Diversity and Distribution of Mites (Acari: Ixodida, Mesostigmata, Trombidiformes, Sarcoptiformes) in the Svalbard Archipelago

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Abstract: Svalbard is a singular region to study biodiversity. Located at a high latitude and geographically isolated, the archipelago possesses widely varying environmental conditions and unique flora and fauna communities. It is also here where particularly rapid environmental changes are occurring, having amongst the fastest increases in mean air temperature in the Arctic. One of the most common and species-rich invertebrate groups in Svalbard is the mites (Acari). We here describe the characteristics of the Svalbard acarofauna, and, as a baseline, an updated inventory of 178 species (one Ixodida, 36 Mesostigmata, 43 Trombidiformes, and 98 Sarcoptiformes) along with their occurrences. In contrast to the Trombidiformes and Sarcoptiformes, which are dominated in Svalbard by species with wide geographical distributions, the Mesostigmata include many Arctic species (39%); it would thus be an interesting future study to determine if mesostigmatid communities are more affected by global warming then other mite groups. A large number of new species (42 spp.) have been described from Svalbard, including 15 that have so far been found exclusively there. It is yet uncertain if any of these latter species are endemic: six are recent findings, the others are old records and, in most cases, impossible to verify. That the Arctic is still insufficiently sampled also limits conclusions concerning endemicity.

Keywords: checklist; Astigmata; Endeostigmata; Oribatida; Prostigmata; climate change; Arctic; Svalbard

1. Introduction

The invertebrate fauna of the Svalbard archipelago is amongst the best known for any region in the Arctic [1]. However, the inventory has been collated from studies over a period of 150 years and has never been subjected to a critical review and taxonomic revision. Without an improved understanding of the current fauna it is not possible to understand the current terrestrial ecosystem or determine its response to on-going environmental change.
The dramatic environmental changes that we see today may be most discernable in polar regions, which possess both a unique flora and fauna and are undergoing the greatest rates of climate change. A particularly interesting area to study this is the Svalbard archipelago that is located at 78° N, isolated, and with a distinctive and diverse flora and fauna that are poorly studied [2]. Svalbard is currently experiencing one of the fastest temperature increases and one of the highest rates of sea ice loss in the Arctic [3]. During the past 50 years, the mean air temperature in Svalbard has increased by 4 °C, the winter mean air temperature has increased by 7 °C, the snow season duration has decreased by 20 days, and precipitation has increased by 65% [4]. For example, at Svalbard airport in 2018, the mean annual temperature was −1.8 °C, winter temperature was −5.3 °C, and annual precipitation was 252.5 mm [5]. These factors, as well as others that are tightly connected to the climate (e.g., faster melting of glaciers, changes in permafrost, landslides, avalanches, and flooding), affect the ecosystems in different manners. Even though a few species benefit from a warming climate, for example vertebrates, most Arctic species in Svalbard are experiencing negative effects in the warming environment [6].

Just south of Svalbard, two sea currents meet, a northern branch of the warm North Atlantic Drift and the southerly flowing cold Arctic Current, with consequences for the local climates on the east and west coasts of the archipelago [7] and potentially for species immigration histories, thus affecting species communities. A good example is the distinctive acarofauna of Edgeøya in the east of the archipelago compared to that observed on the west coast [8] and which includes an oribatid species new to science and not so far recorded elsewhere [9].

As a consequence of the increasing temperatures and changes in precipitation patterns, many glaciers are receding and revealing new land surfaces for primary succession. Therefore, regions such as Svalbard offer a unique opportunity to identify the pioneer species that first colonize barren post-glacial habitats and to analyze long-term processes of change, e.g., in invertebrate community assembly [10].

The diversity and richnes of the environment is much more than simply lists of species occurring in a given area; it is also the regional specificity of these species, for example, those species that are considered to be typically High Arctic. Changing climatic conditions that determine and stimulate changes in habitats also affect the ranges of some mite species. Several studies have considered changes in mite communities in Svalbard in space and time; their dispersal abilities [11–17], as well as their emergence in new areas or retreat from previously occupied locations [10,18–20]. The uniqueness of polar areas, with their characteristic climates and isolated island distribution that often restricts dispersal processes, limits the range of some species. In this context, knowledge of zoogeography (ranges of occurrence of species) is extremely valuable because this suggests not only the migration routes, but also the ability of selected species to colonize new areas. Nonetheless, the climate of Svalbard is changing fast. These changes will undoubtedly provide opportunities for new species to colonize the region with difficult to foresee outcomes. The consequences of human introductions of invasive and alien species (IAS) have been described in the Antarctic [21] and there are examples of similar introductions in Svalbard [18].

Understanding mite ecology is also important since mites are excellent bioindicators of environmental changes and their presence, or changes in their communities, can be used in biological monitoring of naturally occurring processes as well as the consequences of human impacts, for example, those related to industrial activities in Svalbard’s natural environment [20,22].

We here present a review of the mite fauna of Svalbard. These results can be the basis for further analyzes of the acarofauna (e.g., zoogeographic, ecological, taxonomic, and parasitological).

2. Material and Methods

The data were extracted from 104 papers published between 1871 and 2020. The localities presented in Figure 1 are based on Table 1. Distribution of *Ixodes uriae* White, 1852, the only representative of the order Ixodida in Svalbard, follows [23]. The nomenclature and arrangement of the Mesostigmata
families follows [24,25], while the species nomenclature follows [26] with a few modifications [27,28]. Distribution of the families follows [27–30].

Figure 1. Cont.
Figure 1. Localities in Svalbard where mites were found.

The arrangement of the Trombidiiformes families follow [31] with the exception of the Eriophyidae that is included in the Endeostigmata, as suggested by [32,33]. Names and distributions of the Bdellidae follow [34]; Cunaxidae—[35]; Cocceupodidae and Eupodidae—[36,37] for nomenclature, and [38,39] for distributions; Penthaleidae—[40]; Penthalodidae—[41]; Rhagidiidae—[42–44]; Halacaridae—[45]; Triophtydeiidae—[46] for taxonomy, and [47,48] for distribution; Tydeidae—[49,50]; Iolinidae—[51,52]
for taxonomy, and [47,53] for distributions; Sperchontidae—[48,54,55]; Trombidiidae—[56]; Syringophilidae—[57]; Stigmaeidae—[58]; Tetranychidae—[59,60]; and Pygmephoridae—[61].

The nomenclature and arrangement of the Sarcoptiformes families follow [62,63]. For the Endeostigmata, the nomenclature and arrangement of families follow [63,64]. The distribution of Nanorchestidae follow [65]; Alicorhagiidae—[66]; and Eriophyidae—[67]. The species names of the Oribatida (without Astigmata) follow [68] with a few exceptions [69,70] and their distribution is given after [9,68,71,72]. The Astigmata species (families Acaridae, Alloptidae, and Avenzoariidae) follow [73,74] and their distribution is according to [75].

Full names of species are provided in Table 1, while in other tables and figures abbreviations are used. The species within families are organized alphabetically. The names of localities follow in alphabetical order (Table 1).

3. Results

3.1. Ixodida

Only one species, the seabird tick (*Ixodes uriae*), is known from Svalbard. This species has a wide geographical distribution (Table 1) but in Svalbard has been found only recently on Bjørnøya and Spitsbergen [76–78].

3.2. Mesostigmata

Thus far, 36 species of Mesostigmata from 13 families have been found in Svalbard (Table 1). Amongst these families, the richest in species is the Ascidae (12 spp.), followed by the Zerconidae (6 spp.); these two families contribute almost 50% of mesostigmatic alpha diversity in Svalbard (Figure 2).

The peculiarity of the mesostigmatic mite communities of Svalbard compared to other mite groups is manifested by the description of one new genus (*Arctoseius*) and seven species [*Halolaelaps coulsoni* Gwiazdowicz & Teodorowicz, 2017; *H. gerlachi* Hirschmann, 1966; *Antennoseius (Vitzthumia) oudemansi* (Thor, 1930); *Arctoseius laterincisus* Thor, 1930; *Proctolaelaps parvanalis* (Thor, 1930); *Neoseiulus grumantensis* Kolodochka & Gwiazdowicz, 2014; and *N. magnanalis* (Thor, 1930)], all first described from the largest island of the archipelago—Spitsbergen. Moreover, based on recently collected samples from this island, redescriptions of several species have been published: *Zercon solenites* Haarløv, 1942; *Antennoseius (Vitzthumia) oudemansi*; *Arctoseius haarlovi* Lindquist, 1963; *Proctolaelaps parvanalis*; *Neoseiulus ellesmerei* (Chant & Hansell, 1971); and *N. magnanalis* [27–29,79,80].
**Table 1. List of mites of the Svalbard archipelago.**

| No. | Taxon                                     | Distribution                      | Localities                                                                 |
|-----|-------------------------------------------|-----------------------------------|----------------------------------------------------------------------------|
|     | **IXODIDA**                               |                                   |                                                                            |
|     | Ixodidae                                  |                                   |                                                                            |
| 1.  | *Ixodes uriae* White, 1852                | Afrotropical, Australasian, Neotropical, Holarctic | Bjørnøya [77]; Spitsbergen: Ossian Sarsfjellet [76–78]                  |
| 2.  | **MESOSTIGMATA**                          |                                   |                                                                            |
|     | Dinychidae                                |                                   |                                                                            |
| 3.  | *Uroseius acuminatus* (C.L. Koch, 1847)   | Paleartic                         | Spitsbergen [81,82]                                                       |
| 4.  | *Zercon andrei* Sellnick, 1958            | Paleartic                         | Bjørnøya: Alfredfjellet, “Birds colony”, Teltvika [29,30,83]; Spitsbergen: Hornsund [84] |
| 5.  | *Z. curious* Trágárdh, 1910               | Paleartic                         | Spitsbergen: Longyearebyen [85]                                           |
|     |                                           |                                   | Edgeøya: Diskobukta, Kapp Heuglin, Kapp Lee, Negerdalen, Russebukta [8]; Hopen: Koeoedodden, Norwegian Meteorological Institute Station [86]; Nordaustlandet: Kinnvika [30,87]; Spitsbergen: Adventdalen, Billefjord, Bjørnalen, Endalen, Hornsund, Ny-Alesund, Ossian Sarsfjellet, Petuniabukta, Storholmen, Trygghamna [10,20,30,85,88–90] |
| 6.  | *Z. forsslundi* Sellnick, 1958            | Paleartic                         | Spitsbergen: Adventdalen, Bjørnalen, Blomstrandhalvøya, Endalen, Fjordende Julibukta, Gренfjorden, Magdaleneferden, Petuniabukta, Storholmen, Vårsofjorden [10,20,30,85,88–90] |
| 7.  | *Z. solenites* Haarløw, 1942 **           | Arctic                            | Spitsbergen: Adventdalen, Barentsburg, Hanaskogdalen, Hjorthhamn [91]      |
| 8.  | *Z. triangularis* C.L. Koch, 1836         | Paleartic                         | Spitsbergen: Øystese, Bjørnøya: Alfredfjellet [88]; Spitsbergen: Hornsund [83]     |
| 9.  | **Parasitidae**                           |                                   |                                                                            |
|     | *Paragamasus (Aclerogamasus) insertus*    | Paleartic                         | Spitsbergen: Barentsburg [18,19]                                          |
|     | (Micherdzinski, 1969)                     |                                   |                                                                            |
| 10. | *Vulgarogamasus immans* (Berlese, 1904)   | Paleartic                         | Spitsbergen: Barentsburg [92]                                             |
| 11. | *V. reniberti* (Oudemans 1912)            | Paleartic                         | Spitsbergen: Barentsburg [18,19]                                          |
|     | **Digamasellidae**                        |                                   |                                                                            |
| 12. | *Dendrolaelaps formosus* (Leitner, 1949)  | Paleartic                         | Spitsbergen: Pyramiden [20]                                               |
| 13. | **Halolaelapidae**                        |                                   |                                                                            |
|     | *Halolaelaps coulsoni Gwiazdowicz & Teodorowicz, 2017 *† | Arctic | Spitsbergen: Pyramiden [93]                                               |
| 14. | *H. gerlachi* Hirschmann, 1966 *†         | Arctic                            | Spitsbergen: Ny-Álesund [94]                                              |
| 15. | *Saprosecans baliogi* Karg, 1964          | Paleartic                         | Edgeøya: Diskobukta [8]                                                  |
Table 1. Cont.

| No. | Taxon                                           | Distribution | Localities                                                                 |
|-----|-------------------------------------------------|--------------|-----------------------------------------------------------------------------|
| 16. | Ologamasidae                                     |              |                                                                             |
|     | *Gamaseillus borealis* (C.L. Koch, 1879)        | Paleartic    | Spitsbergen: Dirksbukta [7]                                                 |
| 17. | Eviphididae                                      |              |                                                                             |
|     | *Thinoneius spinosus* (Willmann, 1939)          | Paleartic    | Spitsbergen: Longyearbyen, Storholmen [80,95]                               |
| 18. | Macrochelidae                                    |              |                                                                             |
|     | *Macrocheles muscadelicaceae* (Scopoli, 1772)   | Paleartic    | Spitsbergen: Barentsburg [84]                                               |
| 19. | *Antennoseius (Vitzthumia)oudemansi* (Thor, 1930)** | Arctic       | Bjørnøya: “Birds colony” [83]; Edgeøya: Diskobukta, Kapp Lee, Russoebukta [8]; Hopen: Koefoedodden, Norwegian Meteorological Institute Station [86]; Nordaustlandet: Kinnvika [30,79,87]; Spitsbergen: Adventdalen, Barentsburg, Bjørndalen, Endalen, Florabukta, Hjorthamn, Magdalenefjorden, Petuniabukta, Pyramiden, Storholmen, Vestpynten [19,20,22,30,79,85,88–91] |
| 20. | *Arctoseius babenkoi* Makarova, 1999             | Paleartic    | Spitsbergen: Hornsund, Pyramiden [20,84,96] Spitsbergen [96]                |
|     | *A. cetratus* (Sellnick, 1940)                  | Holarctic    | Bjørnøya: “Birds colony” [83]; Edgeøya: Diskobukta, Kapp Lee, Negerdalens, Russoebukta [8]; Hopen: Koefoedodden, Norwegian Meteorological Institute Station [86]; Spitsbergen: Adventdalen, Barentsburg, Bjørndalen, Endalen, Hornsund, Longyearbyen, Magdalenefjorden, Mushamna, Ny-Ålesund, Petuniabukta, Pyramiden, Storholmen, Vestpynten [19,20,22,30,79,85,88–91] |
| 21. | *A. haarlovi* Lindquist, 1963 **                | Arctic       | Spitsbergen: Adventdalen, Barentsburg, Hanaskogdalen, Hjorthamn [91]         |
|     |                                                |              | Edgeøya: Blåbukta, Diskobukta, Kapp Heuglin, Kapp Lee, Negerdalens, Russoebukta [8]; Hopen: Koefoedodden, Norwegian Meteorological Institute Station [86]; Spitsbergen: Adventdalen, Barentsburg, Billefjorden, Endalen, Grønfjorden, Hornsund, Magdalenefjorden, Mushamna, Ny-Ålesund, Petuniabukta, Pyramiden, Storholmen, Serkkapp, Vårsolbukta [10,19,20,30,88–90,96] |
| 22. | *A. laterincisus* Thor, 1930 **†                | Arctic       |                                                                             |
| 23. | *A. multidentatus* Evans, 1955                  | Arctic       |                                                                             |
| 24. |                                                 |              |                                                                             |
| 25. | *A. ornatus* Lindquist, 1961                    | Holarctic    |                                                                             |

*Contributed by Anna Lindblom, 2017*
### Table 1. Cont.

| No. | Taxon                                      | Distribution | Localities                                                                                                                                 |
|-----|--------------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 26. | *A. tajmyricus* Petrova & Makarova, 1991   | Palearctic   | Bjørnøya: Alfredfjellet [83]; Spitsbergen: Hornsund [88,96]                                                                             |
|     |                                            |              | Edgeøya: Blåbukta, Kapp Heuglin, Negerdalen [8]; Nordaustlandet: Kinnvikva [30,87]; Spitsbergen: Adventdalen, Endalen, Hornsund [30,89]    |
| 27. | *A. tschernovi* Makarova, 2000             | Arctic       | Bjørnøya: Alfredfjellet, „Birds colony” [83]; Edgeøya: Kapp Heuglin, Kapp Lee, Negerdal, Russubukta [8]; Spitsbergen: Adventdalen, Bjoøndalen, Endalen, Ossian Sarsfjellet, Petuniabukta, Vestpynten, Vårsofbukta [20,22,30,88,89,96] |
| 28. | *A. weberi* Evans, 1955                    | Arctic       | Bjørnøya: Alfredfjellet, “Birds colony” [83]; Spitsbergen [84]                                                                       |
|     |                                            |              | Edgeøya: Blåbukta, Kapp Heuglin, “Birds colony” [83]; Spitsbergen: Adventdalen, Bjoøndalen, Endalen, Ossian Sarsfjellet, Petuniabukta, Vestpynten, Vårsofbukta [20,22,30,88,89,96] |
| 29. | *Zerconopsis labradorensis* Evans & Till, 1960 | Arctic       | Bjørnøya: Alfredfjellet, “Birds colony” [83]; Spitsbergen [84]                                                                       |
|     |                                            |              | Edgeøya: Blåbukta, Kapp Heuglin, “Birds colony” [83]; Spitsbergen: Adventdalen, Bjoøndalen, Endalen, Ossian Sarsfjellet, Petuniabukta, Vestpynten, Vårsofbukta [20,22,30,88,89,96] |
| 30. | *Z. muestairi* (Schweizer, 1949)           | Palearctic   | Bjørnøya: Alfredfjellet, “Birds colony” [83]; Spitsbergen [84]                                                                       |
|     |                                            |              | Edgeøya: Blåbukta, Kapp Heuglin, “Birds colony” [83]; Spitsbergen: Adventdalen, Bjoøndalen, Endalen, Ossian Sarsfjellet, Petuniabukta, Vestpynten, Vårsofbukta [20,22,30,88,89,96] |
| 31. | *Proctolaelaps parcanalis* (Thor, 1930)    | Arctic       | Bjørnøya: Alfredfjellet, “Birds colony” [83]; Edgeøya: Blåbukta, Diskobukta, Kapp Lee, Russubukta [8]; Spitsbergen: Adventdalen, Bjoøndalen, Endalen, Hiorthhamn, Longyearbyen, Malardalen, Ny-Ålesund, Petuniabukta [10,20,22,29,30,85,89,91] |
| 32. | *Neoseiulus ellesmerei* (Chant & Hansell, 1971) ** | Arctic       | Edgeøya: Russubukta [8,28]; Spitsbergen: Adventdalen, Endalen, Longyearbyen [28]                                                       |
| 33. | *N. grumantensis* Kolodocha & Gwiazdowicz, 2014 *,** | Arctic       | Spitsbergen: Longyearbyen, Petuniabukta [28]                                                                                             |
| 34. | *N. magnanalis* (Thor, 1930) *,**†        | Arctic       | Spitsbergen: Adventdalen, Hiorthhamn, Malardalen, Ny-Ålesund, Petuniabukta [10,20,22,29,30,85,89,91]                                   |
| 35. | *Dermanyssus hirundinis* (Hermann, 1804)   | Holarctic    | Bjørnøya: Alfredfjellet, “Birds colony” [83]; Edgeøya: Blåbukta, Diskobukta, Kapp Lee, Russubukta [8]; Spitsbergen: Adventdalen, Bjoøndalen, Endalen, Hiorthhamn, Longyearbyen, Malardalen, Ny-Ålesund, Petuniabukta [10,20,22,29,30,85,89,91] |
| 36. | *Haemogamasus ambulans* (Theorell, 1872)   | Holarctic    | Bjørnøya: Alfredfjellet, “Birds colony” [83]; Edgeøya: Blåbukta, Diskobukta, Kapp Lee, Russubukta [8]; Spitsbergen: Adventdalen, Bjoøndalen, Endalen, Hiorthhamn, Longyearbyen, Malardalen, Ny-Ålesund, Petuniabukta [10,20,22,29,30,85,89,91] |
| 37. | *Laelaps hilaris* C.L. Koch, 1836          | Holarctic    | Bjørnøya: Alfredfjellet, “Birds colony” [83]; Edgeøya: Blåbukta, Diskobukta, Kapp Lee, Russubukta [8]; Spitsbergen: Adventdalen, Bjoøndalen, Endalen, Hiorthhamn, Longyearbyen, Malardalen, Ny-Ålesund, Petuniabukta [10,20,22,29,30,85,89,91] |

**Prostigmata**

**TROMBIDIFORMES**
| No. | Taxon                                      | Distribution          | Localities                                                                 |
|-----|-------------------------------------------|-----------------------|----------------------------------------------------------------------------|
| 38. | *Bdella longicornis* (Linnaeus, 1758)     | Holarctic, Neotropic, Indomalayan | Bjørnøya: south [99,101]; Prins Karls Forland: MacKenziedale, Richardlagoon almost to Carmichaelpynen, Silene Hill [99,101]; Spitsbergen: Adventfjorden, Bellsund, Billefjorden, Bohemanneset, Brucebyen, Dirksbukta, Eremitten, Gipsdalen, Hiorthhamn, Sorgfjorden, Station Islands at Liefdefjorden, Salmon Lake at Dirksbukta [7,91,99,101,102] |
| 39. | *B. semiscutata* Thor, 1930 *             | Palearctic            | Spitsbergen: Engelskhytta, Hiorthfellet, Longyearbyen [91,103] |
| 40. | *Odontoscirus lapidaria* (Kramer, 1881)   | Cosmopolitan          | Bjørnøya: Eliassen, south [99,101,105]; Prins Karls Forland: MacKenziedale, Silene Hill [99,101]; Spitsbergen: Adventfjorden, Barentsburg, Brucebyen, Engelskhytta, “Großer Trichter”, Grønfjorden, Longyearbyen, Magdelenefjorden, Salmon Lake at Dirksbukta, [7,91,99,101,103]; Svalbard [106] |
| 41. | *Cyta latirostris* (Hermann, 1804)        | Cosmopolitan          | Bjørnøya: south [99,101,104,105], Prins Karls Forland: Silene Hill [99,101]; Islands of Hinlopenstretet: Fosteroyane, Gyldenøyane, Vågattøyane including Von Otterøya and Nordenskiöldøya [7]; Spitsbergen: Adventfjorden, Billefjorden, Bohemanneset, Brucebyen, Eremitten, Grønfjorden, between Hiorthhamn and Advent City, Isfjorden, Liefdefjorden, Ny-Friesland, Salmon Lake at Dirksbukta, Sassenfjorden, Sorgfjorden, south side of Reinsdyrfylla [7,91,99,101,102,105] |
| 42. | *Neomolgus capillatus* (Kramer, 1881)     | Palearctic, Australasian | Bjørnøya: south [99,101,104,105], Prins Karls Forland: Silene Hill [99,101]; Islands of Hinlopenstretet: Fosteroyane, Gyldenøyane, Vågattøyane including Von Otterøya and Nordenskiöldøya [7]; Spitsbergen: Adventfjorden, Billefjorden, Bohemanneset, Brucebyen, Eremitten, Grønfjorden, between Hiorthhamn and Advent City, Isfjorden, Liefdefjorden, Ny-Friesland, Salmon Lake at Dirksbukta, Sassenfjorden, Sorgfjorden, south side of Reinsdyrfylla [7,91,99,101,102,105] |
| 43. | *N. littoralis* (Linnaeus, 1758)          | Holarctic             | Bjørnøya: south [99,101,104,105], Prins Karls Forland: Silene Hill [99,101]; Islands of Hinlopenstretet: Fosteroyane, Gyldenøyane, Vågattøyane including Von Otterøya and Nordenskiöldøya [7]; Spitsbergen: Adventfjorden, Billefjorden, Bohemanneset, Brucebyen, Eremitten, Grønfjorden, between Hiorthhamn and Advent City, Isfjorden, Liefdefjorden, Ny-Friesland, Salmon Lake at Dirksbukta, Sassenfjorden, Sorgfjorden, south side of Reinsdyrfylla [7,91,99,101,102,105] |
| 44. | *N. pallipes* (C.L. Koch, 1879)           | Holarctic             | Bjørnøya: south [99,101,104,105], Prins Karls Forland: Silene Hill [99,101]; Islands of Hinlopenstretet: Fosteroyane, Gyldenøyane, Vågattøyane including Von Otterøya and Nordenskiöldøya [7]; Spitsbergen: Adventfjorden, Billefjorden, Bohemanneset, Brucebyen, Eremitten, Grønfjorden, between Hiorthhamn and Advent City, Isfjorden, Liefdefjorden, Ny-Friesland, Salmon Lake at Dirksbukta, Sassenfjorden, Sorgfjorden, south side of Reinsdyrfylla [7,91,99,101,102,105] |
| 45. | *Cunaxoides croceus* (C.L. Koch, 1838)    | Holarctic             | Spitsbergen: “Großer Trichter” [103] |
| 46. | *Cocceupodes mollicellus* C.L. Koch 1838 | Holarctic             | Spitsbergen: “Großer Trichter”, Hiorthhamn, Longyearbyen, Magdelenefjorden [91,103,106] |
| 47. | *Eupodes variatus* C.L. Koch, 1838        | Holarctic, Afrotropical | Bjørnøya: Engelskelva, Fugleodden [91]; Spitsbergen: Hanaskogdalen, Hiorthhamn, Longyearbyen? [91,103,106] |
| 48. | *Neoproteunetes borneri* (Thor, 1934)     | Holarctic             | Spitsbergen: “Großer Trichter”, Magdelenefjorden, Tempelfjorden [66,103] |
| No. | Taxon | Distribution | Localities |
|-----|-------|--------------|------------|
| 49. | *Penthaleus maior* (Dugès, 1834) | Cosmopolitan | Bjørnøya [102]; Spitsbergen: Hiorthhamn, Longyearbyen, Magdalenebreen, Reinsdyrfjøra–Liefdefjorden, Station Islands at Liefdefjorden [7,91,103] |
| 50. | *Penthalodes ovalis* (Dugès, 1834) | Holarctic | Bjørnøya [105]; Spitsbergen: Barentsburg, Hiorthhamn, Liefdefjorden, Longyearbyen, south side of Reinsdyrfjøra [7,91,103] |
| 51. | *Coccorhagidia clavifrons* (Canestrini, 1886) | Cosmopolitan | Spitsbergen: “Großer Trichter”, Hiorthhamn, Tempelfjorden [91,103] Bjørnøya [101,102,104,105], south [99]; Spitsbergen: Adventfjorden, Bellsund, Billefjorden, Brucebyen, Dirksbukta, Eremitten, “Großer Trichter”, Hiorthhamn, Lomfjorden, Reinsdyrfjøra-Liefdefjorden, Salmon Lake at Dirksbukta, south side of Reinsdyrfjøra [7,91,99,101–103,105] |
| 52. | *Rhagidia gelida* Thorell, 1872 | Holarctic | |
| 53. | *Bradycyga alberti* (Trouessart, 1902) | Arctic | Spitsbergen: north [107]; Hopen [107] |
| 54. | *Copidognathus poucheti* (Trouessart, 1893) | Atlantic Ocean, Arctic | Spitsbergen: western coast [81]; expedition to Spitsbergen: Bellsund, Isfjorden, and Prins Karls Forland [108] |
| 55. | *C. reticulatus* (Trouessart, 1893) | Atlantic Ocean, Arctic | Spitsbergen: western coast [81]; expedition to Spitsbergen: Bellsund, Isfjorden, and Prins Karls Forland [108], Hinlopenstretet [107] |
| 56. | *C. richardi* (Trouessart, 1902) | Atlantic Ocean, Arctic | |
| 57. | *Halacarellus subterraneus* Schulz, 1933 | Atlantic Ocean, Arctic, Palearctic | Spitsbergen: [45] |
| 58. | *H. subcrispus* Bartsch, 1978 | Atlantic Ocean, Arctic | Spitsbergen: [45] |
| 59. | *Halacarus borealis* Trouessart, 1893 | Atlantic Ocean, Arctic | Spitsbergen: western coast [81]; expedition to Spitsbergen: Bellsund, Isfjorden, and Prins Karls Forland [108] |
| 60. | *Isobactrus levii* (Viets, 1927) | Atlantic Ocean, Arctic | Spitsbergen: Grenfjordbreen [109] |
| 61. | *Rhombognathus spinipes* (Viets, 1933) | Atlantic Ocean, Arctic | Spitsbergen: Grenfjordbreen [109] |
| 62. | *Rhombognathus subtilis* Bartsch, 1975 | Atlantic Ocean, Arctic | Spitsbergen [45] |
| 63. | *Thalassarachna coeca* (Trouessart, 1902) | Arctic | Hopen [107] |
| 64. | *T. princeps* (Trouessart, 1902) | Arctic | Hopen [107] |
| 65. | *Triophtydeus pinicolus* (Oudemans, 1929) | Holarctic, Australasian | Spitsbergen: Magdalenebreen [103] |
| No. | Taxon | Distribution | Localities |
|-----|-------|--------------|------------|
| 66. | *Tydeidae*<br>*Tydeus langei* Thor, 1934 | Arctic | Spitsbergen: “Großer Trichter”, Magdalenefjorden, Tempelfjorden [103]; Bjørnøya: Engelskelva, Fugleodden [91,110]; Spitsbergen: “Großer Trichter”, Hanaskogdalen, Hiorthhamn, Longyearbyen, Magdalenefjorden, Tempelfjorden [91,103] |
| 67. | *T. svalbardensis* Thor, 1932 | Arctic | Spitsbergen: “Großer Trichter”, Magdalenefjorden, Tempelfjorden [103]; Svalbard [47] |
| 68. | *Iolinidae*<br>*Tydaeolus globifer* (Thor, 1931) | Arctic | Spitsbergen: “Großer Trichter”, Magdalenefjorden, Tempelfjorden [103]; Svalbard [47] |
| 69. | *T. tenuiclaviger* (Thor, 1931) | Palearctic | Spitsbergen: Tempelfjorden [103]; Svalbard [47] |
| 70. | *Microtydeus constans* Thor, 1931 | Arctic | Spitsbergen: “Großer Trichter”, Magdalenefjorden [103]; Svalbard [47] |
| 71. | *Sperchontidae*<br>*Sperchon breviceps* (Koenike, 1895) | Holarctic | Bjørnøya: Ellasjøen, Engelskelva, Hellevatnet, Mosevatnet, Stevatnet [91,99,111] |
| 72. | *Trombidiidae*<br>*Podothrombium bicolor* (Hermann, 1804) | Palearctic | Spitsbergen: Hiorthhamn [91] |
| 73. | *P. curtipes* (Thor, 1900) | Holarctic | Spitsbergen: Hiorthhamn [91] |
| 74. | *P. svalbardense* Oudemans, 1930 | Arctic | Spitsbergen: Hiorthhamn [91] |
| 75. | *Syringophilidae*<br>*Chenophila nanseni* Skoracki & Zawierucha 2016 | Arctic | Spitsbergen: Nissenfjella [57] |
| 76. | *Stigmaeidae*<br>*Eustigmaeus oudemansi* (Thor, 1930) | Arctic | Spitsbergen: Hiorthhamn [91] |
| 77. | *E. pulchellus* (Thor, 1930) | Arctic | Spitsbergen: Hiorthhamn [91] |
| 78. | *Tetranychidae*<br>*Bryobia borealis* Oudemans, 1930 | Holarctic | Spitsbergen: “Großer Trichter”, Tempelfjorden [103]; Svalbard [106,112]; Bjørnøya [105]; Spitsbergen: Salmon Lake at Dirksbukta, south side of Reinsdyrfjøya [7] |
| 79. | *B. praetiosa* C.L. Koch 1836 | Cosmopolitan | Spitsbergen: Templefjorden [103] |
| 80. | *Pygmephoridae*<br>*Kerdabania arctica* (Thor, 1934) | Arctic | Spitsbergen: Templefjorden [103] |

**SARCOPTIFORMES**

Endeostigmata
Table 1. Cont.

| No. | Taxon                                      | Distribution | Localities                                                                 |
|-----|--------------------------------------------|--------------|-----------------------------------------------------------------------------|
|     | Nanorchestidae                             |              |                                                                             |
| 81. | *Nanorchestes arboreger* (Berlese, 1904)   | Palearctic   | Spitsbergen: “Großer Trichter”, Hiorthhamn, Magdalenefjorden [91,103]       |
|     | Alicorhagiidae                             |              |                                                                             |
| 82. | *Alicorhagia clavipilus* (Thor, 1931)      | Arctic       | Spitsbergen: “Großer Trichter”, Hiorthhamn [103,113]                       |
| 83. | *A. plumipilis* (Thor, 1931)               | Palearctic   | Spitsbergen: “Großer Trichter” [103]                                      |
|     | Eriophyidae                                |              |                                                                             |
| 84. | *Acera saxifragae* (Rostrup, 1900)         | Holartic     | Spitsbergen: Hornsund [67]                                                 |
| 85. | *Cecidophyes siedleckii* Kiedrowicz, Szydlo & Skoracka, 2016 *†* | Holartic     | Spitsbergen: Hornsund [67]                                                 |
|     | Oribatida                                  |              |                                                                             |
| 86. | *Brachycalthonia laetepictus* Berlese, 1910| Palearctic   | Spitsbergen: Magdalenefjorden, Pyramiden [20,103], Bjornaya [83], Spitsbergen: Barentsburg, Longyearbyen, Recherchefjorden [14,114] |
| 87. | *Eobrachychthonius borealis* Forsslund, 1942| Holartic     | Danskoya: Virgohamna [115], Spitsbergen: Bockfjorden, Fivelflyene, Flathuken, “Großer Trichter”, Helvetiadalen, Hiorthhamn, Isdammnen, Longyearbyen, Magdalenefjorden, Reinsdyrfla, Sassenadalen, Sven Olssonodden, Sargattet [91,103,115,116] |
| 88. | *E. latior* (Berlese, 1910)                | Holartic     | Edgesøya: Kapp Lee, Russebukta [8]                                         |
| 89. | *E. oudemansi* Hammen, 1952                | Holartic, Neotropical, Indomalayan, Antarctic | Spitsbergen: Longyearbyen, Pyramiden, Recherchefjorden [20,114,116] |
| 90. | *Liochthonius alpestris* (Forsslund, 1958) | Palearctic   | Spitsbergen: Hornsund [88]                                                 |
| 91. | *L. brevis* (Michael, 1888)               | Holartic     | Spitsbergen: Adventdalen, Barentsburg, Fivelflyene, Flathuken, Hiorthhamn, Isdammnen, Reinsdyrfla, Worsleyneset [19,91,115,116] |
| 92. | *L. clavatus* (Forsslund, 1942)            | Palearctic   | Edgesøya: Blåbukta, Kapp Heuglin [8]                                       |
| 93. | *L. lapponicus* (Trågårdh, 1910)          | Holartic     | Bjornaya [83], Spitsbergen: Barentsburg, Hornsund,                       |
| 94. | *L. muscorum* Forsslund, 1964              | Palearctic   | Longyearbyen, Midtre Lovénbreen, Ny-Ålesund, Recherchefjorden [10,14,15,88,114,117,118] |
| 95. | *L. neglectus* Moritz, 1976                | Palearctic   | Spitsbergen: Barentsburg, Hornsund [19,88]                                |
|     |                                            |              | Spitsbergen: Kongsfjorden [119]; based on Hodkinson’s material stored in Liverpool [120] |
| No. | Taxon                                      | Distribution | Localities                                                                 |
|-----|-------------------------------------------|--------------|----------------------------------------------------------------------------|
| 96. | *L. sellnicki* (Thor, 1930)               | Holarctic    | Bjørnøya [83]; Hopen: Koeoedodden, Hopen radio [86]; Spitsbergen: Barentsburg, "Großer Trichter", Hiorthhamn, Longyearbyen, Magdalenefjorden, Petuniabukta, Pyramiden, Recherchefjorden, Vestpynten [14,19,20,22,91,103,105,114] |
| 97. | *L. strenzkei* Forsslund, 1963            | Holarctic    | Edgeøya: Blåbukta, Kapp Heuglin, Kapp Lee, Negerdalen, Russebukta [8]      |
| 98. | *L. tuxeni* (Forsslund, 1957)             | Palaearctic  | Spitsbergen: Midtre Lovénbreen [10]                                        |
| 99. | *Neoliochthonius piluliferus* (Forsslund, 1942) | Holarctic    | Edgesøya: Kapp Heuglin [8]                                                 |
| 100. |                                            |              |                                                                            |
| 101. | *Eniochthonius minutissimus* (Berlese, 1903) | Cosmopolitan |                                                                            |
| 102. |                                            |              |                                                                            |
| 103. |                                            |              |                                                                            |
| 104. | *C. borealis* (Thorell, 1871)             | Holarctic    | Danskøya: Virgohamna [115]; Spitsbergen: Barentsburg, Hornsund, Isfjorden, Longyearbyen, Recherchefjorden [14,16,102,114,115,130] |
| 105. | *C. dictyna* Collof, 1993                 | Holarctic    | Svalbard [71]; Spitsbergen: Midtre Lovénbreen [10]                         |
| 106. | *C. foceolata* Hammer, 1955               | Holarctic    | Bjørnøya [83]; Edgesøya: Blåbukta, Kapp Heuglin, Negerdalen, Russebukta [8]; Hopen: Hopen radio, Koeoedodden [86]; Spitsbergen: Aldegondabreen, Grenfjordenbreen, Hornsund, Kærstrand, Krudtensheia, Midtre Lovénbreen [10,88,109,133]; Bjørnøya [91]; Edgesøya: Diskobukta, Kapp Lee, Russebukta [8]; Spitsbergen: Barentsburg, "Großer Trichter", Hiorthhamn, Hötrthfjellet, Longyearbyen, Magdalenefjorden, Kongsfjorden, Reinsdyrfjøya, Recherchefjorden, Vestpynten, Petuniabukta, Pyramiden [20,22,91,103,105,114,115,132] |
| 107. | *C. horrida* (Hermann, 1804)              | Holarctic    | Svalbard [71]                                                              |
| 108. | *C. incensata* (Michael, 1888)            | Palaeartic   | Svalbard [71]                                                              |
| 109. | *C. lapponica* (Trägårdh, 1910)          | Holarctic    | Spitsbergen: Barentsburg, Hornsund, Longyearbyen [14,16,88]                |
| 110. | *C. spinifer* (C.L. Koch, 1836)           | Holarctic    | Spitsbergen: Tempelfjorden [103]                                           |
| 111. | *Capillothrus capitatus* (Berlese, 1914)   | Palaeartic   | Spitsbergen: Arctowskifjellet [115]                                        |
| 112. | *Platybothrus peltifer* (C.L. Koch, 1839)  | Holarctic    | Spitsbergen: Recherchefjorden, Sassendalen [114,115]                        |
| 113. | *Punctatus* (L. Koch, 1879)               | Palaeartic   | Spitsbergen: Barentsburg, Grenfjordenbreen, Isfjorden, Longyearbyen, Petuniabukta, Vestpynten [13,14,16,22]  |
| No. | Taxon | Distribution | Localities |
|-----|-------|--------------|------------|
| 114. | *Hermannia reticulata* Thorell, 1871 | Holarctic | Bjørnøya: Fugleodden, Tunheim [83,91,105,133]; Edgøøya: Blåbukta, Russelbukta [134]; Prins Karls Forland: Silene Hill [99,101]; Spitsbergen: Barentsburg, Bellsund, Endalen, “Großer Trichter”, Kongsfjorden, Longyearbyen, Magdalenefjorden, Midtine Lovénbreen, Ny-Ålesund, Observasjonsholmen, Recherchefjorden, Petuniabukta, Tempelfjorden, Vestpynten [10,12,15,22,91,102,103,114,121–123,125,129,132–134]; Bjørnøya [83,105]; Edgøøya: Kapp Lee [135]; Prins Karls Forland: Fuglehøken fyr [135]; Spitsbergen: Kapp Laila, Petuniabukta [135] |
| 115. | *H. scabra* (L. Koch, 1879) | Holarctic | Bjørnøya [83,105]; Edgeøya: Kapp Lee [135]; Prins Karls Forland: Fuglehøken fyr [135]; Spitsbergen: Kapp Laila, Petuniabukta [135] |
| 116. | *Malaconothrus monodactylus* (Michael, 1888) | Palaearctic | Spitsbergen: Barentsburg, Gronfjordenbreen, Isfjorden, Longyearbyen [13,14,16] |
| 117. | *Nanhermannia sellnicki* Forsslund, 1958 | Palearctic | Spitsbergen: Barentsburg, Longyearbyen [14] |
| 118. | *Nothus palustris* C.L. Koch, 1839 | Holarctic | Spitsbergen: Barentsburg, Gronfjordenbreen, Isfjorden, Longyearbyen [13,14,16] |
| 119. | *Damaeus onustus* (C.L. Koch, 1844) | Palaearctic, Afrotropical | Spitsbergen: Barentsburg, Longyearbyen [16] |
| 120. | *Kurstidamaeus arcticus* Miko & Monson, 2013 | Svalbard | Bjørnøya [83]; Spitsbergen [72] |
| 121. | *Subbelba montana* (Kulczynski, 1902) | Palearctic | Bjørnøya: Austervåg [91] |
| 122. | *Ceratoppia bipilis* (Hermann, 1804) | Holarctic, Oriental, Neotropical | Prins Karls Forland: Silene Hill [99,101]; Spitsbergen: Kongsfjorden, Storholmen [7,12]; Bjørnøya: Tunheim [91]; Spitsbergen: Barentsburg, Bockfjorden, “Großer Trichter”, Gronfjordenbreen, Hiorthfjell, Hiorthhamn, Isdammen, Kolhaugen, Kongsfjorden, Longyearbyen, Magdalenefjorden, Recherchefjorden, Worseyneset [91,103,114,115,121–125,127] |
| 123. | *C. hoeli* Thor, 1930 | Arctic | Bjørnøya [83]; Edgøøya: Kapp Lee, Russelbukta [8]; Hopen: Hopen radio, Koeleodden [86]; Spitsbergen: Barentsburg, Hornsund, Longyearbyen, Petuniabukta, Pyramiden, Vestpynten [14–16,20,22,130] |
| 124. | *C. sphaerica* (L. Koch, 1879) | Palearctic | Bjørnøya [83]; Edgøøya: Kapp Lee, Russelbukta [8]; Hopen: Hopen radio, Koeleodden [86]; Spitsbergen: Barentsburg, Hornsund, Longyearbyen, Petuniabukta, Pyramiden, Vestpynten [14–16,20,22,130] |
| No. | Taxon                          | Distribution | Localities                                                                 |
|-----|-------------------------------|--------------|----------------------------------------------------------------------------|
| 125 | Carabodes labyrinthicus (Michael, 1879) | Holarctic    | Spitsbergen: Barentsburg, Longyearbyen [14]                              |
| 126 | C. marginatus (Michael, 1884) | Palearctic   | Spitsbergen: Barentsburg, Longyearbyen [16]                              |
| 127 | Autogneta kaisilai Karppinen, 1967 * | Arctic       | Spitsbergen: Biskayerhuken [115]                                        |
| 128 | Conchogneta dalecarlica (Forsslund, 1947) | Palearctic   | Spitsbergen: Midtre Lovénbreen [10]                                      |
| 129 | Dissorhina ornata (Oudemans, 1900) | Holarctic    | Bjørnøya: Fugleodden, Mossevatnet [91]; Spitsbergen: Adventdalen, Barentsburg, Grønfjordenbreen, Hornsund, Grønfjordenbreen, Stuphallet, Vestpynten, Worsleyset [13,14,16,19,22,115,121,136] |
| 130 | Lauroppia fallax (Paoli, 1908) | Holarctic, IndoMalayan, Australian, Neotropical | Spitsbergen: Magdalenefjorden [103]                                      |
| 131 | Microppia minus (Paoli, 1908) | Cosmopolitan | Spitsbergen: Hornsund [136]                                               |
| 132 | Moritzziella microdentata Gordeeva & Grishina, 1991 | Palearctic | Edgeøya: Negerdalene [8]; Spitsbergen: Barentsburg, Longyearbyen [14,16] |
| 133 | Moritzoppi splendens (C.L. Koch, 1841) | Holarctic | Edgeøya: Kapp Heuglin [8]; Spitsbergen: Barentsburg, “Großer Trichter”, Hanaskogdalen, Hiorthhann, Kongsfjord, Longyearbyen, Magdalenefjorden, Miadre Lovénbreen, Vestpynten [10,14,19,22,91,103,125] |
| 134 | M. unicarinata (Paoli, 1908) | Holarctic    | Spitsbergen: Adventdalen, Barentsburg, Grønfjordenbreen, Hornsund, Isdammen, Isfjorden, Kongsfjorden, Longyearbyen, Petuniabukta, Reinsdyrfylla, Worsleyset [13,14,16,19,22,115,121,123,136] |
| 135 | Opiella neerlandica (Oudemans, 1900) | Holarctic    | Edgeøya: Diskobukta, Kapp Lee, Russebukta [8]; Hopen: Hopen radio, Koefoedoddend [84]; Spitsbergen: Adventdalen, Arctowskifjellet, Barentsburg, Bockfjorden, Fivelfyene, Grønfjordenbreen, Hornsund, Isfjorden, Kolhaugen, Longyearbyen, Magdalenefjorden, Petuniabukta, Recherchefjorden, Reinsdyrfylla, Stuphallet, Vestpynten, Worsleyset [13,14,16,19,22,103,114,115,124,136,138] |
| 136 | O. nova (Oudemans, 1902) | Cosmopolitan |                                                                 |
| 137 | O. translamellata (Willmann, 1923) | Holarctic    |                                                                 |
| No. | Taxon | Distribution | Localities |
|-----|-------|--------------|------------|
| 138. | *Suctobelba hammerae* Krivolutsky, 1965 | Holarctic | Spitsbergen: Barentsburg, Grønfjordenbreen, Isfjorden, Longyearbyen [13,14,16] |
| 139. | *Suctobelba sarekensis* (Forsslund, 1941) | Holarctic | Spitsbergen: Adventdalen, Fivelflyene [115] |
| 140. | *S. subcornigera* (Forsslund, 1941) | Holarctic, Oriental, Australian | Spitsbergen: Barentsburg, Biskayerhuk, Grønfjordenbreen, Isfjorden, Longyearbyen, Reinsdyrflya, Worsleyneset [13,14,16,22,115] |
| 141. | *Tectocepheus alatus* Berlese, 1913 | Palearctic | Spitsbergen: Recherche fjorden [114] |
| 142. | *T. knuellei* Vanek, 1960 | Palearctic | Spitsbergen: Barentsburg, Longyearbyen [14,16] |
| 143. | *T. sarekensis* Trägårdh, 1910 | Palearctic | Spitsbergen: Adventdalen, Blomstrandhalvoya, Bockfjorden, Isdammen, Kongsfjorden, Reinsdyrflya, Worsleyneset [115] Bjørnøya [83]; Edgeoya: Diskobukta, Kapp Lee, Russbukta [8]; Spitsbergen: Barentsburg, Hiorthhamn, Kolhaugen, Kongsfjorden, Longyearbyen, Midtre Lovénbreen, Petuniabukta, Pyramiden, Vestpynten [10,14,16,19,20,22,103,105,124,125] |
| 144. | *T. velatus* (Michael, 1880) | Cosmopolitan | Bjørnøya: Engelskelva, Fugleoddten, Tunheim [83,88,99,101,103,105,132,133,139]; Lågøya: [7]; Prins Karls Forland: MacKenziedale, Richardsonlagoon almost to Carmichaelpynten [99,101]; Spitsbergen: Adventdalen, Barentsburg, Bockfjorden, Colesbukta, Grønfjordenbreen, Kolhaugen, Liefdefjorden, Nordenskiöld Land, Ny-Ålesund, Observasjonsholmen, Reinsdyrflya, Smoerenburg, Worsleyneset [7,12,91,102,109,115,124,132,133,140–145] |
| 145. | *Ameronothrus lineatus* (Thorell, 1871) * | Palaearctic | Spitsbergen: Hornsund [88] Bjørnøya [83] |
| 146. | *A. nidicola* Sitnikova, 1975 | Palaearctic | Spitsbergen: Recherche fjorden [114] |
| 147. | *A. nigrofemoratus* (L. Koch, 1879) | Palaearctic | Spitsbergen: Bockfjorden, Recherche fjorden [114,115] |
| 148. | *Micreremus brevipes* (Michael, 1888) | Palearctic | Spitsbergen: Recherche fjorden [114] |
| 149. | *Scutoverticidae* | Palearctic | Spitsbergen: Barentsburg, Grønfjordenbreen, Isfjorden, Longyearbyen, Vestpynten [13,14,16,22] |
| 150. | *Achipteria punctata* (Nicolet, 1855) | Holarctic | Spitsbergen: Barentsburg, Grønfjordenbreen, Isfjorden, Longyearbyen, Vestpynten [13,14,16,22] |
| No. | Taxon | Distribution | Localities |
|-----|-------|--------------|------------|
| 151. | **Tegoribatidae**<br>Scutozetes clavatosensillus Ermilov, Martens & Tolstikov, 2013 | Palearctic | Spitsbergen: Mosselbukta [146] |
| 152. | **Oribatella arctica** Thor, 1930 * | Holarctic | Edgeøya: Diskobukta, Kapp Lee [8,147]; Spitsbergen: Barentsburg, Hiorthhamn, Longyearbyen, Målardalen, Petuniabukta, Recherchefjorden [15,22,91,103,114] |
| 153. | **Oribatulidae**<br>Oribatula exilis (Nicolet, 1855) | Holarctic | Bjørnøya: Fugleodden, Mosevatnet, Tunheim [91]; Prins Karls Forland: Silene Hill [99,101]; Spitsbergen: Adventdalen, Barentsburg, Engelskhytta, Hanaskogdalen, Hiorthhamn, Isfjord radio, Longyearbyen [14,91] |
| 154. | O. tibialis (Nicolet, 1855) | Holarctic | Bjørnøya [83]; Edgeøya: Diskobukta, Kapp Lee, Russelbukta [8]; Spitsbergen: Barentsburg, Longyearbyen, Observasjonsholmen, Petuniabukta, Storholmen, Vestpynten [12,14,15,19,22] |
| 155. | O. venusta Berlese, 1908 | Holarctic | Bjørnøya [83]; Spitsbergen: Adventdalen, Fivelbyene, “Großer Trichter”, Longyearbyen, Magdalenefjorden, Recherchefjorden, Reinsdyrflya, Worsleyeneset [103,114,115] |
| 156. | Phauloppia lucorum (C.L. Koch, 1841) | Palearctic | Spitsbergen: Bellsund, Isfjorden [81,133] |
| 157. | **Scheloribatidae**<br>Liebstadia similis (Michael, 1888) | Holarctic, Indomalayan, Australian | Spitsbergen: Barentsburg, Grønfjordenbreen, Isfjorden, Longyearbyen [13,14,16] |
| 158. | **Ceratozetidae**<br>Ceratozetes spitsbergensis Thor, 1934 * | Palearctic | Edgeøya: Blåbukta, Kapp Heuglin, Nergerdal [8]; Kong Karls Land [148]; Spitsbergen: Arctowskij hellet, Barentsburg, “Großer Trichter”, Kolhaugen, Longyearbyen, Magdalenefjorden, Pyramiden, Reinsdyrflya, Worsleyeneset [14,20,103,115,124] |
Table 1. Cont.

| No.  | Taxon                                      | Distribution | Localities                                                                                       |
|------|--------------------------------------------|--------------|-----------------------------------------------------------------------------------------------|
| 159. | *Diapterobates notatus* (Thorell, 1871)    | Holarctic    | Bjørnøya: Fugleoddon, Tunheim [14–16,83,91,99,101,105,133]; Barentsøya [130]; Edgeøya: Blåbukta, Diskobukta, Kapp Heuglin, Kapp Lee, Nergendalen, Russebukta, Tjuvfjorden [8,146]; Hopen: Hopen radio, Kofoedoddon [86]; Prins Karls Forland: Fuglehuken, MacKenzie, Silene Hill [99,101,146]; Sofiaeya [146]; Spitsbergen: Adventfjorden, Barentsburg, Bellsund, Billefjorden, Blomstrandhalvøya, Bohemanneset, Dirkobukta, Endalen, Engelskhytta, “Großer Trichter”, Granfjorden, Hiorthfjellet, Hiorthhamn, Hornsund, Isfjorden, Kolhausen, Krykkjefjellet, Liefdefjorden, Longyearbyen, Magdaleneferd, Midtore, Lovénbrek, Osram Sarsfjellet, Petuniabukta, Recherchefjorden, Reinsdyl, Sven Olssonoddon, Storholmen, Vestpynten, Worsleyhavn [7,10,12,14–17,19,22,91,99,101–103,114,115,121–125,129,130,132,133,146,148] |
| 160. | *Edwardzetes edwardsi* (Nicolet, 1855)     | Holarctic    | Spitsbergen: Tempelfjorden; possibly from the North Cape [103] |
| 161. | *Fusozetes coulsoni* A. & S. Seniczak, 2020| Arctic       | Edgeøya: Negerland [9] |
| 162. | *Ingoribates gracilis* Sellnick, 1944      | Holarctic    | Spitsbergen: Kongsfjorden [119]; based on Hodkinson’s material stored in Liverpool [120] |
| 163. | *Oromurcia lucens* (L. Koch, 1879)         | Holarctic    | Barentsøya [130]; Spitsbergen: Vestpynten [22] |
| 164. | *Svalbardia paludicola* Thor, 1930          | Holarctic    | Spitsbergen: Hanaskogdalen, Hiorthhamn, Hornsund, Isfjorden, Reinsdyl, Ringorndalen, Sorkamp [91,139,146] |
| 165. | *Trichoribates berleset* Jacot, 1929       | Holarctic    | Spitsbergen: Hornsund [89] |
| 166. | *T. novus* (Sellnick, 1928)                | Holarctic    | Bjørnøya [83]; Spitsbergen: Recherchefjorden [114] |
| 167. | *T. setiger* (Tragardh, 1910)              | Palaearctic  | Spitsbergen [133] |
| 168. | *Chamobates birulai* (Kulczynski, 1902)    | Palaearctic  | Spitsbergen [88] |
| 169. | *C. borealis* (Tragardh, 1902)             | Palaearctic  | Spitsbergen [133] |
| 170. | *Mycobates bicornis* (Stenzke, 1954)       | Palaearctic  | Spitsbergen: Midtore, Lovénbrek [10] |
| 171. | *M. parmeliae* (Michael, 1884)             | Holarctic    | Spitsbergen: Barentsburg, Longyearbyen, Midtore, Lovénbrek [10,14,16] |
| No. | Taxon | Distribution | Localities |
|-----|-------|--------------|------------|
| 172. | *M. sarekensis* (Trägårdh, 1910) | Holarctic | Bjørnøya [91]; Edgeøya: Kapp Lee, Russebukta [8,149]; Spitsbergen: Adventdalen, Arctowskijfjellet, Bockfjorden, Engelskbytta, Fjortende Juliobukta, “Großer Trichter”, Hiorthfjellet, Hiorthhamn, Hornsund, Isdammen, Kongsfjorden, Longyearbyen, Magdalenefjorden, Moshelbukta, Recherchefjorden, Sassendalen, Signehamna, Storholmen, Sørkapp, Vestpynten [22,91,103,114,121,123,125,149] |
| 173. | *M. tridactylus* Willmann, 1929 | Holarctic | Spitsbergen: Barentsburg, Longyearbyen [14] |
| 174. | *Punctoribates punctum* (C.L. Koch, 1839) | Holarctic, Oriental, Australian | Spitsbergen: Barentsburg, Longyearbyen, Petuniabukta [14,16,22] |
| 175. | *Pergalumna nervosa* (Berlese, 1914) | Holarctic | Spitsbergen: Hornsund [136] |
| 176. | *Sancassania mycophagus* (Méglin, 1874) | Cosmopolitan | Spitsbergen: Hornsund [91] |
| 177. | Alloptidae | Arctic | Spitsbergen: Ny-Ålesund [74] |
| 178. | Avenzoariidae | Arctic, Neotropical, Australian, Afrotropical | Spitsbergen: Ny-Ålesund [74] |

Note: *—new to science; **—redescription on the base of material from Svalbard; †—so far found only on Svalbard. ¹ [150] proposed the genus *Neoprotereunetes* for those species of “Protereunetes” that remained in the Eupodidae after the type specimen of *Protereunetes (P. agilis) Berlese, 1923* was transferred to *Ereynetes* [68]. It is implied that this new genus includes *Protereunetes borneri* Thor, 1934, but the combination was not published. ² Identity and generic affiliation of this species is questionable [46]; possible record from Greenland with inconclusive identification [48]. ³ Species not included in [50], *species inquienda*. ⁴ Inadequately described, not included in key to species [61]. ⁵ Although specimens from Svalbard were apparently examined, this species was not confirmed from Svalbard [65].
Figure 2. Diversity of the mite families in Svalbard: (A) Mesostigmata; (B) Trombidiformes; (C) Sarcoptiformes. The number of species occurring in Svalbard is presented on bars. No figure was made for the Ixodida, which is represented in Svalbard by one family only.

More than a half of the Mesostigmata species known from Svalbard have been recorded there only once (Table 2). The majority of these are recent findings, but four were reported only in the first half of the last century, including *Arctoseius laterincisus*, which has an Arctic distribution. Four other records come from the second half of the last century, including another species with an Arctic distribution—*Halolaelaps gerlachi*.
Table 2. Mite species found on Svalbard only once (or by the same author at a similar time).

| Until 1950 | 1951–2000 | After 2001 | Reference |
|------------|-----------|------------|-----------|
| **Mesostigmata** | | | |
| *U. acuminatus* | *Z. curious* | [81] | |
| *Z. triangularis* | | [91] | |
| *P. (A.) insertus* | *V. immanis* | [18] | |
| | *V. remberti* | [18] | |
| | *D. foveolatus* | [20] | |
| | *H. coulsoni* * | [93] | |
| *H. gerlachi* * | | [94] | |
| *G. borealis* | *M. muscaedomesticae* | [84] | |
| *A. cetratus* | | [96] | |
| *A. laterincisus* * | | [91] | |
| *A. ornatus* | *N. grumantensis* * | [28] | |
| *L. hilaris* | | [100] | |
| **Trombidiformes** | | | |
| *B. semiscutata* * | | [91,103] | |
| *N. capillatus* | | [91] | |
| *C. croceus* | | [103] | |
| | *A. saxifragae* | | [67] |
| *P. borneri* * | | [103] | |
| *P. maior* | | [102] | |
| *C. clavifrons* | | [91,103] | |
| *B. alberti* * | | [107] | |
| *C. poucheti* * | | [81] | |
| *C. reticulatus* * | | [107] | |
| *C. richardi* * | | [107] | |
| | *H. subterraneus* | | [45] |
| | *H. subcrispus* | | [45] |
| *H. borealis* * | | [81] | |
| | *I. levis* | | [109] |
| | *R. spinipes* | | [109] |
| | *R. subtilis* | | [45] |
| | *T. coeca* | | [107] |
| | *T. princeps* | | [107] |
| | *T. globifer* | | [103] |
| | *T. tenuiclaviger* * | | [103] |
| | *M. constans* * | | [103] |
| | *T. langei* * | | [103] |
| | *P. bicolor* | | [91] |
| | *P. curtipalpe* * | | [91] |
| | *P. svalbardense* * | | [91] |
| | *E. oudemansi* * | | [91] |
| | *E. pulchellus* * | | [91] |
| | *C. nanseni* * | | [57] |
| | *K. arctica* | | [103] |
Most of the Mesostigma species known from Svalbard have a Palaearctic distribution (Figure 3). Arctic species are also abundant and comprise nearly 40% of Svalbard’s total mesostigmatic diversity, while Holarctic species are less numerous. Five species have so far been found only in Svalbard (Table 1), including recent records (Halolaelaps coulsoni and Neoseiulus grumantensis) and historic records (Halolaelaps gerlachi, Arctoseius laterincisus and Neoseiulus magnanalis). Mesostigma have been recorded from five islands in the Svalbard archipelago (Figure 1). Although most of the species are known from Spitsbergen, Saprosecans baloghi Karg, 1964, is known only from Edgeøya and Zeronopsis muestairi (Schweizer, 1949) has been found exclusively on Bjørnøya (Table 1).

### Table 2. Cont.

| Species                  | Until 1950 | 1951–2000 | After 2001 | Reference |
|--------------------------|------------|-----------|------------|-----------|
| **Sarcoptiformes**       |            |           |            |           |
| *A. clavipilus*          |            |           |            | [103,113] |
| *A. plumipilis*          |            |           |            | [103]     |
| *L. alpestris*           |            |           |            | [67]      |
| *L. clavatus*            |            |           |            | [88]      |
| *L. neglectus*           |            |           |            | [119]     |
| *L. tuxeni*              |            |           |            | [10]      |
| *C. spinifer*            |            |           |            | [103]     |
| *C. capillatus*          |            |           |            | [115]     |
| *N. sellnicki*           |            |           |            | [14]      |
| *D. onustus*             |            |           |            | [16]      |
| *S. montana*             |            |           |            | [91]      |
| *C. labyrinthicus*       |            |           |            | [14]      |
| *C. marginatus*          |            |           |            | [16]      |
| *A. kaisilai*            |            |           |            | [115]     |
| *C. dalecarlica*         |            |           |            | [10]      |
| *L. fallax*              |            |           |            | [103]     |
| *M. minus*               |            |           |            | [136]     |
| *S. sarekensis*          |            |           |            | [115]     |
| *T. alatus*              |            |           |            | [114]     |
| *T. sarekensis*          |            |           |            | [115]     |
| *A. nidicola*            |            |           |            | [88]      |
| *A. nigrofemoratus*      |            |           |            | [83]      |
| *S. clavatocensillus*    |            |           |            | [146]     |
| *E. edwardsi*            |            |           |            | [103]     |
| *F. coulsoni*            |            |           |            | [9]       |
| *I. gracilis*            |            |           |            | [119]     |
| *T. novus*               |            |           |            | [88]      |
| *C. birulai*             |            |           |            | [133]     |
| *C. borealis*            |            |           |            | [88]      |
| *P. nervosa*             |            |           |            | [136]     |
| *M. bicornis*            |            |           |            | [10]      |
| *S. mycophagus*          |            |           |            | [91]      |
| *A. stercorarii*         |            |           |            | [74]      |
| *Z. isolata*             |            |           |            | [74]      |

Note: *—new to science.
3.3. Trombidiformes

The order Trombidiformes is represented in Svalbard only by the suborder Prostigmata with 17 families and 43 species recorded. The most diverse are the marine Halacaridae (12 spp.), followed by the terrestrial Bdellidae (7 spp.); these two families together comprise 44% of all the Trombidiformes known from Svalbard (Figure 1).

A strikingly large number of new species (19) have been described from Svalbard; i.e., nearly half of all Trombidiformes known from this archipelago: *Bdella semiscutata* Thor, 1930; *Neoprotereunetes borneri* (Thor, 1934); *Rhagidia gelida* Thorell, 1872; *Bradyagaue alberti* (Trouessart, 1902); *Copidognathus*
poucheti (Trouessart, 1893); C. reticulatus (Trouessart, 1893); C. richardi (Trouessart, 1902); Halacarus borealis Trouessart, 1893; Thalassarachna coeca (Trouessart, 1902); T. princeps (Trouessart, 1902); T. langei Thor, 1934; T. svalbardensis Thor, 1932; Podothrombium curtipalpe (Thor, 1900); P. svalbardense Oudemans, 1930; Chenopilia nanseni Skoracki & Zawierucha, 2016; Eustigmaeus oudemansi (Thor, 1930); E. pulchellus (Thor, 1930); Bryobia borealis Oudemans, 1930; and Kerdabania arctica (Thor, 1934). Moreover, 85% of the new species described from Svalbard have been recorded only once and mostly from early studies of the mite fauna (Table 2).

Species with wide geographical distributions predominate; cosmopolitan and Holarctic species, and those present in at least two zoogeographic regions (except that the Holarctic is treated as one unit) together comprise 66% of all the Trombidiformes (Figure 2). Arctic species are also abundant representing 27% of the recorded species, while the fewest number of species have Palaeartic distributions. There are seven species which have only been recorded from Svalbard (Table 1), but these are mostly single old records of Sig Thor, including Tydeus langei, T. svalbardensis, Podothrombium svalbardense, Eustigmaeus oudemansi, E. pulchellus, and Kerdabania arctica. The one exception is the recently described Chenopilia nanseni.

Trombidiformes have been found on five islands/island groups, predominantly on Spitsbergen (40 species), with others collected from Bjørnøya (11), Prins Karls Forland (6), Hopen (4), and a single species on the small islands of the Hinlopenstretet. A large number of species (27) have been found exclusively on Spitsbergen, one species [Sperchon brevirostris (Koenike, 1895)] only on Bjørnøya and two others (Thalassarachna coeca and T. princeps) only on Hopen (Table 1).

3.4. Sarcoptiformes

In Svalbard, 98 species of Sarcoptiformes from two suborders (Endeostigmata with 5 species and Oribatida with 93 species) have been recorded (Table 1). They represent 33 families; the richest in species is the Brachychthoniidae (14 spp.), followed by the Crotoniidae (12 spp.), Ceratozetidae (10 spp.), Oppiidae (9 spp.), and Punctoribatidae (5 spp.). Together, these five families comprise 51% of the species diversity of Sarcoptiformes in Svalbard (Figure 1). Some families are represented by only 1–4 species, yet this constitutes a significant share of their known global diversity. For example, 22% of the species belonging to the endeostigmatid family Alicorhagiidae occur in Svalbard. The oribatid families Eniochthoniidae, Peloppiidae and Tectocepheidae are also represented by large proportions of their total known species diversity, with 17%, 27%, and 24%, respectively.

Sixteen new species of Sarcoptiformes have been described from Svalbard: Alicorhagia clavipilus (Thor, 1931); A. plumipilis (Thor, 1931); Cecidophyes siedleckii Kiedrowicz, Szydlo & Skoracka, 2016; Liochthonius sellnicki (Thor, 1930); Camisia borealis (Thorell, 1871); Hermannia reticulata Thorell, 1871; Kunstidamaeus arcticus Miko & Monson, 2013; Ceratoppia hoeli Thor, 1930; Autogneta kaisilai Karppinen, 1967; Ameronothrus lineatus (Thorell, 1871); Oribatella arctica Thorell, 1930; Ceratozetes spitsbergensis Thor, 1934; Diapterobates notatus (Thorell, 1871); Fuscozetes coulsoni A. & S. Seniczak, 2020; Svalbardia paludicola Thor, 1930; and Chamobates birulai (Kulczyński, 1902).

Species with wide geographic ranges together form 58% (cosmopolitan, 5%; Holarctic, 42%; and those found in at least two regions, 11%) of the sarcoptiform species (Figure 2). Species with a Palaeartic distribution also make up a substantial proportion (33%), with the remaining species having an Arctic distribution. Two of these Arctic species have only been found in the north of Spitsbergen: Autogneta kaisilai in Biskayerhuken and Scutozetes clavatosensillus Ermilov, Martens & Tolstikov, 2013, in Mosselbukta; and Fuscozetes coulsoni exclusively on Edgeøya (Table 1, Figure 3). Three species have been recorded only from Svalbard and these are all recently described new species (Table 1).

Sarcoptiformes have been recorded from ten islands in the Svalbard archipelago, but not on Nordaustlandet. The most commonly collected species is Diapterobates notatus (Table 1) found on seven islands and at nearly all collecting localities. Five species [Camisia foveolata Hammer, 1955; Hermannia reticulata, H. scabra (L. Koch, 1879); Ceratoppia sphaerica (L. Koch, 1879); and Ameronothrus lineatus (Thorell, 1871)] have been found on four islands and another seven other species [Camisia horrida...
(Hermann, 1804); Mycobates sarekensis (Trägårdh, 1910); Ceratozetes spitsbergensis; Oppiella translamellata (Willmann, 1923); Tectocepheus velatus (Michael, 1880); Oribatula exilis (Nicolet, 1855); and O. tibialis (Nicolet, 1855) on three islands. All of these species also have a wider distribution on Spitsbergen (Table 1, Figure 3).

Some species have been found exclusively on one island (Table 1), including 57 found only on Spitsbergen, four [Liochthonius clavatus (Forsslund, 1942); L. strenzkei Forsslund, 1963; Neoliochthonius piluliferus (Forsslund, 1942); and Fuscozetes coulsoni] on Edgeøya, and two [Subbelba montana (Kulczynski, 1902) and Ameronothrus nigrofemoratus (L. Koch, 1879)] from Bjørnøya.

Approximately one third of the sarcoptiform species have been recorded in Svalbard only once (Table 2). Seven of them were found in the first half of the last century and, 12 others, in the second half of the last century, including the descriptions of four new species.

4. Discussion

The acarofauna of the Svalbard archipelago is diverse with 178 recorded species comprising one Ixodida, 36 Mesostigmata, 43 Trombidiformes, and 98 Sarcoptiformes. However, compared with other regions of the Arctic (Alaska, Greenland, Iceland, and Taimyr), the species diversity is lower [151]. This paucity is likely to be explained by a combination of the small area of Svalbard (60% covered by permanent snow or glaciers) [4], the greater geographic isolation, and in some cases, the more northerly locality and harsher climate. As an example, from Iceland there are 428 species of mites known, with eight Ixodida, 131 Mesostigmata, 101 Trombidiformes, and 188 Sarcoptiformes [151–153]. Although Iceland has an area only 1.5 times greater than Svalbard, the island lies at a lower latitude (between 63° and 66° north latitude), glaciers cover only 11% of its area, and it lies in the path of the North Atlantic Current, which results in a more ameliorated climate. The diversity of mites in Svalbard is also much poorer in comparison to mainland Norway: Ixodida comprise 8% here with Mesostigmata—15%, Trombidiformes—13%, and Sarcoptiformes—30% [154–157]. However, these differences are not unexpected considering that the Svalbard archipelago is situated 900 km from the northern border of mainland Norway and has an area of only one fifth of that of mainland Norway [158].

The geographical isolation of islands, as a rule, results in reduced biodiversity [159], but, on the other hand, nurtures unique endemic species [160]. Svalbard has a unique flora and fauna, including endemic invertebrates: three rotifers, four tardigrades, and two aphids [86]. Fifteen mite species have been found exclusively in Svalbard, six of them being recent observations. The remaining are single historic records (i.e., from the first half of the last century) and it is consequently uncertain if any of these are endemic to Svalbard or the result of taxonomic confusion. Finding and studying the types or neotypes in Svalbard, along with more extensive sampling in the Arctic and including molecular studies, could help resolve this question.

Nevertheless, the Svalbard acarofauna is unique due to its specific Arctic elements. Amongst the Svalbard Mesostigmata in particular there are many species with an Arctic distribution (which make up nearly 40% of this group) and are similar to that observed on Greenland [151]. By contrast, the Sarcoptiformes in Svalbard are predominated by species with wide geographical ranges extending beyond the Arctic, as also seen with the Sarcoptiformes species known from Greenland [151] and northern Russia [161]. This difference between the two orders may be explained by the younger geological age of the Mesostigmata and their faster evolution rate [162]. Similarly, the Trombidiformes, which are also an ancient group [163], are dominated in Svalbard by species with wide geographic distributions. Nonetheless, Arctic species seem to be abundant among the Trombidiformes of Svalbard, comprising 27% of the species recorded, but these data should be treated with caution because they are mostly based on historic records that need to be confirmed.

Another characteristic feature of the Svalbard acarofauna is the large number of species new to science described from this region—they form approximately 25% of all mite species known from Svalbard. Seven of these species belong to the Mesostigmata, 19 to Trombidiformes, and 16 to
Sarcoptiformes. However, many of these new species were found only once and early in the study of the mite fauna of Svalbard. These species include one mesostigmatid species, 18 Trombidiformes species (i.e., 90% of all new species from this group), and two Sarcoptiformes species. Confirming these identifications is complicated by outmoded descriptions, incomplete, or too general drawings, and by the unavailability of most type material. These species require special attention in future studies. They are possibly rare or have been wrongly identified but the possibility cannot be excluded that they have disappeared from Svalbard due to environmental changes or that they were introduced and their populations have not established in Svalbard.

Out of 36 mite species found in Svalbard only once by early workers, the majority of species (24) were collected by Sig Thor, including one new species of Mesostigmata, eight new species of Trombidiformes, and two new species of Sarcoptiformes (Table 2). Despite the widespread belief that the collection of Thor along with all his valuable type material was destroyed in accordance with Thor’s wishes (see, e.g., remark 2 on page 1308 in [148]), this collection exists and is kept at the Natural History Museum in Oslo, Norway [164]. However, it is in a very poor condition and it is not certain whether the Svalbard material is in a suitable condition for re-examination.

Fortunately, some of Thor’s species have been found by later sampling campaigns and redescribed, for instance, *Antennoseius* (*Vitzthumia*) *oudemansi*, *Neoseiulus magnanalis*, *Proctolaelaps parvanalis*, and the specimens obtained deposited in zoological collections as neotypes [28,79]. In addition, six new species of mites have been found recently in Svalbard, including two Mesostigmata—*Neoseiulus grumantensis* and *Halolaelaps coulsoni* [28,93], one Trombidiformes—*Chenophila nanseni* [57], and three Sarcoptiformes—*Cecidophyes siedleckii*, *Kunstidamaeus arcticus*, and *Fuscozetes coulsoni* [9,67,72].

Recently, the first species of Ixodida, the seabird tick (*Ixodes uriae*), was discovered in Svalbard [76–78]. This tick is a major parasite of seabirds breeding at high latitudes and has the most extensive geographical distribution of all tick species [23], being also common throughout mainland Norway [165]. Its increasing occurrence in Svalbard may be related to warming winters (the tick overwinters at the breeding sites of the seabirds) [78] as was similarly observed in Iceland with another tick species, *I. ricinus* Linnaeus, 1758, and which has become more common in recent years [153].

Studies conducted during the past 20 years have also added 16 species of Mesostigmata [8,18,20,27,28,30,85,92,93,95,98,166] and 36 species of Sarcoptiformes to the Svalbard fauna [8–10,67,71,72,74,146,167]. This indicates that despite the relatively long history of mite studies for a region in the Arctic, our knowledge remains surprisingly poor. It is striking, however, that the Trombidiformes have been much less studied in Svalbard than other mite groups (Table 1). The reference list presented here includes only 18 papers referring to the Trombidiformes (vs. 72 papers on Sarcoptiformes and 34 on Mesostigmata), most of which were published at the end of the 19th and first half of the 20th centuries. Only three come from the present century. Therefore, it is clear that in future studies this group in particular should receive more attention.

There are also some species in Svalbard that have extraordinary disjunct distribution patterns: they occupy mainly the Arctic and parts of the subarctic regions, but are also found in some distant localities, in harsh conditions. One example is an oribatid species, *Ceratozetes spitsbergensis*, which has been assumed to be an Arctic species, present in Svalbard, Alaska [148], northern Canada [168,169] and the Nordic Arctic of the Russian Far East [148,170], but was found also in the Altai Mountains in Mongolia, at an altitude of 2800–3200 m a.s.l. [171] and in the Alps in Austria, at an altitude of 3300 m a.s.l. [172]. Since it was not found at lower elevations and/or lower latitudes, its presence in the Alps was explained by one of these theories: relict distribution [a cold-adapted species that was widely distributed in Europe during the Last Glacial Maximum (LGM), but when conditions became warmer it retreated to very restricted areas at high altitudes], or the nunatak hypothesis (survival of species on ice-free refuges) [172]. Some studies suggest that parts of Svalbard, e.g., Amsterdamøya (north-west of Svalbard), remained ice-free during the LGM [173]. It is thus possible that some invertebrates survived the LGM *in situ* in these glacial refugia, although, due to the harsh conditions prevailing over an
extended period of time, it seems likely that most biota could probably not survive on nunataks [86]. Another oribatid mite with an interesting distribution is *Scutozetes clavatosensillus*, which has been found only in Svalbard and in Nepal (Dhaulagiri massif, 3200–3600 m a.s.l.); its distribution may also be related to glacial history. Similarly to *S. clavatosensillus*, the mesostigmatic species, *Paragamasus (Aclerogamasus) insertus*, may also be a glacial relict since it is known only from the Gory Stolowe Mtns., Poland [174,175], where it occurred in rock crevices in very extreme conditions with long-lasting snow cover, and recently collected in Svalbard [18].

The composition of the present acarofauna of Svalbard likely results mostly from postglacial immigration [86]. The mites, being wingless, have rather low dispersal abilities. However, phoresy with migrating birds [13–17] or insects [18,95], and transport on driftwood or even direct dispersal in or on seawater with ocean currents [11], are possible dispersal pathways from the mainland to, or between, remote islands such as the Svalbard archipelago. Humans may also play a role in the dispersal of mites; as with the import of fertile agricultural soils transported from southern Russia and contemporary Ukraine to the Russian settlements on Spitsbergen (Barentsburg and Pyramiden) to enrich the soils of the greenhouses and grass lawns [18,19]. Mite communities in such transformed microhabitats differ noticeably from those of the adjacent Arctic tundra. Moreover, manure from abandoned cow sheds provided specific ameliorated environmental conditions enabling the survival of terrestrial invertebrate species not yet recorded elsewhere in Svalbard [18–20]. Introduction of new species to islands can be deleterious since the island communities may be disrupted, often resulting in the extinction of their endemic species [176–178].

Reconstructing the colonization of Svalbard after the LGM may be attempted by observing primary succession before retreating glaciers. For example, at the Midtren Lovén glacier foreland, two oribatid species, *Camisia foveolata* and *Tectocepheus velatus*, were the first colonizers. Mesostigmata appeared later, *Proctolaelaps parvunalis* being the first species recorded at this glacier foreland [10]. All these species are widely distributed in different parts of the archipelago (see Table 1). *Tectocepheus velatus* was also the earliest colonizer on a glacier foreland in southern Norway [179], while *Camisia foveolata* was one of the first colonizers on geothermally active lava fields in Iceland [180]. Oribatida are mainly saprophagous but species that are fungivores, bacteriovores, algivores, or omnivores, such as *T. velatus*, can find the appropriate food on seemingly baren ground [181]. In turn, the development of the first animal communities provides prey to the predatory Mesostigmata.

As shown in the present review, acarological studies of Svalbard are heavily geographically biased since most sampling has been carried out on the largest island—Spitsbergen; 90% of papers refer to this island and 90% of species have been found there (see Table 1). Almost 20% of papers refer to Bjørnøya and 25% of the species total for the archipelago have been found there, while 7% of papers refer to Edgeøya and 17% of the species are known from there. Nine other islands and island groups have been studied to a much lesser extent, with single records from other locations. It needs to be emphasized that some mites have been found exclusively on one island, other than Spitsbergen: five species on Edgeøya (*Saprosecans baloghi*, *Liochthonius clavatus*, *L. strenzkei*, *Neoliochthonius piluliferus*, and *Fuscozetes coulsoni*), four on Bjørnøya (*Zerconopsis muestairi*, *Sperchon brevirostris*, *Subbelba montana*, and *Ameronothrus nigrofemoratus*), and two on Hopen (*Thalassarachna coeca* and *T. princeps*), including three species new to science. It is unclear why these species have not been collected from Spitsbergen despite the more comprehensive sampling efforts on this island. The importance of further studies in different parts of the Svalbard archipelago is highlighted, in particular since the archipelago is extremely diverse geographically and climatically.

In natural conditions, the species composition and abundance of mites depends mainly on the vegetation [89], which, in turn, depends largely on the climate. For example, a relatively high mesostigmatid diversity is present along the western coast of Spitsbergen (about 30 species) [86], which experiences a comparatively mild climate for the latitude, in contrast to the polar deserts, where only five species were recorded [30]. Within the same climatic conditions, the densities of the mites also vary greatly according to the vegetation types [22,30,88,89,136].
Since mites are connected in different ways with other parts of the ecosystem, it would be particularly interesting to apply a multi-disciplinary approach to trace the effect of climate change in Svalbard. For example, one of the understudied mite groups is the family Eriophyidae. This family includes phytophagous species of great economic importance and with high invasive potential, and could be very useful for ecological studies on the effects of a changing climate at Svalbard [67]. Another poorly known group is the hyperorder Astigmata, parasitizing birds [74]. It is well-documented that climatic changes are affecting the diversity of seabirds by changing their foraging and breeding ecology, as well as increasing the abundance of temperate species [6], which could in turn affect bird-associated Astigmata.

Attention should also be paid to the least known mite order in Svalbard, the Trombidiformes, which is extremely diverse with respect to their feeding preferences (this taxon includes algivores, bacterivores, fungivores, predators, and parasites), and occupies terrestrial, freshwater, and marine habitats [182], but has not been studied at all from an ecological perspective in Svalbard.

Acarological research in the Arctic has developed rapidly in the last 20 years, markedly contributing to the knowledge of the mite communities and increasing somewhat our understanding of the factors determining these communities. Nonetheless, little is understood about the physical and morphological adaptations of mites, their adaptations to the extreme Arctic environment, or the genetic biodiversity of these isolated populations. Moreover, research has focused on the larger and more easily accessible regions of the archipelago to the detriment of the more environmentally extreme eastern and northern regions. There has also been a focus on the Sarcoptiformes and Mesostigmata while the Trombidiformes have been neglected. These areas will remain the subject of our research in the forthcoming years.

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