



Chenophila nanseni sp. n. (Acari: Syringophilidae) parasitising the barnacle goose in Svalbard

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Abstract: A new species, *Chenophila nanseni* sp. n., collected from covert quills of the barnacle goose *Branta leucopsis* (Anseriformes: Anatidae) in Svalbard (Spitsbergen) is described and female polymorphism is recorded in this species. In syringophilids this phenomenon was known only for representatives of the genus *Stibarokris*. The new species differs from the similar *Ch. platyrhynchos* by following features: in females of *Ch. nanseni* the anterior margin of the propodonotal shield is flat (vs. concave in *Ch. platyrhynchos*) and the lengths of idiosomal setae *si*, *f2* and *ag3* in *Ch. nanseni* are distinctly shorter than in *Ch. platyrhynchos*.

Key words: Arctic, barnacle goose, parasites, quill mites, female polymorphism.

Introduction

Quill mites of the family Syringophilidae (Acari: Prostigmata: Cheyletoidea) are taxonomically diverse group with over 330 described species grouped in 60 genera (Kethley 1970; Skoracki 2011; Glowska *et al.* 2015). Syringophilids are highly specialized, mono- or stenoxenous parasites, inhabiting feather quills of various parts of the avian plumage (primaries, secondaries, tertials, rectrices, wing coverts and body feathers) (Skoracki 2011). They feed on the soft tissue fluids of their hosts by piercing the fibrous wall of the calamus with their long, styletiform chelicerae (Kethley 1970, 1971; Casto 1974). Although representatives of Syringophilidae are widely distributed on their avian host and known from more than 480 bird species from 95 families and 24 orders (Glowska *et al.* 2015), our knowledge of the syringophilid fauna is still incomplete.

The Svalbard archipelago is located in the European Arctic between latitudes 74°N and 81°N and longitudes 10°E and 35°E. Because of complex terrestrial

High Arctic ecology and intense scientific international attention, Svalbard represents an important natural laboratory for polar invertebrate studies (Coulson 2013). Previous studies on the parasitic invertebrates in Svalbard archipelago have focused mostly on Nematoda, Cestoda, Acanthocephala and Insecta (e.g. Hackman and Nyholm 1968; Haarlov 1977; Halvorsen and Bye 1999; Kuklin *et al.* 2004; Stien *et al.* 2010). Little research has been done on symbiotic mites associated with birds, *i.e.* ticks (Haarlov 1977; Coulson *et al.* 2009), feather mites (Dabert *et al.* 2014) and nidicolous parasites (Gwiazdowicz *et al.* 2012). We still have very little knowledge about the biodiversity of acariform mites parasitizing birds in this region.

Below, we present the first record of syringophilid mites from the Arctic region (Svalbard). A new species, *Chenophila nanseni* sp. n., collected from a covert quill of the barnacle goose *Branta leucopsis* (Bechstein) (Anseriformes: Anatidae) in Svalbard (Spitsbergen) is described here. Previously, the genus *Chenophila* Kethley, 1970 included only three species associated with the Anatidae: *Ch. branta* Kethley, 1970 found on *Branta canadensis* (Linnaeus) in the United States, *Ch. kanduli* Bochkov, 1998 from *Anas querquedula* Linnaeus in Russia, and *Ch. platyrhynchos* Tymcio *et al.*, 2013 from *Anas platyrhynchos* Linnaeus in Poland (Kethley 1970; Bochkov and Mironov 1998; Tymcio *et al.* 2013).

Material and methods

The infected quills were dissected and the mites were removed and mounted on slides in Hoyer's medium. Identification of mite specimens and the making of drawings were carried out with a light microscope (ZEISS Axioscope) with DIC optics and camera lucida. In the descriptions below, the idiosomal setation follows Grandjean (1939) as adapted for Prostigmata by Kethley (1990). The nomenclature of leg chaetotaxy follows that proposed by Grandjean (1944). The morphological terminology follows Skoracki (2011). All measurements are in micrometres (μm). Measurement ranges for paratypes are given in brackets following the data for a holotype. Specimen depositories are cited using the following abbreviations: AMU – Adam Mickiewicz University, Department of Animal Morphology, Poznan, Poland; ZISP – Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia; ZSM – Bavarian State Collection of Zoology, Munich, Germany.

Systematics

Family Syringophilidae Lavoipierre, 1953
Subfamily Syringophilinae Lavoipierre, 1953
Genus *Chenophila* Kethley, 1970

Chenophila nanseni sp. n.

Heteromorphic female, holotype (Figs 1A, B, 2A–D). — Total body length 825 (800–835 in 2 paratypes). *Gnathosoma*. Hypostomal apex as in Fig. 2A. Infracapitulum densely punctate. Each medial branch of peritremes with 7–8 chambers, each lateral branch with 13–14 chambers (Fig. 2B). Stylophore con-

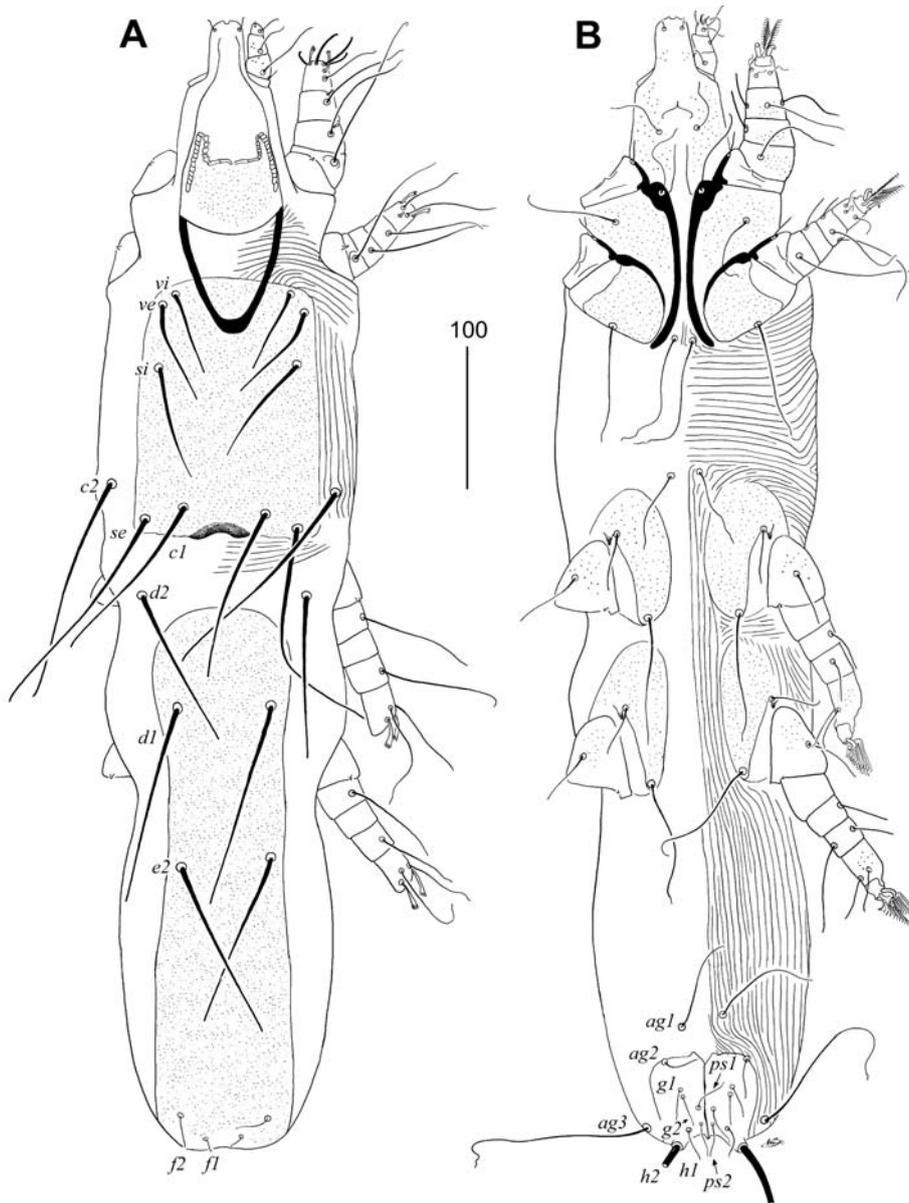


Fig. 1. *Chenophila nanseni* sp. n., heteromorphic female. A. Dorsal view. B. Ventral view.

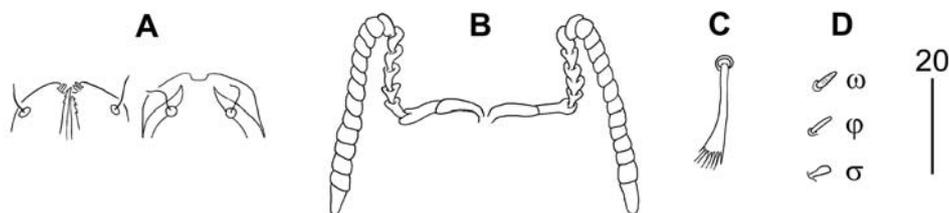


Fig. 2. *Chenophila nanseni* sp. n., heteromorphic female. A. Hypostomal apex in dorsal (left) and ventral (right) view. B. Peritremes. C. Fan-like seta $p'III$. D. Solenidia of leg I.

stricted posteriorly, densely punctate, 230 (230–235) long. *Idiosoma*. Propodotal shield rectangular in shape, strongly sclerotized, bearing bases of setae vi , ve , si , se and $c1$, punctate on whole surface. Bases of setae $c1$ situated slightly anterior to level of setae se . Length ratio of setae $vi:ve:si$ 1:1.2–1.3:1.5. Hysteronotal shield strongly sclerotized, fused with pygidial shield, bearing bases of setae $d1$, $e2$, $f1$, $f2$, completely punctate, anterior margin of this shield reaching almost level of setae $d2$. Setae $d1$, $d2$, $e2$ subequal in length. Setae $f2$ twice as long as $f1$. All dorsal setae spine-like. Length ratio of setae $ag1:ag2:ag3$ 2.1–2.6:1:3.7–4.1. Both pairs of genital and pseudanal setae subequal in length. Genital plate well developed, bases of setae $ag2$ situated on anterior margin of this plate. All coxal fields strongly sclerotized, densely punctate. *Legs*. Fan-like setae p' and p'' of legs III and IV with 7–8 tines (Fig. 2C). Trochanters of legs III and IV ventrally punctate. Solenidia of legs I as in Fig. 2D. Lengths of setae: vi 55 (50–55), ve 70 (60–70), si 80 (80), se 160 (160–175), $c1$ 180 (180–190), $c2$ 160 (160–175), $d1$ 145 (135–145), $d2$ 125 (115–125), $e2$ 125 (110), $f1$ 15 (15–20), $f2$ 30 (30–40), $h1$ 30 (25–30), $h2$ 390 (400–440), $ag1$ 80 (75–90), $ag2$ 35 (35), $ag3$ 140 (130–145), $g1$ and $g2$ 25 (25–30), $ps1$ and $ps2$ 30 (25–30).

Homeomorphic female (Figs 3A, B). — Total body length 780–835 in 6 paratypes. *Gnathosoma*. Infracapitulum punctate. Each medial branch of peritremes with 7–8 chambers, each lateral branch with 14 chambers. Stylophore constricted posteriorly, apunctate, 240–250 long. *Idiosoma*. Propodotal shield well sclerotized, with granular ornamentation in anterior part, punctate on lateral bands, bearing bases of setae vi , ve , si and se , setae $c1$ situated on or near this shield. Length ratio of setae $vi:ve:si$ 1:1–1.1:1.1–1.3. Hysteronotal shield reduced to weakly developed sclerite situated between bases of setae $d1$ and $e2$. Setae $d1$, $d2$, $e2$ subequal in length. Pygidial shield well developed, apunctate. Setae $f2$ 1.8–2.8 times longer than $f1$. All dorsal setae hair-like. Length ratio of setae $ag1:ag2:ag3$ 2:1:3. Genital setae 1.3–1.4 times longer than pseudanal setae. Genital plate well developed, bases of setae $ag2$ situated on anterior margin of this plate. All coxal fields strongly sclerotized, densely punctate. *Legs*. Fan-like setae p' and p'' of legs III and IV with 7 tines. Lengths of setae: vi 70–75, ve 80, si 80–95, se 140–165, $c1$ 155–165, $c2$ 140–160, $d1$ 105–120, $d2$ 110–135, $e2$ 105–115, $f1$ 20–25, $f2$ 45–55, $h1$ 20–30, $h2$ 330–360, $ag1$ 90–100, $ag2$ 45–50, $ag3$ 140–150, $g1$ and $g2$ 40–50, $ps1$ and $ps2$ 30–35.

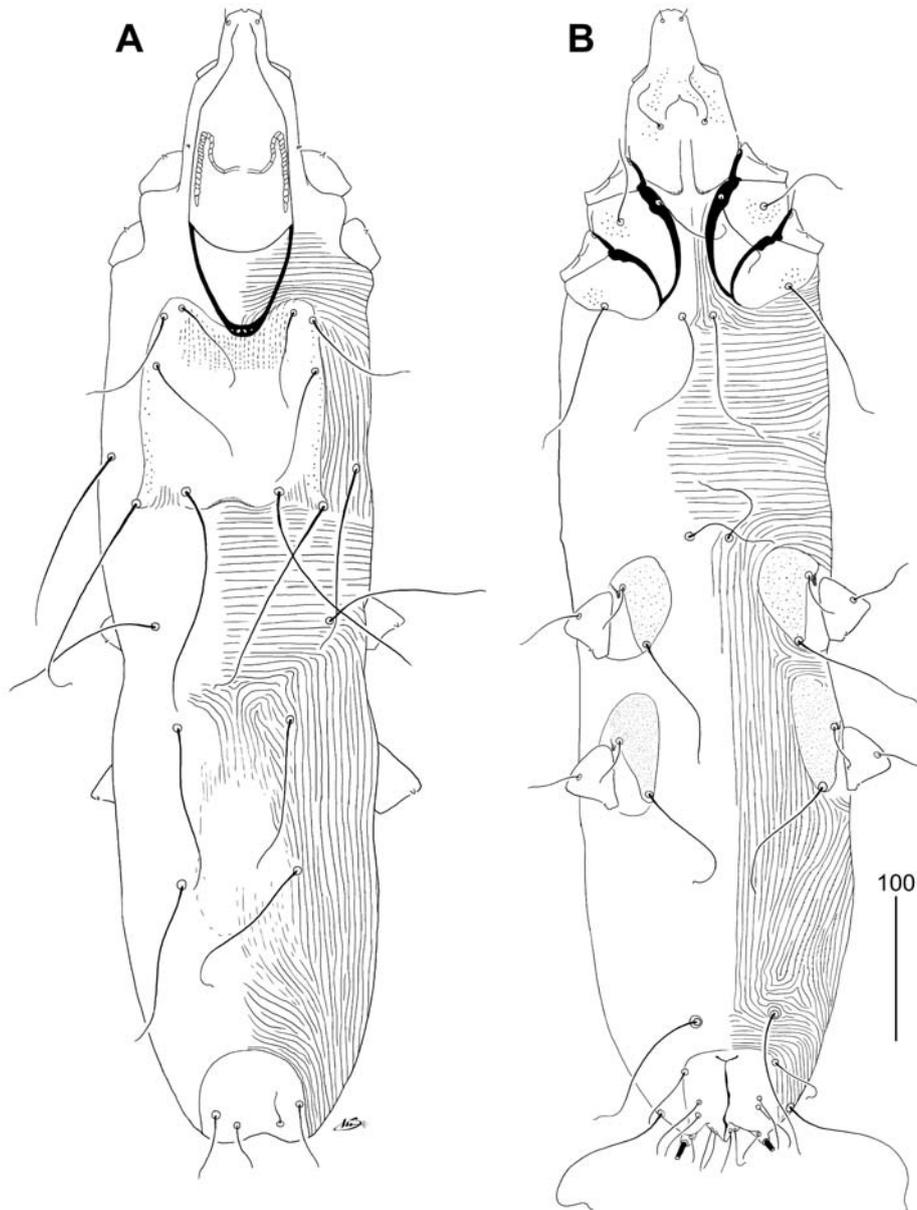


Fig. 3. *Chenophila nanseni* sp. n., homeomorphic female. **A.** Dorsal view. **B.** Ventral view.

Male (Figs 4A–D). — Total body length 580–610 in 4 paratypes. *Gnathosoma*. Hypostomal apex as in Fig. 4B. Each medial branch of peritremes with 7–8 chambers, each lateral branch with 15–17 chambers (Fig. 4C). Stylophore constricted posteriorly, apunctate, 200 long. *Idiosoma*. Propodonal shield well developed, bearing bases of setae *vi*, *ve*, *si* and *c1*, sparsely punctate. Bases of setae

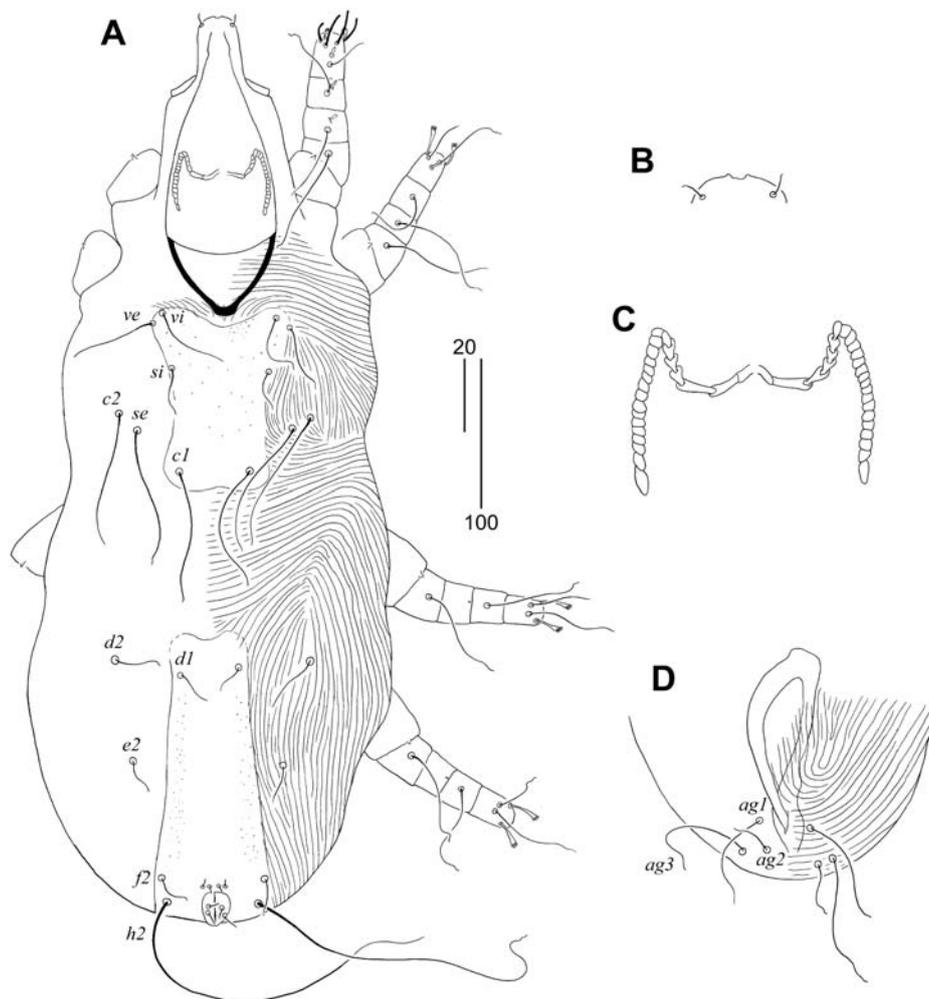


Fig. 4. *Chenophila nanseni* sp. n., male. **A.** Dorsal view. **B.** Hypostomal apex. **C.** Peritremes. **D.** Opisthosoma in ventral view. Scale bars: 100 μ m for A, D); 20 μ m for B, C).

c1 situated distinctly posterior to level of setae *se*. Setae *vi* and *ve* equal in length, both pairs 1.4–1.8 times longer than setae *si*. Hysteronotal shield well developed, fused with pygidial shield, bearing bases of setae *d1*, *f2* and *h2*, punctate, anterior margin of this shield reach above level of setae *d2*. Setae *d2* 1.2–1.7 times longer than *d1* and *e2*. Length ratio of setae *ag1:ag2:ag3* 2–3:1:2.5–3.2. Lengths of setae: *vi* 50–55, *ve* 50–55, *si* 30–35, *se* 100, *c1* 80–95, *c2* 80–100, *d1* 25–30, *d2* 30–50, *e2* 20–25, *f2* 20–25, *h2* 220–225, *ag1* 75–80, *ag2* 25–40, *ag3* 75–100.

Type material. — Female holotype and paratypes: 2 heteromorphic females, 6 homeomorphic females and 4 males from quill of wing covert of the barnacle

goose *Branta leucopsis* (Bechstein) (Anseriformes: Anatidae); NORWAY, Svalbard Archipelago, Spitsbergen, Nissenfjella, 79°2'0"N, 11°0'0"E, August 2013, coll. K. Zawierucha and A. Nawrot.

Type material deposition. — All type specimens are deposited in the AMU, except 1 homeomorphic female and 1 male paratypes in the ZISP and 1 homeomorphic female and 1 male paratypes in the ZSM.

Differential diagnosis. — *Ch. nanseni* sp. n. is morphologically similar to *Ch. platyrhynchos* Tymcio, Kavetska, Czyż et Skoracki, 2013 by the following characters: in females of both species, each lateral branch of the peritremes has more than 13 chambers; the propodonotal and hysteronotal shields are densely punctate on whole surface, and setae *ag3* are longer than *ag1*. This new species differs from *Ch. platyrhynchos* as follows: in heteromorphic females of *Ch. nanseni*, the propodonotal shield is rectangular in the shape; lengths of idiosomal setae *si*, *f2* and *ag3* are 80, 30–40 and 130–145, respectively. In females of *Ch. platyrhynchos*, the propodonotal shield is deeply concave on anterior margin; lengths of idiosomal setae *si*, *f2* and *ag3* are 110–140, 70–110 and 165–245, respectively.

Etymology. — The name of the new species is dedicated to Fridtjof Nansen (1861–1930) – the legendary polar researcher, traveler and Nobel Peace Prize laureate.

Remarks. — Among all syringophilinae species, female polymorphism has been noted only in two species of the genus *Stibarokris* Kethley, 1970: *S. phoeniconaias* Skoracki et O'Connor, 2010 and *S. annae* Glowska, 2015 (Glowska et al. 2014; Glowska 2015). Both female forms of these species differ mainly by the body sclerotization, presence vs. absence of the lateral hypostomal teeth, and by the length and shape of the dorsal setae. Glowska et al. (2014) considered the female polymorphism in *Stibarokris* as a reason of the functional specialization of each morph, i.e. homeomorphic non-dispersing form (named as “C”-form according to Glowska et al. (2014)) and heteromorphic dispersing forms (named as “S”-form). In the genus *Chenophila*, the heteromorphic females have been described for *Ch. kanduli* and *Ch. platyrhynchos*, and only the homeomorphic females for *Ch. branta*.

Discussion

Avifauna of Svalbard, currently contains 202 species belonging to 43 families and 17 orders, and only a small part of this biodiversity (28 species) is regarded as abundant or common breeders. Most of recorded bird species of Svalbard (149 species) are occasional or rare vagrants (Strøm and Bangjord 2004). From a parasitological point of view, this large group of birds is very important because they can be regarded as potential donors of various groups of parasites to the native

populations of birds which are more or less stable but extremely vulnerable. It should be stressed, that studies on many groups of mite parasites associated with birds are completely neglected. It is worthy of note, that this ecological group includes representatives from 40 families which occupy a great diversity of microhabitats on the host body, e.g. surface of skin, intracutaneous layers, respiratory tract, feather shafts and quills (Gaud and Atyeo 1996; Bochkov *et al.* 1999; Dabert and Mironov 1999; Proctor and Owens 2000; Proctor 2003; Skoracki *et al.* 2012; Walter and Proctor 2013). Filling these gaps in our knowledge is an urgent task, because of the crucial role the Arctic birds play in the functioning of the ecosystem (Stempniewicz *et al.* 2007; Jakubas *et al.* 2008).

Quill mites described in this paper, the first for the Arctic region, belong to a taxonomically diverse group of highly specialized parasites inhabiting feather quills of their hosts. Because of the way of feeding and transmission, syringophilids are considered as parasites, which can cause deterioration of the condition and fitness of birds. However, our knowledge concerning the damage caused by syringophilids is still fragmentary. Some of veterinarians report the clinical signs of feather's picking caused by the quill mites in domesticated birds (Rebrassier and Martin 1932; Schwabe 1956; Hwang 1959; Schmaschke *et al.* 2003; Principato *et al.* 2005). In contrast to all these reports, Pires and Daemon (2007) and Skoracki (2011) found no evidence that quill mites induce the pathological changes in structure of skin or morphology of feathers, even during heavy infestations. While the impact of quill mites on their avian host is still unresolved, the studies of Skoracki *et al.* (2006) showed that quill mites may be considered as the potential vectors of an obligate intracellular bacterial pathogen *Anaplasma phagocytophilum*. Current findings indicate that the Arctic birds can transport new pathogens via their parasites. From an epidemiological viewpoint, these observations suggest that infected syringophilids might accelerate the dispersion of various avian diseases among host populations. Although quill mites are a highly host-specific group of parasites mostly restricted to specific host species or phylogenetically closely related species, the horizontal transfer of these mites is quite possible, especially in large bird colonies.

Because syringophilid mites can play an important role in the avian populations and the mite fauna has never been examined in Svalbard, the future intensive studies concerning systematic analysis as well as ecological studies on the host-parasite relationships between Arctic birds and quill mites are needed.

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