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Spermophilus armatus.

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Spermophilus armatus Kennicott, 1863

Uinta Ground Squirrel

Spermophilus armatus Kennicott, 1863:158. Type locality "foothills Uinta Mountains, near Fort Bridger, Wyoming."

CONTEXT AND CONTENT. Order Rodentia, suborder Sciurognathi, family Sciuridae, genus *Spermophilus*, subgenus *Spermophilus* (Hall, 1981). Multivariate analyses of 36 cranial (Robinson and Hoffman, 1975) and biochemical (Nadler et al., 1982) features suggest *S. armatus* is most similar to *S. beldingi*. Thus, Nadler et al. (1974, 1982) placed the two in a single superspecies. No subspecies of *S. armatus* are recognized (Hall, 1981).

DIAGNOSIS. A buff-colored tail with black above and below and edged with pinkish buff aids in distinguishing *S. armatus* from closely related ground squirrels. Underside of tail of *S. armatus* is gray, whereas that of *S. elegans* is ochraceous buff and lacks the black wash and pinkish edge. Tail of *S. beldingi* is reddish underneath (Hall, 1981; Jenkins and Eshelman, 1984; Zeveloff, 1988).

GENERAL CHARACTERS. The Uinta ground squirrel is a medium-size ground squirrel of the big-eared subgroup of *Spermophilus* (Fig. 1). The Uinta ground squirrel is recognized by a crown sprinkled with gray and by cinnamon coloring on its head, front of face, and ears. Sides of head and neck are a pale smoke-gray. Dorsal pelage is sayal brown or cinnamon buff (Howell, 1938). Limbs are colored as follows: forelegs are cinnamon buff with pinkish shading towards forefeet, hind legs are cinnamon, and hind feet are buff. A cinnamon buff or sayal brown dorsum with pinkish-tipped hairs is darker than buffy sides and pinkish buff venter (Hall, 1981). Ranges of external measurements of 12 adults (in mm) are as follows: total length, 280–303; length of tail, 63–81; length of hind foot, 42–45.5; length of ear, 10–12 (Hall, 1981; Howell, 1938). Minimum adult mass (about 211 g), which occurs near the time of emergence, is not reached until at least the second year of age (Sauer and Slade, 1987). Animals are lightest at emergence and heaviest just prior to hibernation.

Skull of *S. armatus* (Fig. 2) is similar to that of *S. richardsonii* but averages slightly longer overall and narrower across zygomata (Howell, 1938). Ranges of cranial measurements of seven adult males and six adult females (in mm) are as follows: greatest length, 45.6–48.5; palatal length, 22–24; zygomatic breadth, 29.6–31.8; cranial breadth, 19.2–21.5; interorbital breadth, 9.4–11.3; postorbital constriction, 10–12.3; length of nasals, 16.4–18.4; length of maxillary tooth row, 9.3–10.2 (Howell, 1938). Males tend to have slightly higher averages than females.

DISTRIBUTION. The Uinta ground squirrel has a relatively small range, much of which is in the Intermountain West region of the United States (Fig. 3). The range extends from southwestern Montana to southern Utah, extending into eastern Idaho, including Pahsimeroi and Big Lost River valleys, and into Wyoming west of the Green River. The Green River to the east forms a barrier that restricts *S. armatus* from crossing into Colorado (Svihla, 1931), and the Snake River restricts movement northward and westward (Davis, 1939). However, animals occur on either side of the Snake River near the headwaters, which may have allowed the Uinta ground squirrel to move further west into Idaho. The species dispersed into the Great Basin from no further east than eastern Wyoming (Kelson, 1951). These animals frequently occur in meadows and fields from 1,219 m along the Snake River up to 2,438 m in mountainous regions (Burt and Grossenheider, 1964).

FOSSIL RECORD. The genus *Spermophilus* evolved in North America from more primitive *Miospermophilus* during the Miocene as climates became drier and as grassland habitats spread in the Great Plains. The subgenus *Spermophilus* first appeared in the Hemphillian period of the Pliocene (Black, 1963, 1972). Fossil remains of *S. armatus* occurred in association with an excavated badger (*Taxidea taxus*) burrow in Morgan County, Utah. Badger bones from the burrow were determined by radiocarbon dating to be from the Holocene (Nelson, 1990). Fossilized remains of a minimum of four individuals from the late Pleistocene were found in the Silver Creek fauna of north-central Utah (Miller, 1976).

FORM AND FUNCTION. The Uinta ground squirrel has 10 mammae (Burt and Grossenheider, 1964). Dental formula is i 1/1, c 0/0, p 2/1, m 3/3, total 22. Serum proteins and transferrins of *S. armatus* have been described (Nadler, 1968). *S. armatus* may have one molt per year (Howell, 1938), although the closely related *S. beldingi* has two molts annually (Turner, 1972).

Using telemetry, average nighttime heart rate was 277.3 beats/min ± 5.7 *SE* (n = 4—Gessaman, 1980). Average daytime heart rates were more variable and higher (315.2 ± 9.6 beats/min). Heart rates were elevated when squirrels were in an unfamiliar area or were on another squirrel's territory. Values as high as 397 beats/min were recorded during combat between squirrels (Ruff, 1971).

Homeothermic activity of *S. armatus* is normally limited to 3 months (Balph, 1984; Ellis et al., 1983; Morse, 1978). Average daily body temperature is about 38°C (Gessaman, 1980). This value is similar to that for Richardson's ground squirrel (*S. richardsonii*—Wang, 1972).

Metabolic rates ranged from 137 to 177 ml O_2/h when animals were maintained at 30°C (Hudson et al., 1972). Metabolism in-

FIG. 1. *Spermophilus armatus* in the Lamar Valley, Yellowstone National Park. Photograph by Don Streubel.

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of skull of *Spermophilus armatus* from 1 mile west of Alta, Salt Lake County, Utah (male, Utah Museum of Natural History, University of Utah UU8933). Greatest length of cranium is 49.3 mm.

creased to 500–570 ml O_2/h when animals were maintained below thermal neutrality at about 10°C.

Breathing rate of *S. armatus* increased from about 100 breaths/min at 30°C to 268 breaths/min at 39°C in an attempt to cool the body (Hudson et al., 1972). At ambient temperatures of 39°C, 100% of heat production is lost through water evaporation. Temperatures >39°C led to death (Hudson et al., 1972). Average daily energy budget for Uinta ground squirrels was about 45 kcal/day (Oldfield, 1973).

Mean body mass of emerging adult males in Utah was 300 g (Ellis et al., 1983). Testes mass was greatest at emergence, averaging 1.90 ± 0.17 g (measure of variability not stated), and decreased after the breeding season. Diameter of seminiferous tubules was significantly and positively related to testes mass (Ellis et al., 1983).

ONTOGENY AND REPRODUCTION. Preparation of the genital tract for breeding occurs during hibernation (Balph and Stokes, 1963; Ellis and Balph, 1976; Ellis et al., 1983). Male physiological preparedness for reproduction at spring emergence includes scrotal testes, maximum testicular weight, high plasma androgen levels, and maximal numbers of spermatozoa in the epididymis (Balph, 1984; Ellis et al., 1983). These indicators decline and reach basal levels in June (Balph, 1984).

Mating normally occurs underground within a week of emergence from hibernation. Males may mate with more than one female (Balph, 1984; Balph and Stokes, 1963). Females are in estrus for a single afternoon within 2–4 days of their emergence (Balph, 1984; Ellis et al., 1983; Rieger, 1996). Within 1–3 days of breeding they begin to aggressively space themselves from other females, presumably a result of endocrine changes during pregnancy (Balph, 1984).

Female yearling Uinta ground squirrels can mate, but their later emergence and failure to find and defend a productive territory may decrease their reproductive success and number of copulations. Yearling males usually do not emerge in reproductive condition and therefore do not breed (Burns, 1968). Presence of scrotal testes in yearlings may be a function of population density before hibernation (Slade and Balph, 1974). High population densities are correlated with increased harassment of juveniles and delayed sexual development when yearling males emerge the following spring (Slade and Balph, 1974).

Spermophilus armatus has only one litter a year. Gestation lasts for about 23–26 days (Rieger, 1996; Ruff, 1971; Slade and Balph, 1974). Average number of embryos is 5.8, with extremes of 4 and 8 (Whitlow and Hall, 1933). Yearlings have smaller litters than adults, with the largest litters occurring at 2–3 years of age (Slade and Balph, 1974). An average of 5.4 young (range, 4–6) usually are born about 1 May (Balph, 1984; Burt and Grossenheider, 1964; Whitaker, 1980). Number of embryos is more than number of young emerging from the burrow (Slade and Balph, 1974). Mean number of young emerging varies with female age and habitat but does not vary with density (Slade and Balph, 1974). Timing of reproduction can affect litter size, offspring mass, and offspring survival (Rieger, 1996). Litter size and litter mass are positively correlated with maternal mass at emergence from hibernation. Juveniles weaned early in the season are lighter than juveniles weaned later (Rieger, 1996).

Juveniles appear aboveground at about 22 days of age and are relatively small (60.3 g ± 5.4 *SD*—Balph, 1984) with open eyes (Saunders, 1970). Once young appear aboveground, almost all maternal care ceases and young are weaned (Balph and Stokes, 1963; Ellis et al., 1983; Saunders, 1970). Young gradually disperse farther from the natal burrow for 2–3 weeks. After this period, sibling groups dissolve and young become isolated, spending most of their time near burrows in which they will hibernate (Balph, 1984).

ECOLOGY. Uinta ground squirrels prefer large open areas (Howell, 1938; Kelson, 1951; Slade and Balph, 1974). They inhabit dry meadows, pasture lands, and cultivated fields in high valleys, ranging into mountain meadows nearly to timber line (Howell, 1938). Previous descriptions of habitat (Howell, 1938; Whitlow and Hall, 1933) suggested that moist habitats were preferred. However, the association with moisture may be because green vegetation occurs in moist environments (Davis, 1939). In western Wyoming, Uinta ground squirrels occur in shrub–steppe communities composed mainly of sagebrush (*Artemisia*) and rabbitbrush (*Chrysothamnus*) with endemic and introduced grasses and shrubs (Minta et al., 1992; Parmenter and MacMahon, 1983; Whitaker, 1980). Uinta ground squirrels climb into shrubs for forage, but shrub architecture and shrub food resources may not be important for population structure because shrub removal caused no significant changes (Parmenter and MacMahon, 1983). Shade provided by shrubs may increase the time that Uinta ground squirrels are able to spend above ground but is not critical to Uinta ground squirrel survival. In northern Utah, amount of time spent above ground was 100% greater in shaded areas than in more open terrains (Morse, 1978).

Spermophilus armatus is a monogastric herbivore (Balph, 1984). Diet consists of green vegetation and varies throughout the active season. In a study in northern Utah, Walker (1968) found the following associations between diet and days since emergence (DSE). From 0 to 30 DSE, 90% of diet consisted of grass leaves, decreasing to 60% by 60 DSE, and to 10% at 90 DSE. A corre-

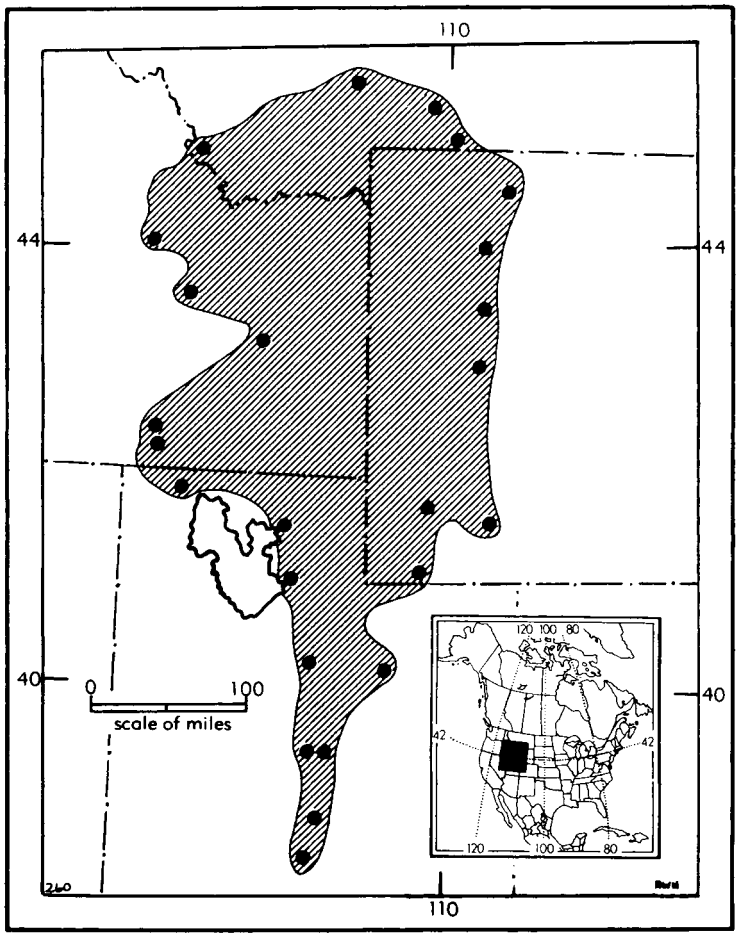

FIG. 3. Distribution of *Spermophilus armatus* in the western United States (Hall, 1981; reprinted by permission of John Wiley & Sons).

sponding increase in forb leaves (from 10 to 19 DSE) and grass seeds (from 50 to 59 DSE) occurred. By 90 DSE, forb leaves comprised >40% of diet. Grass seeds then decreased from a high of 62% to <10% by the end of the season. To compensate, forb seeds increased to 30% and grass leaves to 15%. Kentucky bluegrass (*Poa pratensis*) comprised the bulk of the diet during nesting (from birth of first litter to first emergence of young) as long as moisture content was suitable for metabolic needs of the squirrels and protein content remained high. Consumption of grass continued until either new growth ceased or existing growth became desiccated. Emergence of juveniles occurred when leaves of grasses were most plentiful. Throughout the season, about 10% of the diet consisted of sagebrush leaves (*Artemisia*), roots, earthworms (Oligochaeta), soil, and discarded human food. *S. armatus* does not store food for use during winter; it exists solely on fat reserves accumulated during summer.

During a high-density year, 23–28 yearlings and adults per hectare were found on a field station in northern Utah (Slade and Balph, 1974). Spring population was comprised of about 58% yearlings (males and females). Females (yearling and adult) accounted for 59% of the total population. After a population reduction of 40% by removal of young, Uinta ground squirrels produced enough young the following year to replace the losses. This replacement was accomplished mostly through reproductive activity by yearling females, which would not have produced young at higher densities, and increased persistence of young in the area.

Spermophilus armatus has lived for up to 7 years in the wild (Slade and Balph, 1974). Body mass, sex, and density are related to survival (Sauer and Slade, 1987). As for other sciurids, survival, both during the active season and annually, is lowest for juveniles (Slade and Balph, 1974). Survival rate ($1 - q_x$) over a 2-year period for adults was 0.60 as compared with 0.30 for juveniles in northern Utah (Amend, 1970). Survival rates for juveniles in Grand Teton National Park (females, 0.39; males, 0.30) are similar to those of the Utah population (Rieger, 1996). This trend is probably explained by the lower body mass of juveniles, because heavier squirrels tend to survive hibernation better than lighter squirrels (Sauer and Slade, 1987). However, at lower densities, juveniles reach a larger mass earlier, which may increase their survival rate. Males tend to have lower survivorship than females. During a 3-year study, overall survival rate for a population in northern Utah was 0.32 ($1 - q_x$), with male survival rate at 0.27 and female survival rate at 0.37 (Amend, 1970). At extremely low densities, juvenile and yearling males have higher rates of survival, and at high densities, older males survive better than older females (Sauer and Slade, 1987). Female body mass correlates well with age (r = 0.832) for the first 2 years, but age has no affect on adult body mass (Sauer and Slade, 1987). Body mass equals or exceeds age as a predictor of litter size and survival in *S. armatus* (Sauer and Slade, 1987) and may be a useful alternative to classification by age for studying population dynamics. Female survival increases with age at low density and is greatest at 1, 2, and 3 years of age at high density.

Dispersal and emigration influence population fluctuations. Emigration occurs as a behavioral response to population density (Slade and Balph, 1974). Juvenile and yearling males are more mobile than adults, with males more mobile than females (Amend, 1970). Females tend to remain near the natal burrow (Sauer and Slade, 1987; Slade and Balph, 1974), so their movements do not affect population dynamics as much as those of juvenile male squirrels, especially in relatively small areas (Amend, 1970). However, among adults, sexes do not differ with respect to movement.

Coyotes (*Canis latrans*), weasels (*Mustela*), badgers (*Taxidea taxus*), and raptors are the major predators on *S. armatus* (Minta et al., 1992; Slade and Balph, 1974; Weaver, 1977; Wells and Bekoff, 1982). Near Jackson Hole, Wyoming, Uinta ground squirrels

are a major food source for coyotes from May through July (Minta et al., 1992; Weaver, 1977; Wells and Bekoff, 1982). Occurrence of Uinta ground squirrels in the diet of coyotes decreases as squirrels enter hibernation because coyotes' style of hunting is not effective on animals below ground (Minta et al., 1992; Wells and Bekoff, 1982). Coyotes and badgers may hunt together, with badgers flushing Uinta ground squirrels from their burrows (Minta et al., 1992). *S. armatus* is the major component of the diet of badgers throughout the year (Minta et al., 1992).

Uinta ground squirrels host *Heligmosomoides polygyrus*, a nematode that inhabits the small intestine (Bergstrom and Werner, 1981). Uinta ground squirrels infected with *Eimeria bilamellata* can transmit the coccidium to *Spermophilus lateralis* and *S. variegatus* but not to *S. richardsonii, Tamias minimus,* or *Rattus norvegicus* (Todd et al., 1968). *S. armatus* showed immunity after only one experimental infection with *E. bilamellata*. Individual ground squirrels inoculated with 75,000 oocysts showed effects of massive infections but usually death did not occur. Inoculations of 100,000 oocysts usually led to death of the animal the 7th day after inoculation.

Uinta ground squirrels infected in the laboratory with *Trichomonas* and maintained on half rations of food had decreased infection rates compared with squirrels on normal rations (Noble, 1961). Other forms of stress, including elevated temperature (20–30°C) and light, noises, noxious stimulants, crowding, confinement, and fighting, increased infection rates of experimental animals over field-caught controls (Noble, 1961, 1962). Stressing squirrels with reduced nighttime temperatures of about 5°C versus control squirrels at about 16°C dramatically increased infections of the pinworm *Syphacia citelli* (Noble, 1966).

The flea *Thrasis francisi* is associated with *S. armatus* and several other species of ground squirrels (*S. beldingi, S. richardsonii,* and *S. townsendii*). *S. armatus* also hosts the flea species *Neopsylla inopina, Opisocrostis tuberculatus, Oropsylla idahoensis,* and *T. andorae* (Stark, 1970).

BEHAVIOR. Individuals within an area tend to group together but are extremely intolerant of each other (Balph, 1984; Balph and Stokes, 1963). Encounters between individuals are frequent the first few weeks after emergence but drop to near zero as the season progresses (Paul, 1977). Female aggression increases as the season progresses and is highest during years of high population density. Females are more intolerant of conspecifics than males are (Morse, 1978).

Emergence from hibernation is related to spring weather conditions (Balph, 1984; Ellis et al., 1983; Morse, 1978), and arousal from hibernation is earlier than emergence from the burrow (Knopf and Balph, 1977; Walker, 1968). Adult males are prepared to emerge from hibernation in mid-March (Ellis et al., 1983) but remain underground until weather conditions are mild and <0.5 m of snow remains on the ground. For a population of Uinta ground squirrels located at an elevation of 1,920 m, initial emergence of adult males occurs the first week of April, followed by adult females, yearling females, and yearling males, respectively (Balph and Stokes, 1963; Knopf and Balph, 1977; Saunders, 1970; Slade and Balph, 1974). Emergence for yearling males is dependent on the amount of harassment, a function of population density, that the males received as juveniles (Slade and Balph, 1974). Adults begin to immerge the last week of July, and all adults are normally underground by the second week in August (Balph and Stokes, 1963; Paul, 1977; Saunders, 1970). Juveniles begin hibernating in early August, with all squirrels in hibernation by 1 September.

Thermoregulation is accomplished by returning to burrows where heat gained by the squirrels when above ground is dissipated to the cooler environment of the burrow. In northern Utah, time spent above ground increased for the first 40 days after emergence with an increase in ambient temperature (Morse, 1978). Once ambient temperature was consistently >20°C, ambient temperature and activity were negatively correlated for the remainder of the season.

Males begin marking their territories 1–2 days after emergence by wiping their cheeks, which contain apocrine glands, on the ground (Balph, 1984; Balph and Stokes, 1963). Uinta ground squirrels do not rub their bodies on twigs and stones as do California ground squirrels (*S. beecheyi*—Balph and Stokes, 1963). Home ranges of males may change frequently during the breeding season, probably in response to distribution of females (Balph and Stokes, 1963; Paul, 1977).

Agonistic behavior between males signifies the start of sexual behavior and peaks during the breeding season (Balph and Stokes, 1963; Paul, 1977). Breeding is normally completed by 30 days after emergence of males (Paul, 1977). During the breeding season, males may lock together, bite, and roll for a few seconds with no injury occurring to either individual. Males may also give a chirp call when another male is seen within their territory. A few days after sexual activity begins, males approach females in either a rapid or slow manner, which may or may not result in copulation (Balph and Stokes, 1963). Aggression between the sexes is rare during the breeding season unless the female has already mated, in which case she will adopt a "stay–threat" pose (Paul, 1977). The stay–threat posture differs from a threat in that the animal showing the posture does not move toward or away from the other animal (Balph and Stokes, 1963). Agonistic encounters of free-ranging squirrels include nasonasal contact, nasoanal contact, threat display, locked fight, and boxing (Clark and Russell, 1977). Following the breeding season, males retreat from females and rapidly gain weight until hibernation begins (Balph, 1984; Ellis et al., 1983). Females become the dominant sex after breeding and are highly intolerant of other squirrels until young are weaned. After young are weaned, adult females cease being territorial (Balph and Stokes, 1963; Burns, 1968). Frequency of most agonistic behaviors by females peaked during lactation (Morse, 1978) and was reduced after weaning (Rieger, 1996).

Feeding is the most frequent behavior among Uinta ground squirrels. Feeding accounted for 53% of observed behaviors (Morse, 1978) and occurred most frequently 1–2 h after sunrise and before sunset (Balph and Stokes, 1963; Morse, 1978). On cloudy days, Uinta ground squirrels may feed throughout the entire day, but feeding begins later and ends earlier. A squirrel is on all four feet during the typical feeding posture and may move slowly forward or remain stationary while ingesting food; it may manipulate food with one or two forefeet prior to ingestion. During midday periods, frequency of other behaviors increased as feeding frequency decreased (Morse, 1978).

Running is the normal locomotion, unless the individual is moving only a short distance, such as during feeding, or is near the burrow entrance. Running occurs with a series of bounds, the animal alternately strikes the ground with forefeet and then hind feet (Balph and Stokes, 1963). While walking, three different postures may be adopted: body on ground, when the animal is disturbed; body off ground, during feeding; and hunched. Movement during walking occurs in a typical quadrupedal motion with one forefoot followed by the opposite hind foot (Balph and Stokes, 1963).

Six postures and motor patterns are associated with social behavior and development in adult and juvenile Uinta ground squirrels (Saunders, 1970). Kissing takes place between adults only during the breeding season and for juveniles during the first 20 days after emergence. This behavior consists of nose-to-nose contact with head tilted and mouth sometimes open. Establishing identity of the opposite individual through apocrine glands may play a role in this behavior. Sparring, the interplay of forelimbs in mutual boxing and pushing, occurs between males during the breeding season. Juveniles may begin sparring the second week after emergence, and this behavior becomes more forceful and rapid and may be accompanied by squeals as the juveniles grow older. Biting among adults may elicit squeals or chirps, whereas juveniles only mouth fur when exhibiting biting behavior. Mounting, the placement of forelimbs around another from above and behind, begins between juvenile males several days after emergence and may occur in adults during intense fights. Piloerection of tail hairs, or tail fanning, is exhibited by adults in agonistic encounters as a component of threat. Chase, or the active pursuit of another while running, occurs during agonistic encounters between adults. In juveniles, this behavior increases in frequency and intensity until just before hibernation. In adult *S. armatus,* behaviors vary in form and frequency according to season, age, sex, reproductive condition, population density, and location in relation to burrows and home territory (Morse, 1978; Paul, 1977).

Both male and female Uinta ground squirrels may be cannibalistic and infanticidal (Paul, 1977). In one instance, a female entered and left the burrow of a recently deceased female. Imme-

diate excavation of the burrow revealed fresh puncture wounds on head and neck regions of the young (Burns, 1968).

Six distinct calls are known (Balph and Balph, 1966). Uinta ground squirrels vocalize as a component of agonistic behavior, as warning to other ground squirrels to keep from moving closer, to indicate presence of predators, or as a component of combative encounters when individuals come into contact with one another. Calls are not used to attract conspecifics. Calls always result in a generally alert response by neighboring squirrels, which then use visual cues to make a decision about the proper response (Balph and Balph, 1966).

The chirp call is given by males during the breeding season in response to an approach by another male or for no apparent reason. In females, this call accompanies aggressive behavior. Churr or trill calls are given in response to a conspecific within 1.5 m. Teeth clattering signifies the end of an encounter and is performed while in threat posture. Growls are produced in intraspecific threat situations or when removed from traps. Squeals and squawks are elicited from individuals being attacked or in anticipation of being bitten. Squawks are always associated with physical contact (Balph and Balph, 1966).

Uinta ground squirrels use different calls to warn of airborne or ground predators (Balph and Balph, 1966). Chirp calls signify airborne predators. Neighboring animals respond by running to burrows or adopting an upright or down-alert posture. Churr calls are used to alert others of ground predators, and the response is the same as described above. Unlike California ground squirrels (*S. beecheyi*), Uinta ground squirrels do not call in response to snakes (Balph and Balph, 1966).

Novelty attracts *S. armatus* (Balph, 1968). For maximum trapping success, traps should be conspicuous and periodically moved. Squirrels living in areas of human habitation show reduced fear of humans, as evidenced by rarely calling when humans are present. They are also more trap prone. When handled or in a trap, Uinta ground squirrels may increase their frequency of elimination (Balph and Stokes, 1963). Also, the whole repertoire of calls may be given when trapped, and they squeal or squawk when handled (Balph and Balph, 1966).

Grooming may occur anywhere within the home range of the individual. *S. armatus* grooms by washing, scratching, and mouthing or biting the fur (Balph and Stokes, 1963). Wrists are moistened and then drawn over head and neck regions. Tail and leg fur is mouthed and bit, and lateral portions of trunk and head are scratched with hind feet. Dusting is usually performed in areas of loose dirt near burrow entrances by pawing at the dirt and then moving one or two steps through the pawed area (Balph and Stokes, 1963).

Uinta ground squirrels dig mainly to construct new burrows or to maintain already existing burrows (Balph and Stokes, 1963). They begin by pawing at the ground with the forefeet and then pushing dirt under the body to the hind feet which expell the dirt behind. They do not make mounds with the dirt and do not exhibit any activity associated with scent marking the burrow entrance.

GENETICS. *Spermophilus armatus* has a diploid number of 34 and a fundamental number of 64 (Nadler, 1966). Chromosome patterns were consistent from four allopatric populations (Nadler, 1966). Karyotype contains 20 metacentric and 12 submetacentric chromosomes (Nadler, 1966). The X chromosome is submetacentric and contains a nearly terminal centromere. The acrocentric Y chromosome is distinctly smaller than the X chromosome. The small Y chromosome distinguishes the karyotype of *S. armatus* from the similar karyotypes of *S. undulatus* and *S. richardsonii* (Nadler, 1966). Autosomes are indistinguishable from those of *S. richardsonii*.

A sample of 31 specimens of *S. armatus* from four locations revealed a monomorphic, homozygous transferrin (Nadler et al., 1974). This pattern may be diagnostic for the species (Nadler et al., 1974).

Two melanistic specimens of *S. armatus* were collected from Mountainview, Wyoming (Howell, 1938; Long, 1963). Pink-eyed dilution of the species was seen in a population located in Grand Teton National Park, Wyoming (Pinter, 1973).

REMARKS. *Spermophilus armatus* is derived from the Greek *sperma* (seed), *philos* (loving), and *arma* (armed—Jaeger, 1950).

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