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Caluromys derbianus.

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Caluromys J. A. Allen, 1900

Philander Burmeister, 1856:74. Type species *Philander cayopollin* (=*Didelphis philander* Linnaeus). Not *Philander* Tiedemann, 1808.

Caluromys J.A. Allen, 1900:189. Type species *Didelphis philander* Linnaeus. Renaming of *Philander*.

Micoureus Matschie, 1916:269. Type species *Didelphis laniger* Desmarest (=*Didelphis lanata* Olfers). Not *Micoureus* Lesson, 1842 (=*Marmosa* Gray, 1821).

Mallodelphys Thomas, 1920:195. Renaming of *Micoureus* Matschie, 1916.

CONTEXT AND CONTENT. Superorder Marsupialia, Order Polyprotodonta, Superfamily Didelphoidea, Family Didelphidae, Subfamily Caluromyinae (after Kirsch, 1977*a*). There are three living species in the genus: *C. derbianus*, *C. lanatus*, and *C. philander*.

Caluromys derbianus (Waterhouse, 1841)

Woolly Opossum

Didelphys derbianus Waterhouse, 1841:97. Type locality, Cauca Valley Dept., Colombia.

Didelphys guayanus Thomas, 1899:286. Type locality, Balzar Mountains, Guayas Province, Ecuador.

Caluromys derbianus Allen, 1900:189. Renaming of *Didelphys derbianus* Waterhouse, 1841.

Philander centralis Hollister, 1914:103. Type locality, Talamanca, Costa Rica.

Micoureus canus Matschie, 1917:286. Type locality, Nicaragua (not Guatemala, as stated by Hall and Kelson, 1952:325, but corrected, 1959:17).

Micoureus antioquiae Matschie, 1917:286. Type locality, Caceres, Prov. Antioquia, Columbia [sic].

CONTEXT AND CONTENT. Context noted in generic description above. Seven subspecies are recognized as follows (Cabrera, 1958; Hall and Kelson, 1959):

C. d. aztecus (Thomas, 1913). Type locality, San Juan de la Punta, Veracruz, Mexico.

C. d. canus (Matschie, 1917), see above.

C. d. centralis (Hollister, 1914). Type locality, Talamanca, Costa Rica.

C. d. derbianus (Waterhouse, 1841), see above (*guayanus*, *pyrrhus*, *pictus*, and *senex*, all of Thomas, and *antioquiae* Matschie are synonyms).

C. d. fervidus (Thomas, 1913). Type locality, "Guatemala", lowlands of east-central Guatemala, or northern Honduras (Goodwin, 1942).

C. d. nauticus (Thomas, 1913). Type locality, Gobernadora Island, off west coast of Panama.

C. d. pallidus (Thomas, 1899). Type locality, Bogava (=Bugaba), 2,500 m, Chiriqui, Panama.

DIAGNOSIS. *Caluromys derbianus* differs from other species of the genus as follows: largest species in the genus, total length 600 to 700 mm; ears creamy white to pink (Fig. 1); forelimbs and feet light-colored; grayish median line between shoulders (referred to as "withers mark") usually present (some forms are ornately patterned with general colors ranging from pale gray to bright rufous); undersides buffy-white to golden tawny; proximal 40 to 50% of tail haired dorsally rather than 50 to 75% as in other *Caluromys*.

GENERAL CHARACTERS. The common name of this opossum is derived from its woolly pelage. A dark, median, facial strip is often present, extending from the crown to the fleshy portion of the nose (Fig. 1). The body is slender, with the prehensile tail constituting 58 to 67% of total length. Cranial characteristics (Fig. 2) include: well-developed postorbital processes, temporal ridges occasionally united to form sagittal crest, possibly as a function of age (Goodwin, 1946); strongly flared zygomatic arches; long slender canines; maxillary toothrows slightly arcuate and converging anteriorly; M3 not larger than M1; first upper premolars very small.

DISTRIBUTION. The seven currently recognized subspecies occur from south-central Veracruz to western Colombia and norther Ecuador (Fig. 3). *Caluromys derbianus* lives in both lowland and highland rain forests to an altitude of about 2,460 m. Marginal records for the species in Central America are provided by Hall and Kelson (1959). No fossil forms of the species have been reported; Hershkovitz (1972) suggested that the closely related *Caluromys philander* may have originated in the Guianas.

FORM. *Caluromys derbianus* is a long slender animal weighing from 200 to 400 g. Pelage color exhibits much geographic variation (Goodwin, 1942). All digits of the front feet are clawed, as are digits 2 throuth 5 of the hind feet. The hallux is opposable. A well-developed pouch is present (Hall and Dalquest, 1963). The distal 50 to 60% of the tail is naked and prehensile (Bugher et al., 1941). Hall and Kelson (1959) reported 37 caudal vertebrae, although this may vary. The skull is characterized by massive, flared, zygomatic arches, and broad shelf-like postorbital processes; the posterior part of the palate lacks fenestrae. Segall (1969) described in detail the bulla and inner ear. Cartmill (1974) reported that, "by comparison with other opossums, *Caluromys* shows greater frontation and approximation (but not convergence) of the orbits, more extensive periorbital ossification, a small snout, and more pronounced flexion of the face of the braincase." Adult dental formula for all didelphids is i 5/4, c 1/1, p 3/3, m 4/4, total 50.

The urogenital system of the female was described by Hill and Fraser (1925), and that of the male by Biggers (1966). The median vagina extends much more anteriorly in *Caluromys* than in other didelphids, and the tissue structures also differ somewhat. The testes are external, and lie in a pendulous scrotum, anterior to the penis. Biggers and DeLamater (1965) described the unique form and pairing of spermatozoa: "the spermatozoa of *Caluromys* possess saucer-shaped heads with the midpiece inserted into the convex side, and the acrosome lying in the con-

FIGURE 1. Photograph of *Caluromys derbianus*, from Kirsch (1977*a*), courtesy of Academic Press. This specimen was captured at Pichende, Dept. Valle, Colombia, approximately 2,000 m elevation (CM 3783, Mammal Collection, CSIRO Division of Wildlife Research, Canberra, Australia).

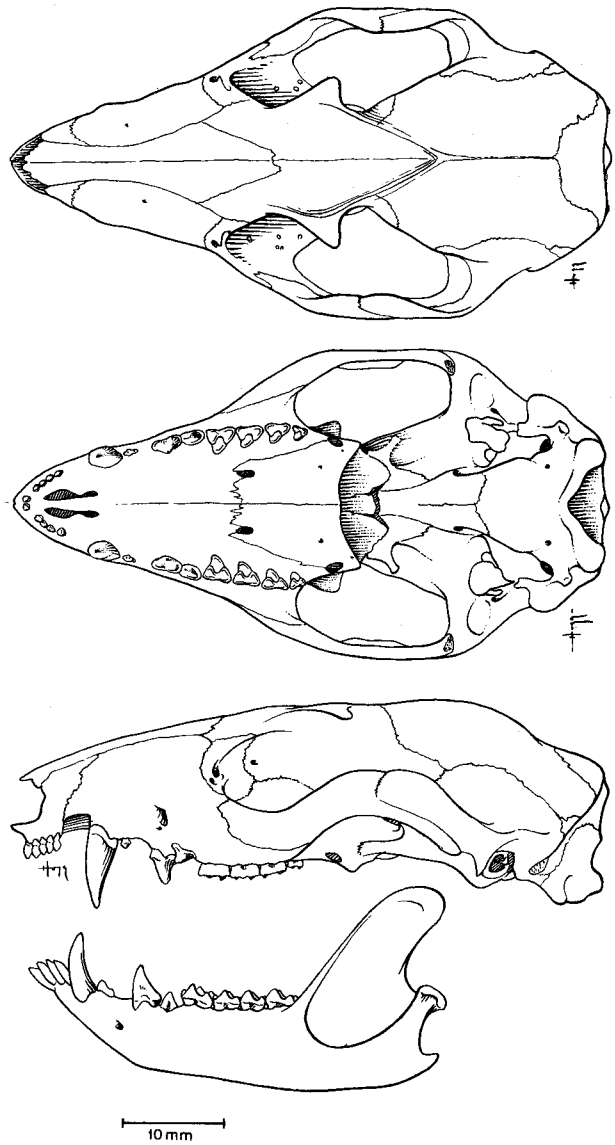

FIGURE 2. Skull of female *Caluromys derbianus centralis* from Costa Rica (KU 26927).

cave side. Pairing occurs by apposition of the two concave sides." Phillips (1970) described the ultrastructure of spermatozoa in *Caluromys philander*. Martan et al. (1967) described the ductuli efferentes in *C. derbianus* and several other didelphids. Works (1950) lists several skeletal measurements for this species as well as several other didelphids.

FUNCTION. Rothstein and Hunsaker (1972) reported baseline hematology and blood chemistry of *C. derbianus*. Blood cell morphology is quite similar to that of humans and monkeys. In a study of Neotropical marsupial energetics, McNab (1978) found *C. derbianus* and *Chironectes minimus* to have basal metabolic rates about equal to placentals of similar mass; rates in other Neotropical didelphids were about 80% of placental rates.

ONTOGENY AND REPRODUCTION. Enders (1966) reported a litter size from one to six in *Caluromys*, with an average "between three and four." In a restricted collection of pouch young, Biggers (1967) recorded a median of three, and Phillips and Jones (1968) recorded an average of 3.3 (range 2 to 4) in Nicaragua. Enders (1966) stated that litter mortality is high before the young are weaned, but Phillips and Jones (1968) found no evidence for this. Enders (1966) reported that the woolly opossums breed during the dry season, January to June, in Central America. However, Biggers (1967) extended this to include the first few months of the rainy season, July to September, and

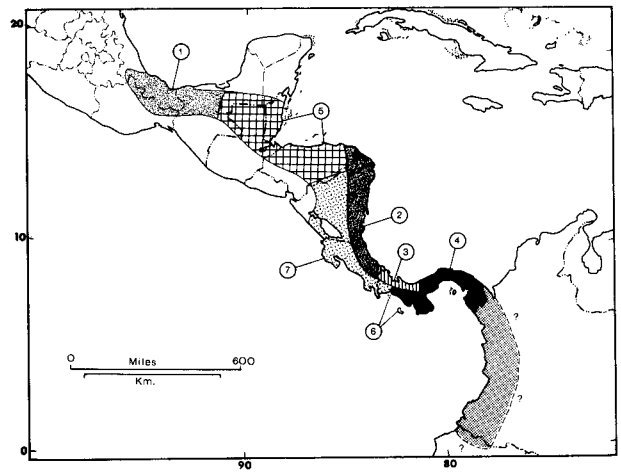

FIGURE 3. Distribution of the subspecies of *Caluromys derbianus*: 1, *C. d. aztecus*; 2, *C. d. canutus*; 3, *C. d. centralis*; 4, *C. d. derbianus*; 5, *C. d. fervidus*; 6, *C. d. nauticus*; 7, *C. d. pallidus*. Redrawn from Hall and Kelson, 1959, and Cabrera, 1958.

Phillips and Jones (1968) have suggested that the woolly opossum may breed throughout the year in Nicaragua. Based on vaginal smears, Bucher and Fritz (1977) found that females housed in the laboratory maintained an estrous cycle year round. Cycles ranged from 16 to 39 days in length, with modal lengths of 27 to 29 days, but no evidence suggested seasonal change in cycle length as reported for *Didelphis* (Reynolds, 1952). There is no information on the life span of *C. derbianus* in nature, but Walker et al. (1975) reported that a specimen lived for more than five years in the New York Zoological Park. Farris (1950) reported successful breeding of woolly opossums in captivity; Collins (1973) reported on three litters of *C. derbianus* that resulted from breeding experiments in Barnes' lab, and noted that *C. derbianus* reached sexual maturity in 7 to 9 months.

ECOLOGY. Very little is known of the woolly opossum's natural history. The species is strictly arboreal, very seldom coming to the ground, and seems to be solitary (Hall and Dalquest, 1963). Davis (1945) reported that the home range of *C. philander* is small and probably is limited to only a few trees. He also reported that females tend to be more sedentary than males. *Caluromys derbianus* probably lives in tree hollows (Hall and Dalquest, 1963) and constructs nests of leaves (Walker et al., 1975). The natural diet has not been investigated thoroughly; Hall and Dalquest (1963) reported a diet of insects and the fruit of the "amate-capulin" tree. Captive animals have eaten fruit, insects, and mice (Hall and Dalquest, 1963) and have been maintained on a laboratory diet of dog food, raw egg, and fruit (Bucher and Fritz, 1977). Collins (1973) listed several diets used by zoological institutions. The woolly opossum has little economic importance, although at one time it was hunted for its fur (Walker et al., 1975). The species' predators are not known. Hunsaker and Shupe (1977) commented on the similarity between the ecology of *C. derbianus* and arboreal prosimians of the Old World tropics.

No blood parasites were found by Rothstein and Hunsaker (1972), but Collins (1973) lists 19 genera of parasites found in *Caluromys*.

BEHAVIOR. There are few reports of the woolly opossum's behavior in nature, but Collins (1973), Bucher and Fritz (1977), and Hunsaker and Shupe (1977) reported on various aspects of laboratory behavior and maintenance for *C. derbianus*. Captive animals exhibited a broad range in temperament, although acclimatization to the laboratory usually took place. The species is strictly nocturnal in captivity, rarely emerging from its nest before dark. Bucher and Fritz (1977) observed *C. derbianus* to be most active during the middle of the dark period, whereas Hunsaker and Shupe (1977) found the greatest activity periods just before and after the illumination period. They also found the species to spend 86% of its time inactive and 14% active when maintained on a cycle of 13.5 L:10.5 D. Food deprivation caused a doubling of the activity level, and 48 h of constant illumination resulted in a 40% decrease in activity. The animal sleeps in a curled position with its tail placed in a complete circle about its body (Hall and Dalquest, 1963; Bucher, unpublished data).

Except for climbing material, special caging provisions are not necessary for laboratory maintenance (Collins, 1973; Bucher and Fritz, 1977). Barnes (in Collins, 1973) bred *Caluromys* in 1.8 × 1.2 × 3.0 m (6.48 m^3) cages. Hunsaker and Shupe (1977) used breeding cages measuring 2 × 2 × 3 m. Elevated temperature (23 to 26°C) and humidity (50 to 80%) were found to be beneficial in maintaining *Caluromys* (Collins 1973; Bucher and Fritz, 1977).

Complete breeding behavior has not been documented, but Collins (1973) and Hunsaker and Shupe (1977) stated that *C. derbianus* displayed an extensive precopulatory chase pattern that was apparently necessary for copulation to occur. Intromission has not been described. Bucher and Fritz (1977) noted courtship behavior in males only, and attributed the lack of female response to lack of environmental cues.

Caluromys derbianus uses its forefeet extensively for food manipulation and in facial grooming (Bucher, 1975; Hunsaker and Shupe, 1977). After eating, the forepaws are licked, then brought behind the ears and drawn anteriorly down the snout. This is repeated several times by one or both feet. The forefeet are also used to groom the ventral and lateral sides; the distal portion of the tail is also held and licked (Bucher, 1975).

Caluromys derbianus always uses symmetrical gaits in locomotion; a trot sequence is used most frequently (Bucher and Fritz, in litt.). The animal is a skillful climber and the tail is used extensively for balance and grip (Hall and Dalquest, 1963).

Defensive behavior was studied by Bucher (1975). A three-point stance is normally assumed with one forefoot raised. Gaping and baring of the teeth is also exhibited, and a hissing sound may be emitted. Prolonged disturbance causes the animal to leap and bite at the object, but reaction is strictly defensive, and the animal will retreat if given the opportunity. Hunsaker and Shupe (1977) described agonistic vocalizations in *C. derbianus* and provided a spectrogram. These consist of squeals with dominant frequency between 4 and 6 kHz, lasting about 0.5 s; they are observed in both sexes and in juveniles.

GENETICS. Biggers et al. (1965), Legator et al. (1966), and Mickey (1969) have studied the chromosomes of *C. derbianus*. The autosomes consist of three pairs of large submetacentrics, one pair of medium-size metacentrics, and two pairs of medium subtelocentric or acrocentric (2n = 14, with a total of 20–24 autosomal arms, depending on the interpretation of the smallest autosome). The sex chromosomes are a small acrocentric X, and a very small telocentric Y. Legator et al. (1966) reported a mitotic index of 3.3% for *C. derbianus*.

REMARKS. Rieg (1955) interpreted osteological evidence as showing that *Caluromys* is an extant member of the subfamily Microbiotherinae. Kirsch (1977*b*) recently used serological evidence to demonstrate that *Caluromys* is not a microbiothere, but instead represents a distinctive line of didelphid evolution. He thus erected a new subfamily, Caluromyinae. Other evidence for separating *Caluromys* from the didelphines is their unique pairing of spermatozoa (Biggers and DeLamater, 1965) and structure of the urogenital tract (see Form) (Hill and Fraser, 1925; Biggers 1966). The genera *Caluromysiops* and *Glironia* are probably closely related to *Caluromys*.

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