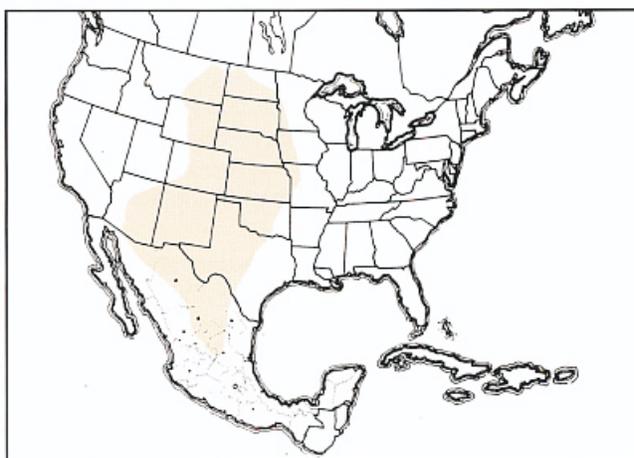


Plains Lubber Grasshopper

Brachystola magna (Girard)

Distribution and Habitat

The plains lubber grasshopper ranges widely on the western plains of the United States and Mexico. It inhabits several types of prairies: shortgrass, mixedgrass, tallgrass, sand, and desert prairies. In these diverse habitats it depends on the presence of certain forbs for its sustenance. It locates patches of host plants along roadsides, field margins, and disturbed rangeland. Patches of common sunflower, *Helianthus annuus*, are especially attractive to this grasshopper.



Geographic range of *Brachystola magna* (Girard)

Economic Importance

In its favored habitat, patches of common sunflower and certain other forbs, the plains lubber grasshopper behaves as a beneficial insect by providing some measure of biological control of weeds. However, large populations inhabiting roadsides and field margins have invaded gardens in Iowa and cotton fields in western Oklahoma and the western plains of Texas. The plains lubber grasshopper can be extremely damaging to young cotton plants; outbreak numbers of adults have completely destroyed stands. They consume all of the foliage and leave only the stems. More often the damage has been limited to 40 or 50 marginal rows. Populations of one adult per 3 feet of row in cotton or two per square yard in vegetation bordering the field are capable of causing economic damage.

Considered an occasional pest of cotton, this grasshopper increased to damaging numbers in 1954, 1959, 1977, and 1979, during a period of 30 years (1951-1980) in Texas.

The plains lubber grasshopper is one of the largest acridids in North America. Collected in Bent County, Colorado from patches of common sunflower, fresh weight of four males averaged 3,935 mg and of five females 4,287 mg (dry weight males 1,188 mg, females 1,292 mg).

Food Habits

The plains lubber grasshopper is a polyphagous insect feeding on a variety of forbs and grasses. Examination of crop contents of 68 individuals collected in a weedy field near North Platte, Nebraska revealed fragments of 16 different species of forbs, four species of grasses, and numerous arthropod parts. The most frequent plants encountered were common sunflower, found in 35 percent of crops, and hoary vervain (*Verbena stricta*), found in 19 percent. Nineteen percent of crops contained arthropod parts. A moderate number of crops contained fragments of western wheatgrass (11 percent), kochia (9 percent), and prickly lettuce (9 percent). Two to 5 percent of crops contained fragments of scarlet globemallow, breadroot scurfpea, Missouri milkvetch, wavyleaf thistle, hoary puccoon, upright prairie coneflower, downy brome, cudweed sagewort, indianpaintbrush (*Castilleja sessiliflora*), horseweed fleabane (*Erigeron canadensis*), western sticktight, foothill bladderpod (*Lesquerella ludoviciana*), and low lupine (*Lupinus pusillus*). These diverse food plants represented nine plant families.

In southeastern Wyoming (Platte County along a gravel road in Whalen Canyon), nymphs and adults were observed to feed mainly on common sunflower. Young nymphs attacked seedling plants, which at the time of observation were 3 to 6 inches tall. To feed, the nymphs climbed the plant, adjusted their bodies, and fed at the edges of leaves, eating into the leaf and creating deep gouges. A third instar was observed to feed on the leaf of a 3-inch plant for three minutes. Later in the season, adults attacked the leaves, buds, and flowers of plants now 17 to 32 inches tall. Two adults (one a female, the other unsexed) were observed feeding into the sides and developing seeds of green heads. Each fed for 16 minutes before completing its meal.

Populations inhabiting two sites near Boulder, Colorado were associated with the sunflower, *Helianthus pumilus*. This leads one to suspect that among the 13 species of *Helianthus* distributed on the Great Plains, other members of the genus may serve as host plants and support isolated populations. A suspected host species is the prairie sunflower, *Helianthus petiolaris*, specimens of which were observed to have been defoliated by a small population of the plains lubber grasshopper inhabiting a roadside in Platte County, Wyoming.

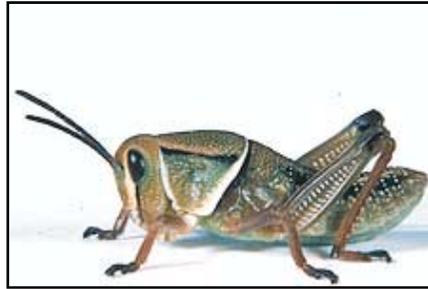
A study of the foraging behavior of the plains lubber grasshopper in a southeastern Arizona site confirmed its highly polyphagous behavior. Adults were observed to feed on 21 species of plants belonging to 15 plant families. Feeding bouts were short with the majority lasting less than two minutes, indicating that few suitable food items were present. Preferred plants included *Boerhaavia coccinea*, *Hymenothrix wislizenii*, and *Gaura coccinea*, but feeding

Instar 1



1. BL 9.5-12.5 mm FL 4.6-5 mm AS 14-16.

Instar 2



2. BL 12-16.5 mm FL 6.4-7.6 mm AS 17-19.

Instar 3



3. BL 16-22 mm FL 8.2-10 mm AS 20.

Instar 4



4. BL 23-24 mm FL 12-13.5 mm AS 22.

Instar 5



5. BL 34.5-47 mm FL 16-19.5 mm AS 23.

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

bouts were also short on these plants. No common sunflowers were present at this site.

The research in Arizona disclosed a remarkable degree of omnivory and predation by the plains lubber grasshopper. A large part of the diet of 15 closely observed females consisted of animal matter. Foraging on the ground, the females ate incapacitated insects and even captured and ate smaller *melanoplinae* grasshoppers.

Laboratory food preference tests conducted in Texas revealed that the plains lubber grasshopper preferred common sunflower, western ragweed, and cotton seedlings. Two-choice tests conducted in Wyoming showed that dandelion, prairie sunflower, and annual sowthistle were also preferred food plants.

Dispersal and Migration

The plains lubber grasshopper disperses and migrates by crawling and hopping. Entomologists have frequently observed adults crossing highways and country roads. Just how fast and how far they travel have not been determined. It is known that from roadsides and field margins they invade fields of young cotton plants.

Brief observations of hopping behavior of adult females were made on a dirt road at the Guernsey, Wyoming, airport on the afternoon of 31 July 1998. At this time the sun was hidden by clouds, soil surface temperature was 93° F, air temperature 84° F, and an east wind of 4 to 9 mph was present. Unflushed hops of females measured 3 to 4 inches. Flushed hops of two females measured 14 inches each. No data on males were obtained; however, Ernest Tinkham, while studying the ecology of grasshoppers inhabiting the Trans-Pecos region of Texas, observed that male plains lubber grasshoppers could jump 9 feet in a single leap.

Identification

The plains lubber grasshopper is a large colorful species (Fig. 6 and 7). The robust adults are flightless possessing only short, round wings; the tegmina are pink and marked by conspicuous black dots that occasionally coalesce. The body is strikingly striped and banded green, brown, and pink. The disk of the pronotum is trapezoidal and surfaced with a dense number of small knobs and several short wrinkles (Fig. 8). The hindlegs are large and multicolored; the male's hind femora are noticeably larger than the female's (Fig. 9); outer side of tibia are pale gray or tan, other sides have hues of orange.

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

Figures 6-10. Appearance of the adult male and female of *Brachystola magna*, hindlegs of both sexes, pronotum and egg pod and exposed eggs.

1. Head green, tan, or fuscous; antennae filiform and chiefly black, each segment with distal ivory annulus, subocular groove black, instars I and II with vertical ivory bar in front of eye on each side of the frons; compound eyes dark brown.
2. Pronotum: disk and lateral lobes trapezoidal, median carina distinct, black, and entire (uncut), lateral carinae distinct, black and cut once in front of middle, disk banded pink and green with dense number of small knobs (Fig. 8); posterior margin of disk ivory, lateral lobes more or less margined with ivory. Mesonotum smooth and shiny black (see Fig. 1, instar I for exposed mesonotum), in subsequent instars the pronotum overgrows and hides the mesonotum. Metanotum knobbed and colored like rest of body. Hind femur patterned, hind tibia hues of orange in instars I to IV, orange or yellow in instar V.
3. Venter of body usually yellow, ivory, or gray.

Hatching

Phenologically, the plains lubber grasshopper belongs to the intermediate group of grasshopper species. Hatching has been observed to start in eastern Kansas in mid May, in northern Colorado and in Wyoming during the first week of June, and in Montana in mid June. In southeast Arizona hatching appears to be retarded until the summer monsoon rains first wet the soil. A fifth instar nymph collected 7 August 1982 in San Rafael Valley indicated that hatching occurred the first part of July.

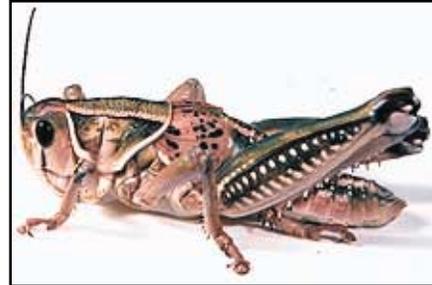
Research of the USDA Grasshopper Laboratory has revealed that the eggs of this species require two years of incubation and overwintering before they hatch. In addition to the laboratory evidence, field observations in Montana, Wyoming, and Texas show higher populations in alternate years, which likewise indicate a two-year life cycle.

Nymphal Development

Nymphs of the plains lubber grasshopper develop through five instars. In nature the nymphal period of an individual lasts about 45 days. Reared in the laboratory and subjected daily to 87.8° F for 14 hours of light and 78.8° F for 10 hours of darkness, the nymphal stage lasted 27 days.

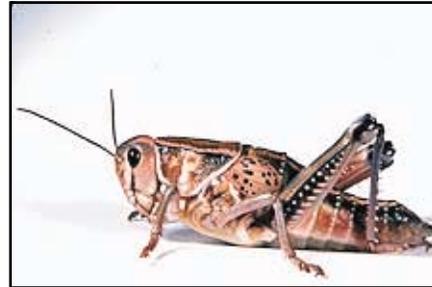
Adults and Reproduction

The adult stage of the plains lubber grasshopper is reached commonly in early summer, allowing an extended favorable time for reproduction. In eastern Kansas, adults first



Male

6. BL 43-52 mm FL 24.5-26 mm AS 23.



Female

7. BL 44.5-55 mm FL 21-24 mm AS 23-24.



Hindleg

8. Inner face of female hindleg (top) and the larger male hindleg (bottom).



Pronotum

9. Colored stripes and knobs of pronotum.



Egg pod

10. Egg pod and exposed eggs.

appear during the last week of June, in northern Colorado the second week of July, in Wyoming the third week of July, and in Montana the fourth week of July. The start of egg laying in Montana has been observed to occur in mid August, indicating a maturation period of 23 days. In 1901 at Fort Collins, Colorado, the first adult appeared July 10, mating was observed July 22, and egg laying began August 1. Oviposition then continues for approximately 60 days until the end of September for surviving females. In milder climates some adults survive even longer. In northeast Kansas adults have been observed during the first week of November.

Little information is available on the site of oviposition, but it appears that females select bare, sandy loam areas in which to deposit their eggs. The pod is large, 1 3/4 to 2 inches long and 3/4 inch diameter in the region of the eggs. It is gourd-shaped (Fig. 10) and contains 20 to 35 large (length 10.1 to 10.8 mm) dark reddish brown eggs.

Population Ecology

The range of the plains lubber grasshopper is widespread in the West, but its distribution is patchy. Populations inhabit disturbed sites occupied by forbs, especially common sunflower, a native American plant. This plant often grows in roadsides and field margins providing favorable habitats for the grasshopper. Biennial populations fluctuate and occasionally reach outbreak proportions. A few reports indicate that one young adult per square yard may be rated as a high density equaling in biomass 11 young adults of *Melanoplus sanguinipes*. In Texas, outbreak populations bordering cotton fields may concentrate to 10 young adults per square yard. Attrition of adults occurs during the summer. This grasshopper has been shown to be an edible one for predators such as birds, rodents, and carnivores. A scat, probably of a swift fox, *Vulpes velox* (Say), collected 1 September 1993 from rangeland in Bent County, Colorado contained parts of the plains lubber grasshopper.

As no sustained study of this grasshopper has been made, we know little of its ecology—the factors that cause it to increase in density, the duration of an outbreak, and what factors may cause the decline or crash of an outbreak population.

Daily Activities

The plains lubber grasshopper occupying a patch of sunflowers spends much of each day resting, basking, and feeding on its host plant. Adults and late instars have been observed in the evening and early morning roosting vertically on the stems or sitting horizontally on leaves at heights of 8 to 41 inches. Basking of these grasshoppers occurs shortly after sunrise when rays of the sun strike their host plants. Turning their backs perpendicularly to the rays of the sun, the grasshoppers “dorsal bask.” A few individuals “flank bask” by exposing a side and lowering the associated hindleg. In a site near Guernsey, Wyoming, basking lasted approximately two hours. Some individuals were observed to bask on the ground.

After basking the grasshoppers adjust their orientation to the sun and for a short time rest quietly on the host plant. Later they stir and begin moving about the plant, feeding, and crawling down head-first to the ground. Mating has been observed to occur on the ground as well as oviposition. While on the ground the adults have been observed to disperse by crawling and to feed on injured grasshoppers. They appear to have a strong disposition to disperse through prairie vegetation traveling in one direction at a relatively rapid speed.

In summer, ground and air temperatures during the middle of the day often rise above the tolerance level of this grasshopper. Temperatures of 110° to 140° F of ground surface exposed to the sun and concomitant air temperatures of 93° to 100° F induce the adults on the ground to move to shade of vegetation or to crawl up 20 inches or higher on a host plant. Grasshoppers that have climbed common sunflowers take positions in the shade, or lacking adequate shade on a defoliated plant, they make a postural response in which they face the sun directly. The rays strike the front of the head while the rest of the body is shielded from the intense rays. On the ground this grasshopper has been observed to stilt, a behavior probably occurring early when temperatures first become excessive.

By late in the afternoon the majority of grasshoppers have returned to host plants, where they rest quietly, perched on main and secondary stems and on leaf surfaces. An odd exception was occasionally noticed in which the adult grasshopper hung onto the edge of a sunflower leaf with the fore and midlegs allowing the body and hindlegs to dangle beneath the leaf.

Selected References

- Alexander, G. and J. R. Hilliard Jr. 1969. Altitudinal and seasonal distribution of Orthoptera in the Rocky Mountains of northern Colorado. *Ecol. Monogr.* 39: 385-431.
- Bright, K. L., E. A. Bernays, and V.C. Moran. 1994. Foraging patterns and dietary mixing in the field by the generalist grasshopper *Brachystola magna* (Orthoptera: Acrididae). *J. Insect Behavior* 7: 779-793.
- Burleson, W. H. 1974. A two-year life cycle in *Brachystola magna* (Orthoptera: Acrididae) with notes on rearing and food preference. *Ann. Entomol. Soc. Am.* 67: 526-528.
- Isely, F. B. 1938. The relations of Texas Acrididae to plants and soils. *Ecol. Monogr.* 8: 551-604.
- Joern, A. 1981. Importance of behavior and coloration in the control of body temperature by *Brachystola magna* Girard (Orthoptera: Acrididae). *Acrida* 10: 117-130.