

Bluelegged Grasshopper

Metator pardalinus (Saussure)

Distribution and Habitat

The bluelegged grasshopper, a large bandwinged species, has a wide geographic range in western North America. It inhabits the shortgrass, mixedgrass, bunchgrass, desert, and tallgrass prairies. In the northern mixedgrass prairie, where populations reach their highest densities, the species prefers to live in areas dominated by western wheatgrass. These are mesic habitats commonly occurring on clay soil flats, in valley bottoms, and in old dry lake beds. The close plant-insect relationship is probably the main reason for a patchy distribution of this grasshopper.

Economic Importance

The bluelegged grasshopper is a heavy feeder on native grasses, particularly western wheatgrass, which abounds in its preferred habitats. Calculations made from a quantitative study of damage in Montana indicate that a density of one bluelegged grasshopper per square yard causes a loss of approximately 100 pounds (air-dry weight) of grass per acre. This figure appears unusually high, suggesting the need for further study of damage by this grasshopper.

The damage is usually done in participation with other rangeland species, often with the bigheaded grasshopper, *Aulocara ellioti*, or the whitecrossed grasshopper, *Aulocara femoratum*. The densities of the bluelegged grasshopper in assemblages occupying its preferred habitats usually range from one to four adults per square yard, but in some situations densities may reach ten per square yard.

The bluelegged grasshopper is a large species. Live weights of males from northern mixedgrass prairie average 294

mg and of females 828 mg (dry weights: males 97 mg, females 236 mg).

Food Habits

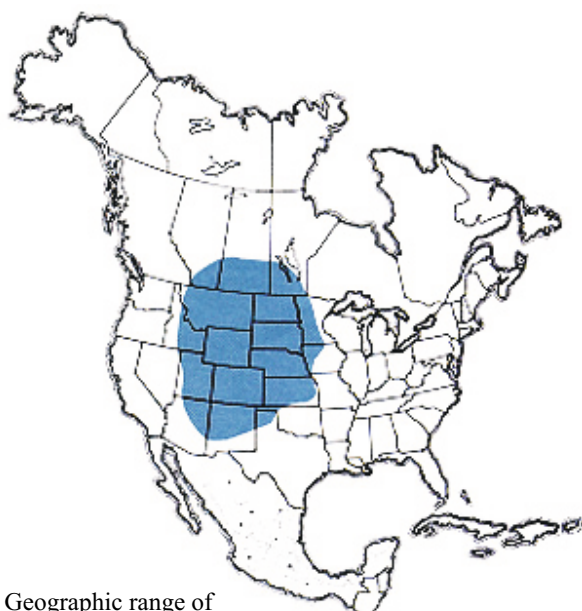
The bluelegged grasshopper feeds almost exclusively on grasses and sedges. It has been observed to feed on the green leaves of western wheatgrass, bluebunch wheatgrass, needleandthread, green needlegrass, sand dropseed, prairie junegrass, and blue grama. Microscopic examination of crop contents of late instars (IV and V) and adult males collected from a western wheatgrass habitat in the northern mixedgrass prairie of eastern Wyoming revealed that these grasshoppers were ingesting two host plants exclusively - western wheatgrass and needleleaf sedge in nearly equal amounts. In a Nebraska study, crops of two specimens from a site near Scottsbluff contained solely prairie sandreed fragments. The bluelegged grasshopper also feeds on both green and dry grass litter and on dry cattle droppings. Although this habit suggests the species should eat bran bait, insecticidal tests indicate otherwise, as only a 2 percent reduction was achieved in a population treated with carbaryl bran bait. Adults have been observed feeding ravenously on a small matforming lichen. This behavior sometimes gives the appearance that the grasshoppers are eating soil.

The method of attacking a host plant by this grasshopper is unusual. Crawling on the ground, a hungry adult contacts a host plant such as western wheatgrass or needleandthread, climbs the plant, and cuts a 3 to 4 inch terminal section of leaf, which falls to the ground. The grasshopper immediately drops to the ground and recovers the cut section. Handling the cut terminal with its front tarsi, the grasshopper devours it from one end to the other. While searching for food, a hungry grasshopper may instead contact a green section of leaf lying on the ground or an attached recumbent leaf and feed on it. The method of attack used by instars II to V is similar to the adults; they climb and cut terminal sections of leaves and feed on them from a horizontal position on the ground or they feed on ground litter, both green and dry grass leaves. No observations of feeding of instar I have been made.

Dispersal and Migration

Possessing long wings that extend beyond the end of the abdomen and strong powers of flight, the bluelegged grasshopper is well known for its vagrant tendencies. In Colorado its upper resident altitude is 5,800 feet at the western edge of the plains, but adult "accidentals" have been collected farther west at several locations in the mountains, the highest at 11,400 feet.

Evasive flights begin about 8:30 a.m. DST on clear days when soil temperatures have risen above 60°F. These



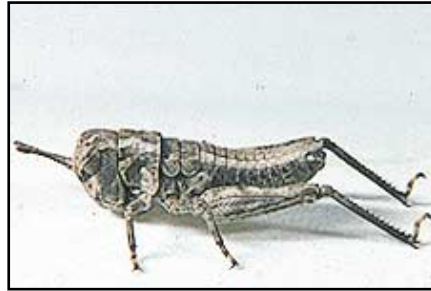
Geographic range of
Metator pardalinus (Saussure)

Instar 1



1. BL 5.9-7.6 mm FL 3.5-3.7 mm AS 9-10.

Instar 2



2. BL 7.4-9.3 mm FL 4.5-5 mm AS 11-14.

Instar 3



3. BL 9.5-11.9 mm FL 5.8-6.2 mm AS 16-17.

Instar 4



4. BL 10.9-15 mm FL 6.4-9.3 mm AS 17-18.

Instar 5



5. BL 12.5-20 mm FL 8.4-11.9 mm AS 19-20.

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

flights are straight and 6 to 12 inches high, the adults softly crepitating and travelling distances of 3 to 15 feet.

Although no direct observations of group migratory flights have been made, circumstantial evidence indicates that such behavior occurs. In eastern Wyoming a preferred habitat dominated by western wheatgrass became drought stricken in July 1989, and the usually luxuriant grasses stopped growing and turned brown. Where both the bigheaded grasshopper and the bluelegged grasshopper occurred in economic densities on 1 July 1989, only the bigheaded grasshopper remained at high densities 20 July 1989. The bluelegged grasshopper had disappeared and presumably emigrated to more favorable habitats that had received spotty rainfall during the summer. Two possible stimuli for the emigration of the bluelegged grasshopper were the exhaustion of its preferred food plants and the deterioration of the microhabitat. On the other hand, the bigheaded grasshopper, with less stringent ecological requirements, chose to remain in the deteriorating habitat.

Identification

The bluelegged grasshopper is a large, tan and brown grassland species (Fig. 6 and 7). The posteroventral angle of the pronotal lobe is acute and drawn down. The tegmen has numerous dark brown spots and a pale streak on the outer edge of the dorsal field. The streaks of the folded tegmina converge posteriorly. The hindwings are marked by a wide outer dark band and the inner or basal area is colored yellow, orange, or red (Fig. 8). The inner face of the hind femur has alternating bands of light and dark blue; the band next to the knee is sometimes tan (Fig. 9). The hind tibia of the male is medium blue, that of the female is light blue on the outer face and medium blue on the inner face. The male often has top and sides of the abdomen (the terga) colored blue.

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

1. Head: face nearly vertical, a diagnostic light band beginning from near top of compound eye and running diagonally backwards on the occiput, the band from one eye converges on the other but the bands do not meet, bands sometimes faint. Figures 1-5 show side view of left band beginning above compound eye and running diagonally on occiput.
2. Pronotum with disk wrinkled; median carina distinct and elevated higher on the prozona than the metazona, cut twice, in front of middle and

Figures 6-10. Appearance of the adult male and female, the hindleg, the left wings, and the eggs.

near middle; lateral lobe with posteroventral angle acute and drawn downward.

- Hind femur with sparse hairs on lower carina; this characteristic separates bluelegged nymphs from Kiowa grasshopper nymphs (*Trachyrhachys kiowa*), which possess a thick fringe of hairs on the lower carina. Color of hind tibia of instars I and II is fuscous, of instars III and IV fuscous and gray, of instar V pale blue or pale blue, tan, and fuscous.
- General body color tan to brown with many dark brown maculations imparting a dark brown aspect to all instars.

Hatching

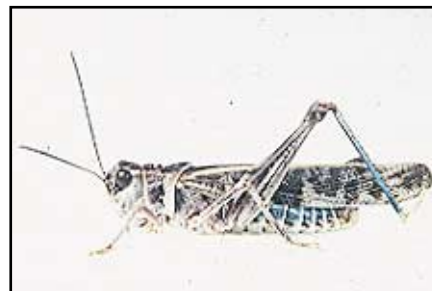
Eggs of the bluelegged grasshopper hatch two to three weeks after those of the bigheaded grasshopper, placing the former species in the intermediate-hatching group. Although egg development of the bluelegged grasshopper has yet to be investigated, we may speculate from its seasonal development and from the results of studies of other rangeland species that the embryos begin to develop in summer, shortly after the eggs are laid, and continue developing until they diapause in an undetermined embryonic stage in fall. Sheltered in soil cells at depths of 1 to 2 inches, the eggs pass the winter and then complete development the following spring. We postulate that eggs of the bluelegged grasshopper diapause in approximately the same developmental stage as eggs of the bigheaded grasshopper, but because of greater depth in the soil eggs of the former species take longer to accumulate the required heat units for completion of their embryonic development and hatching.

Nymphal Development

In the northern mixedgrass prairie, nymphs emerge in June over a short period, possibly as short as one week. They feed and develop in the same habitat as they hatch and dwell on the ground surface. Their nymphal development consists of five instars and takes about 36 days to complete.

Adults and Reproduction

Adults of the bluelegged grasshopper may disperse to new areas, but the majority remain in the same favorable habitat in which the nymphs hatched and developed. There they feed, mature, reproduce, and eventually are eaten by a predator or die from other causes. Observations have not been made of the courting and mating behavior of this grasshopper, but several observations of oviposition in northern mixedgrass prairie have been made. A gravid female



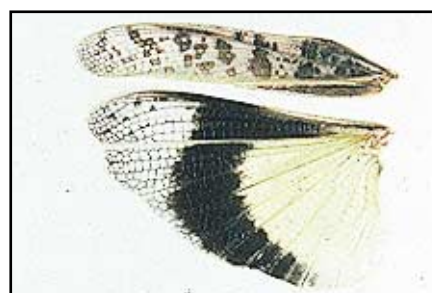
Male

6. BL 22-25 mm FL 13.5-14.5 mm AS 20.



Female

7. BL 30-34 mm FL 15.2-18 mm AS 21-13.



Wings

8. Spread wings from left side.



Hindleg

9. Inner face of female hindleg.



Eggs

10. Loose eggs from single pod.

ready to lay selects either bare ground or ground covered by litter among shortgrass, if available, and works her ovipositor 2 inches deep into the soil. The time taken to begin and end oviposition has not been observed, but one female with her ovipositor already inserted took 32 minutes until withdrawal. A female covers the hole by tamping with her hindlegs and brushing with her ovipositor. A clutch consists of 14 large reddish brown eggs measuring 6.3 to 7.3 mm in length (Fig. 10). There is one generation annually.

Population Ecology

Populations of the bluelegged grasshopper reach their highest densities in habitats dominated by western wheatgrass. These habitats commonly occur under mesic conditions, as in dry lake basins (playas), valley bottoms, and on clay soil flats. In especially favorable habitats, populations may reach a peak density of ten adults per square yard, but usually densities are much less. In a 15 acre playa in the northern mixedgrass prairie of eastern Wyoming, where from 1981 to 1985 adults of the bigheaded grasshopper ranked first in abundance (adult densities of 18, 26, 17, 14, and 9 per square yard in the successive years), the bluelegged grasshopper ranked second (1.7, 1.1, 1.8, 1.8, and 2.8 per square yard). Populations of both species were still high in the spring of 1989, but a severe summer drought caused the vegetation to desiccate and the adults of the bluelegged grasshopper to emigrate. Thus, the bluelegged grasshopper appeared to be more sensitive to conditions of the vegetation and to moisture than the bigheaded grasshopper. Under favorable moisture conditions populations of both species remained high but did fluctuate. The rises and falls of the populations of the two species were not synchronous. In given years the population of one species increased while the other decreased.

A biological control factor affecting populations of the bluelegged grasshopper is parasitism by the tangleveined fly, *Trichopsidea clausa*. In some years 80 percent of females in a population are infested with parasitic larvae. A parasitized

female is unable to reproduce, as all eggs and soft tissues are consumed by an invading larva. Upon developing to maturity a larva leaves its host, which then dies. Interestingly, the bigheaded grasshopper is not affected by this parasite. The tiny larva, 0.5 mm in length, may invade an individual but it is sealed off and killed by the resistant host.

Daily Activity

The bluelegged grasshopper is a ground-dwelling insect. Both nymphs and adults sit horizontally on the ground through the night. Many take positions on ground litter among grasses or on bare ground under canopies of grasses. Others may just sit on bare ground unprotected and exposed to the chilling night temperatures. At sunrise the grasshoppers are found facing in various directions. About two hours later they begin to bask by exposing a side perpendicular to the rays of the sun and lowering the hindleg of the exposed side to the ground. They may also lower both hindlegs to the ground while basking. In both postures the hindlegs are flexed. Some may bask for as long as three hours until 10:30 a.m. (DST), but normal activities of feeding, walking and seeking a mate usually begin about 10 a.m., when ground temperature reaches approximately 80°F and air temperature reaches 67°F 1 inch high above ground.

In the afternoon, activity ceases when temperatures of the soil surface rise to 120°F. The nymphs may rest horizontally on the ground in shade of vegetation or may climb on grasses to a height of 2 inches. Adults may rest horizontally on the ground in the shade of vegetation or they may move into the crowns of grasses and rest diagonally on leaf stems in the shade. Later, when temperatures decline the grasshoppers become active again and begin normal activities. In the evening they bask in the waning rays of the sun and eventually select their night-time locations.

Observations of the species in Montana have revealed that older nymphs and the adults are gregarious. Older nymphs were found in small aggregations while the adults were found in large aggregations.

Selected References

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