Velvetstriped Grasshopper

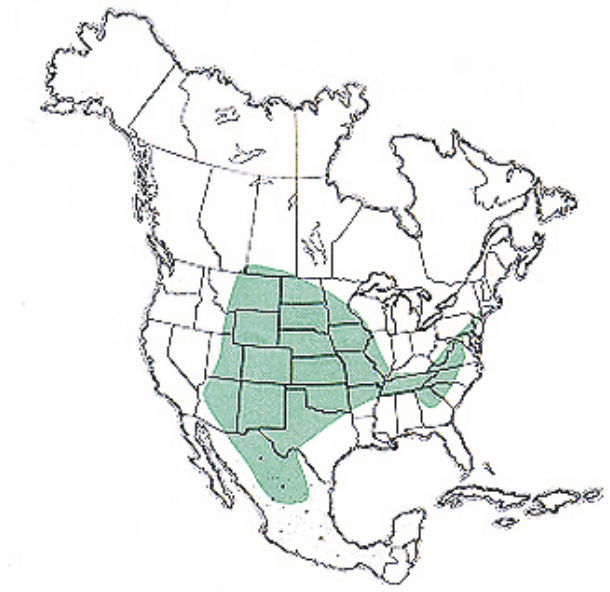
Eritettix simplex (Scudder)

Distribution and Habitat

The velvetstriped grasshopper has an extensive range in North America. There are two main centers of distribution, the larger lies in the Great Plains of western North America and the smaller in the Appalachian Mountains and their eastern slopes. In the West this species develops its highest densities in the tallgrass prairie. Populations find preferred habitats in stands of mid and tall grasses and forbs where the understory is blue grama, a short grass and a preferred food plant. This grasshopper extends its range into desert, mixedgrass, shortgrass, and bunchgrass prairies by occupying mesic swales and drainages.

Economic Importance

Because it feeds almost exclusively on grasses and sedges, the velvetstriped grasshopper is a potentially damaging pest of rangeland. However, densities of less than one per square yard in most areas of its distribution and its development in spring, when range plants usually have adequate moisture, render populations innocuous. High numbers of this grasshopper have been found in at least one area, the Sheyenne National Grasslands of eastern North Dakota, a sand prairie region. For three of ten years (1959 to 1968) the velvetstriped grasshopper was the dominant species. In 1960 the population peaked at an estimated density of approximately seven grasshoppers per square yard. The species is in the smallest of three weight divisions of rangeland grasshoppers; average live weight is 108 mg for males and 269 mg for females (dry weight: males 33 mg, females 110 mg).



Geographic range of *Eritettix simplex* (Scudder)

Food Habits

Host plants of the velvetstriped grasshopper consist almost exclusively of grasses and sedges. When the nymphs emerge from their winter quarters in early spring, they feed on the growing, cool-season plants: bluegrasses, downy brome, junegrass, threadleaf sedge, and needleleaf sedge. As the season progresses, the diet of this grasshopper shifts to warm-season plants, particularly blue grama. This grass appears to be highly preferred and is often the only plant found in the crops of adults. Other grasses found in crops in substantial amounts include hairy grama, sideoats grama, sand dropseed, and needleandthread. In summer and fall the new generation of nymphs feed almost exclusively on blue grama.

A total of 25 species of grasses and three species of sedges have been recorded as eaten in various amounts by this grasshopper. Trace quantities of five forbs, fungi, pollen, and arthropod parts have been found in crop contents.

To feed, the velvetstriped grasshopper normally rests in a head up position on the plant. It may either lean on the plant raising itself by its hindlegs and then attack the plant about 1 inch above ground level, or it may jump or climb onto the plant and attack a leaf near the middle. It will cut a narrow leaf and hold onto the detached section with its front tarsi, feeding toward the tip. The detached leaf may be eaten entirely or may be partly eaten and dropped. Although the feeding posture is usually vertical or diagonal with head up, an individual may turn around head down and feed on the leaf base. Individuals may feed across the entire width of relatively wide grass leaves, or feed only to the midrib and leave the other half attached and standing.

Dispersal and Migration

The velvetstriped grasshopper possesses long wings. Those of the female do not quite reach the end of the abdomen; those of the male extend slightly beyond. Measured evasive flights have ranged from 2 to 6 feet at a height ranging from 4 to 12 inches. Flight is silent and usually straight; the landing is horizontal on the ground, with the head pointing in the direction of flight and away from the intruder. Occasionally a fleeing

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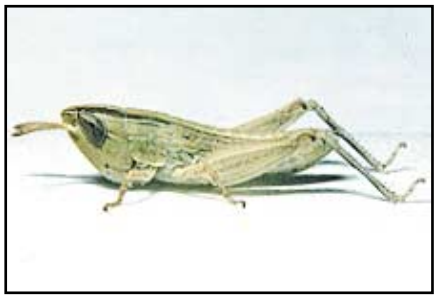
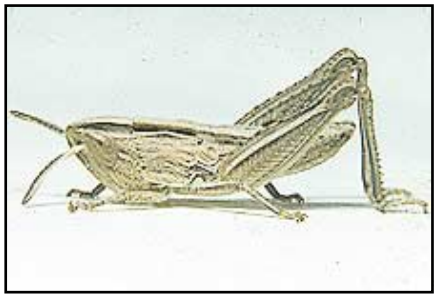


1. BL 6.6-7.5 mm FL 3.3-3.9 mm AS 13-14.

Instar 2

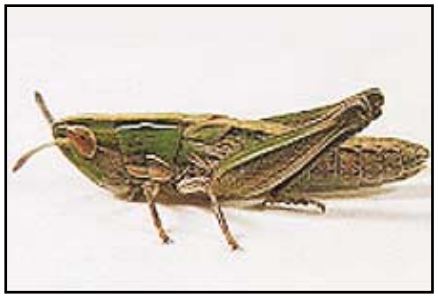


2. BL 8.1-8.8 mm FL 4.5-5.5 mm AS 16-18.

Instar 3

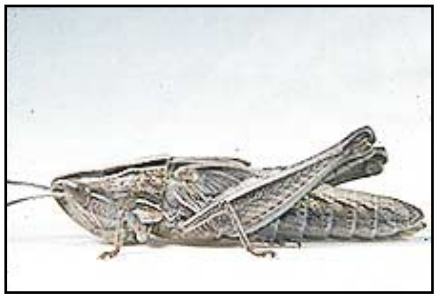
3. BL 8.5-10.2 mm FL 4.9-6.1 mm AS 18-21.

Instar 4



4. BL 11.2-13.2 mm FL 6.3-7.6 mm AS 20-22.

Instar 5



5. BL 12-18.5 mm FL 7.5-10.4 mm AS 23-24.

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

grasshopper will turn near the end of a flight and face the intruder.

A study of dispersal of grasshoppers into the mountains of Colorado showed that the velvetstriped grasshopper did not fly from resident habitats into nonresident habitats at higher altitudes, as did several other rangeland grasshoppers. These findings, however, do not prove that the species is lacking dispersive behavior. Its long wings and wide geographic range suggest that dispersal occurs. A positive piece of evidence for dispersal is its distribution in experimental plots on the Pawnee National Grassland in Colorado. In 1 hectare plots of two irrigated treatments of the shortgrass prairie, the number of adults doubled over the number of late instars. The increase in adults evidently came from outside the experimental plots, as the species was not present in the adjacent unirrigated control plots and existed in very low numbers in the adjacent unirrigated fertilized plots.

Identification

Adults of the velvetstriped grasshopper are medium-sized and tan-colored with brown markings or brown and green markings (Fig. 6 and 7). Top of head bears three diagnostic longitudinal carinae or ridges: a median carina and one accessory carina on each side. The pronotal disk likewise has three carinae: a median and one accessory carina on each side; pronotal disk with distinct lateral carinae colored white or cream and moderately constricted near middle; all carinae cut once near or behind middle; disk usually with dark brown, velvet-like band along each lateral carina and between the velvet bands a wide central tan or gray band (Fig. 9). A few specimens have the disk tan, sparingly spotted brown and pronotal lobes with broad brown band. Medial area of hind femur with a dorsal brown stripe and a ventral pale tan stripe.

The nymphs are identifiable by their external structure, shape, and to a lesser degree color patterns (Fig. 1-5):

1. Head with face strongly slanted and with fastigium pointed; top of head with three longitudinal carinae and lateral brown bands that continue on thorax and abdomen; head with a wide middle pale tan band that continues on thorax and abdomen (Fig. 8).

Figures 6-10. Appearance of the adult male and female of *Eritettix simplex*, diagnostic characters, and the egg pod and several loose eggs.

Antennae broad and flat, slightly ensiform.

2. Disk of pronotum with median carina and two accessory carinae; lateral carinae white or cream, slightly constricted near middle, dark brown velvet band along each lateral carina.
3. Medial area of hind femur in instars I to III unicolored pale tan or with brown central or dorsal stripe; in instars IV and V brown dorsal stripe and pale tan ventral stripe.
4. General color of nymphs cream or pale tan.

To compare early instar *Eritettix simplex* nymphs with two similar species, click here. Both nymphal and adult specimens may have color patterns different from those described above. In one pattern, the top of the head and disk are pale tan or cream with brown spots, and a wide brown band begins behind the compound eye on the side of the head and continues on the thorax and abdomen. In another pattern, the body is olive brown with dark brown spots, and the lateral carinae of the pronotum are also olive brown or pale tan.

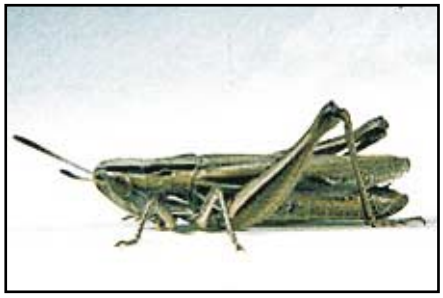
Hatching

The velvetstriped grasshopper is a late-hatching species. In the mixedgrass prairie of eastern Wyoming at altitudes of 4,000 to 5,000 feet, hatching begins the latter part of July and continues for about one month. It is unknown whether the species has a one-year or two-year life cycle, as no thorough study of the life cycle or even egg development has been made.

Nymphal Development

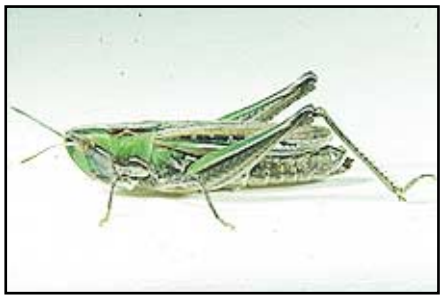
The nymphs develop and grow during summer and fall for about 100 days. At the onset of winter, nymphs are in the third and fourth instars and take refuge under ground litter. They may, however, become active during spells of warm weather. Nymphs are cold-tolerant, surviving freezing and experimental temperatures as low as -15°C, which is about the lower limit of surface ground temperatures in the mixedgrass prairie. Nymphs complete development the following spring in April and May, as temperatures increase and daily photoperiods become longer. Because of the slow growth in fall and the winter dormancy, the nymphal period lasts a relatively long time - approximately nine months.

Male



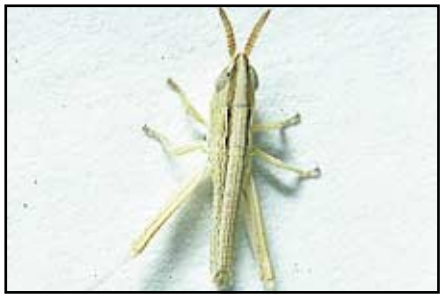
6. BL 15-16.5 mm FL 9.1-10.2 mm AS 23-25.

Female



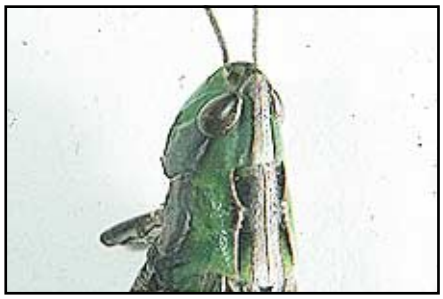
7. BL 22-23.5 mm FL 12-12.7 mm AS 23-25.

Dorsal view



8. Dorsal view of first instar.

Head and pronotum



9. View of head and pronotum of adult female.

Egg pod

10. Egg pod and loose eggs.

Adults and Reproduction

Although adults may disperse, most appear to remain in the same habitat in which they have developed as nymphs. The habitat, including vegetation structure, food plants, and oviposition sites, normally remains favorable. Populations of adults peak in May, slowly declining to sparse densities by July.

Mating occurs in grass foliage. The male follows a female, and when he is within an inch begins to rock from side to side. He then stridulates with one hindleg at a time by rubbing the inside of the femur against a raised vein on the tegmen. After a burst of stridulation, he rushes forward and mounts the female. If she allows, he copulates with her.

Gravid females oviposit into bare ground, taking an hour during the late morning to lay a cluster of about 18 eggs. The eggs are pale yellow and 4.4 mm long. The fragile pod is an inch long and one-eighth inch in diameter (Fig. 10). No study of the potential or realized fecundity of this species has been made.

Population Ecology

In the West, populations of the velvetstriped grasshopper are mainly present in the mesic swales and drainages where densities in early spring range from 0.1 to 0.6 grasshopper per square yard. Only in preferred habitats of the sand prairie of southeastern North Dakota have populations increased to high densities, reaching a maximum of 6.7 grasshoppers per square yard. A study of grasshopper populations in this area over a ten-year period revealed that populations of the velvetstriped grasshopper fluctuated annually, ranging from 0.1 to 6.7 grasshoppers per square yard. The velvetstriped grasshopper became the dominant species in three of the ten years. Mortality was greatest among the late instars during winter and early spring.

Daily Activities

Because nymphs of the velvetstriped grasshopper appear early in spring, they must choose favorable microhabitats that allow them to keep their body temperature at tolerable levels. They take shelter under ground litter during the night, a time when temperatures may fall to near freezing (32°F). Three hours after sunrise, when soil temperatures reach about 60°F, nymphs emerge and bask in the warming rays of the sun. They posture by exposing one side perpendicular to the rays and by lowering the flexed hindleg nearest the sun to the ground and raising the opposite flexed hindleg above the abdomen. Another posture consists of exposing their backs perpendicular to the rays of the sun by resting diagonally on ground litter. Experiments have shown that the nymphs suffer evaporative water loss in dry air at moderate temperatures. This physiological response is probably the reason for their restriction in the West to moist or humid locations.

The adults also take cover in ground litter at night, and in the morning bask on the ground in similar postures as the nymphs. They begin to feed when soil temperatures reach 80°F and air temperatures 55 to 60°F. Only one observation of oviposition in the natural habitat has been made. Oviposition occurred in bare ground in the shade of threadleaf sedge from 10:17 to 11:15 a.m. (DST), when air temperatures 1 inch above the surface ranged from 76 to 79°F.

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