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Article

A new species of nasal mite genus *Ptilonyssus* (Mesostigmata: Rhinonyssidae) from *Parus major* and the first record of *Rhinoecius brikinboricus* from *Asio otus* in Denmark

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ABSTRACT
A new rhinonyssid mite *Ptilonyssus holmhanseni* **sp. nov.** is described from the great tit, *Parus major* (Passeriformes: Paridae), in Eastern Denmark (Lejre) in April 2023. In addition, a rhinonyssid mite *Rhinoecius brikinboricus* Butenko, 1976, collected from the long-eared owl *Asio otus* (Strigiformes: Strigidae) in Denmark, is reported for the first time from Western Europe.

KEYWORDS: Birds, great tit, long-eared owl, nasal mites, Paridae, Strigidae.

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INTRODUCTION

Nasal mites of the family Rhinonyssidae (Parasitiformes: Dermanyssoidea) are permanent parasites living in the respiratory tract of birds. Most species of these mites live in nasal cavities, and some species can occupy the lungs, tracheae and air sacs (Amaral 1962; Feider and Mironescu 1972; McClure *et al*. 1973; Bell 1996; Krantz and Walter 2009; Dimov and Mironov 2012; Gastal *et al*. 2023). Rhinonyssid mites primarily disperse orally, when infested birds regurgitate food to their chicks or during a courtship. The entire life cycle of rhinonyssids (egg, larva, protonymph, deutonymph and imago) occurs in the respiratory system of hosts, except for a short time of settling a new host. Some rhinonyssids were found to be ovoviviparous, – the development of the larva occurs in the eggshells inside the female body before the oviposition (e.g., *Sternostoma tracheacolum* Lawrence, *Ptilonyssus degtiarevae* Dimov & Mironov and *Pt. lovottiae* Dimov & Mironov) (Bell 1996; Dimov 2018). In addition, it was observed in two species (*Tinaminyssus elani* (Fain) and *Pt. ploceanus* Fain) that females laid eggs with already fully developed protonymphs inside the egg and larval cuticles (Fain 1969).

The family Rhinonyssidae currently includes over 600 described species worldwide (Dimov 2018; Beron 2020; De Rojas *et al*. 2020; Haarder and Dimov 2024). Nasal mites are known from representatives of most extant orders of birds and are recorded on all continents (Fain 1957; Domrow 1969; Pence 1975; Butenko 1984; Knee and Proctor 2010; Kadosaka *et al*. 1983; Mascarenhas *et al*.

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2018; Dimov 2024). Investigations of rhinonyssids are of high importance, because in addition to the direct damage to their hosts (rhinonyssidosis avium disease) (Dimov 2011), it is suggested by some researchers that these mites could probably be reservoirs or vectors of various infections, like Lyme borreliosis, Ehrlichia infection, anaplasma infection, and Q fever (e.g., Bregetova 1956).

In this survey, we describe a new rhinonyssid species, *Pt. holmhanseni* **sp. nov.**, from the great tit, *Parus major* L. (Passeriformes: Paridae), and report the first record of *Rhinoecius brikinboricus* Butenko, 1976, collected from the long-eared owl, *Asio otus* (L.) (Strigiformes: Strigidae). Both records are from Denmark, a region of Southern Scandinavia, which is poorly investigated for rhinonyssid mites.

MATERIALS AND METHODS

The host specimens used in this study were two traffic-killed birds, the great tit *Pa. major*, and the long-eared owl *A. otus*, collected in Denmark. The collected birds were kept frozen until examination for the presence of nasal mites. The heads of the birds were removed and placed in a glass dish with 80% ethanol, their nasal cavities were dissected and examined under a stereomicroscope. Detected mites were preserved in 70% ethanol. Then mites were cleared in 75% lactic acid for 4 hr, placed again in 70% ethanol for 5 min, and finally mounted on microscope slides in Hoyer medium.

The description of the new species follows the modern format used for rhinonyssid mites (Butenko 1984; Knee 2008; Dimov and Knee 2012; Dimov and Spicer 2013; Dimov 2018; Haarder and Dimov 2024). The chaetotaxy of idiosoma used in the present work is based on the system proposed by Lindquist and Evans (1965) and Butenko (1984). Abbreviations for terms and measurements provided in the description of species are adapted from Fain and Hyland (1962) and Dimov (2018). The chaetotaxy of tarsal and palpal complex is based on the system proposed by Leonovich (2005) and Leonovich and Dimov (2012). All measurements are in micrometers.

In the species description, standardly measured structures are given with the following abbreviations: LB, length of body including palps; WID, width of idiosoma; LPS, length of podosomal shield; WPS, width of podosomal shield; LOS – the length of the opisthosomal shield; WOS – the width of the opisthosomal shield; LSS, length of sternal shield; WSS, width of sternal shield; LGS, length of genital shield; WGS, width of genital shield; LAS, length of anal shield; WAS, width of anal shield; LG, length of gnathosoma, ventral view, including palps; WG, width of gnathosoma; Lleg, length of leg, including coxa, excluding ambulacrum (LLeg I to LLeg IV).

Holotypes and paratypes are deposited in the Zoological Institute of the Russian Academy of Sciences collection in St. Petersburg, Russia (RASP 8, 9).

RESULTS

Family Rhinonyssidae Trouessart, 1895
Genus *Ptilonyssus* Berlese & Trouessart, 1889

Type species: *Ptilonyssus echinatus* Berlese & Troussart, 1889

Remarks

To date, more than 170 species of the genus *Ptilonyssus* have been described (Domrow 1969; Pence 1975; Butenko 1984; Knee 2008; Dimov and de Rojas 2012; Dimov 2020). Representatives of this genus mainly parasitize birds from the order Passeriformes; a few species of this genus were recorded from host species of the order Falconiformes and Apodiformes (Knee and Proctor 2010; Beron 2020).

Ptilonyssus holmhanseni sp. nov.

http://zoobank.org/urn:lsid:zoobank.org:act:D4FED965-35BA-4004-BE99-58D63BF5D625

Type material

Female holotype (RASP 8) from *Parus major* Linnaeus, 1758 (Passeriformes: Paridae), Denmark, Lejre, near train station (55° 36' 12.0" N, 11° 58' 19.0" E), 12 April 2023, bird collected by Lars Holm Hansen.

Description (Female)

Measurements – LB – 468; WID – 194; LPS – 176; WPS – 144; LOS – 178; WOS – 112; LSS – 83; WSS – 72; LGS – 64; WGS – 72; LAS – 72; WAS – 43; LG – 82; WG – 41; LCH – 63; WCH – 9; Lleg I –228; Lleg II – 179; LlegIII – 184; Lleg IV –225.

Dorsum (Fig. 1) – Podosomal shield (PS) occupies most of the podosomal area. Anterior part of the shield is gradually narrowed to the anterior end, posterior margin straight. Surface of this shield with 8 pairs of setae (j2-6, z2-5), [in holotype left seta z5 absent]. Soft dorsal surface of podosoma with four pairs of mesolateral setae (r5, r6, s5, s6). Soft dorsal surface of opisthosoma with 6 pairs of setae (Z1-4, R1-2). Opisthosomal shield (OS) roughly oval-shaped, with wide shallow concavity on anterior margin; surface of this shield with 3 pairs of setae (J1, J2, J4). Stigmata (Stg) with peritremes located dorsolaterally at level of coxae III.

Venter (Fig. 2) – Sternal shield (SS) large, with oval shape, 3 pairs of sternal setae located on its surface (St1-3), sternal formula (St1< St2 = St3). Genital shield (GS) large, surface with 1 pair of short genital setae (he4). Soft cuticle of opisthosoma with 10 setae (Jv1, 2, 4, Zv1). Anal shield oval, its surface with 2 longer preanal setae are located laterally to anus (An) and 1 short postanal posterior to it, anal formula (Ad > PA). Aspero (Asp) present.

Gnathosoma – Gnathosomal formula 2-0-2. Setae hyp2 and hyp3 are absent. Five deutosternal denticles (Dd) arranged in longitudinal row.

Legs: All legs six-segmented. Formula of coxal setae 2-2-2-1.

Tarsal receptor complex (Fig. 3a) – Two chemo-mechanoreceptor sensilla with apical pore (up), four olfactory porous single-cavity sensilla (sw), and seven chemoreceptor sensilla with peripheral cavities (dw).

Palpal receptor complex (Fig. 3b) – Five (three large and two small) tactile sensilla, three pair of little tactile sensilla with apical pore (np), three double-walled with apical pore sensilla (dw-up), and two single-walled with apical pore sensilla (sw-up). These minute setal structures were examined and recognized with a light microscope.

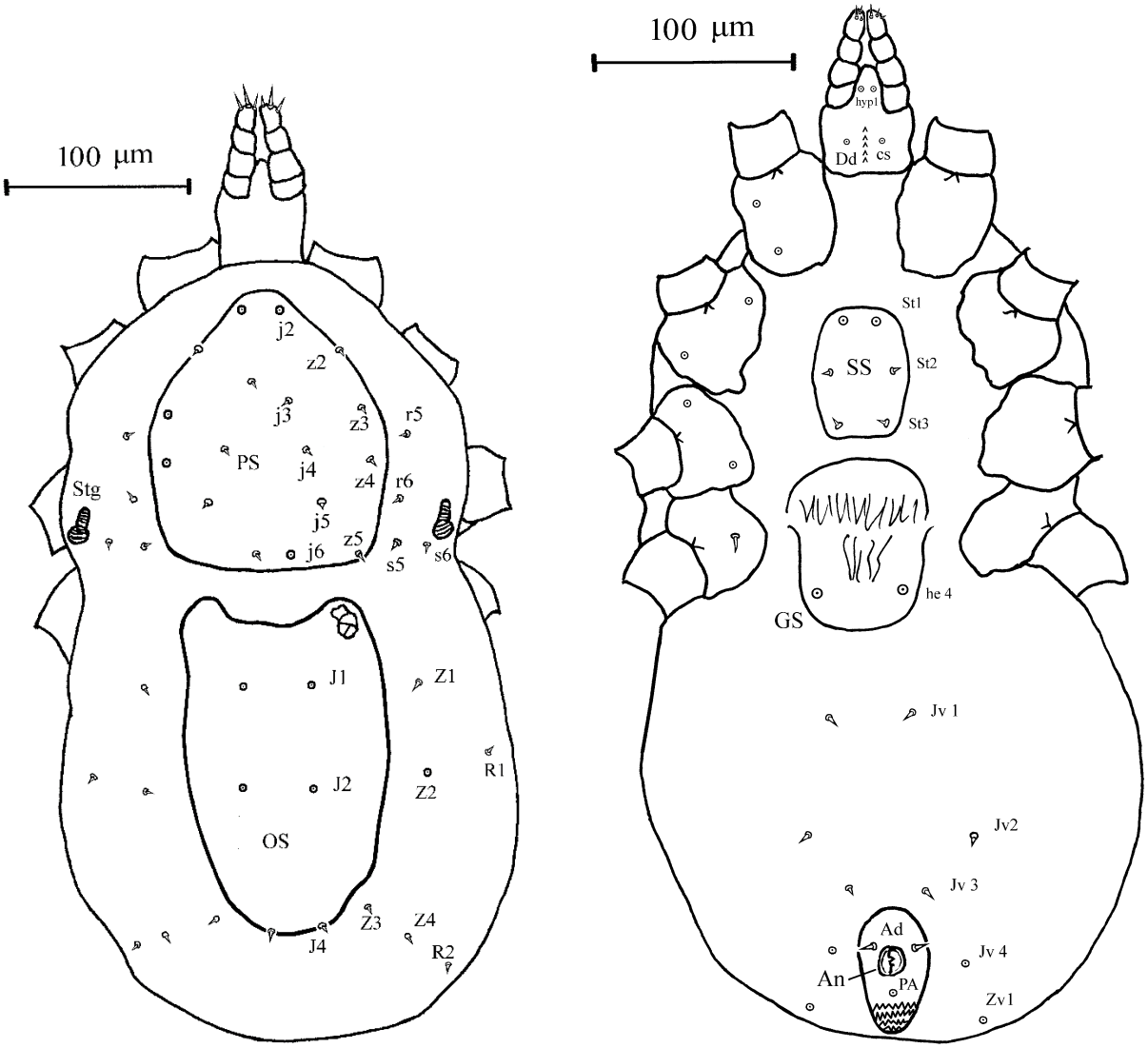
Male, larva, and nymph unknown.

Differential diagnosis

Ptilonyssus holmhanseni **sp. nov.** is most similar to the widespread Holarctic species *Ptilonyssus pari* Fain & Hyland, 1963. The differential characters between the species are given in Table 1. In short, *P. holmhanseni* **sp. nov.** supports fewer setae on the opisthosomal shield and ventral opisthosoma when compared to *P. pari*. The opisthosomal shield of *P. holmhanseni* **sp. nov.** is roughly ovate (with narrow posterior end in *P. pari*) and the anterior margin is concave (straight in *P. pari*). Further important differences are found in the shape of the posterior margin of the podosomal shield as well as the general shape of the sternal shield. More discrete differences are observed in the gnathosomal and sternal formula, and tarsal receptor complex.

Etymology

The new species is named after Lars Holm Hansen, the eminent Danish naturalist, who has contributed immensely to the on-going study of the Danish avian mite fauna.



Figures 1–2. *Ptilonyssus holmhanseni* **sp. nov.** (female) – 1. Dorsum; 2. Venter.

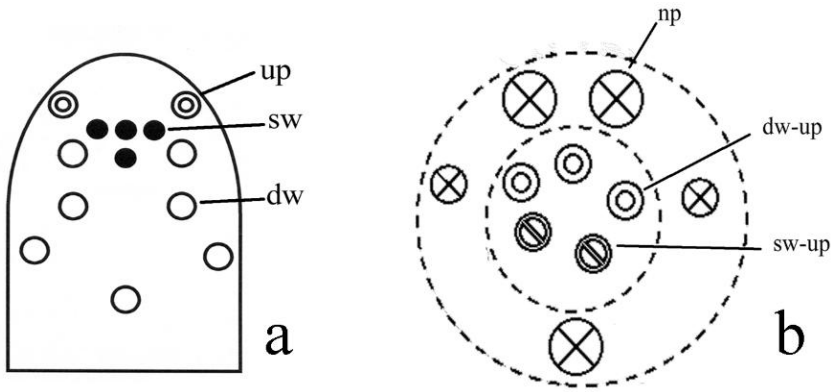


Figure 3. *Ptilonyssus holmhanseni* **sp. nov.** (female) – **a.** Tarsal receptor complex; **b.** palpal receptor complex.
Abbreviations: chemo-mechanoreceptor sensilla with apical pore (up); olfactory porous single-cavity sensilla (sw); chemoreceptor sensilla with peripheral cavities (dw); tactile sensilla with apical pore (np); double-walled with apical pore sensilla (dw-up); single-walled with apical pore sensilla (sw-up).

Table 1. Differential characters of *Ptilonyssus holmhanseni* **sp. nov.** and *P. pari* Fain & Hyland, 1963.

Character	*P. holmhanseni* sp. nov.	*P. pari*
Posterior margin of podosomal shield	smooth	sinuous
Setation of opisthosomal shield	3 pairs (J1, J2, J4)	4 pairs (J1, J2, J3, J4)
General shape of opisthosomal shield	roughly ovate	narrowed posterior end
Anterior margin of opisthosomal shield	with concavity	straight
Gnathosomal formula	2-0-2	2-4-2
Shape of sternal shield	oval	rectangular
Sternal formula (length of setae)	St1 < St2 = St3	St1 = St2 = St3
Setation of ventral opisthosoma	5 pairs (Jv1, Jv2, Jv3, Jv4, Zv1)	7 pairs (Jv1, Jv2, Jv3, Jv4, Zv1, Zv2, Zv3); Jv3 can occasionally be absent
Tarsal receptor complex	sw-4, dw-7	sw-5, dw-4

Genus *Rhinoecius* Cooreman, 1946

Type species: *Rhinoecius oti* Cooreman, 1946

Remarks

Representatives of the genus *Rhinoecius* are specific parasites of owls (Strigiformes). This genus currently includes 12 species (Cooreman 1946; Pereira and Castro 1949; Zumpt and Patterson 1951; Strandtmann 1952; Zumpt and Till 1955; Fain 1956, 1957, 1959; Strandtmann and Wharton 1958; Amaral 1962; Bregetova 1965; Wilson 1968; Domrow 1969; Butenko 1971; McClure *et al.* 1973; Pence 1975; Butenko 1984; Úbeda-Ontiveros *et al.* 2000; Knee *et al.* 2008; Knee and Galloway 2017). Fain (1959) treated mite species differing from typical *Rhinoecius* species by the presence of tritosternum as a separate genus *Zumptnyssus* Fain, 1959. However, Domrow (1969) suggested that the presence or absence of tritosternum cannot serve as a diagnostic criterion for rhinonyssid genera, and treated *Zumptnyssus* as a synonym of *Rhinoecius.*

Rhinoecius brikinboricus Butenko, 1976

Material examined

Female and deutonymph (RASP 9) from *Asio otus* L. (Strigiformes: Strigidae), Denmark, Ravnholt, country road outside the city (55° 32' 28.1" N, 9° 15' 05.0" E), 22 February 2022, bird collected by Ken Alminde.

Type locality

Russia, Ryazanskaya Obl., Brikin Bor.

Distribution

Russia (Butenko 1976), Canada (Knee *et al.* 2008; Knee and Galloway 2017), Denmark (this study).

Type host

Asio otus (Strigiformes: Strigidae).

Our record represents the first finding of *Rhinoecius brikinboricus* in Western Europe. Hitherto, *R. brikinboricus* has been reported from Canada and Russia. It is closely related to *R. oti* Cooreman, 1946, which is known from *Asio otus* from Belgium. According to Butenko (1984), *R. brikinboricus*

can be distinguished from *R. oti* by the bell-shaped podosomal shield, its greater length, and the location of setae j6 on the surface of the podosomal shield.

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گونهٔ جدیدی از جنس کنه‌های بینی جنس *Ptilonyssus* (Mesostigmata: Rhinonyssidae) از روی *Parus major* و نخستین گزارش *Rhinoecius brikinboricus* از *Asio otus* در دانمارک

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چکیده

هرنای جدید رینونیسید ***Ptilonyssus holmhanseni* sp. nov.** از روی چرخ‌ریسک بزرگ، *Parus major* (Passeriformes: Paridae)، در شرق دانمارک (Lejre) در آوریل ۲۰۲۳ توصیف شده است. افزون بر این، هرنای رینونیسید *Rhinoecius brikinboricus* Butenko, 1976، جمع آوری شده از روی جغد گوش‌دراز *Asio otus* (Strigieformes: Strigieformes) برای نخستین بار از دانمارک، و اروپای غربی گزارش می‌شود.

واژگان کلیدی: پرندگان، چرخ‌ریسک بزرگ، جغد گوش‌دراز، کنه‌های بینی، Paridae، Strigidae.

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