

Monitoring Protocol for Grasshoppers

Adult Monitoring

Timing:

Counting adult grasshoppers to estimate adult densities in an area in late summer (when grasshoppers are laying eggs) helps estimate the number of eggs overwintering and to forecast the risk of grasshoppers being at problem levels in the next growing season. **To count fully winged adult grasshoppers, sites should be surveyed between August 1st and September 1st**

Location:

Conduct grasshopper surveys in fields and along the roadside in transects 50 m long and 1 m wide (Figure 1). Sample enough fields so that you have a good representation of the grasshopper populations in your area. If possible, sample at least five locations in your district.

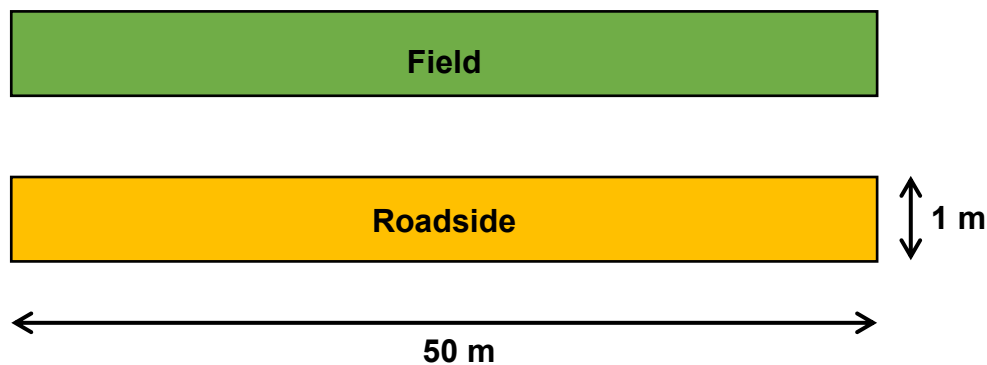


Figure 1. Survey area for each location for both the roadside and field areas.

Density Estimate:

At each location (field), measure off a distance of 50 m on the level road surface and mark both starting and finishing points using markers, flags, or posts on the field margin. These points should be visible from both field and roadside. At the starting point, walk for 10 m towards the finish point and count the number of grasshoppers observed jumping in a width of 1 m. Record the number counted. While counting, a meter stick can be carried as a visual tool to give perspective for a one meter width. With experience, one can often visualize the necessary width and a meter stick may not be required. A hand-held counter can be useful in counting while the observer counts off the required distance. Repeat the counting process while walking each 10 m increment until five counts from both 50 m transects have been recorded.

Calculate the average number of grasshoppers per square meter in each transect by dividing the total number of grasshoppers counted by the total distance walked in the transect. Table 1 provides a guide to relate estimated grasshopper densities to potential crop damage.

Table 1. Relationship between estimated grasshopper density and expected damage to field crops.

0-2 / m ² = None to Very Light	8-12 / m ² = Moderate (action threshold)*
2-4 / m ² = Very Light	12-24 / m ² = Severe
4-8 / m ² = Light	> 24 / m ² = Very Severe

*More than 2 grasshoppers per m² can cause losses in lentils and flax at the flower and pod stages.

Sweep Net Sampling:

To monitor species composition, use a sweep to collect adult grasshoppers at each location. Take at least 5 to 25 sweeps (180°) at each location and put the contents of the net into a clear plastic bag to observe the contents of the net. Estimate the number of species present and record the species names. Use the total number of grasshoppers in the sample and the number of each species present to estimate the percent of the total population accounted for by each species. Record and report species percentages **only** if you are sure of the identification.

Grasshopper Biology and Pest Species

Host plants:

Grasshoppers eat a wide range of cultivated crops and rangeland grasses.

Significant Pest Species:

Melanoplus sanguinipes (Fabricius): Migratory grasshopper

The migratory grasshopper is a grayish-brown species (Figure 2) with a black stripe that usually extends from the eye onto the lateral lobe of the pronotum. Forewings are long, brownish, and typically bear a row of dark-brown spots. Hind femora usually have two oblique dark bands. Hind tibiae are normally red but occasionally blue. The males are about 20 mm and females are about 28 mm long. Favoured habitats are weedy pastures, crops, and similar disturbed areas. They feed on both grass and broad-leafed plants. At high densities, these grasshoppers become gregarious, and move as a group; thus the common name, “migratory grasshopper”.

Migratory grasshoppers overwinter as eggs in the soil. **Hatching occurs from early May to mid-July.**

Nymphs feed for about a month before reaching the adult stage. Egg-laying begins about a week after the female reaches adulthood. Females lay 200-400 eggs in pods (approximately 20 eggs per pod) from late July into the fall. They use their ovipositor to insert egg pods about 5 cm deep. Eggs begin to develop after being laid, with most development typically occurring in the summer that eggs are laid and the remainder occurring in spring of the subsequent growing season.



Figure 2: *Melanoplus sanguinipes*, the migratory grasshopper. Picture: Dan Johnson, University of Lethbridge.

Melanoplus bivittatus (Say): Two-striped grasshopper

Although they can be found in a diversity of habitats, the two-striped grasshopper prefers tall, lush, herbaceous vegetation. Large populations can be found in tallgrass prairie, wet meadows, roadsides, ditches, and crop borders. Hosts include a broad assemblage of grass and broad-leaved weeds, and many crops. It can be very damaging to lentil pods and flowers.

Adults are dark yellowish-green with two pale yellow stripes extending from the back of the eyes to the tip of the forewings and a solid black stripe along the outer side of hind legs (Figure 3). Males are about 24 to 28 mm long; females may grow up to 40 mm in length.

The two-striped grasshopper overwinter in the egg stage. Eggs hatch in late April to late May. Nymphs feed for 5 to 6 weeks and adults appear in July and lay eggs in pods (40 eggs per pod) that are inserted into soil. Each female can produce 400 eggs.



Figure 3: *Melanoplus bivittatus*, the two-striped grasshopper. Picture: Dan Johnson, University of Lethbridge. Note the stripes along the back and legs.

***Melanoplus packardii* Scudder: Packard's grasshopper**

Packard's grasshopper is typically a rangeland species but is well-adapted to cropland. They feed on both broadleaf plants and grasses. They prefer legumes but can be damaging to small grain cereals and vegetables. They will also consume dead insects. Adults are dark gray, brown or yellow-brown above and yellowish below (Figure 4). A diffuse dark stripe extends from the top of the head over the top of the pronotum. The forewings are grayish brown, usually with a few small spots. The hind femora are yellowish with a dark stripe along the upper edge. Males are 22 to 23 mm long; females range in length from 26 to 37 mm.



Figure 4: *Melanoplus packardii*, Packard's grasshopper. Picture: Dan Johnson, University of Lethbridge.

Diapause breaks during the winter and only a few days of warm weather are needed to complete egg development. **Eggs commence hatching in early- to mid-spring.** Nymphal development requires from 47 to 63 days. **Adults are found from July to September.**

Melanoplus bruneri Scudder: Bruner's Grasshopper

This species occurs throughout central and northern North America as far north as the arctic tundra. It has historically been described as damaging to pastures at high elevations, rangelands, and more recently as a pest of crops. It can be a dominant component of local grasshopper populations. Recently, high populations of *M. bruneri* have been documented in alternating years in some parts of the prairies, suggesting that populations have a biennial lifecycle and that multiple cold periods may be needed to break egg diapause. These insects feed on an assortment of grasses and forbs and have been shown to prefer lupin and timothy to the exclusion of other plants. These grasshoppers prefer drier, upland sites.

Adults are pale to dark brown (Figure 5) and can be difficult to distinguish from other *Melanoplus* species. Males are 18 to 22 long; females range from 22 to 27 mm in length.



Figure 5: Two examples of *Melanoplus bruneri*, Bruner's grasshopper. Pictures: Dan Johnson, University of Lethbridge

Camnula pellucida (Scudder): Clear-winged grasshopper

Clear-winged grasshoppers inhabit grassy meadows, often in hilly or mountainous areas. Its tendency to aggregate when densities are high can lead to significant damage to pastures, cereal crops, and canola crops.

The adults are yellowish or grayish brown grasshoppers with transparent hind wings (Figure 6). The forewings bear dark round or oval blotches. The median ridge on the pronotum is slightly elevated and notched and the lateral lobes of the pronotum are marked with black. Males are 20 to 25 mm long. Females range from 25 to 31 mm in length.

Nymphal development ranges from 26 to 40 days. Because nymphs of the clear-winged grasshopper develop faster than those of the two-striped grasshopper, adults of the clear-winged tend to appear first. Adults lay eggs in clutches of 10 to 38, with eggs enclosed in pods.



Figure 6: *Camnula pellucida*, the clear-winged grasshopper. Picture: Dan Johnson, University of Lethbridge.