Revision of the fur-mite family Listrophoridae (Acari: Astigmata) associated with Philippine mammals

by Andre V. BOCHKOV and Barry M. OCONNOR

Abstract

The Philippine species of the family Listrophoridae are revised, with the fauna including six species in five genera: Sciurochirus philippinensis FAIN, 1972 from Sundasciurus philippinensis (WATERHOUSE, 1839), Sundasciurus steeri (GÜNTHER, 1877), and Petinomys crinitus HOLLISTER, 1911 (Rodentia: Sciuridae); Aeromychirus petinomys sp. nov. from Petinomys crinitus; Aforrostrophorus maculatus FAIN, 1976 from Rattus exulans (PEALE, 1848), Aponys datae (MEYER, 1899), Aponys microdon HOLLISTER, 1913, Chrotomys silaceus (THOMAS, 1895), Chrotomys whiteheadi (THOMAS, 1895), Archboldmys masseri RICKART et al., 1998, and Rhynchosmys soricioideus THOMAS, 1895 (Rodentia: Muridae); Asiochirus suncus (RADFORD, 1947) from Suncus murinus (L., 1766) (Eulipotyphla: Soricidae); Lynxacarus semnopithecus FAIN, 1970 from Paradoxurus hermaphroditus (PALLAS, 1777) (Carnivora: Viverridae), and the previously recorded Lynxacarus palawanensis FAI, 1976 from Tupaiia palawanensis THOMAS, 1894 (Scandentia: Tupaiidae). Emended generic and subgeneric diagnoses, redescriptions of most recognized species and description of Aeromychirus petinomys sp. nov., along with host ranges and distributions, and a key to species are given.

Key words: mites, ectoparasites, Listrophoridae, the Philippines, mammals, systematics

Introduction

The fur-mite family Listrophoridae MEGNIN and TROUSSART, 1884 includes permanent parasites living on the hair shafts of mammals belonging to seven orders: Carnivora, Eulipotyphla, Lagomorpha, Macroscelidea, Rodentia, Primates, and Scandentia. These mites attach to the host hair with a pair of enlarged flaps that are derived from extensions of the cuticle between coxae I. The family Listrophoridae is most diverse in the Holartic Region with fewer genera and species in other regions (FAIN, 1971, 1973; FAIN and HYLAND, 1974). It is present in Australia and Madagascar only on introduced host species (OCONNOR, 1982; DOMROW, 1992).

This work presents a taxonomic revision of the Philippine listrophorids. To date, only two species of this family have been reported from the Philippines, Sciurochirus philippinensis FAI, 1972 from the squirrel Sundasciurus steeri (GÜNTHER, 1877) and Lynxacarus palawanensis from the tree-shrew Tupaiia palawanensis THOMAS, 1894 (FAIN, 1972, 1976; CORPUZ-RAROS, 1993). Based on host distributions of these mites in other geographic regions, the Philippine mammal fauna includes 92 species of potential hosts of listrophorids in 40 genera belonging to the families Herpestidae, Mustelidae, and Viverridae (Carnivora), Muridae and Sciuridae (Rodentia), Soricidae and Erinaceidae (Eulipotyphla), CERCOPITHECIDAE and LORIDAE (PRIMATES) (HEANEY et al., 1998). The mammalian fauna of the Philippine Archipelago has one of the highest per-area levels of endemism in the World. Among 175 currently recognized native mammal species inhabiting this archipelago, most species are endemics (HEANEY et al., 1998; ESSELYSTYN et al., 2004). Therefore, a potentially rich listrophorid fauna might be expected to be associated with these hosts. However, these mites are poorly known from other insular areas. Only 13 species are known from the Indonesian archipelago and north Borneo, and no native species are known from the Caribbean region, Madagascar or Australia (OCONNOR, 1982; DOMROW, 1992).

More than 50% of the potential host species were examined during this study, but only five listrophorid species were collected, making a total of six species in five listrophorid genera known from the Philippines today. Among these, Aeromychirus petinomys sp. nov. and Lynxacarus palawanensis are associated exclusively with the Philippine endemics, Petinomys crinitus HOLLISTER, 1911(Rodentia: Sciuridae) and Tupaiia palawanensis, respectively. Most hosts of other three species are recent migrants on the Philippines which are widely distributed in Southeast Asia. It is interesting that mites of the another fur-mite family Atopomelidae (Listrophoridae) show much more biodiversity on this archipelago. Eighteen atopomelid species, including 12 newly recognized, were recently recorded from the Philippines. Most of them are specific parasites of the Philippine endemics of the subfamily Murinae (BOCHKOV and OCONNOR, in press).

Below, we re-described most recorded species, and described one new species. The emended generic and subgeneric diagnoses and key to the Philippine species are provided. Hosts and distribution of the Philippine Listrophoridae are summarized in the Table.
Table — Hosts and distribution of the Philippine Listrophoridae

'? - contamination; '/ - host switching

<table>
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<th>Mite species</th>
<th>Host species</th>
<th>Host family</th>
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Material and methods

Most specimens examined in this study were collected by BMOC or AVB from dried or fluid preserved host specimens in various institutions. 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.

In the descriptions below, the idiosomal chaetotaxy follows GRIFFITHS et al. (1990) with modifications of NORTON (1998) concerning coxal setae. The leg chaetotaxy follows GRANDJEAN (1939). All measurements are given in micrometers (µm) 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 pretarsal ambulacrum. In the collection records, names of hosts follow Wilson and Reeder (1993). Specimen depositories and reference numbers are cited using the following abbreviations:

BMNH – British Museum of Natural History, London, England;
BMOC # - B.M. O'Connor reference number;
FMNH - Field Museum of Natural History, Chicago, USA;
IRSNB - Institut royal des Sciences naturelles de Belgique, Brussels, Belgium;
MNHN - Muséum National d'Histoire Naturelle, Paris, France;
NMP - National Museum of the Philippines, Manila, the Philippines;
OSAL – The Acarology Laboratory, Ohio State University, Columbus, USA;
UMMZ - Museum of Zoology, University of Michigan, Ann Arbor, USA;
USNM - National Museum of Natural History, Smithsonian Institution, Washington, USA;
ZISP - Zoological Institute, Russian Academy of Sciences, Saint-Petersburg, Russia.

Taxonomy

Family Listrophoridae MégGIN AND TrouESSart, 1884

Genus Sciurochirus FAIN, 1972


Type species: Sciurochirus philippinensis FAIN, 1972.

Description: Adults. Anterior margin of prescapular shield straight or slightly convex, not dissected in midline. Postscapular shield absent. Median spot (internal apodeme) absent on propodonotum. Cuticle between coxae II distinctly striated and forming auxiliary valves. Setae se filiform. Setae ps2 absent. Setae d of all tarsi not longer than this segment. Distinct longitudinal ridge connecting base of apodemes II and prescapular shield absent. Femur I without dorso-apical tooth.


Hosts and distribution: Three species currently known in the genus Sciurochirus are parasites of Southeast Asian arboreal mammals. Two of them, S. philippinensis and S. thailandiae are associated with Southeast Asian tree squirrels, whereas, Sciurochirus tupaiæ has been collected from both squirrels of the genus Callosciurus and tree-shrews of the genera Tupaia and Dendrogale (Fain, 1979). The several records from tree-shrews suggest that this species has successfully colonized these hosts from squirrels.

Sciurochirus philippinensis FAIN, 1972

(Figs. 1, 2)

Sciurochirus FAIN, 1972: 242, 1979: 272, Figs. 1-3. [Holotype in MNHN]

Description: Male (10 specimens from Sundasciurus philippinensis mindanensis). Body including gnathosoma 290-300 long, 85-100 wide. Prescapular shield 70-75 long. Hysteronotal shield 100-110 long. Anterior margin of hysteronotal shield widely rounded, setae d1 situated on the anterior margin of this shield. Idiosomal surface between prescapular and hysteronotal shields striated with 16-18 lines. Setae h3 small leaf-like, with pointed apex. Aedeagus 12-14 long. Diameter of para-anal suckers about 15. Legs III and IV subequal, 77-80 long. Lengths of some setae and solenidia: cI, c2, c3 – 10-11, cp 20-22, d2 10-12, h2 60-65, ps1 11-12, ph II 40-45.


Material examined: PHILIPPINES, ex Sundasciurus philippinensis (Waterhouse, 1839), subspecies mindanensis: Two males and 10 females (BMOC 04-0329-050) ex host (FMNH 87452), Mindanao Isl., Misamis Occidental Prov., Mt. Malindag, Gandawan, 08°12'57"N,
Fig. 1 — Sciurochirus philippinensis Fain, 1972, male. Dorsal view (A), ventral view (B), anterior margin of prescapular shield (C), aedeagus (D), opisthosoma in ventral view (E), legs I-IV in ventral view, respectively (F-I). Scale lines 100 μm (A, B) and 50 μm (C-I).

Fig. 2 — Sciurochirus philippinensis FAIN, 1972, female. Dorsal view (A), ventral view (B), spermatheca (C). Scale lines 100 μm (A, B) and 50 μm (C).

(BMOC 04-0329-084) ex host (FMNH 61392), same locality, 4.XI.1946. Coll. P. CONCOVAK.


ADDITIONAL MATERIAL: Sciurochiurus philippensis: 5 males and 6 females (BMOC 86-0224-029) ex Ratufa affinis (RAFFLES, 1821) (FMNH 105534) MALAYSIA: 3rd Division, Kapit Dist., Sungai Baleh, Sungai Menglong, near Tekalit, 01°35'N, 113°35'12"E, 29.I.1972. Coll. K.R. FROGNER. Voucher specimens are deposited in FMNH, NMP, OSAL, UMMZ, ZISP.

**Genus Aeromychirus FAIN, 1976**


**Type species:** Afrolistrophorus aeromys FAIN, 1972.

**DESCRIPTION:** Adults. Anterior margin of prescapular shield straight, not dissected in midline. Postscapular shield with distinct transverse striation. Median spot (internal apodeme) absent on propodonotum. Propodo-

soma distinctly wider than hysterosoma. Full set of idiosomal and leg setae present. Cuticle between coxae II distinctly striated and forming auxiliary valves. Setae *se* filiform. Distinct longitudinal ridge connecting base of apodemes II and prescapular shield absent. Femur I without dorso-apical tooth. Setae *dIII* shorter than tarsi in both sexes.

**Male.** Hysterntonal shield present, entire, occupying most part of hysteronotum. Apodemes III fused to each other. Opisthosoma strongly attenuate, with pair of terminal lobes. Lobar membranes absent. Adanal shields absent. Para-anal suckers distinctly developed. Preagenital sclerites short, not fused to each other, bearing genital papillae. Dorsal apodeme of aedeagus arch-like, with free posterior projections, intermediate sclerite distinctly developed. Setae *f2* filiform, slightly thickened. Setae *h3* wide, membranous. Tarsi and tibiae III and IV slightly thickened or normally developed. Tarsi IV without apical projections.

**Female.** Dorsum covered by distinct transverse furrows, sclerotized or not. Hysterontonal shield present or absent, entire, if present. Setae *4b* situated anterior to genital papillae. Opisthogaster with numerous scales. Basal cap of spermatheca globosely inflated, efferent sperm ducts straight, spatula-like. Setae *h2* and *h3* subequally in length to other idiosomal setae or distinctly longer.

**OTHER SPECIES INCLUDED:** *A. hyllepotes* (FAIN, 1970), *A. petinomys* sp. nov.

**HOSTS AND DISTRIBUTION:** The three species currently known in the genus *Aeromychirus* are parasites of Asian squirrels of the subfamily Pterominae.

**Aeromychirus petinomys** sp. nov.

(Figs. 3, 4)


Paratypes. 6 male and 11 female paratypes (BMOC 04-0329-131, #2-18), same data as holotype; 3 males and 4 females (BMOC 04-0329-130, #1-7) ex *P. crinitus* (FMNH 92787), same locality as holotype, 4.V.1960. Coll. D.S. RASBOR & R.B. GONZALES [more 30 males and females in alcohol].

Holotype in FMNH, paratypes in FMNH, IRSNB, NMP, UMMZ, and ZISP.

**DESCRIPTION:** Male (holotype). Body including gnathosoma 330 (320-340 in 7 paratypes) long, 110 (110-115) wide. Prescapular shield 77 (75-80) long. Postscapular shield 65 (65-70) long, covered by 8-10 narrow trans-
Fig. 3 — *Aeromychirus petinomys* sp. nov., male. Dorsal view (A), ventral view (B), aedeagus (C), opisthosoma in ventral view (D), tibiae and tarsi I-IV in ventral view, respectively (E-H). Scale lines 100 μm (A, B) and 50 μm (C-H).
Fig. 4 — Aeromychirus petinomys sp. nov., female. Dorsal view (A), ventral view (B), spermatheca (C), tibiae and tarsi I and IV in ventral view, respectively (D, E). Scale lines 100 μm (A, B) and 50 μm (C-E).
verse bands. Posterior margin of prescapular shield with median indistinct projection. Hysteronotal shield 130 (125-135) long, covered by 28-30 transverse striations. These striations bearing small teeth spreading from anterior margin of hysteronotal shield to level of setae e2. Anterior margin of hysteronotal shield slightly concave, setae dI situated on this shield. Idiosomal surface between prescapular and hysteronotal shields striated with 3-6 lines. Coxal fields III sclerotized, without striations. Setae f2 thickened in median part. Setae h2 relatively short, about 40 long, and strongly thickened. Setae h3 membranous, distinctly developed, about 20 wide, 2 times wider than longer, with widely rounded lateral margin. Aedeagus 9-10 long. Setae g situated ob base of aedeagus. Diameter of para-anal suckers about 15. Legs III and IV 60-70 long. Setae d of all tarsi not longer than this segment. Lengths of some setae and solenidia: c1, c2, c3, dl, d2 6-9, cp, f2 12-13, el, e2 18-20, h1 23-26, psl 11-12, φl, II 43-45.


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

**REMARK:** This species clearly differ from the two previously recognized species, A. aeromys and A. hylopetes, by the following characters. In males of *A. petlinomys sp. nov.*, the hysteronotal shield is covered by numerous teeth, setae h2 are relatively short and strongly thickened; in females, the hysteronotal shield is relatively short, setae h2 are distinctly longer than other opisthosomal setae. In males of *A. aeromys* and *A. hylopetes*, the hysteronotal shield is without teeth, setae h2 are whip-like; in females, the hysteronotal shield covers most of the hysteronotum, setae h2 are short, not longer than other opisthosomal setae.

**Genus Lynxacarus RADFORD, 1951**

**Subgenus Lynxacarus RADFORD, 1951**


**Type species:** *Lynxacarus morlani* RADFORD, 1951.

**DESCRIPTION:** Adults. Anterior margin of prescapular shield variously shaped. Postcapacular shield present, entire, well developed and distinctly ornamented. Small median spot (internal apodeme) well discernible in posterior third of this shield. Full set of idiosomal and leg setae present, excluding dIV which absent in males. Cuticle between coxae II distinctly striated and forming auxiliary claspers valves. Setae se filiform. Setae d of all tarsi not longer than this segment, except in *L. lyncodon*, in which setae dIII whip-like in both sexes. Distinct longitudinal ridge connecting base of apodemes II and prescapular shield present. Femur I with dorso-apical tooth in most species.

**Male.** Hysteronotum with paired shields, distinctly ornamented. Apodemes III fused to each other, forming distinct median crest. Opisthosoma wide, not narrowing behind coxae IV, with pair of posterior lobes. Adanal sclerites present. Para-anal suckers well developed. Pre-genital sclerites fused to each other, forming inverted Y-shape structure, bearing genital papilla. Dorsal apodeme with median projection. Intermediate sclerite relatively short. Setae g situated on cuticle immediately posterior to aedeagus. Setae psl, f2 thickened in most species. Setae h3 filiform, strongly reduced in most species. Setae dIV absent. Tarsi and tibiae III and IV strongly thickened. Tarsi IV without apical projections.

**Female.** Hysteronotum shield absent. Opisthosoma usually without scales or tubercles (few tubercles present in *L. tupaiæae*). Setae 4b situated posterior to level of genital papilla, at same level as setae g. Setae h2, h3 whip-like, much longer than other opisthosomal setae. Basal cap of spermatheca globose, sperm ducts straight.


**HOSTS AND DISTRIBUTION:** Eight species of the subgenus *Lynxacarus* are associated with carnivores and tree-shrews in Eurasia and the New World. Among them, four species, *L. mustelae*, *L. radovskyi*, *L. nearcticus*, and *L. lyncodon* are specific parasites of carnivores in the families Felidae and Mustelidae. Two closely related species are parasites of tree-shrews, *L. tupaiæae* and *L. palawanensis*. *Lynxacarus semnopithecii*, which is closely related to the previously mentioned species, was described from an alcohol preserved specimen of *Presbytis hosei* (THOMAS, 1889) (= *Semnopithecus sabanus*) (Primates: Cercopithecidae) originating from northern Borneo (FAIN, 1970). Fain (1978a) reported this species from *Tupaia javanica* HOSFIELD, 1822 from Java and suggested that tree-shrews are the true hosts of this species, and we believe that its finding on *P. hosei* was the result of museum contamination. Our several records of this species on the widely distributed viverrid carnivore,
Paradoxurus hermaphroditus (Pallas, 1777) indicates that this species may naturally occur on both carnivores and tree-shrews. Finally, the record of Lynxacarus grandior based on a single male from an alcohol preserved Sundamys infraflatus (Thomas, 1888) (Rodentia: Muridae) originating from northern Borneo (Fain, 1970) is probably the result of museum contamination (Fain, 1976).

*Lynxacarus semnopitheci* Fain, 1970

(Figs. 5, 6)

*Lynxacarus semnopitheci* Fain, 1970: 275; Fain and Hyland, 1974: 42; Fain, 1976: 23, Figs. 7-9 [Holotype in BMNH].


Voucher specimens in FMNH, NMP, OSAL, UMMZ, ZISP.

*Lynxacarus palawanensis* Fain, 1976

*Lynxacarus palawanensis* Fain, 1976: 40; Fain, 1978a: 27, Figs. 10-13 [Holotype in BMNH].

**REMARK:** This species was described from *Tupaia palawanensis* Thomas, 1894 from Balabac Isl. (Palawan Prov.) (Fain, 1976). It has not been subsequently re-collected.

**Genus Afrolistrophorus** Fain, 1970

**Subgenus Afrolistrophorus** Fain, 1970


**Type species:** *Listrophorus lophuromys* Radford, 1940.

**DESCRIPTION:** Adults. Anterior margin of prescapular shield with median process or straight in African species and species from Rhizomyinae (Rodentia: Spalacidae -- see Steppan et al., 2004 for relationships of this host family). Postscapular shield present. Median spot (internal apodeme) absent on propodonotum. Hysteronal shield entire. Cuticle between coxae II smooth or slightly striated, auxiliary clasping valves weakly developed. Setae *se* filiform. Setae *d* of all tarsi usually not longer than this segment (longer in species from Rhizomyinae). Distinct longitudinal ridge connecting base of apodemes II and prescapular shield absent. Femur I without dorso-apical tooth.


*Female.* Hysteronal shield shorter than postscapular shield, situated in anterior part of hysteronotum, entire in most species. Opisthogaster without or with scales or tubercles. Setae *h4* absent. Setae *h2* as short as other opisthosomal setae or distinctly longer. Setae *ps1* and *ps2* present in most African species and species from Rhizomyinae; these setae absent in remaining species. Basal cap of spermatheca slightly oblong, efferent sperm ducts widely curved.
Fig. 5 — *Lynxacarus semnopithei* Fain, 1970, male. Dorsal view (A), ventral view (B), aedeagus (C), opisthosomal lobes in ventral view (D), tarsi I–II in ventral view, respectively (E, F), tibiae and tarsi III–IV in ventral view, respectively (G, H). Scale lines 100 µm (A, B) and 50 µm (C–H).
Fig. 6—Lynxacarus semnopithecii Fain, 1970, female. Dorsal view (A), ventral view (B), leg III in ventral view (C), tibia and tarsus IV in ventral view (D). Scale lines 100 μm (A, B) and 50 μm (C, D).

OTHER SPECIES INCLUDED: This subgenus includes 26 other species (see remark).

HOSTS AND DISTRIBUTION: Twenty-six species of this subgenus are known from rodents of the superfamilies Muroidea and Dipodoidea from Eurasia and Africa. Two species, A. neacomys Fain and Lukoschus, 1983 and A. venezuelensis Fain and Lukoschus, 1983 were described from Central and South America, from Neacomys spinosus (Thomas, 1882) (Rodentia: Cricetidae) and Monodelphis brevicaudata (Erxleben, 1777) (Didelphimorphia: Didelphidae), respectively (Fain and Lukoschus, 1983). The relationships of the latter two species and those of the Neotropical subgenus Amlistrophorus remain to be tested in the context of a thorough taxonomic and phylogenetic review of this subgenus. Afrolistrophus maculatus Fain, 1976, the single species recovered from the Philippines, was described from Leopoldamys sabanus (Thomas, 1887) from Malaysia and later recorded on Niviventer niviventer (Hodgson, 1836) from Thailand (Fain, 1980). The subspecies A. maculatus ratus Fain, 1976 was described simultaneously with the type subspe-
cies from *Rattus rattus* (L., 1758) from Surinam. From the Philippines, we recorded the type subspecies from *Rattus exulans* (Peale, 1848), a host widely distributed in the Southeast Asia and Oceania, and from several different species of Old Philippine endemic rodents. Given the association of this species with several lineages of murid rodents, it is not possible to say with certainty if the species colonized the Philippines along with ancestors of the Old Endemics or the more recently arrived *Rattus* species.

**Remarks:** The species of the subgenus *Afrolistrophorus* strongly differ from each other. This subgenus is in need of revision and is probably not monophyletic. We provisionally separate it onto three species groups, "*apodemi*", "*bothae*", and "*rhizomys*.

**apodemi group:** Anterior margin of prescapular shield with median process. Cuticle between coxal fields II without distinct striations. Male apodemes III fused to each other. Setae *ps1* and *ps2* present or absent in females. Setae *h2* in females not longer than other opisthosomal setae. Setae dIII and IV shorter than this segment. This group includes 10 species parasitizing rodents in Eurasia and the Neotropical *A. neacomyos*.


**bothae group:** Anterior margin of prescapular shield with or without median process. Cuticle between coxal fields II with or without distinct striation. Male apodemes III separated from each other. Setae *ps1* and *ps2* present in females. Setae *h2* in females not longer than other opisthosomal setae. Setae dIII and IV shorter than this segment. This group includes 13 species parasitizing African rodents.


**rhizomys group:** Anterior margin of prescapular shield straight. Male apodemes III fused to each other. Setae *ps1* and *ps2* present in females. Setae *h2* in females longer than other opisthosomal setae. Setae dIII and IV longer than this segment. This group includes 3 species parasitizing Asian rodents of the subfamily Rhizomyinae.

**Species included:** *A. rhizomys* (Fain, 1970), *A. canno­mys* Fain, 1980, and *A. sumatrensis* Fain, 1980.

**Ungrouped species:** *A. venezuelensis* Fain and Lukoschus, 1983.

**Afrolistrophorus maculatus maculatus** Fain, 1976

(Figs. 7, 8)

**Afrolistrophorus maculatus maculatus** Fain, 1976: 38, 1980: 419, Figs. 4-6. [Holotype in BMNH]

**Description:** Male (10 specimens from *Rattus exulans*). Body including gnathosoma 360-370 long, 90-95 wide. Prescapular shield 95-100 long. Anterior margin of prescapular shield with median process. Postscapular shield 105-115 long, covered by 8-10 narrow bands slightly widened in lateral parts. Hysterontal shield 170-180 long, with irregular anterior margin, covered by striation in anterior half, until level of setae *d2*. Idiosomal surface between prescapular and hysterontal shields striated with 3-4 lines. Setae *h3* about 15 wide. Cuticle between coxal fields II not striated. Cuticle between coxal fields III striated. Coxal apodemes III fused to each other. Aedeagus about 18 long. Diameter of para-anal suckers about 8. Legs III and IV about 90 long and 100 long, respectively. Setae dIII and IV shorter than respective tarsi. Lengths of some setae and solenidia: *c1* and *h1* 7-9, *c2*, *c3*, *d1*, *d2*, *e1*, *ps1*, and *ps2* – all 9-12, *cp* and *e2* 18-20, *f2* 4-5, *h2* 190-200, *φ1*, II 30-35.

**Female** (10 specimens from *Rattus exulans*). Body, including gnathosoma, 470-480 long, 110-120 wide. Prescapular shield 105-110 long. Anterior margin of prescapular shield with median process. Postscapular shield 75-80 long, covered by 9-11 narrow bands, slightly widened in lateral parts. Idiosomal surface between postscapular and hysterontal shields striated with 4-5 lines. Hysterontal shield 60-65 long, covered with 9-12 transverse partly interrupted lines. Hysterontal posterior to hysterontal shield with 29-33 transverse striations. Cuticle between coxal fields II not sclerotized. Setae *h2* short, about 8 long, subequal in length to other opisthosomal setae. Setae *ps1* and *ps2* absent. Legs III and IV subequal, 60-65 long. Lengths of some setae and solenidia: *c1* 12-13, *c2*, *c3*, *d1*, *d2*, *el*, *e2* – all 9-11, *cp* 13, *f2* 7, and *φ1-II* 8-10.

**Material examined:** PHILIPPINES, ex *Rattus exulans* (Peale, 1848): 10 males and 6 females (BMOC 01-0920-065) ex host (FMNH 169162), Luzon Is., Kalinga Prov., Balbalangs Barangay, Magpa, 1050m, 17°28'30"N, 121°04'30"E, 15.III.2001. Coll. E.A. Rickart (EAI 4547); 10 males and 10 females (BMOC 01-0920-062) ex host (FMNH 169159), Luzon Is., Kalinga Prov., Balbalangs Munic., Balbalangs, 900 m, 17°29'15"N, 121°03'45"E, 10.III.2001. Coll. L.R.
Fig. 7 — *Afrolistrophorus maculatus maculatus* FAIR, 1976, male. Dorsal view (A), ventral view (B), aedeagus (C), opisthosoma in ventral view (D), legs I-II in ventral view, respectively (E, F), tarsi III-IV in ventral view, respectively (G, H). Scale lines 100 μm (A, B) and 50 μm (C-H).
Fig. 8 — Afrolistrophorus maculatus maculatus Fain, 1976, female. Dorsal view (A), ventral view (B), spermatheca (C), tibia and tarsus I in ventral view (D). Scale lines 100 µm (A, B) and 50 µm (C, D).
Remark. The record of a single specimen from *Rhynchomys soricoides* is likely the result of contamination.
Fig. 9 — *Asiochirus suncus* (RADFORD, 1947), male. Dorsal view (A), ventral view (B), aedeagus (C), opisthosoma in ventral view (D). Scale lines 100 μm (A, B) and 50 μm (C, D).

**DESCRIPTION:** Male (10 specimens from *Suncus murinus*). Body including gnathosoma 330-335 long, 115-120 wide. Prescapular shield 95-100 long. Postscapular shield 55-58, covered by 4-5 transverse lines. Hysterontal shield 84-90 long, without striations. Idiosomal surface between postscapular and hysterontal shields with 10-12 not interrupted striations. Aedeagus 25-28 long. Diameter of para-anal suckers about 9-10 long. Legs III and IV 65-70 long. Lengths of some setae and solenidia: $c_1$ - 18, $c_2$, $d_2$, and $e_1$ - all 22-26, $c_3$, $f_2$, $h_3$, $p_1$, and $p_2$ - all 5-8, $c_p$ - 15, $d_1$ and $p_3$ - 11-13, $h_2$ 132, $\varphi_1$, II 29-31.

Female (10 specimens from *Suncus murinus*). Body, including gnathosoma, 430-440 long, 110-120 wide. Prescapular shield 105-110 long. Postscapular shield 62-66 long, covered by 12-14 transverse lines. Idiosomal surface posterior to prescapular shields 29-32 lines. Hysterontum without tubercles or scales. Opisthogaster with distinct teeth. Setae $4a$ situated on small common sclerotized patch. Legs III and IV subequal, about 70 long. Lengths of some setae and solenidia: $c_1$ 16, $c_2$, $d_1$, $d_2$, $e_1$, $e_2$, $h_3$, and $p_3$ - all 18-22, $c_3$, $f_2$, $h_1$, and $h_2$ - all 4-6, $c_p$ 9-10, $\varphi_1$-II 9-10.
Fig. 10 — *Asiochirus suncus* (RADFORD, 1947), female. Dorsal view (A), ventral view (B), vulva (C), genu, tibia and tarsus I in ventral view (D), tibia and tarsus IV in ventral view (E). Scale lines 100 µm (A, B) and 50 µm (C-E).

**Material examined:** Three males and 5 females (HK 87-0507-004) ex *Suncus murinus* (L., 1766), PHILIPPINES: Negros Isl., Negros Oriental Prov., Dumaguete, 09°18'N, 123°18'E, 7.V.1987. Coll. E.A. RICKART (EAR 1551); 12 males and 5 females (BMOC 95-1214-034) ex *S. murinus* (FMNH 154833), PHILIPPINES: Camiguin Prov., Mt. Timpoong, 2 km N, 6.5 km W. Mahinog, 1275 m, 09°11'N, 124°43'E, 21.V.1995. Coll. L.R. HEANEY (LRH 5405). Voucher specimens in FMNH, NMP, OSAL, UMMZ, ZISP.
Key to the Philippine Listrophoridae

**Males**

1. Setae h3 membranous ............................... 4
   - Setae h3 filiform ................................. 2
2. Anterior margin of prescapular shield concave. Hysteronotal shield paired. Auxiliary valves between coxal fields II distinctly developed. Apodemes of coxae III fused to each other. Setae 4b present. Setae dIV absent ....... **Lynxacarus** RADFORD, 1951 ... 3
   - Anterior margin of prescapular shield with median process. Hysteronotal shield entire. Auxiliary valves between coxal fields II indistinct. Apodemes of coxae III separated from each other. Setae 4b absent. Setae dIV present ............................... **Asiochirus suncus** (RADFORD, 1947) (Fig. 9)
3. Postscapular shield distinctly striated in median part ....... **Lynxacarus** semnopitheci FAIN, 1970 (Fig. 5)  
   - Postscapular shield without striations in median part ...... **Lynxacarus** palawanensis FAIN, 1976
4. Hysteronotal shield without scales. Setae h2 whip-like, filiform ...................................... 5
   - Hysteronotal shield with numerous scales. Setae h2 steak-like, strongly thickened ............................... **Aeromychirus petinomys** sp. nov. (Fig. 3)
5. Anterior margin of prescapular shield straight. Postscapular shield absent. Hysteronotal shield without ornamentation. Setae ps2 absent ............... .... **Sciurochirus philippinensis** FAIN, 1972 (Fig. 1)
   - Anterior margin of prescapular shield with median process. Postscapular shield present. Hysteronotal shield striated. Setae ps2 present ............................... **Afrolistrophorus maculatus maculatus** FAIN, 1976 (Fig. 7)

**Females**

1. Hysteronotal shield present ............................ 3
   - Hysteronotal shield absent .......................... 2
   - Opisthogaster with tubercles..... **Afrolistrophorus maculatus maculatus** FAIN, 1976(Fig. 8)
   - Anterior margin of prescapular shield straight. Hysteronotum posterior to hysteronotal shield distinctly sclerotized. Auxiliary valves between coxal fields II distinctly developed. Setae 4b and ps1-2 present. Setae h2 short, subequal in length to other opisthosomal setae. Opisthogaster without tubercles ...... .... **Aeromychirus petinomys** sp. nov. (Fig. 4)
3. Postscapular shield present ............................ 4
   - Postscapular shield absent .......................... ........ **Sciurochirus philippinensis** FAIN, 1972 (Fig. 2)
4. Anterior margin of prescapular shield concave. Auxiliary valves between coxal fields II distinctly developed. Distinct longitudinal ridge connecting base of apodemes II and prescapular shield present. Setae 4b and ps1-2 present. Setae h2 and h3 distinct longer other opisthosomal setae. Opisthogaster without teeth. Dorso-apical tooth of femora I present ............... .... **Lynxacarus** RADFORD, 1951 ... 5
   - Anterior margin of prescapular shield with median process. Auxiliary valves between coxal fields II indistinct. Longitudinal ridge connecting base of apodemes II and prescapular shield absent. Setae 4b and ps1-2 absent. Setae h2 and h3 short, subequal in length to other opisthosomal setae. Opisthogaster with distinct teeth. Dorso-apical tooth of femora I absent. .... **Asiochirus suncus** (RADFORD, 1947) (Fig. 10)
5. Postscapular shield monotonously striated by thick lines ............................................... .... **Lynxacarus** semnopitheci FAIN, 1970 (Fig. 6)
   - Postscapular shield striated in median part by numerous fine lines and few thick lines in lateral parts ....... **Lynxacarus** palawanensis FAIN, 1976

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References


