Macronyssid Mites in Oral Mucosa of Long-Nosed Bats: Occurrence and Associated Pathology

Abstract. *Macronyssid mites* (Radfordiella) *have been found in the oral mucosa of the long-nosed bat* (Leptonycteris nivalis), *which occurs from Texas southward throughout much of Mexico. This is the first report of mites of the suborder Mesostigmata attached in the oral cavity of a mammal. Osteolysis of hard palate and odontolysis of teeth result from infestations of mites adjacent to the upper premolars and molars; destruction of bone, teeth, and connective tissue often leads to exfoliation of teeth in life. Oral mites have not been found in* Leptonycteris sanborni, *a species in part sympatric with* Leptonycteris nivalis.

Long-nosed bats of the phyllostomatid genus *Leptonycteris* occur from Texas and Arizona southward through Mexico to Guatemala, and also on several islands off the northern coast of South America. Three species are recognized by most mammalogists; *L. nivalis* and *L. sanborni* are restricted to the North American mainland and are in part sympatric, whereas *L. curasoae* is known from Aruba, Curaçao, Bonaire, and Margarita Island.

In studying variation in the dentitions of North American bats, we noted a high incidence of lesions in the hard palate in specimens of *L. nivalis* but never in those of *L. sanborni*, even when these closely related species had been captured in the same cave. Usually the lesions were located lingual to the first upper premolars, sometimes lingual to the second premolars, and occasionally even lingual to the molars. In 13.6 percent (11 of 81 adults) of the specimens of *L. nivalis* having lesions, one or more teeth had been lost as a result of destruction of dental and supporting tissues. The high incidence of these lesions and our interest in the systematics of the genus led us to examine specimens of long-nosed bats preserved in alcohol in the collection of the University of Kansas Museum of Natural History. Mites were discovered between the gingiva and lingual surface of the roots of the teeth mentioned. Sometimes numbering more than 30 at a single site, the mites usually were attached with their anterior end toward the hard palate of the bat.

The mites represent an unnamed species of the genus *Radfordiella* (Macronyssidae) (*1*). All mites recovered were protonymphs, which is not surprising because macronyssid protonymphs feed continuously over a period of 1 to several days without leaving the host, whereas the quick-feeding adults engorge in minutes and generally are nidicolous. Presumably the adults of this species feed elsewhere on the host and do not enter the mouth.

The new species of *Radfordiella* in the oral mucosa of a bat is the first record of mites of the suborder Mesostigmata feeding in the oral cavity of a mammal. In other suborders of the Acarina, species of *Stomatodex* (Trombidiformes) are specific to the buccal mucosa of bats and lemurs, whereas males and immature stages of *Chirnyssus* and some species of *Nycteridocoptes* (Sarcoptiformes) have been repeatedly recovered from the mucosa of the oral cavity of bats (*2*). Many parasitic trombidiform and sarcoptiform mites are extremely small and live continuously in close association with the host tissues, for example, in the skin or in the hair follicles of mammals; it is not surprising, therefore, to find members of these groups invading the tissues of the mouth. Other sarcoptiform mites occur in the mucosa of the stomach and intestines (*Gastronyssus*) and in the subcutaneous tissues (Laminosioptidae and Hypoderidae). The generally more robust and agile Mesostigmata are less often tissue parasites, but three entire families and members of several others reside in the respiratory tract or other cavities of hosts. Heretofore, *Draconyssus belgicae* was the only macronyssid known to infest an internal cavity, females of this species having been found in the nasal passages of lizards of the genus *Ameiva* in Panama.

The infestation of the mouth of *Leptonycteris nivalis* by macronyssid mites may relate to the diet of the host, which consists of nectar, pollen, and soft fruits. *Nycteridocoptes* species (Sarcoptidae) are parasites of Old World fruit bats (Pteropodidae) and insectivorous bats (Vespertilionidae and Rhinolophidae); males and tritonymphs have been found in the mouths of the fruit bats only. *Radfordiella* protonymphs, if situated as they are in the mouth of *Leptonycteris* (Fig. 1), likely would be affected by the mastication of an abrasive diet (such as insects or perhaps even coarse-fibered fruits). The genus *Radfordiella* is restricted to bats, and both active stages (protonymphs and adults) of all three described species have been collected from the ex-

Fig. 1. Cluster of mites (*Radfordiella* sp.) in the palatal tissue of *Leptonycteris nivalis* internal to the first upper premolar. Prominent white projections are palatal ridges.

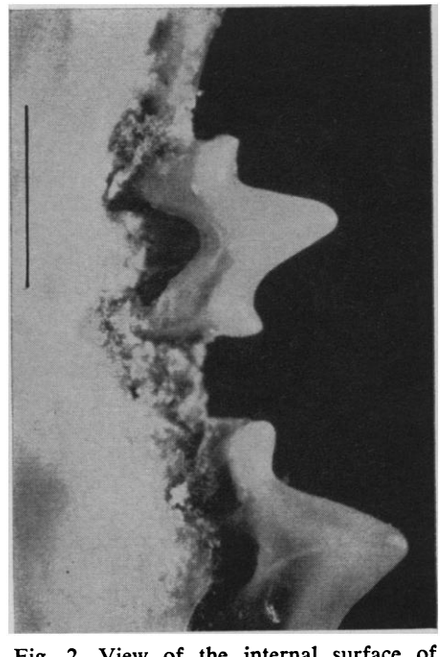

Fig. 2. View of the internal surface of upper premolars, on a cleaned skull of *Leptonycteris nivalis*, illustrating palatal lesion and partial destruction of roots of the first premolar. Scale: 1 mm.

terior of their hosts, chiefly vampire bats (*Desmodus* and *Diaemus*) and short-tailed bats (*Carollia*) (*3*).

The pathology associated with infestations of oral mites is of special interest, because reaction of host tissue to infestation by ectoparasites is poorly known (*4*). Furthermore, palatal lesions are readily recognized in cleaned skulls in museum collections, thus giving an investigator some idea of the incidence of infestation in nature, the degree of host specificity, and the geographic distribution of the parasites. Lesions in *L. nivalis* typically are found in the hard palate along the lingual surface of the first upper premolars, usually extending the full length of the tooth. The breadth and depth of lesions varies; sometimes they are as much as 1.0 mm wide and nearly 0.5 mm deep (Fig. 2). The edges usually are smooth, whereas the sides and bottom are slightly rugose; small pits, exposing the maxillary sinus, are characteristic of severe cases. Palatal lesions often expose most of the lingual surface of roots of the first premolars (Fig. 3B); in specimens that have not lost teeth, the upper half of the roots frequently are exposed but the apical portions still are surrounded by some alveolar bone. In heavy infestations, lesions often are found in the palate along the lingual surface of the second upper premolars and even the upper molars, but they have not been found adjacent to the upper incisors or canines.

Preliminary histological studies of the pathology of infestation by oral mites were made on specimens of *L. nivalis* from Nuevo Leon, Mexico, which were preserved in 10 percent Formalin and stored since 1964 in 70 percent alcohol. Tissue was decalcified in 5 percent nitric acid for 48 hours, embedded in Tissuemat and Piccolyte at 56.5°C, and sectioned at 10 μm. Sections were stained with Mallory triple stain or hematoxylin and eosin.

The normal, or undisturbed, gingival attachment to the upper premolars is shown in Fig. 3A. The epithelial attachment is to the surface of the enamel, beginning at the cemento-enamel junction and extending occlusally. The keratinous covering of the masticatory epithelium ends at the cemento-enamel junction. The two roots of the upper premolars are surrounded by dense connective tissue, contiguous with the connective tissue of the submucosa covering the hard palate. Oblique and horizontal periodontal ligaments connect the midline of the roots with alveolar bone.

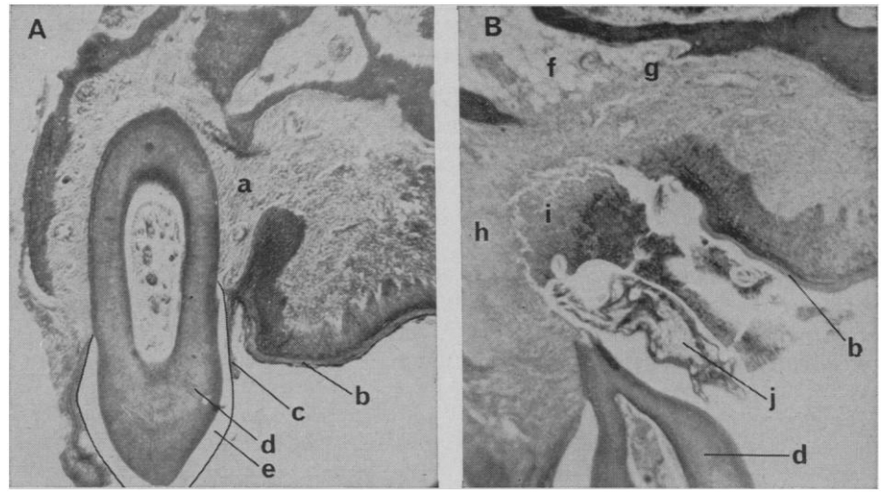

Fig. 3. Histological sections of upper premolars of *Leptonycteris nivalis*. (A) Normal tooth and associated tissues; (B) destruction of dental and associated tissues resulting from infestation of mites; *a*, normal connective tissue; *b*, keratinous outer layer of oral epithelium; *c*, epithelial attachment to the enamel; *d*, dentin; *e*, enamel (decalcified in preparation); *f*, exposed maxillary sinus; *g*, area of resorption in floor of maxillary sinus; *h*, loose, partially destroyed connective tissue; *i*, necrotic tissue and inflammatory cells; and *j*, longitudinal section through an oral mite.

Destruction of tissue by mites is shown in Fig. 3B. Mites evidently initially penetrate the oral epithelium at the site of the epithelial attachment to the enamel rather than through the hard keratinous layer. Osteolysis exposing the maxillary sinus is a secondary effect of the presence of mites. Osteolysis, probably resulting from severe mucosal irritation caused by infestations of nasal mites (Halarachnidae), has been reported previously (*5*). Connective tissue at the sites of infestation in the bats is destroyed; lesions are packed with remnants of necrotic tissue (Fig. 3B). Odontolysis is typical in severe infestations; centrifugal resorption of dental tissue, usually greatest at the apical portion of the roots, contributes directly to eventual loss of teeth.

A total of 111 skulls of *L. nivalis* from Texas and from the Mexican states of Nuevo Leon, Coahuila, Michoacan, Jalisco, Hidalgo, Guerrero, Mexico, and Morelos was examined; all adults from all locations, excepting Texas (only four of 14 individuals), had palatal lesions. (Also, mites were present in but one of five adults from Texas preserved in alcohol). Subadult bats only rarely exhibited these lesions. For comparative purposes, 431 specimens of *L. sanborni* from Arizona and Mexico also were examined; none had palatal lesions. Also, no lesions were found in 16 specimens of *L. curasoae* from Margarita-Island, Venezuela. The presence or absence of palatal lesions, therefore, constitutes a "taxonomic" characteristic in *Leptonycteris*. The host specificity of the undescribed species of *Radfordiella* is especially interesting in view of the morphological and, apparently, ecological similarity between *L. sanborni* and *L. nivalis*.

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References and Notes

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