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Terrestrial Parasitengona mites (Trombidiformes) of Denmark – new data on parasite-host associations and new country records

Simon Haarder ^a, Joanna Mąkol ^b

^a Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Denmark.

^b Department of Invertebrate Systematics and Ecology, Wrocław University of Environmental and Life Sciences, Wrocław, Poland.

Original research

ABSTRACT

An updated list of terrestrial Parasitengona mites of Denmark, containing 34 species aggregated in eight families, is presented and compared to existing records from Fennoscandia. Five parasitengone species, *Charletonia cardinalis*, *Leptus mariae* (Erythraeidae), *Platytrombidium fasciatum* (Microtrombidiidae), *Paratrombium egregium* (Trombidiidae) and *Centrothrombidium blackwellae* (Johnstonianidae) are recorded as new to the fauna of Denmark. We provide 29 records of parasite-host association between terrestrial Parasitengona mites and their arthropod hosts. Of those, 15 associations are recorded for the first time.

Keywords Calyptostomatoidea; Erythraeoidea; Trombidoidea; larvae; hosts; new records; Fennoscandia

Introduction

The terrestrial Parasitengona mites (Trombidiformes) have been inadequately studied in Denmark (incl. Faroe Islands and Greenland). The first records on these mites were included in surveys with a wide systematic scope. O. F. Müller (1776) was the first to provide brief references to terrestrial Parasitengona in Denmark. Kramer (1897) supplemented the list with few species found in Greenland. Almost two centuries after the Müller's (1776) account, Southcott (1961) described *Erythraeus adrastus* (Southcott, 1961) based on larva and, at the same time, he indirectly confirmed the presence of *Erythraeus* (*E.*) *phalangoides* (De Geer, 1778) (= *E. adrastus*) known from postlarval forms in Denmark and also provided a new country record on *Leptus* (*L.*) *trimaculatus* (Rossi, 1794). The Danish mite checklist from the 1970's (Hallas 1978) comprised nine species from five different families; curiously, *Leptus* (*L.*) *trimaculatus* was not included in this list. The renowned Danish Myriapoda-researcher Henrik Enghoff (Natural History Museum of Copenhagen, Denmark) collected Trombidiformes during the following decades, some of which were later identified by Southcott (Southcott 1992, Enghoff, pers. comm. 2021). Among the unpublished records, *Erythraeus* (*E.*) *regalis* (C. L. Koch, 1837), at that time known exclusively from active postlarval forms, but later considered to also accommodate *E. kuyperi* (Oudemans, 1910), known from larvae, was reported to occur in Denmark. A more recent addition to the Danish fauna has been provided by Haitlinger (2008) who recorded 11 species from Denmark based on field work conducted in the summer of 2007. Of these, nine species were first records to Denmark, including a new species to science: *Abrolophus nymindegabicus* Haitlinger, 2008.

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Corresponding author

Joanna Mąkol 

joanna.makol@upwr.edu.pl

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Currently, records of terrestrial Parasitengona from Denmark (incl. Greenland and Faroe Islands) pertain to 29 species aggregated in eight families (O. F. Müller 1776; Thorell 1872; Kramer 1897; Trägårdh 1904, 1931; Bornebusch 1930; Hammer 1950; Tuxen 1950; Haarløv 1957; Southcott 1961, 1992; Hallas 1978; Haitlinger 2008). Of those, the larval instar, usually known for its parasitic lifestyle, contrary to the predatory postlarval forms, has been known for 21 species (including one species of vertebrate-associated Trombiculidae).

In the present paper we provide the results of a recent survey of terrestrial Parasitengona mites in Denmark. The study has focused on parasitic larvae associated with their arthropod hosts. Finally, the list of all species of terrestrial Parasitengona mites recorded from Denmark is compared with the adequate data from Norway, Sweden, and Finland.

Material and methods

Parasitized arthropods were collected from various habitats in Denmark in the period 2015–2020. Some specimens were photographed in the field using a Canon EOS 70D. Hosts and mites were transferred to 70% ethyl ethanol within 24 hours of collecting. Specimens were photographed at the Natural History Museum of Denmark using a Visionary Digital™ system and at the Department of Invertebrate Systematics and Ecology, Wrocław University of Environmental and Life Sciences, Poland using the Nikon SMZ1500 stereomicroscope coupled with DS-Fi3 camera system. Photos were processed in Zerene Stacker® and Adobe Photoshop® and in Helicon Focus ver. 7.7.4, respectively.

The mites were mounted on microscope slides in Faure's fluid, following the controlled clearing of larvae in KOH for up to 10 minutes, depending on the engorgement state. The identification to species level was carried out under a Nikon 80i microscope coupled with differential interference contrast. In the case of *Platytrombidium fasciatum*, the identification of the only postlarval specimens considered in the survey was based on photos.

The names of hosts have been updated according to the recorded synonymies. In the systematic division of terrestrial Parasitengona we follow Mąkol and Wohltmann (2012). The works containing the original descriptions of taxa have not been included in the list of references, unless based on material collected in Denmark. The number of specimens examined is provided in the format: number of hosts (H)/number of larvae (LV)/the recorded attachment site. Question mark in front of species name refers to uncertain identification caused by damage or obscurity of diagnostic structures.

Results

Calyptostomatoidea

Calyptostomatidae

Calyptostoma velutinum (O. F. Müller, 1776)

Species widely distributed in the Palaearctic, known from all active life instars (Mąkol and Wohltmann 2012, and references therein). Hitherto recorded as parasite of Tipulidae and Limoniidae (Diptera): *Limnobia nubeculosa* (Meigen, 1804) (Limoniidae) (Barnes 1924); *Tipula* sp. (Tipulidae) (Shiba 1969); *Dicranophragma nemorale* (Meigen, 1818) (= *Limnophila nemoralis*), *Gonomyia simplex* Tonnoir, 1920, *Idiocera bradleyi* (Edwards, 1939) (= *Gonomyia bradleyi*) (Limoniidae) (Rack 1976); *Limnophila* (*Brachylimnophila*) *nemoralis* agg. (Meigen, 1818) (Limoniidae) (Rack 1977); *Limonia caucasica* Lackschewitz, 1940 (Limoniidae) (Saboori *et al.* 2012).

Record:

- *Limonia phragmitidis* (Schrank, 1781) (Diptera: Limoniidae) [det. Walther Gritsch], Valdemars Plads (Vordingborg), 17 May 2019, leg. Simon Haarder and Brian Willum Petersen; 1 H/3 LV

- *L. phragmitidis*, Ambjerg Skov, 16 June 2020, leg. Simon Haarder; 1 H/2 LV
Note: New host record.

Erythraeoidea

Erythraeidae

***Charletonia cardinalis* (C. L. Koch, 1837) (= *Erythraeus singularis* Oudemans, 1910)**

Species occurring in the Palearctic and in the Oriental, Australian and Nearctic Regions; known from larvae and active postlarval forms (Małol and Wohltmann 2012, and references therein). Larvae parasitize Lepidoptera, Hemiptera and Coleoptera: *Ematurga atomaria* (L.) (Lepidoptera: Geometridae) (Cooreman 1945); *Javesella pelucida* (Fabricius, 1794) (= *Liburnia pellucida*) (Hemiptera: Delphacidae), *Aphrophora* sp. (Hemiptera: Aphrophoridae) (Southcott 1966); *Nerice bidentata* Walker, 1855 (Lepidoptera: Notodontidae), *Simyra henrici* Grote, 1873 (Lepidoptera: Noctuidae) (Treat 1980); Heteroptera indet., *Phyllotreta undulata* Kutschera, 1860 (Coleoptera: Chrysomelidae) (Haitlinger 1987).

The accidental finding of *C. cardinalis* on *Mustela erminea* L. (Mammalia: Carnivora, Mustelidae) by Haitlinger (1987) should be confirmed in terms of parasitism.

Record:

- *Stiroma affinis* Fieber, 1866 (Hemiptera: Delphacidae) [det. Ulrik Hasle Nielsen], Trelde Næs, 01 June 2019, leg. Linda-Kjær Thomsen and Lars Thomas; 1 H/1 LV/dorsal side of the body, at thorax/abdomen border (Fig. 1A)

Note: New species for Denmark, new host record.

***Leptus mariae* Haitlinger, 1987**

Species widely distributed in the western Palaearctic; known exclusively from larvae (Małol and Wohltmann 2012, and references therein); hitherto recorded as parasite of Coleoptera, Dermaptera, Hemiptera and Araneae: *Phyllobius urticae* (De Geer, 1775) (Coleoptera: Curculionidae) (Gabryś 1991); *Lochmaea caprea* (L.) (Coleoptera: Chrysomelidae) (Haitlinger 1991); *Lagria hirta* (L.) (Coleoptera: Tenebrionidae) (Southcott 1992); *Forficula auricularia* L. (Dermaptera: Forficulidae) (Southcott 1992, pro *L. gabrysi*); *Cicadetta montana* Scopoli, 1772 (Hemiptera: Cicadidae) (Fain *et al.* 1992); Tenebrionidae indet. (Coleoptera) (Haitlinger 1998); *Luperus longicornis* (Fabricius, 1781), *Cryptocephalus parvulus* O. F. Müller, 1776



Figure 1 Erythraeid larvae (Parasitengona: Erythraeidae) parasitizing various hosts: A – *Charletonia cardinalis** on *Stiroma affinis* (Hemiptera: Delphacidae); B – [?] *Leptus mariae** on *Brachysomus echinatus* (Coleoptera: Curculionidae). Not to scale. *Larvae depigmented due to preservation in EtOH.

(Coleoptera: Chrysomelidae) (Beenen 2001); *Xysticus lanio* C. L. Koch, 1835 (Araneae: Thomisidae) (Mąkol and Felska 2011).

Records referred to by Southcott (1992) [op. cit. “three larvae, on *Dryobius roboris* (L.) (Aphidoidea), ACA2335A, B. Collection data in writing of A. C. Oudemans with identification label in Oudemans’ handwriting “*Achorolophus opilionis* O. F. Müller larvae dors. vent.”) not included, due to the possible misidentification with *Leptus molochinus* (= *L. ignotus*).

Records:

- Elateridae indet. (Coleoptera), Allindelille Fredsskov, 10 June 2019, leg. Linda-Kjær Thomsen and Lars Thomas; 1 H/2 LV
- Coleoptera indet., Bøtø skov, 13 June 2020, leg. Linda Kjær-Thomsen and Lars Thomas; 1 H/7 LV
- *Lagria hirta* (L.) (Coleoptera: Tenebrionidae), Stenbæk plantage, 07 July 2020, leg. Linda Kjær-Thomsen and Lars Thomas; 1 H/1 LV

[?] *Leptus mariae* Haitlinger, 1987

Record:

- *Brachysomus echinatus* (Bonsdorff, 1785) (Coleoptera: Curculionidae), Knudsskov, 19 May 2020, leg. Simon Haarder; 1 H/2 LV/1 LV on left elytra (Fig. 1B)

Note: New species for Denmark.

Leptus molochinus (C. L. Koch, 1837) (= *L. ignotus*)

Species distributed in the Palaearctic and in the Nearctic region (Greenland), known from all active life instars (Mąkol and Wohltmann 2012, and references therein). Hitherto records refer to parasitism of larvae on Hemiptera, Orthoptera, Dermaptera, Diptera, Coleoptera, Lepidoptera, Opiliones, Araneae, Trombidiformes: *Asilus* sp. (Diptera: Asilidae), *Lagria hirta* (L.) (Coleoptera: Tenebrionidae), *Athous* (*Athous*) *haemorrhoidalis* (Fabricius, 1801) (Coleoptera: Elateridae) (Oudemans 1905, pro *L. ignotus*); Phalangidae (Opiliones) (Bruyant 1909, pro *L. phalangii*); *Cantharis* (*Cantharis*) *rufa* L. (Coleoptera: Cantharidae), *Sitona striatellus* Gyllenhal, 1834 (Coleoptera: Curculionidae), *Nabis* sp. (Hemiptera: Nabidae), *Phalangium* sp. (Opiliones: Phalangidae), Araneae indet. (Bruyant 1911, pro *L. ignotus*); *Haematopota pluvialis* L. (Diptera: Tabanidae), *Orchestes* (*Orchestes*) *pilosus* (Fabricius, 1781) (Coleoptera: Curculionidae), *Opilio parietinus* (De Geer, 1778) (Opiliones: Phalangidae), *Lachnus roboris* (L.) (Hemiptera: Aphididae), Aphidoidea indet. (Hemiptera), Elateridae indet. (Coleoptera), *Centrotus cornutus* (L.) (Hemiptera: Membracidae), *Opilio* sp. (Opiliones: Phalangidae), *Athous* (*Haplathous*) *subfuscus* (O. F. Müller, 1764) (Coleoptera: Elateridae), *Melanoplus bivittatus* (Say, 1825) (Orthoptera: Acrididae), *Phratora* (*Phyllodecta*) *laticollis* (E. Suffrian, 1851) (Coleoptera: Chrysomelidae), *Forficula auricularia* L. (Dermaptera: Forficulidae), *Charletonia globigera* (Berlese, 1885), *Erythraeus phalangoides* (De Geer, 1778) (Trombidiformes: Erythraeidae) (Oudemans 1912, pro *L. ignotus*); *Noctua pronuba* (L.), *Apamea crenata* (Hufnagel, 1766) (Lepidoptera: Noctuidae), *Agriphila aeneociliella* (Eversmann, 1844) (Lepidoptera: Crambidae) (Cooreman 1945, pro *L. ignotus*); *Pachygnatha clercki* Sundevall, 1823 (Araneae: Tetragnathidae) (Parker 1962, pro *L. ignotus*); *Leucania impura* (Hübner, 1808), *Leucania lithargyria* (Esper, 1788), *Hoplodrina* sp., *Xestia triangulum* (Hufnagel, 1766) (Lepidoptera: Noctuidae), Noctuidae indet. (Lepidoptera) (Southcott 1992, pro *L. ignotus ignotus*); *Anoscopus albifrons* (L.) (Hemiptera: Cicadellidae) (Fain and Baugnee 1996, pro *L. ignotus*); *Phalangium opilio* L. (Opiliones: Phalangidae) (Fain and Amico 1997, pro *L. ignotus*); *Mitopus morio* (Fabricius, 1779) (Opiliones: Phalangidae) (Gabrys et al. 2011); Cicadellidae indet. (Hemiptera), Miridae indet. (Hemiptera), Anthicidae indet. (Coleoptera), Anystidae indet. (Trombidiformes: Erythraeidae), *Tetragnatha* sp. (Araneae: Tetragnathidae) (Mąkol and Felska 2011); *Erythraeus aoki* Shiba, 1972, *Erythraeus cinereus* (De Geer, 1778), *Leptus molochinus* (C. L. Koch, 1837), *Leptus trimaculatus* (Rossi, 1794), *Leptus vertex* (Kramer, 1886), *Abrolophus quisquiliarius* (Hermann, 1804) (Trombidiformes: Erythraeidae) (Mąkol et al. 2012).

Hosts listed by Bruyant (1911) need verification due to the synonymy of *Erythraeus ignotus* Oudemans, 1903 with *Rhyncholophus nemorum* C. L. Koch, 1836 and *Leptus phalangii* [part.] proposed by this author and not accepted in the present work (see also: Łaydanowicz and Mąkol 2010, Gabryś *et al.* 2011); 2/. according to Southcott (1992) a list of host-parasite associations provided by Oudemans (1912) may refer to other than *L. molochinus* species.

Records:

- *Tachycixius pilosus* (Olivier, 1791) (Hemiptera: Cixiidae), Hanstholm, 08 July 2020, leg. Linda Kjær-Thomsen and Lars Thomas; 1 H/1 LV
- *Lagria hirta* (L.) (Coleoptera: Tenebrionidae), Bulbjerg, 07 July 2020, leg. Linda Kjær-Thomsen and Lars Thomas; 2 H/2 LV
- Opiliones indet. Staunings Ø (Solrød), 25 July 2019, leg. Linda-Kjær Thomsen and Lars Thomas; 1 H/1 LV/dorsal side of cephalothorax, close to the base of ocularium
- Araneae indet., juv.; Fur, Langstedhuller, 10 July 2020, leg. Linda Kjær-Thomsen and Lars Thomas; 1 H/1 LV

Note: New host record (*Tachycixius pilosus*).

***Leptus phalangii* (De Geer, 1778)**

Species distributed in the Palaearctic, known from all active life instars (Mąkol and Wohltmann 2012, and references therein). Hitherto recorded as parasite of Opiliones: *Mitopus morio* (Fabricius, 1779), *Opilio ruzickai* Šilhavý, 1938 (Opiliones: Phalangiidae) (Beron 1975, pro *L. ignotus* s. Beron); *Phalangium opilio* L., *Rilaena triangularis* (Herbst, 1799), *Lophopilio palpinalis* (Herbst, 1799) (Opiliones: Phalangiidae) (Ignatowicz 1975, pro *L. phalangii*); *Oligolophus hansenii* (Kraepelin, 1896), *Megabunus diadema* (Fabricius, 1779) (Opiliones: Phalangiidae) (Fain and Amico 1997, pro *L. beroni*); *Opilio canestrinii* (Thorell, 1876) (Opiliones: Phalangiidae) (Southcott 1992, pro *L. holmiae*); *Egaenus convexus* (C. L. Koch, 1835), *Platybunus bucephalus* (C. L. Koch, 1835) (Opiliones: Phalangiidae) (Stašiov 2003, pro *L. holmiae*); *Nemastoma lugubre* (O. F. Müller, 1776) (Opiliones: Nemastomatidae), *Platybunus pallidus* Šilhavý, 1938 (Opiliones: Phalangiidae) (Gabryś *et al.* 2011, pro *L. beroni*).

Data summarized by Gabryś (1991) for '*L. phalangii*' not included, due to the likely misidentification with *Leptus molochinus* (= *L. ignotus*).

Record:

- Opiliones indet., Skovsgaard, Langeland, 15 August 2020, leg. Linda Kjær-Thomsen and Lars Thomas; 1 H/2 LV

[?] *L. phalangii* (De Geer, 1778)

Record:

- Opiliones indet., Vestermose (Søllerød), 04 August 2019, leg. Linda-Kjær Thomsen and Lars Thomas; 1 H/2 LV

Trombidioidea

Johnstonianidae

***Centrothrombidium blackwellae* Baker, 1999**

Species hitherto recorded only from Great Britain, known exclusively from larvae which parasitized *Culicoides impunctatus* Goetghebuer, 1920 (Diptera: Ceratopogonidae) (Baker 1999).

Record:

- *Culicoides* sp. (Diptera: Ceratopogonidae), Skovsgaard, Langeland, 14 August 2020, leg. Linda Kjær-Thomsen and Lars Thomas; 1 H/4 LV

Note: New species for Denmark.

Microtrombidiidae

Platytrombidium fasciatum (C. L. Koch, 1836)

Species distributed in the western Palaearctic; known from all active life instars (Mąkol and Wohltmann 2012, and references therein). Known hosts are brachyceran flies (Diptera) from the families Anthomyzidae, Chloropidae, Drosophilidae, Lauxaniidae, Muscidae, Sarcophagidae and Tephritidae (Felska *et al.* 2018).

Records:

- Sommersted (Haderslev), 27 April 2019, leg. Birthe Hjuler; 1 P, in garden
- Aars (Vesthimmerland), 13 May 2021, leg. Jan Tidemand and Merete Christensen; 1 P, in garden

Note: New species for Denmark.

Trombidiidae

Paratrombium egregium Bruyant, 1910

Species earlier recorded from France, known exclusively from larvae (Mąkol and Wohltmann 2012, and references therein). The only hitherto record on parasitism refers to *Pompilus pectinipes* (L.) (Hymenoptera: Pompilidae) (Bruyant 1912).

Record:

- *Pachyneuron groenlandicum* (Holmgren, 1872) (Hymenoptera: Pteromalidae), Staunings Ø (Solrød), 25 July 2019, leg. Linda-Kjær Thomsen and Lars Thomas; 1 H/2 LV/1 LV on leg I (Fig. 2A)

Note: New species for Denmark and new host record.

Trombidium brevimanum (Berlese, 1910)

Species distributed in the Palaearctic, known from all active life instars (Mąkol and Wohltmann 2012, and references therein). Species predominantly known as a parasite of spiders (Araneae), recorded from the following spider families: Araneidae, Argiopidae, Clubionidae, Dictynidae, Linyphiidae, Lycosidae, Philodromidae, Tetragnathidae, Theridiidae, Thomisidae (Felska *et al.* 2018). Recorded also as parasite of Coleoptera (Haitlinger 2008) and pseudoscorpions (Judson and Mąkol 2011).

Record:

- *Enoplognatha ovata* (Clerck, 1757) (Araneae: Theridiidae), Valby (København), 15 July 2015, leg. Simon Haarder; 1 H/1 LV/dorsolateral side of prosoma

Note: Third record from Denmark. First and second record was reported by Haitlinger (2008). *Enoplognatha ovata* is a new host record.

Trombidium holosericeum (L.)

Species widely distributed in the Palaearctic, known from all active life instars (Mąkol and Wohltmann 2012, and references therein); recorded as parasite of Dermaptera (Forficulidae), Orthoptera (Gryllotalpidae), Hemiptera (Lygaeidae Delphacidae, Miridae, Cercopidae, Cicadellidae, Anthocoridae), Mecoptera (Panorpidae), Lepidoptera (Noctuidae, Nymphalidae), Hymenoptera (Ichneumonidae, Apidae), Coleoptera (Chrysomelidae, Cantharidae, Curculionidae, Cerambycidae, Leiodidae, Carabidae, Melolonthidae), Diptera (Empididae, Culicidae, Limoniidae, Drosophilidae, Muscidae, Oestridae, Calliphoridae, Sarcophagidae) and Araneae (Linyphiidae, Pisauridae, Araneidae). The list of hosts' genera and species has been provided by Felska *et al.* (2018).

Records:

- *Pinalitus viscicola* (Puton, 1888) (Hemiptera: Miridae) [det. Ulrik Hasle Nielsen], Mørkøv (Gladsaxe), 17 July 2019, leg. Linda-Kjær Thomsen and Lars Thomas; 1 H/1 LV/dorsal side of the body, at thorax/abdomen border (Fig. 2B)



Figure 2 Trombidiid larvae (Parasitengona: Trombidiidae) parasitizing various hosts: A – *Paratrombium egregium** on *Pachyneuron groenlandicum* (Hymenoptera: Pteromalidae); B – *Trombidium holosericeum* on *Pinalitus viscidola* (Hemiptera: Miridae); C – *T. holosericeum** on [?] *Leptopterna dolabrata* (Hemiptera: Miridae); D – *T. holosericeum* on Cryptinae sp. (Hymenoptera: Ichneumonidae); E – *T. holosericeum** on *Melanostoma scalare* (Diptera: Syrphidae); F – *T. holosericeum* on *Dioctria* sp. (Diptera: Asilidae). Not to scale. *Larvae depigmented due to preservation in EtOH.

• *Campyloneura virgula* (G. A. W. Herrich-Schäffer, 1835) (Hemiptera: Miridae), Birkerød, 19 July 2020, leg. Linda Kjær-Thomsen and Lars Thomas; 1 H/1 LV

• *Dicyphus epilobii* Reuter, 1883 (Hemiptera: Miridae) [det. Linda-Kjær Thomsen and Lars Thomas], Staunings Ø (Solrød), 25 July 2019, leg. Linda-Kjær Thomsen and Lars Thomas; 1

H/1 LV

- *Dicyphus* sp. (Hemiptera: Miridae), Rallebæk (Faaborg), 04 August 2020, leg. Simon Haarder; 1 H/1 LV/at the base of right wing
- [?] *Leptopterna dolabrata* (L.) (Hemiptera: Miridae), Birkerød, 22 July 2020, leg. Linda Kjær-Thomsen and Lars Thomas; 1 H/1 LV/close to the base of left coxa I (Fig. 2C)
- *Himacerus mirmicoides* (O. G. Costa, 1834) (Hemiptera: Nabidae), Bønsvigehoved Skov, 13 July 2020, leg. Brian Willum Petersen; 1 H (nymph)/1 LV/ventral side of the body, at head/thorax border
- Cryptinae indet. (Hymenoptera: Ichneumonidae), Lynghøjen ved Hadsten, 09 June 2018, leg. Kåre Würtz Sørensen; 1 H/3 LV/dorsal side of the body, mesothorax/metathorax (Fig. 2D)
- *Melanostoma scalare* (Fabricius, 1794) (Diptera: Syrphidae) [det. Karsten Thomsen], Oreby Skov, 19 August 2019, leg. Simon Haarder; 1 H/2 LV/dorsal side of the body, at thorax/abdomen border (Fig. 2E)
- *Platypalpus longiseta* (Zetterstedt, 1842) (Diptera: Hybotidae) [det. Walther Gritsch], Flakfortet (Copenhagen), 18 July 2019, leg. Linda-Kjær Thomsen and Lars Thomas; 1 H/1 LV/dorsal side of the body, at mesothorax/metathorax border
- *Platypalpus* sp. (Diptera: Hybotidae), Nysø v. Præstø, 04 July 2020, leg. Brian Willum Petersen; 1 H/1 LV
- *Empis aestiva* Loew, 1867 (Diptera: Empididae) [det. Walther Gritsch], Rude Skov, 21 July 2019, leg. Linda-Kjær Thomsen and Lars Thomas; 1 H/1 LV
- *Dioctria* sp. (Diptera: Asilidae), Bønsvigehoved Skov, 13 July 2020, leg. Brian Willum Petersen; 1 H/1 LV/at the base of wings (Fig. 2F)

Note: *Campyloneura virgula*, *Dicyphus epilobii*, *Leptopterna dolabrata* and *Pinalitus viscidicola* (Miridae), *Himacerus mirmicoides* (Nabidae), *Dioctria* sp. (Asilidae), *Empis aestiva* (Empididae), *Platypalpus longiseta* (Hybotidae), *Melanostoma scalare* (Syrphidae) and Cryptinae indet. (Hymenoptera: Ichneumonidae) are new host records. Further, the families Asilidae, Hybotidae and Syrphidae (Diptera) as well as Nabidae (Hemiptera) have not previously been associated with *T. holosericeum*.

Trombidium sp.

Identification to the level of species was impossible due to the broken gnathosoma in all larvae examined.

Record:

- *Empis lutea* Meigen, 1804 (Diptera: Empididae), Skanderborg, Ladegårde, 27 June 2018, leg. Peter Andersen; 1 H (mal.)/3 LV

Additionally, five larvae representing unidentified species of water mite superfamily Hydryphantoidea were found in the studied material. The larvae parasitized one specimen of *Ptychoptera contaminata* (L.) (Diptera: Ptychopteridae) [det. Walther Gritsch], collected in Kirkemose (Copenhagen), 06 July 2019, leg. Linda-Kjær Thomsen and Lars Thomas).

Discussion

Altogether, 110 nominal species have been hitherto recorded from Denmark, Norway, Sweden, and Finland (Stålstedt *et al.* 2019 and present study). The overall number of 34 species of terrestrial Parasitengona mites, recorded from Denmark (incl. Faroe Islands and Greenland) until the present is still relatively low compared to the fauna of Norway (76 named species), Sweden (51 named species), and Finland (48 named species) (Table 1). The observed differences should be mainly attributed to different intensities of sampling, and to different collecting methods dedicated for larvae and of active postlarval forms. During the survey carried out in Denmark which focused on the collection of ectoparasitic larvae along with their hosts, the methods commonly applied for the collection of insects were implemented. On the contrary, in the studies carried out in Norway, Sweden, and Finland, the methods dedicated for

Table 1 List of families, and nominal species of terrestrial Parasitengona mites recorded from Denmark (DEN; incl. Faroe Islands and Greenland), Norway (NOR), Sweden (SWE) and Finland (FIN) (for original records for Norway, Sweden and Finland see Stålstedt *et al.* 2019). Data on known instars are given in square parentheses: P – active postlarval form (adult and/or deutonymph), L – larva. New records for Denmark are indicated with bold letters NR.

Family	Species	DEN	NOR	SWE	FIN	Family	Species	DEN	NOR	SWE	FIN
Calypstomatidae						Erythraeidae					
Erythraeidae	1. <i>Calypstoma velutinum</i> (O. F. Müller, 1776) [P, L]	X	X	X	X	(continued)					
	2. <i>Abrolophus artemisiae</i> (Schrank, 1803) [P]		X		X	28. <i>Kamertonia polonica</i> Gabryś, 2000 [P]					X
	3. <i>Abrolophus bohmani</i> (Haitlinger, 2003) [L]		X			29. <i>Leptus</i> (L.) <i>coccineus</i> (Scopoli, 1763) [L]		X			
	4. <i>Abrolophus densipapillus</i> (Schweizer, 1951) [P]			X		30. <i>Leptus</i> (L.) <i>groenlandicus</i> (Trägårdh, 1904) [L]	X				
	5. <i>Abrolophus longicollis</i> (Oudemans, 1910) [L]		X	X		31. <i>Leptus</i> (L.) <i>kalaallus</i> Southcott, 1992 [L]	X				
	6. <i>Abrolophus miniatus</i> (Hermann, 1804) [P]	X	X	X	X	32. <i>Leptus</i> (L.) <i>laplandicus</i> Southcott, 1992 [L]				X	
	7. <i>Abrolophus norvegicus</i> (Thor, 1900) [P, L]	X	X	X	X	33. <i>Leptus</i> (L.) <i>longipilis</i> (Berlese, 1910) [P]					X
	8. <i>Abrolophus nymindegabicus</i> Haitlinger, 2008 [L]	X		X		34. <i>Leptus</i> (L.) <i>mariae</i> Haitlinger, 1987 [L]	NR	X	X		
	9. <i>Abrolophus quisquiliarius</i> (Hermann, 1804) [P, L]	X	X	X	X	35. <i>Leptus</i> (L.) <i>molochinus</i> (C. L. Koch, 1837) [P, L]	X	X	X	X	
	10. <i>Abrolophus rhopalicus</i> (C. L. Koch, 1837) [P]		X	X		36. <i>Leptus</i> (L.) <i>phalangii</i> (de Geer, 1778) [P, L]	X	X	X	X	
	11. <i>Abrolophus rubipes</i> (Trouessart, 1888) [P]	X		X		37. <i>Leptus</i> (L.) <i>plumosus</i> (Thor, 1900) [P]		X			
	12. <i>Abrolophus wratislaviensis</i> (Haitlinger, 1986) [L]	X	X	X		38. <i>Leptus</i> (L.) <i>rubricatus</i> (C. L. Koch, 1837) [P]			X	X	
	13. <i>Balaustium murorum</i> (Hermann, 1804) [P, L]			X	X	39. <i>Leptus</i> (L.) <i>sigthori</i> (Oudemans, 1911) [P]			X		
	14. <i>Balaustium nikae</i> Haitlinger, 1996 [L]			X		40. <i>Leptus</i> (L.) <i>slivovi</i> Beron, 1975 [L]		X			
	15. <i>Balaustium unidentatum</i> (Trägårdh, 1904) [P]	X				41. <i>Leptus</i> (L.) <i>trimaculatus</i> (Rossi, 1794) [P, L]	X	X	X	X	
	16. <i>Charletonia cardinalis</i> (C. L. Koch, 1837) [P, L]	NR	X	X	X	42. <i>Leptus</i> (L.) <i>vertex</i> (Kramer, 1886) [P]	X	X	X	X	
	17. <i>Charletonia globigera</i> (Berlese, 1885) [P]		X	X		43. <i>Leptus</i> (L.) <i>verticiformis</i> Trägårdh, 1931 [P]	X				
	18. <i>Curteria episcopalis</i> (C. L. Koch, 1837) [P, L]			X	X	Smarididae					
	19. <i>Erythraeus</i> (E.) <i>adpendiculatus</i> (Schrank, 1781) [P]			X	X	44. <i>Hirstiosoma ampulligera</i> (Berlese, 1887) [P, L]		X			
	20. <i>Erythraeus</i> (E.) <i>cinereus</i> (Dugès, 1834) [P, L]		X	X	X	45. <i>Hirstiosoma latreillei</i> (Grandjean, 1947) [P, L]		X			X
	21. <i>Erythraeus</i> (E.) <i>kresnensis</i> Beron, 1982 [L]		X			Johnstonianidae					
	22. <i>Erythraeus</i> (E.) <i>monikae</i> Haitlinger, 1987 [L]			X	X	46. <i>Centrotrombidium blackwellae</i> Baker, 1999 [L]	NR				
	23. <i>Erythraeus</i> (E.) <i>nivalis</i> (Heer, 1845) [P]	X		X		47. <i>Centrotrombidium schneideri</i> Kramer, 1896 [P, L]		X			
	24. <i>Erythraeus</i> (E.) <i>opilionoides</i> (C. L. Koch, 1837) [P]		X			48. <i>Diplothrombidium longipalpe</i> (Berlese, 1887) [P, L]		X			X
	25. <i>Erythraeus</i> (E.) <i>phalangoides</i> (De Geer, 1778) [P]	X	X	X	X	49. <i>Diplothrombidium rackae</i> Wohltmann, Małol & Gabryś, 2004 [L]	X	X			
	26. <i>Erythraeus</i> (E.) <i>regalis</i> (C. L. Koch, 1837) [P, L]	X	X	X	X	50. <i>Diplothrombidium zbigiewi</i> Haitlinger, 2001 [L]		X	X		
	27. <i>Erythraeus rupestris</i> (L.) [P]			X	X	51. <i>Johnstoniana errans</i> (Johnston, 1852) [P, L]			X		
						52. <i>Johnstoniana eximia</i> (Berlese, 1910) [P, L]		X			
						53. <i>Johnstoniana parva</i> Wendt, Wohltmann, Eggers & Otto, 1994 [P, L]		X			
						54. <i>Johnstoniana rapax</i> Wendt & Eggers, 1994 [P, L]					X

Table 1 Continued.

Family	Species	DEN	NOR	SWE	FIN	Family	Species	DEN	NOR	SWE	FIN
Microtrombidiidae						Podothrombiidae					
	55. <i>Eutrombidium frigidum</i> Berlese, 1910 [P]		X			84. <i>Podothrombium bicolor</i> (Hermann, 1804) [P]		X		X	
	56. <i>Eutrombidium trigonum</i> (Hermann, 1804) [P, L]		X			85. <i>Podothrombium curtupalpe</i> (Thor, 1900) [P]	X	X	X	X	
	57. <i>Atractothrombium fusicomum</i> (Berlese, 1910) [P, L]				X	86. <i>Podothrombium faeroense</i> Trägårdh, 1931 [L]	X				
	58. <i>Atractothrombium sylvaticum</i> (C. L. Koch, 1835) [P, L]		X	X		87. <i>Podothrombium filipes</i> (C. L. Koch, 1837) [P, L]	X	X	X	X	
	59. <i>Atractothrombium tectocervix</i> (Oudemans, 1903) [L]		X	X		88. <i>Podothrombium kordulae</i> Haitlinger, 1995 [L]		X			
	60. <i>Camerotrombidium pexatum</i> C. L. Koch, 1837 [P, L]		X			89. <i>Podothrombium strandi</i> Berlese, 1910 [P]		X		X	
	61. <i>Camerotrombidium rasum</i> (Berlese, 1910) [P, L]		X		X	90. <i>Podothrombium svalbardense</i> Oudemans, 1930 [L]		X			
	62. <i>Camerotrombidium sigthori</i> Thor & Willmann, 1947 [P]		X			Tanaupodidae					
	63. <i>Camerotrombidium vesiculosum</i> (Thor, 1900) [P]		X			91. <i>Rhinotrombium nemoricola</i> (Berlese, 1886) [P]		X			
	64. <i>Campylothrombium clavatum</i> (George, 1909) [P, L]		X	X	X	92. <i>Tanaupodus bifurcatus</i> Carl, 1966 [P]		X			
	65. <i>Campylothrombium striaticeps</i> (Oudemans, 1904) [L]			X		93. <i>Tanaupodus passimpilosus</i> Berlese, 1910 [P]		X			
	66. <i>Dactylothrombium pulcherrimum</i> (Haller, 1882) [P, L]	X	X			94. <i>Tignya sulcatus</i> (O. F. Müller, 1776) [P]	X				
	67. <i>Dimorphothrombium geographicum</i> (Berlese, 1910) [P]		X			Trombellidae					
	68. <i>Dimorphothrombium planicum</i> (C. L. Koch, 1837) [P]		X			95. <i>Nothrotrombidium otiorum</i> (Berlese, 1902) [P, L]		X			
	69. <i>Echinothrombium rhodinum</i> (C. L. Koch, 1837) [P, L]			X	X	Trombiculidae					
	70. <i>Echinothrombium spinosum</i> (Canestrini, 1885) [P, L]		X	X	X	96. <i>Hirsutiella zachvatkini</i> (Schluger, 1948) [P, L]		X	X	X	
	71. <i>Ettmuelleria sucida</i> (Trägårdh, 1910) [L]			X		97. <i>Leptotrombidium ruscicum</i> (Oudemans, 1902) [P, L]				X	
	72. <i>Microtrombidium pusillum</i> (Hermann, 1804) [P, L]		X		X	98. <i>Neotrombicula autumnalis</i> (Shaw, 1790) [P, L]	X		X	X	
	73. <i>Microtrombidium spiniferum</i> (Thor, 1900) [P]		X			99. <i>Neotrombicula talmiensis</i> (Schluger, 1955) [P, L]		X			
	74. <i>Microtrombidium strandi</i> (Thor, 1900) [P]		X			100. <i>Neotrombicula vulgaris</i> (Schluger, 1955) [L]		X			
Microtrombidiidae						Trombidiidae					
	75. <i>Platyrombidium fasciatum</i> (C. L. Koch, 1836) [P, L]	NR	X			101. <i>Allothrombium fuliginosum</i> (Hermann, 1804) [P, L]	X	X	X	X	
	76. <i>Sucidothrombium sucidum</i> (L. Koch, 1879) [P, L]	X	X	X	X	102. <i>Paratrombium egregium</i> Bruyant, 1910 [L]		NR			
	77. <i>Enemotrombium bifoliosum</i> (Canestrini, 1884) [P, L]		X		X	103. <i>Paratrombium insulare</i> (Berlese, 1910) [P, L]		X		X	
	78. <i>Valgothrombium alpinum</i> Willmann, 1940 [P]		X			104. <i>Trombidium brevimanum</i> (Berlese, 1910) [P, L]	X	X		X	
	79. <i>Valgothrombium confusum</i> (Berlese, 1910) [P]		X		X	105. <i>Trombidium geniculatum</i> (Feider, 1955) [P, L]		X	X		
	80. <i>Valgothrombium major</i> (Halbert, 1920) [P]		X	X		106. <i>Trombidium heterotrichum</i> (Berlese, 1910) [P]		X		X	
	81. <i>Valgothrombium mariae</i> Małol & Łaydanowicz, 2010 [L]		X			107. <i>Trombidium holosericeum</i> (L.) [P, L]	X	X	X	X	
	82. <i>Valgothrombium stuarti</i> Baker, 1999 [L]			X		108. <i>Trombidium latum</i> C. L. Koch, 1837 [P, L]		X	X	X	
	83. <i>Valgothrombium valgum</i> (George, 1909) [P, L]				X	109. <i>Trombidium mediterraneum</i> (Berlese, 1910) [P, L]		X			
						110. <i>Trombidium rimosum</i> C. L. Koch, 1837 [P]			X	X	
Total								34	76	51	48

collection of soil and litter mites, with the special reference to pitfall traps and Berlese funnels were applied.

Among new records, a discovery of new hosts for *Trombidium holosericeum* and for *Paratrombium egregium* are especially noteworthy. The former species is widely distributed in the western Palearctic and its larvae have been reported to parasitize not only a variety of insects but also arachnid hosts. Here, the members of hitherto unreported families, namely Nabidae (Hemiptera), Syrphidae, Hybotidae and Asilidae (Diptera) have been stated as new hosts for *T. holosericeum*. In the case of *P. egregium*, hitherto knowledge of host species was limited to *Pompilus pectinipes* (Hymenoptera) (Bruyant 1912), and the second hymenopteran host of this species has been recorded during the present survey.

Among the total number of 110 nominal species known from Denmark, Norway, Sweden, and Finland, there are 16 which are common for the fauna of all four countries and their occurrence in northern Europe does not raise doubts. Reports on a few other species (e.g., *Tignia sulcatus*) are perfunctory and the status of the species itself requires verification. Attention should be also paid to possible misidentifications which are likely to occur in large faunistic works dealing with the wide array of taxa. E.g., Haarløv (1957) reported the presence of *Leptus* sp. and of *Balaustium* sp. in Denmark, however in the identification of '*Balaustium*' he referred to Schweizer's (1951). Unfortunately, Schweizer (1951) under the name *Balaustium* spp. included both the members of *Balaustium* and *Abrolophus*. Considering the number of terrestrial Parasitengona species recorded from Denmark until the present, there is still a high probability of discovery of species new to the fauna of this country. The latter may be at least partly achieved through the analyses of the rich collection of Trombidiformes located in the Natural History Museum of Denmark.

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