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Eremitalpa granti.

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Eremitalpa Roberts, 1924

Eremitalpa Roberts, 1924:63. Type species *Chrysochloris granti* Broom.

CONTEXT AND CONTENT. Order Insectivora, Family Chrysochloridae. The genus *Eremitalpa* includes only one extant species, *Eremitalpa granti.* Generic relationships are uncertain and have been treated in markedly divergent fashion by most authors (Allen, 1939; Ellerman et al., 1953; Roberts, 1951).

DIAGNOSIS. Possesses 40 teeth, lower back teeth without posterior talonids and no temporal bulla. Skull extraordinarily broad in proportion to length, cephalic index 85–90. *Eremitalpa* is the only chrysochlorid genus with a well-developed fourth claw of the fore foot.

Eremitalpa granti (Broom, 1907)

Grant's Golden Mole

Chrysochloris granti Broom, 1907:265. Type locality "Garies, south of Kamiesberg, southern Little Namaqualand, northwestern Cape Province, South Africa."

Eremitalpa granti cana Broom, 1950:240. Type locality "Lambert's Bay, west of Clanwilliam, Western Cape Province, South Africa."

Eremitalpa granti namibensis Bauer and Niethammer, 1959:241. Type locality "Sossusvlei, central Namib Desert, Namibia."

CONTEXT AND CONTENT. Context as for genus. Meester et al. (1986) listed two subspecies: *E. g. granti* from Little Namaqualand and southwestern Cape Province and *E. g. namibensis* from the Namib Desert, Namibia. Subspecies recognition rests on skull dimensions (breadth/length index) and hair length, with *E. g. namibensis* having shorter, broader skulls and shorter hair than *E. g. granti* (Meester, 1964). *E. g. granti* includes *E. g. cana* of earlier authors (Meester, 1964).

E. g. granti (Broom, 1907:265), see above.
E. g. namibensis Bauer and Niethammer, 1959:241, see above.

DIAGNOSIS. The front foot differs from all other species in having a well-developed, fourth claw. The first, second, and fourth claws are broader than in all other species (Roberts, 1951). On the hind foot is a thickened pad in front of the heel which is not found in other species (Roberts, 1951). The skull is similar to that of *Chrysochloris asiatica* but is smaller, broader, and has no temporal bullae (Roberts, 1951). Skull length is <20.6 mm, width is 16.0–18.2 mm, and width to length ratio is 85–90% (Meester et al., 1986). *Eremitalpa granti* can further be distinguished from *C. asiatica* on the basis of dentition (Roberts, 1951). In *E. granti* the first premolar is single-rooted.

GENERAL CHARACTERISTICS. *Eremitalpa granti* is the smallest species within the Chrysochloridae (Smithers, 1983; Fig. 1), and some degree of sexual dimorphism is evident with males larger. Mean body mass (in g), length of head and body (in mm), and length of hind foot (in mm) are 25.3, 73.5, and 7.9 for males ($n = 17$) and 19.8, 66.8, and 6.9 for females ($n = 23$), respectively (Fielden, 1989). Upper parts are pale grayish yellow with an iridescent, silvery sheen; flanks and under parts are paler than upper parts with a slightly more intense yellow tinge (Skinner and Smithers, 1990).

Rhinarium terminates in a hard leathery pad, which protects nostrils and assists in sand excavation. Mouth is ventral. Nose possesses specialized features to prevent sand entering nasal tracts (Nolte, 1968). Lacking pinnae, external ear opening is concealed by hair that prevents sand from entering auditory canals (Broom, 1950; Findlay, 1944; Nolte, 1968). Epitympanic recess is very large and houses a disproportionately large head of the malleus (Fig. 2), suggesting that *E. granti* is particularly sensitive to vibrations. Testes are abdominal and penis is located within the cloaca (Fielden, 1989). One pair of thoracic and one pair of inguinal mammae are present in chrysochlorids (Dobson, 1882; Kuyper, 1985), but only inguinal mammae occur in some specimens of *E. granti* (Fielden, 1989).

DISTRIBUTION. Desert golden moles occur from St. Helena Bay in Western Cape Province of South Africa (Fig. 3), northwards to Walvis Bay in Namibia (Skinner and Smithers, 1990). *E. g. granti* is found south of St. Helena Bay to Port Nolloth (Meester et al., 1986; Roberts, 1951), whereas *E. g. namibensis* occurs north of the Orange River in the Namib Desert but south of the Kuiseb River (Coetzee, 1969; Meester et al., 1986; Stuart, 1975). In the late 1950s and early 1960s the first specimens of *E. g. namibensis* were collected from owl pellets at Sossusvlei (Bauer and Niethammer, 1959) and Natab (Meester, 1962) in Namibia. The first live specimen was captured in 1963 near Gobabeb in the Namib Desert (Haake, 1963). No fossils of *E. granti* are known.

FORM. Body shape is fusiform, but dorsoventrally flattened, and without an external tail (Fig. 1; Fielden, 1989). Limbs are short and medially situated beneath body. Foreclaws on first, second, and third digits are extremely long, broad, and hollow ventrally, as an adaptation to burrowing in loose sand (Smithers, 1983). Functional morphology of the musculoskeletal system of *E. g. namibensis* does

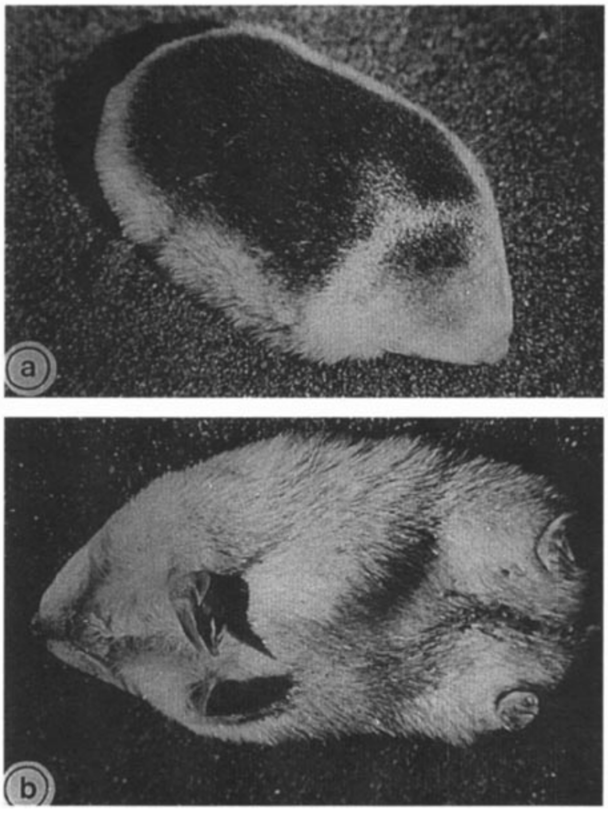

FIG. 1. Dorsal (a) and ventral (b) views of *Eremitalpa granti.*

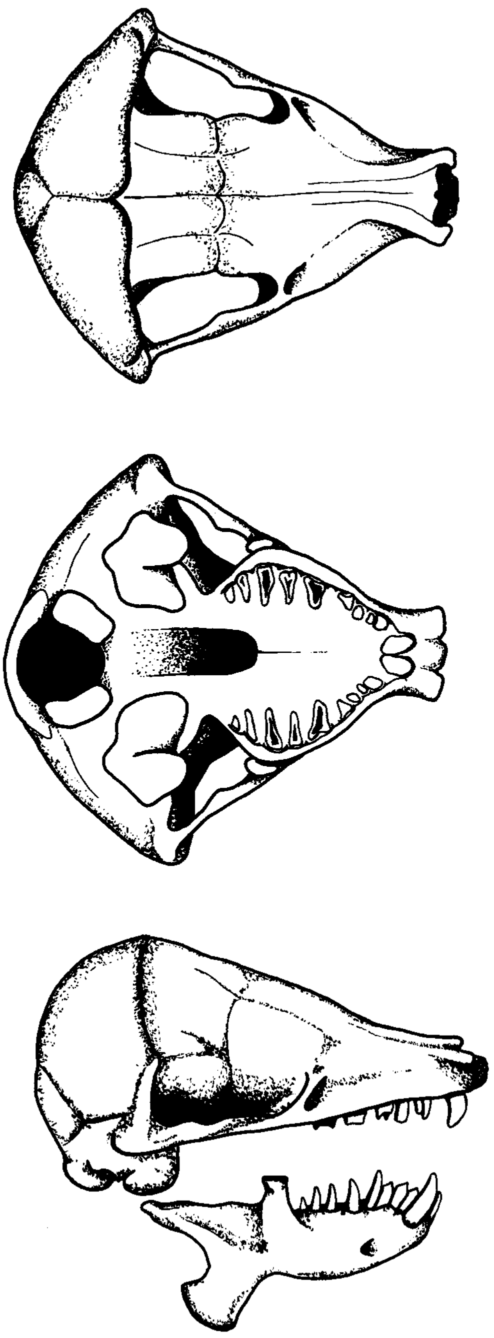

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Eremitalpa granti.* Greatest length of cranium is 20.6 mm.

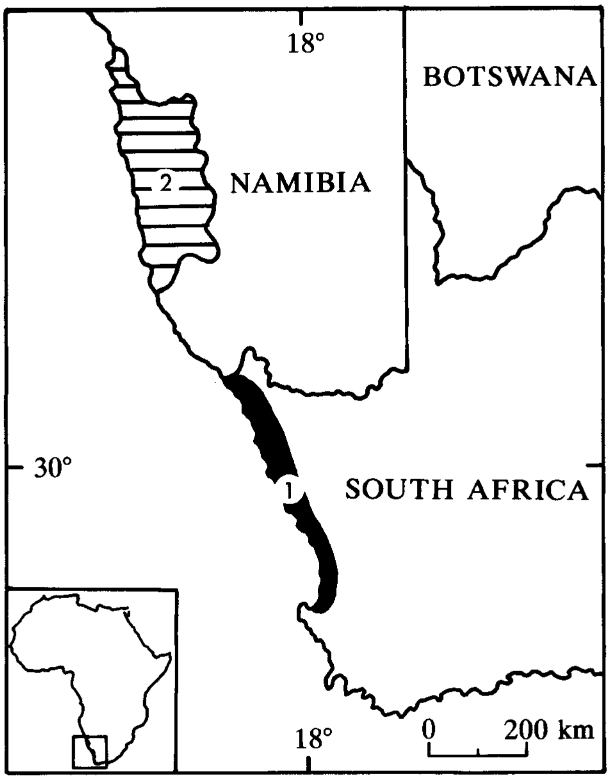

FIG. 3. Distribution of *Eremitalpa granti.* Subspecies are as follows: 1. *E. granti,* 2. *E. g. namibensis.*

not depart significantly from other chrysochlorids (Gasc et al., 1985). Rather, the strikingly modified locomotory system, which facilitates parasagittal head-and-forelimb digging, is well adapted for digging in loose sand of dune ecosystems.

Eremitalpa granti is blind and eyes are not visible externally, although a rudiment embedded in connective tissue can be seen beneath the skin. Eye structure of *E. granti* closely resembles that of *Amblysomus hottentotus* and *C. asiatica* (Gubbay, 1956; Sweet, 1909). In all three species, the retina is well defined, but the iris, lens, and optic nerve are degenerate and eye muscles are absent. Dental formula is i 3/3, c 1/1, p 3/3, m 3/3, total 40 (Meester, 1964).

FUNCTION. Body temperatures is quite labile and varies with ambient temperature. Moles caught in summer (November–April) have significantly higher body temperature (mean ± *SD,* 29.7 ± 3.5°C) than those caught in winter (21.1 ± 3.5°C). A strong, positive, linear correlation exists between body temperature and ambient sand temperature at depths where moles were located. Body temperatures are on average 0.7°C higher than the sand and fluctuate with ambient temperature from 18.1 to 31.6°C over 24 hours (Fielden et al., 1990*a*). For Grant's golden moles out of sand, basal metabolic rate measured at thermoneutrality (31°C) is, in terms of oxygen consumption, 0.52 ml g^{-1} h^{-1}; in sand the thermoneutral zone is 31–36°C.

Both in and out of sand, wet thermal conductance varies widely at different ambient temperatures due to variable body temperatures (Fielden et al., 1990*b*; Seymour et al., 1998) and heart rate (McNab, 1980). Generally, at an ambient temperature of 31°C, thermal conductance is higher in sand (mean ± *SD,* in terms of oxygen consumption, 0.42 cm^3 g^{-1} h^{-1} °C^{-1} ± 0.16; $n = 7$) than out of sand (0.17 cm^3 g^{-1} h^{-1} °C^{-1} ± 0.06; $n = 6$). Four of five moles tested usually selected sand temperatures between 31 and 38°C for resting, and the preferred temperature was ca. 32.4°C. Rate of food (mealworm, *Tenebrio molitor*) consumption is low (15% body mass day^{-1}), and energy expenditure both under laboratory and field conditions is much less than predicted from body mass (Fielden et al., 1990*b*; Seymour et al., 1998). These unusual thermoregulatory characteristics of *E. granti,* including a high thermal conductance, low basal metabolic rate, and a low and labile body temperature, result in poor ability to thermoregulate.

Avenues of water loss are pulmocutaneous (76%), fecal (14%), and urinary (11%); urine osmolality is 3.82 osmol/kg (Fielden et al., 1990*b*). Ratio of energy to water turnover is 0.10 ml/kJ. *E. g. namibensis* possesses a simple kidney (Sperber, 1944), with elongate papilla reni extending well down into the ureter. Relative medullary area ratio is 1.64. Mean isotopically-determined water turnover in the field (ranges from 1.73 to 2.27 ml day^{-1}) is significantly lower than that determined gravimetrically (3.15 ml day^{-1}) for animals maintained in the laboratory (Fielden et al., 1990*b*; Seymour et al., 1998).

ONTOGENY AND REPRODUCTION. Two pregnant females, each with a single, near full-term fetus, were taken in October (Holm, 1969). Placentation (Gabie, 1960) and embryology of *E. granti* (Broom, 1943; Gabie, 1959; Van der Horst, 1946) show that early development of Grant's golden mole conforms to that of other eutherians.

ECOLOGY. *Eremitalpa g. namibensis* uses dune base, dune slope, and occasionally dune-crest and sandy-river-bed habitats within the Namib Desert (Fielden, 1989). Gravel plains and stony interdune valleys are avoided.

Eremitalpa namibensis consumes a wide variety of predominantly sand-dwelling invertebrates. Isopterans (*Psammotermes allocercus silvestri*) constitute >50% of the diet, while coleopteran larvae representing many tenebrionid species are the second most important prey (Fielden et al., 1990*c*). Remaining dietary components include insect larvae (Araneida, Coleoptera, Formicidae, Skincidae, and Thysanura), all of which are taken infrequently, and each contributes <5% of total volume. *Eremitalpa g. namibensis* is common prey of the African spotted eagle owl (*Bubo africanus*) and barn owl (*Tyto alba*—Nel, 1969; Skinner et al., 1980; Tilson and Le Roux, 1983).

Population densities of moles are estimated at 0.014–1.19 ha^{-1}, based on accurate sand-tracking data in one study area over a 10-year period and on home-range estimates (Fielden, 1991; Seymour et al., 1998). The large variation in density of animals results from differences in prey abundance over a 10-year cycle (Seymour et al., 1998). Mean home-range area is 4.63 ha ($n = 8$) and home ranges of males (3.10–12.30 ha) are generally larger than those of females (1.80–4.59 ha). Home ranges have considerable spatial overlap, but the extent of temporal overlap has not been quantified. Two animals were found again within 100 m of their initial capture point after two years. Based on body mass (Lindstedt et al., 1986; Mace et al., 1983), *E. g. namibensis* would be expected to have a home range smaller than those of other subterranean insectivores; however, its home range is several times larger (Kuyper, 1985; Stone and Gorman, 1985).

BEHAVIOR. Grant's golden moles are solitary and confined to relatively constant home ranges. They show a strong fidelity to their home range but do not necessarily have exclusive use of them. However, movements of moles monitored over 3 consecutive days showed discrete centers of activity for each individual with little evidence of any direct encounters with neighboring conspecifics (Fielden, 1991).

Excavations of numerous rest sites (>100) revealed no evidence of nest material, permanent burrows, chambers, or tunnel construction (Fielden, 1991). For 88 recorded rest-site positions, 82% were located beneath plant hummocks and only 12% were in areas of sand lacking vegetation. Rest-site sharing between two or more individuals has never been observed and instances of return to a previous rest site by the same individual were rare (3 in 389 observations).

Grant's golden moles have a distinct nocturnal pattern of locomotory activity (Fielden et al., 1992). In winter, most activity occurs between sunset and midnight. In summer, activity continues from sunset to sunrise. Rare daytime activity always includes subsurface sandswimming (shallow subterranean movement using lateral rather than dorsoventral articulation with the fore limbs providing most propulsion). Surface locomotion is prevalent at night at ambient temperatures between 16 and 32°C.

Differences in prey dispersion influence foraging tactics and pathways of *E. g. namibensis.* Grant's golden moles forage on the sand at night but occasionally dip beneath the surface to sense the presence of prey. Because moles favor termite prey that are sessile, subterranean, and patchily distributed, their foraging behavior is effective in encountering such patches and minimizing energetic costs of travelling between patches (Fielden et al., 1990*c*). Restriction on occurrence of large turns when foraging and a tendency for left and right turns to alternate effectively moves *E. g. namibensis* into unsearched areas. The strong onward-going nature of foraging paths and the observation that plants (and associated termites) within a meter are often bypassed indicate that encounters with patches are purely stochastic events and that Grant's golden moles detect patches only over short distances. Once a termite patch is encountered, distance moved between dips (brief subterranean pauses during which surroundings are monitored) shortens and effectively keeps *E. g. namibensis* in the patches. Often, Grant's golden moles switch from surface movement to sandswimming behavior in a small area when prey is abundant (Fielden et al., 1990*c*). Grant's golden moles may move up to 2300 m during a night (Seymour et al., 1998).

REMARKS. The generic name can be traced to the French *eremite* meaning a recluse or someone who lives in the desert while *talpe* means mole. *Eremitalpa granti* was named after Captain C. H. B. Grant, Honorable Associate of the Zoological Department, British Museum, London. Grant collected zoological material in southern Africa and with C. W. Mackworth Praed coauthored several books on African birds (Skinner and Smithers, 1990).

Bauer and Niethammer (1959) tentatively suggest that *E. g. namibsensis* might be the form described as *Chrysochloris damarensis* Ogilby, 1838; but Meester (1964) has shown this is unlikely. Since that time Meester rediscovered the type *damarensis* in the British Museum (Natural History) collections and confirmed that it belonged to the genus *Chrysochloris.*

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