SCIENTIFIC NOTE

Fox Scat Evidence of Heavy Predation on Beetles on the Alpine Tundra, Front Range, Colorado

On July 3, 1989, a fresh scat was found at 3,475 m (11,400 ft) on Niwot Ridge in Boulder County, Colorado. The scat was located about 300 m above treeline. The general habitus of the scat (diameter of 14 mm) and its location, suggest that is was that of a red fox (Halfpenny 1987). The scat was comprised almost entirely of beetle exoskeletons, with a few strands of mammalian hair. Only two beetle taxa were represented, *Amara alpina* Payk. and *Carabus taedatus agassii* LeC. (both Carabidae). In all, the remains of 70 beetles were found in this one scat, including 52 *C. taedatus agassii* (15 head capsules, 16 pronota, 43 left elytra, 45 right elytra and 52 abdomens) and 18 *A. alpina* (10 head capsules, 11 pronota, 16 left elytra, 18 right elytra and 7 abdomens).

Many of the beetle specimens were broken and showing bite marks, while others were almost intact, suggesting that the fox swallowed them nearly whole. Almost no soft, internal tissues were left undigested, even from specimens in which the head capsule, thorax or abdomen was intact.

These beetle species are two of the most common arthropod inhabitants of the alpine tundra on Niwot Ridge and elsewhere in the alpine zone of the Colorado Front Range (Armin 1963; Elias 1987). Pitfall trapping in the alpine tundra of this region generally yields abundant specimens of both species from June through September. Studies of diel behavior of alpine beetles (Schmoller 1971) showed that *A. alpina* is active nearly equally by night and day, whereas *C. taedatus agassii* is far more active by night. During the day, both species are commonly found under cobbles and boulders, from about 30 to 60 cm in diameter.

During the summer, foxes have been reported eating large amounts of insects, and up to 40% of their scat may contain some insect remains (Samuel and Nelson 1982; Turkowski 1980). Normal nocturnal foraging by foxes corresponds well with the known behavior of *A. alpina* and *C. taedatus agassii* and provides the opportunity for foxes to feed on these beetles. Since these beetle species are solitary in habit, the fact that the fox scat consisted almost exclusively of these beetles suggests that the fox may have made a concerted effort to obtain them. However, both species may occur in large numbers on the alpine tundra in Colorado, thus the fox may have expended only minimal energy in getting the beetles. Two possibilities may have triggered the fox predation on the beetles. The first is that the "reward" for the energy expenditure may be high (*i.e.*, the beetles constitute an excellent source of protein) or desirable (particularly tasty). Second, considerable beetle activity on a warm summer night may attract the attention of foxes and trigger feeding.

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