The First Report of the Feather Mite
Pseudalloptinus milvulinus (Acariformes: Pterolichidae)
from the Black Kite Milvus migrans in Japan

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The feather mite Pseudalloptinus milvulinus (Trouessart, 1884) was collected from feathers of the Black Kite Milvus migrans (Boddaert, 1783) in Ishikawa Prefecture, Japan, in 2019. The identification of this mite was based on the form and arrangement of setae on the idiosoma and aggenital region. This study is the first report of this mite species and the genus Pseudalloptinus Dubinin, 1956 in Japan.

Key Words: Symbiosis, Pterolichidae, central Japan, new record.

Introduction

The feather mite genus Pseudalloptinus Dubinin, 1956 (Acariformes: Pterolichidae) was initially established in the subfamily Pterolichinae and incorporated mites from birds belong to five orders: Accipitriformes, Falconiformes, Gruidae, Ciconiiformes and Psittaciformes. Later on, Gaud (1988) reduced the species content of this genus to five species, all of which are associated with host from the family Accipitridae (Accipitriformes). Mironov et al. (2018) recently described one more species associated with the Philippine Eagle Pithecophaga jefferyi Ogilvie-Grant, 1896 (Accipitridae).

Pseudalloptinus mites have been reported worldwide, and three of the six species known so far have wide host ranges. Pseudalloptinus aquilinus Trouessart, 1884, the type species of the genus, has been recorded from 14 bird species of three genera in Eurasia (from Europe to Far East) and North America (Trouessart 1884; Dubinin 1956; Philips 2000; Galloway et al. 2014); P. milvulinus (Trouessart, 1884) has been recorded from four species of three genera in Eurasia (from Europe to central Russia) and Oceania (Dubinin 1956; Philips 2000); and P. odontopus Gaud and Mouchet, 1959 has been recorded from four host species of three genera in Eurasia (India), Africa, and Oceania (Gaud and Mouchet 1959; Gaud 1988; Mayberry et al. 2000; Philips 2000). The three remaining species, P. pithecophagae Mironov, 2018, P. glosso cercus Gaud, 1988 and P. africanaus Gaud, 1988, have been reported only from their corresponding type host species (Gaud 1988; Mironov et al. 2018). Despite of a wide host ranges and geographical distribution of the three former species, mites of the genus Pseudalloptinus, have never been recorded in Japan. In 2019, we sampled some feather mites from the Black Kite, Milvus migrans (Boddaert, 1783), in Japan, and based on morphological characters, the specimens were identified as P. milvulinus. Our study reports this mite species from Japan for the first time and provides its re-description.

Materials and Methods

The Black Kite male, which was road-killed by motor vehicle on a highway in Noto City, (Ishikawa Prefecture, Noto Peninsula, Japan), was sampled for this study. Its feathers were examined with a stereomicroscope to find mites. When feather mites were detected, they were collected with soft brushes or forceps, and placed into 99% ethanol for fixation and preservation. For morphological observations, the fixed mites were mounted on slides in Hoyer’s medium. Body parts were measured under a light microscope (OLYMPUS BX50, Olympus) provided with the camera control unit (AdvCam-U3II, Advan vision). The mites were identified based on Gaud (1988) and Mironov et al. (2018). General morphological terms and leg chaetotaxy follow Gaud and Atteya (1996) and Mironov et al. (2018); idiosomal chaetotaxy also follows these authors with corrections for coxal setation by Norton (1998). All measurements in the description are in micrometers.

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Results

Family **Pterolichidae** Trouessart and Mégnin, 1884
Subfamily **Pterolichinae** Trouessart and Mégnin, 1884
Genus **Pseudalloptinus** Dubinin, 1956

**Pseudalloptinus milvulinus** (Trouessart, 1884)  
[New Japanese name: Tobi-usuge-ashibuto-umou-dani]
(Figs 1–5)

**Material examined.** MPM Coll. No. 21696a–f, 3 males and 3 females, from the Black Kite *Milvus migrans* (Accipitriformes: Accipitridae), Japan, Ishikawa Prefecture, Noto City, 37°19′26.1″N 137°00′05.6″E, 30 July 2019, collected by Hajime Matsubara.

**Depository.** Meguro Parasitological Museum (MPM), Tokyo, Japan.

**Male (Figs 1A, D–E, 2A, B, 4A, 5A–D).** **Body.** Total body length including gnathosoma 367–394. Length of gnathosoma including palps 45–54, greatest width 42–47. Idiosoma roughly diamond-shaped, length 297–344 and greatest width 159–193. Prodorsal shield occupying most part of prodorsum, length along midline 77–84, greatest width 98–103. Length of hysterosoma 217–237. Hysteronotal shield triangular, without ornamentation, covering most part of dorsal hysterosoma except lateral areas, length 217–237, greatest width 135–150. Length of dorsal setae: *vi* 17–27; *si* 4; *se* 107; *c1* 5–6; *c2* 16–20; *c3* 17–18; *cp* 85–107; *d2* 4–8; *e2* 30–39; *h2* 207–249; *h3* 122–165. Venter: *1a* 33–53; *3a* 41–51; *4a* 34–40; *4b* 19–25; *g* 11–18; *ps1* 48–58; *ps2* 40–46; *ps3* 11–16. Setae *vi* filiform, not delated, and almost extending to palpal apices. Setae *se* long. Setae *c2* filiform, situated in anterior parts of humeral shields. Setae *c3* dagger-shaped. Setae *d2* short and narrow. Setae *e2* spiculiform, situated close to the base of seta *h2*. Setae *ps1* and *ps2* filiform. Setae *h2* and *h3* long and whip-like. Distance between setae: *se-se* 60–62; *si-si* 47–52; *h2-h2* 58–60; *h3-h3* 37–41; *c2-d2* 103–110; *d2-c2* 87–101; *e2-h3* 21–22. Distance between dorsal setae: *g-a4* 41–45; *a4-ps3* 43–45; *a4-g* 41–45; *a4-ps3* 43–45; *4b-g* 27–32; *ps3-h3* 63–67. Setae *a4* closer to *g* than to *ps3*. Setae *3a* and *4b* approximately at same transverse level. Epimerites I fused Y-like, with sternum shorter than free parts. Genital apparatus situated between levels of trachanters III and IV. Epimerites Iva large, with anterior ends flanking genital apparatus laterally. Setae *4a* situated on epimerites IV, slightly closer to setae *g* than to setae *ps3*. Adanal apodemes absent. Postgenital sclerite stirrup shaped, with strongly extending posterior corners. Adanal suckers longitudinally ovate, 11–17 in length, surrounding membrane with circular striae (Figs 1F, 2B, 4B). Terminal cleft semi-ovate, approximately as long as wide. Terminal membranes well developed, entire, occupying margin of terminal...
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Legs (Fig. 5A–D). Length of tarsi I-IV 31–37, 33–37, 37 and 21–29. Setation on legs (I-IV, excluding solenidia) tarsi I-IV 8-8-6-4; tibiae I-IV 1-1-1-1; genua 2-2-0-0; femora 1-1-0-0; trochanters 1-1-1-0. Solenidia on tarsi I-IV 2-1-0-0, tibiae I-IV 1-1-1-1, genua 1-1-1-0. Setae *b* on tarsus I inserted distally from solenidion *ω*1 (Fig. 5A). Length of solenidia: *ω*1 I 14–19, *ω*3 I 33–45, *ω*I II 14–20, *σ*I 69–79, *σ*II 62–71, *σ*III 33–43. Genu I with solenidion *σ* inserted at distal 1/4 of the segment. Leg IV hypertrophied, greatest width of each segment of leg IV ca. 1.5 times wider than that of leg III. Tarsus IV without setae *d* and *e*. Tarsus IV with spine-shaped apical extension (Fig. 5D).

Female (Figs 1B, C, 3A–C, 4B, 5E, F). Body. Total body length including gnathosoma 519–584. Gnathosoma as in male, length including palps 66–76, greatest width 67–79. Idiosoma length 442–469 and greatest width 223–251. Prodorsal shield as in male, greatest width 102–120, length along midline 137–150. Length of hysterosoma 240–289. Hysteronomous shield split into main shield and small pygidial shield shaped as small transverse sclerite. Hysteronomous shield covering most part of dorsal hysterosoma except anterior hysterosoma and area between *e*2 to *ps*2, anterior margin concave, surface without ornamentation, length 183–213, greatest width (at anterior margin) 191–197. Setae *c*1 on anterior margin of hysteronomous shield. Length of dorsal setae: *vi* 50–59; *si* 5–8; *sc* 149–162; *c*1 7–11; *c*2 23–32; *c*3 21–22; *cp* 123–162; *d*2 11–13; *h*2 167–187; *h*3 138–189; *ps*1 22–24; *ps*2 14–20. Venter: *1a* 47–59; *3a* 38–59; *4a* 60–63; *4b* 29–40; *g* 16–29; *ps*3 18–22. Setae *c*3 lanceolate, ca. 6 times longer than width. Setae *e*2 filiform. Seta *g* situated posterior to the level of *3a*. Distance between setae: *se*–*se* 74–80; *si*–*si* 56–62; *h*2–*h*2 31–39; *h*3–*h*3 16–18; *c*2–*d*2 214–239; *d*2–*c*2 43–45; *c*2–*h*3 31–38; *4a–g* 57–59; *4b–g* 27–32; *4a–ps*3 43–45; *ps*3–*h*3 63–67. Epimerites I fused Y-like. Epimerites IVa present. Posterior margin of opisthosoma with cone-shaped external copulatory tube. Spermatheca

![Fig. 2. *Pseudalloptinus milvulinus*, male (MPM Coll. No. 21696a). A, Dorsal view; B, ventral view.](image-url)
and spermaducts as in Fig. 4B.

**Legs** (Fig. 5E, F). Legs I and II similar to those in male. Leg IV not hypertrophied, width of each segment close to that of leg III (Fig. 5E, F). Length of tarsi I-IV: 46–50, 47–50, 51–63 and 71–82. Length of solenidia: \( \omega_1 I 14–18, \omega_3 I 43–53, \omega_1 II 23–28, \sigma_1 I 100–113, \sigma_II 90–104, \) and \( \sigma III 71–74. \)

**Host associations and distribution.** Brahminy Kite *Haliastur indus* (Boddaert, 1783): Australia and New Guinea (Trouessart 1884; Dubinin 1956); Long-Crested Eagle *Lophaetus occipitalis* (Daudin, 1800): Cameroon and Zaire (Gaud 1988); Red Kite *Milvus milvus* (Linnaeus, 1758): Europe (Trouessart 1884), Russia (European part) (Dubinin 1956); Black Kite *M. migrans* (Boddaert, 1783): Russia (both European and Asian parts) (Dubinin 1956), Azerbaijan, (Dubinin 1956), and Japan (this study).

**Remarks.** The mites collected were identified as *Pseudalloptinus milvulinus* based on the following combination of characters. In both sexes, setae \( c_3 \) are lanceolate. In male, the genital apparatus is situated at the midlevel between trochanters III and IV; the terminal membranes are large and occupy entire margin of terminal cleft, the terminal cleft is semi-ovate, approximately as long as wide; ventral setae \( 4a \) are closer to \( g \) than to \( ps3 \); setae \( e2 \) are spiculiform, the postgenital sclerite is stirrup-shaped. In female, setae \( c_3 \) are 6 times longer than wide; ventral setae \( g \) are situated posterior to the level of setae \( 3a \); and dorsal setae \( c1 \) are situated on the anterior margin of the hysteronotal shield.

*Pseudalloptinus milvulinus* resembles *P. africanus* in having similar shapes of terminal membranes, positions of setae \( g, 4a \) and \( ps3 \) and form of dorsal setae \( e2 \) in males. Moreover, in females of these species, genital setae \( g \) are situated posterior to the level of \( 3a \), dorsal setae \( c1 \) are situated on the anterior margin of the hysteronotal shield, and in both sexes, setae \( c3 \) are similar in shape. Males of *P. milvulinus* differ from those of *P. africanus* by the following characters: the terminal cleft is semi-ovate with its greatest width being equal to its length (vs. shaped as a low arch, 3–4 times wider than long), setae \( 4a \) are closer to \( g \) than to \( ps3 \) (vs. equidistant), and the postgenital sclerite is stirrup-shaped with parallel lateral sides (vs. convex lateral sides). Female of *P. mil-
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**Fig. 4.** *Pseudalloptinus milvulinus*: A, male (MPM Coll. No. 21696a). B, female (MPM Coll. No. 21696d). A, Ventral view, terminal membrane (white arrowhead) and adanal suckers (dark arrowhead); B, spermatheca and spermaducts of female.
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vulinus differ from those of P. africanus in having setae c3 ca. 6 times longer than width (vs. ca. 4 times in P. africanus).

The Japanese name newly established for the mite refers to the wide leg IV of male, loss of some setae on the dorsal idiosoma and the Japanese name of the Black Kite.

Discussion

This is the first report of the feather mite P. milvulinus and the genus Pseudalloptinus from Japan. This mite had been originally found and described the Red Kite Milvus milvus and also reported from the Brahminy Kite Haliastur indus by Trouessart (1884). After that, P. milvulinus had been reported repeatedly from four species of raptors (the Black Kite, the Red Kite, the Brahminy Kite and the Long-crested Eagle Lophaetus occipitalis) (Radford 1953, 1958; Dubinin 1956; Gaud 1988). Among the records from Asia, this mite has been reported in the Black Kite in the Onon River region in the Trans-Baikal, Russia (Dubinin 1956), which is the closest locality (ca. 2500 km away) from the sampling point of the present study. The worldwide distribution of the Black Kite, except in North and South Americas (Bird Life International 2019; Hoyo 2020), suggests the wide distribution of this mite.

In the Japanese Archipelago, the bird fauna currently includes ca. 600 species (Ornithological Society of Japan 2012). Such a high diverse in a relatively small terrestrial area should provide fine opportunities to study the diversity and geographic distribution of feather mites; however, there are still have been reported and/or described few species of feather mites in Japan (Konno and Asada 1978; Kuroki et al. 2006a, b, 2009; Yamauchi and Kuroki 2009; Kuroki et al. 2020; Waki and Shimano 2020), and some of the feather mites recorded were not identified to species level (Nagahori 2000; Kuroki 2004; Kuroki et al. 2006a, b, 2009, 2020; Yamauchi and Kuroki 2009; Yoshino et al. 2013; Taniguchi 2020). Although the ecological impact of feather mites on birds is disputable (O’Connor 1982; Gaud and Atyeo 1996; Doña et al. 2019), the feather mites can also help us to understand the evolution and ecology of their hosts.

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