Twostriped Slantfaced Grasshopper

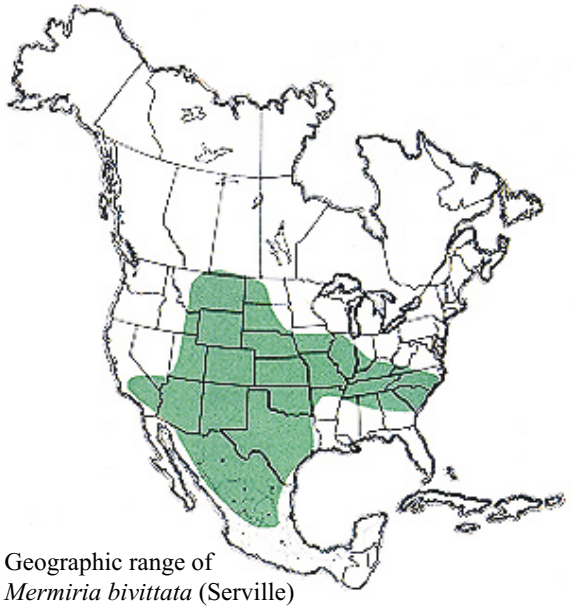
Mermiria bivittata (Serville)

Distribution and Habitat

The twostriped slantfaced grasshopper is widely distributed in North America. Its center of distribution is in the tallgrass prairie where it may reach densities of one adult per square yard in unplowed native grassland. Its habitat consists primarily of tall grasses: big bluestem, yellow indiangrass, and switchgrass, and it frequently inhabits these grasses on slopes and hills. Small, edaphic stands of tall grasses in the mixedgrass, shortgrass, bunchgrass, and desert prairies also provide suitable habitats for the species. In addition, this grasshopper may live in luxuriant stands of midgrasses in the mixedgrass prairie.

Economic Importance

The twostriped slantfaced grasshopper is a frequent and common species in the tallgrass prairie and is a potentially damaging pest. It feeds on valuable forage grasses and occasionally reaches outbreak densities, as it did in native grass pastures of eastern Kansas in 1939. It is a large grasshopper; live weights of males from eastern Wyoming average 222 mg and females 784 mg (average dry weight of males 63 mg, females 204 mg). An estimate of damage indicates that an individual consumes 3.4 gm dry weight of grass during its lifetime, an amount greater than the bigheaded grasshopper, *Aulocara elliotti*, which consumes 2.0 gm. Nevertheless, it rarely becomes a significant pest because densities usually remain light and grass production plentiful in the tallgrass prairie.



Geographic range of
Mermiria bivittata (Serville)

A quantitative study of the impact of grasshoppers on tallgrass prairie disclosed no significant differences in above ground biomass of vegetation between plots with five grasshoppers per square yard and plots with 11 grasshoppers per square yard (early instars). In these studies the twostriped slantfaced grasshopper was a subdominant in an assemblage of 15 species in which *Phoetaliotes nebrascensis*, a grass feeder, was the dominant species. These data indicate that in the tallgrass prairie where grasshopper densities are lower and vegetation production higher than in the drier western grasslands, the impact of grasshoppers is slight and often unmeasurable.

Food Habits

The twostriped slantfaced grasshopper is a grass feeder. Enjoying a wide distribution in North America, the species exploits a variety of grasses that grow in its diverse habitats. In the tallgrass prairie of eastern Kansas, examination of crop contents has shown that it feeds upon sideoats grama, tall dropseed, and yellow indiangrass; in the northern mixedgrass prairie of western Nebraska, it feeds upon prairie sandreed, western wheatgrass, big bluestem, and on eight other grass species; in the blackland (tallgrass) prairie of northeastern Texas, it feeds upon big bluestem, silver beardgrass, prairie dropseed, and several species of grama. This grasshopper has been found to feed on a total of 18 species of grass and on threadleaf sedge. Its dietary, in addition to the grasses already mentioned, includes little bluestem, sand bluestem, blue grama, downy brome, smooth brome, sand dropseed, needleandthread, and hairy grama. Preference tests of caged individuals in a Texas insectary showed that the grasshoppers chose Bermuda grass, an introduced species, and prairie dropseed for food in preference to big bluestem and silver beardgrass.

The twostriped slantfaced grasshopper feeds on green leaves of its host plant. It may attack a plant in three ways. First, sitting vertically, head- up, and near the middle of a wide leaf (sand bluestem), it holds onto its food with the front tarsi and eats from the edge to the midrib, progressing toward the tip. Nymphs and young adults consume lengths of leaf 1 to 2 inches long, causing characteristic semi-elliptical damage. In the second method of attack, the grasshopper, also in a vertical, head-up position, cuts a narrow leaf (needleandthread) near the tip and holds onto a 1 to 2 inch section with the front tarsi and consumes the whole section. The third method of attack involves the grasshopper feeding on a bent over or recumbent leaf

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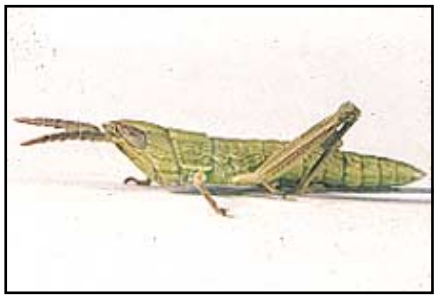

1. BL 9.5-10.4 mm FL 4.3-4.7 mm AS 13.

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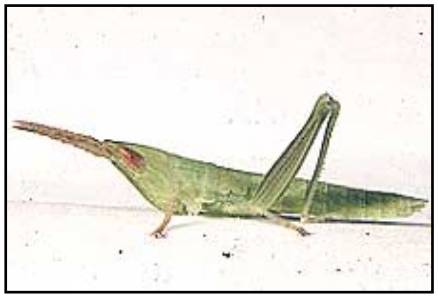

2. BL 12-13.8 mm FL 6.1-6.9 mm AS 16-19.

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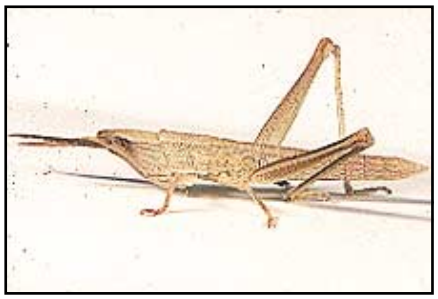

3. BL 16-18.5 mm FL 9.2-9.5 mm AS 21.

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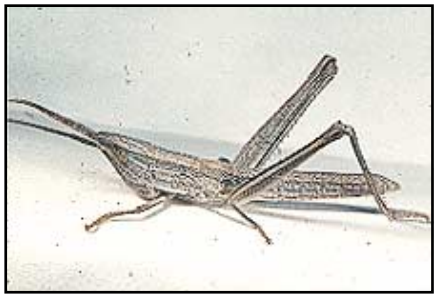

4. Males: BL 21.5-24 mm FL 12.5-12.7 mm AS 22-23.
Females: BL 24-24.7 mm FL 12.5-13.5 mm AS 22-23.

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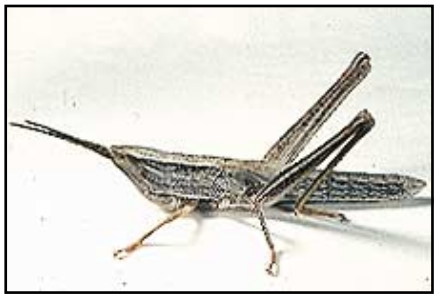


5. Females: BL 28-30 mm FL 16.8-18 mm AS 23-24.

Figures 1-5. Appearance of the five nymphal instars of *Mermiria bivittata* - 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 a horizontal orientation. It then progresses from the middle of the leaf for a short distance toward the base. Feeding bouts of the adults last as long as 7 to 10 minutes. By the end of the season the culms of sand bluestem are stripped of nearly all their leaves and the bunch-like leaves of young plants are partially consumed.

During feeding, the twostriped slantfaced grasshopper may cut and drop sections of leaf, which can still be found on the ground around each plant at the end of the season. In the tallgrass habitat, unlike the mixedgrass prairie, the cut leaves remain uneaten by grasshoppers and become part of the ground litter.

Dispersal and Migration

The twostriped slantfaced grasshopper has long wings that extend to the end of the abdomen. It is a strong and adept flyer. In flushed flights it flies distances of 2 to 12 feet at heights of 9 to 36 inches. The flight is silent and may be straight or sinuous. The grasshopper usually takes off from vegetation and lands on vegetation, but it may also land on plant litter or bare ground. It is able to turn at the end of a flight to land vertically on an upright culm or stem. It can also veer in flight to land within vegetated areas, although many individuals occasionally land in inimical bare areas.

No special study of its dispersal or migration has been made. It has not been found as an “accidental” in the mountains west of Boulder, Colorado, even though it inhabits the adjacent plains and foothills. Although direct evidence of its dispersal is lacking, we may speculate that the species does disperse for the following reasons: 1) good capacity for flight; 2) extensive range in North America; and 3) occupation of small edaphic habitats in the drier grasslands.

Identification

The twostriped slantfaced grasshopper is a large, long-winged, colorful insect (Fig. 6 and 7). It has a strongly slanted face; the antennae are ensiform. A brown stripe beginning behind the compound eye runs along the side of the head and onto the lateral lobe of the pronotum. Four diagnostic characters of this species are: 1) the disk of the pronotum rounds off onto the lateral lobe, i.e., it lacks lateral carinae (Fig. 8); 2) the pronotal disk margin is cut by three sulci; 3) sides of occiput and pronotal disk without ivory stripe; and 4) one longitudinal white or ivory streak on tegmen. The

Figures 6-9. Appearance of the adult male and female of *Mermiria bivittata*, dorsal view of head and pronotum of female, and view of eggs and pod.

hind tibiae are orange and the body is tan, often densely spotted brown (visible under low magnification). In the West, this grasshopper broadly overlaps geographically and seasonally with two other species of the genus - *M. picta* and *M. texana*. All three look superficially alike, but adults can be easily separated by a few distinguishing characters.

Mermiria texana has an ivory stripe on sides of occiput and pronotal disk and it has two longitudinal white streaks on the tegmen, one above base of hindleg and one above abdomen. *Mermiria picta* lacks the ivory stripes on the occiput and pronotal disk and the streaks on tegmen (*M. bivittata* has one streak), and it has well-developed lateral carinae on pronotal disk and the lateral carinae are cut by two posterior sulci (the anterior sulcus is visible on pronotal disk but does not cut the carinae). One other species is known, *M. intertexta*. It is distributed in the eastern United States along the Atlantic and Gulf coasts.

The nymphs (Fig. 1-5) are identifiable by their color patterns, structures, and shape:

1. Head with face strongly slanted; antennae ensiform with proximal segments triangular in cross section, distal segments tubular; lateral foveolae triangular, invisible from above; narrow brown band beginning behind compound eye runs along side of head and continues on dorsal edge of lateral lobe; band faint in early instars.
2. Pronotum with lateral margin of disk rounding off onto lateral lobe; margin of disk cut by three sulci; sulci weak in instar I.
3. Hind femur with upper medial area darker than the lower; hind tibia yellow or pale gray.
4. Body yellow, tan, or green and densely spotted brown (visible with low magnification).

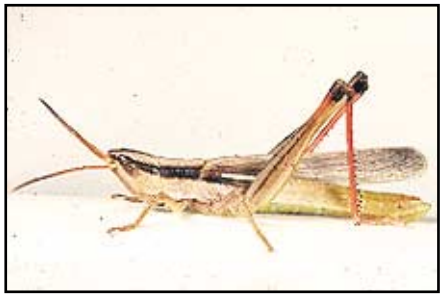
Hatching

The twostriped slantfaced grasshopper is a late-hatching species. In the tallgrass prairie of eastern Kansas, first instars appear in early May, while in the mixedgrass prairie of eastern Wyoming they do not appear until early to mid June. The period of hatching in a habitat may last two weeks or longer.

Nymphal Development

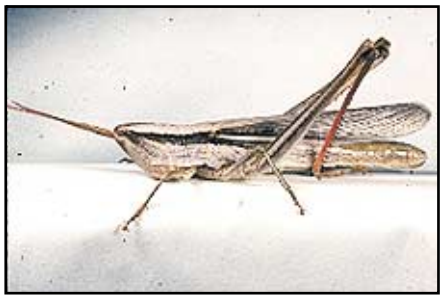
Although nymphs hatch late and normally experience warm conditions and favorable food supply, they develop at a relatively slow rate. Their minimum nymphal period, completed by the males, is 40 days. The slow development is probably due to exposure to the cooler temperatures of their

Male



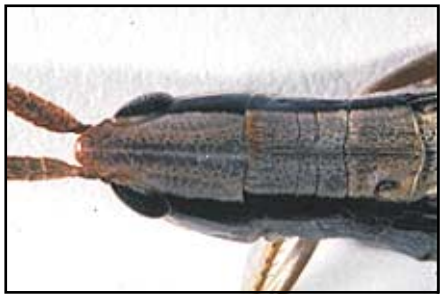
6. BL 25-29 mm FL 14-16.8 mm AS 22-24.

Female



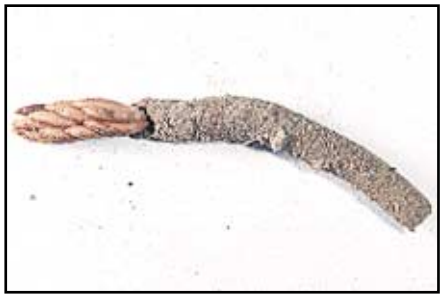
7. BL 35.5-39.8 mm FL 20.5-24.5 mm AS 23-24.

Head and pronotum



8. Dorsal view of female's head and pronotum showing ensiform antennae, sulci of pronotal disk, and color patterns.

Egg pod



9. Egg mass at bottom of pod (left) and froth plug above (right).

luxuriant grass habitat and their above-ground location on tall grass. Studies carried out in eastern Wyoming indicate that the males have four instars and the females five. Because of their smaller size, the males apparently require fewer instars to achieve the weights necessary to metamorphose to the adult stage than do the much larger females. This proposition suggests that the males have a shorter nymphal period and thus emerge before the females.

Adults and Reproduction

Most adults remain in the habitat in which they hatched and developed as nymphs. There they have the tall grasses for feeding, roosting, and shelter and bare ground for oviposition. Several observations of male courtship have been made. On approaching a female, a male stridulates with a burst of two to five strokes of the femora. No information is available on mounting and copulation nor on how soon adult females mate and lay eggs. The females oviposit in bare ground near their host plant. Eggs are placed deep in the soil, lying at depths between one and one-quarter and one and three-quarters inches. The egg mass, which consists of 14 to 18 eggs, has no pod wall; the eggs are held together by spots of froth (Fig. 9). The egg mass itself is one-half inch long. Eggs are tan or two-toned tan and yellow and are 7.2 mm long. A long froth plug of one and one-quarter inches lies above the eggs. The diameter of the plug measures one-eighth inch or slightly more.

Population Ecology

Studies on the population ecology of the twostriped slantfaced grasshopper have been conducted in the tallgrass prairie where the species finds extensive areas of its preferred habitat of tall grasses. These studies show that populations fluctuate around low densities, rarely exceeding one adult per square yard. Food supply is not the limiting factor, as the luxuriant grass foliage of the tallgrass prairie remains plentiful except in cases of heavy use by livestock. Elegant studies of the impacts of burning, which occurs regularly via humans and lightning, show that the grass habitat is maintained by reducing competition or invasion by forbs and shrubs thereby favoring the graminivorous grasshoppers over the forb- or mixed-feeders. A problem that still remains unsolved is the discovery of the factor or factors that limit the size of populations of the twostriped slantfaced grasshopper.

Daily Activity

The twostriped slantfaced grasshopper is a phytophilous species spending most of its days and nights perched on grass. At night, nymphs and adults rest vertically head-up on leaves or culms at heights of 8 to 12 inches. As the sun rises and rays strike their perches, the grasshoppers begin to bask by adjusting their positions so that one side receives the full benefit of the radiant heat. They may bask for two to four hours before they begin to feed or move about on host plants. Movement consists of descent by backing down from their perches, crawling onto another leaf, or jumping from one plant to another. If in jumping they land on the ground, they immediately crawl up on a nearby grass plant. As do grasshoppers of other species, they frequently preen their antennae and compound eyes, presumably to remove dust particles that settle on these organs. High temperatures cause them to change their positions on grass plants to the shady side. When temperatures subside they again become active, feeding and moving about. As evening approaches, they become quiescent and remain largely immobile from 8:30 p.m. to 7 a.m. DST. Rain and cool temperatures extend quiescence. Individuals continue to rest on their nocturnal perches until the sun again shines on them.

In the sandhills grassland of central Nebraska, a study of time and activity budgets of this grasshopper showed that in the daylight hours (13.5 hours), the twostriped slantfaced grasshopper remained quiescent 88 percent of the time, fed 10 percent, and moved 1 percent.

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