Spermophilus spilosoma Bennett, 1833

Spotted Ground Squirrel

Spermophilus spilosoma Bennett, 1833:334. Type locality restricted to Durango, Durango, by Howell, 1938:122; lectotype designated by Thomas, 1927:548.


Spermophilus canescens Merriam, 1890:38. Type locality Wilcox, Cochise Co., Arizona.


CONTEXT AND CONTENT. Order Rodentia, Family Sciuridae. The genus includes at least 21 species. There are 14 New World species; seven species are restricted to Eurasia. In North America, Howell (1938) recognized eight subgenera, with S. spilosoma assigned to Leptomys. Twelve living subspecies of S. spilosoma are recognized (Howell 1938; Dalquest, 1951; Hoffmeister, 1959; Anderson, 1972) as follows:

S. s. spilosoma Bennett, 1833:40, see above.
S. s. obsoletus Kennicott, 1863:157, see above.
S. s. canescens Merriam, 1890:38, see above (macroptilus Merriam, microptilus Elliot, and avenis Bailey are synonyms).
S. s. cryptopsilus Merriam, 1890:57, see above.
S. s. pratensis Merriam, 1890:55. Type locality north base of San Francisco Mountain, Coconino Co., Arizona (obsidianus Merriam a synonym).
S. s. annectens Merriam 1893:132. Type locality “The Tanks,” 12 miles from Point Isabel, Padre Island, Texas.
S. s. marginatus Bailey, 1902:118. Type locality Alpine, Brewster Co., Texas (major Merriam a synonym).
S. s. pallascens (A. H. Howell, 1928:212). Type locality LaVentura, Coahuila.
S. s. cabrerae (Dalquest, 1953:106). Type locality 10 km NNW Nuhe, San Luis Potosi.
S. s. ammophilis Hoffmeister, 1959:37. Type locality 9 km N Samalayauc, Chihuahua.
S. s. altiplanensis Anderson 1972:275. Type locality 5 km ESE Lajunta, Chihuahua.
S. s. basiventeris Anderson 1972:276. Type locality 3 km SW San José Babicora, Chihuahua.

DIAGNOSIS. Spermophilus spilosoma is a small ground squirrel with white non-linear dorsal spots, and white underparts. Measurements (in mm) range as follows: total length 185 to 253, tail 55 to 92, hind foot 28 to 30, greatest length of skull 34.1 to 42.7 (Howell, 1938; Hall and Kelson, 1959). In members of the subgenus Leptomys the metapoph on P4 is not continuous. The molars are hypsodont, with the parastyle ridge on M1 and M2 joining the protocone with an abrupt change of direction.

The three other species in the subgenus Leptomys can be distinguished from S. spilosoma as follows: S. tridecemlineatus has pronounced dorsal striping alternating with longitudinal rows of spots; S. mexicanus possesses dorsal spots arranged in linear series; S. perutensis has buff-colored underparts, and either lacks dorsal spots or the spots are buff in color.

GENERAL CHARACTERS. Hall and Kelson (1959) described S. spilosoma as follows: “Upper parts drab, cinnamon drab, avellaneous, smoke gray, fawn, wood brown, snuff brown, or verona brown, more or less spotted with squarish white spots; tail above usually resembling back but having fuscous black at tip; tail beneath some shade of cinnamon.” Anderson (1972) noted much color variation in this species in Chihuahua and we have noted in Mariposa Co., the variation is not unusual in other areas with variegated substrates. The skull resembles that of S. tridecemlineatus, but as noted by Hall and Kelson (1959) is “relatively broader, especially in rostral and interorbital region; auditory bullae much larger.”

Average skull measurements (in mm) taken from the seven subspecies listed by Howell (1938) are: greatest length 17.6, zygomatic breadth 23.4, cranial breadth 18.2, interorbital breadth 8.4, postorbital constriction 13.6, length of nasals 13.5, and maxillary toothrow 8.0. See Howell (1938) for a more detailed morphological comparison of the subspecies of S. spilosoma. The skull is illustrated in Figure 1.

DISTRIBUTION. The species ranges from south-central South Dakota, through the sandhills of Nebraska, and into southeastern Wyoming; it also occurs throughout eastern Colorado, northwestern Oklahoma, western Kansas, western Texas, most of New Mexico, the southeastern corner of Utah, and eastern Arizona, south to central Mexico (Moore, 1930; Davis and Robertson, 1944; Cockrum, 1952; DeWitt, 1957; Hall and Kelson, 1959; Jones, 1968; Maxwell and Brown, 1968; Armstrong, 1972; Findley et al., 1975). Figure 2 shows the distribution of the 12 subspecies of S. spilosoma.

FOSSIL RECORD. Harris and Findley (1964) reported that fossils of S. spilosoma occur together with fossil Cynomys gymnisoni. Dalquest (1967) discovered 18 isolated complete and partial S. spilosoma teeth from the Pleistocene Slaton local fauna of Texas. Beyond these two sites, fossil evidence of the species is lacking.

FORM AND FUNCTION. Spermophilus spilosoma has two distinct pelages and molts each year. Adults emerge from hibernation in winter pelage and undergo molt by late May in New Mexico and Colorado (Sumrell 1949; Streubelt 1975). The autumn molt is not conspicuous in the adults, being more noticeable in juveniles. Generally, the pelage of adults is paler than the juvenile pelage (Sumrell 1949). Blair (1941) reported on pelage differences between two populations of S. s. major in New Mexico. He observed that a population from the White Sands National Monu.
ment had a significantly paler color with larger, more distinct spots than did another population living on relatively dark soil only 15 miles distant.

Harris (1965) presented an interesting discussion on size relationships of ground squirrels from the Chaco Basin of New Mexico with animals from other parts of the state. He suggested that the small size of the Chaco animals indicates a separation from adjacent populations some 4,000 years ago.

Hudson and Deavers (1973) studied physiological adaptations of eight species of ground squirrels from different environments. They classified S. spiloosa as a high desert species. Their observations indicated these animals: 1) have a low pulmotonesus rate of water loss, 2) have a high level of conductance irrespective of body weight, 3) can decrease conductance and increase insulation at high ambient air temperatures, and 4) have a basal metabolism about 60% of that expected from standard metabolic equations.

REPRODUCTION AND ONGENY. The gestation period for S. spiloosa has not been documented, although Sumrell (1949) had a pregnant female in captivity for 24 days prior to parturition. Gestation in S. tridecemlineatus is reported to be 27 to 28 days (Bridgewater, 1960). The spotted ground squirrel probably has a similar gestation period.

Streubel (1975) analyzed the breeding season of S. s. obsolatus in Colorado based on behavioral observations and the presence of mature sperm in the testes and epididymides of males. Breeding began in mid-April, two to three weeks after emergence from hibernation. Most males were still capable of breeding through June, but by mid-July their breeding season ended. Sumrell (1949) observed that males of S. s. marginatus in New Mexico had descended testes by mid-April and that the testes were abdominal by the first of August.

In Colorado, Streubel (1975) collected pregnant females between 11 May and 24 July. Weights of female reproductive tracts and behavioral observations indicated that most breeding occurred in May and June but that some occurred in early July. The extended breeding season seems to result from later breeding on the part of yearling females. Sumrell (1949) reported females in New Mexico with open vulvas from late April through mid-May.

Numerous authors (Bailey, 1983; Rinker, 1942; Davis and Robertson, 1944; Cockrum, 1963; Jones, 1966) have suggested that S. spiloosa is diestrous in the southern part of its range. Streubel (1975) in Colorado found no evidence the animals were diestrous and suggested that such reports could be based on observations of yearling females that conceived late in the season.

Litter sizes reported for S. spiloosa are: 6.6 (range four to 11) in New Mexico (Sumrell, 1949), five to 12 in Kansas (Cockrum, 1962), 7.0 in Colorado (Burnett, 1924; Streubel 1975) and five to eight for the species in general (Anderson, 1964).

The development of young S. spiloosa was studied by Blair (1942), Sumrell (1949) and Streubel (1975). In early development, the weight gained by juveniles compared closely to gains reported in other ground squirrels by Neal (1965) and Clark (1970). Streubel (1975) found that juveniles weighed 40 to 50 g at the time of emergence from their nest burrows.

ECOLOGY. The spotted ground squirrel is generally found in areas with deep sandy soils and sparse vegetation (Cookrum, 1952; Hall and Keislo, 1959; Jones, 1966; Maxwell and Brown, 1968; Lechleitner, 1969; Green, 1969; and Armstrong, 1972). In Colorado, this ground squirrel is most abundant in the sand hills of the northeastern part of the state and along the eastern slopes in the southeast (Armstrong, 1972). McCampbell (1926) captured two S. spiloosa from abandoned prairie dog burrows south of Cortez, Colorado.

Hall (1952) related the distribution of S. spiloosa in Kansas to areas where the vegetation was sparse as a result of natural site factors or overgrazing. Spermophilus spiloosa is common in deflated sand along rivers in southwestern Kansas (Cookrum, 1952).

In Texas, S. spiloosa was reported in the desert scrub association consisting primarily of cresote (Larrea divaricata) and blackbrush (Flourensia cernua) by Davis and Robertson (1944). Sumrell (1949) in New Mexico, found spotted ground squirrel burrows predominately on short-grass mesas or along banks of Arizona. He also found the species inhabiting disturbed areas along highways where the soil consisted of gravelly sand with enough clay to hold the particles together. DeWitt (1957) characterized S. spiloosa in New Mexico as a mammal present on vast stretches of overgrazed sheep range and in sheep trails along river bottoms and foothills at altitudes from 1490 to 1770 m. He noted that S. spiloosa was found on mesa tops, alluvial slopes, arroyo banks and bottoms, on good black grama range, and on hummocky ground of the sand drift-shrub community. Findley et al. (1975) found the species to be "often conspicuous both visually and auditorily" in arid, often sandy, grasslands and deserts in New Mexico.

Moore (1930) collected two specimens at 2120 m elevation in Utah and noted that they preferred lighter soils for their burrows, and that burrow entrances were usually located under rocks.

In Nebraska, the species is characteristic of the Sand Hills where it occurs sympatrically with S. tridecemlineatus. However, S. spiloosa generally is found in drier habitats than is S. tridecemlineatus (Jones, 1964).

Maxwell and Brown (1968) captured S. spiloosa in southeastern Wyoming on three distinct community types—sand dunes, yucca-grass, and sage-grass. In all three communities the soil was sand to loamy sand, the height of the dominant vegetation exceeded 254 mm and more than 40% of the soil surface was bare. Some evidence indicates that S. spiloosa favors land that is heavily grazed. Green (1966) concluded that S. spiloosa to be most abundant on deep sand soils that were grazed heavily by cattle. Green found the species on ungrazed land only in June when the standing crop of grass was low. Streubel (1975) studied S. spiloosa in sympathy with S. tridecemlineatus on a heavily grazed area in which Dictischi stricta, Festuca ochloflora, and Bouteloua gracilis were the three primary grass species, and Artemisia filifolia was the primary woody plant. Vegetation was sparse (48.8% of the ground was void of vegetation). However, one of us (JPF) and his students have found good numbers of this species on lightly to moderately grazed areas of sand hills, where the vegetation consisted primarily of communities of Artemesia filifolia, Stipa comata, and Ambrosia trifida, or Artemesia filifolia, Helianthus sp., and Calocephalae longifolia.

Scant information is available on population density of S. spiloosa. McMurry (1947) estimated a population density of two to seven per ha in Oklahoma. Streubel (1975) captured and marked 38 S. spiloosa on a 10-ha study area (3.8 per ha) where the species occurred sympatrically with S. tridecemlineatus.

Streubel (1975) obtained data on ratios of males to females. In four litters born in captivity, the sex ratio at birth was 1:0.58 (N = 19). Trapped juveniles showed a sex ratio of 1:0.93 (N = 25), whereas the observed adult sex ratio was 1:0.71 (N = 156). Spermophilus spiloosa is apparently less carnivorous than is S. tridecemlineatus, being more dependent on seeds and green plant parts (Lechleitner, 1969). Sumrell (1949) observed spotted ground squirrels eating numerous plants and listed six plant species in order of their importance; Salolsa pestifer, Tribulus terrestrier, Orzyopsis hymenoidea, Curcubita foetissima, Thesperma megapotamicum, and Ergonom sp. Streubel (1975) observed that S. spiloosa relied heavily on seeds of Solanum rostratum, Mentzelia nudastrica, and Croton texensis early in spring. Green grass shoots became important as they appeared.
and in late May and June the flowers and seeds of Festuca octoflora and other grasses were utilized. This squirrel was observed feeding on beet larvae and it is believed that intergeneric competition was minimized by temporal differences in their annual cycles. Various events in the annual cycle of S. tridecemlineatus occurred two to four days later than they occurred in S. lasiurus and in spite of their coexistence in the same habitat, competition was minimal. Only 20 intergeneric encounters were observed in 150 hours of observation of the two species, indicative of the tolerance that existed between them.

Streubel (1975) calculated home ranges of the S. spatulata. In May and early June, during the breeding season, one male had a home range of 3.16 ha. In late June and early July, three males had home ranges of 1.02, 1.12, and 4.86 hectares.

Three gestating females had a mean home range size of 1.55 ha. Although actual copulation was never observed, sexual litters had emerged from the nest burrows, but before the young were weaned. Three other nonparous females had a mean home range size of 0.71 ha during the prehibernation period. The mean size of the home range for S. spatulata in this study was 1.31 ha.

Sumrell (1949) recorded three species of roundworms (Physaloptera sp., Rictulata sp., and Sabalula sp.) in S. spatulata. Additionally, Sumrell collected Thrasius pungens (Thrisias pungens), Echinophaga gallinaeae, a tick (Dermacentor parumapuntum), and biting lice, and Streubel (1975) collected numerous fleas (Thrisias festiva) from the species.

Bull snakes (Pituophis catenifer) may represent a major predator on S. spatulata in Colorado as Streubel (1975) observed these snakes crawling from burrow to burrow in the study area. Additional information has been obtained by Bueche, (Bueche and Bueche), which indicates the availability of a ground squirrel (species unknown) on the study area.

**BEHAVIOR.** Sumrell (1949) described some aspects of the behavior of S. spatulata. Streubel (1975) reported that foraging and feeding comprised about 66% of all activity above ground, aggression behavior 15%, other maintenance behavior (including grooming, nesting, resting in shade, sandbathing) 8%, investigative (non-foraging) behavior about 6%, and sexual and agonistic behavior less than 2% for males and less than 0.5% for females.

In the breeding season, the time spent in definite sexual and agonistic behavior was 5 to 7% for males and 2 to 2.5% for females. Although actual copulation was never observed, sexual behavior was indicated by a noticeable "frenzy" of activity at a particular burrow system. This activity was characterized by individual males repeatedly approaching a female, which generally adopted a defensive posture. Occasional males would enter a burrow system together; perhaps copulation occurred there. Streubel (1975) noted: "On one occasion during 1.36 hours of continuous observation of a male with a female, it did not appear that the male was enticing the female into the burrow. The male entered the female's burrow seven times and spent a total of 3.5 minutes in the burrow. The female entered the burrow with the male twice, one time for 2.8 min. and the other time for 0.66 min."

Seven different alert postures have been observed in the species. These postures are similar to alert postures described by Balph and Stokes (1963) for the Uinta ground squirrel (S. armatus) and by Wistrand (1974) for the thirteen-lined ground squirrel (S. tridecemlineatus). Foot storages (alternately, rapidly stomping the hind feet) was observed on several occasions; twice while a bull snake was investigating the burrows of two different females, and also when a male was approaching a female. This behavior may be a form of displacement behavior or signify threat or apprehension and has been observed by Grubitz (1963) and Wistrand (1974) in S. tridecemlineatus. Streubel (1975) observed that behavior appeared to be most pronounced in juvenile S. tridecemlineatus (McCarley, 1966). The dependence of juvenile S. spatulata on their mother appears to cease two to three weeks after their first emergence from the nest burrow.

**CITED LITERATURE**


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