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MITES FROM MAMMALS OF WEST PAKISTAN

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Abstract. Nearly 15,000 gamasine mites of 46 species and 17 genera were identified from mammals of 29 species and 26 genera taken from 79 localities in West Pakistan between September, 1962 and May, 1967. Mites of *Laelaps pavlovskyi* were found in greater numbers than those of other species, although *Eulaelaps stabularis*, *L. algericus*, and *L. nuttalli* were on the greatest variety of hosts. Mammals of the genus *Meriones* were the most heavily infested, although greater varities of mites were found on *Apodemus* and *Mus*. Most of the species of mites were widely distributed geographically, but *L. pavlovskyi*, *L. algericus*, and *Allodermanyssus sanguineus* were not found in some localities even though their common hosts occurred there.

During investigations on viral and rickettsial infections associated with ectoparasites and small mammals in West Pakistan, undertaken by personnel of the Department of Microbiology, University of Maryland, School of Medicine (Baltimore), and the Pakistan Medical Research Center (Lahore), extensive collections of gamasine mites, fleas and other parasitic arthropods were made, often in areas where these groups had been little studied. This paper presents data and observations based upon identification of nearly 15,000 gamasine mites collected during the field projects.

The majority of the specimens were collected by Robert Traub, who directed 3 field teams during the intensive studies in Pakistan. Other collections were made by Arthur C. Risser and Robert L. Amoureux. Others who participated as entomologists, mammalogists, or collectors were Abid Beg Mirza, James J. O'Keefe, Max C. Thompson, A. Dean Stock, and David T. Wright, employees of the University of Maryland or the University of Maryland International Center for Medical Research and Training, Pakistan Medical Research Center. Dr. Henry W. Setzer of the Smithsonian Institution collected mammals on one trip and identified the hosts.

The main mission of the field teams was to isolate infectious agents. The ensuing work load and logistical difficulties encountered made it impractical to process each collection of ectoparasites individually; hence, mites from more than one host frequently were placed together. In such cases, however, all the ectoparasites were from hosts of the same species and locality. In some instances quantities of the arthropods were used for inoculation, and only a few specimens were saved for identification.

Brief descriptions of the main collection areas and hosts have been discussed by Traub *et al.*,[39] and additional notes by Traub and Evans.[40] Phillips[28] discussed some ecological aspects of the distribution of voles and their ectoparasites in Kashmir and West Pakistan.

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Allodermanyssus sanguineus (Hirst, 1915)[17]

Collection Records. *Apodemus* sp. : Chinarbagh, Gupis, Kargah Nullah, Phandar. *Calomyscus bailwardi* : Ziarat. *Calomyscus* sp. : Kalat. *Cricetulus migratorius* : Phandar, Ziarat. *Cricetulus* sp. : Gupis, Kalat, Kargha Nullah, Naltar. *Meriones* sp. : Gulistan, Kalat, Ziarat. *Mus* sp. : Chitral, MES Rest House. *Ochotona* sp. : Sibi. *Rattus rattoides* : Chilas, Chinarbagh, Gupis, Kargah Nullah, Phandar. *Rattus rattus* : Akbari Mandi, Changa Manga,

Charwa village, Doonga village, Kargah Nullah. *Rattus* sp. : Bari Doab Canal, Kalian Bajwat, Khari village, Kundal village, Lahore, MES Rest House. *Suncus* sp. : Dir Mtn. *Tatera indica* : Charwa village.

Comments. Totals of 233 protonymphs, 306 deutonymphs, 200 unclassified nymphs, 26 males, and 314 females were collected. In 58 of 94 collections *A. sanguineus* was the only mite on its host, and in 24 collections it was associated with only 1 other species. It was found most commonly on *Rattus* and *Cricetulus*, and to a lesser degree on *Meriones* and *Calomyscus*. Records of *A. sanguineus* are also known from *Acomys*, *Alticola*, *Arvicanthis*, *Peromyscus*, and man. Its known distribution includes Ceylon, Egypt, Europe, Israel, U.S.A., and the U.S.S.R.

Androlaelaps aduncus Allred, 1969[2]

Collection Records. *Gerbillus* sp. : Dera Ghazi Khan, Hakara Canal, Qurash Rest House. *Herpestes* sp. : Marala Rest House. *Meriones* sp. : Dera Ghazi Khan, Lorali. *Mus* sp. : Bari Doab Canal, Sathan Gali. *Rattus rattus* : Changa Manga. *Tatera indica* : Changa Manga Forest, Lahore, Taunsa Barrage, Thatta. *Tatera* sp. : Bari Doab Canal, Daudkhel, Dera Ghazi Khan, Dera Ismail Khan, Mansehra, Marala Rest House, Muzaffargarh, Punjab University, Qurash Rest House, Ravi River Bridge, Sakhisarwar, Shadan Lund Civil Rest House, Sialkot (Ranger Headquarter area), Ziarat.

Comments. 179 protonymphs, 115 deutonymphs, 962 females, and 37 males were taken. *Gerbillus* and *Tatera* were the most frequently infested hosts. In 6 of 76 collections *H. aduncus* was the only mite on its host. In 53 of 54 associations with 1 other species it was found with *Androlaelaps marshalli.*

Androlaelaps marshalli Berlese, 1911[6]

Collection Records. *Apodemus* sp. : Naran. *Gerbillus* sp. : Dera Ghazi Khan, Qurash Rest House. *Herpestes* sp. : Marala Rest House. *Meriones* sp. : Lorali. *Mus* sp. : Kawai. *Nesokia* sp. : Lahore. *Rattus rattus* : Changa Manga. *Tatera indica* : Changa Manga Forest Reserve, Charwa village, Ravi River Bridge. *Tatera* sp. : Ayub National Park, Bari Doab Canal, Daudkhel, Dera Ghazi Khan, Dera Ismail Khan, Lahore, Marala Headworks, Marala Rest House, Muzaffargarh, Punjab University, Qurash Rest House, Sakhisarwar, Shaden Lund Civil Rest House, Shahpur village, Sialkot.

Comments. Total of 4 protonymphs, 5 deutonymphs, 42 unclassified nymphs, 87 males, and 1862 females were collected. In 26 of 129 collections *A. marshalli* was the only mite on its host, and in 79 collections it was associated with only 1 other species. It was associated 67 times with *Haemolaelaps aduncus*, and was taken most commonly from *Tatera* and *Gerbillus*, and to a lesser degree from *Meriones* and *Nesokia.* It was seldom found on other mammals. It has also been taken from *Aethomys*, *Allactaga*, *Arvicanthus*, *Crocidura*, *Cryptomys*, *Desmodillus*, *Lemniscomys*, *Oryctolagus*, *Pachyuromys*, *Parechinus*, *Pedetes*, *Rhabdomys*, *Saccostomus*, and *Steatomys* from Ethiopia, Israel, and South Africa.

Androlaelaps pakistanicus Allred, 1969[2]

Collection Record. *Cricetulus* sp. : Naltar.

Comment. Only 2 females were collected.

Androlaelaps pavlovskii Bregetova, 1955[8,9]

Collection Records. *Apodemus* sp. : Naltar, Naran, Shogran, Soch. *Mus* sp. : Ayub National Park, Dir, Dir Mtn., Soch. *Rattus rattoides* : Dir Mtn., Gabral.

Comments. 18 females were taken, and in all 13 collections *A. pavlovskii* was associated with 1–5 other species of mites on its hosts. It is also known from *Apodemus* and *Rattus* from the U.S.S.R.

Androlaelaps zuluensis (Zumpt, 1950)[44]

Collection Records. *Nesokia* sp. : Kohat. *Rattus* sp. : Dir Mtn.

Comments. Only 2 females were taken in Aug. Host record for *Nesokia* is new. It is also known to occur on *Aethomys*, *Arvicanthis*, *Galago* (nest), *Mus*, *Petromyscus*, and *Rattus* from Egypt, Kenya, Sudan, Southwest Africa, and Zululand.

Eulaelaps indiscretus Allred, 1969[2]

Collection Records. *Apodemus* sp. : Naran, Shogran, Soch. *Crocidura* sp. : Naran. *Rattus* sp. : Naran.

Comment. 18 females were taken, mostly from *Crocidura.*

Eulaelaps stabularis (Koch, 1836)[22]

Collection Records. *Alticola roylei* : Babusar village, Naran. *Alticola* sp. : Gitidas, Mt. Makra. *Apodemus agrarius* : Naran. *Apodemus* sp. : Babusar village, Dir, Gabral, Gupis, Kalam, Kalam Rest House, Mt. Makra, Naltar, Phandar, Rajwal, Shogran, Soch. *Calomyscus bailwardi* : Ziarat. *Cricetulus migratorius* : Ziarat. *Cricetulus* sp. : MES Rest House, Naltar, Phandar. *Crocidura* sp. : Naran. *Hylopetes* sp. : Mt. Makra. *Hyperacrius fertilis* : Soch. Mouse nest : Naran. *Meriones* sp. : Ziarat. *Mus* sp. : Dir, Dir Mtn. Kalam, Kalam Rest House, Kund Forest Rest House, MES Rest House, Naran, Sathan Gali, Shogran. *Petaurista petaurista* : Shogran. *Rattus rattoides* : Chilas, Dir Mtn., Gabral, Naran. *Rattus rattus* : Dir, Naran. *Rattus* sp. : Shogran. *Tatera* sp. : Saidu.

Comments. Totals of 3 deutonymphs, 5 males, and 426 females were collected. In 18 of 122 collections *E. stabularis* was the only mite on its hosts. In 36 collections it was associated with only 1 other species (18 times with *Laelaps*), 27 times with 2 species, and the remaining times with 3 to 7 species. Other workers have designated this species a nest-dweller, and its frequency of occurrence on *Apodemus*

and *Cricetulus* may be indicative of preference for those hosts. It was the most widely distributed species relative to kinds of hosts infested. It is also known from *Alactagulus*, *Arvicanthus*, *Arvicola*, *Bandicota*, *Blarina*, *Callosciurus*, *Citellus*, *Clethrionomys*, *Cricetus*, *Didelphis*, *Dremomys*, *Eothenomys*, *Eudyptula*, *Melogale*, *Microtus*, *Mustela*, *Myospalax*, *Nannosciurus*, *Nesokia*, *Ochotona*, *Oenanthe* (bird nest), *Sorex*, *Talpa*, *Tscherskia*, and *Tupaia* from Borneo, Canada, Campbell Is., China, Egypt, England, Germany, Hawaii, Ireland, Isle of Lewis, Israel, Japan, Korea, Malaysia, Nepal, Norway, New Zealand, Outer Hebrides, Philippines, Scotland, Switzerland, Taiwan, Thailand, U.S.A., and Viet Nam.

Haemogamasus dorsalis Teng *et al.*, 1964[35]

Collection Records. *Apodemus* sp. : Soch. *Hyperacrius* sp. : Naran.

Comments. Only 12 females were taken. It is also known from *Rattus* from China.

Haemogamasus gyrinodes Allred, 1969[2]

Collection Records. *Alticola roylei* : Babusar village. *Alticola* sp. : Gitidas. *Apodemus* sp. : Kalam, Utrar.

Comment. Only 5 females were taken.

Haemogamasus ivanovi Bregetova, 1955[8,9]

Collection Records. *Alticola roylei* : Babusar village. *Alticola* sp. : Sandoz Farm. *Apodemus* sp. : Babusar village, Gabral, Naltar. *Cricetulus* sp. : Naltar. *Hyperacrius fertilis* : Soch. *Mus* sp. : Naltar.

Comments. The 14 females and 2 males that were taken were from a variety of hosts. This species is also known from *Citellus* and *Microtus* from Europe.

Haemogamasus nidiformis Bregetova, 1955[8,9]

Collection Records. *Alticola roylei* : Saif ul Maluke, Lalazar, Naran, Sandoz Farm. *Alticola stoliczkanus* : Dir. *Alticola* sp. : Gitidas, Mt. Makra, Sandoz. *Apodemus* sp. : Dunga Gali, Ghoradaka, Kalam, Kalam Rest House, Mt. Makra, Naran, Rajwal Shogran, Soch. *Crocidura* sp. : Shogran. *Hyperacrius fertilis* : Naran, Soch. *Mus* sp. : Babusar slope, Kalam Shogran. *Ochotona* sp. : Gitidas. *Rattus* sp. : Naran, Shogran, Thug Nullah.

Comments. Totals of 6 deutonymphs, 33 unclassified nymphs, 7 males, and 189 females were collected. In only 8 of 60 collections was *H. nidiformis* the only species on its host. At other times it was associated with 1–4 species. It was found most frequently on *Alticola* and *Apodemus*. It has also been taken from *Chodsigoa*, *Clethrionomys*, and *Microtus*, and is known from China, Europe, Korea, Nepal, Taiwan, U.S.S.R., and Viet Nam.

Haemolaelaps casalis (Berlese, 1887)[3]

Collection Records. *Funambulus* sp. : Ravi. *Mus* sp. : Ayub National Park, Balakot, Chitral Dir, Dir Mtn., MES Rest House. *Nesokia* sp.: Doonga village. *Rattus* sp.: Ravi River Bridge, Shogran. *Suncus* sp.: Amandara, Niaz Beg Thoker. *Tatera* sp. : Ayub National Park.

Comments. 2 protonymphs, 2 deutonymphs, and 44 females were collected. *Haemolaelaps casalis* occurred more commonly on *Suncus* and *Mus* than on other mammals. It is also known from *Apodemus*, *Felis*, *Glaucomys*, *Mus*, *Oryzomys*, *Peromyscus*, *Sciurus*, *Sigmodon*, and *Xerus* and is cosmopolitan in distribution.

Haemolaelaps congoensis (Till, 1963)[36]

Collection Records. *Hylopetes* sp.: Soch. *Mus* sp.: Chitral, MES Rest House.

Comments. The 4 females taken vary somewhat from Till's description of the type, but are tentatively placed here until further detailed comparisons can be made. The host records from Pakistan are unusual on the basis of the known hosts in Ethiopia, *Spermestes* (bird nest) and nests of other birds.

Haemolaelaps fahrenholzi group

Comments. Six females, 7 deutonymphs, and 1 protonymph tentatively relegated to this group were taken from *Jerboa jaculus* at Loralai. This was the only species of mite on the host.

Haemolaelaps longipes Bregetova, 1952[7]

Collection Records. *Gerbillus* sp.: Gulistan. *Meriones* sp.: Kalat, Ziarat. *Rattus* sp.: MES Rest House. *Suncus* sp. : Kohat.

Comments. One protonymph, 31 deutonymphs, 2 unclassified nymphs, 13 males, 100 females, and 267 undifferentiated mites were collected. Most of this species were found on *Meriones*. This mite is also known from *Citellus*, *Nesokia*, and *Rhombomys* from Armenia, Astrakchan, Ethiopia, Israel, Tadzhikistan, and Turkmenistan.

Hirstionyssus brevisternum Allred, 1969[2]

Collection Records. *Apodemus* sp.: Naran, Soch. *Hyperacrius fertilis*: Naran.

Comment. Only 1 male and 12 females were taken.

Hirstionyssus ellobii Bregetova, 1956[10]

Collection Records. *Alticola roylei*: Saif ul Maluke. *Tatera indica*: Ayub National Park.

Comments. Only 2 males and 7 females were taken. These specimens vary slightly from Bregetova's description of the type. This species is also known from *Ellobius*, *Mus*, and *Spalax* from Israel, Mongolia, and the U.S.S.R.

Hirstionyssus latiscutatus (DeMeillon *et al.*, 1944)[26]

Collection Records. *Alticola roylei*: Naran. *Alticola* sp.: Dir, Sandoz Farm, Soch. *Apodemus agrarius*: Naran. *Apodemus* sp.: Dir, Gabral, Gupis, Ghoradaka, Kalam, Kalam Rest House, Lalazar, Naran, Mt. Makra, Naltar, Naran, Rajwal, Sandoz Farm, Shangla, Shogran, Soch, Utror, Yakh Tangai. *Cricetulus migratorius*: Ziarat.

Cricetulus sp.: Kalat, Kargah Nullah, Naltar. *Crocidura* sp.: Gupis. *Dryomys nitedula*: Dir. *Hylopetes* sp.: locality? (pine forest). *Hyperacrius fertilis*: Sandoz Farm, Soch. *Hyperacrius* sp.: Shangla. Mouse nest: Naran. *Mus* sp.: Amandra (Malakand Agency), Balakot, Kalam, Kalam Rest House, Shogran, Soch. *Petaurista petaurista*: Ghoradaka. *Rattus rattoides*: Chinarbagh, Naran. *Rattus rattus*: Kargah Nullah. *Rattus* sp.: Shogran.

Comments. Totals of 27 deutonymphs, 33 unclassified nymphs, 30 males, 611 females, and 348 undifferentiated to sex were collected. In 15 of 106 collections *H. latiscutatus* was the only mite on its hosts. It was found most commonly on *Apodemus*, and to a much lesser extent on *Alticola* and *Cricetulus*. It is also known from *Micromys* and *Microtus* and from England, Scotland, Transvaal, Union of South Africa, and the U.S.S.R.

Hirstionyssus meridianus Zemskaja, 1955[43]

Collection Records. Meriones sp.: Ziarat. *Rattus* sp.: locality ? (Quetta District).

Comments. One male, 4 females, and 25 undifferentiated to sex were collected. It is also known from *Rhombomys* and from Europe, Turkmenia, and the U.S.S.R.

Hirstionyssus sunci Wang, 1962[41]

Collection Records. Apodemus sp.: Naran. *Crocidura* sp.: Shogran. *Mus* sp.: Shogran. *Rattus* sp.: Naran.

Comments. 30 females were taken, mostly from *Mus*. This mite is also known from *Suncus* from China.

Hirstionyssus transiliensis Bregetova, 1956[10]

Collection Records. Alticola roylei: Saif ul Maluke. *Alticola* sq. : Babusar village, Gitidas, Lulu Sar, Mt. Makra. *Apodemus* sp.: Phandar. *Cricetulus* sp.: Phandar. *Rattus rattoides*: Phandar.

Comments. Three deutonymphs, 6 males, and 29 females were taken. This mite was found most commonly on *Alticola* and *Rattus*. It is also known from *Clethrionomys* and *Microtus* from Europe and the U.S.S.R.

Hypoaspis miles (Berlese, 1892)[5]

Collection Records. Cricetulus migratorius: Ziarat. *Millardia* sp.: Qurash Rest House. *Tatera indica*: Lahore.

Comments. Only 3 females were taken. This species has also been taken from a variety of rodents and their nests from Europe, Scotland, the U.S.A., and the U.S.S.R.

Hypoaspis vacua (Michael, 1891)[27]

Collection Record. Mus sp.: Lahore.

Comments. Only two females were taken. It is also known from moss and ant's nests from Austria, England and Italy.

Laelaps algericus Hirst, 1925[19]

Collection Records. Apodemus agrarius: Naran. *Apodemu* sq. : Dir, Dunga Gali, Kalam, Kalam Rest House, Shogran, Soch, Yakh Tangai. Bat: locality? *Calomyscus* sp.: Kalat. *Crocidura* sp.: Naran. *Funambulus* sp.: Inst. of Hygiene. *Hyperacrius fertilis*: Sandoz Farm, Soch. *Millardia* sp.: Bari Doab Canal, Qurash Rest House. *Mus* sp.: Amandra, Ayub National Park, Azad Kashmir Muzaffarabad, Balakot, Bari Doab Canal, Changa Manga Forest Reserve, Charsa village, Chitral, Dir, Dir Mtn., Dunga Gali, Ghoradaka, Hindubagh, Jaba, Kalam, Kalam Rest House, Kawai, Kohat, Kund Forest Rest House, Lahore, Marala Rest House, Naran, Saidu, Rawalpindi, Sathan Gali, Shangla, Shogran. *Pipistrellus* sp.: Amandra. *Rattus rattoides*: Gabral. *Rattus* sp.: Dir Mtn., Lahore, Ravi River Bridge, Shogran. *Scotophilus* sp.: Kohat. *Suncus* sp.: Amandra, Balakot, Bari Doab Canal, Dir Mtn., Kohat. *Tatera indica*: Taunsa Barrage.

Comments. Totals of 23 protonymphs, 11 deutonymphs, 28 unclassified nymphs, 32 males, and 2047 females were taken. In 45 of 116 collections *L. algericus* was the only mite found on its hosts. This mite was found most commony on *Mus*, but was also of frequent occurrence on *Suncus* and *Millardia*. It is also known from *Microtus*, and from Algeria, Egypt, Israel, Touggourt, Turkey, and the U.S.S.R.

Laelaps buxtoni Radford, 1941[29]

Collection Records. Alticola roylei: Saif ul Maluke. *Apodemus* sp.: Naran. *Millardia* sp.: Ravi River Bridge. *Suncus* sp. : Charwa village. *Tatera indica*: Ayub National Park, Lahore, Taunsa Barrage. *Tatera* sp.: Bari Doab Canal, Marala Rest House.

Comments. Only 2 males and 16 females were collected, mostly from *Tatera*. It is also known from *Gerbillus* from India.

Laelaps jugalis Allred, 1969[2]

Collection Records. Millardia sp.: Bari Doab Canal, Changa Manga Forest Reserve, Khari village, Marala, Qurash Rest House, Shahpur village. *Mus* sp.: Bari Doab Canal. *Nesokia* sp.: Lulliani. *Rattus rattus*: Bari Doab Canal. *Rattus* sp.: Kundal village. *Tatera* sp.: Sialkot.

Comments. 351 females were collected predominantly from *Millardia*. In 7 of 22 collections this mite was the only species on its host.

Laelaps longisetosus Allred, 1969[2]

Collection Records. Calomyscus: Ziarat. *Cricetulus migratorius*: Ziarat. *Cricetulus* sp.: Gupis, Kalat, MES Rest House, Phandar. *Meriones* sp.: Ziarat.

Comment. The 24 males and 12 females were taken mostly from *Cricetulus.*

Laelaps myonyssognathus Grochovskaya *et al.*, 1961[15]

Collection Records. Millardia sp.: Marala, Qurash Rest House. *Mus* sp.: Amandra, Ayub National Park, Azad Kashmir, Balakot, Dir, Dir Mtn., Kohat. *Suncus* sp.: Amandra, Dir, Kohat, Sialkot. *Tatera* sp.: Sialkot.

Comments. 131 females and only one male were taken, mostly from *Suncus.* This mite is also known from *Bandicota* and *Rattus* from China, India, the Philippines, Taiwan, Viet Nam and Volcano Is.

Laelaps nuttalli Hirst, 1916[18]

Collection Records. Alticola roylei: Lalazar. *Apodemus* sp. : Babusar village, Dir, Naran, Soch. *Cricetulus* sp.: locality ?. *Gerbillus* sp.: Qurash Rest House. *Hylopetes* sp.: locality ? (pine forest in Hazara District). *Hyperacrius fertilis*: Lalazar, Lulu Sar, Saif ul Maluke, Soch. *Hyperacrius wynaei*: Dunga Gali. *Hyperacrius* sp.: Sandoz Farm, Shogran, Thandiana. *Marmota caudata*: Saif ul Maluke. *Millardia* sp.: Bari Doab Canal, Ravi River Bridge, Qurash Rest House. *Mus* sp.: Ayub National Park, Charwa village, Dir Mtn., Lahore, Shogran. *Nesokia* sp.: Amandra Ayub National Park, Charwa village, Doonga village, Kohat, Lahore, Inst. of Hygiene. *Rattus* sp. : Rawalpindi. *Suncus* sp.: Charwa village, Lahore.

Comments. Totals of 3 protonymphs, 17 deutonymphs, 3 unclassified nymphs, 29 males, and 517 females were taken. In 24 of 57 collections *L. nuttalli* was the only species found on its hosts. This mite was found most commonly on *Hyperacrius*, but also common on *Millardia* and *Nesokia.* It is also known from *Arvicanthis, Bandicota, Crocidura, Mastomys, Melomys, Ptilinopus,* and *Sciurus,* and from Australia, Bermuda, Brazil, Ceylon Egypt, Hawaii, India, Japan, Java, Korea, Malay Peninsula, Marquesas Is., Micronesia, the Philippines, Puerto Rico, Surinam, Taiwan, Union of South Africa, U.S.A., U.S.S.R., Venezuela, West Africa, and Zululand.

Laelaps pavlovskyi Zachvatkin, 1948[42]

Collection Records. Alticola roylei: Lalazar. *Alticola* sp.: Mt. Makra, Soch. *Apodemus agrarius*: Saif ul Maluke, Lalazar, Naran. *Apodemus* sp.: Babusar village, Dir, Dunga Gali, Gabral, Ghoradaka, Kalam, Kalam Rest House, Kund Forest Rest House, Mt. Makra, Naltar, Rajwal, Sandoz Farm, Shangla, Shogran, Soch, Thandiana, Utror, Yakh Tangai. *Cricetulus* sp.: Naltar. *Crocidura* sp.: Naran. *Hyperacrius fertilis*: Sandoz Farm, Soch. *Meriones* sp.: Kalat. *Mus* sp.: Dir, Dunga Gali, Kalam, Kawai, Naltar, Rawalpindi, Shangla, Shogran, Soch. *Petaurista petaurista*: Ghoradaka. *Rattus* sp.: Murree Hills, Naran, Shogran.

Comments. One larva, 15 protonymphs, 121 deutonymphs, 346 males, and 3357 females were collected. In 61 of 191 collections *L. pavlovskyi* was the only species on its hosts. This mite was by far the most frequent in occurrence and abundance on *Apodemus.* It is also known from *Microtus* from the U.S.S.R.

Laelaps turkestanicus Lange, 1955[25]

Collection Records. Apodemus sp.: Kalam, Shogran, Utror. *Gerbillus* sp.: Dera Ghazi Khan. *Mus* sp.: Dir, Dir Mtn. *Rattus rattoides*: Gabral, Sathan Gali. *Rattus* sp.: Dir Mt., Dunga Gali, Murree Hills, Shogran, Thug Nullah.

Comments. One protonymph, 4 males, and 157 females were taken. In 3 of 16 collections *L. turkestanicus* was the only species on its hosts. It was found most commonly on *Rattus.* It is also known from Tadzhikistan, Taiwan, and the U.S.S.R.

Macronyssus angustus Allred, 1969[2]

Collection Record. Bat: Naltar.
Comment. Only 2 females were taken.

Myonyssus montanus Furman *et al.*, 1955[13]

Collection Record. Ochotona sp.: Saif ul Maluke.
Comments. Only 1 female was taken. It is also known from the U.S.A.

Laelaspis patulus Allred 1969[2]

Collection Records. Apodemus sp.: Naltar, Naran. *Mus* sp.: Shogran.
Comment. Two males and 4 females were taken.

Myonyssus quinarius Allred, 1969[2]

Collection Record. Apodemus sp.: Naltar.
Comment. Only 3 females were taken.

Ornithonyssus bacoti (Hirst, 1913)[16]

Collection Records. Apodemus sp.: Kalam Rest House. *Mus* sp.: Kalam Rest House. *Pipistrellus* sp.: Dir. *Rattus rattoides*: Gabral. *Rattus* sp.: Ghoradaka.

Comments. Only 4 protonymphs and 9 females were taken. It is also known from *Acomys, Arvicanthis, Cavia, Citellus, Gerbillus* (nest), *Onychomys, Perognathus, Sigmodon,* and *Sminthopsis,* and from Australia, Egypt, Israel, Kenya, Sudan, and the U.S.S.R.

Ornithonyssus bursa (Berlese, 1888)[4]

Collection Record. Petaurista petaurista: Murree hills.

Comments. Only 1 female was taken. This specimen differs from the type description of *O. bursa,* but does not correspond as closely to any other species. It is also known from the bandicoot

and *Isoodon* but mostly from birds and their nests. It is cosmopolitan in distribution.

Spinturnix nudatus Allred, 1969[2]

Collection Records. Bat: Locality ? *Ontonycteris*: Locality ?.

Comment. Seven unclassified nymphs, 9 males, 12 females, and 16 undifferentiated specimens were taken.

Spinturnix plecotinus (Koch, 1839)[23]

Collection Records. Megaderma sp.: Gilgit Agency. *Plecotis* sp.: Shogran.

Comments. Only 3 males and 1 female were taken. It is also known from *Nyctalus* and *Plecotus* from England, Germany, Ireland, and the Netherlands.

Steatonyssus crassisetosus Till *et al.*, 1964[37]

Collection Record. Scotophilus sp.: Kohat.

Comments. 26 protonymphs, 7 males, 30 females, and 180 undifferentiated specimens were taken. This species is also known from *Tadarida* from Africa.

Steatonyssus heteroventralis Ah *et al.*, 1967[1]

Collection Records. Bat: Locality ?. *Ontonycteris* sp.: Locality ?.

Comments. Only 5 females were taken. This mite is also known from *Pipistrellus* from Korea.

Steatonyssus periblepharus Kolenati, 1858[24]

Collection Record. Pipistrellus sp.: Chitral.

Comments. Only 1 protonymph and 2 females were taken. The species is also known from *Eptesicus* and *Myotis* and from Algeria, British Isles, Bulgaria, Egypt, Germany, Hungary, and Lebanon.

Discussion

Based on frequency of occurrence, total numbers collected and host distribution, 15 species of mites are common on small mammals in West Pakistan. Each of these was found on more than 3 species of hosts, and the numbers found were greater than 100. This is an arbitrary judgment, however, for other species could potentially be regarded as prevalent had greater numbers of their particular hosts been examined. Ten of the 12 most common species known to occur in areas other than Pakistan are known from eastern Asia, 6 from the eastern Mediterranean and Africa, and 4 in both areas. Eight of the less common species are known from eastern Asia, 8 from the Mediterranean–African area, and only 2 occur in both areas. The mite fauna of West Pakistan likely is more closely related to that of China and the U.S.S.R. than to the European–Mediterranean–African complex.

Based on host preference nidex, the closest affinities between host and mite are between *Tatera* and *Androlaelaps marshalli*, *Gerbillus* and *Androlaelaps aduncus*, *Mus* and *Laelaps algericus*, and *Apodemus* and *Laelaps pavlovskyi*. Other less frequent associations are *Gerbillus* and *Androlaelaps marshalli*, *Millardia* and *Laelaps jugalis*, and *Tatera* and *Androlaelaps aduncus*. Mites of *Eulaelaps stabularis*, *Hirstionyssus latiscutatus*, *Laelaps algericus* and *Laelaps nuttalli* occurred on the greatest variety of hosts.

The species most widely distributed in West Pakistan is *Laelaps algericus*. Other species widely distributed are *Allodermanyssus sanguineus*, *Androlaelaps aduncus*, *Androlaelaps marshalli*, *Eulaelaps stabularis*, *Hirstionyssus latiscutatus*, *Laelaps nuttalli* and *Laelaps pavlovskyi*..

TABLE 1. FREQUENCY OF ASSOCIATION BETWEEN SOME MAMMALS AND MITES OF WEST PAKISTAN.

Host and mite*	No. of hosts infested†		No. of mites found	Frequency index**
	With mites	With species indicated		
Alticola	22			
Haemogamasus nidiformis		9	66	27
Hirstionyssus latiscutatus		5	40	9
H. transiliensis		5	34	8
Eulaelaps stabularis		4	5	1
Apodemus	202			
Laelaps pavlovskyi		31	1297	199
Hirstionyssus latiscutatus		22	799	87

(continued)

(Table 1 continued)

Eulaelaps stabularis		26	299	29
Haemogamasus nidiformis		13	143	9
Laelaps algericus		10	33	2
Allodermanyssus sanguineus		6	44	1
Laelaps nuttallii		4	53	1
Calomyscus	7			
Allodermanyssus sanguineus		5	74	53
Cricetulus	28			
Allodermanyssus sanguineus		13	135	63
Eulaelaps stabularis		14	81	41
Laelaps longisetosus		8	145	41
Hirstionyssus latiscutatus		5	60	11
Cerbillus	23			
Androlaelaps aduncus		23	548	548
A. marshalli		23	292	292
Hyperacrius	21			
Laelaps nuttalli		8	273	104
Hirstionyssus latiscutatus		3	10	1
Meriones	15			
Haemolaelaps longipes		5	398	133
Androlaelaps aduncus		5	86	29
Allodermanyssus sanguineus		4	71	19
Androlaelaps marshalli		3	38	8
Eulaelaps stabularis		3	14	3
Millardia	18			
Laelaps jugalis		17	331	313
L. nuttalli		8	119	53
L. algericus		3	24	4
L. myonyssognathus		2	9	1
Mus	97			
Laelaps algericus		36	1946	722
L. pavlovskyi		11	52	6
L. myonyssognathus		8	46	4
Hirstionyssus latiscutatus		7	37	3
Allodermanyssus sanguineus		3	54	2
Eulaelaps stabularis		6	31	2
Nesokia	19			
Laelaps nuttalli		10	60	32
Androlaelaps marshalli		3	51	8
Rattus	71			
Allodermanyssus sanguineus		20	826	233
Laelaps turkestanicus		6	119	10
Hirstionyssus latiscutatus		4	112	6
Eulaelaps stabularis		8	34	4
Hirstionyssus transiliensis		2	108	3
Laelaps algericus		5	16	1

(continued)

(Table 1 continued)

Suncus	13			
Laelaps myonyssognathus		4	73	22
L. algericus		5	25	10
Tatera	82			
Androlaelaps aduncus		49	624	373
A. marshalli		9	137	15

*Only those with a frequency index of 1 or more are listed. †Numbers referrable to the host represent groups (pools) of animals rather than individuals. **Frequency index (FI)=MH/T, where M, total number of mites of that species collected from that host; H, total number of individuals (or pools) of that host on which the mites of that species were found; and T, total number of individuals (or groups) of that host on which mites of any species were found. The higher the number, the greater the frequency of association.

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