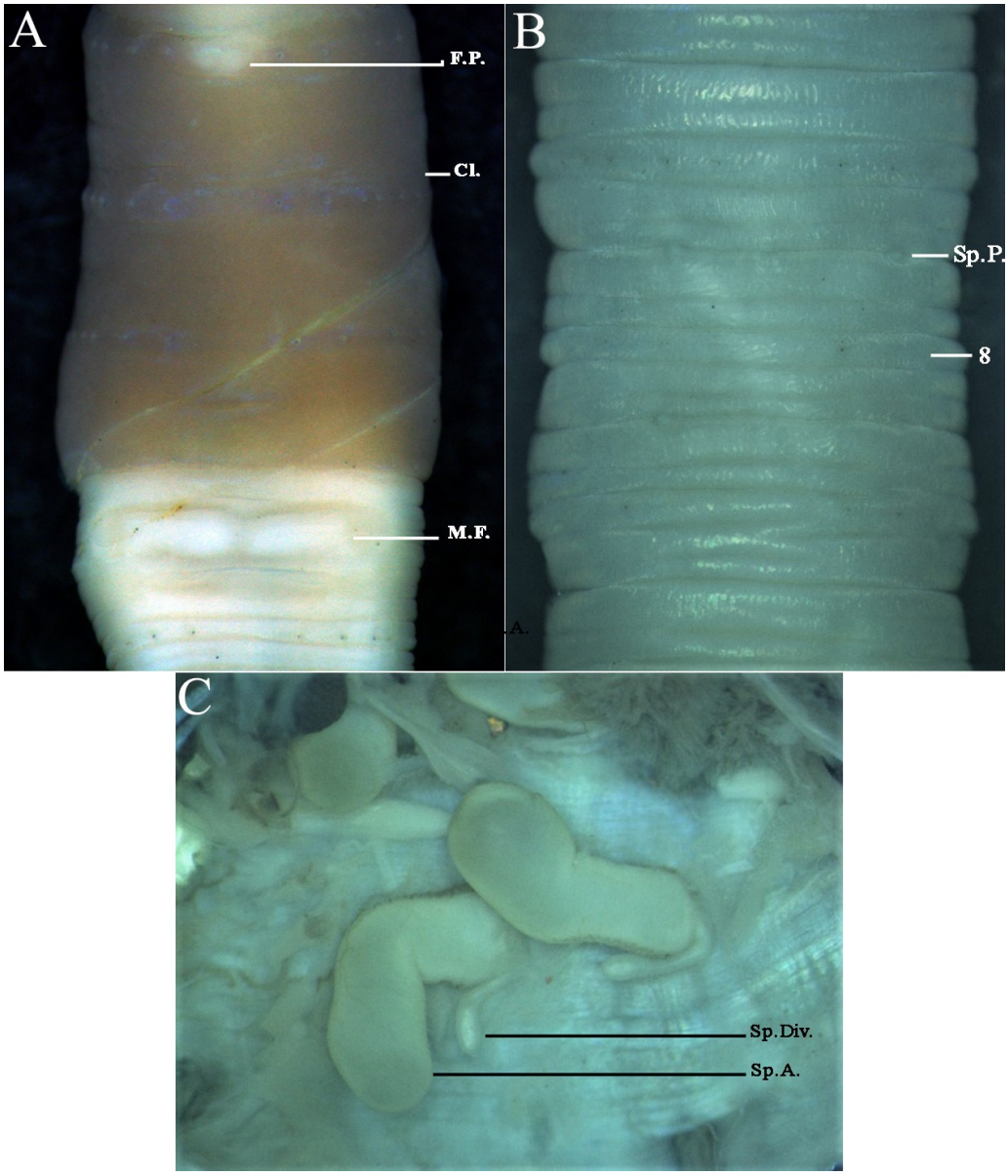

Figure 4. *Megascolex pentagonalis* Stephenson, 1916: A = Male field; B = Spermathecal pore region; C = Spermathecae of the right hand side. *Cl.* = clitellum, *F.P.* = female pore, *M.F.* = male field, *Sp.A.* = spermathecal ampulla, *Sp.Div.* = spermathecal diverticulum, *Sp.P.* = spermathecal pore.

Metaphire houlleti (Perrier, 1872)

Perichaeta houlleti Perrier, 1872: 99.
Metaphire houlleti: Blakemore 2012: 478 (for complete synonymy).

Material examined. 2 clitellates (ACESSD/EW/70), Ramankary (9°25'27"N 76° 27'55"E), Alappuzha Dist., Kerala, home surroundings, 12.10.2012, leg. S.P. Narayanan; 1 clitellate (ACESSD/EW/868), Perumthuruthu (9°41'22.7" N 76°27'49.5"E), Kottayam dist., Kerala, paddy field, 11.12.2017, leg. R. Anuja, S. Sathrumithra, V. T. Kurien; 13 clitellate (ACESSD/EW/1485), Eramathoor (9°18'27"N 76°31'27"E), Alappuzha Dist., Kerala, homestead near paddy field, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 4 clitellate (ACESSD/EW/1486), Edathua (9°21'

47”N 76°28’52”E), Alappuzha Dist., Kerala, home surrounding, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 6 clitellates (ACESSD/EW/1489), Mepral (9°21’47”N 76°28’52”E), Pathanamthitta Dist., Kerala, home surroundings in paddy field, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 3 clitellates (ACESSD/EW/1516), Neendoor (9°41’33” N 76°29’29” E), Kottayam Dist., Kerala, roadside in paddy field, 12.10.2022, leg. S.P. Narayanan, V.T. Kurien; 1 clitellate (ACESSD/EW/1531), Veliyanadu (9°26’43” N 76°27’49” E), Alappuzha Dist., Kerala, reclaimed land in wetland, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien.

Distribution in Kerala. Edathua, Eramathoor, Mepral, Neendoor, Veliyanadu (new records), Athirampuzha, Changanacherry, Changuvetty, Chathurangappara, Chelamattom, Chempakathozhukudy, Chennithala, Chevayur near Calicut (Kozhikode), Chorayankundu, Edakadathy, East Okkal, Ethanur, Jellippara, Kadambupara, Kalady, Kallar, Karicode, Karippanthodu, Koratty, Kuttamathu temple - Cheruvathoor, Manjery, Manjeshwar, Marottikkadavu, Moovattupuzha, Muthalamada, Paloor streamside – Muthoor, Parapuram, Pattal, Perumthuruthu, Ponpally, Pozhuthana, Pulpally, Puthuppady, Ramankary, Sivajipuram, Thiruvengappura, Travancore, Trichur (Thrissur), Trivandrum (Thiruvananthapuram), Vandiperiyar, Vazhichal, Vengoor, Virakuthodu – Chimmony Wildlife Sanctuary, Vythiri (Fedarb 1898, Michaelsen 1910, Stephenson 1916, Gates, 1934, 1937, Narayanan *et al.* 2014*a*, 2015, 2019*b*, Balachandran *et al.* 2015, Sathrumithra *et al.* 2018, John *et al.* 2019, Chandini *et al.* 2021, Anuja *et al.* 2023).

Remarks. Exotic species (Narayanan *et al.* 2016*a*) with cosmopolitan distribution (Blakemore 2012).

Perionyx ceylanensis Michaelsen, 1903

Perionyx ceylanensis Michaelsen, 1903: 6.

Material examined. 1 aclitellate, 1 clitellate (ACESSD/EW/719), Kidangara, paddy field, 28. 12.2016, leg. S.S. Nair.

Distribution in Kerala. Kidangara (new record), Pozhuthana, Pulpally, Silent Valley National Park, Wayanad Wildlife Sanctuary (Mohan *et al.* 2011, John *et al.* 2019).

Remarks. Subendemic species (Narayanan *et al.* 2016*a*), outside India it is known only from Sri Lanka.

Perionyx excavatus Perrier, 1872

Perionyx excavatus Perrier, 1872: 126; Blakemore 2012: 283 (for complete synonymy).

Material examined. 2 clitellates (ACESSD/EW/588), Ramankary (9°25’27”N 76°27’55”E), Alappuzha Dist., Kerala, homestead, 08.06.2016, leg. S.P. Narayanan; 1 clitellate (ACESSD/EW/1268), Ramankary (9°25’27”N 76°27’55”E), Alappuzha Dist., Kerala, from bathroom wall, 16.01.2021, leg. S.P. Narayanan; 1 clitellate (ACESSD/EW/1305), Ramankary (9°25’27”N 76°27’55”E), alt. 0 m asl, 18.07.2021, leg. S.P. Narayanan; 2 juveniles, 3 clitellates (ACESSD/EW/1534), Veliyanadu (9°26’43”N 76°27’49”E), Alappuzha Dist., Kerala, reclaimed land in wetland, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien.

Distribution in Kerala. Ramankary, Veliyanadu (new records), Athirampuzha, Kalady, Kalleli, Karumam, Monipally, Muthalamada, Orekar, Periya, Thalamanam, Vellayambalam, Vettoor (Nair *et al.* 2007, Manazhy *et al.* 2013, Narayanan *et al.* 2014a, Balachandran *et al.* 2015, George *et al.* 2017, Sathrumithra *et al.* 2018, Chandini *et al.* 2021, Anuja *et al.* 2023).

Remarks. Native peregrine species (Narayanan *et al*. 2016*b*), it acquired wide global distribution.

Family Ocnerodrilidae Beddard, 1891

Eukerria kuekenthali (Michaelsen, 1908)

Kerria küekenthali Michaelsen, 1908: 24.
Eukerria kuekenthali: Blakemore 2012: 182 (for complete synonymy).

Material examined. 16 clitellates, 184 aclitellates (ACESSD/EW/872), Cheepunkal (9°38' 26.2"N 76°25'16.9"E), Kottayam Dist., Kerala, paddy field, 11.12.2017, leg. R. Anuja, S. Sathrumithra, V.T. Kurien; 1 clitellate (ACESSD/EW/1479), Illichira (9°20'23"N 76°23'7"E), Alappuzha Dist., Kerala, dyke with grass patch close to *Pandanus* stand, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien.

Distribution in Kerala. Illichira (new record), Cheepunkal (Anuja *et al.* 2020, 2023).

Remarks. Exotic species. As of now in Kerala, it is known only from the Kuttanad wetlands.

Ocnerodrilus occidentalis Eisen, 1878

Ocnerodrilus occidentalis Eisén, 1878:10.
Ocnerodrilus occidentalis: Blakemore 2012: 195 (for complete synonymy).

Material examined. 6 clitellates (ACESSD/EW/592), Ramankary (9°25'27"N 76°27'55"E), Alappuzha Dist., Kerala, homestead, 29.06.2016, leg. S.P. Narayanan.

Distribution in Kerala. Ramankary (new record), Athirampuzha, Chengannur, Nedumangad, Trivandrum (Thiruvananthapuram) (Michaelsen 1910, Aiyer 1929, Narayanan *et al.* 2014a).

Remarks. Exotic species (Narayanan *et al.* 2016*a*).

Family Rhinodrilidae Benham, 1890

Pontoscolex corethrurus (Müller, 1857)

Lumbricus corethrurus Müller, 1857: 113.
Pontoscolex corethrurus: Blakemore 2012: 554 (for complete synonymy).

Material examined. 1 juvenile, 2 clitellates (ACESSD/EW/24), Ramankary (9°25'27"N 76° 27'55"E), Alappuzha Dist, Kerala, homestead, 20.12.2010, leg. S.P. Narayanan; 3 aclitellates, 5 clitellates (ACESSD/EW/864), Mannanam (9° 38'37.66"N 76°30'42.19"E), Kottayam Dist., Kerala, 2 m asl, paddy field, 11.12.2017, leg. R. Anuja, S. Sathrumithra, V.T. Kurien; 9 clitellates (ACESSD/EW/865), Neendoor (9°41'33.8"N 76°29'29.2"E), Kottayam Dist., Kerala, paddy field, 11.12.2017, leg. R. Anuja, S. Sathrumithra, V.T. Kurien; 9 clitellates (ACESSD/EW/869), Perumthuruthu (9°41'22.7"N 76°27'49.5"E), Kottayam Dist., Kerala, paddy field, 11.12.2017, leg. R. Anuja, S. Sathrumithra, V.T. Kurien; 1 clitellate (ACESSD/EW/871), Cheepunkal (9°38' 26.2"N 76°25'16.9"E), Kottayam Dist., Kerala, paddy field, 11.12.2017, leg. R. Anuja, S. Sathru mithra, V.T. Kurien; 1 juvenile, 1 clitellate (ACESSD/EW/1097), Cheepunkal (9°38'26.2"N 76°25'16.9"E), Kottayam Dist., Kerala, paddy field, 21.12.2018, leg. R. Anuja; 1 juvenile ACESSD/EW/1375, Neelamperoor (9°29'48"N 76°30'21"E), Alppuzha Dist., Kerala, home surroundings in lateritic soil within Kuttanad, 08.10.2021, leg. Sreehari Mohan; 1 clitellate (ACESSD/EW/1481), Illichira (9°20'23"N 76° 23'7"E), Alappuzha Dist., Kerala, dyke with grass patch close to *Pandanus* stand, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 1 juvenile, 1 clitellate (ACESSD/EW/1484), Eramathoor (9°18' 27"N 76°31'27"E), Alappuzha Dist., Kerala, homestead near paddy field, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 1 juvenile (ACESSD/EW/1493), Karumadi (9°22'48"N 76°23'12"E), Alappuzha Dist., Kerala, Open grassy (*Axonopus compressus*) area in a dyke, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 2 juveniles, 1 aclitellate, 2 clitellates (ACESSD/EW/1495), Mukkada (9° 20'29"N 76°25'5"E), Alappuzha Dist., Kerala, dyke in paddy field, 15.08.2022, leg. S.P. Narayanan, V.T. Kurien; 1 juvenile, 2 clitellates (ACESSD/EW/1503), Chennithala (9°16'43"N 76°30'10"E), Alappuzha Dist., Kerala, home surrounding in a reclaimed land within paddy field, 1.08.2022, leg. S.P. Narayanan, V.T. Kurien; 3 juveniles (ACESSD/EW/1518), Neendoor (9°41'33"N 76°29'29"E), Kottayam Dist., Kerala, roadside in paddy field, 12.10.2022, leg. S.P. Narayanan, V.T. Kurien; 3 juveniles (ACESSD/EW/1519), Vadayar (9°45'29"N 76° 26'50"E), Kottayam Dist., Kerala, edge of paddy field, 12.10.2022, leg. S.P. Narayanan, V.T. Kurien; 1clitellate (ACESSD/EW/1527), Kainady

(9°30'4" N 76°28'28" E), Alappuzha Dist., Kerala, bund between paddy field and lake, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien; 1 clitellate (ACESSD/EW/1528), Paral (9°26'57" N 76°31'32" E), Kottayam Dist., Kerala, reclaimed land in wetland, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien; 3 juveniles, 1 clitellate, 1 post-clitellate (ACESSD/EW/1535), Veliyanadu (9° 26'43"N 76°27'49''E), Alappuzha Dist., Kerala, reclaimed land in wetland, beneath decaying tree trunk, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien; 2 clitellates (ACESSD/EW/1536), Kainakari (9°29'4''N 76°23'3" E), Alappuzha Dist., Kerala, bund with tree near river, 07.12.2022, leg. S.P. Narayanan, V.T. Kurien; 1 juvenile, 2 clitellates (ACESSD/EW/1572), Pathiramanal Island (9°37'6" N 76°23'9" E), Alappuzha Dist., Kerala, wooded island, near canal, 21.12.2022, leg. S.P. Narayanan, V.T. Kurien.

Distribution in Kerala. Eramathoor, Illichira, Kainady, Kainakari, Karumadi, Mukkada, Neelamperoor, Paral, Perumthuruthu, Vadayar, Veliyanadu (new records), widespread in Kerala (Michaelsen 1910, 1913, Cognetti 1911, Stephenson 1916, Gates 1973, Mohan *et al.* 2011, Kathireswari *et al.* 2005, Nair *et al.* 2007, Narayanan *et al.* 2014*a*, 2016*a*, c, 2019b, Balachandran *et al*. 2015, ElAmmari *et al.* 2015, Nair *et al.* 2015, Deepthi & Kathireswari, 2016, Athira *et al*. 2016, George *et al*. 2017, Sathrumithra *et al.* 2018, John *et al.* 2019, Anuja *et al.* 2023).

Remarks. Invasive exotic species, wide spread within India. Most widely distributed earthworm species (Gates 1972) in tropical and sub-tropical regions of the world (Taheri *et al.* 2018).

DISCUSSION

This study enhanced the knowledge available on the megadrile fauna of Kuttanad wetland. Current investigation has documented 17 species, before only 8 species of earthworms were known from this wetland. Species such as *Drawida ghatensis, D. travancorensis, Glyphidrilus annandalei, G. fluviatilis, Ocnerodrilus occidentalis, Dichogaster bolaui, Lennogaster chittagongensis, Amynthas alexandri, Megascolex pentagonalis, Perionyx ceylanensis, Perionyx excavatus* were recorded for the first time from Kuttanad wetland. The study also noticed the absence of two species, *Argilophilus variabilis* (from North Kuttanad zone) and *Megascolex insignis* (Upper Kuttanad zone) which were previously recorded from this place (Michaelsen 1910, Aiyer 1929). Now, altogether 19 species of earthworms are known to inhabit this ecosystem. Among the earthworm species recorded, native peregrine and exotic species together forms the major portion (52.94%) of the earthworm fauna of this wetland.

In a broadly generalized approach, Kerala can be divided into three distinct physiographic regions, namely the coastal lowlands (< 75 m a.s.l.), midlands (75 – 500 m a.s.l.), and high ranges (500 – 2000 m a.s.l.) (Iype *et al.* 1991). *D. ghatensis* is mainly a species of the midlands and high ranges of the state (Narayanan, unpublished observations), but it has been recorded from Aymanam, Kumarakom and Vadayar, of this wetland. Among these, Aymanam is located in the eastern boundary, where Kuttanad wetland meets the midland areas of the Kerala state. However, it would have been introduced to the other two localities, as part of the wetland reclamation activities.

Exotic, invasive *Pontoscolex corethrurus* is the most widespread species followed by the native peregrine *D. impertusa.* Among the various agro-ecological zones maximum species number were recorded from the Lower Kuttanad (10 species), followed by Upper Kuttanad and North Kuttanad (9 species each), whereas Vaikom Kari has the lowest species diversity (2 species) (Table 1). This difference is mainly due to the differential exploration frequency.

Megascolex pentagonalis was previously known only from the type locality Trivandrum (Thiruvananthapuram) (Stephenson 1916). In the present study, collections from two more additional sites (Chennithala and Eramathoor) indicated the expansion of its range to further north.

Table 1. Earthworm species recorded from various agro-ecological zones of Kuttanad wetland during the present study

	Vaikom Kari	North Kuttanad	Kayal lands	Lower Kuttanad	Upper Kuttanad	Purakkad Kari
Moniligastridae						
Drawida ghatensis	+	+				
Drawida impertusa		+	+	+	+	+
Drawida travancorensis			+			
Acanthodrilidae						
Lennogaster chittagongensis				+		
Almidae						
Glyphidrilus annandalei		+	+			
Glyphidrilus fluviatilis					+	
Benhamiidae						
Dichogaster bolaui				+		
Megascolecidae						
Amynthas alexandri		+		+		
Lampito mauritii		+		+	+	+
Megascolex konkanensis		+	+	+	+	
Megascolex pentagonalis					+	
Metaphire houlleti		+		+	+	
Perionyx ceylanensis				+		
Perionyx excavatus				+	+	
Ocnerodrilidae						
Eukerria kuekenthali						
Ocnerodrilus occidentalis		+			+	
Rhinodrilidae						
Pontoscolex corethrurus	+	+	+	+	+	+

Previously, *Glyphidrilus fluviatilis* was considered endemic to 4 locations, Madapur (= Madapura), Fraserpett (Kushalnagar), Shimoga (Shivamogga) in Karnataka state and Narayan of Vordeviu Dicu (Karnataka state?) (Rao 1922, Chanabun *et al.* 2013). Present record of *G. fluviatilis* from Kerala state is the first record after its original collection.

Ramsar sites like Renuka wetland and Pong Dam have 11 species each. Thus the Kuttanad wetland with its 19 species recorded proved to be earthworm rich among the wetlands of India. This is mainly due to geographical location of this wetland. Further investigation may add more species into the faunal list.

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REFERENCES

AIYER, K.S.P. (1929): An account of the Oligochaeta of Travancore. *Records of the Indian Museum*, 31(1): 13–76. https://doi.org/10.26515/rzsi%2Fv31%2Fi1%2F1929%2F162534

ANON. (2009): *Faunal diversity of Vembanad Lake* - a *Ramsar site in Kerala, India, Wetland Ecosystem Series,10.* Zoological Survey of India, Kolkata.

ANUJA, R., NARAYANAN, S.P., SATHRUMITHRA, S., THOMAS, A.P. & JULKA, J.M. (2020): First record of exotic earthworm *Eukerria kuekenthali* (Michaelsen, 1908) (Annelida: Oligochaeta) from Kerala, India. *Journal of the Bombay Natural History Society*, 117: 165–167. https://doi.org/10.17087/jbnhs/2020/v117/131225

ANUJA, R., NARAYANAN, S.P., SATHRUMITHRA, S., THOMAS, A.P. & JULKA, J.M. (2023): Diversity of earthworms in different land use systems of Kottayam District, Kerala, India. *Proceedings of*

the National Academy of Sceinces, India, Biological Sciences, 93(1): 27–44. https://doi.org/10.1007/s40011-0222-01397-5

ATHIRA, C.S., ATHIRA, B.C., JAMES, J., SIVARAMAN, K., KAVYRA, K.S., MDHUNA, B.V.B., RAJANEESH, K.B., REMYA, P.G., ROSHINI, T., VISHNU, P.M.D., MANAZHY, A., MANAZHY, J. & REYNOLDS, J.W. (2016): Studies on the biology and ecology of earthworms collected from urban and suburban areas of Thrissur districts, Kerala, India. *Megadrilogica,* 21(1): 1–8.

BALACHANDRAN, S., NARAYANAN, S.P., SATHRUMITHRA, S., MINI, K.D., BABU, R. & KUMAR, S.S. (2015): *Diversity of earthworms in Kalady region, Kerala, India*. In: NANDAN, S.B., KUMAR, S.S., MINI, K.D., BABU, R. (Eds.) Biodiversity and Evaluation, Perspectives and Paradigm Shifts: Cochin University of Science and Technology, Cochin and Sree Sankara College, Kalady, p. 251–253.

BEDDARD, F.E. (1901): On a new species of earthworm from India, belonging to the Genus *Amyntas*. *Proceedings of the Zoological Society of London,* 1900: 998–1002. [imprint 1900]

BLAKEMORE, R.J. (2012): *Cosmopolitan earthworms – an eco-taxonomic guide to the peregrine species of the World*. (5thEdn.). VermEcologySo(i)lutions, Yokohama, Japan.

CHANABUN, R., SUTCHARIT, C., TONGKERD, P. & PANHA, S. (2013): The semi aquatic freshwater earthworms of the genus *Glyphidrilus* Horst, 1889 from Thailand (Oligochaeta, Almidae) with redescriptions of several species. *ZooKeys*, 265: 1–76. https://doi.org/10.3897/zookeys.265.3911

CHANDINI, P.K., JAYASOORYAN, K.K., GAYATHRI, O.S., MATHEW, S. & SIVALINGAM, R. (2021): An assessment of earthworm population density of different habitat types in a mango cultivation region of Palakkad district, Western Ghats. *International Journal of Research in Applied Science & Engineering Technology,* 9(4): 585–590. https://doi.org/10.22214/ijraset.2021.33677

CHANDRA, K., BHARTI, D., KUMAR, S., RAGHUNATHAN, C., GUPTA, D., ALFRED, J.R.B. & CHOWDHURY, B.R. (2021): *Faunal Diversity in Ramsar Wetlands of India*. Zoological Survey of India and Wetland Division, Ministry of Environment, Forest and Climate Change, Government of India.

COGNETTI, L. (1911): A contribution to our knowledge of the Oligochaeta of Travancore. *Annals and Magazine of Natural History,* 7: 494–506. https://doi.org/10.1080/00222931108692969

CSUZDI, C., PAVLÍČEK, T. & NEVO, E. (2008): Is *Dichogaster bolaui* (Michaelsen, 1891) the first domicole earthworm species? *European Journal of Soil Biology,* 44: 188–201. https://doi.org/10.1016/j.ejsobi.2007.05.003

CSUZDI, C. (2010): *A monograph of the paleotropical Benhamiinae earthworms (Annelida: Oliochaeta, Acanthodrilidae).* Pedozoologica Hungarica, No 6. Hungarian Natural History Museum, Budapest.

DEEPTHI, M.P. & KATHIRESWARI, P. (2016): Earthworm diversity and soil analysis of soil inhabited by earthworms in the Vatakara area, Kozhikode, Kerala, India. *International Journal Current Microbiology and Applied Sciences,* 3: 917–925. https://doi.org/10.20546/ijcmas.2016.503.106

EISEN, G. (1878): On the anatomy of *Ocnerodrilus*. *Nova Acta Regiae Societatis Scientiarum Upsaliensis*, 10(3): 1–12.

ELAMMARI, N.E., NAIR, G.A. & VIJAYAMOHANAN, T.G. (2015): Comparative study of the earthworm resources of Benghazi, Libya, a Chapparal biome, and Kollam district, Kerala, India, a tropical humid biome. *Journal of Global Biosciences*, 4(2): 1412–1429.

FEDARB, S.M. (1898): On some earthworms from India. *Journal of the Bombay Natural History Society*, 11(3): 431–437.

GATES, G.E. (1934): Notes on some earthworms from the Indian Museum. *Records of the Indian Museum,* 36(3): 233–277. https://doi.org/10.26515/rzsi%2Fv36%2Fi3%2F1934%2F162933

GATES, G.E. (1937): Indian earthworms. I. The genus *Pheretima*. *Records of the Indian Museum*, 39(2): 175–212. https://doi.org/10.26515/rzsi%2Fv39%2Fi2%2F1937%2F162298

GATES, G.E. (1940): Indian earthworms. VII. Contributions to a revision of the genus *Eudichogaster*. *Records of the Indian Museum*, 41(2): 151–218. [imprint 1939] https://doi.org/10.26515/rzsi%2Fv41%2Fi2%2F1939%2F162232

GATES, G.E. (1965): On peregrine species of the Moniligastrid earthworm genus *Drawida* Michaelsen, 1900. *Annals and Magazine of Natural History (series 13),* 8: 85–93. https://doi.org/10.1080/00222936508651544

GATES, G.E. (1972): Burmese earthworms, an introduction to the systematic and biology of the megadrile oligochaetes with special reference to southeast Asia. *Transactions of the American Philosophical Society,* 62(7): 1–326.

GATES, G.E. (1973): Contributions to a revision of the earthworm family Glossoscolecidae I. *Pontoscolex corethrurus* (Müller, 1857). *Bulletin of the Tall Timbers Research Station*, 14: 1–12.

GEORGE, J., DEEPTHI, M.P., SAMINATHAN, K. & KATHIRESWARI (2017): *Biodiversity and ecological category of earthworms in Periya of Wayanad forest division, Kerala.* Conference Proceedings on "Life Science: Research, Practices and application for sustainable development, 7-8, September 2017, Macmillan publishers.

INDO-DUTCH MISSION (1989): *Kuttanad water balance study - plant report*. Government of Kerala, Trivandrum, Kerala.

IYPE, V.C., NYBE, E.V. & PILLAI, P.V. (1991): *Status report of high range zone*. National agricultural research project, Kerala Agriculture University, Thrissur, Kerala.

JACOB, D., SREELEKSHMI, K., RAJAN, T.S., SAMINATHAN, K. & KATHIREWARI, P. (2017): Soil analysis and diversity of earthworms in the polluted area of Palakkad, Kerala and Kanuvai, Coimbatore, India. *International Journal Current Microbiology and Applied Sciences*, 6(4): 1594–1599. https://doi.org/10.20546/ijcmas.2017.604.196

JOHN, J., SREERAJ, P.R., ASIYA, P., KATHIREWARI, P., JOSEPH, R. & GEORGE, J. (2019): Earthworm population in relation to different agro climatic regions of Wayanad District of Kerala. *Mapana Journal of Sciences,*18(4): 62–73. https://doi.org/10.12723/mjs.51.6

JOHN, C.M., SYLAS, V.P., PAUL, J. & UNNI, K.S. (2009): Floating islands in a tropical wetland of peninsular India. *Wetlands Ecology and Management*, 17(6): 641–653. https://doi.org/10.1007/s11273-009-9140-z

JULKA, J.M. (1988): *The Fauna of India and Adjacent Countries. Megadrile Oligochaeta (Earthworms). Haplotaxida: Lumbricina: Megascolecoidea: Octochaetidae*. Zoological Survey of India, Calcutta, India.

JULKA, J.M. (1990): *Annelida*. In: Collection and preservation of animals, (Director, Ed.). Zoological Survey of India, Calcutta. p. 57–64.

JULKA, J.M. & CHANDRA, M. (1986): On a small collection of earthworms and leeches (Annelida) from the Silent Valley, Kerala, India. *Records of the Zoological Survey of India,* 84(1-4): 165–171. http://dx.doi.org/10.26515/rzsi%2Fv84%2Fi1-4%2F1986%2F161091

JULKA, J.M., PALIWAL, R. & KATHIREWARI, P. (2009): *Biodiversity of Indian earthworms - an overview*. In: EDWARDS, C.A., JAYARAJ, R., JAYARAJ, I.A. (Eds.) Proceedings of Indo-US Workshop on Vermitechnology in Human Welfare, Rohini Achagam, Coimbatore, India. p. 36–56.

JULKA, J.M. & PALIWAL, R. (2000): Oligochaeta. *Fauna of Renuka Wetland: Wetland Ecosystem Series,* 2: 21–25. Zoological Survey of India, Calcutta.

KATHIREWARI, P., JEYARAAJ, R. & JEYARAJ, A. (2005): Distribution and diversity of earthworm resources in Kanjikode, Palakkad district, Kerala state, India. *Pollution Research*, 24: 117–120.

KINBERG, J.G.H. (1867): Annulata nova. *Öfversigt af Königlich Vetenskaps-Akademiens Förhandlingar, Stockholm,* 23(9): 97–103, 337–357.

KUMARI, S., KUMARI, C., NARAYANAN, S.P., DEV, K. & JULKA, J.M. (2021): Phylogenetic relatedness of *Drawida japonica* (Michaelsen, 1892) and *Drawida nepalensis* (Michaelsen, 1907) (Clitellata: Moniligastridae) from the Western Himalaya, India. *Annals of Biology*, 37(1): 36–41.

KUSHWAHA, T., VISHWAKARMA, A., PALIWAL, R., BURLA, S. & YADAV, S. (2015): A simple protocol to extract DNA from earthworm tissue for molecular studies. *Research & Reviews: Journal of Zoological Sciences,* 4(1): 33–37.

LONE, A.R., THAKUR, S.S., TIWARI, P., JAMES, S.W. & YADAV, S. (2022): Phylogenetic relationships in earthworm *Megascolex* species (Oligochaeta: Megascolecidae) with addition of two new species. *Diversity,* 14: 1006. https://doi.org/10.3390/d14111006

MANAZHY, J., MANAZHY, A., NAIR, K.V., JOE, H. & KURIAKOSE, S. (2013): NIR spectroscopy based metabolic profiling of earthworms from Western

Ghats, one of the biodiversity hotspots of the World. *Cibtech Journal of Zoology,* 3(2): 36–52.

MICHAELSEN, W. (1891): Oligochaeten des Naturhistorischen Museums in Hamburg. IV. *Jahrbuch der hamburgischen wissenschaftlichen Anstalten*, 8: 3–42.

MICHAELSEN, W. (1903): Oligochaeten von Peradeniya auf Ceylon, ein beitrag sur kenntnis des einflusses botanischer garten auf die einschleppung peregriner thiere. *Sitzungsberichte der Königlischen Böhmischen Gesellschaft der Wissenschaften. Mathematisch-naturwissenschaftliche Classe*, 55: 1–16.

MICHAELSEN, W. (1908): Die Oligochäten Westindiens. *Zoologische Jahrbücher Jena, Supplement*, 11: 13–32.

MICHAELSEN, W. (1910): Die Oligochätenfauna der Vorderindisch-CeylonischenRegion. *Abhandlungen aus dem Gebiete der Naturwissenschaften, herausgegeben vom Naturwissenschaftlichen Verein in Hamburg*, 19(5): 1–108.

MICHAELSEN, W. (1913): Oligochäten von Travancore und Bomeo. *Jahrbuch der hamburgischen wissenschaftlichen Anstalten*, 30: 73–92.

MITSCH, W.J. & GOSSELINK, J.G. (2000): *Wetlands*. John Wiley & Sons Inc, New York.

MOHAN, M., CHANDRAN, M.S.S. & RAMASAMY, E.V. (2011): Vulnerable earthworm species identified from Nilgiri Biosphere Reserve. *International Journal of Zoological Research,* 7(6): 410–413. https://doi.org/10.3923/ijzr.2011.410.413

NAIR, K.V., MANAZHY, J., MANAZHY, A. & REYNOLDS, J.W. (2007): Earthworm (Annelida: Oligochaeta) fauna of Kerala, India: 1. some species from Thiruvananthapuram corporation. *Megadrilogica,* 11(8): 85–90.

NAIR, G.A., VIJAYAMOHANAN, T.G., HAEBA, M. & SAMINATHAN, P.K. (2015): *Diversity and distribution of earthworms in relation to altitude and soil factors of Kollam district, Kerala, India*. In: GURJAR, B.R., KUMAR, A. (Eds.) Environmental Science and Engineering, Volume 2, Biodiversity and Conservation. Studium Press LLC, Houston. p. 86–113.

NARAYANAN, S.P., THOMAS, A.P. & SREEKUMAR, B. (2011): Ornithofauna and its conservation in the Kuttanad wetlands, southern portion of Vembanad-Kole Ramsar site, India. *Journal of Threatened Taxa,* 3(4): 1663–1676. https://doi.org/10.11609/JoTT.o1870.1663-76

NARAYANAN, S.P., SATHRUMITHRA, S., KURIAKOSE, D., CHRISTOPHER, G., THOMAS, A.P., & JULKA, J.M. (2014): Earthworms (Oligochaeta: Megadrile) from the Mahatma Gandhi University campus, Kottayam, Kerala. *Malabar Trogon*, 12(1–3): 2–9.

NARAYANAN, S.P., SATHRUMITHRA, S., CHRISTOPHER, G., THOMAS, A.P. & JULKA, J.M. (2015*): Distribution of the invasive earthworm* Metaphire houletti *(Perrier, 1872) in Kerala (India): after a century of its first record.* In: NANDAN, S.B., KUMAR, S.S., MINI, K.D., BABU, R. (Eds.) Biodiversity and Evaluation, Perspectives and Paradigm Shifts: Cochin University of Science and Technology, Cochin and Sree Sankara College, Kalady. p. 27–29.

NARAYANAN, S.P., SATHRUMITHRA, S., CHRISTOPHER, G., THOMAS, A.P. & JULKA, J.M. (2016*a*): Checklist of the earthworms (Oligochaeta) of Kerala, a constituent of Western Ghats biodiversity hotspot, India. *Zootaxa*, 4193(1): 117–137. https://doi.org/10.11646/zootaxa.4193.1.5

NARAYANAN, S.P., SATHRUMITHRA, S., KURIAKOSE, D., CHRISTOPHER, G., THOMAS, A.P. & JULKA, J.M. (2016*b*): Are exotics *Amynthas alexandri* (Beddard, 1900) and *Metaphire peguana* (Rosa, 1890) (Clitellata: Oligochaeta: Megascolecidae) a threat to native earthworms in Kerala, India? *Journal of Threatened Taxa,* 8(2); 8938–8942. https://doi.org/10.11609/jott.2872.8.6.8938-8942

NARAYANAN, S.P., SATHRUMITHRA, S., ANUJA, R., Christopher, G., Sureshan, P.M., THOMAS, A.P. & JULKA, J.M. (2016*c*): Recent records of rare earthworm genera from Kerala, India. *Malabar Trogon,* 14(1–3): 38–43.

NARAYANAN, S.P., SATHRUMITHRA, S., CHRISTOPHER, G., THOMAS, A.P. & JULKA, J.M., (2016*d*): Current distribution of the invasive earthworm *Pontoscolex corethrurus* (Müller, 1857) after a century of its first record from Kerala, India. *Opuscula Zoologica Budapest,* 47(1): 101–107. https://doi.org/10.18348/opzool.2016.1.101

NARAYANAN, S.P., SATHRUMITHRA, S., CHRISTOPHER, G. & JULKA, J.M. (2017): New species and new records of earthworms of the genus *Drawida* from Kerala part of the Western Ghats biodiversity hotspot, India (Oligochaeta, Moniligastridae). *ZooKeys*, 691: 1–18. https://doi.org/10.3897/zookeys.691.13174

NARAYANAN, S.P., SATHRUMITHRA, S., CHRISTOPHER, G., THOMAS, A.P. & JULKA, J.M. (2019*a*): First

record of some earthworm species (Oligochaeta: Megadrile) from Kerala part of the Western Ghats biodiversity hotspot. *National Academy Science Letters,* 42(6): 509–512. https://doi.org/10.1007/s40009-019-00797-y

NARAYANAN, S.P., SATHRUMITHRA, S., ANUJA, R., CHRISTOPHER, G., THOMAS, A.P. & JULKA, J.M., (2019*b*): First record of the exotic *Metaphire bahli* (Gates, 1945) (Oligochaeta: Megascolecidae) from India. *Opuscula Zoologica Budapest,* 50(1): 99–103. https://doi.org/10.18348/opzool.2019.1.99

NARAYANAN, S.P., THOMAS, B., SREERAJ, P.R., JOSEPH. R., SATHRUMITHRA, S., KURIEN, V.T., ANUJA, R., KUNNATH, S.M., JOHN, J., THOMAS, A.P., JULKA, J.M. & Reynolds, J.W. (2019*c*): The first record of *Megascolex lawsoni* (Beddard, 1886) (Clitellata: Megascolecidae) from the state of Kerala, India. *Megadrilogica,* 24(6): 67–73.

NARAYANAN, S.P., PALIWAL, R., KUMARI, S., AHMED, S., THOMAS, A.P. & JULKA, J.M. (2020*a*): *Annelida: Oligochaeta*. In: Faunal Diversity of Biogeographic Zones of India: Western Ghats: (Director, Ed.). Zoological Survey of India, Kolkata, India. p. 87–102

NARAYANAN, S.P., THOMAS, B., SUNISH, K.S., ANUJA, R., SATHRUMITHRA, S., SMIJA, M.K., CHRISTOPHER, G., THOMAS, A.P. & JULKA, J.M. (2020*b*): First record of exotic *Dichogaster saliens* (Beddard, 1893) and *Metaphire posthuma* (Vaillant, 1868) (Annelida: Oligochaeta) from Kerala, southern India. *Records of the Zoological Survey of India,* 120(2): 161–166. https://doi.org/10.26515/rzsi/v120/i2/2020/131422

NARAYANAN, S.P., SATHRUMITHRA, S., ANUJA, R., CHRISTOPHER, G., THOMAS, A.P. & JULKA, J.M. (2021): Three new species and four new species records of earthworms of the genus *Moniligaster* Perrier, 1872 (Clitellata: Moniligastridae) from Kerala region of the Western Ghats Biodiversity Hotspot, India. *Zootaxa,* 4949(2): 381–397. https://doi.org/10.11646/zootaxa.4949.2.11

PALIWAL, R. & JULKA, J.M. (2009): Earthworm (Oligochaeta). *Faunal Diversity of Pong Dam and its Catchment Area, Wetland Ecosystem Series,* 12: 7–12. Zoological Survey of India, Kolkata.

PALIWAL, R. (2018): Annelida: Oligochaeta. *Faunal Resources of Cold Desert Spiti Valley and Chandertal Lake (District Lahaul & Spiti, Himachal Pradesh),* (Anon, Ed.) *Himalayan Ecosystem Series,* 4: 21–24. Zoological Survey of India, Kolkata.

PERRIER, E. (1872): Recherches pour servir à l'histoire des lombriciens terrestres. *Nouveaux Archives du Muséum National d'Histoire Naturelle, Paris,* 8: 5–198. https://doi.org/10.5962/bhl.title.12201

RAO, C.R.N. (1922): Some new species of earthworms belonging to the genus *Glyphidrilus*. *Annals and Magazine of Natural History,* Series 9, 9(49): 51–68. https://doi.org/10.1080/00222932208632640

REYNOLDS, J.W. & WETZEL, M.J. (2023): Nomenclatura Oligochaetologica – a catalogue of names, descriptions and type specimens. Editio Secunda. Available from: http://wwx.inhs.illinois.edu/people/mjwetzel/nomenoligo (accessed 09 May 2023).

TIWARI, N., LONE, A.R., THAKUR, S.S., JAMES, S.W. & YADAV, S. (2021): Three uncharted endemic earthworm species of the genus *Eutyphoeus* (Oligochaeta: Octochaetidae) from Mizoram, India. *Zootaxa,* 5005(1): 041–061. https://doi.org/10.11646/zootaxa.5005.1.3

SASHIKUMAR, C. & PALOT, M.J. (2002): *Wetlands and waterfowls of Kerala, India – an overview*. In: RAHMANI, A.R. & UGRA, G. (Eds.) Birds of Wetlands and Grasslands. Proceedings of the Salim Ali Centenary Seminar, Bombay Natural History Society. p. 147–153.

SATHRUMITHRA, S., NARAYANAN, S.P., ANUJA, R., KURIAN, P., THOMAS, A.P., JULKA, J.M. & REYNOLDS, J.W. (2018): Diversity of earthworms (Annelida: Oligochaeta) in Konni, a part of the Western Ghats of Kerala, India. *Megadrilogica,* 23(3): 57–68.

SHARI, P.V. & CHITRA, K.P. (2005): Kuttanadinte charithravum bhoomisastravum (History and geography of Kuttanad),). In: JOSEPH, M.J. (Ed.) *Kuttanattile jala punarujjeevana prayoga sadhyathakal* (*Water reclaiming in Kuttanad; Possible Chances*). Planet Kerala, Trivandrum, p. 9–18. [In Malayalam].

SREELEKSHMI, K., RAJAN, T.S., JACIB, P.D. & KATHIRESWARI, P. (2017): Earthworm resources and soil parameters of Chittur, Palakkad and Kanuvai, Coimbatore, India. *International Journal Current Microbiology and Applied Sciences*, 6(4): 1860–1866. https://doi.org/10.20546/ijcmas.2017.604.221

STEPHENSON, J. (1915): On some Indian Oligochaeta, mainly from Southern India and Ceylon. *Memoirs of the Indian Museum*, 6: 35–108.

STEPHENSON, J. (1916): On a collection of Oligochaeta belonging to Indian Museum. *Records of the Indian Museum,* 12: 299–354. https://doi.org/10.26515/rzsi%2Fv12%2Fi7%2F1916%2F163025

STEPHENSON, J. (1917): On a collection of Oligochaeta from various parts of India and further India. *Records of the Indian Museum,* 13: 353–416. https://doi.org/10.26515/rzsi%2Fv13%2Fi6%2F1917%2F163594

STEPHENSON, J. (1920): On a collection of Oligochaeta from lesser parts of known parts of India and Eastern Persia. *Memoirs of the Indian Museum,* 7(3): 191–261.

STEPHENSON, J. (1922): A note on some supposed new species of earthworms of the Genus *Glyphidrilus. Annals and Magazine of Natural History, Series 9*, 9(52): 387–389. https://doi.org/10.1080/00222932208632688

STEPHENSON, J. (1923): *The Fauna of British India, including Ceylon and Burma – Oligochaeta*. Taylor and Francis, London.

STEPHENSON, J. (1925): On some Oligochaeta mainly from Assam, South India, and the Andaman Islands. *Records of the Indian Museum,* 27, 43–73. https://doi.org/10.26515/rzsi%2Fv27%2Fi2%2F1925%2F163458

TAHERI, S., PELOSI, C. & DUPONT, L. (2018): Harmful or useful? A case study of the exotic peregrine earthworm morphospecies *Pontoscolex corethrurus. Soil Biology and Biochemistry,* 116: 277–289. https://doi.org/10.1016/j.soilbio.2017.10.030

THAKUR, S.S., LONE, A.R., TIWARI, N., JAIN, S.K., JAMES, S.W. & YADAV, S. (2021). A contribution to the earthworm diversity (Clitellata, Moniligastridae) of Kerala, a component of the Western Ghats biodiversity hotspot, India, using integrated taxonomy. *Animal Biodiversity and Conservation*, 44(1): 117–137. https://doi.org/10.32800/ abc.2021.44.0117

TIWARI, N., LONE, A.R., THAKUR, S.S., JAMES, S.W. & YADAV, S. (2021): Three uncharted endemic earthworm species of the genus *Eutyphoeus* (Oligochaeta: Octochaetidae) from Mizoram, India. *Zootaxa,* 5005(1): 041–061. https://doi.org/10.11646/zootaxa.5005.1.3

On the Trichoptera of Western Europe: survey on Ptilocolepidae family, *Anisogamus* and *Sericostoma* genera

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Abstract. In this paper on the Western European Trichoptera we survey the Ptilocolepidae family and the *Anisogamus* and *Sericostoma* genera as well as describe 12 new species: *Wormaldia arlua* sp. nov. (France), *Plectrocnemia estrela* sp. nov. (Portugal and Spain), *Rhyacophila fusunae* sp. nov. (Spain), *Ptilocolepus kover* sp. nov. (France and Spain), *Ptilocolepus sovan* sp. nov. (France and Spain), *Drusus demonta* sp. nov. (Italy), *D. roya* sp. nov. (France), *Anisogamus nahueli* sp. nov. (France), *A. sandreniko* sp. nov. (France), *Consorophylax vellach* sp. nov. (Austria), *Sericostoma unaequale* sp. nov. (Italy). Moreover, *Rhyacophila ildefonsa* sp. nov. (Spain), is distinguished from *R. relicta* McLachlan, 1879, and *Rhyacophila erkakanae* Sipahiler, 1993 stat. nov. is considered as a valid species different from *R. rupta* McLachlan, 1879. The male of *Chaetopteryx cantabrica* Oláh & Vinçon, 2022 is described for the first time. *Wormaldia maclachlani* Kimmins, 1953, *Tinodes jeekeli* Botosaneanu, 1980, *Lithax obscurus* (Hagen, 1859), *Crunoecia kempnyi* Morton, 1901 are new for Italy, *Diplectrona magna* Mosely, 1930, *Drusus thibaulti* Decamps, 1972 are reported as new for Spain; *Chaetopteryx tomaszewski* Moretti, 1991, *Consorophylax kimera* (Oláh & Vinçon, 2021) are new for France.

Keywords. Incipient siblings, species complexes, new species, Western Europe.

INTRODUCTION

Applying the principles and procedures of fine phenomics, beside describing 12 new Western European caddisfly species, here we revise the small Ptilocolepidae family based on the lateral profile of the harpago, the second segment of the gonopod, overview the small *Anisogamus* genus with the description of a unique highly perturbated new lineage, as well as survey the *Sericostoma* genus by the divergences in the lateral profile of the spine-like pair of paraprocts. The particularly decorative small genus of *Sericostoma* was considered and treated as an unsettled taxon facing great difficulties in species delineation and identification. Suggested by the Atlas of European Trichptera (Malicky 2004) many of us have identified species to "*personatum*" Kirby & Spence, 1826 or "*flavicorne*" Schneider, 1845 and set aside them for future revision. When starting this revision we were almost shocked to realise that the confusion in their taxonomy was created almost artificially, by human hubris. We have found the paraproct, as the magic speciation trait, very applicable to establish the taxonomic position of each species. We are glad to declare that we do not need even to clear the genitalia to identify the *Sericostoma* species if we sacrifice and cut the left gonopod to expose the lateral profile of the left paraproct. This heavily sclerotized structure is very pronounced, easy to see, and as an adaptive, non-neutral speciation trait is very stable varying only in contact populations of the closely related sibling species like *Sericostoma personatum* and *S. pedemontanum*.

MATERIAL AND METHODS

In the present survey we have not sacrificed any gonopods; instead we have carefully cleared the genitalia of all specimens in 10 percent potassium hydroxid solution and carefully cleaned

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by superfine tipped forceps for examination and drawings. All the collections of new specimens were realized by the second author.

Depositories. Canadian National Collection, Ottawa, Canada (CNC), Oláh Private Collection, Debrecen, Hungary, under national protection by the Hungarian Natural History Museum, Budapest (OPC).

TAXONOMY

Philopotamidae Stephens, 1829

Wormaldia ariega Oláh & Vinçon, 2021

*Material examined***. France,** Ariège, below Crouzette Pass, nice spring, 760 m, 42.9137°N, 1.314°E, 15.IV.2022, leg. G. Vinçon (4 males, 1 female; OPC). France**,** Ariège, Vicdessos, Las Rougos, Pla de l'Izard, Mounicou tributary, spring and brook, 1220 m, 42.6949°N, 1.4497°E, 15.IV.2022, leg. G. Vinçon (3 males, OPC). France, Ariège, below Crouzette Pass, nice spring, 840 m, 42.9195°N, 1.3267°E, 15.IV.2022, leg. G. Vinçon (3 males, OPC). France, Ariège, below Crouzette Pass, nice spring, 850m, 42.9195°N, 1.3267°E, 9.X.2022, leg. Gilles Vinçon (5 males, OPC). France, Ariège, Vicdessos, Las Rougos, Pla de l'Izard, Mounicou tributary, spring and brook, 1220m, 42.6956°N, 1.451°E, 8.X.2022, leg. Gilles Vinçon (12 males, OPC).

Remarks. In the same locality and at the same collecting dates occurs *W. artillac* Sipahiler, 1999 together with *W. ariega*. We have found significant and outstanding differences between the examined type specimens of *W. ariega* and Sipahiler's drawings of *artillac*, especially in the lateral profile of the head of segment X, the speciation trait of the genus as well as in the endothecal spine pattern. In case of the head lateral profile the delineation is very easy, reliable and stable. Unfortunately the drawing of the endothecal spine pattern is highly subjective and very sensitive to the individually varying disposition of spines as a result of copulatory processes. Imagine a semicircularly curving small spine cluster of three spines turning around freely in the three dimensional space and you see and draw it, not carefully enough, only from a not perfectly perpendicular angle. Unfortunately no type specimens of *W. artillac* were available for direct comparative study.

Wormaldia arlua sp. nov.

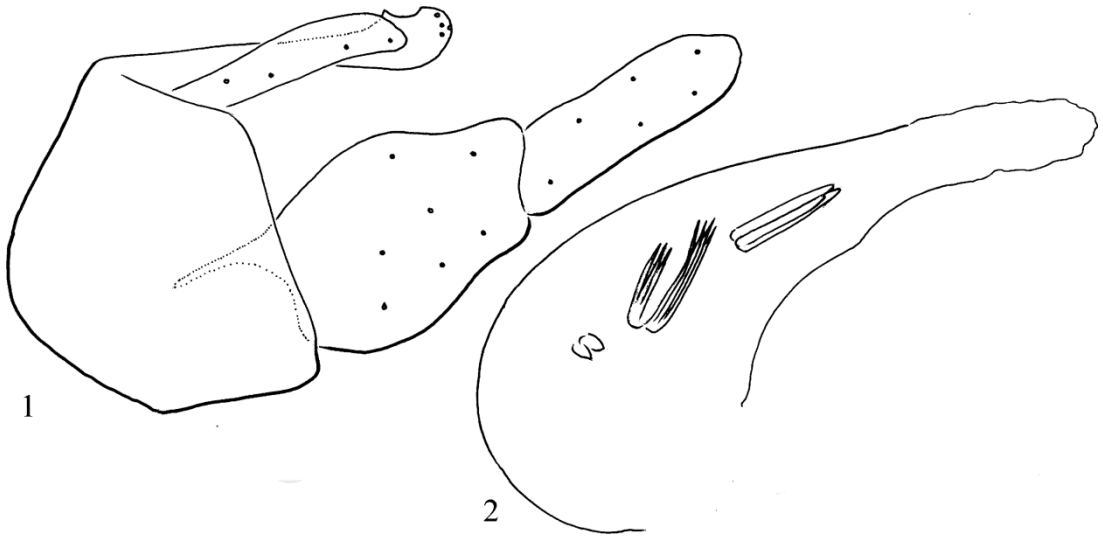
(Figures 1–2) (Photos 1, 2)

*Material examined***.** Holotype: **France**, Ariège, path to Arlu Lake, nice spring, 1650m, 42.8142°N, 1.438°E, 9.X.2022, leg. Gilles Vinçon (1 male, OPC).

Diagnosis. This new species is rather unique integrating character states of pointed apex of harpago present in *Wormaldia charalambi* species group and concave dorsum of the head of segment X, a rather specialised, apomorphic character state in the *Wormaldia subnigra* clade of the *Wormaldia subnigra* species complex in the *Wormaldia triangulifera* species group. Moreover, it has a peculiar spine pattern in the endotheca of the phallic organ that differs from any species known presently in the *Wormaldia charalambi* group (*ameliae*, *charalambi*, *gardensis*, *kurta*, *marilouae*, *yavuzi*). *Wormaldia arlua* sp. nov. is characterized by endothecal spine pattern of spine clusters. In contrary, all the species in the *charalambi* group have various numbers of single spines in the endotheca. We are unable to place our new species in any of the known species group and keep it among species with Incertae Sedis, with uncertain placement.

Description. Male (in alcohol). Medium-sized brown animal. Sclerites medium brown, setal warts both on head and thorax and legs brown. Maxillary palp formula is I-II-IV-III-V. Forewing length 7 mm. Spur formula is 244.

Male genitalia. Segment X characterized by narrow parallel-sided and narrowing apex in dorsal view, and by a large, upward directed dorsal pointed subapical process dominating in lateral view; the apex or the head of segment X typically with concave dorsum semicircular apicad; the ending is armed with sensory struc



Figures 1–2. *Wormaldia arlua* sp. nov. Holotype male: 1 = genitalia in left lateral view; 2 = gonopods in ventral view.

tures of *sensilla basiconica* (pegs) or *sensilla coeloconica* (pitted pegs) both on the very dorsal ending of the apex. Cerci slender with blunt apex, slightly downward directed in lateral view. Gonopods very produced coxopodite and harpago with almost equal length; harpagones long, stout, with tapering apex in lateral view. Phallic organ with eversible membranous endotheca containing four components of endothecal spines. Two almost touching basad, the shorter cluster composed of three slender spines and the slightly longer cluster composed of four slender spines. Third is composed of three adhering stout spines. The fourth component is a pair of very short and stout structures near to the phallotremal sclerite complex.

Character combination. (1) Dorso-subapical point of segment X is a pronounced pointed process, visible in lateral profile as the top formed by the apical right-angle of the very shallow dorsal concavity as well as by the concavity of the head dorsum. (2) Apex of segment X with concave dorsum; counted from the dorso subapical point it is elongated and its apical margin clearly semicircular. (3) Apex of cerci elongated slightly ventrad directed. (4) Ventromesal projection of cerci absent. (5) Harpagones long, robust with slightly narrowing head. (6) Four components of endothecal spines present. (7) Two almost touching basad, the shorter composed of three slender spines and the slightly longer cluster composed of four slender spines. (8) Third is composed of three adhering stout spines. (9) The fourth component is a pair of very short and stout structures.

Etymology. Coined from the name of the type locality, a noun in apposition.

Wormaldia cantabrica González & Botosaneanu, 1983

Material examined. **Spain,** Asturias, road to the Puerto del Palo Allande, nice brook, 720 m, 43.2897N, 6.6431W, 22.IV.2022, leg. G. Vinçon (1 male, OPC). Spain, Asturias, Puerto del Palo Allande, brook and spring, 950 m, 43.2778°N, 6.6681°W up to 1000 m, 43.2764°N, 6.6725°W, 22.IV.2022, leg. G. Vinçon (1 male, OPC). Spain, Cantabria, above Yera, nice brook, 550–650 m, 43.1377°N, 3.7461°W, 20.IV.2022, leg. G. Vinçon (2 males, OPC). Spain, Asturias, Puerto de Tarna, brook and springs, from 1130m, 43.1095°N, 5.2188°W, to 1220m, 43.1073°N, 5.2159°W, 12.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Cantabria, Puerto de la Palombera, brook, 1020m, 43.0847°N, 4.2515°W, 11.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Cantabria, Puerto de la Palombera, nice brook and seeping rocks, 1010m, 43.0857°N, 4.2589°W,

11.X.2022, leg. Gilles Vinçon (3 males, OPC). Spain, Asturias, Somiedo, La Peral, brook and nice spring, from 1310m, 43.0409°N, 6.2519°W, to 1410m, 43.039°N, 6.2555°W, 13.X.2022, leg. Gilles Vinçon (5 males, OPC). Spain, Asturias, Puerto del Palo Allande, brook and spring, from 950m, 43.2778°N, 6.6681°W, up to 1000m, 43.2764°N, 6.6725°W, 13.X.2022, leg. Gilles Vinçon (1 male, OPC). **Spain,** Cantabria, Puerto del Ponton, Fuente del Infierno, brook and spring, 1260m, 43.1023°N, 5.0303°W, 12.X.2022, leg. G. Vinçon (2 males, OPC).

Wormaldia cianficconiae Neu, 2017

*Material examined***. Italy,** Marches, E. Purello, nice spring and two brooks, 530 m, 43.32°N, 12.7733°E, 20.V.2022, leg. G. Vinçon (1 male, OPC).

Wormaldia copiosa (McLachlan, 1868)

Material examined. **Switzerland**, Vaud, Les Fontannets de la Mothe, very nice spring, 600 m, 46.8195°N, 6.567°E, 10.III.2022, leg. G. Vinçon (6 males, OPC). Switzerland, Jura Massif, Soubey, Bief de la Côte au Bouvier, 600–650 m, 47.3°N, 7.06°E, 13.III.2022, leg. G. Vinçon (1 male, OPC).

Wormaldia echinata Tobias, 1995

Material examined. **France,** Alpes-Maritimes, Bevera Valley, spring and brook, 1400-1500 m, 43.981N, 7.425E, 6.I.2022, leg. G. Vinçon (1 male, OPC).

Wormaldia gattolliati Malicky & Graf, 2017

*Material examined***. Italy,** Emilie-Romagne, N.E. Passo Lagastrello, nice spring, 1110 m, 44.3562°N, 10.156°E, 17.V.2022, leg. G. Vinçon (2 males, OPC). Italy, Emilie-Romagne, W. Rigoso, road to Prato Spilla, nice brook and spring, 1220 m, 44.3678°N, 10.127°E, 16.V.2022, leg. G. Vinçon (1 male, OPC).

Wormaldia ligurica Oláh & Vinçon, 2022

*Material examined***. Italy,** Ligurian Apennines, above Rocca d'Aveto, nice brook and spring, 1400 m, 44.555°N, 9.4767°E, 15.V.2022, leg. G. Vinçon (1 male, OPC).

Wormaldia maclachlani Kimmins, 1953

Material examined. **Italy,** Piemont, Pennines Alps, Civiasco, spring below water catchment, 770 m, 45.8104N, 8.2973E, 27.V.2022, leg. Gilles Vinçon (1 male, OPC).

Remark. New for the Italian Fauna.

Wormaldia morettii Vigano, 1974

*Material examined***. Italy,** Marches, Parco Nazionale dei Monti Sibillini , above Casali, nice brook and spring, 1080 m, 42.9506°N, 13.177°E, 18.V.2022, leg. G. Vinçon (2 males, OPC).

Wormaldia moselyi Kimmins, 1953

Material examined. **France**, Pyrénées-Atlantiques, Marie-Blanque Pass, nice spring, 910 m, 43.0697°N, 0.5213°W, 18.IV.2022, leg. G. Vinçon (1 male, OPC).

Wormaldia occipitalis (Pictet, 1834)

Material examined. **France,** Pyrénées-Orientales, above Sorède, La Farga, nice brook, 450 m, 42.4979°N, 2.9572°E, 30.IV.2022, leg. G. Vinçon (3 males, OPC).

Wormaldia subterranea Radovanovic, 1932

Material examined. **Switzerland**, Vaud, Les Fontannets de la Mothe, very nice spring, 600 m, 46.8195°N, 6.567°E, 10.III.2022, leg. G. Vinçon (1 male, OPC). Switzerland, Jura Massif, Soubey, Bief de la Côte au Bouvier, 600 – 650 m, 47.3°N, 7.06°E, 13.III.2022, leg. G. Vinçon (5 males, OPC).

***Wormaldia triangulifera* McLachlan, 1878**

Material examined. **France,** Pyrénées-Orientales, above Sorède, La Farga, nice brook, 450 m, 42.4979°N, 2.9572°E, 30.IV.2022, leg. G. Vinçon (12 males, OPC). France, Haute-Garonne, Bagnère-de-Luchon, Pique Valley above Hospice de France, nice spring, 1400m, 42.7195°N, 0.6564° E, 9.X.2022, leg. Gilles Vinçon (1 male, OPC).

***Wormaldia vargai* Malicky, 1981**

Material examined. **Slovenia,** Julian Alps, S. Vrsic Pass, Minarica trib., nice spring, 1300 m, 46.4113N, 13.7515E, 21.V.2022, leg. G. Vinçon (2 males, 2 females; OPC). Slovenia, N.E. Bovec, nice seeping rocks, 430 m, 46.3399°N, 13.5745° E, 21.V.2022, leg. G. Vinçon (2 males, 3 females; OPC).

***Philopotamus ludificatus* McLachlan, 1878**

*Material examined***. France,** Drôme, Vercors, Tourtre, Adouin, 760 m, 45.0035°N, 5.4563°E, 11.III.2022, leg. G. Vinçon (6 males, 4 females; OPC). **Italy**, Atesine Alps, N. Maranza, spring and brook, 1590 m, 46.8345°N, 11.6479°E, 25.V. 2022, leg. G. Vinçon (2 males, 3 females; OPC). **Italy,** Atesine Alps, N. Maranza, big brook near Hexenhütte, 1750 m, 46.8562°N, 11.6637°E, 25. V.2022, leg. G. Vinçon (4 males, 3 females; OPC). Italy, Emilie-Romagne, above Prato Spilla, from 1580 m, 44.352°N, 10.1001°E to 1630 m, 44.35°N, 10.1°E, 16.V.2022, leg. G. Vinçon (4 males, 3 females; OPC).

***Philopotamus montanus* Donovan, 1813**

Material examined. **France,** Hautes-Pyrénées, N.W. Aspin Pass, 1450 m, nice brook, 42.9454°N, 0.3202°E, 17.IV.2022, leg. G. Vinçon (8 males, 3 females; OPC). **Spain,** Val d'Aran, Portillon Pass, brook, 1260 m, 42.7645°N, 0.66°E, 17.IV.2022, leg. G. Vinçon (6 males, 2 females; OPC). Spain, Asturias, Puerto de Leitariegos, Brañas de Arriba, nice spring, 1400 m, 43.0128°N, 6.4451°W, 21.IV.2022, leg. G. Vinçon (8 males, 3 females; OPC). Spain, Cantabria, above Yera, nice brook, 550–650 m, 43.1377°N, 3.7461°W, 20.IV.2022, leg. G. Vinçon (1 male, OPC).

Psychomyiidae Walker, 1852

***Tinodes consiglioi* Botosaneanu, 1980**

*Material examined***. Italy,** Marches, Parco Nazionale dei Monti Sibillini, nice torrent at Ussita, 730 m, 42.943°N, 13.138°E, 18.V.2022, leg. G. Vinçon (4 males, 3 females; OPC). **Italy,** Molise, Castel San Vincenzo, Sorgente Acquaruolo, 470 m, 41.6594°N, 14.0783°E, 19.V.2022, leg. G. Vinçon (1 male, OPC). Italy, Molise, Castel San Vincenzo, River Volturno, 530 m, 41.654°N, 14.077°E, 19.V.2022, leg. G. Vinçon (7 males, 6 females; OPC).

Remark. It is considered as a subspecies of *T. dives* in Lodovici & Valle (2020).

***Tinodes jeekeli* Botosaneanu, 1980**

Material examined. **Italy**, Lombardian Pre-Alps, Bergamo, Passo San Marco, S. slope, nice spring, 1730 m, 46.0381°N, 9.6358°E, 26.V.2022, leg. G. Vinçon (6 males, 2 females; OPC). **Slovenia**, Kranj, Pohorje Mountains, Travertine springs (limestone substratum), Kokra trib., 850 m, 46.3993°N, 14.4698°E, 22.V.2022, leg. G. Vinçon (8 males, 5 females; OPC).

Remark. This species is new for the Italian Fauna.

***Tinodes rostocki* McLachlan, 1878**

Material examined. **Spain,** Cantabria, Peñarrubia, E Linares, resurgence, 420 m, 43.2554°N, 4.5741°W, 20.IV.2022, leg. G. Vinçon (4 males, 3 females; OPC). **Slovenia,** near the Italian border, Julian Pre-Alps, below Livek, spring and brook, 600 m, 46.2123°N, 13.5939°E, 21.V.2022, leg. G. Vinçon (1 male, OPC). Slovenia, N.E. Bovec, nice seeping rocks, 430 m, 46.3399°N, 13.5745° E, 21.V.2022, leg. G. Vinçon (5 males, 3 females; OPC).

Polycentropodidae Ulmer, 1903

***Plectrocnemia estrela* sp. nov.**

(Figures 3–5) (Photos 3, 4)

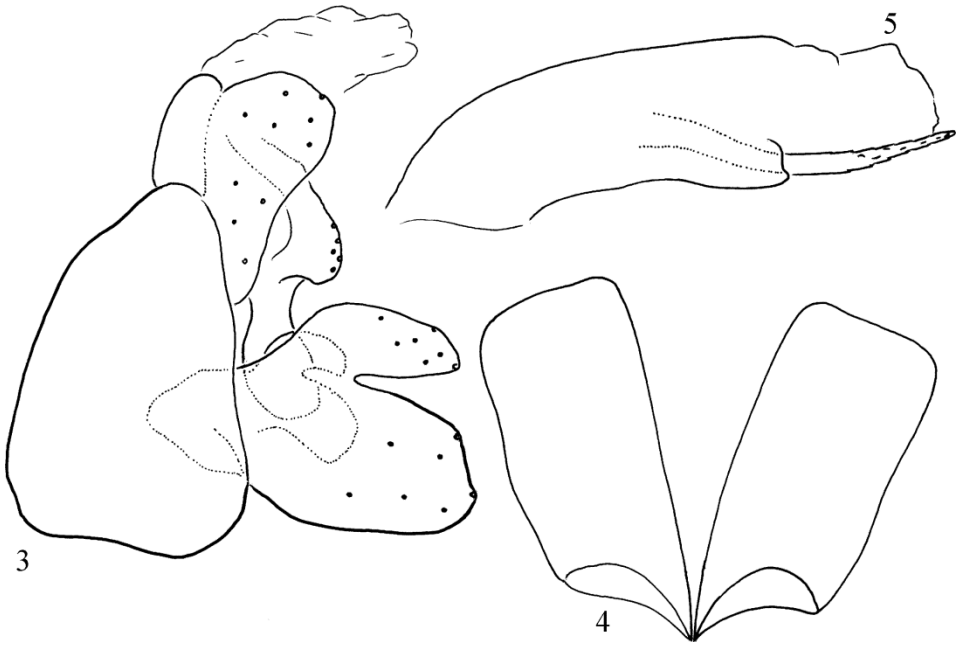
Material examined. Holotype: **Portugal**, Serra da Estrela Massif, brooklet, on the snow, 1450–1480 m, 40.3802°N, 7.6457°W, 23.IV.2022, leg. G. Vinçon (1 male, OPC). Paratype: **Spain**, Asturias, Puerto del Palo Allande, brook and spring, from 950m, 43.2778°N, 6.6681°W, up to 1000m, 43.2764°N, 6.6725°W, 13.X.2022, leg. Gilles Vinçon (1 male, OPC).

Diagnosis. A sibling species, close to *Plectrocnemia laetabilis* McLachlan, 1880 described from the Pyrenees (Col de Menté, Haute Garonne). This species from the Pyrenees is distinguished in the original species description by the very short, broad, and deeply excised inferior appendages (gonopods). Its ventral shape is characterized by pronounced apicomesal lobe. *Plectrocnemia estrela* sp. nov. differs from *laetabilis* by the almost perfectly regular quadrangular shape of the gonopods in ventral view as well as by the more elongated and differently patterned ventral profile of the dorsal and ventral arms of the paraproct.

Description. Medium-sized *Plectrocnemia* species of brownish body and wing colour with forewing length of 10 mm. Forewing densely covered with recumbent setae.

Male genitalia. In lateral view sternite IX subtriangular, dominating over the entire genitalia articulating and holding the periphallic organs of cerci-parapoct fused complex and the gonopods. Tergite IX small vertically elongated giving support to the membranous segment X. Cerci large foliform. Paraproct bipartite vertically elongated, its dorsal arms form part of the phallocrypt giving ventral support for the phallic organ, its ventral arm directed downward deep and densely covered with short stout peg-like setae. Gonopods regular quadrangular in ventral view without any apicomesal lobes. Phallic organ composed, badly discernible without dissection, supplied with a pair of parameres corrugated from middle.

Etymology. Coined from the name of locus typicus, a noun in apposition.



Figs 3-5. *Plectrocnemia estrela* sp. nov. Holotype male: 3 = genitalia in left lateral view; 4 = gonopods in ventral view; 5 = phallic organ in left lateral view.

***Plectrocnemia praestans* McLachlan, 1884**

Material examined. **France**, Alpes-Maritimes, Caïros Valley, Fromagine spring, 1500m, 44.0208°N, 7.4317°E, 17.VII.2022, leg. Gilles Vinçon (1 male, OPC). **Italy**, Piémont, brook and spring tributary of Stura di Demonte, above Villaggio Primavera, 1530 m, 44.373°N, 6.9755°E, 14.V.2022, leg. Gilles Vinçon (1 male, OPC).

***Plectrocnemia scruposa* McLachlan, 1880**

Material examined. **France,** Pyrénées-Atlantiques, Osse-en-Aspe, Labays Pass, Oueils d'Issaux, nice resurgence, 680m, 43.00655°N, 0.691° W, 18.IV.2022, leg. G. Vinçon (1 male, OPC).

***Polycentropus flavomaculatus* Pictet, 1834**

Material examined. **Spain,** Cantabria, Vega de Pas, brook and cascade, arroyo Enverao, 900m, 43.1208°N, 3.7133°W, 11.X.2022, leg. Gilles Vinçon (1 male, OPC).

Hydropsychidae Curtis, 1835

Diplectroninae Ulmer, 1951

***Diplectrona atra* McLachlan, 1878**

*Material examined***. Italy**, Lombardian Pre-Alps, Bergamo, Passo San Marco, S. slope, nice spring, 1730 m, 46.0381N, 9.6358E, 26.V.2022, leg. G. Vinçon (6 males, 2 females; OPC).

***Diplectrona magna* Mosely, 1930**

*Material examined***. Spain,** Asturias, North Pola de Allande, nice springs, 750 m, 43.2862°N, 6.6136°W, 22.IV.2022, leg. G. Vinçon (1 male, OPC).

Remark. This species is probably new for the Iberian Fauna.

Rhyacophilidae Stephens, 1836

***Rhyacophila adjuncta* McLachlan, 1884**

*Material examined***. Spain,** Castilla y Leon, Sierra de Candelario, Rio Becedillas at Becedas, 1110 m, 40.4013N, 5.6371W, 23.IV.2022, leg. G. Vinçon (2 males, OPC). Spain, Communauté de Madrid, Sierra de Guadarrama, South-West Rascafria, nice brook, 1450 m, 40.8361N, 3.9131W, 26.IV.2022, leg. G. Vinçon (1 male, OPC).

***Rhyacophila denticulata* McLachlan, 1879**

*Material examined***. France,** Ariège, Vicdessos, Videssos River at Mounicou, 1100 m, nice river with abundant aquatic vegetation, 42.7077° N, 1.4503°E, 15.IV.2022, leg. G. Vinçon (1 male, 2 females; OPC). France**,** Ariège, Vicdessos, Videssos River at Mounicou, nice river with abundant aquatic vegetation, 1110 m, 42.70775° N, 1.4503°E, 8.X0.2022, leg. Gilles Vinçon (1 male, OPC).

***Rhyacophila eatoni* McLachlan, 1879**

Material examined. **France,** Pyrénées-Atlantiques, Osse-en-Aspe, Labays Pass, Oueils d'Issaux, nice resurgence, 680 m, 43.00655°N, 0.6913°W, 18.IV.2022, leg. G. Vinçon (9 males, OPC). France, Pyrénées-Atlantiques, Iraty, nice resurgence, 1100 m, 43.0451°N, 1.0546°W, 19. IV.2022, leg. G. Vinçon (2 males, OPC). France, Ariège, Vicdessos, above Soulcem Lake, Gardelle brook, 1820 m, 42.657°N, 1.439°E, 15.IV.2022, leg. G. Vinçon (1 male, OPC). France, Pyrénées-Atlantiques, Eaux-Bonnes, Iscoo spring, nice resurgence, 820 m, 42.969°N, 0.3806°W, 18.IV. 2022, leg. G. Vinçon (4 males, 2 females; OPC). France, Pyrénées-Atlantiques, Marie-Blanque Pass, nice brook, 1050 m, 43.0643°N, 0.5033°W, 18.IV.2022, leg. G. Vinçon (1 male, OPC). France, Haute-Garonne, Bagnère-de-Luchon, Pique Valley above Hospice de France, nice spring, 1400m, 42.7195°N, 0.6564°E, 9.X.2022, leg. Gilles Vinçon (2 males, OPC). France, Pyrénées-Orientales, Canigou Massif, above Py, Rotja tributary, 1530m, nice brook, 42.4838°N, 2.3245°E, 7.X.2022, leg. G. Vinçon (1 male, OPC). **Spain,** Val d'Aran, Artiga de Lin, nice spring and brook, 1150 m, 42.7073°N, 0.7138°E, 17.IV.2022, leg. G. Vinçon (2 males, OPC). Spain, Cantabria, above Yera, nice brook, 550-650 m, 43.1377°N, 3.7461°W, 20.IV.2022, leg.

G. Vinçon (1 male, OPC). Spain, Navarra, Puerto de Ibañeta, Valcarlos, brook and spring, Luzaide tributary, 890 m, 43.0309°N, 1.3435°W, 19.IV. 2022, leg. G. Vinçon (2 males, 1 female; OPC). Spain, Navarra, Puerto de Ibañeta, Valcarlos, brook, Luzaide tributary, 620m, 43.0446°N, 1.3266°W, 10.X.2022, leg. Gilles Vinçon (1 male, OPC). France, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, brook and spring, 1740m, 42.4459°N, 2.4155°E, 15.X.2022, leg. Gilles Vinçon (2 males, 2 females; OPC). Spain, Cantabria, Puerto de la Palombera, nice brook and seeping rocks, 1010m, 43.0857°N, 4.2589°W, 11.X.2022, leg. Gilles Vinçon (7 males, OPC). Spain, Navarra, Puerto de Ibañeta, Valcarlos, brook, Luzaide tributary, 880-1000m, 43.0309°N, 1.3435°W, 10.X.2022, leg. G. Vinçon (3 males, 3 females; OPC).

Rhyacophila erkakanae Sipahiler, 1993 stat. nov.

Rhyacophila rupta erkakanae Sipahiler, 1993:46–47.

Material examined. **France**, Pyrénées-Orientales, Canigou Massif, above Py, Rotja tributary, 1530m, nice brook, 42.4838°N, 2.3245°E, 7.X. 2022, leg. G. Vinçon (1 male, OPC).

Remarks. In the phylogenetic species concept subspecies and races are taken out from sciences (Oláh *et al.* 2018). Moreover, the morphological divergences between *Rhyacophila rupta* McLachlan, 1879 and *Rhyacophila erkakanae* Sipahiler, 1993 **stat. nov.** are very great both in the phallic and the periphallic structures.

Rhyacophila evoluta McLachlan, 1879

Material examined. **France,** Pyrénées-Orientales, Puigmal Massif, Ribera d'Err, 1900–2200 m, 42.3855°N, 2.0926°E, 14.IV.2022, leg. G. Vinçon (1 male, OPC). France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent and lateral springs, 1800-1900 m, 42.556° N, 1.768°E, 14.IV.2022, leg. G. Vinçon (9 males, OPC). France, Ariège, Vicdessos, Videssos River at Mounicou, nice river with abundant aquatic vegetation, 1110 m, 42.70775°N, 1.4503°E, 8.X. 2022, leg. Gilles Vinçon (1 male, OPC).

Rhyacophila fasciata Hagen, 1859

*Material examined***. Slovenia, N**.E. Bovec, nice seeping rocks, 430 m, 46.3399N, 13.5745E, 21.V.2022, leg. G. Vinçon (2 males, OPC).

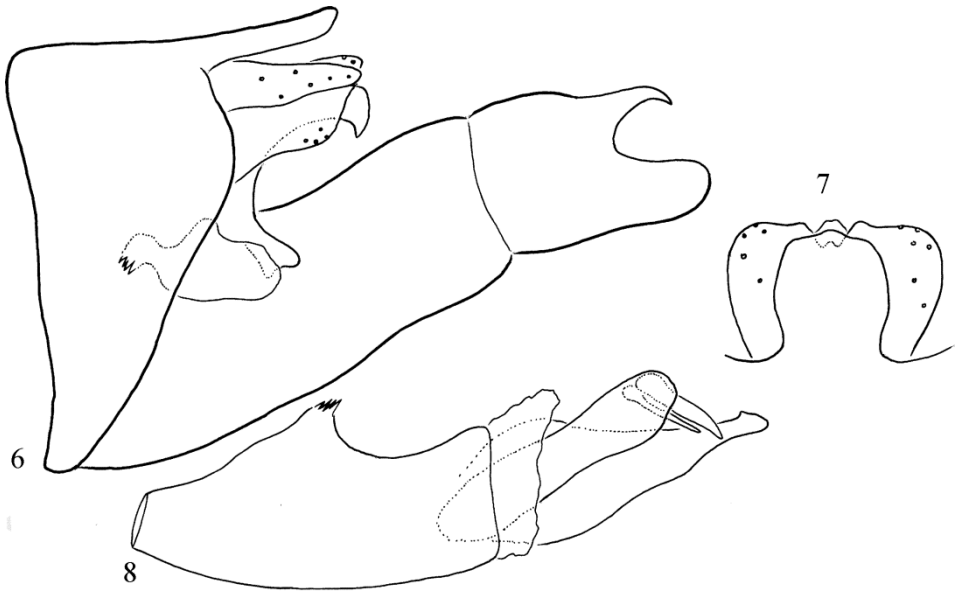
Rhyacophila fusunae sp. nov.

(Figures 6–8) (Photo 5)

Material examined. Holotype: **Spain,** Cantabria, above Yera, nice brook, 550–650 m, 43.137° N, 3.7461°W, 20.IV.2022, leg. G. Vinçon (1 male, OPC).

Diagnosis. This new species is close as a sibling to *Rhyacophila joani* Sipahiler, 2000; which was described from nearby habitat and related closely to the Pyrenean species *Rhyacophila rupta* McLachlan, 1879. *Rhyacophila fusunae* sp. nov. differs from *R. joani* by the differently shaped mesoapical dorsal process of segment IX both in the dorsal and lateral views; by the apically strait truncated dorsal profile of the cerci; by the harpago having apicodorsal pointed process turning mesad, not dorsad; by the longer paramere and by the ventral view of the aedeagus with lateral wings less pronounced.

Description. Dorsal apicomesal lobe of segment IX as long as cerci, little longer than broad in dorsal view, digitiform in lateral view. Cerci broad plate-like, almost straight truncated apicad. Segment X with downward curving hook-like apex in lateral view. Epiproct (anal sclerites), as usual, heavily sclerotized; slightly bilobed both in lateral and dorsal views. Paraproct (U-shaped tergal straps) short and high in lateral view. Harpago, the second segment of gonopod, with apicodorsal lobe pointed, slightly mesad turned. Phallic organ has very stout pair of parameres with two terminal unequal spines directed mesad; aedeagus narrowing apicad.



Figures 6–8. *Rhyacophila fusunae* sp. nov. Holotype male: 6 = genitalia in left lateral view; 7 = apicodorsal process of segment IX and the cerci in dorsal view; 8 = phallic organ in left lateral view.

Etymology. The name of this species is dedicated to Füsun Sipahiler who has described its sibling relative.

Rhyacophila hirticornis McLachlan, 1879

Material examined. **Italy,** Julian Pre-Alps, Cepletischis, spring and brook, 580 m, 46.1795° N, 13.5696°E, 21.V.2022**,** leg. G. Vinçon (1 male, OPC). **Slovenia,** Julian Alps, E. Srednji Vrh, nice spring, 1060 m, 46.4952°N, 13.8518°E, 23.V. 2022, leg. G. Vinçon (1 male, OPC). Slovenia, Kranj, Pohorje Mountains, Travertine springs (limestone substratum), Kokra tributary, 850 m, 46.3993°N, 14.4698°E, 22.V.2022, leg. G. Vinçon (1 male, OPC).

Rhyacophila intermedia McLachlan, 1868

Material examined. **France,** Isère, Taillefer Massif, below Brouffier lake, Guiliman, 1990 m, 45.0354°N, 5.884°E, 6.VIII.2022, leg. G. Vinçon (2 males, 1 female, OPC). France, Pyrénées-Orientales, Puigmal Massif, Ribera d'Err, lateral spring, 2140m, 42.3855°N, 2.0926°E, 7.X.2022, leg. Gilles Vinçon (1 male, OPC).

Rhyacophila laevis Pictet, 1834

Material examined. **Italy,** Julian Pre-Alps, road to Cepletischis, nice springs and seeping rocks, 340m, 46.1701°N, 13.5581°E and 46.1703° N, 13.5575°E, 21.V.2022, leg. G. Vinçon (1 male, OPC). **Slovenia,** near Italian border, Julian Pre-Alps, below Livek, spring and brook, 600 m, 46.2123°N, 13.5939°E, 21.V.2022, leg. G. Vinçon (5 males, 1 female; OPC).

Rhyacophila laufferi Navas, 1918

Material examined. **Spain,** Asturias, Puerto de Leitariegos, Brañas de Arriba, nice spring, 1400 m, 43.0128N, 6.4451W, 21.IV.2022, leg. G. Vinçon (1 male, OPC).

Rhyacophila martynovi Mosely, 1930

Material examined. **France,** Pyrénées-Atlantiques, Osse-en-Aspe, Labays Pass, Oueils d'Issaux, nice resurgence, 680 m, 43.00655°N, 0.6913°W, 18.IV.2022, leg. G. Vinçon (2 males, OPC). France, Pyrénées-Atlantiques, Osse-en-Aspe, Oueils d'Issaux, nice resurgence, 720m,

43.0045°N, 0.693°W, 10.X.2022, leg. Gilles Vinçon (1 male, OPC). **Spain**, Navarra, Puerto de Ibañeta, Valcarlos, brook, Luzaide tributary, 620m, 43.0446°N, 1.3266°W, 10.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Asturias, Puerto de Tarna, brook and springs, from 1130m, 43.1095°N, 5.2188°W, to 1220m, 43.1073°N, 5.2159°W, 12.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Asturias, Somiedo, La Peral, brook and nice spring, from 1310m, 43.0409°N, 6.2519° W, to 1410m, 43.039°N, 6.2555°W, 13.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Navarra, Puerto de Ibañeta, Valcarlos, brook, Luzaide tributary, 880-1000m, 43.0309°N, 1.3435°W, 10. X.2022, leg. G. Vinçon (6 males, 7 females; OPC). **Spain,** Cantabria, Puerto del Ponton, Fuente del Infierno, brook and spring, 1260m, 43.1023°N, 5.0303°W, 12.X.2022, leg. G. Vinçon (8 males, 3 females; OPC).

Rhyacophila melpomene Malicky, 1976

*Material examined***. Spain,** Cantabria, Puerto del Ponton, Fuente del Infierno, brook and spring, 1260m, 43.1023°N, 5.0303°W, 12.X.2022, leg. G. Vinçon (1 male, OPC).

Rhyacophila meyeri McLachlan, 1879

Material examined. **Italy,** Julian Alps, S. Fusine, nice spring below the water catchment, 840 m, 46.4922°N, 13.6689°E and two nice springs at 910 m, 46.4857°N, 13.6735°E, 23.V. 2022, leg. G. Vinçon (4 males, OPC). Italy, Julian Alps, W. Sella Nevea, brook, 1040 m, 46.3897°N, 13.4693°E, 24.05.2022, leg. G. Vinçon (2 males, OPC). **Slovenia,** Julian Alps, N. Vrsic Pass, Pišnica trib., nice spring, 1390 m, 46.4399°N, 13.7538°E, 22.V.2022, leg. G. Vinçon (6 males, OPC).

Rhyacophila pongensis Sipahiler, 2000

Material examined. **Spain,** Asturias, Somiedo, La Peral, brook and nice spring, from 1310m, 43.0409°N, 6.2519°W, to 1410m, 43.039°N, 6.2555°W, 13.X.2022, leg. Gilles Vinçon (1 male, OPC).

Rhyacophila producta McLachlan, 1879

*Material examined***. Italy,** Julian Alps, S. Fusine, nice spring below the water catchment, 840 m, 46.4922°N, 13.6689°E and two nice springs at 910 m, 46.4857°N, 13.6735°E, 23.V.2022, leg. G. Vinçon (2 males, 6 females; OPC). **Slovenia,** Julian Alps, N. Vrsic Pass, Pišnica trib., nice spring, 1390 m, 46.4399°N, 13.7538°E, 22.V. 2022, leg. G. Vinçon (2 males, 1 female; OPC).

Rhyacophila rupta McLachlan, 1879

*Material examined***. France,** Ariège, above Biert, in direction of the Crouzette Pass, nice brook, 670 m, 42.9009°N, 1.3131°E, 15.IV.2022, leg. G. Vinçon (2 males, OPC). France, Haute-Garonne, Bagnère-de-Luchon, Pique Valley above Hospice de France, nice spring, 1400m, 42.7195°N, 0.6564°E, 9.X.2022, leg. Gilles Vinçon (2 males, OPC). France, Ariège, path to Arlu Lake, nice spring, 1650m, 42.8142°N, 1.438°E, 9.X.2022, leg. Gilles Vinçon (2 males, OPC).

Rhyacophila rectispina McLachlan, 1884

*Material examined***. Italy,** Piemont, Pennines Alps, high Sesia Valley, above Sant'Antonio, big spring below Lago Nero, 2630 m, 45.814°N, 7.88°E, 26.V.2022, leg. G. Vinçon (1 male, OPC).

Rhyacophila relicta species complex

Having complex phallic organ, vertical segment X and cerci present this small complex belongs to the *Rhyacophila vulgaris* branch. Segment IX abbreviated ventrad and supplied with a strong dorsal lobe, a character state relating it to the *R. vulgaris* species group. Close to *R. nubila* and *R. dorsalis* complexes. Two species belong to this complex: *Rhyacophila ildefonsa* sp. nov. and *R. relicta*.

Rhyacophila ildefonsa sp. nov.

Rhyacophila relicta McLachlan, 1879: Schmid 1970: 121. Identified and redrawn as *Rhyacophila relicta* McLachlan, 1879. Misidentification.

Rhyacophila relicta McLachlan, 1879: Malicky, 1983: 7. Schmid's drawings accepted as *Rhyacophila relicta* McLachlan, 1879. Misidentification.

Rhyacophila relicta McLachlan, 1879: Malicky, 2004: 9. Schmid's drawings accepted as *Rhyacophila relicta* McLachlan, 1879. Misidentification.

Material. Holotype: **Spain**, San Ildefonso, Sierra de Guadarrama, (Schmid 1970: documented in figure explanation, table VII, figures 16–18. Deposited as *Rhyacophila relicta* McLachlan, 1879 in the Canadian National Collection, Ottawa)

Diagnosis. The new species is close to *Rhyacophila relicta* McLachlan, 1879, forming together a small species complex, but differs by the short, not long, tapering, not parallel-sided, dorsal process of segment IX; it is much longer than the fused cerci. The fused cerci are convex apicad in dorsal view, not concave. The harpago with longer apicoventral narrowing structure. The pair of the ventral arm of aedeagus rounded apicad, not truncated.

Description. Dorsal process of segment IX elongated parallel-sided broad plate with truncated apex only slightly longer than cerci. Cerci fused to segment X forming together slightly convex apical margin in dorsal view. Paraproct (apical band of Schmid) well-developed, membranous, slightly sclerotized. Ventral arm of segment X pronounced, less sclerotized and attached to the pair of short heavily sclerotized epiprocts (anal sclerite of Schmid). The second segment of gonopod, the harpago with elongated ventral half. Phallic organ composed of a pair of stout spine-like paramere with mesad directed apical half and the complex of aedeagus; ventral arms of aedeagus rounded apicad.

Etymology. Coined from the name of locus typicus, as a noun in apposition

Rhyacophila relicta McLachlan, 1879

Rhyacophila relicta McLachlan, 1879:442. Pyrenees (River Néez, near Gan and Rénénacq, Basses Pyrénées, 17th June, Eaton, 2♂, 1♀). „In the ♂ the dorsal process is longer than the lateral lobe, narrow, gradually narrowing from base to apex, which is truncate (not dilated)."

Material examined. **France**, Pyrenees, River system Nivelle, 12–18. VII. 1986, singled leg. J. Oláh (6 males, 1 female; OPC).

Rhyacophila stigmatica Kolenati, 1859

Material examined. **Italy,** Lombardian Pre-Alps, Bergamo, Passo San Marco, S. slope, nice spring, 1730 m, 46.0381°N, 9.6358°E, 26.V.2022, leg. G. Vinçon (2 males, OPC).

Rhyacophila tristis Pictet, 1834

Material examined. **France,** Isère, Taillefer Massif, below Brouffier lake, Guiliman, 1990 m, 45.0354°N, 5.884°E, 6.VIII.2022, leg. G. Vinçon (2 males, 2 females, OPC). **Italy,** Marches, below Monte Acuto, Fonte Acera, 1190 m, 43.4628°N, 12.6944°E, 20.05.2022**,** leg. G. Vinçon (1 male, OPC). Italy, Lombardian Pre-Alps, Bergamo, Passo San Marco, S. slope, nice spring, 1730 m, 46.0381°N, 9.635°8E, 26.V.2022, leg. G. Vinçon (6 males, 2 females; OPC). **Portugal,** Serra da Estrela Massif, above Loriga, torrent, 850 m, 40.333°N, 7.6869°W, 23.IV.2022, leg. G. Vinçon (1 male, OPC). **Portugal**, Serra da Estrela Massif, above Loriga, nice brooklets, 940 m, 40.3381°N, 7.7074°W, 23.IV.2022, leg. G. Vinçon (2 males, OPC). **Spain,** Asturias, Puerto de Tarna, nice spring with abundant aquatic vegetation, 980 m, 43.1156°N, 5.2395°W, 21.IV.2022, leg. G. Vinçon (1 male, OPC). Spain, Asturias, Puerto de Leitariegos, Brañas de Arriba, nice spring, 1400 m, 43.0128°N, 6.4451°W, 21.IV.2022, leg. G. Vinçon (1 male, OPC). Spain, Gallicia, North-East Manzaneda, brook, 670 m, 42.3055°N, 7.2305°W, 22.IV.2022, , leg. G. Vinçon (2 males, 1 female; OPC). Spain, Gallicia, West Ponte de Neira, nice springs tributaries of the Neira River, 550 m, 42.9185°N, 7.2147°W, 22.IV.2022, leg. G. Vinçon (2 males, OPC).

Rhyacophila vandeli Despax, 1933

Material examined. **France**, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste,

nice brook and spring, 1860 m, 42.4523°N, 2.4102°E, 30.IV.2022, leg. G. Vinçon (21 males, 3 females; OPC). France, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, brook and springs, 1910 m, 42.4603°N, 2.4161°E, 30.IV.2022, leg. G. Vinçon (1 male, OPC). France, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, 2 brooks and 1 nice spring, 1630 m, 42.4348°N, 2.394°E, 30.IV.2022, leg. G. Vinçon (4 males, 2 females; OPC). France, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, Jourdonna brook and spring, 1740 m, 42.4459°N, 2.4155°E, 30.IV.2022, leg. G. Vinçon (6 males, 3 females; OPC). **Spain,** Catalogna, tributaries of Riu de Carboner: spring, 1980 m, 42.4063°N, 2.324°6E, and torrent dels Forquets, 2020–2050 m, 42.4118°N, 2.3171°E, 30.IV.2022, leg. G. Vinçon (5 males, 1 female; OPC).

Rhyacophila vulgaris Pictet, 1834

Material examined. **France,** Drôme, South Vercors Massif, Archiane, nice big resurgence, 770 m, 44.7461°N, 5.5064°E, 11.III.2022, leg. G. Vinçon (3 males, OPC). **Italy,** Atesine Alps, N. Maranza, big brook near Hexenhütte, 1750 m, 46.8562°N, 11.6637°E, 25.V.2022, leg. G. Vinçon (2 males, OPC).

Glossosomatidae Wallengren, 1891

Glossosoma privatum McLachlan, 1884

Material examined. **Spain**, Castilla y Leon, Sierra de Gredos, Garganta de Navamediana, 1130 m, 40.3156°N, 5.4159°W, 24.IV.2022, leg. G. Vinçon (2 males, OPC). Spain, Cantabria, Rio Saja, Mina da Lapiz, 520 m, 2 springs and the river, 43.1232°N, 4.2961°W, 20.IV.2022, leg. G. Vinçon (4 males, OPC).

Agapetus arvernensis Malicky, 1980

Material examined. **France**, Ariège, path to Arlu Lake, nice spring, 1650m, 42.8142°N, 1.438°E, 9.X.2022, leg. Gilles Vinçon (1 male, OPC).

Agapetus diversus McLachlan, 1884

*Material examined***. Portugal,** Serra da Estrela Massif, above Loriga, torrent, 850 m, 40.333°N, 7.6869°W, 23.IV.2022, leg. G. Vinçon (1 male, OPC).

Agapetus dubitans McLachlan, 1879

Material examined. France, Alpes-Maritimes, Caïros Valley, Fromagine spring, 1500m, 44.0208°N, 7.4317°E, 17.VII.2022, leg. Gilles Vinçon (1 male, OPC).

Agapetus fuscipes Curtis, 1834

Material examined. **France,** Pyrénées-Orientales, above Sorède, La Farga, nice brook, 450 m, 42.4979°N, 2.9572°E, 30.IV.2022, leg. G. Vinçon (1 male, OPC).

Agapetus insons McLachlan, 1879

Material examined. **France,** Pyrénées-Atlantiques, Osse-en-Aspe, Labays Pass, Oueils d'Issaux, nice resurgence, 680 m, 43.00655°N, 0.6913°W, 18.IV.2022, leg. G. Vinçon (5 males, OPC). France, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, nice brook and spring, 1860 m, 42.4523°N, 2.4102°E, 30.IV. 2022, leg. G. Vinçon (2 males, OPC). France, Haute-Garonne, Bagnère-de-Luchon, Pique Valley above Hospice de France, nice spring, 1400m, 42.7195°N, 0.6564°E, 9.X.2022, leg. Gilles Vinçon (14 males, OPC). **Spain,** Val d'Aran, Artiga de Lin, nice spring and brook, 1150 m, 42.7073°N, 0.7138°E, 17.IV.2022, leg. G. Vinçon (1 male, OPC).

Agapetus krawanyi Ulmer,1938

*Material examined***. Slovenia,** near Italian border, Julian Pre-Alps, below Livek, spring and

brook, 600 m, 46.2123°N, 13.5939°E, 21.V.2022, leg. G. Vinçon (1 male, OPC).

Agapetus lusitanicus (Malicky, 1980)

Material examined. **Spain,** Asturias, Puerto de Tarna, nice spring with abundant aquatic vegetation, 980 m, 43.1156N, 5.2395W, 21.IV.2022, leg. G. Vinçon (10 males, 3 females, OPC). Spain, Asturias, road to the Puerto del Palo Allande, nice brook, 720 m, 43.2897N, 6.6431W, 22.IV.2022, leg. G. Vinçon (2 males, OPC). Spain, Asturias, Puerto de Tarna, brook and springs, from 1130m, 43.1095°N, 5.2188°W, to 1220m, 43.1073°N, 5.2159°W, 12.X.2022, leg. Gilles Vinçon (1 male, OPC).

Catagapetus nigrans McLachlan, 1884

*Material examined***. Italy,** Marches, Parco Nazionale dei Monti Sibillini, nice torrent at Ussita, 730 m, 42.943°N, 13.138°E, 18.V.2022, leg. G. Vinçon (2 males, OPC). Italy, Marches, E. Purello, nice spring and two brooks, 530 m, 43.32°N, 12.7733°E, 20.V.2022, leg. G. Vinçon (1 male, OPC).

Ptilocolepidae Martynov, 1913

These small caddisflies with somewhat iridescent rounded forewing of 4–6 mm and primitive neuration populate hygropetric habitats of montane springs and seeps, among growths of moss and liverwort (Marshall 1979). *Ptilocolepus granulatus* (Pictet, 1834) was originally described in the *Rhyacophila* genus, later shown to be a senior synonym of *Ptilocolepus turbidus* Kolenati, 1848 (Hagen 1855), the type species thus became *Ptilocolepus granulatus*. McLachlan (1879) discussed its taxonomic status among rhyacophilids and glossosomatids. Describing its larval stage Thieneman (1904) noted its hydroptilid affinities, with the conclusion that it fits neither in the Glossosomatinae of Rhyacophilidae nor in Hydroptilidae. This position somehow prompted Ulmer (1907) to place the genus in the Hydroptilidae. Martynov (1913) describing two new species from the Caucasus erected the Ptilocolepinae subfamily for the nominate genus retaining its taxonomic position in the Rhyacophilidae family. Finally, Ross (1956) transferred the subfamiliy to Hydroptilidae with inclusion of *Ptilocolepus* and *Palaeagapetus* genera.

Completing Thieneman (1904) findings, Malicky (2001) recently has raised the Ptilocolepinae subfamily to family rank: Ptilocolepidae Martynov, 1913. However, its taxonomic position was retained as a subfamily within Hydroptilidae by Holztenthal *et al.* (2007). The migration of *Ptilocolepus* through the Trichoptera system was discussed by Malicky (2008) and documented by Thieneman's original text.

Isolation and delineation by harpago

Harpago, harpagones in plural, is the grabbling terminal structure, the second segment of the gonopod usually with important functions in sexual processes. Already McLachlan (1879, 1884) has used exclusively the shape of harpago to separate species in the *Ptilocolepus* genus as well as presented rather reliable drawings of the furcate harpago suggesting that more species are hidden under the name of *Ptilocolepus granulatus*. He figured the differences in the lateral profile of the furcated harpago between specimens from Belgium and from the Pyrenees.

Diversity rate is significantly increasing from non-genital structures through non-intromittent genital structures to intromittent genital structures of the phallic organ. This gradient of diversity pattern suggests empirically that divergence mechanisms are driven by sexual integration (selection) operating in relation to sensory manipulation in mating, to ability of sperm removal in sperm competition, to control fertilization in sexual conflict, and to induce post-copulatory, prezygotic sperm selection in cryptic female choice (Arnquist 1997), the postcopulatory equivalent of the classic Darwinian precopulatory female choice.

Harpago could function as grasping, sensory, titillating, or even a harming organ liable to diver-

sify in isolation and producing distinct species by both prezygotic and postzygotic reproductive isolation that is performing the magic role of speciation traits and enabling us to delineate these incipient, sibling species.

Harpagones are almost completely fused to the gonopods with (*P. atiloma*) or without (*P. namnao*) visible vestigial sutures. The densely setosed gonopods themselves are fused completely (*P. atiloma*, *P. namnao*) or partially and definitely more ancestrally than the harpago. Based on the more recently diverging harpago structure, reflecting its integrative organization with speciation trait function and applying the principle of complex is plesiomorphic we distinguished three lineages in the *Ptilocolepus* genus. (1) *Ptilocolepus colchicus* species complex; (2) *Ptilocolepus granulatus* species complex; (3) *Ptilocolepus atiloma* species complex.

Ptilocolepus colchicus species complex

The gonopods are partially fused with the vestigial basal plate present in mesal position in the form of heavily sclerotized structure ending in an apical spine. Harpago fused to the coxopodite apicad forming a specific lobe pattern together with the gonopod. *Ptilocolepus colchicus* Martynov, 1913 specimens from Georgia, Iran and Turkey listed below, are cleared, cleaned and examined. Based on the lateral profile of the harpago they may represent several sibling species, but we do not describe them here.

Ptilocolepus colchicus Martynov, 1913

(Map 1)

Ptilocolepus colchicus Martynov, 1913:26–27. In Russian: Type specimen: "1♂. Forested mountain stream near Kvareli (Georgia) 21.VI.1907, leg. A. Martynov."

Material examined. **Georgia**: Adjara, Mtirala NP, Chakvistavi 20 km NE Batumi, brooks, 41°40.6′N, 41°52.4′E, 315 m, 30.VI.2013, leg.P. Chvojka (2 males, OPC; 3 males, 4 females; NMPC); Georgia, Kakheti, Batsara Nat. Res., Samkura R. and Khadori waterfall, 42°16'28"N, 45°21'06"E, 1250 m, 2.V.2019, leg. D. Murányi & J. Oboňa (4 males, 1 female; OPC; 4 males, 1 female, NMPC); Georgia, Svanetia, stream N of Mestia, 43°03.0′N, 42°43.1′E, 1510–1700m, 5.VII.2013, leg.P. Chvojka (13 males, 1 female, NMPC). Georgia, Gouria region, brooklet and cascade, tributary of Bzhuzhi River, 41°51'03" N, 42°06'55"E, 660m, 24.IX.2019, leg. G. Vinçon (1 male, OPC). **Iran**, Gilan Province, South of Bandar Anzali, Talesh Mountain, small tributary to Masula River, 12.VIII.1990, leg. J. Oláh (2 males, OPC). Iran, Gilan Province, South of Bandar Anzali, Talesh Mountain, small tributary to Masula River, 16.IV.1991, leg. J. Oláh (2 males, OPC). **Turkey**, NE Anatolia, Rize prov., Çat SW of Çamlıhemşin - springs, brooks, 40°51.6′N 40°56.6′E; ca.1290 m, 9.VII.2013, leg. P. Chvojka (3 males, OPC; 5 males, 1 female; NMPC). Turkey, NE Anatolia, Artvin; source NE Hopa, 41 25 45 N, 41 26 50 E; 6.VII.1993, leg. P. Chvojka (3 males, OPC; 9 males, 8 females; NMPC). Turkey, NE Anatolia, Artvin; streams, Altiparmak NW Yusufeli, 40 57 00 N, 41 21 00 E; 7.VII.1993, leg. P. Chvojka (2 males, OPC; 9 males, 3 females; NMPC). Turkey, NE Anatolia, Trabzon; source, Sumela, 40 41 24 N, 39 39 39 E; 5.7.1993, leg. P. Chvojka (3 males, OPC; 4 males, 7 females; NMPC).

Ptilocolepus granulatus species complex

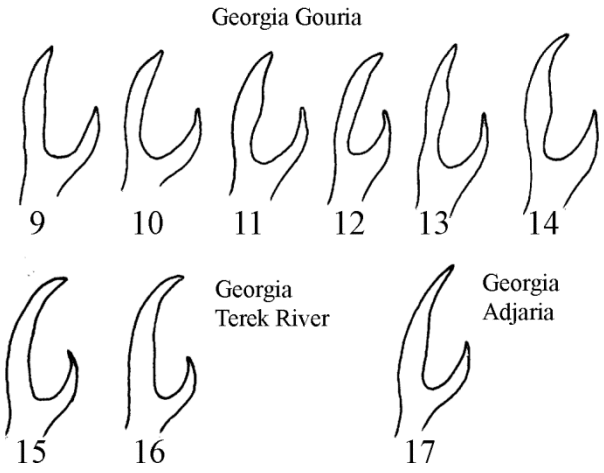
The gonopods are almost entirely fused with some mesal excision on its apical margin. Harpago fused to the coxopodite on its dorsum subapicad. Mostly European species complex with one species in the Caucasus: *Ptilocolepus dilatatus* Martynov, 1913, *P. extensus* McLachlan, 1884; *Ptilocolepus granulatus* (Pictet, 1834); *Ptilocolepus kover* sp. nov.; *Ptilocolepus sovan* sp. nov.

Ptilocolepus dilatatus Martynov, 1913

(Figures 9–17) (Map 1)

Ptilocolepus dilatatus Martynov, 1913:23–26. In Russian: Type specimens: "2♂, 1♀. Mountain stream in gorge near Lagodekhi (Georgia), 17.VI.1907, leg. A. Martynov. 2♂. Mountain stream

Map 1. Distribution of Ptilocolepidae species in Asia (full circles represent the type localities).



Figures 9–17. *Ptilocolepus dilatatus* Martynov, 1913. 9–14 = Georgia, Gouria; 15–6 = Georgia, Terek River; 17 = Georgia, Adjara.

Material examined. **Georgia**: Adjara, Mtirala NP, Chakvistavi 20 km NE Batumi, brooks, 41° 40.6′N, 41°52.4′E, 315 m, 30.VI.2013, leg. P. Chvojka (25 males 9 females, NMPC); the same but spring brook, 41°40.7′N, 41°51.8′E, 280 m, 30.VI.2013, leg. P. Chvojka (15 males, 10 females, NMPC); the same but stream, 41°40.5′N, 41°52.2′E, 320m, 30.VI.2013, leg. P. Chvojka (26 males, 18 females, NMPC); the same but springs and brooks, 41°40.4′N, 41°51.2′E, 410 m, 1.VII. 2013, leg. P. Chvojka (56 males, 31♀ females NMPC); Imereti, Pereval Nakeral'skii, tributary of Tkibula River, 42°22'55"N, 43°01'07"E, 1016 m, 18.IX.2018, leg. J. Oboňa (1 male, 1 female, NMPC). Georgia, Mtskheta-Mtianeti region, side-stream of Terek r. with small waterfall in narrow rocky ravine, below Tsdo village, 1710m, 42°40' 56.379"N, 44°37'58.846"E, 6.VII.2019, leg. P. Manko (1 male, OPC). Georgia, Adjara, Kintrishi Nature Reserve, sidebrook of Cherulisghele Stream, N41°44.003' E42°04.922', 1040m, 26.IX. 2019, leg. T. Kovács, D. Murányi, & G. Vinçon (1 male, 1 female; OPC). Georgia, Gouria region, brooklet, tributary of Bzhuzhi River, above Gomi, 41°52'25" N, 42°06'19"E, 390m, 24.IX.2019, leg. G. Vinçon (7 males, 1 female; OPC).

Ptilocolepus extensus McLachlan, 1884

(Map 2)

Ptilocolepus extensus McLachlan, 1884:70: "Portugal (between São Antonio and Coimbra, Beira Baixa,

3rd June, 1♂; near Cea, about 1800 ft., Beira Baixa, 11th June, 2 ♂, 1♀."

Material examined. **Portugal**, Serra da Estrela Massif, above Loriga, nice brooklets, 940 m, 40.3381°N, 7.7074°W, 23.IV.2022, leg. G. Vinçon (1 male, OPC). Portugal, Serra da Estrela Massif, brooklet, on the snow, 1450–1480 m, 40.3802°N, 7.6457°W, 23.IV.2022, leg. G. Vinçon (4 males, 1 female; OPC). **Spain,** Galicia, south-west A Fonsagrada, brooklet and cascade, 750 m, 43.0726°N, 7.1785°W, 22.IV.2022, leg. G. Vinçon (6 males, OPC). Spain**,** Asturias, Puerto de Tarna, nice spring with abundant aquatic vegetation, 980 m, 43.1156°N, 5.2395°W, 21.IV. 2022, leg. G. Vinçon (2 males, OPC). Spain, Gallicia, West Ponte de Neira, nice springs tributaries of the Neira River, 550 m, 42.9185°N, 7.2147°W, 22.IV.2022, leg. G. Vinçon (4 males, OPC). Spain, Cantabria, above Yera, nice brook, 550–650 m, 43.1377°N, 3.7461°W, 20.IV.2022, leg. G. Vinçon (1 male, OPC). Spain**,** Cantabria, Peñarrubia, E Linares, resurgence, 420 m, 43.2554°N, 4.5741°W, 20.IV.2022, leg. G. Vinçon (4 males, 3 females; OPC). Spain, Asturias, Puerto del Palo Allande, brook and spring, 950 m, 43.2778°N, 6.6681°W up to 1000 m, 43.2764°N, 6.6725°W, 22.IV.2022, leg. G. Vinçon (7 males, OPC). Spain**,** Asturias, Somiedo, La Peral, brook and nice spring, 1360m, 43.0384°N, 6.2499°W, 13.X.2022, leg. Gilles Vinçon (2 males, OPC). Spain, Cantabria, Puerto de la Palombera, nice brook and seeping rocks, 1010 m, 43.0857°N, 4.2589°W, 11.X.2022, leg. Gilles Vinçon (3 males, OPC). Spain, Cantabria, Peñarrubia, E Linares, resurgence, 420m, 43.2554°N, 4.5741° W, 12.X.2022, leg. Gilles Vinçon (13 males, 9 females; OPC).

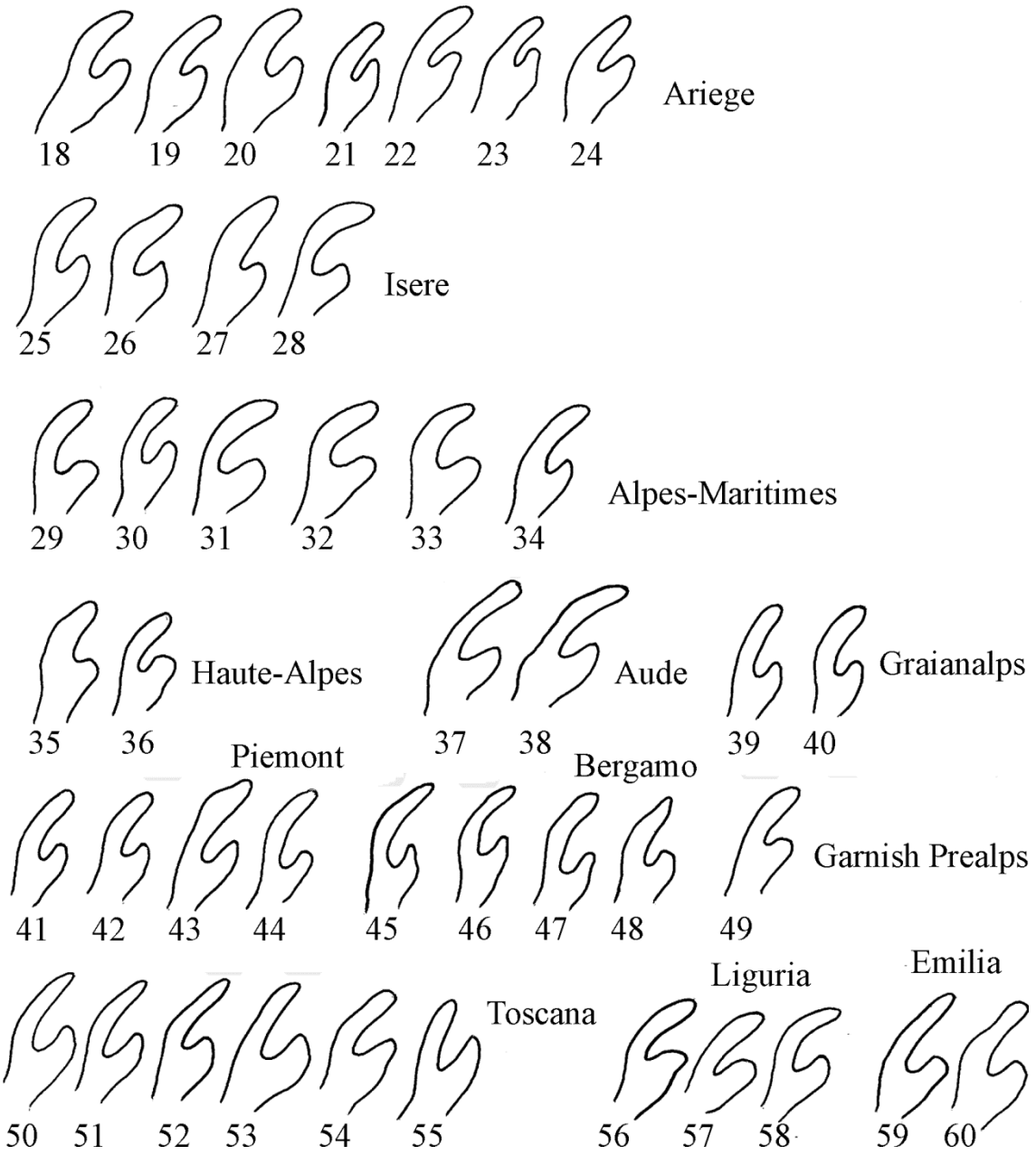
Ptilocolepus granulatus (Pictet, 1834)

(Figures 18–60) (Map 2)

Rhyacophila granulata Pictet, 1834: 197–198. „J'ai trouvé cette espèce dans la vallée de Chamounix à la fin Juillet."

Ptilocolepus granulatus (Pictet, 1834): McLachlan, 1879: 490. "France (Chamounix, Savoy, July, Pictet)."

Material examined. **France,** Ariège, below Crouzette Pass, nice spring, 760 m, 42.9137N, 1.314E, 15.IV.2022, leg. G. Vinçon (4 males, 2 females; OPC). France, Ariège, below Crouzette Pass, nice spring, 840 m, 42.9195°N, 1.3267°E 15.IV.2022, leg. G. Vinçon (1 male, 1 female; OPC). France, Ariège, above Biert, in direction of the Crouzette Pass, nice brook, 670 m, 42.9009° N, 1.3131°E, 15.IV.2022, leg. G. Vinçon (11 males, 2 females; OPC). France, Alpes-Maritimes, Courmes, brook, 570 m, 43.753°N, 7.005° E, 6.I.2022, leg. G. Vinçon (3 males, 5 females; OPC). France, Alpes-Maritimes, Caïros Valley, lateral spring, 1020 m, 44.011°N, 7.4602°E, 6.I. 2022, leg. G. Vinçon (3 males, 1 female; OPC). France, Alpes-Maritimes, Caïros Valley, Fromagine spring, 1500m, 44.0208°N, 7.4317°E, 17. VII.2022, leg. Gilles Vinçon (9 males, 6 females; OPC). France, Isère, Vercors Massif, springs ang brooks below Cascade de Moulin Marquis, 450 m, 45.0563°N, 5.4343°E, 11.III.2022, leg. G. Vinçon (9 males, 5 females; OPC). France, Hautes-Alpes, Queyras Massif, Vars Pass, above Guillestre, 1630 m, Nice spring, 44.6241°N, 6.6834°E, 14.V.2022, leg. G. Vinçon (2 males, OPC). France, Aude, Citou, 43.408°N 2.591°E, 906 m, 14. VII.2007, leg. M. Bálint (2 males, OPC). **Italy,** Graian Alps, Viu Valley, Borgial, big torrent, 45.203°N 7.302°E, 1500 m, 26.VI. 2020, leg. Gilles Vinçon (2 males, 2 females; OPC). Italy, Ligurian Apennines, above Rocca d'Aveto, nice brook and spring, 1400 m, 44.555°N, 9.4767°E, 15.V.2022, leg. G. Vinçon (3 males, OPC). Italy, Ligurian Alps, above Garessio, brook and spring 'Sorgente del Carulin', 650 m, 44.1925°N, 8.0404°E, 15.V.2022, leg. Gilles Vinçon (4 males, 4 females; OPC). Italy, Emilie-Romagna, S. Cerreto Laghi, Fosso dei Fontanini, nice spring and brook, 1550 m, 44.28°N, 10.25°E, 11.VI.2022, leg. G. Vinçon (2 males, OPC). Italy, Emilie-Romagne, N.E. Passo Lagastrello, nice spring, 1110 m, 44.3562°N, 10.156°E, 17.V.2022, leg. G. Vinçon (1 male, OPC). Italy, Toscana, Passo di Cerreto, La Nuda Glacial Circus, spring + brook, 1440–1500 m, 44.2867°N, 10.2268°E, 10.VI.2022, leg. Gilles Vinçon (14 males, 26 females; OPC). Italy, Piemont, Pennines Alps, Civiasco, spring below



Figuress 18–60. *Ptilocolepus granulatus* (Pictet, 1834). Lateral profile of the harpago in 12 populations. 18–24 = Ariege, 25–28 = Isere, 29–34 = Alpes-Maritimes, 35–36 = Haute-Alpes, 37–38 = Aude, 39–40 = Graian Alps, 41–44 = Piemont, 45–48 = Bergamo, 49 = Garnish Prealps, 50–55 = Toscana, 56–58 = Liguria, 59–60 = Emilia.

water catchment, 770 m, 45.8104°N, 8.2973°E, 27.V.2022, leg. Gilles Vinçon (2 males, OPC). Italy, Carniche Pre-Alps, Dolomiti Friuli, S. Preone, Casali Chiampon, nice spring and Arzino torrent, "il Fontanone", 760 m, 46.3416°N, 12.8827°E, 24.V.2022, leg. G. Vinçon (1 male, OPC). Italy, Piémont, brook and spring tributary of Stura di Demonte, above Villaggio Primavera, 1530 m, 44.373°N, 6.9755°E, 14.V.2022, leg. Gilles Vinçon (17 males, 7 females; OPC).

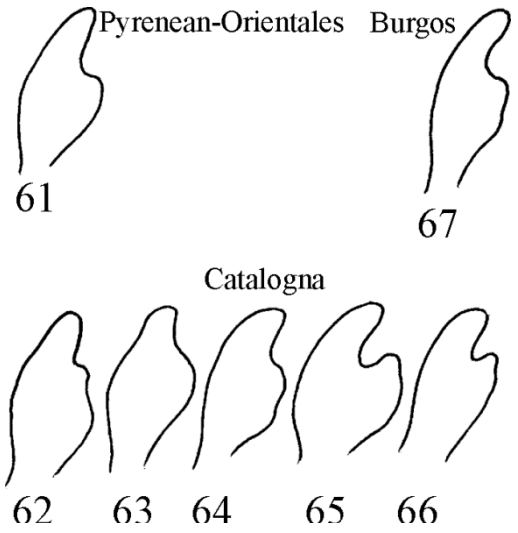
Ptilocolepus kover sp. nov.

(Figures 61–67) (Map 2) (Photo 6)

Material examined. Holotype: **France**, Pyrénées-Orientales, above Sorède, La Farga, nice brook, 450 m, 42.4979N, 2.9572E, 30.IV.2022, leg. G. Vinçon (1 male, OPC). Paratypes: **Spain**, Catalogna, Rio Rilort tributary, above Espinavel, nice brooklet, 1220 m, 42.3812N, 2.3932E, 30.IV.2022, leg. G. Vinçon (5 males, OPC). Spain, Burgos, Espinosa de los Monteros, Portillo de Las Estecas de Trueba, Fuente Cornejo, spring, 1030 m, 43.1115N, 3.6786W, 19.IV.2022, leg. G. Vinçon (1 male, OPC).

Diagnosis. This new species with speciation trait of very fat harpago is closer to *Ptilocolepus granulatus*, the ancestral species of the complex, but the ventral lobe of the harpago is vestigial as well as the dorsal lobe much abbreviated.

Description. Small dark species with forewing length of 2 mm. Hyaline transparent spot window at the fork of the median veins small. The speciation trait, the harpago is fused subapicad to the coxopodite. Its lateral profile is very specific; the lower or ventral lobe is much reduced or completely disappeared; the upper or dorsal lobe is very stout broad with rounded apex; the entire harpago is rounded fat.



Figures 61–67. *Ptilocolepus kover* sp. nov. Lateral profile of the harpago in 3 populations. Holotype: 61 = Pyrenees-Orientales, Paratypes: 62–66 = Catalogna, 67 = Burgos.

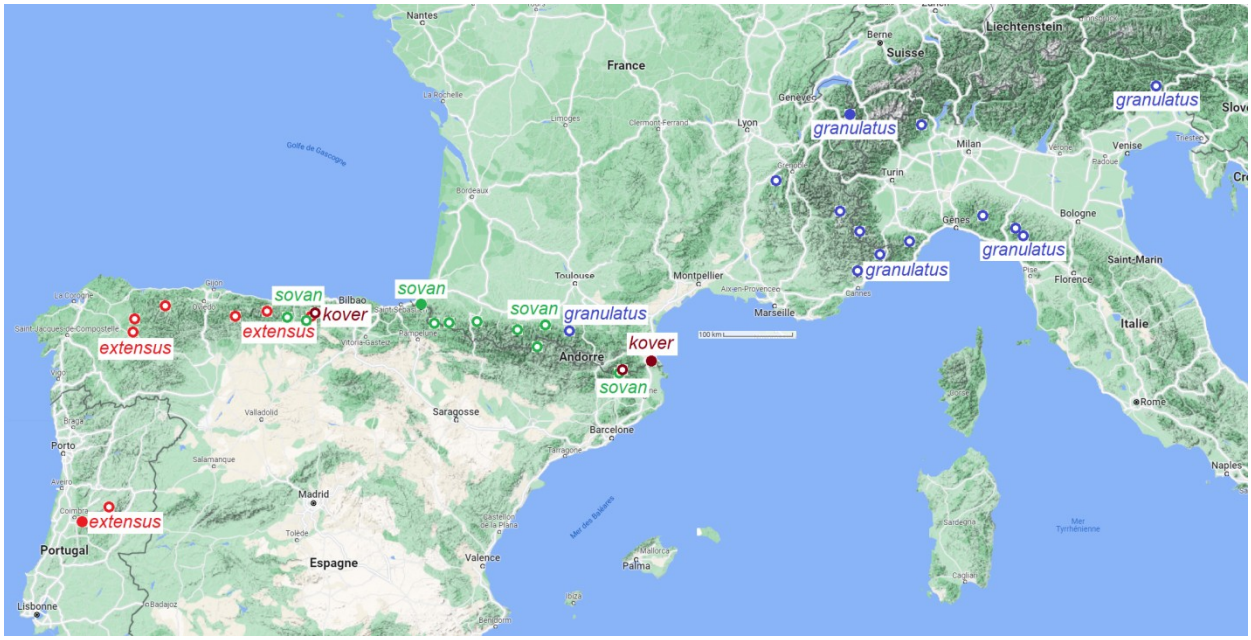
Etymology. kover from "kövér" fat in Hungarian, refers to the rounded, fat lateral profile of the harpago.

Ptilocolepus sovan sp. nov.

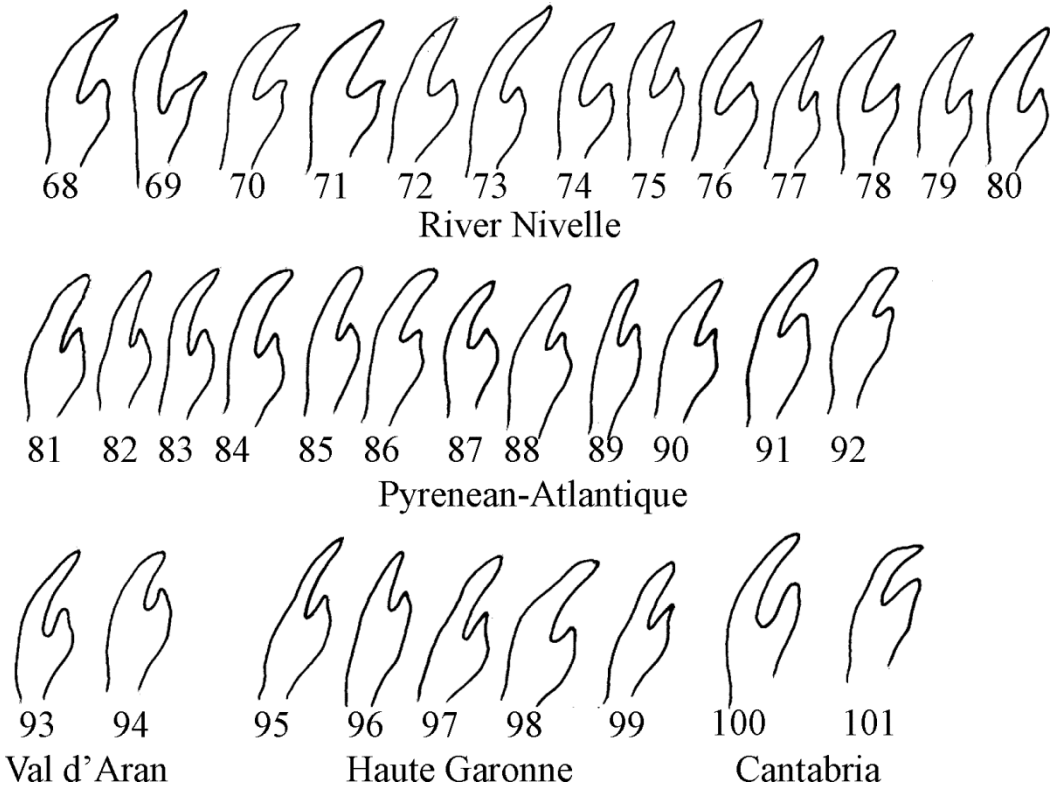
(Figures 68–101) (Map 2)

Material examined. Holotype: **France**, Pyrénées-Atlantiques, River system Nivelle, 12-18.VII.1986, leg. J. Oláh (1 male, OPC). Paratypes: same as holotype (16 males, 3 females; OPC). France, Pyrénées-Atlantiques, Marie-Blanque Pass, nice spring, 910 m, 43.0697N, 0.5213W, 18.IV.2022, leg. G. Vinçon (11 males, 2 females; OPC). France, Pyrénées-Atlantiques, Iraty, nice resurgence, 1100 m, 43.0451N, 1.0546W, 19.IV.2022, leg. G. Vinçon (2 males, OPC). France, Hautes-Pyrénées, N.W. Aspin Pass, 1450 m, nice brook, 42.9454N, 0.3202E, 17.IV.2022, leg. G. Vinçon (1 male, 3 females; OPC). France, Haute-Garonne, Arbas Massif, Fontaine de l'Ours, spring, 1190 m, 42.9647N, 0.8789E, 15.IV.2022, leg. G. Vinçon (8 males, 2 females; OPC). **Spain,** Val d'Aran, Artiga de Lin, nice spring and brook, 1150 m, 42.7073N, 0.7138E, 17.IV.2022, leg. G. Vinçon (2 males, 4 females; OPC). Spain, Cantabria, Puerto de la Palombera, nice brook and 2 cascades, 1010 m, 43.0857N, 4.2589W, 20.IV.2022, leg. G. Vinçon (1 male, OPC). Spain, Cantabria, above Yera, nice brook, 550-650 m, 43.1377N, 3.7461W, 20.IV.2022, leg. G. Vinçon (1 male, OPC). Spain, Catalogna, Rio Rilort tributary, above Espinavel, 2 brooks, 1350 m, 42.3811N, 2.3734E, and 1400 m, 42.3811N, 2.3665E, 30.IV.2022, leg. G. Vinçon (1 male, OPC). Spain, Navarra, Puerto de Ibañeta, Valcarlos, brook and spring, Luzaide tributary, 890 m, 43.0309N, 1.3435W, 19.IV. 2022, leg. G. Vinçon (2 males, 1 female; OPC).

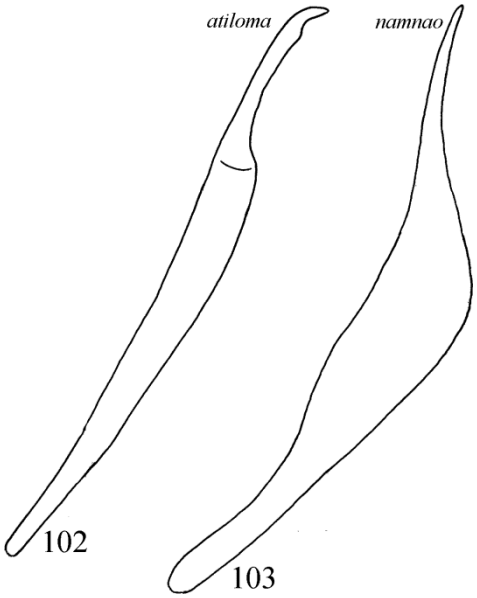
Diagnosis. This new Pyrenean and Cantabrian species with speciation trait of slender and pointed harpago is closer to *Ptilocolepus granulatus*, the ancestral species of the complex,



Map 2. Distribution of Ptilocolepidae species in Western Europe (full circles represent the type localities).



Figures 68–101. *Ptilocolepus sovan* sp. nov. Lateral profile of the harpago in 5 populations. Holotype: 68 = River Nivelle, Paratypes: 69–80 = River Nivelle, 81–92 = Pyrenees-Atlantique, 93–94 = Val d'Aran 95–99 = Haute-Garonne, 100–101 = Cantabria.



Figures 102–103. *Ptilocolepus atiloma* Schmid, 1990 and *Ptilocolepus namnao* Malicky, 1996. Lateral profile of the gonopod. 102 = *Ptilocolepus atiloma,* 103 = *Ptilocolepus namnao*

but the excision between the dorsal and ventral lobes is narrow, not wide; the dorsal arm is slim, slender with pointed apex, not so slim with rounded apex; the ventral lobe is abbreviated and pointed, not long and rounded.

Description. Small dark species with forewing length of 2 mm. Hyaline transparent spot window at the fork of the median veins small. The harpago, second segment of gonopod is fused subapicad to the coxopodite. Its lateral profile is characterized with pointed lobe apices; the lower or ventral lobe is short abbreviated with pointed, tapering apex; the upper or dorsal lobe is slender with pointed apex; the excision between dorsal and ventral lobes are very narrow.

Etymology. sovan from "sovány" thin or lean in Hungarian, refers to the slim lateral profila of the harpago.

Ptilocolepus atiloma new species complex

The gonopods are almost entirely fused with some mesal less sclerotized region. Harpago fused to the coxopodite with (*P. atiloma*) or without (*P. namnao*) vestigial sutures as a direct tapering structural continuation. Oriental species: *Ptilocolepus atiloma* Schmid, 1990 from India and *P. namnao* Malicky & Chantaramongkol, 1996 from Thailand.

Ptilocolepus atiloma Schmid, 1990

(Figures 102) (Map 1)

Ptilocolepus atiloma Schmid, 1990:239–241. "Holotype ♂ Inde, Assam, United Jaintia and Khasi Hills, Mawpran, 4–7.II.1961. Allotype ♀: Ibid., Tarangblang, 27.XII.1959 (CNC 21234)." "La découverte d'un *Ptilocolepus* en Assam est très inattendue, car ce genre n'avait encore jamais été signalé hors la région européenne, dont il semblait être un des éléments faunistiques typiques."

Ptilocolepus namnao Malicky, 1996

(Figures 103) (Map 1)

Ptilicolepus namnao Malicky, 1996:119. "HT♂: Thailand, Nam Nao NP, 800m, 16.–17.IV.1996." "♂ Kopulationsarmaturen: Sehr ähnlich den anderen Arten, besonders P. atiloma. Die untere Anhänge sind in eine lange dünne Spitze ausgezogen, und ihre theoretische Zweigliedrigkeit ist nicht zu erkennen."

Brachycentridae Ulmer, 1903

Micrasema servatum Navas, 1918,

Material examined. **Spain,** Galicia, south-west A Fonsagrada, brooklet and cascade, 750 m, 43.0726°N, 7.1785°W, 22.IV.2022, leg. G. Vinçon (4 males, OPC). Spain, Asturias, Puerto de Tarna, nice spring with abundant aquatic vegetation, 980 m, 43.1156°N, 5.2395°W, 21.IV. 2022, leg. G. Vinçon (4 males, OPC). Spain, Asturias, Puerto de Leitariegos, Brañas de Arriba, nice spring, 1400 m, 43.0128°N, 6.4451°W, 21.IV.2022, leg. G. Vinçon (1 male, OPC). Spain, Gallicia, West Ponte de Neira, nice springs tributaries of the Neira River, 550 m, 42.9185°N, 7.2147°W, 22.IV.2022, leg. G. Vinçon (4 males, OPC). Spain, Asturias, road to the Puerto del Palo Allande, nice brook, 720 m, 43.2897°N, 6.6431°W, 22.IV.2022, leg. G. Vinçon (8 males,

OPC). Spain**,** Asturias, Somiedo, La Peral, brook and nice spring, 1360m, 43.0384°N, 6.2499°W, 13.X.2022, leg. Gilles Vinçon (2 males, OPC).

Micrasema vestitum Navas, 1918

Material examined. **France,** Pyrénées-Atlantiques, Osse-en-Aspe, Labays Pass, Oueils d'Issaux, nice resurgence, 680 m, 43.00655°N, 0.6913°W, 18.IV.2022, leg. G. Vinçon (2 males, OPC). France, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, nice brook and spring, 1860 m, 42.4523°N, 2.4102°E, 30.IV. 2022, leg. G. Vinçon (2 males, OPC).

Uenoidae Iwata, 1927

Thremmatinae Martynov, 1935

Thremma tellae González, 1978

*Material examined***. Portugal,** Serra da Estrela Massif, above Loriga, torrent, 850 m, 40.333°N, 7.6869°W, 23.IV.2022, leg. G. Vinçon (1 male, OPC). Portugal, Serra da Estrela Massif, brooklet, on the snow, 1450–1480 m, 40.3802°N, 7.6457° W, 23.IV.2022, leg. G. Vinçon (1 male, OPC). **Spain,** Castilla y Leon, Sierra de Gredos, Hoyos del Espino, nice brook with abundant aquatic vegetation, 1470 m, 40.3582°N, 5.1773°W, 24.IV. 2022, leg. G. Vinçon (1 male, OPC). Spain, Gallicia, North-East Manzaneda, brook, 670 m, 42.3055°N, 7.2305°W, 22.IV.2022, leg. G. Vinçon (1 male, OPC). Spain, Gallicia, West Ponte de Neira, nice springs tributaries of the Neira River, 550 m, 42.9185°N, 7.2147°W, 22.IV.2022, leg. G. Vinçon (2 males, OPC). Spain, Castilla y Leon, Sierra de Candelario, Rio Becedillas at Becedas, 1110 m, 40.4013°N, 5.6371°W, 23.IV. 2022, leg. G. Vinçon (1 male, OPC). Spain, Communauté de Madrid, Sierra de Guadarrama, South-West Rascafria, nice brook, 1450 m, 40.8361°N, 3.9131°W, 26.IV.2022, leg. G. Vinçon (6 males, OPC). Spain, Cantabria, above Yera, nice brook, 550–650 m, 43.1377°N, 3.7461°W, 20.IV.2022, leg. G. Vinçon (5 males, OPC). Spain, Castilla y Leon, Sierra de Gredos, road to 'La Plataforma de Gredos', big brook, 1490 m, 40.304°N, 5.2088°W, 24.IV.2022, leg. G. Vinçon (26 males, 4 females; OPC). Spain, Cantabria, Puerto de la Palombera, brook, 1020m, 43.0847°N, 4.2515°W, 11.X.2022, leg. Gilles Vinçon (2 males, OPC). Spain, Cantabria, Puerto de la Palombera, nice brook and seeping rocks, 1010m, 43.0857°N, 4.2589°W, 11.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Cantabria, Vega de Pas, brook and cascade, arroyo Enverao, 900m, 43.1208°N, 3.7133°W, 11.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Asturias, Puerto del Palo Allande, brook and spring, from 950m, 43.2778°N, 6.6681°W, up to 1000m, 43.2764°N, 6.6725°W, 13.X.2022, leg. Gilles Vinçon (1 male, OPC).

Goeridae Ulmer, 1903

Lithax niger (Hagen, 1859)

Material examined. **France,** Isère, Taillefer Massif, below Brouffier lake, spring Guiliman tributary, 1850 m, 45.033°N, 5.877°E, 21.06. 2022**,** leg. G. Vinçon (2 males, 3 females; OPC). **Italy**, Julian Alps, W. Sella Nevea, brook, 1040 m, 46.3897°N, 13.4693°E, 24.05.2022, leg. G. Vinçon (4 males, 1 female; OPC). Italy, Atesine Alps, N. Maranza, spring and brook, 1590 m, 46.8345° N, 11.6479°E, 25.V.2022, leg. G. Vinçon (2 males, 3 females; OPC). Italy**,** Atesine Alps, N. Maranza, big brook near Hexenhütte, 1750 m, 46.8562°N, 11.6637°E, 25.V.2022, leg. G. Vinçon (6 males, 5 females; OPC). Italy, Rhaetian Alps, above Livigno, brook, 2130m, 46.5308° N, 10.1539°E. 25.V.2022, leg. G. Vinçon (3 males, 2 females; OPC). Italy, Aosta Valley, High Ayas Valley, above St Jacques, near 'Alpe Mase', nice spring, 2400 m, 45.8929°N, 7.7039°E, 11.VI. 2022, leg. G. Vinçon (2 males, OPC).

Lithax obscurus (Hagen, 1859)

*Material examined***. Italy,** Marches, E. Purello, nice spring and two brooks, 530 m, 43.32N, 12.7733E, 20.V.2022, leg. G. Vinçon (9 males, 7 females; OPC).

Remark. This species is new for the Italian Fauna.

Lepidoptomatidae Ulmer, 1903

***Crunoecia irrorata* Curtis,1834**

*Material examined***. Italy,** Molise, Castel San Vincenzo, Sorgente Acquaruolo, 470 m, 41.6594° N, 14.078°3E, 19.V.2022, leg. G. Vinçon (1 male, OPC).

***Crunoecia kempnyi* Morton, 1901**

*Material examined***. Italy,** Julian Alps, S. Fusine, nice spring below the water catchment, 840 m, 46.4922°N, 13.6689°E and two nice springs at 910 m, 46.4857°N, 13.6735°E, 23.V.2022, leg. G. Vinçon (2 males, 6 females; OPC). **Slovenia, N**.E. Bovec, nice seeping rocks, 430 m, 46.3399° N, 13.5745°E, 21.V.2022, leg. G. Vinçon (1 male, OPC).

Remark. This species is new for the Italian Fauna.

Apataniidae Wallengren, 1886

***Apatania eatoniana* McLachlan, 1880**

Material examined. **France,** Pyrénées-Atlantiques, Osse-en-Aspe, Labays Pass, Oueils d'Issaux, nice resurgence, 680m, 43.00655°N, 0.6913°W, 18.IV.2022, leg. G. Vinçon (3 males, 1 female; OPC). France, Pyrénées-Atlantiques, Iraty, resurgence, 1100 m, 43.0451°N, 1.0546°W, 19.IV.2022, leg. G. Vinçon (1 male, OPC). France, Pyrénées-Atlantiques, Marie-Blanque Pass, nice brook, 1050 m, 43.0643°N, 0.5033°W, 18.IV.2022, leg. G. Vinçon (12 males, OPC). **Spain,** Cantabria, Puerto del Ponton, nice spring and brook, 1180 m, 43.1036°N, 5.0157°W, 21. IV.2022, leg. G. Vinçon (7 males, 1 female; OPC). Spain, Navarra, Puerto de Ibañeta, Valcarlos, brook and spring, Luzaide tributary, 890 m, 43.0309°N, 1.3435°W, 19.IV.2022, leg. G. Vinçon (7 males, 1 female; OPC). Spain, Asturias, Puerto del Palo Allande, brook and spring, 950 m, 43.2778°N, 6.6681°W up to 1000 m, 43.2764°N, 6.6725°W, 22.IV.2022, leg. G. Vinçon (4 males,1 female; OPC). Spain, Asturias, Somiedo, La Peral, brook and nice spring, 1360m, 43.0384°N, 6.2499°W, 13.X.2022, leg. Gilles Vinçon (3 males, 1 female; OPC).

***Apatania fimbriata* Pictet, 1834**

Material examined. **France**, Ariège, below Crouzette Pass, nice spring, 840 m, 42.9195°N, 1.3267°E, 15.IV.2022, leg. G. Vinçon (2 males, 1 female; OPC). France, Ariège, path to Arlu Lake, nice spring, 1650m, 42.8142°N, 1.438°E, 9.X. 2022, leg. Gilles Vinçon (2 males, OPC).

Limnephilidae Kolenati, 1848

Drusinae Banks, 1916

***Drusus annulatus* Stephens, 1837**

Material examined. **France,** Isère, Taillefer Massif, below Brouffier lake, spring Guiliman tributary, 1850 m, 45.033°N, 5.877°E, 6.VIII.2022, leg. Gilles Vinçon (1 male, OPC).

***Drusus apados* Oláh & Coppa, 2017**

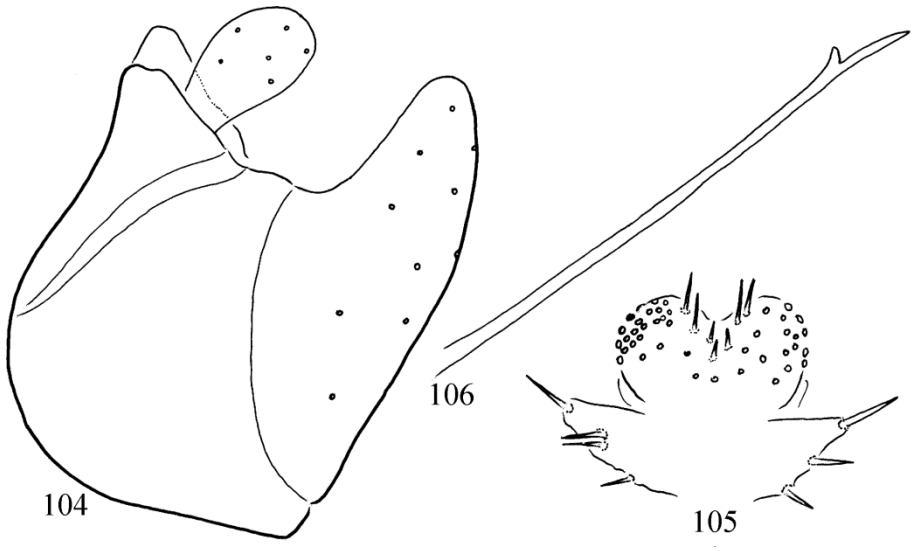
Material examined. **France,** Drôme, South Vercors Massif, Archiane, nice big resurgence, 770 m, 44.7461N, 5.5064E, 13.V.2022, leg. G. Vinçon (8 males, 14 females; OPC). France, Drôme, South Vercors Massif, Archiane, nice big resurgence, 770 m, 44.7461°N, 5.5064°E, 15.VI. 2022, leg. G. Vinçon (25 males, 5 females; OPC).

***Drusus roya* sp. nov.**

(Figures 104–106) (Map 3) (Photos 7, 8)

Material examined. Holotype: **France,** Alpes-Maritimes, Caïros Valley, tributary of Roya Valley, lateral spring, 1020 m, 44.011N, 7.46E, 17.VII.2022, leg. Gilles Vinçon (1 male, OPC).

Diagnosis. A new species related to the *Drusus lepidopterus* siblings of the *D. greacus* species complex in the *Drusus bosnicus* species group. This species belongs to the southern group of *D. lepidopterus* siblings with pronounced microplate structures in the surface pattern on the



Figures 104–106. *Drusus roya* sp. nov. Holotype: 104 = genitalia in left lateral view, 105 = Paraproct in dorsal view; 106 = phallic organ in lateral view.

dorsal surface of the fused dorsal branches of the paraproct. The new species *D. roya* is most close to *D. lepidopterus*, but differs by both the shape and the surface pattern of the fused dorsal branch of the paraproct in dorsal view. The partially fused lobes of the dorsal arms of paraproct are rounded circular, not quadrangular; its basolateral lobes are longer; 2–3 primary setae of macrochaetes present also on the middle region.

Description. Black, large species with forewing length of 14 mm. The architectural shape of the dorsal profile of the fused dorsal arm of the paraproct is characterized by two circular lobes. Composed of the pair of fused circular dorsal arms and the triangular basolateral pair of lobes. The microplate field very pronounced, dominating on the surface; the entire surface is almost fully covered with small circular microplates having some pointed central outgrowth. The mesal suture line indiscernible. The paramere setal pattern of the holotype symmetrical, the erect, primary spine is short and robust.

Etymology. Name coined from the name of the type locality as a noun in apposition.

Remark. In the Roya Valley both siblings occur; *D. roya* sp. nov. and *D. lepidopterus* (Oláh *et al.* 2021, Oláh *et al.* 2022).

***Drusus camerinus* Moretti, 1981**

*Material examined***. Italy,** Marches, E. Purello, nice spring and two brooks, 530 m, 43.32°N, 12.7733°E, 20.V.2022, leg. G. Vinçon (2 males, OPC). Italy**,** Marches, Parco Nazionale dei Monti Sibillini, Panico Valley, nice brook and spring, 1180 m, 42.945°N, 13.1995°E, 18.V.2022, leg. G. Vinçon (9 males, 4 females, OPC).

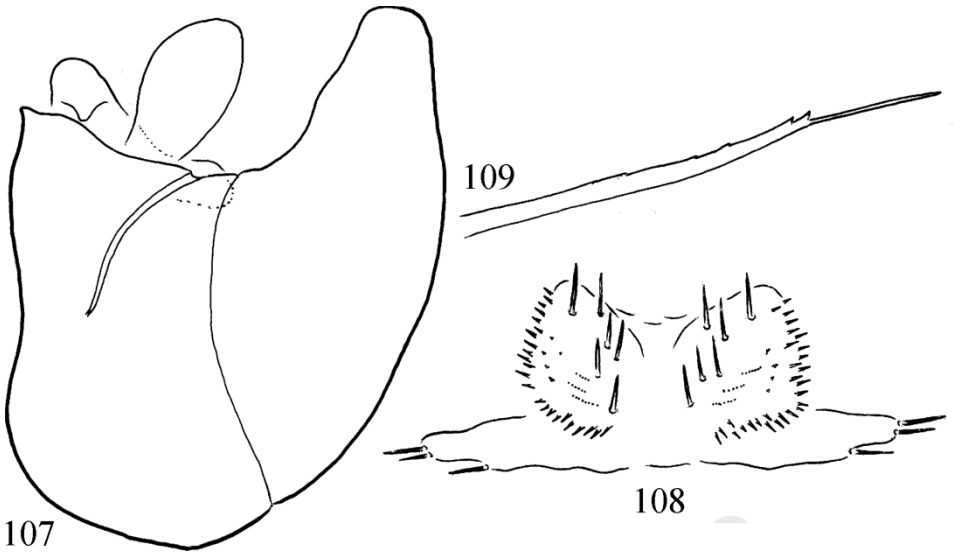
***Drusus demonta* sp. nov.**

(Figures 107–109) (Map 3) (Photo 9)

Material examined. Holotype: **Italy**, Piémont, brook and spring tributary of Stura di Demonte, above Villaggio Primavera, 1530 m, 44.373°N, 6.9755°E, 14.V.2022, leg. Gilles Vinçon (1 male, OPC).

Diagnosis. A new species related to the *Drusus lepidopterus* siblings of the *D. greacus* species complex in the *Drusus bosnicus* species

Map 3. Distribution of the *Drusus lepidopterus* siblings in the western Alps and northern Apennines (full circles represent the type localities).



Figures 107–109. *Drusus demonta* sp. nov. Holotype: 107 = genitalia in left lateral view, 108 = paraproct in dorsal view; 109 = phallic organ in lateral view.

group. This species belongs to the northern group of *D. lepidopterus* siblings without pronounced microplate structures in the surface pattern on the dorsal surface of the fused dorsal branches of the paraproct. The new species *D. demonta* is most close to *D. piemontensis*, lives and was collected

together in the same habitat, but differs by both the shape and the surface pattern of the fused dorsal branch of the paraproct in dorsal view as well as radically differs by the spine pattern of the paramere. The partially fused lobes of the dorsal arms of paraproct are trapezoid, not rounded and more subdivided; its basolateral lobes are triple longer; 2–3 primary setae of macrochaetes present also on the middle region. The single robust and erected primary paramere spine characterizing all the known species of the siblings is unique in *Drusus demonta* sp. nov., reduced in size and subdivided.

Description. The forewing of the male is completely covered with slightly elongated scales; forewing length 9 mm. The architectural shape of the dorsal profile of the fused dorsal arm of the paraproct is characterized by complex amalgamated lobe system. Composed of the pair of fused vestigial dorsal arms and the elongated basolateral pair of lobes. There is no microplate field discernible; the entire surface is almost fully covered with short microspines as well as short transversal lines of spots as visible in dorsal view. The mesal suture line vestigial, present markedly apicad. The paramere setal pattern of the holotype asymmetrical, the erect, primary spine is uniquely subdivided, less pronounced; lateral and basal margin full of small tertiary spines.

Etymology. Name coined from the name of the type locality as a noun in apposition.

Remark. The distribution area of *D. demonta* sp. nov. meets the southern edge of the distribution area of its closest sibling *D. piemontensis* (Map 3).

***Drusus discolor* (Rambur, 1842)**

*Material examined***. France,** Isère, Taillefer Massif, below Brouffier lake, Guiliman, 1990 m, 45.0354N, 5.884E, 6.VIII.2022, leg. G. Vinçon (1 male, 1 female, OPC). France, Alpes-de-Haute-Provence, > Cayolle Pass, spring and brook, 2460 m, 44.258N, 6.733E, 18.VII.2022, leg. G. Vinçon (6 males, 3 females, OPC).

***Drusus flavipennis* (Pictet, 1834)**

*Material examined***. France**, Alpes-de-Haute-Provence, > Cayolle Pass, spring and brook, 2460 m, 44.258°N, 6.733°E, 18.VII.2022, leg. G. Vinçon (1 male, OPC).

***Drusus improvisus* (McLachlan, 1884)**

*Material examined***. Toscana,** Passo del Cerreto, 1400–1500 m, springs and brooks, 44.285° N, 10.2286°E, 17.V.2022, leg. G. Vinçon (1 male, 1 female, OPC). Italy, Emilie-Romagne, Lagdei, brook and spring near the peat bog, 1270 m, 44.4122°N, 10.0075°E, 16.V.2022, leg. G. Vinçon (1 male, OPC). Italy, Ligurian Apennines, above Rocca d'Aveto, spring, 1640 m, 44.5598° N, 9.4872°E, 15.V.2022, leg. Gilles Vinçon (3 males, 2 females; OPC). Italy, Toscana, Passo di Cerreto, La Nuda Glacial Circus, spring + brook, 1440–1500 m, 44.2867°N, 10.2268°E, 10.VI. 2022, leg. Gilles Vinçon (14 males, 26 females; OPC).

***Drusus lapos* Oláh, 2017**

Material examined. **Italy**, Dolomiti, S.E. Moso, Parco Naturale Tre Cime, many springs below water captures, trib. Rio Bianco, 1650 m, 46.6557N, 12.4062E, 24.V.2022, leg. Gilles Vinçon (2 males, 1 female; OPC).

Remark. Based upon the lateral profile of the dorsal arm of paraproct and on the spine pattern of paramere we have distinguished two separate distinct species hidden under the name of *Drusus chrysotus* (Oláh *et al.* 2017). *Drusus chrysotus* (Rambur, 1842) the western sibling species and *Drusus lapos* Oláh, 2017 the eastern sibling species. All the examined specimens from France, Western Switzerland, and Western Italy represent *Drusus chrysotus* and all the specimens from Eastern Switzerland, Eastern Italy, Austria and Czech Republic represent *Drusus lapos*.

In the lateral profile the dorsum of the fused dorsal branches of paraproct is sloping anterad at *D. chrysotus* and flat horizontal at *D. lapos*.

Subapical spine on the paramere subdivided into two spines at *D. chrysotus* and not divided; only a sole spine is present at *D. lapos*. Recent collection of a single male of *Drusus chrysotus* in France (Oláh *et al.* 2022) and the present collection of two males and a single female have confirmed the stability of the paraproct and paramere divergences of the two sibling species.

Drusus liguriensis Oláh, 2017

(Map 3)

Material examined. **Italy,** Ligurian Apennines, above Rocca d'Aveto, nice brook and spring, 1400 m, 44.555°N, 9.4767°E, 15.V.2022, leg. G. Vinçon (1 male, 1 female, OPC). Italy, Emilie-Romagne, above Lagdei, lateral spring, 1290 m, 44.4098°N, 10.01°E, 16.V.2022, leg. G. Vinçon (1 male, 3 females, OPC). Italy, Emilie-Romagne, above Prato Spilla, 1450 m, 44.3578°N, 10.1057° E, 16.V.2022, leg. G. Vinçon (4 males, 2 females, OPC).

Remark. Lodovici & Valle (2020) mistakenly did not report this species from Italy. Its distribution area extends much to the east in the Northern Apennines and nearly meets the distribution area of its two siblings, *D. cerreto* Oláh & Vinçon, 2021 and *D. apuanensis* Oláh, 2017 (Map 3).

Drusus magas Oláh, 2017

Material examined. **Italy,** Aosta Valley, High Ayas Valley, St Jacques, above Lago Blu, nice torrent, 2400 m, 45.8964°N, 7.7457°E, 12.VI. 2022, leg. G. Vinçon (3 males, OPC). Italy, Aosta Valley, High Ayas Valley, St Jacques, above Lago Blu, big spring, 2470 m, 45.89775°N, 7.7471°E, 12.VI.2022, leg. G. Vinçon (5 males, OPC).

Remark. In our previous study (Oláh & Vinçon 2022), we described *D. italiano* Oláh & Vinçon, 2022, close to *D. magas*, and at that time we thought that "It seems that all the known Italian specimens belong to the new species *D. italiano* and *D. magas* Oláh, 2017 is represented only by Swiss specimens, by the holotype and by the drawings of Schmid (1956) from Swiss specimen under the name *D. muelleri*." Now we can confirm that both species *D. italiano* and *D. magas* are sympatric in the Italian Pennines Alps.

Drusus malickyi (Sipahiler, 1992)

Material examined. **France,** Drôme, South Vercors Massif, Archiane, nice big resurgence, 770 m, 44.7461°N, 5.5064°E, 11.III.2022, leg. G. Vinçon (3 males, OPC).

Drusus marinettae Sipahiler, 1992

Material examined. **France,** Pyrénées-Orientales, Puigmal Massif, Ribera d'Err, 1900-2200 m, 42.3855°N, 2.0926°E, 14.IV.2022, leg. G. Vinçon (1 male, OPC). France, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, nice brook and spring, 1860 m, 42.4523°N, 2.4102°E, 30.IV.2022, leg. G. Vinçon (2 males, OPC). France, Pyrénées-Orientales, Canigou Massif, above Mantet, Rotja tributary, 1850 m, nice big spring, 42.4755°N, 2.325°E, 14.IV.2022, leg. G. Vinçon (1 male, OPC).

Drusus melanchaetes McLachlan, 1876

Material examined. **Italy,** Aosta Valley, High Ayas Valley, St Jacques, above Lago Blu, nice torrent, 2400 m, 45.8964°N, 7.7457°E, 12.VI. 2022, leg. G. Vinçon (5 males, 3 females; OPC). Italy, Aosta Valley, High Ayas Valley, above St Jacques, N.E. 'Alpe Mase', spring and brook, 2530 m, 45.8965°N, 7.7093°E, 11.06.2022, leg. G. Vinçon (2 males, OPC).

Drusus mixtus (Pictet, 1834)

Material examined. **Switzerland**, Jura Massif, Soubey, Bief de la Côte au Bouvier, 600–650 m, 47.3°N, 7.06°E, 13.III.2022, leg. G. Vinçon (9 males, 3 females; OPC).

Drusus monticola McLachlan, 1876

Material examined. **Italy,** Rhaetian Alps, S.W. Passo dello Stelvio, springs and brooks, 2030 m,

46.5152°N, 10.4057°E, 25.V.2022, leg. G. Vinçon (2 males, 1 female; OPC). Italy, Dolomiti, S.E. Moso, Parco Naturale Tre Cime, many springs below water captures, trib. Rio Bianco, 1650 m, 46.6557°N, 12.4062°E, 24.V.2022, leg. Gilles Vinçon (1 male, OPC).

Drusus nebulicola (McLachlan, 1867)

Material examined. **France,** Isère, Alpe du Grand Serre, Lavaldens, Rif bruyant, 1860 m, dessous cascade, 44.9513°N, 5.911°E, 14.VII. 2022, leg. Gilles Vinçon (6 males, 18 females; OPC).

Drusus piemontensis Oláh, 2017

(Map 3)

Material examined. **Italy**, Piémont, brook and spring tributary of Stura di Demonte, above Villaggio Primavera, 1530 m, 44.373°N, 6.9755° E, 14.V.2022, leg. Gilles Vinçon (1 male, OPC). Italy, Piémont, brook and spring tributary of Stura di Demonte, above Villaggio Primavera, 1530 m, 44.373°N, 6.9755°E, 16.VII.2022, leg. G. Vinçon (6 males, OPC).

Drusus spelaeus (Ulmer, 1920)

*Material examined***. France,** Drôme, Vercors, Tourtre, Adouin, 760 m, 45.0035°N, 5.4563°E, 11.III.2022, leg. G. Vinçon (3 males, OPC).

Drusus thibaulti Decamps, 1972

*Material examined***. Spain,** Navarra, Puerto de Ibañeta, Valcarlos, brook and spring, Luzaide tributary, 890 m, 43.0309°N, 1.3435°W, 19.IV. 2022, leg. G. Vinçon (2 males, 1 female; OPC).

Remarks. The recollection of this rare species is a great luck! During our revision of Drusinae subfamily we were unable to examine the type or any other specimens. The examination of the two males and single female confirm our conclusion based on the original description and drawings that this is a distinct independent species. (Oláh *et al.* 2017). This species is probably new for the Spanish Fauna.

Drusus vinconi Sipahiler, 1992

Material examined. **France,** Pyrénées-Atlantiques, Osse-en-Aspe, Labays Pass, Oueils d'Issaux, nice resurgence, 680 m, 43.00655°N, 0.6913°W, 18.IV.2022, leg. G. Vinçon (3 males, 2 females; OPC). France, Pyrénées-Atlantiques, Osse-en-Aspe, Oueils d'Issaux, nice resurgence, 720m, 43.0045°N, 0.693°W, 10.X.2022, leg. Gilles Vinçon (1 male, 1 female; OPC).

Remarks. This large elegant species was described from a single male accompanied by 5 females collected at the end of June, 1987 by Gilles Vinçon in the Pyrénées-Atlantiques, France. The single male holotype and the female allotypes were re-examined, re-diagnosed and its taxonomic position corrected and established (Oláh *et al*. 2017). Examination of the species group character state of paramere fine structure as well as the speciation trait of paraproct of the three newly collected specimens, the taxonomic position in the *Drusus annulatus* species group and *Drusus annulatus* species complex was confirmed.

Ecclisopteryx asterix Malicky, 1979

*Material examined***. Slovenia,** Julian Alps, N. Vrsic Pass, Pišnica trib., nice spring, 1390 m, 46.4399N, 13.7538E, 22.V.2022, leg. G. Vinçon (2 males, 4 females; OPC). Slovenia**,** Julian Alps, E. Srednji Vrh, nice spring, 1060 m, 46.4952°N, 13.8518°E, 23.V.2022, leg. G. Vinçon (2 males, 3 females; OPC).

Limnephilinae Kolenati, 1848

Limnephilini Kolenati, 1848

Limnephilus affinis Curtis, 1834

Material examined. **France,** Hautes-Pyrénées, below Tourmalet Pass, between 1610 m, Garet torrent, 42.9063°N, 0.2115°E, and 1970m, 42.8987°N, 0.2024°E, 17.IV.2022, leg. G. Vinçon (1 male, OPC).

Limnephilus auricula Curtis, 1834

Material examined. **Italy,** Molise, below Sant Angelo del Pesco, brooklet on calcareous substratum, 750 m, 41.882°N, 14.25°E, 19.V. 2022, leg. G. Vinçon (1 male, OPC). Italy, Molise, above Pescopennataro, Fonte della Gallina, nice springs and brooklets, 1420 m, 41.8547°N, 14.2932°E, 18.V.2022, leg. G. Vinçon (1 male, OPC).

Limnephilus ignavus McLachlan, 1865

Material examined. France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, 1900m, 42.556°N, 1.768°E, 8.X.2022, leg. Gilles Vinçon (1 male, OPC).

Chaetopterygini Hagen, 1858

Annitella pyrenaea (Navas, 1930)

*Material examined***. France,** Ariège, Vicdessos, Videssos River at Mounicou, river with abundant aquatic vegetation, 1110 m, 42.70775° N, 1.4503°E, 8.X0.2022, leg. Gilles Vinçon (2 males, OPC). France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, 1900m, 42.556° N, 1.768°E, 8.X.2022, leg. Gilles Vinçon (4 males, 2 females; OPC). France, Pyrénées-Orientales, Puigmal Massif, Ribera d'Err, lateral spring, 2140m, 42.3855°N, 2.0926°E, 7.X.2022, leg. Gilles Vinçon (3 males, 2 females; OPC). France, Pyrénées-Orientales, Puigmal Massif, Ribera d' Err, lateral spring, 2140m, 42.3855°N, 2.0926° E, 7.X.2022, leg. Gilles Vinçon (3 males, 4 females; OPC). France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, nice brook and lateral springs, 2170m, 42.5426° N, 1.76°E, 8.X. 2022, leg. Gilles Vinçon (5 males, 2 females; OPC). France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, nice lateral spring, 1990m, 42.55175°N, 1.76484°E, 8.X. 2022, leg. G. Vinçon (4 male, 3 females; OPC).

Chaetopterygopsis maclachlani Stein, 1874

Material examined. **France,** Ariège, path to Arlu Lake, nice spring, 1650m, 42.8142°N, 1.438°E, 9.X.2022, leg. Gilles Vinçon (1 male, OPC). France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, brook and lateral springs, 2170m, 42.5426°N, 1.76°E, 8.X. 2022, leg. Gilles Vinçon (3 males, 2 females; OPC).

Chaetopteryx cantabrica Oláh & Vinçon, 2022

(Figure 110) (Map 4)

Material examined. **Spain,** Cantabria, San Roque de Riomiera, Portillo de Lunada, brook and spring below water catchment, 900m, 43.17°N, 3.686°W, 11.10.2022, leg. Gilles Vinçon (2 male, OPC). Spain, Burgos, Espinosa de los Monteros, Portillo de Las Estecas de Trueba, Nacimiento del Rio Trueba, brook and spring, 1140m, 43.114°N, 3.7021°W, 11.X.2022, leg. Gilles Vinçon (1 male, 1 female in copula, OPC).

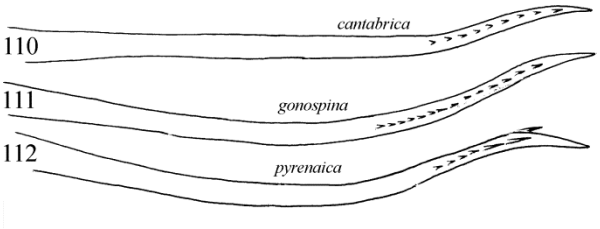
Description of male. Chaetopteryx cantabrica Oláh & Vinçon, 2022 was described from a female holotype. We were lucky to collect three males of this sibling species in the *Chaetopteryx gonospina* species complex. Siblings in this small species complex indicate pronounced divergences in the female genital structures. The periphallic organs of the male genitalia are rather stable without any discernible divergences. The parameres of the phallic organ seem to be the speciation trait exhibiting subtle, but stable divergences. The paramere shaft of the *Chaetopteryx cantabrica* male is straight, not curving as much as the shaft of the two other species. As well as the apicolateral spine row is shorter than at *C. gonospina* and the terminal S-curving is less pronounced that at *C. pyrenaica*.

Chaetopteryx decampsi Oláh & Vinçon, 2022

(Map 4)

*Material examined***. France,** Pyrénées-Atlantiques, Osse-en-Aspe, road to Labays Pass, nice spring, 670m, 43.0177°N, 0.69°W, 10.X. 2022, leg. Gilles Vinçon (5 females, OPC). **France,** Pyrénées-Atlantiques, Osse-en-Aspe, before Oueils d'Issaux, nice resurgence, 680m, 43.00655°N, 0.6913°W, 10.X.2022, leg. Gilles Vinçon (1 male, OPC).

Map 4 Distribution of the *Chaetopteryx gonospina* siblings in the Pyrenees and Cantabrian Cordillera (full circles represent the type localities).



Figures 110–112. Lateral profile of the parameres in the *Chaetopteryx gonospina* species complex. 110 = *Chaetopteryx. cantabrica* Oláh & Vinçon, 2022, 111 = *Chaetopteryx gonospina* Marinković, 1966, 112 = *Chaetopteryx. pyrenaica* Oláh & Vinçon, *2022*.

Remark. In the Aspe Valley (surroundings of Oueils d'Issaux) both siblings *C. decampsi* Oláh & Vinçon, 2022 and *C. pyrenaica* Oláh & Vinçon, 2022 are sympatric (Map 4).

Chaetopteryx lusitanica Malicky, 1974

Material examined. **Spain**, Asturias, Somiedo, La Peral, brook and nice spring, from 1310m, 43.0409°N, 6.2519°W, to 1410m, 43.039°N, 6.2555°W, 13.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Leon, NE Aralla de Luna, nice brook, 1370m, 42.909°N, 5.8274°W, 14.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Leon, Puerto de Leitariegos, nice spring, 1480m, 42.9837°N, 6.409°W, 13.X.2022, leg. Gilles Vinçon (2 males, 3 females; OPC). **Spain,** Cantabria, Puerto del Ponton, Fuente del Infierno, brook and spring, 1260m, 43.1023°N, 5.0303°W, 12.X.2022, leg. G. Vinçon (1 male, OPC).

Chaetopteryx tomaszewski Moretti, 1991

Material examined. **France,** Alpes-de-Haute-Provence, N.W. La Bâtie, Couissine brook and lateral spring, 1000 m, 43.8172°N, 6.5943°E, 5.I.2022, leg. G. Vinçon (1 male, 1 female; OPC). France, Alpes-de-Haute-Provence, Above Castellane, Lecques Pass, brook, 1220 m, 43.875°N, 6.464°E, 5.I.2022, leg. G. Vinçon (1 male, 1 female; OPC).

Remarks. Apicomesal process on the aedeagus is more blunt compared to populations from Toscana, Italy as well as from Alpes-Maritimes, France. The single male specimen collected from the same habitat in 23.X.2021 by G. Vinçon exhibited similar divergences from the populations of locus typicus. It is possible that populations from Alpes-de-Haute-Provence may represent a distinct new sibling species. However, more specimens are required to examine the stability of this speciation trait splitting siblings in the *Chaetopteryx gessneri* species complex. This species is new for the French Fauna.

Chaetopteryx villosa (Fabricius, 1798)

Material examined. **France,** Pyrénées-Atlantiques, Osse-en-Aspe, Oueils d'Issaux, nice resurgence, 720m, 43.0045°N, 0.693°W, 10.X. 2022, leg. Gilles Vinçon (1 male, OPC). France, Pyrénées-Atlantiques, Iraty, resurgence, 1100m,

43.0451°N, 1.0546°W, 10.X.2022, leg. Gilles Vinçon (1 female, OPC). France, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, brook and spring, 1740m, 42.4459°N, 2.4155°E, 15.X.2022, leg. Gilles Vinçon (2 males, 2 females; OPC). France, Ariège, Vicdessos, Las Rougos, Pla de l'Izard, Mounicou tributary, spring and brook, 1220m, 42.6956°N, 1.451°E, 8.X.2022, leg. Gilles Vinçon (9 males, OPC). France, Pyrénées-Orientales, Canigou Massif, above Py, Rotja tributary, 1530m, lateral spring, 42.48375°N, 2.3246°E, 7.X.2022, leg. Gilles Vinçon (8 males, OPC). France, Ariège, Vicdessos, Videssos River at Mounicou, nice river with abundant aquatic vegetation, 1110 m, 42.70775° N, 1.4503°E, 8.X0.2022, leg. Gilles Vinçon (4 males, 2 females; OPC). France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, 1900m, 42.556°N, 1.768°E, 8.X.2022, leg. Gilles Vinçon (14 males, 4 females; OPC). France, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, brooklet and spring, 1860m, 42.4523°N, 2.4102°E, 15.X.2022, leg. Gilles Vinçon (4 males, 2 females; OPC). France, Haute-Garonne, Bagnère-de-Luchon, Pique Valley above Hospice de France, Pique spring, 1450m, 42.7168°N, 0.6536°E, 9.X.2022, leg. Gilles Vinçon (14 males, 6 females; OPC). France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, nice brook and lateral springs, 2170m, 42.5426°N, 1.76°E, 8.X. 2022, leg. Gilles Vinçon (5 males, 2 females; OPC). France, Pyrénées-Orientales, Canigou Massif, above Py, Rotja tributary, 1530m, nice brook, 42.4838°N, 2.3245°E, 7.X.2022, leg. G. Vinçon (3 males 2 females; OPC). **Spain,** Burgos, Espinosa de los Monteros, Portillo de Las Estecas de Trueba, Fuente Cornejo, spring, 1030m, 43.1115°N, 3.6786°W, 11.X.2022, leg. Gilles Vinçon (1 male, OPC).

Stenophylacini Schmid, 1955

Allogamus brauerii (Kolenati, 1859)

Material examined. France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, nice brook and lateral springs, 2170m, 42.5426°N, 1.76°E, 8.X.2022, leg. Gilles Vinçon (2 males, OPC).

Allogamus fuesunae Malicky, 2004

Material examined. France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, nice brook and lateral springs, 2170m, 42.5426°N, 1.76°E, 8.X.2022, leg. Gilles Vinçon (1 male, OPC).

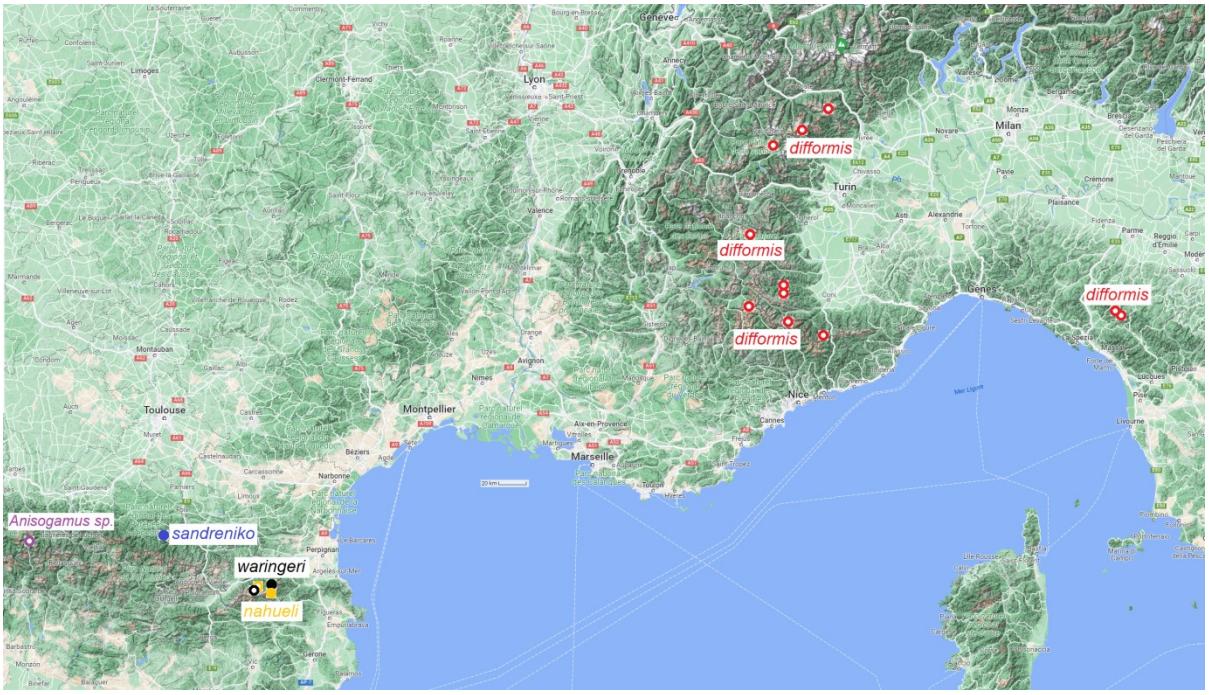
Allogamus laureatus (Navas, 1918)

Material examined. **Spain,** Asturias, Puerto de Leitariegos, Brañas de Arriba, nice spring, 1400m, 43.0128°N, 6.4451°W, 13.X.2022, leg. Gilles Vinçon (1 male, 3 females; OPC).

Anisogamus McLachlan, 1874

(Map 5)

In the original genus description *Anisogamus* was placed close to *Stenophylax* (McLachlan, 1874, 1875). Schmid (1955) related it to *Potamophylax*. The following genital character state combination for the *Anisogamus* genus was elaborated in a lineage sorting study on the entire Limnephilinae subfamily (Oláh *et al*. 2019) (1) Presence (apomorphic) of spinulose protuberance on tergite VIII; (2) Reduced (apomorphic) state of tergite IX; (3) Setose inerm (plesiomorphic) state of cerci without sclerotic enforcement; (4) Produced (plesiomorphic) state of the dorsal branch of paraproct; (5) Separate free from each-other (plesiomorphic) state of the dorsal branch of paraproct; (6) Separate free-from-cerci (plesiomorphic) state of the dorsal branch of paraproct; (7) Reduced (apomorphic) state of the ventral branch of paraproct; (8) Separate free from each-other (plesiomorphic) state of the ventral branches of paraproct. This character state combination was based on the taxonomy of the type species *Anisogamus difformis* (McLachlan, 1867) but valid also for its sibling species *A. waringeri* Graf & Vitecek, 2015 and *A. nahueli* sp. nov. Discovering in France (see below: Pyrenean Ariège), a rather modified lineage in the *Anisogamus* genus and describing here as *Anisogamus sandreniko* sp.



Map 5 Distribution of the *Anisogamus* genus in the western Alps, northern Apennines and eastern Pyrenees (full circles represent the type localities).

nov. has modified significantly the character state combination of the *Anisogamus* genus. In the new lineage the tergite IX is not reduced, rather produced and the dorsal branch of the paraproct is vestigial, indiscernible, almost disappeared.

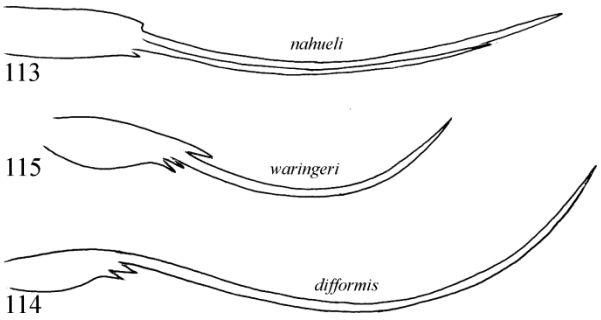
Paramere organisation proved to be the single speciation trait separating it to the three sibling species of the genus. The paramere of the phallic organ is a pair of simple spine-like, spiniform rods with upward turning apical portion; paramere surface is glabrous; the subapical region has corrugated-striated surface; the very tip of the paramere glabrous again without corrugations. The paramere of the new lineage has the same spine-like architecture, but more stout and with bifid apical head.

Remarks. The type species *A. difformis* populates crenal and epirhithral alpine habitats and of the Alps and was recently collected in Toscana (Oláh *et al*. 2022). A sibling species, *A. waringeri* Graf & Vitecek, was described (Graf *et al*. 2015) from the Pyrenees with well-defined divergences in the paramere organisation. The paramere of *A. waringeri* is shorter and supplied with dorsomesal tine on the apical ending of the basal bulbous part lacking at *A. difformis*. One of the tiny ventral tines of *A. difformis* has developed into a long spine at *Anisogamus nahueli* sp. nov. The variability/stability of paramere divergences was not examined comparatively in details due to lack of adequate number of specimens. We have found stable fine structures on the parameres at all of the examined specimens of *A. difformis*, well discernible paramere asymmetry among the 9 specimens of *A. nahueli* sp. nov. as well as stable bifid paramere head at all of the 12 paratypes of *A. sandreniko* sp. nov.

Anisogamus difformis (McLachlan, 1867)

(Figure 114) (Map 5)

Material examined. **Italy,** Piemont, above Limonetto, < Lago dell Abisso, spring, 2200m, 44.1398°N, 7.5186°E, 16.VII.2022, leg. G. Vinçon (7 males, 4 females; OPC).



Figures 113–115. Lateral profile of the parameres in the *Anisogamus* genus. 113 = *A. nahueli* sp. nov, 114 = *A. difformis* (McLachlan, 1867) 115 = *A. waringeri* Graf & Vitecek, 2015.

Anisogamus nahueli sp. nov.

(Figure 113) (Map 5) (Photos 10, 11)

Material examined. Holotype: **France,** Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, nice brook and spring, 1860 m, 42.4523°N, 2.4102°E, 30.IV.2022, leg. G. Vinçon (1 male, OPC). Paratypes: same as holotype (7 males, OPC). France, Pyrénées-Orientales, Canigou Massif, above Mantet, Rotja tributary, 1850 m, nice big spring, 42.4755N, 2.325E, 14.IV. 2022, leg. G. Vinçon (1 male, 1 female; OPC).

Diagnosis. It was a great surprise to discover this unique species on both slopes of the Canigou Massif, not far from the locus typicus of *Anisogamus waringeri* located on the northern slope of the same mountain range. Actually, we have found more divergences (Figures 108–110) between *A. nahueli* sp. nov. living nearby to *A. waringeri* and the other two species *A. difformis*, *A. waringeri* than between *A. difformis* and *A. waringeri* living far from each other's due probably to character displacement in reinforcement processes of speciation. Strictly speaking there are no real differences in the structure of the periphallic organs between the three species of this small genus, except perhaps the apical length of the gonopods. The difference between *A. difformis* and *A. waringeri* is almost limited to the presence of the single tiny tine on the apicodorsal region of the paramere basement, beside the abbreviation of the entire paramere of *A. waringeri*. This subtle divergence seems to be stable at least our discovery of *A. waringeri* in a new habitat (see below) confirms the stability of this small character state divergence. However, there are more distinct, definite divergence in the structure of the parameres of the new species, *Anisogamus nahueli* sp. nov. In the new species one of the short tiny ventral tines is developed into a long secondary spine. However, examining the 12 paratypes there is a pronounced paramere asymmetry in the length of the long secondary spine.

Description. Similarly both to *Anisogamus difformis* (McLachlan, 1867) and *A. waringeri* Graf & Vitecek, 2015, this new species has yellow, fawn ochraceous colour. The basic architecture of the genitalia is almost identical to the above listed two species. Apical region of the gonopods appears similar to *A. waringeri*, a little longer and more slender than *A. difformis*. The paramere has unique structure; the spine-like paramere shaft is almost doubled. The main shaft is accompanied by a long spine, little shorter than the main paramere shaft with a tendency to paramere asymmetry as well as with a certain range of variation in the length of the second spine.

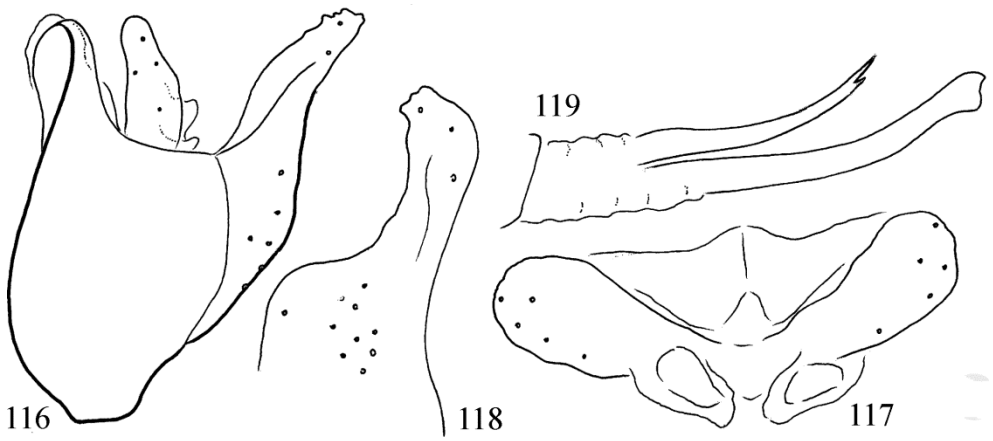
Etymology. This species was dedicated to Nahuel, newly born grandson of the collector Gilles Vinçon, son of Amélia Vinçon.

Anisogamus sandreniko sp. nov.

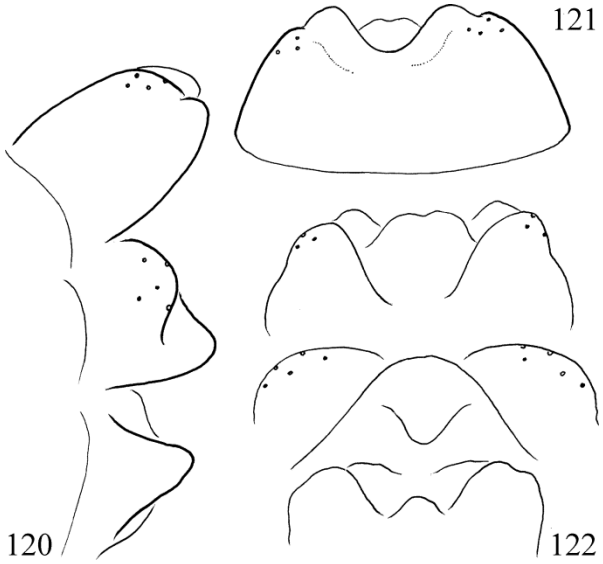
(Figures 116–122) (Map 5) (Photos 1, 2)

*Material examined***.** Holotype**: France**, Ariège, path to Arlu Lake, nice spring, 1650m, 42.8142° N, 1.438°E, 9.X.2022, leg. Gilles Vinçon (1 male, OPC). Allotype: same as holotype (1 female, OPC). Paratypes: same as holotype (12 males, 2 females; OPC).

Diagnosis. The known members of the genus *Anisogamus* have very conservative genital structure. Especially the periphallic organs are stable. Speciation is realised by subtle divergences of the paramere. The new species of



Figures 116–119. *Anisogamus sandreniko* sp. nov. Holotype male: 116 = genitalia in lateral view; 117 = Cerci with the ventral arm of paraproct and the dorsum of segment IX in caudal view; 118 = left gonopod in ventral view; 119 = phallic organ in lateral view.



Figures 120–122. *Anisogamus sandreniko* sp. nov. Allotype female: 120 = genitalia in lateral view; 121 = genitalia in dorsal view; 122 = genitalia in ventral view.

Anisogamus sandreniko is a highly modified taxon. Dorsum of segment IX produced, dorsal arm of paraproct lost and the gonopods modified. Such a great change in the genitalia is considered to occur on genus level of lineages. However, we retain this new lineage in the *Anisogamus* genus because of the unchanged habitus of the male and particularly because of the unmodified female. The modification is restricted to male genital structure as well as to the reduced male spur number of 034.

Description. Similarly to all *Anisogamus* species, this new highly modified species has preserved the typical yellow, fawn ochraceous colour as well as the pronounced sexual dimorphism of female brachyptery, but the spur formula has been reduced from 134 to 034 at the male, but preserved 134 at the female. The character state combination of the genital architecture is highly modified having the dorsal arm of the paraproct reduced, vestigial; it is almost completely disappeared. Dorsum of segment IX produced. Gonopods elongated enforced, particularly their apical region highly sclerotized and dentate.

Etymology. This unique, highly modified *Anisogamus* species or a possible representative of a new genus was dedicated to the granddaughters of the first author. The name was coined from their names Sandra and Enikő, as a noun in apposition: *sandreniko*.

Anisogamus waringeri Graf & Vitecek, 2015

(Figure 115) (Map 5) (Photo 11)

Material examined. **France,** Pyrénées-Orientales, Canigou Massif, above Mantet Pass, Rotja

tributary, 1850m, big spring, 42.4755°N, 2.325°E, 7.X.2022, leg. Gilles Vinçon (1 male, OPC).

Consorophylax kimera (Oláh & Vinçon, 2021)

(Map 6)

Material examined. **France,** Pyrénées-Orientales, Puigmal Massif, Ribera d'Err, 1900–2200 m, 42.3855°N, 2.0926°E, 14.IV.2022, leg. G. Vinçon (22 males, 3 females; OPC). **Italy,** Piemont, Pennines Alps, high Sesia Valley, above Sant' Antonio, big spring below Lago Nero, 2630 m, 45.814°N, 7.88°E, 26.V.2022, leg. G. Vinçon (1 male, 4 females; OPC). Italy, Aosta Valley, High Ayas Valley, above St Jacques, near 'Alpe Mase', nice spring, 2400 m, 45.8929°N, 7.7039° E, 11.VI.2022, leg. G. Vinçon (1 female, OPC). **Italy,** Dolomiti, S.E. Moso, Parco Naturale Tre Cime, many springs below water captures, trib. Rio Bianco, 1650 m, 46.6557°N, 12.4062°E, 24. V.2022, leg. Gilles Vinçon (8 males, 4 females; OPC). Italy, Rhaetian Alps, Livigno, N. slope of Passo del Foscagno, brook and spring, 2270 m, 46.4979°N, 10.2051°E. 25.V.2022, leg. G. Vinçon (1 male, OPC).

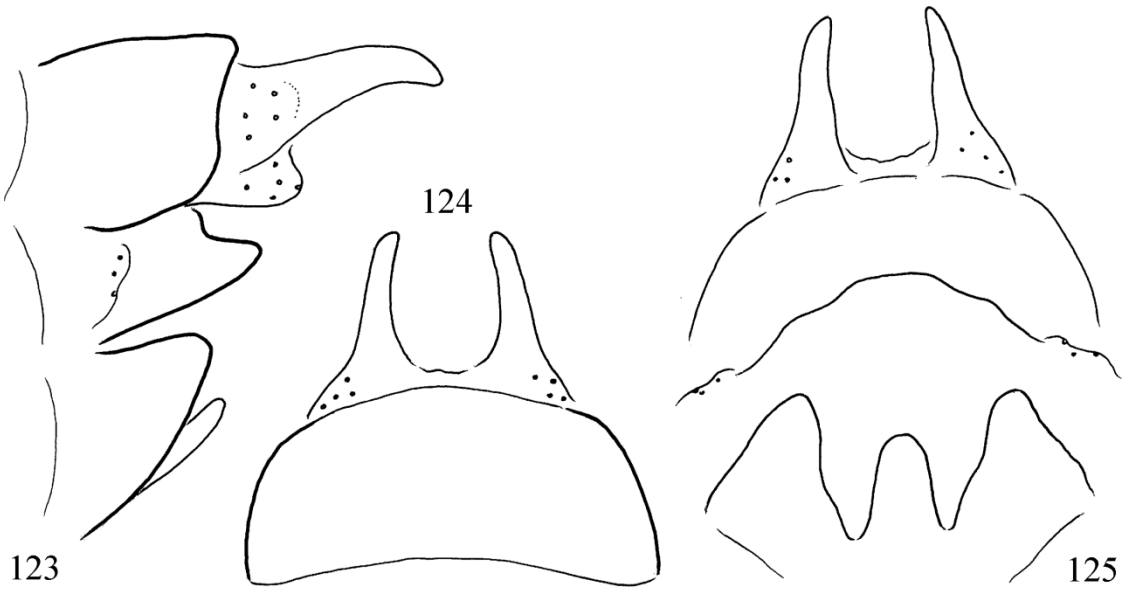
Remarks. This species was only known from the Italian Alps. It is new for France and also the first mention of the genus *Consorophylax* in the Pyrenees (Map 6). The general tendency for brachyptery is lacking at specimens from the Dolomiti.

Consorophylax vellach sp. nov.

(Figures 123–125) (Photos 12, 13)

*Material examined***.** Holotype: **Austria,** Kärnten, S. Bad Vellach, Vrnik-Quelle, spring, 1380 m, 46.4214°N, 14.5723°E and brook, 1060 m, 46.4192N, 14.5607E, 22.V.2022, leg. G. Vinçon (1 female, OPC).

Diagnosis. This new species in the *Consorophylax* genus is described by a single beautyful female with remarkably brown-banded and light-spotted forewing. Its genital structure is diverged from all the female genitalia known in the genus (*cairos*, *carinthiacus*, *consors*, *juliae*, *kimera*, *lagoverde*, *montivagus*, *seolan*, *styriacus*, *vinconi*) by the extremely elongated digitiform lobes with downward turning apices on segment X and the males without known females are not banded and not spotted on forewing conspicuously (*corvo*, *delmastroi*, *lepontiorum*, *livek*, *piemontanus*).



Figures 123–125. *Consorophylax fellach* sp. nov. Holotype female: 123 = genitalia in lateral view; 124 = genitalia in dorsal view; 125 = genitalia in ventral view.

Map 6. Distribution of *Consorophylax kimera* in the Alps and eastern Pyrenees (full circles represent the type localities).

Description. Female (in alcohol). This is a brown species with light brown cephalic and thoracic sclerites and with variously lighter appendages. Forewing with strong, erect spine-like setae on the longitudinal veins; membrane mostly covered with tiny recumbent setae; forewing length 9 mm. Forewing is broad and beautifully patterned. Most of the longitudinal veins accompanied with darker brown band; bands are less pronounced along R1 and anal veins. Forewing membrane is remarkably light-spotted with spot-size of around the cell-size. Tibial spur number 134.

Female genitalia. Female genitalia is characterized with elongated two partited anal tube, formed by the complex of the fused tergite IX and segment X, basal part is almost quadrangular in dorsal view and the apical part is composed of two slender digitiform and elongated lateral lobes. Sternite IX is without true setal surface like at other member of this genus, but this new species retained some area with a few setae; the mesal plate with ventral lobe as visible in lateral view; it is rounded in ventral view; this usually glabrous ventral surface of sternite IX functions like the upper vaginal lip present as a free supragenital plate. The lower vaginal lip, the vulvar scale is visible somewhat separated from sternite VIII by its more sclerotized structure; the mesal lobe is shorter than the lateral lobes.

Etymology. Coined after the name of the Locus Typicus, a noun in apposition.

Enoicyla pusilla (Burmeister, 1839)

Material examined. **France,** Ariège, Vicdessos, Videssos River at Mounicou, nice river with abundant aquatic vegetation, 1110 m, 42.70775° N, 1.4503°E, 8.X0.2022, leg. Gilles Vinçon (1 male, OPC). **Spain**, Asturias, Puerto de Tarna, brook and springs, from 1130m, 43.1095°N, 5.2188°W, to 1220m, 43.1073°N, 5.2159°W, 12. X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Asturias, Somiedo, La Peral, brook and nice

spring, from 1310m, 43.0409°N, 6.2519°W, to 1410m, 43.039°N, 6.2555°W, 13.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain**,** Asturias, Somiedo, La Peral, brook and nice spring, 1360m, 43.0384°N, 6.2499°W, 13.X.2022, leg. Gilles Vinçon (2 males, OPC). Spain, Leon, NE Aralla de Luna, nice brook, 1370m, 42.909°N, 5.8274° W, 14.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Asturias, Puerto del Palo Allande, brook and spring, from 950m, 43.2778°N, 6.6681°W, up to 1000m, 43.2764°N, 6.6725°W, 13.X.2022, leg. Gilles Vinçon (1 male, OPC).

Halesus rubricollis **(Pictet, 1834)**

Material examined. **France,** Alpes-de-Haute-Provence, Laverq Valley, brook, 2230 m, 44.305°N, 6.5136°E, 16.VII.2022, leg. G. Vinçon (1 male, OPC).

Parachiona picicornis**, Pictet, 1834**

Material examined. **Slovenia,** Julian Alps, S. Vrsic Pass, Minarica trib., nice spring, 1300 m, 46.4113°N, 13.7515°E, 21.V.2022, leg. G. Vinçon (1 male, OPC).

Potamophylax albergaria **Malicky,1976**

Material examined. **Spain,** Asturias, North Pola de Allande, nice springs, 750m, 43.2862°N, 6.6136°W, 13.X.2022, leg. Gilles Vinçon (1 male, OPC). Spain, Asturias, Puerto del Palo Allande, brook and spring, from 950m, 43.2778°N, 6.6681°W, up to 1000m, 43.2764°N, 6.6725°W, 13.X.2022, leg. Gilles Vinçon (6 males, OPC).

Potamophylax asturicus **Martinez, Martin & González, 2016**

*Material examined***. Spain,** Asturias, Puerto de Tarna, brook and springs, from 1130m, 43.1095° N, 5.2188°W, to 1220m, 43.1073°N, 5.2159°W, 12.X.2022, leg. Gilles Vinçon (1 male, OPC).

Potamophylax inermis **Moretti & Cianficconi, 1994**

*Material examined***. Italy,** Marches, Parco Nazionale dei Monti Sibillini, Panico Valley, nice brook and spring, 1180 m, 42.945°N, 13.1995°E, 18.V.2022, leg. G. Vinçon (3 males, 5 females, OPC).

Simaphylax andorricus **Oláh & Vinçon, 2022**

Material examined. **France,** Pyrénées-Orientales, Puigmal Massif, Ribera d'Err, brook and spring, 2380m, 42.3882°N, 2.105°E, 7.X.2022, leg. Gilles Vinçon (1 male, OPC). France, Pyrénées-Orientales, Puigmal Massif, Ribera d'Err, lateral spring, 2140m, 42.3855°N, 2.0926°E, 7.X. 2022, leg. Gilles Vinçon (8 males, 2 females; OPC).

Simaphylax ariegeus **Oláh & Vinçon, 2022**

Material examined. **France**, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, 1900m, 42.556°N, 1.768°E, 8.X.2022, leg. Gilles Vinçon (3 males, 1 female; OPC). France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, nice brook and lateral springs, 2170m, 42.5426°N, 1.76°E, 8.X. 2022, leg. Gilles Vinçon (5 males, 2 females; OPC). France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, nice brook and lateral springs, 2170m, 42.5426°N, 1.76°E, 8.X. 2022, leg. Gilles Vinçon (12 males, 3 females; OPC). France, Pyrénées-Orientales, Canigou Massif, above Py, Rotja tributary, 1530m, nice brook, 42.4838°N, 2.3245°E, 7.X.2022, leg. G. Vinçon (1 male, 5 females; OPC). France, Pyrénées-Orientales, below Pas de la Case, rec del Baladrar torrent, nice lateral spring, 1990m, 42.55175°N, 1.76484°E, 8.X.2022, leg. G. Vinçon (6 male, 5 females; OPC).

Simaphylax orientalopyrenaeus **(Coppa, 2017)**

*Material examined***. France,** Pyrénées-Orientales, Canigou Massif, above Mantet Pass, Rotja tributary, 1870m, brook and spring, 42.4765°N, 2.3223°E, 7.X.2022, leg. Gilles Vinçon (1 male, OPC). France, Pyrénées-Orientales, Canigou Massif, Prats-de-Mollo-la-Preste, brook and spring, 1630m, 42.4348°N, 2.394°E, 15.X.2022, leg. G. Vinçon (1 male, 1 female, OPC).

Map 7. Distribution of the *Sericostoma flavicorne* group in Anatolia and Lebanon (full circles represent the type localities).

***Stenophylax permistus* McLachlan, 1895**

*Material examined***. Italy,** Ligurian Apennines, above Rocca d'Aveto, nice brook and spring, 1400 m, 44.555N, 9.4767E, 15.V.2022, leg. G. Vinçon (1 male, 1 female, OPC).

Odontoceridae

***Odontocerum albicorne* (Scopoli, 1763)**

Material examined. **France,** Isère, Taillefer Massif, below Brouffier lake, spring Guiliman tributary, 2050 m, 45.0355°N, 5.8861°E, 21.VII. 2022, leg. G. Vinçon (1 male, OPC). **Italy**, Molise, Castel San Vincenzo, River Volturno, 530 m, 41.654°N, 14.077°E, 19.V.2022, leg. G. Vinçon (6 males, 3 females; OPC).

Leptoceridae Leach, 1815

***Adicella meridionalis* Morton, 1906**

Material examined. **Portugal,** Serra da Estrela Massif, North Valezim, nice spring, 650 m, 40.3718°N, 7.713°W, 23.IV.2022, leg. G. Vinçon (1 male, OPC).

***Adicella reducta* (McLachlan, 1865)**

*Material examined***. Spain,** Castilla y Leon, Sierra de Candelario, Rio Becedillas at Becedas, 1110 m, 40.4013°N, 5.6371°W, 23.IV.2022, leg. G. Vinçon (1 male, OPC).

Beraeidae Wallengren, 1891

***Beraea dira* McLachlan, 1875**

Material examined. **Italy,** Julian Pre-Alps, road to Cepletischis, nice springs and seeping rocks, 340 m, 46.1701N, 13.5581E and 46.1703N, 13.5575E, 21.V.2022, leg. G. Vinçon (1 male, OPC).

Sericostomatidae Stephens, 1836

***Sericostoma* Latreille, 1825**

Sericostoma genus is considered from the very beginning (McLachlan, 1874-1880), until recently

(Malicky 2005), as one of the most difficult taxon among caddisflies. The discrimination or delineation of species in this genus presented unusual and grave difficulties, sometimes of artificial construct, wasteful byproduct of science, overly created by human limitations, including our hubristic and apophantic attitudes. Here, applying the paraproct as a speciation trait we delineate and specify each species lineages of the genus. However, in this survey we do not revise unsettled synonymies and poorly known species, instead we establish species groups and produce the lateral profile of the paraproct speciation traits for each species considered or proved to be valid with distinct and stable divergences in pure populations and taking into consideration the intermediate forms of the incipient sibling species under reinforcement with standing genetic variations and incomplete lineage sorting.

Having monotonous morphological characters, the present delineation of species in the *Sericostoma* genus is mainly, if not completely, based on the form of spines on segment X (Moretti & Cianficconi, 1978; Botosaneanu, 2000) that is on the shape of the paraproct and usually drawn and compared in lateral view. Already McLachlan (1876) considered that the superior and inferior appendages, the penis, the ventral process, and even the ventral triangle, do not, in most cases, furnish any good and safe characters, and there rest only the penis-sheaths, which do in many cases provide very satisfactory characters. According to McLachlan the penis-sheaths (paraproct), one of the primary sexual traits, are the most salient character in the *Sericostoma* genus. Corneous testaceous sheaths, shorter than the penis, and usually furcate or lanceolate at their tips (varying in form according to the species).

Species are separated both by reproductive isolation and by non-sexual differences in morphology and behaviour. Sexual mechanism is a fundamental function dominating in any kind of life beings. Environmental and sexual integration of any new species is a complex, interactive organisation. Male genitalia diverge more rapidly than any other morphological traits. Rapidly diverging primary sexual traits suggest directly and empirically that speciation is initiated, driven and completed more by sexual organisation (sexual selection according to the Darwinist) and less by adaptive organisation (natural selection). The high diversity of paraproct is the direct, unquestionable indication of its central role in the sexual integration resulting in speciation processes mostly in allopatric isolation.

The speciation trait of the paraproct in the *Sericostoma* genus that are the lateral spiniform processes of segment X is not examined systematically for trait stability. Most species have rather peculiar shape divergence without creating any difficulties in species delineation. Only some species in the *Sericostoma personatum* and *S. vittatum* species complexes are experienced having rather wide range of variability in the lateral profile of the paraproct.

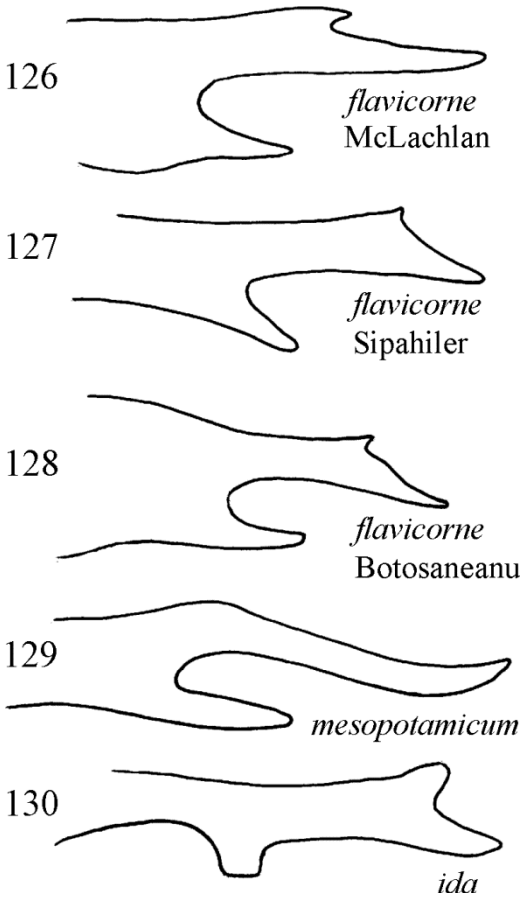
In practice, there are significant intermediate/intermedier paraproct shapes detected between species of *Sericostoma baeticum* and S. *vittatum* as well as between *S. pedemontanum* and *S. personatum*. However all the four species have very distinct and peculiar lateral profile of the paraproct in pure populations and the observed shape variations are typical sign of standing genetic variation and incomplete lineage sorting of incipient siblings, as well as suggesting speciation processes under reinforcement by character displacement either in primary or in secondary contact zones and along contact clines.

Moreover, the observed and drawn variations in the lateral profile of the paraproct are frequently produced by the observer due to lack of experience, inadequate observing angle and drawing style, prejudiced/biassed attitude or are the result of mating battles. In worn *Sericostoma* male the apical branches of the paraproct are frequently broken in various positions resulted in apparent, unusual bifid apices, distorted prongs, abbreviations or even the complete disappearance of either the dorsal or ventral branch.

Sericostoma flavicorne species group

(Figures 126–130) (Map 7)

A small species group of enlarged maxillary palp with very long dorsal and very short ventral branches on the apical region of the paraproct. The dorsal branch has some additional dorsal elevation. Three species belong to this complex distributed in Turkey and in the Levant: *Sericostoma flavicorne* Schneider, 1845; *Sericostoma ida* Sipahiler, 2000; *Sericostoma mesopotamicum* McLachlan, 1898. All the three species are well differentiated, and easy to delineate by the lateral profile of the paraproct.



Figures 126–130. Lateral profile of the paraproct in the *Sericostoma flavicorne* species group. 126 = *Sericostoma flavicorne*, McLachlan's drawing; 127 = *S. flavicorne* Sipahiler's drawing; 128 = *S. flavicorne* Botosaneanu's drawing; 129 = *S. mesopotamicum*; 130 = *S. ida*.

Sericostoma flavicorne Schneider, 1845

(Figures 126–128) (Map 7)

Sericostoma flavicorne Schneider, 1845:155. "♂ von Kellemisch (Turkey: Gelemis). Nigrum; palpis maxillaribus cochleiformibus."

Sericostoma flavicorne Schneider, 1845: McLachlan 1880: 48. "I have seen Schneider's type, now in Hagen's collection. The antennae have decided traces of dark annulations in their basal portion; nevertheless, I think it may be distinct from *schneideri*. … the lower branch of the penis-sheaths is more considerably shorter than the upper, stouter and less contiguous."

Sericostoma flavicorne Schneider, 1845: McLachlan 1898:49. "examples in Albarda's collection (whereof he presented me with one ♂) from Beirut, Syria pertain here. The penis-sheaths show an approach towards a condition sometimes present in *S. personatum*. There now seems no reason to doubt its distinctness from *S. schneideri*." Excellent drawing is produced about the lateral profile of the apical region of the paraproct with short ventral branch and long dorsal branch; there is a pointed prong subapicad on the dorsum of the dorsal branch.

Sericostoma flavicorne Schneider, 1845: Botosaneanu 1992: 266–267. "a distinct species probably present exclusively in Asia Minor and the Levant." The lateral profile of the paraproct apical region of four specimens from the Levant has exactly the same pattern as drawn by McLachlan (1898): short ventral branch, long dorsal branch with subapical dorsal prong.

Sericostoma flavicorne Schneider, 1845: Sipahiler 2000:23–24. Examination and drawings of newly collected specimens nearby to locus typicus in Turkey confirmed the structural pattern of the paraproct presented first by McLachlan (1898).

Sericostoma flavicorne Schneider, 1845: Botosaneanu 2001:518. "Schneider (1845: 155) described *Sericostoma flavicorne*, based on a ♂ specimen from a locality in SW Anatolia ("Kellemisch"; presently: Gelemis, a locality near the Mediterranean shores of Anatolia in one of the southernmost points, on a tributary of river Esen in its lower course)." "I could study the type specimen of *S. flavicorne* (from H. Hagen's collection; kept in the MZC)." The lateral profile of the paraproct apical region of the holotype from Turkey has exactly the same pattern as presented first by McLachlan (1898) from specimen collected in Beirut.

Diagnosis. Holotype paraproct: upper branch considerably longer than the small, spiniform lower branch, and always anteapically bearing a short dorsal prong or point (Botosaneanu 2001).

Remarks. It was simply a prejudiced/biassed attitude (Malicky 2005) to question the identity of *Sericostoma flavicorne* Schneider, 1845 and trouble the delineation between *S. flavicorne* and *S. schneideri* (Kolenati, 1848). Especially after published redrawings of type specimens of both species became available (Botosaneanu 2001). Not speaking about the long availability of the excellent drawings about the paraproct of the type specimen published already by McLachlan (1898). The same quality of excellent drawings was also available (McLachlan 1876, 1880) for the paraproct lateral profile of the other species *Sericostoma schneideri* (Kolenati, 1848). Difficult to understand why was any kind of questioning regarding the reliable delineation between *S. flavicorne* and *S. schneideri* having so different, clearly distinguishable paraproct structures.

Sericostoma ida Sipahiler, 2000

(Figure 130) (Map 7)

Sericostoma ida Sipahiler, 2000:24–25. "This species was found in the Kazdag (Ida Mountains) in northwestern Anatolia. Holotype male and paratypes (3 females): Turkey, Balikesir, 25 km east of Edremit, Güre-Zeytinli, Kazdaglari, 400 m, Ayi deresi, (39°40'N; 26°49'E), 7.VIII.1994." "Closely related to *S. flavicorne* Schneider."

Sericostoma mesopotamicum McLachlan, 1898

(Figure 129) (Map 7)

Sericostoma mesopotamicum McLachlan, 1898: 49. "Maxillary palpi of ♂ very prominent. A very distinct form, in consequence of the great disproportion of the two branches of the penis sheaths." "Mesopotamia (Malatia, 4♂, Albarda's and my collection)."

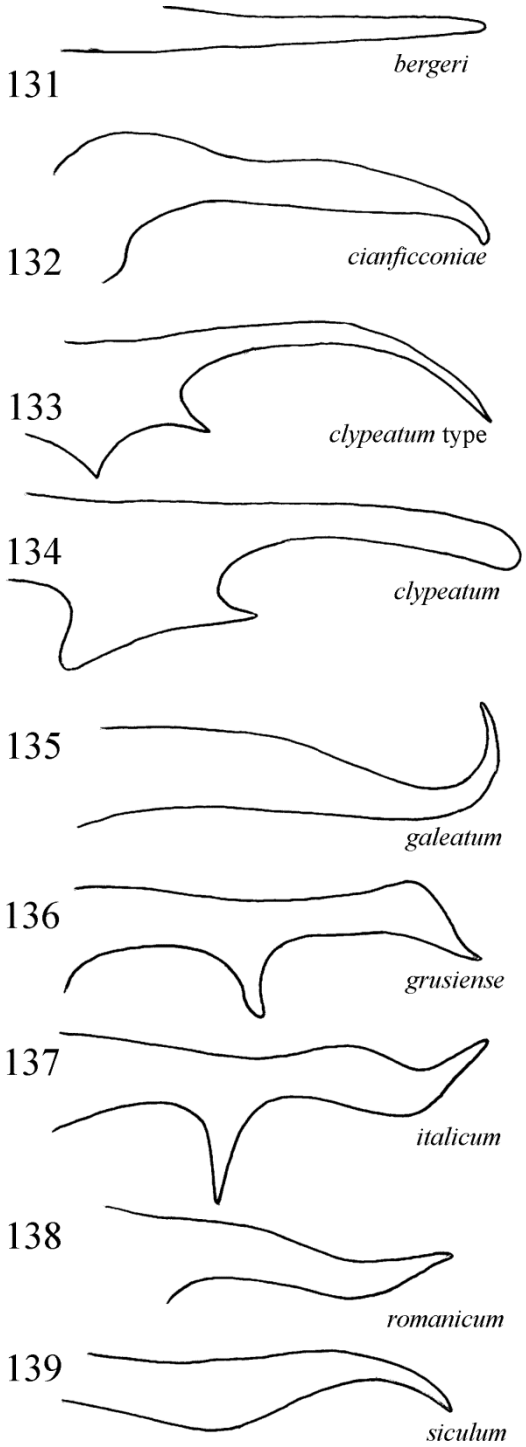
Sericostoma mesopotamicum McLachlan, 1898: Botosaneanu 1992:266. "Mention should be made of *Sericostoma mesopotamicum* McLachlan, 1898; I shall not discuss the problem of its validity as a good species (this seems unlikely); the point is that it was described from "Mesopotamia, Malatia", but there is no Malatia in Mesopotamia (instead, there is one in Asia Minor, and a"Malatie" in Egypt)."

Sericostoma mesopotamicum McLachlan, 1898: Botosaneanu 2004:177. "McLachlan (1898) described and illustrated this species from a specimen caught in "Mesopotamia (Malatia)"; Malatia is in central-eastern Anatolia. No subsequent recording of *S. mesopotanicum* is known, and in Botosaneanu (1992:266) the opinion is expressed that this is unlikely a good species. Most to my surprise I have found in the Z.M.A. collections 4 males and 1 female of *S. mesopotamicum* sampled in Anatolia by Dutch entomologists and perfectly matching McLachlan's description and illustration. The sampling data are as follows: 1 male "Nigde, 10 km S of Camardi, 1,300 m., 30.VI.1982, H. v. Oorschot & H. v. d. Brink"; 1 male "Sivas, Env. Gökpinar, 10 km S. of Gürün, 1,500-1,700 m, 30.VII.-2.VIIII.1983, H. v. Oorschot, H. v. d. Brink & H. Wiering"; 2 males, 1 female "Hakkari, W. side and E. side Suvarihalil Gecidi, 1,900–2,250 m, 14.VI. 1985, H. v. Oorschot & H. v. d. Brink"."

Sericostoma galeatum species group

(Figures 131–139) (Map 8)

This species group could be the putative ancestral group distributed more widely, represented also in the Caucasus. However, its paraproct is apomorphic, at least if we follow the principles "complex is plesiomorphic". According to Williston (1914), Ross (1956) and Schmid (1979) structures tend toward reduction (Oláh *et al.* 2014). Species in the *Sericostoma galeatum* group have simple, lanceolate apical region that is narrow and tapering to a point, not furcate. There are eight species in this group with simple monolobed apical region. We simply list the members of this group with their taxonomic history and present their paraproct lateral profile to distinguish them easily in routine determination procedures: *Sericostoma bergeri* Malicky, 1973; *Sericostoma cianficconiae* Moretti, 1978; *Sericostoma clypeatum* Hagen, 1864; *Sericostoma galeatum* Rambur, 1842; *Sericostoma grusiense* Martynov, 1913; *Sericostoma italicum* Moretti, 1978; *Sericostoma romanicum* Navas, 1930; *Sericostoma siculum* McLachlan, 1876.



Figures 131–139. Lateral profile of the paraproct in the *Sericostoma galeatum* species group. 131 = *Sericostoma bergeri*; 132 = *S. cianficconiae*; 133= holotype of *S. clypeatum*; 134 = putative new species from Corsica; 135 = *S. galeatum;* 136 = *S. grusiense*; 137 = *S. italicum*; 138 = *S. romanicum*; 139 = *S. siculum*.

***Sericostoma bergeri* Malicky, 1973**

(Figure 131) (Map 8)

Sericostoma bergeri Malicky, 1973:249–251. "Holotypus ♂, Allotypus ♀ und mehrere Paratypen: Graecia, Insel Andros,: Andros, 27.V.1973. Weitere Paratypen: Insel Andros: Apikia, 29.V.1973. Alle in meiner Sammlung. Diese Art steht durch die Form der Seitenteile des 10. Segments, der unteren Anhänge und des Ventralteiles des 9. Segments innerhalb der Gattung isoliert."

***Sericostoma cianficconiae* Moretti, 1978**

(Figure 132) (Map 8)

Sericostoma cianficconii Moretti, 1978:9. "This species was previously assigned, with reserve, by one of us (Moretti) to *S. siculum*, but the differences that emerged from a subsequent direct comparison with specimens belonging to *S. siculum* made it necessary to separate it from this species and to create a new one. It has been found in Emilia, Apuanian Mountains, the Marches and in Umbria" Unfortunately there is no holotype with locus typicus designated. The species description was accompanied with a note "The *S. cianficconii* and *S. italicum* species have already been described in a special paper, now being printed." However this paper with holotype and locus typicus designation has not been printed. We are unable to map its exact locus typicus. Instead we map the approximate empirical centre of the distributional area suggested by listing the provinces where *S. cianficconiae* was collected.

Material examined. **Italy**, Calabria, Aspromonte, 2 nice brooklets separated by about 10 m, with mosses and dripping rocks, 38.25°N, 15.853°E, 850–900 m, 7.IX.2020, leg. Gilles Vinçon (2 males, OPC).

***Sericostoma clypeatum* Hagen, 1864**

(Figures 133–134) (Map 8)

Sericostoma clypeatum Hagen, 1864:43. "Névroptères de la Corse.""Les intermédiaires aussi longs que les inférieurs, leur branche interne peu visible, tournée en bas, formant un crochet court au milieu des appendices intermédiaires, la branche externe très longue, en lame aplatie."

Material examined. **France**, Corsica, Haute-Corse, Castifao, Ponte Carnispola, 274 m, 14.X. 1999, leg. Salmini (1 male, 1 female; OPC).

Remarks. We have a single male identified as *Sericostoma clypeatum* Hagen, 1864 and presented to our collection by the Bergamo Museum. After clearing, cleaning and drawing the paraproct lateral profile we were surpised to recognise an entirely new taxon with the same basic paraproct architecture characterising the known species of Corsica, *Sericostoma clypeatum* but with significantly diverged substructures. It would be reasonable to re-examine the taxonomic status of the *Sericostoma* populations in Corsica in a comprehensive sampling programme. Malicky (2010) has separated two very closely related species in Sicily in a carefully planned and sampled study with less diverged substructures.

Sericostoma galeatum Rambur, 1842

(Figure 135) (Map 8)

Sericostoma galeatum Rambur, 1842:95–96. "Habite le midi de la France. C'est brobablement l'espèce qui a servi de type à Latreille pour la création de ce genre."

Sericostoma grusiense Martynov, 1913

(Figures 136) (Map 8)

Sericostoma grusiense Martynov, 1913:64–67. Translated from Russian: „6♂, 1♀, Forested stream at Baisubani near village Mihailovki, 19.VI.1919, (leg. A. Martynov)."Species close to *S. baeticum* Pict. and *S. vittatum* Ramb., especially to the first.

Material examined. Caucasus, Armenia, Alagez, Inaklju, 27.VII.1934 (1 male, 2 females; OPC).

Sericostoma italicum Moretti, 1978

(Figure 137) (Map 8)

Sericostoma italicum Moretti, 1978:10–12. "The appendages of segment X, seen from above, appear to be convergent or crossed and the ventral teeth are strong, robust, long, turned outwards and a little backwards." It is found in a well defined and continuous area, namely Tuscany, and the Apuanian Mountains, Umbria, Latium, Abruzzo, Molise and Campania Unfortunately there is no holotype with locus typicus designated. The species description was accompanied with a note "The *S. cianficconii* and *S. italicum* species have already been described in a special paper, now being printed." However this paper with holotype and locus typicus designation has not been printed. We are unable to map its exact locus typicus. Instead we map the approximate empirical centre of the distributional area suggested by listing the provinces where *S. italicum* was collected.

Material examined. **Italy**, Abruzzi, Prati di Mezzo, spring below the water capture, 41.651N, 13.959E, 1700m, 1.VII.2020, leg. Gilles Vinçon (22 males, 4 females; OPC). **Italy,** Molise, Castel San Vincenzo, Sorgente Acquaruolo, 470 m, 41.6594N, 14.0783E, 19.V.2022, leg. G. Vinçon (8 males, 1 female; OPC).

Sericostoma romanicum Navas, 1930

(Figure 138) (Map 8)

Sericostoma romanicum Navas, 1930: 149–151. Italy, Emilia Romagna.

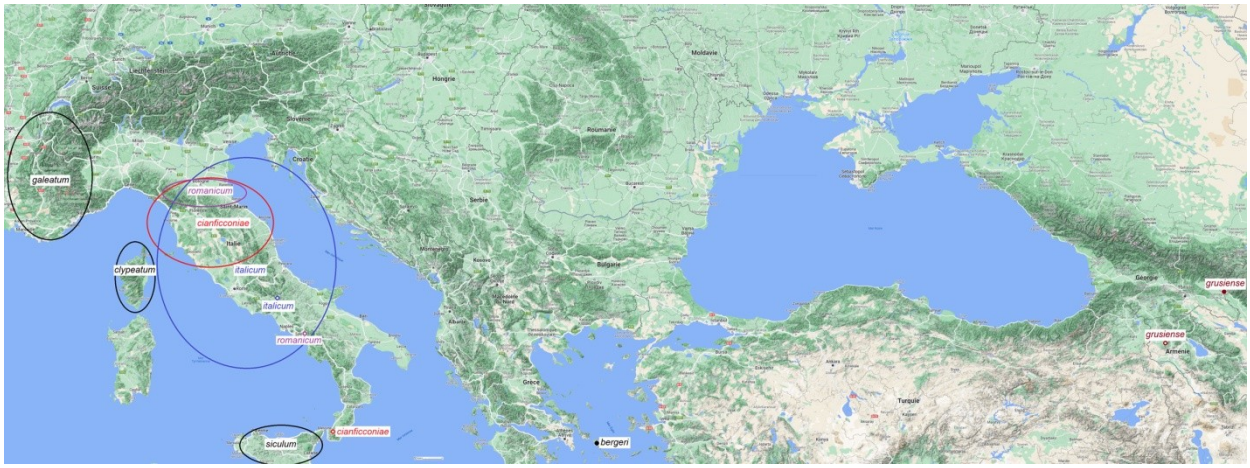
Sericostoma romanicum Navas, 1930: Malicky 2002: 11. „I, Rio Meri, 26.VI.2001 1♂, 1♀." "Die mittleren Anhänge sind ungeteilt, schlank, spitz und distal leicht nach oben gekrümmt."

Material examined. **Italy**, Campania, N Curticelle, N Giffoni Valle Piana, spring and brooklet, 720 – 820 m, 40.781°N, 14.924°E, 21.V.2021 leg. G. Vinçon (1 male, OPC).

Sericostoma siculum McLachlan, 1876

(Figure 139) (Map 8)

Sericostoma siculum McLachlan, 1876:232. "Sicily (Bellier de la Chavignerie), one ♂ in the De Selys1 collection." "In the ♂ the penis-sheaths are simple, the lower branch being entirely absent; the lower edge somewhat dilated before the slender apical portion, which is very slightly curved."



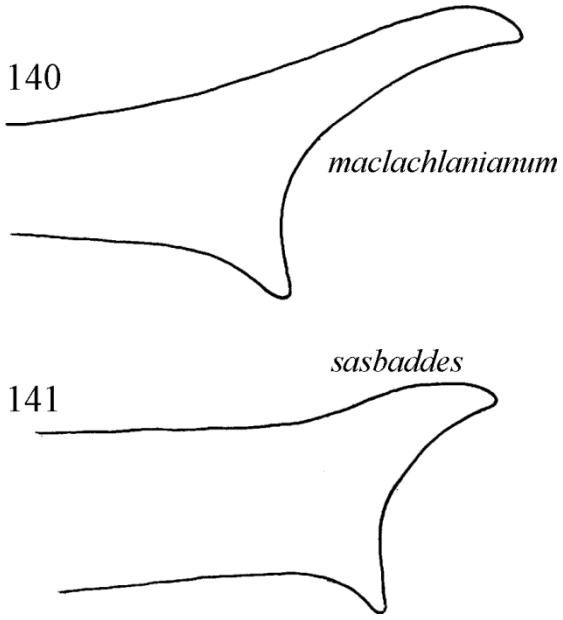
Map 8. Distribution of the *Sericostoma galeatum* group in Greece, Sardinia, and Spain (full circles represent the type localities).

Sericostoma maclachlanianum species complex

(Figures 140–141) (Map 9)

This small species complex represented by two species in Sardinia: *Sericostoma maclachlanianum* and *S. sasbaddes*. This is a species complex with maxillary palp slightly prominent. Paraproct is characterized by very widely opened abbreviated folk with broad short branches; dorsal branch longer; ventral branch is very short. The dorsal branch is longer at *S. maclachlanianum* that at *S. sasbaddes*. According to the widely opened terminal structure of the paraproct the *Sericostoma maclachlanianum* complex is close and has relation to the *Sericostoma vittatum complex*.

According to Malicky (2010) at some specimens the delineation of the two species with the length of the dorsal branch of the paraproct is not consistent. This is not surprising, it is rather a rule, a typical condition characterizing the development of incipient sibling species. However, it is remarkable how the divergence of the two lineages is realised in isolation by integrative organisation in a small Island. The divergence of such a genetically and spatially close lineages is detectable only by such a detailed sampling as realised in the detection of splitting and in the delineation of siblings as well as describing the new species, *S. sasbaddes* Malicky, 2010.



Figures 140–141. Lateral profile of the paraproct in the *Sericostoma maclachlanianum* species complex 140 = *S. maclachlanianum*; 141 = *S. sasbaddes.*

Sericostoma maclachlanianum Costa, 1884

(Figure 140) (Map 9)

Sericostoma maclachlanianum Costa, 1884:21. Sardinia!

Sericostoma maclachlanianum Costa, 1884: McLachlan 1884:22. “Island of Sardinia (Aritzo and the Mt. Gennargento, A. Costa, 2 ♂ in the Naples Museum;

Map 9. Distribution of the *Sericostoma maclachlanium* and *vittatum* groups in the Alps and Italian Peninsula (full circles represent the type localities).

also one in my own collection, presented to me by Prof. Costa).” Maxillary palpi of the ♂ slightly prominent.” “In the ♂ the upper branch of the penis-sheaths is long, nearly straight, or slightly curved downward at the tip (in one example the appendage seems slightly crenulated at the tip); lower branch shorter, directed downward almost at a right angle, triangular at the base, the apical portion slightly curved.” “Very distinct in the form of the penis-sheaths from anything known to me. In some respects intermediate between *clypeatum* (of Corsica) and *baeticum* (of Spain and Portugal), and, on the whole, probably more allied to the latter.”

Sericostoma maclachlanianum Costa, 1884: Malicky 2010:34. Typen stammen von Aritzo und vom Gennargentu-Gebirge (McLachlan, 1884:22).” „Wie die Karte zeigt, bewohnt *S. maclachlanianum* das Gennargentu Gebirge.”

Sericostoma sasbaddes Malicky, 2010

(Figure 141) (Map 9)

Sericostoma sasbaddes Malicky, 2010:31–33. „Holotypus ♂: Sardinien, Sas Baddes, 8°51’E, 40°25’N, 430m, 2.VI.1981, leg Malicky, in meiner Sammlung. Close to *S. maclachlanianum* Costa, 1884. „Characteristisch sind die mittleren Anhänge, die eine nach hinten und eine nach unten gerichtete Spitze haben, wobei die erste kürzer ist als bei maclachlanianum.”

Sericostoma personatum species group

(Figures 142–150) (Map 10)

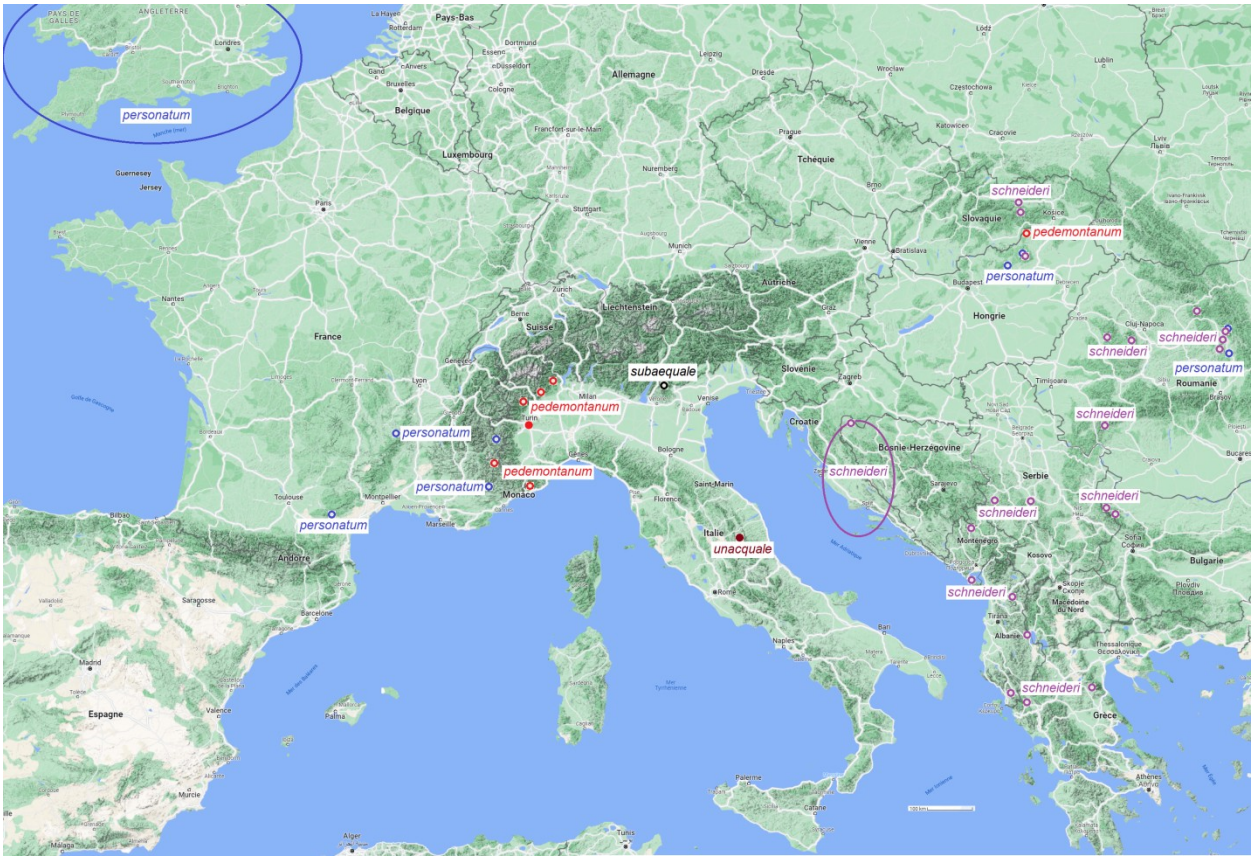
This species group has apical region of paraproct clearly simple furcate. The dorsal branch of paraproct is simple (typically) spine-like, usually a tapering pointed process as the dominant trait. Possibly the recessive (sleeping) traits of dorsal prong, tooth or corrugation on the dorsal branch could be present, infrequently observable as signs of standing genetic variation, incomplete lineage sorting or indication of reinforcement processes in contact zones or clines.

Five species belong to this group: *Sericostoma pedemontanum* McLachlan, 1876; *Sericostoma personatum* (Spence, 1826); *Sericostoma schneideri* (Kolenati, 1848); *Sericostoma subaequale* McLachlan, 1898; *Sericostoma unaequale* sp. nov.

Sericostoma pedemontanum McLachlan, 1876

(Figures 142, 147) (Map 10)

Sericostoma pedemontanum McLachlan, 1876:229. “Turin (Italy) (Ghiliani). I possess one ♂. Possibly only an extreme local form of *personatum*. Upper branch of the fork of the penis-sheaths much longer



Map 10. Distribution of the *Sericostoma personatum* group in Europe (full circles represent the type localities).

than the lower, slender, slightly curved, the two branches rather widely divergent."

Sericostoma pedemontanum McLachlan, 1876: McLachlan 1884:20–21. "My former *personatum* was in part made up of materials that I now consider to belong to *pedemontanum*. Regarding all the materials (200–300 examples) before me as pertaining to one species, this is one of the most common insects in all the more hilly district from Northern Central Europe to Central Italy, but I have not seen it (with certainty) from the Pyrenees and the Iberian Peninsula."

Material examined. **France**, Provence Alps, Jausiers, 44.390 6.776, 1500 m, 11.VII.2007, leg. M. Bálint (7 males, 5 females, OPC). France, Alpes-Maritimes, Caïros Valley, Fromagine spring, 1500m, 44.0208°N, 7.4317°E, 17.VII. 2022, leg. Gilles Vinçon (5 males, 5 females; OPC). **Hungary**, Aggtelek national Park, Ménes stream, 23.VII.1985, light leg. J. Oláh (1 male, OPC). **Italy**, Piemonte, Pennines Alps, Biella, above Sanctuario di Oropa, spring, 45.6435°N, 7.969°E, 1800m, 4.VII.2020, leg. Gilles Vinçon (1 male, OPC). Italy, Graian Alps, Ingria, torrent, Rio del Mulinet, 45.463°N, 7.5676°E, 900 m, 8. VIII.2020, leg. Gilles Vinçon (1 male, OPC). Italy, Castel Vittorio (IM) 400m, affl. Rio Gordale T.L., 30.V.2001, leg. Museo Caffi BG, Coll Mus. Sc. Nat. Bergamo (1 male, OPC). Italy, Piemont, Pennines Alps, Civiasco, spring below water catchment, 770 m, 45.8104°N, 8.2973°E, 27.V. 2022, leg. Gilles Vinçon (2 males, OPC).

Remarks. Due to the various intermediate forms of paraproct between *Sericostoma personatum* described from England and *Sericostoma pedemontanum* described from Italy (Piemonte) their delineation became uncertain and doubtful, sometimes synonymised in faunal list (Coppa &

Tachet 2022). However, as explained above the presence of intermediate forms are rather a rule than exception for incipient sibling species in contact or along cline populations under reinforcement with standing genetic variation and incomplete lineage sorting. In Italy (Piemont) and in France (Provence Alps) near locus typicus we have examined pure population with typical paraproct, identical with the type's speciation trait. The divergence in the lateral profile of the paraproct is supported by the divergence in the curvature of the sclerotized phallic organ. The curvature is more developed in *S. pedemontanum* than in *S. personatum*.

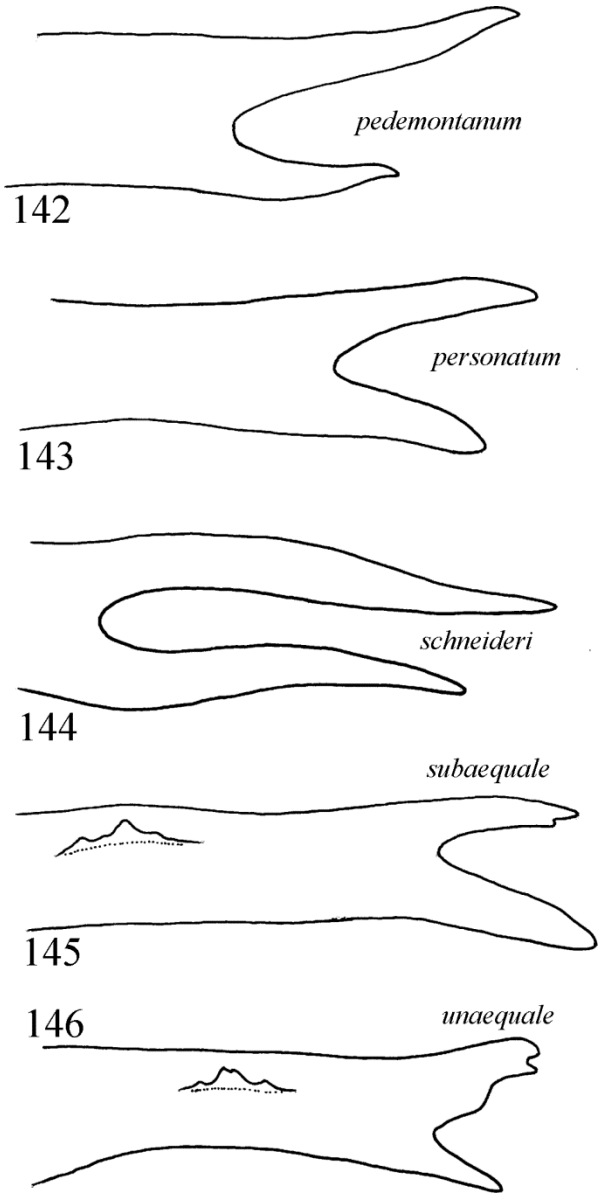
***Sericostoma personatum* (Spence, 1826)**

(Figures 143, 148) (Map 10)

Phryganea personata Spence. In Kirby & Spence 1826:489. „But the animal distinguished by the most remarkable cheeks is a species of *Phryganea* L. (*Phryganea personata* Spence); for from this part projects a spoon-shaped process, which curves upwards, and uniting with that of the other cheek, forms an ample mask before the face, the anterior and upper margin of which, in the insect's natural state, are closely united; and the posterior part being applied to the anterior part of the eye, causes the face to appear much swoln. It looks as if it was a single piece; but upon pressing the thorax it opens, both above and in front, into two parts, each convex without and hollow within, and each having attached to its inside a yellow tuft of hair resembling a feather. The use of this machinery at present remains a mystery." This species was described from Britain (England) without any collecting data!

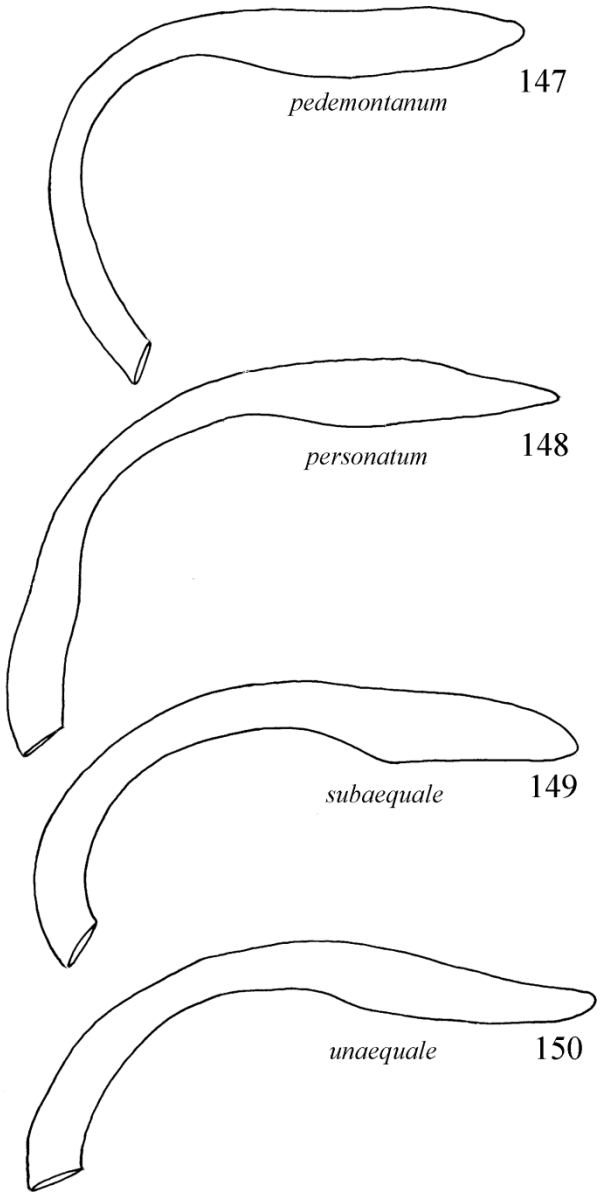
Phryganea personata Spence. Kirby & Spence 1826: McLachlan 1876:226–229. „Sheaths (Typically) with the upper branch of the fork straight, broad at its base, and somewhat suiddenly acuminate, lower branch curved downward, thinner, and slightly longer."

Phryganea personata Spence. Kirby & Spence 1826: McLachlan 1879:46. „I have again examined the large mass of materials representing *personatum* in my collection, with regard to the possibility of two distinct species being comprised under the name. Taking the extremes in the condition of the furcated penis-sheaths, two species should exist, but I find intermediate gradations."



Figures 142–146. Lateral profile of the paraproct in the *Sericostoma personatum* species group. 142 = *S. pedemontanum*; 143 = *S. personatum*; 144= *S. schneideri*; 145 = *S. subaequale*; 146 = *S. unaequale sp. nov.*

Phryganea personata Spence. Kirby & Spence 1826: McLachlan 1880.19: „It is extraordinarly variable in the form of penis-sheaths, and I cannot decide that this is to any considerable extent dependent upon locality. As a rule, the upper branch is shorter than the lower, thicker, the upper apical edge oblique to the apex, and turned slightly downward, sometimes with distinct notch before the oblique apical edge."



Figures 147–150. Lateral profile of the phallic organ in the *Sericostoma personatum* species group. 147 = *Sericostoma pedemontanum*; 148 = *S. personatum*; 149 = *S. subaequale*; 150 = *S. unaequale sp. nov.*

Material examined. **France**, Lespinassiére, 43.402°N 2.532°E, 450 m, 14.VII.2007, leg. M. Bálint (1 male, OPC). France, Mt. Mezenc, Borée, Massif Central, 44.908 4.228, 1026m, 15.VII. 2007, leg. M. Bálint (1 male, OPC). France, Hautes-Alpes, Queyras Massif, Aiguilles, torrent below 'Grand Laus lake', 2560 m, 44.82°N, 6.87°2E, 15.VIII.2021, leg. G. Vinçon (1 male, OPC). France, Alpes-de-Haute-Provence, Ravin de St Barnabé, Verdon trib., road to Stade de neige de Vauplane, spring, 1400 m, 43.867°N, 6.632°E, 19.IX.2021, leg. G. Vinçon (1 male, OPC). France, Alpes-de-Haute-Provence, < Cayolle Pass, spring 'Fontaine Gaudine', 1690 m, 44.3216°N, 6.7039°E, 18.VII.2022, leg. G. Vinçon (1 male, OPC). France, Haute-Savoie, Bauges Massif, above Chevaline, spring, 1560 m, 45.7245°N, 6.1993°E, 26.VI.2022, leg. G. Vinçon (1 male, OPC). **Hungary**, Bükk Mountains, Szalajka stream, collected by folia tent of J. Szabó, 11.VII.1982 (1 male, 2 females; OPC). Hungary, Recsk, Oroszlánvár, 18.VI.2012, leg. P. Gombkötő, T. Korompai, G. Magos & L. Urbán (1 male, OPC). **Italy**, Piémont, brook and spring tributary of Stura di Demonte, above Villaggio Primavera, 1530 m, 44.373°N, 6.9755°E, 16.VII. 2022, leg. G. Vinçon (1 male, OPC). **Romania**, Valea Cupas, Lacu Rosu, 9.VII.1981, leg. Peregovits & Ronkay (1 male, OPC). Romania, Judetul Hargitha, Sincraieni, Valea Mare, 13.VII.1993, light trap leg. L. Keresztes (1 male, OPC).

Remarks. The real difficulty in *Sericostoma* taxonomy was to differentiate between *Sericostoma personatum* (Spence, 1826) and *Sericostoma pedemontanum* McLachlan, 1876. The two species are frequently intermingled in various habitats of contact zones or clines and producing various intermediate shapes of paraproct lateral profiles. However, in pure population we have very typical form of paraproct as drawn for the type specimens already by Mclachlan. Moreover, we have found the rigid, not flexible sclerotized curved tube of the phallic organ very specific in the examined four species in the *Sericostoma personatum* species group (Figs. 147–150).

Sericostoma schneideri and its synonyms

Sericostoma schneideri (Kolenati, 1848)

(Figures 144) (Map 10)

Prosoponia schneiderii Kolenati, 1848:89. „Habitat in Dalmatia (Stenz.!), apad Kellemisch (Loew!)."

Prosoponia schneiderii Kolenati, 1848: Botosaneanu 2001:520. „I could study the type specimen of *S.*

schneideri (kept in the NHMW). Compared to the holotype of *S. flavicorne*, the holotype of *S. schneideri* has completely different lateral sclerites of the ♂ Xth segment."

Prosoponia schneideri Kolenati, 1848: Botosaneanu 2001:519. „Kolenati proposed *Prosoponia schneideri* as replacement name for *Sericostoma flavicorne* Schneider, 1845, arguing that „jam *Phryganea flavicornis* sub Genere *Chaetotaulii* existit" (*Chaetotaulius* Kolenati, 1848 is a synonym of *Limnephilus* Leach, 1815). In his description Kolenati mentions not only Dalmatia, but also „Kellemisch" under „Habitat". Kolenati's errors were noticed by McLachlan (1876:230): „Kolenati united it (i.e.: *flavicorne*) to the next species (i.e.: *schneideri*) changing the name unnecessary"."

Sericostoma carinthiacum McLachlan, 1868:296. "Preth Valley, Upper Carinthia, 26th May (Zeller), 1♂." "App. intermed. deeply furcate, the prongs nearly equal in length, each being very acute, and slightly curved at the tips in opposite directions."

Sericostoma pyrenaicum Pictet, 1856:88–89. „J'ai trouvé cette espèce à Eaux-Bonnes (Spain, [in fact Eaux-Bonnes is in France]), dans les Pyrénées, au mois de juillet."

Sericostoma selysi Pictet, 1856:91–92. „J'ai pris cette espèce dans la Sierra de Guadarrama (Spain), au mois de juillet."

Sericostoma No. 5 sp. nov. Hagen, 1859:148. „Baiern, Oesterreich." „Fühler einfarbig, gelb." „Die untere Spitze der app. interm. länger als die obere."

Sericostoma timidum Hagen, 1864:88. „Baiern, Oesterreich." „Fühler einfarbig, gelb." „Die untere Spitze der app. interm. länger als die obere."

Sericostoma timidum Hagen, 1864: McLachlan 1876: 22–230. I have not seen Hagen's types of *timidum*, and there is a discrepancy in his description, for he says the under point of the sheaths is longer than the upper; it may be that the words „untere" and „obere are transposed, and with this idea I have sunk my *carinthiacum* as a synonym. My description and figures are from the type of *carinthiacum*."

Sericostoma turbatum McLachlan, 1876:231: 231. ""Belgium (Vieil Salm, Halloy, &c., De Selys), apparently common." "According to the structure of the anal parts, *pyrenaicum*, *flavicorne* (?), *schneideri*, *selysi*, and *turbatum*, are scarcely distinguishable."

Examined material. **Albania**, Delvina Region, between Bistrica Village and Syri i Kalter, 127 m, 39°55'53"N; 20°09'13"E 13.V.2017, leg. S. Beshkov & A. Nahirnic (4 males, 1 female; OPC). Albania**,** Periferi Dibre, Fushe-Lure, streamside and lumber–yard, 1055m, 29.VI.2007, leg. L. Dányi, Z. Erőss, Z. Fehér, A. Hunyadi & D. Murányi (1 male, HNHM). Albania*,* Delvinë District, Krongj, streem Vrisi, 140m, 39.91720°N 20.18245°E, to light, 09.05.2014 leg. Z. Barina, D. Pifkó & G. Puskás (6 males, 3 females; OPC). Albania, Pogradec district, Piskupat, Ohrid Lake at Hotel Leon S of the village, 41°01.152'N, 20°38.196'E, 695 m, 12.05.2014, T. Kovács, D. Murányi (1 female, OPC). **Bosnia & Herzegovina**: Una-Sana Canton, Mrazovac, stream at open spring, 45°02'42"N, 16°05'19.7"E, 246 m, 26.V.2012, leg. T. Kovács & G. Puskás (3 males, OPC). **Bulgaria**, W Stara Planina Mts. Gushovski Monastir above Tchiprovtzi Town, 43.3661°N 22.8402°E, 808 m, 26.VI.2021, leg. S. Beshkov & A. N ahirnic-Beshkova (1 male, OPC). Bulgaria, W. Stara Planina Mts, Zarezan Tcheshma above Tchuprene on Tchuprenska Reka reiver, 674m, 43.4874°N, 22.6154°E, 24.VI.2021, leg.S. Beshkov & A. Nahirnić-Beshkova (40 males, 10 females; OPC). **Greece,** Ioannina county, Lefkothea, Smolitsas River 4km E of the village, 39°43'03.2"N, 20°36'38.7"E, 198m, 12.V.2006, leg. L. Dányi, J. Kontschán & D. Murányi (1 male, 8 females, HNHM). Greece, Olympos, 1100 m, 9.VII.1986, leg. Á. Uherkovich (1 male, OPC). **Hungary**, Bükk Mountains, Garadna stream, just below Sebesvíz tributary, 8.VII.1983, leg. J. Oláh (5 males, 2 females; OPC). **Montenegro**, Bar municipality, Rumija Mts, Stari Bar, M. Mikulići, Rikavac, 42°06'16.7"N, 19°08'55.8"E, 320 m, 26.V.2013, leg. P. Juhász, T. Kovács, G. Magos, G. Puskás, (1 male, 3 females; OPC). Montenegro, Durmitor Mts., Zabljak, 24–26, VII. 1965, leg. Z. Varga (1 male, 8 females; OPC). **Romania**, Valea Cupas, Lacu Rosu, 21.VII.1981, leg. Peregovits & Ronkay (1male, 1 female; OPC). Romania, Banat, Iauna, 29.VII.2006, leg. M. Bálint (1 male, OPC). Romania, Apuseni Mts. Muntii Gilaului, Muntele Baisorii, stream Valea Gera, 46°33.001'N 23°20.014'E, 1055m, 18.VI. 2013, light leg. J. Oláh, Cs. Balogh, & S. Fekete (7 males, OPC). Romania, Apuiseni Mts., Bihor Mts., Crisul Pietros – Valea Bulz, Pietra Bulzului, 560m, 3.VII.2013, light leg. Cs. Balogh, (2 males, 6 females; OPC). Romania, Apuiseni Mts., Bihor

Mts., Crisul Pietros, Boga, Valea Bulz and Valea Galbena, 46°35'23.25"N 22°37'54.74"E, 450m, 4.VII.2013, light leg. Cs. Balogh, (14 males, 1 female; OPC). Romania, Eastern Carpathians, Vasláb (Voslabeni), Hargita County, marshy area, 11.VII.2002, leg. L. Keresztes (2 males, 24 females; OPC). Romania, Eastern Carpathians, Calimani Mts., Toplita stream, 29.VII.2003, leg. L. Keresztes (2 male, OPC). Romania, Eastern Carpathians, Hargitha County, Baile Chirui (Királyfürdő), 14.VII.1998, leg. Z. Izsák (11 male, 7 females; OPC). Romania, Eastern Carpathians, Hargitha County, Sincraieni, Valea Mare, 24.VI.1993, light trap leg. L. Keresztes (17 male, 13 females; OPC). Romania, Eastern Carpathians, Hargitha County, Sincraieni, forester's house, 31.VII.1992, leg. L. Keresztes, T. Ujvárosi & Z. Izsák (17 male, 6 females; OPC). Romania, Eastern Carpathians, Vasláb (Voslabeni), Hargita County, marshy area, 11.VII.2002, leg. L. Keresztes (3 males, 15 females; OPC). **Serbia**, Zlatibor district, Zlatibor Mts, spring brook of Crni Rzav Stream beneath Mt. Cigota, 43°37.932'N, 19°46.305'E, 1160 m, 25.V.2013, leg. P. Juhász, T. Kovács, G. Magos, G. Puskás, (1 male, OPC). Kraljevo, above Kamenica Village, Stolovi Mt. Veliki čukar, 43°36'07"N 20°41'08"E, 688 m, 4.VII.2021, leg. S. Beshkov & A. Nahirnic-Beshkova (1 male, 2 females; OPC). **Slovakia**, Hnilec stream, 27.VII.1964, leg. J. Oláh (14 male, 4females; OPC). Slovakia: Hrabusice (Káposztafalva), Podlesok camping, Velka Bela voda, 48°57'50"N 20°23'1"E, 546 m, 9. VII. 2012 light trap, leg. P. Boda, B. A. Lukács, I Szivák & G. Várbíró (4 males, 1 female; OPC).

Diagnosis. Holotype paraproct: "practically parallel slender branches, lower one mostly slightly shorter, with acute apices, dorsal branch devoid of any dorsal prong or point" (Botosaneanu 2001). Paraproct structure is extremely stable in the examined populations from Albania, Bosnia & Herzegovina, Bulgaria, Greece, Hungary, Montenegro, Romania, Serbia, Slovakia. The basic structure of the paraproct is entirely different, unmistakable with the paraproct of *Sericostoma flavicorne*. Following synonymes belong to *Sericostoma schneideri* (Kolenati, 1848): *Sericostoma carinthiacum* McLachlan, 1868; *Sericostoma pyrenaicum* Pictet, 1856; *Sericostoma selysi* Pictet, 1856; *Sericostoma timidum* Hagen, 1864; *Sericostoma turbatum* McLachlan, 1876.

Sericostoma subaequale McLachlan, 1898

(Figures 145, 149) (Map 10)

Sericostoma subaequale McLachlan, 1898:49. „It seems to me that the examples from North Italy and South Tyrol… should be considered to have claim to specific rank and a name. The designation above given has reference to the sub-equal condition of the branches of the penis-sheaths, which is the most salient character."

Material examined. **Italy,** Trentino Alto Adige, Venetian Pre-Alps, Raossi, Speccheri, brook below the dam, low current, 670 m, 45.7648°N, 11.1301°E, 27.V.2021, leg. G. Vinçon (4 males, OPC).

Sericostoma unaequale sp. nov.

(Figures 146, 150) (Map 10) (Photos 14, 15)

Material examined. Holotype: **Italy,** Marches, Parco Nazionale dei Monti Sibillini, above Casali, nice brook and spring, 1080 m, 42.9506°N, 13.177°E, 18.V.2022, leg. G. Vinçon (1 male, OPC). Paratype: same as holotype (1 female in copulation with the holotype, OPC).

Diagnosis. Having apical region of the paraproct furcate, this new species belongs to the *Sericostoma personatum* species group and the paraproct lateral region bearring a dark dental ridge a character present in *Sericostoma subaequale*. However *Sericostoma unaequale* differs from *S. subaequale* by having completely unaequal apical branches.

Description. The uniform and monotonous external morphological characters are the same as or similar to all of the others species of this small genus. Male facial mask, the sexually modified maxillary palp of the male is small. Medium-sized species with forewing length of 13 mm. Wing and parts of the body are covered by pubescent

bronzish-brown coloured setae. The spiniform pair of paraprocts closely associated with segment X has unequally bilobed apical ending. Dorsal arm is more robust characterized by bifid apex; ventral arm is slender spine-like.

Etymology. Named by the characteristic, unequally shaped apical lobes or arms of the paraproct.

Sericostoma vittatum species complex

(Figures 151–153) (Map 9)

This small species complex consists of three species. Two species distributed in the Iberian Peninsula: *Sericostoma baeticum*, *S. vittatum* and one species in Greece: *S. herakles*. Species complex with small maxillary palp. Paraproct is characterized by very widely opened folk branches; dorsal branch longer with or without subapical dorsal prong; ventral branch is short.

A species complex of well-known variability in Spain with incipient sibling species under reinforcement. This is represented in the rather pronounced variation of the lateral profile of the speciation trait that is the paraproct. However, the variation is within the limits of the basic structural characters. There is distinct variation in the form of paraproct of the *S. baeticum*, influenced largely by locality, but it is impossible to regard all the examples other than as pertaining to a single species as stated clearly already by McLachlan (1880). *S. vittatum*, one of the most distinct-looking species due to the golden-yellow vitta on the anterior wings of the males. However, there are intermedier paraproct shapes between the two species in the Iberian Peninsula (Schmid, 1952).

Sericostoma baeticum Pictet, 1856

(Figure 151) (Map 9)

Sericostoma baeticum Pictet, 1856:88. „J'ai trouvé cette espèce à San Ildefonso (Spain), au mois de juillet."

Sericostoma baeticum Pictet, 1856: McLachlan 1876: 234. „Spain, (San Ildefonso, July, E. Pictet)." „Maxillary palpi of the ♂ small." „Superior branch of the penis-sheaths is long, flattened, its apex cut very obliquely, the extreme point acute; the lower branch forms an elongately triangular acute tooth."

Material examined. **Portugal,** Serra da Estrela Massif, above Loriga, nice brooklets, 940 m, 40.3381°N, 7.7074°W, 23.IV.2022, leg. G. Vinçon (2 males, 1 female; OPC). **Portugal,** Serra da Estrela Massif, North Valezim, nice spring, 650 m, 40.3718°N, 7.713°W, 23.IV.2022, leg. G. Vinçon (1 male, 1 female; OPC).

Sericostoma herakles Malicky, 1999

(Figure 152) (Map 9)

Sericostoma herakles Malicky, 1999:47. "HT ♂: Griechenland, Peloponnes, Ano Kastritsi bei Patras, 23.V.1979, leg. m." "Diese Art unterscheidet sich von allen anderen bekannten durch die sehr langen, in einem Winkel von etwa 60° gespreizten Gabeläste der mittleren Anhänge des ♂, wobei der dorsale leicht nach unten gekrümmt, der ventral fast gerade und deutlich kürzer ist."

Sericostoma vittatum Rambur, 1842

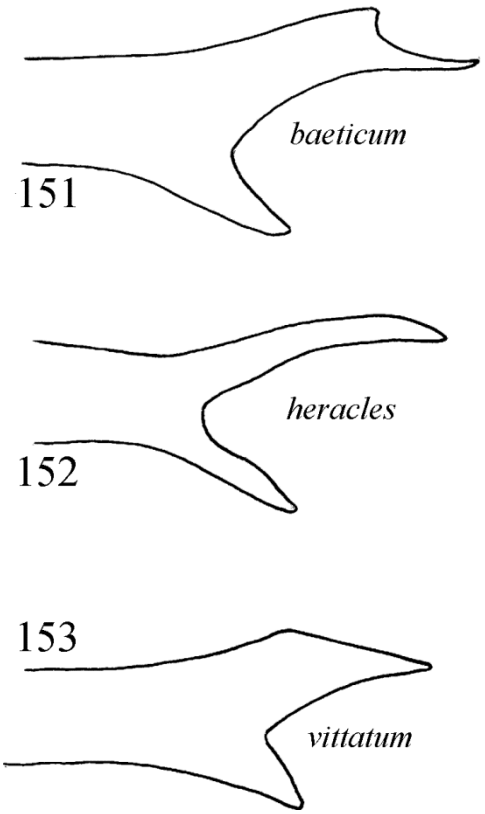
(Figure 153) (Map 9)

Sericostoma vittatum Rambur, 1842:497. "J'ai pris deux individus mâles de cette espèce dans des pentes marécageuses et herbeuses de la Sierra-Nevada, aux environs de Grenade."

Sericostoma vittatum Rambur, 1842: McLachlan 1876:234. "Spain, Granada and San Ildefonso, Rambur, and Pictet)." "Maxillary palpi of the ♂ only slightly prominent. "Anterior-wings with median longitudinal golden-yellow vitta. The only species in the genus in which the anterior wings have distinct markings. "The penis-sheaths formed after the same style as in *S. baeticum*, but the upper branch is very much shorter, and is broader."

Poorly known species

Still there are poorly known, puzzling species. They are without available type specimens and without published proper drawings or with insufficient examination of the paraproct. Judging from the available information, mostly from their locus typicus, they are probably synonyms of one of the above surveyed species.



Figures 151–153. Lateral profile of the paraproct in the *Sericostoma vittatum* species complex. 151 = *Sericostoma baeticum*; 152 = *S. herakles*; 153= *S. vittatum*.

Sericostoma cristatum Navas, 1924

Sericostoma cristatum Navas, 1924:27–28. "L'aspecte exterior és de semblance amb el *S. selysi* E. Pict." " "Patria. (Spain) Olot (Girona), 10 de Julio de 1923."

Sericostoma faciale McLachlan, 1868

Sericostoma faciale McLachlan, 1868:296–197. "Switzerland, on the Aar (Eaton). The form of app. interme. is also very different from any other species with which I am acquainted."

Sericostoma festivum Rambur, 1842

Sericostoma festivum Rambur, 1842:497. "J'ai reçu cette belle espèce de M. le professeur Graells, qui l'a découverte dans les environs de Madrid."

Sericostoma hamiferum McLachlan, 1876

Sericostoma hamiferum McLachlan, 1876:232. "Dartmoor (England). I believe this locality to be erroneous, and that they are more probably from some part of North Italy, in which Leach resided before his death." "A very distinct species. According to homology it is the inner (or upper) branch of the penis-sheaths that is totally absent, whereas the outer (or lower) forms the hook."

Sericostoma indivisum McLachlan, 1880

Sericostoma indivisum McLachlan, 1880:48. "Pomerania (in Hagen's collection); also Elberfeld and Hamburg according to Hagen, but I have not examined these." "A puzzling form with the palpi of the ♂ very prominent as in *personatum* and most of the species that follow it, but with the penis-sheaths consisting of little more than a slender curved upper branch as in the Corsican *clypeatum*." "I give no figure of the penis-sheaths, as it cannot be made satisfactorily without removing one on the inferior appendages."

Sericostoma medium Navas, 1917

Sericostoma medium Navas, 1917:12–13. "Simile vittato Ramb." "Patria. (Spain) Tortosa (Tarragona), 22 de Julio de 1914; Albarracin (Teruel), 12 de Julio de 1904; Tramacastilla (Teruel), 12 de Julio de 1904 (Col. m.)."

Sericostoma memorabile McLachlan, 1876

Sericostoma memorabile McLachlan, 1876:229. „Alps of Dauphiné, France. I captured one ♂ at a roadside spring on the summit of the Col du Lautaret, a mountain pass of about 5500 feet elevation; July 12th."

REFERENCES

ARNQVIST, G. (1997): The evolution of animal genitalia: distinguishing between hypotheses by single species studies. *Biological Journal of the Linnean Society,* 60: 365–379. https://doi.org/10.1111/j.1095-8312.1997.tb01501.x

BOTOSANEANU, L. (1992): *Trichoptera of the Levant-imagines*. Fauna Palistina, Insecta VI. Jerusalem,

The Israel Academy of Sciences and Humanities, 291 ppp.

BOTOSANEANU, L. (2001): *Sericostoma flavicorne* Schneider, 1845 and *S. schneideri* Kolenati, 1848: two distinct species and the correct use of their names (Trich., Sericostomatidae). *Bulletin de la Société entomologique de France,* 106: 518–520.

BOTOSANEANU, L. 2004. Western palaearctic trichopterological miscellanea (Insecta: Trichoptera). *Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa",* 46: 161–179.

COPPA, G. & TACHET, H. (2022): *Liste faunistique des Trichoptères de France avec les combinaisons originales et les principales synonymies*. Office pour les Insectes et leur Environnement, 29 pp..

HAGEN, H.A. (1855): Versuch die Pryganiden Pictet's zu bestimmen. *Stettiner Entomologische Zeitung,* 16: 204–210.

HAGEN, H.A. (1859): Die Phryganiden Pictet's nach typen bearbeitet von. *Stettiner Entomologische Zeitung,* 20(1–2): 131–170.

HAGEN, H.A. (1864): Névroptères (non-Odonates) de la Corse. *Annales de la Société Entomologique de France,* 4(4): 38–45.

HOEIJMAKERS, J.H. (2009): DNA damage, aging, and cancer. *New England Journal of Medicine,* 361: 1475–1485. https://doi.org/10.1056/nejmra0804615

HOLZENTHAL, R.W., Blahnik, R.J. Prather, A.L. & Kjer, K.M. (2007): Order Trichoptera Kirby, 1813 (Insect), Caddisflies. *Zootaxa*, 1668: 639–698. https://doi.org/10.11646/zootaxa.1668.1.29

KIRBY, W. & SPENCE, W. (1826): *An introduction to entomology*. Vol. III. Printed by Richard Taylor, London. 732 p.

KOLENATI, F. A. (1848): *Genera et species Trichopterorum*. Pars prior. Heteropalpoidea. Pragae, Adameus Haase, 108 pp. 4 tab.

LODOVICI O. & VALLE, M. (2020): *Checklist dei Tricotteri Italiani*. Versione Aprile 2020. Available at http://www.trichoptera.it

MALICKY, H. (1973): Eine neue Sericostomatide aus der Ägäis: *Sericostoma bergeri* n. sp. (Trichoptera). *Entomologische Zeitschrift,* 83(22): 249–251.

MALICKY, H. (1983): Atlas of European Trichoptera. First edition. Springer, The Netherlands. 298 p.

MALICKY, H. (1996): Neue Köcherfliegen aus Thailand (Trichoptera). *Entomologische Berichte Luzern,* 36: 119–128.

MALICKY, H. (1999): Neue Köcherfliegen aus Europa, Asien und von den Seychellen. *Braueria,* 26: 44–48

Malicky, H. (2001): Notes on the taxonomy of *Rhadicoleptus*, *Ptilocolepus* and *Pseudoneureclipsis*. *Braueria,* 28: 19–20.

Malicky, H. (2002): Einige Köcherfliegen (Trichoptera) aus Frankreich und Italien. *Entomofauna*, 23(1): 1–12

MALICKY, H. (2004): *Atlas of European Trichoptera*. Second edition. Springer, The Netherlands, 359 p.

MALICKY, H. (2005): Ein kommentiertes Verzeichnis der Köcherfliegen (Trichoptera) Europas und des Mediterrangebietes. *Linzer biologische Beitrage*, 37(1): 533–596.

MALICKY, H. (2008): On the migration of *Ptilocolepus* through the Trichoptera system. *Braueria*, 35: 43–44.

MALICKY, H. (2010): Eine zweite *Sericostoma*-Art aus Sardinien (Trichoptera: Sericostomatidae). *Zeitschrift der Arbeitsgemeinschaft österreichischer Entomologen*, 62: 31–35.

MARSHALL, J.E. (1979): A review of the genera of the Hydroptilidae (Trichoptera). *Bulletin of the British Museum* (*Natural History*). *Entomology series,* 39(3): 1–239.

MARTYNOV, A. (1913): Contribution to the knowledge of the Trichoptera fauna of the Caucasus (in Russian). *Studies of the Laboratory of the Zoological Cabinet of Warsaw University*, p. 1–111, 9 pls.

MASLY, J.P., Dalton, J.E., Srivastava, S., Chen, L. & Arbeitman, M.N. (2011): The genetic basis of rapidly evolving male genitalia in *Drosophila*. *Genetics* 189: 357–374. https://doi.org/10.1534/genetics.111.130815

MCLACHLAN, R. (1868): Contributions to a knowledge of European Trichoptera. *Transactions of the Entomological Society of London*, 1868: 289–308. https://doi.org/10.1111/j.1365-2311.1868.tb00629.x

MCLACHLAN, R. (1874–1880): *A monographic revision and synopsis of the Trichoptera of the European fauna*. Reprinted 1968. E.W.Classey Ltd. Hampton, Middlesex. https://doi.org/10.5962/bhl.title.28556

McLachlan, R. (1884): *A monographic revision and synopsis of the Trichoptera of the European fauna*. First additional supplement. John van Voorst, London & Friedländer & Sohns, Berlin, 76 pp. 7 plts.

McLachlan, R. (1898): Some new species of Trichoptera belonging to the European fauna, with notes on others. *Entomologist's Monthly Magazine*, (2)9: 46–52.

Moretti, G.P. & Cianficconi, F. (1978): The *Sericostoma* Latr. genus in Italy. *Proceedings of the Second International Symposium on Trichoptera*. Crichton, M.I. (Ed.), D. W. Junk B.V. Publisher, p. 7–30.

Navas, L. (1917): Tricópteros nuevos de España. *Brotéria. Série Zoologica*, 15: 16–28.

Navas, L. (1924): Excursió entomológica al cabrerés (Girona-Barcelona) del 8 al 18 de Julio de 1923. *Trabajos del Museo de Ciencias Naturelles de Barcelona*, 4(10): 1–59.

Navas, L. (1930): Insetti della Romagna. *Bollettino della Società Entomologica Italiana*, 62: 148–151.

Oláh, J., Beshkov, S., Chvojka, T.P., Ciubuc, C., Coppa, G., Ibrahimi, H., Kovács, T., Mey W., & Oláh, J. jr. (2017): Revision of Drusinae subfamily (Trichoptera, Limnephilidae): divergence by paraproct and paramere, speciation in isolation by integration. *Opuscula Zoologica, Budapest,* 48 (Supplementum 1): 3–228. https://doi.org/10.18348/opzool.2017.S1.3

Oláh, J., Andersen, T., Beshkov, S., Ciubuc, C., Coppa, G., Ibrahimi, H., Kovács, T., Oláh, J. jr. & Szczesny, B. (2018): Unified phylogenetic species concept: taking subspecies and race out of science: postmodern theory applied to the *Potamophylax cingulatus* group (Trichoptera, Limnephilidae). *Opuscula Zoologica, Budapest*, 49(1): 33–70. https://doi.org/10.18348/opzool.2018.1.33

Oláh, J., Andersen, T., Beshkov, S., Billali, A., Coppa, G., Ibrahimi, H., Johanson, K.A., Kovács, T., Mey, W., Musliu, M.. Oláh, J. Jr. & Ruiz-Garcia. A. (2019): Lineage sorting by paramere in Limnephilinae subfamily (Trichoptera): with description of a new tribe, new genera and new species. *Opuscula Zoologica, Budapest*, 50 (Supplementum 1): 3–98. https://org/10.18348/opzool.2019.S1.3

Oláh, J., Vinçon, G., Coppa, G. (2021): On the Trichoptera of Italy with delineation of incipient sibling species. *Opuscula Zoologica, Budapest*, 52(1): 3–67. https://doi.org/10.18348/opzool.2021.1.3

Oláh, J., Kovács, T. & Vinçon, G. (2022): On the Trichoptera of Western Europe, with surveys of *Platyphylax*, *Simaphylax* genera, *Drusus chapmani*, *Chaetopteryx gessneri*, and *C. gonospina* species complexes. *Opuscula Zoologica Budapest*, 53(2): 113–197. https://doi.org/10.18348%2Fopzool.2022.2.113

Pictet, F.J. (1834): *Recherches pour servir à l'histoire et l'anatomie des Phryganides*. Genève, 228 pp. 19 pl.

Pictet, A.E. (1865): *Synopsis des Névroptères d'Espagne*. Geneva, 123 pp. 14 pls..

Rambur, J.P. (1842): *Histoire Naturelle des Insectes Névroptères*. Paris. Librairie Encyclopédique de Roret. XVII and 534 pp., with 12 tables.

Ross, H.H. (1956): *The evolution of the mountain caddisflies*. Urbana, Illinois. 213 pp.

Schafer, M.A., Routtu, J., Vieiras, J., Hoikkala, A., Ritchie, M.G. & Schlötterer, C. (2011): Multiple quantitative trait loci influence intra-specific variation in genital morphology between phylogenetically distinct lines of *Drosophila montana*. *Journal of Evolutionary Biology*, 24: 1879–1886. https://doi.org/10.1111/j.1420-9101.2011.02316.x

Schmid, F. (1952): Contribution à l'étude des Trichoptères d'Espagne. *Instituto de Estudios Pirenaicos Consejo Superior de Investigaciones Cientificas, Zaragoza*, 1952: 627–695.

Schmid, F. (1970): Le Genre *Rhyacophila* et la Famille des Rhyacophilidae (Trichoptera). *Mémoires de la Société entomologique du Canada*, 102(S66): 1–130 + 52 plates. https://doi.org/10.4039/entm10266fv

Schmid, F. (1979): On some new trends in Trichopterology. *Bulletin of the Entomological Society of Canada* 11:48-57.

Schmid, F. (1990): Quelques nouveaux trichoptères indiens (Trichoptera). *Le Naturaliste canadien* (*Revued'ecologie et de systematique*), 117: 239–251.

Schneider, W.G. (1845): Verzeichnis der von Prof Loew in Sommer 1842 in der Turkei und Klein-Asien Gesammelten Neuropteren nebst Kurzer

Beschreibung der Neuen Arten. *Stettiner Entomologische Zeitung*, 6: 110–116.

SERVEDIO, M.R., VAN DOORN, G.S., KOPP, M., FRAME, A.M. & NOSIL, P. (2011): Magic traits in speciation: "magic" but not rare? *Trends in Ecology and Evolution* 26(8): 389–397. https://doi.org/10.1016/j.tree.2011.04.005

SIPAHILER, F. (1993): Three new *Rhyacophila* subspecies from France. *Spixiana*, 16(1): 43–47.

SIPAHILER, F. (2000): Redescription of *Sericostoma flavicorne* Schneider, 1845 and a new species of genus *Sericostoma* Latreille from Turkey (Trichoptera, Sericostomatidae). *Braueria*, 27: 23–25.

STEPHENS, C.R., ZAMORA, A., WRIGHT, A.H. (2005): *Perturbation Theory and the Renormalization Group in Genetic Dynamics*. In: Wright, A.H., VOSE, M.D., DE JONG, K.A., SCHMITT, L.M. (Eds.) Foundations of Genetic Algorithms. FOGA 2005. Lecture Notes in Computer Science, vol 3469. Springer, Berlin, Heidelberg. https://doi.org/10.1007/11513575_11

THIENEMANN, A. (1904): *Ptilicolepus granulatus* Pictet, eine Übergangsform von den Rhyacophiliden zu den Hydroptiliden. *Allgemeine Zeitschrift für Entomologie*, 9: 418–424.

ULMER, G. (1907): *Trichoptera*. In: WYTSMAN, P.G., Genera Insectorum. Hamburg. Fasc. 60. 259 pp.

WILLISTON , S W. (1914): *Water Reptiles of the past and present*. University of Chicago Press, Chicago, 251 pp.

Appendix 1. Habitat photos of the collection localities

Photo 1. France, Ariège, path to Arlu Lake, 1650m, 42.8142°N, 1.438°E (G. Vinçon)
(*Wormaldia arlua* sp. nov. and *Anisogamus sandreniko* sp. nov.).

Photo 2. France, Ariège, path to Arlu Lake, nice spring, 1650m, 42.8142°N, 1.438°E (G. Vinçon)
(*Wormaldia arlua* sp. nov. and *Anisogamus sandreniko* sp. nov.).

Photo 3. Portugal, Serra da Estrela, 1450m, 40.3802°N, 7.6457°W (G. Vinçon) (*Plectrocnemia estrela* sp. nov.).

Photo 4. Spain, Asturias, Puerto del Palo Allande, 950m, 43.2778°N, 6.6681°W (G. Vinçon) (*Plectrocnemia estrela* sp. nov.).

Photo 5. Spain, Cantabria, above Yera, 600 m, 43.1377N, 3.7461W (G. Vinçon) (*Rhyacophila fusunae* sp. nov.).

Photo 6. France, Pyrénées-Orientales, Sorède, La Farga, 450 m, 42.4979°N, 2.9572°E (G. Vinçon) (*Ptilocolepus kover* sp. nov.).

Photo 7. France, Alpes-Maritimes, Caïros tributary of Roya Valley, 1020 m, 44.011°N, 7.46°E (G. Vinçon) (*Drusus roya* sp. nov.).

Photo 8. France, Alpes-Maritimes, Caïros tributary of Roya Valley, 1020 m, 44.011°N, 7.46°E (G. Vinçon) (*Drusus roya* sp. nov.).

Photo 9. Italy, Piémont, above Villaggio Primavera 1530 m, 44.373°N, 6.9755°E (G. Vinçon) (*Drusus demonta* sp. nov.).

Photo 10. France, Pyrénées-Orientales, Prats-de-Mollo-la-Preste, 1860 m, 42.4523°N, 2.4102°E (G. Vinçon) (*Anisogamus nahueli* sp. nov.).

Photo 11. France, above Mantet, 1850 m, 42.4755°N, 2.325°E (G. Vinçon) (*Anisogamus nahueli* sp. nov. and *A. waringeri* Graf & Vitecek, 2015).

Photo 12. Austria, Kärnten, S. Bad Vellach, Vrnik-Quelle, 1380 m, 46.4214°N, 14.5723°E (G. Vinçon) (*Consorophylax vellach* sp. nov.).

Photo 13. Austria, Kärnten Alpen (G. Vinçon) (*Consorophylax vellach* sp. nov.).

Photo 14. Italy, Marches, Monti Sibillini, above Casali, 1080 m, 42.9506°N, 13.177°E (G. Vinçon) (*Sericostoma unaequale* sp. nov.).

Photo 15. Italy, Marches, Monti Sibillini, Panico Valley (G. Vinçon) (*Sericostoma unaequale* sp. nov.).

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Der Regenwurm *Proctodrilus tuberculatus* (Černosvitov, 1935) auf Hangschultern der mitteldeutschen Lössrandstufe (Oligochaeta: Lumbricidae)

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Abstract. The earthworm *Proctodrilus tuberculatus* (Černosvitov, 1935) on the crest of slopes in the central-German loess-edge ramp (Oligochaeta: Lumbricidae). – The distribution of *Proctodrilus tuberculatus* (Černosvitov) along the line of gradient (fall line) on the slopes of the central-German loess-edge ramp (Lössrandstufe) was investigated. The highest density on loess-edge ramps reached by the species (max. 47 adults/0.25 m²) was on the crest of slopes where the fall line of the slope merges with the plateau of the culmination area. In these locations the occurrence of surface runoff along the fall line of the slope is at its lowest and percolation into the soil profile at its highest. The soil depth in the luvisol preferred by *P. tuberculatus* lies in the transition zone of the A1/Bt horizons, which are influenced by soil leaching (lessivage) and conspicuously marked by the presence of many argillans. The dietary strategy of *P. tuberculatus* is apparently a specialisation in that the species extracts its nutrition principally from the mineral part of the soil profile in luvisols. It seems that the channels in the luvisol, which are filled with muddy sediment, are advantageous to the endogeic *P. tuberculatus* as it moves through the soil and feeds. In the A1/Bt layer this species probably takes up pluviolessivate, which contains microorganisms and finely dispersed or unstable organic and mineral components. This means that the ecological niche of the species is determined by the movements of nutritional material in the soil. *Aporrectodea caliginosa* (Sav.) and *Ap. rosea* (Sav.), which were always found in association with the species in the loess slopes studied, can contribute to the flow of nutrients in the mineral part of the profile by their finely dispersed particles of excrement.

Keywords. Earthworms, *Proctodrilus tuberculatus*, ecological strategies, soil leaching, loess-edge ramp, crest of slopes, Germany.

EINLEITUNG

Im mitteldeutschen Lössgebiet kommt der transägäisch verbreitete (Csuzdi *et al.* 2011) Regenwurm *Proctodrilus tuberculatus* (Černosvitov, 1935) in flussnahen Auenböden (Höser 2008, 2018, 2022) und auf Hängen (Höser 2012) vor. Bisher fiel auf, dass diese Art sich in lithologisch geschichteten Auenböden an Schichtgrenzen im feiner gekörnten Substrat konzentriert (Höser 2018), das auf einer Schicht gröberen Substrats lagert. Das wurde als Zeichen der Gunst der feiner gekörnten Schicht gedeutet, die hängendes Kapillarwasser führt und so in Trockenperioden die Lebensansprüche der Art gewährleistet. Im Folgenden wird über einen anderen, prinzipiell ähnlich günstigen Lebensraum der Art berichtet, der sich im Boden der Lössrandstufe an der nördlichen Lössgrenze Mitteldeutschlands befindet.

MATERIAL UND METHODEN

Untersuchungsgebiet

Die Untersuchungen fanden in der mäßig feuchten Pleiße-Lössprovinz (Lieberoth 1963) des mitteldeutschen Lössgürtels statt, also westlich der Zwickauer Mulde (Abb.1). Die untersuchten Bodenstandorte liegen an der Nördlichen Lössgrenze, zumeist im Bereich der mitteldeutschen Lössrandstufe (Haase et al. 1970, Leger 1990), die im Gebiet eine Sprunghöhe von 20–50 m hat. Hier setzt an der ostwestverlaufenden Stufe eine über 3 m (bis 12 m) mächtige Löss-Ansammlung

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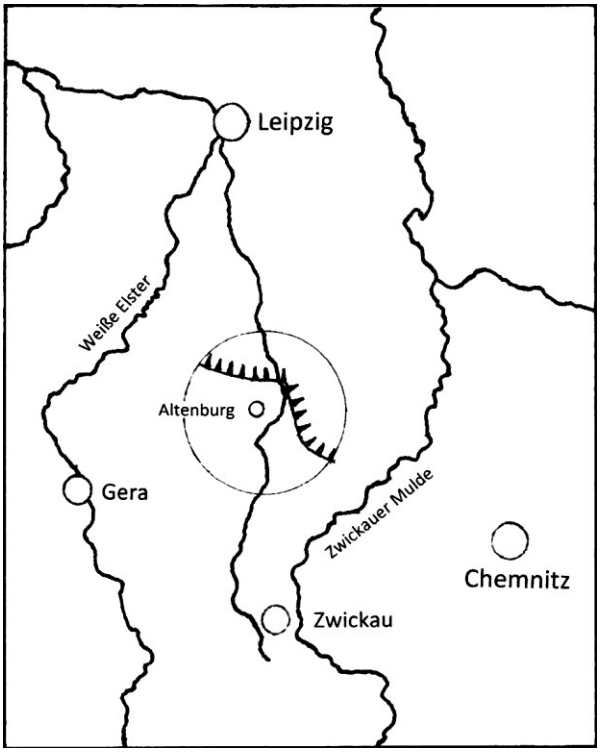

Abbildung 1. Das Untersuchungsgebiet (großer Kreis). ▲▲▲▲ regionaler Abschnitt der Lössrandstufe.
The study area (large circle). ▲▲▲▲ regional section of the loess-edge ramp.

ein, die jungweichselzeitliches, geschichtetes Material ist (Haase *et al.* 1970, Gehrt & Hagedorn 1996, Gehrt 2000). Das untersuchte Gebiet ist überwiegend Agrarlandschaft. Auf den Hängen herrscht Parabraunerde (Luvisol) vor, an die sich im Lössgürtel nach Südosten Pseudvergleyte Böden anschließen (Pseudogley-Parabraunerden und Pseudogleye). Dem Gebietscharakter entsprechend wurden zumeist Offenland-Standorte untersucht, vor allem solche auf Wiesen oder Grünland.

Auf Probeflächen von 0,25 m² Größe wurde die Regenwurmfauna vollständig erfasst, indem alle Regenwürmer bis zur Tiefe von 0,6 m ausgegraben, in zweimaliger Durchsicht des Bodens ausgelesen und in Formalin (4 bis 5 %) überführt wurden. Die Schürfgrube diente der Bodenansprache. Die Bodenmerkmale wurden nach üblicher Feldmethode (Fiedler & Schmiedel 1973, Schlichting *et al.* 1995) geschätzt und die Merkmale des untersuchten Standorts im Freiland protokolliert. Derartig untersucht wurden Standorte auf Transekten entlang der Falllinien der Löss-Hänge oder einzelne Probeflächen auf Hangschultern. Von den auf Artniveau im Labor determinierten Tieren wurden nur die adulten in die Auswertung einbezogen. Ein Teil des gewonnenen Regenwurmmaterials befindet sich in der Belegsammlung des Autors.

ERGEBNISSE

Im Bereich der Lössrandstufe der mitteldeutschen Pleiße-Lössprovinz tritt *Proctodrilus tuberculatus* (Černosvitov, 1935) außerhalb der Auen überwiegend auf Löss-Hängen auf. Bisher wurden ca. 50 derartige Fundpunkte ermittelt. Das ist ein Bruchteil der Nachweise der Art, die aus den untersuchten Auenböden der Pleiße-Lössprovinz vorliegen.

Im Bereich dieser Lössrandstufe konnte mehrfach die charakteristische Verteilung von *P. tuberculatus* entlang der Fallinie eines Löss-Hangs nachgewiesen werden: Die Art tritt im Kulminationsbereich auf, Vorkommen am Hangfuß sind spärlich oder fehlen zumeist. Sie lebt im humusarmen mineralischen Boden. Den Höchstwert ihrer Siedlungsdichte am Hang erreicht sie auf der Hangschulter, wo die Falllinie in das angrenzende Plateau des Kulminationsbereichs übergeht (Abb. 2). Die dort ermittelten Werte höchster Siedlungsdichte enthält Tab. 1. Die entlang der Falllinie des Zelbenbergs untersuchte Strecke betrug ca. 200 m. Auf dem ca. 110 m langen Teil davon, der die Hangschulter enthält, konnte an jedem der sechs geprüften Standorte *P. tuberculatus* angetroffen werden (Abb. 2).

Bevorzugt besiedelt *P. tuberculatus* die Parabraunerde-Standorte jener Kulminationsbereiche, die durch Fingerprobe am klebrigen Boden als bindig und relativ tonhaltig ausgewiesen sind (z.B. auf dem Zelbenberg, Abb. 2, Tab. 1). In vielen Fällen sind die Bodenprofile dieser Standorte ein wenig geköpft, besitzen aber die Merkmale ursprünglicher Al- und Bt-Horizonte. Sie fallen durch Tonhäutchen in den Makroporen

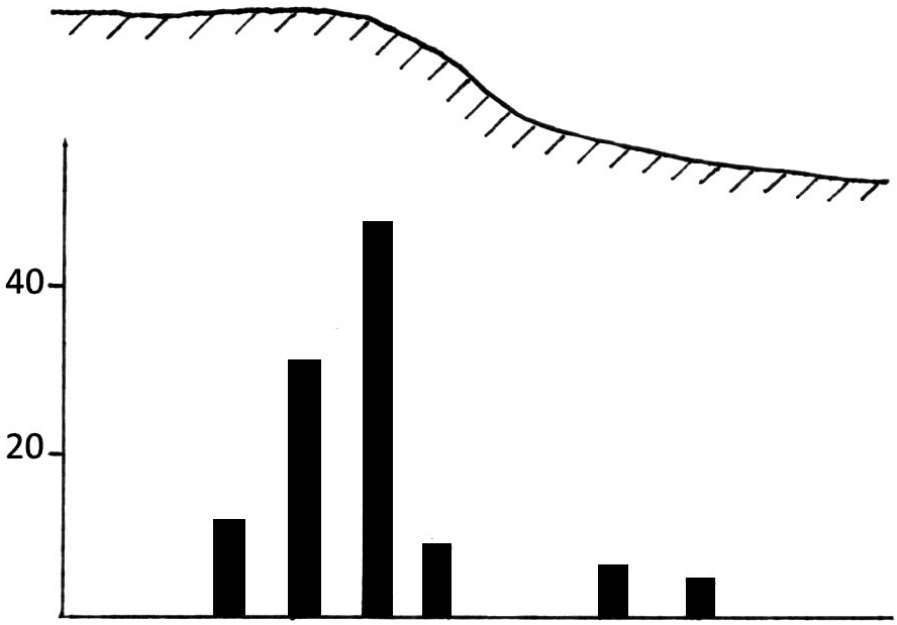

Abbildung 2. *Proctodrilus tuberculatus* (Černosvitov, 1935) auf der Hangschulter des Zelbenbergs. Oben: Schematischer Gang der Falllinie des Hangs. Unten: Individuendichte der Art (Individ./ 0,25 m²), Maximum am Übergang von der Hangschulter zum Plateau.
Proctodrilus tuberculatus (Černosvitov, 1935) on the crest of a slope on the Zelbenberg. Above: schematic course of the fall line of the slope. Below: individual densities of the species (inds./ 0.25 m²), maximum at the transition from the slope crest to the plateau.

Tabelle 1. Die größten vorgefundenen Individuendichten von *Proctodrilus tuberculatus* (Černosvitov, 1935) auf Hängen des untersuchten Bereichs der mitteldeutschen Lössrandstufe.

Tonhäutchen im Bodenprofil +++ sehr auffällig, ++ auffällig, + vorhanden.
The highest individual densities of *Proctodrilus tuberculatus* (Černosvitov, 1935) found on sloping ground in the central-German loess-edge ramp area studied. Argillans in the soil profile +++ very prominent, ++ prominent, + present.

Individuen *Proctodrilus tuberculatus* pro 0,25 m²	Ort	Koordinaten	am Standort	
			Reliefformtyp, % Neigung	Ton-häutchen
47	Primmelwitz, Zelbenberg	51º02′21″N, 12º27′28″E	fast ebener Kulminationsbereich, ca. 1 %	+++
31				
21	Saara	50º55′59″N, 12º24′40″E	Hangschulter am Kulminationssattel, < 1 %	++
14	Langenleuba-Niederhain	50º56′57″N, 12º35′02″E	hängiger Kulminationsbereich, 3,5 %	++
10	Waltersdorf, Läuseberg	51º02′01″N, 12º23′05″E	hängiger Kulminationsbereich, 3 %	+
9	Oberleupten	50º57′46″N, 12º28′46″E	Hangschulter am Hohlweg, < 1 %	+

und Schwundrissen auf. Am nördlichen Rand des untersuchten Löss-Gebiets fehlt *P. tuberculatus* auf Kuppen oder einzelnen Hangschultern, deren Bodenprofile sichtlich stark geköpft und kieshaltiger sind. Hier sind die im Löss angelegten oberen Profilteile mitsamt ursprünglichem Al-Horizont weitgehend abgetragen. In diesen Fällen beschränkt sich die Art in geringer Siedlungsdichte (< 3 Individuen/ 0,25 m²) auf den unterhalb des Kulminationsbereichs liegenden Teil des Oberhangs, der noch von Löss bedeckt ist (z.B. Sandberg bei Pähnitz, 51°02′01″N, 12°28′26″E).

P. tuberculatus tritt auf den Hängen im Wesentlichen in 10–40 cm Tiefe des Bodens auf, dabei schwerpunktartig bei 22–28 cm Tiefe. Auf der Hangschulter des Kulminationssattels bei Saara (Tab. 1) lebt die Art in 7–21 cm Tiefe. Den Kulminationsbereich des Zelbenbergs bevorzugt sie in 27–34 cm Tiefe, wobei dort im Profil die von ihr insgesamt besiedelte vertikale Bandbreite *ca*. 26 cm beträgt. Die genannten Vorkommen liegen im kompakten, wenig belüfteten Boden und den Merkmalen der Bodenprofile zufolge im Übergangsbereich der Horizonte Al/Bt.

Die treuesten Begleiter des *P. tuberculatus* auf den untersuchten Löss-Hängen sind *Ap. caliginosa* (Präsenz >75 %) und *Ap. rosea* (Präsenz 50–75 %), die dort im mineralischen A-Horizont hohe Abundanzen erreichen (Tab. 2). Zudem tritt an jenen Hangstandorten des Gebiets, die nur spärlich von 1–2 *P. tuberculatus*/ 0,25 m² besiedelt sind, regelmäßig die Art *O. cyaneum* hinzu, die in dieser Standort-Gruppe eine Präsenz von *ca.* 35 % erreicht. An den Standorten mit größter Individuendichte des *P. tuberculatus* (> 8 Individuen/ 0,25 m²) hat *Ap. caliginosa* ein relativ niedriges Abundanz-Niveau (Tab. 2).

DISKUSSION

Die Ergebnisse zeigen, dass *P. tuberculatus* neben den flussbegleitenden Auenböden (Höser 2008, 2018) auch Lössböden anderer, strukturell besonderer Standorte besiedelt, so in Konzentration die Hangschultern in Kulminationsbereichen des Offenlands. Fundorte der Art auf Hängen des überwiegend agrarischen Offenlands zu ermitteln, ist aufgrund des dort beachtlichen Anteils gestörter Böden weniger erfolgreich als in den Flussauen des Gebiets. Dennoch brachten unsere Untersuchungen zutage, dass sich die Art im Offenland auf die Böden der Hangschultern konzentriert.

Die ökologische Strategie von *P. tuberculatus*

P. tuberculatus ist unseren Befunden zufolge eine typische, tiefer im Boden lebende endogäische Art, die zu den „hypoendogées“ (Bouché 1977) oder „subsoil species“ (Lee 1985) gehört. Im Schema der morpho-ökologischen Kategorien von Perel (1977) ist *P. tuberculatus* den „humus feeders“ zuzuordnen. Da ihm im Mineralboden nur stark zersetztes organisches Material zur Verfügung steht, gehört er zu den geophagen Arten (Piearce 1978), aber als in dieser Gruppe anscheinend besondere Form, die wahrscheinlich den Großteil ihrer Nahrung aus den dispersen organischen Partikeln bezieht, die im Gemisch der Pluviolessivate transportiert werden. Diese Art ist deshalb in besonderem Maße vom Nahrungsfluss im Boden abhängig und hat bezüglich der organischen Stoffe des Bodens eine Ernährungsstrategie aus der „oligohumosen“ Gruppe der geophagen Arten (Lavelle 1981, 1988, Bouché 1987, Curry & Schmidt 2006). Sie ernährt sich im kompakten mineralischen Bereich der Parabraunerde-Profile, die von der Lessivierung, der mechanischen Verfrachtung der Feintonfraktion durch Sickerwasser, geprägt sind und durch reichlich Tonhäutchen auffallen (Tab. 1). Oft werden Tiere dieser Art in oder an den mit Tonbelägen tapezierten Schwundrissen des Bodens und an Bruchstellen der Bodenaggregate aufgefunden (Höser 2008).

Die von *P. tuberculatus* am Hang bevorzugten Standorte

Auf den Löss-Hängen wurde *P. tuberculatus* zumeist an relativ ungestörten Standorten auf Hangschultern und in hangnahen plateauartigen Bereichen gefunden (Abb. 2). An diesen Stand

Tabelle 2. Vier Größenklassen der Individuendichte des *P. tuberculatus* pro 0,25 m² auf Hangschultern der Lössrandstufe und die dazugehörige maximale Individuendichte von *Aporrectodea caliginosa* (Sav.) und *Ap. rosea* (Sav.).

Four size-classes of the density of *P. tuberculatus* individuals per 0.25 m² on the crests of slopes in the loess-edge ramp and the accompanying maximum individual densities of *Aporrectodea caliginosa* (Sav.) and *Ap. rosea* (Sav.).

Proctodrilus tuberculatus		*Ap. caliginosa*	*Ap. rosea*
Individuendichte Adulte pro 0,25 m²	Anzahl der Probeflächen	max. Individuendichte Adulte pro 0,25 m²	max. Individuendichte Adulte pro 0,25 m²
1	15	13	11
2-4	18	45	18
5-8	10	34	12
>8	7 (s. Tab. 1, Abb. 2)	17	10

orten ist zu erwarten, dass die Perkolation des Niederschlagswassers, der Sickerwasserstrom, und das in ihrem Zuge bereitgestellte Angebot an Pluviolessivaten die größten sind, die entlang der Falllinie des Hangs zustande kommen. Denn hier ist der hangabwärts gerichtete Oberflächenabfluss von Niederschlag am geringsten. Das trifft am deutlichsten auf den untersuchten Standort im Kulminationsbereich des Zelbenbergs zu (Tab. 1), der aufgrund fast ebener Hangfläche eines der kleinsten Niederschlags-Einzugsgebiete hat. Hier war auch die Profilverkürzung im Al/Bt-Bereich durch Bodenabtrag am geringsten und daher *P. tuberculatus* am wenigsten eingeschränkt. Die weitgehend ungestörten Lössboden-Standorte auf Hangschultern entsprechen damit offenbar annähernd jenen Lebensansprüchen, die *P. tuberculatus* am Grunde von Trockentälchen des Lössgürtels (Höser 2021) gewährt werden. Die Konzentration von *P. tuberculatus* auf Hangschultern im Lössgebiet ist offenbar ein charakteristisches Phänomen. Höser (2016) fand eine solche Konzentration erstmals bei einer Exkursion im siebenbürgischen Kokel-Hochland (22.06. 1994, >6 ad. Individuen/0,25 m², Hangplateau der Fâneata Îngustă bei Betfalva/ Beteşti). Das Fehlen des *P. tuberculatus* bei reduziertem Al/Bt-Übergang des Bodenprofils, so auf Kuppen am nördlichen Rand der Lössrandstufe (z.B. auf dem Sandberg bei Pähnitz), weist auf seine Abhängigkeit von der Lessivierung im Boden hin. Die von der Norm abweichende geringere Bodentiefe (7–21 cm), in der die Art auf der Hangschulter des Kulminationssattels Saara vorkommt, beruht wohl auf stärkerer Profilkappung an diesem Standort, bedingt durch etwas größeren Oberflächenabfluss aus relativ größerem Niederschlags-Einzugsgebiet.

Die Lessivierung, die Nahrungsbewegungen im Boden und die ökologische Nische des *P. tuberculatus*

Das Auftreten von *P. tuberculatus* ausschließlich im lessivierten mineralischen Boden, insbesondere im Übergang Al/Bt des Parabraunerde-Profils, dort schwerpunktartig in 22–28 cm Tiefe, legt nahe, dass er sich nicht wie *Ap. rosea* durch den Mineralboden frisst (Bolton & Phillipson 1976), sondern den durch Lessivierung vorgefertigten Leitbahnen der eingeschlämmten Lessivate folgt. Die Lessivierung füllt in der Parabraunerde die wegsamen Gefügeteile, die Leitbahnen, mit Schlämmstoffen von Braunlehmcharakter auf (Fließplasma: Kubiena 1986). Diese Leitbahnen, die maximale Durchmesser von etwa 0,5 bis 3 mm erreichen (Kubiena 1986), bieten anscheinend dem endogäischen *P. tuberculatus* Vorteile, so bei seiner Bewegung im Solum und bei der Nahrungsaufnahme. Wahrscheinlich sind diese Leitbahnen, die einen Teil des Flusses organischer und mineralischer Feinpartikel führen, wesentliche Orte für *P. tuberculatus* im humusarmen Bodenprofil, um Nahrung aus Lessivaten aufzunehmen. So ist zu erwarten, dass er seine Nahrung überwiegend aus Pluviolessivaten bezieht, die aus Wurzelexsuden, Mikroorganismen, kleinsten organischen Partikeln und aus mineralischer Bodensubstanz bestehen. Möglicherweise tragen andere endogäische Arten, z.B. *Ap. caliginosa*

und *Ap. rosea*, mit einem Anteil konditionierter Partikel aus ihren Exkrementen (Lowe & Butt 2003, Felten & Emmerling 2009) zum Nahrungsfluss für *P. tuberculatus* (und *O. cyaneum*) bei, so dass sich im Mineralbodenprofil die ökologischen Nischen dieser Arten überlagern (Bouché 1987).

Dabei besetzt *P. tuberculatus* eine von Nahrungsbewegungen (Bouché 1987) bestimmte, eigenständige ökologische Nische im Mineralboden, die eng mit denen seiner treuesten Begleiter *Ap. caliginosa* und *Ap. rosea* zusammenhängt (Tab. 2). So gehören diese Arten unterschiedlicher endogäischer Kategorien einem Kontinuum im isotopischen Nischenraum verschiedener ökologischer Gruppen an (Hsu *et al.* 2023). Im Fall der hier untersuchten Lössboden-Profile reicht dieses ernährungsstrategisch basierte Kontinuum von Arten, die sich von Laubstreu ernähren, bis hin zu Arten, die vorwiegend Mineralboden oder Pluviolessivate aufnehmen. *Ap. caliginosa*, nach Lavelle (1988) eine „polyhumose" endogäische Art, frisst tote Feinwurzeln und mikrobiell besiedelte und vorzersetzte organische Substanz (Waters 1955, Barley 1959, Bouché & Kretzschmar 1974), *Ap. rosea* nimmt große Mengen Mineralboden auf und wählt dabei organisches Material vor anorganischem (Bolton & Phillipson 1976). In diesen Bodenprofilen sind Pluviolessivate, die konditionierte Exkremente beider Arten enthalten, ein geeignetes Mittel, um Nahrung vom Oberboden in die humusarme Bodentiefe zu bewegen, die von den extremen „Oligohumosen" wie *P. tuberculatus* und *O. cyaneum* besetzt ist. Die Art *O. cyaneum*, die sich vorwiegend von Mineralboden ernährt (Neilson & Boag 2003, Curry & Schmidt 2006), tritt regelmäßig stark im Pejus der Mineralboden-Umwelt des *P. tuberculatus* auf.

Den Nahrungspräferenzen entsprechend (Lavelle 1988) zeigt sich als charakteristische vertikale Arten-Verteilung im Lössboden-Profil, dass die anscheinend „polyhumose" *Ap. caliginosa*, die höheren organischen Gehalt im Boden bevorzugt, vor allem im obersten Mineralboden (A-Horizont) vorkommt, während die „oligohumosen" Arten (*O. cyaneum, P. tuberculatus*) in tieferen Horizonten leben, die arm an organischer Substanz sind.

In den Tab. 1 und 2 deutet sich an, dass relativ hohe Sickerwasserrate und Bodenfeuchte in der Parabraunerde der fast ebenen Kuppen die Population des *P. tuberculatus* stimulieren (max. 47 Ind./0,25 m²), jedoch wahrscheinlich den Bestand von *Ap. caliginosa* beschränken, indem diese Faktoren die Feinwurzeln reduzieren, die Nahrungsquelle für die letztgenannte Art sind. Denn die Wurzeldichte verhält sich umgekehrt proportional zur Bodenfeuchte (Könekamp & Zimmer 1955). Das widerspiegelt sich in der verminderten Individuendichte von *Ap. caliginosa* (max. 17 Ind./ 0,25 m²) am standörtlichen Optimum des *P. tuberculatus* und weist auf die unterschiedliche Ernährungsstrategie der beiden Arten hin.

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LITERATUR

BARLEY, K.P. (1959): The influence of earthworms on soil fertility. II. Consumption of soil and organic matter by the earthworm *Allolobophora caliginosa* (Savigny). *Australian Journal of Agricultural Research*, 10 (2): 179–185. https://doi.org/10.1071/ar9590179

BOLTON, P.J. & PHILLIPSON, J. (1976): Burrowing, feeding, egestion and energy budgets of *Allolobophora rosea* (Savigny) (Lumbricidae). *Oecologia*, 23: 225–245. https://doi.org/10.1007/BF00361238

BOUCHE, M.B. (1977): *Stratégies lombriciennes*. In. LOHM, U. & PERSSON, T. (Eds.): Soil organisms as components of ecosystems. *Ecological Bulletins (Stockholm),* 25: 122–132.

BOUCHÉ, M.B. (1987): *The subterranean behaviour of the earthworm*. In. BONVICINI PAGLIAI, A.M. & OMODEO, P. (Eds.) On earthworms. *Selected Symposia and Monographs (Modena),* 2: 159–169.

BOUCHE, M.B. & KRETZSCHMAR, A. (1974): Fonctions des lombriciens. II. Recherches méthodologiques

pour l'analyse du sol ingéré. *Revue d' écologie et de biologie du sol*, 11: 127–139.

CSUZDI, CS., POP, V.V. & POP, A.A. (2011): The earthworm fauna of the Carpathian Basin with new records and description of three new species (Oligochaeta: Lumbricidae). *Zoologischer Anzeiger*, 250(1): 2–18. https://doi.org/10.1016/j.jcz.2010.10.001

CURRY, J.P. & SCHMIDT, O. (2006): The feeding ecology of earthworms – A review. *Pedobiologia,* 50(6): 463–477. https://doi.org/10.1016/j.pedobi.2006.09.001

FELTEN, D. & EMMERLING, C. (2009): Earthworm burrowing behavior in 2D-Terraria with single- and multi-species assemblages. *Biology and Fertility of Soils*, 45(8): 789–797. https://doi.org/10.1007/s00374-009-0393-8

FIEDLER, H.J. & SCHMIEDEL, H. (1973): *Methoden der Bodenanalyse, Band 1: Feldmethoden*. Verlag Theodor Steinkopff, Dresden.

GEHRT, E. (2000): *Nord- und mitteldeutsche Lössbörden und Sandlössgebiete*. In. BLUME, H.-P., FELIX-HENNINGSEN, P., FISCHER, R., FREDE, H.-G., HORN, R. & STAHR, K. (Hrsg.) Handbuch der Bodenkunde, 9. Ergänzungslieferung, 3.4.4.4: 1–53.

GEHRT, E. & HAGEDORN, J. (1996): *Zur Entstehung der nördlichen Lössgrenze in Mitteleuropa*. In. Landesamt für Natur und Umwelt des Landes Schleswig-Holstein (Hrsg.): Böden als Zeugen der Landschaftsentwicklung, p. 59-66.

HAASE, G., LIEBEROTH, I. & RUSKE, R. (1970): *Sedimente und Paläoböden im Lößgebiet*. In: RICHTER, H., HAASE, G., LIEBEROTH, I. & RUSKE, R.(Hrsg.): Periglazial – Löß – Paläolithikum im Jungpleistozän der Deutschen Demokratischen Republik. – *Ergänzungsheft Nr. 274 zu Petermanns Geographischen Mitteilungen,* p. 99–212.

HÖSER, N. (2008): Die Regenwürmer *Proctodrilus tuberculatus* (Černosvitov, 1935) und *Proctodrilus antipai* (Michaelsen, 1891) als Indikatoren der fossilen Oberflächengliederung der Flussaue (Oligochaeta: Lumbricidae). *Hercynia N.F.*, 41(2): 263–272.

HÖSER, N. (2012): Regenwürmer (Oligochaeta: Lumbricidae) in der Hangcatena. *Hercynia N.F.,* 45(2): 193–208.

HÖSER, N. (2016): Präferenzen der *Proctodrilus*-Arten (Lumbricidae: Oligochaeta) auf einem Hang des unteren Kokel-Hochlandes in Rumänien. *Opuscula Zoologica Budapest*, 47(2): 143–149. https://doi.org/10.18348/opzool.2016.2.143

HÖSER, N. (2018): Interrelation of *Proctodrilus* species (Oligochaeta: Lumbricidae) with lessivage and layering in European soil profiles. *Zootaxa*, 4496(1): 96–110. https://doi.org/10.11646/zootaxa.4496.1.7

HÖSER, N. (2021): Zur Regenwurmfauna (Oligochaeta: Lumbricidae) des Leinawaldes, eines mitteldeutschen Lösswaldes. *Hercynia N.F.,* 54(1): 77–96.

HÖSER, N. (2022): Zur Regenwurmfauna (Oligochaeta: Lumbricidae) im Querschnitt des Leipziger Elster-Pleiße-Auenwaldes. *Hercynia N.F.,* 55: 45–65.

HSU, G.-C., SZLAVECZ, K., CSUZDI, CS., BERNARD, M. & CHANG, C.-H. (2023): Ecological groups and isotopic niches of earthworms. *Applied Soil Ecology*, 181: 104655. https://doi.org/10.1016/j.apsoil.2022.104655

KÖNEKAMP, A.H. & ZIMMER, E. (1955): Ergebnisse der Wurzeluntersuchungen Völkenrode 1949-1953. *Zeitschrift für Pflanzenernährung, Düngung und Bodenkunde*, 68(2): 158-169.

KUBIENA, W.L. (1986): *Grundzüge der Geopedologie und der Formenwandel der Böden*. Österreichischer Agrarverlag, Wien.

LAVELLE, P. (1981): Stratégies de reproduction chez les vers de terre. *Acta Oecologica/ Oecologia Generalis*, 2: 117–133.

LAVELLE, P. (1988): Earthworm activities and the soil system. *Biology and Fertility of Soils*, 6(3): 237–251. https://doi.org/10.1007/BF00260820

LEE, K.E. (1985): *Earthworms. Their ecology and Relationships with Soils and Land Use*. Academic Press Australia

LEGER, M. (1990): Loess landforms. *Quaternary International*, 7-8: 53–61. https://doi.org/10.1016/1040-6182(90)90038-6

LIEBEROTH, I. (1963): Lößsedimentation und Bodenbildung während des Pleistozäns in Sachsen. *Geologie*, 12(2): 149–187.

LOWE, C.N. & BUTT, K.R. (2003): Influence of food particle size on inter- and intra-specific interactions of *Allolobophora chlorotica* and *Lumbricus terrestris*. *Pedobiologia,* 47(5–6): 574–577. https://doi.org/10.1078/0031-405600231

NEILSON, R. & BOAG, B. (2003): Feeding preferences of some earthworm species common to upland pastures in Scotland. *Pedobiologia,* 47(1): 1–8. https://doi.org/10.1078/S0031-4056(04)70173-0

PEREL, T.S. (1977): Differences in lumbricid organization connected with ecological properties. In. LOHM, U. & PERSSON, T. (Eds.) Soil organisms as components of ecosystems. *Ecological Bulletins (Stockholm),* 25: 56–63.

PIEARCE, T.G. (1978): Gut contents of some lumbricid earthworms. *Pedobiologia*, 18: 153–157.

SCHLICHTING, E., BLUME, H.-P. & STAHR, K. (1995): *Bodenkundliches Praktikum*, 2. Auflage. Blackwell Wissenschaftsverlag, Berlin, Wien.

WATERS, R.A.S. (1955): Numbers and weights of earthworms under highly productive pasture. *New Zealand Journal of Science and Technology*, 36 A: 516–525.

Opusc. Zool. Budapest, 2023, 54: 91–157

Oribatid mites of Madagascar (Acari: Oribatida)

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„Dedicated to our family members from whom we inherited our restless blood, who had been living with Indians, sailing and possibly even been pirating in the Far East in earlier centuries, or searching the new and the unknown at home, may it be the world exhibition in Paris or a furniture factory in Budapest. But above all, we dedicate our book to Count Móricz Benyovszky, who was probably the first Hungarian to reach Madagascar, became the ruler and master of it, and worked for this land and people." (Sándor Mahunka)

Abstract. Around 350 Oribatid mite species are listed from Madagascar, with their synonyms and distribution data. New records are provided for 29 species from which three species are new to the fauna of Madagascar: *Acrotritia reticulata* (Mahunka, 1988), *Malaconothrus (Malaconothrus)* cf. *monodactylus* (Michael, 1888) and *Parasuctobelba subcomplexa* (Balogh & Mahunka, 1968). *Notophthiracarus puylaerti* Niedbała, 2001 is excluded from the fauna of Madagascar due to erroneous citation.

Keywords. Madagascar hotspot, monograph, checklist, fauna list, endemism, species richness

INTRODUCTION

Madagascar is the fourth-largest island in the world and at the same time it is one of the 35 biodiversity hotspots of the world (Myers *et al.* 2000). Its species richness and the high level of endemism is a result of the islands biogeographyical history (Vences *et al.* 2009). Acarological interest turned to Madagascar dominantly concerning parasitic and commensal mites of vertebrates (for details see O'Connor 2003). However, the first oribatid mites from the island have been described by János Balogh very early, in the 60's (Balogh 1960, 1962). His disciple, the also world renown specialist, Sándor Mahunka continued the study of Malagasy oribatid fauna (*e.g.* Mahunka, 1983a, 1993a, 1994 etc.).

Based on large collecting activities [*e.g.* by Tamás Pócs (bryologist) and Csaba Csuzdi (earthworm specialist) from the Hungarian Natural History Museum, and researchers of the Museum d'Histoire Naturelle Geneva, Switzerland (Dr. B. Hauser and Dr. C. Lienhard)], the study of Madagascar's Oribatida fauna considerably accelerated from the 80's but mostly from 90's. As the number of oribatid species described or recorded grew higher and higher (outlined in Mahunka 2001), the first survey of Oribatid mites of Madagascar was written in 2002 (Mahunka 2002b). In that paper he gave a species list of all known species, completed with literature references. Mahunka's aim at that time was to give a good survey and basis for future research focusing on the group.

During the following decade taxonomic work on Malagasy Oribatida became more and more intensive (see papers of Mahunka, Fernandez, Ermilov, Niedbała) so Mahunka intended to write

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a comprehensive monograph (as already proposed *e.g.* in Mahunka 2009b, 2010a, Mahunka & Mahunka-Papp 2011). Sadly, preparation of this monograph was demolished by the death of Luise Mahunka-Papp in 2011 and Sándor Mahunka in 2012. Originally it should have been published as a new volume of the Pedozoologica Hungarica series. By the end of 2012 the colophon, table of contents, species list and list of localities (as the Material and Methods chapter) has already been written as a cooperation of the couple. After their death, we did not want this huge work to remain unpublished. Based on the notes originally written by Sándor Mahunka and Luise Mahunka-Papp here we present a shorter monograph than originally intended. Such a really deep, comprehensive monograph which resembles Mahunka's first intention was published in 2017 by Niedbała (dedicated to Sándor Mahunka), but not on the whole order Oribatida, "just" on ptyctimous mites (Niedbała 2017).

MATERIALS AND METHODS

From personal communication with Sándor Mahunka and Luise Mahunka-Papp and from their notes which were left behind we know that they wanted to publish not only an up-to-date species list including synonyms and literature references but they wanted to supply it with illustrated redescriptions and distribution data for all species. As such a work is beyond our abilities, we decided to represent a slightly re-edited version, with only an updated species list supplied with synonym lists and distribution data.

Classification is based on the world catalogue by Subìas (2004–2022). Although some authors do not exclusively follow Subìas' classification, here we follow him because his world catalogue is the mainstay for acarologists dealing with Oribatida in the world. The only exceptions are ptyctimous mites, where we follow Niedbała (Niedbała 2017). Synonym lists contain the descriptive paper and all citations from Madagascar in timeline. We list them without critics or any taxonomic action, just willing to sum all information. In case the last Madagascan citation uses an old version of the name we end the synonym list with the current name used by Subías (with the year where it was first mentioned in the current form).

Distribution data are given on large scale, also based on Subìas (2004-2022) supplied with other literature data only if needed. The list of localities is limited to Madagascar and it contains all locality data supplied with literature references where they were published (in the form as they were published, *i.e.* we did not introduce uniformed names).

For some species we found non-published material in the Soil Zoology Collections of the Hungarian Natural History Museum, Budapest, too, all identified by Sándor Mahunka. These data are represented here as new records.

List of Oribatid mites of Madagascar

PALAEOSOMATA Grandjean, 1969

CTENACARIDAE Grandjean, 1954

Beklemishevia Zachvatkin, 1945

Beklemishevia demeteri Mahunka, 1984

Beklemishevia demeteri Mahunka, 1984: 88, figs. 1A–G.
Beklemishevia cf. demeteri: Mahunka 1997a: 120.
Beklemishevia cf. demeteri: Mahunka 2002b: 6.
Beklemishevia cf. demeteri: Mahunka 2010a: 48.

Distribution. Ethiopian region.
Localities in Madagascar. 53 km from Tôlanaro on the road to Amboasary (Mahunka 1997a); Mananara Nord Biosphere Reserve and National Park (Mahunka 2010a).

APHELACARIDAE Grandjean, 1954

Aphelacarus Grandjean, 1932

Aphelacarus acarinus (Berlese, 1910)

Parhypochthonius acarinus Berlese, 1910a: 219, pl. 19: 42.

Aphelacarinus acarinus: Grandjean 1954: 226, figs 11–17.
Aphelacarus acarinus: Mahunka 1994: 48.
Aphelacarus acarinus: Mahunka 1997a: 117.
Aphelacarus acarinus: Mahunka 2002b: 7.

Distribution. Semicosmopolitan (Holarctis, Ethiopis & Nearctis).

Locality in Madagascar. 53 km from Tôlanaro on the road to Amboasary (Mahunka 1997a).

HYPOCHTHONIOIDEA Berlese, 1910

HYPOCHTHONIIDAE Berlese, 1910

Eohypochthonius (Eohypochthonius) Jacot, 1938

Eohypochthonius (Eohypochthonius) robustus Mahunka, 2011

Eohypochthonius robustus Mahunka, 2011b: 44, figs 1a–d.
Eohypochthonius (Eohypochthonius) robustus: Subías 2021: 21.

Distribution. Ethiopian region (Madagascar and Mozambique).

Locality in Madagascar. Ranomafana (Mahunka 2011b).

New records. Prov. Antsiranana [formerly Diego Suarez] Sub-Pref Antsiranana: National Park "Montagne Amber" (= Ambohitra), drive to the "Petit Lac" primary forest soil sampling in the angles by the foothills of a large dead tree. 1090 m, 24.11.1989, leg. B. Hauser (Mad-89/19), Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with Marattia fraxinea, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29.07.1998, leg. T. Pócs (No. 9862) (Afr-917).

Malacoangelia Berlese, 1913

Malacoangelia remigera Berlese, 1913

Malacoangelia remigera Berlese, 1913: 101, pl. 7: 86, pl. 8: 88.
Malacoangelia remigera: Mahunka 1997a: 121, fig.4.
Malacoangelia remigera: Mahunka 2002b: 7.

Distribution. Pantropical and subtropical.

Locality in Madagascar. Island of Nosy Be, Lokobe Strict Nature Reserve (Mahunka 1997a).

ENIOCHTHONIIDAE Grandjean, 1947

Hypochthoniella Berlese, 1910

Hypochtoniella sumatrana Mahunka, 1989

Hypochthoniella sumatrana Mahunka, 1989: 675, figs 1–4.
Hypochthoniella sumatrana: Mahunka 1993: 290.
Hypochthoniella sumatrana: Mahunka 2002b: 7.
Eniochthonius sumatranus: Mahunka 2010a: 48.
Hypochthoniella sumatrana: Subías 2022: 32.

Distribution. Oriental and Malgache region.

Localities in Madagascar. Analamazoatra Special Reserve (Mahunka 1993); Mount Maromizaha, south of the Andasibe National Park (Mahunka 2010a).

New records. Ambohitantely Forest Reserve E of Manonkazo village (Ankaszabz town). Relic xerophyllous (dry evergreen) plateau forest at 1500–1530 m alt. 18°09'23"S, 47°7'02"E. 05–06. 09.1994, leg. T. Pócs (No. 9444) (Afr 857). Toamasina Province. Maromizaha forest. Mossy montane rainforest with bamboo (Nastus sp.) undergrowth on the summit ridge of Mount Maromizaha, south of the Andasibe National Park and the Antananarivo Toamasina road, 2 km W of Anevoka village, at 1080–1214 m alt. 18°57.8'S, 48°27.5'E, 26.08.1998, leg. T. Pócs (No. 9890) (Afr-923) [2 vials from the same locality, with the same labels]; (Prov. Tamatave), Sub-pref. Moramanga): Analamazoatra Special Reserve (formerly Perinet) near Andasibe, primary forest, soil sample from the foot of a Ravensara sp. tree (Lauraceae), 1020 m, extracted with Berlese funnel, 21.11. 1989, leg. B. Hauser (Mad-89/3).

LOHMANNIDAE Berlese, 1916

Dendracarus Balogh, 1961

Dendracarus pulchellus Balogh, 1960

Dendracarus pulchellus Balogh, 1960: 16, figs 13–14.

Dendracarus pulchellus: Balogh 1961: 30, figs 35–36.
Dendracarus pulchellus: Balogh & Balogh 1987: 346, pl. 34: A–B.
Dendracarus pulchellus: Mahunka 2002b: 9.
Dendracarus pulchellus: Balogh & Balogh 2002: 74, pl. 128: 9–10.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Mont Papango near Befotaka (Balogh 1960).

Javacarus Balogh, 1961

Javacarus porosus Hammer, 1979

Javacarus porosus Hammer, 1979: 9, fig. 8.
Javacarus porosus: Mahunka 1993: 291, figs 1–4.
Javacarus porosus: Mahunka 1997a: 118.
Javacarus porosus: Mahunka 2002b: 9.

Distribution. Pantropical except Australia.
Localities in Madagascar. Island of Nosy Be, Lokobe Strict Nature Reserve (Mahunka 1993, Mahunka 1997a).

Meristacarus Grandjean, 1934

Meristacarus madagascarensis Balogh, 1961

Meristacarus madagascarensis Balogh, 1961: 28, figs 23–24.
Meristacarus madagascarensis: Balogh 1962a: 122, figs 1–3.
Meristacarus madagascarensis madagascarensis: Balogh & Balogh 1987: 340, pl. 23: B.
Meristacarus madagascarensis: Mahunka 1997a: 118.
Meristacarus madagascarensis: Mahunka 2002b: 9.
Meristacarus madagascarensis madagascarensis: Balogh & Balogh 2002: 69, pl. 122: 2.

Distribution. Ethiopian region (Madagascar) and Oriental region (Thailand and Vietnam).
Localities in Madagascar. Nosy Be, Pointe a la Fievre (Balogh 1962a); Island of Nosy Be, Lokobe Strict Nature Reserve (Mahunka 1997a).

Paulianacarus (Millotacarus) Balogh, 1961

Paulianacarus (Millotacarus) granulatus (Balogh, 1960)

Millotacarus granulatus Balogh, 1960: 12, figs 10–12.
Millotacarus granulatus: Balogh 1961a: 29, figs 31–32.
Millotacarus granulatus: Balogh & Balogh 1987: 344, pl. 31. figs A–B.
Millotacarus granulatus: Coetzee 2001: 65.
Millotacarus granulatus: Mahunka 2002b: 9.
Millotacarus granulatus: Balogh & Balogh 2002: 72, pl. 126. fig. 7.
Paulianacarus (*Millotacarus*) *granulatus*: Subías 2004: 41.

Distribution. Madagascar and India (Andhra Pradesh).
Locality in Madagascar. Maroansetra, Ambodivoangy (Balogh 1960).

Paulianacarus (Paulianacarus) Balogh, 1961

Paulianacarus (Paulianacarus) laevis Balogh, 1960

Paulianacarus laevis Balogh, 1960: 10, figs 3–4.
Paulianacarus levis (sic!): Balogh 1961: 29, figs 25–26.
Paulianacarus levis (sic!): Balogh & Balogh 1987: 344, pl. 31: C.
Paulianacarus laevis: Coetzee 2001: 64.
Paulianacarus laevis: Mahunka 2002b: 9.
Paulianacarus levis (sic!): Balogh & Balogh 2002: 72, pl. 127: 5.
Paulianacarus laevis: Subías 2004: 40.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ankaratra, Man jakatomso (Balogh 1960).

Paulianacarus (Paulianacarus) nodosus Balogh, 1961

Paulianacarus nodosus Balogh, 1960: 10, figs 5–7.
Paulianacarus nodosus: Balogh 1961: 29, figs 27–28.
Paulianacarus nodosus: Balogh & Balogh 1987: 344, pl. 30: B–C.
Paulianacarus nodosus: Coetzee 2001: 64.
Paulianacarus nodosus: Mahunka 2002b: 9.
Paulianacarus nodosus: Balogh & Balogh 2002: 72, pl. 127: 3–4.
Paulianacarus nodosus: Mahunka 2011b: 44.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Maroansetra, Ambodivoangy (Balogh 1960); Andasibe (Perinet) (Mahunka 2011b).

New record. Nosy Mangabe Island in Antongil Bay S of Maroantsetra town. Mesic lowland rainforest on the W slope at 1-300 m alt. 15°29'S, 49°45'E, 13.09.1994, leg. T. Pócs (No. 9450) (Afr-859)

Paulianacarus (Paulianacarus) rugosus
Balogh, 1960

Paulianacarus rugosus Balogh, 1960: 12, figs 8–9.
Paulianacarus rugosus: Balogh 1961: 29, figs 29–30.
Paulianacarus rugosus: Balogh & Balogh 1987: 344, pl. 29: D.
Paulianacarus rugosus: Mahunka 1997a: 118.
Paulianacarus rugosus: Coetzee 2001: 64.
Paulianacarus rugosus: Mahunka 2002b: 9.
Paulianacarus rugosus: Balogh & Balogh 2002: 72, pl. 127: 2.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Italaviana, Fanovana (Balogh 1960); Analamazoatra Special Reserve, Ile de Nosy Boraha (Mahunka 1997a).

New record. Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with Marattia fraxinea, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29. 07. 1998, leg. T. Pócs (No. 9862) (Afr-917).

MESOPLOPHORIDAE Ewing, 1917

***Archoplophora* Hammen, 1959**

Archoplophora rostralis (Willmann, 1930)

Phthiracarulus rostralis Willmann, 1930: 245, figs 8–9.
Archoplophora rostralis: Niedbała 2017: 13, fig. 4.

Distribution. Semicosmopolitan.

Locality in Madagascar. Ankarafantsika National Park (Niedbała 2017)

***Mesoplophora (Mesoplophora)* Berlese, 1904**

Mesoplophora (Mesoplophora) Africana
Balogh, 1958

Mesoplophora africana Balogh, 1958: 32.
Mesoplophora (Mesoplophora) africana: Niedbała 2017: 13, fig. 5.

Distribution. Afrotropical, central and eastern parts (Niedbała 2017).

Localities in Madagascar. Andasibe National Park, Ankarafantsika National Park, Zombitse National Park (Niedbała 2017).

Mesoplophora (Mesoplophora) invisitata
Niedbała, 1983

Mesoplophora (Mesoplophora) invisitata Niedbała, 1983b: 647, figs 1–11.
Mesoplophora (Mesoplophora) invisitata: Niedbała 2017: 16, fig. 6.

Distribution. Pantropical, Oriental and Afrotropical Regions (Niedbała 2017).

Locality in Madagascar. Ankarafantsika National Park (Niedbała 2017).

Mesoplophora (Mesoplophora) similis
Mahunka, 2011

Mesoplophora (*Mesoplophora*) *similis* Mahunka, 2011b: 46, figs 2a–d.
Mesoplophora (*Mesoplophora*) *similis*: Niedbała 2017: 16, fig. 7.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 2011b).

***Mesoplophora (Parplophora)* Niedbała, 1985**

Mesoplophora* (*Parplophora*) *madegassica
Mahunka, 2009

Mesoplophora (*Parplophora*) *madegassica* Mahunka, 2009c: 340, figs 1–4.
Mesoplophora (*Parplophora*) *madegassica*: Niedbała 2017: 19, fig. 9.
Mesoplophora (*Parplophora*) *madegassica*: Ermilov & Frolov 2022a: 442.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2009c).

PROTOPLOPHOROIDEA Ewing, 1917

COSMOCHTHONIIDAE Grandjean, 1947

Cosmochthonius (Cosmochthonius) Berlese, 1910

Cosmochthonius (Cosmochthonius) margaritatus Mahunka & Mahunka-Papp, 2011

Cosmochthonius margaritatus Mahunka & Mahunka-Papp, 2011: 126, figs 1a–f.
Cosmochthonius (Cosmochthonius) margaritatus: Subías 2014: 27.

Distribution. Endemic to Madagascar.
Locality in Madagascar. On the summit ridge of Mount Maromizaha, south of the Andasibe National Park (Mahunka & Mahunka-Papp 2011).

Cosmochthonius (Cosmochthonius) semiareolatus Hammer, 1966

Cosmochthonius semiareolatus Hammer, 1966: 14, pl. 3, fig. 12.
Cosmochthonius (Cosmochthonius) semiareolatus: Subías 2004: 33.
Cosmochthonius semiareolatus: Mahunka & Mahunka-Papp 2011: 128, figs 2a–d.

Distribution. New Zeland, Madagascar and Argentina.
Locality in Madagascar. Mananara Nord Biosphere Reserve and National Park (Mahunka & Mahunka-Papp 2011). However, this locality data may be doubtful. For details see the *Remarks*.
Remarks. During collection research we found the label in the vial referring to a different locality than the published: Toamasina Province, Maromizaha forest. Mossy montane rainforest with bamboo (Nastus sp.) undergrowth on the summit ridge of Mount Maromizaha, south of the Andasibe National Park and the Antananarivo Toamasina road, 2 km W of Anevoka village, at 1080–1214 m alt. 18°57.8'S, 48°27.5'E, 26.08. 1998, leg. T. Pócs (No. 9890) (Afr-923). Even in the handwritten notebook of Sándor Mahunka this locality is connected to the species.

SPHAEROCHTHONIIDAE Grandjean, 1947

Sphaerochthonius Berlese, 1910

Sphaerochthonius variesetosus Mahunka, 1997

Sphaerochthonius variesetosus Mahunka, 1997a: 121, figs 1–4.
Sphaerochthonius variosetosus (sic!): Mahunka 2002b: 7.
Sphaerochthonius variesetosus: Balogh & Balogh 2002: 53, pl. 103. fig. 11.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Lokobe Strict Nature Reserve (Mahunka 1997a).
New record. Toamasina Province. Maromizaha forest. Mossy montane rainforest with bamboo (Nastus sp.) undergrowth on the summit ridge of Mount Maromizaha, south of the Andasibe National Park and the Antananarivo Toamasina road, 2 km W of Anevoka village, at 1080–1214 m alt. 18°57.8'S, 48°27.5'E, 26.08.1998, leg. T. Pócs (No. 9890) (Af-923).

PROTOPLOPHORIDAE Ewing, 1917

Bursoplophora Subías & Pérez-Iñigo, 1978

Bursoplophora madagassica Mahunka, 1994

Bursoplophora madagassica Mahunka, 1994: 49, figs 1–7.
Bursoplophora madagassica: Mahunka 2002b: 7.
Bursoplophora madagassica: Niedbała 2004b: 820, figs 7. D–J.
Bursoplophora madagassica: Niedbała 2017: 10, fig. 2.

Distribution. Endemic to Madagascar.
Localities in Madagascar. 45 km from Tôlanaro on the road to Amboasary, 53 km from Tôlanaro on the road to Amboasary (Mahunka 1994).

Prototritia Berlese, 1916

Prototritia armadillo (Berlese, 1916)

Arthrhoplophora (Prototritia) armadillo Berlese, 1916: 66.
Prototritia armadillo: Niedbała 2017: 11, fig. 3.

Distribution. Africa, eastern part.
Localities in Madagascar. Ankarafantsika National Park, Montagne de Francais (Niedbała 2017).

EPILOHMANNIOIDEA Oudemans, 1923

EPILOHMANNIIDAE Oudemans, 1923

Epilohmannia (Epilohmannia) Berlese, 1916

Epilohmannia (Epilohmannia) insignipes Balogh, 1962

Epilohmannia insignipes Balogh, 1962a: 123, figs 4–6.
Epilohmannia insignipes: Mahunka 2002b: 9.
Epilohmannia insignipes: Balogh & Balogh 2002: 56, pl. 106. figs 3–4.
Epilohmannia insignipes: Mahunka 2010a: 48.
Epilohmannia insignipes: Subías 2017: 50.

Distribution. Ethiopian region (Guinea Ecuatorial: Isl. Bioko [Fernando Poo] and Kenya).
Localities in Madagascar. Mont Papango near Befotaka (Balogh 1962a); Mount Maromizaha, south of the Andasibe National Park (Mahunka 2010a).

Epilohmannia (Epilohmannia) minuta Berlese, 1920

Epilohmannia minuta Berlese, 1920: 149.
Epilohmannia pallida: Mahunka 2009c: 338.
Epilohmannia (Epilohmannia) minuta: Subías 2017: 50.
Epilohmannia minuta: Ermilov & Frolov 2022a: 442.

Distribution. Tropical (Ethiopian, Oriental: India and Thailand, and Neotropical) central and eastern U.S.A.
Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2009c).

EUPHTHIRACAROIDEA JACOT, 1930

EUPHTHIRACARIDAE JACOT, 1930

Acrotritia Jacot, 1923

Acrotritia ardua (C. L. Koch, 1841)

Hoplophora ardua C. L. Koch, 1841: 32, 15.
Rhysotritia ardua: Niedbała 2001: 87.
Rhysotritia ardua: Mahunka 2002b: 8.
Rhysotritia ardua: Niedbała 2004a: 334.
Acrotritia ardua: Niedbała & Starý 2016a: 588.
Acrotritia ardua: Niedbała 2017: 44, fig. 27.

Distribution. Cosmopolitan.
Localities in Madagascar. Befingotra (Niedbała 2001); Montagne de Francais (Niedbała & Starý 2016a, Niedbała 2017); Ambohitantely Special Reserve, Ankarafantsika National Park, Montagne d'Ambre National Park, Montagne de Francais, North of Manankazo village, Ranomafana National Park, Zombitse National Park (Niedbała 2017).

Acrotritia divida (Mahunka, 1991)

Rhysotritia divida Mahunka, 1991: 344, figs 51–55.
Acrotritia divida: Niedbała 2017: 48, fig. 28.

Distribution. Pantropical (eastern part) (Niedbała 2017).
Locality in Madagascar. Montagne d'Ambre National Park (Niedbała 2017).

Acrotritia granulata (Mahunka, 1999)

Rhysotritia granulata Mahunka, 1999b: 81, figs 18–20.
Rhysotritia granulata: Mahunka 2002b: 9.
Rhysotritia granulata: Balogh & Balogh 2002: 46.
Rhysotritia granulata: Niedbała 2004a: 334.
Acrotritia granulata: Niedbała 2017: 48: fig. 34D.

Distribution. Endemic to Madagascar.
Localities in Madagascar. between Ambatolaona and Mandraka (Mahunka 1999b); Ambohitantely Special Reserve (Niedbała 2017).

Acrotritia paraardua Niedbała & Starý, 2015

Acrotritia paraardua Niedbała & Starý, 2015c: 1692, fig. 2.
Acrotritia paraardua: Niedbała & Starý 2016a: 589.
Acrotritia paraardua: Niedbała 2017: 48, fig. 29.
Acrotritia paraardua: Ermilov & Frolov 2022a: 442.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Ambohitantely Special Reserve, Andasibe National Park, Reservation Expérimentale de Vohimana (Niedbała & Starý 2015c, Niedbała 2017); Andasibe-Mantadia National Park, Montagne d'Ambre National Park (Niedbała & Starý 2016a, Niedbała 2017); Andasibe-Mantadia National Park, Montagne d'Ambre National Park (Niedbała 2017).

Acrotritia paradikra Niedbała & Starý, 2015

Acrotritia paradikra Niedbała & Starý, 2015c: 1695, fig. 3.
Acrotritia paradikra: Niedbała 2017: 51, fig. 30.

Distribution. Madagascar, Brasil and Mexico.

Localities in Madagascar. Ankarafantsika National Park, Ranomafana National Park (Niedbała & Starý 2015c); Ambohitantely Special Reserve, Andasibe National Park, Ankarafantsika National Park, Ranomafana National Park (Niedbała 2017).

Acrotritia refracta (Niedbała, 1998)

Rhysotritia refracta Niedbała, 1998b: 479, figs 155–159.
Acrotritia refracta: Niedbała 2017: 51, fig. 31.

Distribution. Pantropical.

Localities in Madagascar. Andasibe National Park, Ranomafana National Park (Niedbała 2017).

Acrotritia reticulata (Mahunka, 1988)

Rhysotritia reticulata Mahunka, 1988a: 358, figs 32–34.
Acrotritia reticulata: Subías 2004: 46.

Distribution. Tanzania, Canada, Argentina.

New record. National Park Montagne d'Ambre, Lac Maudit, leg. R. Schabetsberger.

Remarks. This species is new to the fauna of Madagascar.

Acrotritia rustica (Niedbała, 1991)

Rhysotritia rustica Niedbała, 1991: 34, figs 8–14.
Rhysotritia rustica: Niedbała 2001: 88.
Rhysotritia rustica: Mahunka 2002b: 9.
Rhysotritia rustica: Niedbała 2004a: 334.
Acrotritia rustica: Niedbała & Starý 2016a: 589.
Acrotritia rustica: Niedbała 2017: 51, fig. 32.
Acrotritia rustica: Ermilov & Frolov 2022a: 443.

Distribution. Pantropical (Australian: Australia and New Guinea) and Holarctic: Southern Palearctic (Turkey and Eastern Palearctic) and Southeastern U.S.A.

Localities in Madagascar. Fianarantsoa (Niedbała 2001); Andasibe-Mantadia National Park, Montagne d'Ambre National Park (Niedbała & Starý 2016a); Ambohitantely Special Reserve, Andasibe National Park, Andasibe-Mantadia National Park, Ankarafantsika National Park, Border of Andasibe National Park, Montagne d'Ambre National Park, Ranomafana National Park, Reservation Expérimentale de Vohimana (Niedbała 2017).

Acrotritia spiculifera (Mahunka, 1991)

Rhysotritia clavata spiculifera Mahunka, 1991: 344, figs 43–50.
Rhysotritia spiculifera: Mahunka 1999b: 81.
Rhysotritia spiculifera: Niedbała 2001: 88.
Rhysotritia spiculifera: Mahunka 2002b: 9.
Rhysotritia spiculifera: Niedbała 2004a: 334.
Acrotritia spiculifera: Niedbała 2017: 55, fig. 33.

Distribution. Pantropical (except Neotropical) and subtropical.

Localities in Madagascar. Between Ambatolaona and Mandraka (Mahunka 1999b); Andasibe National Park, Beforona commune Ambatondralanga (Niedbała 2017).

Acrotritia vestita (Berlese, 1913)

Hoploderma vestita Berlese, 1913: 103, figs: 8: 103, 130a.

Rhysotritia anchistea: Niedbała 1998a: 468, figs 112–116.
Rhysotritia cf. anchistea: Mahunka 1999b: 78.
Rhysotritia cf. anchistea: Mahunka 2002b: 8.
Rhysotritia comteae Mahunka, 1983: 273, figs 4–7.
Rhysotritia comteae: Niedbała 2001: 87.
Rhysotritia comtae (sic!): Mahunka 2002b: 8.
Rhysotritia comteae: Niedbała 2004a: 334.
Acrotritia comteae: Niedbała 2008: 3.
Acrotritia vestita: Niedbała & Starý 2016a: 589.
Acarotritia vestita: Niedbała 2017: 55, fig. 34.

Distribution. Pantropical (frequent), Eastern Palearctic and Eastern Canada.

Localities in Madagascar. Between Ambatolaona and Mandraka (Mahunka 1999b *Rhysotritia cf. anchistea*); Fianarantsoa (Niedbała 2001, Niedbała 2008 *Rhysotritia comteae*); Andasibe-Mantadia National Park, Montagne de Francais (Niedbała & Starý 2016a *Acrotritia vestita*); Ambohitantely Special Reserve, Andasibe-Mantadia National Park, Ankarafantsika National Park, Beforona commune Ambatondralanga, Border of Andasibe National Park, Montagne d'Ambre National Park, Montagne de Francais, Ranomafana National Park, Reservation Expérimentale de Vohimana (Niedbała 2017 *Acrotritia vestita*).

New record. National Park Montagne d'Ambre, Lac Maudit, leg. R. Schabetsberger.

Bukitritia Mahunka, 1990

Bukitritia timah Mahunka, 1990

Bukitritia timah Mahunka, 1990a: 69, figs 14–21.
Bukitritia timah: Mahunka 1999b: 73.
Bukitritia timah: Niedbała 2001: 89.
Bukitritia timah: Mahunka 2002b: 8.
Bukitritia timah: Niedbała 2004a: 334.
Bukitritia timah: Niedbała 2017: 58, fig. 35.

Distribution. Malaysia and Madagascar.

Locality in Madagascar. between Ambatolaona and Mandraka (Mahunka 1999b).

Euphthiracarus (Euphthiracarus) Ewing, 1917

Euphthiracarus (Euphthiracarus) duplex Niedbała & Starý, 2014

Euphthiracarus (Euphthiracarus) duplex Niedbała & Starý, 2014c: 486, figs 1A–G.
Euphthiracarus (Euphthiracarus) duplex: Niedbała 2017: 41, fig. 23.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Beforona commune, Vohidrazana (Niedbała & Starý 2014c, Niedbała 2017).

Euphthiracarus (Euphthiracarus) incredibilis (Mahunka, 1999)

Niedbalaia incredibilis Mahunka, 1999b: 77, figs 12–17.
Euphthiracarus incredibilis: Niedbała 2001: 86, figs 656–658.
Niedbalaia incredibilis: Mahunka 2002b: 8.
Niedbalaia incredibilis: Balogh & Balogh 2002: 45.
Euphthiracarus (Euphthiracarus) incredibilis: Niedbała 2004a: 334.
Euphthiracarus (Euphthiracarus) incredibilis: Niedbała 2017: 41, fig. 24.

Distribution. Endemic to Madagascar.

Locality in Madagascar. between Ambatolaona and Mandraka (Mahunka 1999b).

Euphthiracarus (Euphthiracarus) netron Niedbała & Starý, 2014

Euphthiracarus (Euphthiracarus) netron Niedbała & Starý, 2014c: 486, figs 2A–E.
Euphthiracarus (Euphthiracarus) netron: Niedbała 2017: 44, fig. 25.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Ranomafana National Park, Vatoharanana (Niedbała & Starý 2014c, Niedbała 2017).

Euphthiracarus (Euphthiracarus) paranetron Niedbała & Starý, 2016

Euphthiracarus (Euphthiracarus) paranetron Niedbała & Starý, 2016b: 486, fig. 2.
Euphthiracarus (Euphthiracarus) paranetron: Niedbała 2017: 44, fig. 26.
Euphthiracarus paranetron: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Montagne d'Ambre National Park (Niedbała & Starý 2016b, Niedbała 2017).

Microtritia Märkel, 1964

Microtritia hauseri Mahunka, 1993

Microtritia hauseri Mahunka, 1993a: 293, figs 11–14.
Microtritia hauseri: Niedbała 1998a: 67, figs 146–148.
Microtritia hauseri: Mahunka 1999b: 73.
Microtritia hauseri: Niedbała 2001: 89.
Microtritia hauseri: Mahunka 2002b: 8.
Microtritia hauseri: Balogh & Balogh 2002: 46, pl. 96. figs 4–6.
Microtritia hauseri: Niedbała 2004a: 334.
Microtritia hauseri: Mahunka 2010a: 48.
Microtritia hauseri: Niedbała 2017: 58, fig. 36.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Analamazoatra Special Reserve before Andasibe (Mahunka 1993a, Niedbała 1998a); between Ambatolaona and Mandraka (Mahunka 1999b); Fianarantsoa (Niedbała 2001); Mount Maromizaha, south of the Andasibe National Park, Ambatondralanga, Ambohitantely Special Reserve, Beforona commune (Niedbała 2017).

New record. Nosy Mangabe Island in Antongil Bay S of Maroantsetra town. Mesic lowland rainforest on the W slope at 1-300 m alt. 15°29'S, 49°45'E, 13.09.1994, leg. T. Pócs (No. 9450) (Afr-859).

Microtritia striatissima Mahunka, 1999

Microtritia striatissima Mahunka, 1999b: 74, figs 8–11.
Microtritia striatissima: Niedbała 2001: 89, figs 660–661.
Microtritia striatissima: Mahunka 2002b: 8.
Microtritia striatissima: Balogh & Balogh 2002: 45.
Microtritia striatissima: Niedbała 2004a: 334.
Microtritia striatissima: Niedbała 2017: 61, fig. 37.

Distribution. Endemic to Madagascar.

Localities in Madagascar. between Ambatolaona and Mandraka (Mahunka 1999b); Ambohitantely Special Reserve, Beforona commune, Ranomafana National Park (Niedbała 2017).

Microtritia tropica Märkel, 1964

Microtritia tropica Märkel, 1964: 49, fig. 11a–e.
Microtritia tropica: Niedbała 2008: 3.
Microtritia tropica: Mahunka 2009c: 338.
Microtritia tropica: Niedbała & Starý 2016a: 589.
Microtritia tropica: Niedbała 2017: 61, fig. 38.
Microtritia tropica: Ermilov & Frolov 2022a: 443.

Distribution. Pantropical and Japan.

Localities in Madagascar. Fianarantsoa (Niedbała 2008); Montagne d'Ambre National Park (Mahunka 2009c); Andasibe-Mantadia National Park, Montagne d'Ambre National Park (Niedbała & Starý 2016a, Niedbała 2017); Ambohitantely Special Reserve, Andasibe National Park, Montagne d'Ambre National Park, North of Manankazo village, Ranomafana National Park, Reservation Expérimentale de Vohimana (Niedbała 2017).

ORIBOTRITIIDAE Grandjean, 1954

Indotritia (Indotritia) Jacot, 1929

Indotritia (Indotritia) javensis (Sellnick, 1923)

Tritia javensis Sellnick, 1923: 14, figs 3, 14, 26.
Indotritia (Indotritia) javensis: Subías: 2004: 43.
Indotritia javensis: Niedbała & Starý 2016a: 588.
Indotritia javensis: Niedbała 2017: 35, fig. 19.

Distribution. Pantropical species introduced to southern and eastern parts of Palaearctic (Niedbała 2017).

Localities in Madagascar. Montagne de Francais (Niedbała & Starý 2016a, Niedbała 2017); Ambohitantely Special Reserve, Andasibe National Park, Andasibe-Mantadia National Park, Ankarafantsika National Park, Beforona commune, Montagne de Francais, Ranomafana National Park (Niedbała 2017).

Indotritia (Indotritia) paulyi Niedbała, 1998

Indotritia (Indotritia) paulyi Niedbała, 1998a: 41, figs 52–57.
Indotritia paulyi: Mahunka 1999b: 69.
Indotritia (Indotritia) paulyi: Niedbała 2001: 85.

Indotritia paulyi: Mahunka 2002b: 9.
Indotritia paulyi: Balogh & Balogh 2002: 44, pl. 91. figs 7–9.
Indotritia (Indotritia) paulyi: Niedbała 2004a: 334.
Indotritia (Indotritia) paulyi: Niedbała 2017: 38, fig. 21.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Foulpointe (Niedbała 1998a); between Ambatolaona and Mandraka (Mahunka 1999b); Befingotra, Fianarantsoa (Niedbała 2001); Ambohitantely Special Reserve, Andasibe National Park, Ankarafantsika National Park, Ranomafana National Park (Niedbała 2017).

Indotritia (Indotritia) tripartita Niedbała, 1998

Indotritia (Indotritia) tripartita Niedbała, 1998: 44, figs 58–63.
Indotritia (Indotritia) tripartita: Niedbała 2017: 38, fig. 22.

Distribution. Afrotropical.
Localities in Madagascar. Andasibe National Park, Ankarafantsika National Park, Ranomafana National Park (Niedbała 2017).

***Oribotritia (Oribotritia)* Jacot, 1924**

Oribotritia (Oribotritia) breviseta
Niedbała & Starý, 2015

Oribotritia breviseta Niedbała & Starý, 2015c: 1690, fig. 1.
Oribotritia breviseta: Niedbała & Starý 2016a: 588.
Oribotritia breviseta: Niedbała 2017: 22, fig. 10.
Oribotritia (Oribotrita) breviseta: Subías 2020: 51.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Andasibe National Park (Niedbała & Starý 2015c); Andasibe National Park, Andasibe-Mantadia National Park (Niedbała & Starý 2016a, Niedbała 2017); Andasibe National Park, Andasibe-Mantadia National Park, Ankarafantsika National Park, Beforona commune, Reservation Expérimentale de Vohimana (Niedbała 2017).

Oribotritia (Oribotrita) mahunkai
Niedbała & Starý, 2013

Oribotritia mahunkai Niedbała & Starý, 2013: 338, figs 1A–F.
Oribotritia mahunkai: Niedbała 2017: 24, fig. 11.
Oribotritia (Oribotrita) mahunkai: Subías 2020: 52.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ambohitantely Special Reserve (Niedbała & Starý 2013, Niedbała 2017); Ambohitantely Special Reserve, Andasibe National Park, Ankarafantsika National Park, Beforona commune, Montagne d'Ambre National Park, Montagne de Francais, North of Manankazo village, Ranomafana National Park (Niedbała 2017).

Oribotritia (Oribotritia) paraspinosa
Mahunka, 1999

Oribotritia paraspinosa Mahunka, 1999b: 70, figs 1–5.
Oribotritia paraspinosa: Niedbała 2001: 82, figs 646–650.
Oribotritia paraspinosa: Mahunka 2002b: 9.
Oribotritia paraspinosa: Niedbała 2004a: 334.
Oribotritia paraspinosa: Niedbała 2008: 3.
Oribotritia paraspinosa: Niedbała & Starý 2016a: 588.
Oribotritia paraspinosa: Niedbała 2017: 24, fig. 12.
Oribotritia (Oribotrita) paraspinosa: Subías 2020: 52.
Oribotritia paraspinosa: Ermilov & Frolov 2022a: 442.

Distribution. Eastern islands of the Afrotropical Region (Niedbała 2017).
Localities in Madagascar. Between Ambatolaona and Mandraka (Mahunka 1999b); Befingotra, Fianarantsoa (Niedbała 2001); Fianarantsoa, 28 km SSW Ambositra, (Niedbała 2008); Andasibe-Mantadia National Park, Montagne d'Ambre National Park, Montagne de Francais (Niedbała & Starý 2016a, Niedbała 2017); Ambohitantely Special Reserve, Beforona commune, Ranomafana National Park (Niedbała 2017).

Oribotritia (Oribotritia) perpusilla Niedbała & Starý, 2016

Oribotritia perpusilla Niedbała & Starý, 2016b: 486, fig. 1.

Oribotritia perpusilla: Niedbała 2017: 24, fig. 13.
Oribotritia (Oribotritia) perpusilla: Subías 2020: 52.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ranomafana National Park (Niedbała & Starý 2016b, Niedbała 2017).

Oribotritia (Oribotritia) spinosa (Mahunka, 1988)

Philotritia spinosa Mahunka, 1988b: 1098, figs 38–44.
Oribotritia spinosa: Niedbała 1998a: 23, figs 11–17.
Oribotritia spinosa: Mahunka 1999b: 73, figs 6–7.
Oribotritia spinosa: Niedbała 2001: 91.
Oribotritia spinosa: Mahunka 2002b: 9.
Oribotritia spinosa: Balogh & Balogh 2002: 42, pl. 86. figs 1–3.
Oribotritia spinosa: Niedbała 2004a: 334.
Oribotritia spinosa: Niedbała 2008: 3.
Oribotritia spinosa: Niedbała 2017: 28, fig. 14.
Oribotritia (Oribotrita) spinosa: Subías 2020: 53.

Distribution. Madagascar, Mauritius and Reunion.
Localities in Madagascar. Foulpointe, Pont Onibé, Vavatèze (Niedbała 1998a); Mananara Nord Biosphere Reserve and National Park, between Ambatolaona and Mandraka (Mahunka 1999b); Fianarantsoa (Niedbała 2008); Ambohitantely Special Reserve, Beforona commune, Montagne de Francais, Ranomafana National Park (Niedbała 2017).

Oribotritia (Oribotritia) striata Mahunka, 2009

Oribotritia striata Mahunka, 2009a: 93, figs 6–9.
Oribotritia striata: Niedbała 2017: 28, fig. 15.
Oribotritia (Oribotrita) striata: Subías 2020: 53.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Vohimana Reserve (Mahunka 2009a); Ambohitantely Special Reserve, Andasibe National Park, Andasibe-Mantadia National Park, Ankarafantsika National Park, Beforona commune, Border of Andasibe National Park, Montagne d'Ambre National Park, Montagne de Francais, Ranomafana National Park, Reservation Expérimentale de Vohimana (Niedbała 2017).

Oribotritia (Oribotrita) succincta Niedbała, 1998

Oribotritia succincta Niedbała, 1998: 25, figs 18–22.
Oribotritia succincta: Mahunka 2002b: 9.
Oribotritia succincta: Balogh & Balogh 2002: 42, pl. 85. figs 10–12.
Oribotritia succincta: Niedbała 2004a: 334.
Oribotritia succincta: Niedbała 2017: 31, fig. 16.
Oribotritia (Oribotrita) succincta: Subías 2020: 53.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Fuolpointe, Vavatèze (Niedbała, 1998).

Oribotritia (Oribotritia) tiwi Mahunka, 1987

Oribotritia tiwi Mahunka, 1987: 83, figs 27–30.
Oribotritia tiwi: Niedbała 1998a: 28, figs 23–27.
Oribotritia tiwi: Niedbała 2001: 84.
Oribotritia tiwi: Mahunka 2002b: 9.
Oribotritia tiwi: Niedbała 2004a: 334.
Oribotritia tiwi: Niedbała 2017: 31, fig. 17.
Oribotritia (Oribotrita) tiwi: Subías 2020: 53.

Distribution. Afrotropical, eastern part (Niedbała 2017).
Localities in Madagascar. Foulpointe (Niedbała 1998a); Befingotra, Fianarantsoa (Niedbała 2001).

Oribotritia (Oribotritia) virgulata Niedbała, 2001

Oribotritia virgulata Niedbała, 2001: 84, figs 651–655.
Oribotritia virgulata: Mahunka 2002b: 9.
Oribotritia virgulata: Niedbała 2004a: 334.
Oribotritia virgulata: Niedbała 2008: 3.
Oribotritia virgulata: Niedbała 2017: 31, fig. 18.
Oribotritia (Oribotrita) virgulata: Subías 2020: 53.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Befingotra (Niedbała 2001); Fianarantsoa (Niedbała 2008); Andasibe National Park, Ambohitantely Special Reserve (Niedbała 2017).

PHTHIRACAROIDEA Petry, 1841

PHTHIRACARIDAE Perty, 1841

Atropacarus (Atropacarus) Ewing, 1917

Atropacarus (Atropacarus) primus
Niedbała & Starý, 2015

Atropacarus (Atropacarus) primus Niedbała & Starý, 2015a: 46, figs 32–41.
Atropacarus (Atropacarus) primus: Niedbała 2017 169, fig. 115.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ranomafana National Park (Niedbała & Starý 2015a, Niedbała 2017).

Atropacarus (Atropacarus) striculus
(C. L. Koch, 1836)

Hoplophora stricula C. L. Koch, 1836: 2, 10.
Atropacarus (Atropacarus) striculus: Niedbała 2017: 169, fig. 116.

Distribution. Semicosmopolitan.
Locality in Madagascar. Ranomafana National Park (Niedbała 2017).

***Atropacarus (Hoplophorella)* Berlese, 1923**

Atropacarus (Hoplophorella) andrei
(Balogh, 1958)

Steganacarus andrei Balogh, 1958: 33.
Atropacarus (Hoplophorella) andrei: Niedbała 2017: 141, fig. 96.

Distribution. Pantropical.
Locality in Madagascar. Montagne d'Ambre National Park (Niedbała 2017).

Atropacarus (Hoplophorella) balazsi
(Mahunka, 1983)

Hoplophorella balazsi Mahunka, 1983a: 99, figs 1–4.
Atropacarus (Hoplophorella) balazsi: Niedbała 2001: 58, figs 492–495.
Hoplophorella balazsi: Mahunka 2002b: 8.
Kakophthiracarus balazsi: Balogh & Balogh 2002: 22, pl. 35. figs 3–5.
Atropacarus (Hoplophorella) balazsi: Niedbała 2004a: 333.
Atropacarus (Hoplophorella) balazsi: Niedbała 2017: 144, fig. 97.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Is. Nosy Be, (Mahunka 1983a); Ambohitantely Special Reserve (Niedbała 2017).

Atropacarus (Hoplophorella) cucullatus
(Ewing, 1909)

Hoploderma hamata Ewing, 1909: 133, fig. 35.
Atropacarus (Hoplophorella) cucullarus: Niedbała & Starý 2016a: 590.
Atropacarus (Hoplophorella) cucullarus: Niedbała 2017: 144, fig. 98.

Distribution. Semicosmopolitan.
Localities in Madagascar. Montagne de Francais (Niedbała & Starý 2016a, Niedbała 2017); Ankarafantsika National Park (Niedbała 2017).

Atropacarus (Hoplophorella) distinctus
Niedbała & Starý, 2014

Atropacarus (Hoplophorella) distinctus Niedbała & Starý, 2014b: 75, figs 2A–J.
Atropacarus (Hoplophorella) distinctus: Niedbała 2017: 147, fig. 99.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ambohitantely Special Reserve (Niedbała & Starý 2014b, Niedbała 2017).

Atropacarus (Hoplophorella) hamatus
(Ewing, 1909)

Hoploderma hamatum Ewing, 1909: 134, fig. 36.
Hoplophorella hamata: Mahunka 2009c: 340.
Atropacarus (Hoplophorella) hamatus: Niedbała & Starý 2016a: 590.
Atropacarus (Hoplophorella) hamatus: Niedbała 2017: 147, fig. 100.

Distribution. Semicosmopolitan.
Localities in Madagascar. 73 km from Tôlanaro on the road to Amboasary (Mahunka 2009c); Andasibe-Mantadia National Park, Montagne de Francais (Niedbała & Starý 2016a, Niedbała 2017); Ankarafantsika National Park, (Niedbała 2017).

Atropacarus (Hoplophorella) lemurius
(Mahunka, 1993)

Hoplophorella lemuria Mahunka, 1993a: 293, figs 5–10.
Atropacarus (Hoplophorella) lemurius: Niedbała 2001: 61, figs 536–538.
Hoplophorella lemuria: Mahunka 2002b: 8.
Hoplophorella lemuria: Balogh & Balogh 2002: 23, pl. 37. figs 9–10.
Atropacarus (Hoplophorella) lemurius: Niedbała 2004a: 333.
Atropacarus (Hoplophorella) lemurius: Niedbała 2017: 147, fig. 101A.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Analamazoatra Special Reserve (Mahunka 1993a); Ambohitantely Special Reserve (Niedbała 2017).

Atropacarus (Hoplophorella) mahunkai
Niedbała & Starý, 2013

Atropacarus (Hoplophorella) mahunkai Niedbała & Starý, 2013: 342, figs 3A–F.
Atropacarus (Hoplophorella) mahunkai: Niedbała 2017: 151, figs 101B–G, 102.
Atropacarus (Hoplophorella) othneios Niedbała & Starý, 2014b: 78, figs 3A–G, 4A–E.
Atropacarus (Hoplophorella) othneios: Niedbała 2017: 151.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ranomafana National Park (Niedbała & Starý 2013 *mahunkai,* Niedbała 2017 *mahunkai*), Ambohitantely Special Reserve; Ranomafana National (Niedbała & Starý 2014b *othneios*).

Atropacarus (Hoplophorella) oblongus
Niedbała, 1983

Hoplophorella oblonga Niedbała, 1983a: 131, figs 18–32.
Atropacarus (Hoplophorella) oblongus: Niedbała & Starý 2016a: 590.
Atropacarus (Hoplophorella) oblongus: Niedbała 2017: 154, fig. 107.

Distribution. Afrotropical, central and eastern parts.
Localities in Madagascar. Montagne de Francais (Niedbała & Starý 2016a, Niedbała 2017); Ankarafantsika National Park (Niedbała 2017).

Atropacarus (Hoplophorella) paralemurius
Niedbała & Starý, 2016

Atropacarus (Hoplophorella) paralemurius Niedbała & Starý, 2016a: 595, figs 3A–K.
Atropacarus (Hoplophorella) paralemurius: Niedbała 2017: 159, fig. 108.
Atropacarus (Hoplophorella) paralemurius: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ambohitantely Special Reserve, Montagne d'Ambre National Park, Montagne de Francais (Niedbała & Starý 2016a, Niedbała 2017).

Atropacarus (Hoplophorella) parastenos
Niedbała & Starý, 2016

Atropacarus (Hoplophorella) parastenos Niedbała & Starý, 2016b: 494, fig. 6.
Atropacarus (Hoplophorella) parastenos Niedbała 2017: 159, fig. 109.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Niedbała & Starý 2016b, Niedbała 2017).

Atropacarus (Hoplophorella) stilifer
(Hammer, 1961)

Steganacarus stilifer Hammer, 1961: 132, fig. 132.
Atropacarus (Hoplophorella) stilifer: Niedbała 2017: 162, fig. 111.

Distribution. Pantropical.
Localities in Madagascar. Andasibe National Park, Ankarafantsika National Park, Montagne de Francais, Ranomafana National Park (Niedbała 2017).

Atropacarus (Hoplophorella) vitrinus
(Berlese, 1913)

Hoploderma vitrinum Berlese, 1913: 103, figs 100a–b.

Hoplophorella vitrina: Mahunka 2009c: 339.
Hoplophorella vitrina: Mahunka 2010a: 48.
Atropacarus (Hoplophorella) vitrinus: Niedbała & Starý 2016a: 590.
Atropacarus (Hoplophorella) vitrinus: Niedbała 2017: 166, figs 113–114.

Distribution. Semicosmopolitan.

Localities in Madagascar Lokobe Strict Nature Reserve (Mahunka 2009c); Manongarivo Special Reserve (Mahunka 2010a); Montagne de Francais (Niedbała & Starý 2016a); Andranomena Special Reserve, Ankarafantsika National Park, Montagne de Francais, Zombitse National Park, (Niedbała 2017).

Arphthicarus Niedbała, 1994

Arphthicarus inelegans (Niedbała, 1986)

Hoplophthiracarus inelegans Niedbała, 1986: 115, figs 1–7.
Arphthiracarus inelegans: Niedbała & Starý 2016a: 589.
Arphthiracarus inelegans: Niedbała 2017: 85, fig. 54.
Arphthiracarus inelegans: Ermilov & Frolov 2022a: 443.

Distribution. Pantropical.

Localities in Madagascar. Montagne d'Ambre National Park (Niedbała & Starý 2016a, Niedbała 2017); Ranomafana National Park, Reservation Expérimentale de Vohimana (Niedbała 2017).

Arphthicarus phoxos Niedbała & Starý, 2016

Arphthiracarus phoxos Niedbała & Starý, 2016: 590, figs 1A–G.
Arphthiracarus phoxos: Niedbała 2017: 88, fig. 56.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Montagne de Francais (Niedbała & Starý 2016a, Niedbała 2017).

Arphthicarus sculptilis (Niedbała, 1988)

Hoplophthiracarus sculptilis Niedbała, 1988: 79, figs 1–8.
Arphthicarus sculptilis: Niedbała 2001: 42, figs 313–318.
Arphthicarus sculptilis: Mahunka 2002b: 8.
Arphthicarus sculptilis: Niedbała 2004a: 332.
Arphthicarus sculptilis: Niedbała & Starý 2016a: 589.
Arphthicarus sculptilis: Niedbała 2017: 88, figs 57–58.

Distribution. Madagascar, Comoro Islands, Reunion and Cameroon.

Localities in Madagascar. Foulpointe (Niedbała 2001); Montagne de Francais (Niedbała & Starý 2016a); Andasibe-Mantadia National Park, Andranomena Special Reserve, Ankarafantsika National Park, Montagne de Francais (Niedbała 2017).

Arphthicarus veteratorius (Niedbała, 1988)

Hoplophthiracarus veteratorius Niedbała, 1988: 81, figs 9–15.
Arphthicarus veteratorius: Niedbała 2017: 92, fig. 60.

Distribution. Afrotropical, eastern islands: Madagascar and Comoros.

Localities in Madagascar. Andasibe National Park, Andasibe-Mantadia National Park, Beforona commune, Border of Andasibe National Park, Montagne d'Ambre National Park, Reservation Expérimentale de Vohimana (Niedbała 2017).

Hoplophthiracarus Jacot, 1933

Hoplophthiracarus paratryssos Niedbała & Starý, 2015

Hoplohthiracarus paratryssos Niedbała & Starý, 2015a: 42, figs 9–16.
Hoplohthiracarus paratryssos: Niedbała 2017: 82, fig. 53.

Distribution. Endemic to Macagascar.

Localities in Madagascar. Ranomafana National Park (Niedbała & Starý 2015a, Niedbała 2017); Montagne d'Ambre National Park (Niedbała 2017).

Notophthiracarus Ramsay, 1966

Notophthiracarus andasibensis Niedbała & Starý, 2014

Notophthiracarus andasibensis Niedbała & Starý, 2014a: 80, figs 1A–G.

Notophthiracarus andasibensis: Niedbała 2017: 99, fig. 64.
Notophthiracarus andasibensis: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Macagascar.
Localities in Madagascar. Andasibe National Park (Niedbała & Starý 2014a); Andasibe National Park, Ankarafantsika National Park, Montagne d'Ambre National Park (Niedbała & Starý 2014a, Niedbała 2017).

Notophthiracarus bicarinatus Niedbała, 2001

Notophthiracarus bicarinatus Niedbała, 2001: 48, figs 381–387.
Notophthiracarus bicarinatus: Mahunka 2002b: 8.
Notophthiracarus bicarinatus: Niedbała 2004a: 332.
Notophthiracarus bicarinatus: Niedbala 2017: 99. fig. 65.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Befingotra (Niedbała 2001).

Notophthiracarus dispersus
Niedbała & Starý, 2015

Notophthiracarus dispersus Niedbała & Starý, 2015a: 44, figs 25–31.
Notophthiracarus dispersus: Niedbała 2017: 102, fig. 68.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Beforona commune (Niedbała & Starý 2015a, Niedbała 2017).

Notophthiracarus echinus (Balogh, 1962)

Hoplophorella echinus Balogh, 1962a: 146, figs 41–43.
Notophthiracarus (N.) echinus: Mahunka 1990b: 204, figs 15–17.
Notophthiracarus echinus: Niedbała 2001: 49, figs 401–404.
Notophthiracarus echinus: Mahunka 2002b: 8.
Notophthiracarus echinus: Balogh & Balogh 2002: 28, pl. 49. figs 11–13.
Notophthiracarus echinus: Niedbała 2004a: 332.
Notophthiracarus echinus: Niedbała & Starý 2016a: 589.
Notophthiracarus echinus: Niedbała 2017: 106, fig. 69.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Mont Papango near Befotaka (Balogh 1962a); Andasibe-Mantadia National Park (Niedbała & Starý 2016a, Niedbała 2017); Andasibe National Park, Border of Andasibe National Park, Montagne d'Ambre National Park, Ranomafana National Park (Niedbała 2017).

Notophthiracarus inusitatus Mahunka, 2010

Notophthiracarus inusitatus Mahunka, 2010a: 50, figs 5–9.
Notophthiracarus inusitatus: Niedbała 2017: 106, figs 70–71.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Mount Maromizaha, south of the Andasibe National Park (Mahunka 2010a); Ranomafana National Park (Niedbała 2017).

Notophthiracarus lineatus
Niedbała & Starý, 2015

Notophthiracarus lineatus Niedbała & Starý, 2015b: 64, fig. 1.
Notophthiracarus lineatus: Niedbała 2017: 110, fig. 72.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ranomafana National Park (Niedbała & Starý 2015b, Niedbała 2017).

Notophthiracarus liratus Niedbała & Starý, 2015

Notophthiracarus liratus Niedbała & Starý, 2015b: 66, fig. 2.
Notophthiracarus liratus: Niedbała 2017: 110, fig. 73.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ranomafana National Park (Niedbała & Starý 2015b, Niedbała 2017).

Notophthiracarus malagasensis
(Mahunka, 2010)

Austrophthiracarus aokii malagasensis Mahunka, 2010a: 48, figs 1–4.
Notophthiracarus malagasensis: Niedbała 2017: 110, figs 74–75.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Mount Maromizaha, south of the Andasibe National Park (Mahunka 2010a).

Remarks. During collection research we found that the label in the vial refers to a different locality than the published one: Antsiranana Prov. Réserve Spéciale de Manongarivo. Tall mesic evergreen forest with huge sandstone cliff and boulders 7.5 km SW of Antanambao village, at the W side of Ambakatra river. At 460–570 m alt. 13°55.5'N, 48°27.3'E, 24.07.1998, leg. T. Pócs (No. 9857) (Afr-918). Even in the handwritten notebook of Sándor Mahunka this locality is connected to the species.

Notophthiracarus medius
Niedbała & Starý, 2016

Notophthiracarus medius Niedbała & Starý, 2016b: 491, fig. 5.
Notophthiracarus medius: Niedbała 2017: 115, fig. 76.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Andasibe–Mantadia National Park (Niedbała & Starý 2016b, Niedbała 2017).

Notophthiracarus micidus
Niedbała & Starý, 2015

Notophthiracarus micidus Niedbała & Starý, 2015b: 66, fig. 3.
Notophthiracarus micidus: Niedbała 2017: 115, fig. 77.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Ranomafana National Park, Zombitse National Park (Niedbała & Starý 2015b, Niedbała 2017); Andasibe-Mantadia National Park, Beforona commune, Montagne d'Ambre National Park (Niedbała 2017).

Notophthiracarus obliquus
Niedbała & Starý, 2015

Notophthiracarus obliquus Niedbała & Starý, 2015b: 68, fig. 4.
Notophthiracarus obliquus: Niedbała 2017: 118, fig. 78.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Ranomafana National Park (Niedbała & Starý 2015b, Niedbała 2017).

Notophthiracarus pandanensis
Niedbała & Starý, 2014

Notophthiracarus pandanensis Niedbała & Starý, 2014a: 80, figs 2A–H.
Notophthiracarus pandanensis: Niedbała 2017: 118, fig. 79.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Ambohitantely Special Reserve (Niedbała & Starý 2014a, Niedbała 2017).

Notophthiracarus parapaulianus
Niedbała & Starý, 2016

Notophthiracarus parapaulianus Niedbała & Starý 2016a: 592, figs 2A–G.
Notophthiracarus parapaulianus: Niedbała 2017: 118, fig. 80.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Andasibe-Mantadia National Park (Niedbała & Starý 2016a, Niedbała 2017).

Notophthiracarus parasomalicus Niedbała, 2001

Notophthiracarus parasomalicus Niedbała, 2001: 50, figs 419–424.
Notophthiracarus parasomalicus: Mahunka 2002b: 8.
Notophthiracarus parasomalicus: Niedbała 2004a: 332.

Notophthiracarus parasomalicus: Niedbała 2017: 122, fig. 82.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Fianarantsoa, Befingotra (Niedbała 2001); Ambohitantely Special Reserve, Andasibe-Mantadia National Park, Ankarafantsika National Park, Montagne d'Ambre National Park, Ranomafana National Park (Niedbała 2017).

Notophthiracarus parasummersi Niedbała, 2001

Notophthiracarus parasummersi Niedbała, 2001: 51, figs 425–430.
Notophthiracarus parasummersi: Mahunka 2002b: 8.
Notophthiracarus parasummersi: Niedbała 2004a: 332.
Notophthiracarus parasummersi: Niedbała 2017: 125, fig. 83.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Fianarantsoa (Niedbała 2001); Ambohitantely Special Reserve (Niedbała 2017).

Notophthiracarus parilloi Niedbała, 2001

Notophthiracarus parilloi Niedbała, 2001: 51, figs 432–437.
Notophthiracarus parilloi: Mahunka 2002b: 8.
Notophthiracarus parilloi: Niedbała 2004a: 332.
Notophthiracarus parilloi: Niedbała 2017: 125, fig. 84.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Befingotra (Niedbała 2001); Ambohitantely Special Reserve (Niedbała 2017).

Notophthiracarus paulianus (Balogh, 1962)

Hoplophorella pauliani Balogh, 1962a: 148, figs 44–45.
Notophthiracarus (?) paulianus: Niedbała 2001: 52, figs 405–406.
Hoplophorella pauliani: Mahunka 2002b: 8.
Notophthiracarus pauliani: Balogh & Balogh 2002: 28, pl. 50. figs 1–2.
Notophthiracarus (?) paulianus: Niedbała 2017: 125, fig. 85.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Mont Papango near Befotaka (Balogh 1962a).

Notophthiracarus procerus Niedbała, 2001

Notophthiracarus procerus Niedbała, 2001: 52, figs 438–443.
Notophthiracarus procerus: Mahunka 2002b: 8.
Notophthiracarus procerus: Niedbała 2004a: 332.
Notophthiracarus procerus: Niedbała 2017: 128, fig. 86.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Fianarantsoa, Befingotra (Niedbała 2001).

Notophthiracarus pseudosomalicus Mahunka, 2010

Notophthiracarus pseudosomalicus Mahunka, 2010a: 50, figs 10–17.
Notophthiracarus pseudosomalicus: Niedbała 2017: 128, fig. 87.

Distribution. Endemic to Madgascar.

Locality in Madagascar. Mount Maromizaha, south of the Andasibe National Park (Mahunka 2010a).

Notophthiracarus quasisimilis Niedbała & Starý, 2015

Notophthiracarus quasisimilis Niedbała & Starý, 2015b: 70, fig. 5.
Notophthiracarus quasisimilis: Niedbała 2017: 131, fig. 89.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Ranomafana National Park (Niedbała & Starý 2015b, Niedbała 2017).

Notophthiracarus quasisomalicus Niedbała & Starý, 2014

Notophthiracarus quasisomalicus Niedbała & Starý, 2014a: 81, figs 3A–H.
Notophthiracarus quasisomalicus: Niedbała 2017: 134, fig. 90.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Ambohitantely Special Reserve (Niedbała & Starý 2014a); Andasibe National Park (Niedbała 2017).

Notophthiracarus rafalskii Niedbała, 1997

Notophthiracarus rafalskii Niedbała, 1997: 87, figs 38–44.
Notophthiracarus rafalskii: Niedbała 2001: 53, figs 454–458.
Notophthiracarus rafalskii: Mahunka 2002b: 8.
Notophthiracarus rafalskii: Niedbała 2004a: 333.
Notophthiracarus rafalskii: Niedbała 2017: 134, fig. 91.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Foulpointe (Niedbała 1997, Niedbała 2001).

Notophthiracarus reticularis Niedbała & Starý, 2014

Notophthiracarus reticularis Niedbała & Starý, 2014a: 81: Figs 4A–F.
Notophthiracarus reticularis: Niedbała 2017 137, fig. 92.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Andasibe National Park, Ranomafana National Park (Niedbała & Starý 2014a, Niedbała 2017); Reservation Expérimentale de Vohimana (Niedbała 2017).

Notophthiracarus similis Niedbała, 2001

Notophthiracarus similis Niedbała, 2001: 54, figs 465–470.
Notophthiracarus similis: Mahunka 2002b: 8.
Notophthiracarus similis: Niedbała 2004a: 333.
Notophthiracarus similis: Niedbała & Starý 2016a: 590.
Notophthiracarus similis: Niedbała 2017: 137, fig. 93.
Notophthiracarus similis: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Fianarantsoa, Befingotra (Niedbała 2001); Andasibe-Mantadia National Park (Niedbała & Starý 2016a); Andasibe-Mantadia National Park, Montagne de Francais (Niedbała & Starý 2016a, Niedbała 2017); Ambohitantely Special Reserve, Andasibe National Park, Beforona commune, Montagne d'Ambre National Park, Ranomafana National Park, Reservation Expérimentale de Vohimana (Niedbała 2017).

Notophthiracarus summersi Niedbała, 2001

Notophthiracarus summersi Niedbała, 2001: 56, figs 471–475.
Notophthiracarus summersi: Mahunka 2002b: 8.
Notophthiracarus summersi: Niedbała 2004a: 333.
Notophthiracarus summersi: Niedbała 2017: 137, fig. 94.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Fianarantsoa, Befingotra (Niedbała 2001).

Notophthiracarus zebra (Balogh, 1962)

Hoplophorella zebra Balogh, 1962a: 144 figs 36–40.
Notophthiracarus zebrus: Niedbała 2001: 56, figs 477–484.
Hoplophorella zebra: Mahunka 2002b: 8.
Notophthiracarus zebra: Balogh & Balogh 2002: 28, pl. 49. figs 8–10.
Notophthiracarus zebrus: Niedbała 2004a: 333.
Notophthiracarus zebra: Mahunka 2009a: 92, figs 1–5.
Notophthiracarus zebra: Mahunka 2010a: 48.
Notophthiracarus zebrus: Niedbała 2017: 141, fig. 95.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Mont Papango near Befotaka, (Balogh 1962a); Fianarantsoa (Niedbała 2001); Vohimana Reserve (Mahunka 2009a); Mount Maromizaha, south of the Andasibe National Park (Mahunka 2010a); Ambohitantely Special Reserve, Andasibe National Park, Ranomafana National Park, Reservation Expérimentale de Vohimana (Niedbała 2017).

***Phthiracarus* Perty, 1841**

Phthiracarus anonymus Grandjean, 1933

Phthiracarus anonymus Grandjean, 1933: 313, figs 3a–b.
Phthiracarus anonymus: Niedbała, 2001: 12, figs 1–3.

Phthiracarus anonymus: Mahunka 2002b: 7.
Phthiracarus anonymus: Niedbała 2004a: 332.
Phthiracarus (Archiphthiracarus) anonymus: Subías 2004: 55.
Phthiracarus anonymus: Niedbała & Starý 2016a: 589.
Phthiracarus anonymus: Niedbała 2017: 64, fig. 39.
Phthiracarus anonymous (sic!): Ermilov & Frolov 2022a: 443.

Distribution. Semicosmopolitan.

Localities in Madagascar. Fianarantsoa, (Niedbała 2001); Montagne d'Ambre National Park (Niedbała & Starý 2016a); Ambohitantely Special Reserve, Andasibe National Park, Andasibe-Mantadia National Park, Border of Andasibe National Park, Montagne d'Ambre National Park, Montagne de Francais, Ranomafana National Park (Niedbała 2017).

Phthiracarus baloghorum (Mahunka, 1997)

Phthiracarus insularis: Balogh, 1962a: 149, figs 46–49.
Archiphthiracarella bulbifera Mahunka, 1996a: 18, figs 1–5.
Archiphthiracarella insularis: Mahunka 1996a: 20, figs 6–11.
Phthiracarus insularis: Mahunka 1997a: 117.
Archiphthiracarella baloghorum Mahunka, 1997b: 86.
Phthiracarus minor: Niedbała 2001: 15, figs 33–39.
Archiphthiracarella baloghorum: Mahunka 2002b: 7.
Archiphthiracarella bulbifera: Mahunka 2002b: 7.
Phthiracarus minor: Niedbała 2004a: 332.
Phthiracarus baloghorum: Niedbała 2008: 6.
Phthiracarus baloghorum: Niedbała & Starý 2016a: 589.
Phthiracarus baloghorum: Niedbała 2017: 64, fig. 40.

Distribution. Endemic to Madagascar.

Localities in Madagascar. La Mandraka (Balogh 1962a *P. insularis*); Andasibe (Perinet) Forest Reserve (Mahunka 1996a *A. bulbifera, A. insularis*); Ile de Nosy Boraha (Mahunka 1997a *A. baloghorum*); Andasibe-Mantadia National Park (Niedbała & Starý 2016a *P. baloghorum*); Andasibe-Mantadia National Park (Niedbała & Starý 2016a *P. baloghorum,* Niedbała 2017 *P. baloghorum*); Ambohitantely Special Reserve, Andasibe National Park, Andasibe-Mantadia National Park, Ankarafantsika National Park, Beforona commune, Border of Andasibe National Park, Ranomafana National Park, (Niedbała 2017 *P. baloghorum*).

Phthiracarus crispus Hammer, 1972

Phthiracarus crispus Hammer, 1972: 9, fig. 5.
Phthiracarus (Archiphthiracarus) crispus: Subías 2004: 55.
Phthiracarus crispus: Niedbała & Starý 2016a: 589.
Phthiracarus crispus: Niedbała 2017: 67: fig. 41.
Phthiracarus crispus: Ermilov & Frolov 2022a: 443.

Distribution. Pantropical, eastern part.

Localities in Madagascar. Montagne d'Ambre National Park (Niedbała & Starý 2016a); Andasibe National Park, Montagne d'Ambre National Park, Ranomafana National Park (Niedbała 2017).

Phthiracarus lentulus (C. L. Koch, 1841)

Hoplophora lentula C. L. Koch, 1841: 32, 16.
Phthiracarus (Phthiracarus) lentulus: Subías 2004: 55.
Phthiracarus lentulus: Niedbała 2017: 67, fig. 42.

Distribution. Holarctic, and Afrotropical (Angola, Madagascar).

Localities in Madagascar. Border of Andasibe National Park, Ranomafana National Park, Reservation Expérimentale de Vohimana, (Niedbała 2017).

Phthiracarus ochthus Niedbała, 2001

Phthiracarus ochthus Niedbała, 2001: 16, figs 46–47.
Phthiracarus ochthus: Mahunka 2002b: 8.
Phthiracarus ochthus: Niedbała 2004a: 332.
Phthiracarus (Archiphthiracarus) ochthus: Subías 2004: 55.
Phthiracarus ochthus: Niedbała 2017: 71, fig. 44.

Distribution. Ethiopian region.

Localities in Madagascar. Fianarantsoa, Befingotra (Niedbała 2001); Andasibe National Park, Montagne d'Ambre National Park (Niedbała 2017).

Phthiracarus paracrispus
Niedbała & Starý, 2016

Phthiracarus paracrispus Niedbała & Starý, 2016b: 489, fig. 3.
Phthiracarus (Archiphthiracarus) paracrispus: Subías 2017: 90.
Phthiracarus paracrispus: Niedbała 2017: fig. 45.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ankarafantsika National Park (Niedbała & Starý 2016b, Niedbała 2017); Ranomafana National Park (Niedbała 2017).

Phthiracarus parapocsi Niedbała, 2001

Phthiracarus parapocsi Niedbała, 2001: 17, figs 52–56.
Phthiracarus parapocsi: Mahunka 2002b: 8.
Phthiracarus parapocsi: Niedbała 2004a: 332.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Fianarantsoa (Niedbała 2001).

Phthiracarus pygmaeus Balogh, 1958

Phthiracarus pygmaeus Balogh, 1958: 32.
Phthiracarus pygmaeus: Niedbała 2017: 75, fig. 47.

Distribution. Pantropical.
Locality in Madagascar. Ranomafana National Park (Niedbała 2017).

Phthiracarus ranomafanensis Niedbała & Starý, 2016

Phthiracarus ranomafanensis Niedbała & Starý, 2016b: 491, fig. 4.
Phthiracarus ranomafanensis: Niedbała 2017: 75, fig. 48.
Phthiracarus (Archiphthiracarus) ranomafanensis: Subías 2017: 90.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ranomafana National Park (Niedbała & Starý 2016b).

***Plonaphacarus* Niedbała, 1986**

Plonaphacarus kugohi (Aoki, 1959)

Hoplophthiracarus kugohi Aoki, 1959: 17, fig. 12.
Plonaphacarus kugohi: Niedbała 2001: 21, figs 97–101.
Plonaphacarus kugohi: Mahunka 2002b: 8.
Plonaphacarus kugohi: Niedbała 2004a: 332.
Plonaphacarus kugohi: Niedbała & Starý 2016a: 589.
Plonaphacarus kugohi: Niedbała 2017: 78, fig. 49.

Distribution. Pantropical, Subtropical and southern Palaearctic regions.
Localities in Madagascar. Foulpointe (Niedbała 2001); Montagne de Francais (Niedbała & Starý 2016a); Ankarafantsika National Park, Montagne de Francais (Niedbała 2017).

Plonaphacarus machadoi (Balogh, 1958)

Steganacarus machadoi Balogh, 1958: 33.
Plonaphacarus machadoi: Niedbała 2017: 78, fig. 50.

Distribution. Ethiopian region.
Localities in Madagascar. Andasibe-Mantadia National Park, Ankarafantsika National Park, Montagne de Francais (Niedbała 2017).

Plonaphacarus persimilis Niedbała, 1994

Plonaphacarus persimilis Niedbała, 1994: 48, figs 23–25, 32–35.
Plonaphacarus persimilis: Niedbała & Starý 2016a: 589.
Plonaphacarus persimilis: Niedbała 2017: 78, fig. 51.

Distribution. Afrotropical species, eastern part.
Locality in Madagascar. Montagne de Francais (Niedbała & Starý 2016a, Niedbała 2017).

Plonaphacarus tanzicus (Mahunka, 1993)

Hoplophthiracarus (Plonaphacarus) tanzicus Mahunka, 1993b: 91, figs 1–7.
Plonaphacarus tanzicus: Niedbała 2017: 82, fig. 52.

Distribution. Semicosmopolitan.
Locality in Madagascar. Ambohitantely Special Reserve (Niedbała 2017).

Protophthiracarus Balogh, 1972

Protophthiracarus araios Niedbała, 2001

Protophthiracarus araios Niedbała, 2001: 44, figs 338–342.
Protophthiracarus araios: Mahunka 2002b: 8.
Protophthiracarus araios: Niedbała 2004a: 332.
Protophthiracarus araios: Niedbała & Starý 2016a: 590.
Protophthiracarus araios: Niedbała 2017: 96, fig. 61.
Protophthiracarus araios: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Foulpointe (Niedbała 2001); Montagne d'Ambre National Park, Montagne de Francais (Niedbała & Starý 2016a); Ambohitantely Special Reserve (Niedbała 2017).

Protophthiracarus mahunkai Niedbała & Starý, 2013

Protophthiracarus mahunkai Niedbała & Starý, 2013: 340, figs 2A–G.
Protophthiracarus mahunkai: Niedbała 2017: 96, fig. 62.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ambohitantely Special Reserve (Niedbała & Starý 2013, Niedbała 2017); Andasibe-Mantadia National Park, Ankarafantsika National Park, Montagne d'Ambre National Park, Montagne de Francais (Niedbała 2017).

CROTONIOIDEA Thorell, 1876

MALACONOTHRIDAE Berlese, 1916

Malaconothrus (Malaconothrus) Berlese, 1904

Malaconothrus (Malaconothrus) cf. *monodactylus* (Michael, 1888)

Nothrus monodactylus Michael, 1888: 528. pl. XLV, figs 10–14.
Malaconothrus (Malaconothrus) monodactylus: Subías 2004: 61.

Distribution. Holarctic and Neotropical.
New record. Ranomafana, E from Fianarantsoa, soil samples from litter of tropical rain forest, 24–26.09.1979, leg. D. Balázs. (Afr-311).
Remarks. This species is new to the fauna of Madagascar.

Tyrphonothrus (Cristonothrus) Subías, 2004

Tyrphonothrus (Cristonothrus) subrasus (Balogh, 1962)

Malaconothrus subrasus Balogh, 1962a: 125, figs 7–8.
Malaconothrus subrasus: Mahunka 2002b: 9.
Malaconothrus subrasus: Balogh & Balogh 2002: 76, pl. 131: figs 7–8.
Tyrphonothrus (Cristonothrus) subrasus: Subías 2014: 103.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Mont Papango near Befotaka (Balogh 1962a).

NOTHRIDAE Berlese, 1896

Nothrus C. L. Koch, 1836

Nothrus madagascarensis Mahunka, 2000

Nothrus madagascarensis Mahunka, 2000b: 21, figs 1–4.
Nothrus madagascarensis: Mahunka 2002b: 9.

Distribution. Pantropical: Neotropical, Oriental (Borneo), Ethiopian (Guinea Ecuatorial: I. Bioko [Fernando Poo] and Kenya) and Hawaii.
Locality in Madagascar. between Ambatolaona and Mandraka (Mahunka 2000b).

NANHERMANNIIDAE Sellnick, 1928

Masthermannia Berlese, 1913

Masthermannia hauseri Mahunka, 2009

Masthermannia hauseri Mahunka, 2009c: 342, figs 5–7.
Masthermannia hauseri: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2009c).

Nanhermannia (Nanhermannia) Berlese, 1913

Nanhermannia (Nanhermannia) milloti Balogh, 1960

Nanhermannia milloti Balogh, 1960: 7, figs 1–2.
Nanhermannia milloti: Mahunka 1997a: 118.
Nanhermannia milloti: Mahunka 2002b: 10.
Nanhermannia milloti: Balogh & Balogh 2002: 61.
Nanhermannia (Nanhermannia) milloti: Subías 2004: 68.
Nanhermannia milloti: Mahunka 2009a: 96, figs 10–11.
Nanhermannia milloti: Mahunka 2009c: 339.
Nanhermannia milloti: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Manjahandriana (Balogh 1960); Manjakatompo Forest Station (Mahunka 1997a); Vohimana Reserve (Mahunka 2009a); Montagne d'Ambre National Park (Mahunka 2009c).

New records. Nosy Mangabe Island in Antongil Bay S of Maroantsetra town. Mesic lowland rainforest on the W slope at 1-300 m alt. 15°29'S, 49°45'E, 13.09.1994, leg. T. Pócs (No. 9450) (Afr-859); Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with *Marattia fraxinea*, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29. 07. 1998, leg. T. Pócs (No. 9862) (Afr-917); Toamasina Prov., Mananara Nord Biosphere Reserve and National Park. Lowland rainforest on the E slopes of Mahavoho Hill (very wet types along Manahovo River, with many tree ferns, palms and Pandanus ssp., less humid on slopes) at 220–300 m alt. 16°27'S, 49°46.9-47.5'E, 14–15.08.1998, leg. T. Pócs (No. 9878) (Afr-921).

HERMANNIIDAE Sellnick, 1928

Hermannia (Phyllhermannia) Berlese, 1916

Hermannia (Phyllhermannia) exornata (Balogh, 1962)

Phyllhermannia exornata Balogh, 1962a: 127, figs 9–11.
Phyllhermannia exornata: Woas 1981: 44.
Phyllhermannia exornata: Mahunka 2002b: 10.
Phyllhermannia exonata (sic!): Balogh & Balogh 2002: 59, pl. 111. figs 11–12.
Hermannia (Phyllhermannia) exornata: Mahunka 2009b: 48.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Mont Papango near Befotaka (Balogh 1962a); Vohimana Reserve (Mahunka 2009b).

Hermannia (Phyllhermannia) pauliani (Balogh, 1962)

Phyllhermannia pauliani Balogh, 1962a: 128, figs 12–13.
Phyllhermannia pauliani: Woas 1981: 44.
Phyllhermannia pauliani: Mahunka 2002b: 10.
Phyllhermannia pauliani: Balogh & Balogh 2002: 59, pl. 110. figs 11–12.
Hermannia (Phyllhermannia) pauliani: Subías 2004: 70.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Ambatovositra (Balogh 1962a).

TRHYPOCHTHONIIDAE Willmann, 1931

Trhypochthoniellus Willmann, 1928

Trhypochthoniellus longisetus setosus Willmann, 1928

Trhypochthonius longisetus Berlese, 1904: 27, fig. 2:44.
Trhypochthoniellus longisetus: Mahunka 2011a: 3, figs 1–4.
Trhypochthoniellus longisetus f. *setosus*: Schabetsberger et al. 2013: 331.
Trhypochthoniellus longisetus: Ermilov & Frolov 2022a: 443.
Trhypochthoniellus longisetus setosus: Subías 2010: 92.

Distribution. Continental Southeast Asia, Palearctis and Madagascar.

Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2011a).

Remarks. Looking at the synonym list and the publication list it seems that the species was found

twice in Madagascar, in the same national park. At first Mahunka cited it without subspecies designation (Mahunka 2011a). When it was found again in the same national park – but with different collecting method –, he cited it with subspecies designation (Schabetsberger *et al*. 2013). As the nominotypical subspecies is cosmopolitan and the subspecies *T. l. setosus* is known to have more restricted distribution (Corpuz-Raros & Ermilov 2020), we keep this subspecies in the list.

HERMANIELLOIDEA Grandjean, 1934

HERMANNIELLIDAE Grandjean, 1934

Hermanniella Berlese, 1908

Hermanniella madagascarensis Balogh, 1962

Hermanniella madagascarensis Balogh, 1962b: 419, figs 1–4.
Hermanniella madagascarensis: Mahunka 2002b: 10.
Hermanniella madagascarensis: Balogh & Balogh 2002: 96, pl. 154. figs 9–11.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Quest Tanikely (Balogh 1962b).

Hermanniella vohimana Mahunka & Mahunka-Papp, 2011

Hermanniella vohimana Mahunka & Mahunka-Papp, 2011: 128, figs 2a–d.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka & Mahunka-Papp 2011).

PLASMOBATIDAE GRANDJEAN, 1961

Malgachebates Fernandez, Cleva & Theron, 2011

Malgachebates peyrierasi Fernandez, Cleva & Theron, 2011

Malgachebates peyrierasi Fernandez, Cleva & Theron, 2011: 62, figs 1–53.

Distribution. Ethiopian and Neotropical.
Locality in Madagascar. Ankarongambe forest (10 km E/SE of Ambohidray) (Fernandez, Cleva & Theron 2011).

PLATEREMAEOIDEA Trägardh, 1926

PLATEREMAEIDAE Trägardh, 1926

Paralopheremaeus Paschoal, 1987

Paralopheremaeus legendrei (Balogh, 1962)

Plateremaeus legendrei Balogh, 1962b: 421, figs 5–6.
Paralopheremaeus legendrei: Paschoal 1987: 351.
Paralopheremaeus legendrei: Mahunka 2002b: 10.
Plateremaeus legendrei: Balogh & Balogh 2002: 106, pl. 167. fig. 12., pl. 168. fig. 1.

Distribution. Ethiopian region (Madagascar and Kenya) and Sri Lanka.
Locality in Madagascar. Quest Tanikely (Balogh 1962b).

PHEROLIODIDAE PASCHOAL, 1987

Malgacheliodes Fernandez & Cleva, 2010

Malgacheliodes guillaumeti Fernandez & Cleva, 2010

Malgacheliodes guillaumeti Fernandez & Cleva, 2010b: 419, figs 1–4.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Amindramiova (Fernandez & Cleva 2010b).

Nooliodes Paschoal, 1989

Nooliodes glaber (Balogh, 1962)

Plateremaeus glaber Balogh, 1962b: 421, figs 7–8.
Nooliodes glaber: Paschoal 1989: 180.
Nooliodes glaber: Mahunka 1997a: 118.
Nooliodes glaber: Mahunka 2002b: 10.
Nooliodes glaber: Balogh & Balogh 2002: 106, pl. 169. figs 1–2.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Quest Tanikely (Balogh 1962b); Island of Nosy Be, Lokobe Strict Nature Reserve, (Mahunka 1997a).

CEPHEOIDEA Berlese, 1896

MICROTEGEIDAE Balogh, 1972

Microtegeus Balogh, 1972

Microtegeus paracervus Mahunka, 1997

Microtegeus cervus Mahunka, 1996b: 109, figs 1–5.
Microtegeus paracervus: Mahunka 1997b: 86.
Microtegeus cervus: Mahunka 2002b: 10.
Microtegeus paracervus: Mahunka 2009a: 91.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Mount Ambatokirijy at the S edge of Andasibe (Perinet) Forest Reserve (Mahunka 1996b); Vohimana Reserve (Mahunka 2009a).

Microtegeus zigzag Mahunka, 2011

Microtegeus zigzag Mahunka, 2011b: 46, figs: 3a–c.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe (Perinet) (Mahunka 2011b).

NOSYBEIDAE Mahunka, 1993

Nosybea Mahunka, 1993

Nosybea genavensis Mahunka, 1993

Nosybea genavensis Mahunka, 1993a: 298, figs 17–25.
Nosybea genavensis: Mahunka 2002b: 10.
Nosybea genavensis: Balogh & Balogh 2002: 255, pl. 353. figs 2–3.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Island of Nosy Be, Lokobe Strict Nature Reserve (Mahunka 1993a).

POLYPTEROZETOIDEA Grandjean, 1959

NODOCEPHEIDAE Piffl, 1972

Nodocepheus Hammer, 1958

Nodocepheus baloghi Mahunka, 1983

Nodocepheus baloghi Mahunka, 1983b: 164, figs 41–43, 46.
Nodocepheus baloghi: Mahunka & Mahunka-Papp 2011: 126.

Distribution. Tanzania and Madagascar.
Locality in Madagascar. Nosy Mangabe Island (Mahunka & Mahunka-Papp 2011).

MICROZETOIDEA Grandjean, 1936

MICROZETIDAE Grandjean, 1936

Acaroceras (Malgoceras) Mahunka, 1993

Acaroceras (Malgoceras) helleri Mahunka, 1993

Acaroceras (Malgoceras) helleri Mahunka, 1993a: 301, figs 26–29.
Acaroceras (Malgoceras) helleri: Mahunka 1997a: 118.
Acaroceras (Malgoceras) helleri: Mahunka 2002b: 10.
Malgoceras helleri: Balogh & Balogh 2002: 282, pl. 389, fig. 7.
Acaroceras (Malgoceras) helleri: Mahunka 2009c: 339.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Island of Nosy Be, Lokobe Strict Nature Reserve (Mahunka 1993a, Mahunka 1997a, Mahunka 2009c).

Berlesezetes Mahunka, 1980

Berlesezetes africanus (Balogh, 1958)

Microzetes africanus Balogh, 1958: 28.
Microzetes africanus: Mahunka 1999a: 67.
Microzetes africanus: Mahunka 2002b: 11.
Berlesezetes africanus: Mahunka 2009c: 339.
Berlesezetes ornatissimus ornatissimus: Subías 2004: 87.
Berlesezetes ornatissimus: Ermilov & Frolov 2022a: 443.

Distribution. Democratic Republic of Congo (Balogh 1958) and Madagascar (Mahunka 1999, 2009c).

Localities in Madagascar. Mananara Nord Biosphere Reserve and National Park (Mahunka 1999a); Montagne d'Ambre National Park (Mahunka 2009c).

Remarks. One can see that the material collected in the Ambohitra National Park ("Mad-89/8") was first identified as *B.* cf. *auxiliaris* (Mahunka 1997a), then the same locality is used for *B. africanus* (Mahunka 2009c). We checked the material in the HNHM collection and found that from the originally identified 5 *B.* cf. *auxiliaris* specimens 1 individual was later identified as *B. africanus*.

The species was described by Balogh (1958) from Belgian Congo [currently Democratic Republic of the Congo]. In the description, Balogh admits that except for one character the species is similar to *M. auxiliaris* Grandjean, 1936. In 1999 – dealing with Madagascan material – Mahunka writes: „*The status of the species has been ambiguous ever since its descripton, for many author, including myself, considered it to be synonymous with Microzetes auxiliaris. This is the first time when I found a specimen on which the guttiform incision, as described by Balogh is clearly seen just beside the outer apex of the lamellae*" (Mahunka 1999a). He was also able to investigate the types of the species preserved in the Hungarian Natural History Museum (Mahunka 2005). The last draft of the present monograph – prepared by Mahunka and Mahunka-Papp in 2011 – holds on this opinion, *i.e. B. africanus* is treated as a separate species. These are the reasons why we cite it here as a separate species, not as a synonym of *B. ornatissimus* (Berlese, 1913), as Subías (2004) and Ermilov & Frolov (2022a) treat it. Further investigations and/or molecular evidences are needed to decide about the synonymies.

Berlesezetes* cf. *auxiliaris (Grandjean, 1936)

Microzetes auxiliaris Grandjean, 1936: 138, figs 1–4.
Berlesezetes cf. auxiliaris: Mahunka 1997a: 118.
Berlesezetes cf. auxiliaris: Mahunka 2002b: 11.
Berlesezetes ornatissimus ornatissimus: Subías 2004: 87.

Distribution. Questionably circumtropical (Mahunka 2005).

Localities in Madagascar. Montagne d'Ambre National Park, Lokobe Strict Nature Reserve (Mahunka 1997a).

Remarks. Since many years there has been a debate on the identity of *B. ornatissimus* (Berlese, 1913) and *B. auxiliaris* (Grandjean, 1936) (see J. & P. Balogh 2002; Subías 2004; Mahunka 2005). From the literature we know that Sándor Mahunka has seen the types of *B. ornatissimus* (Mahunka 1980), and he was the first who has found and made drawings of *B. ornatissimus* since its description (Mahunka 1988). At that time he pointed out that: "*The difference from* B. auxiliaris *Grandjean, 1936 is very small, thus a revision is necessary*."(Mahunka 1988). Later, he also has studied *B. auxiliaris* well, as he found topotypical individuals which he regarded "*nearly identical with the ones that Grandjean described and drew*" (Mahunka 2005). We do not want to make taxonomic decisions on this issue, nor do we want to cause a loss of information. Thus, compiling the facts listed here with the remarks discussed above by *B. africanus*, we cite *B.* cf. *auxiliaris* as a separate species (and not as a synonym of *B. ornatissimus* (Berlese, 1913), as Subías (2004) and Ermilov & Frolov (2022a) treat it). Mahunka cited it always with uncertainity ("cf."), *i.e.* not as *B. auxiliaris* (even in the last drafts of the present monograph – prepared by Mahunka and Mahunka-Papp in 2011). Once he also proposed a new African species of the genus (Mahunka 2005) but without referring to that as *B.* cf. *auxiliaris*. We may never find out what he meant at that time (Mahunka 2005) but further investigations can decide on the identity of this *B.* cf. *auxiliaris* material. Further investigations and /or molecular evidences are also needed to decide about the possible synonymies in the genus.

***Comorozetes* Mahunka, 1994**

Comorozetes concurvatus Mahunka, 1999

Comorozetes concurvatus Mahunka, 1999a: 61, figs 1–4.

Comorozetes concurvatus: Mahunka 2002b: 11.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Mount Maromizaha south of the Andasibe National Park, Mananara Nord Biosphere Reserve and National Park (Mahunka 1999a).

New records. Toamasina Prov., Mananara Nord Biosphere Reserve and National Park. Lowland rainforest on the E slopes of Mahavoho Hill (very wet types along Manahovo River, with many tree ferns, palms and Pandanus ssp., less humid on slopes) at 220–300 m alt. 16°27'S, 49°46.9-47.5'E, 14–15.08.1998, leg. T. Pócs (No. 9878) (Afr-921); Prov. Antsiranana [anciennement Diego-Suarez], Sous-prèf. Antsiranana: Parc National "Montagne d'Ambre" (= Ambohitra). près de la "Petite Cascade", forêt primaire. prélèvement de sol dans les angles formés par les contreforts d'un grand arbre, 980 m, 23.11.1989, leg. B. Hauser (Mad-98/7).

Remarks. During collection research we have recognized that the label at the holotype refers to a different locality than published: Toamasina Prov., Mananara Nord Biosphere Reserve and National Park. Lowland rainforest on the E slopes of Mahavoho Hill (very wet types along Manahovo River, with many tree ferns, palms and Pandanus ssp., less humid on slopes) at 220–300 m alt. 16°27'S, 49°46.9-47.5'E, 14–15.08.1998, leg. T. Pócs (No. 9878) (Afr-921). However, we found no vials of the species with the published locality (i.e. No. 9890). Additionally, there is a non-type vial in the collection with this locality data (*i.e.* No. 9878). In the handwritten notebook of Sándor Mahunka the published locality is connected to the holotype. Thus, in this case we suppose that an erroneous labelling happened. Altogether we found four vials in the collection: one with the holotype, one with the paratype, and two vials which are published here as *New records* (see above).

Comorozetes corrugatus Mahunka, 1997

Comorozetes corrugatus Mahunka, 1997a: 123, figs 5–10.
Comorozetes corrugatus: Mahunka 2002b: 11.
Comorozetes corrugatus: Balogh & Balogh 2002: 287, pl. 393. fig. 8.
Comorozetes corrugatus: Mahunka 2009a: 92.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Lokobe Strict Nature Reserve, Ile de Nosy Boraha (Mahunka 1997a), Vohimana Reserve (Mahunka 2009a).

New records. Prov. Antsiranana [formerly Diego Snarez] Sub-Pref Antsiranana: National Park "Montagne Amber", drive to the "Petit Lac" primary forest soil sampling in the angles by the foothills of a large dead tree. 1090 m, 24.11.1989, leg. B. Hauser (Mad-89/19), Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with *Marattia fraxinea*, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29. 07. 1998, leg. T. Pócs (No. 9862) (Afr-917).

Hymenozetes **Balogh, 1962**

Hymenozetes csuzdii Mahunka, 2009

Hymenozetes csuzdii Mahunka, 2009a: 116, figs 50–52.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Vohimana Reserve (Mahunka 2009a).

Hymenozetes mirabilis Balogh, 1962

Hymenozetes mirabilis Balogh, 1962a: 142, figs 32–33.
Hymenozetes mirabilis: Mahunka 1990b: 204, figs 24–28.
Hymenozetes mirabilis: Mahunka 2002b: 11.
Hymenozetes mirabilis: Balogh & Balogh 2002: 288, pl. 394. fig. 9.
Hymenozetes mirabilis: Mahunka 2009a: 118.

Distribution. Endemic to Madagascar.

Locality in Madagascar. La Mandraka (Balogh 1962a).

Hymenozetes quadricornutus Mahunka, 1993

Hymenozetes quadricornutus Mahunka, 1993a: 303, figs 30–33.

Hymenozetes quadricornutus: Mahunka 2002b: 11.
Hymenozetes quadricornatus (sic!): Balogh & Balogh 2002: 289, pl. 394. fig. 10.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Island of Nosy Be, Lokobe Strict Nature Reserve (Mahunka 1993a).

Hymenozetes reticulatus Mahunka, 1996

Hymenozetes reticulatus Mahunka, 1996b: 110, figs 6–10.
Hymenozetes reticulatus: Mahunka 2002b: 11.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996b).

Hymenozetes stellifer Mahunka, 1999

Hymenozetes stellifer Mahunka, 1999a: 64, figs 5–7.
Hymenozetes stellifer: Mahunka 2002b: 11.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Mananara Nord Biosphere Reserve and National Park, between Ambatolaona and Mandraka (Mahunka 1999a).

Hymenozetes verticillatus Mahunka, 1997

Hymenozetes verticillatus Mahunka, 1997a: 126, figs 11–13.
Hymenozetes verticillatus: Mahunka 2002b: 11.
Hymenozetes verticillatus: Balogh & Balogh 2002: 289, pl. 394. fig. 11.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ile de Nosy Boraha (Mahunka 1997a).

***Rhopalozetes (Rhopalozetes)* Balogh, 1962**

Rhopalozetes (Rhopalozetes) cornutus
(Mahunka, 1999)

Magoebazetes cornutus Mahunka, 1999a: 65, figs 8–11.
Magoebazetes cornutus: Mahunka 2002b: 11.
Rhopalozetes (Rhopalozetes) cornutus: Subías 2022: 315.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Mount Maromizaha, south of the Andasibe National Park (Mahunka 1999a).

Rhopalozetes (Rhopalozetes) lokobensis
Mahunka, 1993

Rhopalozetes lokobensis Mahunka, 1993a: 308, figs 42–45.
Rhopalozetes lokobensis: Mahunka 2002b: 11.
Rhopalozetes lokobensis: Balogh & Balogh 2002: 290, pl. 395, fig. 8.
Rhopalozetes (Rhopalozetes) lokobensis: Subías 2022: 315.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Lokobe Strict Nature Reserve (Mahunka 1993a).

Rhopalozetes (Rhopalozetes) madecassus
Mahunka, 1993

Rhopalozetes madecassus Mahunka, 1993a: 308, figs 38–41.
Rhopalozetes madecassus: Mahunka 1997a: 118.
Rhopalozetes medecassus (sic!): Mahunka 1999a: 68.
Rhopalozetes madecassus: Mahunka 2002b: 11.
Rhopalozetes madecassus: Balogh & Balogh 2002: 290, pl. 394. fig. 7.
Rhopalozetes madecassus: Mahunka 2009a: 92.
Rhopalozetes madecassus: Mahunka 2010a: 48.
Rhopalozetes (Rhopalozetes) madecassus: Subías 2022: 315.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Lokobe Strict Nature Reserve (Mahunka 1993a, Mahunka 1997a); Vohimana Reserve (Mahunka 2009a); Mount Maromizaha, south of the Andasibe National Park (Mahunka 1999a, Mahunka 2010a).

Rhopalozetes (Rhopalozetes) milloti
Balogh, 1962

Rhopalozetes milloti Balogh, 1962a: 143, figs 34–35.
Rhopalozetes milloti: Mahunka 1990b: 206, figs 29–31.
Rhopalozetes milloti: Mahunka 2002b: 11.
Rhopalozetes milloti: Balogh & Balogh 2002: 290, pl. 395. fig. 9.

Rhopalozetes (Rhopalozetes) milloti: Subías 2022: 315.

Distribution. Endemic to Madagascar.
Locality in Madagascar. La Mandraka (Balogh 1962a).

Schalleriella Engelbrecht, 1972

Schalleriella nosybe (Mahunka, 1993)

Megazetes nosybe Mahunka, 1993a: 306, figs 34–37.
Megazetes nosybe: Mahunka 1997a: 118.
Megazetes nosybe: Mahunka 2002b: 11.
Mahunkaceras nosibe (sic!): Balogh & Balogh, 2002: 285, fig. 392: 4.
Schalleriella nosybe: Subías 2011: 158.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Lokobe Strict Nature Reserve (Mahunka 1993a, Mahunka 1997a).

Schalleriella phaseola Mahunka, 2011

Schalleriella phaseola Mahunka, 2011b: 48, figs: 4a–c.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2011b).

Vermacarus Balogh & Mahunka, 1980

Vermacarus armatus Mahunka, 1997

Vermacarus armatus Mahunka, 1997a: 126, figs 14–16.
Vermacarus armatus: Mahunka 2002b: 11.
Vermacarus armatus: Balogh & Balogh 2002: 284, pl. 391. fig. 2.
Vermacarus armatus: Mahunka 2009a: 92.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Manjakatompo Forest Station (Mahunka 1997a); Vohimana Reserve (Mahunka 2009a).

AMEROIDEA Bulanova-Zachvatkina, 1957

AMERIDAE Grandjean, 1965

Hymenobelba Balogh, 1962

Hymenobelba exclamationis Mahunka, 2010

Hymenobelba exclamationis Mahunka, 2010b: 63, figs 1–6.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Mount Maromizaha, south of the Andasibe National Park (Mahunka 2010b).

Hymenobelba flagellatissima Mahunka, 2009

Hymenobelba flagellatissima Mahunka, 2009b: 48, figs 1–3.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009b).
New record. Prov. Antsiranana [formerly Diego Suarez] Sub-Pref Antsiranana: National Park "Montagne Amber" (= Ambohitra), drive to the "Petit Lac" primary forest soil sampling in the angles by the foothills of a large dead tree. 1090 m, 24.XI.1989; leg. B. Hauser (Mad-89/19), Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with Marattia fraxinea, at 570-580 m alt. 13°23.2'S, 48°20.8'E. 29. July 1998. Coll. T. Pócs. (No. 9862) (Afr-917).

Hymenobelba ypsilon Balogh, 1962

Hymenobelba ypsilon Balogh, 1962a: 423, figs 9–11.
Hymenobelba ypsilon: Mahunka 2002b: 11.
Hymenobelba ypsilon: Balogh & Balogh 2002: 104, pl. 165. figs 10–11.

Distribution. Madagascar and North East India.
Locality in Madagascar. Quest Tanikely (Balogh 1962a).

Pteramerus Balogh, 1962

Pteramerus clypeatus Mahunka, 2010

Pteramerus clypeatus Mahunka, 2010b: 65, figs 7–17.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Mount Maromizaha, south of the Andasibe National Park (Mahunka 2010b).

New records. Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with *Marattia fraxinea*, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29. 07. 1998, leg. T. Pócs (No. 9862) (Afr-917); Toamasina Prov., Mananara Nord Biosphere Reserve and National Park. Lowland rainforest on the E slopes of Mahavoho Hill (very wet types along Manahovo River, with many tree ferns, palms and Pandanus ssp., less humid on slopes) at 220–300 m alt. 16°27'S, 49°46.9-47.5'E, 14–15.08.1998, leg. T. Pócs (No. 9878) (Afr-921).

Pteramerus draco Balogh, 1962

Pteramerus draco Balogh, 1962a: 136, figs 26–28.
Pteramerus draco: Mahunka 2002b: 11.
Pteramerus draco: Balogh & Balogh 2002: 104, pl. 165, figs 1–2.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Mont Papango near Befotaka (Balogh 1962a).

EREMULIDAE Grandjean, 1965

Caveremulus Mahunka, 1983

Caveremulus cordisetus Mahunka, 1983

Caveremulus cordisetus Mahunka, 1983a: 103, figs 5–6.
Caveremulus cordisetus: Mahunka 1993: 291.
Caveremulus cordisetus: Mahunka 1994: 49.
Caveremulus cordisetus: Mahunka 1997a: 119.
Caveremulus cordisetus: Mahunka 2002b: 11.
Caveremulus cordisetus: Balogh & Balogh 2002: 105, pl. 167. figs 1–2.
Caveremulus cordisetus: Mahunka 2009c: 339.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Ranomafana (Mahunka 1983a); Lokobe Strict Nature Reserve (Mahunka 1993); Lokobe Strict Nature Reserve (Mahunka 1994, Mahunka 1997a, Mahunka 2009c).

New record. Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with *Marattia fraxinea*, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29. 07. 1998, leg. T. Pócs (No. 9862) (Afr-917).

Caveremulus foliaceus Mahunka, 2009

Caveremulus foliaceus Mahunka, 2009c: 343, figs 8–10.
Caveremulus foliaceus: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2009c),

New record. Peyrieras, Causse de Kelifelly. Forest humus and litter from dry forest. 20-30.11.1974, leg. D. Smith (Afr-JB-1).

Caveremulus salicinus Mahunka, 2009

Caveremulus salicinus Mahunka, 2009c: 345, figs 11–13.
Caveremulus salicinus: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2009c).

DAMAEOLIDAE GRANDJEAN, 1965

Fosseremus Grandjean, 1954

Fosseremus laciniatus (Berlese, 1905)

Dameosoma laciniatum Berlese, 1905: 236.
Fosseremus quadripertitus: Mahunka 2011b: 44.
Fosseremus laciniatus: Subías 2004: 103.

Distribution. Cosmopolitan (except Antartica).

Locality in Madagascar. Mangabé Island, Antongil Bay (Mahunka 2011b).

Gressittolus Balogh, 1970

Gressittolus ocellatus (Mahunka, 2000)

Damaeolus ocellatus Mahunka, 2000b: 23, figs 5–6.

Damaeolus ocellatus: Mahunka 2002b: 10.
Gressittolus ocellatus: Baran, Ayyildiz & Subías 2010: 344.

Distribution. Endemic to Madagascar.
Locality in Madagascar. N of Andovoranto, between Artdombo and Andovoa (Mahunka 2000b).

EREMOBELBIDAE Balogh, 1961

Eremobelba Berlese, 1908

Eremobelba cellulosa Mahunka, 1997

Eremobelba cellulosa Mahunka, 1997a: 130, figs 17–21.
Eremobelba cellulosa: Mahunka 2002b: 11.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Lokobe Strict Nature Reserve (Mahunka 1997a).

RHYNCHORIBATIDAE BALOGH, 1961

Eurhynchoribates (Eurhynchoribates) Miko, 2016

Eurhynchoribates (Eurhynchoribates) genavensium (Mahunka, 1997)

Rhynchoribates genavensium Mahunka, 1997a: 150, figs 54–60.
Rhynchoribates genavensium: Balogh & Balogh 1999a: 14, figs 7–8.
Rhynchoribates genavensium: Mahunka 2002b: 13.
Rhynchoribates genavensium: Balogh & Balogh 2002: 134, pl. 196. figs 8–9.
Eurhynchoribates genavensium: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Montagne d'Ambre National Park; Island of Nosy Be, Lokobe Strict Nature Reserve (Mahunka 1997a).

Eurhynchoribates (Eurhynchoribates) robinsoni (Balogh, 1962)

Rhynchoribates robinsoni Balogh, 1962b: 425, figs 23–24.
Rhynchoribates robinsoni: Balogh & Balogh 1999a: 14, fig. 15.
Rhynchoribates robinsoni: Mahunka 2002b: 13.
Rhynchoribates robinsoni: Balogh & Balogh 2002: 134, pl. 197. fig. 4.
Eurhynchoribates (Eurhynchoribates) robinsoni: Miko 2016: 133.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Quest Tanikely (Balogh 1962b).
New records. Nosy Mangabe Island in Antongil Bay S of Maroantsetra town. Mesic lowland rainforest on the W-slope at 100–300 m alt. 13.09. 1994, leg. T. Pócs (No. 9450) (Afr-859); Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with *Marattia fraxinea*, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29. 07. 1998, leg. T. Pócs (No. 9862) (Afr-917); Toamasina Province, Maromizaha forest. Mossy montane rainforest with bamboo (Nastus sp.) undergrowth on the summit ridge of Mount Maromizaha, south of the Andasibe National Park and the Antananarivo Toamasina road, 2 km W of Anevoka village, at 1080–1214 m alt. 18°57.8'S, 48°27.5'E, 26.08.1998, leg. T. Pócs (No. 9890) (Afr-923).

Eurhynchoribates (Eurhynchoribates) subaequalis (Balogh, 1962)

Rhynchoribates subaequalis Balogh, 1962b: 425, figs 21–22.
Rhynchoribates subaequalis: Balogh & Balogh 1999a: 14, fig. 4.
Rhynchoribates subaequalis: Mahunka 2002b: 13.
Rhynchoribates subaequalis: Balogh & Balogh 2002: 134, pl. 196. fig. 5.
Eurhynchoribates (Eurhynchoribates) subaequalis: Miko 2016: 133.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Quest Tanikely (Balogh 1962b).

ZETORCHESTOIDEA Michael, 1898

ZETORCHESTIDAE Michael, 1898

Zetorchestes Berlese, 1888

Zetorchestes phylliferus Mahunka, 1983

Zetorchestes (Phyllorchestes) phylliferus Mahunka, 1983a: 105, figs 7–8.
Zetorchestes (Phyllorchestes) phylliferus: Mahunka 2002b: 11.
Zetorchestes phylliferus: Balogh & Balogh 2002: 227, pl. 314. figs 4–5.
Zetorchestes (Phyllorchestes) phylligerus (sic!): Mahunka 2009c: 339.
Zetorchestes phylliferus: Kolesnikov & Leonov 2021: 558.
Zetorchestes phylliferus: Ermilov & Frolov 2022a: 443.

Distribution. Afrotropical and Oriental.
Localities in Madagascar. Ranomafana (Mahuka 1983a); Montagne d'Ambre National Park (Mahunka 2009c); Montagne d'Ambre National Park (Ermilov & Frolov 2022a).
New records. Vohimana Reserve, primary forest. 17.04.2008, leg. Cs. Csuzdi (Afr-996); Ambohitantely Forest Reserve E of Manonkazo village (Ankaszabz town). Relic xerophyllous (dry evergreen) plateau forest at 1500–1530 m alt. 18˚09′ 23″S, 47˚17′02″E. 05–06.09.1994, leg. T. Pócs (No. 9444) (Afr 857).

GUSTAVIOIDEA Oudemans, 1900

ASTEGISTIDAE Balogh, 1961

Cultroribula Berlese, 1908

Cultroribula bicuspidata Mahunka, 1978

Cultroribula bicuspidata Mahunka, 1978b: 317, figs 17–20.
Cultroribula bicuspidata: Mahunka 2010a: 48.

Distribution. Pantropical (except Australian).
Locality in Madagascar. Mananara Nord Biosphere Reserve and National Park (Mahunka 2010a).

CERATOPPIIDAE Kunst, 1971

Trichoppia Balogh, 1961

Trichoppia longiseta Balogh, 1960

Trichoppia longiseta Balogh, 1960: 20, figs 20–22.
Trichoppia longiseta: Mahunka 1990b: 206, figs 32–35.
Trichoppia longiseta: Mahunka 1993: 291.
Trichoppia longiseta: Mahunka 1997a: 119.
Trichoppia longiseta: Mahunka 2002b: 11.
Trichoppia longiseta: Balogh & Balogh 2002: 244, pl. 338. figs 1–2.
Trichoppia longiseta: Mahunka 2009a: 91.
Trichoppia longiseta: Mahunka 2010a: 48.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Manjakandriana, La Mandraka (Balogh 1960); Analamazoatra Special Reserve (Mahunka 1993); Manjakatompo Forest Station (Mahunka 1997a); Vohimana Reserve (Mahunka 2009a); Mount Maromizaha, south of the Andasibe National Park (Mahunka 2010a).

GUSTAVIIDAE Oudemans, 1900

Gustavia Kramer, 1879

Gustavia ornata Mahunka 2011

Gustavia ornata Mahunka, 2011b: 49, figs 5a–g.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Mount Maromizaha south of the Andasibe National Park (Mahunka 2011b).

Gustavia sineornata Mahunka, 2011

Gustavia sineornata Mahunka, 2011b: 52, figs 6a–d.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Peyrieras, Causse de Kelifelly (Mahunka 2011b).

CARABODOIDEA C. L. Koch, 1837

CARABODIDAE C. L. Koch, 1837

Afticarabodes Fernandez, Theron & Rollard, 2013

Afticarabodes anjavidilavai Fernandez, Theron & Rollard, 2013

Afticarabodes anjavidilavai Fernandez, Theron & Rollard, 2013b: 465, figs. 1–25.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Anjavidilava (Fernandez, Theron & Rollard 2013b).

Antongilibodes Fernandez, Theron, Leiva, Rollard & Tiedt, 2014

Antongilibodes paulae Fernandez, Theron, Leiva, Rollard & Tiedt, 2014

Antongilibodes paulae Fernandez, Theron, Leiva, Rollard & Tiedt, 2014: 309, figs 39–72.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ile de Nosy Mangabe (Fernandez, Theron, Leiva, Rollard & Tiedt 2014).

Austrocarabodes (Austrocarabodes) Hammer, 1966

Austrocarabodes (Austrocarabodes) albidus (Balogh, 1960)

Carabodes albidus Balogh, 1960: 22, figs 23–24.
Carabodes albidus: Mahunka 2002b: 12.
Austrocarabodes albidus: Balogh & Balogh 2002: 240, pl. 333. figs 1–2.
Austrocarabodes (Austrocarabodes) albidus: Subías 2004: 148.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Manjakandriana La Mandraka (Balogh 1960).

Austrocarabodes (Austrocarabodes) blancharti Mahunka, 2009

Austrocarabodes blancharti Mahunka, 2009a: 100, figs 22–26.
Austrocarabodes (Austrocarabodes) blancharti: Subías 2010: 282.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009a).
New record. Mangabé Island, Antongil Bay. Primary rain forest, rotten wood. 19.02.1977. leg. W. L. & D. L. Brown (Afr-JB2).

Austrocarabodes (Austrocarabodes) cellularis (Balogh, 1962)

Carabodes cellularis Balogh, 1962b: 425, figs 17–18.
Carabodes cellularis: Mahunka 2002b: 12.
Austrocarabodes cellularis: Balogh & Balogh 2002: 240, pl. 332. figs 11–12.
Austrocarabodes (Austrocarabodes) cellularis: Subías 2004: 148.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Quest Tanikely (Balogh 1962b).

Austrocarabodes (Austrocarabodes) lateoalveolatus Mahunka, 2009

Austrocarabodes lateoalveolatus Mahunka, 2009a: 102, figs 27–29.
Austrocarabodes (Austrocarabodes) lateoalveolatus: Subías 2010: 283.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009a).

Austrocarabodes (Austrocarabodes) lunaris (Balogh, 1962)

Carabodes lunaris Balogh, 1962b: 423, figs 15–16.
Carabodes lunaris: Mahunka 1993: 291.
Carabodes lunaris: Mahunka 2002b: 12.
Austrocarabodes lunaris: Balogh & Balogh 2002: 238, pl. 329. figs 10–11.
Austrocarabodes (Austrocarabodes) lunaris: Subías 2004: 148.

Distribution. Endemic to Madagscar.
Localities in Madagascar. Quest Tanikely (Balogh 1962b); Lokobe Strict Nature Reserve (Mahunka 1993).

Austrocarabodes (Austrocarabodes) madagascarensis Ermilov & Starý, 2020

Austrocarabodes (Austrocarabodes) madagascarensis Ermilov & Starý, 2020c: 354, figs 1–4.
Austrocarabodes (Austrocarabodes) madagascarensis: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020c).

Austrocarabodes (Austrocarabodes) mixtus Mahunka, 1996

Austrocarabodes mixtus Mahunka, 1996b: 113, figs 11–17.
Austrocarabodes mixtus: Mahunka 2002b: 12.
Austrocarabodes (Austrocarabodes) mixtus: Subías 2004: 148.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996b).

Austrocarabodes (Austrocarabodes) parapustulatus Mahunka, 2009

Austrocarabodes parapustulatus Mahunka, 2009a: 105, figs 30–32.
Austrocarabodes (Austrocarabodes) parapustulatus: Subías 2010: 283.
Austrocarabodes parapustulatus: Ermilov & Starý 2020c: 360, figs 5–7.
Austrocarabodes parapustulatus: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Vohimana Reserve (Mahunka 2009a); Montagne d'Ambre National Park (Ermilov & Starý 2020c).

Austrocarabodes (Austrocarabodes) planisetus Mahunka & Mahunka-Papp, 2011

Austrocarabodes planisetus Mahunka & Mahunka-Papp, 2011: 130, figs 4a–e.
Austrocarabodes (Austrocarabodes) planisetus: Subías 2014: 285.
Austrocarabodes planisetus: Ermilov & Starý 2020c: 364, figs 8–10.
Austrocarabodes planisetus: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Nosy Komba Island (Mahunka & Mahunka-Papp 2011); Montagne d'Ambre National Park, (Ermilov & Starý 2020c).

Austrocarabodes (Austrocarabodes) pustuloreticulatus Mahunka, 2009

Austrocarabodes pustuloreticulatus Mahunka, 2009a: 107, figs 33-39.
Austrocarabodes (Austrocarabodes) pustuloreticulatus: Subías 2010: 283.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009a).

Austrocarabodes (Austrocarabodes) semilunatus Mahunka, 2011

Austrocarabodes semilunatus Mahunka, 2011b: 54, figs 7a–d.
Austrocarabodes (Austrocarabodes) semilunatus: Subías 2012: 279.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Peyrieras, Causse de Kelifelly (Mahunka 2011b).

Austrocarabodes (Austrocarabodes) spathulatus Mahunka, 1978

Austrocarabodes (Austrocarabodes) spathulatus Mahunka, 1978a: 204, figs 68–70.
Austrocarabodes (Austrocarabodes) spathulatus: Ermilov & Starý 2020c: 369.
Austrocarabodes (Austrocarabodes) spathulatus: Ermilov & Frolov 2022a: 443.

Distribution. Madagascar and Reunion.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020c).

***Austrocarabodes (Austroflexa)* Subías, 2019**

Austrocarabodes (Austrofelxa) armatus Mahunka, 2009

Austrocarabodes armatus Mahunka, 2009a: 98, figs 15–21.
Austrocarabodes (Austrocarabodes) armatus: Subías 2010: 282.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009a).

New record. Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with *Marattia fraxinea*, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29. 07. 1998, leg. T. Pócs (No. 9862) (Afr-917).

Bovicarabodes Fernandez, Theron & Rollard, 2013

Bovicarabodes deharvengi Fernandez, Theron & Rollard, 2013

Bovicarabodes deharvengi Fernandez, Theron & Rollard, 2013a: 4, figs: 1–32.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Marositry (Fernandez, Theron & Rollard 2013a).

Bovicarabodes fortdauphini Fernandez, Theron & Rollard, 2013

Bovicarabodes fortdauphini Fernandez, Theron & Rollard, 2013a: 13, figs: 50–69.

Distribution. Endemic to Madagascar.
Locality in Madagascar. St. Luke Coastal Forest (Fernandez, Theron & Rollard 2013a).

Bovicarabodes jacquelinae Fernandez, Theron, Rollard, Leiva & Tiedt, 2016

Bovicarabodes jacquelinae Fernandez, Theron, Rollard, Leiva & Tiedt, 2016: 80, figs: 1–5.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ile de Nosy Mangabe (Fernandez, Theron, Rollard, Leiva & Tiedt 2016).

Bovicarabodes levyi Fernandez, Theron & Rollard, 2013

Bovicarabodes levyi Fernandez, Theron & Rollard, 2013a: 8, figs: 33–49.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Anjavililava (Fernandez, Theron & Rollard 2013a).

Carabodes (Klapperiches) C. L. Koch, 1835

Carabodes (Klapperiches) afrominusculus Mahunka & Mahunka-Papp 2011

Carabodes afrominusculus Mahunka & Mahunka-Papp, 2011: 132, figs 5a–c.
Carabodes (Klapperiches) afrominusculus: Subías 2014: 289.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ambohitantely Forest Reserve (Mahunka & Mahunka-Papp 2011).

Carabodes (Klapperiches) andasibe Mahunka, 1993

Carabodes andasibe Mahunka, 1993a: 311, figs 46–49.
Carabodes andasibe: Mahunka 2002b: 12.
Carabodes abdasibe (sic!): Balogh & Balogh 2002: 232, pl. 319. figs 11–12.
Carabodes (Klapperiches) andasibe: Subías 2004: 150.
Carabodes andasibe: Mahunka 2009a: 91.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Analamazoatra Special Reserve before Andasibe (Mahunka 1993a); Vohimana Reserve (Mahunka 2009a).

Cavaecarabodes Fernandez, Theron, Rollard & Castillo, 2014

Cavaecarabodes anouchkae Fernandez, Theron, Rollard & Castillo, 2014

Cavaecarabodes anouchkae Fernandez, Theron, Rollard & Castillo, 2014b: 547, figs 36–53.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Manankaza Forest Station Ambohitantely (Fernandez, Theron, Rollard & Castillo 2014b).

Congocepheus (Congocepheus) Balogh, 1958

Congocepheus (Congocepheus) germani Fernandez, Theron, Rollard & Castillo, 2014

Congocepheus germani Fernandez, Theron, Rollard & Castillo, 2014b: 536, figs 1–12.

Congocepheus (Congocepheus) germani: Subías 2018: 302.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Ivontaka (15 km au S. de Mananara) (Fernandez, Theron, Rollard & Castillo 2014b).

Congocepheus (Congocepheus) involutus Mahunka, 1997

Congocepheus involutus Mahunka, 1997a: 133, figs 22–24.
Congocepheus involutus: Mahunka 2002b: 12.
Congocepheus involutus: Fernandez, Theron, Rollard & Tiedt 2013: 553, figs 1–5.
Congocepheus (Congocepheus) involutus: Subías 2018: 302.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Ile de Nosy Boraha (Mahunka 1997a); Vanjamanitra forest (8 km SE of Anjorzorobe), Ile de Nosy Mangabe (Fernandez, Theron, Rollard & Tiedt 2013).

New record. Central Plateau: Ambohitantely Forest Reserve E of Manonkazo village (Ankaszabz town). Relic xerophyllous (dry evergreen) plateau forest at 1500–1530 m alt. 18° 09′23″S, 47°17′02″E. 05–06.09.1994, leg. T. Pócs (No. 9444) (Afr 857).

Machadocepheus Balogh, 1958

Machadocepheus pauliani Balogh, 1962

Machadocepheus pauliani Balogh, 1962b: 423, figs 12–14.
Machadocepheus pauliani: Mahunka 2002b: 12.
Machadocepheus pauliani: Balogh & Balogh 2002: 234, pl. 323. figs 7–8.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Quest Tanikely (Balogh 1962b).

Malgasodes Mahunka, 2000

Malgasodes curvisetus Mahunka, 2000

Malgasodes curvisetus Mahunka, 2000a: 87, figs 1–4.
Malgasodes curvisetus: Mahunka 2002b: 12.
Malgasodes curvisetus: Fernandez, Theron, Rollard & Castillo 2014a: 28, figs: 1–23.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Mount Maromizaha south of the Andasibe National Park (Mahunka 2000a); Sainte Luce (Fernández, Theron, Rollard & Castillo 2014a).

Malgasodes hungarorum Mahunka, 2000

Malgasodes hungarorum Mahunka, 2000a: 90, figs 5–6.
Malgasodes hungarorum: Mahunka 2002b: 12.
Malgasodes hungarorum: Fernandez, Theron, Rollard & Castillo 2014a: 37, figs: 24–27.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Mananara Nord Biosphere Reserve and National Park (Mahunka 2000a, Fernandez, Theron, Rollard & Castillo 2014a).

Rugocepheus Mahunka, 2009

Rugocepheus formosus Mahunka, 2009

Rugocepheus formosus Mahunka, 2009b: 50, figs 4–7.
Rugocepheus formosus: Fernandez, Theron & Rollard 2013b: 470.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Vohimana Reserve (Mahunka 2009b).

Rugoceheus joffrevillei Fernandez, Theron & Rollard, 2013

Rugocepheus joffrevillei Fernandez, Theron & Rollard, 2013b: 472, figs 26–60.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Joffreville (Fernandez, Theron & Rollard 2013b).

Tuberocepheus Balogh & Mahunka, 1969

Tuberocepheus (Tuberocepheus) Balogh & Mahunka, 1969

Tuberocepheus (Tuberocepheus) longus
(Balogh, 1962)

Machadocepheus longus Balogh, 1962a: 139, figs 29–31.
Machadocepheus longus: Mahunka 2002b: 12.
Tuberocepheus longus: Balogh & Mahunka 1969: 9.
Tuberocepheus longus: Mahunka 2009a: 91.
Tuberocepheus longus: Mahunka 2011a: 5, figs 5–12.
Tuberocepheus longus: Fernandez, Theron, Rollard, Leiva & Tiedt 2016: 83, figs: 6–32.
Tuberocepheus (Tuberocepheus) longus: Subías 2017: 304.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Manjahandriana, Ambotolaona (Balogh 1962a); Vohimana Reserve (Mahunka 2009a); Mount Maromizaha south of the Andasibe National Park (Mahunka 2011a).

***Tuberocepheus (Mangabebodes)* Fernández, Theron, Leiva, Rollard & Tiedt, 2014**

Tuberocepheus (Mangabebodes) kymatismosi
Fernández, Theron, Leiva, Rollard & Tiedt, 2014

Mangabebodes kymatismosi Fernández, Theron, Leiva, Rollard & Tiedt, 2014: 298, figs 1–38.
Tuberocepheus (Mangabebodes) kymatismosi: Subías 2017: 305.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ile de Nosy Mangabe (Fernández, Theron, Leiva, Rollard & Tiedt 2014).

OTOCEPHEIDAE Balogh, 1961

***Afrotocepheus (Didierotocepheus)* Mahunka, 1994**

Afrotocepheus (Didierotocepheus) berndi
Mahunka, 1994

Didierotocepheus berndi Mahunka, 1994: 52, figs 8–12.
Didierotocepheus berndi: Mahunka 1997a: 119.
Didierotocepheus berndi: Mahunka 2002b: 12.
Didierotocepheus berndti (sic!): Balogh & Balogh 2002: 154, pl. 222. figs 4–5.
Afrotocepheus (Didierotocepheus) berndi: Subías 2004: 141.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Lokobe Strict Nature Reserve (Mahunka 1994); 45 km from Tôlanaro on the road to Amboasary (Mahunka 1994, Mahunka 1997a); Manjakatompo Forest Station (Mahunka 1997a),

***Leptotocepheus (Leptotocepheus)* Balogh, 1961**

Leptotocepheus (Longocepheus) longus
(Balogh, 1960)

Pseudotocepheus longus Balogh, 1960: 25, figs 27–29.
Pseudotocepheus longus: Mahunka 2002b: 12.
Pseudotocepheus longus: Balogh & Balogh 2002: 153, pl. 220. fig. 7.
Leptotocepheus (Longocepheus) longus: Ermilov & Minor 2018: 2271.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ankazobe, Ambohitantely; Andranomalaza, Manakombahiny-Est (Balogh 1960).

***Papillocepheus* Balogh & Mahunka, 1966**

Papillocepheus decoratus Mahunka, 1994

Papillocepheus decoratus Mahunka, 1994: 54, figs 13–17.
Papillocepheus decoratus: Mahunka 2002b: 12.
Papillocepheus decoratus: Balogh & Balogh 2002: 151, pl. 218, figs 9–10.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ile de Nosy Boraha (Mahunka 1994).

Papillocepheus reductus Mahunka, 1994

Papillocepheus reductus Mahunka, 1994: 56, figs 18–20.
Papillocepheus reductus: Mahunka 2002b: 12.
Papillocepheus reductus: Balogh & Balogh 2002: 151, pl. 218. figs 3–4.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Analamazoatra Special Reserve, Ile de Nosy Boraha (Mahunka 1994).

Pseudotocepheus Balogh, 1961

Pseudotocepheus atolanaro Mahunka, 2009

Pseudotocepheus atolanaro Mahunka, 2009b: 52, figs 8–11.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Vohimana Reserve (Mahunka 2009b).

New record. Toamasina Province, Maromizaha forest. Mossy montane rainforest with bamboo (*Nastus* sp.) undergrowth on the summit ridge of Mt. Maromizaha, south of Andasibe Nat. Park and the Antananarivo – Toamasina road, 2 km W of Anevoka village, at 1080–1214 m alt. 18°57.8'S, 48°27.5'E, 26.08.1998, leg. T. Pócs (No. 9890) (Afr-923).

Pseudotocepheus lienhardi Mahunka, 1993

Pseudotocepheus lienhardi Mahunka, 1993a: 314, figs 50–53.
Pseudotocepheus lienhardi: Mahunka 1997a: 119.
Pseudotocepheus lienhardi: Mahunka 2002b: 12.
Pseudotocepheus lienhardi: Balogh & Balogh 2002: 152, pl. 219. figs 8–9.

Distribution. Madagascar and Kenya.

Localities in Madagascar. Analamazoatra Special Reserve (Mahunka 1993a, Mahunka 1997a), 45 km from Tôlanaro on the road to Amboasary (Mahunka 1997a).

Pseudotocepheus pauliani Balogh, 1960

Pseudotocepheus pauliani Balogh, 1960: 23, figs 25–26.
Pseudotocepheus pauliani: Mahunka 2002b: 12.
Pseudotocepheus pauliani: Balogh & Balogh 2002: 155, pl. 222. figs 8–9.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Ambatovositra, Manakambahiny-Est (Balogh 1960).

Pseudotocepheus pygmaeus Balogh, 1962

Pseudotocepheus pygmaeus Balogh, 1962b: 427, figs 19–20.
Pseudotocepheus pygmaeus: Mahunka 1997a: 119.
Pseudotocepheus pygmaeus: Mahunka 2002b: 12.
Pseudotocepheus pygmaeus: Balogh & Balogh 2002: 152, pl. 219. fig. 3.

Distribution. Madagascar and Mozambique.

Localities in Madagascar. Quest Tanikely (Balogh 1962b); Lokobe Strict Nature Reserve (Mahunka 1997a).

Pseudotocepheus subtilis Mahunka & Mahunka-Papp, 2011

Pseudotocepheus subtilis Mahunka & Mahunka-Papp, 2011: 133, figs 6a–d.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Nosy Komba Island (Mahunka & Mahunka-Papp 2011).

Pseudotocepheus tolanaro Mahunka, 1997

Pseudotocepheus tolanaro Mahunka, 1997a: 135, figs 25–27.
Pseudotocepheus tolanaro: Mahunka 2002b: 12.
Pseudotocepheus tolanaro: Balogh & Balogh 2002: 152, pl. 218. figs 15–16.

Distribution. Endemic to Madagascar.

Locality in Madagascar. 45 km from Tôlanaro on the road to Amboasary (Mahunka 1997a).

OPPIOIDEA Grandjean, 1951

OPPIIDAE Grandjean, 1951

OPPIINAE Sellnick, 1937

Erioppia Balogh, 1983

Erioppia corpuzrarosae Ermilov & Starý, 2020

Erioppia corpuzrarosae Ermilov & Starý, 2020i: 448, figs 1–3.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Andasibe-Mantadia National Park (Ermilov & Starý 2020i).

Erioppia malalatinae (Mahunka, 2009)

Multioppia malalatinae Mahunka, 2009b: 54, figs 13–15.

Erioppia malalatinae: Subías 2010: 204.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009b).

Fusuloppia Balogh, 1983

Fusuloppia neonominata (Balogh, 1962)

Oppia simplex Balogh, 1962a: 129, figs 14–15.
Fusuloppia simplex: Subías & Balogh 1989: 377.
Fusuloppia simplex: Mahunka 2002a: 162.
Fusuloppia simplex: Mahunka 2002b: 12.
Fusuloppia simplex: Balogh & Balogh 2002: 203, pl. 282. figs 6–7.
Fusuloppia neonominata: Subías 2004: 113.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ankaratra, col de Faratsiho (Balogh 1962a).

Fusuloppia variosetosa Mahunka, 2010

Fusuloppia variosetosa Mahunka, 2010a: 53, figs 18–22.
Fusuloppia variosetosa: Ermilov & Starý 2020i: 446.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ranomafana; Mananara Nord Biosphere Reserve and National Park (Mahunka 2010a); Andasibe-Mantadia National Park (Ermilov & Starý 2020i).

Goyoppia Balogh, 1983

Goyoppia sexpilosa (Balogh, 1961)

Oppia sexpilosa Balogh, 1961: 17, fig. 15.
Goyoppia sexpilosa: Balogh 1983: 53, table 16. fig. 24-4.
Goyoppia sexpilosa: Subías & Balogh 1989: 377.
Goyoppia sexpilosa: Mahunka 1997a: 119.
Goyoppia sexpilosa: Mahunka 2002a: 162.
Goyoppia sexpilosa: Mahunka 2002b: 12.
Goyoppia sexpilosa: Balogh & Balogh 2002: 226, pl. 312. fig. 3.
Goyoppia sexpilosa: Ermilov & Starý 2020i: 446.
Goyoppia sexpilosa: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Manjahandriana, Ambotolaona (Balogh 1960); Montagne d'Ambre National Park (Mahunka 1997a); Andasibe-Mantadia National Park (Ermilov & Starý 2020i).

Lemuroppia Mahunka, 1994

Lemuroppia helleri Mahunka, 1994

Lemuroppia helleri Mahunka, 1994: 62, figs 33–39.
Lemuroppia helleri: Mahunka 2002a: 162.
Lemuroppia helleri: Mahunka 2002b: 13.
Lemuroppia helleri: Balogh & Balogh 2002: 226, pl. 312. figs 1–2.
Lemuroppia helleri: Mahunka 2009a: 91.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Analamazoatra Special Reserve (Mahunka 1994); Vohimana Reserve (Mahunka 2009a).
New records. Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnant in the NW valley of Antaninaomby summit with tree ferns and with *Marattia fraxinea*, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29.07.1998, leg. T. Pócs (No. 9862) (Afr-917); Toamasina Prov. Mananara Nord Biosphere Reserve and National Park. Lowland rainforest on the NW slope of Behafotra Hill, at 250–300 m alt., with 3500 mm annual rainfall. 16°27.1-3'S, 49°47.6'E, 14–15.08.1998, leg. T. Pócs (No. 9877) (Afr-920).

Oppia (Lasiobelba) Aoki, 1959

Oppia (Lasiobelba) lemuria Mahunka, 1997

Lasiobelba lemuria Mahunka, 1997a: 139, figs 34–40.
Lasiobelba lemuria: Mahunka 2002a: 162.
Lasiobelba lemuria: Mahunka 2002b: 13.
Oppia (Lasiobelba) lemuria: Subías 2022: 195.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Lokobe Strict Nature Reserve (Mahunka 1997a).

Paroppia Hammer, 1968

Paroppia breviseta (Balogh, 1962)

Oppia breviseta Balogh, 1962c: 100, figs 14–16.

Paroppia breviseta: Ermilov & Starý 2020i: 447.

Distribution. Ethiopian region.
Locality in Madagascar. Andasibe-Mantadia National Park (Ermilov & Starý 2020i).

BRACHIOPPIINAE Subías, 1989

***Brachioppiella (Gressittoppia)* Balogh, 1983**

Brachioppiella (Gressittoppia) sensilla (Mahunka, 2002)

Jermyia sensilla Mahunka, 2002a: 167, figs 1–4.
Jermyia sensilla: Mahunka 2002b: 12.
Gressittoppia sensilla: Mahunka 2010a: 48.
Brachiopiella (Gressittoppia) sensilla: Ermilov & Starý 2020i: 446.

Distribution. Endemic to Madagascar.
Localities in Madagascar. N of Andovoranto, between Artdombo and Andovoa (Mahunka 2002a); Mount Maromizaha, south of the Andasibe National Park (Mahunka 2010a); Andasibe-Mantadia National Park (Ermilov & Starý 2020i).

Brachioppiella (Gressittoppia) pocsi Mahunka, 2002

Gresittoppia pocsi Mahunka, 2002a: 169, figs 5–9.
Gresittoppia pocsi: Mahunka 2002b: 12.
Brachioppiella (Gressittoppia) pocsi: Subías 2004: 122.

Distribution. Endemic to Madagascar.
Locality in Madagascar. N of Andovoranto, between Artdombo and Andovoa (Mahunka 2002a).

***Leptoppia* Mahunka, 1997**

Leptoppia benyovszkyi Mahunka, 1996

Leptoppia benyovszkyi Mahunka, 1996b: 116, figs 18–22.
Leptoppia benyovszkyi: Mahunka 2002a: 162.
Leptoppia benyovszkyi: Mahunka 2002b: 13.
Leptoppia benyovszkyi: Mahunka 2009b: 48.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996b); Vohimana Reserve (Mahunka 2009b).

Leptoppia procera Mahunka, 1997

Leptoppia procera Mahunka, 1997a: 142, figs 41–43.
Leptoppia procera: Mahunka 2002a: 162.
Leptoppia procera: Mahunka 2002b: 13.
Leptoppia procera: Mahunka 2009b: 48.
Leptoppia procera: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madgascar.
Localities in Madagascar. Montagne d'Ambre National Park (Mahunka 1997a); Vohimana Reserve (Mahunka 2009b).

OXYOPPIINAE Subías, 1989

***Arcoppia* Balogh, 1983**

Arcoppia zsuzsankae (Mahunka, 2002)

Oxyoppiella zsuzsankae Mahunka, 2002a: 174, figs 13–16.
Oxyoppiella zsuzsankae: Mahunka 2002b: 13.
Oxyoppiella (Oxyoppiella) zsuzsankae: Mahunka & Mahunka-Papp 2012: 44.
Arcoppia zsuzsankae: Subías 2021: 220.

Distribution. Endemic to Madagascar.
Localities in Madagascar. N of Andovoranto, between Artdombo and Andovoa (Mahunka 2002a); Nosy Mangabe Island (Mahunka & Mahunka-Papp 2012).

***Fossoppia (Fossoppia)* Mahunka, 1994**

Fossoppia (Fossoppia) calcarata Mahunka, 1994

Fossoppia calcarata Mahunka, 1994: 81, figs 71–77.
Fossoppia calcarata: Mahunka 2002a: 162.
Fossoppia calcarata: Mahunka 2002b: 12.
Fossoppia calcarata: Mahunka 2009b: 48.
Fossoppia calcarata: Mahunka 2009c: 339.
Fossoppia (Fossoppia) calcarata: Subías 2017: 243.
Fossoppia calcarata: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Lokobe Strict Nature Reserve (Mahunka 1994); Vohimana Reserve (Mahunka 2009b); Montagne d'Ambre National Park (Mahunka 2009c).

Fossoppia (Multifossoppia) Subías, 2017

Fossoppia (Multifossoppia) pirata Mahunka, 1994

Fossoppia pirata Mahunka, 1994: 83, figs 78–81.
Fossoppia pirata: Mahunka 2002a: 162.
Fossoppia pirata: Mahunka 2002b: 12.
Fossoppia (Multifossoppia) pirata: Subías 2017: 244.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Ile de Nosy Boraha (Mahunka 1994).

Lineoppia Balogh & Balogh, 1983

Lineoppia tuberosa (Mahunka, 2009)

Oxyoppia (Oxyoppia) tuberosa Mahunka, 2009b: 56, figs 16–18.
Lineoppia tuberosa: Subías 2010: 238.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Vohimana Reserve (Mahunka 2009b).

Oxyoppia Balogh & Mahunka, 1969

Oxyoppia (Dzarogneta) Kulijev, 1978

Oxyoppia (Dzarogneta) pustulata Mahunka, 1997

Oxyoppia pustulata Mahunka, 1997a: 144, figs 44–48.
Oxyoppia pustulata: Mahunka 2002a: 162
Oxyoppia pustulata: Mahunka 2002b: 13.
Oxyoppia pustulata: Balogh & Balogh 2002: 185, pl. 256. fig. 15., pl. 257. fig. 1.
Oxyoppiella (sic!) *punctulata* (sic!): Mahunka 2011b: 44.
Oxyoppia (Dzarogneta) pustulata: Subías 2004: 129.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Ile Nosy Boraha (Mahunka 1997a); Nosy Komba Island (Mahunka 2011b).

Oxyoppia (Oxyoppiella) Subías & Rodriguez, 1986

Oxyoppia (Oxyoppiella) crassata Mahunka & Mahunka-Papp, 2012

Oxyoppia (Oxyoppiella) crassata Mahunka & Mahunka-Papp, 2012: 44, figs 1a–1b.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Antongil Bay, Nosy Mangabe Island (Mahunka & Mahunka-Papp 2012).

MYSTROPPIINAE Balogh, 1983

Brachioppiella (Brachioppiella) Mahunka, 1986

Brachioppiella (Brachioppiella) boraha Mahunka, 1994

Brachioppiella boraha Mahunka, 1994: 57, figs 21–25.
Brachioppiella boraha: Mahunka 1997a: 119.
Brachioppiella boraha: Mahunka 2002a: 162.
Brachioppiella boraha: Mahunka 2002b: 12.
Brachioppiella boraha: Balogh & Balogh 2002: 211, pl. 294, figs 9– 10.
Rugoppia boraha: Mahunka 2009a: 110, figs 40–42.
Rugoppia boraha: Mahunka 2010a: 48.
Brachioppiella (Brachioppiella) boraha: Subías 2019: 204.

Distribution. Madagascar and New Zealand.

Localities in Madagascar. Ile de Nosy Boraha (Mahunka 1994, Mahunka 1997a); Vohimana Reserve (Mahunka 2009a); Mananara Nord Biosphere Reserve and National Park (Mahunka 2010a).

Striatoppia Balogh, 1958

Striatoppia luisae Mahunka, 1994

Striatoppia luisae Mahunka, 1994: 76, figs 67–70.
Striatoppia luisiae (sic!): Mahunka 1997a: 120.
Striatoppia luisiae (sic!): Mahunka 2002a: 162.

Striatoppia luisae: Mahunka 2002b: 13.
Striatoppia luisae: Balogh & Balogh 2002: 185, pl. 257. figs 6–7.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Analamazoatra Special Reserve (Mahunka 1994); Ile de Nosy Boraha (Mahunka 1994, Mahunka 1997a).

Striatoppia madagascarensis Balogh, 1961

Striatoppia madagascarensis Balogh, 1961: 19, figs 18–19.
Striatoppia madagascarensis: Balogh 1983: 32.
Striatoppia madagascarensis: Subías & Balogh 1989: 388.
Striatoppia madagascarensis: Mahunka 2002a: 162.
Striatoppia madagascarensis: Mahunka 2002b: 13.
Striatoppia madagascarensis: Balogh & Balogh 2002: 185, pl. 257. figs 10–11.
Striatoppia madagascarensis: Mahunka & Mahunka-Papp 2012: 44.

Distribution. Madagascar and Vietnam.
Localities in Madagascar. Mont Papango near Befotaka (Balogh 1960); Nosy Komba Island (Mahunka & Mahunka-Papp 2012).

LANCEOPPIINAE Balogh, 1983

***Lanceoppia (Baioppia)* Luxton, 1985**

Lanceoppia (Baioppia) rugosa
Ermilov & Starý, 2020

Lanceoppia (Baioppia) rugosa Ermilov & Starý, 2020d: 703, fig. 3.
Lanceoppia (Baioppia) rugosa: Ermilov & Starý 2020i: 447.
Lanceoppia (Baioppia) rugosa: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020d); Andasibe-Mantadia National Park (Ermilov & Starý 2020i).

***Lanceoppia (Bicristoppia)* Subías, 1989**

Lanceoppia (Bicristoppia) cucheana
Mahunka, 1994

Lanceoppia cucheana Mahunka, 1994: 58, figs 26–32.
Lanceoppia cucheana: Mahunka 2002a: 162.
Lanceoppia (Lanceoppia) cucheana: Mahunka 2002b: 12.
Lanceoppia cucheana: Balogh & Balogh 2002: 219, pl. 303. figs 5–6.
Aethioppia cucheana: Mahunka & Mahunka-Papp 2012: 44.
Lanceoppia (Bicristoppia) cucheana: Subías 2004: 111.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Analamazoatra Special Reserve (Mahunka 1994); Mananara North Biosphere Reserve and National Park (Mahunka & Mahunka-Papp 2012).

Lanceoppia (Bicristoppia) kalalao
Mahunka, 1997

Lanceoppia (Bicristoppia) kalalao Mahunka, 1997a: 135, figs 28–33.
Lanceoppia (Bicristoppia) kalalao: Mahunka 2002a: 162.
Lanceoppia (Bicristoppia) kalalao: Mahunka 2002b: 12.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ile de Nosy Boraha (Mahunka 1997a).
New record. Nosy Mangabe Island in Antongil Bay S of Maroantsetra town. Mesic lowland rainforest on the W slope at 1–300 m alt. 15°29'S, 49°45'E, 13.09.1994, leg. T. Pócs (No. 9450) (Afr-859).

***Lanceoppia (Lanceoppia)* Hammer, 1962**

Lanceoppia (Lanceoppia) madagascarensis
Mahunka, 2002

Lanceoppia madagascarensis Mahunka, 2002a: 171, figs 10–12.
Lanceoppia (Lanceoppia) madagascarensis: Mahunka 2002b: 12.
Lanceoppia madagascarensis: Mahunka 2011b: 44.
Lanceoppia madagascarensis: Mahunka & Mahunka-Papp 2012: 44.

Lanceoppia madagascarensis: Ermilov & Starý 2020i: 446.
Lanceoppia (Lanceoppia) madagascarensis: Subías 2004: 110.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Mount Maromizaha, south of the Andasibe National Park (Mahunka 2002a); Nosy Komba Island (Mahunka 2011b, Mahunka & Mahunka-Papp 2012); Andasibe-Mantadia National Park (Ermilov & Starý 2020i).

Lanceoppia (Lancelalmoppia) **Subías, 1989**

Lanceoppia (Lancelalmoppia) ravenala (Mahunka, 1994)

Radamoppia ravenala Mahunka, 1994: 68, figs. 47–55.
Radamoppia ravenata (sic!): Mahunka 2002a: 162.
Radamoppia ravenala: Mahunka 2002b: 13.
Radamoppia ravenala: Balogh & Balogh 2002: 222, pl. 306. figs 11–12.
Lancelalmoppia ravenala: Mahunka 2009a: 91.
Lancelalmoppia (Lancelalmoppia) ravenala: Ermilov & Starý 2020i: 447.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Analamazoatra Special Reserve (Mahunka 1994); Vohimana Reserve (Mahunka 2009a); Andasibe-Mantadia National Park (Ermilov & Starý 2020i).

Otoppia **Balogh, 1983**

Otoppia midas (Balogh, 1962)

Oppia midas Balogh, 1962a: 133, figs 20–22.
Otoppia midas: Balogh 1983: 42, table 11 fig. 17-5.
Otoppia midas: Subías & Balogh 1989: 384.
Otoppia midas: Mahunka 2002a: 162.
Otoppia midas: Mahunka 2002b: 13.
Otoppia midas: Balogh & Balogh 2002: 215, pl. 298. figs 6–7.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Manjakandriana, La Mandraka (Balogh 1962a).

Pustuloppia **Mahunka, 1994**

Pustuloppia madagassica Mahunka, 1994

Pustuloppia madagassica Mahunka, 1994: 66, figs 40–46.
Pustuloppia madagassica: Mahunka 2002a: 162.
Pustuloppia madagassica: Mahunka 2002b: 13.
Pustuloppia madagassica: Balogh & Balogh 2002: 224, pl. 309. figs 4–5.
Pustuloppia madagassica: Ermilov & Starý 2020i: 447.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Analamazoatra Special Reserve (Mahunka 1994); Andasibe-Mantadia National Park (Ermilov & Starý 2020i).

Setoppia **Balogh, 1983**

Setoppia vanga (Mahunka, 1994)

Radamoppia vanga Mahunka, 1994: 70, figs 56–61.
Radamoppia vanga: Mahunka 2002a: 162.
Radamoppia vanga: Mahunka 2002b: 13.
Radamoppia vanga: Balogh & Balogh 2002: 218, pl. 302. figs 5–6.
Setoppia vanga: Subías 2004: 112.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Ile de Nosy Boraha (Mahunka 1994).

Trematoppia **Balogh, 1962**

Trematoppia cristipes Balogh, 1962

Trematoppia cristipes Balogh, 1962a: 135, figs 23–25.
Trematoppia cristipes: Balogh 1983: 40, table 10 fig. 17–1.
Trematoppia cristipes: Subías & Balogh 1989: 389.
Trematoppia cristipes: Mahunka 1997a: 120.
Trematoppia cristipes: Mahunka 2002a: 162.
Trematoppia cristipes: Mahunka 2002b: 13, figs 13–16.
Trematoppia cristipes: Balogh & Balogh 2002: 221, pl. 306. figs 7–8.
Trematoppia cristipes: Mahunka 2011a: 7, figs 13–16.
Trematoppia cristipes: Ermilov & Frolov 2022a: 443.

Distribution. Madagascar and Mexico.

Localities in Madagascar. Mont Papango near Befotaka (Balogh 1962a); Montagne d'Ambre National Park, Island of Nosy Be Lokobe Strict Nature Reserve (Mahunka 1997a); Ranomafana (Mahunka 2011a).

MEDIOPPIINAE Subías & Mínguez, 1985

Microppia Balogh, 1983

Microppia minus (Paoli, 1908)

Damaeosoma minus Paoli, 1908: 48, pl. 3. fig. 11.
Microppia minus: Mahunka 2009a: 91.

Distribution. Cosmopolitan.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009a).

MULTIOPPIINAE Balogh, 1983

Multioppia (Hammeroppia) Vasiliu & Ivan, 2009

Multioppia (Hammeroppia) wilsoni Aoki, 1964

Multioppia wilsoni Aoki, 1964: 652, figs 6–8.
Multioppia (Hammeroppia) wilsoni: Ermilov & Starý, 2020d: 705.
Multioppia (Hammeroppia) wilsoni: Ermilov & Starý 2020i: 447.
Multioppia (Hammeroppia) wilsoni: Ermilov & Frolov 2022a: 443.

Distribution. Cosmopolitan except the Antarctic region.
Localities in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020d); Andasibe-Mantadia National Park (Ermilov & Starý 2020i).

Ramusella (Insculptoppia) Subías, 1980

Ramusella (Insculptoppia) alata (Mahunka, 1997)

Sphagnoppia alata Mahunka, 1997a: 147, figs 49–53.
Sphagnoppia alata: Mahunka 2002a: 162.
Sphagnoppia alata: Mahunka 2002b: 13.
Sphagnoppia alata: Balogh & Balogh 2002: 226, pl. 311. fig. 13–14.
Ramusella (Insculptoppia) alata: Subías 2004: 118.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ile de Nosy Boraha (Mahunka 1997a).

Ramusella (Insculptoppia) lata Mahunka & Mahunka-Papp, 2012

Ramusella (Insculptoppia) lata Mahunka & Mahunka-Papp, 2012: 47, figs 3a–3d.
Ramusella (Insculptoppia) lata: Ermilov & Starý 2020i: 447.

Distribution: Endemic to Madagascar.
Localities in Madagascar. Mananara North Biosphere Reserve and National Park (Mahunka & Mahunka-Papp 2012); Andasibe-Mantadia National Park (Ermilov & Starý 2020i).
Remarks. During collection research we recocnized that the label in the vial refers to a different locality than the published one; holotype and one paratype: Nosy Mangabe Island in Antongil Bay S of Maroantsetra town. Mesic lowland rainforest on the W slope at 1-300 m alt. 15°29'S, 49°45'E, 13.09.1994, leg. T. Pócs (No. 9450) (Afr-859). Even in the handwritten notebook of Sándor Mahunka this locality is connected to the holotype. From the published holotype locality we found just another paratype: Toamasina Prov., Mananara Nord Biosphere Reserve and National Park. Lowland rainforest on the E slopes of Mahavoho Hill (very wet types along Manahovo River, with many tree ferns, palms and Pandanus ssp., less humid on slopes) at 220–300 m alt. 16°27'S, 49°46.9-47.5'E, 14–15.08.1998, leg. T. Pócs (No. 9878) (Afr-921).

Ramusella (Insculptoppiella) Subías & Rodrigez, 1986

Ramusella (Insculptoppia) aepyornis Mahunka, 1994

Ramusella aepyornis Mahunka, 1994: 74, figs 62–66.
Ramusella aepyornis: Mahunka 2002a: 162.
Ramusella aepyornis: Mahunka 2002b: 13.
Ramusella aepiornis (sic!): Balogh & Balogh 2002: 207, pl. 288. fig. 15., pl. 289. fig. 1.

Ramusella (Insculptoppiella) aepyornis: Subías 2004: 119.
Ramusella (Insculptoppia) aepyornis: Mahunka 2009c: 339.

Distribution. Endemic to Madagascar.
Localities in Madagascar. 53 km from Tôlanaro on the road to Amboasary (Mahunka 1994); 73 km from Tôlanaro on the road to Amboasary (Mahunka 2009c).

Ramusella (Ramusella) **Hammer, 1962**

Ramusella (Ramusella) arcuata Mahunka & Mahunka-Papp, 2012

Ramusella (Ramusella) arcuata Mahunka & Mahunka-Papp, 2012: 45, figs 2a–2c.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Mananara North Biosphere Reserve and National Park (Mahunka & Mahunka-Papp 2012).

Ramusella (Ramusella) clavipectinata (Michael, 1885)

Notaspis clavipectinata Michael, 1885: 395, pl. 7. fig. 6.
Ramusella (Ramusella) clavipectinata: Mahunka 2009c: 339.
Ramusella clavipectinata: Ermilov & Frolov 2022a: 243.

Distribution. Semicosmopolitan (Paleartic: frequent, U.S.A.: California, furthermore Madagascar, Oriental and Hawai).
Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2009c).

Ramuselloppia **Subías & Rodríguez, 1986**

Ramuselloppia indistincta Ermilov & Starý, 2020

Ramuselloppia indistincta Ermilov & Starý, 2020d: 689, figs 1–2.
Ramuselloppia indistincta: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020d).

OPPIELLINAE Seniczak, 1975

Berniniella (Berniniella) **Balogh, 1983**

Berniniella (Berniniella) bicarinata (Paoli, 1908)

Dameosoma bicarinatum Paoli, 1908: 59, fig. 4: 21.
Berniniella bicarinata: Mahunka & Mahunka-Papp 2012: 44.
Berniniella (Berniniella) bicarinata: Subías 2004: 125.

Distribution. Palearctic region, Madagascar and Vietnam.
Locality in Madagascar. Nosy Komba Island (Mahunka & Mahunka-Papp 2012).

Elaphoppia **Balogh, 1983**

Elaphoppia quadripilosa (Balogh, 1960)

Oppia quadripilosa Balogh, 1960: 18, figs 16–17.
Elaphoppia quadripilosa: Balogh 1983: 24, table 3, figs 9–5.
Elaphoppia quadripilosa: Subías & Balogh 1989: 377.
Elaphoppia quadripilosa: Mahunka 1997a: 119.
Elaphoppia quadripilosa: Mahunka 2002a: 162.
Elaphoppia quadripilosa: Mahunka 2002b: 12.
Elaphoppia quadripilosa: Balogh & Balogh 2002: 188, pl. 262. figs 1–2.

Distribution. Madagascar and Vietnam.
Localities in Madagascar. Manjahandriana, Ambotolaona (Balogh 1960); Ile de Nosy Boraha (Mahunka 1997a).

Oppiella **Jacot, 1937**

Oppiella nova (Oudemans, 1902)

Eremaeus novus Oudemans, 1902: 36.
Oppiella nova: Mahunka 1997a: 120.
Oppiella nova: Mahunka 2002a: 162.
Oppiella nova: Mahunka 2002b: 13.
Oppiella nova: Mahunka 2009c: 339.
Oppiella nova: Mahunka 2011b: 44.
Oppiella (Oppiella) nova: Mahunka & Mahunka-Papp 2012: 44.
Oppiella nova: Ermilov & Frolov 2022a: 443.

Distribution. Cosmopolitan.

Localities in Madagascar. Montagne d'Ambre National Park (Mahunka 1997a, Mahunka 2009c); Andasibe (Perinet) (Mahunka 2011b); Nosy Komba Island (Mahunka 2011b, Mahunka & Mahunka-Papp 2012).

QUADROPPIIDAE Balogh, 1983

Quadroppia (Coronoquadroppia) Balogh, 1983

Quadroppia (Coronoquadroppia) circumita (Hammer, 1961)

Oppia circumita Hammer, 1961: 48, fig. 39.
Quadroppia circumita: Mahunka & Mahunka-Papp 2012: 48, figs 4a–4b.
Quadroppia (Coronoquadroppia) circumita: Subías 2004: 113.

Distribution. Pantropical and subtropical.

Locality in Madagascar. Nosy Komba Island (Mahunka & Mahunka-Papp 2012).

TRIZETOIDEA Ewing, 1917

NOSYBELBIDAE Mahunka, 1994

Nosybelba Mahunka, 1994

Nosybelba oppiana Mahunka, 1994

Nosybelba oppiana Mahunka, 1994: 86, figs 82–90.
Nosybelba oppiana: Mahunka 2002a: 162.
Nosybelba oppiana: Mahunka 2002b: 13.
Nosybea (sic!) *oppiana*: Balogh & Balogh 2002: 194, pl. 270. figs 6-7.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Analamazoatra Special Reserve (Mahunka 1994).

Nosybelba spinipes (Balogh, 1962)

Oppia spinipes Balogh, 1962a: 131, figs 16–19.
Aethioppia spinipes: Balogh 1983: 54.
Aethioppia spinipes: Subías & Balogh 1989: 373.
Aethioppia spinipes: Mahunka 2002a: 162.
Aethioppia spinipes: Mahunka 2002b: 12.
Nosybelba spinipes: Subías 2014: 201.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Manjakandriana, La Mandraka (Balogh 1962a).

SUCTOBELBIDAE JACOT, 1938

Interbelba Mahunka & Mahunka-Papp, 2012

Interbelba solifera Mahunka & Mahunka-Papp, 2012

Interbelba solifera Mahunka & Mahunka-Papp, 2012: 48, figs 5a–5b.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Antongil Bay, Nosy Mangabe Island (Mahunka & Mahunka-Papp 2012).

Novosuctobelba (Leptosuctobelba) Chinone, 2003

Novosuctobelba (Leptosuctobelba) bercziki (Mahunka, 2009)

Madabelba bercziki Mahunka, 2009b: 58, figs 19–21.
Novosuctobelba (Leptosuctobelba) bercziki: Subías 2017: 259.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Vohimana Reserve (Mahunka 2009b).

Novosuctobelba (Leptosuctobelba) duplicondyla (Mahunka, 2009)

Suctobelbella duplicondyla Mahunka, 2009a: 113, figs 46–49.
Novosuctobelba (Leptosuctobelba) duplicondyla: Subías 2017: 259.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Vohimana Reserve (Mahunka 2009a).

Novosuctobelba (Leptosuctobelba) madegassica (Mahunka, 2011)

Neosuctobelba madegassica Mahunka, 2011a: 9, figs 17–20.

Novosuctobelba (Leptosuctobelba) madegassica: Subías 2017: 259.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2011a).

Parasuctobelba Hammer, 1977

Parasuctobelba subcomplexa (Balogh & Mahunka, 1968)

Suctobelba subcomplexa Balogh & Mahunka, 1968: 328, fig. 18.
Parasuctobelba subcomplexa: Subías 2009: 247.

Distribution. Pantropical: Neotropical, Oriental (Borneo), Ethiopian (Guinea Ecuatorial: I. Bioko [Fernando Poo] and Kenya) and Hawaii.
New record. Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with *Marattia fraxinea*, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29. 07. 1998, leg. T. Pócs (No. 9862) (Afr-917).
Remarks. New to the fauna of Madagascar.

Parasuctobelba vohimana Mahunka, 2009

Parasuctobelba vohimana Mahunka 2009a: 110, figs 43–45.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009a).

Persuctobelba Mahunka, 2001

Persuctobelba divisa Mahunka, 2001

Persuctobelba divisa Mahunka, 2001: 278, figs 1–4.
Persuctobelba divisa: Mahunka 2002b: 13.

Distribution. Endemic to Madagascar
Localities in Madagascar. Mount Maromizaha, south of the Andasibe National Park, Mananara Nord Biosphere Reserve and National Park (Mahunka 2001).
New record. Ambohitantely Forest Reserve, E of Manonkazo village (Ankaszabz town). Relic xerophyllous (dry evergreen) plateau forest at 1500–1530 m alt. 05–06.09.1994, leg. T. Pócs (No. 9444) (Afr-857).

Persuctobelba flagellatissima Mahunka & Mahunka-Papp, 2012

Persuctobelba flagellatissima Mahunka & Mahunka-Papp, 2012: 50, figs 6a–6c.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Antongil Bay, Nosy Mangabe Island (Mahunka & Mahunka-Papp 2012).

Persuctobelba monster Mahunka, 2001

Persuctobelba monster Mahunka, 2001: 281, figs 5–8.
Persuctobelba monster: Mahunka 2002b: 13.
Persuctobelba monster: Mahunka 2009b: 48.

Distribution. Endemic to Madagascar.
Localities in Madagascar. between Ambatolaona and Mandraka (Mahunka 2001); Vohimana Reserve (Mahunka 2009b).

Suctobelbella (Ussuribata) Ryabinin, 1975

Suctobelbella (Ussuribata) spirochaeta Mahunka, 1983

Suctobelbella spirochaeta Mahunka, 1983c: 425, figs 84–88.
Suctobelbella spirochaeta: Mahunka 2009a: 91.
Suctobelbella (Ussuribata) spirochaeta: Ermilov, Shtanchaeva & Subías 2014: 1594.

Distribution. Ehtiopian and Japan.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009a).

Suctobelbella (Ussuribata) variosetosa (Hammer, 1961)

Suctobelba variosetosa Hammer, 1961: 43, fig. 35.
Discosuctobelba variosetosa: Mahunka & Mahunka-Papp 2012: 44.
Suctobelbella (Ussuribata) variosetosa: Ermilov, Shtanchaeva & Subías 2014: 1595.

Distribution. Pantropical (frequent) and Japan.

Locality in Madagascar. Masoala Peninsula (Mahunka & Mahunka-Papp 2012).

Remarks. During collection research we recognized that the label in the vial refers to a different locality than the published one: Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with Marattia fraxinea, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29.07.1998, leg. T. Pócs (No. 9862) (Afr-917). Even in the handwritten notebook of Sándor Mahunka this locality is connected to the species.

Suctobelbila Jacot, 1938

Suctobelbila punctocostulata Mahunka & Mahunka-Papp, 2012

Suctobelbila punctocostulata Mahunka & Mahunka-Papp, 2012: 51, figs 7a–7c.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Antongil Bay, Nosy Mangabe Island (Mahunka & Mahunka-Papp 2012).

Suctobelbila tumida Mahunka & Mahunka-Papp, 2012

Suctobelbila tumida Mahunka & Mahunka-Papp, 2012: 53, figs 8a–8c.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Nosy Mangabe Island (Mahunka & Mahunka-Papp 2012).

TECTOCEPHEOIDEA Grandjean, 1954

TECTOCEPHEIDAE Grandjean, 1954

Tectocepheus Berlese, 1896

Tectocepheus minor Berlese, 1903

Tectocepheus minor Berlese, 1903: 252.
Tectocepheus minor: Mahunka & Mahunka-Papp 2011: 126.

Distribution. Semicosmopolitan: Central and South Europe, East Asia, tropical.

Locality in Madagascar. Vohimana Reserve (Mahunka & Mahunka-Papp 2011).

Tectocepheus velatus velatus (Michael, 1880)

Tegeocranus velatus Michael, 1880: 190, pl. 6. figs 6–9.
Tectocepheus velatus velatus: Mahunka 2009c: 347.
Tectocepheus velatus velatus: Schabetsberger et al. 2013: 331.
Tectocepheus velatus velatus: Ermilov & Frolov 2022a: 443.

Distribution. Cosmopolitan.

Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2009c); Amber Mountains National Park (Schabetsberger *et al*. 2013).

LIMNOZETOIDEA Thor, 1937

AUSTRACHIPTERIIDAE Luxton, 1985

Lamellobates (Lamellobates) Hammer, 1958

Lamellobates (Lamellobates) cuneatus Mahunka, 2010

Lamellobates cuneatus Mahunka, 2010a: 54, figs 23–25.
Lamellobates (Lamellobates) cuneatus: Subías 2010: 321.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Vohimana Reserve (Mahunka 2010a).

AMERONOTHROIDEA Willmann, 1931

TEGEOCRANELLIDAE P. Balogh, 1987

Tegeocranellus Berlese, 1913

Tegeocranellus hungarorum Mahunka, 2009

Tegeocranellus hungarorum Mahunka, 2009a: 96, figs 12–14.
Tegeocranellus hungarorum: Mahunka 2011: 2.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Vohimana Reserve (Mahunka 2009a); Mananara Nord Biosphere Reserve and National Park (Mahunka 2011a).

CYMBAEREMAEOIDEA Sellnick, 1928

CYMBAEREMAEIDAE Sellnick, 1928

Scapheremaeus Berlese, 1910

Scapheremaeus anteriorugosus Mahunka, 2011

Scapheremaeus anteriorugosus Mahunka, 2011a: 11, figs 21–23.
Scapheremaeus anteriorugosus: Ermilov & Frolov 2022b: 809.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Mount Maromizaha south of the Andasibe National Park (Mahunka 2011a); Ankaratra Mount (Ermilov & Frolov 2022b).

Scapheremaeus pauliani Fernandez & Cleva, 2010

Scapheremaeus pauliani Fernandez & Cleva, 2010a: 103, figs 1–6.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Anosyenne Mountains (Fernandez & Cleva 2010a).

EREMAEOZETOIDEA Piffl, 1972

EREMAEOZETIDAE Piffl, 1972

Idiozetes Aoki, 1976

Idiozetes malgache Fernandez, Cleva & Theron, 2010

Idiozetes malgache Fernandez, Cleva & Theron, 2010: 438, figs 1–40.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Antongil Bay, Nosy Mangabe Island (Fernandez, Cleva & Theron 2010).

Rogerzetes Fernandez, Theron & Cleva, 2011

Rogerzetes betschi (Fernandez & Cleva, 2009)

Eremaeozetes betschi Fernandez & Cleva, 2009: 70, figs 1–8.
Eremaeozetes betschi: Mahunka 2011a: 3.
Rogerzetes betschi: Fernandez, Theron & Cleva 2011: 69, fig. 7.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Ankarongambe forest (10 km E/SE Ambohidray) (Fernandez & Cleva 2009); Mount Maromizaha, south of the Andasibe National Park (Mahunka 2011a).

Rogerzetes lacouturieri Fernandez, Theron & Cleva, 2011

Rogerzetes lacouturieri Fernandez, Theron & Cleva, 2011: 62, figs 1–24.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Manankaza Forest Station, Ambohitantely (Fernandez, Theron & Cleva 2011).

LICNEREMAEOIDEA Grandjean, 1931

EREMELLIDAE Balogh, 1961

Afreremella (Arboreremella) Ermilov & Frolov, 2022

Afreremella (Arboreremella) madagascarensis Ermilov & Frolov, 2022

Afreremella (Arboreremella) madagascarensis Ermilov & Frolov, 2022b: 800, figs 1–3.

Distribution. Endemic to Madagscar.
Locality in Madagascar. Ankaratra Mount (Ermilov & Frolov 2022b).

Eremella Berlese, 1913

Eremella (Eremella) induta Berlese, 1913

Eremella induta Berlese, 1913: 97.
Eremella induta: Mahunka 2011b: 44.
Eremella (Eremella) induta: Subías 2020: 290.

Distribution. Pantropical and Subtropical.
Locality in Madagascar. Nosy Komba Island (Mahunka 2011b).

Eremella (Licnocepheus) simpliseta
(Mahunka, 2011)

Triteremella simpliseta Mahunka, 2011b: 54, figs 8a–c.
Eremella simpliseta: Ermilov & Frolov 2019: 223.
Eremella (Licnocepheus) simpliseta: Subías 2020: 290.

Distribution. Endemic to Madagscar.
Locality in Madagascar. Peyrieras, Causse de Kelifelly (Mahunka 2011b).

LAMELLAREIDAE Balogh, 1972

***Microlamellarea* Coetzee, 1987**

Microlamellarea coetzeeae
Mahunka & Mahunka-Papp, 2011

Microlamellarea coetzeeae Mahunka & Mahunka-Papp, 2011: 136, figs 7a–b.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Nosy Mangabe Island in Antongil Bay S of Maroantsetra town (Mahunka & Mahunka-Papp 2011).

LICNEREMAEIDAE Grandjean, 1931

***Licneremaeus* Paoli, 1908**

Licneremaeus polygonalis Hammer, 1971

Licneremaeus polygonalis Hammer, 1971: 29, pl. 18–19, fig. 31a–b.
Licneremaeus polygonatus (sic!): Mahunka & Mahunka-Papp 2011: 126.

Distribution. Pacific Islands, Vietnam and Madagascar.
Locality in Madagascar. Nosy Komba Island (Mahunka & Mahunka-Papp 2011).

PASSALOZETIDAE Grandjean, 1954

Bipassalozetes (Passalobates)
Pérez-Íñigo & Peña, 1996

Bipassalozetes (Passalobates) berndhauseri
(Mahunka, 1997)

Passalozetes (Bipassalozetes) berndhauseri Mahunka, 1997a: 153–156.
Passalozetes (Bipassalozetes) hauseri (sic!) Mahunka, 1997a: figs 65–68.
Passalozetes (Bipassalozetes) berndhauseri: Mahunka 2002b: 13.
Passalozetes hauseri: Balogh & Balogh 2002: 264, pl. 365. figs 7–8.
Bipassalozetes (Passalobates) berndhauseri: Subías 2017: 327.

Distribution. Endemic to Madagascar.
Locality in Madagascar. 45 km from Tôlanaro on the road to Amboasary (Mahunka 1997a).

***Passalozetes (Passalozetes)* Grandjean, 1932**

Passalozetes (Passalozetes) lienhardi
Mahunka, 1997

Passalozetes (Passalozetes) lienhardi Mahunka, 1997a: 153, figs 61–64.
Passalozetes (Passalozetes) lienhardi: Mahunka 2002b: 13.
Passalozetes lienhardi: Balogh & Balogh 2002: 264, pl. 365. figs 9–10.

Distribution. Endemic to Madagascar.
Localities in Madagascar. 45 km from Tôlanaro on the road to Amboasary, 53 km from Tôlanaro on the road to Amboasary (Mahunka 1997a).

PHENOPELOPOIDEA Petrunkevich, 1955

PHENOPELOPIDAE Petrunkevich, 1955

***Eupelops* Ewing, 1917**

Eupelops costulatus Mahunka, 2011

Eupelopos costulatus Mahunka, 2011b: 56, figs 9a–d.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2011b).

ACHIPTERIOIDEA Thor, 1929

TEGORIBATIDAE Grandjean, 1954

Lemurobates Mahunka, 1997

Lemurobates antsiranana Mahunka, 1997

Lemurobates antsiranana Mahunka, 1997a: 159, figs 75–81.
Lemurobates antsiranana: Mahunka 2002b: 14.
Lemurobates antsirarana (sic!): Balogh & Balogh 2002: 333, pl. 442. figs 2–3.
Lemurobates antsiranana: Mahunka 2010a: 48.
Lemurobates antsiranana: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Montagne d'Ambre National Park; Island of Nosy Be, Lokobe Strict Nature Reserve (Mahunka 1997a); Mananara Nord Biosphere Reserve and National Park, Vohimana Reserve (Mahunka 2010a).

New record. Toamasina Prov. Mananara Nord Biosphere Reserve and National Park. Lowland rainforest on the NW slope of Behafotra Hill, at 250–300 m alt., with 3500 mm annual rainfall. 16°27.1-3'S, 49°47.6'E, 14–15.08.1998, Leg. T. Pócs (No. 9877) (Afr-920).

ORIBATELLOIDEA Jacot, 1925

ORIBATELLIDAE Jacot, 1925

Oribatella (Oribatella) Banks, 1895

Oribatella (Oribatella) madagascarensis Mahunka, 1997

Oribatella madagascarensis Mahunka, 1997a: 156, figs 69–74.
Oribatella madagascarensis: Mahunka 2002b: 14.
Oribatella madagascarensis: Balogh & Balogh 2002: 298, pl. 404. figs 3–4.
Oribatella (Oribatella) madagascarensis: Subías 2004: 171.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Island of Nosy Be, Lokobe Strict Nature Reserve (Mahunka 1997a).

ORIPODOIDEA Jacot, 1925

CALOPPIIDAE Balogh, 1961

Zetorchella Berlese, 1916

Zetorchella semirugosa (Mahunka, 2011)

Chaunoproctus semirugosus Mahunka, 2011b: 60, figs 11a–d.
Zetorchella semirugosa: Subías 2012: 385.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Nosy Komba Island (Mahunka 2011b).

HAPLOZETIDAE Grandjean, 1936

Indoribates (Haplozetes) Willmann, 1935

Indoribates (Haplozetes) madagascarensis (Balogh, 1960)

Scheloribates madagascarensis Balogh, 1960: 25, figs 30–31.
Scheloribates madagascarensis: Mahunka 2002b: 14.
Indoribates (Haplozetes) madagascarensis: Subías 2017: 440.

Distribution. Ethiopian region.

Locality in Madagascar. Nosy Be, Pointe a la Fievre (Balogh 1960).

Indoribates (Indoribates) Jacot, 1929

Indoribates (Indoribates) olszanowskii Ermilov & Starý, 2020

Indoribates olszanowskii Ermilov & Starý, 2020k: 362, figs 1–7.
Indoribates (Indoribates) olszanowskii: Subías 2021: 400.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Andasibe-Mantadia National Park (Ermilov & Starý 2020k).

***Peloribates (Peloribates)* Berlese, 1908**

Peloribates (Peloribates) pocsi
Mahunka & Mahunka-Papp, 2011

Peloribates (Peloribates) pocsi Mahunka & Mahunka-Papp, 2011: 138, figs 9a–c.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Ambohitantely Forest Reserve (Mahunka & Mahunka-Papp 2011).

***Peloribates (Peloribatodes)* Mahunka, 2011**

Peloribates* (*Peloribatodes*) *incompatibilis
Mahunka, 2011

Peloribates (Peloribatodes) incompatibilis Mahunka, 2011b: 62, figs 12a–d.

Distribution. Ethiopian, Holarctic and Neotropical.
Locality in Madagascar. Peyrieras, Causse de Kelifelly (Mahunka 2011b).

Peloribates (Peloribatodes) montagnensis
Ermilov & Starý, 2020.

Peloribates (Peloribatodes) montagnensis Ermilov & Starý, 2020e: 146, figs 1–3.
Peloribates (Peloribatodes) montagnensis: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020e).

Pilobatella (Pilobatella)
Balogh & Mahunka, 1967

Pilobatella (Pilobatella) brevipila Mahunka, 2011

Pilobatella brevipila Mahunka, 2011a: 13, figs 24–27.
Pilobatella (Pilobatella) brevipila: Subías 2017: 447.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2011a).

Pilobatella (Pilobatella) kovaci
Ermilov & Starý, 2020

Pilobatella kovaci Ermilov & Starý, 2020g: 550, fig. 4.
Pilobatella (Pilobatella) kovaci: Subías 2021: 406.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe-Mantadia National Park (Ermilov & Starý 2020g).

Pilobatella (Pilobatella) mikoi
Ermilov & Starý, 2020

Pilobatella mikoi Ermilov & Starý, 2020g: 547, figs 1–3.
Pilobatella (Pilobatella) mikoi: Subías 2021: 406.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe-Mantadia National Park (Ermilov & Starý 2020g).

***Pilobates (Pilobates)* Balogh, 1960**

Pilobates (Pilobates) africanus
Ermilov & Starý, 2020

Pilobates africanus Ermilov & Starý, 2020e: 150, figs 4–6.
Pilobates (Pilobates) africanus: Subías 2021: 407.
Pilobates africanus: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020e).

Pilobates (Pilobates) longiprocessus
Ermilov & Starý, 2020

Pilobates longiprocessus Ermilov & Starý, 2020j: 124, figs 1–7.
Pilobates (Pilobates) longiprocessus: Subías 2021: 407.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe-Mantadia National Park (Ermilov & Starý 2020j).

Pilobates (Pilobates) parastaryi Ermilov, 2020

Pilobates parastaryi Ermilov, 2020: 1325, fig. 4.

Pilobates (Pilobates) parastaryi: Subías 2021: 407.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe-Mantadia National Park (Ermilov 2020).

Pilobates (Pilobates) staryi Ermilov, 2020

Pilobates staryi Ermilov, 2020: 1321, figs 1–3.
Pilobates (Pilobates) staryi: Subías 2021: 407.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe-Mantadia National Park (Ermilov 2020).

***Protoribates (Triaunguis)* Kulijev, 1978**

Protoribates (Triaunguis) ziemowiti
Ermilov & Starý, 2020

Protoribates ziemowiti Ermilov & Starý, 2020k: 365, figs 8–14.
Protoribates (Triaunguis) ziemowiti: Subías 2021: 397.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe-Mantadia National Park (Ermilov & Starý 2020k).

***Rostrozetes* Sellnick, 1925**

Rostrozetes poensis (Mihelčič, 1957)

Carabozetes poensis Mihelčič, 1957: 64, fig. 10.
Rostrozetes pulcherrimus Balogh, 1960: 29, fig. 35.
Trachyoribates (Rostrozetes) pulcherrimus: Mahunka 2009a: 120.
Rostrozetes pulcherrimus: Mahunka 2011a: 3.
Rostrozetes poensis: Subías 2021: 408.

Distribution. Pantropical (frequent) and subtropical.
Localities in Madagascar. Manjakandriana, La Mandraka (Balogh 1960); Vohimana Reserve (Mahunka 2009a, Mahunka 2011a).

***Vilhenabates* Balogh, 1963**

Vilhenabates ambohitra Mahunka, 2009

Vilhenabates ambohitra Mahunka, 2009c: 348, figs 17–19.
Vilhenabates ambohitra: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2009c).

Vilhenabates dissecatus Mahunka, 2009

Vilhenabates dissecatus Mahunka, 2009a: 118, figs 53–56.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009a).

ORBATULIDAE Thor, 1929

***Lucoppia* Berlese, 1908**

Lucoppia ankaratraensis Ermilov & Frolov, 2022

Lucoppia ankaratraensis Ermilov & Frolov, 2022b: 804, figs 4–6.

Distribution. Endemic to Madagscar.
Locality in Madagascar. Ankaratra Mount (Ermilov & Frolov 2022b).

PARAKALUMMIDAE Grandjean, 1936

***Neoribates (Neoribates)* Berlese, 1914**

Neoribates (Neoribates) africanus
Ermilov & Starý, 2020

Neoribates (Neoribates) africanus Ermilov & Starý, 2020b: 115, figs 1–3.
Neoribates africanus: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020b).

Neoribates (Neoribates) madagascarensis
Ermilov & Starý, 2020

Neoribates (Neoribates) madagascarensis Ermilov & Starý, 2020b: 119, figs 4–6.
Neoribates madagascarensis: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020b).

ORIPODIDAE JACOT, 1925

Oripoda Banks, 1904

Oripoda attenuata Mahunka, 2011

Oripoda attenuata Mahunka, 2011b: 58, figs 10a–c.

Distribution. Endemic to Madagasar.
Locality in Madagascar. Mangabé Island, Antongil Bay (Mahunka 2011b).

Oripoda auriculata Mahunka, 1996

Oripoda auriculata Mahunka, 1996b: 118, figs 23–25.
Oripoda auriculata: Balogh & Balogh 1999b: 35, figs 76–77.
Oripoda auriculata: Mahunka 2002b: 14.
Oripoda auriculata: Balogh & Balogh 2002: 311, pl. 421. figs 3–4.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996b).

Protoripoda (Protoripoda) Balogh, 1970

Protoripoda (Protoripoda) nasuta Mahunka, 2009

Protoripoda nasuta Mahunka, 2009b: 58, figs 22–23.
Protoripoda (Protoripoda) nasuta: Subías 2010: 398.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2009b).

Pseudopirnodus Baranek, 1985

Pseudopirnodus madegassus Mahunka, 1996

Pseudopirnodus madegassus Mahunka, 1996b: 122, figs 26–29.
Pseudopirnodus madegassus: Balogh & Balogh 1999b: 43, figs 124–125.
Pseudopirnodus madegassus: Mahunka 2002b: 14.
Pseudopirnodus madegassus: Balogh & Balogh 2002: 308, pl. 416. figs 4–5.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996b).

SCHELORIBATIDAE Grandjean, 1933

Euscheloribates Kunst, 1958

Euscheloribates translamellatus (Mahunka, 2009)

Ambrobates translamellatus Mahunka, 2009c: 348, figs 14–16.
Euscheloribates translamellatus: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2009c),

Heteroleius Balogh & Mahunka, 1966

Heteroleius flagellifer Mahunka & Mahunka-Papp, 2011

Heteroleius flagellifer Mahunka & Mahunka-Papp, 2011: 141, figs 10a–c.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Analamazoatra Special Reserve, Antsiranana Province, Nosy Komba Island (Mahunka & Mahunka-Papp 2011).
Remarks. According to the original description the holotype and 4 paratypes are deposited in Geneva (MHNG) and 3 paratypes are in Budapest (HNHM). However, in the HNHM collection we found two vials: one is labelled as holotype Nosy Mangabe Island in Antongil Bay S of Maroantsetra town. Mesic lowland rainforest on the W slope at 1–300 m alt. 15°29'S, 49°45'E, 13.09. 1994, leg. T. Pócs (No. 9450) (Afr-859) and one is labelled as paratype with 5 specimens (same locality as the holotype).We checked Mahunka's handwritten notebook but we found no helpful information there.

Scheloribates (Scheloribates) Berlese, 1908

Scheloribates (Scheloribates) mahnerti Mahunka & Mahunka-Papp, 2008

Scheloribates mahnerti Mahunka & Mahunka-Papp, 2008: 84, figs 21–23.
Scheloribates (Scheloribates) mahnerti: Subías 2009: 384.
Scheloribates mahnerti: Mahunka 2011b: 44.

Distribution. Ethiopian region.
Locality in Madagascar. Mangabé Island, Antongil Bay (Mahunka 2011b).

Scheloribates (Scheloribates) striolatus Balogh, 1960

Scheloribates striolatus Balogh, 1960: 27, figs 32–34.
Scheloribates striolatus: Mahunka 2002b: 14.
Scheloribates (Scheloribates) striolatus: Subías 2004: 202.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Manjakandriana, Ambotolaona (Balogh 1960).

Tuberemaeus Sellnick, 1930

Tuberemaeus puruczkyi Mahunka & Mahunka-Papp, 2011

Tuberemaeus puruczkyi Mahunka & Mahunka-Papp, 2011: 143, figs 11a–c.

Distribution. Endemic to Madgascar.
Locality in Madagascar. Mananara Nord Biosphere Reserve and National Park (Mahunka & Mahunka-Papp 2011).

CERATOZETOIDEA Jacot, 1925

HUMEROBATIDAE Grandjean, 1970

Antarctozetes Balogh, 1961

Antarctozetes nasalis (Mahunka & Mahunka-Papp, 2011)

Africoribates nasalis Mahunka & Mahunka-Papp, 2011: 137, figs 8a–c.
Antarctozetes nasalis: Subías 2019: 339.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Antsiranana Province, Nosy Komba Island, Vohimana Reserve (Mahunka & Mahunka-Papp 2011).
Remarks. During collection research we recognised that the label in the vial refers to a different locality than the published one: Toamasina Province. Maromizaha forest. Mossy montane rainforest with bamboo (*Nastus* sp.) undergrowth on the summit ridge of Mount Maromizaha, south of the Andasibe National Park and the Antananarivo Toamasina road, 2 km W of Anevoka village, at 1080–1214 m alt. 18°57.8'S, 48°27.5'E, 26.08.1998, leg. T. Pócs (No. 9890) (Afr-923). Even in the handwritten notebook of Sándor Mahunka this locality is connected to the species and not the published one.

Humerobates Sellnick, 1928

Humerobates africanus (Mahunka, 1984)

Baloghobates africanus Mahunka, 1984: 118, figs 21 A–E.
Humerobates africanus: Ermilov & Frolov 2022b: 809.

Distribution. Afrotropical region.
Locality in Madagascar. Ankaratra Mount Ermilov & Frolov 2022b).

PUNCTORIBATIDAE Thor, 1937

Punctoribates Berlese, 1908

Punctoribates longiporosus Balogh, 1963

Punctoribates longiporosus Balogh, 1963: 41, figs 12–13.
Punctoribates (Minguezetes) longiporosus: Subías 2008: 346.
Punctoribates longiporosus: Mahunka 2011a: 3.
Punctoribates longiporosus: Ermilov & Frolov 2022a: 443.

Distribution. Ethiopian, Oriental, Northeast China, Mexico.
Locality in Madagascar. Montagne d'Ambre National Park (Mahunka 2011a).

GALUMNOIDEA Jacot, 1925

GALUMNELLIDAE Balogh, 1961

Galumnella (Galumnella) Berlese, 1916

Galumnella (Galumnella) pauliani Balogh, 1960

Galumnella pauliani Balogh, 1960: 36, fig. 45.
Galumnella pauliani: Balogh & Balogh 2002: 361, pl. 475. fig. 8.
Galumnella pauliani: Mahunka 2002b: 15.
Galumnella (Galumnella) pauliani: Subías 2004: 222.

Distribution. Madagascar and Vietnam.

Locality in Madagascar. Mont Papango near Befotaka (Balogh 1960).

New record. Toamasina Prov., Mananara Nord Biosphere Reserve and National Park. Lowland rainforest on the E slopes of Mahavoho Hill (very wet types along Manahovo River, with many tree ferns, palms and *Pandanus* ssp., less humid on slopes) at 220–300 m alt. 16°27'S, 49°46.9-47.5'E, 14–15.08.1998, leg. T. Pócs (No. 9878) (Afr-921).

GALUMNIDAE JACOT, 1925

Allogalumna (Acrogalumna) Grandjean, 1956

Allogalumna (Acrogalumna) costata Mahunka, 1996

Allogalumna costata Mahunka, 1996c: 164, figs 1–5.
Allogalumna costata: Mahunka 2002b: 14.
Allogalumna costata: Balogh & Balogh 2002: 382, pl. 498. figs 3–4.
Allogalumna costata: Mahunka 2011a: 3.
Allogalumna (Acrogalumna) costata: Subías 2021: 412.

Distribution. Madagascar and Vietnam.

Localities in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996c); Vohimana Reserve (Mahunka 2011a).

Allogalumna (Acrogalumna) superporosa Mahunka, 1996

Allogalumna superporosa Mahunka, 1996c: 169, figs 16–18.
Allogalumna superporosa: Mahunka 2002b: 14.
Allogalumna superporosa: Balogh & Balogh 2002: 382, pl. 498. figs 6–7.
Allogalumna (Acrogalumna) superporosa: Subías 2021: 413.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996c).

Allogalumna (Allogalumna) Grandjean, 1936

Allogalumna (Allogalumna) insolita Mahunka, 1996

Allogalumna insolita Mahunka, 1996c: 164, figs 6–10.
Allogalumna insolita: Mahunka 2002b: 14.
Allogalumna insolita: Balogh & Balogh 2002: 382, pl. 498. fig. 1.
Allogalumna (Allogalumna) insolita: Subías 2019: 404.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996c).

Allogalumna (Allogalumna) longula Balogh, 1960

Xenogalumna longula Balogh, 1960: 32, figs 39–41.
Xenogalumna longula: Mahunka 2002b: 15.
Allogalumna (Allogalumna) longula: Ermilov & Klimov 2017: 55.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Mont Papango near Befotaka (Balogh 1960).

Allogalumna (Allogalumna) madagascarensis (Balogh, 1960)

Ctenogalumna madagascarensis Balogh, 1960: 34, figs 42–44.
Allogalumna madagascarensis: Mahunka 1996c: 168, figs 11–12.
Allogalumna madagascarensis: Mahunka 2002b: 14.
Ctenogalumna madagascarensis: Balogh & Balogh 2002: 380, pl. 495. fig. 10.
Allogalumna (Allogalumna) madagascarensis: Subías 2019: 404.

Distribution. Endemic to Madagascar.

Localities in Madagascar. Mont Papango near Befotaka (Balogh 1960); Andasibe (Perinet) Forest Reserve (Mahunka 1996c).

Allogalumna (Allogalumna) paramadagascarensis Ermilov & Starý, 2020

Allogalumna paramadagascarensis Ermilov & Starý, 2020f: 100, figs 1–4.
Allogalumna (Allogalumna) paramadagascarensis: Subías 2021: 412.
Allogalumna paramadagascarensis: Ermilov & Frolov 2022a: 443.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020f).

Allogalumna (Allogalumna) paravojnitsi Ermilov & Starý, 2020

Allogalumna paravojnitsi Ermilov & Starý, 2020f: 105, figs 1–4.
Allogalumna (Allogalumna) paravojnitsi: Subías 2021: 412.
Allogalumna paravojnitsi: Ermilov & Frolov 2022a: 243.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020f).

Allogalumna (Allogalumna) pocsi Mahunka, 1996

Allogalumna pocsi Mahunka, 1996c: 169, figs 13–15.
Allogalumna pocsi: Mahunka 2002b: 14.
Allogalumna pocsi: Balogh & Balogh 2002: 382, pl. 498. fig. 9., pl. 499. fig. 1.
Allogalumna (Allogalumna) pocsi: Subías 2021: 415.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996c).

***Angulogalumna* Grishina, 1981**

Angulogalumna grishinae Ermilov & Starý, 2020

Angulogalumna grishinae Ermilov & Starý, 2020l: 67, figs 1–4.
Angulogalumna grishinae: Ermilov & Frolov 2022a: 444.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020l, Ermilov & Frolov 2022a).

***Galumna (Galumna)* Heyden, 1826**

Galumna (Galumna) ankaratra Mahunka, 1997

Galumna ankaratra Mahunka, 1997a: 162, figs 82–85.
Galumna ankaratra: Mahunka 2002b: 14.
Galumna ankarata (sic!): Balogh & Balogh 2002: 369, pl. 483. fig. 10.
Galumna ancaratra (sic!): Mahunka 2011a: 3.
Galumna (Galumna) ankaratra: Subías 2004: 214.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Manjakatompo Forest Station (Mahunka 1997a); Vohimana Reserve (Mahunka 2011a).

Galumna (Galumna) armatifera Mahunka, 1996

Galumna armatifera Mahunka, 1996c: 172, figs 19–22.
Galumna armatifera: Mahunka 2002b: 15.
Galumna armatifera: Balogh & Balogh 2002: 369, pl. 483. figs 8–9.
Galumna armatifera: Mahunka 2009b: 48.
Galumna armatifera: Mahunka 2011a: 3.
Galumna armatifera: Ermilov & Starý 2020a.
Galumna armatifera: Ermilov & Frolov 2022a: 444.
Galumna (Galumna) armatifera: Subías 2004: 214.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Masoala peninsula, Andasibe (Perinet) Forest Reserve (Mahunka 1996c); Vohimana Reserve (Mahunka 2009b, Mahunka 2011a); Montagne d'Ambre National Park (Ermilov & Starý 2020a).

Galumna (Galumna) brevilineata Ermilov & Starý, 2020

Galumna (Galumna) brevilineata Ermilov & Starý, 2020h: 1385, figs 1–3.

Distribution. Endemic to Madagascar.

Locality in Madagascar. Andasibe-Mantadia National Park (Ermilov & Starý 2020h).

Galumna (Galumna) engelbrechti
Mahunka, 1997

Galumna engelbrechti Mahunka, 1997a: 162, figs 86–90.
Galumna engelbrechti: Mahunka 2002b: 15.
Galumna engelbrechti: Balogh & Balogh 2002: 369, pl. 483. fig. 11.
Galumna (Galumna) engelbrechti: Subías 2004: 215.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Lokobe Strict Nature Reserve (Mahunka 1997a).

Galumna (Galumna) granalata Aoki, 1984

Galumna granalata Aoki, 1984: 146, fig. 23.
Galumna (Galumna) granalata: Subías 2004: 215.
Galumna granalata: Ermilov & Starý 2020a: 73.
Galumna granalata: Ermilov & Frolov 2022a: 444.

Distribution. Oriental region and Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020a).

Galumna (Galumna) janosbaloghi
Ermilov & Starý, 2020

Galumna (Galumna) janosbaloghi Ermilov & Starý, 2020a: 68, figs 4–6.
Galumna janosbaloghi: Ermilov & Frolov 2022a: 444.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020a).

Galumna (Galumna) montagnensis
Ermilov & Frolov, 2022

Galumna (Galumna) montagnensis Ermilov & Frolov, 2022a: 445, fig. 3.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Frolov 2022a).

Galumna (Galumna) paraarmatifera
Ermilov & Starý, 2020

Galumna (Galumna) paraarmatifera Ermilov & Starý, 2020h: 1389, figs 4–5.
Galumna paraarmatifera: Ermilov & Frolov 2022a: 444.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Andasibe-Mantadia National Park (Ermilov & Starý 2020h); Montagne d'Ambre National Park (Ermilov & Frolov 2022a).

Galumna (Galumna) sandormahunkai
Ermilov & Starý, 2020

Galumna (Galumna) sandormahunkai Ermilov & Starý, 2020a: 65, figs 1–3.
Galumna sandormahunkai: Ermilov & Frolov 2022a: 444.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020a).

Galumna (Galumna) tuberculata Mahunka, 1997

Galumna tuberculata Mahunka, 1997a: 167, figs 91–95.
Galumna tuberculata: Mahunka 2002b: 15.
Galumna tuberculata: Balogh & Balogh 2002: 369, pl. 483. figs 5–6.
Galumna (Galumna) tuberculata: Subías 2004: 217.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Lokobe Strict Nature Reserve (Mahunka 1997a).
New record. Antsiranana Prov. Nosy Komba Island. Submontane rainforest remnants in the NW valley of Antaninaomby summit with tree ferns and with *Marattia fraxinea*, at 570–580 m alt. 13°23.2'S, 48°20.8'E, 29. 07. 1998, leg. T. Pócs (No. 9862) (Afr-917).

Leptogalumna (Leptogalumna) Balogh, 1960

Leptogalumna (Leptogalumna) reducta Mahunka, 1996

Leptogalumna reducta Mahunka, 1996c: 174, figs 23–26.
Leptogalumna reducta: Mahunka 2002b: 15.
Leptogalumna (Leptogalumna) reducta: Subías 2015: 455.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe Forest Reserve (Mahunka 1996c).

Orthogalumna Balogh, 1960

Orthogalumna saeva Balogh, 1960

Orthogalumna saeva Balogh, 1960: 31, figs 36–38.
Orthogalumna saeva: Balogh & Balogh 2002: 374, pl. 488. fig. 6.
Orthogalumna saeva: Mahunka 2002b: 15.

Distribution. Ethiopian, Oriental (Indian: Tripura, and south-eastern China, Okinava), Neotropical (Lesser Antilles).
Locality in Madagascar. Ile Tromelin (Balogh 1960).

Pergalumna (Pergalumna) Grandjean, 1936

Pergalumna (Pergalumna) amamiensis Aoki, 1984

Pergalumna amamiensis Aoki, 1984: 146, fig. 24.
Pergalumna (Pergalumna) amamiensis: Subías 2016: 460.
Pergalumna amamiensis: Ermilov & Starý 2020a: 73.
Pergalumna amamiensis: Ermilov & Frolov 2022a: 444.

Distribution. Ethiopian region and Japan.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020a).

Pergalumna (Pergalumna) ambrensis Ermilov & Frolov, 2022

Pergalumna (Pergalumna) ambrensis Ermilov & Frolov, 2022a: 444, figs 1–2.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Frolov 2022a).

Pergalumna (Pergalumna) andasibe Mahunka, 1996

Pergalumna andasibe Mahunka, 1996c: 175, figs 27–29.
Pergalumna andasibe: Mahunka 2002b: 15.
Pergalumna andasibe: Balogh & Balogh 2002: 377, pl. 492. fig. 8.
Pergalumna (Pergalumna) andasibe: Subías 2016: 460.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996c).

Pergalumna (Pergalumna) bicristata Mahunka, 2011

Pergalumna bicristata Mahunka, 2011a: 16, figs 32–34.
Pergalumna (Pergalumna) bicristata: Subías 2016: 460.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2011a).

Pergalumna (Pergalumna) conspicua Balogh, 1962

Pergalumna conspicua Balogh, 1962c: 119, figs 59–60.
Pergalumna (Pergalumna) conspicua: Subías 2016: 461.
Pergalumna conspicua: Ermilov & Starý 2020a: 73.
Pergalumna conspicua: Ermilov & Frolov 2022a: 444.

Distribution. Ethiopian region.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020a).

Pergalumna (Pergalumna) fastigata Mahunka, 1996

Pergalumna fastigata Mahunka, 1996c: 177, figs 30–33.

Pergalumna fastigata: Mahunka 2002b: 15.
Pergalumna fastigata: Balogh & Balogh 2002: 379, pl. 495. fig. 9.
Pergalumna (Pergalumna) fascigata: Subías 2016: 461.
Pergalumna fastigata: Ermilov & Starý 2020a: 73.
Pergalumna fastigata: Ermilov & Frolov 2022a: 444.

Distribution. Endemic to Madagascar.
Localities in Madagascar. Masoala peninsula, Ambanizana village (Mahunka 1996c); Montagne d'Ambre National Park (Ermilov & Starý 2020a).

Pergalumna (Pergalumna) filifera Mahunka, 1978

Pergalumna (Pergalumna) filifera Mahunka, 1978b: 337, figs 61–63.
Pergalumna filifera: Ermilov & Frolov 2022a: 444.

Distribution. Australia, Mauritius, Madagascar.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Frolov 2022a).

Pergalumna (Pergalumna) frater Balogh, 1960

Pergalumna frater Balogh, 1960: 32, figs 54–58.
Pergalumna (Pergalumna) frater: Ermilov & Starý 2020a: 73.
Pergalumna frater: Ermilov & Frolov 2022a: 444.

Distribution. Ethiopian region and Japan.
Locality in Madagascar. Montagne d'Ambre National Park (Ermilov & Starý 2020a).

Pergalumna (Pergalumna) infinita Mahunka, 2011

Pergalumna infinita Mahunka, 2011a: 180, figs 34–37.
Pergalumna (Pergalumna) infinita: Subías 2016: 462.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Vohimana Reserve (Mahunka 2011a).

Pergalumna (Pergalumna) nasifera Mahunka, 2011

Pergalumna nasifera Mahunka, 2011b: 63, figs 13a–c.
Pergalumna (Pergalumna) nasifera: Subías 2016: 463.

Distribution. Ethiopian region (Madagascar and Côte d'Ivoire).
Locality in Madagascar. Andasibe (Perinet) (Mahunka 2011b).

***Trichogalumna (Trichogalumna)* Balogh, 1960**

Trichogalumna (Trichogalumna) madagassica Mahunka, 1996

Trichogalumna madagassica Mahunka, 1996c: 180, figs 34–37.
Trichogalumna madagassica: Mahunka 2002b: 15.
Trichogalumna madagassica: Balogh & Balogh 2002: 372, pl. 487. fig. 1.
Trichogalumna (Trichogalumna) madagassica: Subías 2008: 422.

Distribution. Endemic to Madagascar.
Locality in Madagascar. Andasibe (Perinet) Forest Reserve (Mahunka 1996c).

Excluded species from the Oribatid fauna of Madagascar

***Phthiracarus (Archiphthiracarus)* Balogh & Mahunka, 1979**

Phthiracarus (Archiphthiracarus) puylaerti Niedbała, 2001

Notophthiracarus puylaerti Niedbała, 2001: 53, figs 444–450.
Notophthiracarus puylaerti: Mahunka 2002b: 8.
Notophthiracarus puylaerti: Niedbała 2017: 131, fig. 88.
Phthiracarus (Archiphthiracarus) puylaerti: Subías 2022: 88.

Distribution. Ethiopian [Congo].
Remarks. This species is not a real member of the Malagasy mite fauna. It was originally described by Niedbała from Congo (Niedbała 2001), then most probably erroneusly cited as a Madagascan species by Mahunka (2002), referring to the original description (Niedbała 2001: 53). Later, making a new, partial revision of the country's ptyctimous mite fauna, Niedbała (2017) cited the species on the basis of Mahunka (2002).

DISCUSSION

So far, *ca*. 350 species of Oribatid mites have been recorded in Madagascar. [The currently known species and subspecies in the world are 11.435 (Subías 2022)]. Of the 63 Malagasy families and 154 genera, 311 species have been described from Madagascar (89%) of which 219 were described by Hungarian acarologists (70%): 144 by Mahunka, 18 by Mahunka & Mahunka-Papp, 56 by Balogh and 1 by Balogh & Mahunka. The next most fruitful authors are Niedbała (53), Ermilov (24) and Fernández (15) and their co-authors. From the 350 species 8 are cosmopolitan, 10 are semicosmopolitan, 10 species are restricted to the Ethiopian region, while 254 species (72%) are endemic to the island. The observed ratio of endemisms in a region is sometimes affected by artefacts such as lack of specialists/increased interest by a specialist or lack of collection activities/increased number of field trips. Madagascar has a long history of interest in its natural history, going back centuries (Andriamialisoa & Langrand 2003, Goodman & Benstead 2003). It is now well-known that the high ratio of endemism in the country can be derived from the island's biogeographical past (e.g. Vences *et al*. 2009). However, one can still feel surprised and astonished while directly discovering this biodiversity: "*The richness of this fauna is so high that it requires much more investigation than planned before*" (Mahunka 2011).

It is very sad to think of the many non-described species, non-published papers and monographs which could have been written by Sándor Mahunka and Luise Mahunka-Papp who deceased so prematurely. We are thankful for all those scientists who continue their work on the Oribatid fauna of Madagascar.

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REFERENCES

ANDRIAMIALISOA, F. & LANGRAND, O. (2003): *The History of Zoological Exploration of Madagascar.* In. GOODMAN, S.M. & J. P. BENSTEAD (Eds.) The Natural History of Madagascar. The University of Chicago Press, Chicago, p. 1–15. 43

AOKI, J. (1959): Die Moosmilben (Oribatei) aus Südjapan. *Bulletin of the Biogeographical Society of Japan,* 21(1): 1–22.

AOKI, J. (1964): Some oribatid mites (Acarina) from Laysan Island. *Pacific Insects*, 6(4): 649–664.

AOKI, J. (1984): New and unrecorded oribatid mites from Amami-Ohshima Island, southwest: Japan. *Zoological Science*, 1: 132–147.

BALOGH, J. (1958): Oribatides nouvelles de l' Afrique tropicale. *Revue de zoologie et de botanique africaines*, 58(1–2): 1–34.

BALOGH, J. (1960): Oribates (Acari) nouveaux de Madagascar (1re serie). *Mémoires de l'Institut Scientifique de Madagascar Série (A).*, 14: 7–37.

BALOGH, J. (1961): An outline of the family Lohmanniidae Berl. 1916 (Acari Oribatei). *Acta zoologica Academiae Scientiarum Hungaricae,* 7: 19–44.

BALOGH, J. (1962a): Recherches sur la faune endogee de Madagascar. VII. Oribates (Acariens) nouveaux. *Naturaliste malgache,* 13: 121–151.

BALOGH, J. (1962b): New Oribatids from Madagascar (Acari). *Annales historico-naturales Musei nationalis hungarici,* 54: 419–427.

BALOGH, J. (1962c): Resultats scientifiques des missions zoologiques de 1'I.R.S.A.C. en Afrique Orientale (P. Basilewsky et N. Leleup, 1957). LXXV. Acari, Oribates. *Annales du Musée Royal de l'Afrique central Zoologie*, 110: 90–131.

BALOGH, J. (1963): Oribates (Acari) nouveaux d' Angola et du Congo (3eme serie). *Publicações culturais Companhia de Diamantes de Angola, Lisboa*, 68: 33–48.

BALOGH, J. (1983): A partial revision of the Oppiidae Grandjean, 1954 (Acari: Oribatei). *Acta zoologica Academiae Scientiarum Hungaricae,* 29: 1–79.

BALOGH, J. & BALOGH, P. (1987): A new outline of the family Lohmanniidae Berlese, 1916 (Acari: Oribatei). *Acta zoologica Academiae Scientiarum Hungaricae,* 33: 327–398.

BALOGH, J. & BALOGH, P. (1999a): The species of the Rhynchoribates Grandjean, 1929. *Folia entomologica hungarica*, 60: 13–20.

BALOGH, J. & BALOGH, P. (1999b): The extra-holarctic species of the Oripodidae Jacot, 1925 (Acari: Oribatei). *Folia entomologica hungarica*, 60: 21–43.

BALOGH, J. & BALOGH, P. (2002): *Identification keys to the Oribatid mites of the extra-Holarctic Regions I.-II.* – Well-Press, 1–453. + 1–504.

BARAN, Ş., AYYILDIZ, N. & SUBÍAS, L. S. (2010): Review of the family Damaeolidae Grandjean, 1965 (Acari, Oribatida) with two new records from Turkey. *Turkish Journal of Zoology*, 34: 343–349. https://doi.org/ 10.3906/zoo-0902-12

BERLESE, A. (1910): Acari nuovi. Manipulus V, VI. *Redia*, 6: 199–234.

BERLESE, A. (1913): Acari nuovi. Manipulus VII–VIII. *Redia*, 9: 77–111.

CORPUZ-RAROS, L. & ERMILOV, S. G. (2020): Catalogue of oribatid mites (Acari: Oribatida) from Continental Southeast Asia. *Zootaxa*, 4893: 1–216. https://doi.org/10.11646/zootaxa.4893.1.1

ERMILOV, S. G. (2020): Two new species of Pilobates (Acari, Oribatida, Haplozetidae) from Madagascar. *Systematic & Applied Acarology*, 25(7): 1319–1328. https://doi.org/10.11158/saa.25.7.11

ERMILOV, S. G. & FROLOV, A. V. (2019): Contribution to the knowledge of the oribatid mite genus Eremella (Acari, Oribatida, Eremellidae). *Acarologia*, 59(2): 214–226. https://doi.org/10.24349/acarologia/20194326

ERMILOV, S. G. & FROLOV, A. V. (2022a): New faunistic and taxonomic data on oribatid mites (Acari, Oribatida) from Montagne d'Ambre National Park, Madagascar. *International Journal of Acarology*, 48(6): 442–449. https://doi.org/10.1080/01647954.2022.2105947

ERMILOV, S. G. & FROLOV, A. V. (2022b): A new subgenus and two new species of oribatid mites (Acari, Oribatida) from Madagascar. *Acarologia*, 62(3): 798–810. https://doi.org/10.24349/1m3y-yi0t

ERMILOV, S. G. & KLIMOV, P. B. (2017): Generic revision of the large-winged mite superfamily Galumnoidea (Acari, Oribatida) of the world. *Zootaxa*, 4357(1): 1–72. https://doi.org/10.11646/zootaxa.4357.1.1

ERMILOV, S. G. & MINOR, M. A. (2018): Contribution to the knowledge of the oribatid mite genus Leptptocepheus (Acari, Oribatida, Otocepheidae). *Systematic & Applied Acarology*, 23(11): 2269–2278. http://doi.org/10.11158/saa.23.11.18

ERMILOV, S. G., SHTANCHAEVA, U. YA. & SUBÍAS, L. S. (2014): New species of oribatid mites (Acari: Oribatida) of the genera Suctobelbella (Suctobelbidae) and Neoribates (Parakalummidae) from Vietnam. *Biologia*, 69(11): 1593–1600. https://doi.org/10.2478/s11756-014-0457-6

ERMILOV, S. G. & STARÝ, J. (2020a): New and interesting species of the genera Galumna and Pergalumna (Acari, Oribatida, Galumnidae) from the Montagne d'Ambre National Park, Madagascar. *Acarologia*, 60(1): 64–74. https://doi.org/10.24349/acarologia/20204357

ERMILOV, S. G. & STARÝ, J. (2020b): Contribution to the knowledge of African Parakalummidae (Acari, Oribatida). *Systematic & Applied Acarology*, 25(1): 113–124. https://doi.org/10.11158/saa.25.1.9

ERMILOV, S. G. & STARÝ, J. (2020c): Contribution to the knowledge of oribatid mites of the genus Austrocarabodes (Acari, Oribatida, Carabodidae) of Madagascar. *Acarologia*, 60(2): 353–370. https://doi.org/10.24349/acarologia/20204373

ERMILOV, S. G. & STARÝ, J. (2020d): New species and records of Oppiidae (Acari, Oribatida) from the Montagne d'Ambre National Park (Madagascar). *Systematic & Applied Acarology*, 25(4): 697–706. https://doi.org/10.11158/saa.25.4.9

ERMILOV, S. G. & STARÝ, J. (2020e): Two new species of Haplozetidae (Acari, Oribatida) from Madagascar. *International Journal of Acarology*, 46(3): 146–154. https://doi.org/10.1080/01647954.2020.1746831

ERMILOV, S. G. & STARÝ, J. (2020f): Two new species of Allogalumna (Acari, Oribatida, Galuumnidae) from Madagascar. *Acta Zoologica Academiae Scientiarum Hungaricae*, 66(2): 99–110. https://doi.org/10.17109/AZH.66.2.99.2020

ERMILOV, S. G. & STARÝ, J. (2020g): Contribution to the knowledge of the oribatid mite genus *Pilobatella* (Acari, Oribatida, Haplozetidae). *Acarologia*, 60(3): 545–556. https://doi.org/10.1080/01647954.2020.1746831

ERMILOV, S. G. & STARÝ, J. (2020h): Two new species of Galumna (Acari, Oribatida) form Andasibe-

Mantadia National Park, Madagascar. *Systematic & Applied Acarology*, 25(8): 1387–1394. https://doi.org/10.11158/ssa.25.8.3

ERMILOV, S. G. & STARÝ, J. (2020i): A new species of Erioppia with remarks on Oppiidae (Acari: Oribatida) from Andasibe-Mantadia National Park, Madagascar. *International Journal of Acarology*, 46(6): 446–451. https://doi.org/10.1080/01647954.2020.1800817

ERMILOV, S. G. & STARÝ, J. (2020j): A new species of the genus Pilobates (Acari, Oeibatida, Haplozetidae) from Madagascar. *Acarina*, 28(2): 123–128. https://doi.org/10.11158/saa.25.7.11

ERMILOV, S. G. & STARÝ, J. (2020k): New species of oribatid mites of the genera Indoribates and Protoribates (Acari: Oribatida: Haplozetidae) from Madagascar. *Annales Zoologici*, 70(3): 361–369. https://doi.org/10.3161/00034541ANZ2020.70.3.008

ERMILOV, S. G. & STARÝ, J. (2020l): Contribution to the knowledge of the oribatid mite genus Angulogalumna (Acari: Oribatida: Galumnidae). *International Journal of Acarology*, 46(2): 67–72. https://doi.org/10.1080/01647954.2020.1725626

EWING, H. E. (1909): New American Oribatioidea. *Journal of the New York Entomological Society*, 17: 116–136.

FERNANDEZ, N. & CLEVA, R. (2009): A new species of Eremaeozetes (Acari, Oribatida, Eremaeozetidae) from Madagascar *Eremaeozetes betschi* n. sp. *Acarologia*, 49(1–2): 69–82.

FERNANDEZ, N. & CLEVA, R. (2010a): Une nouvelle espèce de Scapheremaeus (Arachnida, Acari, Oribatida, Cymbaeremaeidae) de Madagascar: Scapheremaeus pauliani n. sp. *Zoosystema*, 32(1): 101–115. https://doi.org/10.5252/z2010n1a5

FERNANDEZ, N. & CLEVA, R. (2010b): Malgacheliodes guillaumeti n. gen., n. sp. (Acari, Oribatida, Pheroliodidae) de Madagascar. *Zoosystema*, 32(4): 567–584. https://doi.org/10.5252/z2010n4a2

FERNANDEZ, N., CLEVA, R. & THERON, P. (2010): Idiozetes malgache, a new species of Idiozetidae (Acari, Oribatida) from Madagascar. *International Journal of Acarology*, 36(5): 437–451. https://doi.org/10.1080/01647954.2010.485132

FERNANDEZ, N., CLEVA, E. & THERON, P. (2011): Malgachebates peyrierasi n. gen., n. sp. (Acari: Oribatida: Plasmobatidae) from Madagascar. *International Journal of Acarology*, 37(1): 61–74. https://doi.org/10.1080/01647954.2010.495082

FERNANDEZ, N., THERON, P. D. & CLEVA, R. (2011): *Rogerzetes lacouturieri* n. gen., n. sp., (Acari: Oribatida: Eremaeozetidae) from Madagascar. *International Journal of Acarology*, 37(Suppl. 1): 61–70. https://doi.org/10.1080/01647954.2010.539980

FERNANDEZ, N., THERON, P. & ROLLARD, C. (2013a): The family Carabodidae (Acari: Oribatida) I. Description of a new genus, *Bovicarabodes* with three new species, and the redescription of Hardybodes mirabilis Balogh,1970. *International Journal of Acarology*, 39(1): 26–57. https://doi.org/10.1080/01647954.2012.741144

FERNANDEZ, N., THERON, P. & ROLLARD, C. (2013b): Revision of the family Carabodidae (Acari: Oribatida) IV. *Afticarabodes anjavidilavai* gen. nov., sp. nov., *Rugocepheus joffrevillei* sp. nov. and redefinition of the genus *Rugocepheus* Mahunka, 2009. *International Journal of Acarology*, 39(6): 462–480. https://doi.org/10.1080/01647954.2013.822928

FERNANDEZ, N., THERON, P., ROLLARD, C. & TIEDT, L. (2013): Family Carabodidae (Acari: Oribatida) V. The genus *Congocepheus* Balogh, 1958 (second part), with a redescription of *Congocepheus involutus* Mahunka, 1997, and descriptions of two new species. *Zoosystema*, 35(4): 551–579. https://doi.org/10.5252/z2013n4a8

FERNANDEZ, N., THERON, P., ROLLARD, C. & CASTILLO, E. R. (2014a): Revision of the family Carabodidae (Acari, Oribatida) VII. Redefinition of the genus *Malgasodes*; redescription of *M. curvisetus* Mahunka, 2000; and complementary description of *M. hungarorum* Mahunka, 2010. Phylogenetic relationships between *Malgasodes*, *Bovicarabodes*, *Afticarabodes*, *Congocepheus* and *Cavaecarabodes* are discussed. *ZooKeys,* 435: 25–48. https://doi.org/10.3897/zookeys.435.8071

FERNANDEZ, N., THERON, P., ROLLARD, C. & CASTILLO, E. R. (2014b): Revision of the family Carabodidae (Acari: Oribatida) V (third part). Redefinition of *Congocepheus*, definition of *Cavaecarabodes* gen. nov., and descriptions of three new species, *Congocepheus germani* sp. nov., *Cavaecarabodes pulchritude* gen. nov., sp. nov., and *Cavaecarabodes anouchkae* gen. nov., sp. nov. *International Journal of Acarology*, 40(7): 535–555. https://doi.org/10.1080/01647954.2014.959050

FERNANDEZ, N., THERON, P. LEIVA, S., ROLLARD, C. & TIEDT, L. (2014): Revision of the family Carabodidae (Acari: Oribatida) VI. *Mangabebodes kymatismosi* gen. nov., sp. nov. and *Antongilibodes paulae* gen. nov., sp. nov. from Madagascar. *International Journal of Acarology*, 40 (4): 296–319. http://doi.org/10.1080/01647954.2014.914972

FERNANDEZ, N., THERON, P., ROLLARD, C., LEIVA, S. & TIEDT, L. (2016): Revision of the family Carabodidae (Acari: Oribatida) X. *Bovicarabodes jacquelinae* sp. nov., redefinition of the genus *Tuberocepheus* Balogh & Mahunka, 1969 and redescription of *Tuberocepheus longus* (Balogh, 1962). *International Journal of Acarology*, 42(2): 79–91. shttps://doi.org/10.1080/01647954.2015.1124920

GOODMAN, S.M. & BENSTEAD, J.P. (2003): *The Natural History of Madagascar.* The University of Chicago Press, Chicago, 1709 pp.

GRANDJEAN, F. (1936): *Microzetes auxiliaris* n. sp. (Oribates). *Bulletin du Muséum d'histoire naturelle*, 8(2): 138–145.

HAMMER, M. (1961): Investigations on the Oribatid fauna of the Andes Mountains II. Peru. *Biologiske Skrifter udgivet af Det Kongelige Danske Videnskabernes Selskab*, 13(1): 1–157 + 63 pl.

HAMMER, M. (1966): Investigations on the oribatid fauna of New Zeland. Part I. *Biologiske Skrifter udgivet af Det Kongelige Danske Videnskabernes Selskab*, 15(2): 1–108 + 45 pl.

HAMMER, M. (1971): On some Oribatids from Viti Levu, the Fiji Islands. *Biologiske Skrifter udgivet af Det Kongelige Danske Videnskabernes Selskab*, 16(6): 1–60 + 35 pl.

HAMMER, M. (1972): Investigation on the oribatid fauna of Tahiti, and on some oribatids found on the atoll Rangiroa. *Biologiske Skrifter*, 19(3): 1–65 + 26 pl.

HAMMER, M. (1979): Investigations on the Oribatid Fauna of Java. *Det Kongelige Danske Videnskabernes Selskab Viologiske Skrifter*, 22(9): 1–78 + 47 pl.

KOCH, C. L. (1835–1844): Deutschlands Crustaceen, Myriapoden und Arachniden, 1835, Heft 1–3; 1836, Heft 4–9; 1837, Heft 10–16; 1838, Heft 17–22; 1839, Heft 23–30; 1841, Heft 31–34; 1844, Heft 35–40, Herrich-Schäffer. Regensburg.

KOLESNIKOV, V.B. & LEONOV, V.D. (2021): *Zetorchestes krisperi* sp. nov. (Acari: Oribatida: Zetorchestidae) from Vietnam with juvenile morphology and identification key to known species of the genus. *Zootaxa*, 5057(4): 545–561. https://doi.org/10.11646/zootaxa.5057.4.5

MAHUNKA, S. (1978a): Neue und interessante Milben aus dem Genfer Museum XXVII. A first survey of the Oribatid (Acari) fauna of Mauritius, Reunion and the Seychelles I. *Revue suisse de Zoologie*, 85 (1): 177–236. https://doi.org/10.5962/bhl.part.82228

MAHUNKA, S. (1978b): Neue und interessante Milben aus dem Genfer Museum XXXIV. A compendium of the Oribatid (Acari) fauna of Mauritius, Reunion and the Seychelles Is. II. *Revue suisse de Zoologie*, 85(2): 307–340. https://doi.org/10.5962/bhl.part.82234

MAHUNKA, S. (1983a): Some new Oribatids from Madagascar (Acari). *Folia entomologica hungarica,* 44(1): 99–107.

MAHUNKA, S. (1983b): Oribatids from the Eastern Part of the Ethiopian Region II. *Acta Zoologica Academiae Scientiarum Hungaricae*, 29(1–3): 151–180.

MAHUNKA, S. (1983c): Oribatids from the Eastern Part of the Ethiopian Region (Acari). III. *Acta Zoologica Academiae Scientiarum Hungaricae*, 29(4): 397–440.

MAHUNKA, S. (1984): Oribatids of the Eastern Part of the Ethiopian Region (Acari). V. *Acta Zoologica Academiae Scientiarum Hungaricae*, 30(1–2): 87–136.

MAHUNKA, S. (1987): Studies on the Oribatid fauna of Kenya (Acari: Oribatida) I. *Miscellanea Zoologica Hungarica*, 4: 71–91.

MAHUNKA, S. (1988a): The Oribatid fauna of Tanzania (Acari) I. *Acta Zoologica Academiae Scientiarum Hungaricae*, 34(4): 345–378.

MAHUNKA, S. (1988b): Neue und interessante Milben aus dem Genfer Museum LII. Oribatids from Mauritius, Reunion and Seychelles III. (Acari: Oribatida). *Revue suisse Zoologie*, 95(4): 1079–1115. https://doi.org/10.5962/bhl.part.81954

MAHUNKA, S. (1990a): A survey of the superfamily Euphthiracaroidea Jacot, 1930 (Acari: Oribatida). *Folia Entomologica Hungarica*, 51: 37–80.

MAHUNKA, S. (1990b): Notes and remarks on Oribatid taxa (Acari), I. *Annales historico-naturales Musei nationalis hungarici,* 82: 191–215.

MAHUNKA, S. (1991): New and interesting mites from the Geneva Museum LXVII. Soil inhabiting Ptychoid Oribatids from Malaysia (Acari: Oribatida). *Revue suisse de Zoologie,* 98(2): 325–354. https://doi.org/10.5962/bhl.part.79795

MAHUNKA, S. (1993a): Oribatids from Madagascar I. (Acari: Oribatida). New and interesting mites from the Geneva Museum LXXVI. *Revue suisse de Zoologie,* 100(2): 289–315. https://doi.org/10.5962/bhl.part.79862

MAHUNKA, S. (1993b): A new series of publication on new or little known oribatid taxa from Africa (Acari), I. *Acta Zoologica Academiae Scientiarum Hungaricae*, 39(1–4): 91–119.

MAHUNKA, S. (1994): Oribatids from Madagascar II. (Acari: Oribatida). (New and interesting mites from the Geneva Museum LXXIX.) *Revue suisse de Zoologie*, 101(1): 47–88. https://doi.org/10.5962/bhl.part.79900

MAHUNKA, S. (1996a): Oribatid mites (Acari: Oribatida) from Madagascar I. *Archiphthiracarella* gen. nov. *Acta Zoologica Academiae Scientiarum Hungaricae,* 42(1): 17–22.

MAHUNKA, S. (1996b): Oribatid mites (Acari: Oribatida) from Madagascar. II: Descriptions of six new species. *Folia entomologica hungarica,* 57: 109–123.

MAHUNKA, S. (1996c): Galumnatoid taxa (Acari: Oribatida) from Madagascar (Part 1). *Acta Zoologica Academiae Scientiarum Hungaricae,* 42(2): 163–181.

MAHUNKA, S. (1997a): Oribatids from Madagascar III. (Acari: Oribatida). (Acarologica Genavensia LXXXIII). *Revue suisse de Zoologie,* 104(1): 115–170. https://doi.org/10.5962/bhl.part.79993

MAHUNKA, S. (1997b): Notes and remarks on Oribatid taxa (Acari), III. *Folia entomologica hungarica,* 58: 83–87.

MAHUNKA, S. (1999a): Oribatid mites (Acari: Oribatida) from Madagascar – III: Some microzetid species. *Folia entomologica hungarica,* 60: 61–68.

MAHUNKA, S. (1999b): Ptychoid oribatids from Madagascar (Acari: Oribatida). *Folia entomologica hungarica,* 60: 69–82.

MAHUNKA, S. (2000a): *Malgasodes* gen. n., with two new species from Madagascar (Acari: Oribatida: Carabodidae). *International Journal of Acarology,* 26(1): 87–91. https://doi.org/10.1080/01647950008683639

MAHUNKA, S. (2000b): Oribatids mites (Acari: Oribatida) from Madagascar IV: new Nothrus and Damaeolus species. *Folia entomologica hungarica,* 61: 21–25.

MAHUNKA, S. (2001): *Persuctobelba* gen. n., with two new species from Madagascar (Acari, Oribatida: Suctobelbidae). *Acarologia*, 41: 277–282. [2000]

MAHUNKA, S. (2002a): *Jermyia* gen. n. and some new oppiid mites from Madagascar (Acari: Oribatida). *Acta zoologica Academiae Scientiarum Hungaricae,* 48(Suppl. 1): 161–175.

MAHUNKA, S. (2002b): A survey of the Oribatida fauna of Madagascar (Acari: Oribatida). *Folia entomologica hungarica,* 63: 5–16.

MAHUNKA, S. (2009a): Oribatid mites from the Vohimana Reserve (Madagascar) (Acari: Oribatida). I. *Acta Zoologica Academiae Scientiarum Hungaricae,* 55(2): 89–122.

MAHUNKA, S. (2009b): Oribatid mites from the Vohimana Reserve (Madagascar) (Acari: Oribatida), II. *Opuscula Zoologica (Budapest),* 40(2): 47–61.

MAHUNKA, S. (2009c): Oribatids from Madagascar IV (Acari: Oribatida) *Revue suisse de Zoologie*, 116(3–4): 337–352. https://doi.org/10.5962/bhl.part.81323

MAHUNKA, S. (2010a): New and little known oribatid mites from Madagascar (Acari: Oribatida). I. *Opuscula Zoologica (Budapest),* 41(1): 47–56.

MAHUNKA, S. (2010b): Two new species of Ameroidea (Acari: Oribatida) from Madagascar. *Zootaxa,* 2631: 62–68.

MAHUNKA, S. (2011a): New and little known Oribatid mites from Madagascar (Acari: Oribatida) II. *Acta Zoologica Academiae Scientiarum Hungaricae,* 57(1): 1–21.

MAHUNKA, S. (2011b): New and little known oribatid mites from Madagascar (Acari: Oribatida) III. *Opuscula Zoologica (Budapest),* 42(1): 43–66.

MAHUNKA, S. & MAHUNKA-PAPP, L. (2008): Poronotic oribatids from Kenya (Acari Oribatida). *Tropical Zoology*, 21(1): 75–90.

MAHUNKA, S. & MAHUNKA-PAPP, L. (2011): New and little known oribatid mites from Madagascar

(Acari: Oribatida) IV. *Opuscula Zoologica (Budapest)*, 42(2): 125–145.

MAHUNKA S. & MAHUNKA-PAPP, L.† (2012): New Oppioidea taxa from Madagascar (Acari: Oribatida). *Opuscula Zoologica (Budapest)*, 43(1): 43–55.

MIKO, L. (2016): Oribatid mites (Acarina, Oribatida) from French Guyana: review of the genus *Rhynchoribates* and description of three new species. *Zootaxa*, 4061: 131–145. http://doi.org/10.11646/zootaxa.4061.2.3

MIHELČIČ, F. (1957): Oribatiden der iberischen Halbinsel VI. *Zoologischer Anzeiger*, 158(3/4): 53–66.

MYERS, N., MITTERMEIER, R.A., MITTERMEIER, C.G., DA FONSECA, G.A.B. & KENT, J. (2000): Biodiversity hotspots for conservation priorities. *Nature*, 403: 853–858. https://doi.org/10.1038/35002501

NIEDBALA, W. (1983a): Trois nouvelles espéces du genre *Hoplophorella* (Acari, Oribatida, Phthiracaridae) du Kenya. *Bulletin de la Société des Amis des Sciences et des Lettres de Poznań*, 22: 127–141.

NIEDBALA, W. (1983b): *Mesoplophora invisitata* sp. nov. de l'Ouganda (Acari, Oribatida, Mesoplophoridae). *Journal of Natural History*, 17: 647–650. https://doi.org/10.1080/00222938300770531a

NIEDBAŁA, W. (1986): *Hoplophthiracarus inelegans* sp. n. (Acari, Oribatida, Phthiracaridae) de Costa Rica. *Bulletin de la Société des Amis des Sciences et des Lettres de Poznań*, 25: 115–117.

NIEDBAŁA, W. (1988): Deux nouveaux Phthiracaridae des Comores (Acari, Oribatida). *Revue de Zoologie africaine*, 102(1): 79–83.

NIEDBAŁA, W. (1991): Description of two new Euphthiracaroid species (Acari, Oribatida). *Genus*, 2(1), 33–44.

NIEDBAŁA, W. (1997): Contribution to the knowledge of Euptyctima (Acari: Oribatida) *Genus*, 8(1): 81–101.

NIEDBAŁA, W. (1998a): Ptyctimous mites of the Ethiopian region. I. Euphthiracaroidea (Acari, Oribatida). *Journal of African Zoology*, 112(1): 15–75.

NIEDBAŁA, W. (1998b) Ptyctimous mites of the Pacific Islands. Recent knowledge, origin, descriptions, redescriptions, diagnoses and zoogeography (Acari, Oribatida). *Genus*, 9(4): 431–558.

NIEDBAŁA, W. (2001): Study on the diversity of ptyctimous mites (Acari, Oribatida) and quest for centres of its origin: the fauna of the Ethiopian region. *Monographs of the Upper Silesian Museum, Bytom*, 3: 1–245.

NIEDBAŁA, W. (2004a): Zoogeography of the ptyctimous mites (Acari: Oribatida) of Madagascar and other eastern Africa islands. *International Journal of Tropical Insect Science,* 24(4): 330–335. https://doi.org/10.1079/IJT200444

NIEDBAŁA, W. (2004b): Protoplophoridae (Acari: Oribatida) of the World. *Annales Zoologici, Warsawa,* 54(4): 807–834.

NIEDBAŁA, W. (2008): Description of a new species of ptyctimous mites (Acari Oribatida) from Ethiopia and a checklist of ptyctimous mites of the Afrotropical Region. *Tropical Zoology*, 21: 1–9.

NIEDBAŁA, W. (2017): Ptyctimous mites (Acari, Oribatida) of Madagascar and neighbouring islands. *Acarologia*, 57(1): 3–205. https://doi.org/10.1051/acarologia/20164149

NIEDBAŁA, W. & STARÝ, J. (2013): Contibution to the knowledge of Ptycrimous mites (Acari: Oribatida) from Madagascar. *Acta Zoologica Scientiarum Hungaricae*, 59(4): 337–345.

NIEDBAŁA, W. & STARÝ, J. (2014a): New species of Notophthiracarus (Acari: Oribatida: Phthiracaroidea) from Madagascar. *Annales Zoologici* (Warsawa), 64(1): 79–86. https://doi.org/10.3161/000345414X680591

NIEDBAŁA, W. & STARÝ, J. (2014b): New species of *Atropacarus (Hoplophorella)*, (Acari, Oribatida, Phthiracaridae) from the Afrotropical Region. *Zootaxa*, 3774(1): 074–082. http://dx.doi.org/10.11646/zootaxa.3774.1.5

NIEDBAŁA, W. & STARÝ, J. (2014c): New species of *Euphthiracarus* Ewing, 1917 (Acari: Oribatida: Euphthiracaroidea) from the Afrotropical Region. *Annales Zoologici*, 64(3): 485–493. https://doi.org/10.3161/000345414X684812

NIEDBAŁA, W. & STARÝ, J. (2015a): New species of the superfamily Phthiracaroidea (Acari, Oribatida) from the Afrotropical Region. *African Invertebrates*, 56(1) 39–49. https://doi.org//10.5733/afin.056.0105

NIEDBAŁA, W. & STARÝ, J. (2015b): The next new species of Notophthiracarus Ramsay, 1966 (Acari, Oribatida, Phthiracaroidea) from Madagascar. *African Invertebrates*, 56(1): 63–73. https://doi.org/10.5733/afin.056.0107

NIEDBAŁA W. & STARÝ J. (2015c): New species of the superfamily Euphthiracaroidea (Acari, Oribatida) from Madagascar and Tanzania. *Journal of Natural History*, 49: 1689–1702. http://dx.doi.org/10.1080/00222933.2014.976670

NIEDBAŁA W. & STARÝ J. (2016a): New and little known species of ptyctimous mites (Acari, Oribatida) from Madagascar. *Zootaxa*, 4103(6): 587–599. http://doi.org/10.11646/zootaxa.4103.6.8

NIEDBAŁA W. & STARÝ J. (2016b): Six new species of ptyctimous mites (Acari: Oribatida) from Madagascar. *Acarologia*, 56(4): 485–496 https://doi.org/10.1051/acarologia/20164134

NORTON, R.A. & BEHAN-PELLETIER, V. (2009): *Suborder Oribatida.* In: KRANTZ, GW. & WALTER, D. E. (Eds.) A manual of Acarology. 3rd edition. Texas Tech University Press, Lubbock, p. 430–564.

O'CONNOR, B.M. (2003): *Parasitic and Commensal Mites of Vertebrates.* In. GOODMAN, S.M. & J. P. BENSTEAD (Eds.) The Natural History of Madagascar. The University of Chicago Press, Chicago, p. 593–602.

OUDEMANS, A.C. (1902): Acarologische Aanteekeningen. *Entomolofische Berichten*, 1: 36–39.

PAOLI, G. (1908): Monografia del genere *Dameosoma* Berl. e generi affini. *Redia*, 5(1): 31–91.

PASCHOAL, A. D. (1987): A revision of the Plateremaeidae (Acari, Oribatei). *Revista Brasileira de Zoologia*, 3(6): 327–356. https://doi.org/10.1590/S0101-81751986000200001

PASCHOAL, A. D. (1989): Description of *Nooliodes* gen. n. and Nooliodidae fam. n. (Acari, Oribatei) from Madagaskar. *Revista brasileira de Zoologia, Sao Paulo,* 6(2): 179–182. https://doi.org/10.1590/S0101-81751989000200001

SCHABETSBERGER, R., KAISER, R., Rott, E., LENZENWEGER, R., TRAUNSPURGER, W., KOTOV, A.A., FIERS, F., GAVIRIA, S., MEISCH, C., MAHUNKA, S., CAMPBELL, R.D., RAZAFINDRANAIVO, E. & SZTATECSNY, M. (2012): On the brink – investigating biodiversity in endangered crater lakes of the Amber Mountains National Park (Madagascar). *Aquatic Conservation: Marine and Freshwater Ecosystems*, 23: 316–331. https://doi.org/10.1002/aqc.2286

SELLNICK, M. (1923): Die mir bekannten Arten der Gattung Tritia Berl. *Acari, Blätter für Milbenkunde*, 3: 7–22.

SUBÍAS, L.S. & BALOGH, P. (1989): Identification keys to the genera of Oppiidae Grandjean, 1951 (Acari: Oribatei). *Acta zoologica Academiae Scientiarum Hungaricae,* 35(3–4): 355–412.

SUBÍAS, L.S. (2004–2022): Listado sistemático, sinonímico y biogeográfico de los ácaros oribátidos (Acariformes: Oribatida) del mundo (1758–2002) Excepto fósiles. *Graellsia*, 60: 3–305. [Updated: June 2006, 531 pp.; April 2007, 536 pp.; May 2008, 540 pp.; April 2009, 547 pp.; July 2010, 557 pp.; February 2011, 561 pp.; April 2012, 564 pp.; May 2013: 570 pp; February 2014, 577 pp; May 2015, 587 pp.; February 2016, 593 pp.; February 2017, 598 pp.; January 2018, 605 pp.; March 2019, 536 pp.; January 2020, 527 pp.; March 2021, 532 pp.; March 2022, 537 pp.].

VENCES, M., WOLLENBERG, K.C., VIETES, D.R. & LEES, D.C. (2009): Madagascar as a model region of species diversification. *Trends in Ecology & Evolution* 24: 456–465.

WILLMANN, C. (1928): Neue Oribatiden I. *Zoologischer Anzeiger*, 76(1/2): 1–5.

WILLMANN, C. (1930): Neue Oribatiden aus Guatemala. *Zoologischer Anzeiger*, 88(9/10): 239–246.

Opusc. Zool. Budapest, 2023, 54: 159–169

A new free-living nematode species, *Terschellingia didistalamphida* sp. nov. (Nematoda: Linhomoeidae), with female intersexuality from West Bengal, India

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Abstract. A new species of free-living soil nematode, *Terschellingia didistalamphida* sp. nov., is described from paddy field in West Bengal, India. It is characterized by moderate body length (L=1.0–3.5 mm), possesses two amphids, only four cephalic setae. Amphideal fovea distant from the anterior end, stoma small and narrow, pharynx with well-developed terminal bulb. Females with amphidelphic ovaries. Males with paired testes, ventrally arcuate, short and stout spicules, gubernaculum with clearly developed dorso-caudal apophysis. Tail long and filiform, similar in both sexes. Fourteen female intersexes of *Terschellingia didistalamphida* sp. nov., with a prominent female reproductive structure and a less conspicuous male reproductive system, were found. These female intersexes are with well-developed vulva and prominent spicules, however, lack apophysis. A checklist for known cases of intersex across various nematode orders has been appended.

Keywords. New species, new records, female intersex, soil nematodes, meiofauna, Monhysterida.

INTRODUCTION

The members of the family Linhomoeidae Filipjev, 1929, are primarily found in marine habitats. However, *Terschellingia* de Man, 1888, is an exception within this family, as it includes mostly freshwater and some marine species (Abebe *et al.* 2006, Armenteros *et al*. 2009). De Man (1888) initially identified the genus *Terschellingia* based on characteristics such as a narrow buccal cavity (when present), four cephalic setae, anterior amphids, a pharynx with a well-developed basal bulb, and amphidelphic ovaries in females. Males of this genus possess robust spicules and a gubernaculum with a prominent dorso-caudal apophysis. The tail may or may not have a filiform expansion.

Amenteros *et al.* (2009) made an extensive review of 38 species of the genus *Terschellingia* described by various authors over the past century and concluded only 15 odds among them as valid species.

Intersexuality has been observed in various forms of nematodes, including those that are insect-parasitic (Hirschmann & Sasser 1955, Steiner 1923), free-living, animal-parasitic (Hirschmann *et al.* 1955), and plant-parasitic (Chitwood 1949, Jairajpuri *et al.* 1977, Triantaphyllou & Hirschmann 1964). Among the reported cases of intersex nematodes, the majority are female intersex, exhibiting fully developed female reproductive structures and rudimentary male reproductive systems (Renubala *et al.* 1992); while a few are

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male intersex, having matured male reproductive organs. Some species display both types of intersexuality (Zhuo *et al*. 2009).

It has been stated in earlier literature that intersexuality is comparatively rare among plant-parasitic forms (Zhuo *et al*. 2009). In addition to recording the descriptions of a new species *Terschellingia didistalamphida* sp. nov., we performed an exhaustive literature review and prepared a comprehensive checklist of records of intersexuality in nematodes across all ecological categories available to date.

MATERIALS AND METHODS

Soil samples (mud) were collected from a depth of 0–15cm from a paddy field in Purba (East) Midnapore district (22.1375°N, 88.0799° E), West Bengal, India. Nematodes were then extracted by processing the mud samples following the modified Baermann funnel technique (Jana *et al*. 2010). Nematodes were fixed in hot (90°–100°C), diluted FAA (formalin acetic acid: 4:1, i.e., 10 parts 40% formalin, 1 part acetic acid, and 89 parts distilled water) solution. Nematodes were then picked up into glycerin-alcohol (5 parts 1.5% glycerin in 95 parts of 30% alcohol) and kept inside a desiccator containing anhydrous calcium chloride ($CaCl_2$). After 4–8 weeks of desiccation, slides were prepared by mounting nematodes into glycerin. The morpho-taxonomic descriptions were made from glycerin mounts using light microscopy. Line drawings were made either using a Dewinter microscope fitted with a drawing tube or digitally drawn using Adobe CS 2021 software from captured images. Imaging was done with an optical microscope (Carl Zeiss Axio Vert. A1 with Zeiss Zen Pro software, Carl Zeiss, Jena, Germany) equipped with an advanced camera (Axiocam 305 Color) sensor and IC measure application.

TAXONOMY

Order Monhysterida Filipjev, 1929

Superfamily Siphonolaimoidea Filipjev, 1918

Family Linhomoeidae Filipjev, 1922

Genus *Terschellingia* de Man, 1888

Diagnosis. Moderate body length Linhomoeidae (L = 1.0–3.5 mm), with transversely striated cuticle. Only four cephalic setae present. Stoma small and narrow. Pharynx with well-developed terminal bulb. Female with amphidelphic ovaries. Testes paired. Spicules short and stout, ventrally arcuate. Gubernaculum with clearly developed caudal apophyses. Pre-anal, mid-ventral genital papillae present in some species. Tail long and filiform. Mostly marine, few found in freshwater.

Type species: *T. communis* de Man, 1888

Terschellingia didistalamphida sp. nov.

(Figures 1–4)

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Type locality and habitat. Soil samples were collected in June 2019 from a paddy field at Haldia (22.1375°N, 88.0799°E), East Midnapore, West Bengal, India.

Type material. Five females (one holotype and four paratypes), four males and fourteen intersex specimens were collected from the study site. Statistical calculations on the morphometric parameters were performed on the basis of all the specimens collected except for the intersexes (seven intersex specimens were used for calculation) as mentioned in Table 1.

Type designation and deposition. Specimens are deposited in the Nemathelminthes Section of the National Zoological Collections (NZC) of ZSI, Kolkata, West Bengal, India. Holotype, Reg. No. WN4130/1 (Female), Paratypes, Reg. No. WN4130/2, WN4130/3 and WN4130/4 (female, male & intersex specimens).

Measurements. Measurements of the new species are given in Table 1. (following de Man's formulae)

Diagnosis. Terschellingia didistalamphida sp. nov. is morphologically close to *Terschellingia lutosa* Gagarin & Nguyen, 2014 (Gagarin & Nguyen 2014) and *Terschellingia rivalis* Gagarin &

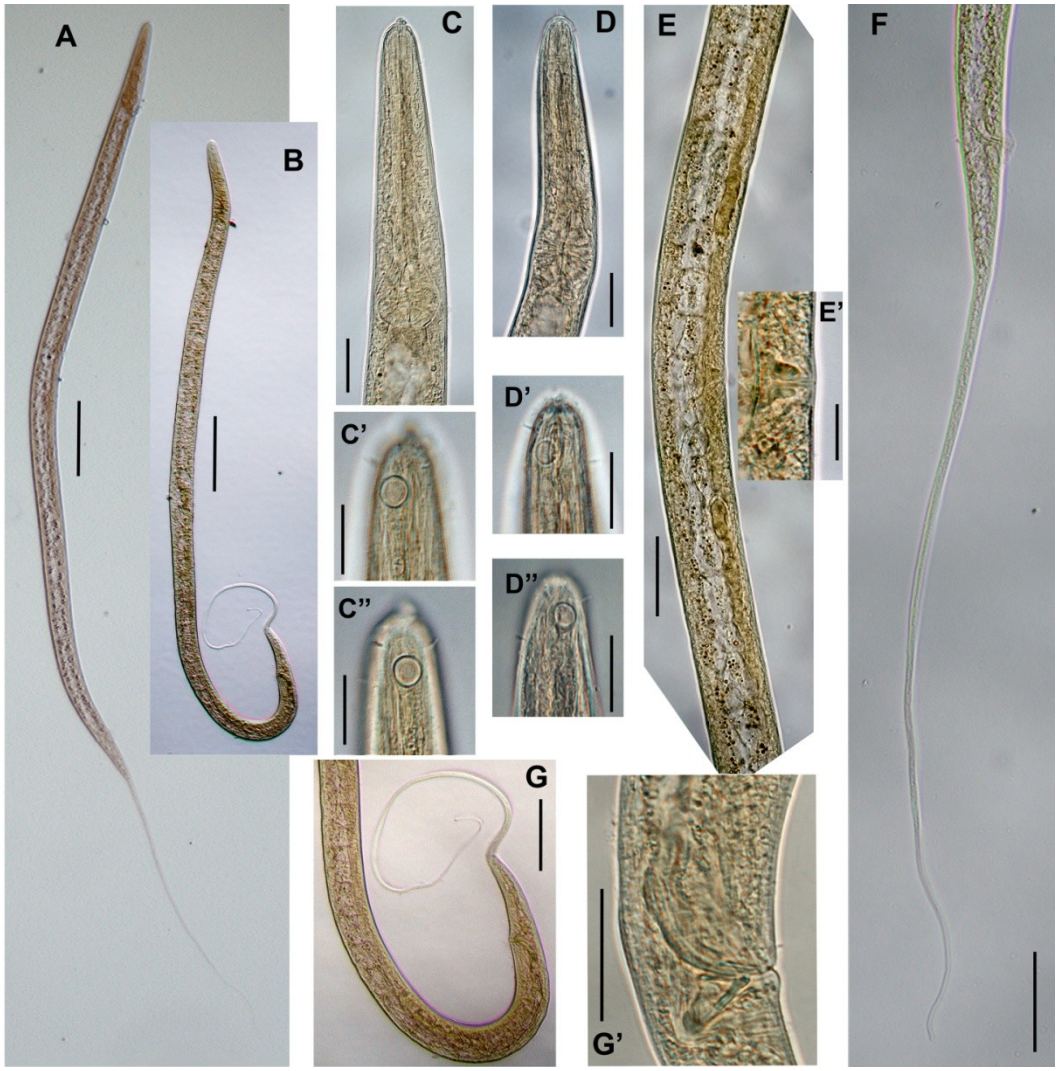


Figure 1. Photographs of *Terschellingia didistalamphida* sp. nov. holotype female and paratype male. Whole body– **A.** female **B.** male; **C.** Anterior end of female showing distinct basal bulb and cardia [**C'** & **C"–**enlarged view at different focal planes to show the amphids and cephalic setae]; **D.** Anterior end of male [**D'** & **D"** – enlarged view to show the amphids at different focal planes]; **E.** Gonads with vulva [**E'** – enlarged view to show vulval lips]; **F.** Tail region with anus in female; **G.** Tail region of male with spicules and **G'**. enlarged view to show the spicules. **Scale bars**: **A** & **B** : 100µm; **C**, **C'**, **C"**, **D**, **D'**, **D"** & **G'**: 20µm; **E**: 40µm; **E'**: 10µm and **F** & **G**: 50µm.

Thanh, 2009 (Gagarin & Thanh 2009). However, the new species differs significantly from *T. lutosa* in total body length (1165–1562.5 µm in *T. didistalamphida* sp. nov. vs. 1924–2235 µm in *T. lutosa*) and tail length (c'12–25.87 vs. c'7–8.8). It also differs from *T. rivalis* in tail length (c'12–25.87 in *T. didistalamphida* sp. nov. vs. c'32–33 in *T. rivalis*); the ratio of total body length and GBD also vary significantly (a 31.62–48.06 vs. a 66–83) and in V% (32.58–41.2 vs. 26.4–30.5).

Terschellingia didistalamphida sp. nov. shows some similarities to *T. distalamphida* Juario, 1974 (Portnova 2009) but can be distinguished by many morphological and morphometric features. The female specimens strikingly differ in body length when compared with *T. distalamphida* (1307.5–1467.5 µm in *T. didistalamphida* sp. nov. vs. 750–937.5 µm in *T. distalamphida*). A single circular amphid (6 µm in diameter) is present at a distance of 13–14 µm from the anterior end in case of *T.*

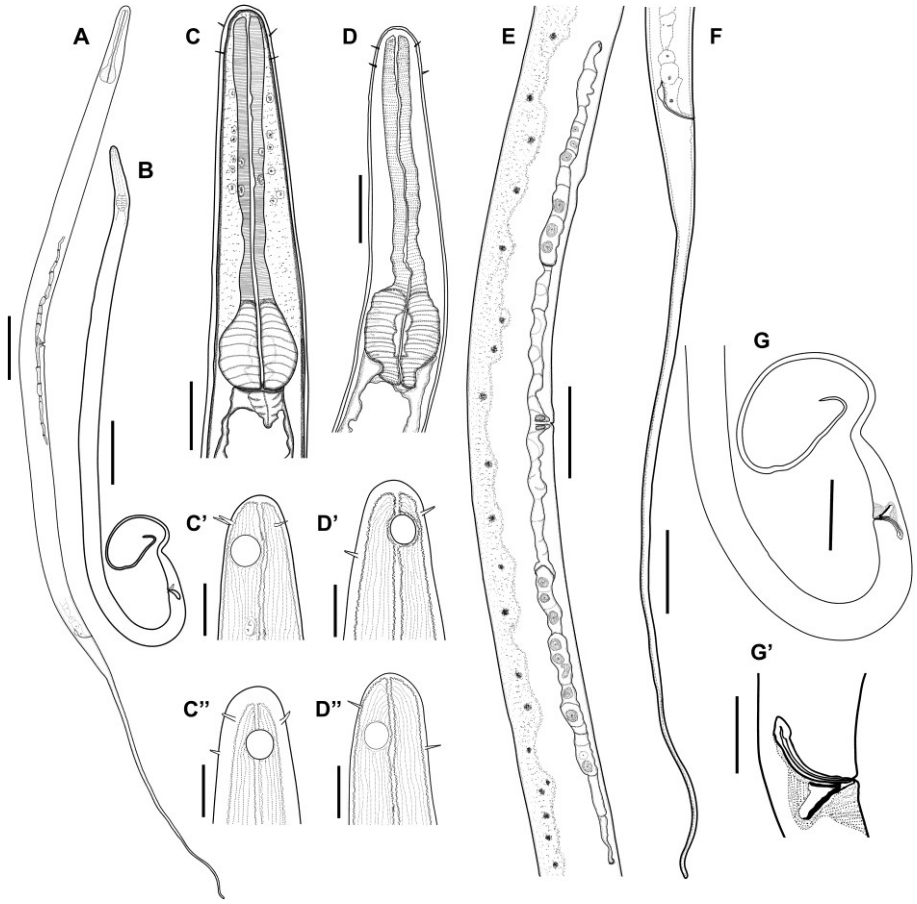
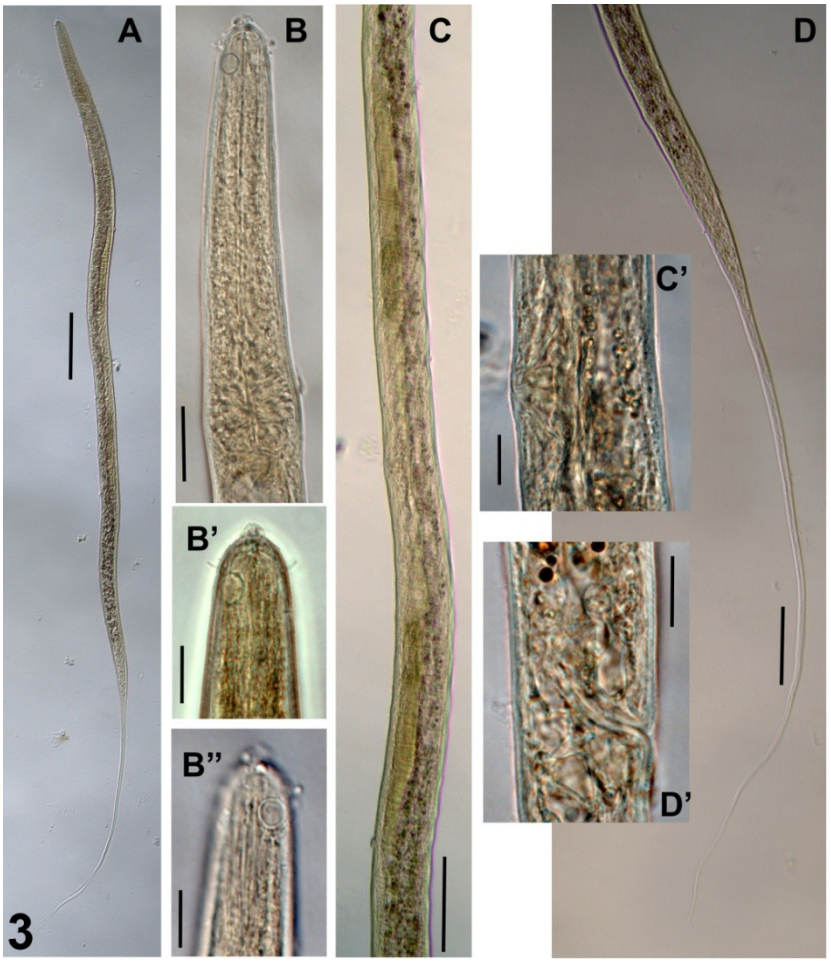


Figure 2. Drawing of *Terschellingia didistalamphida* sp. nov. holotype female and paratype male. Whole body– **A**. female **B**. male; **C**. Anterior end of female showing distinct basal bulb and cardia [**C'** & **C"**–drawn from images of different focal planes to show the amphids and cephalic setae]; **D.** Anterior end of male [**D'** & **D"** – drawn from images of different focal planes to show the amphids]; **E.** Gonads with vulva; **F**. Tail region with anus in female; **G.** Tail region of male with spicules and **G'**. enlarged view of the spicules. **Scale bars**: **A** & **B**: 100µm; **C**, **D** & **G'**: 20µm; **C'**, **C"**, **D'**& **D"**: 10µm and **E**, **F** & **G**: 50µm.

distalamphida whereas, there are two amphids (4–6 µm in diameter) in this new species. Two amphids are not placed at the same plane in the newly reported species. In *T. distalamphida*, no cervical setae found, but the novel species possesses prominent setae, including cervical setae.

Description. *Female* (Figs.1, 2) (Table 1). Elongated body with a long filiform tail (437.5–512.5 µm). The female is longer than the male. Body almost straight following heat fixation. Cuticle appears thin and smooth under light microscope. Four prominent cephalic setae, paired round amphids, measuring 5.4–6.4 µm in diameter, are located at the anterior end. Pharynx with a large muscular basal bulb and a small cardia. Ovary amphidelphic and reflexed. Vulva transverse with well-developed pars distalis. The filiform part of the tail is distinctively longer than the conical part. A few random caudal setae and cervical setae present.

Male (Fig.1, 2) (Table 1). The male exhibits an elongated body with a long filiform tail (362.5–437.5 µm). Following heat fixation, the body assumes a "J" shape or becomes almost straight. Cuticle appears thin and smooth under light microscope. Pharynx with a large muscular terminal bulb and a small cardia. Testes paired and reflexed. Spicules slightly curved at the anterior end and with a very prominent dorso-caudal apo-



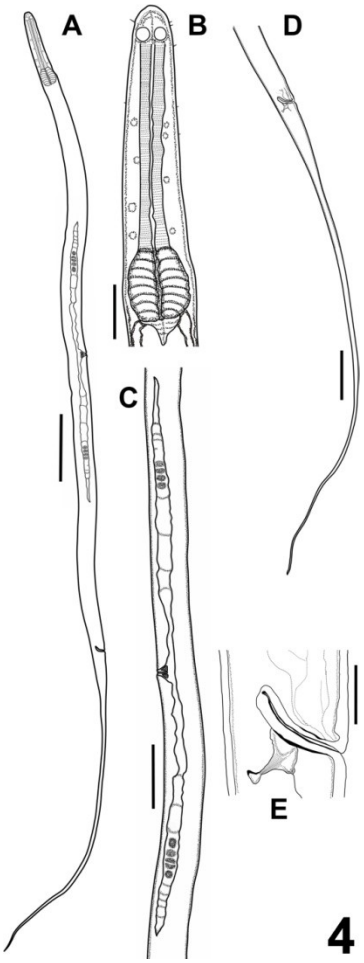


Figure 3. Photographs of *Terschellingia didistalamphida* sp. nov. intersex. **A**. Whole body; **B**. Anterior end showing distinct basal bulb and cardia; **B'** & **B''**. Enlarged view showing amphids and cephalic setae; **C**. Gonads with vulva; **C'**. Enlarged view showing vulva; **D**. Tail region with spicules; **D'**. spicules. **Scale bars**: **A**: 100µm; **B**: 20µm; **B'**, **B"**, **C'** & **D'**: 10µm; and **C** & **D**: 50µm.

Figure 4. Drawings of *Terschellingia didistalamphida* sp. nov. intersex. **A**. Whole body; **B**. Anterior end showing distinct basal bulb, cardia and cephalic setae; **C**. Gonads (ovaries) with vulva; **D.** Tail region with spicules; **E**. Spicules without apophysis. **Scale bars**: **A**: 100µm; **B**: 20µm; **C** & **D**: 50µm; **E**: 10µm.

physis. The filiform part of the tail is very long and bears a few distinct caudal setae.

Female intersex. (Fig.3, 4) (Table 1). Moderate body length with a very long, filiform tail (337.5–512.5 µm). Cuticle thin and smooth under light microscope. Four cephalic setae, very short and thin, measuring 2–3 µm in length. Amphids round, 5.4–6.4 µm in diameter and located 8–10 µm away from the anterior end; stoma narrow and tiny. Pharynx with large muscular basal bulb. Nearly rounded, small cardia with a diameter of 7.5–12.5 µm. Ovary amphidelphic and reflexed, while the vulva transverse with well-developed pars distalis. Spicules slightly curved at the anterior end and without any gubernaculum. No caudal apophysis is developed, being a female intersex. The filiform part of the tail is very long and contains caudal setae.

Etymology. The newly reported species shows similarity with previously described *Terschellingia distalamphida* Juario, 1974 that is characterized by a single distant amphid. However, in this new species 'two' amphids are present dis-

tantly from the anterior end compared to other species under the genus-*Terschellingia,* hence the name *'didistalamphida'* (Greek word, '*di'* derived '*two'*; '*distal'* came from Latin word '*distere'* meaning distant and '*amphid'* comes from greek word '*amphidia'*).

DISCUSSION

Previously described female intersex (Renubala *et al.* 1992, Zhuo *et al*. 2009) were found to possess a well-developed female reproductive system and prominent spicules as the only male reproductive part. However, in our study, we found *T. didistalamphida* sp. nov. with a well-developed amphidelphic ovary, and a prominent vulva but no testes. Based on these characteristics, we can conclude that it is a female intersex individual. This finding represents the first-ever recorded instance of intersex in the genus *Terschellingia*.

As mentioned earlier, all previous reports state that intersex specimens are typically uncommon in plant nematodes (Zhuo *et al*. 2009). However, after a thorough review of available literature, we found intersexuality is most commonly reported in plant nematodes and, rather, rare among free-living forms as reflected in the checklist (Table 2). Our study also uncovered another aspect, a surprisingly high number of female intersex individuals, 14 in total, during a relatively small sampling effort. This abundance cannot be dismissed as a mere coincidence, nor can it be attributed to developmental deformities, as none of the other nematode species examined at the same sites exhibited this phenomenon (unpublished data). Understanding why such a substantial number of female intersex individuals occur and the potential selective advantages conferred by nature to these intersex forms over normal females presents an intriguing question. Furthermore, it would be of interest from a developmental perspective to elucidate the mechanisms by which these individuals deviate from the regular developmental pathway. Additionally, the potential role of the environment in sex determination in this species cannot be disregarded (Hodgkin 2002). Substantial research is required to address these questions, which lie beyond the scope of our current work.

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REFERENCES

ABEBE, E., ANDRÁSSY, I. & TRAUNSPURGER, W. (2006): *Freshwater nematodes: ecology and taxonomy*. CABI, Wallingford, 754 pp.

ABOUL-EID, H.Z. & COOMANS, A. (1966): Intersexuality in *Longidorus macrosoma*. *Nematologica*, 12(2): 343–344.

ANDERSON, R.V. & KIMPINSKI, J. (1977): Sexual anomalies in a female intersex of a species of *Aphelenchoides* (Nematoda: Aphelenchoididae). *Canadian Journal of Zoology*, 55(7): 1209–1211. https://doi.org/10.1139/z77-159

ARMENTEROS, M., RUIZ-ABIERNO, A., VINCX, M. & DECRAEMER, W. (2009): A morphometric analysis of the genus *Terschellingia* (Nematoda: Linhomoeidae) with redefinition of the genus and key to the species. *Journal of the Marine Biological Association of the United Kingdom*, 89(6): 1257–1267. https://doi.org/10.1017/S0025315409000381

BAJAJ, H. K. & JAIRAJPURI, M. S. (1977): Variability within *Xiphinema insigne* populations from India. *Nematologica*, 23(1): 33–46.

BARSI, L. & DE LUCA, F. (2005): Morphological and molecular characterization of *Longidorus helveticus* (Nematoda: Dorylaimida) from Serbia. *Nematologia Mediterranea*, 33: 41–49.

BRAASCH, H. (1987): Ein Intersex von *Aphelenchoides saprophilus* Franklin, 1957 (Nematoda, Aphelenchoides). *Biologische Rundschau*, 256: 377–378.

CHITWOOD, B.G. (1949): "Root-knot nematodes". Part 1. A revision of the genus *Meloidogyne goeldi*, 1887. *Proceedings of the Helminthological Society of Washington*, 16(2): 90–114.

DA ROCHA MOURA, J., DA SILVA, M.C. & ESTEVES, A. M. (2014): Four new species of *Desmodora* (Nematoda) from the deep south-east Atlantic, and a case of intersexuality in Desmodoridae. *Journal*

of the Marine Biological Association of the United Kingdom, 94(1): 85–104. https://doi.org/10.1017/S0025315413001458

DALMASSO, A. (1966): Cad d'intersexe chez un Tylenchidae (Nematoda). *Revue D'Ecologie et de Biologie du Sol*, 3: 611–615.

DAVIDE, R.G. & TRIANTAPHYLLOU, A.C. (1967): Influence of the environment on development and sex differentiation of root-knot nematodes. *Nematologica*, 13(1): 102–110.

EDWARD, J.C. & MISRA, S.L. (1969): Occurrence of some new species of Aphelenchoidea in the rhizosphere of certain field crops of Uttar Pradesh, India, with a note on an intersex. *Allahabad Farmer*, 43(1): 1–6.

GAGARIN, V.G. & THANH, N.V. (2009): Three species of linhomeids (Nematoda, Linhomoeidae) from mangroves in the Mekong River Delta, Vietnam. *Zoologicheskij Zhurnal,* 88(3): 263–271. [in Russian]

GAGARIN, V.G. & NGUYEN, V.T. (2014): Two new species of free living nematodes (Nematoda and Chromadorea) from mangrove thicket in Vietnam. *Inland Water Biology*, 7(4): 338–347. https://doi.org/10.1134/S1995082914030067

GOSECO, C.G. & FERRIS, V.R. (1973): Intersexes of *Leptonchus obtusus* Thorne. *Journal of Nematology*, 5(3): 226–228.

GRUZDEVA, L.I. (1980): Occurrence of intersex in a nematode from the genus *Aphelenchoides*, Tylenchida, Aphelenchoididae. *Zoologicheskii Zhurnal*, 59(5): 780–781.

HIRSCHMANN, H. & SASSER, J.N. (1955): On the occurrence of an intersexual form in *Ditylenchus triformis* n. sp. (Nematoda, Tylenchida). *Proceedings of the Helminthological Society of Washington*, 22(2): 115–123.

HODGKIN, J. (2002): Exploring the envelope: Systematic alteration in the sex-determination system of the nematode *Caenorhabditis elegans*. *Genetics*, 162(2): 767–780. https://doi.org/10.1093/genetics/162.2.767

ISHIBASHI, N. (1965): The increase in male adults by Gamma-ray irradiation in the root-knot nematode, *Meloidogyne incognita* Chitwood. *Nematologica*, 11(3): 361–369.

JAIRAJPURI, M.S., AHMAD, I. & AHMAD, M. (1977): Record of an intersex of *Aquatides thornei* with remarks on the phenomenon of intersexuality in nematodes. *Indian Journal of Nematology*, 7(2): 177–181.

JAIRAJPURI, M.S. & SIDDIQI, A.H. (1964): Intersexuality in *Tyleptus striatus*. *Nematologica*, 10(1): 182–183. https://doi.org/10.1163/187529264X00826

JANA, T., GHOSH, G. & CHATTERJEE, A. (2010): *Actus shamimi* n. sp. (Nematoda: Mononchida) from the Andaman and Nicobar Islands, India, with a key to the species of *Actus* Baqri & Jairajpuri, 1974. *Nematology*, 12(3): 343–348. https://doi.org/10.1163/138855409X12519673803877

JUARIO, J.V. (1974): New free-living nematodes from the sublittoral zone of the German Bight. *Veröffentlichungen Des Instituts Für Meeresforschung in Bremerhaven*, 14(3): 275–303.

KHERA, S. & CHATURVEDI, Y. (1971): On the occurrence of an intersexual form and possibly a new species of *Aphelenchoides* Fischer (Nematoda: Tylenchida). *Current Science*, 40(19): 519–520.

KRALL, E. L. (1959): New and little known Tylenchida with description of a case of gynandromorphism in the genus *Aphelenchoides*. *Izvestiya Akademii Nauk Estonskoi SSR*, 8(3): 190–198.

LAMBERTI, F., CHOLEVA, B. & AGOSTINELLI, A. (1983): Longidoridae from Bulgaria (Nematoda, Dorylaimida) with description of three new species of *Longidorus* and two new species of *Xiphinema*. *Nematologia Mediterranea*, 11: 49–72.

LIŠKOVÁ, M. (2007): Morphometrics of females, juveniles and a hermaphrodite of *Longidorus distinctus* Lamberti et al., 1983 (Nematoda: Longidoridae) from Slovakia. *Helminthologia*, 44(4): 210–213. https://doi.org/10.2478/s11687-007-0033-5

LUC, M. (1961): *Xiphinema* De L'Ouest Africain (Nematoda-Dorylaimoidea) Deuxième Note. *Nematologica*, 6(2): 107–122.

MARTIN, G. W. (1970): Ecology and Taxonomy. In *BioScience,* 20(18): 993–994. https://doi.org/10.2307/1295439

MCLEOD, R.W. & KHAIR, G T. (1973): Male intersexes in *Meloidogyne thamesi*. *Nematologica*, 19(4): 561–562.

PORTNOVA, D. (2009): Free-living nematodes from the deep-sea Hakon Mosby Mud Volcano, including. the description of two new and three known spe-

cies. *Zootaxa*, 2096: 197–213. https://doi.org/10.11646/zootaxa.2096.1.13

RASCHKÉ, I.E. & BOAG, B. (1981): Morphological variation and distribution frequency of hermaphrodite *Longidorus elongatus. Revue de Nématologie*, 4(2): 283–285.

RENUBALA, K., DHANACHAND, C. & GAMBHIR, R. K. (1992): One new species of *Hirschmanniella* and record of intersex of *Hirschmanniella* and *Helicotylenchus* from Manipur state, India. *Current Nematology*, 3(2): 189–192.

SESHADRI, A.R., MUTHUKRISHNAN, T.S. & SHUNMUGAM, S. (1967): A new species of *Tylenchorhynchus* (Tylenchidae: Nematoda) from Madras State, India. *Current Science*, 36(20): 551–553.

SHENG-FU, Y U. & YONG-FANG, C. (1998): Discovery of a new esterase phenotype in *Meloidogyne javanica*. *Biodiversity Science*, 6(1): 27–30. https://doi.org/10.17520/biods.1998005

SLEPETIENE, J. (1962): Description of male nematodes and *Aphelenchoides* sp. (intersex). *Lietuvos TSR aukštųjų mokyklų mokslo darbai*. *Biologija*, 1: 135–140.

STEINER, G. (1923): Intersexes in nematodes. *Journal of Heredity*, 14(4): 147–158. https://doi.org/10.1093/oxfordjournals.jhered.a102298

TRIANTAPHYLLOU, A.C. & HIRSCHMANN, H. (1964): Reproduction in plant and soil nematodes. *Annual Review of Phytopathology*, 2(1): 57–80. https://doi.org/10.1146/annurev.py.02.090164.000421

WEIZHI, L. & QINGLI, L. (2002): Description of stem nematodes: *Ditylenchus triformis* Hirschmann & Sasser, 1955. *Yournal of Shenyang Agricultural University*, 33(5): 338–340.

WOUTS, W. M. (1966): The identity of New Zealand populations of *Tylenchorhynchus capitatus* Allen, 1955, with a description of an intersex. *New Zealand Journal of Science*, 9: 878–881.

WOUTS, W. M. (1978): On the males of *Heterodera trifolii* Goffart, 1932 (Nematoda: Heteroderidae). *Nematologica*, 24(1): 115–120. https://doi.org/10.1163/187529278X00146

ZHUO, K., LIAO, J., CUI, R. & LI, Y. (2009): First record of female intersex in *Hirschmanniella shamimi* Ahmad, 1972 (Nematoda: Pratylenchidae), with a checklist of intersexes in plant nematodes. *Zootaxa*, 1973(1): 61–68. https://doi.org/10.11646/zootaxa.1973.1.5

Table 1. Morphometric characteristics of *Terschellingia didistalamphida* sp. nov., Measurements recorded in micrometer and in the form of mean±standard deviation (range). Number of specimens used for statistical calculation is mentioned within parentheses in the Table header.

Characters	**Holotype female**	**Paratype females (n=4)**	**Paratype males (n=4)**	**Paratype female intersexes (n=7)**
Body length	1509.5	1441.88±53.71 (1382.5–1512.5)	1165.62±174.43 (905–1207)	1374.28±54.03 (1307.5–1467.5)
Greatest body diameter	39.5	35.63±4.73 (32.5–425)	35±6.12 (27.5–40)	34.64±3.65 (30–40)
a	38.31	40.92±4.69 (33.94–44)	33.48±3.02 (31.37–37.92)	40.05±4.56 (34.25–46.25)
b	12.96	12.71±0.68 (12.1–13.6)	11.006±1.87 (8.22–12.32)	12.33±0.89 (10.46–13.07)
c	3.25	2.95±0.17 (2.81–3.16)	2.89±0.51 (2.23–3.46)	3.12±0.18 (2.85–3.26)
c’	20.80	21.18±1.57 (19.44–22.77)	18.47±0.65 (18–19.44)	20.57±0.93 (18.88–21.87)
V (%)	33.30	36.30±169 (34.44–36.51)	–	36.21±2.46 (33.19–37.11)
Length of gonad	527.76	523.13±24.36 (492.5–550)	456.87±53.99 (390–512.5)	520.71±60.47 (462.5–615)
Distance of amphids from anterior end	8.70	8.13±1.25 (7.5–10)	8.75±1.44 (7.5–10)	8.92±1.33 (7.5–10)
Amphids diameter	5.60	5.97±0.43(5.4–6.4)	5.88±0.44 (5.4–6.3)	5.97±0.40 (5.4–6.4)
Pharynx length	116.43	113.75±9.24 (105–125)	106.25±4.33 (100–110)	111.78±7.17 (102.5–125)
Vulva–anus distance/tail	1.08	0.88±0.07 (0.80–0.942)	–	0.98±0.09 (0.81–1.09)
Vulval body diam.	37.56	31.25±4.79 (27.5–37.5)	–	30.35±4.19 (27.5–37.5)
Anal body diam.	22.28	28.13±1.25 (22.5–25)	21.87±1.25 (20–22.5)	21.78±1.21 (20–22.5)
Tail length	463.61	489.38±34.96 (437.5–512.5)	404.37±31.18 (362.5–437.5)	440.35±24.59 (402.5–467.5)
Lenth of spicules	–	–	22.5±2.5 (12.5–15)	23.21±4.26 (17.5–30)
Length of apophysis	–	–	13.75±1.44 (12.5–15)	–

Table 2. Checklist of reported intersex in nematodes
(Categorization of the species mentioned in this list is given as per the original references only)

Order	Species	Reported from and its Habitat	Ecological status	Type of intersexuality	Reference
Aphelenchida	*Aphelenchoides brassicae*	Canada, Corn field	Plant parasitic	Female intersex	(Edward & Misra 1969)
	Aphelenchoides composticola	Canada, Corn field	Free-living	Female intersex	(Anderson & Kimpinski 1977)
	Aphelenchoides parietinus	California	Plant parasitic	Female intersex	(Krall 1959)
	Aphelenchoides saprophilus	–	Plant parasitic	Female intersex	(Braasch 1987)
	Aphelenchoides sp.	–	Both Plant parasitic & Free-living	Female intersex	(Slepetiene 1962)
	Aphelenchoides sp.	West Bengal, India Rhizosphere of paddy	Both Plant parasitic & Free-living	Female intersex	(Khera & Chaturvedi 1971)
	Aphelenchoides subparietinus	–	Plant parasitic	Male intersex	(Gruzdeva 1980)
Tylenchida	*Ditylenchus triformis*	China, Soil around the rhizosphere of plants	Plant parasitic	Female intersex	(Weizhi & Qingli 2002)
	Tylenchorhynchus capitatus	New Zealand, tobacco fields	Plant parasitic	Female intersex	(Wouts 1966)
	Tylenchorhynchus nilgiriensis	southern Alberta, Potato field	Plant parasitic	Female intersex	(Seshadri *et al.* 1967)
	Tylenchorhynchus sp.	–	Plant parasitic	Female intersex	(Dalmasso 1966)
	Heterodera trifolii	Germany, soil-root samples from a Pasture	Plant parasitic	male intersex	(Wouts 1978)
	Meloidogyne incognita	Japan	Plant parasitic	Male and Female intersex	(Ishibashi 1965)
	Meloidogyne incognita	India	Plant parasitic	Male intersex	(Martin 1970)
	Meloidogyne thamesi	Australia, Grape root	Plant parasitic	Male intersex	(McLeod & Khair 1973)
	Meloidogyne javanica	–	Plant parasitic	Male intersex	(Sheng-Fu & Yong-Fang 1998)
	Meloidogyne javanica	Philippines, Tomato plant root	Plant parasitic	Female intersex	(Davide & Triantaphyllou 1967)
	Helicotylenchus indicus	India	Plant parasitic	Female intersex	(Renubala *et al.* 1992)
	Hirschmanniella oryzae	India, Paddy field	Plant parasitic	male intersex	(Zhuo *et al.* 2009)
	Hirschmanniella shamimi	China, Paddy field	Plant parasitic	Female intersex	(Zhuo *et al.* 2009)
	Tyleptus striatus	India, around the roots of *Saccharum ravennae*	Plant parasitic	Female intersex	(Jairajpuri & Siddiqi 1964)
Mermithida	*Mermis mirabilis*	–	Insect parasitic	–	(Hirschmann & Sasser 1955)
	Mermis sp.	–	Insect parasitic	–	(Hirschmann & Sasser 1955)
	Paramermis fluviatilis	–	–	–	(Hirschmann & Sasser 1955)

	Agamermis decaudata	–	Insect parasitic	Female intersex	(Steiner 1923)
	Agamermis albicans	–	Insect parasitic	Female intersex	(Steiner 1923)
	Pseudomermis vanderlindei	–	Parasitic	Female intersex	(Steiner 1923)
Rhabditida	*Tetanonema strongylurus*	–	Animal parasite (Fish)	Female intersex	(Steiner 1923)
	Porrocaecum heteroura	–	Animal parasite (Bird)	–	(Hirschmann & Sasser 1955)
Enoplida	*Enoplus communis*	Marine	Free-living	–	(Hirschmann & Sasser 1955)
	Enoplus michaelseni	Marine	Free-living	Female intersex	(Steiner 1923)
	Thoracostoma figuration	Marine	Free-living	Female intersex	(Steiner 1923)
	Trilobus diversipapillatus syn. Trilobus longus	–	Free-living	Female intersex	(Hirschmann & Sasser 1955)
	Trilobus gracilis	Freshwater	Free-living	Female intersex	(Hirschmann & Sasser 1955)
Chromadorida	*Chromadora poecilosoma*	Marine	Free-living	–	(Hirschmann & Sasser 1955)
Dorylaimida	*Longidorus africanus*	Israel, avocado roots	Plant parasitic	Female intersex	(Zhuo *et al.* 2009)
	Longidorus distinctus	South-eastern Slovakia, rhizosphere of plum trees	Plant parasitic	Female intersex	(Lišková 2007)
	Longidorus elongates	Scotland, Soil	Plant parasitic	Female intersex	(Raschké & Boag 1981)
	Longidorus helveticus	Serbia, rhizosphere of black-berry	Plant parasitic	Female intersex	(Barsi & De Luca 2005)
	Longidorus macrosoma	–	Plant parasitic	–	(Abouleid & Coomans 1966)
	Aquatides thornei	India, near the roots of *Oryza sativa*	Plant parasitic	Female intersex	(Jairajpuri *et al.* 1977)
	Leptonchus obtusus	Missouri, Soil collected from wooded area	Plant parasitic	Female intersex	(Goseco & Ferris 1973)
	Xiphinema attorodorum	France, Sandy soil	Plant parasitic	Female intersex	(Luc 1961)
	Xiphinema ingens	–	Plant parasitic	Female intersex	(Lamberti *et al.* 1983)
	Xiphinema insigne	India	Plant parasitic	male intersex	(Bajaj & Jairajpuri 1977)
Desmodorida	*Desmodora porosum*	Deep sea, Atlantic	Free-living	Female intersex	(da Rocha Moura *et al.* 2014)
Monhysterida	*Terschellingia didistalamphida sp. nov.*	Soil, paddy field, India	Free-living	Female intersex	Current study

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New Indonesian species in the *Oecetis tripunctata* species group (Trichoptera: Leptoceridae)

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Abstract. Applying the principles and practices of fine phenomics five new species are described from Indonesia in the *Oecetis tripunctata* species group: *Oecetis makala*, *Oecetis pejenkaja*, *Oecetis posoa*, *Oecetis pelenga*, and *Oecetis saluopa* spp. nov.

Keywords. Fine phenomics, Indonesia, *Oecetis*, new species.

INTRODOCTION

Oecetis tripunctata species group is one of the seven species groups in the *Oecetis* (*Oecetis*) subgenus (Chen, 1993). *Oecetis tripunctata* (Fabricius, 1793) was long considered as a dubious taxon with unsettled taxonomy. Recently it was revised using specimens from the entire distributional area covering the Afrotropical, Palaearctic, Oriental and Australasian fauna regions (Oláh 2022). The principles, procedures and practices of fine phenomics were applied in the revision but only about ten percent of the possible potential diversity was included due to the highly limited sampling coverage. The high diversity of the species complex is also confirmed by elaborating of a small sample from Indonesia which resulted in discovery of five species new to science.

MATERIAL AND METHODS

The biodiversity of Indonesia, like of any other fauna region, including even the most examined areas like Europe and especially North America, is very poorly known. Only a single Indonesian species of the *Oecetis tripunctata* group**,** *Oecetis kamba* Oláh, 2022 is known from Sumatra (Way Kambas National Park). The limited samples from six habitats in Bali and Sulawesi yielded five new species. Delineation of the species was based on the speciation traits of lateral profile of the phallic organ as well as the ventral shape of the gonopods. All the specimens including holotypes and paratypes are deposited in the Oláh Private Collection (Debrecen, Hungary) under the national protection of the Hungarian Natural History Museum, Budapest, Hungary (OPC).

TAXONOMY

Oecetis makala sp. nov.

(Figures 1–4)

Material examined. Holotype: **Indonesia,** Sulawesi, Makale SE, Uluway village, 3°17’ 05.7”S 119°59’06.0”E, 1060 m, 20.I.2020, light trap, leg. Marko Jaakkola (male, OPC).

Diagnosis. *Oecetis makala* sp. nov. is a remarkably unique species. According to the apicoventral lip of the phallic organ it has some resemblance to *Oecetis saluopa* sp. nov. but distinguished from all the known species by the very short and high lateral profile and the regular semicircular dorsal profile of the cerci.

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Description. The entire body light brown yellowish in alcohol. Forewing partially rubbed in alcohol, membrane hyaline, length 8 mm. Forewing anastomosis cross-veins arranged in stepwise, transverse base of MA distad of transverse base of MP3+4, by more than its length. Tibial spurs 1,2,2.

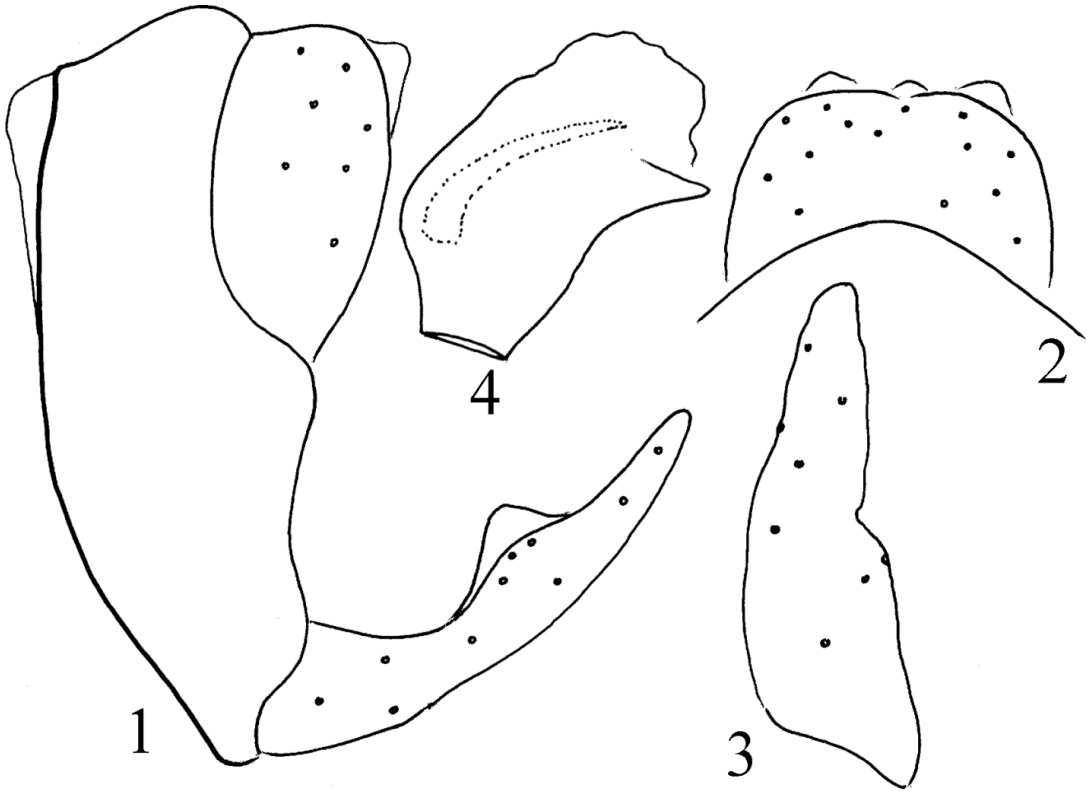
Male genitalia. Segment IX short; dorsum long, ventrum very much abbreviated. Cerci very short and high entirely fused to segment X almost semicircular in in dorsal views. Segment X almost lost, represented by a very short membranous lobe in lateral view, tripartite in dorsal view. Gonopods with a minute excision mesad on midway in ventral view. Phallic organ with slightly elongated rounded dorsum; single paramere curved with more curved basal region; apicoventral lip short, obtuse angled with tapering apex.

Etymology. Coined after the name of locus typicus, a noun in apposition.

Oecetis pejenkaja **sp. nov.**

(Figures 5–8)

Material examined. Holotype: **Indonesia,** Bali, Gianyar, Pejeng Kaja, stony, rocky small brook, 8°29’55.8”S 115°17’25.7”E, 251 m, 5.XII. 2019, light trap, leg. Marko Jaakkola (male, OPC). Paratypes: same as holotype (2 males, 2 females; OPC).



Figures 1–4. *Oecetis makala* sp. nov. Holotype male: 1 = genitalia in left lateral view; 2 = genitalia in dorsal view; 3 = left gonopod in ventral view; 4 = phallic organ in lateral view.

Description. The body, including appendages light brown yellowish in alcohol. Forewing partially rubbed in alcohol, membrane hyaline, length 7 mm. Forewing anastomosis cross-veins arranged in step-wise, transverse base of MA distad of transverse base of MP3+4, by more than its length. Tibial spurs 1,2,2.

Male genitalia. Segment IX long; dorsum long, ventrum shorter, half as long. Cerci very high entirely fused to segment X; quadrangular in dorsal and subquadrangular in lateral views. Segment X excised in dorsal view, represented by a very short membranous lobe in lateral view. Gonopods very thin in lateral view with a minute excision mesad on midway in ventral view. Phallic organ with slightly elongated flat dorsum, elongated straight ventrum; single paramere curved with more curved basal region; apicoventral lip long, regular right angled with less tapering apex.

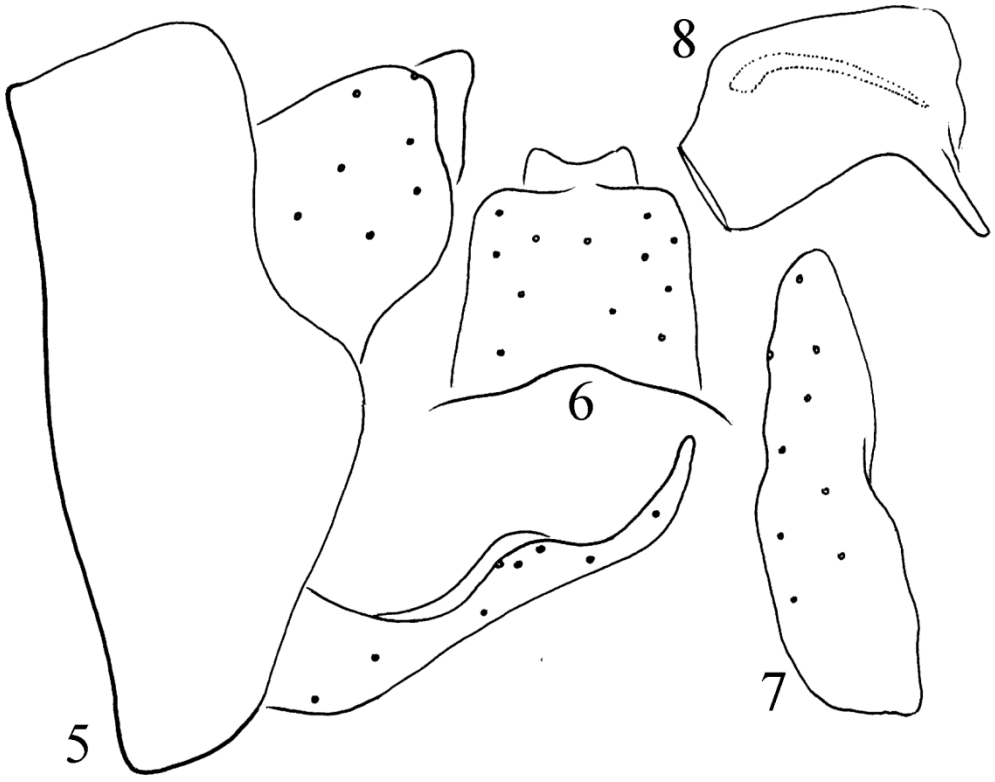
Etymology. Coined after the name of locus typicus, a noun in apposition.

Oecetis posoa **sp. nov.**

(Figures 13–16)

Material examined. Holotype: **Indonesia,** Sulawesi, Poso Regency, Poso large lake outlet, 1°46'13.4"S 120°38'23.4"E, 527 m, 16.II.2020, light trap, leg. Marko Jaakkola (male, OPC). Paratypes: same as holotype (2 males, 3 females, OPC).

Diagnosis. *Oecetis posoa* sp. nov. has resemblance to *Oecetis kamba* Oláh, 2022, described from Indonesia, Sumatra, but distinguished by the ventral profile of the gonopods as well as the shape of the apicoventral lip of the phallic organ.



Figures 5–8. *Oecetis pejenkaja* sp. nov. Holotype male: 5 = genitalia in left lateral view; 6 = genitalia in dorsal view; 7 = left gonopod in ventral view; 8 = phallic organ in lateral view.

Description. Head, thorax, scape light brown yellowish in alcohol. Forewing rubbed in alcohol, membrane hyaline, length 7 mm. Forewing anastomosis cross-veins arranged in step-wise, transverse base of MA distad of transverse base of MP3+4, by more than its length. Tibial spurs 1,2,2.

Male genitalia. Segment IX short with long dorsum and abbreviated ventrum. Cerci entirely fused to segment X and triangular in lateral and subquadrangular in dorsal views. Segment X slightly and widely excised apicad. Gonopods with mesad displaced apical third in ventral view. Phallic organ slightly elongated rounded; single paramere shorter; apicoventral lip robust, almost right angled with apicad turning apex.

Etymology. Coined after the name of locus typicus, a noun in apposition.

***Oecetis pelenga* sp. nov.**

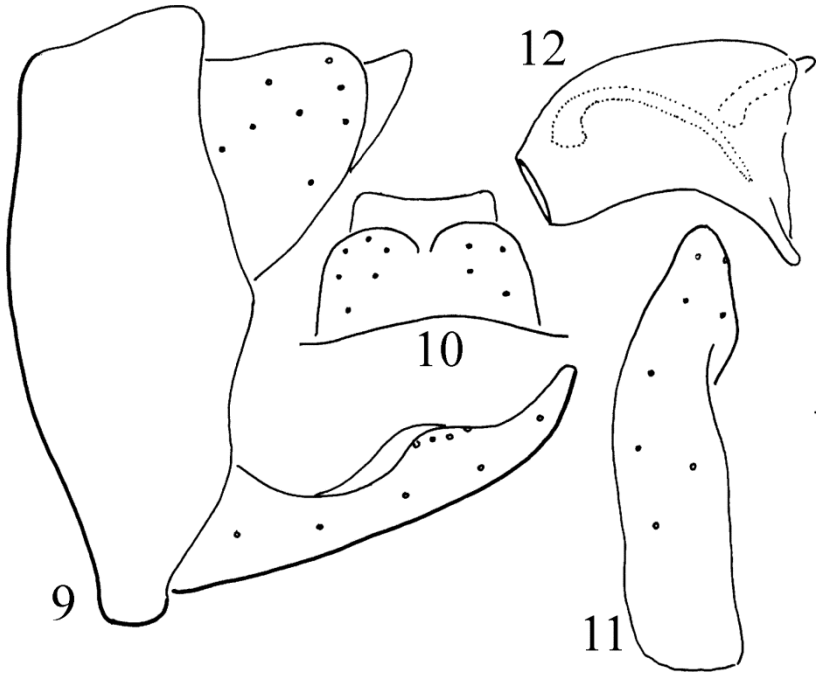
(Figures 9–12)

Material examined. Holotype: **Indonesia,** Sulawesi, Banggai Kepulauan, Peleng Island, North Tinankung, Air Terjun Tembang Luk Sagu, river fall, 1°16'42.3"S 123°25'35.3"E, 76 m, 9.II.2020, light trap, leg. Marko Jaakkola (male, OPC). Paratypes: same as holotype (15 females; OPC).

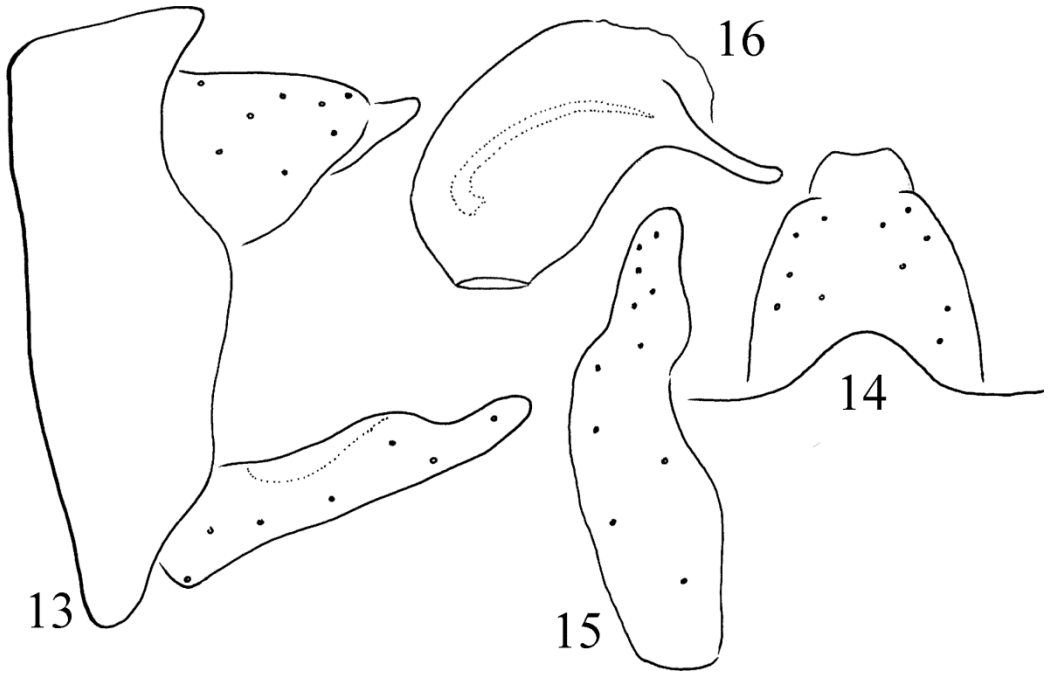
Diagnosis. *Oecetis pelenga* sp. nov. has close resemblance to *Oecetis kamba* Oláh, 2022, described from Indonesia, Sumatra, but distinguished by the much shorter cerci both in lateral and dorsal view; the ventral profile of the gonopods mesad produced on its apex and parallel-sided, not with much broader basal region, the phallic organ supplied with an additional short rod and the shape of the apicoventral lip of the phallic organ broader based.

Description. The entire body light brown yellowish in alcohol. Forewing partially rubbed in alcohol, membrane hyaline, length 7 mm. Forewing anastomosis cross-veins arranged in step-wise, transverse base of MA distad of transverse base of MP3+4, by more than its length. Tibial spurs 1,2,2.

Male genitalia. Segment IX short; dorsum long, ventrum abbreviated. Cerci short entirely



Figures 9–12. *Oecetis pelenga* sp. nov. Holotype male: 9 = genitalia in left lateral view; 10 = genitalia in dorsal view; 11 = left gonopod in ventral view; 12 = phallic organ in lateral view.



Figures 13–16. *Oecetis posoa* sp. nov. Holotype male: 13 = genitalia in left lateral view; 14 = genitalia in dorsal view; 15 = left gonopod in ventral view; 16 = phallic organ in lateral view.

fused to segment X almost semicircular in lateral and subquadrangular in dorsal views. Segment X almost truncated without apical excision. Gonopods with slightly mesad displaced apical quarter in ventral view. Phallic organ with slightly elongated rounded dorsum; single paramere curved with more curved basal region, accompanied by a unique short rod; apicoventral lip broad-based, short, obtuse angled with tapering apex.

Etymology. Coined after the name of locus typicus, a noun in apposition.

***Oecetis saluopa* sp. nov.**

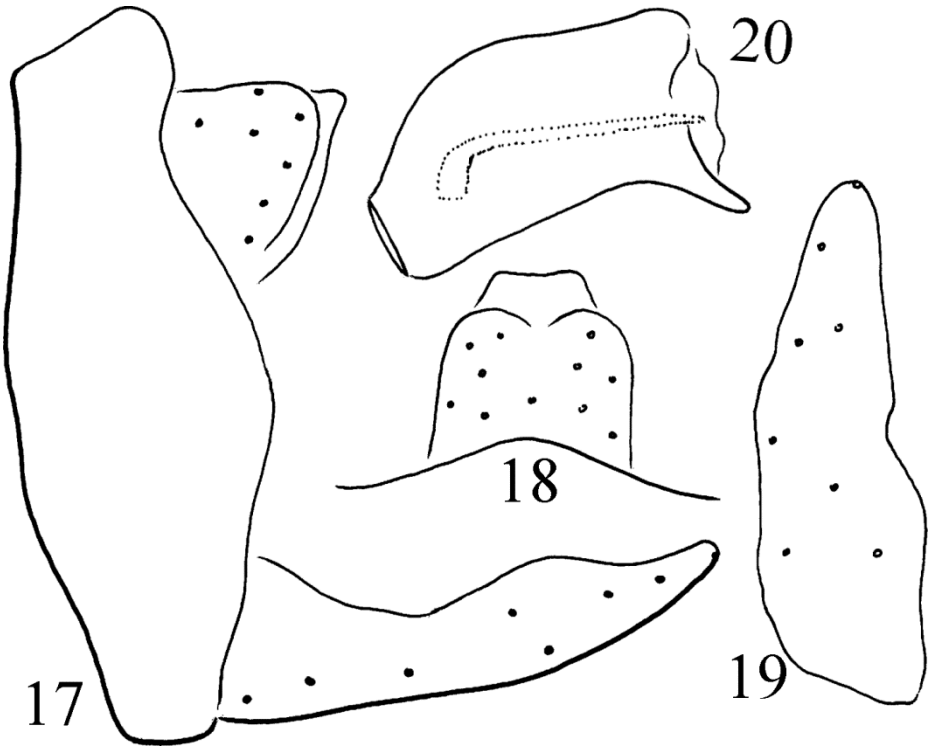
(Figures 17–20)

Material examined. Holotype: **Indonesia,** Sulawesi, Poso Regency, Air Terjun Saluopa, small river fall, 1°44’59.6”S 120°32’29.2”E, 563 m, 17.II.2020, light trap, leg. Marko Jaakkola (1 male, OPC). Paratypes: same as holotype (5 males, 7 females; OPC). Indonesia, Sulawesi, Banggai Regency, Air Terjun Salodik, large brook fall, 0°49’50.8”S 122°52’11.5”E, 473 m, 14.II. 2020, light trap, leg. Marko Jaakkola (3 males, 3 females;OPC).

Diagnosis. *Oecetis saluopa* sp. nov. has resemblance to *Oecetis kamba* Oláh, 2022, described from Indonesia, Sumatra, but dis tinguished by the much shorter cerci, ventral profile of the gonopods as well as by the longer phallic organ and the shape of the apicoventral lip of the phallic organ.

Description. The entire body, head, thorax, scape light brown yellowish in alcohol. Forewing partially rubbed in alcohol, membrane hyaline, length 7 mm. Forewing anastomosis cross-veins arranged in step-wise, transverse base of MA distad of transverse base of MP3+4, by more than its length. Tibial spurs 1,2,2.

Male genitalia. Segment IX short with almost equal dorsum and ventrum. Cerci particularly short, abbreviated, entirely fused to segment X and rounded triangular in lateral and subquadrangular in dorsal views. Segment X slightly and widely excised apicad, but variously formed at paratypes; even the holotype excised apical mar-



Figures 17–20. *Oecetis saluopa* sp. nov. Holotype male: 17 = genitalia in left lateral view; 18 = genitalia in dorsal view; 19 = left gonopod in ventral view; 20 = phallic organ in lateral view.

gin could be an artefact; the membranous and gentile apical region of segment X is liable to deformation during copulation or preparation. Gonopods with slightly mesad displaced apical half in ventral view. Phallic organ slightly elongated rounded; single paramere almost straight with curved basal region; apicoventral lip short, obtuse angled with tapering apex.

Etymology. Coined after the name of locus typicus, a noun in apposition.

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REFERENCES

CHEN, Y.E. (1993): *Revision of the Oecetis (Trichoptera: Leptoceridae) of the world*. Ph.D. Dissertation Presented to the Graduate School of Clemson University. UMI Dissertation Services, 704 pp.

OLÁH, J. (2022): Contribution to the taxonomy of the *Oecetis* (*Oecetis*) *tripunctata* (Fabricius, 1793) species group (Trichoptera: Leptoceridae). *Opuscula Zoologica (Budapest),* 53 (1):3–30. https://doi.org/10.18348/opzool.2022.1.3