Common Wyoming Pest
GRASSHOPPERS

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with updated species distribution maps

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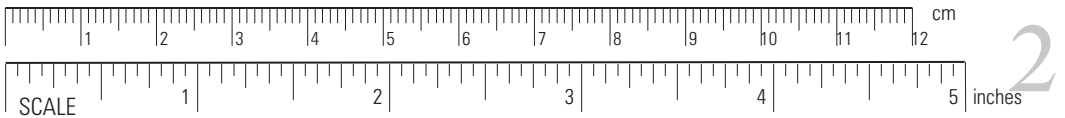


How to Use This Handbook

The grasshopper species in this handbook were chosen because they are the most probable species to reach population densities that cause economic injury to agriculturists. These 17 pest species are just a small fraction of all the innocuous or even beneficial insects present in Wyoming. In areas where grasshopper populations are at damaging levels it is useful to know what species are present. Not all species are susceptible to all control measures, and some species pose no threat to broadleaf crops.

A typical adult and mid-instar nymph are pictured for each species. The identification of nymphs is very important as most treatments occur before the grasshoppers mature and begin to lay eggs. The sampling of grasshoppers from infestations and a close comparison with the photos in this guide should allow for identification of the predominant species in an outbreak. The shape, size, coloration, highlighted diagnostic characters, and small number of probable species of concern should make field identification possible. To identify less common or less pestiferous species of grasshoppers, the *Field Guide to Common Western Grasshoppers* by R. E. Pfadt is an excellent reference.

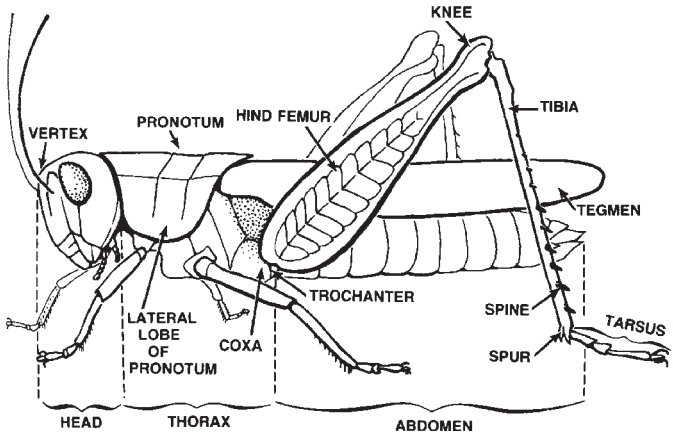


Figure 1. Side view of adult grasshopper with nomenclature (T. S. Sechrist).

Important Grasshopper Structures

For pest species identification it may be important to note the coloration, shape, and surface of the antennae, eyes, head, pronotum, forewing (tegmen), hindwing, thorax, the end of the abdomen, and both the femur and tibia of the hind leg are important. The identification of every species making up the grasshopper complex involves detailed examination and as a rule is not required for management decisions.

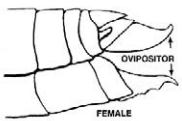


Figure 2. Female abdomen (T. S. Sechrist).

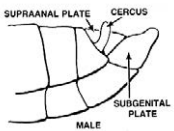


Figure 3. Male abdomen (T. S. Sechrist).

Figure 4. Male vs. female size difference.

How to Determine Grasshopper Sex

Either males or less frequently females can possess the clear diagnostic character for a species. The end of the abdomen differs between the sexes. The females have four dark, pointed valves that form the ovipositor (Fig. 2). They can either be held in the closed, pointed position or be splayed open, as shown, if they have already laid eggs. The adult males have a smooth, hard, subgenital plate and paired cercus which can vary, depending on species, from small and simple as illustrated in Figure 3 to uniquely shaped and prominent. On early instar nymphs, it takes some magnification to distinguish males from females, and the distinctive shapes are often underdeveloped until adulthood. Male grasshoppers are usually smaller than the females of their species as illustrated by the adult male (upper) and female (lower) bigheaded grasshoppers sitting on the quarter in Figure 4.

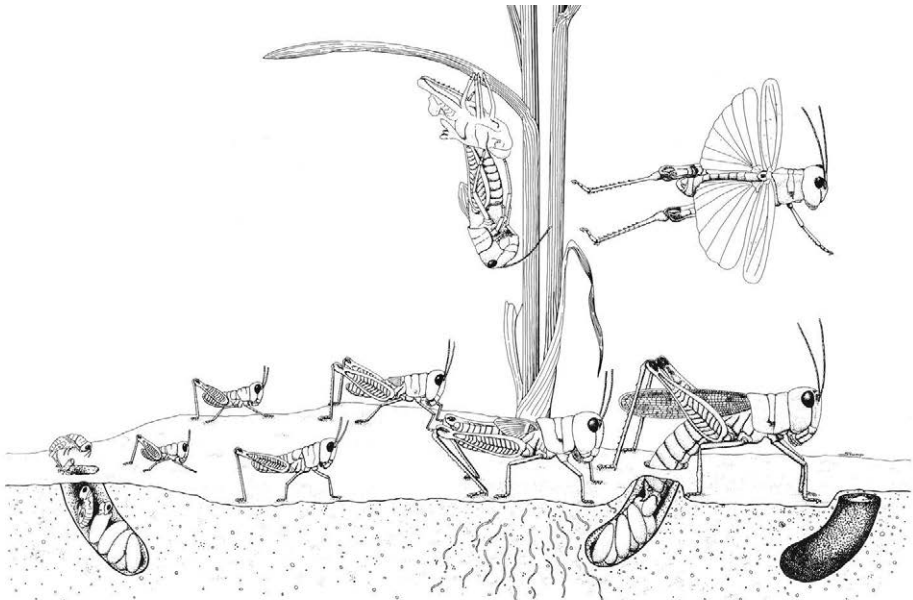


Figure 5. All of the stages in the 12-month life cycle of the bigheaded grasshopper (W. L. Stump).

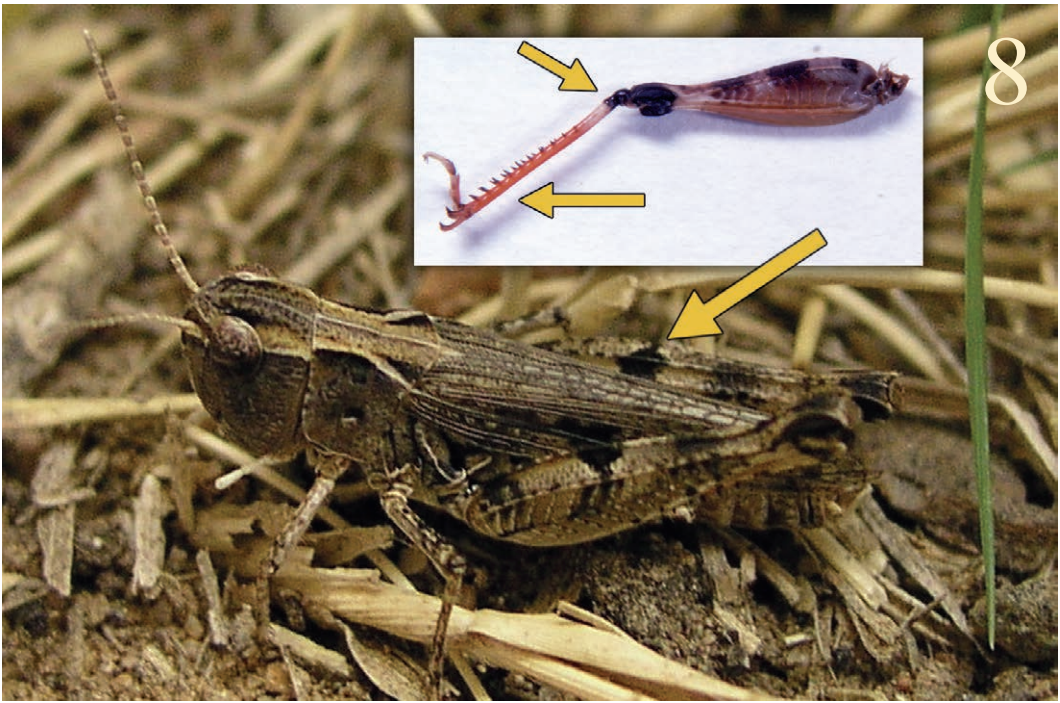
Common Grasshopper Life Cycle

As illustrated by Figure 5, all Wyoming grasshoppers hatch from an egg, molt, and grow through multiple nymphal stages or instars to reach adulthood, complete sexual reproduction, lay eggs (oviposition), and die in a 12-month cycle. The timing of both oviposition and egg hatching vary considerably among grasshopper species. The common pest species in this book all lay their eggs in the soil in the mid to late summer so that they hatch the next spring. All of these grasshoppers molt four to five times, depending on their species and sex, as they grow into adults. The presence of functional, full-length wings indicate that the adult stage has been reached. The timing of the hatch sometimes helps to distinguish among species. In the spring, some grasshoppers will be encountered that are already adults, having either hatched the previous summer and overwintered as nymphs or hatched extremely early in the spring. These species are not included in this book because they rarely cause economic damage to range land or crops. Many of these species are quite large, colorful, and obvious but rarely achieve the densities that cause more than superficial damage.

Figure 6. From left to right: early instars with no wing pads, mid-instars with small wing pads, last instars with large, and veined wing pads (T. S. Sechrist).

How to Determine the Nymphal Instar

The predominant nymphal instar or developmental stage provides important information that can influence management decisions. Because much of the feeding damage is done in the nymphal stages and nymphs do not produce eggs, the mid-instar stage offers the ideal time for control measures. Dimilin 2L®, an insect growth regulator, can only be used on nymphs. With other conventional insecticides, it often takes higher rates to effectively control adult grasshoppers. Grasshoppers have hard exoskeletons that they must shed or molt in order to increase in size until they become adults. Because immature grasshoppers have the same basic body form as adults, the best features to use to determine the instars are wing pads and body length. For the pest species in this book, the first two instars have very little wing development (Figure 6) and are less than 9 mm long. Third and fourth instars have wing pads that point up and are slightly veined (Figure 6) and are usually 9 to13 mm long. The last instar has large wing pads with distinct parallel veins (Figure 6) and is usually more than 13 mm long.



8

Adult *Ageneotettix deorum* or Whitewhiskered Grasshopper

Size: Females are from 21 to 24 mm and males 15 to 16 mm in body length.

Adult description: The body color between specimens does not vary much from the shades of brown, black, and tan illustrated in the photo. A black triangle on the top side of the femur in combination with black hind leg joints and reddish-orange tibia distinguish this species from other non-pest species (See inset and arrows). The dorsal sides of the antennae are very pale colored as indicated by the common name. A light-colored patch just below the eyes is also common.

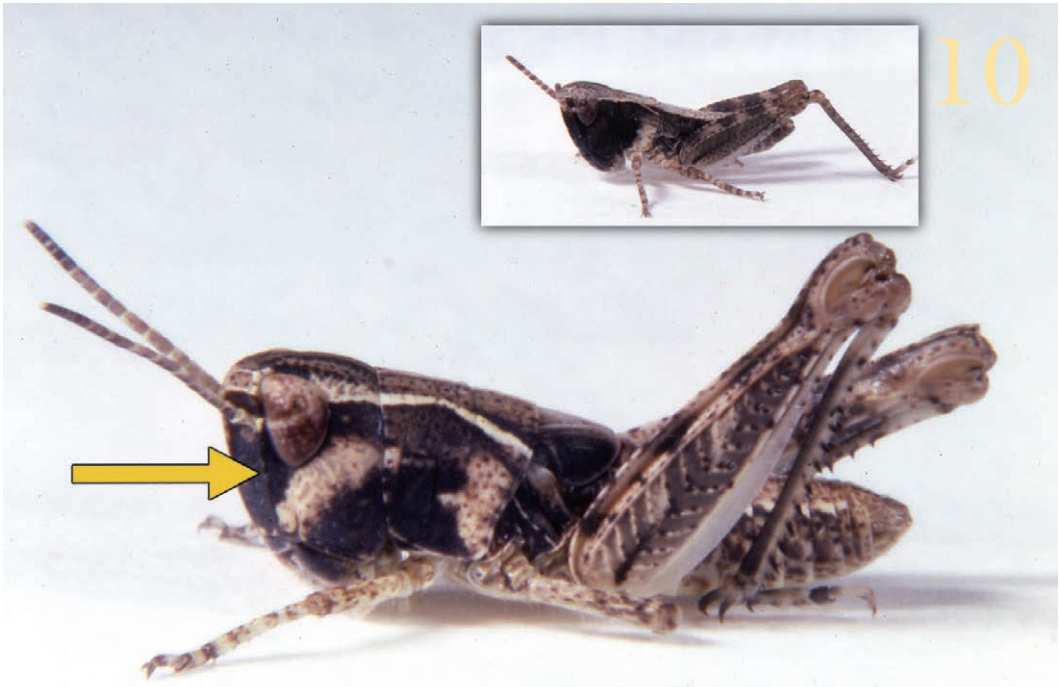
Life Cycle: The species hatches in mid-spring during a four to six-week period. It can take 40 days after hatching for females to reach sexual maturity. Daily mortality due to natural factors usually causes the population to collapse by late summer.

Food Preferences: They eat only grass and sedges although no particular species is preferred. Small amounts of forbs and plant litter are also consumed. They will clip leaves when feeding, wasting more than they eat.

Population Ecology: This species can reach adult densities greater than 20 per square yard. High populations can persist for three to five years before crashing, and often this grasshopper will be the most numerous species in outbreaks in southeast Wyoming's native prairie.

Migration: Adults are capable of dispersal flights. This species has not been recorded migrating in swarms.

Fecundity: In nature, a female produces on average 12 eggs during her life. The greatest number of eggs produced by one female in a cage study was 107.



Nymph *Ageneotettix deorum* or Whitewhiskered Grasshopper

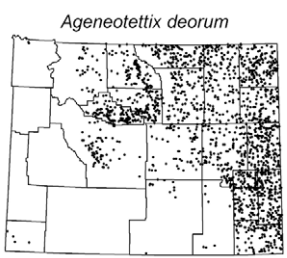
Size: First instar nymphs are 4 to 5 mm in body length = |***|

Nymph description: The body colors of most specimens do not vary much from the shades of brown, black, and gray illustrated in the photo. A light-colored patch just below the eyes is very common (See arrow). Some nymphs have an entirely black face (See inset). Flattened antennae are very pale colored as indicated by the common name. The faces are moderately slanted.

Hatching and Development: Peak hatching occurs from May 15 to June 15 in most years. Males commonly have just four instars while females have five. Approximately five days are spent per instar, depending on ambient temperatures.

Bait Acceptance: This species will readily feed on wheat-bran-based poison bait.

Economic Importance: This species can hatch at densities greater than 30 per square yard. High populations can persist for three to five years before crashing.



Movement: Nymphs have not been recorded migrating in bands, and they will stay in the area where they hatched as long as sufficient food remains. Nymphs spend most of their time on the ground.

Distribution: They are commonly found all over the state in grasslands below 5,750 feet in elevation.

Similar Species: The *Psoloessa delicatula* looks similar but its nymphs lack light-colored cheek patches, hatch in early July, overwinter, and become adults early in the spring.


12

Adult *Amphitornus coloradus* or Striped Grasshopper

Size: Females are 21 to 25 mm and males 18 to 20 mm in body length.

Adult description: The body color between specimens does not vary much from the shades of brown, black, and beige illustrated in the photo. Diagnostic features include the prominent dark-brown stripes that run from the wing bases to the top of the head over the eyes (See arrow, more prominent on inset photo). The face is strongly slanted, and the antennae are flattened. The femur has three dark bands and a black leg joint. The hind tibias are pale blue.

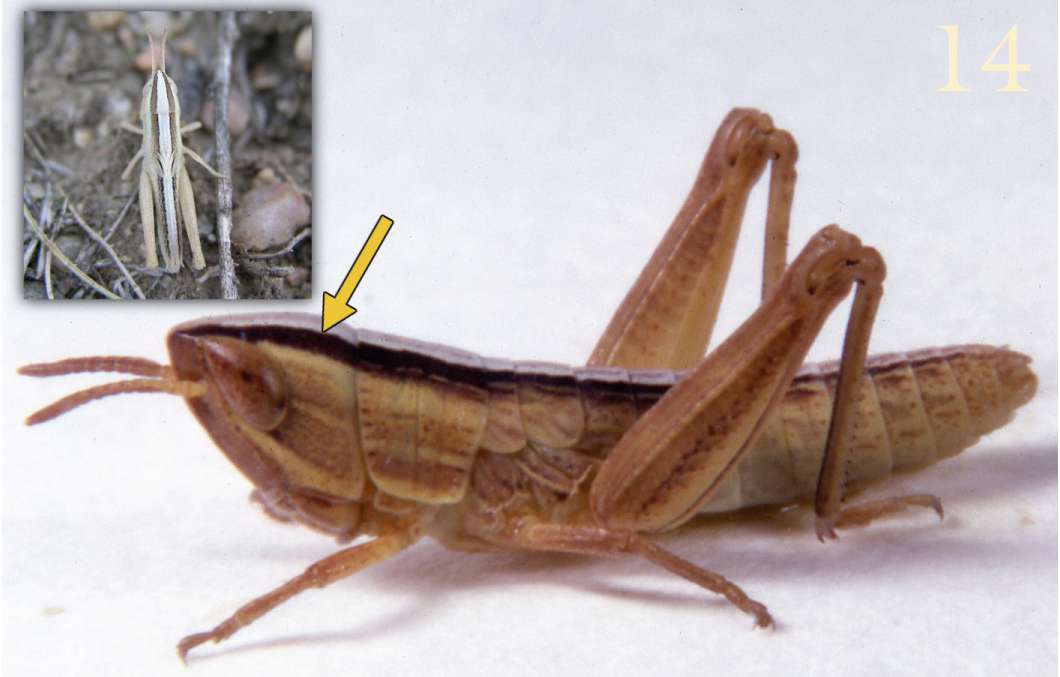
Life Cycle: The species hatches in mid-spring during a four to five-week period. It usually takes 50 to 56 days after hatching for females to reach sexual maturity. Daily mortality due to natural factors causes the population to collapse by late summer. This species lays its eggs in the root crowns of its preferred food plants.

Food Preferences: This species feeds almost exclusively on grasses and sedges. Blue grama, needleandthread grasses and threadleaf, and needleleaf sedges are the preferred foods. Very small amounts of forbs and litter are consumed. Usually the clipped grasses or leaves are consumed completely.

Population Ecology: This species can reach adult densities between 5 and 10 per square yard. Populations gradually build for multiple years and then suddenly triple or quadruple in one year, often in concert with other pest species populations.

Migration: Adults are capable of dispersal flights. This species has not been recorded migrating in swarms.

Fecundity: There have been no studies on the reproduction of this species, but because it rarely dominates in outbreaks its fecundity is thought to be lower than in other major pest species.



Nymph *Amphitornus coloradus* or Striped Grasshopper

Size: First instar nymphs are 5 to 7 mm in body length = |****|

Nymph description: The body colors of most specimens do not vary much from the shades of brown, tan, and beige illustrated in photo. Diagnostic features include the two prominent dark-brown stripes that run from the abdomen to the top of the head over the eyes (visible from above on the inset photo). A small percentage of the nymphs will have more diffuse striping.

Hatching and Development: Peak hatching occurs from May 15 to June 15 in most years. Males and females commonly have five instars. They are slower to develop into adults than other pest species, perhaps due to their habit of roosting on grass in cooler temperatures above the ground.

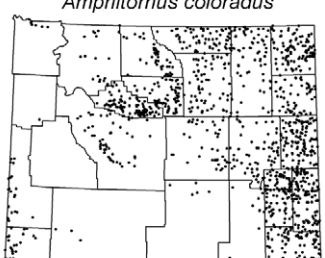
Bait Acceptance: This species is not likely to find bran-based poison bait due to its roosting behavior.

Economic Importance: This species can hatch at densities greater than 30 per square yard. High populations can persist for three to five years before crashing.

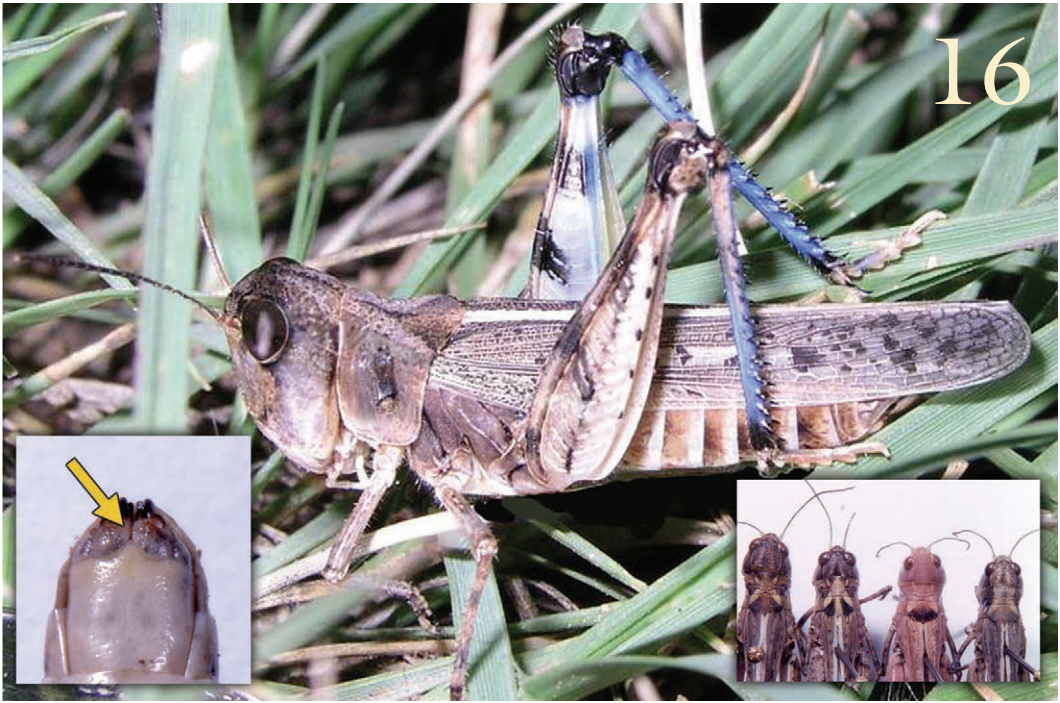
Movement: They have not been recorded migrating in bands and will stay in the area where they hatched as long as sufficient food remains.

Distribution: They are commonly found all over the state in grasslands below 7,500 feet in elevation.

Amphitornus coloradus



Similar Species: *Eritettix simplex* nymphs are similar but hatch in late July, overwinter as nymphs, and are present as adults when the striped grasshopper starts hatching.



Adult *Aulocara elliotti* or Bigheaded Grasshopper

Size: Females are 20 to 25 mm and males 17 to 20 mm in body length.

Adult description: The most common coloration is grayish brown with a light-colored "x" on the pronotum. Several other color patterns can be encountered as illustrated by the inset photo. The adults have bright blue tibias. The adult females can be distinguished from the similar *Aulocara femoratum* by the shape of the lower rear edge of the eighth abdominal segment. (See inset photo.)

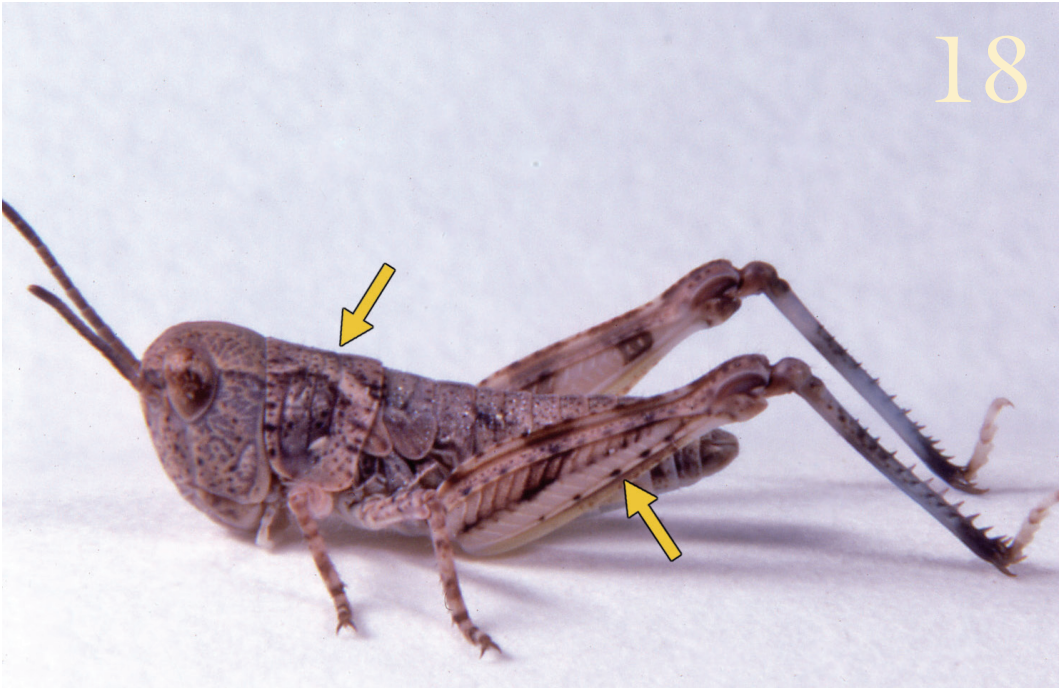
Life Cycle: The species hatches in mid-spring over a three to four-week period. It usually takes 36 to 42 days after hatching to reach adulthood. Daily mortality due to natural factors causes the population to collapse by late summer. This species lays its eggs in a hard, smooth, foam egg pod placed just below the soil surface in the bare ground around the bases of grasses.

Food Preferences: This species feeds primarily on grasses and sedges but also scavenges litter, seeds, manure, and dead insects. Crested and western wheatgrass and blue grama are the preferred food plants. This species does not feed on forbs by choice.

Population Ecology: This species can reach adult densities of more than 50 per square yard. Populations gradually build for multiple years and then suddenly triple or quadruple in one. Often the dominant species in an outbreak, high populations of *A. elliotti* have been observed persisting for more than five years.

Migration: Adults are capable of dispersal flights and migration when food plants are depleted. This species has been recorded traveling as far as seven miles in Arizona.

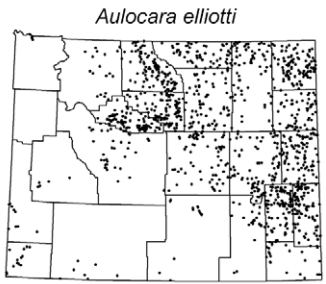
Fecundity: In nature, research indicates that the average female will survive approximately 20 days and produce 15 eggs. In captivity, females have produced more than 76 eggs during their lifespan.



Nymph *Aulocara elliotti* or Bigheaded Grasshopper

Size: First instar nymphs are 5 to 6 mm in body length = |***|

Nymph description: The body colors of most specimens do not vary much from the shades of brown, gray and tan illustrated in the photo. Diagnostic features include the light-colored "x" on the pronotum (see arrow) and four to seven spots on the lower edge of the femur. The hind tibias are pale blue with dark bands. The head is large compared to the body.



Hatching and Development: Peak hatching occurs from May 15 to June 15 in most years. Males have four and females five instars. They rapidly develop into adults during warm temperatures.

Bait Acceptance: This species readily takes wheat-bran-based poison bait.

Economic Importance: This species is a serious pest of forage grasses due to its abundance and its feeding habit of clipping more grass than it eats. It can be especially damaging on crested wheatgrass pastures.

Movement: This species has not been recorded moving in bands but will disperse from where it hatches if the food supply runs out.

Distribution: It is commonly found throughout the state in grasslands below 7,500 feet in elevation.

Similar Species: *Aulocara femoratum* is a closely related species that resembles *A. elliotti*. The nymphs of *A. femoratum* are lighter colored with more contrasting dark-brown markings. From a management perspective, these two species are interchangeable. None of the other common species with big heads have the light blue tibia.


20

Adult *Aulocara femoratum* or Whitecrossed Grasshopper

Size: Females are 20 to 25 mm and males 15 to 17 mm in body length.

Adult description: The most common coloration is beige with grayish-brown markings and a light colored "x" on the pronotum. Both sides of the pronotum have large dark marks, and the femurs have three dark-brown black bands (see arrows). The adults have bright blue tibias. To distinguish the adult females from the very similar *Aulocara elliotti*, the shape of the rear edge of the eighth abdominal segment can be examined from below (see inset photo). Females are significantly larger than the male grasshoppers in this species.

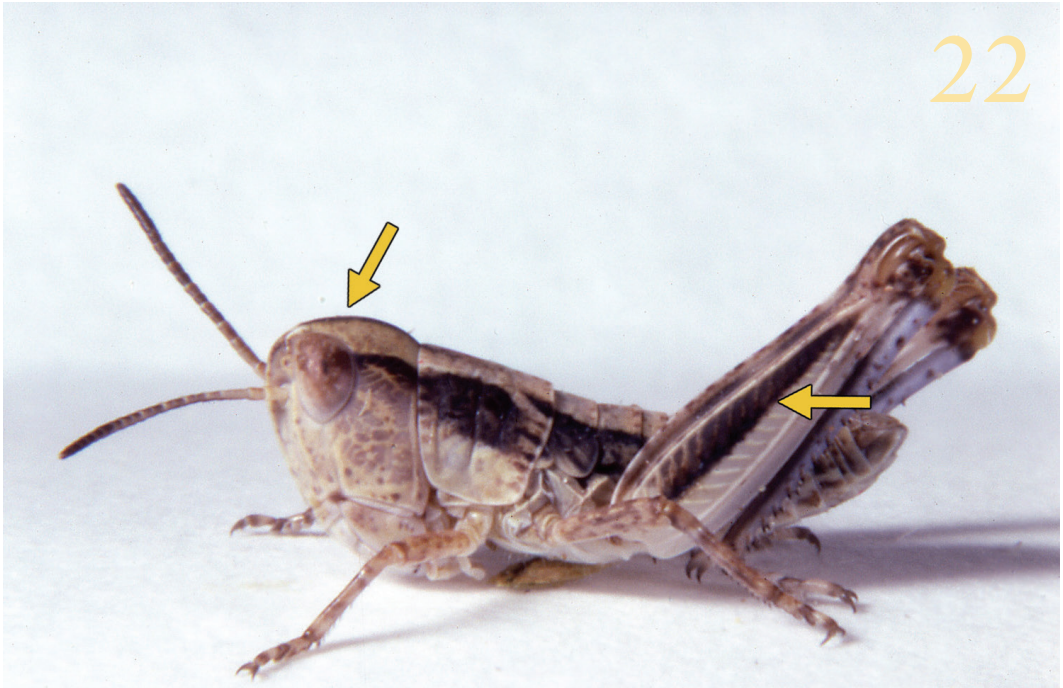
Life Cycle: This species hatches in late spring over a two-week period. It takes a minimum of 42 days after hatching for females to reach sexual maturity. Daily mortality due to natural factors causes the population to collapse by late summer. This species lays its eggs in small patches of bare ground surrounded by preferred food plants.

Food Preferences: This species feeds almost exclusively on grasses and sedges, with the females preferring western wheatgrass and the males needleleaf sedge.

Population Ecology: It is usually the sub-dominant species in outbreaks and only rarely reaches densities greater than 10 per square yard. High populations of this species usually do not last more than one year. It is not as commonly encountered as *A. elliotti* in Wyoming.

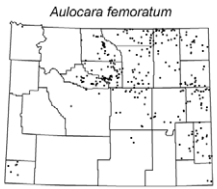
Migration: Adults are capable of dispersal flights. This species has not been recorded migrating in swarms.

Fecundity: No study has been conducted on the reproduction of this species, but its fecundity is thought to be less than the closely related bigheaded grasshopper.



Nymph *Aulocara femoratum* or Whitecrossed Grasshopper

Size: First instar nymphs are 6 to 7 mm in body length = |****|



Nymph description: The body colors of most specimens do not vary much from the shades of brown, tan, and cream illustrated in photo. The white "x" marking on the pronotum becomes visible on the older nymphs. The hind tibia changes from gray to light blue as the nymphs develop into adults. The very top of the head has a dark stripe dividing the tan band (see arrow). The upper half of the medial area of the femur is dark brown (see arrow).

Hatching and Development: Peak hatching occurs about June 10 and is at least 10 days after the first appearance of *A. elliotti* in most years. Males have four and females have five instars.

Bait Acceptance: This species will consume bran bait but control can be variable.

Economic Importance: This species feeds primarily on the best forage grasses and contributes to damage when it is part of an outbreak. It is not a threat to broadleaf plants and is less likely to clip and waste grass leaves than *A. elliotti*.

Movement: This species has not been recorded moving in bands but will disperse if the local food supply runs out.

Distribution: It is found mainly in the eastern half of the state in grasslands below 7,000 feet in elevation.

Similar Species: *Aulocara elliotti* is a closely related species that resembles *A. femoratum*. The nymphs of *A. femoratum* are lighter colored with more contrasting dark-brown markings and have four to seven spots on the lower femur. From a management perspective, these two species are interchangeable. No other common species with big heads have light blue tibias.


24

Adult *Camnula pellucida* or Clearwinged Grasshopper

Size: Females are 22 to 25 mm and males 19 to 21 mm in body length.

Adult description: They are medium-sized mottled brown grasshoppers with wings that extend past the end of the abdomen. The inner femur and underside of this grasshopper is often yellow. The forewings have, along their upper edges, a light-colored stripe that extends from the bases to the tips (see arrow) that form a narrow "v" when viewed from above.

Life Cycle: This species hatches from May to early July depending on the altitude and aspect of the oviposition site. It has been recorded living in mountain meadows more than 10,500 feet in elevation. Hatching of all eggs in a location usually occurs within 12 days although unfavorable conditions can extend this period considerably. Development is rapid in ideal conditions of warmth, and good grass and can take from 26 to 40 days. Daily mortality due to natural factors causes the population to collapse by late summer. The females of this species prefer to congregate together and oviposit into the root crowns of sod-forming grasses.

Food Preferences: This species feeds mainly on native and introduced grasses and will readily attack small grains. Small amounts of forbs and legumes will also be consumed.

Population Ecology: This species often dominates grasshopper populations in its preferred habitat and can rapidly increase from unnoticeable levels to high densities in as little as three years.

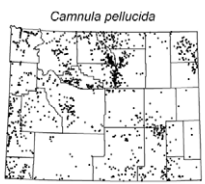
Migration: Adults are capable of dispersal flights at both low or high altitudes as well as long distance migration. Females will fly back and forth from feeding grounds to egg beds for oviposition.

Fecundity: In field cage studies, females produced an average of 180 eggs. Even if they produce only one egg pod, ranging from 10 to 38 eggs, they have the potential for rapid population increase.

Nymph *Camnula pellucida* or Clearwinged Grasshopper

Size: First instar nymphs are 4 to 6 mm in body length = |***|

Nymph description: Except for the boldly marked first instars nymphs, (see inset) the body colors of most specimens do not vary much from the shades of brown, tan, and black as illustrated. They often have a yellow underbelly. A ridge called a carina on the top of the pronotum is not notched (see arrow), and a dark bar wraps from below the antennae bases through the eyes (see arrow).



Hatching and Development: Peak hatching occurs from May 15 to June 15 in most years from concentrations of egg pods placed, preferentially, in sod. Hatching occurs en masse and usually peaks around noon, especially on warm days following rain. Males and females both have five instars.

Bait Acceptance: This species readily takes wheat-bran-poisoned bait.

Economic Importance: This species is a severe pest of forage grasses and small grains. When adults swarm, they may threaten even broadleaf crops. They are voracious feeders on rangelands, and as few as 20 grasshoppers per square yard will destroy all available forage. Populations well above 125 per yard have been commonly documented.

Movement: Nymphs start dispersing from the egg beds to the nearest green vegetation. Older nymphs will march in cohesive bands.

Distribution: They are commonly found all over the state in grasslands, irrigated pasture, river valleys, and mountain meadows.

Similar Species: *Metator pardalinus* and other similar-sized band-winged species resemble *C. pellucida* but have colored hind wings.


28

Adult *Cordillacris occipitalis* or Spottedwinged Grasshopper

Size: Females are 21 to 24 mm and males 16 to 19 mm in body length.

Adult description: Mainly colored tan and gray with a very slanted face, they have a conspicuous brown stripe extending from just behind the eye and continuing through the pronotum (see arrow). The forewings have rows of brown spots (see arrow). The hind tibias are pale orange (see arrow). Males are much smaller than the females.

Life Cycle: This species starts hatching in the spring usually seven days before the bigheaded grasshopper over a four-week period. It often takes more than 40 days after hatching for females to reach sexual maturity. Daily mortality due to natural factors causes the population to collapse by late summer. This species lays its eggs in bare ground near its preferred food plants.

Food Preferences: This species feeds primarily on any available grass or sedge and only rarely are any forbs or litter eaten.

Population Ecology: This species usually persists at low densities, but in areas of its habitat with sandy loam soils it can reach population densities of 20 per square yard. It usually makes up less than half of the population of a grasshopper outbreak in Wyoming.

Migration: Adults are capable of flight but have never been recorded dispersing or migrating in swarms.

Fecundity: Field studies have not been made on the reproductive potential of this species. From studies of wild adult population densities compared to eggs sampled in the field, it can be inferred that fecundity is less than half that of the bigheaded grasshopper or no more than seven eggs per female.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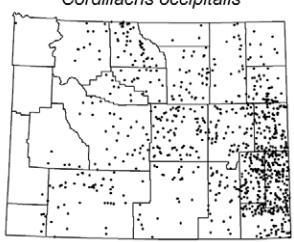
Nymph *Cordillacris occipitalis* or Spottedwinged Grasshopper

Size: First instar nymphs are 5 to 6 mm in body length = |****|

Nymph description: The body colors of most specimens do not vary much from the shades of brown, tan, and gray illustrated in the photo. Diagnostic features include the two prominent dark brown stripes that run from the end of the abdomen, across the pronotum, to just behind the eyes (see arrow). The head is strongly slanted with sword-shaped antennae.

Cordillacris occipitalis



Hatching and Development: Peak hatching occurs from May 15 to June 1 in most years. Males and females commonly have five instars. Males are much smaller than females and develop faster.

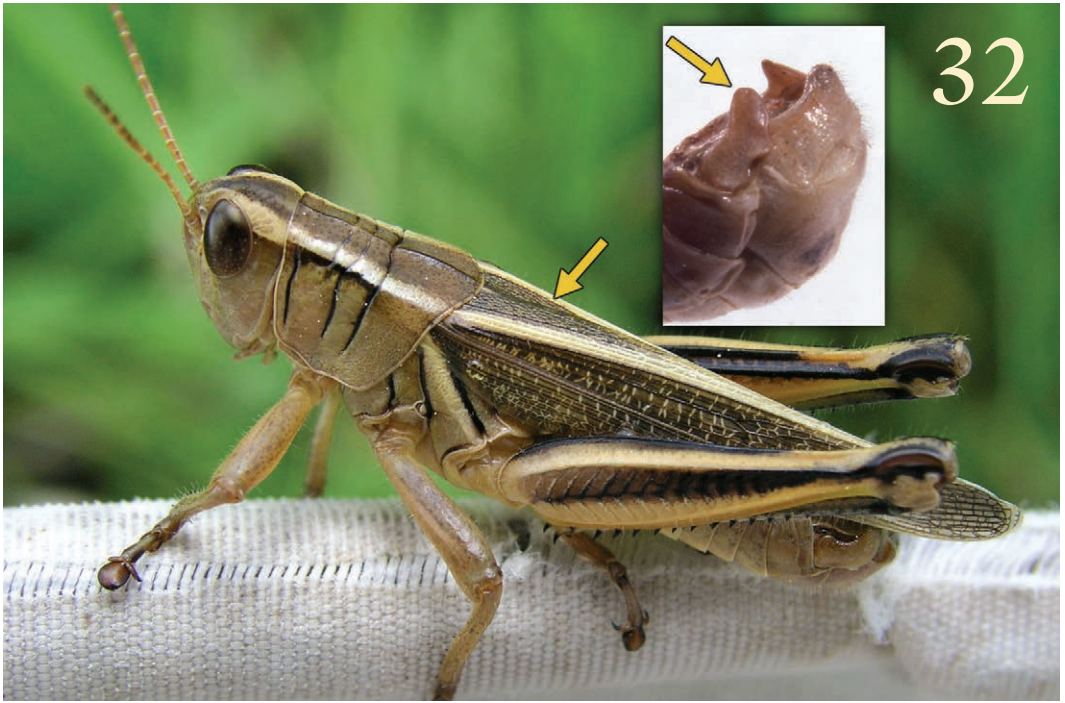
Bait Acceptance: This species is not likely to find bran-based poison bait due to its behavior.

Economic Importance: It can reach densities as high as 40 per square yard, which combined with a dietary preference for grasses and sedges to make them a pest. They do not consistently clip leaves, and their small body size makes them less damaging to forage than the bigheaded grasshopper.

Movement: This species has not been recorded moving in bands but will disperse from where it hatches if the food supply runs out.

Distribution: It is commonly found throughout the state in grasslands below 7,500 feet in elevation.

Similar Species: *Cordillacris crenulata* is a smaller related species with similar coloration that hatches three to four weeks after *C. occipitalis.* The brown stripe on *C. crenulata* is darker and interrupted on the forward edge of the pronotum with a lighter color (see inset photo arrow). From a management perspective, these two species are interchangeable.


32

Adult *Melanoplus bivittatus* or Twostriped Grasshopper

Size: Females are 36 to 41 mm and males 28 to 30 mm in body length.

Adult description: This large brown and yellow species has prominent black medial stripes on the femurs. Two pale yellow stripes start at the top of the eyes and run all the way down the back of specimens to form a triangle on the forewings (see arrow). The males have distinctively shaped cerci (see photo inset).

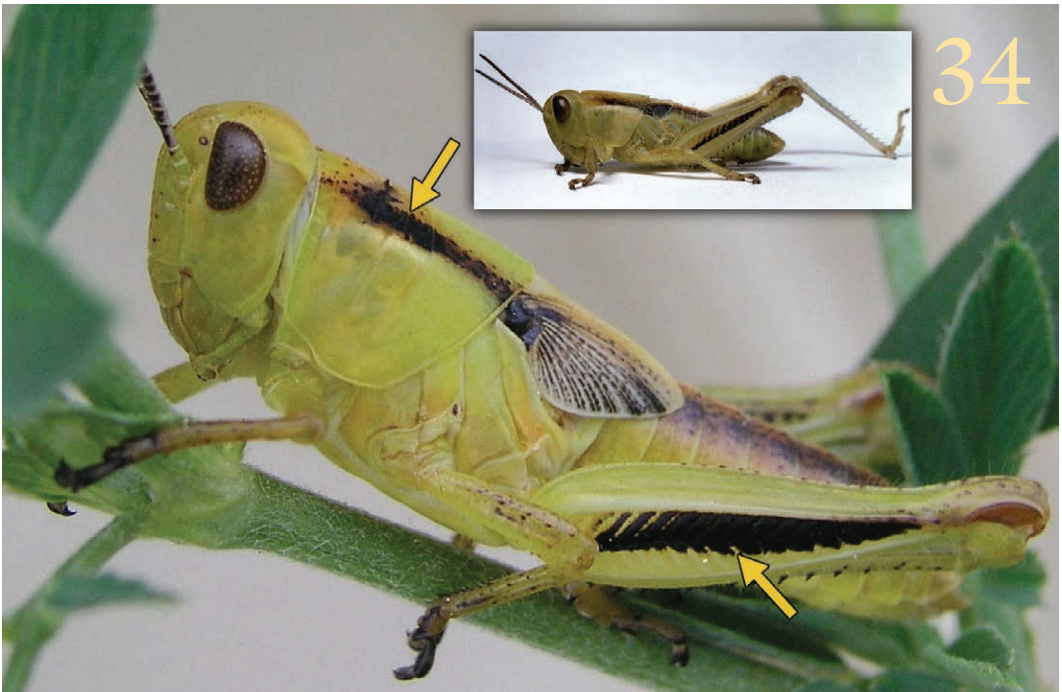
Life Cycle: The species hatches in mid-spring during a four to six-week period. First instar nymphs and new adults can be present at the same time. It can take only 40 days after hatching for females to reach the adult stage. Daily mortality due to natural factors causes the population to decline by late summer, but a few specimens often persist until the first hard frosts. This species lays its egg pods in the root crowns of its preferred food plants such as yellow sweet clover.

Food Preferences: This species feeds on many kinds of plants including grasses, forbs, trees, shrubs, and many cultivated crop plants. Legumes and sunflowers are relished along with plant litter and dead insects. It is commonly found as a pest of garden plants in suburban settings.

Population Ecology: Weedy roadsides, lots, and fallow fields create ideal habitat for this prolific species. High populations can persist for succeeding years as long as food plants are available.

Migration: Adults are capable of dispersal and migration flights at altitudes 1,400 feet above ground. Adults from high-density populations develop longer wings and slimmer bodies better suited for flight.

Fecundity: In cage studies, females have produced an average of 450 eggs during their life. A single egg pod may contain from 50 to more than 100 eggs.

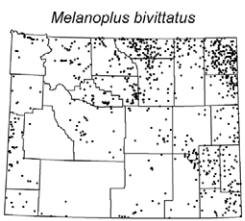

34

Nymph *Melanoplus bivittatus* or Twostriped Grasshopper

Size: First instar nymphs are 5 to 7 mm in body length = |****|

Nymph description: The general body colors are either tan or light green (see inset photo). Dark spots speckle the head and body. The eyes have light tan spots but no dark bands. The pronotum has a dark stripe over a light horizontal stripe (see arrow). The upper half of the medial area of the femur is black (see arrow).

Hatching and Development: Peak hatching occurs from May 15 to June 15 in most years. Males and females have five instars. This large species can reach the adult stage in only 40 days. Because of extended periods of hatching, nymphs may be present in any one area or in the species complex for as long as 75 days.



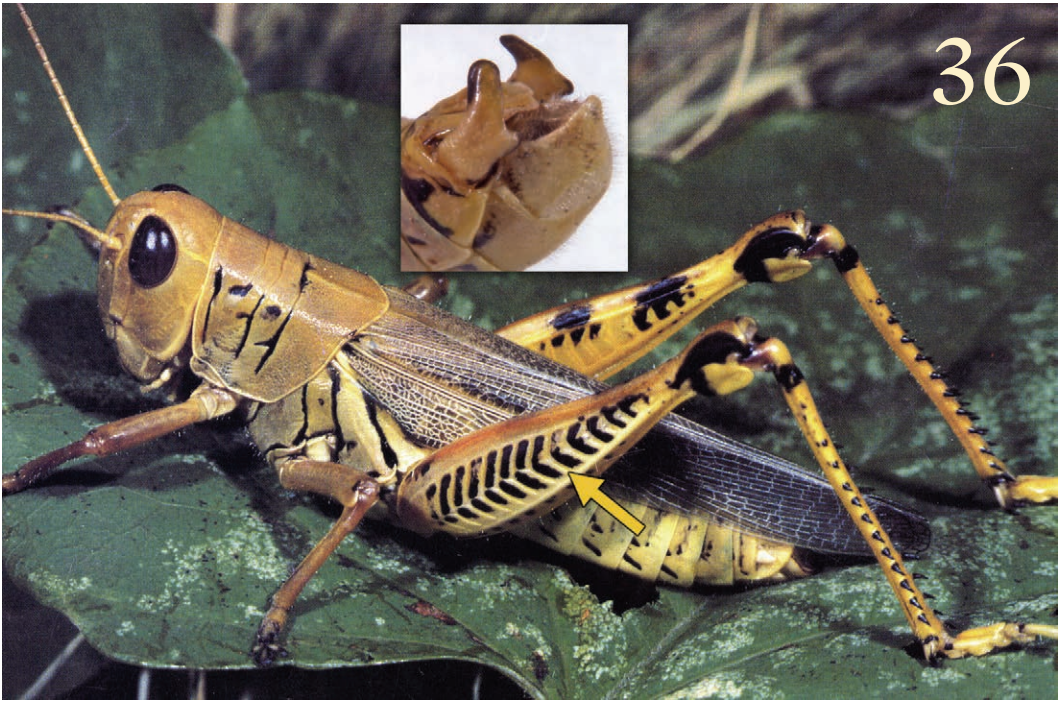
Bait Acceptance: This species readily takes wheat-bran-based poison bait but control may not reach acceptable levels.

Economic Importance: It is a major crop and horticultural pest species due to its feeding habits, large size, and ability to reach very high densities.

Movement: Nymphs will readily move from where they hatch and will move in bands in the third and later instars.

Distribution: Commonly found all over the state in croplands, roadsides, riparian areas, and in towns.

Similar Species: *Melanoplus differentialis* is not as common as *M. bivittatus* but is also a large grasshopper found in the lowest elevation areas of the state. In the later instars of *M. differentialis* the black marks on the femurs are chevron like. From a management perspective, these two species are interchangeable.


36

Adult *Melanoplus differentialis* or Differential Grasshopper

Size: Females are 32 to 41 mm and males 30 to 33 mm in body length.

Adult description: This is a large yellow grasshopper with black markings. A small percentage of populations are mainly black in color. The black chevrons on the outside of the femur (see arrow) and the shape of the male cerci (see inset) are diagnostic.

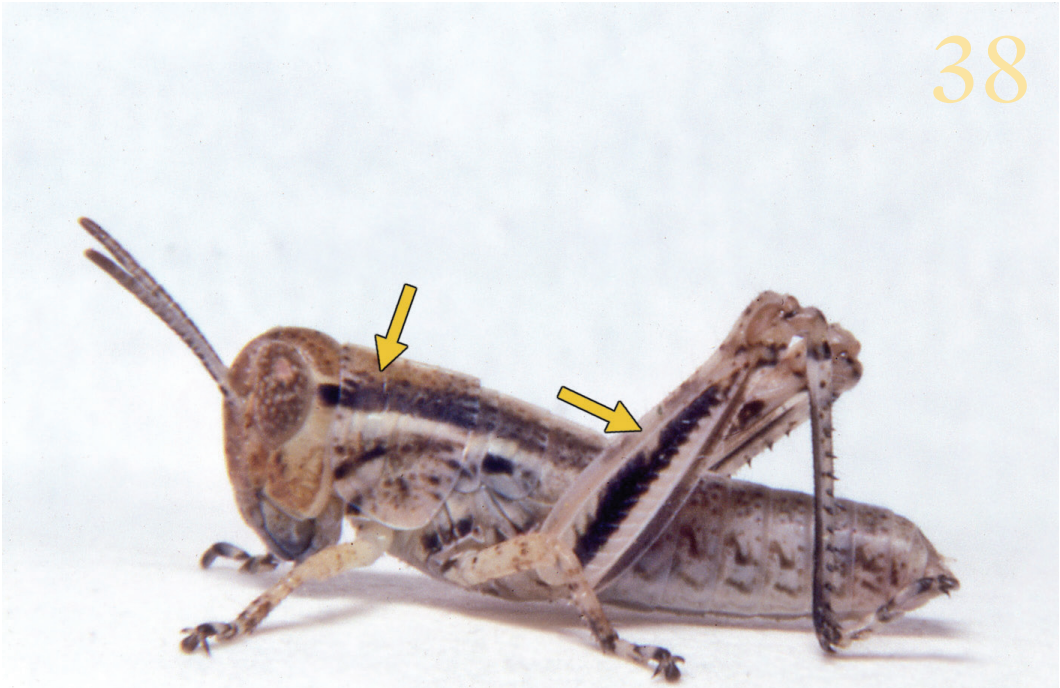
Life Cycle: The species hatches in late spring over a two-week period. Despite the large size of these insects and their need for six nymphal instars, they can reach adulthood in 32 days in ideal conditions. Daily mortality due to natural factors causes the population to collapse by early fall. This species lays its eggs in the roots of sod or rank weeds, often on the edges of cultivated fields.

Food Preferences: This species will feed on a wide range of grasses and forbs with sunflowers, corn, beans, and wheat being readily consumed.

Population Ecology: This species does best in the warmer areas of the state. It has a high reproductive potential, but because of its adaptation to warmer climates it is not as likely to achieve high density populations in Wyoming as the twostriped grasshopper.

Migration: The adults are strong fliers capable of dispersal flights and have been recorded traveling more than 100 miles. This species has been observed flying as high as 1,400 feet above the ground.

Fecundity: Although the number of eggs produced by the average female in the wild is not known, in cage studies the average number of eggs per pod was 107, and up to six pods could be produced.

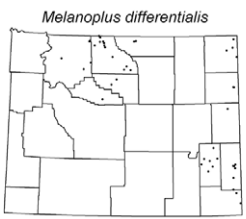


Nymph *Melanoplus differentialis* or Differential Grasshopper

Size: The first instar nymphs are 5 to 6 mm in body length = |****|

Nymph description: The general body colors are either tan, pale yellow, or pale green. Dark spots speckle the head and body. The eyes have light tan spots but no dark bands. The pronotum has a dark stripe over a pale yellow horizontal stripe (see arrow). The black stripe on the hind femur occupies the center of the medial area in the first to fourth instars (see arrow). The black chevrons on the femur begin to appear in the fifth and sixth instars.

Hatching and Development: Peak hatching occurs in late June in most years. Males and females have six instars. They develop rapidly into adults in hot weather. Development is well synchronized.



Bait Acceptance: This species readily takes wheat-bran-based poison bait but control may not reach acceptable levels.

Economic Importance: This species is a severe pest to almost all crops and deciduous fruit trees and can cause total losses at high densities.

Movement: After hatching, the nymphs will move as cohesive bands into crop fields. They are rarely found on native prairies.

Distribution: This species is found only in the lowest elevation areas of Wyoming, often in association with weedy roadsides and crop fields.

Similar Species: *Melanoplus bivittatus* is more common than *M. differentialis,* but the different black markings on the femurs help distinguish the two species. From a management perspective, these two species are interchangeable.

Adult *Melanoplus femurrubrum* or Redlegged Grasshopper

Size: Females are 24 to 28 mm and males 18 to 23 mm in body length.

Adult description: The majority of these insects are medium sized with bright yellow undersides and bright red tibias. The males have bulbous subgenital plates and distinctively shaped cerci (see inset). A color variant can be encountered when a blue color replaces the tan, brown, and gray colors that are most common.

Life Cycle: The species hatches in late spring over a seven-week period. It usually takes 40 days for the nymphs to become adults. Due to the extended hatching period, nymphs may be encountered all summer. Daily mortality due to natural factors causes the population to decline by late summer, but a few specimens often persist until the first hard frosts. This species lays its eggs in sod and will concentrate in field borders.

Food Preferences: It can feed on just about any plant including grasses, legumes, and such diverse broadleaf plants as beets, cabbage, potatoes, and tobacco.

Population Ecology: In ideal habitat this prolific species can go from sub-economic densities to outbreaks in a single year. High populations can persist for succeeding years as long as environmental conditions remain favorable.

Migration: Adults are strong fliers capable of dispersal flights and can make lengthy flights.

Fecundity: In cage studies, females of this species produced an average of 336 eggs during their lifespan. The average egg pod contained 20 to 26 eggs.

Nymph *Melanoplus femurrubrum* or Redlegged Grasshopper

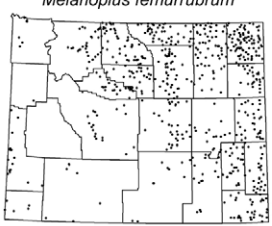
Size: First instar nymphs are 4 to 6 mm in body length = |***|

Nymph description: The nymphs are boldly marked with stripes of black and pale yellow. A pale yellow stripe runs from the top of the head to the end of the abdomen. The upper two thirds of the medial area of the femurs are black (see arrow).

Hatching and Development: Peak hatching occurs the last week of June in most years. Males and females have five instars.

Bait Acceptance: This species will take poisoned bait, but the resulting control can be less than optimal.

Melanoplus femurrubrum



Economic Importance: This species is a serious crop pest. In the eastern U.S. it is the most abundant grasshopper species. It is not normally a problem on native rangelands but can damage legumes in improved pastures.

Movement: Nymphs will disperse from where they hatch in search of food plants.

Distribution: These grasshoppers can be found all over the state except in the driest desert and highest elevation areas.

Similar Species: *Melanoplus dawsoni* and *Melanoplus keeleri* nymphs are also boldly marked with black and pale yellow. The eyes of *M. dawsoni* are all black, not brown like *M. femurrubrum*'s. The eyes of *M. keeleri* have two parallel transverse yellow stripes that distinguish them from *M. femurrubrum*.


44

Adult *Melanoplus infantilis* or Little Spurthroated Grasshopper

Size: Females are 16 to 19 mm and males 16 to 17 mm in body length.

Adult description: This is a small gray, brown, and tan species with wings that extend past the end of the abdomen. The shape of the male cercus has a fork with a lower arm ending in a blunt tip (see arrow). *M. alpinus* has a similar but sharp pointed cercus and lives at higher altitudes in alpine meadows.

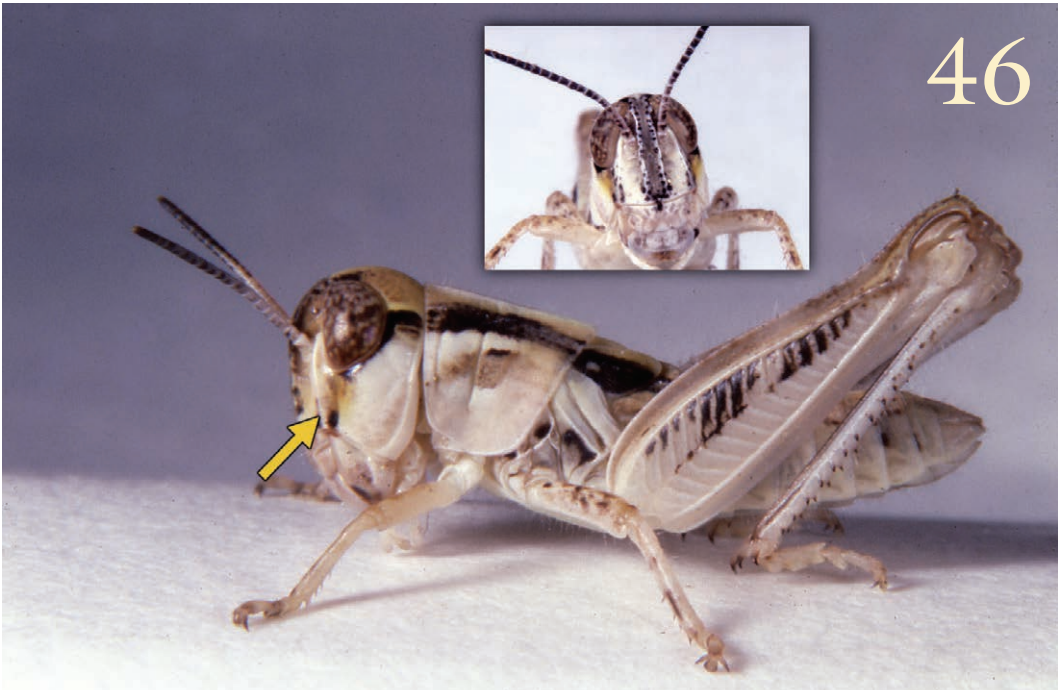
Life Cycle: The species hatches in mid spring. It develops from nymph to adult in less than 35 days. Daily mortality due to natural factors causes the population to collapse by late summer. This species lays its eggs in bare ground and on the sod of grasses.

Food Preferences: This species feeds on a wide variety of native and non-native grasses and forbs. In laboratory studies, one of the preferred plants was the introduced noxious weed downy brome grass.

Population Ecology: Most of the time this species exists at densities of less than one per square yard in its habitat. During outbreaks it can reach densities as high as 40 per square yard.

Migration: Adults are capable of dispersal and migratory flights. Normally, this species only makes short evasive flights when disturbed.

Fecundity: The fecundity of this species is not known.



Nymph *Melanoplus infantilis* or Little Spurthroated Grasshopper

Size: First instar nymphs are 4 to 5 mm in body length = |***|

Nymph description: The body color of most specimens is a creamy white. The dark line that extends from the lower eye to the mouthparts (see arrow) and the dark-colored frontal ridge between the eyes (see inset) are distinctive.

Hatching and Development: Peak hatching occurs from June 1 to June 15 in most years. Males and females have five instars. They are faster to develop into adults than many other pest species, perhaps due to their small size.

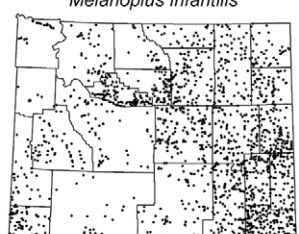
Bait Acceptance: This species readily takes wheat-bran-based poison bait, but control may not reach acceptable levels.

Economic Importance: Because this species can reach high densities and will readily feed on forage grasses, it can have economic impact on rangeland. Due to its smaller size and tendency to feed o forbs not utilized by livestock, it is not as damaging as some other pest species of grasshoppers.

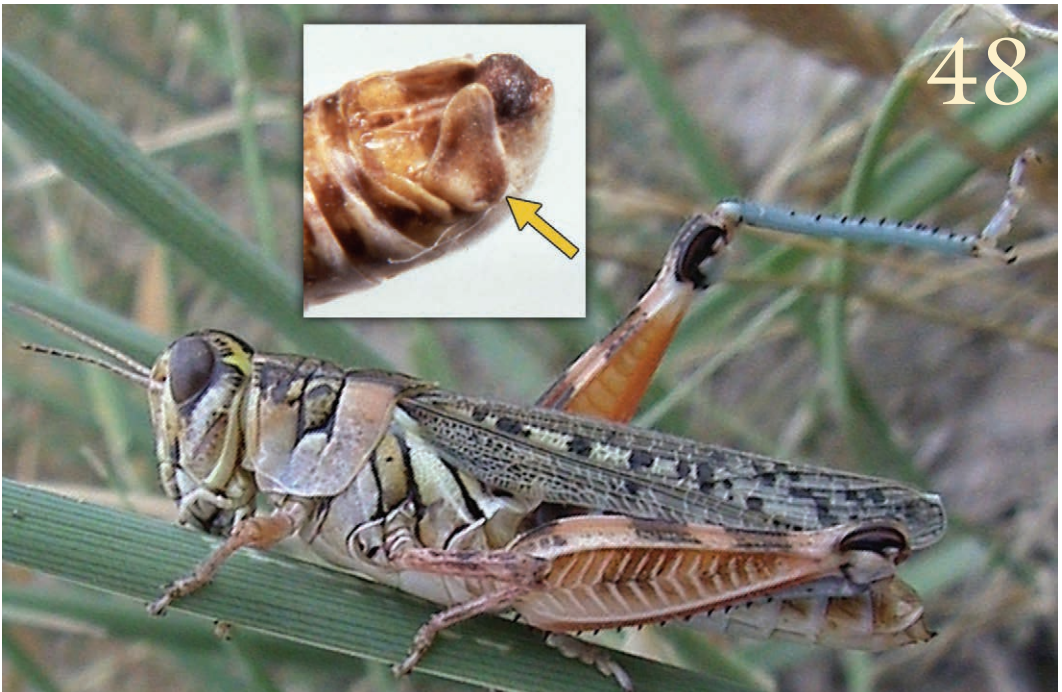
Movement: Nymphs have not been observed moving in cohesive bands.

Distribution: This species is commonly found all over the state's grasslands.

Melanoplus infantilis



Similar Species: *Melanoplus alpinus* looks very similar as a nymph, but it is found in mountain meadow habitats. The difference in shape of the adult male cerci is the only sure way to distinguish them.



Adult *Melanoplus occidentalis* or Flabellate Grasshopper

Size: Females are 22 to 24 mm and males 19 to 21 mm in body length.

Adult description: This is a medium-sized brightly colored species with wings that sometimes extend past the end of the abdomen. Both the lower and inner surfaces of the femurs are bright orange. The tibias are light blue. The male cercus is large and shaped like a hand fan (see arrow). This is the origin of the common name "flabellate." The gray body and legs are marked with dark brown and pale orange.

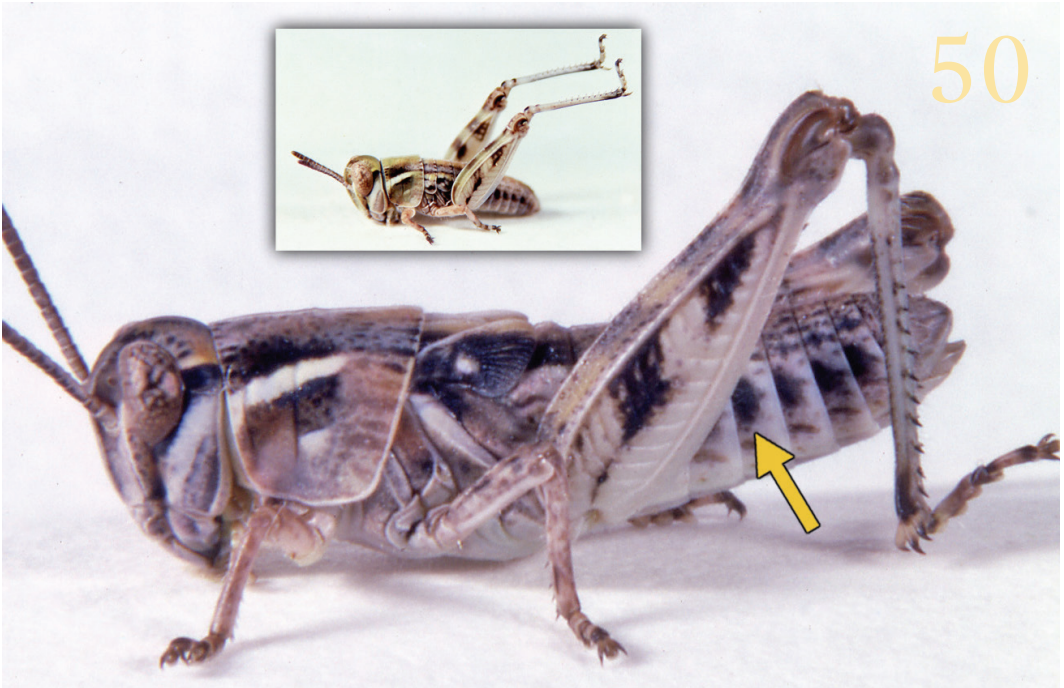
Life Cycle: The species hatches in mid spring at the same time as bigheaded grasshoppers. It develops from nymph to adult in 40 to 45 days. Daily mortality due to natural factors causes the population to collapse by late summer. This species prefers to lay its eggs in bare ground.

Food Preferences: This species feeds on a wide variety of native and non-native grasses and forbs. Western wheatgrass, globemallow, and milkvetch plants are preferred if available. This species will scavenge plant litter and dead insects. Flabellate grasshoppers can be crop pests.

Population Ecology: Most of the time this species exists at densities of less than one per square yard in its habitat but can reach densities of more than eight per square yard. This species can occasionally contribute significantly to the total grasshopper density and cause serious damage.

Migration: Adults are capable of dispersal flights, but migration has never been recorded. This species usually makes low, evasive flights of two to seven feet when disturbed.

Fecundity: The fecundity of this species is not known.



Nymph *Melanoplus occidentalis* or Flabellate Grasshopper

Size: First instar nymphs are 4 to 5 mm in body length = |***|

Nymph description: The body color can be gray, tan, or green (see inset photo). A prominent cream-colored stripe runs from below each eye back onto the pronotal lobes. The fourth and fifth instars have prominent black spots on sides of the abdominal segments (see arrow).

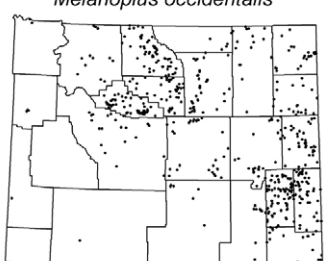
Hatching and Development: Peak hatching occurs from May 15 to June 15 in most years. Males and females have five instars. They are faster to develop into adults than many other pest species, perhaps due to their small size.

Bait Acceptance: This species readily takes wheat-bran-based poison bait, but control may not reach acceptable levels.

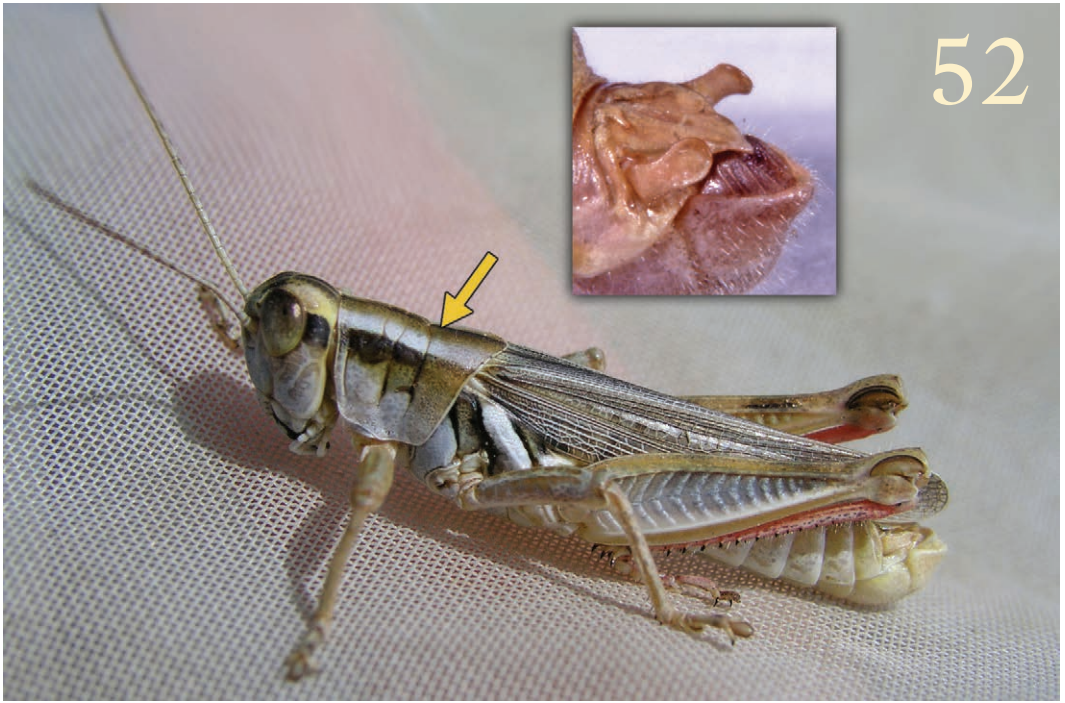
Economic Importance: This species competes for forage with both cattle and sheep. The flabellate grasshopper by itself normally would not be cause for concern, but when at outbreak levels it contributes significantly to the total forage loss.

Movement: Nymphs have not been observed moving in cohesive bands.

Distribution: These grasshoppers are commonly found all over the state's grasslands.



Similar Species: None of the other common *Melanoplus* species that hatch in mid spring have big black spots on the sides of their abdominal segments. The first three instars of many *Melanoplus* species are difficult to distinguish visually.



Adult *Melanoplus packardii* or Packard Grasshopper

Size: Females are 32 to 36 mm and males 27 to 32 mm in body length.

Adult description: A large grasshopper, this species has body colors of tan, brown, and yellow. The tibias are usually bright red but are sometimes blue. Pale stripes start on the head and continue onto the pronotum but do not extend onto the forewings (see arrow). The shape of the male cerci (see inset photo) and the shape of the aedeagus (which is enclosed inside the end of the abdomen) are the diagnostic characters of this species.

Life Cycle: The species hatches in mid spring during a four-week period. The nymphal period can range from 47 to 63 days. Daily mortality due to natural factors causes the population to collapse by late September. This species prefers to lays its eggs in bare ground.

Food Preferences: This species primarily feeds on broadleaf plants but will eat some grasses and ground litter. It is not as damaging on rangeland as it is in crop situations. It will feed on vegetables, small grains, and legumes.

Population Ecology: This species usually persists in low densities on rangeland. It can reach densities of six adults per square yard in weedy roadside and crop borders.

Migration: Adults are capable of dispersal flights. This species has not been recorded migrating in swarms.

Fecundity: The number of eggs per pod ranges from 16 to 29. The average fecundity of this species in a laboratory study was 94 eggs per female. This is less than most of the other crop pests in this genus of grasshoppers.

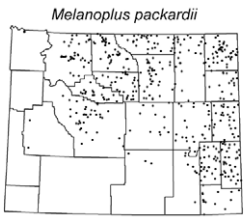
Nymph *Melanoplus packardii* or Packard Grasshopper

Size: First instar nymphs are 5 to 6 mm in body length = |***|

Nymph description: The body color of this species starts out in the first two instars as greenish tan then changes to light green as illustrated in the photo. All instars are speckled with small, dark brown spots sparsely distributed all over the upper surfaces of the body.

Hatching and Development: Peak hatching occurs from May 1 to May 30 in most years. Males and females have five instars. They develop into adults at a rate similar to other pest species with the nymphal period lasting from 47 to 63 days depending on ambient temperatures.

Bait Acceptance: This species readily takes wheat-bran-based poison bait, but control may not reach acceptable levels.



Economic Importance: On rangeland, this species is not a major problem because of its preference for poor forage plants such as scurfpea rather than grasses. In crops, it can cause serious damage to cereal grains and legumes.

Movement: No record of nymphal migration in cohesive bands is known.

Distribution: It is commonly found in non-desert regions of the state including mountain meadows up to 9,000 feet in elevation.

Similar Species: *Melanoplus foedus* is a very similar species that prefers areas with sandy soils. However, for practical purposes the management of the two species is the same. *Melanoplus bivittatus* adults have similar stripes on the pronotum but their stripes continue onto the wings.


56

Adult *Melanoplus sanguinipes* or Migratory Grasshopper

Size: Females are 20 to 29 mm and males 20 to 26 mm in body length.

Adult description: This species is medium sized and typically has black, brown, tan, and gray coloration. Its wings can extend well over the end of the abdomen. Hind tibia can be blue-green or red. The bottom edge of the femur is often red-orange. The males have diagnostically shaped cercis (see arrow), and the end on the abdomen is notched (see inset photo). Both males and females have a bump on the center of the thorax between the front and middle leg attachments.

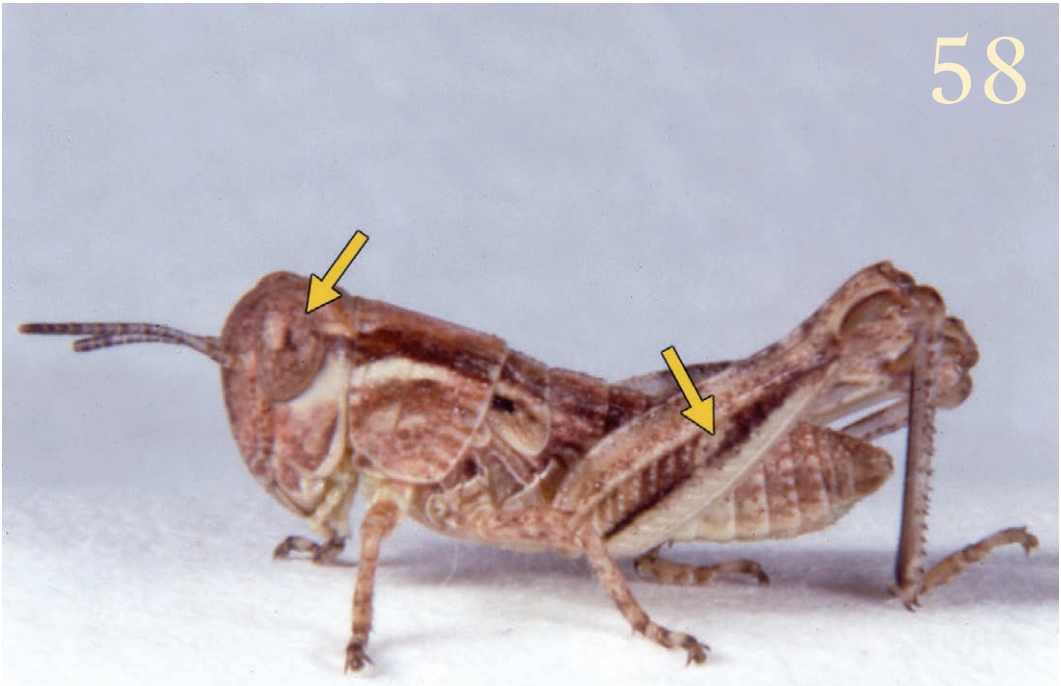
Life Cycle: The species hatches in mid spring during a period that can be three to six weeks long, depending on environmental conditions. In favorable conditions, the nymphal period can be as short as 35 days. In warmer areas of this species' continental distribution, a second generation can be produced, but in Wyoming one generation per year is the rule. This species lays its eggs in the root crowns of blue grama grass and other food plants.

Food Preferences: This species can utilize almost any plant but prefers weedy forbs, wheat, and barley. It also scavenges on ground litter, dead insects, and dried manure.

Population Ecology: This species has a great capacity for rapid population increase from year to year. In one year an observed population went from three to 30 adults per square yard. These insects can easily reach densities of more than 100 per square yard in succeeding years.

Migration: Adults are capable of dispersal and migration flights. The longest one recorded was 575 miles.

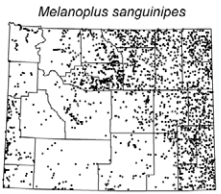
Fecundity: The average egg pod for this species contains 18 to 24 eggs. In ideal conditions, females can produce many pods. In the laboratory, a single, well-fed female produced 20 pods.



Nymph *Melanoplus sanguinipes* or Migratory Grasshopper

Size: First instar nymphs are 4 to 6 mm in body length = |***|

Nymph description: The body colors of most specimens are usually the shades of brown to beige illustrated in the photo although a small percentage may be pale green. Diagnostic features include the eyes with many pale spots and a narrow brown band across their mid sections (see arrow). A pale-colored area just behind the eye extends into a stripe on the sides of the pronotum below a brown stripe. The dark line on the median area of the femur is broken in the middle with a lighter color (see arrow).



Hatching and Development: Peak hatching occurs from May 15 to June 15 in most years. Males and females have five instars. In climates with short growing seasons, this species often develops faster than its relatives living in warm climates.

Bait Acceptance: This species takes wheat-bran-based poison bait with good control results.

Economic Importance: This species is a serious pest of both rangeland and crops. In outbreaks the insects readily feed on just about all plants including trees and ornamentals. Small grains at all growth stages are vulnerable to complete destruction by swarms of this grasshopper.

Movement: The third instar and older nymphs move together in bands in search of food plants. They can march at rates of 0.1 miles per hour and move distances up to 10 miles.

Distribution: Commonly found all over the state, this species has been recovered from glaciers at more than 10,000 feet in elevation when flying swarms have made terminal stops on mountain snowfields.

Similar Species: *M. confusus* hatches about a month earlier than *M. sanguinipes.* Those nymphs have a wide, dark band through their eyes.


60

Adult *Opeia obscura* or Obscure Grasshopper

Size: Females are 18 to 20 mm and males 13 to 15 mm in body length.

Adult description: The adults are small and pale tan to pale green with strongly slanted faces and sword-shaped antennae. The forewings have a long, thin, broken dark-brown stripe (see arrow). The hind femur has a thin dark stripe on upper medial area (see arrow).

Life Cycle: The species hatches in early summer during a two to four-week period concurrent with the new growth of warm-season grasses. It can take 36 to 50 days after hatching for nymphs to reach adulthood. Daily mortality due to natural factors causes the population to collapse by early fall. This species lays its eggs in the bare ground adjacent to its preferred food plants.

Food Preferences: This species prefers blue grama and buffalograss to all other foods but will consume small amounts of other plants, litter, and arthropod parts.

Population Ecology: This species exists at low densities, usually less than three per square yard, but can contribute to forage damage during outbreaks due to its food preferences.

Migration: The adults are capable of low evasive flights but do not colonize into vacant areas very readily. This species has not been recorded migrating in swarms.

Fecundity: This species produces small pods containing eight to 10 small eggs. No study has been conducted on the fecundity of this species. Because it rarely reaches densities of more than three per square yard, its reproductive potential is less than most of the other grasshopper species considered pests.

Nymph *Opeia obscura* or Obscure Grasshopper

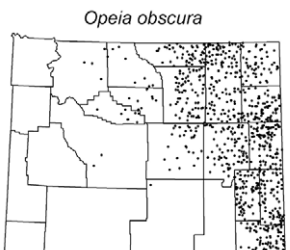
Size: First instar nymphs are 5 to 6 mm in body length = |***|

Nymph description: The body colors of most specimens do not vary much from the shades of brown, tan, and beige illustrated in the photo. Most of the dark striping of the adults does not appear until the last nymphal instar. Brown spots on the body are replaced with brown stripes on the fifth instar. The stripes run from the back of the eye along the side of the pronotum to the end of the abdomen. The face is strongly slanted, and the antennae are sword shaped.

Hatching and Development: Peak hatching occurs after June 21 in most years. Males and females have five instars. Males reach adulthood a week sooner than females.

Bait Acceptance: This species will take bait, but the resulting control can be less than optimal.

Economic Importance: Because this species concentrates its feeding on native forage grasses, it is economically important even though it rarely reaches high densities.



Movement: No mass movement of the nymphs has ever been recorded.

Distribution: It is commonly found only in the eastern grasslands of the state where its preferred grasses grow.

Similar Species: Early instars of *Psoloessa delicatula* and *Eritettix simplex* are present at the same time as *O. obscura*. *P. delicatula* has a vertical face. *E. simplex* has brown stripes over the eye and white or cream-colored stripes at the bottom edge of the brown stripes on the pronotum.


64

Adult *Phlibostroma quadrimaculatum* or Fourspotted Grasshopper

Size: Females are 18 to 22 mm and males 14 to 15 mm in body length.

Adult description: Adults are stocky, medium-sized grasshoppers with very large heads. They can either have the gray, gray-brown, and black coloration illustrated in the photo, or they can be grass green with black and tan markings (see inset photo). The hind tibias are bright orange. A light colored "tear streak" extends down from the eye (see arrow). Black spots, usually four in number, mark the forewings (see arrow).

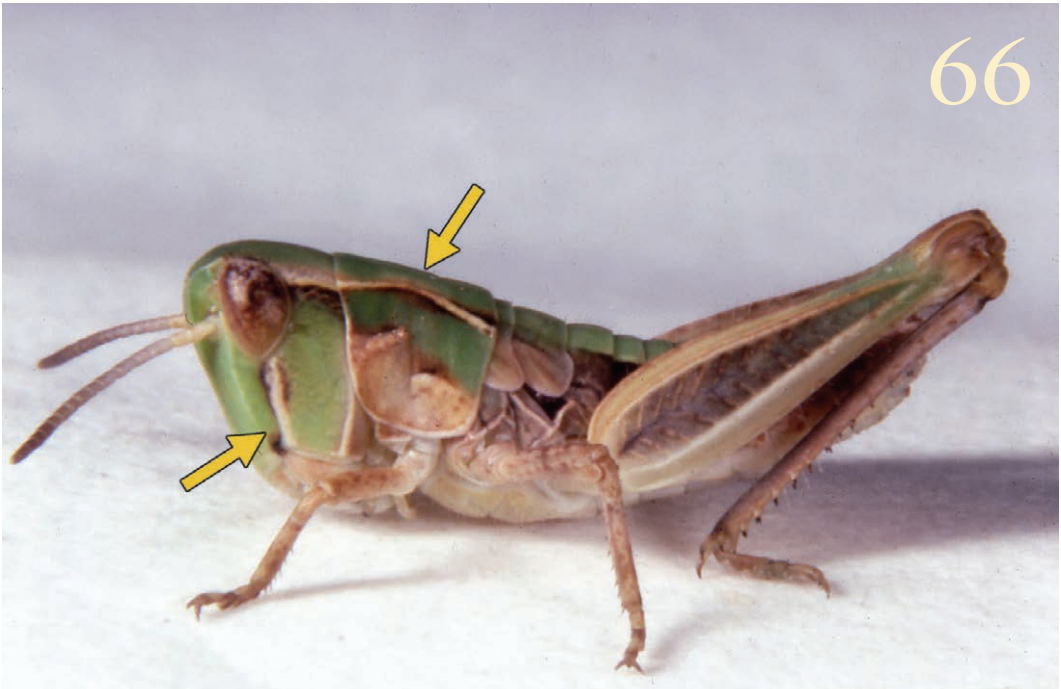
Life Cycle: The species hatches in late spring during a two to three-week period. They develop slowly and, on the average, it takes 48 days for a nymph to reach adulthood. Daily mortality due to natural factors causes the population to collapse by early fall. This species lays its eggs in bare soil adjacent to its preferred food plants.

Food Preferences: This species feeds almost exclusively on grasses. The green leaves of blue grama grass are the preferred food, but they will feed on other grasses if no choice is given.

Population Ecology: Though commonly found on native prairie, this species is rarely the dominant one during outbreaks, and usually its densities do not exceed five per square yard.

Migration: Adults are capable of evasive flights. This species has not been recorded migrating in swarms, and dispersal is thought to be slow.

Fecundity: Cage studies of reproduction have not been done, but in the wild, egg pods were observed to contain from six to 14 eggs. If the females of this species average only one pod during their lives, this would explain why these grasshoppers do not achieve the extreme densities some of the other pest grasshoppers reach.

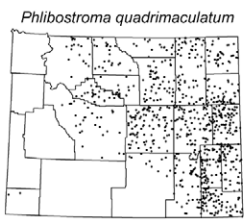


Nymph *Phlibostroma quadrimaculatum* or Fourspotted Grasshopper

Size: First instar nymphs are 5 to 6 mm in body length = |***|

Nymph description: The body colors of most specimens do not vary much from the shades of brown, tan, green, and beige illustrated in the photo. Sometimes the green color is absent. Diagnostic features include a large head and a moderately slanting face with an ivory "tear streak" extending from the bottom of the eye to the mouth (see arrow). The lateral carinae on the pronotum are constricted in the middle and are ivory colored (see arrow).

Hatching and Development: Peak hatching occurs in late June in most years concurrent with the greening of its preferred food grass. Males can have four or five instars while females have five instars. They are slower to develop into adults than many other pest species and can take as long as 55 days to reach maturity.



Bait Acceptance: Because this species feeds almost exclusively on green grass leaves it does not take wheat-bran-based poison bait.

Economic Importance: Because of its dietary preference for important forage plants of livestock, it can be a serious pest during outbreaks.

Movement: This species has never been recorded moving en masse.

Distribution: It is commonly found all over the state in native prairies below 7,500 feet in elevation.

Similar Species: It resembles *Aulocara*, but the large head with coloration and hatching dates that are distinctly different from the *Aulocara* species make this grasshopper hard to confuse.


68

Adult *Trachyrhachys kiowa* or Kiowa Grasshopper

Size: Females are 17 to 24 mm and males 15 to 18 mm in body length.

Adult description: This is a medium-sized grasshopper, most frequently colored tan with brown, blotchy camouflage markings. Some color variants have pale green replacing the tan color. The hind wing is clear, and the ridge on top of the pronotum is notched twice (see arrow). The bottom edge of the femur has a diagnostic fringe of short hairs (see arrow).

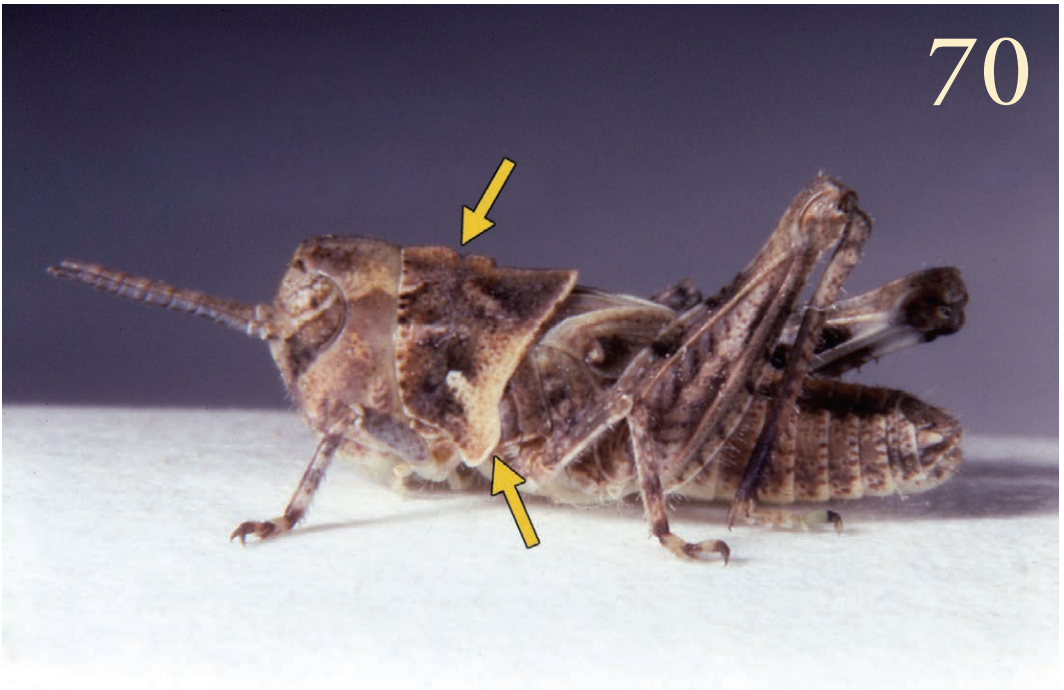
Life Cycle: The species hatches in late spring over a two to four-week period. It can take 37 to 53 days after hatching for the nymphs to complete development. Daily mortality due to natural factors causes the population to collapse by late summer. This species lays its eggs in the bare ground adjacent to its preferred food plants.

Food Preferences: This species eats primarily grasses and sedges with blue grama grass being the favorite food plant. It has never been observed eating plant litter.

Population Ecology: This species can exist at low densities and then increase sevenfold in one season. However, this grasshopper rarely exceeds three grasshoppers per square yard and is probably never the most numerous species in an outbreak.

Migration: Adults are good fliers capable of evasive and dispersal flights and have even occasionally been observed migrating.

Fecundity: No laboratory studies have been conducted on the reproduction of this grasshopper. Field observations of egg pods showed that they usually contain only eight to 10 eggs. Females in the wild may only produce one pod during their lives. Low reproduction rates may explain why this species is unlikely to reach high densities.

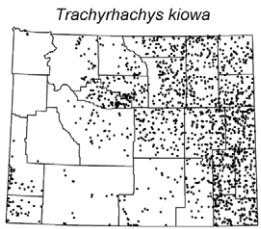


Nymph *Trachyrhachys kiowa* or Kiowa Grasshopper

Size: First instar nymphs are 4 mm in body length = |***|

Nymph description: The body colors of most specimens do not vary much from the shades of brown, tan, and beige illustrated in the photo except for a small percentage that may be pale green. The pronotum has two notches in the center ridge (see arrow). The bottom rear corner of the pronotum has a forward sweeping curve (see arrow). On the third instar and older hoppers the fringe of hairs on the lower edge of the femur is visible and diagnostic (see arrow).

Hatching and Development: Peak hatching occurs from June 7 to June 21 in most years. Males and females have five instars. During warm summers, the development to adulthood will be accelerated.



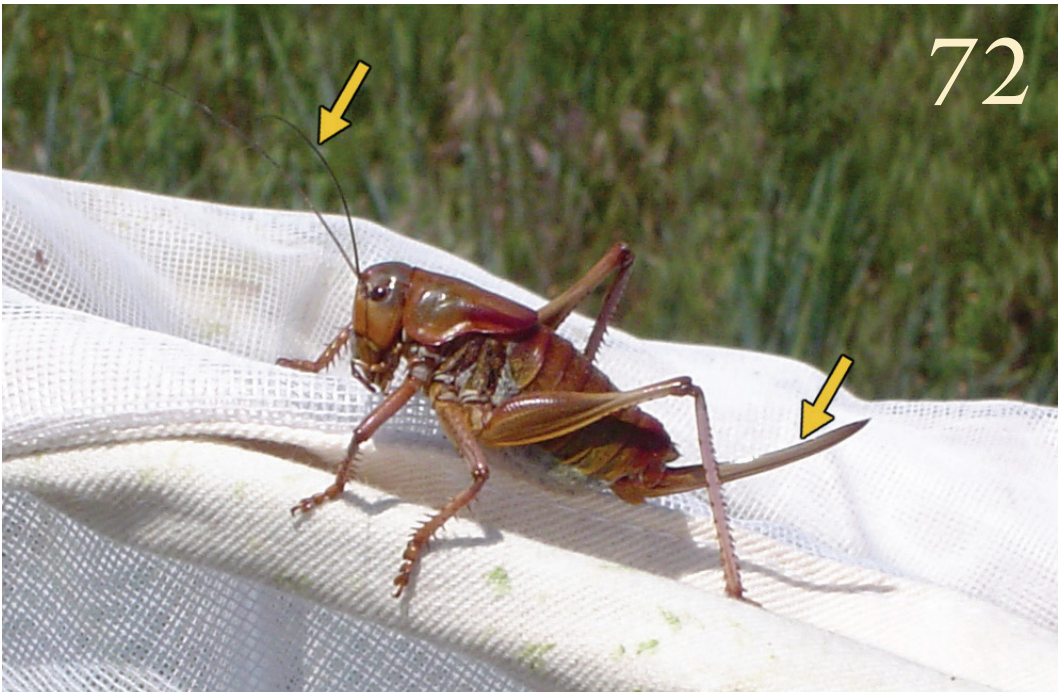
Bait Acceptance: This species is not likely to feed on wheat-bran-based poison bait.

Economic Importance: Because this species prefers to feed on high-quality forage grasses, it can be an injurious part of an outbreak of grasshoppers on mixed grass prairie.

Movement: The nymphs have not been observed moving in cohesive bands.

Distribution: These insects are commonly found all over the state in native grasslands below 7,500 feet in elevation.

Similar Species: Other species that may superficially resemble the Kiowa grasshopper can be quickly distinguished by the lack of the fringe of hair on the bottom edge of the femur and/or the possession of colored hind wings.


72

Adult *Anabrus simplex* or Mormon Cricket

Size: Females are 27 to 32 mm and males 17 to 26 mm in body length.

Adult description: This is not a grasshopper per se but a rather large, flightless, ground-dwelling, shieldbacked katydid. The presence of antennae that are longer than the body and the presence of a long sword-like ovipositor (see arrows) on the adult females distinguish them from true grasshoppers. They range in color from brick red to brown and olive drab.

Life Cycle: The species hatches in very early spring when soil temperatures reach 40° F. The development can take 60 to 90 days to complete. After another 10 to 14 days the adult female mates and accepts a large white proteinaceous spermatophore from a male. She then eats the protein part of the spermatophore and begins to oviposit fertilized eggs singly in bare ground. The mounds of western harvester ants are favorite oviposition sites. In high-altitude areas, it may take two years for a single generation, but most of Wyoming will support one generation per year. Daily mortality due to natural factors causes the population to collapse by fall.

Food Preferences: This species feeds on a wide variety of plants with many crops like wheat, barley, and alfalfa being vulnerable to damage. Succulent forbs like milkvetches, penstemons, and mustards are preferred native host plants.

Population Ecology: *A. simplex* populations tend to grow gradually but can eventually reach more than 100 per square yard, and the high densities can persist for years.

Migration: Migration is a characteristic part of the Mormon cricket biology. Adults from high-density populations migrate in cohesive bands and can travel 25 to 50 miles in a summer season.

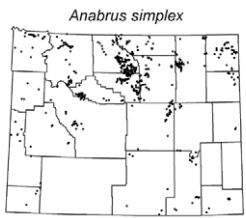
Fecundity: The average fecundity for tested caged females was 86 eggs, with the high being 160 eggs.

Nymph *Anabrus simplex* or Mormon Cricket

Size: First instar nymphs are 6 to 8 mm in body length = |****|

Nymph description: The body colors of nymphs can vary widely, but the ivory stripe at the rear edge of the pronotum and pale green stripe on the bottom edge of their hind femurs occur in all seven instars (see arrows). The later instars often take on a reddish, greenish, or purplish color as they mature. The very long antennae help to distinguish them from grasshopper nymphs.

Hatching and Development: Peak hatching occurs from March to April depending on altitude and soil temperature. Males and females commonly have seven instars and take from 60 to 90 days to reach the adult stage. They can tolerate and survive heavy spring snows. Many predators will feed on them, but at low densities they are cryptic and hide in brush and debris.



Bait Acceptance: This species is vulnerable to wheat-bran-based poison bait.

Economic Importance: Although Mormon crickets can damage forage plants on rangeland, their greatest threat is to high-value irrigated crops, which migrating bands can completely destroy.

Movement: Fifth and older instars will migrate in cohesive bands up to 1 mile per day.

Distribution: These crickets are commonly found throughout the state in mountainous and foothill areas.

Similar Species: There are many species of shieldbacked katydids in Wyoming, but none of the other ground-dwelling species look like the distinctive Mormon cricket.

All photos of adult grasshoppers and Mormon crickets were taken by the authors except for the *Melanoplus differentialis* adult photo, which was taken by Michael H. Blust and reproduced with permission from the Kansas State University Cooperative Extension Service. The inset photos of the nymph Amphitornus coloradus and *Cordillacris occipitalis*, as well as the photos of the nymph *Melanoplus bivittatus* and *M. packardii* were taken by the authors.

Figures 1, 2, 4, and 6 are from *Grasshoppers (Acrididae) of Colorado*, by J. L. Capinera and T. S. Sechrist. It is out of print but can be viewed at: https://www.sidney.ars.usda.gov/grasshopper/ID_Tools/index.htm

The Wyoming grasshopper distribution maps were generated by the Wyoming Pest Detection Program at http://www.uwyo.edu/capsweb/wyoming-grasshopper-atlas.html

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