

*Xerus princeps*. By Jane M. Waterman and Matthew D. Herron

Published 15 December 2004 by the American Society of Mammalogists

*Xerus princeps* (Thomas, 1929)

Mountain Ground Squirrel

*Geosciurus princeps* Thomas, 1929:106. Type locality “Otjitundua, Central Kaokoveld, Namibia, Africa.”

*Geosciurus inauris princeps*: Allen, 1939:294. Demotion to subspecies.

*Xerus princeps*: Ellerman, 1940:422. First use of current name combination.

**CONTEXT AND CONTENT.** Order Rodentia, suborder Sciurognathi, family Sciuridae, subfamily Sciurinae, tribe Xerini, genus *Xerus*, subgenus *Geosciurus* (Moore 1959). *X. princeps* is monotypic (de Graaff 1981; Skinner and Smithers 1990).

**DIAGNOSIS.** *Xerus princeps* is similar to both *X. inauris* and *X. erythropus* in having lateral longitudinal body stripes (Fig. 1) but is sympatric only with *X. inauris*. *X. princeps* and *X. inauris* are almost identical in appearance, but hairs on the head and lateral hips are white-tipped in *X. princeps* versus evenly colored along their length in *X. inauris*, resulting in a more grizzled appearance in *X. princeps* (de Graaff 1981). Tail hairs are white with 3 black bands in *X. princeps* as opposed to 2 in *X. inauris* (Thomas 1929). Incisors are yellow to orange in *X. princeps*, not white as in *X. inauris* (Herzig-Straschil et al. 1991; Thomas 1929). Ossa nasalia of *X. princeps* are significantly narrower (mean = 7.8 mm  $\pm$  0.28 SD,  $n$  = 22) than those of *X. inauris* (9.0  $\pm$  0.71 mm,  $n$  = 157) and do not widen in the anterior area (Herzig-Straschil et al. 1991; Thomas 1929; Fig. 2). Skulls of *X. princeps* ( $n$  = 22) are significantly larger than those of *X. inauris* ( $n$  = 157) in condylobasal length (54.6 mm  $\pm$  1.38 SD versus 53.1  $\pm$  1.82 mm), occipitonasal length (58.2  $\pm$  1.53 versus 56.4  $\pm$  1.99 mm), interorbital width (17.9  $\pm$  0.83 versus 17.0  $\pm$  0.86 mm), postorbital width (22.5  $\pm$  0.39 versus 21.4  $\pm$  0.84 mm), and incisor thickness (3.9  $\pm$  0.26 versus 3.6  $\pm$  0.23 mm—Herzig-Straschil et al. 1991). Ratio of orbital diameter to the occipitonasal length (less than one-third in *X. inauris*; more than one-third in *X. princeps*) has been used as a discriminating feature; however, this distinction was not supported in a detailed comparison of the skulls of the 2 species (Herzig-Straschil et al. 1991). *X. princeps* is heavier (612.4 g  $\pm$  94.8 SD,  $n$  = 7) than *X. inauris* (523.8  $\pm$  50.7 g,  $n$  = 7—Haim et al. 1987).

**GENERAL CHARACTERS.** *Xerus princeps* is large-bodied compared with other African sciurids. Average length of head and body is 248 mm ( $n$  = 10—de Graaff 1981). In addition to average mass reported by Haim et al. (1987), individual body masses of 528 and 665 g have been reported for 2 males (Skinner and Smithers 1990). On the basis of specimens from the State Museum of Namibia and privately collected live specimens (J. M. Waterman, in litt.), average body mass is 636 g (range 490–710 g,  $n$  = 11). Sexual dimorphism is slight (de Graaff 1981; Herzig-Straschil et al. 1991). Ranges of external measurements (in mm) are: length of head and body, 225–290 ( $n$  = 38); length of tail, 210–282 ( $n$  = 39); length of hind foot, 62–71 ( $n$  = 40); length of ear, 13–15 ( $n$  = 35—de Graaff 1981; Shortridge 1934).

Ranges of cranial measurements of 22 adult specimens (in mm) are: greatest length of skull, 54.6–61.4; condylobasal length, 51.4–57.0; zygomatic width, 33.4–37.1; interorbital width, 16.2–19.2; orbital width, 15.2–17.5; postorbital width, 21.8–23.1; nasalia width, 7.2–8.4; length of mandible, 33.5–39.1; length of maxillary toothrow, 10.3–11.9; length of mandibular toothrow, 11.5–12.9; incisor thickness, 3.4–4.4 (Herzig-Straschil et al. 1991).

Dorsal pelage is pale cinnamon brown, and ventral portions of limbs and belly are white. Body is covered in short hair, with no underfur, and skin is black. Eyes are prominent with dull white

lines around them, and front of face is white. A white lateral stripe extends from shoulders to hips. Pinnae are small.

**DISTRIBUTION.** Over 90% of the range of *X. princeps* is within Namibia (Griffin 1999). *X. princeps* is restricted to the southwest arid region along the narrow band of the western escarpment that runs from southern Namibia north into southern Angola (Fig. 3). Populations south of Berseba, Namibia, were 1st described by Herzig-Straschil and Herzig (1989). *X. princeps* in Richtersveld National Park, South Africa, might represent a range expansion or the 1st report of previously existing populations (Hanks 2003). *X. princeps* has been reported as far north as Mucungu, Angola (14°50'S, 12°25'E—Hill and Carter 1941). Although burrows of *X. princeps* can be found within 200 m of burrows of *X. inauris* in areas of sympatry, the 2 species are separated by habitat and behavior (Haim et al. 1987; Herzig-Straschil and Herzig 1989).

**FOSSIL RECORD.** *Xerus* fossils have been recorded in Tanzania (Laetoli, 3.7–3.5 million years ago—Dietrich 1942), Kenya (Kanapoi, 4.1 million years ago—Winkler 1998), and Ethiopia (Omo Shungura, ca. 3.1–2.6 million years ago—Jaeger and Wesselman 1976; Sabatier 1979; Taieb et al. 1976). Only 1 fossil xerine has been found in southern Africa, and this has been referred to *Xerus* cf. *inauris* (Denys 1990). No fossils of *X. princeps* are known.

**FORM AND FUNCTION.** Dental formula is  $i\ 1/1, c\ 0/0, p\ 1/1, m\ 3/3$ , total 20. Tail is used as a thermal shade; in heat of day, *X. princeps* keeps to shade of bushes, trees, and rocks (Herzig-Straschil and Herzig 1989). *X. princeps* is well adapted to high ambient temperatures (Haim et al. 1987), has a thermoneutral zone of 32–35°C, and becomes hyperthermic at 35°C (Haim et al. 1987). Salivation was observed at 38°C. The metabolic rate in the thermoneutral zone was 0.565 ml O<sub>2</sub> g<sup>-1</sup> h<sup>-1</sup>  $\pm$  0.10 SD, with a rectal temperature between 37.6 and 38.7°C. Thermal conductance was 0.084 ml O<sub>2</sub> g<sup>-1</sup> h<sup>-1</sup> °C<sup>-1</sup>  $\pm$  0.005 SD. This high conductance is a great advantage for heat dissipation and water conservation. Feces of *X. princeps* are significantly drier (14.21%  $\pm$  4.2 SD moisture content) than those of *X. inauris* (Haim et al. 1987).

**ONTOGENY AND REPRODUCTION.** No juveniles (<8 weeks of age) have been observed during summer (November–January—Herzig-Straschil and Herzig 1989). Gestation is ca. 42–49 days and litter size is 1–3 (Herzig-Straschil and Herzig 1989). Eyes open within 21 days of birth (Herzig-Straschil and Herzig 1989).



FIG. 1. Adult *Xerus princeps* from Namibia. Photograph by Jane M. Waterman.

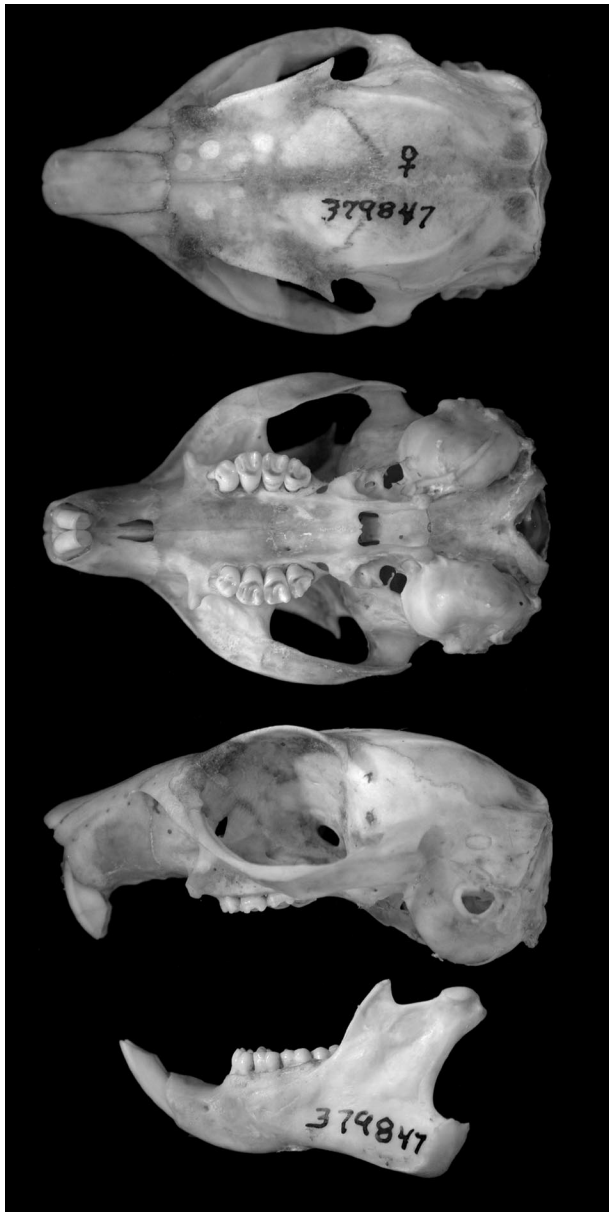


FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Xerus princeps* from Warmbad, Namibia (adult female, National Museum of Natural History, USMN 379847). Greatest length of cranium is 57.8 mm. Photograph by Chad Schennum.

**ECOLOGY AND BEHAVIOR.** *Xerus princeps* inhabits rocky, hilly ground in an arid area where annual rainfall ranges from ca. 125 to 250 mm (Herzig-Straschil and Herzig 1989). Mountain ground squirrels prefer to burrow in gravel and rocks in areas with single trees or sparse bush cover, and burrow entrances are usually under piles of rocks or boulders. Burrow openings are also under concrete platforms at water pumps. Burrows rarely occur in sandy soils, but can occasionally be found on the plains, where the burrow entrances are similar to those built by *X. inauris* (Herzig-Straschil and Herzig 1989; Roberts 1951). Low mounds of material removed during excavation are associated with most burrow entrances. Burrow systems are simple when compared with those of *X. inauris*, with only 2–5 openings and a single nest chamber (Herzig-Straschil and Herzig 1989). Floor of nest chamber was 67 cm below the ground. Burrow temperatures (60–100 cm inside burrow and 27–50 cm below surface) in the summer averaged 24.6°C at night (when average ambient temperature was 9.7°C) and 31.5°C in the day (when average ambient temperature was 37.5°C). Inhabited burrow systems were usually located more than 100 m apart,

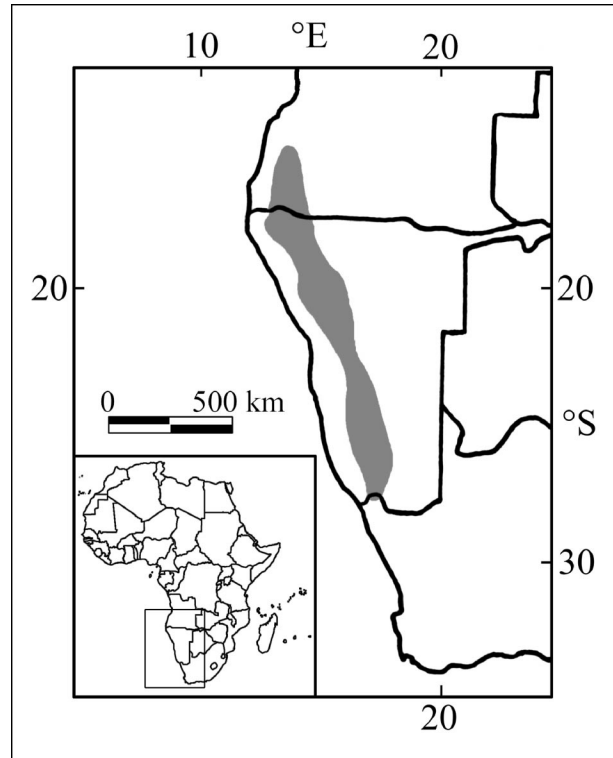


FIG. 3. Distribution of *Xerus princeps* in Africa.

although sometimes as little as 80 m (Herzig-Straschil and Herzig 1989).

*Xerus princeps* is strictly diurnal, arising in summer at 0655–0750 h and returning to the sleeping burrow at 1805–1915 h. Mountain ground squirrels avoid exceptional heat or heavy rain by leaving the burrow later or returning to it earlier (Herzig-Straschil and Herzig 1989). When disturbed, they take refuge in the nearest site, either behind rocks, under bushes, or in nearby burrows. They do not run directly back to their home burrow and often move up to 1 km from their sleeping burrow (Herzig-Straschil and Herzig 1989). After initial emergence from the burrow in the morning, they spend time grooming and, in winter, sitting in the sun. After 10–15 min, they move away from the sleeping burrow to begin feeding. *X. princeps* feeds on the base of grass stems and roots. In the mopane savanna, animals were observed climbing mopane trees (*Colophospermum mopane*) to feed on leaves and plant lice (*Copaiifera mopane*—Herzig-Straschil and Herzig 1989).

*Xerus princeps* lives either solitarily or in small family groups (mothers and young) of 2–4 individuals (Haim et al. 1987; Herzig-Straschil and Herzig 1989). Adult males were associated with 2 of 7 female groups, but otherwise males were solitary (Herzig-Straschil and Herzig 1989). No allogrooming, playing, or other cohesive behaviors have been observed, and social contacts were rare (Herzig-Straschil and Herzig 1989). The pulcid flea *Ctenocephalides conatus* has been recorded on *X. princeps* (Zumpt 1966).

**GENETICS.** The diploid number is 38 (Robinson et al. 1986). The autosomal karyotype comprises 7 metacentrics, 9 submetacentrics, and 2 acrocentrics with distinct satellites. The X chromosome is submetacentric and constitutes 5.03% of the genome, and the Y chromosome is metacentric and constitutes 2.21%. The major difference between the karyotypes of *X. princeps* and *X. inauris* is the centromeric region of autosomal pair 5, which is Giemsa-positive following G-banding in *X. inauris* but is Giemsa-negative in *X. princeps*. This difference is caused by distinct pericentromeric heterochromatin in pair 5 of *X. princeps* (Robinson et al. 1986).

**CONSERVATION STATUS.** *Xerus princeps* is uncommon and confined to a limited range, but it is not considered an endangered species (Griffin 1999).

**REMARKS.** Whether *X. princeps* is specifically distinct from *X. inauris* was controversial (de Graaff 1981; Skinner and Smithers 1990), but differences in morphology (Herzig-Straschil et al. 1991), chromosomal traits (Robinson et al. 1986), physiology (Haim et al. 1987), and general ecology (Herzig-Straschil and Herzig 1989) as well as their sympatric occurrence, confirm the distinction.

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Associate editors of this account were GAIL MICHENER, PAMELA OWEN, and KRIS HELLGREN. Editor was VIRGINIA HAYSSEN.

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