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PTEROHERPUS SURMACHI SP. N., FIRST RECORD OF THE FEATHER MITE FAMILY PTERONYSSIDAE (ACARI: ANALGOIDEA) FROM NUTHATCHES (PASSERIFORMES: SITTIDAE)

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ABSTRACT

A new feather mite species, *Pteroherpus surmachi* sp. n. (Analgoidea: Pteronyssidae), is described from the Chinese nuthatch *Sitta villosa* Verreaux, 1865 (Sittidae) from the Primorsky Kray, Russia. This is the first record of a pteronyssid mite from representatives of the family Sittidae. Feather mite fauna currently known from nuthatches is briefly discussed. *Analges sittae* Mironov, 1985 syn. n. is synonymized with *A. picicola* Černý et Schumilo, 1973 (Analgidae).

Key words: feather mites, *Pteroherpus*, Pteronyssidae, systematics, host associations, Passeriformes, Sittidae

PTEROHERPUS SURMACHI SP. N., ПЕРВАЯ НАХОДКА ПЕРЬЕВЫХ КЛЕЩЕЙ СЕМЕЙСТВА PTERONYSSIDAE (ACARI: ANALGOIDEA) НА ПОПОЛЗНЯХ (PASSERIFORMES: SITTIDAE)

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РЕЗЮМЕ

Новый вид перьевого клеща *Pteroherpus surmachi* sp. n. (Analgoidea: Pteronyssidae) описан с хохлатого поползня *Sitta villosa* Verreaux, 1865 (Sittidae) из Приморского края (Россия). Это является первой находкой клеща данного семейства на поползнях. Кратко обсуждается фауна перьевых клещей известная с птиц семейства Sittidae. *Analges sittae* Mironov, 1985 syn. n. синонимизирован с *A. picicola* Černý et Schumilo, 1973 (Analgidae).

Ключевые слова: перьевые клещи, *Pteroherpus*, Pteronyssidae, систематика, связи с хозяевами, Passeriformes, Sittidae

INTRODUCTION

The genus *Pteroherpus* Gaud, 1981 is one of most species-rich genera of the feather mite family Pteronyssidae, and prior to this work included 20 named species (Faccini and Atyeo 1981; Mironov and Wauthy 2008; Mironov and Proctor 2011). As for most pteronyssids, mites of this genus live on feathers with large and firm vanes, such as the flight and covert feathers of wings, where they are located in ventral corridors formed by feather barbs.

Among seven pteronyssid genera restricted to Passeriformes, this genus along with three closely related genera, *Dicrurobius* Mironov, 2001, *Micropteroherpus* Mironov 2001, and *Vanginyssus* Mironov, 2001, constitute the *Pteroherpus* generic group, which

is clearly diagnosed by having a palpal seta *dTi* (seta *d2* or *dp2* of previous authors) bifurcate with unequal branches (Figs. 1A, 2C), a unique feature within the family Pteronyssidae (Mironov and Wauthy 2005, 2006, 2008). In the context of this group, the genus *Pteroherpus* is characterized by the following combination of features: in males, tarsus III has a bidentate apex, supranal concavity is relatively short and does not extend to the level of dorsal setae *e1*, the opisthosomal lobes are short, rounded, and commonly close to each other; in females, the hysteronotal shield is represented by a complicated set of 4–9 paired and unpaired sclerites, among which the pygidial sclerite is always paired and the opisthosomal sclerites are entire or split into inner and lateral fragments.

As it was shown in the recent revision of *Pteroherpus* (Mironov and Wauthy 2008), representatives of this genus are associated with passerines of eight families: Cisticolidae, Pycnonotidae, Sylviidae, Timaliidae, Zosteropidae (Sylvioidea), Muscicapidae (Muscicapoidea), Monarchidae, and Paradisaeidae (Corvoidea). Most currently known *Pteroherpus* species were recorded from hosts of the families Pycnonotidae and Timaliidae; from birds of the remaining listed families, only one or a few species are known from each family so far. Based on phylogeny of the genus *Pteroherpus* and host associations of its species, Mironov and Wauthy (2010) hypothesized that this genus most probably originated on the ancestors of the superfamilies Sylvioidea and Muscicapoidea, while the presence of its representatives on hosts from the superfamily Corvoidea is of a secondary origin.

The present paper describes a new *Pteroherpus* species from a passerine host of the family Sittidae, and is the first record of this genus from nuthatches.

MATERIAL AND METHODS

The material used in the present study was gathered from an individual of *Sitta villosa* Verreaux, 1865 (the Chinese or Snow-browed Nuthatch) captured for the museum collection of the Institute of Biology and Soil Sciences of the Russian Academy of Sciences (Vladivostok). Feather mites were removed from the plumage of the bird under a dissecting microscope using a preparation needle and placed in 96% ethanol. Subsequently, mite specimens were mounted on microslides in Faure medium according to the standard technique (Evans 1992).

The general morphological terms and nomenclature of leg and idiosomal chaetotaxy follow Gaud and Atyeo (1996). The description of the new species is given in the current format used for Pteronyssidae (Mironov 1992, 2001; Mironov and Wauthy 2006, 2008). All measurements are in micrometers (μm). Latin names of birds used in the text follow Dickinson (2003).

SYSTEMATICS

Family Pteronyssidae Oudemans, 1941

Genus *Pteroherpus* Gaud in Faccini et Atyeo, 1981

Pteroherpus surmachi Mironov sp. n.

Type material. Male holotype (ZISP 4685), 8 male and 8 female paratypes from *Sitta villosa* Verreaux, 1865 (Sittidae), Russia, Primorsky Kray, Mikhailovsky District, Otradnoye, 4 km SW, 43°50′18′′N 132°30′13′′E, 25 August 2007, coll. S.G. Surmach.

Type deposition. Holotype and all paratypes are deposited in the Zoological Institute of the Russian Academy of Sciences, Saint Petersburg (ZIN).

Description. *Male* (holotype, range for 8 paratypes in parentheses). Gnathosoma: palpal seta *dTi* with very short additional branch, scale-like extension of palp well developed (Fig. 2C). Idiosoma 425 (410–435) in length, 200 (195–220) in width. Length of hysterosoma 263 (255–268). Propodonotal shield: occupying median part of prodorsum, lateral margins with small incisions around bases of setae *se*, posterolateral angles not expressed, posterior margin strongly convex, 122 (115–126) long and 95 (93–100) wide; setae *se* separated by 73 (70–75). Setae *c2* whip-like, 135 (130–138) long, almost twice as long as humeral shields; setae *c3* lanceolate, 40 (38–44) × 5 (4.5–5). Propodonotal and hysteronotal shields separated by large area with transverse fine striae, distance between these shields along midline 85 (80–88). Hysteronotal shield: entire, with anterior end extending to midlevel between setae *c2* and *cp*, not encompassing bases of setae *c1*, with anterior margin concave, with roughly rectangular anterior angles, greatest length 223 (220–235), width at anterior margin 102 (100–122) (Fig. 1A). Supranal concavity opened posteriorly, its anterior end almost extending to level of setae *e1*. Opisthosomal lobes slightly longer than wide, rounded apically, with slightly convex lateral margins, greatest width of lobar region 95 (90–100).

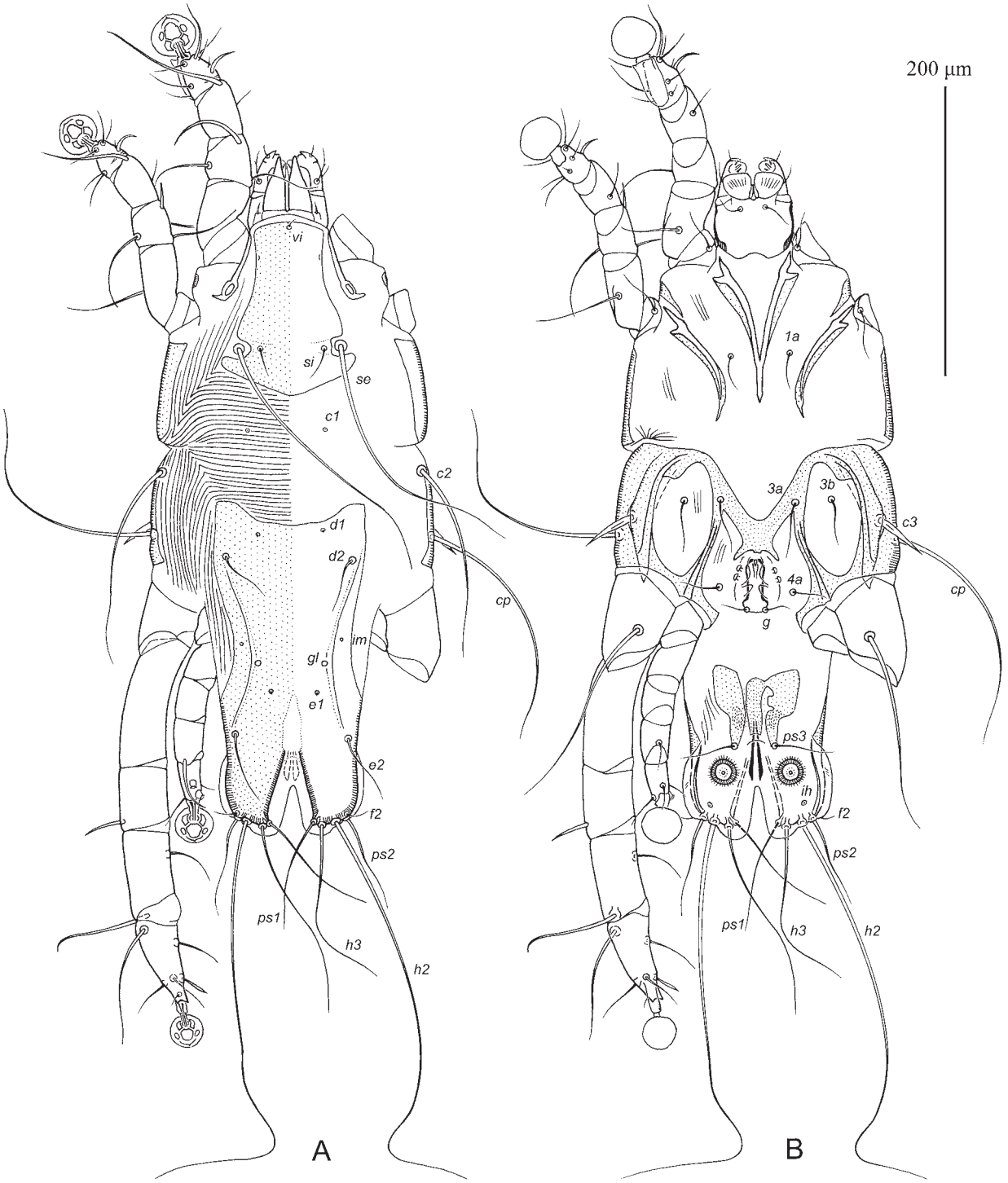

Fig. 1. *Pteroherpus surmachi* sp.n., male: A – dorsal view, B – ventral view.

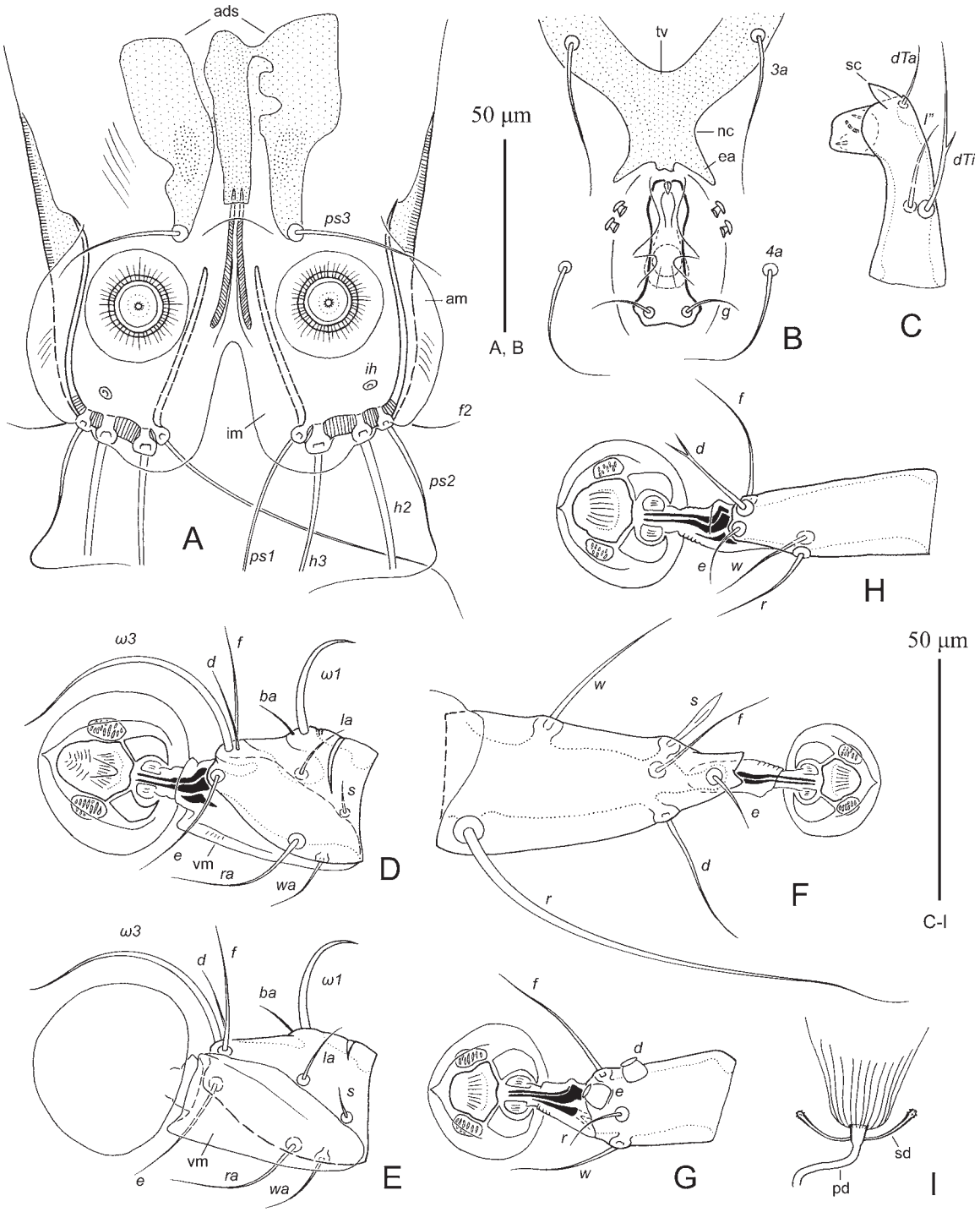

Fig. 2. *Pteroherpus surmachi* sp.n., details: A–G – male, H, I – female; A – ventral view of opisthosoma, B – genital apparatus and transventral sclerite, C – palp, dorsal view, D – tarsus I, dorsal view, E – tarsus I, ventral view, F – tarsus III, dorsal view, G – tarsus IV, dorsal view, H – tarsus IV, dorsal view, I – spermatheca and spermaducts.

Abbreviations: ads – adanal shield, am – adanal membrane, ea – tips of epiandrum, im – interlobar membrane, nc – neck of transventral sclerite, sc – scale-like projection of palp, tv – transventral sclerite, vm – ventral membrane of tarsus I.

Terminal cleft U-shaped, with diverging branches, 46 (44–48) long, length of this cleft including supranal concavity 88 (85–90); inner and distal margins of opisthosomal lobes with entire interlobar membrane extending to bases of setae *h3*. Setae *e1* posterior to level of hysteronotal gland openings *gl*. Setae *ps2* setiform; setae *f2* situated laterally at same level with setae *ps2*. Dorsal measurements: *c2:d2* 66 (64–68), *d2:e2* 122 (120–130), *d2:gl* 71 (66–78), *e2:h3* 58 (55–58), *d1:d2* 16 (16–22), *gl:e1* 20 (13–20), *h2:h2* 64 (64–74), *h3:h3* 44 (44–50), *ps1: ps1* 29 (29–37).

Transventral sclerite shaped like a thick and short Y, length along midline 22 (22–24), width of neck part 20 (17–22); tips of epiandrum very short, extending to level of genital arch apex (Fig. 1B, 2B). Length of genital apparatus 38 (36–38), width at base 11 (11–13); aedeagus minute, much shorter than total length of genital apparatus; basal sclerite shorter than genital apparatus (Fig. 2B). Setae *g* situated at base of genital apparatus. Adanal shield consisting of three pieces: median sclerite as longitudinal bar, and pair of lateral pieces strongly attenuated posteriorly and with setae *ps3* on their very tips (in some samples lateral pieces partly fused with medial one, Fig. 2A). Anterior ends of adanal membrane extending to level of setae *ps3*. Diameter of anal suckers 15 (15–16). Ventral measurements: *3a:4a* 62 (57–62), *4a:g* 13 (13–15), *g: ps3* 95 (95–98), *ps3:ps3* 29 (29–32), *ps3:h3* 55 (53–55). Ventral membrane of tarsus I equal in length to this segment (Fig. 2D, E). Tarsus III 62 (60–62) long, with narrow bidentate apex; setae *w, f* filiform, seta *s* narrowly lanceolate, 12 (12–13) long, seta *r* slightly longer than segment, extending to midlevel of ambulacral disc (Fig. 2F). Tarsus IV subequal in length to tibia IV; setae *d, e* barrel-like, with apical discs, seta *d* situated in distal half of segment (Fig. 2G).

Female (4 paratypes). Idiosoma 485–505 in length, 200–210 in width. Length of hysterosoma 334–352. Propodonotal shield shaped as in male, with more pronounced median extension on posterior margin, 135–140 long, 110–115 wide, setae *se* separated by 82–85. Setae *c2* whip-like, about 115–125 long, exceeding half-width of idiosoma, situated on striated tegument; setae *c3* lanceolate, 35–37 × 5–6.5. Arrangement of hysteronotal shields: paired anterior hysteronotal sclerites, central sclerite (absent in 4 of examined paratypes), and pair of opisthosomal sclerites (Fig. 3A). Pygidial sclerites absent. Anterior hysteronotal sclerites small, ovate in shape, situated at midlevel between trochanters III and IV near lateral margins oh hysterosoma, poorly sclerotized. Central sclerite, when present, small, almost square-shaped, 75–80 long, 72–78 wide, anterior end at midlevel between trochanters III and IV. Opisthosomal sclerites represented by relatively small longitudinal sclerites strongly attenuated posteriorly, with posterior ends almost extending to bases of setae *h2*, with setae *e2* situated on outer margins, 75–85 long, 37–47 greatest wide, shortest distance between their inner margins 55–65. Setae *d1* situated on anterior part of central sclerite when it presents; setae *d2, e1, ps1* and openings *gl* on striated tegument. Setae *d1* and *d2* situated at same transverse level, setae *ps1* situated slightly posterior to level of setae *h2*. Dorsal measurements: *c2:d2* 97–110, *d2:e2* 155–160, *e2:h3* 55–60, *d2:gl* 88–100, *e1:gl* 10–14, *h2:ps1* 7–10, *h2:h2* 117–126, *h3:h3* 104–110.

Epigynum short, with slightly convex transverse branch, with short and acute longitudinal branches, with acute lateral extensions, 33–37 long, 85–90 wide (Fig. 3B). Copulatory opening indistinct (probably situated between posterior ends of anal opening flaps). Secondary spermaducts about 15 long, distal ends slightly enlarged, with few indentations (Fig. 2I). Anal opening situated ventrally, at very posterior margin of opisthosoma. Tarsi III and IV 33–35 and 42–45 long, respectively, setae *d* on these tarsi bifurcate apically (Fig. 2H) (in few paratypes, these setae on some tarsi normal, setiform).

Differential diagnosis. *Pteroherpus surmachi* sp. n. clearly differs from other named species of the genus *Pteroherpus* by having the following unique features: in females, the pygidial sclerites are absent, the opisthosomal sclerites almost extend to bases of setae *h2*, the central sclerite is small square-shaped and can completely absent in some individuals, the hysteronotal gland openings *gl* are situated on striated tegument; in males, the adanal shield is split completely or partly into three pieces (median and two lateral pieces), setae *ps3* are situated on posterior ends of lateral pieces of the adanal shield. In females of other known species of the genus *Pteroherpus*, the pygidial sclerites are always present, the opisthosomal sclerites are far distant from setae *h2*, the central sclerite is always present and distinctly longer than wide (in most species half as long as hysterosoma), and the hysteronotal gland openings are situated on opisthosomal sclerites; in males, the adanal shield is always entire, represented by a transverse plate or T-shaped sclerite, and setae *ps3* are off the adanal shield.

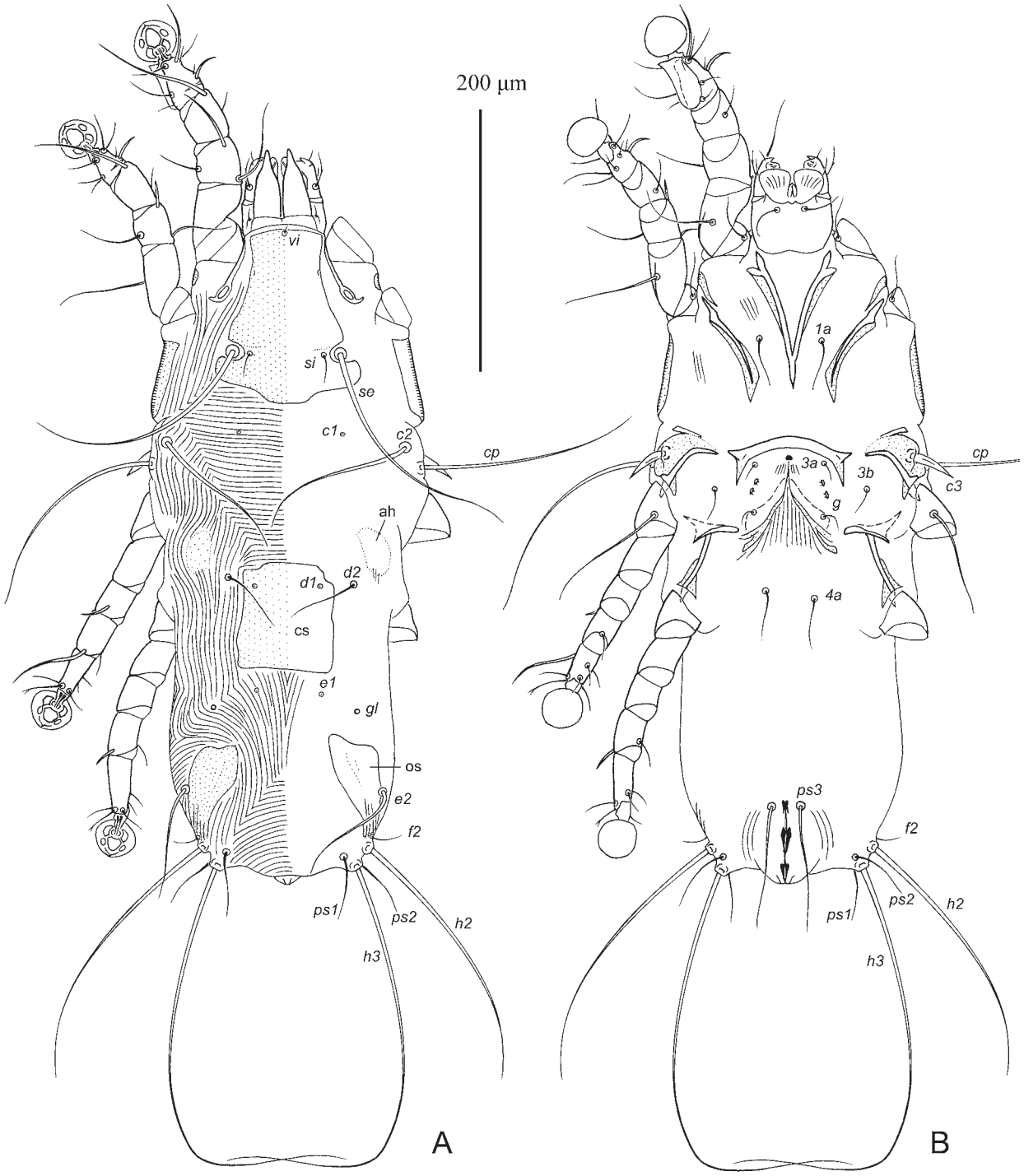

Fig. 3. *Pteroherpus surmachi* sp.n., female: A – dorsal view, B – ventral view. Sclerites of hysteronotal shield: ah – anterior hysteronotal sclerite, cs – central sclerite, os – opisthosomal sclerite.

Because of these unique features, *P. surmachi* cannot be referred to any species groups recognized so far in *Pteroherpus* (Mironov and Waithy 2008) and may be treated as a single representative of a separate species group. Among previously described species it can be compared with species of the *diploplax* group based on the proportions of the propodonotal shield, which is relatively narrow (the distance from anterior margin of this shield to the level of setae *se* is longer than the distance between bases of these setae). Among species of this group, the new species looks most comparable with *P. krivolutskii* Mironov, 1992 described from *Timalia pileata* Horsfield from Vietnam (Mironov 1992; Mironov and Wauthy 2008) in having a similar arrangement of hysteronotal sclerites in the females (Fig. 2A). In addition to the discriminating features listed above, *Pteroherpus surmachi* is distinguished from that species by the following characters: in both sexes, the propodonotal shield is incised around setae *se*; in males, the anterior margin of hysteronotal shield is concave, the tips of the epiandrum are short and extend only to the apex of the genital apparatus, the length of transventral sclerite along midline is subequal to its width at the neck (Fig. 1B); in females, the anterior hysteronotal sclerites are situated between levels of trochanters III and IV, setae *c2* are long (about half as long as hysterosoma width), the central sclerite (if present) is square-shaped and one quarter as long as of hysterosoma length, the opisthosomal sclerites are entire (Fig. 2A). In both sexes of *P. krivolutskii*, the lateral margins of the propodonotal shields have a small incision posterior to bases of setae *se*; in males, the anterior margin of hysteronotal shield is straight, the tips of the epiandrum extend to the midlevel of the genital apparatus, the transventral sclerite is twice as long as its width at the neck; in females, the anterior hysteronotal sclerites are situated at the level of humeral setae *cp*, setae *c2* are not longer than trochanters III, the central sclerite is strongly elongated, half as long as hysterosoma, and with rounded posterior margin, and each of the opisthosomal sclerites is almost completely split longitudinally into inner and outer fragments.

Etymology. The species is named after Dr. S.G. Surmach (the Institute of Biology and Soil Sciences of the Russian Academy of Sciences, Vladivostok), the chairman of the Amur-Ussurian Centre for Biodiversity of Birds.

DISCUSSION

Nuthatches Sittidae are a small family of oscine passerines currently including about 24 species of a single genus *Sitta* Linnaeus (Clements 2007). The wallcreeper *Tichodroma muraria* (Linnaeus) previously included into this family as a separate subfamily (Howard and Moore, 1991; Dickinson, 2003) has been recently moved to a separate family Tichodromidae (Clements, 2007). The nuthatches are widely distributed in the Northern hemisphere, mainly in Eurasia and North America, in forest and rock biotopes. Within the infraorder Passerida, the family Sittidae together with treecreepers Certhiidae and wrens Troglodytidae constitute a distinct phylogenetic lineage occupying a separate position or appearing as the most basic lineage of the superfamily Muscicapoidea (Barker *et al.* 2002; Alström *et al.* 2006; Jønsson and Fjeldså 2006; Johansson *et al.* 2008); sometimes this lineage is even treated as a separate superfamily Certhioidea (Cracraft *et al.* 2004).

Just few species of the family Sittidae have been explored with regard to their feather mite fauna. The Eurasian Nuthatch *Sitta europaea* Linnaeus usually bears two species: *Proctophyllodes vitzthumi* Fritsch, 1961 (Proctophyllodidae) occupying flight feather and *Analges picicola* Černý et Shumilo, 1973 (Analgidae) living on the downy and body covert feathers (Fritsch 1961; Atyeo and Braasch 1966; Černý and Shumilo 1973; Shumilo and Mironov 1983; Mironov 1985, 1996). The Red-breasted Nuthatch *Sitta canadensis* Linnaeus widely distributed in North America is known only as a host of *Proctophyllodes canadensis* Atyeo et Braasch, 1966. Both *Proctophyllodes* species are known as monoxenous inhabitants of corresponding nuthatch species. Although *A. picicola* was originally described from the Grey-headed Woodpecker *Picus canus* (Piciformes: Picidae), this was an obvious contamination, because this mite is common on *S. europaea* in the European part of Russia (Mironov 1996). It is necessary to add that *Analges picicola* was also described from the Eurasian Nuthatch under the names *A. unidentatus* Zimmermann, 1894 (nom. preocc. *A. unidentatus* Berlese, 1886 from *Monticola solitarius* (Linnaeus)) and *A. sittae* Mironov, 1985 **syn. n.** (Zimmermann 1894; Berlese 1886; Mironov 1985).

Analges picicola and *P. vitzthumi* and are morphologically quite distinct from other representatives of corresponding genera, and it is most likely these mites

represent a primary feather mite fauna inherited from the ancestor of the family Sittidae. At the same time *P. canadensis* from *S. canadensis* belongs to the *pinnatus* species group (Atyeo and Braasch 1966), representatives of which are predominately distributed on passerines of the superfamily Passeroidea (buntings, finches, sparrows and allies). It is quite probably that *P. canadensis* is an inhabitant of secondary origin on this host from the family Sittidae.

The finding of *Pteroherpus surmachi* (Pteronyssidae) on *Sitta villosa,* which is distributed in Korea and the eastern part of China and suggested to be close to *S. canadensis* (Pasquet 1998), shows that the feather mite fauna associated with the family Sittidae could potentially be richer in mite families than it is possible to judge based on the investigation of a few sittid species. Representatives of such plumage-inhabiting mite families as Analgidae, Proctophyllodidae, Pteronyssidae, Trouessartiidae, Psoroptoididae, and Xolalgidae are quite common for most groups of passerines (Gaud and Atyeo 1996). In relation with this, it would be quite intriguing to investigate other *Sitta* species, especially those from Central and Southeast Asia, where nuthatches are most diverse and where this family probably evolved (Menon *et al.* 2008). Here it is possible to add that undetermined feather mite species belonging to the genera *Pteroherpus, Neodectes* Park et Atyeo, 1971 (Proctophyllodidae), and *Trouessartia* Canestrini, 1899 (Trouessartiidae) have been recently detected on the Velvet-fronted Nuthatch *S. frontalis* Swainson from the Philippines (H.C. Proctor, University of Alberta, Canada, pers. communication). A solitary position of *Pt. surmachi* within the genus *Pteroherpus* and separate position of the Sittidae and allies within the Passerida support the hypothesis that this mite could be a member of the primary feather mite fauna ancestrally associated with nuthatches. Considering the two most northern species of nuthatches, *S. europaea* and *S. canadensis*, having extensive ranges in Eurasia and North America, respectively, it is possible to hypothesize that they have probably lost some components of the primary feather mite fauna of Sittidae.

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REFERENCES

Alström P., Ericson P.G.P., Olsson U. and Sundberg P. 2006. Phylogeny and classification of the avian superfamily Sylvioidea. *Molecular Phylogenetics and Evolution*, **38**: 381–397.

Atyeo W.T. and Braasch N.L. 1966. The feather mite genus *Proctophyllodes* (Sarcoptiformes: Proctophyllodidae). *Bulletin of the University of Nebraska State Museum*, **5**: 1–354.

Barker F.K., Barrowclough G.F. and Groth, J.G. 2002. A phylogenetic hypothesis for passerine birds: taxonomic and biogeographic implications of an analysis of nuclear DNA sequence data. *Proceedings of the Royal Society, London, B. Biological Sciences*, **269**: 295–308.

Berlese A. 1886. Acari, Myriopoda et Scorpiones hucusque in Italia reperta. Padova and Portici. Fascicule 27, No. 5.

Černý V. and Shumilo R.P. 1973. The feather mite genus *Pteronyssus* (Analgoidea, Avenzoariidae) of European woodpeckers. *Folia Parasitologica*, **20**: 89–95.

Clements J.F. 2007. The Clements Checklist of Birds of the World. 6th Edition, Cornell University Press, Ithaca, 864 p.

Cracraft J., Barker F. Keith, Braun M. J., Harshman J., Dyke G., Feinstein J., Stanley S., Cibois A., Schikler P., Beresford P., García-Moreno J., Sorenson M.D., Yuri T. and Mindell D. P. 2004. Phylogenetic relationships among modern birds (Neornithes): Toward an avian tree of life. In: J. Cracraft and M. J. Donoghue (Eds.). Assembling the tree of life. Oxford University Press, New York: 468–489.

Dickinson E.C. 2003. The Howard and Moore Complete Checklist of the Birds of the World, 3rd Edition. Princeton University Press, Princeton, N.J., 1056 p.

Evans G.O. 1992. Principles of Acarology. C.A.B International, Wallingford, 563 p.

Faccini J.L.H. and Atyeo W. T.1981. Generic revisions of the Pteronyssinae and Hyonyssinae (Analgoidea: Avenzoariidae). *Proceedings of the Academy of Natural Sciences of Philadelphia*, **133**: 20–72.

Fritsch W. 1961. Die Milbengattung *Proctophyllodes* Robin 1868 (Subordo Sarcoptiformes, Fam. *Proctophyllodidae* Megnin et Trouessart 1883). *Zeitschrift für Parasitenkunde*, **21**: 1–29.

Gaud J. and Atyeo W.T. 1996. Feather mites of the World (Acarina, Astigmata): the supraspecific taxa.

Musée Royal de l'Afrique Centrale, Annales, Sciences Zoologiques, **277**: 1–193 (Pt. 1 – text), 1–436 (Pt. 2 – illustrations).

Howard R. and Moore A. 1991. A complete checklist of the birds of the World. Second Edition. Academic Press, San Diego, California, 622 p.

Johansson U.S., Fjeldså J. and Bowie R.C.K. 2008. Phylogenetic relationships within Passerida (Aves: Passeriformes): A review and a new molecular phylogeny based on three nuclear intron markers. *Molecular Phylogenetics and Evolution*, **48**: 858–876.

Jønsson, K.A. and Fjeldså J. 2006. A phylogenetic supertree of oscine passerine birds (Aves: Passeri). *Zoologica Scripta*, **35**: 149–186.

Menon S., Islam Z.-U., Soberon J. and Peterson A.T. 2008. Preliminary analysis of the ecology and geography of the Asian nuthatches (Aves: Sittidae). *The Wilson Journal of Ornithology,* **120**: 692–699.

Mironov S.V. 1985. Feather mites of the genera *Analges* and *Pteronyssoides* from the European part of the USSR (Sarcoptiformes, Analgoidea). *Parazitologicheskii Sbornik Zoologicheskogo Instituta AN SSSR, Leningrad*, **33**: 159–208. [In Russian with English summary]

Mironov, S.V. 1992. Five new species of the feather mite genus *Pteroherpus* Gaud (Analgoidea: Avenzoariidae) from passerine birds of Vietnam. *International Journal of Acarology*, **18**: 1–12.

Mironov S.V. 1996. Feather mites of the passerines in the North-West of Russia. *Parazitologiya*, **30**: 521–539. [In Russian with English summary]

Mironov S.V. 2001. Four new genera of the feather mite family Pteronyssidae Oudemans 1941 (Astigmata: Analgoidea) with notes on systematics of the family. *Acarina*, **9**: 3–22.

Mironov S.V. and Proctor H. 2011. Four new feather mite species of the family Pteronyssidae (Astigmata: Analgoidea) from laughing thrushes (Passeriformes: Timaliidae) in China. *Acarina*, **19**: 35–51.

Mironov S.V. and Wauthy G. 2005. Two new species of the feather mite genus *Dicrurobius* Mironov, 2001 (Acari: Astigamata: Pteronyssidae) from drongos (Passeriformes: Dicruridae) in Africa. *Zootaxa*, **1103**: 27–39.

Mironov S.V. and Wauthy G. 2006. Three new species of the feather mite genus *Pteroherpus* Gaud, 1981 (Astigmata: Pteronyssidae) from the bulbuls (Passeriformes: Pycnonotidae) in Africa. *Acta Parasitologica*, **51**: 65–72.

Mironov S.V. and Wauthy G. 2008. A systematic review of the feather mite genus *Pteroherpus* Gaud, 1981 (Astigmata: Pteronyssidae). *Bulletin de l'Institut Royal des Sciences naturelles de Belgique, Entomologie*, **78**: 155–200.

Mironov S.V. and Wauthy G. 2010. Phylogeny and host-parasite associations of feather mites of the *Pteroherpus* generic group (Astigmata: Pteronyssidae). In: M. Sabelis and J. Bruin (Eds.). *Trends in Acarology: Proceedings of 12th International Congress*. Springer-Verlag: 23–30.

Pasquet E. 1998. Phylogeny of the nuthatches of the *Sitta canadensis* group and its evolutionary and biogeographic implications. *Ibis*, **140**: 150–156

Shumilo R.P. and Mironov S.V. 1983. Feather mites (Acariformes, Analgoidea) of passerine birds of Moldavia. *Izvestiya Akademii Nauk Moldavskoi SSR, Seria biologicheskikh i khimicheskikh nauk*, **2**: 75–76. [In Russian]

Zimmermann H. 1894. Einige neue Arten aus der Familie der Federmilben. *Verhandlungen des naturforschenden Vereins in Brünn*, **32**: 211–230.

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