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Microdipodops megacephalus.

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Microdipodops Merriam, 1891

Microdipodops Merriam, 1891:115. Type species *Microdipodops megacephalus* Merriam.

CONTEXT AND CONTENT. Order Rodentia, Suborder Myomorpha, Family Heteromyidae, Subfamily Perognathinae. The genus *Microdipodops* includes two living species, *M. megacephalus* and *M. pallidus*.

Microdipodops megacephalus Merriam, 1891
Dark Kangaroo Mouse

Microdipodops megacephalus Merriam, 1891:115. Type locality Halleck, Elko Co., Nevada.
Microdipodops californicus Merriam, 1901:128. Type locality Sierra Valley, near Vinton, Plumas Co., California.
Microdipodops polionotus Grinnell, 1914:302. Type locality McKeever's Ranch, 2 mi. S Benton Station, 5200 ft., Mono Co., California.

CONTEXT AND CONTENT. Context noted in generic summary above. Twelve subspecies are recognized (Hall and Kelson, 1959) as follows:

M. m. albiventer Hall and Durrant, 1937:357. Type locality Desert Valley, 5300 ft., 21 mi. W Panaca, Lincoln Co., Nevada. Originally considered a subspecies of *M. pallidus*. First regarded as a subspecies of *megacephalus* by Hall (1941*a*).
M. m. ambiguus Hall, 1941*a*:252. Type locality 1¼ mi. S Sulphur, 4050 ft., Humboldt Co., Nevada.
M. m. californicus Merriam, 1901:128, see above.
M. m. leucotis Hall and Durrant, 1941:6. Type locality 18 mi. SW Orr's Ranch, 4400 ft., Tooele Co., Utah.
M. m. medius Hall, 1941*a*:256. Type locality 3 mi. S Vernon, 4250 ft., Pershing Co., Nevada.
M. m. megacephalus Merriam, 1891:115, see above.
M. m. nasutus Hall, 1941*a*:251. Type locality Fletcher, 6098 ft., Mineral Co., Nevada.
M. m. nexus Hall, 1941*a*:257. Type locality 3 mi. S Izenhood, Lander Co., Nevada.
M. m. oregonus Merriam, 1901:127. Type locality Wild Horse Creek, 4 mi. NW Alvord Lake, Harney Co., Oregon.
M. m. paululus Hall and Durrant, 1941:5. Type locality Pine Valley, ½ mi. E headquarters building of Desert Range Exp. Station, U. S. Forest Service, sec. 33, T. 25S, R. 17W, Salt Lake B. M., Millard Co., Utah.
M. m. polionotus Grinnell, 1914:302, see above.
M. m. sabulonis Hall, 1941*b*:59. Type locality 5 mi. SE Kawich P. O., 5400 ft., Kawich Valley, Nye Co., Nevada.

DIAGNOSIS. The dark kangaroo mouse (figure 1) is brownish, blackish, or grayish above and the underparts are basally plumbeous and white-tipped, whereas *M. pallidus* is pale pinkish cinnamon above and the hair of underparts is white to the base. The distal half of the tail is usually darker than the back. The hind foot is slightly smaller (23 to 25 mm) than that of *M. pallidus* (> 25 mm). The anterior palatine foramina are wide posteriorly and taper to a sharp point anteriorly. The nasals extend posteriorly nearly as far as the premaxillae extend.

GENERAL CHARACTERS. Measurements (in millimeters) are: total length, 140 to 177; length of tail, 68 to 103; length of hind foot, 23 to 27. Weight of adults ranges from 10.0 to 16.9 g. The tail is wider near the center than at either end. More detailed descriptions are presented by Hall (1946) and Hall and Kelson (1959). The skull is illustrated in Figure 2.

DISTRIBUTION. The geographic range is shown in Figure 3. *Microdipodops megacephalus* is associated with Upper Sonoran sagebrush desert and occurs in Oregon, Utah, California, and Nevada (Hall and Kelson, 1959).

There are no accounts of fossil evidence for this species. However, Wood (1935) has speculated on the origin of the genus: "It is possible that the kangaroo mice are descended from Miocene members of the genus *Perognathus*, but there is no direct evidence, and . . . I have considered it best to indicate this genus as a separate derivative of the Oligocene heteromyid stock, close to *Perognathus* but with intermediate stages unknown."

FIGURE 1. Photograph of *Microdipodops megacephalus* by A. C. Risser.

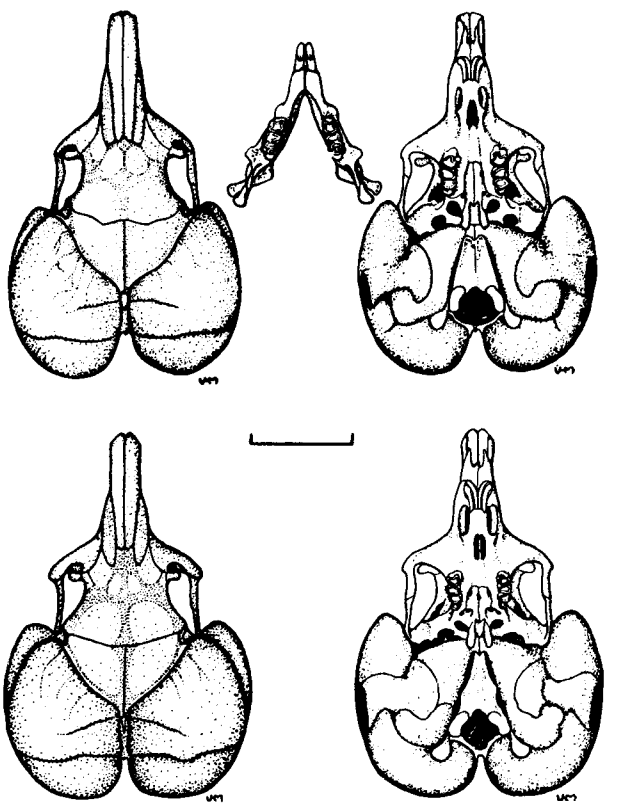

FIGURE 2. Drawings from Hall (1941*a*) of the skull and lower jaw of *Microdipodops megacephalus* (above) and skull of *Microdipodops pallidus* for comparison (below). The central scale represents 10 mm.

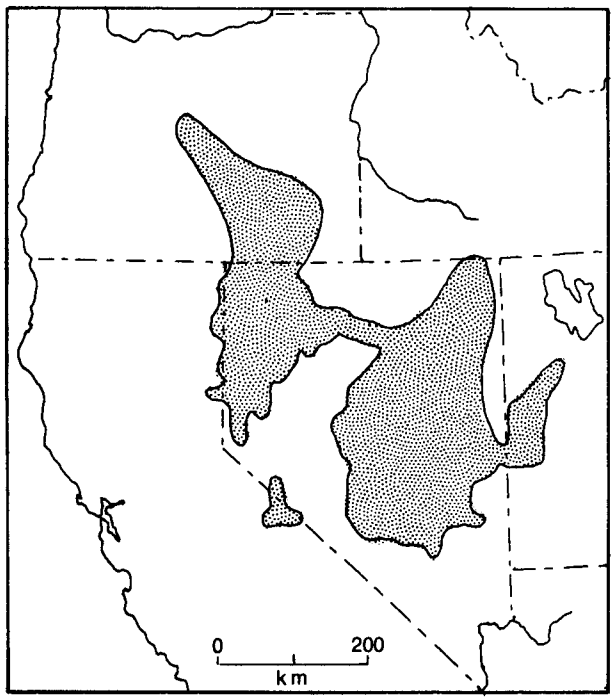

FIGURE 3. Geographic distribution of *Microdipodops megacephalus* in the western United States.

FORM AND FUNCTION. A comprehensive study by Hatt (1932) of the vertebral columns of ricochetal rodents gave information on the skeletal structures of *M. megacephalus*. He found the following to be true of the species: the neck is short, the cervical vertebrae are shorter than about 15% of the thoraco-lumbar length; the tail is long, vertebrae both lengthened and numerous; the anterior caudal vertebrae are short; a cervical neural spine occurs only on the axis and is narrow antero-posteriorly; the spines of the posterior lumbar region are long, narrow antero-posteriorly, and inclined forward; the spines over the sacrum are reduced or lost; the transverse process of the atlas is reduced. These are characters of both species of *Microdipodops* and some also occur in both the subfamilies Perognathinae and Dipodomyinae.

Quay (1960) noted alpha cell clumping in the pancreatic islets of the Heteromyidae; the most extreme clumping occurred in *Microdipodops*. Eccrine glands are in the palmar tubercles and traces occur in the terminal pads of the digits (Quay, 1965). Hall (1946) noted a swelling in the proximal third or half of the tail. He speculated on its probable function as a balancing organ aiding in bipedal locomotion. Bartholomew and MacMillen (1961) believed that the swelling functioned as a fat storage depot in preparation for periods of torpor. Quay (1965) described this characteristic thickening as subcutaneous masses of large, unilocular fat cells. It probably does function to store fat, but O'Farrell (1973) found no seasonal variations in the size of the swelling when low plant productivity and drought conditions prevailed.

ONTOGENY AND REPRODUCTION. Little is known concerning reproduction in *M. megacephalus*. Hall (1946) found pregnant individuals from 28 April to 22 September and suggested that this species is polyestrous, the majority of young being born in May and June. O'Farrell (1973) found females with perforate vaginal orifices in April and again in July indicating two periods of estrus. Litter size ranges from two to seven with a mean of 3.9 (Hall, 1946). Reproduction is negatively affected by a lack of fall and winter precipitation and consequent germination of winter annuals (O'Farrell, 1973). Egoscue *et al.* (1970) maintained wild-trapped *M. megacephalus* in captivity for 5 years 5 months.

ECOLOGY. The habitat of *M. megacephalus* lies exclusively in the Upper Sonoran Life-zone (Hall, 1946). Edaphic factors controlling the distribution of this species have been discussed by Hall (1946) and Ghiselin (1970). The species is restricted to fine, gravelly soils, particularly where sympatric with *M. pallidus*. However, near the margins of its range, it may occur in sand dunes.

O'Farrell (1973) found that in west-central Nevada *M. megacephalus* maintained a 2:1 adult sex ratio favoring males. Over a year no mortality was observed and a high degree of fidelity to a given locus was noted. He further determined that a small territory was maintained around the burrow and a relatively large home range was utilized that overlapped considerably with the home ranges of conspecifics. Seasonal changes in size of home range were noted. The mean yearly circular home range value for males was 6613 m^2, and for females 3932 m^2. In relation to interspecific interactions, O'Farrell (1973) determined that *Perognathus longimembris* inhibited the movements and activity of *M. megacephalus*. It was suggested that during the summer when these pocket mice (*longimembris*) were at peak activity, *M. megacephalus* probably shifted from a granivorous to an insectivorous feeding strategy. In addition, these species maintained a constant spatial isolation of centers of activity. Hall and Linsdale (1929) determined that *M. megacephalus* was primarily a seed eater but mentioned the high incidence of insect matter in cheek pouches during the summer. These mice do not seem to utilize free water. Blaustein (1973) has kept several individuals for 7 months without water. One individual lived for more than a year without water.

BEHAVIOR. *Microdipodops megacephalus* utilizes bipedal locomotion. The bipedalism is probably a by-product of the foraging habits of this species with locomotor significance of secondary importance (Bartholomew and Cary, 1954). They are quadrupedal at times when moving about a cage (Blaustein, 1973), however, bipedalism is the most common locomotor form. Full upright postures are used when defending nest areas against intruders (Blaustein, 1973) and erratic leaps are used when escaping from another animal (Bartholomew and Cary, 1954; Eisenberg, 1963; and Blaustein, 1973). During nest defense, Blaustein heard *M. megacephalus* utter high pitched squeals.

Hall and Linsdale (1929) reported that *M. megacephalus* constructs simple, short, unbranched tunnels. Seed caches and nesting areas were not found. Blaustein (1973) has noted that in the laboratory this species constructs elaborate nests and utilizes seed caches. O'Farrell (1973) has given evidence that this species stores food in seed caches within the burrow system. This species has been noted to sleep on its back with its forelimbs stretched over the head and the hind limbs tucked ventrally on the belly (Blaustein, 1973).

Intraspecific behavior is poorly known. Hall and Linsdale (1929) observed that several *M. megacephalus* could be kept in captivity together, but Blaustein (1972) noted cannibalism when two individuals were placed together. Huey (1959) noted that *M. megacephalus* and *Perognathus parvus* kicked sand at each other through a wire screen partition. In laboratory pairings of the former species with *P. parvus* and *P. longimembris*, Blaustein (1973) noted *M. megacephalus* to be subordinate.

Activity was observed for this species only from March through October. Probably it hibernates. The peak of activity occurred in the first 2 hours after sunset. Activity then declined and occurred only sporadically the remainder of the night. In spring and autumn, activity ceased 2 hours before sunrise, whereas in the summer a second large peak in activity occurred prior to sunrise. In addition to time after sunset, moonlight was an important environmental factor influencing activity. Activity was greatly reduced when any moon was present. Ambient temperature also influenced activity. Optimal temperature ranges were observed and activity declined above and below the range, which varied with the seasonal temperature acclimation of the animals. Wind above 13 km per hour (8 mph) inhibited activity, probably due to blowing sand. Activity was highest under partly cloudy skies and ceased during rain. Above from O'Farrell (1973).

GENETICS. The following karyotypic information was kindly provided from unpublished data by Dr. James L. Patton. A male *M. megacephalus nasutus*, collected ¼ mi. N Fletcher, Mineral Co., Nevada, was examined. The X chromosome was a medium acrocentric and the Y chromosome was a small subtelocentric ($2N = 40$, $FN = 74$). The autosomes were: six pairs of metacentrics, seven pairs of submetacentrics, five pairs of subtelocentrics, and one pair of small acrocentrics.

Hall (1946) presented evidence that hybridization occurs between *M. megacephalus* and *M. pallidus* in Penoyer Valley, N of Groom Baldy, Lincoln Co., Nevada.

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