

HOST DISTRIBUTION OF LICE ON NATIVE AMERICAN RODENTS NORTH OF MEXICO

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Mammals are infested with two distinct kinds of parasitic lice, those of the order Anoplura, which have mouthparts fitted for piercing the skin and sucking the blood of their hosts, and those of the order Mallophaga, with mandibulate mouthparts for feeding on the epidermal scales, hair, and skin secretions.

These orders are alike in that all species are entirely wingless, the eggs are attached to the hair of the host, and the immature stages resemble the adults in both form and parasitic habit. The Anoplura are parasitic only upon mammals. Some Mallophaga occur on mammals but most genera and species are parasites of birds.

Infestations with lice are not transitory. If a genus of wild mammals is infested with lice, it has been the writer's experience in the Western United States to find at least a few specimens whenever an individual of the genus is examined.

Host specificity is developed to a high degree in lice as has been emphasized by Kellogg (1913, 1914). Also related species occur on related host genera and in many instances related genera occur on related host families. This is sometimes true even though these related hosts have been geographically separated for geologic ages. Accidental parasitism is uncommon, but does occur. In a few instances lice have become established on new hosts, as the kangaroo louse, which is now quite common on dogs and has even been recorded from coyotes in North America.

Some native North American mammals are parasitized by Anoplura and some by Mallophaga but rarely is a wild host species regularly parasitized by both types of lice. Parasitism of domestic cattle, dogs, goats, horses, and sheep by both orders of lice is more common, however.

The distribution of the two kinds of lice on native mammals does not appear to be accidental, yet no logical division of the hosts utilized by these two distinct orders of lice has been offered. The problem has been discussed by Kellogg and Ferris (1915), Wilson (1937) and Olsen (1938). A division on a strictly syste-

matic basis appears untenable as Rodentia, Carnivora, and Artiodactyla occur among the hosts of Anoplura and also among the hosts of Mallophaga, although all genera in a family are usually parasitized by the same type of lice. Any ecological division also appears unsatisfactory.

The writer believes that a possible explanation can be found in a study of the place of origin of the host genera and families and the history of their subsequent geographic distribution.

The following division of the mammals of North America into hosts of Anoplura and Mallophaga is suggested. Those genera or families that evolved in South America, the Neotropical Region, and later entered North America, are hosts to Mallophaga; the genera or families that evolved in the Holarctic Region are hosts to Anoplura; and the genera or families that evolved in the Sonoran or intermediate Region are hosts to either Mallophaga or Anoplura, or possibly to both.

The present study deals mainly with this hypothesis in relation to the Rodentia.

A host list prepared by Kellogg and Ferris in 1915 has been used for analysis and for the preparation of Table I. A few species that have been described from North American hosts since that date are discussed later. Hosts are listed by genus only, as detailed species records would add little of significance. Following Miller's *List of North American Recent Mammals 1923* (1924) and Howell's *Revision of the North American Ground Squirrels* (1938) certain changes in generic names have been necessary and where such changes have been made those names used by Kellogg and Ferris are also given in quotation marks.

In Table I the North American rodents representing five families that are known to be infested with lice are divided into 3 groups on the basis of geographical origin: first, the Neotropical, which includes only the Erethizontidae; second, the Sonoran, which includes the Geomyidae and Heteromyidae; and third, the Holarctic, including the Cricetidae and Sciuridae.

GROUP 1, NEARCTIC AND NEOTROPICAL IN DISTRIBUTION

THE ERETHIZONTIDAE

This family of rodents is widely distributed and abundant in South America but is represented in North America only by *Erethizon epixanthum* in the western states and *E. dorsatum* in the eastern states. Although the fossil remains of this genus date back to the Upper Pliocene (R. W. Wilson, 1937), the Hystricoidea are still considered as invaders of North America from the Neotropical fauna (Scott, 1937). Both species of *Erethizon* are consistently and often heavily parasitized by Mallophaga of the genus *Eutrichophilus*, which is reported from porcupines even as far north as Alaska. *Eutrichophilus setosus* of porcupines is probably the only Mallophagan parasite on Alaskan rodents. This genus is also characteristic for Central American and South American porcupines. Guinea pigs of the family Caviidae are related to this family of rodents and are hosts to Mallophagan parasites of the genera *Gliricola* and *Gyropus*. In North America, guinea pigs occur only as captive animals.

GROUP 2, OF SONORAN ORIGIN

THE GEOMYIDAE AND HETEROMYIDAE

Several genera of both Geomyidae and Heteromyidae are found in Central America and in the northern part of South America in the Neotropical Region. As Scott (1937) considers the only autochthonous rodents of South America to be the Hystrichomorpha, these families must be considered early immigrants but

TABLE 1.—*Host Distribution of Lice and Geographic Origin of Host Families*

HOST	PARASITE		FAUNAL REGION		
	Mallophaga	Anoplura	Neotropical	Sonoran	Holarctic
GROUP I Erethizontidae <i>Erethizon</i>	M		+		
GROUP II Geomyidae <i>Geomys</i> <i>Thomomys</i>	M M			+	
Heteromyidae <i>Perognathus</i> <i>Dipodomys</i>	M? M?	A A		+	
GROUP III Cricetidae <i>Microtus</i> = " <i>Arvicola</i> " <i>Phenacomys</i> <i>Peromyscus</i> = " <i>Hesperomys</i> " <i>Neotoma</i>		A A A A			+
Sciuridae <i>Sciurus</i> <i>Citellus</i> = " <i>Spermophilus</i> " = " <i>Callospermophilus</i> " <i>Marmota</i> = " <i>Arctomys</i> " <i>Eutamias</i> <i>Tamias</i>		A A A A A A			+

originating elsewhere. Some species of *Thomomys* extend into the lower part of the Boreal zone of the Nearctic Region in North America, but do not extend into the far North and apparently neither family ever reached the Palearctic Region. *Thomomys* and *Geomys* of the Geomyidae and *Dipodomys* and *Perognathus* of the Heteromyidae are widely distributed in the Sonoran Region so it seems safe to assume, even in absence of authoritative statements, that these families are of Sonoran origin.

Published records and the writer's own collections indicate that at least the family Geomyidae is regularly parasitized by Mallophaga which have been assigned to a special genus, *Geomydoecus*, by Ewing (1929). The one record of Anoplura from *Geomys* was based on a single collection and was considered doubtful by Kellogg and Ferris. Ferris later (1932) reduced this species to synonymy with the species found on moles, *Scalopus*, so it is doubtful if *Geomys* is a true host of Anoplura. Ferris himself (Kellogg and Ferris, 1915) examined for Anoplura about a hundred individuals in the related genus, *Thomomys*, with negative results.

The records of Mallophaga from *Perognathus* and *Dipodomys* of the Heteromyidae are all for the same species that occurs on Geomyidae, i.e., *Geomydoecus geomyidis* (= "*Trichodectes geomyidis*"). Parasitism of rodents in two distinct families by the same species of louse is quite unusual. This may represent accidental parasitism of the heteromyids as suggested by Ewing (1936), it may indicate a very close phylogenetic relationship of the Heteromyidae and Geomyidae which is in accord with the view of Hill (1937) who would place them in a single family, or *Geomydoecus californicus* (= *Trichodectes californicus*) may be a distinct species contrary to Kellogg and Ferris who reduced it to synonymy with *G. geomyidis* (= *Trichodectes geomyidis*). If these records of Mallophaga from Heteromyidae are correct, though there is reason to doubt them, then this family is the exception in being hosts to both kinds of lice since the genus *Fahrenholzia* of the Anoplura is stated by Ferris (1922) to "occur as far as known only on rodents of the family Heteromyidae—a small family confined to the Western Hemisphere." Three distinct species of *Fahrenholzia* are known.

GROUP 3, OF HOLARCTIC ORIGIN

THE CRICETIDAE AND SCIURIDAE

The third group of rodents, including the Cricetidae and Sciuridae, is regularly parasitized in North America only by Anoplura. Both families are widely distributed in the Holarctic Region. A few genera of both families, as *Cynomys*, *Neotoma*, and *Peromyscus*, appear to be more typical of the Sonoran Region at the present time. Their family relationships are with the Holarctic rodents.

These families are considered as fairly recent immigrants into South America by Scott (1937) in contrast to the indigenous Hystriehomorpha and it is of interest that they have carried their characteristic genera of Anoplura with them.

DISCUSSION

The single record of the Castoridae as hosts to Mallophaga is omitted from the present table. This record was credited to Osborn (1896) but Ewing (1936) after re-examining some of Osborn's specimens believes they are carnivore lice and suggests that their presence on beaver represents a case of accidental parasitism.

In 1927 Ewing described a mallophagan: *Philandesia foxi* from two specimens, a male collected from *Marmota flaviventris* at Brewster, Washington, and a female from *Rattus norvegicus* in New York. The genus *Philandesia* is a characteristic

parasite of South American rodents and its presence on *Marmota* and *Rattus* is difficult to explain. The writer has examined many woodchucks, *M. flaviventris*, and several hundred collections of woodchuck ectoparasites from western states and has not encountered this or other mallophagan parasites. It apparently has never been recorded again from *Rattus*.

It should be emphasized that many records of lice from mammals are based on collections made in zoological gardens and from dried skins in museum collections. Unusual records may therefore represent accidental parasitism or straying of parasites from their freshly dead hosts.

With a few conspicuous exceptions discussed, the North American rodents that are hosts of lice can be divided into three groups, (1) a Neotropical element that harbors only Mallophaga, (2) an intermediate or Sonoran element that may harbor either Mallophaga, Anoplura, or both, and (3) a more Holarctic element that harbors only Anoplura. Of the rodents, records suggest, only *Dipodomys* and *Perognathus* may be parasitized by both kinds of lice.

If this information on rodents and their parasitic lice has been interpreted correctly, it must lead to the conclusions (1) that the faunal region in which a genus or family of rodents evolved has been an important factor in determining what type of lice they acquired, and (2) that these host-parasite relationships, with few exceptions, have remained fixed regardless of subsequent dispersion or association of the hosts with other rodents or mammals infested with the other type of lice.

This division may also be extended to the Lagomorpha, two families of which, the Leporidae and Ochotonidae, are Holarctic in distribution with some species extending through the Sonoran into the Neotropical Region. The Leporidae are hosts of Anoplura in North America and Anoplura have been reported for Ochotonidae in Asia (Ferris, 1922). There is some indication of the applicability of this division to the Carnivora and Artiodactyla but here more numerous exceptions are encountered, possibly due to the greater mobility of these hosts.

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