

SUCKING LICE (ANOPLURA) FROM PAKISTAN MAMMALS, WITH NOTES ON ZOOGEOGRAPHY¹

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ABSTRACT: Anoplura collected from wild rodents, insectivores and canids in Pakistan are documented. Twenty-two species of lice were recovered as follows: *Hoplopleura* (8), *Linognathoides* (1), *Neohaematopinus* (1), *Polyplax* (12). At least 14 of these species are recorded from Pakistan for the first time and some significant range extensions are established. Some of the records pertain to species previously known only from the type series or from other limited collections. Zoogeographically, Pakistan's anopluran fauna has strong Palearctic affinities although elements of this fauna show clear Oriental, Ethiopian or cosmopolitan associations.

Except for records of widespread species or descriptions of new taxa, the sucking lice (Anoplura) of Pakistan are poorly known. This is surprising because contributions documenting the anopluran fauna of adjacent regions in Afghanistan (Smetana and Daniel, 1970), India (numerous papers), Iran (Kim and Emerson, 1971), southern USSR (numerous papers) and the People's Republic of China (numerous papers) are available. Mishra (1981) produced a monograph of the hoplopleurid sucking lice of the Indian subcontinent and included the Pakistan fauna only from the Indus valley eastwards to the Indian border; however, that work principally addressed the Indian fauna and no specific records for Pakistan are given.

This paper provides records of sucking lice from wild land mammals (mainly rodents) obtained in Pakistan from 1962-1979. Most specimens were collected by field teams of the Department of Microbiology, University of Maryland School of Medicine, Baltimore under the direction of Robert Traub. Additional material was collected by Robert G. Tuck, then with the Division of Mammals, National Museum of Natural History (NMNH), Washington, D.C. Collection data for the 22 species of sucking lice recovered during these surveys includes hosts, collection localities, altitude (if available) and dates, followed by remarks. Louse synonymies listed are not new but are important to this study. Host mammal names follow Honacki *et al.* (1982) and Anoplura classification follows Kim and Ludwig (1978). Louse and host mammal material documented here is deposited in the collections of the NMNH, Washington, D.C.

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Family Hoplopleuridae Ferris

1) *Hoplopleura affinis* (Burmeister, 1838)

Specimens examined: (44 collections (39♂, 253♀) ex *Apodemus* sp. (Rodentia, Muridae)) HAZARA DIST.: Kaghan valley: Soch, Naran, 2430 m and 2615 m, IX.X.1962, VII.1964, VII.1965 - 29 colls.; Shogran, 2385 m and 2770 m, VIII.1963, VIII.1964 - 3 colls.; Burawai, 3080 m, IX.1963 - 5 colls.; Battakundi, 2740 m, VIII.1963 - 1 coll.; 6.4 km E. of Lalazar, 2430 m, X.1962 - 1 coll.; GILGIT AGENCY: Naltar, 2985 m, VIII.1964 - 4 colls.; Gupis, Kohighizar, 2360 m, VIII.1964 - 1 coll.

Hoplopleura affinis is a common ectoparasite of Eurasian field mice of the genus *Apodemus*. There is some confusion regarding the status of *Apodemus* in Pakistan (Roberts, 1977); *A. sylvaticus* (Linn.) definitely occurs in that country but *A. flavicollis* (Melchior) may also be present. Hosts for the above-mentioned collections were listed as *Apodemus* sp., *A. flavicollis* or *A. sylvaticus*. To avoid erroneous records, a conservative approach is taken here and all hosts are listed as *Apodemus* sp. *Hoplopleura affinis* has previously been recorded from both *A. flavicollis* and *A. sylvaticus*.

2) *Hoplopleura alticola* Mishra and Bhat, 1972.

Specimens examined: (1 collection (2♀) ex *Alticola roylei* Gray (Rodentia, Arvicolidae)) HAZARA DIST.: Kaghan valley, 4155 m, VIII.1963.

Until now, this louse was known only from the type series taken from the vole, *A. roylei*, in montane regions in the Indian states of Uttar Pradesh and Himachal Pradesh (Mishra and Bhat, 1972; Mishra, 1981).

3) *Hoplopleura captiosa* Johnson, 1960 (synonym: *musculi* Wegner, 1961).

Specimens examined: (8 collections (6♂, 17♀) ex *Mus musculus* Linn. (Rodentia, Muridae)) HAZARA DIST.: Murree Hills, Dunga Gali, 2495 m, IX.1962 - 3 colls.; Balakot, IX.1962 - 2 colls.; LAHORE DIST.: Near Ravi River bridge, 215 m, IX.1963 - 1 coll.; Changa Manga Forest, II.1965 - 1 coll.; PARACHINAR AGENCY: Parachinar, 1540 m, III.1964 - 1 coll. (5 collections (5♂, 14♀) ex *Mus* sp. (Rodentia, Muridae)) CHITRAL DIST.: Chitral, 1490 m, VIII.1964 - 3 colls.; HAZARA DIST.: Kaghan valley, Shogran, 2385 m, VIII.1964 - 1 coll.; MALAKAND AGENCY: Amandarra, 845 m, VIII.1964 - 1 coll.

Hoplopleura captiosa is principally parasitic on the house mouse, *M. musculus* and probably occurs in most areas of the world where this largely peridomestic mammal is found. It would therefore be expected to occur throughout most of Pakistan, particularly in association with human settlements.

4) *Hoplopleura maniculata* (Neumann, 1909) (synonym: *mitsuii* Kaneko, 1963).

Specimens examined: (6 collections (33♂, 37♀, 4 nymphs) ex *Funambulus pennanti* Wroughton (Rodentia, Sciuridae)) LAHORE DIST.: Near Ravi River bridge, 215 m, IX.1963 - 2 colls.; Model Town, XI.1962 - 1 coll.; unspecified locality, XI.1962 - 1 coll.; RAWALPINDI DIST.: Ayub Natl. Park, XI.1962 - 1 coll.; SIND PROV.: Karachi, University campus, VII.1976 - 1 coll.

This louse was originally described from palm squirrels, *Funambulus palmarum* (Linn.), collected in India. It appears to be a widespread parasite of squirrels of the genus *Funambulus* (*F. palmarum*, *F. pennanti*, *F. tristriatus* (Waterhouse)) in India and Sri Lanka (Pratt and Stojanovich, 1961; Kaneko, 1963; Mishra *et al.*, 1974; Mishra, 1981). However, the specimens recorded here appear to be the first noted for Pakistan.

5) *Hoplopleura merionidis* Ferris, 1921.

Specimens examined: (1 collection (3♂, 1♀) ex *Meriones libycus* Lichtenstein (Rodentia, Cricetidae)) KALAT DIST.: unspecified locality, 2320 m, X.1963.

Hoplopleura merionidis has not previously been reported from Pakistan although it is known from neighboring regions in Iran (Kim and Emerson, 1971), the People's Republic of China (Ferris, 1921) and the USSR (Sosnina, 1982). The type series from Shaanxi (as Shensi) Province, China, was recovered from the gerbil, *Meriones meridianus* (Pallas), while the Iran material was collected from both *M. libycus* and *M. crassus* Sundevall, and the USSR specimens were from both *M. libycus* (as *M. erythraeus*) and *M. meridianus*.

6) *Hoplopleura pacifica* Ewing, 1924.

Specimens examined: (8 collections (2♂, 9♀, 17 nymphs) ex *Rattus norvegicus* (Berkenhout) (Rodentia, Muridae)) SIND PROV.: Karachi: town area, I.1977 - 3 colls.; Empress market, I.1977 - 3 colls.; East wharf, I.1977 - 2 colls. (2 collections (1♂, 2♀) ex *Rattus rattus* (Linn.) (Rodentia, Muridae)) GILGIT AGENCY: Kohistan, 2360 m, IX.1963. (2 collections (2♂, 11♀) ex *Rattus* sp. (Rodentia, Muridae)) HAZARA DIST.: Kaghan valley, Shogran, 2385 m, VIII.1964 - 1 coll.; RAWALPINDI DIST.: Ayub Natl. Park, XII.1962 - 1 coll.

Hoplopleura pacifica has an almost global distribution along with that of its domestic *Rattus* hosts.

7) *Hoplopleura pavlovskyi* Sosnina, 1951.

Specimens examined: (1 collection (2♀) ex *Rattus turkestanicus* (Satunin) (Rodentia, Muridae)) GILGIT AGENCY: Gilgit, Chinari Bagh, 1490 m, VIII.1964.

This species is similar to *H. pacifica* but whereas the dorsal apical angle of the paratergal plate of abdominal segment seven is extended in *H. pacifica*, no such lobe is present in *H. pavlovskyi*. Although *H. pavlovskyi* is well documented from numerous collections in Turkestan, USSR (Sosnina, 1951, 1967, 1982), this species does not appear to have been reported from other regions. The host rat, *R. turkestanicus*, ranges from southern Turkestan, northeastern Iran and Afghanistan to northern India and southwest China (Roberts, 1977; Honacki *et al.*, 1982).

8) *Hoplopleura ramgarh* Mishra, Bhat and Kulkarni, 1972.

Specimen examined: (1 collection (1♀) ex *Mus saxicola* Elliot (Rodentia, Muridae)) SIND PROV.: Rani Kot, I.1977.

This louse was previously documented only from several states in India as an ectoparasite of the mice, *M. saxicola* and *M. platythrix* Bennett

(Mishra *et al.*, 1972, 1974; Mishra, 1980, 1981; Saxena, 1987). Mishra (1980) pointed out that although mice belonging to the *M. platythrix* complex are morphologically similar, their sucking lice are quite different and could be utilized to aid studies of host systematics.

Family Polyplacidae Fahrenholz

9) *Linognathoides palaeartus* (Olsoufjev, 1938.)

Specimens examined: (2 collections (2♂, 1♀, 7 nymphs) ex *Marmota caudata* (Geoffroy) (Rodentia, Sciuridae)) HAZARA DIST.: Kaghan valley: Saif Ul Maluke, 3200 m, X.1962 - 1 coll.; Besal, 3260 m, IX.1963 - 1 coll.)

This louse is a specific parasite of *M. caudata* (the long-tailed marmot) and was originally described from Turkestan, USSR. It has also been reported from Afghanistan (Smetana and Daniel, 1970), Jammu and Kashmir state, India (Mishra *et al.*, 1974; Mishra, 1981), Pakistan (Kim and Adler, 1982) and several provinces in the People's Republic of China (Chin, 1985).

10) *Neohaematopinus echinatus* (Neumann, 1909.)

Specimens examined: (11 collections (53♂, 60♀, 9 nymphs) ex *Funambulus pennanti* Wroughton (Rodentia, Sciuridae)) LAHORE DIST.: Jahangir's tomb, IX.1962 - 2 colls.; Near Ravi River bridge, 215 m, IX.1963 - 1 coll.; Model Town, XI.1962 - 1 coll.; Luliani, X.1963 - 1 coll.; unspecified localities, XI.1962 - 2 colls.; BAHAWALPUR DIST.: Uch-Sharif, XII. 1963 - 2 colls; SIND PROV.: Rani Kot, I, VI.1977 - 2 colls.

Neohaematopinus echinatus has previously been reported only from India where it is a widely distributed parasite of the squirrels, *Funambulus pennanti*, *F. palmarum* and *F. tristriatus* (Pratt and Stojanovich, 1961; Kaneko, 1963; Mishra *et al.*, 1974; Mishra, 1981; Kim and Adler, 1982). *Funambulus pennanti* is widely distributed in Pakistan but is the only squirrel of this genus occurring in that country (Roberts, 1977).

11) *Polyplax asiatica* Ferris, 1923 (synonym: *turkestanica* Blagoveshtchensky, 1950).

Specimens examined: (17 collections (18♂, 38♀, 9 nymphs) ex *Nesokia indica* (Gray and Hardwicke) (Rodentia, Muridae)) LAHORE DIST.: Near Ravi River bridge, 215 m, IX.1962, IX.1963, I.IV.1964 - 6 colls.; Lahore, IX.1962 - 4 colls.; 6.4 km NW of Luliani, I.1964 - 1 coll.; DERA ISMAIL KHAN DIST.: unspecified localities, XII.1963, I.1964 - 2 colls.; RAWALPINDI DIST.: Ayub Natl. Park, XII.1962, I.1964 - 2 colls.; SIALKOT DIST.: Charwa, IX.1962 - 2 colls. (1 collection (2♀) ex *Nesokia* sp. (Rodentia, Muridae)) KOHAT DIST.: Kohat, 310 m, VIII.1964. (1 collection (2♀) ex *Apodemus* sp. (Rodentia, Muridae)) HAZARA DIST.: Battakundi, 2740 m, VIII.1963. (1 collection (1♀) ex *Suncus* sp. (Insectivora, Soricidae)) LAHORE DIST.: Near Ravi River bridge, 215 m, IX.1962.

This louse is a well documented ectoparasite of the burrowing rat, *N. indica* and has been reported from Taiwan westwards across central and southern Asia to North Africa. *Polyplax asiatica* has also been collected frequently from *Bandicota* spp., another fossorial murid genus, and occasionally from other commensal rodents and shrews. Except for

collections from *Nesokia* and *Bandicota*, these records are considered to represent accidental infestations. The type series of *P. asiatica* designated by Ferris (1923) includes specimens recovered from *N. indica* (as *N. hardwicki*) in Quetta, Baluchistan Province, Pakistan.

12) ***Polyplax brachyrrhyncha*** Cummings, 1915.

Specimens examined: (2 collections (34♂, 68♀) ex *Acomys cahirinus* (Desmarest) (Rodentia, Muridae)) SIND PROV.: Karachi, Khadeji Falls, XI.1976.

Polyplax brachyrrhyncha was originally described from *A. cahirinus* from Asyut, Egypt and is a common ectoparasite of this spiny mouse in that country (Johnson, 1960). It has also been recorded previously from various species of *Acomys* (principally *A. cahirinus*) from Iran (Kim and Emerson, 1971) and from North and East Africa but the present records are the first ones from Pakistan.

13) ***Polyplax calomysci*** Kim and Emerson, 1971.

Specimens examined: (5 collections (5♂, 6♀) ex *Calomyscus bailwardi* Thomas (Rodentia, Cricetidae)) BALUCHISTAN PROV.: Quetta, Ziarat, 2315 m, X, XI.1963 - 3 colls.; Sibi, IX.1975 - 1 coll.; Kalat, 2135 m. IX.1975 - 1 coll.

This species was previously documented only by the type series from *C. bailwardi* from Iran (Kim and Emerson, 1971). The rodent host is confined to mountain steppe regions of Turkmenistan (USSR), Iran, Afghanistan and Pakistan (Roberts, 1977).

14) ***Polyplax chinensis*** Ferris, 1923.

Specimens examined: (5 collections (5♂, 4♀) ex *Meriones crassus* Sundevall (Rodentia, Cricetidae)) BALUCHISTAN PROV.: 48 km SSW of Surab, IV, VII.1965.

Polyplax chinensis was originally described from the gerbil, *Meriones meridianus*, from Shaanxi (as Shensi) Province, People's Republic of China (Ferris, 1923) but has also been reported from the southeastern USSR (Sosnina, 1982). The present collections are the first ones documented from Pakistan.

15) ***Polyplax hurrianicus*** Mishra 1981.

Specimens examined: (5 collections (1♂, 34♀, 28 nymphs) ex *Meriones hurrianae* Jerdon (Rodentia, Cricetidae)) SIND PROV.: Rani Kot, X, XI.1976, I.1977 - 3 colls.; Karachi, Malir Cantonment, X.1976, I.1977 - 2 colls. (1 collection (2♀) ex *Gerbillus nanus* Blanford (Rodentia, Cricetidae)) SIND PROV.: Rani Kot, VII.1976.

Until now, *P. hurrianicus* was known only from the type series from the gerbil, *M. hurrianae*, in Gujarat State, India (Mishra, 1981).

16) ***Polyplax kaiseri*** Johnson, 1960.

Specimens examined: (1 collection (2♀) ex *Gerbillus nanus* Blanford (Rodentia, Cricetidae)) DERA ISMAIL KHAN DIST.: unspecified locality, I.1964. (12 collections (18♂, 31♀) ex *Gerbillus* sp. (Rodentia, Cricetidae)) BALUCHISTAN PROV.: 18 km SE of Kharan, II.1965 - 7 colls.; LASBELA DIST.: 8 km S of Bela, III.1965 - 5 colls.

Polyplax kaiseri is well-known from various gerbils of the genus *Ger-*

billus in North and East Africa, although Ledger (1980) has questioned records of this louse in sub-Saharan Africa. Kim and Emerson (1971) reported *P. kaiseri* from both *G. nanus* and *G. cheesmani* Thomas in Iran but the records given here represent the most easterly ones to date for this louse and the first ones for Pakistan. It is expected that *P. kaiseri* also parasitizes gerbils between the North Africa and Iran/Pakistan extremes.

17) ***Polyplax kondana* Mishra, 1981.**

Specimens examined: (3 collections (2♂, 5♀, 1 nymph) ex *Millardia meltada* (Gray) (Rodentia, Muridae)) SIND PROV.: Badin, I.1977 - 2 colls.; Thatta, VIII.1975 - 1 coll.

This louse was previously documented only by the type series recovered from *Millardia kondana* Mishra and Dhanda in Maharashtra State, India (Mishra, 1981).

18) ***Polyplax paradoxa* Johnson, 1960.**

Specimens examined: (1 collection (2♀) ex *Meriones persicus* (Blanford) (Rodentia, Cricetidae)) BALUCHISTAN PROV.: unspecified locality, I.1963.

Polyplax paradoxa parasitizes various gerbils belonging to the genus *Meriones* in North and East Africa (Ledger (1980) questioned some of these records) and the Near East. Although *P. paradoxa* has not previously been reported from Pakistan, it has been recorded from *M. persicus* and *M. tristrami* Thomas in Iran by Kim and Emerson (1971) and Kaneko (1972), respectively.

19) ***Polyplax reclinata* Nitzsch, 1864 (synonyms: *deltoides* Fahrenholz, 1938; *shimizui* Kaneko, 1957).**

Specimens examined: (11 collections (44♂, 68♀, 2 nymphs) ex *Suncus murinus* (Linn.) (Insectivora, Soricidae)) GUJRAT DIST.: Mangowal, VI.1965 - 1 coll.; HAZARA DIST.: Balakot, IX.1962 - 2 colls.; LAHORE DIST.: Near Ravi River bridge, 215 m, VI.1965 - 2 colls.; Model Town, XI.1962 - 1 coll.; SIALKOT DIST.: Charwa, 275 m, X.1962 - 1 coll.; SIND PROV.: Karachi, town area, XII.1975, II, III, IV.1976 - 4 colls. (1 collection (1♀) ex *Suncus* sp. (Insectivora, Soricidae)) LAHORE DIST.: Lahore, VII.1964.

This species is widespread in Eurasia and Africa (including Madagascar) as a parasite of numerous species of shrews (Soricidae).

20) ***Polyplax serrata* (Burmeister, 1839) (synonyms: *affinis* Fahrenholz, 1938; *serrata paxi* Eichler, 1952).**

Specimens examined: (1 collection (2♀) ex *Cricetulus migratorius* (Pallas) (Rodentia, Cricetidae)) GILGIT AGENCY: Kohighizar, Phandar, 3050 m, IX.1963.

This louse is a well-known cosmopolitan ectoparasite of the house mouse, *Mus musculus* Linn., although it is sometimes collected from other murid rodents (particularly *Apodemus* spp.). The present Pakistan record from a migratory hamster is considered atypical.

21) *Polyplax spinulosa* (Burmeister, 1839) (synonyms: *denticulatus* Nitzsch, 1864; *campylopteri* Zavaleta, 1945).

Specimens examined: (3 collections (6♂,31♀) ex *Rattus rattus* (Linn.) (Rodentia, Muridae)) LAHORE DIST.: Luliani, I.1964 - 2 colls.; Ravi road, IX.1963 - 1 coll. (1 collection (1 nymph) ex *Rattus norvegicus* (Berkenhout) (Rodentia, Muridae)) BALUCHISTAN PROV.: Kalat, IV.1976. (5 collections (12♂,18♀, 2 nymphs) ex *Rattus* sp. (Rodentia, Muridae)) LAHORE DIST.: 6.2 km NW of Luliani, XII.1963, I.1964 - 4 colls.; RAWALPINDI DIST.: Ayub Natl. Park, XII.1962 - 1 coll. (1 collection (1♂) ex *Apodemus* sp. (Rodentia, Muridae)) HAZARA DIST.: Kaghan valley, Burawai, 3050 m, IX.1963.

Polyplax spinulosa is a cosmopolitan ectoparasite of domestic *Rattus* and is probably widely distributed in Pakistan.

22) *Polyplax stephensi* (Christophers and Newstead, 1906.)

Specimens examined: (62 collections (229♂,453♀, 63 nymphs) ex *Tatera indica* (Hardwicke) (Rodentia, Cricetidae)) RAWALPINDI DIST.: Ayub Natl. Park, X,XII.1962, III.1963, I.1964 - 15 colls.; on Murree-Rawalpindi road, I.1964 - 1 coll.; DERA ISMAIL KHAN DIST.: unspecified localities, XI,XII.1963, I.1964 - 6 colls.; LAHORE DIST.: Near Ravi River bridge, 215 m, IX.1963 - 4 colls.; Luliani, IX.1963, I.1964 - 3 colls.; 6.2 km NW of Luliani, IX.1963 - 1 coll.; Sodhana, 17.6 km NW of Luliani, X.1963 - 1 coll.; Lahore, Jahangir's tomb, IX.1962 - 1 coll.; Model Town, XII.1963 - 1 coll.; Balloki, XII.1962 - 1 coll.; Bari Doab canal, 16 km W of highway, VI.1964 - 1 coll.; Changa Manga Forest, V.1965 - 1 coll.; unspecified localities, VII.1965 - 2 colls.; SIALKOT DIST.: Charwa, 275 m, X.1962 - 3 colls.; Marala, III.1965 - 1 coll.; BAHAWALPUR DIST.: Uch-Sharif, Abbraria canal, XII.1963, I.1964 - 3 colls.; Islam Headworks, VIII.1963 - 1 coll.; unspecified localities, I.1964 - 3 colls.; MULTAN DIST.: Mian Channun, XII.1963, XII.1970 - 3 colls.; SIND PROV.: Karachi: TPX Godowns, II.1975, I.1976 - 2 colls.; port area, I.1977 - 1 coll.; GUJRAT DIST.: Mangowal, VI.1965 - 2 colls.; HAZARA DIST.: Mansehra, VII.1965 - 2 colls.; LAS-BELA DIST.: 8 km S of Bela, III.1965 - 1 coll.; MUZAFFARGARH DIST.: Taunsa barrage, III.1964 - 1 coll.; ZORALAI DIST.: Zoralai, XI.1963 - 1 coll. (4 collections (7♂,4♀, 14 nymphs) ex *Millardia meltada* (Rodentia, Muridae)) SIND PROV.: Gharo, VIII.1976 - 2 colls.; Mahro Bula Khan, VIII.1976 - 1 coll.; Rani Kot, VIII.1976 - 1 coll. (1 collection (1♂) ex *Nesokia indica* (Rodentia, Muridae)) LAHORE DIST.: Luliani, IX.1963. (1 collection (1♂,2♀, 6 nymphs) ex *Gerbillus nanus* (Rodentia, Cricetidae)) SIND PROV.: Rani Kot, VII.1976. (1 collection (2♀,1 nymph) ex *Canis aureus* Linn. (Carnivora, Canidae)) SIND PROV.: Karachi, Hawkes Bay, VIII.1963. (1 collection (2♀) ex *Vulpes bengalensis* (Shaw) (Carnivora, Canidae)) SIND PROV.: Thatta, IV.1976.

Clearly, *P. stephensi* is principally parasitic on the gerbil, *T. indica*. Records from other hosts cited here are presumed to represent accidental associations although the carnivore infestations could have been acquired as a consequence of recent predation on gerbils. There are numerous records of *P. stephensi* from India, and Kim and Emerson (1971) reported this species from Iran. Curiously, *P. stephensi* does not appear to have been documented previously from Pakistan although it is possible that some pre-1948 records given as 'India' actually refer to localities now within Pakistan's borders.

DISCUSSION

Twenty-two species of sucking lice, at least 14 of them new for the country, are reported here from wild land mammals of Pakistan. The large number of new records for Pakistan can be attributed to the scant literature on the Anoplura of the region. Six additional species of sucking lice have been reported from wild land mammals in Pakistan but were not recorded during the present survey. Three of these species were described from the palm squirrel, *Funambulus pennanti*: *Hoplopleura funambuli* Bilquees, *H. karachiensis* Khanum, and *Neohaematopinus qadrii* Khan and Khanum; the first two were from Karachi in Sind Province (Bilquees, 1976; Khanum, 1983) and the last was from Thatta District also in Sind Province (Khan and Khanum, 1980). Two more polyplacids, *Polyplax sindensis* Shafi, Samad and Rehana, from the shrew, *Suncus murinus*, and *P. humae* Khan and Khan, from the murid rodent, *Cremnomys blanfordi* (Thomas) have been described from the Karachi area (Shafi *et al.*, 1984; Khan and Khan, 1985). Lastly, the linognathid louse, *Linognathus vulpis* Werneck, was described from the fox, *Vulpes rüppelli* (Schinz), near Karachi (Werneck, 1952); *L. vulpis* has also been collected from *Vulpes vulpes* Linn. in Iran (Kim and Emerson, 1971). Detailed ectoparasite collections are not available for many of Pakistan's native mammalian species and it is estimated that about 10 additional species of sucking lice actually parasitize this fauna.

The zoogeographical affinities of Pakistan's anopluran fauna are worthy of brief consideration here. While most of Pakistan is situated within the Palearctic Region, the extreme southeastern section of the country is usually considered to be within the boundaries of the Oriental Region (Roberts, 1977). Traub *et al.* (1983) point out that topography and other factors such as climate, often have a profound effect on zoogeography; this is especially true for Pakistan's diverse terrain which they categorize into an 'Arid Southwestern Sector', and two 'Montane Central Asian Sectors' of the Palearctic and an 'Inter-Indian Sector' of the Oriental Region.

Predictably, most Anoplura occurring in Pakistan have largely Palearctic or Oriental distributions. Three species (*Hoplopleura affinis*, *H. merionidis*, *Linognathoides palaeartus*) have wide, more or less exclusively Palearctic distribution patterns. Nine (*Hoplopleura alticola*, *H. chinensis*, *H. funambuli*, *H. karachiensis*, *H. pavlovskyi*, *Linognathus vulpis*, *Neohaematopinus qadrii*, *Polyplax calomysci*, *P. sindensis*) have more limited geographical and/or altitudinal Palearctic distributions. Three species of Pakistan gerbil lice (*Polyplax brachyrrhyncha*, *P. kaiseri*, *P. paradoxa*) are principally Palearctic and are widespread across the Near and Middle East and North Africa but also extend to varying degrees into the

Ethiopian Region. Six species are considered here to represent the Oriental fauna: *Hoplopleura maniculata*, *H. ramgarh*, *Neohaematopinus echinatus*, *Polyplax humae*, *P. hurrianicus*, *P. kondana*. At least two species (*Polyplax asiatica*, *P. stephensi*) are widespread in both Palearctic and Oriental Regions. The remaining five species of Anoplura are cosmopolitan or nearly so; *Polyplax reclinata* occurs throughout much of the Palearctic, Oriental and Ethiopian Regions; *Hoplopleura captiosa*, *H. pacificia*, *Polyplax serrata* and *P. spinulosa* are distributed throughout much of the world.

Many of the louse distributions outlined above clearly mirror those of their hosts. This is true for the Palearctic *H. alticola*/*A. roylei*, *P. calomysci*/*C. bailwardi* (both of these associations are at high altitude), *H. affinis*/*Apodemus* sp., *L. palaeearctus*/*M. caudata* associations, the Palearctic-North African *P. brachyrrhyncha*/*Acomys* sp. association, and the Oriental-Palearctic *H. maniculata*/*Funambulus* sp., *H. ramgarh*/*Mus* sp., *N. echinatus*/*Funambulus* sp., *P. asiatica*/*Nesokia* sp. and *Bandicota* sp., *P. hurrianicus*/*M. hurrianae*, *P. kondana*/*Millardia* sp. and *P. stephensi*/*T. indica* associations. The very widespread distributions of *P. reclinata* on numerous species of shrews and of the four cosmopolitan lice mainly on peridomestic murid rodents are likewise understandable. However, certain species of lice occupy ranges smaller in size than those of their hosts, possibly reflecting climatic or topographic factors. For example, *P. kaiseri* and *P. paradoxa* parasitize gerbils (*Gerbillus* and *Meriones*, respectively) from North Africa to Pakistan but have not been recorded further east despite the availability of seemingly suitable gerbil hosts. The opposite trend is apparent for *H. merionidis* and *P. chinensis* both of which parasitize *Meriones* spp. in the southeastern Palearctic but do not extend to congeneric North African gerbils. To some extent, *P. kaiseri* and *P. paradoxa* replace *H. merionidis* and *P. chinensis* as parasites of *Meriones* spp. gerbils in the southwestern Palearctic. Similarly, although *Rattus turkestanicus* is widely distributed in the south-central Palearctic Region (Honacki *et al.*, 1982), its characteristic hoplopleurid louse, *H. pavlovskyi*, has been reported only from the USSR and (now) Pakistan. The six Pakistan louse species that were not collected during this survey appear to have restricted Palearctic distributions but they are known principally from their respective type series and further collecting may reveal their presence elsewhere. Only *L. vulpis* is represented by more than the type collection and is known from outside of Pakistan. One of these, *P. humae*, is known only from *Cremnomys blanfordi* from the Karachi area; this murid host is known from India and Sri Lanka (neither Roberts (1977) nor Honacki *et al.* (1982) list it for Pakistan) and *P. humae* is here assumed to have Oriental affinities.

It is instructive to consider the number of anopluran species (assoc-

iated with wild land mammals) shared by Pakistan and its neighboring countries/regions. Extensive literature searches have revealed that the following numbers of species are shared as part of the 28 species reported here for Pakistan: India (15 shared species), Iran (14), southwestern USSR (10), People's Republic of China (10), North Africa (9), Afghanistan (6). Thus, the geographically adjacent Indian (Oriental) and Iranian (Palearctic) faunas appear to be most similar to the Pakistan fauna. It must be pointed out, however, that not all of the faunas have received equal study. Overall, while the Pakistan anopluran fauna has significant Oriental and minor Ethiopian and cosmopolitan elements, this fauna principally has Palearctic affinities.

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