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## A New Species of Sucking Louse (Insecta, Anoplura) from a Montane Forest Rat in Central Sulawesi and a Preliminary Interpretation of the Sucking Louse Fauna of Sulawesi

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### ABSTRACT

*Hoplopleura traubi*, a new species of hoplopleurid sucking louse collected from the murine rodent, *Maxomys wattsi*, is described. The louse and its host are known only from montane forest on Gunung (Mount) Tambusisi (1°38'S, 121°23'E) in Central Sulawesi, Indonesia. The morphology of *H. traubi* is compared to that of related species of *Hoplopleura* known from Sulawesi and Sunda-

land. The polyplacid sucking louse *Polyplax reclinata* is recorded for the first time from Sulawesi; specimens were recovered from a house shrew, *Suncus murinus*. The anopluran fauna as currently known from native Sulawesian mammals is briefly analyzed and compared with the known faunas of other parts of the Indo-Australian region.

### INTRODUCTION

With more than 40 murine and six sciurid rodent species known to be endemic to Sulawesi (Musser, 1987; Musser and Holden, 1991), this Indonesian island is expected to

have a similarly varied sucking louse (Anoplura) fauna living in close association with these potential hosts. To date, however, anopluran collections from this comparatively

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rich rodent fauna have been sparse with just five species of lice documented. These lice comprise two species of *Polyplax* (Ewing, 1935; Johnson, 1958; Durden, 1987) and three species of *Hoplopleura* (Durden, 1990). Both of these genera are virtually cosmopolitan, primarily rodent-associated taxa with 74 species of *Polyplax* and 137 of *Hoplopleura* currently known worldwide. In addition to the five species of Sulawesi lice mentioned above, another two species of Anoplura (*Hoplopleura pacifica* and *Polyplax spinulosa*) parasitize commensal *Rattus* on Sulawesi as they do elsewhere in Indo-Australia and across most of the globe (Ewing, 1924; Pritchard, 1947; Durden, 1986, 1987, 1990). Undoubtedly, the native rodent fauna of Sulawesi supports additional species of sucking lice that await description. In this paper, we describe a new species of *Hoplopleura* collected from a new species of murine rodent, *Maxomys watti* (Musser, 1991), known only from Gunung (Mount) Tambusisi in Central Sulawesi. In addition, a known species of sucking louse is newly recorded from Sulawesi and a new host association for Sulawesi is noted for the human louse, *Pediculus humanus*. The sucking louse fauna, as currently known from Sulawesi, is briefly analyzed and compared with the known faunas of other areas within Indo-Australia.

#### ABBREVIATIONS AND PROCEDURES

Specimens examined and referred to here are deposited in the collections of the American Museum of Natural History, New York (AMNH); the Natural History Museum, London (BMNH); Lance A. Durden (LAD); the Museum Zoologicum Bogoriense, Bogor (MZB); and the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM).

Abbreviations used in the descriptive portions of this work are as follows:

AnMHS	Anterior marginal head setae
ApHS	Apical head setae
DACHS	Dorsal accessory head setae
DAnHS	Dorsal anterior head setae
DCAS	Dorsal central abdominal setae
DLAS	Dorsal lateral abdominal setae
DMHS	Dorsal marginal head setae
DPHS	Dorsal principal head setae
DPoCHS	Dorsal posterior central head setae

DPrS	Dorsal paratergal setae
OrS	Oral setae
SpAtHS	Supraantennal head setae
StAS	Sternal abdominal setae
SuHS	Sutural head setae
TeAS	Tergal abdominal setae
VPaHS	Ventral preantennal head setae
VPHS	Ventral principal head setae
VPrS	Ventral paratergal setae

Description of the new species presented here follows the format and terminology of Kim (1966), Kim and Ludwig (1978), and Durden (1987, 1990). Drawings of entire lice conventionally illustrate dorsal morphology to the left of the midline and ventral features to the right. Measurements were made using a calibrated eyepiece micrometer inserted into a high-power phase contrast microscope.

#### ACKNOWLEDGMENTS

The new species described here was obtained by Dr. C. H. S. Watts, Chief Scientist, Division of Natural Science, South Australian Museum, Adelaide, while he was a participant of Operation Drake. Operation Drake was organized by the British Scientific Exploration Club to survey a region near Morowali, in the eastern part of Central Sulawesi (Sulawesi Tengah). Additional louse specimens were obtained for this work through the courtesies of Drs. Robert Traub (USNM) and K. C. Emerson (Sanibel, Florida). Robert Traub also provided facilities that allowed the completion of this work. We greatly appreciate the help of Drs. Robert V. Peterson and Richard G. Robbins who read through and commented on an earlier draft of this paper.

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#### *Hoplopleura traubi*, new species

**HOLOTYPE:** Male collected by C. H. S. Watts from *Maxomys watti* Musser (Rodentia, Muridae, Murinae; as used by Carleton and Musser, 1984) at Tambusisi Damar, on the slopes of Gunung Tambusisi (1°38'S, 121°23'E), 4500 ft in Central Sulawesi, Indonesia on 8 March, 1980 (R. Traub catalog no. B95384). Deposited in the USNM.

**REFERRED SPECIMENS:** Twenty-two individuals (4 males, 18 females) with collection data identical to holotype, except for 1 female paratype removed from *M. watsi* museum skin (AMNH 265080) with the same host collection data but at 6000 ft elevation. Two immature *Hoplopleura* specimens removed from another *M. watsi* skin (AMNH 265081) with the same collection data (at 6000 ft) almost certainly belong to the same new species but will not be described here because adult lice cannot be definitively associated with them. Allotype female: USNM. Paratypes: AMNH, BMNH, LAD, MZB, USNM.

**DISTRIBUTION:** Known from two collections ex *Maxomys watsi* collected at 4500 and 6000 ft, respectively, in montane forest on Gunung Tambusisi (see map in Musser, 1991).

**ETYMOLOGY:** The species is named after Dr. Robert Traub in recognition of his enduring studies on the mammal ectoparasites of Southeast Asia and elsewhere, and for his much appreciated assistance with aspects of this paper.

**DIAGNOSIS:** *Hoplopleura traubi* is distinguished from all other species of *Hoplopleura* by the following combination of characters: (1) the displacement of thoracic spiracles to the lateral edge of the thorax; (2) the angulate shape of the thorax; (3) the absence of thoracic setae (except on the legs); (4) the shape and setation of the paratergal plates, particularly the tapering elongation of the ventral apical angle of plate VIII; and (5) the shape and setation of the female subgenital plate.

**DESCRIPTION:** **Male** (fig. 1A, B, C, D). Length of holotype 0.98 mm (mean for series 0.92; range 0.88–0.98; N = 5). Head, thorax, and abdomen well sclerotized.

**Head.** Almost as wide as long with blunt, squarish, anterior apex; 2 SHS and 3 DMHS distinct on each side; DPHS fairly short, not extending to thoracic spiracle, with 1 DAChS medial to DPHS on each side; 1 pair of ApHS, 1 pair of AnMHS, 1 pair of DAnHS, 1 SpAtHS, 1 VPahS, 1 VPHS, and 1 OrS on each side. **Antenna** 5-segmented with basal segment much larger than second segment, wider than long.

**Thorax.** Broader than long with angulate shape; thoracic sternal plate (fig. 1B) tapering to blunt anterior and posterior apices; meso-

thoracic spiracle moderate in size (0.017 mm in diameter) but displaced to lateral edge of thorax; dorsal thoracic setae absent. **Legs.** Hind coxa with posterior spur; mid and fore coxae subtriangular; coxae with 2 large setae each; forelegs small, each with narrow acuminate claw; hindlegs robust, each with large acuminate claw; midlegs intermediate in size between fore and hind legs.

**Abdomen.** Wider than thorax; 1 plate per segment dorsally and 2 plates per segment ventrally on each of segments 3–7; 1 row of 4 setae dorsally (2 DCAS inside 2 DLAS) on each of first and second setal rows followed by 5 rows of TeAS, each with 8 setae; 12 rows of StAS, rows 1–10 each with 5–8 setae, row 11 with 4 setae, row 12 with 2 setae; StAS on sternite of third abdominal segment consisting of 2 robust lateral setae on each side and 3 setae of regular thickness between these; sternites of segments 2 and 3 extending completely across ventral surface to articulate with corresponding paratergal plates. **Paratergal plates** (fig. 1C) present on segments 1–8: plate I without setae; plate II with 1 ventral and 1 dorsal seta; plate III with ventral seta only; plate VIII with 1 ventral and 1 dorsal seta, both elongated; plates IV–VII without setae; plates II and III subtriangular with apical angles developed into points; plates IV–VI more squarish with lobulate apical angles; plate VIII with ventral apical angle developed as a tapered point; plates III–VII each with apical sculpting and a moderate size spiracle.

**Genitalia** (fig. 1D). Aedeagal basal apodeme longer than paramere; parameres curved and tapered apically; pseudopenis short, barely extending beyond apices of parameres.

**Female** (fig. 2A, B, C, D). Length of allotype 1.25 mm (mean for series 1.19; range 1.06–1.28; N = 17).

**Head, thorax, and legs.** As in male unless indicated otherwise. Fore and midcoxae with small sclerotized distal processes; thoracic spiracle diameter 0.019 mm.

**Abdomen.** With 3 plates per segment dorsally on segments 4–7 and 3 plates per segment ventrally on segments 3–6; 1 row of 4 setae dorsally (2 DCAS inside 2 DLAS) on each of first and second rows followed by 16 rows of TeAS, each with 4–8 setae; 15 rows of StAS each with 5–8 setae; sternites of seg-

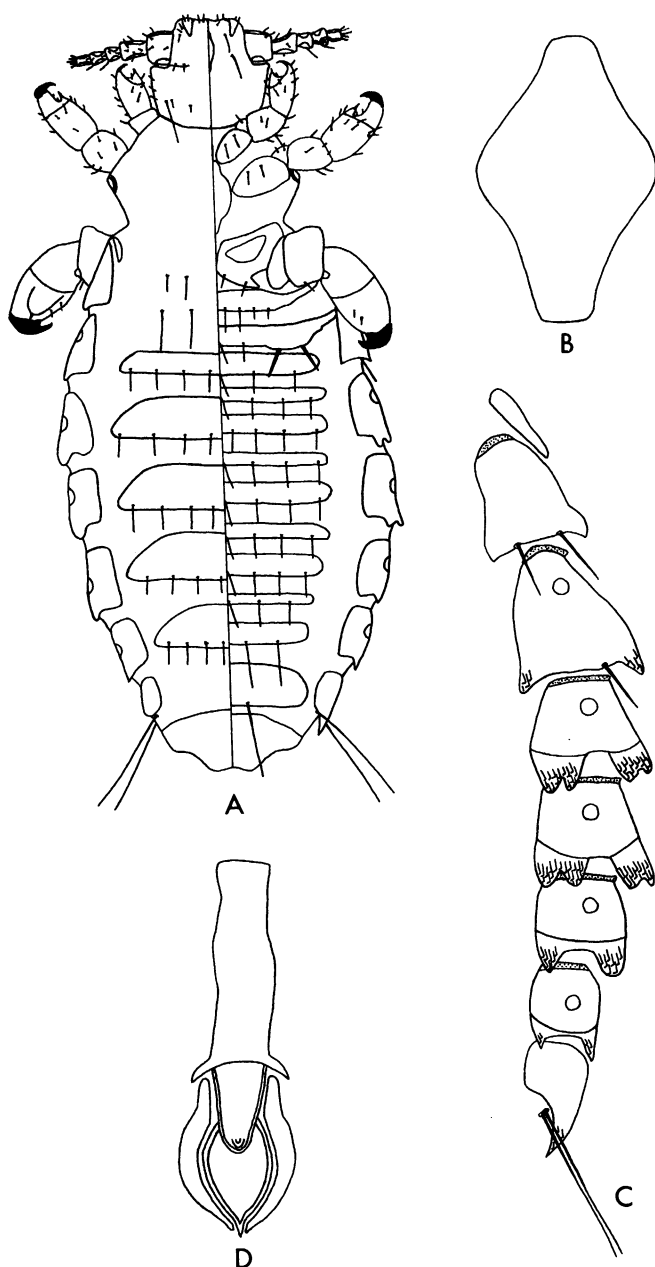


Fig. 1. *Hoplopleura traubi*, male. A, habitus; B, thoracic sternal plate; C, paratergal plates; D, genitalia.

ments 2 and 3 as in male. *Paratergites* (fig. 2C) as in male except plates II–V subtriangular and plates III–VIII with apical sculpting.

*Genitalia* (fig. 2D). Subgenital plate subtriangular but with deep anterior indentations, lightly sclerotized posteriorly; gonopod

VIII with 3 setae consisting of a short medial seta, an intermediate central seta, and a long lateral seta; gonopod IX with 1 stout seta; vulvar fimbriae indistinct.

**REMARKS:** *Hoplopleura traubi* possesses an intriguing suite of morphological characters particularly when it is compared to other spe-

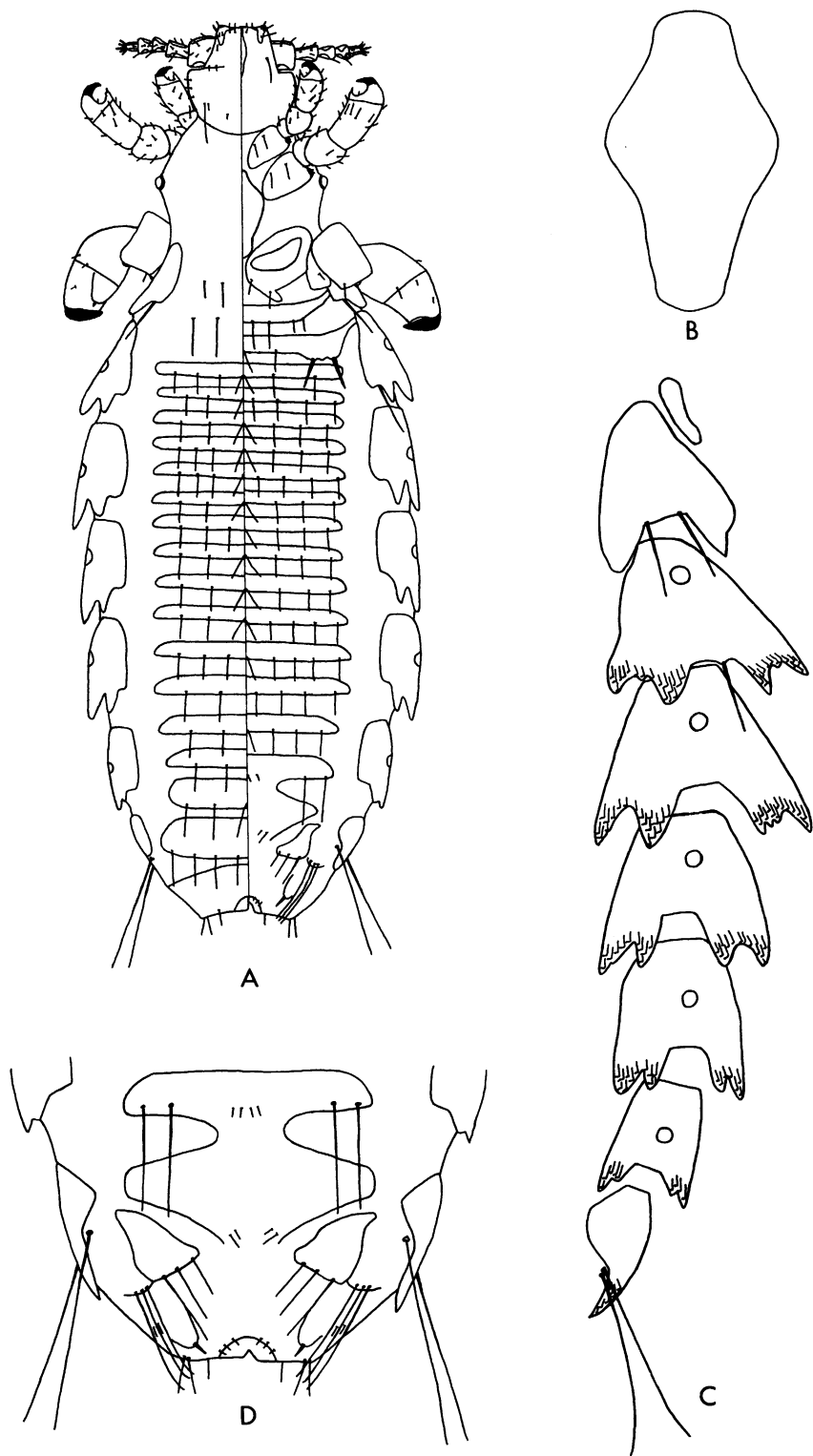


Fig. 2. *Hoplopleura traubi*, female. A, habitus; B, thoracic sternal plate; C, paratergal plates; D, genitalia.

cies of *Hoplopleura* that are ectoparasitic on species of *Maxomys*. *Hoplopleura traubi* shares many features with *H. pectinata* Cummings (a parasite of various species of *Maxomys* in Sundaland) and with *H. musseri* Durden (a specific parasite of *Maxomys musschenbroekii* [Jentink] in Sulawesi). These common features include the displacement of the dorsal thoracic spiracle to the lateral edge of the thorax, the absence of thoracic setae (except on the legs), the tapering elongation of the ventral apical angle of paratergal plate VIII, and the general shape of the subgenital plate in the female. These features are rare or unknown in other species of *Hoplopleura*, although reduction in thoracic setation is a common feature in other lice of this genus known from Sulawesi (Durden, 1990). However, *H. traubi* females do not possess the curious pectenlike spine arrangements at the tip of the abdomen that distinguish both *H. pectinata* and *H. musseri*. Also, the apical elongation of paratergal plate VIII is shorter in *H. traubi* than in both *H. pectinata* and *H. musseri*. In this respect, the morphology of *H. traubi* appears to be intermediate between the extreme characters of both *H. pectinata* and *H. musseri* and the comparatively conservative ones of *H. sembeli* Durden. *Hoplopleura sembeli* is principally parasitic on *Maxomys hellwaldii* (Jentink) in Sulawesi.

The spectrum of morphologies exhibited by the various species of *Hoplopleura* known to parasitize *Maxomys* forest rats may reflect the habits, pelage type, and/or evolution of their hosts. One significant ecological difference between the three Sulawesi species of *Maxomys* mentioned here is the habitat occupied by each of them. *Maxomys musschenbroekii* is found in all forest formations from coastal plain to mountain top, whereas *M. hellwaldii* occurs only in tropical lowland evergreen forest and *M. wattsi* appears to be a denizen of lower and upper montane forest (Musser et al., 1979; Musser, 1991). Each of these altitudinally distinct forests develops characteristic vegetation and habitat (Whitmore, 1984; Musser and Dagosto, 1987). It should be considered that the contrasting morphologies of the three species of *Hoplopleura* associated with each of these murines

may be related in some way to host habitat as dictated by altitude.

## NEW SUCKING LOUSE RECORDS FOR SULAWESI

*POLYPLAX RECLINATA* (Nitzsch, 1864).

**REFERRED SPECIMENS:** Seven males, 26 females, 1 first instar nymph ex *Suncus murinus* (L.) (Insectivora, Soricidae). Langa (3°51'S, 119°31'E), South Sulawesi (Sulawesi Selatan); 15 November, 1973; collector unknown; collection number G01910.

**REMARKS:** The polyplacid sucking louse *Polyplax reclinata* parasitizes many species of shrews across Africa (including Madagascar) and Eurasia (Durden et al., 1990). It is a well-known ectoparasite of the house shrew, *S. murinus* (Durden et al., 1990), a commensal mammal that is considered to have been introduced into Sulawesi (Musser, 1987). Although this collection represents the first record of *P. reclinata* from Sulawesi, this louse is probably widespread in commensal habitats on the island as a parasite of *S. murinus*.

There are at least eight species of native shrews (*Crociodura* spp.) in Sulawesi (Musser, 1987), but no sucking lice are known from this significant potential host group.

*PEDICULUS HUMANUS* L., 1758.

**REFERRED SPECIMENS:** Two nymphs ex *Canis familiaris* L. (Carnivora, Canidae). Talim Eipomek Valley, Rantepao, Toraja area (2°59'S, 119°54'E), South Sulawesi (Sulawesi Selatan); June, 1975; collector unknown (R. Traub catalog no. B92635).

**REMARKS:** The human louse, *P. humanus*, has been reported from humans in Sulawesi (Durden and Page, 1991) but has not been collected previously from domestic dogs there. Although other records exist of *P. humanus* parasitizing dogs, this is considered to represent an accidental host-parasite association (Hopkins, 1949), perhaps arising because of shared living space between louse-infested persons and their dogs. The linognathid louse *Linognathus setosus* (von Olfers, 1816) is the sucking louse that is typically associated with domestic dogs throughout the world but this species has yet to be reported from Sulawesi.

TABLE 1  
Sucking Lice (Anoplura) Documented from Sulawesian Mammals

Host species	Louse species	Reference(s)
Insectivora:		
<i>Suncus murinus</i>	<i>Polyplax reclinata</i>	12
Rodentia:		
<i>Bunomys chrysocomus</i>	<i>Hoplopleura chrysocomi</i>	3
	<i>Polyplax wallacei</i>	2, 5
<i>Bunomys fratorum</i>	<i>Hoplopleura sembeli</i>	3
	<i>Polyplax wallacei</i>	2, 5
<i>Eropeplus canus</i>	<i>Polyplax eropepli</i>	2, 5, 7, 8, 9
<i>Maxomys hellwaldii</i>	<i>Hoplopleura sembeli</i>	3
<i>Maxomys musschenbroekii</i>	<i>Hoplopleura musseri</i>	3
<i>Maxomys wattsi</i>	<i>Hoplopleura traubi</i>	12
<i>Rattus argentiventer</i>	<i>Hoplopleura pacifica</i>	1, 3, 4
	<i>Polyplax spinulosa</i>	1, 2, 4
<i>Rattus exulans</i>	<i>Hoplopleura pacifica</i>	1, 3, 4, 6, 11
	<i>Polyplax spinulosa</i>	1, 2, 4
<i>Rattus hoffmanni</i>	<i>Hoplopleura sembeli</i>	3
<i>Rattus rattus</i>	<i>Hoplopleura pacifica</i>	4
	<i>Polyplax spinulosa</i>	4
Carnivora:		
<i>Canis familiaris</i>	<i>Pediculus humanus</i>	12
Primates:		
<i>Homo sapiens</i>	<i>Pediculus humanus</i>	4
<i>Macaca maura</i>	<i>Pedicinus obtusus</i>	3, 10
<i>Macaca nigra</i>	<i>Pedicinus obtusus</i>	3, 8, 10
<i>Macaca tonkeana</i>	<i>Pedicinus cynopithecii</i>	3, 10

References: 1—Durden, 1986; 2—Durden, 1987; 3—Durden, 1990; 4—Durden and Page, 1991; 5—Durden and Traub, 1990; 6—Ewing, 1924; 7—Ewing, 1935; 8—Hopkins, 1949; 9—Johnson, 1958; 10—Kuhn and Ludwig, 1967; 11—Pritchard, 1947; 12—present report.

## THE SUCKING LOUSE FAUNA OF SULAWESI

Table 1 lists the species of sucking lice currently known from Sulawesian mammals. Additional species almost certainly parasitize humans (i.e., *Pthirus pubis* [L.]), domestic animals (various species of *Haematopinus*, *Linognathus*, and *Solenopotes*), house mice, *Mus musculus* L. (one or both of *Hoplopleura captiosa* Johnson, and *Polyplax serrata* [Burmeister]), and native mammals but have not been reported from the island. Excluding lice associated with domestic or commensal mammals, eight described species of Anoplura are known to parasitize Sulawesian mammals (table 1). In addition, at least three undescribed species of *Hoplopleura* collected

from native Sulawesian squirrels are known to us.

Table 2 lists the numbers of species of sucking lice known from six regions or islands within Indo-Australia. A preliminary comparison can be made between each of these faunas and the sucking lice of Sulawesi, although additional species of Anoplura undoubtedly await description from all of the areas. In general, mainland Southeast Asia, represented in table 2 by peninsular Malaysia, has a richer fauna than any of the other regions listed and there is a gradual decline in species diversity traveling eastward to Australia. This may be partly explained by the presence of increasing numbers of marsupial species from Sulawesi southeastward through New Guinea to Australia (Musser,

TABLE 2  
Sucking Louse (Anoplura) Faunas of Native Terrestrial Mammals<sup>a</sup> in Indo-Australia<sup>b</sup>

Louse genus (hosts)	Number of species in region (moving west to east)					
	Peninsular Malaysia	Borneo	Philippines	Sulawesi	New Guinea	Australia
<i>Ancistroplox</i> (Soricidae)	1	1	0	0	0	0
<i>Atopophthirus</i> (Sciuridae)	1	0	0	0	0	0
<i>Enderleinellus</i> (Sciuridae)	2	3	0	0	0	0
<i>Haematopinus</i> (Artiodactyla)	0	0	2	0	0	0
<i>Hamophthirus</i> (Cynocephalidae)	0	1	0	0	0	0
<i>Hoplopleura</i> (Rodentia)	6	3	3 <sup>c</sup>	7 <sup>c</sup>	13 <sup>d</sup>	7
<i>Neohaematopinus</i> (Sciuridae)	6	4	1 <sup>c</sup>	0	0	0
<i>Pedicinus</i> (Primates)	3	3	2	2	0	0
<i>Polyplax</i> (Rodentia, Soricidae)	3	3	4	2	0	0
<i>Sathrax</i> (Tupaiaidae)	1	1	0	0	0	0
Total Anoplura	23	19	12	11	13	7

<sup>a</sup> Domestic and commensal mammals are excluded although some of these may have originated within Indo-Australia.

<sup>b</sup> Sumatra, Java, and the Moluccan Islands are excluded because their sucking louse faunas are extremely poorly known.

<sup>c</sup> Five undescribed species of sucking lice known to us are included as follows: 3 species of *Hoplopleura* from Sulawesian squirrels; 1 species of *Hoplopleura* from *Sundasciurus samarensis* (Steere) on Biliran Island, Philippines; 1 species of *Neohaematopinus* from *Sundasciurus juvencus* (Thomas) on Palawan Island, Philippines.

<sup>d</sup> No published records exist for Anoplura from native New Guinean mammals but Richardson (1982) described 13 new species in a thesis.

1987)—marsupials are not parasitized by sucking lice but instead by boopid chewing lice (Mallophaga). Also, Sundaic regions listed (peninsular Malaysia and Borneo) are particularly rich in rodent species; rodents are typical hosts of many sucking lice.

Other noteworthy trends are apparent from table 2. The squirrel-associated louse genera *Enderleinellus* and *Neohaematopinus* appear to be well represented in peninsular Malaysia and Borneo but are not known from Sulawesi or the Philippines proper (the Philippines *Neohaematopinus* listed in table 2 is parasitic on a squirrel endemic to Palawan Island which is politically part of the Philippines but zoogeographically more allied to Borneo as shown by Heaney [1986] and others). Although *Enderleinellus* and *Neohaematopinus* are unknown in Indo-Australia east of Borneo/Palawan, seemingly appropriate callosiurine squirrel hosts occur on Sulawesi, Mindanao, and adjacent small islands. On these latter islands, the only known sucking lice associated with squirrels belong to the genus *Hoplopleura*. Three closely related species of *Hoplopleura* parasitize callosiurines in mainland Southeast Asia, and it is curious

that *Hoplopleura* appears to replace *Enderleinellus* and *Neohaematopinus* on squirrels belonging to this tribe in Indo-Australia east of Borneo.

The primarily rodent-associated anopluran genus *Polyplax* shows an intriguing geographical distribution in Indo-Australia, as noted by Durden and Traub (1990). *Polyplax* is well represented in mainland Southeast Asia, the Greater Sunda islands, Sulawesi, and the Philippines but is unknown (except as parasites of introduced commensal rats and mice) further eastward, despite the presence of numerous species of seemingly suitable native murine hosts. Apparently, *Polyplax* failed to accompany the ancestral murids that progressively colonized islands southeastward from mainland Southeast Asia across the Moluccas to New Guinea and Australia.

Unlike *Polyplax*, the large anopluran genus *Hoplopleura* parasitizes native murines throughout Indo-Australia all the way from peninsular Malaysia to Australia (including Tasmania). A large number of potential murine host species exists for *Hoplopleura* throughout Indo-Australia, and it seems inevitable that additional species belonging to



this louse genus await discovery there. It is interesting to note that of the two large significantly murine-associated louse genera in Indo-Australia, one (*Polyplax*) is not known to occur to the east of Sulawesi and the Philippines, while the other (*Hoplopleura*) occurs on murines all the way to Australia. Perhaps *Hoplopleura* has been able to evolve more rapidly than *Polyplax* and thereby keep pace to some extent with the comparatively rapid evolution of its murine hosts in the region.

The shrew-associated louse genus *Ancistrotplx* is currently known in Indo-Australia from peninsular Malaysia and from Borneo. The comparatively rich fauna of *Crocidura* spp. shrews known from Sulawesi (Musser, 1987) and the Philippines (Heaney, 1986) suggests that *Ancistrotplx* might also occur on these islands. The louse genera *Hamophthirus*, *Pedicinus*, and *Sathrax* predictably occur in those regions where their hosts (colugos, primates, and tree shrews, respectively) are found although neither *Hamophthirus* nor *Sathrax* have been reported from the Philippines.

Overall, the sucking louse fauna of Sulawesi, as it is presently known, is fairly typical for a large Indo-Australian island. A notable exception to this is that *Hoplopleura* is the only sucking louse on Sulawesi's native squirrels; *Enderleinellus* and *Neohaematopinus*—which might be expected—are not present. Future ectoparasite collections from Sulawesi should serve to clarify some of the ideas presented here.

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