

Kiowa Grasshopper

Trachyrhachys kiowa (Thomas)

Distribution and Habitat

The Kiowa grasshopper ranges widely in North America, occupying sparse grassland areas. Preferred habitats are dominated by short grasses, especially blue grama. The largest populations develop in the mixedgrass, shortgrass, and desert prairies. In the tallgrass prairie, the Kiowa grasshopper frequents sites of shorter, sparser grasses that occur on hilltops and in overgrazed or disturbed land.

Economic Importance

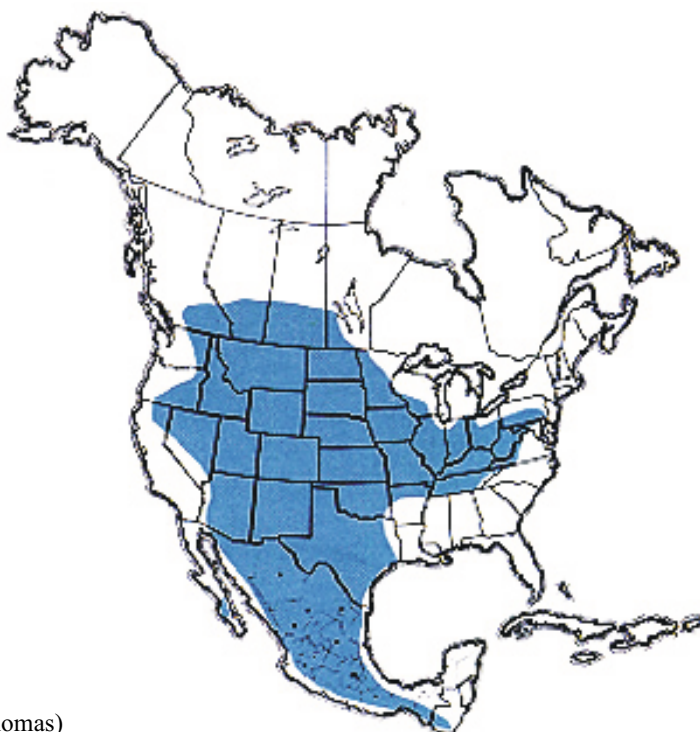
The Kiowa grasshopper feeds on high-quality forage grasses and sedges. It often becomes an injurious component of outbreak populations in the mixedgrass prairie. Its representation in these populations usually ranges from 1 to 13 percent, while densities range from 0.1 to 2 adults per square yard. Although rarely the dominant species, it may become the second most abundant species in an assemblage. In 1957 a “moderate” infestation was recorded from rangeland in British Columbia.

The Kiowa grasshopper is a medium-sized species. Live weight of males from mixedgrass prairie averages 148 mg and of females 303 mg (dry weight: males 44 mg, females 80 mg).

Food Habits

The Kiowa grasshopper feeds almost exclusively on grasses and sedges. In the mixedgrass and shortgrass prairies blue grama is its principal host, making up 84 to 100 percent of the diet. In other grasslands where blue grama occurs, it is again the preferred host plant. A total of twelve grasses and three sedges have been found in crop contents. In addition to blue grama, plants eaten in substantial quantities include western wheatgrass, needle-andthread, Kentucky bluegrass, threadleaf sedge, needle-leaf sedge, and Penn sedge. Due to its wide distribution, this grasshopper probably feeds on many more species of grasses and sedges than have been reported. Laboratory and field evidence indicate that it does not feed on bran bait. Nymphs have never been observed eating plant litter and adults infrequently.

The Kiowa grasshopper usually attacks a leaf at the tip and eats toward the base. It may feed on a green leaf of blue grama that is oriented horizontally about one-half inch above the soil surface, or it may raise on its hindlegs and bring an erect leaf down to feed while resting on the ground. The front tarsi handle the leaf while the mid- and hindlegs support the body. It may also feed head down at the base of grasses. Adults have been observed feeding on a small lichen that grows in mats on the soil surface.



Geographic range of
Trachyrhachys kiowa (Thomas)

Instar 1



1. BL 4-4.3 mm FL 2.3-2.5 mm AS 9-11.

Instar 2



2. BL 4.9-5.9 mm FL 3.1-3.4 mm AS 12-13.

Instar 3



3. BL 5.8-7.9 mm FL 3.6-4.5 mm AS 14-15.

Instar 4



4. BL 7.6-12.1 mm FL 4.7-6.5 mm AS 16-18.

Instar 5



5. BL 11-16 mm FL 7.8-9.4 mm AS 20-21.

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

Dispersal and Migration

Possessing wings that extend considerably beyond the end of the abdomen, the Kiowa grasshopper is known as an inveterate wanderer. An investigation of resident and nonresident populations inhabiting sites at different altitudes in Colorado shows that dispersal of this species is a common phenomenon. In Nebraska a migratory swarm was observed flying over Overton on 8 July 1936. One male and two females from the swarm were caught and identified.

In evasive flights the adults take off from the ground and land on the ground. Distances range from 4 to 12 feet at heights of 6 to 18 inches. Crepitating softly, the adults fly straight or curved, often taking a right angle turn near the end so that a side is presented to the intruder.

Identification

The Kiowa grasshopper, a medium-sized rangeland species, becomes adult two to three weeks after the bigheaded grasshopper, *Aulocara elliotti*. General body color is tan, occasionally pale green, with maculations (Fig. 6 and 7). The tegmen has two or three large, dark brown markings in the middle and numerous dark brown spots at each end; the hindwing is mainly colorless and usually without a dark band (Fig. 9). Lateral lobe of the pronotum has the posteroventral angle drawn acutely downward. The hind femur has the lower carina with a fringe of long (male 3-4 mm, female 4-5 mm) hairs (Fig. 8). Hind femur with inner medial area fuscous and two pale yellow bands, one located in center and the other next to knee; hind tibia blue, especially inner face, with proximal end usually tan and spotted brown.

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

1. Head: face nearly vertical; dark narrow band on upper edge of fastigium running transversely between top of compound eyes; dark band often becomes broken and less distinct in instars IV and V.
2. Pronotum with disk wrinkled, median carina distinct, cut twice, elevated full length but slightly higher on prozona than metazona; lateral lobe with posteroventral angle drawn acutely downward.

Figures 6-10. Appearance of the adult male and female of *Trachyrhachys kiowa*, left hind femur of adult female, left wings of female, and eggs and egg pod.

3. Hind femur with diagnostic fringe of hairs on lower carina, more clearly evident in instars III to V.
4. General body color tan with dark brown markings; some individuals pale green with fewer but highly contrasting dark markings (see Figure 2).

Hatching

The Kiowa grasshopper begins to hatch 15 to 17 days after the bigheaded grasshopper, *Aulocara elliotti*, placing it in the intermediate-hatching group. In the mixedgrass prairie of eastern Wyoming and the shortgrass prairie of eastern Colorado, first hatch normally occurs sometime during the first half of June. Depending on heat accumulation of the soil, actual dates of hatching in a site may differ by as much as 15 days between years and the period of hatching may last from two to four weeks.

Nymphal Development

The nymphal period ranges from 37 to 53 days in the mixedgrass prairie of eastern Wyoming. In years of an early hatch the nymphal period is extended, while in years of a late hatch it is shortened. Like several species of grasshoppers that have been reared in laboratories at selected temperatures, nymphs of the Kiowa grasshopper undoubtedly develop slower under cooler conditions and faster under warmer.

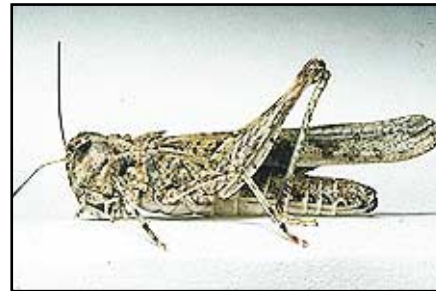
Adults and Reproduction

Although the adults are dispersive, the majority appear to remain in the habitat in which they developed as nymphs. Food generally stays green and abundant through their adult life, and the nymphal habitat contains the bare areas in which females prefer to oviposit. Courtship by the males is carried out on the ground. While approaching a female, the male makes single stridulating strokes of both hind femora. As a male mounts a female, he taps her head with his antennae. Copulation lasts from 25 to 40 minutes. Gravid females deposit their eggs close to vegetation in bare ground. Females take from 40 to 60 minutes to complete an oviposition. After extracting the ovipositor, they brush soil over the hole with their hind tarsi. The pod is an inch and one-eighth to an inch and one-quarter long and contains eight to ten eggs. The eggs lie in a soil cell



Male

6. BL 15-18 mm FL 9.4-11.5 mm AS 21-23.



Female

7. BL 17-24 mm FL 12-14 mm AS 21-22.



Femur

8. Left hind femur of adult female showing fringe of hairs.



Wings

9. Tegmen and hindwing of female.



Eggs

10. Pod and cluster of eggs in soil cell.

with slight protection by a minute amount of surrounding froth; a definite froth plug, however, lies above them (Fig. 10). Eggs are 4.4 to 5 mm long and two-toned, brown and tan. When digging pods from the soil, the cluster of eggs invariably falls apart. The species has one generation annually.

Population Ecology

Populations of the Kiowa grasshopper in the mixedgrass prairie may remain at low densities, from 0.2 to 0.5 adults per square yard, for periods of five years or more. Under favorable conditions population densities suddenly increase from three- to as much as seven-fold from one year to the next. This increase comes when other rangeland grasshoppers, such as the bigheaded grasshopper, *Aulocara elliotti*, and the whitewiskered grasshopper, *Ageneotettix deorum*, make similar increases, and together the species assembled in a habitat reach outbreak proportions. Maximum adult densities of the Kiowa grasshopper during an outbreak reach 2.5 per square yard. Scientists doing research on population ecology of grasshoppers have yet to discover the causes of these outbreaks and their eventual collapse.

In the bunchgrass prairie of southern Idaho where the Kiowa grasshopper inhabits areas lacking blue grama, populations rarely reach densities exceeding one nymph per square yard.

Daily Activity

The Kiowa grasshopper is a ground-dwelling insect with activities greatly influenced by temperature and light. Both nymphs and adults rest horizontally on the ground at night and do not appear to seek protection from the low nightly temperatures of summer on the high plains (48 to 55°F at the soil surface and 1 inch above). In early morning shortly after sunrise they continue to sit quietly on the ground in no particular orientation to the sun. Two hours later they begin basking by orienting a side perpendicular to the rays of the sun and lowering the flexed hindleg on the sunny side of the grasshopper to the ground to expose the abdomen. Occasionally a basking individual will lower both hindlegs or take a diagonal position pointing the dorsum to the rays of the sun. Basking may continue until 10 or 11 a.m. DST.

On warm, clear days feeding begins at 9 a.m. with some individuals feeding as late as 11 a.m. After noon when temperatures rise excessively (about 130°F at the soil surface), the Kiowa grasshopper climbs grasses and forbs to rest 1/2 to 1 inch above ground level. Some individuals may crawl on the ground into the shade of vegetation. As temperatures moderate in the afternoon they descend to the ground and may begin to feed once more. Later, around 6 p.m. when temperatures drop to 90°F at the exposed soil surface and 80°F 1-inch high in shade, they begin basking and continue basking until sunset. They evidently shift positions during the night since individuals are found at dawn in various orientations and locations.

Selected References

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