

# Migratory Grasshopper

## *Melanoplus sanguinipes* (Fabricius)

### Distribution and Habitat

The migratory grasshopper, *Melanoplus sanguinipes* (Fabricius) is widely distributed in North America and lives in a multitude of habitats. It is a common inhabitant of grasslands, meadows, and fields of small grains and alfalfa. Host plants include many kinds of forbs and grasses. Depending on availability of plant species, it may be either a mixed herbivorous or a forbivorous feeder.

### Food Habits

Examinations of gut contents show that the migratory grasshopper is usually feeding on several species of plants in its habitat. This behavior is important in its ecology because laboratory studies have demonstrated that a mixed diet affords individual grasshoppers better nutrition. Although polyphagous the migratory grasshopper selects host plants from its habitat. Preferred foods include dandelion, tumbling hedgemustard, charlock mustard, pepperweed, western ragweed, cheatgrass brome, Kentucky bluegrass, barley, and wheat. Nymphs and adults ingest dry materials lying on the ground surface including plant litter, cattle manure, and bran flakes.

### Capacity for Increase

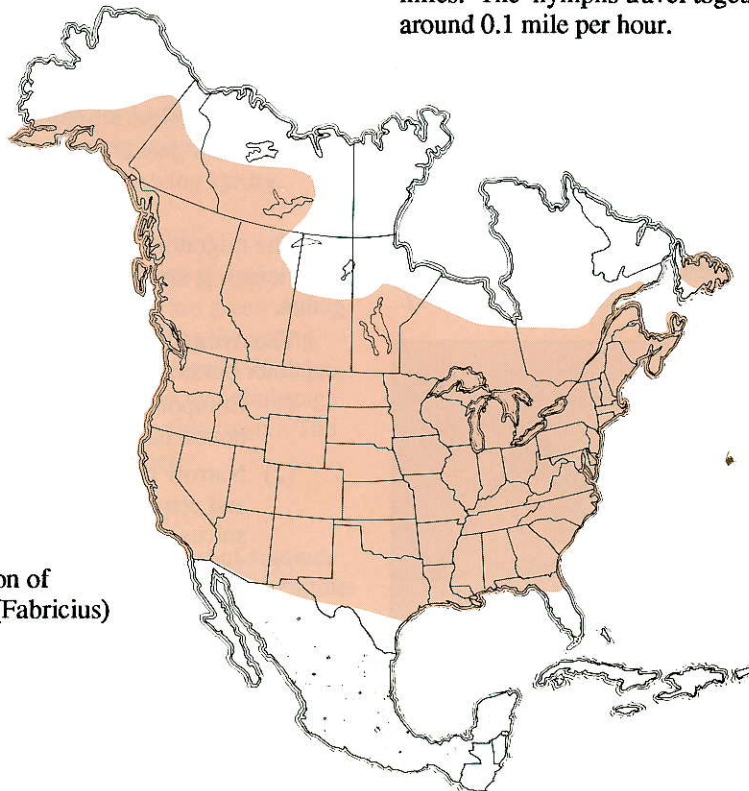
The migratory grasshopper has a great capacity for increase. Large populations develop in disturbed or cultivated land, e.g., overgrazed rangeland, crops of small grains, reverted fields and roadsides.

In a favorable year, a noneconomic population of three adults per square yard can reproduce so that in the next year the population may reach an outbreak density of 30 adults per square yard. Over a period of several favorable years, densities may reach enormous numbers. In 1938 in northeastern South Dakota, densities of the migratory grasshopper reached as high as 1,500 to 8,000 nymphs per square yard in cropland, idle land, and depleted rangeland. Restraints of weather and enemies (predators, parasites, and diseases) usually keep populations from increasing to such a high degree. Densities are normally between 0 and 9 nymphs or 0 and 3 adults per square yard.

### Migration

The migratory grasshopper, as the common name implies, is a migratory species. Many accounts of adult swarming have been published, although there are few records of nymphal migration and still fewer accounts of adult migration in the absence of mass swarming. Recent research has revealed that migratory behavior is inherent and regularly displayed. Much variability occurs, however, among different populations. The greatest degree of migration has been found in populations inhabiting areas where resources are patchy and unpredictable, as in Arizona and New Mexico. The least degree of migratory behavior was detected in a population inhabiting a relatively lush and stable environment in Colorado.

The older nymphs, third to sixth instars, may migrate as far as 10 miles but usually the distance is less than five miles. The nymphs travel together in a band at rates of around 0.1 mile per hour.



Known general distribution of *Melanoplus sanguinipes* (Fabricius) in North America.



Instar 1



1. Body length 4-6 mm. Antennal segments 12-13.

Instar 2



2. Body length 6-8 mm. Antennal segments 16-17.

Instar 3



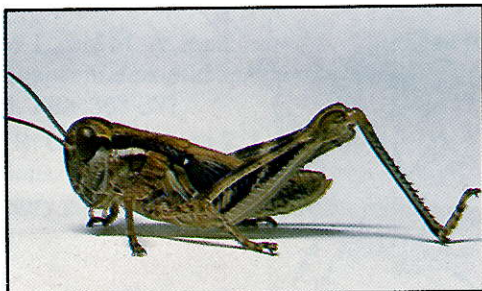
3. Body length 8-11 mm. Antennal segments 18-20.

Instar 4



4. Body length 11-16 mm. Antennal segments 21-22.

Instar 5



5. Body length 14-23 mm. Antennal segments 22-24.

Figures 1-5. Appearance of the five nymphal instars of *M. sanguinipes*—their sizes, structures, and color patterns. Notice progressive development of the wing pads and the black spot at the base of metathoracic wing pad, especially evident in picture of second instar.

Adults are highly migratory in their prereproductive stage. Swarming occurs on clear days when temperatures approach 80 F and winds are gentle and intermittent. Migrants take off into the wind and then turn around and fly with the wind at speeds of 10 to 12 miles per hour. They usually begin flight in late morning, fly during the middle of the day, and alight in the afternoon to feed and rest. With favorable conditions the following morning they continue their migration. From trials of marked adults, individuals are known to travel 30 miles in a day and probably fly much farther. In 1938 one record of migration indicates a swarm averaged 66 miles per day for four days, flying from Highmore, South Dakota to Beach, North Dakota, a distance of 265 miles. The longest migrations recorded in 1938 were made by swarms that travelled from northeastern South Dakota to the southwestern corner of Saskatchewan, a distance of 575 miles.

Flights of the migratory grasshopper have been classified as low flights which are 25 feet or less above the ground or high flights, more than 25 feet above ground. The high flights occur at various elevations. Pilots of observation aircraft in the grasshopper control program often encounter swarms flying 1,000 feet above ground and pilots of ferrying aircraft encounter swarms 2,000-3,000 feet above ground. Pilots of commercial aircraft have reported encountering swarms at all elevations up to 13,000 feet above sea level.

Swarms in the sky can be observed by cupping a hand over the eye and looking toward the sun. The flying grasshoppers reflect the sun's rays and this shimmer of light can be seen at great distances.

### Identification

The migratory grasshopper, *Melanoplus sanguinipes* (Fabricius), is a medium sized representative of this large genus.

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

- (1) Compound eye with many light spots, narrow brown bar across middle.
- (2) Narrow pale yellow crescent on gena below eye and continuing on pronotal lobe to principal sulcus.
- (3) Metathoracic wing pad with black spot near base.



Figures 6-9. Appearance of the adult male and female of *M. sanguinipes* and two diagnostic characters of the male—the shape of cercus (Fig. 8) and the notch in the apex of the subgenital plate (Fig. 9). Notice the two different color forms of hind tibia—red and pale blue.

- (4) Hind femur with dorsal black stripe cut in middle by light bar; light bar on each end.
- (5) Hind tibia of first instar fuscous with pale basal ring; hind tibia of other instars pale blue green or reddish without pale ring.
- (6) General color of majority tan or gray, few light green.

Adult males (Fig. 6) are easily identified by the shape of the cercus (Fig. 8) and the notch of the subgenital plate (Fig. 9). The females (Fig. 7) are slightly larger than the males and can be associated with them and distinguished by their similar color patterns. Hind tibia blue green or red.

### Hatching

The migratory grasshopper is an early hatching species appearing on rangeland about one week after the bigheaded grasshopper begins to hatch. Several environmental factors, especially soil temperature and moisture, affect the exact timing and duration of this event. Hatching starts first along open south slopes, in fields and rangeland with little vegetative cover, and in sandy soils. Hatching is retarded by heavy clay loam soils and by tall vegetation that shades the ground. In any one year, a mosaic of these conditions in an area as well as below normal temperatures may extend the hatching period to six weeks. The duration of hatching is shortened by uniform soil and vegetation and high temperatures and may be completed in three weeks. For complete embryonic development the eggs require 527 day-degrees above a threshold of 50 F soil temperature. Under favorable conditions 80% of development occurs during the summer that the eggs are laid and 20% the following spring.

### Nymphal Development

Nymphs develop and grow during late spring when weather is usually warm and food plants are green and abundant. Under these favorable conditions the young grasshoppers pass through the nymphal stage in 35 days. Cool weather, however, may lengthen the nymphal stage to 55 days. Nymphal instars range from five to six. The females usually require the larger number.

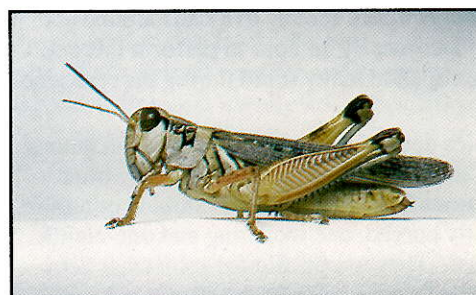
### Adults and Reproduction

Emergence of adults begins the first part of summer and may continue for three or four weeks. The first adults to emerge have the best chance for reproductive success. At this time there is more likely to be an abundance of



Male

6. Body length 16-26 mm.



Female

7. Body length 20-29 mm.



Note Cercus

8. Side view end of male abdomen.



Note Notch

9. End view of male abdomen.



green food plants to provide the nourishment necessary for rapid egg production. In addition the first eggs laid will usually experience more favorable soil moisture and have a longer time to reach an advanced developmental stage before entering diapause.

The females have a preoviposition period of two to three weeks. During this time they increase in weight and mature their first group of 18 to 24 eggs. The male is able to recognize a mature, virgin female and performs a short courtship in which he waves his antennae and vibrates his hind femora before he makes a sudden copulatory leap onto the female. A mated female oviposits around six days later and takes nearly an hour to perform this act. Healthy adults copulate many times during the reproductive period.

The females deposit their eggs on rangeland among the roots of blue grama grass. In cropland they often deposit them around the base of wheat stubble or alfalfa. Pods are slightly curved, one inch long and one-eighth inch in diameter. They are positioned somewhat vertically in the soil. The top half of the pod is dried froth, the

bottom half contains the eggs. The midpoint of the clutch is three-fourths inch below the soil surface. Eggs have a banana-like shape, are 4.5 mm long, and pale yellow or cream colored. A long-lived female may produce as many as 20 pods and a total of 400 eggs. The average fecundity in nature is unknown, but may not be more than 20 eggs.

### Daily Activity

The migratory grasshopper, a diurnal insect, is ordinarily active during the day and inactive at night. The activities of both nymphs and adults are largely controlled by temperature. Most feeding occurs between 8 and 11 a.m.; most mating between 8:30 a.m. and 12 noon; and oviposition through the day. When temperatures drop in the evening the grasshoppers form aggregations on the ground and may even seek protection from the cold. They remain inactive at night and only start activity the next morning when temperatures rise. J. R. Parker categorized their activities and correlated these with air and soil temperatures (Table 1).

Table 1. Activity of nymphs and adults of the migratory grasshopper, *Melanoplus sanguinipes* (Fabricius) correlated with air and soil temperatures (After Parker 1930).

Name of activity	Description	Average temperature °F			
		Nymphs		Adults	
		Air	Soil	Air	Soil
Beginning of activity	Basking, exposure to sun	61	75	62	79
Beginning of normal activity	Feeding	64	92	66	94
	Starting migration	71	94	84	112
	Starting oviposition			71	100
Beginning of climbing to escape heat	Climbing vegetation			81	113
Beginning of clustering	Aggregating on ground	69	87	71	88
Ending of activity	Ceasing to move or hiding	66	77	69	79

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