

First records of ten species of Mesostigmata (Acari, Mesostigmata) added to the published Norwegian species list

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The Mesostigmata occurring in aboveground microhabitats in two Norwegian woodlands were surveyed which revealed ten species new to Norway's fauna: *Cilliba cassidea* (Hermann, 1804), *Zercon lindrothi* Lundqvist & Johnston, 1986, *Holoparasitus inornatus* (Berlese, 1906), *Lysigamasus armatus* Halbert 1915, *Paragamasus alstoni* (Bhattacharyya, 1963), *Paragamasus integer* (Bhattacharyya, 1963), *Pergamasus longicornis* (Berlese, 1906), *Macrocheles dentatus* (Evans & Browning, 1956), *Macrocheles opacus* (Koch, 1839) and *Macrocheles submotus* Falconer, 1924. This paper presents details of these new records and comments on the known distribution of the species.

Key words: Mites, Acari, Mesostigmata, species new for Norway, forest, *Gamasina*, *Uropodina*, *Cilliba*, *Zercon*, *Holoparasitus*, *Lysigamasus*, *Paragamasus*, *Pergamasus*, *Macrocheles*.

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Introduction

There are currently 230 species of Mesostigmata recorded from Norway (Gwiazdowicz & Gulvik 2005, 2007, Gwiazdowicz *et al.* 2013). However, according to Gwiazdowicz & Gulvik (2007), the Norwegian Mesostigmata have only been studied in a sporadic and piecemeal fashion and therefore it is likely that more species will be recorded as additional habitats are investigated more thoroughly.

Early works by scientists such as Bornebusch (1930) and van der Drift (1951) showed that mites are the most abundant microarthropods present in woodland soils and Berthet & Gerard (1965) recorded abundances in the range 6.700–134.000 m⁻². Among the mites, species from the Order Mesostigmata are frequently common in forest

habitats such as humus and litter (Evans 1957), moss (Madej *et al.* 2011, Manu *et al.* 2018), tree holes (Napierała & Błoszyk 2013), rotting wood (Krantz 2009), fungal sporophores (O'Connell & Bolger 1997a,b) and in canopies (Lindo & Winchester 2006, Moraza *et al.* 2009, Arroyo *et al.* 2013). In addition, several studies have indicated the importance of moss microhabitats in maintaining diversity in forests (Salmane & Brumelis 2008, Bolger *et al.* 2014). In forest soils the Mesostigmata typically reach densities of 4.000–10.000 m⁻², which is far greater than other arthropod predators, and, although relatively small in size, their total biomass can be equivalent to that of larger predators such as centipedes (Chilopoda) and spiders (Araneida) (Schaefer 1990, Scheu *et al.* 2003, Klarner *et al.* 2013). It is therefore of interest to know which species occur in forests

because the prey species are members of the soil fauna which are important in the decomposition process and, although many Mesostigmata appear to be relatively generalist feeders and the soil species feed primarily on important decomposer groups such as Nematoda and Collembola (Karg, 1993; Klärner *et al.* 2013; Walter *et al.* 1988; Walter & Ikonen, 1989) while many Uropodina while being omnivores also feed on detritus and fungi (Gulvik, 2007).

This paper contains records of ten species which have been recorded during a survey of the acarine fauna occurring in some aboveground microhabitats in two Norwegian woodlands which were not included in previously published Norwegian lists.

Methods

Site descriptions. Samples were collected from two forests in Western Norway. The first site is a rich broadleaf forest located between Mundheim and Furhovda (HOI, Kvam: Mundheim, Furhovda, 32 N 328026 6673275, 8 June 2017, 97 m a.s.l.) (Figure 1). It is a low-herb oak and low-herb hazel forest located on slopes, which has been classified as an important type of habitat. The dominant trees are oak (*Quercus robur* L.) and hazel (*Corylus avellana* L.), with some addition of wych elm (*Ulmus glabra* Huds.), ash (*Fraxinus excelsior* L.), birch (*Betula pubescens* Ehrh.), pine (*Pinus sylvestris* L.), lime (*Tilia cordata* Mill.) and aspen (*Populus tremula* L.). The lower canopy layer is mainly formed by yew (*Taxus baccata* L.), holly (*Ilex aquifolium* L.) and guelder-rose (*Viburnum opulus* L.).

The second site is a wet broadleaf forest located on the Nes Peninsula (HOI, Kvam: Nes Peninsula, 32 N 329553 6672694, 63 m a.s.l.) (Figure 2). There was a stream passing close to the sampling area and the forest has a large variety of tree species: wych elm, ash, oak, birch, hazel, lime, yew, bird cherry (*Prunus padus* L.), holly, black and gray alder (*Alnus glutinosa* Gaertn. & *A. incana* (L.) Moench), aspen, rowan (*Sorbus aucuparia* L.) and goat willow (*Salix caprea* L.). Many of these trees, especially some of the oaks,



FIGURE 1. Site at Mundheim, Furhovda.

are very old and stand as monumental shapes in the landscape (Nord *et al.* 2013).

Sampling. Samples were collected from the following microhabitats: dead wood, moss on soil surface, moss from stumps, moss from dead wood, moss from trees at ground level, moss from trees 1.5m above ground level & lichens on trees. These were collected by hand (each sample had a volume of 500 cm³) on 08 June 2017 and the animals extracted using Tullgren funnels for 14 days and preserved in 90% ethanol. The Mesostigmata were identified following Bhattacharyya (1963), Lundqvist & Johnston (1986), Hyatt & Emberson (1988), Karg (1989, 1993). All material was determined by T. Bolger (TB) and collected by A. Seniczak (AS).

Basis for comparison of geographical distributions. The discussion of microhabitat preferences is largely based on taxonomic literature and, in order to provide a geographical context for the records, the presence of the species



FIGURE 2. Site at Nes.

in Finland, Denmark, Latvia and Ireland, for which species lists exist (Salmane & Brumelis 2010, Huhta 2016, Bolger *et al.* 2018, Skipper 2018), is discussed.

RESULTS

Cilliba cassidea (Hermann, 1804)

HOI, Kvam: Mundheim, Furhovda, 32 N 328026 6673275, 8 June 2017, 25 specimens, Tullgren funnel extract, det. TB, coll. AS.; HOI, Kvam: Nes Peninsula, 32 N 329553 6672694, 8 June 2017, 61 specimens, Tullgren funnel extract, det. TB, coll. AS.

This species was abundant in moss on the soil surface, moss on dead wood and moss on tree stumps at both sites. It was not found in moss samples taken from above 1.5m on trees. *Cilliba cassidea* is a widespread species in Europe and has been found in deciduous forests & seashores in Finland (Huhta 2016) and has been recorded in Denmark (Skipper 2018) but not Latvia (Salmane & Brumelis 2010). In Ireland it has been recorded

from similar habitats but also from peatlands and fungal sporocarps (Bolger *et al.* 2018).

Zercon lindrothi Lundqvist & Johnston, 1986

HOI, Kvam: Mundheim, Furhovda, 32 N 328026 6673275, 8 June 2017, 346 specimens, Tullgren funnel extract, det. TB, coll. AS.; HOI, Kvam: Nes Peninsula, 32 N 329553 6672694, 8 June 2017, 231 specimens, Tullgren funnel extract, det. TB, coll. AS.

This species was the most abundant species found in this survey and was particularly abundant at Mundheim. It occurred in all of the microhabitats sampled. Although not in the lists of Gwiazdowicz & Gulvik (2005, 2007), this species has previously been found in Norway and specimens (18 females and 1 male) collected by T. Solhøy from a lichen heath at Hardangervidda (60° 18' N; 7° 40' E), were examined in the description of the species (Lundqvist & Johnston 1986). Lehtinen (1987) recorded this species as *Zercon colligans* Berlese in association with ants from several locations in Finland but Huhta (2016) attributes the records to *Z. lindrothi*. It has not been recorded from Latvia,

Denmark or Ireland but specimens identified following Karg (1993) might be of this species as it is not separated in that key.

***Holoparasitus inornatus* (Berlese, 1906)**

HOI, Kvam: Mundheim, Furhovda, 32 N 328026 6673275, 8 June 2017, 7♀♀, Tullgren funnel extract, det. TB, coll. AS.; HOI, Kvam: Nes Peninsula, 32 N 329553 6672694, 8 June 2017, 4 ♀♀1♂, Tullgren funnel extract, det. TB, coll. AS.

This species occurred in the moss microhabitats at both sites but never in large numbers and never in the dead wood microhabitats. It is a widely distributed species occurring in coniferous and deciduous forest stands, primarily in moss and decaying litter (Karg 1993) and has been found in Finland, Denmark and Ireland.

***Lysigamasus armatus* Halbert, 1915**

HOI, Kvam: Mundheim, Furhovda, 32 N 328026 6673275, 8 June 2017, 1♀, Tullgren funnel extract, det. TB, coll. AS.

A single specimen of this species was recovered from moss on dead wood from the Mundheim site. This species is found in leaf litter but also occurs frequently in agricultural soils and has been found in an *Iris* bog close to the seashore (Bhattacharyya 1963, Curry 1976, 1979, Purvis 1982, Huhta 2016). It has recently been recorded in Finland, it occurs in Denmark, is widespread in Ireland but has not yet been recorded in Latvia.

***Paragamasus alstoni* (Bhattacharyya, 1963)**

HOI, Kvam: Mundheim, Furhovda, 32 N 328026 6673275, 8 June 2017, 1♀, Tullgren funnel extract, det. TB, coll. AS.

A single female of this species was collected from moss above 1.5m on a tree at the Mundheim site. This appears to be an uncommon species and has not previously been recorded from Finland, Latvia, Denmark or Ireland. Although originally described from specimens collected in glasshouses and botanic gardens (Bhattacharyya 1963), Karg (1993) says that this species occurs frequently in farmland and compost and occasionally in deciduous forest, humus and decaying litter where is moderately to very moist.

***Paragamasus integer* (Bhattacharyya, 1963)**

HOI, Kvam: Mundheim, Furhovda, 32 N 328026 6673275, 8 June 2017, 1♂, Tullgren funnel extract, det. TB, coll. AS.; HOI, Kvam: Nes Peninsula, 32 N 329553 6672694, 8 June 2017, 4♀♀3♂♂ specimens, Tullgren funnel extract, det. TB, coll. AS.

This species appears to favour microhabitats above ground level. All of the specimens were recovered from moss above 1.5m on trees or from moss on dead wood. It occurred at both sites but only one specimen was recovered from the Mundheim site. It is described by Karg (1993) as a western European species occurring in leaf litter, in decaying wood and in moss and the original description from Bhattacharyya (1963) is based on specimens from similar woodland microhabitats. It has not been recorded from Finland, Denmark or Latvia but has been found in fungal sporocarps in Ireland.

***Pergamasus longicornis* (Berlese, 1906)**

HOI, Kvam: Mundheim, Furhovda, 32 N 328026 6673275, 8 June 2017, 6♀♀5♂♂ specimens, Tullgren funnel extract, det. TB, coll. AS.; HOI, Kvam: Nes Peninsula, 32 N 329553 6672694, 8 June 2017, 4♀♀6♂♂ specimens, Tullgren funnel extract, det. TB, coll. AS.

This was found at both sites in moss and on dead wood. It is a widespread species which has been recorded in many parts of Europe, Juan Fernandez and Easter Islands, and Australia (Bhattacharyya, 1963). It occurs in many woodland habitats, moss, peatland, pasture, nests of small mammal and in several coastal habitats. Karg (1993) synonymises it with *Pergamasus crassipes* (Linné, 1758) but it has several features which mark it as a different species and is recognised as such in Halliday (1998) and in several databases such as Fauna Europea and GBIF. It was previously recorded in Norway by Trägårdh (Bhattacharyya 1963) but has not been recognised as a separate species in the current checklist of Norwegian species.

***Macrocheles dentatus* (Evans & Browning, 1956)**

HOI, Kvam: Nes Peninsula, 32 N 329553 6672694, 8 June 2017, 2♀♀, Tullgren funnel extract, det. TB, coll. AS.

Only two specimens (both female) of this species were recovered. These were from moss on soil and from moss on dead wood and were both found in a single site, Mundheim. It has been recorded from a variety of habitats including leaf litter, grassland soil, *Salix* ditch at seashore and from *Microtus agrestis* (Purvis 1982, Hyatt & Emberson 1988) but has not yet been recorded from Finland, Denmark or Latvia.

***Macrocheles opacus* (Koch, 1839)**

HOI, Kvam: Mundheim, Furhovda, 32 N 328026 6673275, 8 June 2017, 1♀, Tullgren funnel extract, det. TB, coll. AS.; HOI, Kvam: Nes Peninsula, 32 N 329553 6672694, 8 June 2017, 3♀♀, Tullgren funnel extract, det. TB, coll. AS

Occurred in small numbers at both sites where it occurred in moss on both soil surface and on dead wood. It also occurred in dead wood. This is a widespread species in Europe where it occurs mainly in moss and rotting wood (Hyatt & Emberson 1988, Karg 1993, Bolger et al. 2018). It has been recorded from Ireland, Denmark but not Finland or Latvia.

***Macrocheles submotus* Falconer, 1924**

HOI, Kvam: Mundheim, Furhovda, 32 N 328026 6673275, 8 June 2017, 1♂, Tullgren funnel extract, det. TB, coll. AS.; HOI, Kvam: Nes Peninsula, 32 N 329553 6672694, 8 June 2017, 8♀♀, Tullgren funnel extract, det. TB, coll. AS.

This species occurred in small numbers at the two sites where it was found in moss on both soil surface and on dead wood. It also occurred in dead wood. Karg (1993) describes this species as having a European distribution occurring in the litter and humus layers of forests and Salmane & Brumelis (2010) show that forests are the only habitat in which it has been found in Latvia. It appears to have a broader distribution in Ireland and Great Britain where it has been found in peatland, flood debris, saltwater marsh and the nests of small mammals (Hyatt & Emberson 1988, Bolger et al. 2018). It has not been recorded in either Denmark or Finland and Hyatt & Emberson (1988) stated that at that point they were not aware of records outside of the British Isles.

Discussion

All of the species recorded in this paper are relatively widespread species and it was not surprising to find any of them in the woodland habitats examined. This perhaps emphasizes the need for further systematic study of the Norwegian fauna. Although the diversity of the fauna might be expected to be comparatively low because of its northern location of the country, a comparison with the Finnish species fauna which contains 451 recorded species (Huhta 2016) suggests that many more species are likely to be present. Indeed, as pointed out by Gwiazdowicz & Gulvik (2007), despite the country's northern location, it extends over a large range of latitudes and has a large variety of habitats ranging from sea level to high mountain ranges all within comparatively short distances from one another and thus may contain a larger diversity of species than might be suspected. In conclusion, to paraphrase the comment of Luxton (1998) in a discussion of the known Irish fauna, Norway may still be "acarologically uncharted territory".

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