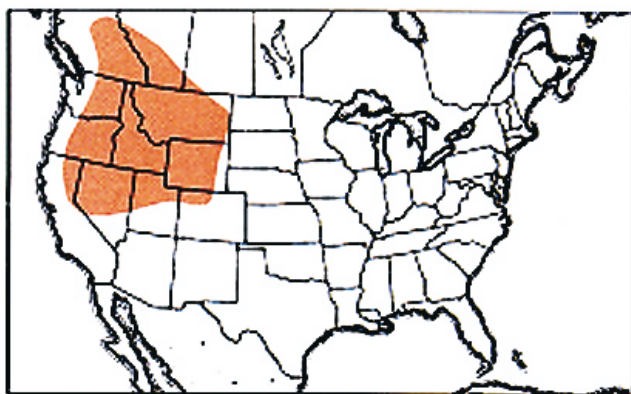


Alpine Grasshopper

Melanoplus alpinus Scudder

Distribution and Habitat

The geographic range of the alpine grasshopper is located in northwestern North America. It inhabits the grass-forb meadows and parklands of the Rocky Mountains and the Sierra Nevada Mountains. In the United States, altitudes of its habitats range from 6,400 feet in Montana to 11,000 feet in Colorado. In Canada, the species lives not only in mountain meadows and parklands but also in foothill habitats as low as 3,200 feet.



Geographic range of *Melanoplus alpinus* Scudder

Economic Importance

The alpine grasshopper, a common resident of mountain meadows, has a history of low densities and no documented outbreaks. Researchers of the species consider it to be a minor pest during some years and often a beneficial insect due to its feeding on competing weeds and poisonous plants such as locoweed and lupine. Populations in Wyoming meadows have ranged in density from less than 0.1 to 3.7 adults per square yard. Because the alpine grasshopper feeds readily on Idaho fescue, it is considered a potentially competitive pest with livestock on summer range, particularly during droughts when forage is in short supply.

Food Habits

The alpine grasshopper feeds on both forbs and grasses, and will eat fungi and injured or dead arthropods. About 26 species of forbs, 11 grasses, and 2 sedges are known to be ingested. Preferred forbs include *Arenaria congesta*, *Arenaria fendleri*, *Astragalus adsurgens*, *Lupinus laxiflorus*, *Oxytropis campestris*, *Musineon tenuifolium*, and *Taraxacum laevigatum*. Preferred grasses include *Poa* spp., *Elymus lanceolatus*, *Festuca idahoensis*, and *Stipa occidentalis*. Over its geographic range the alpine grasshopper subsists on different diets. In Canada it is

reported to feed on grasses. In Idaho, crop content examinations show it to feed evenly on forbs and grasses; in Colorado, 69 percent of its diet is forbs and 18 percent grasses; in southern Wyoming, 77 percent forbs and 12 percent grasses; and in northern Wyoming, 93 percent forbs and 7 percent grasses.

Direct observations of the grasshoppers feeding in their natural habitat west of Laramie, Wyoming totaled 13 bouts on *Arenaria congesta*, 13 on *Poa* spp., and 9 on *Taraxacum laevigatum*. Average times spent feeding on these plants were *A. congesta*, 3 minutes; *Poa* spp., 1.8 minutes; and *T. laevigatum* 1.8 minutes. These results suggest that *A. congesta* was the preferred food plant. In a northern Colorado mountain meadow, *A. fendleri* served as the chief food plant. Crops of the alpine grasshopper contained 35 percent of this plant on both 10 and 23 August 1967 (Table 1).

The number of food items per crop is of importance to the nutrition of grasshoppers; laboratory tests have shown increased weight, survival, and egg production of individuals among several species of *Melanoplus* when fed more than one kind of food plant. Adults of the alpine grasshopper usually contain more than one species of host plant in their crops. Collected from a meadow of the Laramie range, males contained an average of 1.2 items and females 3.2 items. Collected from a meadow of the Big Horn Mountains, males contained an average of 1.8 items and females 2.4 items. These differences between the sexes were statistically significant.

Dispersal and Migration

Possessing long wings and developed wing muscles, the alpine grasshopper is able to fly evasively and to disperse. Within the center of its distribution in the Big Horn Mountains of northern Wyoming, the species inhabits a high percentage of the available montane meadows, which suggests effective dispersal. Additional evidence for dispersal was the collection of one adult male on 5 September 1995 in a bunchgrass-sagebrush habitat lying at an altitude of 7,300 feet - a foothill locale atypical for the species. None of the species was collected in this site on 3 August 1995 nor in the previous year on 25 July 1994. On the other hand, no adults have been found in grasshopper glaciers with other species that inhabit montane meadows, a fact suggesting that the alpine grasshopper disperses primarily by short, low flights.

When flushed, the adult alpine grasshopper appears more often to jump than to fly. Nymphs (instar V) and adults jump from 4 inches to 3 feet at air temperatures of 46° to 70°F. Adults fly short distances at

Instar 1



1. BL 4.5-5.2 mm FL 2.3-2.6 mm AS 13.

Instar 2



2. BL 5.1-7 mm FL 3.3-3.9 mm AS 15.

Instar 3



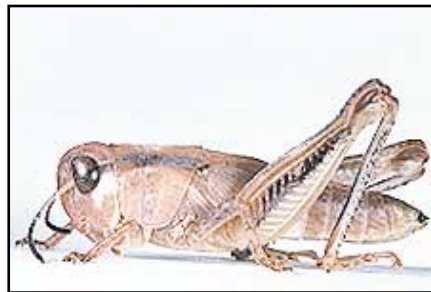
3. BL 8.1-9.2 mm FL 5-5.4 mm AS 17-18.

Instar 4



4. BL 9.2-12 mm FL 6.6-7.7 mm AS 18-21.

Instar 5



5. BL 13-15 mm FL 8.4-10.3 mm AS 21-23.

Figures 1-5. Appearance of the five nymphal instars of *Melanoplus alpinus* - their sizes, structures, and color patterns. Notice progressive development of the wing pads. BL = body length, FL = hind femur length, AS = antennal segments number.

temperatures of 54° to 70°F. The flight is low and silent.

Identification

The alpine grasshopper is a medium-sized, long-winged species (Fig. 6 and 7). Head, thorax, and tegmen are usually gray but may range in color to shades of light tan. The venter and sides of the abdomen are cream colored. The dark dorsal stripe of the hind femur is continuous and may fill most of the medial area, often the stripe has a wedge-shaped mark dorsally in the middle; the lower medial area is pale gray or tan (Fig. 8). The upper marginal area is tan and marked by three black transverse bars. The hind tibia is green, blue, or pink. The male cercus is bifurcate, the dorsal arm is stubby and blunt, and the ventral arm is sharply pointed and both arms bend medially (Fig. 9). The smaller *Melanoplus infantilis*, which often resides alongside the alpine grasshopper in mountain meadows, has a similar bifurcate cercus, but the lower arm ends in a rounded blunt tip and does not bend toward the median (compare the two).

The nymphs are identifiable by their color patterns, shape, and structures (Fig. 1-5). The early nymphs and some of the late nymphs are recognizable in the field by their green bodies, dark compound eyes, and prominent dark dorsal stripe of the hind femur.

1. Head with face nearly vertical and colored plain green, often tan in older instars; ridges of frontal costa and preocular ridges spotted brown; a black bar is present on the side of the head behind the compound eye.
2. Pronotal disk with dusky band, which is spotted brown and present on each side; the band continues onto the meso- and metanotum or the wing pads of older instars and to the end of the abdomen. The venter of the thorax and abdomen is green or pale tan, sometimes with pale brown spots.
3. The hind femur is green or tan and has a prominent dark dorsal stripe, often with a light dorsal wedge in the middle. The lower medial area and the lower marginal area are pale green or pale tan. The upper marginal area is green or tan.
4. Nymphs may change body color when they undergo metamorphosis. All specimens are green in instar I. In Instar II approximately 85

Figures 6-10. Appearance of the adult male and female of *Melanoplus alpinus*, left hindleg of adult female, male cercus, and eggs and egg pod.

percent are green and 15 percent are cream or pale tan; in instars III and IV approximately 52 percent are green and 48 percent are cream or pale tan; in instar V approximately 20 percent are green and 80 percent are tan.

Hatching

Before eggs of the alpine grasshopper will hatch, they require a long developmental period in the soil. A study of eggs laid in the Big Horn Mountains of Montana and Wyoming revealed that the majority of eggs (92 percent) required three years of development before hatching and a smaller number (8 percent), two years. None hatched in one year; the eggs laid in one summer were unable to hatch the following spring. The cause for the delay is unknown but may be due to both cold temperatures of mountain soils and to an extended diapause of the embryos.

In mountain meadows of Wyoming, eggs of the alpine grasshopper start hatching from early to late June. The precise time depends on seasonal temperatures that affect snow melt and the thawing and warming of the soil. The period of hatching is short, ranging from 6 to 17 days.

Nymphal Development

In spite of cold night temperatures and frequent cold rains in the mountain environment, nymphs of the alpine grasshopper develop rapidly to the adult stage. During the day in their meadow habitats, they bask in the warming rays of the sun and then at night they seek shelter in ground litter and crowns of grass insulating themselves from night air temperatures that range from 34° to 53°F. Nymphal periods have been found to last from 25 to 40 days. The shortest period of 25 days occurred in 1955 in a meadow lying at 9,800 feet in the Snowy Range west of Laramie, Wyoming. Daily scouting of the meadow revealed the first hatch of nymphs on June 21 and the first adult on July 16. In 1994 and 1995, slightly longer nymphal periods of 35 and 38 days were found to occur in a Pole Mountain meadow east of Laramie (altitude 8,600 feet). In 1994, in a Big Horn Mountain meadow of northern Wyoming (altitude 8,200 feet), the nymphal period took 37 days. Both male and female alpine grasshoppers have five instars.

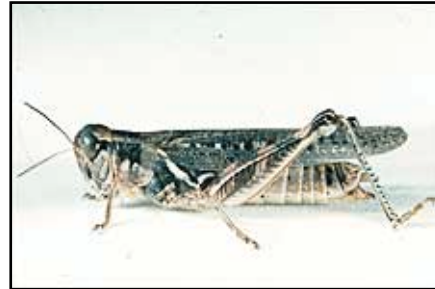
Adults and Reproduction

The alpine grasshopper reaches the adult stage by early July in the mountains of Wyoming. In 1994, adults were first discovered on July 8 in both northern and southern mountains. In the Snowy Range study meadow west of Laramie, Wyoming (altitude 9,800 feet), adults



Male

6. BL 17.5-18.5 mm FL 10.7-11.2 mm AS 23-25.



Female

7. BL 20.5-24 mm FL 12-13.2 mm AS 22-24.



Hindleg

8. Hindleg of female showing yellow wedge in dorsal stripe.



Cercus

9. End of male abdomen showing the cercus.



Eggs

10. Exposed eggs and egg pod.

were first observed on 16 July 1955. The first observation of mating in this site was noted on August 12, and the first oviposition a week later. Females select bare ground between clumps of grass to deposit groups of 8 to 12 eggs. Although populations of adults dwindle through the summer, residual individuals are still present in mid September. These individuals continue to mate and presumably to deposit eggs. Because alpine grasshoppers retreat into shelters when weather becomes inclement, early frosts do not affect their survival.

The pods are 1 to 1 1/8 inches long and curved at the bottom so that the terminal section with eggs, 3/8 inch long, lies diagonally in the soil. Offwhite froth fills the top section of the pod; tan froth surrounds the eggs at the bottom. Eggs are yellow or pale tan and 4.3 to 5.0 mm long (Fig. 10).

Population Ecology

The alpine grasshopper enjoys a high frequency of occurrence in mountain meadows of Wyoming. In the Big Horn mountains of northern Wyoming, 12 of 14 meadow sites (85 percent) surveyed in 1994 were inhabited by resident populations. Densities were low in all populations, ranging from less than 0.1 to 0.5 adult per square yard. The highest density of adults ever recorded in the Wyoming annual grasshopper survey (1988-94) was 3.7 adults per square yard in a meadow of the Big Horn Mountains (13 August 1991). The entire grasshopper assemblage living in this site numbered 16 adults per square yard. Densities of the six species were: *Bruneria brunnea*, 5.7; *M. alpinus*, 3.7; *M. bruneri*, 2.4; *M. borealis*, 2; *Camnula pellucida*, 2; and *Chorthippus curtippennis*, 0.2. The study of the alpine grasshopper in the Snowy Range in 1954-55 revealed densities ranging from 0.4 to 0.9 adult per square yard. To date, no irruptions of the alpine grasshopper have been observed even in years favorable for outbreaks of *M. borealis* and *M. bruneri*. The requirement of alpine grasshopper eggs to be in the soil for two to three years before hatching complicates the study of population ecology of this species.

Daily Activity

The alpine grasshopper is a geophilous species resting, walking, feeding, and performing other activities

on the ground. At night, the grasshoppers rest deep in grass crowns or wedge themselves as much as 2 inches below the soil surface alongside a rock or boulder. Two hours after sunrise they emerge from their shelters and begin to bask, resting horizontally on bare ground or on litter. They turn a side perpendicular to the rays of the sun and lower the associated hindleg, exposing the abdomen. In meadows of the Big Horn Mountains of northern Wyoming, basking begins about 7:30 a.m. DST and may last for two to three hours. Feeding occurs in the forenoon and again in the afternoon. During a feeding observation in a Big Horn Mountain meadow at 9:51 a.m. DST, an adult male sitting horizontally on the ground was seen to feed on a short green sprout from its tip to base. Adults may remain inactive on the ground in sheltered spots for long periods of time during the day and may not move unless disturbed by roving insects, wind, or rain. A second period of basking occurs in late afternoon. Then as evening approaches and temperatures fall, the grasshoppers enter their nighttime shelters.

Table 1. Mean percent dry weight of food items in the crops of *Melanoplus alpinus* in northern Colorado, Larimer County. (Adapted from Hansen and Ueckert, 1970.)

Item	8/10/67	8/23/67
<i>Arenaria fendleri</i>	34.9	34.7
<i>Astragalus</i> spp. and <i>Oxytropis lambertii</i>	19.7	15.8
<i>Penstemon</i> sp.	3.2	0.5
<i>Taraxacum officinale</i>	2.1	0.8
<i>Antennaria parvifolia</i>	2.1	0.5
<i>Achillea lanulosa</i>	2.1	0.0
<i>Cryptantha virgata</i>	2.1	0.0
<i>Erigeron</i> spp.	2.1	0.0
<i>Poa</i> spp.	4.6	2.6
<i>Festuca idahoensis</i>	2.1	9.5
<i>Agropyron</i> spp.	1.7	3.9
<i>Muhlenbergia filiculmis</i>	1.4	2.9
<i>Danthonia parryi</i>	0.3	3.9
<i>Bouteloua gracilis</i>	1.2	1.5
Arthropod parts	2.4	4.8
Fungi	10.2	8.3
Number Crops	23	40

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