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Alticola argentatus.

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Alticola argentatus (Severtzov, 1879)

Silvery Mountain Vole

Arvicola argentata Severtzov, 1879:63. Type locality "Alichur," Murgabskiy Raion, Pamir Mountains, Tadzhikistan.

Arvicola blanfordi Scully, 1880:399. Type locality "Gilgit, Kashmir" (Pakistan).

Arvicola severtzovi Tichomirov and Korchagin, 1889:28. Type locality "Mashat (= "Massat"), Karatau" Range, Tiulkubasskiy Raion, 'Chimkentskaya oblast,' Kazakhstan.

Alticola worthingtoni Miller, 1906:372. Type locality "Tian Shan Mountains (Koksu), altitude 9,000 feet [2,743 m]," Terek River Basin, Khalik-Tau, Sinkiang, China.

Microtus (Alticola) argurus Thomas, 1909:264. Type locality Hissar Mountains, 9,500 feet [2,895 m], 100 mi [160 km], east of Samarkand, Tadzhikistan.

Alticola phasma Miller, 1912:59. Type locality "eastern side of Kara Korum [Karakorum] Mts., Chinese Turkestan," Sin Kiang, China.

Alticola glacialis Miller, 1913:197. Type locality "Chogo Lungma Glacier (altitude 11,000 feet [3,352 m]), Baltistan," Kashmir, India.

Alticola gracilis Kashkarov, 1923:203. Type locality Besh-tash ravine, Tzlassk Ala-Tau, Tien-Shan mountains, Kirgiziya.

Alticola longicauda Kashkarov, 1923:203. Type locality Kayand ravine, Alexandrovsk range, Tien-Shan mountains, Kirghiziya.

Alticola villosa Kashkarov, 1923:203. Type locality Sary-Bulak pass, Alexandrovsk range, Tien-Shan mountains, Kirghiziya.

CONTEXT AND CONTENT. Order Rodentia, Family Muridae, Subfamily Arvicolinae, Tribe Clethrionomyini (Gromov and Polykov, 1977; Hooper and Hart, 1962, Musser and Carlton, 1993). Status of the genus is summarized by Mead and Nadachowski (1999). The systematics of the subgenus *Alticola* Blanford, 1881 (to which *A. argentatus* belongs) is still complicated and controversial. Over 30 nominative taxa were described in this group. Sometimes they are united within one species, *Alticola roylei* (Heptner and Rossolimo, 1968), but more frequently two or three forms are distinguished (Corbet, 1978; Ellerman and Morrison-Scott, 1951; Gromov and Polyakov, 1977; Honacki et al., 1982; Ognev, 1950). Recent revisions of the subgenus (Rossolimo, 1989*a*, 1989*b*; Rossolimo and Pavlinov, 1992; Rossolimo et al., 1988, 1994) show that it consists of probably eight species very closely related morphologically: *Alticola stoliczkanus* (Blanford, 1875); *A. roylei* Gray, 1842; *A. barakshin* Bannikov, 1947; *A. semicanus* (Allen, 1924); *A. tuvinicus* Ognev, 1950; *A. argentatus* (Severtzov, 1879); *A. montosa* (True, 1894); and *A. albicauda* (True, 1894).

The status of certain forms is not clear (*kosogol, leucurus, longicauda, rosanovi, shnitnikovi,* and *villosa*—Gromov and Polyakov, 1977); confusion still exists with synonyms of certain subspecies (Musser and Carleton, 1993). The following nine subspecies are currently recognized (for synonomy see Rossolimo, 1989*a*; Rossolimo and Pavlinov, 1992):

A. a. argentatus (Severtsov, 1879:63). Type locality "Alichur," Murgabskiy Raion, Pamir Mountains, Tadzhikistan.

A. a. blanfordi (Scully, 1880:399). See above (*lahulius* is a synonym).

A. a. glacialis Miller, 1913:197. See above.

A. a. parvidens Schlitter and Setzer, 1973. Type locality "20.5 miles N Dir, 10,400 feet [3,170 m], West Pakistan."

A. a. phasma Miller, 1912:59. See above.

A. a. severtzovi (Tikhomirov and Korchagin, 1889:20, 28). See above.

A. a. subluteus Thomas, 1914:570. Type locality "Djarkent, Semiretchensk, Central Asia, . . . on Uszek River, Middle Ili . . . Thian-shan Mountains" Panfilov (= "Dzharkent"), Taldi-Kurganskaya Oblast', foothills of Dzungarski Alatau, Kazakhstan (*saurica* is a synonym).

A. a. tarasovi Rossolimo and Pavlinov, 1992:165. Type locality "banks of Inylchek River, system of Inylchek and Sary Dzhaz Ridges, E. Kirghistan."

A. a. worthingtoni Miller, 1906:372. See above (*gracilis* is a synonym).

DIAGNOSIS. Characterized by wide color variation, from bright-rust to dark brown. Length of tail varies from 32 to 51% length of body, and is almost hairless. The skull rounded, not flattened, incurvation on the interorbital part underdeveloped (Fig. 1). Tympanic bullae are relatively small and narrow. Third upper molar

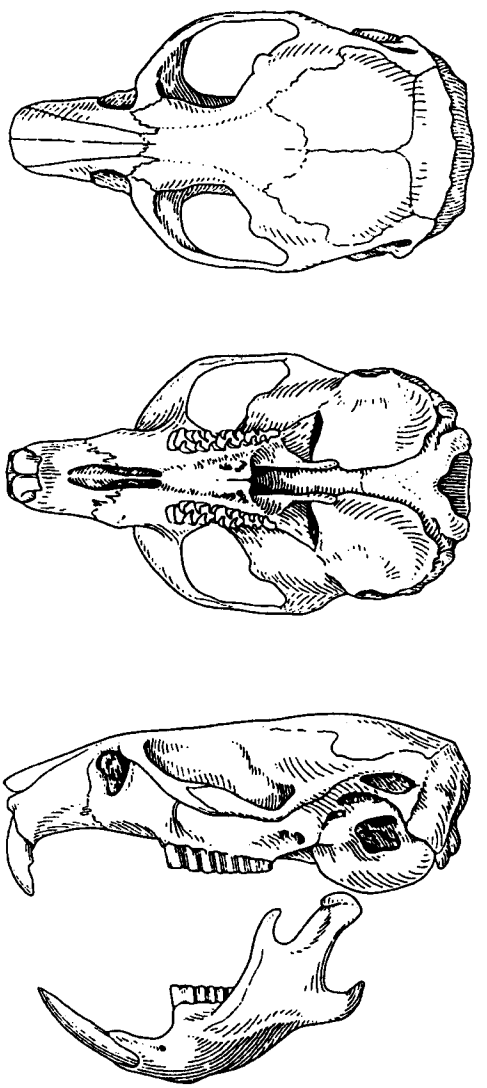

FIG. 1. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Alticola argentatus* (from Gromov and Polyakov, 1977). Greatest length of cranium is 26.6 mm.

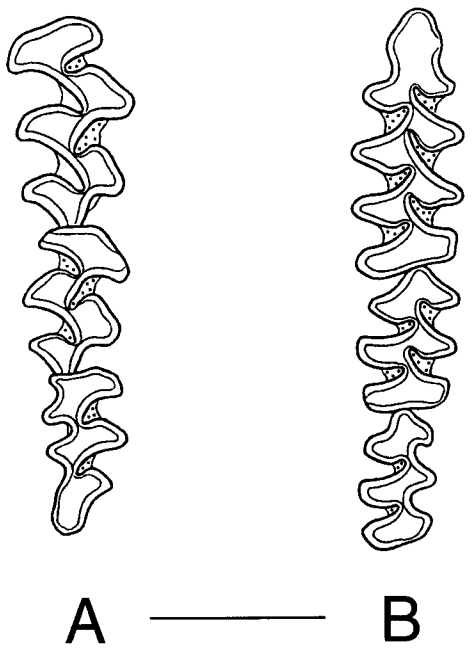

FIG. 2. Occlusal views of upper right (A) and lower right (B) molars of adult *Alticola argentatus*. Bar equals 2.0 mm.

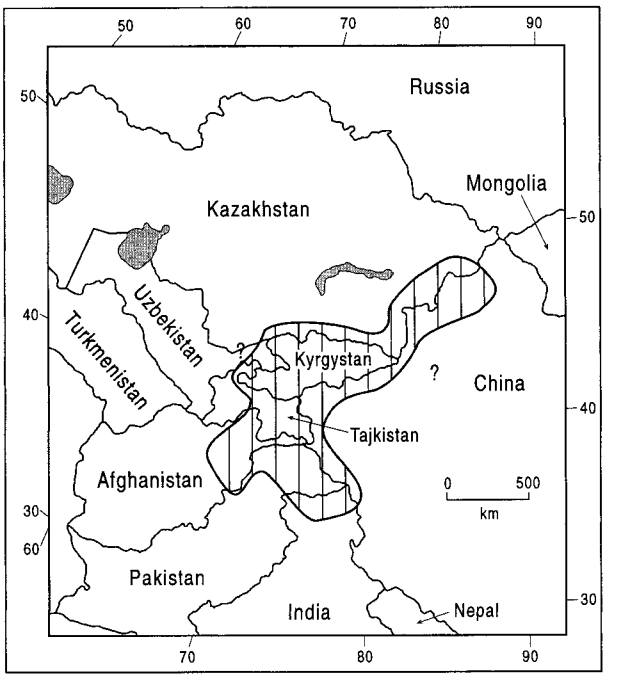

FIG. 3. Distribution of *Alticola argentatus* in Asia (Rossolimo et al., 1994). Question marks are unverified locations.

(M3) shows in most cases a complex pattern with three (sometimes four) internal triangles (Fig. 2).

GENERAL CHARACTERS. This small or medium-sized silver mountain vole shows extensive pelage color variation in different geographical regions. Upper parts are bright yellowish or rust-colored (*A. a. argentatus, A. a. worthingtoni, A. a. phasma*), light gray-brownish (*A. a. subluteus*) or dark brown with small additions of rufous tinge (*A. a. blanfordi, A. a. severtzovi*). Color differences probably are connected with the dryness gradient and not with altitude (Rossolimo, 1989*a*). The tail is hairless or slightly hirsute, white in light-colored specimens and distinctly bicolored in dark animals. In most cases the darkest colors occur on the back and sometimes on the top of the head. Underparts are light gray or almost white (Rossolimo and Pavlinov, 1992).

External and cranial measurements (in mm) are as follows: total length of head and body, 87–128; length of tail, 36–64; length of hindfoot, 16–21; length of ear, 13–18; condylobasal length, 23.3–29.5. Adult body masses range from 20.8 to 54.6 g (Davydov, 1988; Odinaschoev, 1987; Rossolimo, 1989*a*; Rossolimo and Pavlinov, 1992).

Skull measurements show geographic variation. Skull length varies independent of body length (Rossolimo and Pavlinov, 1992). Principal components analysis of 30 body, skull, and dental traits for 23 samples of *A. argentatus* from the whole range of the species has shown that populations can be divided into two distinct groups: those from Tien-Shan and those from the Pamir-Hindu Kush mountain system (Rossolimo, 1989*a*). Main differences between them concern body size, some skull dimensions, and the pattern of M3. According to Rossolimo (1989*a*), the most variable parameters are length of body and tail, width of tympanic bullae, and length of the posterior part and shape of M3. These features are the best criteria for distinguishing particular subspecies. Variation of the occlusal surface of m1 and M3 is great (Tokmergenov, 1983). The simplest morphotypes are common in the southern part of the species range (*A. a. blanfordi*), whereas in the "northern" populations (*A. a. subluteus, A. a. severtzovi*) a high frequency of complicated patterns is observed (Tokmergenov, 1992).

DISTRIBUTION. The silvery mountain vole occurs in Tien-Shan (in the widest meaning of this geographical name), Pamir, Karakorum, and Hindu Kush mountains (Fig. 3; Rossolimo, 1989*a*). The northernmost part of its geographic distribution is the Saur Range, and the southernmost locality is in Gilgit (upper part of Swat River near Kabul). The nominative subspecies is distributed over the entire Pamir from the Trans-Alai Range in the north to the Vaghan Range in the south and from the Kugitang-Tau Range in the west to the Tash Kurghan in the eastern part of Chinese Pamir as well as in the western parts of Hindu Kush (Afganistan). Odinaschoev (1987) and Davydov (1988) presented a detailed distribution of subspecies in the Pamir. *A. a. subluteus* occurs in the most northern part of the species range (Saur Range, Dzungarian Ala-Tau, Kungey-Ala-Tau). *A. a. severtzovi* occupies the northern, western, and central parts of Tien-Shan. In the west it reaches Trans-Ili Ala-Tau and in the southeast it reaches Terskei Ala-Tau. *A. a. worthingtoni* is known only from Khalik-Tau (in Chinese Tien-Shan), whereas *A. a. phasma* is noted exclusively from the type locality in Karakorum Mountains. *A. a. blanfordi* is distributed in the most southern part of the species range in Hindu Kush in Pakistan and India. Vertical distribution is wide (900–4,800 m) and depends on the occurrence of scree-covered regions which are the most preferred habitats for this species (Davydov, 1964, 1988).

FOSSIL RECORD. The only fossil remains of *Alticola argentatus* come from Sel'-Ungur in Kyrgystan and are dated to Middle Pleistocene (Markova, 1992; Velichko et al., 1991).

FORM AND FUNCTION. Dental formula of *A. argentatus* is i 1/1, c 0/0, p 0/0, m 3/3, total 16 (Gromov and Polyakov, 1977). Molars are hypsodont (ever-growing and rootless) with little cement in the re-entrant angles. Enamel is relatively thin (Hinton, 1926).

Young animals start molting when they reach body mass of ca. 18–21 g. In adults, the process of molting is extensive. It starts in March–April in lateral centers and progresses dorsally and ventrally to proximal parts of the body. The autumn molt takes place in September–October and spreads from the head to other parts (Davydov, 1988; Odinaschoev, 1987).

ECOLOGY. The silvery mountain vole occupies high mountains, especially subalpine and alpine zones. They build their nests mainly in talus slopes and other scree-covered regions, rarely in rock crevices. Fissures often are filled with their excrement mixed with plant fragments and small stones that form a kind of wall. Nests are built as a soft sphere of plant debris and are functionally divided into brooding nests and areas for rest. Nests range in length from 13 to 40 cm, with widths from 8 to 44 cm and heights from 11 to 60 cm. Nest chambers are filled with grass (Sludsky, 1989).

The silvery mountain vole is active during the day as well as at night. Movements under snow have been recorded during winter (Sludsky, 1989). In winter and early spring, these voles feed mainly on roots of plants and on seeds. During November, December, and

February, their stomachs contain 87–92% of such food, whereas the amount of roots diminishes to 52% in March. The characteristic feature of their diet is the addition of small amounts (up to 4%) of animal food (Davydov, 1988). In March, these voles start to feed on green parts of plants, and from April to September their stomachs contain 90–99% fresh growth. *A. argentatus* consumes ca. 80 species of plants (Davydov, 1988). In autumn, the voles stock food reserves for winter that consist of about 40 species of those plants most commonly found in the vicinity of the nest. The mass of reserves found in fissures is not large, ranging from 2–5 g to 35–42 g (Davydov, 1988) and rarely up to 700 g (Odinaschoev, 1987).

Twenty-four species of ticks were described from *Alticola argentatus*: *Anomalohimalayana lama, Dermacentor daghestanicus, D. marginatus, Euschongastia rotundata, Haemogamasus, Haeomamasus criceti, H. ivanovi, Hirstionyssus musculi, H. transiliensis, Ixodes crenulatus, I. redikorzevi, Leptotrombidium, L. absoluta, L. hirsuta, L. raropinis, Neotrombicula mera, N. monticola, N. obscura, N. ovalis, N. pamiriensis, N. tenera, N. tolmera, Rhipicephalus turanicus,* and *Trombicula* (Davydov and Morozova, 1970*a*, 1970*b*; Shluger and Davydov, 1968; Starkov and Davydov, 1972). The following fleas also are known from this vole: *Amphipsylla anceps, A. montana, A. phaiomydis iskue, A. phaiomydis phaiomydis, A. primaris, A. rossica, Ceratophyllus capius, C. lebiedevi principes, Citellophyllus relicticola, Frontopsylla elata, F. protera, Leptopsylla nana, Neopsylla pleskei, N. terratura, Paradoxpsylla narini,* and *Paranoppsylla ioffi* (Kafarskaya and Lysenko, 1963; Odinaschoev, 1987). One species of louse (*Hoplopleur*) also occurs on *A. argentatus*. Four species of cestodes (*Aspiculuris tetraptera, Hydatigera diminuta, Moniliformis moniliformis,* and *Syphacia obvelata*) were recorded (Gafurov et al., 1971).

REPRODUCTION AND ONTOGENY. Reproductive parameters are diversified according to altitude (Davydov, 1988). The most favorable circumstances occur in forest and subalpine zones, where the breeding season lasts from March–April to September–October. At higher altitudes in the alpine zone, the silvery mountain vole breeds from May to September. On the southern slopes of foothills, at the altitude of 900–1,300 m, they also breed during winter (Obidina, 1972).

In the forest and the lower parts of subalpine zones, young individuals appear in May, and during June–August they are fertile. Normally three litters are born each year; in unfavorable climatic circumstances, sometimes only two. Females carrying embryos have been recorded from February to December, and the percentage of pregnant females during winter and early spring is ca. one half that of summer (31–55% and 62–95%, respectively). The mean number of embryos per female is 4.7 (observed range, 2–9). At lower altitudes, where reproduction takes place practically over the whole year, the number of embryos is lower (3.5 per female). In the forest and subalpine zones this value is 4.8 embryos, whereas in the alpine zone it diminishes to 3.8 embryos per female. Fecundity in winter (February, December) is very low (3.0 embryos), whereas in spring and summer (April–July) it ranges from 5.3 (April) to 4.5 (July) embryos per female. Sexual maturity is attained at a relatively early age. The youngest pregnant females were about 27 g in mass. Approximately 60% of females with body masses of 27 to 32 g were able to breed, whereas all animals which exceeded 37 g took part in breeding.

GENETICS. The diploid and fundamental numbers for *Alticola argentatus* are both 56. Autosomes are telo- or subtelocentric (Lyapunova and Fisher, 1969). Jacenko (1982, 1983) observed the same basic autosomes and X chromosomes in *Alticola argentatus, A. barakshin, A. macrotis, A. strelzovi,* and various species of *Clethrionomys*.

REMARKS. *Alticola argentatus* is, generally speaking, responsible for the confusion of taxonomic subdivisions within the subgenus *Alticola*. This is caused by several factors: its great size and color variability, the inadequately defined morphological boundaries between this species and it closest allies, and the inadequacy of classical morphological data for more decisive conclusions (Rossolimo and Pavlinov, 1992). According to the tentative phylogenetic hypothesis of Rossolimo and Pavlinov (1992), *A. argentatus* is a descendant of *A. roylei,* meaning that it is a Himalayan form resembling the latter species morphologically and an ancestor of *A. tuvinicus*. This implies that *A. argentatus* originated somewhere in Hindu Kush and then spread over Pamir and Tien Shan to eastern Kazakhstan. Apomorphic features discussed in Hielscher et al. (1992), Jacenko (1982), and Stubbe et al. (1994) support species status of *A. argentatus* and are in agreement with Rossolimo (1989*a*, 1989*b*).

The etymology of the generic name is *altus* (Latin: high; reference to high elevation) and *colo* or *incola* (Latin: to inhabit, an inhabitant), therefore *Alticola* refers to an inhabitant of high elevations such as in mountains. The specific name *argentatus* comes from the Latin *argentum* meaning silver and refers to the occasionally silver-colored fur. Editing suggestions were supplied by I. Ya. Pavlinov, B. Krystufek, and O. Rossolimo. Interlibrary loan at the Cline Library, Northern Arizona University helped with locating certain citations. M. Carpenter provided some translations of Russian literature. Drafting was provided by the Bilby Research Center, Northern Arizona University, and R. O'Reilly.

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