

**FOUR NEW FEATHER MITE SPECIES OF THE FAMILY PTERONYSSIDAE
(ASTIGMATA: ANALGOIDEA) FROM LAUGHING-THRUSHES
(PASSERIFORMES: TIMALIIDAE) IN CHINA**

S. V. Mironov¹ and H. C. Proctor²

¹Zoological Institute, Russian Academy of Sciences, Universitetskaya quay 1, 199034, Saint Petersburg, Russia; e-mail: astigmata@zin.ru

²Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada T6G 2E9; e-mail: hproctor@ualberta.ca

ABSTRACT: Four new species of the feather mite family Pteronyssidae are described from passerines of the family Timaliidae in China (Guangxi and Guizhou Provinces): *Mouchetia stachyris* sp. n. from *Stachyris ruficeps* Blyth, *Pteroherpis garrulacis* sp. n. from *Garrulax maesi* (Oustalet), *Timalinyssus curvilobus* sp. n. from *Garrulax sannio* Swinhoe, and *T. grallator* sp. n. from *Alcippe chrysotis* (Blyth). New data on distribution and host associations are provided for six more species of pteronyssids found in the area surveyed. Four species, *M. indochinensis* Mironov, 1990, *P. pycnonoti* Mironov, 1992, *P. krivolutskii* Mironov, 1992 and *Pteronyssoides (Pteronyssoides) faini* Mironov et Wauthy, 2005, are found in China for the first time; for the two latter species and for *Pteronyssoides (Holonyssoides) desmiphorus* (Gaud, 1952) and *Timalinyssus longitarsus* Wang et Wang, 2008 new avian hosts are recorded.

KEY WORDS: Astigmata, feather mites, Pteronyssidae, systematics, Timaliidae, China

INTRODUCTION

Feather mites are ectoparasitic and commensal mites (Acari: Astigmata) permanently living in the plumage and on the skin of birds. Approximately 2500 described species of these mites (in about 450 genera, 34–38 families and 2 superfamilies) are currently known throughout the World and have been recorded from almost all recent avian orders (Gaud and Atyeo 1996; Mironov 2003; Proctor 2003; OConnor 2009). Nevertheless, experts believe that the currently known number of species represents less than 20% of the actual extant fauna (Peterson 1975; Atyeo and Gaud 1979; Gaud and Atyeo 1996).

Diversity of feather mites in China is known quite poorly. The first records of feather mites associated with wild birds in this country were made in the middle of the 20th century (e.g. Sugimoto 1940a, 1940b, 1941). Wang and Fan (2010) summarize literature (~40 publications) on feather mites recorded from China up to 2010; this work reveals that only 61 species belonging to 41 genera and 16 families have been reported so far. Considering that the avian fauna of China includes over 1300 species (MacKinnon and Phillips 2000), and each of them is potentially a host of several feather mite species, it is obvious that investigation of feather mites in this country is at a very early stage.

In the present paper we describe four new feather mite species of the family Pteronyssidae Oudemans, 1941 (Astigmata: Analgoidea) from birds of the family Timaliidae in the Guangxi and Guizhou Provinces of China. Additionally, we report four pteronyssid species in China for the first time, and new hosts are recovered for four species.

The family Pteronyssidae currently includes about 170 species in 23 genera (Gaud and Mouchet 1959; Faccini and Atyeo 1981; Mironov 2001, 2003; Mironov and Wauthy 2005a, 2005b, 2008). These mites are predominately distributed on hosts from the orders Piciformes and Passeriformes, with only three species recorded from wood hoopoes Phoeniculidae (Coraciiformes). Within the plumage of their hosts, pteronyssids usually inhabit the ventral surface of feathers with large and firm vanes, the flight feathers and the large upper coverts of wings. Five species of this family belonging to the genera *Neopteronysus* Mironov, 2003, *Pteronyssoides* Hull, 1931, and *Timalinyssus* Mironov, 2003 have been recorded so far from China (Wang and Fan 2010).

MATERIAL AND METHODS

Host specimens were collected in the course of an international ornithological survey funded by a U.S. National Science Foundation grant led by Dr. A. Townsend Peterson (University of Kansas) in the Guangxi and Guizhou Provinces of the People's Republic of China in 2004–2007 (see Robbins et al. 2006; Boyd et al. 2008). Mite specimens used in the present study were collected from hosts by Dr. Sarah Bush, then a postdoctoral researcher at the University of Kansas, and Dr. Dale Clayton, University of Utah. Mite specimens were preserved in 95% ethanol and subsequently mounted on slides in PVA medium medium (#6371A, BioQuip Products Inc., Rancho Dominguez, California). Slides were placed for 4–5 days into slide a warmer set at 40° C. Draw-

ings were made using a drawing device attached to a Leica DM4000 light microscope with DIC illumination.

Descriptions of new species are made in the current format used for mites of the family Pteronyssidae (Mironov and Wauthy 2005b, 2008). General morphological terms including body and leg chaetotaxy follow Gaud and Atyeo (1996). Nomenclature for sclerites in genera having the female hysteronotal shield split into various pieces was proposed by Mironov (1992). All measurements in the descriptions are in micrometers. Measuring techniques for particular structures are as follows:

(i) Length of idiosoma is measured from the anterior margin of the body excluding gnathosoma to the posterior margin or to lobar apices (if opisthosoma with lobes); width of idiosoma is the greatest width at the level of humeral shield;

(ii) Hysterosoma is measured from the level of sejugal furrow on lateral margins to posterior margin of opisthosoma or lobar apices (if opisthosoma with lobes);

(iii) Prodorsal shield length is measured from anterior margin to posterior margin along midline (if posterior margin convex) and to the level of posterolateral angles (in posterior margin is concave); and width is greatest width at posterior margin;

(iv) Hysteronotal shield length is the greatest length from the anterior margin (if it is convex) or from the level of anterior angles (if anterior margin is concave) to posterior margin of opisthosoma or lobar apices (if lobes present);

(v) Distance between different pairs of setae is the shortest distance between the transverse levels formed by setae of respective setal pairs;

(vii) Length of tarsi is measured without pretarsus (ambulacrum).

Abbreviation used in accession numbers and depositories of type and other materials: UASM — E.H. Strickland Entomological Museum of the University of Alberta (Edmonton, Canada); UMMZ — Museum of Zoology of the University of Michigan (Ann Arbor, USA); ZISP — the Zoological Institute of the Russian Academy of Sciences (Saint Petersburg, Russia). Most host specimens (with accession prefix KUMNH) are deposited in the University of Kansas Natural History Museum (Lawrence, Kansas); a few other host specimens were retained in China for subsequent deposition in museums of that country. Latin and common names of bird taxa are given after Dickin-

son (2003). Collectors mentioned below are those who collected the host; all mites were removed by S. Bush and D. Clayton soon after the hosts had been collected.

SYSTEMATICS

Family Pteronyssidae Oudemans, 1941

Genus *Pteroherpus* Gaud, 1981

The genus *Pteroherpus* Gaud, 1981 (in: Facchini and Atyeo 1981) is one of the most species-rich genera of Pteronyssidae. According to the most recent taxonomic revision (Mironov and Wauthy 2008), this genus includes 18 species arranged in four species groups. *Pteroherpus* together with *Dicrurobium* Mironov, 2001, *Micropteroherpus* Mironov 2001, and *Vanginyssus* Mironov, 2001, constitute the *Pteroherpus* generic group, which is clearly characterized by having a bifurcate palpal seta *dTi* (*d2* or *dp2* of previous authors, e.g. Bruce and Johnston 1969; Mironov and Wauthy 2006). In the context of this group, the genus *Pteroherpus* is characterized by the following combination of diagnostic features. In males, tarsi III have a bidentate apex, the supranal concavity is relatively short and does not extend to the level of dorsal setae *e1*, the opisthosomal lobes are short and rounded and are usually close to each other (Figs. 1A, 3C). In females, the hysteronotal shield is represented by a complicated set of 4–9 paired and unpaired sclerites, among which the pygidial sclerites are always paired and the opisthosomal sclerites are entire or split into inner and lateral fragments; hysteronotal gland openings *gl* are always situated on opisthosomal sclerites (Fig. 2A).

Representatives of *Pteroherpus* are associated exclusively with oscine passerines in the Old World. The majority of known species (14) are associated with hosts from the superfamily Sylvioidea (Old World warblers and related families), and remaining species are known from birds of the families Muscicapidae (Muscicapoidea), Monarchidae and Pardisaeidae (both Corvoidea). About two thirds of known species (13) are from hosts distributed in Africa including Madagascar (Gaud and Till 1961; Mironov and Wauthy 2008), four species, *P. dentilobus* Mironov, 1992, *P. krivolutskii*, Mironov, 1992, *P. pycnonoti* Mironov, 1992, and *P. zosteropis* Mironov, 1992, are known from the South-East Asia, in particular from Vietnam (Mironov 1992), and one species, *P. hipposathes* (Trouessart, 1887), is from New Guinea (Trouessart 1887). This modest number of species

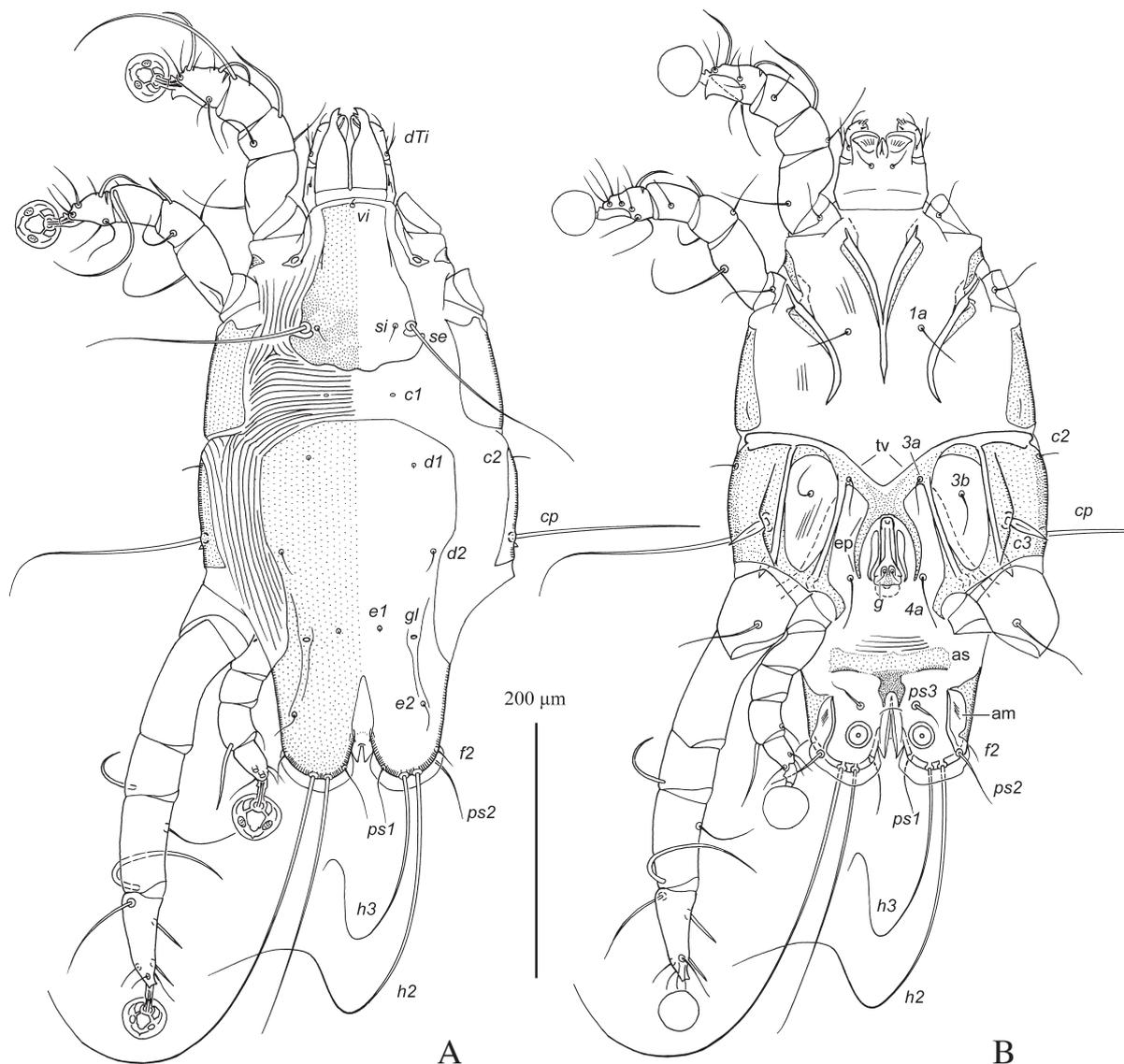


Fig. 1. *Pteroherpus garrulacis* sp. n., male. A — dorsal view, B — ventral view. am — adanal membrane, as — adanal shield, ep — epiandrum, tv — transventral sclerite.

is the result of very poor investigation rate of feather mites in Asia.

***Pteroherpus garrulacis* sp. n.**

Figs. 1, 2, 3A–E

Type material. Male holotype (ZISP 4565), 4 male and 7 female paratypes from the grey laughing-thrush *Garrulax maesi* (Oustalet, 1890), Timaliidae, (KUMNH 96275), China, Guangxi Province, Shiwandashan National Nature Preserve, 21°50'24"N, 107°52'48"E, 2 May 2005, coll. M.B. Robbins. Holotype, 1 male and 2 female paratypes — ZISP, 1 male and 3 female paratypes — UASM, 2 male and 2 female paratypes — UMMZ.

Description. Male (holotype, range for 3 paratypes). Idiosoma 458 in length, 245 in width

(425–455 × 175–200). Length of hysterosoma 268 (255–265). Prodorsal shield: posterolateral angles not expressed, lateral margins with small incisions posterior to bases of setae *se*, posterior margin uneven and distinctly convex, 135 (130–135) long and 108 (97–110) wide, posterior part much more sclerotized than anterior one, setae *se* separated by 86 (77–85). Setae *c2* filiform, 35 (28–38) long; setae *c3* lanceolate, 29 (28–33) × 7(7–8). Prodorsal and hysteronotal shields separated by large area with numerous transverse striae, distance between these shields along midline 35 (30–37). Hysteronotal shield: entire, not encompassing bases of setae *c1*, with anterior margin strongly convex and extending anterior to level of setae *c2* (Fig. 1A), with bluntly rounded anterior angles, greatest length 276 (265–275), width at anterior margin

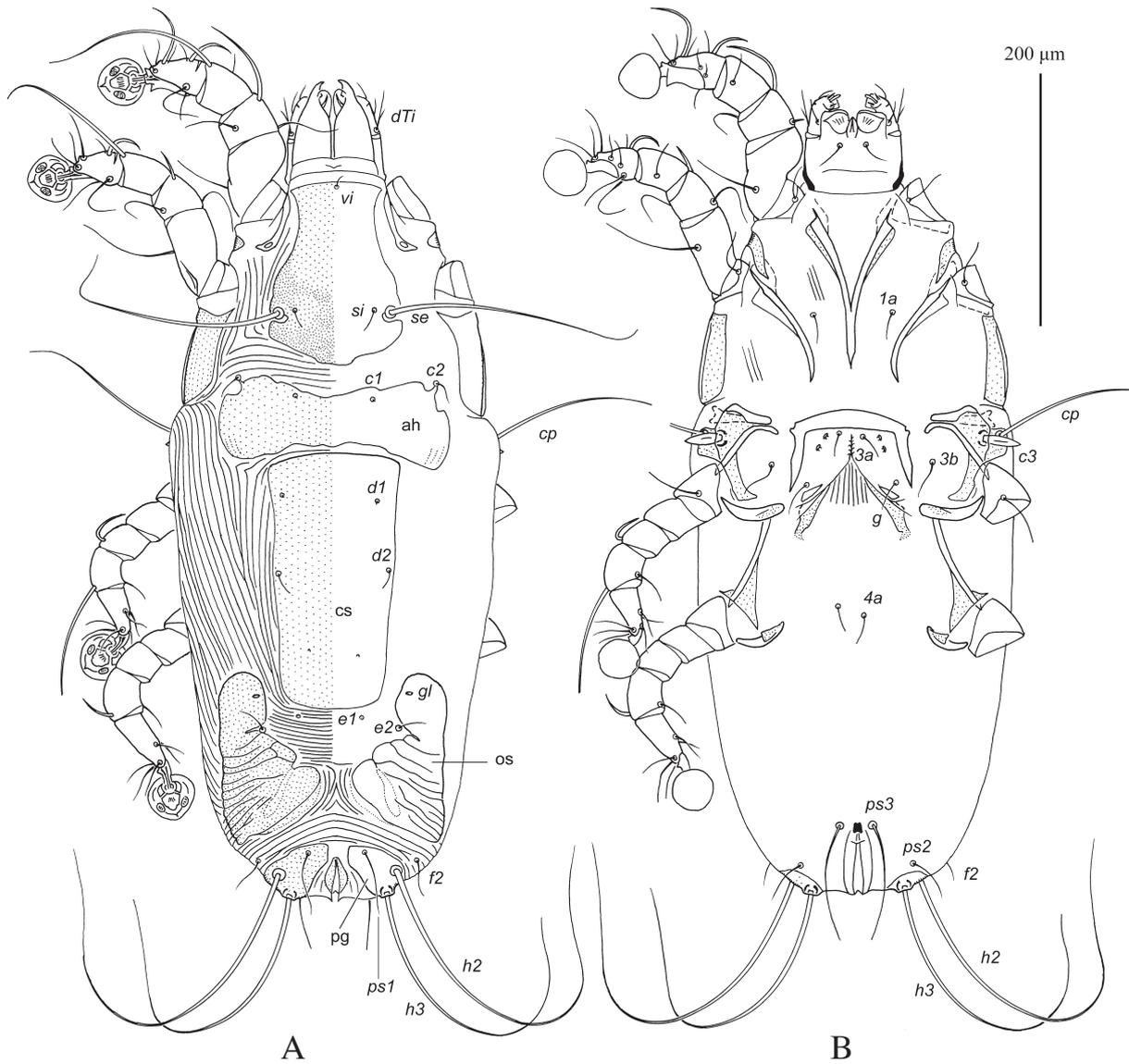


Fig. 2. *Pteroherpis garrulacis* sp. n., female. A—dorsal view, B—ventral view. Hysteronotal sclerites: ah— anterior hysteronotal sclerite, cs— central sclerite, os— opisthosomal sclerite, pg— pygidial sclerite.

155 (145–158). Supranal concavity opened posteriorly, its anterior extending to midlevel between gland openings *gl* and setae *e2*. Opisthosomal lobes short and rounded; terminal cleft small U-shaped, 35 (35–44) long, length of the cleft including supranal concavity 94 (85–95); distal and inner margins of lobes with narrow entire membrane. Setae *e1* and openings *gl* approximately at same transverse level. Setae *f2* situated laterally. Width of opisthosoma at level of setae *f2* 122 (105–125). Dorsal measurements: *c2:d2* 82 (70–85), *d2:e2* 120 (120–130), *d2:gl* 67 (65–73), *e2:h3* 60 (48–60), *h2:h2* 80 (77–80), *h3:h3* 60 (58–62), *ps1:h3* 7 (4–7).

Transventral sclerite shaped like a thick upside-down Y, length along midline 26 (25–27), width of neck part 27 (25–27); tips of epiandrium extending to level of setae *4a* (Fig. 1B). Length of

genital apparatus 57 (55–57), width at base 22 (20–22); aedeagus minute, much shorter than total length of genital apparatus; latigenital apodemes well developed, as long as 2/3 of genital apparatus length (Fig. 3E). Adanal shield T-shaped, posterior part of longitudinal piece strongly sclerotized, transverse piece poorly sclerotized, barely distinct. Diameter of anal suckers 22 (21–22). Ventral measurements: *3a:4a* 80 (75–80), *g:4a* 7 (4–7), *g:ps3* 106 (100–106), *ps3:ps3* 44 (42–45), *ps3:h3* 51 (50–53). Tarsus III 75 (72–75) long, with narrow bidentate apex, setae *w*, *s* spiculiform, 33 (28–33) and 23 (22–24) long, respectively, remaining setae filiform, seta *r* slightly shorter than segment (Fig. 3C). Tarsus IV subequal in length to tibia IV; setae *d*, *e* with apical caps, seta *d* in distal half of segment (Fig. 3D).

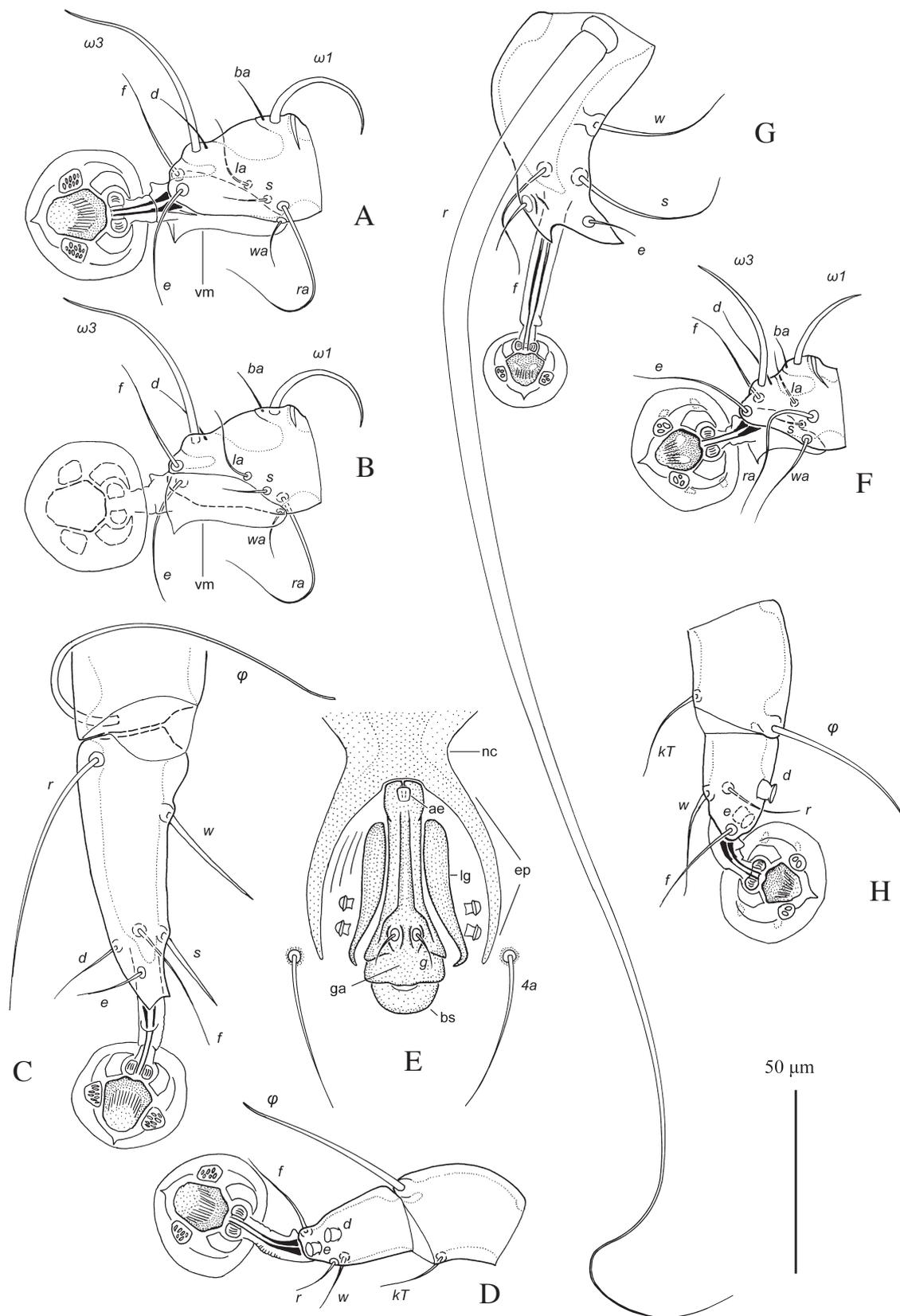


Fig. 3. Details of *Pteroherpus* and *Mouchetia* males. A–E — *Pteroherpus garrulacis* sp. n., F–H — *Mouchetia stachyris* sp. n. A — tarsus I, dorsal view, B — tarsus I, ventral view, C — tarsus III, D — tarsus and tibia IV, E — genital apparatus, F — tarsus I, dorsal view, G — tarsus III, dorsal view, H — tibia and tarsus IV, dorsal view. ae — tip of aedeagus, bs — basal sclerite, ep — epiandrium, ga — genital arch, lg — latigenital apodeme, nc — neck of trans-ventral sclerite, vm — ventral membrane of tarsus I.

Female (4 paratypes). Idiosoma 545–575 in length, 235–265 in width. Length of hysterosoma 365–385. Prodorsal shield as in male, 135–142 long, 102–110 wide, setae *se* separated by 85–90. Setae *c2* filiform, about 20–25 long; setae *c3* lanceolate, 28–30 × 8–8.5. Arrangement of hysteronotal shields: unpaired anterior hysteronotal sclerite, central sclerite, pair of opisthosomal sclerites, and pair of pygidial sclerites (Fig. 2A). Anterior hysteronotal sclerite as large transverse plate with slightly narrowed median part, encompassing bases of setae *c1*, *c2* (in 1 specimen setae *c2* off this sclerite), separated from prodorsal shield by narrow band of soft tegument with 4–6 striae. Central sclerite almost rectangular, 195–206 long, 95–100 wide at anterior margin, anterior end at level of anterior margin of trochanters III, anterior and posterior margins straight or slightly convex. Lateral opisthosomal sclerites represented by plates of roughly triangular form, with surface crossed by numerous transverse wavy striae, with openings *gl* in anterior part and setae *e2* on inner margins (or near it on striated tegument), 125–133 long, 70–75 wide. Setae *d1*, *d2* on central sclerite, setae *e1* on striated tegument near posterior margin of central sclerites. Setae *ps1* anterior to level of setae *h2*, near anterior margin of pygidial sclerites. Dorsal measurements: *c2:d2* 100, *d2:e2* 98, *d2:gl* 73, *e1:gl* 3–5, *e2:h3* 80, *h2:h2* 77, *h3:h3* 60. Anal opening terminal, copulatory opening indistinct. Epigynum almost rectangular, without noticeable lateral extensions, posterior ends with acute tips, 57–66 × 95–102 (Fig. 2B). Tarsi III and IV 38–40 and 44–47 long, respectively.

Differential diagnosis. *Pteroherpus garrulacis* sp. n. belongs to the *diploplax* species group based on the proportions of the prodorsal shield, which is relatively narrow (the distance from anterior margin of this shield to the level of setae *se* is longer than distance between bases of these setae). Among species of this group, the new species is most close to *P. krivolutskii* Mironov, 1992 from the chestnut-capped babbler *Timalia pileata* Horsfield from Vietnam (Mironov 1990; Mironov and Wauthy 2008) in having a similar arrangement of hysteronotal sclerites in the female (Fig. 2A). *Pteroherpus garrulacis* is distinguished from that species by the following features: in males, the anterior margin of hysteronotal shield is strongly convex, tips of the epiandrum extend to the base of the genital arch, setae *e1* and gland openings *gl* are approximately at the same transverse level, length of transventral sclerite and its width at neck

are subequal (Fig. 1B); in females, the anterior hysteronotal sclerite is unpaired and encompasses the bases of setae *c1*, the central sclerite has a truncate posterior margin, and the opisthosomal sclerites are roughly triangular and have numerous wavy striae (Fig. 2A). In males of *P. krivolutskii*, the anterior margin of hysteronotal shield is straight, tips of the epiandrum extend to the midlevel of the genital arch, setae *e1* are much posterior to the level of openings *gl*, the transventral sclerite is twice as long as its width at neck; in females, the anterior hysteronotal sclerite is paired and does not encompass bases of setae *c1*, the central sclerite has widely rounded posterior margins, and each of the opisthosomal sclerites is as a thin C crossed with a few striae.

It is necessary to add that the arrangement and shape of hysteronotal sclerites in *P. garrulacis* females are very similar to those in *P. doleoplax* (Gaud et Mouchet, 1959) belonging to the *hoplophorus* species group and associated with the swamp greenbul *Thescelocichla leucopleura* (Cassin) (Pycnonotidae). Mites of the *hoplophorus* group are characterized by a wider prodorsal shield than those in the *diploplax* group: the distance between setae *se* is greater or at least equal to the distance from anterior margin of prodorsal shield to the level of these setae. In addition to the narrower prodorsal shield as for all species of the *diploplax* group, females of *P. garrulacis* are distinguished from those of *P. doleoplax* by their roughly triangular opisthosomal sclerites with numerous wavy striae and significantly longer idiosoma (545–575). In females of *P. doleoplax*, the opisthosomal sclerites are thick C-shaped with 4–5 transverse striae, and the length of idiosoma is 380–430.

Etymology. The specific epithet derives from the generic name of the type host and is a noun in the genitive case.

Pteroherpus krivolutskii Mironov, 1992

Material examined. 5 males and 5 females from the spot-throated babbler *Pellorneum albiventris* (Godwin-Austen, 1877), Timaliidae, (KUMNH 96492), China, Guangxi Province, Shiwandashan National Nature Preserve, 21°50'24"N, 107°52'48"E, 20 April 2005, coll. T.J. Davis. Specimens — UMMZ, ZISP.

This species was previously known only from the chestnut-capped babbler *Timalia pileata* (Horsfield) (Timaliidae) in Vietnam (Mironov 1992; Mironov and Wauthy 2008). Our finding

represents a new host for this species and is the first record of this mite in China.

***Pteroherpus pycnonoti* Mironov, 1992**

Material examined. 7 males, 5 females from the light-vented bulbul *Pycnonotus sinensis* (Gmelin, 1789) (Pycnonotidae), (KUMNH 96428), China, Guangxi Province, Shiwandashan National Nature Preserve, 21°50'24"N, 107°52'48"E, 27 April 2005, coll. T.J. Davis. Specimens — UASM, UMMZ, ZISP.

This species was previously recorded from three species of bulbuls, the sooty-headed bulbul *Pycnonotus aurigaster* (Vieillot), red-whiskered bulbul *P. jocosus* (Linnaeus) and *P. sinensis* (Gmelin), in Vietnam (Mironov 1992; Mironov and Wauthy 2008). Our finding is the first record of this species in China.

Genus *Mouchetia* Gaud, 1961

Mites of the genus *Mouchetia* Gaud, 1961 are medium- and large-sized pteronyssids easily discriminated from all other genera by the following features. In males, tarsi III have a large spine on apex and subapical spine on the outer margin of this segment, and seta *r* of this segment is hypertrophied to form a long whip-like macroseta (Figs. 3G). In females, the opisthosoma has a pair of small tongue-shaped and widely separated lobes, and the anterior part of the hysteronotal shield is strongly narrowed and has a form of narrow trapezium (Fig. 5A) (Gaud 1961; Faccini and Atyeo 1981; Mironov and Wauthy 2005a). Mites of the genus *Mouchetia* are known from passerines of the families Sylviidae, Timaliidae, and Zosteropidae in the Old World (Gaud 1961, 1962, 1968; Mironov 1990; Mironov and Galloway 2002; Mironov and Wauthy 2005a). According to the most recent revision of the genus (Mironov and Wauthy 2005a), this genus includes six species. Among them, only two species, *Mouchetia indochinensis* Mironov, 1990 and *M. rumi-antzevi* Mironov, 1990, have been recorded from South-East Asia.

***Mouchetia stachyris* sp. n.**

Figs. 3F–H, 4, 5

Type material. Male holotype (ZISP 4567), 2 male and 1 female paratypes from the rufous-capped babbler *Stachyris ruficeps* Blyth, 1847, Timaliidae, China, Guizhou Province, Kuankuoshui National Nature Reserve, 28°13'34"N, 107°09'35"E, 25 April 2006, coll. R.L. Boyd. Holotype, 1 male and 1 female paratypes — ZISP, 1 male paratype — UMMZ.

Description. Male (holotype, range for 2 paratypes). Idiosoma 472 in length, 325 in width (435–475 × 290–340). Length of hysterosoma 357 (325–350). Prodorsal shield: with rounded posterior angles, without incisions around scapular *se*, posterior margin slightly convex, length along median line 133 (126–135), width at posterior margin 115 (110–117), setae *se* separated by 104 (95–105). Setae *c2* thick, 120–140 long, slightly shorter than humeral macrosetae *cp*, situated near antero-median angles of humeral shields; setae *c3* long, with thickened basal part, about 170 (155–170) in length, greatest width 7 (6–7). Prodorsal and hysteronotal shields widely separated, distance midline 85 (80–90). Hysteronotal shield: anterior margin straight, anterior angles not extending laterally, greatest length 230 (230–240), width at anterior margin 122 (110–125). Opisthosomal lobes short, widely separated, lobar apex bearing seta *h3* narrow and bidentate, lateral margins with short angular extension bearing base of seta *ps2* (Fig. 4A). Width of opisthosoma at level of setae *f2* 110 (105–110). Terminal cleft shallowly concave, 28 (25–28) long, greatest width (at level of setae *ps1*) 58 (55–60). Setae *e1* situated at level of openings *gl*. Dorsal measurements: *c2:d2* 115 (110–118), *dl:d2* 33 (30–36), *d2:e2* 126 (106–130), *d2:gl* 57 (44–60), *e2:ps2* 60 (54–60), *e2:h3* 73 75 (48–70), *h2:h2* 86 (80–86), *h3:h3* 69 (65–70), *ps1: h3* 6 (5–6).

Epiandrum horseshoe-shaped with short anterior extension, posterior tips extending slightly beyond base of genital apparatus (Fig. 4B); genital arch 22 (22–24) long, 15 (10–15) wide, aedeagus about half as long as genital arch. Setae *g* situated on base of genital arch. Setae *4a* and anterior pair of genital papillae situated at level of genital arch apex. Anal suckers ovate, their size excluding surrounding membrane: longer diameter 24 (24–25), shorter diameter 15 (13–15). Adanal shield as an inverted Y fused by its curved branches with ventral sclerotized area of opisthosomal lobes and completely encircling anal field. *3a:4a* 51 (50–53), *4a:g* 24 (22–25), *g: ps3* 104 (95–105), *ps3:ps3* 18 (17–19), *ps3:h3* 64 (52–60).

Tarsus III 64 (57–64) long, with well developed apical and subapical spines and small dorsal crest at base of setae *d*; seta *r* as macroseta, greatly thickened in basal part; other setae short filiform (Fig. 3G). Femur IV with longitudinal crest on median surface; tarsus IV 26 (24–26) long slightly shorter than corresponding tibia (Fig. 3H).

Female (1 paratype). Idiosoma 455 in length, 276 in width. Posterior end of opisthosoma with

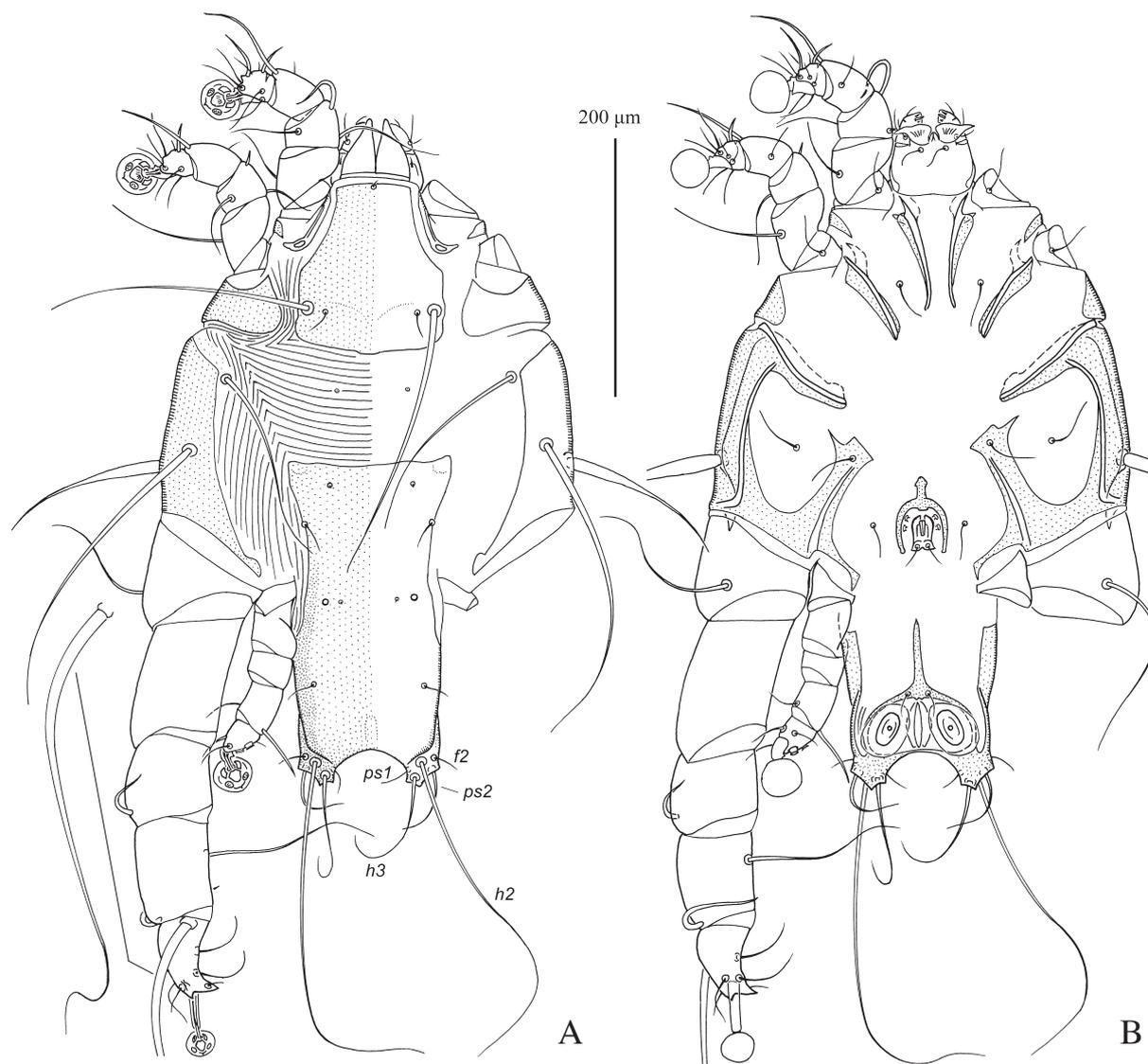


Fig. 4. *Mouchetia stachyris* sp. n., male. A — dorsal view, B — ventral view.

pair of widely separated small opisthosomal lobes bearing bases of setae *h3*. Length of hysterosoma 312. Prodorsal shield as in male, length 119, width 128, setae *se* separated by 110. Setae *c2* thick, 70–80 long, situated near antero-mesal angle of humeral shield. Setae *c3* lanceolate with filiform apex, 66 long, 5 wide. Prodorsal and hysteronotal shield separated by wide striated area, distance along midline 77. Hysteronotal shield strongly attenuate anteriorly, length (from anterior margin to lobar apices) 250, width at anterior margin 67 (Fig. 5A). Length of terminal cleft 22, width between lobar bases 86. Setae *d1* on anterior margin of hysteronotal shield, *e1* approximately at level of openings *gl*; setae *e2* 120–125 long, *f2* 70–80 long. Dorsal measurements: *c2:d2* 95, *d1:d2* 40, *d2:e2* 100, *d2:gl* 44, *e2:h3* 88, *h2:h3* 180, *h3:h3* 115. Epigynum bow-shaped, 44 long, 100 in width (Fig. 5B). Apodemes of egg opening ex-

tending slightly beyond level of posterior margin of trochanters III. Epimerites IVa present, rudimentary. Setae *ps3* not extending beyond posterior margin of opisthosoma. Copulatory opening indistinct. Tarsus III and IV 22 and 26 long, respectively. Legs IV slightly extending beyond level of setae *e2*.

Differential diagnosis. *Mouchetia stachyris* sp. n. is most similar to *M. viduata* Gaud, 1962 described from the Rennell Island white-eye *Zosterops rennelliana* Murphy from the Solomon Islands (Gaud 1962; Mironov and Wauthy 2005) in having the terminal cleft in males wider than long. *Mouchetia stachyris* differs from that species by the following features: in males, the terminal cleft is shallowly concave, approximately two times wider than long, the lateral margins of opisthosomal lobes with short angular extensions bearing seta *ps2*, setae *d2* and *e2* are subequal in length; in

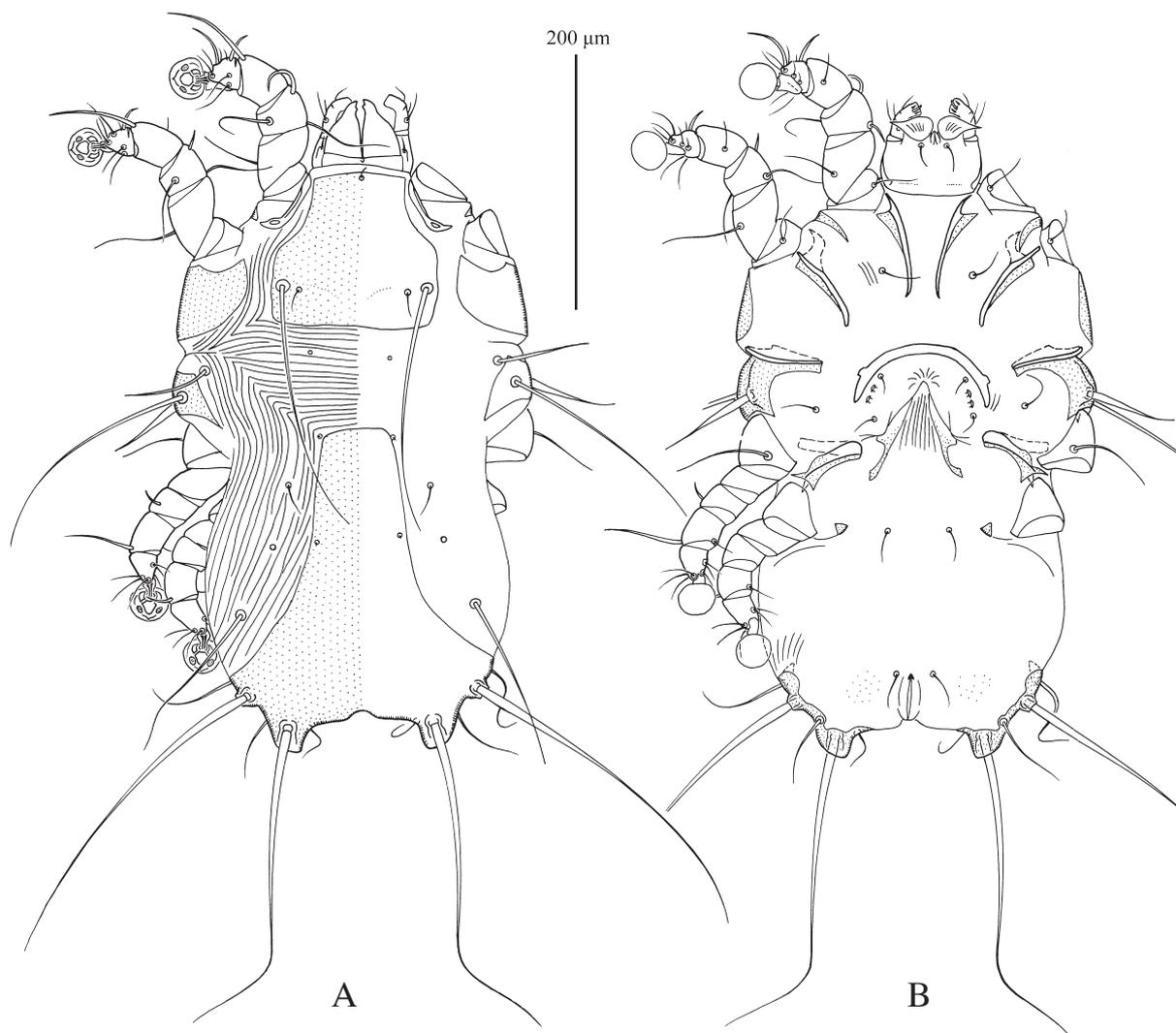


Fig. 5. *Mouchetia stachyris* sp. n., female. A — dorsal view, B — ventral view.

females, the length of setae *c2* is about 2/3 of distance between setae *se*, legs IV extend slightly beyond the level of setae *e2*. In males of *M. viduata*, the terminal cleft is roughly trapezoidal, its greatest width subequal to its length, opisthosomal lobes have rounded lateral extension, setae *e2* are twice as long as setae *d2*; in females, the length of setae *c2* is equal to distance between bases of setae *se*, legs IV extend slightly beyond the level of setae *h2*.

Etymology. The specific epithet is taken from the generic name of the type host and is a noun in apposition.

***Mouchetia indochinensis* Mironov, 1990**

Material examined. 1 male, 2 females from the Japanese white-eye *Zosterops japonicus* Temminck et Schlegel, 1847, Zosteropidae, (KUMNH 110317), China, Guizhou Province, Libo County, Shuipu village, 25°29'05" N, 107°52'54" E, 6 April 2007, coll. R.L. Boyd. Specimens — ZISP.

This species was previously described from *Z. japonicus* in Vietnam (Mironov, 1990; Mironov and Wauthy, 2005a). Our finding is the first record of *M. indochinensis* in China.

Genus *Timalinyssus* Mironov, 2001

The genus *Timalinyssus* Mironov, 2001 includes large-sized pteronyssids and is very close to the genus *Mouchetia*. The clearest feature differentiating the genera is the structure of tarsus III in males. In contrast to *Mouchetia* (Fig. 3G), tarsus III in *Timalinyssus* is noticeably elongated and curved, with a claw-like or bidentate apical process; the dorsal surface of this segment bears a smooth or indented longitudinal crest (Figs. 8B, E). *Timalinyssus* females differ from those of *Mouchetia* by having the hysteronotal shield not narrowed anteriorly.

All three previously known species are described from babblers Timaliidae, two of them are

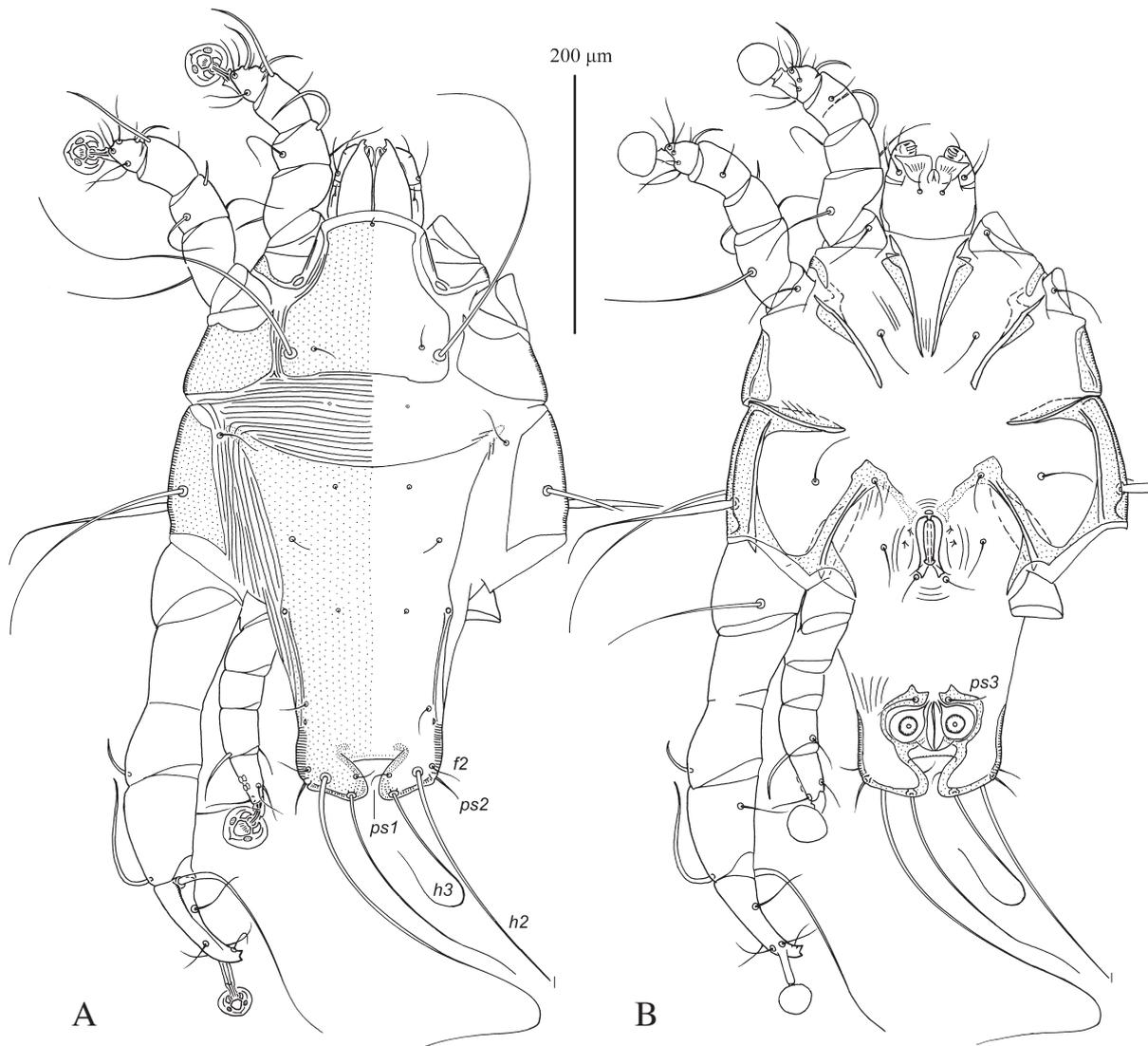


Fig. 6. *Timalinyssus curvilobus* sp. n., male. A — dorsal view, B — ventral view.

from China and one is from Vietnam (Mironov 1990, 2001; Wang and Wang 2008).

***Timalinyssus curvilobus* sp. n.**

Figs. 6, 7, 8A–C

Type material. Male holotype (ZISP 4569), 4 male and 5 female paratypes from the white-browed laughing-thrush *Garrulax sannio* Swinhoe, 1867, Timaliidae, (KUMNH 97570), China, Guizhou Province, Kuankuoshui National Nature Reserve, 28°13'34" N, 107°09'35" E, 25 April 2006, coll. B.W.Benz. Holotype, 1 male and 2 female paratypes — ZISP, 1 male and 1 female paratypes — UASM, 2 males and 2 female paratypes — UMMZ.

Description. Male (holotype, range for 3 paratypes in parentheses). Idiosoma 460 in length, 312 in width (440–446 × 265–268). Length of hysterosoma 315 (303–305). Prodorsal shield:

with rounded posterior angles, without incisions around scapular *se*, posterior margin slightly concave, greatest length 124 (119–127), width at posterior margin 133 (128–133), setae *se* separated by 118 (113–117). Setae *c2* filiform, short, about 20 in length, situated near antero-mesal angles of humeral shields; setae *c3* long, with thickened basal part, about 180 (167–175) in length, greatest width 7 (6–7). Hysteronotal shield: anterior margin strongly concave, anterior angles acute, strongly extending laterally, greatest length 290 (285–290), width at anterior margin 210 (200–214). Area between n prodorsal and hysteronotal shields wide, distance along midline between these shields 70 (65–75). Opisthosomal lobes short, strongly bent medially, lobar apices rounded, almost touching each other (Fig. 4A); width of opisthosoma at level of setae *f2* 110 (110–115). Length of terminal cleft 33 (28–33), greatest width at anterior margin

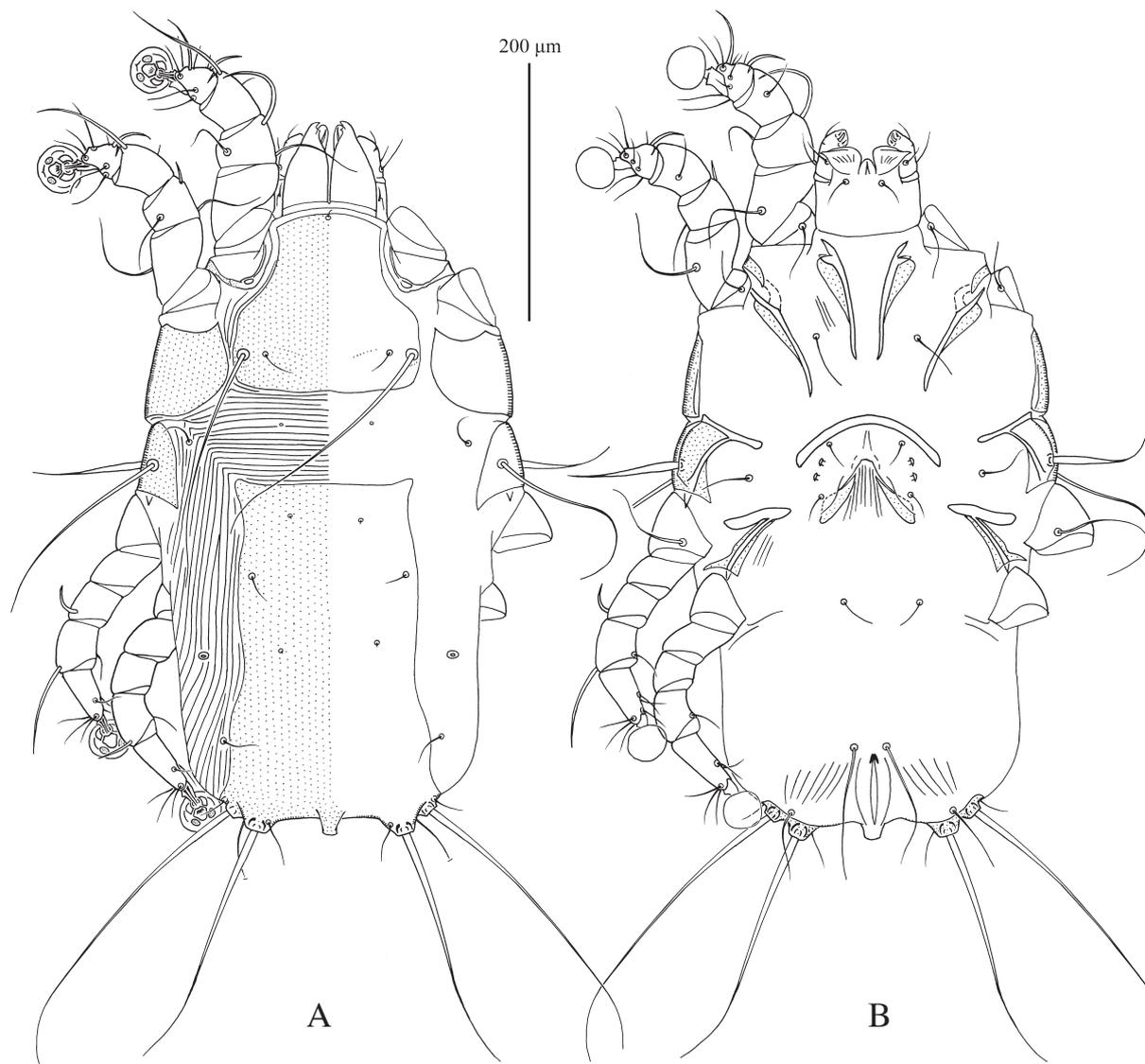


Fig. 7. *Timalinyssus curvilobus* sp. n., female. A — dorsal view, B — ventral view.

37 (39–44), minimal width between lobar apices 9 (7–10). Setae *e1* and openings *gl* approximately at the same transverse level. Dorsal measurements: *c2:d2* 77 (775–84), *dl:d2* 42 (35–42), *d2:e2* 133 (130–135), *d2:gl* 55 (55–62), *e2:ps2* 60 (55–60), *e2:h3* 66 (63–67), *h2:h2* 73 (70–75), *h3:h3* 33 (28–32), *ps1:h3* 13 (9–13).

Epiandrum absent, genital arch 47 (42–56) long, 20 (17–20) wide at base, aedeagus 34 (30–33) long, with enlargement at apex. Transventral sclerite incomplete, its branches reaching genital arch apex but not fused to each other (Fig. 4B). Setae *g* at tips of genital arch. Setae *4a* and both pairs of genital papillae at level of genital arch. Anal suckers tear-drop shaped (circular with acute extension), greatest diameter including extension 42 (35–39). Adanal shields C-shaped, narrow, almost completely encircling anal field, not fused

anteriorly and posteriorly. Ventral measurements: *3a:4a* 53 (46–50), *4a:g* 26 (26–31), *g:ps3* 95 (93–100), *ps3:ps3* 24 (24–27), *ps3:h3* 15 (12–15).

Tarsus III 88 (84–88) in length, slightly curved, with narrow bidentate apex, with longitude dorsal crest; seta *r* as macroseta, thickened in basal part, approximately twice as long as segment greatly; other setae short setiform (Fig. 8B). Femur IV without longitudinal crest on inner surface, tarsus IV slightly shorter than tibia, setae *d*, *e* adjacent to each other, situated approximately at midlevel of segment (Fig. 8C).

Female (4 paratypes). Idiosoma 490–520 in length, 300–320 in width. Length of hysterosoma 325–345. Prodorsal shield as in the male, 140–146 long, 148–155 wide, setae *se* separated by 133–140. Setae *c2* short filiform, about 20 in length, situated on striated tegument near humeral shields.

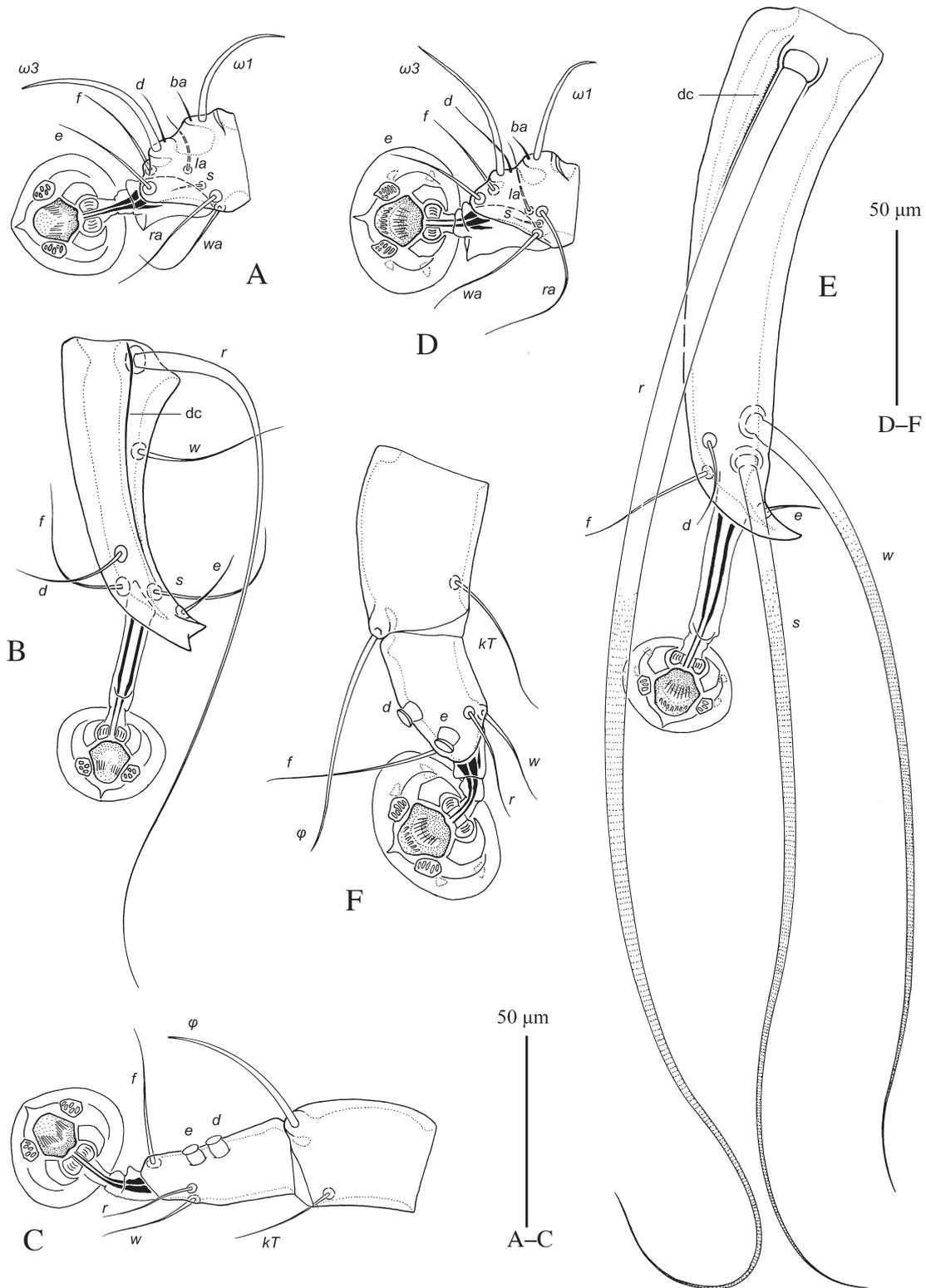


Fig. 8. Details *Timalinyssus* males. A–C — *Timalinyssus curvilobus* sp. n., D–F — *T. grillator* sp. n. A — tarsus I, dorsal view, B — tarsus III, C — tarsus and tibia IV, D — tarsus I, dorsal view, E — tarsus III, F — tarsus and tibia IV. dc — dorsal crest of tarsus III.

Setae *c3* narrowly lanceolate with filiform apex, 84–90 in length, 6–7 in width. Distance between prodorsal and hysteronotal shields 70–78. Hysteronotal shield almost rectangular, greatest length (from anterior margin to bases of setae *h3*) 265–

285, width at anterior margin 150–155, width at level of setae *f2* 175–190 (Fig. 5A). Opisthosoma without distinct lobes, setae *h3* situated on short cone-like extensions, margin between these setae slightly concave. External copulatory tube pres-

ent, cone-shaped with truncate apex, situated terminally, 10–12 long. Setae *e1* approximately at level of openings *gl*. Setae *e2*, *f2*, short filiform, each 20–22 long, setae *ps2* 40–45. Dorsal measurements: *c2:d2* 80, *d2:e2* 96, *d2:gl* 51, *e1:gl* 16, *e2:h3* 73, *h3:h3* 122.

Epigynum bow-shaped, 40–42 long, 114–122 wide (Fig. 5B). Apodemes of egg opening short, not extending beyond midlevel of trochanters III. Epimerites IVa absent. Setae *ps3* extending beyond posterior margin of opisthosoma. Tarsi III and IV 44–48 and 54–56 long, respectively. Legs IV extending to level of setae *h2*.

Differential diagnosis. Among three previously known species, *Timalinyssus curvilobus* sp. n. is closest to *T. longitarsus* Wang et Wang, 2008 from the melodious laughing-thrush *Garrulax canorus* (Linnaeus) by having the prodorsal shield free from scapular shields in both sexes, the acute and strongly extended anterior angles of hysteronotal shield in males, and by the absence of opisthosomal lobes in females. The new species clearly differs from *T. longitarsus* as well from the two other previously known species by the following features: in males, the opisthosomal lobes are bent towards the midline and their rounded apices appear very close to each other, the epiandrium is absent, the adanal shield is paired and without a median piece stretching anterior of the anal opening, the anal suckers are tear-drop shaped and with one acute extension on antero-mesal margin, and tarsus III has a bidentate apical process and smooth dorsal crest; in females, the external copulatory tube is present and situated on the posterior margin of opisthosoma. In males of *T. longitarsus*, the opisthosomal lobes are straight with oblique posterior margins, the epiandrium is present and extending almost to the base of genital arch, the adanal shield is shaped as an inverted Y, the anal suckers are ovate, and tarsus III has an acute apical process and indented dorsal crest; in females, the external copulatory tube is absent.

Etymology. The specific epithet refers to the curved opisthosomal lobes in males.

***Timalinyssus grillator* sp. n.**

Figs. 8 D–F, 9

Type material. Holotype male (ZISP 4571) and 5 male paratypes from the golden-breasted fulvetta *Alcippe chrysotis* (Blyth, 1845), Timaliidae, (KUMNH 97435), China, Guizhou Province, Kuankuoshui National Nature Reserve, 28°13'34" N, 107°09'35" E, 14 April 2006, coll.

B.W.Benz. Holotype and 2 male paratypes — ZISP, 2 male paratypes — UASM, 1 male paratype — UMMZ.

Description. Male (holotype, 3 paratypes). Idiosoma 752 in length, 355 in width (645–762 × 345–460). Length of hysterosoma 545 (465–565). Prodorsal shield: separated from scapular shields, with rounded posterior angles, without incisions around scapular setae, posterior margin straight with a small median extension, length along median line 160 (143–160), width at posterior margin 133 (125–133), setae *se* separated by 110 (107–115). Setae *c2* 105 (90–105) long, subequal in length to distance between setae *se*, situated on anterior margin of humeral shield; setae *c3* thickened basal part, 305 (275–320) long, greatest width 9 (9–10). Prodorsal and hysteronotal shields separated by wide striated area, distance along midline 95 (95–120). Hysteronotal shield: anterior margin deeply concave, anterior angles acute and strongly extending antero-laterally, greatest length 530 (425–525), width at anterior margin 190 (170–190). Opisthosomal lobes strongly elongated and thin, separated by large terminal cleft; each lobe bifurcate apically, inner apical extension longer than outer one, both extensions acute. Setae *f2*, *h2* and *ps1* situated at base of bifurcation, setae *h3* on inner extension, setae *ps2* on outer extension (Fig. 9A); Width of opisthosoma at level of setae *e2* 140 (132–144). Length of terminal cleft 156 (112–170), greatest width 150 (105–140). Setae *e1* situated slightly posterior to level of gland openings *gl*. Dorsal measurements: *c2:d2* 178 (165–170), *d1:d2* 62 (55–62), *d2:e2* 165 (145–166), *d2:gl* 55 (44–55), *e2:h3* 170 (124–165), *h2:h2* 178 (125–160), *h3:h3* 145 (115–135), *ps1:h3* 22 (17–23).

Tips of epimerites I connected by very thin transverse crosspiece. Epiandrium absent. Transventral sclerites represented by triangular sclerite usually separated but fused in 1 paratype by anterior angles with epimerites IV (Fig. 9B, C). Genital arch small, 28 (26–26) long, 15 (15–17) in wide at base, aedeagus half as long as genital arch. Setae *4a* situated anterior to genital arch, setae *g* at tips of genital arch, posterior pair of genital papillae at level of genital arch apex. Adanal shield as long narrow longitudinal bar just anterior to anal opening. Anal suckers circular, 22 (18–23) in diameter, situated near anterior margin of terminal cleft. Ventral measurements: *3a:4a* 107 (70–97), *4a:g* 45 (45–55), *g:ps3* 128 (110–128), *ps3:ps3* 62 (62–66), *ps3:h3* 166 (150–165).

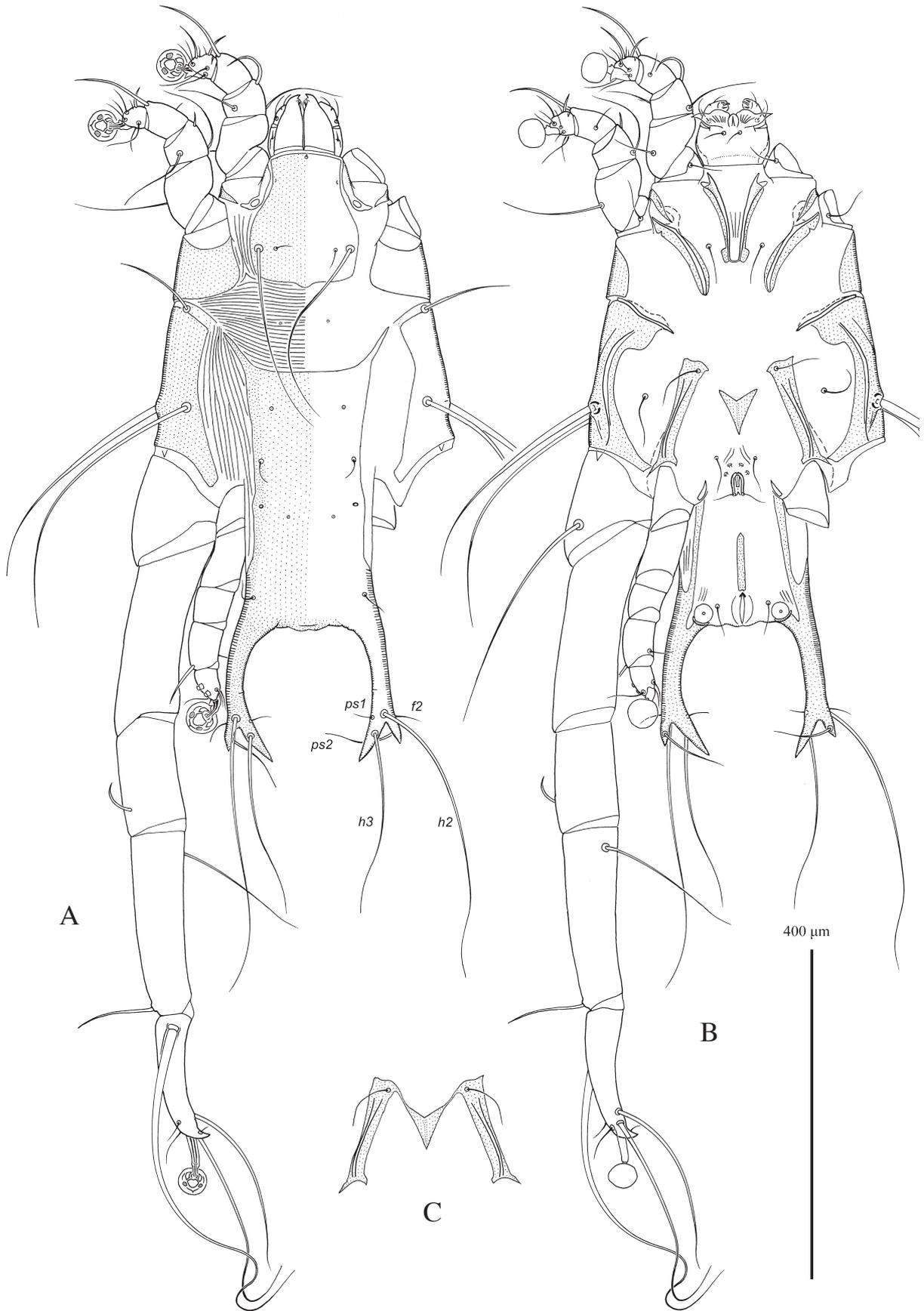


Fig. 9. *Timalinyssus gallator* sp. n. males. A — dorsal view, B — ventral view, C — variant of transventral sclerite.

Legs III very long, slightly longer than the total length of idiosoma and extending past the api-

ces of opisthosomal lobes by more than half of their length (Fig. 9A). Tarsus III 151 (133–155) in

length, with well developed apical claw-like extension, with smoothed longitudinal dorsal crest, base of seta *w* strongly moved apically to base of seta *s*, setae *r*, *w*, *s* represented by macrosetae, seta *r* finely verrucose in distal half, setae *w*, *s* verrucose for almost entire lengths; other setae of segment short filiform (Fig. 8E). Tarsus IV 42 (40–46) long, slightly shorter than corresponding tibia (Fig. 8F).

Female. Unknown.

Differential diagnosis. Males of *Timalinyssus grallator* sp. n. strongly differ from all previously known species, including *T. curvilobus* described above, by the unique structure of the opisthosoma with widely separated and bifurcate opisthosomal lobes resembling horns of a roe deer and extremely long legs III exceeding in length the total body length (Fig. 9A). Among previously described species the new species can be compared with *T. longitarsus* Wang et Wang, 2008 because of such similar features as the prodorsal shield separated from scapular shields and strongly elongated legs III in males. Males of *T. grallator* differ from that species by the features as follows: opisthosomal lobes are 5–6 times longer than wide and bifurcate apically, the terminal cleft is extremely large and comparable in size with prodorsal shield, the epiandrium is absent, the transventral sclerite is present and represented by triangular sclerite usually separated from epimerites IV, adanal shield is represented by a simple longitudinal bar, and setae *c2* are long and comparable in length with the distance between seta *se* bases. In males of *T. longitarsus*, the opisthosomal lobes are short, roughly trapezoidal, slightly longer than wide, the terminal cleft is semicircular and much less than area of prodorsal shield, the epiandrium is present and horsehoe-shaped, the transventral sclerite is absent, adanal shield is an inverted Y-shape, and setae *c2* are filiform and much shorter than distance between scapular setae.

Etymology. From *grallatores* (L., stilt-walkers) in reference to the extremely long legs in males.

***Timalinyssus longitarsus* Wang et Wang, 2008**

Material examined. 5 males, 4 females from the greater necklaced laughing-thrush *Garrulax pectoralis* (Gould, 1836), Timaliidae, (KUMNH97554), China, Guizhou Province, Kuankuoshui National Nature Reserve, 28°13'34" N, 107°09'35" E, 19 April 2006, coll. B.W. Benz. Specimens — UASM, UMMZ, ZISP.

This species was originally described from *Garrulax c. canorus* (Linnaeus) in China, Guizhou Province, by Wang and Wang (2008). Our finding represents a new host record for *T. longitarsus*.

Genus *Pteronyssoides* Hull, 1931

The genus *Pteronyssoides* Hull, 1931 is the most species-rich genus of Pteronyssidae, currently including 30 species (Mironov and Wauthy 2005b). The combination of features allowing discrimination of this rather diverse genus from other pteronyssids is as follow: in both sexes, epimerites I are free with slightly diverging posterior ends; in males, the opisthosomal lobes are short and roughly rounded (in most species), adanal membranes are present, cupules *ih* on ventral side of opisthosoma well developed, tarsus III with bidentate apex, and tarsus IV with short dorso-basal spine. An impressive morphological peculiarity of this genus among other pteronyssids is a great variability of the hysteronotal sclerite complex in females, which can include 1–5 sclerites; in rare cases the hysteronotal sclerites are completely lost as in *Pteronyssoides striatus* (Robin, 1877). At the same time, females of the subgenus *Holonyssoides* Mironov, 1990 have an entire hysteronotal shield covering the median part of hysterosoma as in females of *Timalinyssus*. Due to this feature, identification of *Pteronyssoides* species, in contrast to most feather mite taxa, is much easier for the females than for the males.

Representatives of this genus are mostly associated with oscine passerines from the Old World and most species are known from hosts of the superfamilies Passeroidea and Sylvioidea (Passerida) and only two species have been recorded from hosts belonging to Corvoidea (the families Dicruridae and Paradisaeidae). The majority of known *Pteronyssoides* species (23) are described from passerines distributed in Africa (Gaud and Till 1961; Facini and Atyeo 1981; Mironov and Wauthy 2005b). Two species of this genus, *Pteronyssoides lonchurae* (Sugimoto, 1941) and *P. desmiphorus* (Gaud, 1952), were previously recorded in China (see Wang and Fan 2010).

***Pteronyssoides (Pteronyssoides) faini*
Mironov et Wauthy, 2005**

Material examined. 2 males, 2 females from the white-rumped munia *Lonchura striata* (Linnaeus, 1766), Estrildidae, (KUMNH 99939), China, Guizhou Province, Libo County, Shuipu village, 25°29'05" N, 107°52'54" E, 30 March 2007, coll. R.L. Boyd. Specimens — UMMZ, ZISP.

This species was described from the black-and-white manikin *Lonchura bicolor poensis* (Fraser) from Fernando Po Island (Mironov and Wauthy 2005b). The white-rumped munia *Lonchura striata* is a new host for *P. faini*, and it is the first record of this mite in China. We cannot exclude the possibility that *P. faini* is a synonym of *P. lonchurae* (Sugimoto, 1941) described from the black-headed munia *L. malacca formosana* in Taiwan (Sugimoto 1941). Unfortunately the description of the latter species is quite incomplete and its type specimens have been apparently lost. Therefore, the final solution of this question requires examination of new material from the type hosts.

***Pteronyssoides (Holonyssoides) desmiphorus*
(Gaud, 1952)**

Material examined. 1 male and 1 female from the mountain bulbul *Hypsipetes mcclllandii* Horsfield, 1840, Pycnonotidae, China, Guangxi Province, Jing Xin County Provincial Nature Reserve, 23°07'12"N, 105°57'36"E, 30 September 2004, coll. Chen Guojun. Specimens — ZISP.

This species was previously recorded from two species of bulbuls, the Madagascar black bulbul *Hypsipetes madagascariensis* (Müller) in Cameroon and the Himalayan black bulbul *H. leucocephalus stresemanni* (Mayr) (Pycnonotidae) in China (Gaud 1952; Mironov and Wauthy 2008). *Hypsipetes mcclllandii* is a new host for this species.

ACKNOWLEDGEMENTS

We thank Drs. Sarah Bush and Dale Clayton (University of Utah) for collecting mites from the hosts and sending them to us. Collection of host material in China was supported by a U.S. National Science Foundation grant (DEB-030820) to Dr. A. Townsend Peterson, University of Kansas. The investigation was supported by the Russian Fund for Basic Research (Grant No 10-04-00160a) for S.V. Mironov and by a Natural Sciences and Engineering Research Council of Canada Discovery Grant for H.C. Proctor.

REFERENCES

Atyeo, W.T. and Gaud, J. 1979. Feather mites and their hosts. In: Rodriguez J.G. (Ed.). Recent Advances in Acarology. Academic Press, New York, pp. 355–361

Boyd, R.L., Nyári, Á.S., Benz, B.W., and Chen, G. 2008. Aves, province of Guizhou, China. *Check List*, 4: 107–114.

Bruce, W.A. and Johnston, D.E. 1969. A redescription of *Pteronyssoides tyrrelli* (Canestrini, 1899) a

feather mite from the tree swallow (Acari — Acariformes). *Acarologia*, 11: 104–120.

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.

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.

Gaud, J. 1952. Sarcoptides plumicoles des oiseaux de Madagascar. *Mémoires de l'Institut scientifique de Madagascar, Séries A*, 7: 81–107.

Gaud, J. 1961. Six genres nouveaux de Sarcoptiformes plumicoles (Analgoidea). *Acarologia*, 3: 78–95.

Gaud, J. 1962. Sarcoptiformes plumicoles (Analgoidea) parasites d'oiseaux de l'île Rennell. *The Natural History of Rennell Island, British Solomon Islands*, 4: 31–51.

Gaud, J. 1968. Sarcoptiformes plumicoles (Analgoidea) parasites d'oiseaux de l'île Rennell. *The Natural History of Rennell Island, British Solomon Islands*, 5: 121–151.

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).

Gaud, J. and Mouchet, J. 1959. Acariens plumicoles des oiseaux du Cameroun. V. Pterolichidae. *Annales de Parasitologie humaine et comparée*, 34: 493–545.

Gaud, J. and Till, W.M. 1961. Suborder Sarcoptiformes. In: F. Zumpt (Ed.). The arthropod parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Volume I (Chelicerata). Publications of the South African Institute of Medical Research, No L (Vol. IX), Johannesburg, South Africa: 180–352.

MacKinnon, J. and Phillips, K. 2000. A field guide to the birds of China. Oxford University Press, Oxford, 586 pp.

Mironov, S.V. 1990. [New species of feather mites of the genus *Mouchetia* (Analgoidea, Avenzoariidae) from Passeriformes in Vietnam]. *Parazitologiya*, 24: 268–278. [In Russian]

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

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. 2003. On some problems in the systematics of feather mites. *Acarina*, 11: 3–29.

- Mironov, S.V. and Galloway, T.D. 2002. New feather mite taxa (Acari: Analgoidea) and mites collected from native and introduced birds of New Zealand. *Acarologia*, 42: 185–201.
- Mironov, S.V. and Wauthy, G. 2005a. A new species of the feather mite genus *Mouchetia* Gaud, 1961 (Astigmata: Pteronyssidae) from the greencap eremomela *Eremomela scotops* (Passeriformes: Sylviidae) and taxonomic notes to species of the genus. *Acarina*, 13: 3–14.
- Mironov, S.V. and Wauthy, G. 2005b. A review of the feather mite genus *Pteronyssoides* Hull, 1931 (Astigmata: Pteronyssidae) from African and European passerines (Aves: Passeriformes) with analysis of mite phylogeny and host associations. *Bulletin de l'Institut Royal des Sciences naturelles de Belgique, Entomologie*, 75: 155–214.
- 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.
- OConnor, B.M. 2009. Chapter sixteen: Cohort Astigmatina. In: Krantz G.W. and Walter D.E. (Eds.). *A Manual of Acarology*. Third edition. Texas Technical University Press; Lubbock, Texas, pp. 565–657.
- Peterson, P.C. 1975. An analysis of host-parasite associations among feather mites (Acari: Analgoidea). *Miscellaneous Publications of the Entomological Society of America*, 9: 237–242.
- Proctor, H.C. 2003. Feather mites (Acari: Astigmata): Ecology, behavior and evolution. *Annual Review of Entomology*, 48, 185–209.
- Robbins, M.B., Peterson, A.T., Nyári, Á.S., Chen, G., and Davis, T.J. 2006. Ornithological surveys of two reserves in Guangxi province, China, 2004–2005. *Forktail*, 22: 140–146.
- Sugimoto, M. 1940a. Studies on the Formosan mites (3rd report) (On the feather mites Analgesidae Canestrini, 1892). *Bulletin of the School of Agriculture and Forestry, Taihoku Imperial University*, 1: 40–58 + pls. III–VII.
- Sugimoto, M. 1940b. A list of the Formosan Acarina with references. Part I: Families Tyroglyphidae and Analgesidae. *Transactions of the Natural History Society of Formosa*, 30: 248–258.
- Sugimoto, M. 1941. Studies on the Formosan mites (Fourth Report) (On the feather mites, Analgesidae Canestrini, 1892, Part II.). *Sylvia (Journal of the Taihoku Society of Agriculture and Forestry)*, 5: 129–149.
- Trouessart, E.L. (1886) 1887. Diagnoses d'espèces nouvelles de Sarcoptides plumicoles (Analgesinae). *Bulletin de la Société d'Études scientifiques d'Angers*, 16:85–156.
- Wang, Z.-Y. and Fan, Q.-H. 2010. Psoroptidia (Acari: Astigmatina) of China: a review of research and progress. In: Zhang, Z.Q., Hong, X.-Y. and Fan, Q.-H. (Eds.) *Xin Jie-Liu Centenary: Progress in Chinese Acarology. Zoosymposia*, 4: 260–271.
- Wang, Z.-Y. and Wang, J.-J. 2008. A new species of feather mites: *Timalinyssus* Mironov, 2001 (Astigmata: Pteronyssidae) from *Garrulax canorus canorus* (Linnaeus) (Passeriformes: Timaliidae) in China. *Zootaxa*, 1962: 65–68.