Narrowwinged Sand Grasshopper

Melanoplus angustipennis (Dodge)

Distribution and Habitat

Despite its local distribution in sand prairies and in smaller open tracts of sandy land, the narrowwinged sand grasshopper ranges widely in North America. It lives in vegetated sand dunes, blowouts, and banks of streams and lakes. Vegetation in the sand prairie consists of thin stands of tall, mid, and short grasses and a variety of forbs. Common species include sand bluestem and prairie sandreed (tall grasses); needleandthread, sand dropseed, little bluestem, prairie junegrass, and western wheatgrass (mid grasses); blue grama and sun sedge (short grass and sedge); scarlet globemallow, slimflower scurfpea, and western ragweed (forbs); and sand sagebrush (shrub). In regions of sand and sandy loam soils this grasshopper also inhabits roadsides, edges of crop fields, and weedy fields of the Conservation Reserve Program (CRP). Large populations may build up in these disturbed sites.

Economic Importance

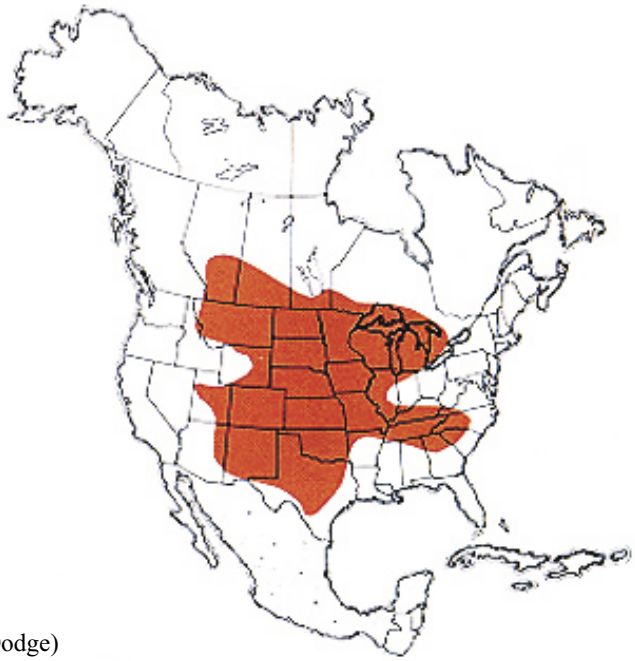
Damage to rangeland forage by this grasshopper has not been investigated quantitatively. However, in 1978 this grasshopper was the dominant species in high density assemblages in the Nebraska Sand Hills, which caused much concern among ranchers. Regrettably, no data on damage and absolute densities were obtained. The following year, densities were still high, but *M. angustipennis* dropped to second place while *Ageneotettix deorum* became the dominant species. In 1980 the outbreak ended and densities of the grasshopper assemblage fell, ranging from two to six per square yard with *M. angustipennis* averaging 0.3 per square yard.

Populations of this grasshopper, as well as certain other species of *Melanoplus*, build up in roadside vegetation and in abandoned fields, posing a hazard for adjacent fields of winter wheat. In Ontario, infestations have damaged grain crops grown in sandy soil.

Of the three size divisions of grasshoppers, the narrowwinged sand grasshopper belongs to the middle group. Live weight of males and females from a sand prairie of eastern Wyoming averaged 271 mg and 381 mg, respectively (dry weight of males averaged 82 mg and females averaged 121 mg).

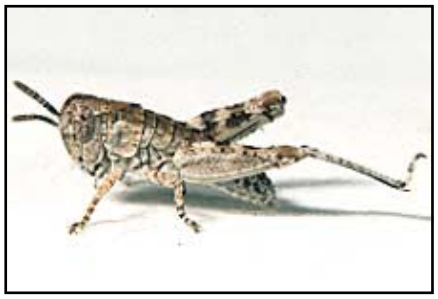
Food Habits

The narrowwinged sand grasshopper is a polyphagous species. It feeds on forbs, grasses, shrubs, moss, and fungi, and also dead insects if available. Examination of crops of grasshoppers collected in three western states (Nebraska, North Dakota, and Colorado) indicates that this species feeds principally on forbs. Consumption of forbs ranges from 41 to 78 percent (average 62) and of grasses from 12 to 47 percent (average 21). A large number of plant species have been detected in crops: 21 grasses, 4 sedges, 47 forbs, and 2



Geographic range of
Melanoplus angustipennis (Dodge)

Instar 1

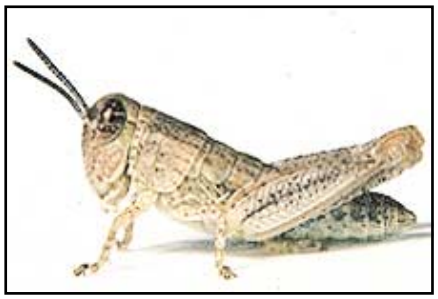


1. BL 3.9-4.5 mm FL 2.5-2.7 mm AS 13.

Instar 2

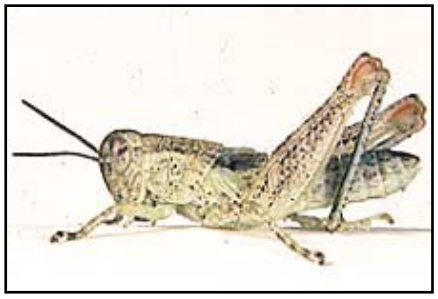
2. BL 5-6.4 mm FL 3.2-4 mm AS 15-17.

Instar 3



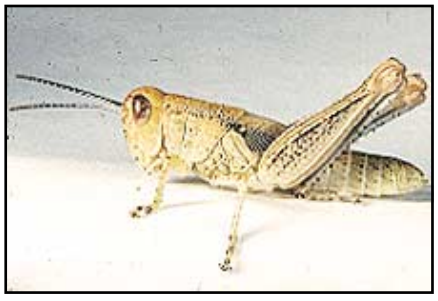
3. BL 7.2-10 mm FL 4.6-6.9 mm AS 20-21.

Instar 4



4. BL 10.5-13.5 mm FL 6.9-8.6 mm AS 21-23.

Instar 5



5. BL 13.5-18.6 mm FL 9-11.5 mm AS 23-25.

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

shrubs. The majority of these appear only in trace amounts (less than 1 percent). Native rangeland forbs eaten in substantial amounts include western ragweed, prairie sunflower, western sticktight, and cudweed sagewort, while rangeland grasses eaten in substantial amounts include blue grama, needleandthread, sand dropseed, and western wheatgrass. Sun sedge has been found in large amounts in crops of grasshoppers collected in the Nebraska Sand Hills.

In two-choice food tests, the narrowwinged sand grasshopper showed a preference for petals of sunflower, leaves of dandelion, downy brome, and alfalfa, and a lack of preference for blue grama, western wheatgrass, yellow sweetclover, kochia, lambsquarters, and tumble mustard. These results indicate that this grasshopper, although polyphagous, discriminates among food plants and may feed heavily on grasses only when preferred forbs are unavailable.

Few direct observations have been made of the feeding of the narrowwinged sand grasshopper. One female near the top of a lemon scurfpea plant was observed to feed on the edge and then the tip of the small lanceolate leaf. Another observation was made of two females with their heads buried in the composite center of common sunflower. They were presumably feeding on parts of the reddish brown disk flowers. Two observations were made of a fifth instar and an adult male feeding on ground litter. They crawled on the ground tasting litter and then stopped to feed. The fifth instar lifted a small piece of litter with the front tarsi and directed the food to its mouthparts.

Dispersal and Migration

The narrowwinged sand grasshopper possesses long wings that extend to the end of the abdomen or may surpass it by up to 4 mm. Evasive flight ranges from 2 to 8 feet, at heights of 4 to 10 inches. The flight is silent and usually straight. Landing may be on the ground or onto vegetation.

Evidence for dispersal is the discovery of “accidentals” at high altitudes west of Boulder, Colorado. A distance of 13 miles separated the habitat of a resident population near Boulder and the site at 8,500 feet. Circumstantial evidence of its ability to disperse is also found in its distribution in eastern Wyoming. The species is present in sandy roadside habitats and CRP land, while it is absent in surrounding mixedgrass prairie. Migrating swarms of this grasshopper have not been observed.

Figures 6-10. Appearance of the adult male and female of *Melanoplus angustipennis*, wings of female, end of male abdomen, and egg pod and eggs.

Identification

The adult narrowwinged sand grasshopper is a medium-sized spurthroated species. It may be dull gray or brightly colored yellow and tan (Fig. 6 and 7). Wings are long, extending as much as 4 mm beyond the abdomen. The hind tibiae are red or blue. The male possesses diagnostic characters of the species: the cerci are spatulate and the distal third of the supraanal plate narrows abruptly (Fig. 9). In a collection of grasshoppers one may identify the females by associating them with the males using size, markings, and color.

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

1. Head with face nearly vertical, head usually tan but sometimes green and usually with numerous brown spots; frontal costa without brown spots in center but with brown spots on the carinae; compound eye fuscous with numerous light spots; antennae filiform and fuscous, each segment ringed anteriorly pale yellow.
2. Pronotum with lateral lobes usually tan or cream (sometimes green) and with several to many brown spots; disk of pronotum tan or green with numerous brown spots imparting a dark contrast to the lighter lateral lobes, this dorsal dark band extends posteriorly to the end of the abdomen.
3. Outer medial area of hind femur with four to five rows of fuscous spots and two faint, irregular dark patches; spots of first row (below upper carinula) often enlarged, coalescing and forming a dark broken line; tibia mainly pale gray, fuscous on front edge.
4. General color: instars I and II tan, instars III to V pale tan, pale gray, or cream.

Hatching

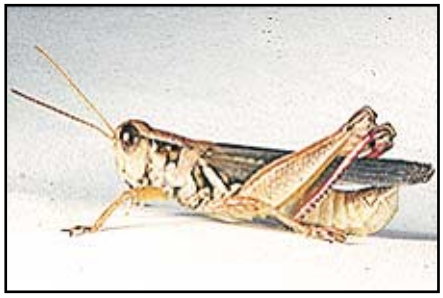
The narrowwinged sand grasshopper is an early developing species. First instars appear about the same time as those of *Ageneotettix deorum*, which is also a common member of the grasshopper assemblage in sand prairie. In eastern Wyoming, hatching begins in early to late May and continues for approximately two weeks.

Nymphal Development

Both male and female nymphs develop through five instars, taking from 36 to 42 days to reach the adult stage.

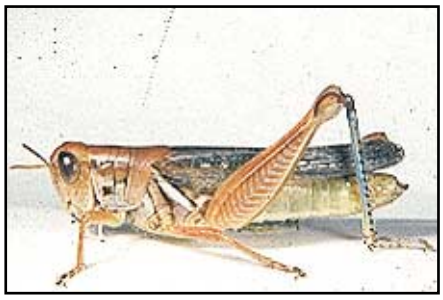
It is not surprising that the males and females have the same number of instars, as the sexes differ little in size.

Male



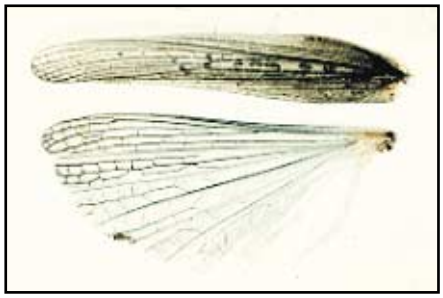
6. BL 19.7-22.2 mm FL 11-12.7 mm AS 23-26.

Female



7. BL 20.5-24.5 mm FL 12.2-13.5 mm AS 24-26.

Wings



8. Spread wings of an adult female.

Cercus

9. End of male abdomen showing shape of cercus and supraanal plate.

Egg pod

10. Egg pod (froth section broken off and missing) and exposed eggs.

The length of hind femur in male and female first instar nymphs is equal, while this part in the female fifth instar and the adult is only 1.1 fold longer than in the male.

Adults and Reproduction

The majority of adults remain in the same sandy soil habitat in which the nymphs hatched and developed. In eastern Wyoming, young adults appear during the first half of July, while a few old adults survive into October. The males fledge about one week before the females. Sexual maturation of the females occurs approximately two weeks after they fledge. Mating pairs may first be observed toward the end of July. An attempt at mating was observed in a laboratory terrarium. A male facing a female resting on vegetation stridulated several times and suddenly jumped and mounted her. Both fell to the sandy floor but failed to copulate.

Oviposition has not been observed in nature. Adults (four males and eight females) confined in a laboratory terrarium produced a total of 18 pods during October 1992. Examination of five of the pods revealed 12, 12, 14, 17, and 17 eggs. The females laid in bare sand that had been transported from their sand prairie habitat. Twice as many were laid close to vegetation (sand bluestem) as in the peripheral bare sand. This indicates that in their natural habitat the females prefer ovipositing close to vegetation.

The pods are 5/8 inch long, curved, and contain from 12 to 18 eggs each (Fig. 10). The egg portion of the pod is 3/8 inch long and is topped by a 1/4 inch section of froth. The bottom eggs lie 1/2 inch deep in the soil. Eggs are tan and range from 4 to 4.8 mm in length.

Population Ecology

Grasshopper outbreaks in the sand prairies consist of assemblages of species in which the narrowwinged sand grasshopper and A. deorum are often dominant. The absolute densities reached by the narrowwinged grasshopper during these outbreaks have been infrequently measured. In a Nebraska Sand Hills site it was the dominant species in 1978 during an outbreak that lasted at least two years. In 1979, the last year of outbreak, A. deorum became dominant while the narrowwinged sand grasshopper fell to second place.

A study of populations in a sand prairie of southeastern North Dakota from 1959 to 1968 revealed an outbreak of grasshoppers (25 per square yard) in one year of the ten. In this outbreak the narrowwinged sand grasshopper was a subdominant species with a density of 1.3 individuals per square yard. Density of this species, dominant in a sand prairie site in eastern Wyoming in a non-outbreak population, measured two young adults per square yard. Outbreak densities have been observed in ruderal habitats, but absolute densities have not been ascertained.

Daily Activity

In its sand prairie habitat, the narrowwinged sand grasshopper spends most of its day on the ground. Early in the morning before the sun strikes them, the grasshoppers emerge from their nighttime shelters. Because temperatures of the ground surface and 1 inch above may be as low as 50°F, the chilled grasshoppers do not fly evasively but are able to jump away from an intruder. They rest horizontally on the ground with no particular orientation to the sun. Flushed grasshoppers may land on vegetation, but the majority of these jump quickly to the ground.

Later (8 a.m. DST) as solar radiation increases the temperatures of the air (60°F) and ground (70°F), the grasshoppers begin to bask on the ground by turning a side perpendicular to the sun's rays and by lowering the associated hindleg. When grasshoppers have warmed sufficiently, they become active and begin to walk, feed, and mate. No observation has been made of their response to inimical high temperatures. In late afternoon as temperatures cool they again bask. Later (5:30-6:30 p.m. DST), adults seek shelter for the night by crawling under canopies of ground litter, mainly dry grass leaves. Although temperatures at these times are above 70°F and well within their normal activity range, the grasshoppers do not flush, even when one walks within 1 foot of them. In ruderal habitats most individuals climb on high vegetation, such as sunflower, western ragweed, and sweetclover, to spend the night vertically (head up) at heights of 10 to 40 inches.

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.

Joern, A. 1982. Distributions, densities, and relative abundances of grasshoppers (Orthoptera: Acrididae) in a Nebraska sandhills prairie. Prairie Naturalist 14: 37-45.

Mulkern, G. B. 1980. Population fluctuations and competitive relationships of grasshopper species (Orthoptera: Acrididae). Trans. Amer. Entomol. Soc. 106: 1-41.

Newton, R. C. and A. B. Gurney. 1956. Distribution maps of range grasshoppers in the United States. Cooperative Economic Insect Report 6(43): 1020.

Onsager, J. A. and G. B. Mulkern. 1963. Identification of eggs and egg-pods of North Dakota grasshoppers. North Dakota Agr. Exp. Stn. Bull. 446 (Technical).

Ueckert, D. N. and R. M. Hansen. 1971. Dietary overlap of grasshoppers on sandhill rangeland in northeastern Colorado. Oecologia 8: 276-295.