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Peromyscus alstoni.

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Peromyscus alstoni (Merriam, 1898)

Volcano Mouse

Neotomodon alstoni Merriam, 1898:128. Type locality, Nahuatzin, 8,500 ft, Michoacán.

Neotomodon perotensis Merriam, 1898:129. Type locality, Cofre de Perote, 9,500 ft, Veracruz.

Neotomodon orizabae Merriam, 1898:129. Type locality, Volcán de Orizaba, 9,500 ft, Puebla.

Peromyscus alstoni Yates et al., 1979:45. First use of current name combination.

CONTEXT AND CONTENT. Order Rodentia, Family Cricetidae, Subfamily Cricetinae (Simpson, 1945). Recent work by Carleton and Musser (1984) assigns the species to the Superfamily Muroidea, Family Muridae, and Subfamily Sigmodontinae. *Peromyscus alstoni* was originally described in the genus *Neotomodon*, which contained three species (see above). Davis and Follansbee (1945) recognized one species with two subspecies, but Williams and Ramírez-Pulido (1984) considered *P. alstoni* to be monotypic. Yates et al. (1979) placed *Neotomodon* in synonymy under *Peromyscus*. In spite of the synonymy, the original generic designation is still used by some authors (Carleton and Musser, 1984).

DIAGNOSIS. *Peromyscus alstoni* is a unique member of the genus as indicated by its previous generic designation as *Neotomodon*. In spite of its uniqueness, its similarities to *Peromyscus* have been well documented (Burt, 1960; Davis and Follansbee, 1945; Hooper, 1959, 1968; Klingener, 1968; Uribe et al., 1974; Yates et al., 1979). *Peromyscus alstoni* is characterized by two complete and five incomplete palatal ridges, moderate zygomatic notch, and prismatic, flat-crowned molars (Carleton, 1980; Hall, 1981; Hall and Kelson, 1959). The molars are large and heavily enameled; M1 and M2 each have three loops and two reentrant angles labially; M1 and M2 each have two loops and one reentrant angle lingually; M3 is peglike and single-rooted (Hall, 1981; Merriam, 1898). Chromosomally, *P. alstoni* has a diploid number of 48 and a fundamental number of 66 (Rodriguez-Romero et al., 1975; Uribe et al., 1973, 1974; Yates et al., 1979).

GENERAL CHARACTERS. *Peromyscus alstoni* is medium-sized compared with other members of the genus. It has large, nearly naked ears, and soft dense fur that is grayish to fulvous brown dorsally and whitish ventrally. The tail is relatively short (less than head and body) and sharply bicolored (Fig. 1). There are six mammae, one pectoral pair and two inguinal pairs. Six plantar tubercles are present. The dental formula is i 1/1, c 0/0, p 0/0, m 3/3, total 16. The skull (Fig. 2) is broad and has a short braincase, expanding zygomata, and long, broad incisive foramina (Hall, 1981; Hall and Kelson, 1959; Merriam, 1898).

Williams and Ramírez-Pulido (1984) showed by morphometrical analysis that different age groups of *P. alstoni* vary significantly. They identified five age groups primarily on the wear of the maxillary dentition. The youngest age group included individuals with a third molar that had not completely erupted. The next age group showed wear on the third molar, but not so much that the reentrant angle was not evident; the second and third molars showed little or no wear. The third age group had three reentrant angles on both the first and second molars, and an incomplete reentrant angle on the third molar. The fourth age group, representing adult individuals, exhibited two to three reentrant angles on the first and second molars, and no traces of the reentrant angle on the third molar. In the last age group, representing old adult individuals, all reentrant angles were either incomplete or missing. Although there were some dimensional trends between the two adult age groups, the differences were not significant.

Means and ranges (in parentheses) for selected external and cranial measurements (in mm) for adult males, and females, are (Williams and Ramírez-Pulido, 1984): total length, 204.4 (179 to 227), 211.1 (192 to 240); length of tail, 90.7 (80 to 103), 94.1 (86 to 111); length of hindfoot, 25.8 (24 to 27), 25.6 (24 to 28); length of ear, 20.8 (18 to 25), 21.1 (19 to 23); greatest length of skull, 29.7 (28.3 to 31.3), 29.9 (27.9 to 31.6); palatilar length, 13.5 (12.8 to 14.5), 13.6 (12.8 to 14.3); nasal length, 12.5 (11.7 to 13.8), 12.5 (11.7 to 13.5); zygomatic breadth, 15.7 (15.0 to 16.7), 15.7 (14.9 to 16.3); mastoid breadth, 12.8 (12.1 to 13.4), 13.0 (12.1 to 13.6); interorbital breadth, 4.2 (3.9 to 4.5), 4.2 (3.9 to 4.5); length of maxillary toothrow, 5.0 (4.8 to 5.3), 5.1 (4.8 to 5.5). Secondary sexual variation revealed no significant differences between males and females. Analysis of geographical variation failed to differentiate samples of *P. alstoni*, thus indicating the species is monotypic.

DISTRIBUTION. *Peromyscus alstoni* is generally restricted to the higher elevations of the transvolcanic belt of central Mexico. State records have been reported from northern Michoacan, Mexico, Distrito Federal, northern Morelos, Tlaxcala, central Puebla, and western Veracruz (Fig. 3). Davis (1944), Davis and Follansbee (1945), Davis and Russell (1954), Hall (1981), Hall and Dalquest (1963), Hall and Kelson (1959), Hall and Villa R. (1949, 1950), Hooper (1947), Merriam (1898), Ramírez-Pulido (1969), Villa R. (1953), and Williams and Ramírez-Pulido (1984) listed specific collecting localities.

FOSSIL RECORD. Nothing is known specifically of the fossil record of *P. alstoni*. Hoffmeister (1945) commented on the similarities between this species and the fossil rodent *Pliotomodon* that he described from the Middle Pliocene.

FORM AND FUNCTION. Morphologically, *P. alstoni* and other *Peromyscus* have a bilocular-discoglandular stomach, characterized by an incisura angularis that projects beyond the esophageal opening, thus suggesting a well-defined bipartite condition. However, *P. alstoni* differs from other *Peromyscus* by having a broader bordering fold on the left side of the glandular portion of the stomach (Carleton, 1973).

The glans penis of *P. alstoni* averages 4.9 mm in length, is awl-shaped with a terminally positioned meatus urinarius, and is covered with epidermal spines (Hooper, 1959). The baculum has a bulbous base and tapers to a slender, gently curving shaft that is capped with a cartilaginous cone (Burt, 1960; Hooper, 1959). Burt (1960) reported a range of 4.6 to 5.3 mm for the length of the baculum.

Carleton (1980) utilized qualitative characteristics to evaluate

FIG. 1. Photograph of an adult *Peromyscus alstoni*.

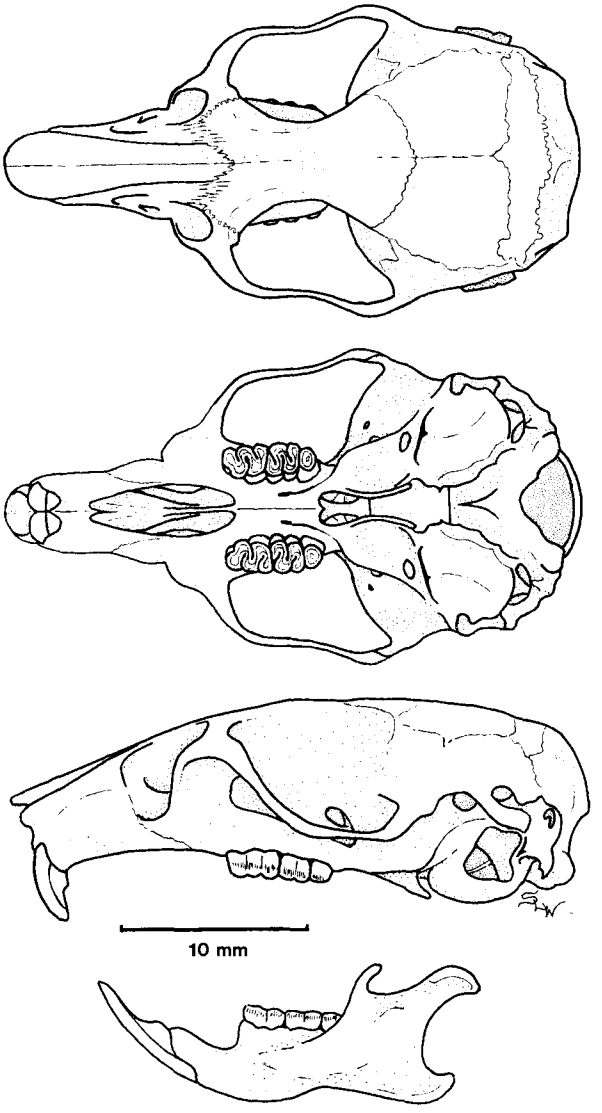

FIG. 2. Dorsal, ventral, and lateral views of the cranium and lateral view of the mandible of a young adult *Peromyscus alstoni* (CM 55981) from Iztaccihuatl Mt., 1 km S, 2½ km W Rio Frio, 3,100 m, in the state of Mexico.

the relationship of *P. alstoni* to similar rodents, specifically the neotomine-peromyscine rodents. The characteristics used in the analyses included dentition, cranium, postcranial skeleton, alimentary canal, phallus, male accessory reproductive glands, and external features. Based on these analyses, he suggested this species most resembles members of the peromyscine tribe, which is one of four tribes he recognized among the North American cricetines.

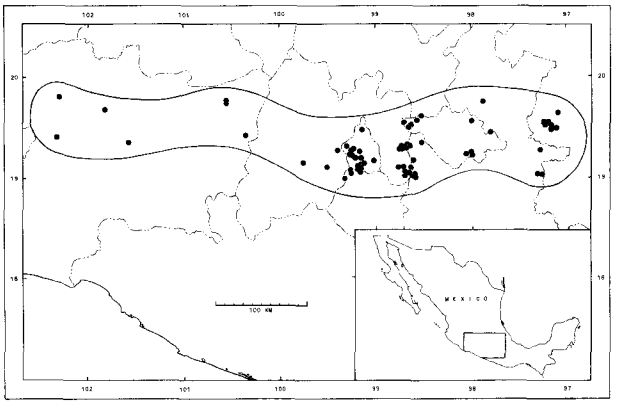

FIG. 3. Localities at which *Peromyscus alstoni* has been collected in the transvolcanic belt of central Mexico.

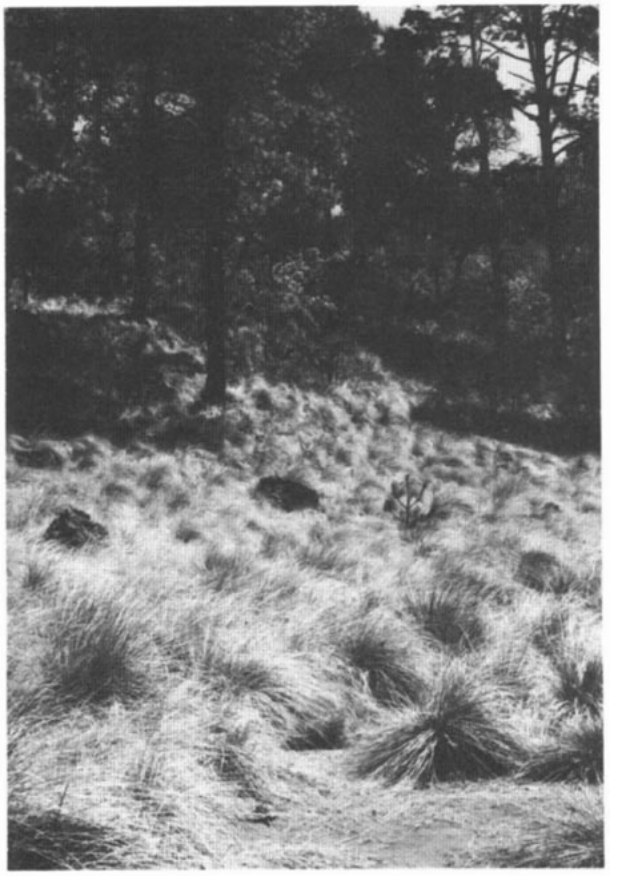

FIG. 4. Sacaton grass and open pine forest at elevations above 2,500 m represent the typical habitat of *P. alstoni*.

ONTOGENY AND REPRODUCTION. Most records indicate that the breeding season of *P. alstoni* begins in early June and ends in September, and that litter size ranges from two to five young with an average of about 3.3 (Davis, 1944; Davis and Follansbee, 1945; Davis and Russell, 1953, 1954; Goodwin, 1954; Villa R., 1953; Walker et al., 1975). However, the breeding season has started as early as May (Ramírez-Pulido, 1969) and ended as late as November (Hall and Dalquest, 1963). During the breeding season, adult males have enlarged testes measuring 10 to 18 mm in length and 7 mm in width (Davis and Follansbee, 1945). Females may produce two or three litters annually (Davis, 1944), and young from early litters may mature sexually and produce their own young during the same season (Davis and Follansbee, 1945). Davis and Russell (1953, 1954) reported crown–rump measurements up to 29 mm for embryos. Collections of young individuals have been restricted to the months of July to November (Davis and Follansbee, 1945; Davis and Russell, 1953, 1954; Hall and Dalquest, 1963). Hooper (1947) reported collecting a specimen in October that had partially molted into an adult pelage.

ECOLOGY. *Peromyscus alstoni* is endemic to boreal habitats (Fig. 4) of the transvolcanic belt of central Mexico; typically, it occurs in association with "sacaton" grass and open pine (*Pinus*) forest (Baker, 1963; Davis, 1944; Davis and Follansbee, 1945; Davis and Russell, 1953, 1954; Hall and Dalquest, 1963; Ingles, 1958; Villa R., 1953; Walker et al., 1975). Davis and Follansbee (1945) reported an altitudinal range from 2,590 to 4,267 m. During summer months such areas may have snow and frequent rains, but winter months are generally dry and cold (Goldman and Moore, 1946; Hall and Dalquest, 1963).

Mammal species that have been reported from habitats of *P. alstoni* include *Cryptotis alticola, Sorex saussurei, Romerolagus diazi, Sylvilagus floridanus, S. cunicularis, Thomomys umbrinus,*

Sigmodon alticola, *Peromyscus boylii*, *P. melanotis*, *Reithrodontomys megalotis*, and *Microtus mexicanus* (Baker, 1963; Davis, 1944; Davis and Follansbee, 1945; Goldman, 1951; Goldman and Moore, 1946; Hall and Dalquest, 1963). Non-mammalian associations include external parasitism by a laelaptid mite, *Eubrachylaelaps martini* (Jameson, 1951), and possible predation by *Crotalus triseriatus* (Hall and Dalquest, 1963). Barrera (1969) described a commensal association of the cucujoid beetle *Loberopsyllus traubi* with *P. alstoni*. This beetle attaches itself to the rump and thighs of *P. alstoni* and feeds on the skin and other organic materials that are sloughed off by the host.

The effect of volcanic activity on *P. alstoni* and other vertebrates was suggested by the wasteland caused by the eruption of Volcán Parícutin. After almost 20 years, species (including *P. alstoni*) previously collected from Cerro Tancitaro had not reinhabited the area of the volcano (Burt, 1961). This phenomenon might explain the absence of reports of *P. alstoni* on the volcano, Nevado de Colima, in the state of Jalisco, in spite of field investigations (Baker and Phillips, 1965; Genoways and Jones, 1973; Goldman, 1951) in areas that seem to have ecological features similar to those in the current known range of the species.

BEHAVIOR. The burrow system of *P. alstoni* is simple and ranges from 48 to 169 cm in length and is about 50 mm in diameter. Burrow systems of other mammals, such as *Thomomys umbrinus*, also may be used. Burrows tend to occur in well-drained areas and may pass under boulders; openings are partially concealed by vegetation (Davis and Follansbee, 1945).

Davis and Follansbee (1945) suggested that the nocturnal activity of *P. alstoni* is primarily before midnight. The natural clumping and spacing of sacaton grass obviates the need for this species to construct special runways (Davis and Follansbee, 1945; Hall and Dalquest, 1963).

GENETICS. Populations representing previously recognized taxonomic subdivisions of *P. alstoni* have a reported diploid number of 48 and a fundamental number of 66. The karyotype consists of 30 acrocentric and 16 biarmed chromosomes; the sex chromosomes are biarmed (Rodriguez-Romero et al., 1975; Uribe et al., 1974; Yates et al., 1979).

Yates et al. (1979) described the G- and C-banded karyotypes of *P. alstoni* and interpreted the data as suggesting that this species had a common evolutionary history with the ancestor of some (but not all) of the subgenera of *Peromyscus*. That study has been supported by subsequent analyses of G- and C-banded karyotypes of *Peromyscus* (Robbins and Baker, 1980; Rogers et al., 1984; Stangl and Baker, 1984); thus, if *P. alstoni* actually evolved outside of *Peromyscus* (Hooper and Musser, 1964) then considerable convergent chromosomal evolution has occurred. Cladistical analysis of electrophoretic data from several peromyscine taxa (Patton et al., 1981) provided additional synapomorphies for the evolution of *P. alstoni* and some of the *Peromyscus* subgenera.

REMARKS. In this account, *Peromyscus* is the generic designation used for the volcano mouse as discussed by Yates et al. (1979), thus making *P. alstoni* somewhat unique in that its current generic status has been determined primarily by evaluation of chromosomal and electrophoretic data. However, some investigators (Carleton, 1980; Carleton and Musser, 1984) recognized the species as distinct from *Peromyscus* and preferred to retain the original generic designation *Neotomodon*. Future systematic investigations may support the latter position.

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