

# Crenulatewinged Grasshopper

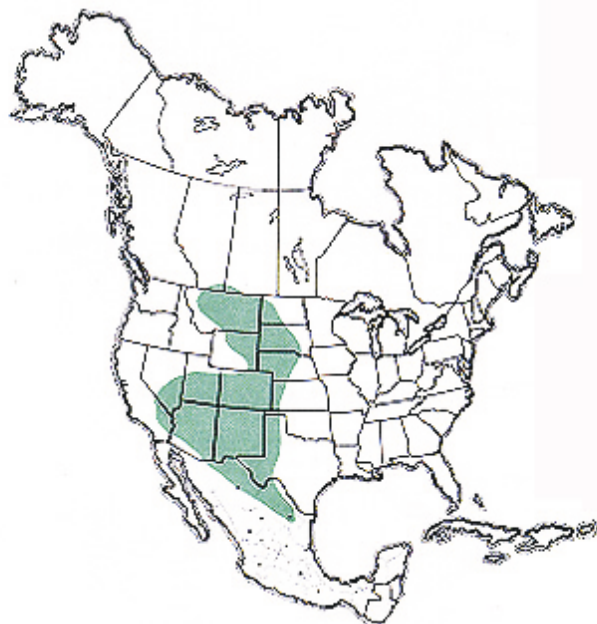
## *Cordillacris crenulata* (Bruner)

### Distribution and Habitat

The crenulatewinged grasshopper is a small, grassland species that reaches its greatest abundance in the shortgrass and desert prairies and in heavily grazed upland sites of the mixedgrass prairie. Its geographic range extends westward into the bunchgrass prairie and shrub-grass associations as far as Nevada and California. It prefers short stands of grass in which blue grama is dominant and interspersed with bare ground. The species does not invade the tallgrass prairie nor dense stands of mid grasses in the mixedgrass prairie.

### Economic Importance

The crenulatewinged grasshopper attacks and eats the green leaves of blue grama, a preferred forage grass of livestock. The grasshopper's presence in an economically damaging assemblage on rangeland adds slightly to the total damage. In the northern mixedgrass prairie it has been found to comprise 1 to 4 percent of some outbreak populations. Occasionally it becomes the most abundant species in an assemblage, with adult densities reaching eight per square yard. In Montana it has been recorded as causing considerable damage to threadleaf sedge, and in Arizona it has been observed destroying young grasses on newly seeded rangeland. However, because of its small size and generally low densities, it usually is not a serious pest on grasslands. Live weight of males averages 45 mg and of females 110 mg (dry weight males 15 mg, females 24 mg).



Geographic range of *Cordillacris crenulata* (Bruner)

### Food Habits

The crenulatewinged grasshopper is a grass feeder, preferring blue grama whenever it is present in the habitat. In the shortgrass prairie of eastern Colorado, it fed almost exclusively on blue grama. This grass comprised over 99 percent of crop contents of instars I to IV and over 96 percent of crop contents of the adults. Small amounts of needleleaf sedge, red threeawn, prairie junegrass, and a trace of one forb, tansy aster, were also found in crop contents.

In Montana the crenulatewinged grasshopper has been observed to feed heavily on threadleaf sedge in addition to blue grama. In a desert prairie of southwest Texas, crop contents of this species consisted of 71 percent blue grama, 7 percent hairy grama, 6 percent buffalograss, 4 percent burrograss, 4 percent of an undetermined grass, 4 percent of flax (a forb), and 2 percent of fall witchgrass. This grasshopper can live in communities where blue grama does not occur, subsisting on other grass species. In the mixedgrass prairie of Wyoming, one observation has been made of its feeding on needleandthread grass.

The method by which older instars and adults of this grasshopper attack the primary host plant, blue grama, has been observed in the mixedgrass prairie of eastern Wyoming. A hungry individual appears agitated and crawls on the ground and over host plants waving its antennae and shaking its hindlegs. It stops at several blue grama plants and tastes leaves until it finds one it apparently likes. The grasshopper crawls up the leaf a short distance, tastes the leaf again, then turns around head down and backs up toward the tip. It begins to feed on the edge about one-quarter inch from the tip and proceeds toward the base. It consumes most of the width, but leaves behind a narrow standing length to which it clings. On a recumbent or detached leaf lying on the ground, an individual feeds from a horizontal position.

### Dispersal and Migration

A study of local movement by adult crenulatewinged grasshoppers in a habitat of the desert prairie revealed an average daily displacement of 16 feet and a maximum of 210 feet. Observations of normal activity of adults in the mixedgrass prairie of eastern Wyoming indicate that movement is achieved both by walking and flying. Adults have been observed to walk both in short bouts of a few inches and to walk as much as 6 feet without stopping. Walking crenulatewinged grasshoppers wave their antennae and, when they stop, shake their hindlegs.

Evasive flights are straight and silent with distances ranging from 2 to 8 feet and with peak heights of approximately 6 inches. The grasshopper usually takes off

Instar 1



1. BL 4.8-5.7 mm FL 2.9-3.3 mm AS 13.

Instar 2



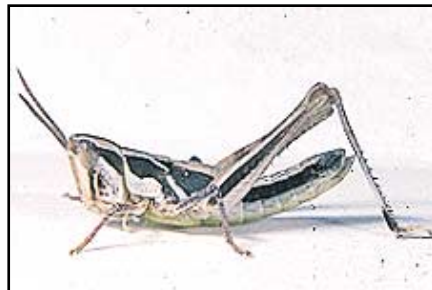
2. BL 6.3-7.5 mm FL 4-4.7 mm AS 15-17.

Instar 3



3. BL 8-11.1 mm FL 5.4-6.2 mm AS 20-21.

Instar 4



4. BL 10.3-13 mm FL 6.7-8.5 mm AS 22.

Figures 1-4. Appearance of the four nymphal instars of *Cordillacris crenulata* - their sizes, structures, and color patterns. Notice progressive development of the wing pads. BL = body length, FL = hind femur length, AS = antennal segments number.

from the ground and lands on the ground facing away from the intruder. No information is available on long-distance dispersal and migration by this grasshopper.

### Identification

Adults of the crenulatewinged grasshopper are small and slender (Fig. 5 and 6). The body is cream-colored with brown markings and stripes. A diagnostic character is the wide, brown, crenulate or scalloped stripe on each tegmen (Fig. 7). The subocular groove is edged posteriorly with a narrow brown stripe. On the side of the head behind each compound eye a conspicuous triangular brown stripe is present. The upper part of the lateral lobe is brown; the lower is cream-colored. An anterior cream-colored wedge runs nearly to the top of the lateral lobe separating the brown postocular stripe from the brown stripe of the lateral lobe. The hind tibiae are pale gray to yellowish and have a distal dark annulus.

Nymphs are identifiable by their shape and distinctive color patterns (Fig. 1- 4).

1. Head with strongly slanted face; antennae slightly ensiform in instars I to III, filiform in instar IV. Postocular brown stripe present on side of head. Dorsum of head with brown medial stripe that is usually divided by narrow light line. Subocular groove edged posteriorly with a brown stripe.
2. Pronotum with lateral lobe brown on upper half, cream on lower half. Distinctive cream-colored wedge on upper anterior edge of lateral lobe. Lateral carinae low but conspicuously cream-colored. Disk of pronotum with triangular posterolateral markings.
3. Hind femur with medial area brown dorsally and cream ventrally, as in *Cordillacris occipitalis* but with greater contrast of colors. Hind tibia pale gray with a dark annulus distally.

### Hatching

The crenulatewinged grasshopper hatches three to four weeks after the spottedwinged grasshopper, *Cordillacris occipitalis*, and belongs to the intermediate-hatching group of grasshoppers. Eggs probably begin development upon being laid in the ground in summer. They develop to embryonic stage 18 by fall and enter diapause at this time. They overwinter protected in soil cells constructed by the ovipositing

Figures 5-8. Appearance of the adult male and female of *Cordillacris crenulata*, spread wings of female, and clutch of two eggs.

females. Eggs lie at a shallow depth in the top one-half inch of soil. When temperatures rise in spring, development resumes. Hatching usually occurs in mid May in the desert prairie of Arizona and during the first half of June in the mixedgrass prairie of eastern Wyoming and the shortgrass prairie of northcentral Colorado.

### Nymphal Development

The length of the nymphal period ranges from 30 to 43 days and averages 36 days. The period is approximately five days shorter than that of *C. occipitalis*. This difference is probably due to warmer temperatures experienced by the later-hatching crenulatewinged grasshoppers and the requirement of only four instars to reach the adult stage. A few females require five instars.

### Adults and Reproduction

Adults appear in July in the northern mixedgrass and shortgrass prairies, and remain in the same habitat in which the nymphs hatched and developed. Ordinarily, this habitat continues to provide a plentiful supply of green leaves of its primary host plant, blue grama, and a favorable place in which to live and reproduce.

Courtship appears to be similar to that of *C. occipitalis*. A male moves close to a female, tips his hindlegs, depresses his antennae, and then produces a single burst of stridulation. He then tips his hindlegs forward and advances towards the female. The act of mounting and initial copulation has not been observed. A field observation was made of a pair in copulation at 11:20 a.m. DST 27 July 1973 in the usual manner of grasshoppers with the male atop the female.

One observation of oviposition from start to finish was made in the mixedgrass prairie of eastern Wyoming on 22 August 1991. A gravid female selected an old crown of blue grama grass in which to oviposit. She braced herself with the forelegs and midlegs on an adjacent blue grama plant and held the hindlegs off the ground. Oriented diagonally at a 45° angle she started boring into the soil at 10:53 a.m. DST (soil surface was 105°F, air temperature 1 inch above ground was 82°F, clear, wind 0-5 mph). An attending male stridulated briefly at the beginning of oviposition, but otherwise stood quietly one-quarter inch from her pronotum. She completed oviposition and withdrew her abdomen after 26 minutes (soil surface was 112°F, air temperature 1 inch above ground was 89°F, clear, wind 0-5 mph). For one minute she brushed soil and litter over the hole with her



Male

5. BL 12-13 mm FL 8-9 mm AS 23-24.



Female

6. BL 15-16 mm FL 9-10.3 mm AS 23.



Wings

7. Forewing (tegmen) showing crenulate dark pattern and clear hind wing.



Eggs

8. Clutch of two eggs.

hind tarsi, but the opening remained visible. Afterwards, she climbed on top of a blue grama plant and rested, while the attending male walked away. Three eggs, lightly cemented together and vertically oriented, were recovered from the soil cell. Another observation of oviposition was made 26 July 1978 between 8:30 and 9:00 a.m. (air temperature at 8:30 was 72°F); this female also bored into an old blue grama crown.

Crenulatewinged females produce two to three eggs at one time, but do not produce a pod for their protection. The eggs are pale yellow and 5 to 5.5 mm long (Fig. 8).

### Population Ecology

The crenulatewinged grasshopper is a resident of western grasslands, and lives most often as a subdominant member of an assemblage of 12 to 18 acridid species. Densities usually remain low, ranging from 0.05 to 1 young adult per square yard. In many areas of the mixedgrass, shortgrass, and desert prairies it does not appear to be present as measured by square foot visual sampling or by sweep net collection. On sites where it is present, populations persist from year to year in fluctuating low numbers (Table 1).

The environmental factors that allow increases in typically dominant species also allow increases in the crenulatewinged grasshopper. How increases arise in the latter species to dominance of eight per square yard is unknown.

### Daily Activity

The crenulatewinged grasshopper spends the night resting in the crown of blue grama grass or on ground litter under a canopy of blue grama. At sunrise the grasshoppers are immobile and quiet. At this time, ground surface and air temperatures are low, ranging from 50° to 60°F. About 90 minutes later, the grasshoppers begin to stir and take basking positions in which they assume two main orientations. Sitting on top of blue grama or on ground litter they may present a side perpendicular to the sun's rays and lower the exposed hindleg. In this orientation, some grasshoppers tilt their bodies slightly to expose their backs as well as their sides. In the second orientation, grasshoppers rest diagonally on blue grama with their hindlegs on the ground so as to expose their backs to the sun's rays. Grasshoppers bask for about one to two hours before they begin normal activities of pottering, feeding, mating, and ovipositing. These activities continue until temperatures become too hot (surface of soil 120°F and air temperature 1 inch above ground 85°F). The grasshoppers then either climb grass leaves and rest head up one-fourth to one inch above ground level or they climb on top of blue grama and face the sun to expose a minimum of their body surface. In the latter orientation, they may spread apart their flexed hindlegs. When temperatures moderate they again become active. Only one observation has been made of this grasshopper as it settled down for the night. Shortly before sunset, a female was discovered sitting quietly on the ground under a canopy of blue grama plants.

Number young adults per sq. yd.							
Site	1968	1969	1970	1971	1972	1973	1974
Guernsey, WY	0.05	0.05	0.05	0.1	0.1	0.5	0.9
Nunn, CO				0.5	0.4	0.6	0.9

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