

## OBSERVATIONS ON THE LISTROPHORID (ACARI: LISTROPHORIDAE) FAUNA OF PAKISTAN

### К ФАУНЕ ЛИСТРОФОРИД (ACARI: LISTROPHORIDAE) ПАКИСТАНА

A.V. Bochkov<sup>1,2</sup>, B.M. OConnor<sup>1</sup>

А.В. Бочков<sup>1,2</sup>, Б.М. ОКоннор<sup>1</sup>

<sup>1</sup>Museum of Zoology, University of Michigan, 1109 Geddes Ave., Ann Arbor, Michigan 48109 USA, e-mails: (AVB) bochkov@umich.edu, (BMO) bmoc@umich.edu

<sup>2</sup>Zoological Institute, Russian Academy of Sciences, Universitetskaya emb. 1, 199034 St. Petersburg, Russia

Key words: mites, Listrophoridae, parasites, taxonomy, rodents

Ключевые слова: клещи, Listrophoridae, паразиты, таксономия, грызуны

#### ABSTRACT

Two fur mite (Acari: Listrophoridae) taxa from Pakistan, a new species *Aeromychirus fimbriatus* sp.n. ex *Hylopetes fimbriatus* (Gray, 1837) (Sciuridae) and *Spalacarus mediolineatus nesokia* Fain et Hyland, 1980 ex *Nesokia indica* (Gray et Hardwicke, 1830) (Muridae), are described and redescribed, respectively.

#### РЕЗЮМЕ

Приведено соответственно описание и переписание двух таксонов волосяных клещей (Acari: Listrophoridae) из Пакистана: *Aeromychirus fimbriatus* sp.n. с *Hylopetes fimbriatus* (Gray, 1837) (Sciuridae) и *Spalacarus mediolineatus nesokia* Fain et Hyland, 1980 с *Nesokia indica* (Gray et Hardwicke, 1830) (Muridae).

#### INTRODUCTION

The fur mite family Listrophoridae Megnin et Trouessart, 1884 (Acari: Sarcoptoidea) is represented by permanent parasites living on the hair shafts of mammals and currently includes more than 150 species arranged into 21 genera [Fain, 1981a; Bochkov and OConnor, 2005]. It is likely that many more species remain to be discovered because many potential hosts have not yet been examined for these mites, and some countries with diverse host faunas, e.g. Egypt, Pakistan, India, Brasil, etc. are still largely “blank spots” with respect to listrophorids. To date only two listrophorid species and one subspecies have been reported from Pakistan, all from rodent hosts [Fain, 1976; Fain and Hyland, 1980]: *Afrolistrophorus musculus* Wilson et Lawrence, 1967 from *Mus musculus* L., 1758 and *Millardia meltada* (Gray, 1837) (Muridae); *Afrolistrophorus pakistanensis* Fain, 1976 from several murines, *Mus* sp. (type host), *M. musculus*, *Ml. meltada*, and *Rattus rattus*

(L., 1758) (Muridae), and gerbils *Meriones hurrianae* Jordon, 1867 and *Tatera indica* (Hardwicke, 1807) (Gerbillidae); and *Spalacarus mediolineatus nesokia* (Fain et Hyland, 1980) from *Nesokia indica* (Gray et Hardwicke, 1830) (Muridae).

Examination of fluid preserved rodents collected in the Northwest Frontier province of Pakistan yielded collections of listrophorid mites from two host species. Below, we describe a new species, *Aeromychirus fimbriatus* sp.n. from *Hylopetes fimbriatus* (Gray, 1837) (Rodentia: Sciuridae) and redescribe *S. m. nesokia* based on new material from the type host.

#### MATERIAL AND METHODS

During a survey of small mammals at several sites in the Northwest Frontier Province in 1990, seven species of rodents and two species of shrews were collected. Mammal specimens were individually bagged and wrapped in cheesecloth to prevent parasite contamination before fixation in formalin and ultimate transfer to 70% ethanol. Host specimens were unwrapped in the laboratory of BMO and examined for ectoparasites, with a total of 79 individual hosts among these species examined. Mite specimens were cleared in lactophenol and mounted in Hoyer's medium. Drawings were made with a Zeiss microscope with a camera lucida using phase contrast optics. Specimens were also studied using a Leica DMLB microscope equipped with differential interference contrast optics. Host specimens examined are deposited in the collections of the Museum of Zoology of the University of Michigan (Ann Arbor, USA) and the Field Museum of Natural History (Chicago, USA).

In the descriptions below, the idiosomal chaetotaxy follows Griffiths et al. [1990] as modified by Norton [1998] regarding genital and coxal setae.

The leg chaeto- and solenidiotaxy follow Grandjean [1939]. All measurements are given in micrometers ( $\mu\text{m}$ ) and were taken as follows: body length = the total length from the anterior extremity of the prescapular shield to the posterior border of the body; body width = maximum width taken at whatever level it occurs; length of dorsal shields = maximum length, measured in the median line of the shields; length of the posterior legs = length from the most basal point of the trochanter to the apex of the tarsus, excluding pretarsus. In the collection records, names of hosts follow Wilson and Reeder [1993]. Specimen depositories and reference numbers are cited using the following abbreviations:

BMOC # — B.M. OConnor reference number;

FMNH — Field Museum of Natural History, Chicago, USA;

FUA — Department of Agricultural Entomology, University of Agriculture, Faisalabad, Pakistan;

IRSNB — Institut royal des Sciences naturelles de Belgique, Brussels, Belgium;

OSAL — The Acarology Laboratory, Ohio State University, Columbus, USA;

UMMZ — Museum of Zoology, University of Michigan, Ann Arbor, USA;

ZISP — Zoological Institute, Russian Academy of Sciences, Saint-Petersburg, Russia.

## DESCRIPTIONS

### Family Listrophoridae

Megnin et Trouessart, 1884

Genus *Aeromychirus* Fain, 1976

*Aeromychirus fimbriatus* sp.n.

Figs 1–2

**Type material.** Male holotype (BMOC 90–1500–066, #1) ex *Hylopetes fimbriatus* (FMNH 140504), Pakistan: NW Frontier Prov., Malakand Div., Swat Distr., Yakh Tangai, 2076 m, 34°55'N, 72°38'E, 28.04.1990, coll. P. Myers (PM 6646).

Paratypes. 5 male and 12 female paratypes (BMOC 90–1500–066, #2–18), same data as holotype; 5 male, 10 female, 2 teleonymph, 2 protonymph, and 1 larva paratypes (BMOC 90–1500–065, #1–20) ex *H. fimbriatus* (UMMZ 167667), same locality, 28.04.1990, coll. P. Myers (PM 6645) [numerous mites in alcohol].

**Type depositories.** Holotype in FMNH, paratypes in FMNH, FUA, IRSNB, OSAL, UMMZ, and ZISP.

**Male** (holotype). Body including gnathosoma 470 long (460–470 in 10 paratypes), 135 wide (130–135). Prescapular shield 40 long (37–42).

Postscapular shield 77 long (75–80), completely covered by narrow transverse bands. Posterior margin of postscapular shield triangular in outline. Hysteronotal shield 220 long (210–220), without striation, completely covered by triangular tooth-like projections arranged in transverse rows. Anterior margin of hysteronotal shield slightly concave, setae *d1* situated on this shield. Idiosomal surface between prescapular and hysteronotal shields striated with numerous lines, and tubercles in lateral parts (Fig. 1A). Coxal fields III distinctly striated (Fig. 1B). Setae *f2* filiform. Setae *h2* relatively short, about 40 long, and strongly thickened. Setae *h3* membranous, distinctly developed, about 35 wide, 2 times wider than long, with widely rounded lateral margin. Aedeagus about 60 long (Fig. 1C). Setae *g* thickened. Diameter of paranal suckers about 10–12. Cuticle between paranal suckers and setae *4a* with few tubercles (Fig. 1B). Legs III and IV 100–105 and 110–115 long, respectively. Setae *d* of all tarsi III slightly shorter than this segment. Trochanters and femora IV with distinct dorsal crests. Lengths of some setae and solenidia: *c1*, *c3*, *d1*, *d2*—9–13, *c2* 25–27, *cp* 18–20, *e1* 37–40, *e2* 33–35, *f2* 28, *h1* 23–26, *ps1*–*ps3* 7–10,  $\varphi$  I, II 55–60.

**Female** (10 paratypes). Body, including gnathosoma, 560–575 long, 130–140 wide. Prescapular shield 100–110 long. Postscapular shield 85–90, covered by narrow transverse bands in lateral parts and densely striated in median part. Hysteronotal shield absent. Hysteronotum posterior to postscapular shield transversely striated and covered by tubercles (Fig. 2A). Distance between setae *4a* about 13 long. (Fig. 2B). Setae *h2* and *h3* about 90 long, distinctly longer than other idiosomal setae 9–25 long. Legs III and IV subequal, 85–90 long. Setae *d* of tarsi III–IV longer than this segment. Lengths of some setae and solenidia: *c1*, *c3*, *d1*, *d2* — all 9–10, *c2* 20–22, *e1* 18–20, *e2* 23–26, *f2* 7–9,  $\varphi$  I, II 12–15.

**Etymology.** The species name is derived from the species name of the host and is a noun in apposition.

**Differential diagnosis.** This species clearly differs from the other two species known in the genus [Fain, 1979], *A. aeromys* (Fain, 1970) from *Aeromys tephromelas* (Günther, 1873) from Borneo and *A. hylopetes* (Fain, 1970) from *Hylopetes lepidus* (Horsfield, 1823) [= *sagitta* (L., 1766) in part] from Indonesia, by the following characters. In males of *A. fimbriatus* sp. n., the hysteronotal shield is covered by numerous tooth-like projec-

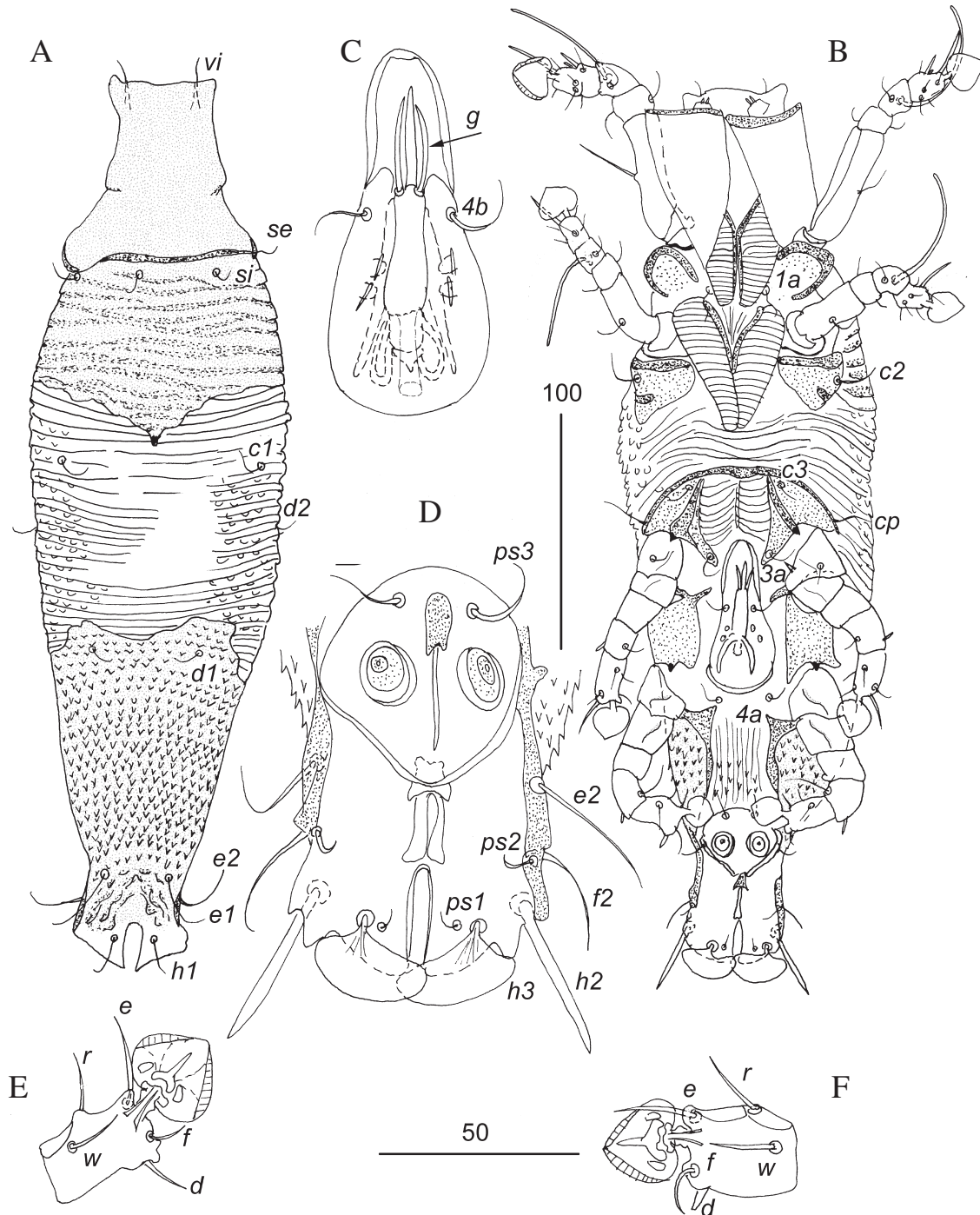


Fig. 1. *Aeromychirus fimbriatus* sp. nov., male. Dorsal view (A), ventral view (B), aedeagus (C), opisthosoma in ventral view (D), tarsi III and IV in ventral view, respectively (E — left leg, F — left leg). Scale bars 100 µm (A, B) and 50 µm (C–F).

tions, setae *h2* are relatively short, about 45 long, and strongly thickened; in females, the hysteronotal shield is present and setae *h2* are distinctly longer than other opisthosomal setae, excluding *h3*. In males of *A. aeromys* and *A. hylopetes*, the hysteronotal shield is without projections and setae *h2* are whip-like; in females, the hysteronotal shield covers most of the hysteronotum and setae *h2* are short, not longer than the other opisthosomal setae.

**Genus *Spalacarus* Fain, 1980**  
***Spalacarus mediolineatus nesokia***  
**Fain et Hyland, 1980**

Figs 3–4.

*Spalacarus mediolineatus nesokia* Fain et Hyland, 1980: 233 [Holotype in USNM]

**Material examined.** Nine males and 14 females (BMOC 02–0515–005) ex *Nesokia indica* (UMMZ 16768), Pakistan: NW Frontier Prov.,



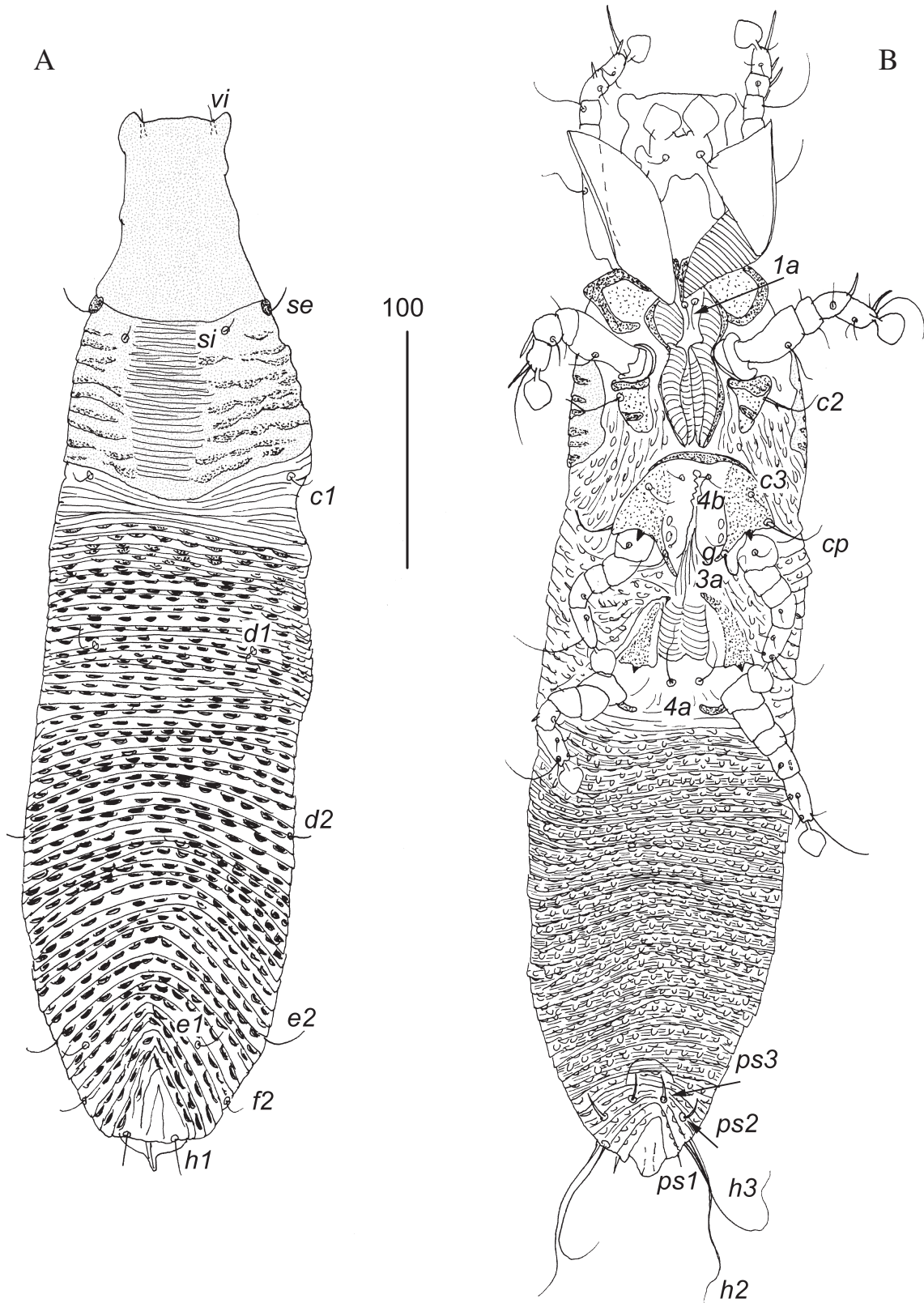


Fig. 2. *Aeromychirus fimbriatus* sp. nov., female. Dorsal view (A), ventral view (B).

Malakand Div., Swat Distr., 1 km SE Karakar Pass, Jaba, 1303 m, 34°54'50"N, 71°51'48"E, 16.04.1990, coll. P. Myers (PM 6537). Voucher specimens in FMNH, FUA, OSAL, UMMZ, and ZISP.

**Male** (9 specimens from *Nesokia indica*). Body including gnathosoma 365–380 long, 130–135 wide. Prescapular shield 95–100 long. Anterior margin of prescapular shield with short median process (Fig.

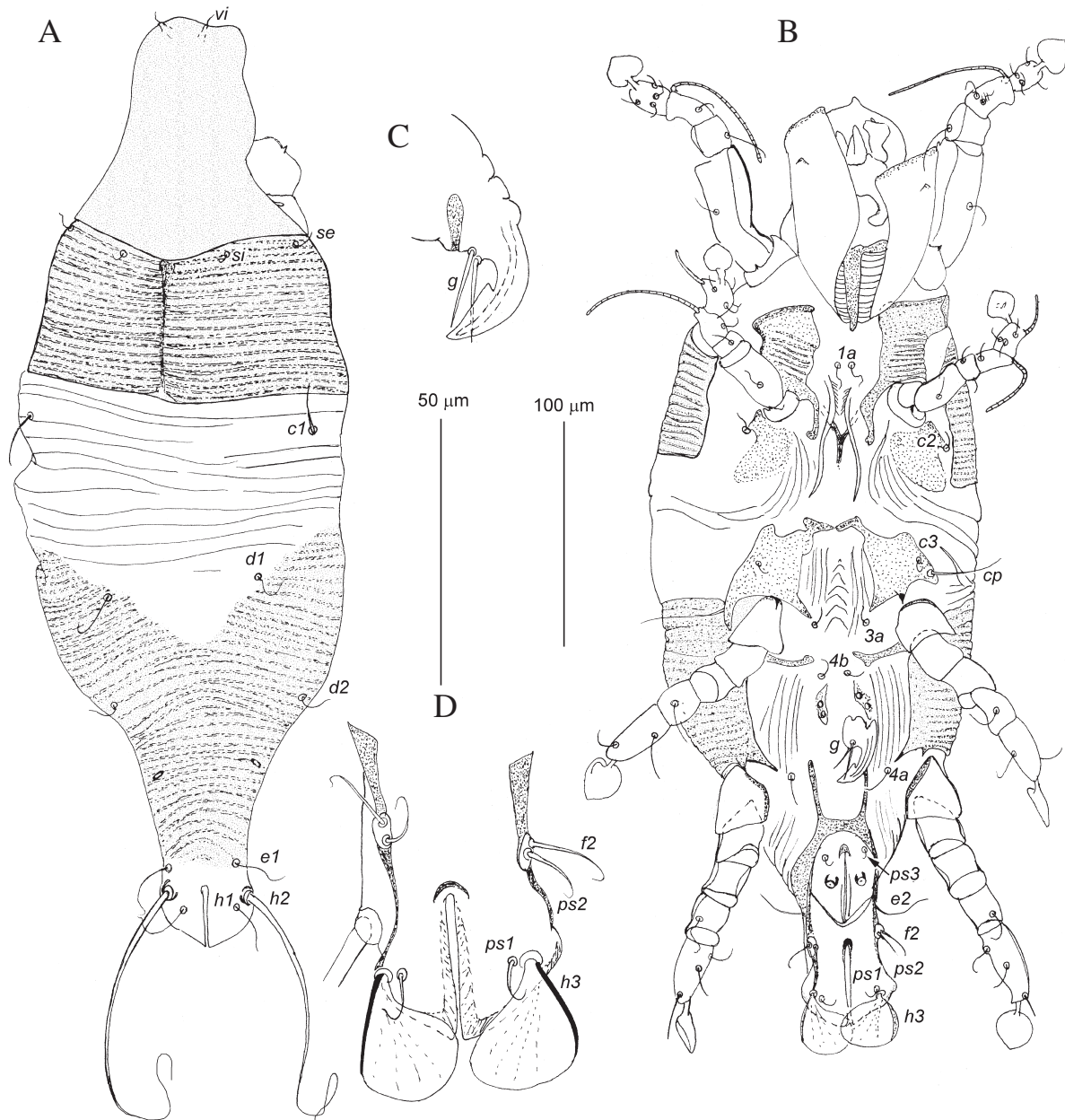


Fig. 3. *Spalacarus mediolineatus nesokia* Fain et Hyland, 1980, male. Dorsal view (A), ventral view (B), aedeagus (C), opisthosoma in ventral view (D). Scale bars s 100 µm (A, B) and 50 µm (C).

3B). Postscapular shield 70–80 long, with median longitudinal apodeme almost reaching posterior margin of this shield, covered by 20–25 narrow transverse bands. Hysteronotal shield 80–85 long in midline, with irregular deeply concave anterior margin, surface of the shield completely covered by striation. Idiosomal surface between prescapular and hysteronotal shields with 8–10 sparsely disposed transverse lines (Fig. 3A). Setae *h3* about 17 wide, with widely rounded posterior margin. Cuticle between coxal fields II striated. Cuticle between coxal fields III striated. Coxal apodemes

jointed to each other (Fig. 3B). Aedeagus about 25 long, harpoon-like (Fig. 3C). Diameter of para-anal suckers about 4 (Fig. 3D). Legs III and IV about 90 long and 100 long, respectively. Setae *d* of tarsi III and IV shorter than respective segments. Lengths of some idiosomal setae: *c1*, *c2*, *cp*—25–30, *c3*, *e2*, *f2*—13–16, *d1*, *d2*, *e1*—17–20.

**Female** (10 specimens from *Nesokia indica*). Body, including gnathosoma, 460–480 long, 165–170 wide. Prescapular shield 110–115 long. Anterior margin of prescapular shield with short median process. Postscapular shield 70–75 long, with lon-

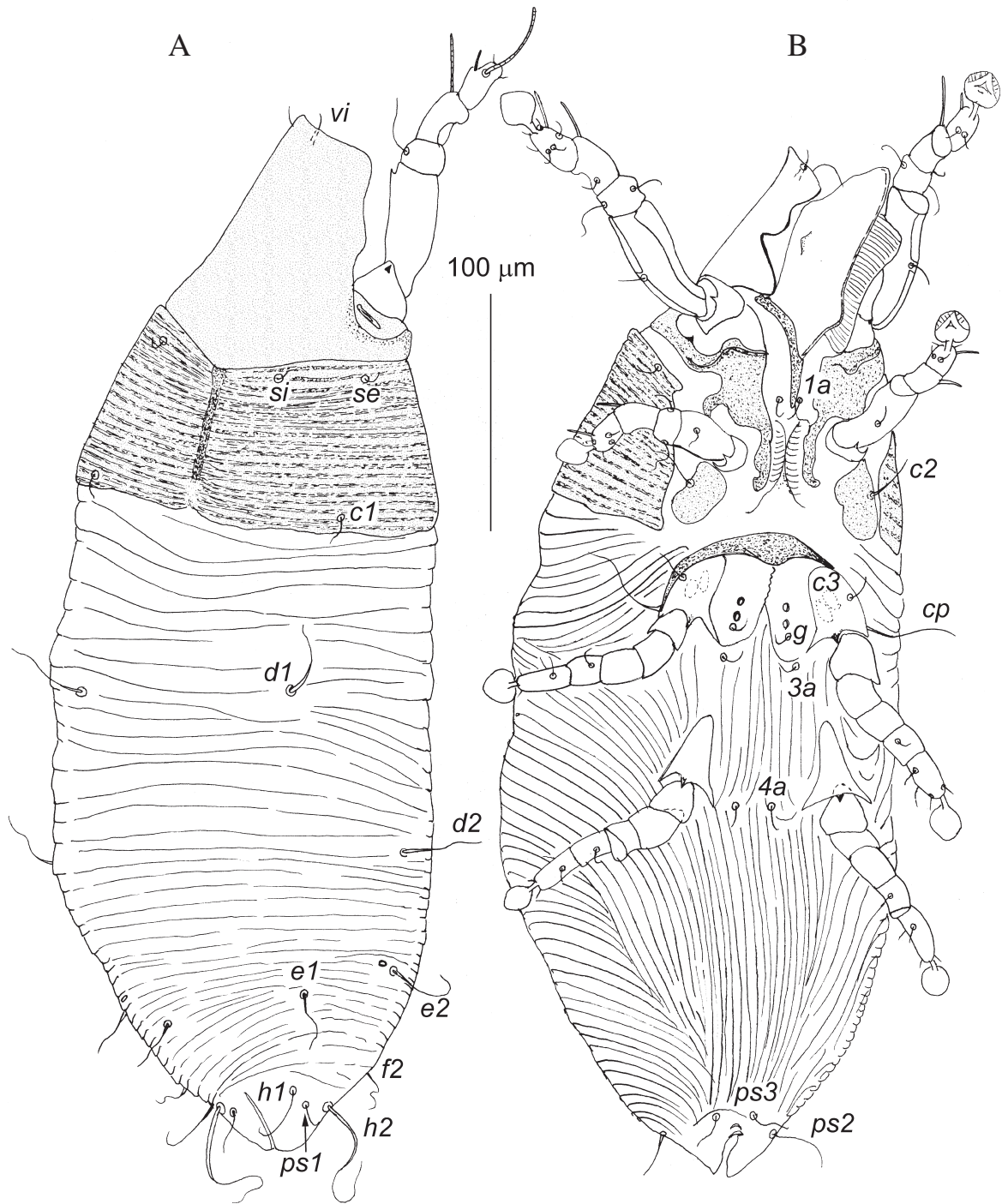


Fig. 4. *Spalacarus mediolineatus nesokia* Fain et Hyland, 1980, female. Dorsal view (A), ventral view (B).

gitudinal apodeme medially almost reaching posterior margin of this shield, covered by 20–25 narrow bands (Fig. 4A). Cuticle between coxal fields II striated. Setae *h2* longer than other hysterosomal setae, 35–40 long. Setae *ps1* and *ps2* present. Legs III and IV subequal, 60–65 long (Fig. 4B). Lengths of some setae: *c1*, *f2*, *e1* — 18–22, *c2*, *d1*, *d2*, *e2* — 25–30, *c3* 13–15, *cp* 40.

**Remarks.** This subspecies differs from the type subspecies *Spalacarus mediolineatus mediolineatus* (Fain, 1976) from a “bandicoot rat” [? *Bandicota bengalensis* (Gray et Hardwicke, 1833)] from Laos [Fain, 1976] mainly by the smaller body size, length 360–380 in males (vs. 480 in holotype of *S. m. mediolineatus*), and 460–480 in females (vs. 555 in allotype of *S. m. mediolineatus*). We



suggest that these differences could either represent actual species differences or be manifestations of geographic variability and these two forms are actually conspecific. Collection of additional material from intervening geographic regions will be needed to answer this question.

#### DISCUSSION

Northwest Pakistan includes faunal elements from both the Palaearctic and Oriental regions. Host specimens examined during this study were collected at moderate elevations (1500–2500m) during the colder part of the year when snow was present. Interestingly, the only hosts to harbor listrophorid mites, *N.indica* and *H.fimbriatus*, have Oriental affinities. The other oriental species collected, *Rattus turkestanicus* (Satunin, 1903) (2 examined), did not yield listrophorid mites, nor did any of the Palaearctic hosts. Of the latter, *Calomyscus baluchi* Thomas, 1920 (12 examined) and *Hyperacrius wynnei* (Blanford, 1881) (2 examined) (Cricetidae) are not known to harbor listrophorid mites. Thirty specimens originally identified as *Apodemus sylvaticus* (L., 1758) (Muridae) but more likely *A. wardi* (Wroughton, 1908), and 13 specimens of *Mus musculus* (L., 1758) also did not harbor listrophorid mites. European *A. sylvaticus* are known to host *Afrolistrophorus apodemi* Fain, 1970, while *M. musculus* hosts *A. musculus* [Fain, 1981b; Fain and Hyland, 1980].

#### ACKNOWLEDGEMENTS

We thank Drs. Philip Myers (UMMZ) and Steven Goodman (FMNH), who provided access to the host specimens examined in this study. This research was supported by a grant from the U.S.

National Science Foundation DEB–0118766 (PEET) to BMOC.

#### REFERENCES

- Bochkov A.V., OConnor B.M. 2005. The life-cycle of *Hemigalichus chrotogale* sp. nov. (Acari: Listrophoridae), with comparative observations on listrophorid morphology. *Journal of Natural History*, 39: 3811–3832
- Fain A. 1976. Nouveaux acariens parasites de la super-famille Listrophoroidea (Astigmatés). *Acta Zoologica et Pathologica Antverpiensia*, 64: 37–67.
- Fain A. 1979. Observations sur les genres *Sciurochirus*, *Aeromychirus* et *Tamiopsochirus* (Acarina: Listrophoridae). *Acarologia*, 20: 270–285.
- Fain A. 1981a. Notes sur les Listrophoridae (Acari, Astigmata). — I. Distribution géographique, caractères morphologiques et clé des genres. *Acarologia*, 22: 305–312.
- Fain A. 1981b. Notes sur les Listrophoridae (Acari, Astigmata) II. Description d'espèces insuffisamment connues et de deux espèces nouvelles. *Acarologia*, 22: 415–426.
- Fain A., Hyland K.E. 1980. New fur mites (Acari) from mammals collected in Pakistan. *International Journal of Acarology*, 6: 229–238.
- Grandjean F. 1939. La chaetotaxie des pattes chez les Acaridiae. *Bulletin de la Société Zoologique de France*, 64: 50–60.
- Griffiths D.A., Atyeo W.T., Norton R.A., Lynch C.A. 1990. The idiosomal chaetotaxy of astigmatid mites. *Journal of Zoology, London*, 220: 1–32.
- Norton R. 1998. Morphological evidence for the evolutionary origin of Astigmata (Acari: Acariformes). *Experimental & Applied Acarology*, 22: 559–594.
- Wilson E., Reader M. 1993. *Mammal species of the world. A taxonomic and geographic reference* (2nd. ed.). Smithsonian Institution Press. Washington. London. 1206 pp.