PREFERENCES OF SEVERAL GRASSHOPPER SPECIES (ACRIDIDAE:ORTHOPTERA) AMONG CERTAIN CULTIVATED GRASSES

by

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TABLE OF CONTENTS

INTRODUCTION

The Acrididae composes one of the most widely distributed groups of insects in the world. Evidence indicates that they always have been a pest to agriculture. The writings of the Egyptians, Greeks and Ancient Hebrews contain references as pests of agriculture.

The problem of grasshoppers as economic factors of rangelands and grasslands also has been long in existence. Damage in varying amounts takes places in one area or another every year. Most damage to range vegetation has been done by overgrazing by livestock, but in some areas grasshopper damage has been the primary cause of erosion and in many cases grasshopper damage has forced overgrazing by livestock. Hight populations have prevented establisment of grass cover by killing seedlings on seeded fields and have prevented natural reseeding by clipping off immature seed heads. In a light infestation on a range with an average of 6 or 7 grasshoppers to the square yard, it has been estimated that those on 10 acres consume grass at about the same rate as a cow. If the grass is sparce, the amount destroyed may reduce the supply to the point where cattle can no longer subsist. During outbreaks when there may be 30 to 60 to square yard, all the grass may be destroyed.

The distribution and abundance of food plants affect the distribution and abundance of grasshoppers. Vegetation has been shown to control the distribution of grasshoppers both by its influence on the microclimate and by restriction of the insects' diet. The importance of the latter has been recognized for sometime, but not until recently have critical studies been made on the food habits of grasshoppers, particularly those of grasslands and rangelands. Several papers have appeared which treat a single or small number of species, but for the majority, the amount of critical information is small. Little is

known about extent and type of damage to heads of cultivated grasses.

The key to predicting, detecting, and eventually preventing disastrous outbreaks of range and grassland grasshoppers lies in a more thorough understanding of their basic biology, ecology, and habits. Knowledge of specificity and damage may give clues to better control methods. Likewise, excessive use of insecticides can be avoided by knowing which species of grasshoppers, although abundant, and feeding on weeds rather than beneficial grasses.

This study was conducted to determine the relative food preferences and rates of ingestion and destruction to some cultivated grasses.

REVIEW OF LITERATURE

There is more literature on grasshoppers than on any family except mosquitoes. However, most deals with taxonomy,general ecology, and chemical control measures. Relatively little is available on the life histories, food plants, extent and type of damage to plants, and non-chemical methods of control of rangeland grasshoppers.

The old idea was that grasshoppers are to a large extent omnivorous and, as Wolcott (1936) stated, "like cows, feed on any kind of vegetation". This is slowly giving place to the view that they are much more restricted feeders. Their habit of nibbling at almost anything, particularly when they are present in large numbers, probably led to this erroneous concept. More work using cage studies and field observations such as that of Rubtzov (1931), Criddle (1933), Isely (1937, 1938, 1944, 1946), Brett (1947), Pfadt (1949), Anderson and Wright (1952), Scharff (1954, 1960), and Mulkern (1959, 1962) emphasized that many species confine their feeding to a group of related plants, and a few to a single plant. Grasshoppers, like many other group of insects, fall into three typical classes of food choices: (1) many species are oligophagous, using as food only a limited number of plant species; (2) a few species are essentially monophagous and their optimum dietary requirements are met by a single plant species (Hypochlora alba is known to feed only on Artemesia spp.); and (3) many species are polyphagous species feeding upon both grasses and forbs and, in general, selecting their food from a wide range of plants.

Correlation between mandibular morphology and food specificity was studied by Isely (1944). He segregated grasshoppers by mandibular types into three major groups: (1) graminivorous, (2) forbivorous, and (3) herbivorous.

Kaufmann (1965) reported that Bavarian species showed differing food preferences by differences in maxillary lacinae. Isely (1944) and Isely and Alexander (1949) described the mandibular structure of grasshoppers in relation to their food habits and stated the possibility of determining food preferences by identifying plant fragment contents in the crop (ventriculus). The technique of crop content analysis by utilizing plant epidermal characteristics was developed by Mulkern and Anderson (1959). Mulkern and Anderson (1959), Pruess (1960), Mulkern, Anderson, and Brusven (1962), Mulkern, Toczek, and Brusven (1964), Campbell (1966), and Lambley (1967) determined the food of certain grasshopper species by examining crop content.

Work by Parker (1930), Shotwell (1941), and Brett (1947) showed the effects of food, temperature and humidity on grasshopper development. Langford (1930) studied some factors relating to the feeding habits of grasshoppers. He showed that temperature was one of the most important factors in reproduction, development and feeding habits. Gangwere (1959) cited that food consumption increases in direct proportion to size during the nymph stages and that species differ in amounts of food consumed. The kind of food eaten determined the volume eaten and the number of times feeding occurs. The stage of development of the grass at the time of feeding is much more important than the amount of food consumed by an individual.

Smith (1959) noted that certain plants eaten are nutritionally inadequate to certain grasshopper species. Painter (1953) stated that different parts of the same plant may differ nutritionally and implied that this may be a possible explanation for some resistance which seemed to be a preference phenomenon rather than a nutrition phenomenon. Uvarov (1928) reported that differential feeding on plants is due to insects looking for water, and water is the only chemical compound which made grasshoppers show positive chemotropism. Criddle

(1933) studied Melanoplus bivittatus (Say) and observed that plant containing a large amount of water might greatly attract grasshoppers. Fraenkel (1959) reported that insects were attracted to secondary compounds such as glucosides, saponins, tannins, alkaloids, and organic acids, rather than the plants themselves. Kresaky (1960) worked on Melanoplus bruneri and showed that, in certain cases, a species will feed on one plant, and during later development, change food plant.

Most of the taxonomic work has dealt with adult grasshoppers: Brunner (1885, 1887), Isely (1905), Beamer (1915), Claassen (1915), Hebard (1925, 1929, 1936, 1938), Knutson (1940), Alexander (1941), Ball et al.(1942). Froeschner (1954), Brooks (1958), Gurney and Brooks (1959), Coppock (1962), and Pfadt (1965). Little taxonomic literature occurs on nymphs: Criddle (1931), Handford (1946), and Brusven (1966). Most of the above includes little detailed information on food plants and favorable habitats.

Felt (1915), Shotwell (1930), and Herrick and Hadley (1916) mentioned that grasshoppers attacked the milky kernels of wheat, rye, barley and oats and clip oat kernels. Corkens (1932) summarized the situation: "Especially during a dry season when succulent food is scarce, severe damage may be done by a limited number of grasshoppers upon the heads of grain. Kernels of wheat and barley may be eaten out, or even the heads cut off completely. Oats kernels are often clipped off one by one and dropped untouched to the ground". This types of injury is very similar to the damage to the inflorescence of grasses.

The first reference concerning grasshopper damage to the inflorescence of pasture grasses was reported by Wilbur (1936). He described the injury to the inflorescence of grama, big bluestem, little bluestem, Hungarian brome grass, two wild ryes, western wheat grass, slough grass, Sporobalus asper (Knuth), and common crab grass. He also described general types of injury

during field observations. Similar injury to a lesser degree has been noted each year since.The injuried heads withered and failed to produce seeds.

Woodruff (1937) did a survey of the grasshoppers inhabiting the native grasses in Kansas and noted that the native grasslands supported a different fauna from other habitats. Wilbur and Fritz (1940) made collections throughout the growing season of 1933 through 1939 on three representative pasture types to study the populations present in typical pastures of the bluestem region of Kansas. They observed that Orphulella and Mermiria dominate the native prairie. They also indicated that the crop-infested species of Melanoplus together with Ageneotettix deorum deorum dominate Kentucky bluegrass and orchard-brome grass pastures.

Smith (1954) assembled and analyzed the available information on the annual populations of grasshoppers in Kansas from 1854 to 1954. He noted that the numbers each year must be dependent in some way on the kind, amount and quality of natural food available to them and their parents, though modified by other environmental factors. But there was little information on grassland and rangeland species and virtually none on their food preferences.

Scharff (1954) studied outbreaks of Melanoplus sanguinipes and believed the relationship between drought and outbreaks is not entirely a direct effect of the weather on the grasshoppers but also the effect of weather on the host plant complex. Williams (1954) studied the problem of orientation with various species of Acridoidea in England, and concluded that grasshoppers usually prefer to feed on grass blades that stand vertically.

The feeding habits have been investigated by numerous other authors. However, most have been limited to one or two crop-land species. Specific work relating to grasshopper damage to the head of cultivated grasses is sparse in the literature.

MATERIALS AND METHODS

Experiments were carried out to evaluate feeding upon selected species of cultivated grasses by eight grasshopper species under laboratory conditions in cages. The study was conducted from June 5 to September 23, 1967, using both nymphs and adults as they became available in the field.

Grasshoppers studied were Ageneotettix deorum deorum (Scudder), Melanoplus bivittatus (Say), Melanoplus differentialis (Thomas), Melanoplus femurrubrum-femurrubrum (DeGeer), Melanoplus keeleri luridus (Dodge), Melanoplus sanguinipes (Fabricius), Orphulella speciosa (Scudder), and Phoetaliotes nebrascensis (Thomas). Grasshopper adult identification was confirmed by keys cited in the literature review and by comparisons with specimens in the insect collection of the Entomology Department at Kansas State University. Identification of the nymphs was more difficult, because few keys were available and some specimens preserved in the alcohol faded, so that color was altered.

Eleven cultivated grass species were used: Agropyron elongatum, Agropyron smithii, Andropogon gerardi, Bouteloua curtipendula, Bromus inermis, Dactylis glomerata, Elymus junceus, Festuca arundinacea, Panicum virgatum, Phalaris arundinacea, and Phleum pratense. The scientific name is abbreviated in the tables by using the first letter of the genus and first two letters of the species name (Table 1). These grasses were selected because they were generally available and because they are important species. When the grasses had matured and had subsequently dried, they were no longer evaluated. These instances are represented by an absence of data in the Tables (see appendix). Some grass species were identified by crop analysis by Mulkern et al.(1964), Campbell (1966), and Lambley (1967), which also was a factor in determining the species of grasses studied.

The cages were of the type developed by Isely. It consisted of a frame and top made of wood. The outside dimensions were 1.5 x 1 x 0.75 feet. The cage was supported by 7 inch legs. The laterals and back of the cage were covered with screen wire. The front was closed with a removable sliding glass which served as the door. In each cage, there were three recessed metal pans, 3" x 6" x 3", which were filled with soil-sand. The tests were conducted at a room temperature around 25°C.

Samples of two species of plants were introduced into an insectary cage with a certain number of grasshoppers, during a 48 hour period. Each of the 11 species of grasses was paired against each other species. Cut heads and leaves of grasses were placed in glass vials with water and leaned against the rear screen wall so that the grasshoppers could easily reach the heads (see appendix for representative plots). The vials with cuttings were inserted into the soil-sand mixture in the metal pans, until the lips of vials were level with the soil-sand mixture surface. Water for the grasshoppers was provided as needed in petri dishes, soaked with cellulose or cotton. In order to obtain all damaged seeds for accurate evaluation, white paper was placed on bottom of cage.

Two grass species of equal volume and one grasshopper species were maintained for each test. Usually 10 individual grasshoppers were put in each cage, whereas the large size of adults of M. differentialis and M. bivittatus made necessary a reduction to five individuals. When nymphs were tested, an attempt was made to use two consecutive instars in each cage.

The grasshoppers were first observed one hour after the plants were placed in cages, as this was sufficient for almost all grasshoppers to locate the food and to make a selection between the two cuttings. It appeared that no

discrimination was made between the eventially preferred and unpreferred plant, until contact with the plant was made, and even then it appeared that nibbling the plant was a necessary prerequisite. The number of grasshoppers feeding was recorded at 8:30 A.M., 10:30 A.M., 12:30 P.M. and 4:30 P.M. Feeding was recorded when movement of the mouthparts was observed in contact with the plant. After 48 hours, the plants were removed and replaced by another series of two plant species. The cages were cleaned before the next trial began, which involved removing plant debris, feces and dead grasshoppers.

After removal from the cage, all plants were photographed to make a permanent record and some are included in this thesis (Fig. 1-10). Inflorescence and seeds then were observed under microscopes.

The intensity of leaf feeding was recorded by ranking the damage: A = no feeding; B = trace to 1/2 of leaf eaten; C = 1/2 or more eaten; D = eaten entirely. The intensity of inflorescence and seed feeding was recorded on: none = no damage; slight = slight feeding but no appreciable injury; medium = injuried so that reproduction probably not possible; heavy = reproduction destroyed. For the convenience of comparing the degree of leaf damage, a leaf feeding index number was given: A = 0, B = 0.25, C = 0.5 and D = 1 (Table 2 through 9).

In order to represent the degree of inflorescence and seed injury in numerical genus, an inflorescence-seed feeding index was calculated: (no. of "none" x 0) + (no. of "slight" x 0.25) + (no. of "medium" x 0.5) + (no. of "heavy" x 1)÷100 (Table 2 through 9).

Table 10 to 37 are condensed summaries of (1) leaf, and (2) seed and inflorescence feeding. For the convenience of evaluating and comparing relative food preferences among the grasses, the leaf feeding indexes and the inflores-

cence-seed feeding indexes of each base plant were assigned "1.0" in column 1. They were then compared with the transformed indexes of the other grass species. The transformed indexes were derived by dividing leaf feeding index or the inflorescence-seeding feeding index of base plant into that of the plant to which it is being compared. When no damage was recorded with resulting zero (Table 2 to 9), the "100%, none" was changed to 97%, giving an index figure of 0.0075 which make calculation possible. The superscripts (in parentheses) are the rankings.

RESULTS AND DISCUSSION

Table 2 through 9, present the results of evaluation of feeding damage to leaves, inflorescences and seeds. Tables 10 through 37 present the transformed indexes from data in Tables 2 through 9. The superscript (in parentheses), when read horizontally, indicates rank of feeding preference when a given base plant was placed in a cage with each of the other plants (the smaller the number, the greater the feeding preference). When these superscripts are read vertically, a more reliable evaluation is obtained. In theory, the ranks of feeding preferences in each vertical line should be identical. However, these were not unanimously consistant because of differences in such factors as maturity of grasses, and differences in stage of grasshopper development.

1. Ageneotettix deorum deorum

Table 10 shows the summary of leaf feeding of adults on eight grass species. Only adults were studied because of insufficient nymphs.

Andropogon gerardi (Age), Agropyron smithii (Asm), and Festuca arundinacea (Far) were preferred. Phalaris arundinacea (Par) was the least preferred.

A summary of rank is: Andropogon gerardi (Age) = Agropyron smithii (Asm) = Festuca arundinacea (Far) > Bouteloua curtipendula (Bcu) = Phleum pratense (Ppr) > Bromus inermis (Bin) > Panicum virgatum (Pvi) > Phalaris arundinacea (Par).

Table 11 shows the summary of inflorescence and seed feeding of adults.

Bromus inermis (Bin) was preferred. Panicum virgatum (Pvi) was the least preferred even though it was still succulent while B. inermis was becoming mature. The summary of rank is: Bromus inermis (Bin) > Festuca arundinacea (Far) = Phleum pratense (Ppr) > Agropyron smithii (Asm) > Bouteloua curtipendula (Bcu) > Phalaris arundinacea (Par) > Andropogon gerardi (Age) > Panicum virgatum (Pvi).

2. Melanoplus bivittatus (Say)

Tables 12 and 13 show the summaries of leaf feeding.

In the nymph stage, Dactylis glomerata (Dgl) was preferred. Agropyron elongatum (Ael) and Bouteloua curtipendula (Bcu) were the least preferred.

In the adult stage, Bromus inermis (Bin) was preferred. Agropyron elongatum (Age) and Bouteloua curtipendula (Bcu) were the least preferred.

The summary of rank in the nymph stage is: Dactylis glomerata (Dgl) > Phleum pratense (Ppr) > Bromus inermis (Bin) = Phalaris arundinacea (Par) > Agropyron smithii (Asm) = Elymus junceus (Eju) = Festuca arundinacea (Far) > Panicum virgatum (Pvi) > Agropyron elongatum (Ael) = Bouteloua curtipendula (Bcu).

The summary of rank in the adult stage is: Bromus inermis (Bin) > Festuca arundinacea (Far) = Phleum pratense (Ppr) > Panicum virgatum (Pvi) > Andropogon gerardi (Age) = Bouteloua curtipendula (Bcu).

Tables 14 and 15 show the summaries of inflorescence and seed feeding.

In the nymph stage, Bromus inermis (Bin) and Elymus junceus (Eju) were preferred. Agropyron elongatum (Ael) was the least preferred.

In the adult stage, Festuca arundinacea (Far) was preferred; and Bouteloua curtipendula (Bcu) was the least preferred.

The summary of rank in the nymph stage is: Bromus inermis (Bin) = Elymus junceus (Eju) > Panicum virgatum (Pvi) > Phalaris arundinacea (Par) > Dactylis glomerata (Dgl) > Agropyron smithii (Asm) > Bouteloua curtipendula (Bcu) = Phleum pratense (Ppr) > Festuca arundinacea (Far) > Agropyron elongatum (Ael).

The summary of rank in the adult stage is: Festuca arundinacea (Far) > Phleum pratense (Ppr) > Panicum virgatum (Pvi) > Agropyron smithii (Asm) > Bromus inermis (Bin) > Andropogon gerardi (Age) > Phalaris arundinacea (Par) > Bouteloua curtipendula (Bcu).

3. Melanoplus differentialis

Tables 16 and 17 show the summaries of leaf feeding.

In the nymph stage, Bromus inermis (Bin), Dactylis glomerata (Dgl), Elymus junceus (Eju), Festuca arundinacea (Far) and Phleum pratense (Ppr) were preferred over the remaining five grass species; and Bouteloua curtipendula (Bcu) was the least preferred.

In the adult stage, Bromus inermis (Bin) and Festuca arundinacea (Far) was preferred; and Bouteloua curtipendula (Bcu) was the least preferred.

The summary of rank in the nymph stage is: Bromus inermis (Bin) = Dactylis glomerata (Dgl) = Elymus juneus (Eju) = Festuca arundinacea (Far) = Phleum pratense (Ppr) > Phalaris arundinacea (Par) > Agropyron smithii (Asm) > Panicum virgatum (Pvi) > Agropyron elongatum (Ael) > Bouteloua curtipendula (Bcu).

The summary of rank in the adult stage is: Bromus inermis (Bin) = Festuca arundinacea (Far) > Agropyron smithii (Asm) > Panicum virgatum (Pvi) > Andropogon gerardi (Age) = Phalaris arundinacea (Par) > Bouteloua curtipendula (Bcu).

Tables 18 and 19 show the summaries of inflorescence and seed feeding.

In the nymph stage, Elymus junceus (Eju) was preferred over the remaining nine grass species; and Agropyron elongatum (Ael) was the least preference.

In adult stage, Festuca arundinacea (Far) was preferred; and Bouteloua curtipendula (Bcu) was the least preferred.

The summary of rank in the nymph stage is: Elymus junceus (Eju) > Bromus inermis (Bin) > Phalaris arundinacea (Par) > Agropyron smithii (Asm) = Dactylis glomerata (Dgl) = Panicum virgatum (Pvi) > Bouteloua curtipendula (Bcu) = Festuca arundinacea (Far) > Phleum pratense (Ppr) > Agropyron elongatum (Ael).

The summary of rank in the adult stage is: Festuca arundinacea (Far) >

Bromus inermis (Bin) = Panicum virgatum (Pvi) > Agropyron smithii (Asm) > Andropogon gerardi (Age) = Phalaris arundinacea (Par) > Bouteloua curtipendula (Bin).

4.Melanoplus femurrubrum-femurrubrum

Tables 20 and 21 show the summaries of leaf feeding.

In the nymph stage, Phleum pratense (Ppr) was preferred over the remaining nine grass species; and Bouteloua curtipendula (Bcu) and Panicum virgatum (Pvi) were the least preferred.

In the adult stage, Festuca arundinacea (Far) was preferred; and Bouteloua curtipendula (Bcu) was the least preferred.

The summary of rank in the nymph stage is: Phleum pratense (Ppr) > Bromus inermis (Bin) = Dactylis glomerata (Dgl) = Elymus junceus (Eju) > Festuca arundinacea (Far) > Agropyron smithii (Asm) > Agropyron elongatum (Ael) = Phalaris arundinacea (Par) > Bouteloua curtipendula (Bcu) = Panicum virgatum (Pvi).

The summary of rank in the adult stage is: Festuca arundinacea (Far) > Bromus inermis (Bin) > Andropogon gerardi (Age) = Panicum virgatum (Pvi) > Bouteloua curtipendula (Bcu).

Tables 22 and 23 show the summaries of inflorescence and seed feeding.

In the nymph stage, Bromus inermis (Bin) and Elymus junceus (Eju) were preferred over the remaining eight grass species; and Agropyron elongatum (Ael) was the least preferred.

In the adult stage, Festuca arundinacea (Far) was preferred; and Bouteloua curtipendula (Bcu) was the least preferred.

The summary of rank in the nymph stage is: Bromus inermis (Bin) = Elymus junceus (Eju) > Festuca arundinacea (Far) > Bouteloua curtipendula (Bcu) >

Phalaris arundinacea (Par) > Agropyron smithii (Asm) > Dactylis glomerata (Dgl) > Phleum pratense (Ppr) > Panicum virgatum (Pvi) > Agropyron elongatum (Ael).

The summary of rank in the adult stage is: Festuca arundinacea (Far) > Agropyron smithii (Asm) > Bromus inermis (Bin) > Panicum virgatum (Pvi) > Andropogon gerardi (Age) > Bouteloua curtipendula (Bcu).

5. Melanoplus keeleri luridus

Table 24 shows the summary of leaf feeding of nymphs. Only nymphs were studied because of insufficient adults.

Festuca arundinacea (Far) was preferred over the remaining seven grass species; and Bouteloua curtipendula (Bcu) and Phalaris arundinacea (Par) were least preferred.

The summary of rank is: Festuca arundinacea (Far) > Bromus inermis (Bin) > Agropyron smithii (Asm) = Phleum pratense (Ppr) = Panicum virgatum (Pvi) > Andropogon gerardi (Age) > Bouteloua curtipendula (Bcu) = Phalaris arundinacea (Par).

Table 25 shows the summary of inflorescence and seed feeding of nymphs.

Festuca arundinacea (Far) was preferred over the remaining eight grass species; and Bromus inermis (Bin) was the least preferred.

The summary of rank is: Festuca arundinacea (Far) > Agropyron elongatum (Ael) > Phleum pratense (Ppr) > Panicum virgatum (Pvi) > Agropyron smithii (Asm) > Bouteloua curtipendula (Bcu) > Phalaris arundinacea (Par) > Andropogon gerardi (Age) > Bromus inermis (Bin).

6. Melanoplus sanguinipes

Tables 26 and 27 show the summaries leaf feeding.

In the nymph stage, Bromus inermis (Bin), Dactylis glomerata (Dgl), Festuca arundinacea (Far) and Phleum pratense (Ppr) were preferred over the

remaining five grass species; and Bouteloua curtipendula (Bcu) was the least preferred.

In the adult stage, Bromus inermis (Bin) and Festuca arundinacea (Far) were preferred; and Agropyron elongatum (Ael), Bouteloua curtipendula (Bcu) were the least preferred.

The summary of rank in the nymph stage is: Bromus inermis (Bin) = Dactylis glomerata (Dgl) = Festuca arundinacea (Far) = Phleum pratense (Ppr) > Agropyron smithii (Asm) = Elymus junceus (Eju) > Phalaris arundinacea (Par) > Agropyron elongatum (Ael) > Bouteloua curtipendula (Bcu).

The summary of rank in the adult stage is: Bromus inermis (Bin) = Festuca arundinacea (Far) > Agropyron smithii (Asm) > Andropogon gerardi (Age) = Elymus juneus (Eju) = Phalaris arundincea (Par) = Panicum virgatum (Pvi) > Phleum pratense (Ppr) > Agropyron elongatum (Ael) = Bouteloua curtipendula (Bcu).

Tables 28 and 29 show the summaries of inflorescence and seed feeding.

In the nymph stage, Elymus juneus (Eju) was preferred over the remaining nine grass species; and Bouteloua curtipendula (Bcu) was the least preferred.

In the adult stage, Elymus junceus (Eju) was preferred; and Andropogon gerardi (Age) was the least preferred.

The summary of rank in the nymph stage is: Elymus junceus (Eju) > Bromus inermis (Bin) > Agropyron smithii (Asm) > Phalaris arundinacea (Par) > Festuca arundinacea (Far) > Dactylis glomerata (Dgl) > Phleum pratense (Ppr) > Panicum virgatum (Pvi) > Agropyron elongatum (Ael) > Bouteloua curtipendula (Bcu).

The summary of rank in the adult stage is: Elymus junceus (Eju) > Phleum pratense (Ppr) > Bromus inermis (Bin) = Festuca arundinacea (Far) > Phalaris arundinacea (Par) > Agropyron elongatum (Ael) > Panicum virgatum (Pvi) > Agropyron smithii (Asm) = Bouteloua curtipendula (Bcu) > Andropogon gerardi (Age).

7. Orphulella speciosa

Tables 30 and 31 show the summaries of leaf feeding.

In the nymph stage, Dactylis glomerata (Dgl) was preferred over the remaining nine grass species; and Agropyron smithii (Asm) was the least preferred.

In the adult stage, Andropogon gerardi (Age) was preferred; and Phalaris arundinacea (Par) was the least preferred.

The summary of rank in the nymph stage is: Dactylis glomerata (Dgl) > Elymus junceus (Eju) > Agropyron elongatum (Ael) = Bouteloua curtipendula (Bcu) = Phleum pratense (Ppr) > Bromus inermis (Bin) = Panicum virgatum (Pvi) > Festuca arundinacea (Far) = Phalaris arundinacea (Par) > Agropyron smithii (Asm).

The summary of rank in the adult stage is: Andropogon gerardi (Age) > Bromus inermis (Bin) = Festuca arundinacea (Far) > Bouteloua curtipendula (Bcu) > Phleum pratense (Ppr) > Agropyron smithii (Asm) = Panicum virgatum (Pvi) > Phalaris arundinacea (Par).

Tables 32 and 33 show the summaries of inflorescence and seed feeding.

In the nymph stage, Elymus junceus (Eju) was preferred over the remaining nine grass species; and Agropyron elongatum (Ael) was the least preferred. The summary of rank in the nymph stage is: Elymus junceus (Eju) > Phalaris arundinacea (Par) > Dactylis glomerata (Dgl) > Festuca arundinacea (Far) > Bromus inermis (Bin) > Phleum pratense (Ppr) > Bouteloua curtipendula (Bcu) > Agropyron smithii (Asm) > Panicum virgatum (Pvi) > Agropyron elongatum (Ael).

The summary of rank in the adult stage is: Festuca arundinacea (Far) > Elymus junceus (Eju) > Phalaris arundinacea (Par) > Phleum pratense (Ppr) > Bromus inermis (Bin) > Panicum virgatum (Pvi) > Bouteloua curtipendula (Bcu) > Andropogon gerardi (Age) > Agropyron smithii (Asm) > Agropyron elongatum (Ael).

8. Phoetaliotes nebrascensis

Tables 34 and 35 show the summaries of leaf feeding.

In the nymph stage, Agropyron elongatum (Ael), Andropogon gerardi (Age), Bromus inermis (Bin), Festuca arundinacea (Far) and Panicum virgatum (Pvi) were preferred over the remaining four grass species; and Phalaris arundiancea (Par) was the least preferred.

In the adult stage, Bromus inermis (Bin) was preferred; and Bouteloua curtipendula (Bcu) was the least preferred.

The summary of rank in the nymph stage is: Agropyron elongatum (Ael) = Andropogon gerardi (Age) = Bromus inermis (Bin) = Festuca arundinacea (Far) = Panicum virgatum (Pvi) > Agropyron smithii (Asm) = Phleum pratense (Ppr) > Bouteloua curtipendula (Bcu) > Phalaris arundinacea (Par).

The summary of rank in the adult stage is: Bromus inermis (Bin) > Andropogon gerardi (Age) = Festuca arundinacea (Far) = Panicum virgatum (Pvi) > Bouteloua curtipendula (Bcu)

Tables 36 and 37 show the summaries of inflorescence and seed feeding.

In the nymph stage, Festuca arundinacea (Far) was preferred over the remaining eight grass species; and Phalaris arundinacea (Par) was the least preferred.

In the adult stage, Festuca arundinacea (Far) was preferred; and Andropogon gerardi (Age) was the least preferred.

The summary of rank in the nymph stage is: Festuca arundinacea (Far) > Panicum virgatum (Pvi) > Agropyron smithii (Asm) > Bouteloua curtipendula (Bcu) > Agropyron elongatum (Ael) > Phleum pratense (Ppr) > Bromus inermis (Bin) > Andropogon gerardi (Age) > Phalaris arundinacea (Par).

The summary of rank in adult stage is: Festuca arundinacea > Panicum

virgatum (Pvi) > Agropyron smithii (Asm) > Bromus inermis (Bin) > Bouteloua curtipendula (Bcu) > Andropogon gerardi (Age).

The technique employed in measuring food preferences adequate to show that grasshoppers in general are selective in their feeding habits, the degree of selectivity varying with the species. However, when both grasses were eaten in large amounts, it became difficult to determine which was preferred.

There was little difference in food preference between nymphs and adults. Changes in preference paralleled seasonal changes in individual grass maturity and succulence. The grasses were generally equally succulent early in the season, but later, grasses matured and dried out to various degrees and at different time. The palatability between the leaf and the inflorescence and seeds in the same grass species was not simultaneous.

Most grasses became least acceptable as they matured and dried with the advancing season, and usually, feeding virtually ceased when they were completely dry. One exception was Bromus inermis, on which feeding occurred throughout the season, no less when green than when dry.

The damage caused by cutting off the heads of the grasses which fall to the ground, is apparent, particulary when seed harvest is involved.

There are various opinions as to why some plants are preferred to others. Kennedy (1951) thought that there may be a definite causal relationship between preference and nutritional differences. However, Fraenkel (1951, 1953) considered that the selection of plants for food is not made on the basis of any nutritional need. He suggested that "It is the presence or absence of odd chemical substances in which the plants differ, such as glucosides, essential oils, alkaloids, saponins, or tannins, which render the plant a suitable or

unsuitable food". Dethier (1954) also believed that nutritionally unimportant stimuli are predominantly responsible for plant preferences. So far, there is little information about the nutritional substances and chemical substances which compose these eleven grass species.

In summary, there were striking preferences for the leaves of Bromus inermis, Festuca arundinacea and Phleum pratense, and the inflorescences of Festuca arundinacea, Elymus junceus and Bromus inermis. There was little or no feeding on the leaves of Bouteloua curtipendula, Phalaris arundinacea, Panicum virgatum and Agropyron elongatum, and the inflorescence of Bouteloua curtipendula, Agropyron elongatum and Andropogon gerardi.

Table 1. Abbreviation, scientific and common names[a] of the grasses.

Abbreviation	Scientific name	Common name
Ael	Agropyron elongatum	tall wheatgrass
Age	Andropogon gerardi	big bluestem
Asm	Agropyron smithii	western wheatgrass
Bcu	Bouteloua curtipendula	sideoats grama
Bin	Bromus inermis	smooth brome
Dgl	Dactylis glomerata	orchardgrass
Eju	Elymus junceus	russian wildrye
Far	Festuca arundinacea	tall fescue
Par	Phalaris arundinacea	reed canarygrass
Ppr	Phleum pratense	timothy
Pvi	Panicum virgatum	switchgrass

(a) Following Anderson, K. L. (1961), Fernald (1950), and Stevens (1950).

Table 2. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Ageneotettix deorum deorum (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	% Slight	% Medium	% Heavy	Inflorescence and seed feeding: Index
Jul. 18-20	5,6	10	Asm	*	D	1.0	0.3	int.	72	3	5	20	0.2325
			Ppr	*	D	1.0	0.4	int.	30	15	25	20	0.4625
Jul. 20-22	5,6	10	Asm	*	D	1.0	*	int.	0	0	0	100	1.0
			Par	0	A	0	0.5	int.	0	80	10	10	0.35
Jul. 21-23	5,6	10	Ppr	0.3	C	0.5	0.3	int.	65	0	0	35	0.35
			Pvi	0.1	B	0.25	0	int.	100	0	0	0	0.0
Jul. 23-25	5,6	10	Par	0	A	0	0.2	int.	65	20	5	10	0.175
			Ppr	*	D	1.0	0.3	det.	90	0	0	10	0.10
Jul. 23-25	5,6	10	Bin	*	D	1.0	0.2	det.	70	15	15	0	0.1125
			Pvi	*	D	1.0	0.6	int.	90	5	5	0	0.0625
Jul. 25-27	5,6	10	Bcu	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	0.1	C	0.5	0.6	det.	93	7	0	0	0.0175
								int.	85	5	0	10	0.1125
Jul. 25-27	5,6	10	Bcu	*	D	1.0	0.2	det.	20	25	30	25	0.4625
			Par	0.1	B	0.25	0.2	det.	75	20	5	0	0.075

Table 2. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Ageneotettex deorum deorum (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 27-29	5,6	10	Ael	*	D	1.0	0.4	int.	0	0	0	100	1.00
			Ppr	0.2	B	0.25	*	int.	0	0	0	100	1.00
Jul. 29-31	6	10	Bcu	*	D	1.0	*	int.	0	0	0	100	1.00
			Ppr	*	D	1.0	0.9	int.	10	0	10	80	0.85
Aug. 1-3	6	10	Bcu	*	D	1.0	0.3	det.	70	10	5	15	0.20
								int.	85	10	0	5	0.075
			Bin	*	D	1,0	*	det.	0	0	0	100	1.00
Aug. 6-8	6	10	Age	*	D	1.0	0.2	int.	82	5	5	8	0.1175
			Ppr	0.1	B	0.25	*	int.	0	0	0	100	1.00
Aug. 6-8	6	10	Age	0.2	C	0.5	0.1	int.	95	5	0	0	0.00125
			Bin	0.2	B	0.25	0.1	int.	60	10	10	20	0.275
Aug. 6-8	6	10	Age	*	D	1.0	0.2	int.	70	5	10	15	0.2125
			Pvi	0.2	B	0.25	0.4	int.	85	2	3	10	0.12
Aug. 7-9	6	10	Age	*	D	1.0	0.3.	int.	90	5	0	5	0.0625
			Par	0.1	B	0.25	0.2	int.	50	50	0	0	0.125

Table 2. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Ageneotettix deorum deorum (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Aug. 7-9	6	10	Bcu	*	D	1.0	*	int.	0	0	0	100	1.00
			Ppr	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 7-9	6	10	Bcu	*	D	1.0	0.3	det.	95	5	0	0	0.0125
								int.	95	5	0	0	0.0125
			Dgl	*	D	1.0	*	int.	0	0	0	100	1.00
Aug.	6	10	Bin	*	D	1.0	*	int.	0	0	0	100	1.00
			Par	0	B	0.25	0.1	int.	80	20	0	0	0.05
Aug. 9-11	6	10	Asm	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	0.1	B	0.25	0.3	det.	90	0	0	10	0.10
								int.	90	5	5	0	0.0375
Aug. 9-11	6	10	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	0.1	B	0.25	0.3	int.	90	0	0	10	0.10
Aug. 11-13	6	10	Age	*	D	1.0	0.3	int.	60	20	10	10	0.2
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 11-13	6	10	Age	*	D	1.0	0.5	int.	40	0	0	60	0.60
			Bcu	*	D	1.0	*	int.	0	0	0	100	1.00

Table 2. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Ageneotettix deorum deorum (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Inflorescence and seed feeding: Index
Aug. 13-15	6	10	Age	*	D	1.0	0.1	int.	60	20	20	0	0.15
			Asm	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 13-15	6	10	Asm	-	-		0.3	int.	0	10	20	70	0.825
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 15-17	6	10	Bin	*	D	1.0	*	int.	0	0	0	100	1.00
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 15-17	6	10	Asm	-	-		*	int.	0	0	0	100	1.00
			Bcu	*	D	1.0	0.4	int.	65	0	30	5	0.20
Aug. 17-19	6	10	Asm	-	-		0.1	int.	0	20	10	70	0.80
			Bin	*	D	1.0	*	int.	0	0	0	100	1.00

(a) Stage of life history: 1 = first instar; 2 = second instar; 3 = third instar; 4 = fourth instar; 5 = fifth instar; 6 = adult.
(b) Table 1 identified the species of grass by full scientific name.
(c) Leaf feeding: A = no feeding; B = trace to 1/2 of leaf eaten; C = 1/2 or more eaten; D = eaten entirely.
(d) * = plant consumed within 48 hours.
(e) Detached = stalk bearing inflorescence or seeds severed so that it fell to bottom of cage; intacted = not severed.
(f) None = no damage; slight = slight feeding but no appreciable injury; medium = injured so that reproduction probably not possible; heavy = reporduction destroyed.

Table 3. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus bivittatus (Say).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Jun. 5-7	2,3	10	Bin	0.4	B	0.25	0.1	int.	65	0	16	19	0.27
			Ppr	0	A	0.0	0.2	int.	97	3	0	0	0.0075
Jun. 5-7	2,3	10	Dgl	0	A	0	1.6	int.	63	12	5	20	0.255
			Par	0	A	0	0.4	int.	52	30	8	10	0.215
Jun. 5-7	2,3	10	Bin	0	A	0	0.1	int.	67	12	4	17	0.22
			Eju	0.3	C	0.5	0.2	int.	86	7	0	7	0.0875
Jun. 5-7	2,3	10	Dgl	0.2	B	0.25	0.5	int.	10	0	0	90	0.90
			Par	*	D	1.0	0.1	int.	69	18	6	7	0.145
Jun. 10-12	2,3	10	Bin	0	A	0	1.1	int.	58	12	0	30	0.33
			Eju	*	D	1.0	0.1	int.	86	0	4	10	0.12
Jun. 10-12	2,3	10	Far	*	D	1.0	0	int.	100	0	0	0	0.0
			Ppr	*	D	1.0	0.2	int.	97	3	0	0	0.0075
Jun. 10-12	2,3	10	Bin	*	D	1.0	0.5	int.	53	10	3	34	0.38
			Dgl	*	D	1.0	0.1	int.	90	0	2	8	0.09

Table 3. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. *Melanoplus bivittatus* (Say).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or Intact[e]	Inflorescence and seed feeding: %[f] None	Slight	Medium	Heavy	Inflorescence and seed feeding: Index
Jun. 10-12	2,3	10	Bin	0.1	B	0.25	0.5	int.	24	15	5	56	0.6225
			Far	0.2	B	0.25	0.1	int.	97	3	0	0	0.0075
Jun. 13-15	2,3	10	Asm	0.2	C	0.5	0.3	int.	97	3	0	0	0.0075
			Bin	0.1	B	0.25	0.8	int.	55	11	2	32	0.3575
Jun. 13-15	2,3	10	Asm	*	D	1.0	0	int.	98	2	0	0	0.005
			Eju	0	B	0.25	0.1	int.	96	4	0	0	0.01
Jun. 13-15	2,3	10	Asm	*	D	1.0	0.2	int.	12	44	31	13	0.395
			Far	*	D	1.0	0.1	int.	70	10	13	7	0.16
Jun. 13-15	2,3	10	Far	*	D	1.0	0.4	int.	96	4	0	0	0.01
			Par	*	D	1.0	0.9	int.	29	26	16	29	0.4350
Jun. 15-17	2,3	10	Par	0.2	B	0.25	1.4	int.	52	43	5	0	0.1325
			Ppr	*	D	1.0	0.1	int.	97	3	0	0	0.0075
Jun. 15-17	2,3	10	Asm	*	D	1.0	0.1	int.	98	2	0	0	0.005
			Par	0.5	C	0.5	0.3	int.	70	27	3	0	0.0825

Table 3. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus bivittatus (Say).

Date	Stage[a]	No. speci-mens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jun. 15-17	2,3	10	Dgl	*	D	1.0	0.6	int.	96	4	0	0	0.01
			Far	0.4	C	0.5	0.7	int.	97	3	0	0	0.0075
Jun. 15-17	2,3	10	Bin	0.2	C	0.5	0.2	int.	56	9	0	35	0.3725
			Par	*	D	1.0	1.1	int.	53	43	4	0	0.1275
Jun. 15-17	2,3	10	Asm	0.3	C	0.5	0	int.	100	0	0	0	0.0
			Dgl	*	D	1.0	0.4	int.	95	5	0	0	0.0125
Jun. 15-17	2,3	10	Dgl	*	D	1.0	0.3	int.	96	4	0	0	0.01
			Ppr	0.4	C	0.5	0.2	int.	96	4	0	0	0.01
Jun. 18-20	3,4	10	Dgl	*	D	1.0	0.2	int.	95	5	0	0	0.0125
			Eju	0.2	B	0.25	1.0	int.	10	14	0	76	0.795
Jun. 18-20	3,4	10	Eju	*	D	1.0	0.8	int.	0	0	0	100	1.00
			Far	0.4	C	0.5	0	int.	100	0	0	0	0.0
Jun. 18-20	3,4	10	Eju	0.4	C	0.5	1.0	int.	36	32	2	30	0.39
			Par	0.3	B	0.25	1.1	int.	40	60	0	0	0.15

Table 3 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus bivittatus (Say).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact	Inflorescence and seed feeding: %[e] None	Slight	Medium	Heavy	Inflorescence and seed feeding: Index
Jun. 18-20	3,4	10	Eju	*	D	1.0	1.0	int.	6	6	14	74	0.825
			Ppr	*	D	1.0	0	int.	100	0	0	0	0.0
Jun. 22-24	3,4	10	Bcu	0	A	0	0.3	int.	95	5	0	0	0.0125
			Dgl	*	D	1.0	0.4	int.	97	1	0	2	0.0225
Jun. 22-24	3,4	10	Bcu	0	A	0	0	int.	95	5	0	0	0.0125
			Bin	*	D	1.0	0.9	int.	34	5	4	57	0.6025
Jun. 22-24	3,4	10	Bcu	0.1	B	0.25	0.3	int.	95	5	0	0	0.0125
			Eju	*	D	1.0	0.7	det.	0	0	20	80	0.90
Jun. 22-24	3,4	10	Bcu	0	B	0.25	0.1	int.	90	10	0	0	0.025
			Far	*	D	1.0	0.2	int.	97	3	0	0	0.0075
Jun. 22-24	3,4	10	Bcu	0.1	B	0.25	0.2	int.	76	0	0	24	0.24
			Ppr	*	D	1.0	0	int.	100	0	0	0	0.0
Jun. 22-24	3,4	10	Bcu	0	A	0	0	int.	95	5	0	0	0.0125
			Par	0.2	C	0.5	0.7	int.	80	5	5	10	0.1375

Table 3. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus bivittatus (Say).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: %[f] None	Slight	Medium	Heavy	Inflorescence and seed feeding: Index
Jun. 22-24	3,4	10	Asm	0.2	B	0.25	0.5	int.	40	0	35	25	0.425
			Bcu	0	A	0	0.1	int.	40	30	20	10	0.275
Jun. 24-26	3,4	10	Ael	0	A	0	0.1	int.	97	3	0	0	0.0075
			Par	*	D	1.0	0.4	int.	80	5	5	10	0.1375
Jun. 24-26	3,4	10	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Bin	*	D	1.0	0.9	int.	18	35	4	43	0.5375
Jun. 24-26	3,4	10	Bcu	0.1	B	0.25	0.1	int.	90	10	0	0	0.024
			Pvi	0.8	C	0.5	0.2	int.	70	5	5	20	0.2375
Jun. 24-26	3,4	10	Asm	0	A	0	0	int.	100	0	0	0	0.0
			Ppr	*	D	1.0	0	int.	95	5	0	0	0.0125
Jun. 26-28	4,5	10	Asm	*	D	1.0	0.2	int.	30	10	50	10	0.375
			Ael	0.2	B	0.25	0.3	int.	40	30	0	30	0.375
Jun. 26-28	4,5	10	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Ppr	*	D	1.0	0.2	int.	97	3	0	0	0.0075

Table 3. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus bivittatus (Say).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	% Slight	% Medium	% Heavy	Index
Jun. 26-28	4,5	10	Ael	0	A	0	0.1	int.	98	2	0	0	0.005
			Far	*	D	1.0	0.2	int.	73	10	0	17	0.195
Jun. 26-28	4,5	10	Ael	0.1	B	0.25	0	int.	100	0	0	0	0.0
			Dgl	*	D	1.0	0.4	int.	90	5	0	5	0.0625
Jun. 28-30	4,5	10	Ael	0.2	B	0.25	0	int.	100	0	0	0	0.0
			Pvi	*	D	1.0	0.6	int.	55	5	0	40	0.4125
Jun. 28-30	4,5	10	Ael	0.1	B	0.25	0.3	int.	43	50	0	7	0.195
			Bcu	0.2	C	0.5	0.3	int.	85	15	0	0	0.0375
Jun. 28-30	4,5	10	Dgl	*	D	1.0	1.0	int.	70	15	8	7	0.1475
			Pvi	*	D	1.0	0.2	int.	75	5	0	20	0.2125
Jun. 28-30	4,5	10	Bin	*	D	1.0	0.7	int.	28	18	11	43	0.53
			Pvi	0.2	B	0.25	0.2	int.	95	0	0	5	0.05
Jul. 1-3	4,5	10	Ael	0.2	B	0.25	0	int.	96	4	0	0	0.01
			Eju	*	D	1.0	1.1	int.	0	0	0	100	1.00

Table 3. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus bivittatus (Say).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 1-3	4,5	10	Asm	*	D	1.0	0.2	int.	80	0	10	10	0.15
			Pvi	*	D	1.0	0.4	int.	60	0	10	30	0.35
Jul. 1-3	4,5	10	Ppr	*	D	1.0	0	int.	97	3	0	0	0.0075
			Pvi	0.3	C	0.5	0.2	int.	65	0	0	35	0.35
Jul. 1-3	4,5	10	Par	*	D	1.0	0.5	int.	55	15	20	10	0.2375
			Pvi	0.3	C	0.5	0.3	int.	55	0	0	45	0.45
Jul. 4-6	4,5	10	Eju	0.2	B	0.25	0.4	int.	0	0	0	100	1.00
			Pvi	*	D	1.0	0.3	int.	93	5	2	0	0.0225
Jul. 7-9	4,5	10	Far	*	D	1.0	0.3	int.	74	8	6	12	0.2775
			Pvi	*	D	1.0	0.2	int.	65	0	0	35	0.35
Aug. 6-8	6	3	Bin	*	D	1.0	0	int.	100	0	0	0	0.0
			Pvi	0.1	B	0.25	0.2	int.	95	0	0	5	0.05
Aug. 6-8	6	3	Age	0.2	B	0.2	0	int.	100	0	0	0	0.0
			Par	*	D	1.0	0	int.	100	0	0	0	0.0

Table 3. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus bivittatus (Say).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	% Slight	% Medium	% Heavy	Index
Aug. 7-9	6	3	Bcu	0	A	0	0.1	det.	95	5	0	0	0.0125
			Ppr	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 7-9	6	3	Bin	*	D	1.0	0	int.	100	0	0	0	0.0
			Ppr	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 7-9	6	5	Asm	*	D	1.0	0	det.	100	0	0	0	0.0
			Pvi	*	D	1.0	0.4	det.	80	0	0	20	0.20
								int.	40	0	20	40	0.50
Aug. 7-9	6	5	Bcu	0	A	0	0	int.	100	0	0	0	0.0
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 11-13	6	5	Bin	*	D	1.0	0	int.	100	0	0	0	0.0
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 11-13	6	5	Ppr	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	*	D	1.0	0.1	det.	80	0	0	20	0.20
								int.	30	0	20	50	0.60
Aug. 11-13	6	5	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	0.2	C	0.5	0.1	int.	92	0	0	8	0.08

Table 3. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus bivittatus (Say).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Aug. 13-15	6	5	Age	0.2	C	0.5	0.1	int.	80	0	5	15	0.175
			Pvi	*	D	1.0	0.2	int.	20	0	5	75	0.775
Aug. 13-15	6	5	Age	0.1	B	0.25	0.1	int.	50	10	20	20	0.325
			Bin	*	D	1.0	0.2	int.	10	0	0	90	0.90
Aug. 13-15	6	5	Par	*	D	1.0	0	int.	100	0	0	0	0.0
			Pvi	0.1	B	0.25	0.4	int.	10	0	20	70	0.80
Aug. 15-17	6	5	Age	*	D	1.0	0.1	int.	85	0	8	7	0.11
			Asm	–	–		0.3	det.	0	0	20	80	0.90
Aug. 15-17	6	5	Bcu	0	A	0	0	int.	100	0	0	0	0.0
			Bin	*	D	1.0	0.2	int.	20	0	10	70	0.75
Aug. 17-19	6	5	Asm	-	-		0.2	int.	20	0	25	55	0.675
			Bin	*	D	1.0	0.2	int.	80	5	0	15	0.1625
Aug. 17-19	6	5	Bcu	0	A	0	0	int.	100	0	0	0	0.0
			Pvi	*	D	1.0	0.1	int.	75	0	0	25	0.25

Table 3. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus bivittatus (Say).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Aug. 21-23	6	5	Asm	-	-		0.1	int.	75	5	15	5	0.1375
			Far	*	D	1.0	0.1	int.	70	5	5	20	0.2375
Aug. 21-23	6	5	Age	*	D	1.0	0.1	int.	93	7	0	0	0.0175
			Far	*	D	1.0	0.4	det.	65	0	5	30	0.325
								int.	85	0	0	15	0.15
Aug. 23-25	6	5	Age	0.2	B	0.25	0.4	int.	50	10	10	30	0.375
			Bcu	0.1	B	0.25	0	int.	100	0	0	0	0.0
Aug. 23-25	6	5	Asm	-	-		0.1	int.	30	10	20	40	0.525
			Bcu	0	A	0	0	int.	100	0	0	0	0.0

(a) Stage of life history: 1 = first instar; 2 = second instar; 3 = third instar; 4 = fourth instar; 5 = fifth instar; 6 = adult.
(b) Table 1 identifies the species of grass by full scientific name.
(c) Leaf feeding: A = no feeding; B = trace to 1/2 of leaf eaten; C = 1/2 or more eaten; D = eaten entirely.
(d) * = plant consumed within 48 hours.
(e) Detached = stalk bearing inflorescence or seeds severed so that it fell to bottom of cage; intacted = not severed.
(f) None = no damage; slight = slight feeding but no appreciable injury; medium = injured so that reproduction probably not possible; heavy = reproduction destroyed.

Table 4. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus differentialis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Inflorescence and seed feeding: Index
Jun. 15-17	2,3	10	Asm	*	D	1.0	0.1	int.	63	21	0	16	0.21
			Ppr	*	D	1.0	0.2	int.	97	3	0	0	0.0075
Jun. 18-20	2,3	10	Dgl	0.5	C	0.5	0.1	int.	83	10	7	0	0.06
			Par	0	B	0.25	0.4	int.	90	10	0	0	0.025
Jun. 18-20	2,3	10	Far	0.3	C	0.5	0.3	int.	92	3	0	5	0.0575
			Par	0.4	C	0.5	0.7	int.	5	85	0	10	0.3125
Jun. 18-20	2,3	10	Bin	0.7	C	0.5	0.5	int.	40	13	12	35	0.44
			Dgl	*	D	1.0	1.3	int.	97	3	0	0	0.0075
Jun. 18-20	2,3	10	Bin	*	D	1.0	1.0	int.	38	10	4	48	0.565
			Ppr	*	D	1.0	0	int.	100	0	0	0	0.0
Jun. 18-20	2,3	10	Asm	*	D	1.0	0.1	int.	92	0	0	8	0.08
			Dgl	*	D	1.0	1.0	int.	22	60	20	0	0.25
Jun. 18-20	2,3	10	Bin	*	D	1.0	0.2	int.	77	14	4	5	0.105
			Far	*	D	1.0	0.1	int.	85	5	10	0	0.0625

Table 4. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus differentialis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact	%[e] None	%[e] Slight	%[e] Medium	%[e] Heavy	Index
Jun. 22-24	2,3	10	Asm	0.2	B	0.25	0	int.	96	2	2	0	0.015
-			Eju	*	D	1.0	0.9	int.	0	0	20	80	0.90
Jun. 22-24	2,3	10	Bcu	0	B	0.25	0.4	int.	90	10	0	0	0.025
			Bin	*	D	1.0	0.9	int.	25	0	12	63	0.69
Jun. 22-24	2,3	10	Asm	*	D	1.0	0.5	int.	40	30	30	0	0.225
			Par	*	D	1.0	0.4	62	30	5	3	0.13	
Jun. 22-24	2,3	10	Eju	*	D	1.0	1.0	int.	0	40	10	50	0.65
			Ppr	*	D	1.0	0	int.	100	0	0	0	0.0
Jun. 22-24	2,3	10	Dgl	0	A	0	0.3	int.	80	20	0	0	0.05
			Far	*	D	1.0	0.2	int.	80	20	0	0	0.05
Jun. 22-24	2,3	10	Bin	*	D	1.0	0.9	int.	12	13	22	53	0.6725
			Eju	*	D	1.0	0.3	int.	24	32	4	40	0.50
Jun. 24-26	2,3	10	Eju	*	D	1.0	0.5	int.	0	0	0	100	1.0
			Par	0.1	B	0.25	0.5	int.	10	75	5	10	0.3125

Table 4 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus differentialis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jun. 24-26	2,3	10	Eju	0.3	C	0.5	1.0	int.	0	0	0	100	1.0
			Far	0.2	C	0.5	0	int.	100	0	0	0	0.0
Jun. 24-26	2,3	10	Far	*	D	1.0	0	int.	89	0	4	7	0.09
			Ppr	*	D	1.0	0.5	int.	75	10	5	10	0.15
Jun. 24-26	2,3	10	Asm	0.1	B	0.25	0.1	int.	97	3	0	0	0.0075
			Bin	*	D	1.0	1.1	int.	33	15	21	31	0.4535
Jun. 24-26	2,3	10	Dgl	*	D	1.0	0.3	int.	30	20	30	20	0.40
			Ppr	*	D	1.0	0.1	int.	95	0	0	5	0.05
Jun. 24-26	2,3	10	Bin	*	D	1.0	0.3	int.	59	10	5	26	0.31
			Par	0.2	B	0.25	0.4	int.	70	7	8	15	0.2075
Jun. 24-26	2,3	10	Par	0.5	C	0.5	0.2	int.	90	3	2	5	0.0675
			Ppr	0.5	C	0.5	0.2	int.	95	5	0	0	0.0125
Jun. 26-28	2,3	10	Par	0	B	0.25	1.1	int.	5	5	10	80	0.8625
			Pvi	0	A	0	0.1	int.	92	3	5	0	0.0325

Table 4. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. **Melanoplus differentialis** (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jun. 26-28	2,3	10	Bcu	0	A	0	0.4	det.	80	10	10	0	0.075
								int.	90	10	0	0	0.025
			Dgl	*	D	1.0	0.3	int.	95	5	0	0	0.0125
Jun. 26-28	2,3	10	Asm	*	D	1.0	0.5	int.	20	10	50	20	0.475
			Bcu	0	B	0.25	0.1	int.	90	10	0	0	0.025
Jun. 26-28	2,3	10	Bcu	0	A	0.0	0.3	int.	90	10	0	0	0.025
			Ppr	*	D	1.0	0.1	int.	95	5	0	0	0.0125
Jun. 26-28	2,3	10	Bcu	0	A	0	0.4	int.	60	40	0	0	0.10
			Par	*	D	1.0	0.3	int.	50	35	10	5	0.1875
Jun. 26-28	2,3	10	Bcu	0	A	0	0.2	int.	90	10	0	0	0.025
			Far	*	D	1.0	0	int.	100	0	0	0	0.0
Jun. 26-28	2,3	10	Asm	0	A	0	0.1	int.	70	30	0	0	0.075
			Far	*	D	1.0	1.5	int.	85	15	0	0	0.0375
Jun. 28-30	2,3	10	Ael	0.1	B	0.25	0	int.	100	0	0	0	0.0
			Dgl	*	D	1.0	1.1	int.	20	50	30	0	0.2750

Table 4. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus differentialis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jun. 28-30	2,3	10	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Par	0	A	0	0.6	int.	15	75	10	0	0.2375
Jun. 28-30	2,3	10	Bcu	*	D	1.0	0.2	int.	85	15	0	0	0.0375
			Pvi	0.1	B	0.25	0.5	int.	70	0	10	20	0.25
Jun. 28-30	2,3	10	Bin	*	D	1.0	0.4	int.	70	15	0	15	0.1875
			Pvi	0.1	B	0.25	0.4	int.	90	0	0	10	0.10
Jun. 28-30	2,3	10	Ael	0.5	C	0.5	0	int.	100	0	0	0	0.0
			Ppr	*	D	1.0	0.1	int.	93	0	0	7	0.07
Jun. 28-30	2,3	10	Bcu	0.1	B	0.25	0.1	int.	90	10	0	0	0.025
			Eju	*	D	1.0	0.9	int.	0	0	0	100	1.00
Jun. 28-30	2,3	10	Dgl	*	D	1.0	0.2	int.	80	20	0	0	0.05
			Eju	0.3	B	0.25	1.3	int.	0	0	0	100	1.00
Jul. 1-3	3,4	10	Ppr	*	D	1.0	0.1	int.	90	10	0	0	0.025
			Pvi	0	A	0	0.1	int.	93	0	0	7	0.07

Table 4 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus differentialis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact	Inflorescence and seed feeding: %[e] None	Slight	Medium	Heavy	Index
Jul. 1-3	3,4	10	Par	0.1	B	0.25	0.5	int.	70	30	0	0	0.075
			Pvi	0.2	C	0.5	0.8	int.	90	0	0	10	0.10
Jul. 1-3	3,4	10	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Pvi	0.1	B	0.25	0.3	int.	90	0	0	10	0.10
Jul. 1-3	3,4	10	Ael	0.1	B	0.25	0	int.	100	0	0	0	0.0
			Bcu	0	A	0	0.1	int.	60	40	0	0	0.10
Jul. 1-3	3,4	10	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Asm	*	D	1.0	0.5	int.	75	0	10	15	0.20
Jul. 1-3	3,4	10	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Eju	*	D	1.0	0.3	int.	10	0	0	90	0.90
Jul. 1-3	3,4	10	Ael	0.1	B	0.25	0.1	int.	95	5	0	0	0.0125
			Bin	*	D	1.0	0.5	int.	65	5	10	20	0.27
Jul. 4-6	3,4	10	Asm	*	D	1.0	0.6	int.	30	5	15	50	0.5875
			Pvi	*	D	1.0	0.1	int.	50	5	10	35	0.4125

Table 4. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus differentialis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Inflorescence and seed feeding: Index
Jul. 4-6	3,4	10	Eju	*	D	1.0	0.7	int.	40	20	5	35	0.425
			Pvi	0.3	C	0.5	0.5	int.	50	5	10	35	0.4125
Jul. 3,4	3,4	10	Ael	*	D	1.0	0.1	int.	95	5	0	0	0.0125
			Far	*	D	1.0	0.3	int.	50	0	10	40	0.45
Jul. 7-9	3,4	10	Far	*	D	1.0	0.8	int.	15	15	30	40	0.5875
			Pvi	0.2	C	0.5	0.2	int.	93	0	0	7	0.07
Aug. 6-8	6	3	Par	*	D	1.0	0.1	int.	97	3	0	0	0.0075
			Pvi	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 6-8	6	3	Bcu	0.3	C	0.5	0	int.	100	0	0	0	0.0
			Ppr	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 7-9	6	3	Bcu	*	D	1.0	0	int.	100	0	0	0	0.0
			Par	*	D	1.0	0.1	int.	40	30	10	20	0.325
Aug. 7-9	6	3	Age	*	D	1.0	0.4	int.	30	5	15	50	0.5875
			Pvi	*	D	1.0	0.4	det.	10	0	0	90	0.90

Table 4. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus differentialis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Inflorescence and seed feeding: Index
Aug. 9-11	6	5	Bcu	0	A	0	0.2	int.	60	35	5	0	0.1125
			Bin	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 9-11	6	5	Asm	*	D	1.0	0.3	int.	70	0	10	20	0.25
			Par	0.3	C	0.5	0	int.	100	0	0	0	0.0
Aug. 11-13	6	5	Asm	*	D	1.0	0.4	det.	0	0	20	80	0.90
			Pvi	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 11-13	6	5	Bcu	0.1	B	0.25	0	int.	100	0	0	0	0.0
			Pvi	*	D	1.0	0.1	det.	85	0	0	15	0.15
								int.	30	0	20	50	0.60
Aug. 11-13	6	5	Age	0	A	0	0	int.	100	0	0	0	0.0
			Far	*	D	1.0	*	int.	0	0	0	0	1.00
Aug. 11-13	6	5	Age	0.3	C	0.5	0	int.	100	0	0	0	0.0
			Bin	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 11-13	6	5	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	0.1	B	0.25	0.3	int.	30	0	20	50	0.60

Table 4 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus differentialis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Aug. 11-13	6	5	Bin	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 11-13	6	5	Age	*	D	1.0	*	int.	0	0	0	100	1.00
			Asm	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 13-15	6	5	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Par	*	D	1.0	0.3	det.	30	70	0	0	0.175
Aug. 13-15	6	5	Asm	-	-		0.2	int.	0	0	0	100	1.00
			Bin	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 13-15	6	5	Asm	-	-		0.3	int.	0	0	0	100	1.00
			Bcu	0.2	B	0.25	0.1	det.	80	20	0	0	0.05
Aug. 13-15	6	5	Bin	*	D	1.0	*	int.	0	0	0	100	1.00
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 13-15	6	5	Age	*	D	1.0	*	int.	0	0	0	100	1.00
			Bcu	0.1	B	0.25	0.1	int.	30	0	20	50	0.6

Table 4 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus differentialis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Index
Aug. 13-15	6	5	Asm	-	-		0.2	int.	40	0	0	60	0.6
			Far	*	D	1.0	*	int.	0	0	0	100	1.00

(a) Stage of life history: 1 = first instar; 2 = second instar; 3 = third instar; 4 = fourth instar; 5 = fifth instar; 6 = adult.
(b) Table 1 identifies the species of grass by full scientific name.
(c) Leaf feeding: A = no feeding; B = trace to 1/2 of leaf eaten; C = 1/2 or more eaten; D = eaten entirely.
(d) * = plant consumed within 48 hours.
(e) Detached = stalk bearing inflorescence or seeds severed so that it fell to bottom of cage; intacted = no severed.
(f) None = no damage; slight = slight feeding but no appreciable injury; medium = injured so that reproduction probably not possible; heavy = reporduction destroyed.

Table 5. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus femurrubrum-femurrubrum (DeGeer).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jun. 10-12	1,2	10	Dgl	0	B	0.25	0.6	int.	97	3	0	0	0.0075
			Ppr	*	D	1.0	0	int.	97	3	0	0	0.0075
Jun. 13-15	1,2	10	Asm	0	A	0	0.1	int.	94	6	0	0	0.005
			Bin	0.3	C	0.5	0.4	int.	65	7	0	28	0.2975
Jun. 15-17	1,2	10	Far	0.4	C	0.5	0.1	int.	75	10	10	5	0.125
			Par	0	A	0	0.3	int.	64	32	4	0	0.01
Jun. 18-20	1,2	10	Bin	0.5	C	0.5	0.6	int.	81	7	5	7	0.1125
			Par	0.2	B	0.25	0.5	int.	95	5	0	0	0.0125
Jun. 18-20	1,2	10	Asm	0.2	B	0.25	0	int.	97	3	0	0	0.0075
			Far	0	A	0	0.1	int.	96	4	0	0	0.01
Jun. 18-20	1,2	10	Bin	*	D	1.0	0	int.	80	10	10	0	0.075
			Ppr	*	D	1.0	0	int.	97	3	0	0	0.075
Jun. 18-20	1.2	10	Par	0	A	0	0.3	int.	98	2	0	0	0.005
			Ppr	1.0	C	0.5	0.1	int.	97	3	0	0	0.0075

Table 5. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus femurrubrum-femurrubrum (DeGeer).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jun. 22-24	1,2	10	Bin	0.7	C	0.5	1.7	int.	64	17	4	15	0.21
			Eju	0.1	B	0.25	0.1	int.	80	10	4	6	0.1
Jun. 22-24	1,2	10	Dgl	*	D	1.0	0.1	int.	95	5	0	0	0.0125
			Far	0.2	B	0.25	0	int.	90	4	4	2	0.06
Jun. 22-24	1,2	10	Eju	0.2	B	0.25	0.9	int.	60	15	0	25	0.29
			Par	0	A	0	0.1	int.	92	8	0	0	0.02
Jun. 22-24	1,2	10	Bcu	0	A	0	0.2	det.	90	10	0	0	0.025
								int.	90	5	5	0	0.0375
			Par	0.2	B	0.25	0.1	int.	97	3	0	0	0.0075
Jun. 24-26	2,3	10	Asm	0	A	0	0.2	int.	97	3	0	0	0.0075
			Ppr	*	D	1.0	0	int.	100	0	0	0	0.0
Jun. 24-26	2,3	10	Dgl	0.1	C	0.5	0	int.	90	8	2	0	0.03
			Par	0	A	0	0.4	int.	80	15	0	5	0.09
Jun. 24-26	2,3	10	Bin	0.3	B	0.25	0.1	int.	95	5	0	0	0.0125
			Far	*	D	1.0	0.1.	int.	95	5	0	0	0.0125

Table 5. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus femurrubrum-femurrubrum (DeGeer).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jun. 24-26	2,3	10	Bin	0.7	C	0.5	0.1	int.	90	0	3	7	0.085
			Dgl	0.3	C	0.5	0	int.	100	0	0	0	0.0
Jun. 26-28	2,3	10	Bcu	0	A	0	0.2	int.	90	5	5	0	0.0375
			Dgl	0.3	C	0.5	0	int.	100	0	0	0	0.0
Jun. 26-28	2,3	10	Bcu	0	A	0	0.2	int.	90	10	0	0	0.025
			Ppr	*	D	1.0	0	int.	96	4	0	0	0.01
Jun. 26-28	2,3	15	Asm	0	A	0	0	int.	90	6	4	0	0.005
			Par	0	A	0	0.7	int.	87	6	4	3	0.04
Jun. 26-28	2,3	15	Asm	0	A	0	0.2	int.	90	0	5	5	0.025
			Par	0.3	C	0.5	0	int.	100	0	0	0	0.0
Jun. 28-30	2,3	15	Bcu	0.1	B	0.25	0.1	int.	95	5	0	0	0.025
			Bin	*	D	1.0	0.5	int.	85	10	0	5	0.05
Jun. 28-30	2,3	15	Eju	0.1	B	0.25	0.7	int.	15	0	15	70	0.775
			Ppr	*	D	1.0	0	int.	95	2	3	0	0.02

Table 5. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus femurrubrum-femurrubrum (DeGeer).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: %[f] None	Slight	Medium	Heavy	Inflorescence and seed feeding: Index
Jun. 28-30	2,3	15	Eju	0.2	B	0.25	0.3	int.	60	5	20	15	0.2625
			Far	*	D	1.0	1.0	int.	55	0	10	35	0.40
Jun. 28-30	2,3	15	Dgl	*	D	1.0	1.0	int.	96	4	0	0	0.01
			Eju	*	D.	1.0	0.6	int.	60	0	5	35	0.375
Jul. 1-3	2,3	15	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Ppr	0.5	C	0.5	0.3	int.	95	5	0	0	0.0125
Jul. 1-3	2,3	15	Par	0.4	B	0.25	0.2	int.	60	30	10	0	0.125
			Pvi	0.1	B	0.25	0.2	int.	95	0	0	5	0.05
Jul. 1-3	2,3	15	Bcu	0	A	0	0	int.	100	0	0	0	0.0
			Eju	*	D	1.0	0.5	int.	10	65	20	5	0.3125
Jul. 1-3	2,3	15	Asm	0.4	B	0.25	0.4	int.	55	0	40	5	0.25
			Eju	*	D	1.0	0.6	int.	30	0	35	35	0.525
Jul. 4-6	2,3	15	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Ppr	0.7	C	0.5	0.5	int.	92	8	0	0	0.02

Table 5. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus femurrubrum-femurrubrum (DeGeer).

Date	Stage[a]	No. speci-mens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[a]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 4-6	2,3	15	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Eju	0.2	B	0.25	1.0	int.	0	0	0	100	1.0
Jul. 4-6	2,3	15	Dgl	*	D	1.0	1.4	int.	90	10	0	0	0.025
			Pvi	0	A	0	0	int.	97	0	3	0	0.015
Jul. 4-6	2,3	15	Bin	0.5	C	0.5	0.6	int.	50	15	5	30	0.3625
			Pvi	0	A	0	0.1	int.	99	0	0	1	0.01
Jul. 7-9	2,3	10	Ppr	*	D	1.0	0.2	int.	85	15	0	0	0.0375
			Pvi	0	A	0	0	int.	100	0	0	0	0.0
Jul. 7-9	2,3	10	Asm	0.5	B	0.25	0	int.	100	0	0	0	0.0
			Pvi	0	A	0	0	int.	100	0	0	0	0.0
Jul. 7-9	2,3	10	Bcu	0	A	0	0.2	int.	80	20	0	0	0.05
			Pvi	0.3	B	0.25	0.1	int.	97	3	0	0	0.0075
Jul. 7-9	2,3	10	Eju	*	D	1.0	1.1	int.	0	0	0	100	1.0
			Pvi	0	A	0	0.2	int.	96	4	0	0	0.01

Table 5. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus femurrubrum-femurrubrum (DeGeer).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Jul. 7-9	2,3	10	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Ppr	*	D	1.0	0.5	int.	75	0	0	25	0.25
Jul. 9-11	2,3	10	Ael	0	A	0	0	int.	97	3	0	0	0.0075
			Par	0	A	0	0.9	int.	60	40	0	0	0.10
Jul. 9-11	2,3	10	Ael	0.2	B	0.25	0	int.	100	0	0	0	0.0
			Dgl	0.2	B	0.25	0.25	int.	95	5	0	0	0.0125
Jul. 9-11	2,3	10	Ael	*	D	1.0	0	int.	100	0	0	0	0.0
			Pvi	0.1	B	0.25	0	int.	100	0	0	0	0.0
Jul. 9-11	2,3	10	Ael	0	A	0	0	int.	97	3	0	0	0.0075
			Bin	0.6	B	0.25	0.6	int.	85	7	0	8	0.0975
Jul. 14-16	2,3	10	Ael	0.1	B	0.25	0	int.	97	3	0	0	0.0075
			Asm	0.3	B	0.25	0.2	int.	85	5	0	10	0.1125
Jul. 14-16	2,3	10	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Bcu	0	A	0	0.2	int.	90	10	0	0	0.025

Table 5. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus femurrubrum-femurrubrum (DeGeer).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 14-16	2,3	10	Far	0.4	C	0.5	0.3	int.	75	15	0	10	0.1375
			Pvi	0	A	0	0	int.	100	0	0	0	0.0
Jul. 14-16	2,3	10	Bin	0.4	C	0.5	0	int.	100	0	0	0	0.0
			Far	0.4	C	0.5	1.3	int.	60	0	5	35	0.375
Jul. 14-16	2,3	10	Asm	*	D	1.0	0	int.	90	4	6	0	0.04
			Bcu	0	A	0	0.2	det.	100	0	0	0	0.0
Aug. 11-13	6	10	Age	*	D	1.0	0	int.	100	0	0	0	0.0
			Bin	*	D	1.0	0.1	det.	50	20	30	0	0.20
								int.	20	0	0	80	0.80
Aug. 11-13	6	10	Bcu	*	D	1.0	0.1	int.	80	20	0	0	0.05
			Pvi	*	D	1.0	0.5	det.	95	0	0	5	0.05
Aug. 11-13	6	10	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	0.2	C	0.5	0.1	int.	90	0	0	10	0.10
Aug. 13-15	6	10	Asm	-	-		0.3	int.	60	0	10	30	0.35
			Bin	*	D	1.0	0.1	int.	80	20	0	0	0.05

Table 5. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus femurrubrum-femurrubrum (DeGeer).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	% Slight	% Medium	% Heavy	Index
Aug. 13-15	6	10	Bcu	0	A	0	0.1	int.	80	15	5	0	0.1
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 13-15	6	10	Age	0.1	C	0.5	0.2	int.	90	0	10	0	0.05
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 15-17	6	10	Age	*	D	1.0	0.2	int.	80	15	5	0	0.0625
			Bcu	0.1	B	0.25	0.2	int.	80	20	0	0	0.05
Aug. 15-17	6	10	Bcu	0.3	C	0.5	0.1	int.	85	5	0	10	0.1125
			Bin	*	D	1.0	0.3	int.	20	10	0	70	0.725
Aug. 15-17	6	10	Asm	-	-		0	int.	70	15	10	5	0.0
			Pvi	0.1	B	0.25	0.1	int.	75	5	10	10	0.2125
Aug. 17-19	6	10	Bin	*	D	1.0	0.2	int.	70	20	0	10	0.15
			Pvi	0.4	C	0.5	0.3	int.	20	0	0	80	0.80
Aug. 17-19	6	10	Bin	*	D	1.0	0.1	int.	75	20	0	5	0.15
			Far	*	D	1.0	0.3	int.	0	0	10	90	0.95

Table 5. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Meanoplus femurrubrum-femurrubrum (DeGeer).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight[f]	% Medium[f]	% Heavy[f]	Index
Aug. 21-23	6	10	Age	0.1	B	0.25	0.1	int.	80	5	5	10	0.13
			Pvi	0.3	C	0.5	0.2	int.	85	0	5	10	0.125
Aug. 21-23	6	10	Age	0.3	B	0.25	0.3	int.	66	15	4	15	0.2075
			Asm	-	-		0.1	int.	40	10	15	35	0.45
Aug. 21-23	6	10	Asm	-	-		0.4	int.	30	15	20	35	0.4875
			Bcu	0	B	0.25	0.1	int.	80	10	10	0	0.075
Aug. 23-25	6	10	Asm	-	-		0.1	int.	65	10	10	15	0.225
			Far	*	D	1.0	*	int.	0	0	0	100	1.00

(a) Stage of life history: 1 = first instar; 2 = second instar; 3 = third instar; 4 = fourth instar; 5 = fifth instar; 6 = adult.
(b) Table 1 identifies the species of grass by full scientific name.
(c) Leaf feeding: A = no feeding; B = trace to 1/2 of leaf eaten; C = 1/2 or more eaten; D = eaten entirely.
(d) * = plant consumed within 48 hours.
(e) Detached = stalk bearing inflorescence or seeds severed so that it fell to bottom of cage; intacted = not severed.
(f) None = no damage; slight = slight feeding but no appreciable injury; medium = injured so that reproduction probably not possible; heavy = reproduction destroyed.

Table 6. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus keeleri luridus (Dodge).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Index
Jul. 21-23	3,4	10	Ael	0	A	0	0	int.	65	20	10	5	0.15
			Asm	0.3	B	0.25	0	int.	100	0	0	0	0.0
Jul. 21-23	3,4	10	Bcu	0.1	B	0.25	0.2	det.	95	5	0	0	0.0125
			Par	0	A	0	0.1	int.	80	20	0	0	0.05
Jul. 23-25	3,4	10	Bin	0.1	B	0.25	0	int.	100	0	0	0	0.0
			Ppr	*	D	1.0	0.3	int.	93	2	0	5	0.055
Jul. 23-25	3,4	10	Bcu	0	A	0	0	int.	100	0	0	0	0.0
			Pvi	0.1	B	0.25	0	int.	100	0	0	0	0.0
Jul. 25-27	3,4	10	Asm	*	D	1.0	0	int.	100	0	0	0	0.0
			Pvi	0.5	B	0.25	0.1	int.	95	0	0	5	0.05
Jul. 25-27	3,4	10	Asm	0.1	B	0.25	0.2	int.	70	5	10	15	0.2124
			Bin	*	D	1.0	0.3	int.	75	5	5	15	0.1875
Jul. 27-29	3,4	10	Age	0.1	B	0.25	0	int.	100	0	0	0	0.0
			Asm	*	D	1.0	0	int.	100	0	0	0	0.0

Table 6. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus keeleri luridus (Dodge).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 27-29	3,4	10	Age	0.1	B	0.25	0	int.	100	0	0	0	0.0
			Bcu	0	A	0	0	int.	100	0	0	0	0.0
Jul. 27-29	3,4	10	Age	0.1	B	0.25	0.1	int.	95	5	0	0	0.0125
			Par	0.1	B	0.25	0.2	int.	96	4	0	0	0.01
Jul. 29-31	3,4	10	Ael	0	A	0	0.5	int.	0	20	30	50	0.70
			Bcu	0	A	0	0.2	int.	90	5	5	0	0.0375
Jul. 29-31	3,4	10	Ppr	0.3	B	0.25	0.3	int.	40	60	0	0	0.15
			Pvi	0	A	0	0.3	int.	95	0	0	5	0.05
Aug. 1-3	3,4	10	Bcu	0	A	0	0.4	int.	95	5	0	0	0.0125
			Ppr	0.2	B	0.25	0.1	int.	60	10	5	25	0.30
Aug. 6-8	3,4	10	Age	0.1	B	0.25	0	int.	100	0	0	0	0.0
			Far	*	D	1.0	0.2	int.	40	8	20	32	0.44
Aug. 6-8	3,4	10	Age	0.2	C	0.5	0.3	int.	95	5	0	0	0.0125
			Bin	*	D	1.0	0	int.	100	0	0	0	0.0

Table 6. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. **Melanoplus keeleri luridus (Dodge).**

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	% Slight	% Medium	% Heavy	Index
Aug. 6-8	3,4	10	Age	0	A	0	0	int.	100	0	0	0	0.0
			Pvi	0.1	C	0.5	0.1	int.	85	5	0	10	0.1125
Aug. 7-9	4,5	10	Par	0	A	0	0	int.	100	0	0	0	0.0
			Pvi	0.1	B	0.25	0.1	int.	95	0	0	5	0.05
Aug. 7-9	4,5	10	Bin	0.3	B	0.25	0	int.	k00	0	0	0	0.0
			Far	*	D	1.0	0.1	int.	90	0	3	7	0.085
Aug. 4,5	4,5	10	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	0.1	B	0.25	0.3	int.	95	5	0	0	0.0125
Aug. 4,5	4,5	10	Age	0	A	0	0	int.	100	0	0	0	0.0
			Ppr	0.1	B	0.25	0	int.	91	0	4	5	0.07
Aug. 9-11	4,5	10	Far	*	D	1.0	0.3	int.	60	5	15	20	0.2875
			Par	0	A	0	0	int.	100	0	0	0	0.0
Aug. 11-13	4,5	10	Bcu	0	A	0	0	int.	100	0	0	0	0.0
			Bin	*	D	1.0	0	int.	100	0	0	0	0.0

Table 6. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus keeleri luridus (Dodge).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight[f]	% Medium[f]	% Heavy[f]	Index
Aug. 13-15	4,5	10	Asm	-	-		0	int.	100	0	0	0	0.0
			Far	*	D	1.0	0	int.	84	0	6	10	0.13

(a) Stage of life history: 1 = first instar; 2 = second instar; 3 = third instar; 4 = fourth instar; 5 = fifth instar; 6 = adult.
(b) Table 1 identifies the species of grass by full scientific name.
(c) Leaf feeding: A = no feeding; B = trace to 1/2 of leaf eaten; C = 1/2 or more eaten; D = eaten entirely.
(d) * = plant consumed within 48 hours.
(e) Detached = stalk bearing inflorescence or seeds severed so that it fell to bottom of cage; intacted = not severed.
(f) None = no damage; slight = slight feeding but no appreciable injury; medium = injured so that reproduction probably not possible; heavy = reproduction destroyed.

Table 7 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus sanguinipes (Fabricius).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact	Inflorescence and seed feeding: %[e] None	Slight	Medium	Heavy	Index
Jun. 5-7	2,3	10	Bin	*	D	1.0	0.6	int.	6	0	0	94	0.94
			Far	*	D	1.0	0.1	int.	70	7	11	12	0.1925
Jun. 5-7	2,3	10	Dgl	*	D	1.0	1.2	int.	15	3	3	79	0.8125
			Far	*	D	1.0	0.1	int.	52	33	7	8	0.1975
Jun. 10-12	3,4	10	Bin	*	D	1.0	0.2	int.	5	2	8	85	0.89
			Ppr	*	D	1.0	0.5	int.	90	0	5	5	0.075
Jun. 13-15	3,4	10	Bin	*	D	1.0	0.2	int.	0	0	0	100	1.00
			Dgl	*	D	1.0	0.4	int.	90	7	3	0	0.0325
Jun. 15-17	3,4	10	Far	*	D	1.0	0.1	int.	78	3	0	19	0.1975
			Par	0.1	B	0.25	0.4	int.	57	18	12	13	0.235
Jun. 18-20	3,4	10	Far	*	D	1.0	0.2	int.	28	15	7	50	0.5725
			Ppr	*	D	1.0	0	int.	100	0	0	0	0.0
Jun. 22-24	4,5	10	Eju	*	D	1.0	0.9	int.	90	0	0	10	0.10
			Far	*	D	1.0	0.1	int.	96	4	0	0	0.01

Table 7. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus sanguinipes (Fabricius).

Date	Stage[a]	No. speci-mens	Grass[b]	Leaf feeding			Inflorescence and seed feeding						
				Av. No.[c] feeding	Rating[d]	Index	Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Jun. 24-26	4,5	10	Dgl	*	D	1.0	0.2	int.	87	3	4	6	0.0875
			Ppr	*	D	1.0	0	int.	100	0	0	0	0.0
Jun. 24-26	4,5	10	Bcu	0.2	B	0.25	0.3	int.	75	20	0	5	0.09
			Dgl	*	D	1.0	0.2	int.	95	0	5	0	0.025
Jun. 24-26	4,5	10	Asm	*	D	1.0	0.1	int.	90	4	0	10	0.1
			Par	*	D	1.0	0.8	int.	40	30	10	20	0.32
Jun. 24-26	4,5	10	Asm	*	D	1.0	0.3	int.	20	0	30	50	0.65
			Ppr	*	D	1.0	0	int.	100	0	0	0	0.0
Jun. 26-28	4,5	10	Asm	*	D	1.0	0.2	int.	40	20	30	10	0.30
			Bin	*	D	1.0	*	int.	0	0	0	100	1.00
Jun. 26-28	4,5	10	Asm	*	D	1.0	0.2	int.	35	20	35	10	0.325
			Dgl	*	D	1.0	0.2	int.	97	3	0	0	0.0075
Jun. 26-28	4,5	10	Par	0.1	B	0.25	0.1	int.	65	5	0	30	0.3125
			Ppr	*	D	1.0	0.3	int.	75	0	0	25	0.25

Table 7 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus sanguinipes (Fabricius).

				Leaf feeding			Inflorescence and seed feeding						
Date	Stage[a]	No. specimens	Grass[b]	Av. No.[c] feeding	Rating[d]	Index	Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Jun. 26-28	4,5	10	Bin	*	D	1.0	*	int.	0	0	0	100	1.00
			Par	0.3	B	0.25	0.3	int.	20	75	0	5	0.2375
Jun. 28-30	4,5	10	Dgl	*	D	1.0	0.1	int.	65	35	0	0	0.0875
			Par	*	D	1.0	0.6	int.	20	80	0	0	0.20
Jun. 28-30	4,5	10	Asm	*	D	1.0	0.2	int.	75	0	5	20	0.225
			Eju	*	D	1.0	0.6	int.	0	0	0	100	1.00
Jun. 28-30	4,5	10	Eju	*	D	1.0	0.2	int.	0	0	0	100	1.00
			Par	*	D	1.0	1.5	int.	0	0	0	100	1.00
Jun. 28-30	4,5	10	Dgl	*	D	1.0	0.2	int.	60	15	25	0	0.1625
			Eju	*	D	1.0	0.8	int.	0	0	0	100	1.00
Jul. 1-3	5	10	Bcu	0	B	0.25	0.2	int.	90	10	0	0	0.025
			Ppr	*	D	1.0	0.1	int.	30	60	0	10	0.25
Jul. 1-3	5	10	Bcu	0	B	0.25	0.3	int.	90	10	0	0	0.025
			Par	*	D	1.0	0.2	int.	65	35	0	0	0.0875

Table 7. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhatten, Kansas, 1967. Melanoplus sanguinipes (Fabricius).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Jul. 1-3	5	10	Eju	*	D	1.0	0.5	int.	0	0	0	100	1.00
			Ppr	*	D	1.0	0.1	int.	90	6	4	0	0.035
Jul. 1-3	5	10	Bcu	0.1	B	0.25	0	int.	100	0	0	0	0.0
			Bin	*	D	1.0	0.8	int.	72	8	5	15	0.195
Jul. 4-6	5	10	Bin	*	D	1.0	0.7	int.	5	5	10	90	0.9625
			Eju	*	D	1.0	0.2	int.	50	5	10	35	0.4125
Jul. 4-6	5	10	Ael	*	D	1.0	0.1	int.	90	10	0	0	0.025
			Par	*	D	1.0	0.2	int.	60	27	5	8	0.1725
Jul. 4-6	5	10	Ppr	*	D	1.0	0.5	int.	75	5	0	20	0.2125
			Pvi	0.4	C	0.5	0	int.	95	0	5	0	0.025
Jul. 4-6	5	10	Bcu	0.4	C	0.5	0	int.	100	0	0	0	0.0
			Eju	*	D	1.0	0.3	int.	0	0	0	100	1.00
Jul. 7-9	5,6	10	Ael	0.4	C	0.5	0.1	int.	100	0	0	0	0.0
			Eju	*	D	1.0	0.5	int.	15	25	30	30	0.5125

Table 7. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus sanguinipes (Fabricius).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Jul. 7-9	5,6	10	Ael	0.3	C	0.5	0.1	int.	95	5	0	0	0.0125
			Dgl	*	D	1.0	0	int.	100	0	0	0	0.0
Jul. 7-9	5,6	10	Ael	0.3	B	0.25	0.1	int.	95	5	0	0	0.0125
			Bin	*	D	1.0	0.5	int.	20	10	20	50	0.625
Jul. 7-9	5,6	10	Ael	*	D	1.0	0	int.	100	0	0	0	0.0
			Pvi	0.3	B	0.25	0	int.	100	0	0	0	0.0
Jul. 9-11	6	10	Bin	*	D	1.0	0.1	int.	92	0	0	8	0.08
			Pvi	0.2	C	0.5	0.1	int.	97	3	0	0	0.0075
Jul. 9-11	6	10	Dgl	*	D	1.0	0.1	int.	97	0	0	3	0.03
			Pvi	0.1	C	0.5	0.1	int.	96	0	0	4	0.04
Jul. 9-11	6	10	Ael	*	D	1.0	0	int.	100	0	0	0	0.0
			Ppr	*	D	1.0	0.8	int.	40	0	0	60	0.60
Jul. 14-16	6	10	Eju	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	*	D	1.0	0.3	int.	95	0	0	5	0.05

Table 7 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus sanguinipes (Fabricius).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 14-16	6	10	Dgl	*	D	1.0	0.4	int.	30	10	0	60	0.625
			Pvi	0.1	B	0.25	0.1	int.	97	3	0	0	0.0075
Jul. 14-16	6	10	Par	0.3	C	0.5	0.3	int.	0	0	0	100	1.00
			Pvi	0.2	C	0.5	0.1	int.	95	0	0	5	0.05
Jul. 14-16	6	10	Bin	*	D	1.0	0.8	det.	100	0	0	0	0.0
								int.	80	15	5	0	0.0625
			Pvi	0.2	C	0.5	0	int.	100	0	0	0	0.0
Jul. 16-18	6	10	Eju	*	D	1.0	0.3	int.	0	0	30	70	0.85
			Pvi	*	D	1.0	0.5	int.	75	5	0	20	0.2125
Jul. 16-18	6	10	Bcu	0.2	C	0.5	0.1	int.	95	5	0	0	0.0125
			Eju	*	D	1.0	0.5	int.	0	0	0	100	1.00
Jul. 16-18	6	10	Asm	*	D	1.0	0.3	int.	50	10	20	20	0.325
			Bin	*	D	1.0	*	int.	0	0	0	100	1.00
Jul. 16-18	6	10	Bcu	*	D	1.0	0.1	det.	90	10	0	0	0.025
			Pvi	*	D	1.0	0.1	int.	90	0	0	10	0.10

Table 7. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus sanguinipes (Fabricius).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Inflorescence and seed feeding: Index
Jul. 18-20	6	10	Ael	0.4	C	0.5	0.2	int.	75	10	10	5	0.125
			Asm	*	D	1.0	0.1	int.	90	0	5	5	0.075
Jul. 18-20	6	10	Asm	*	D	1.0	0.2	int.	60	5	10	25	0.3125
			Pvi	*	D	1.0	0.4	int.	85	0	5	10	0.125
Jul. 18-20	6	10	Bcu	0.2	B	0.5	0.2	int.	90	10	0	0	0.025
			Pvi	*	D	1.0	0.7	int.	80	0	5	15	0.175
Jul. 18-20	6	10	Par	*	D	1.0	0.4	int.	40	10	25	25	0.40
			Pvi	*	D	1.0	0.5	int.	90	0	0	10	0.10
Jul. 20-22	6	10	Asm	*	D	1.0	0.2	int.	65	10	10	15	0.225
			Pvi	*	D	1.0	0.3	int.	40	10	10	40	0.475
Jul. 20-22	6	10	Ael	*	D	1.0	0.1	int.	80	10	10	0	0.075
			Bcu	*	D	1.0	0	int.	95	5	0	0	0.0125
Jul. 20-22	6	10	Asm	*	D	1.0	0.1	int.	65	5	10	20	0.2625
			Bcu	0.1	B	0.25	0.1	int.	35	15	25	25	0.4125

Table 7 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus sanguinipes (Fabricius).

Date	Stage[a]	No. speci-mens	Grass[b]	Leaf feeding			Inflorescence and seed feeding						
				Av. No.[c] feeding	Rating[d]	Index	Av. No.[c] feeding	Detached[e] or intact	% None	% Slight	% Medium	% Heavy	Index
Jul. 23-25	6	10	Asm	*	D	1.0	0.1	int.	90	6	4	0	0.035
			Par	*	D	1.0	0.1	int.	80	20	0	0	0.05
Jul 23-25	6	10	Bin	*	D	1.0	0.3	det.	50	25	25	0	0.1875
			Ppr	0.1	C	0.5	0.2	int.	60	10	5	25	0.30
Jul. 25-27	6	10	Par	*	D	1.0	0.1	int.	90	10	0	0	0.025
			Ppr	*	D	1.0	0.3	int.	78	2	5	15	0.18
Jul. 25-27	6	10	Asm	*	D	1.0	0.2	int.	85	10	5	0	0.05
			Ppr	0.2	C	0.5	0.2	int.	80	5	5	10	0.1375
Sept. 15-17	6	10	Bcu	0.3	B	0.25	0.2	int.	92	8	0	0	0.02
			Pvi	0.4	C	0.5	0.4	int.	60	0	10	30	0.35
Sept. 15-17	6	10	Bin	*	D	1.0	0.3	int.	0	30	20	50	0.68
			Far	*	D	1.0	0.4	int.	0	0	0	100	1.0
Sept. 18-20	6	10	Age	*	D	1.0	0.1	int.	95	5	0	0	0.012
			Far	*	D	1.0	0.3	int.	0	0	0	100	1.00

Table 7 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Melanoplus sanguinipes (Fabricius).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact	%[e] None	Slight	Medium	Heavy	Index[f]
Sept. 18-20	6	10	Age	0.2	B	0.25	0.2	int.	90	10	0	0	0.025
			Pvi	0.3	D	1.0	0.4	int.	55	5	0	40	0.41
Sept. 18-20	6	10	Bcu	0.1	B	0.25	0.2	int.	90	10	0	0	0.025
			Bin	*	D	1.0	0.3	int	0	0	40	60	0.8
Sept. 18-20	6	10	Far	*	D	1.0	0.4	int.	0	0	20	80	0.9
			Pvi	0.1	B	0.25	0.3	int.	50	0	10	40	0.45
Sept. 21-23	6	10	Age	*	D	1.0	0.1	int.	92	8	0	0	0.02
			Bcu	0	A	0	0.1	int.	90	10	0	0	0.026
Sept. 21-23	6	10	Far	*	D	1.0	0.3	int.	30	0	30	40	0.55
			Bcu	0	A	0	0	int.	100	0	0	0	0.0
Sept. 21-23	6	10	Age	*	D	1.0	0.1	int.	90	10	0	0	0.025
			Bin	*	D	1.0	0.3	int.	0	0	40	60	0.8

(a) Stage of life history: 1 = first instar; 2 = second instar; 3 = third instar; 4 = fourth instar; 5 = fifth instar; 6 = adult.
(b) Table 1 identifies the species of grass by full scientific name.

(c) Leaf feeding: A = no feeding; B = trace to 1/2 of leaf eaten; C = 1/2 or more eaten; D = eaten entirely.
(d) * = plant consumed with 48 hours.
(e) Detached = stalk bearing inflorescence or seeds severed so that it fell to bottom of cage; intacted = not severed.
(f) None = no damage; slight = slight feeding but no appreciable injury; medium = injured so that reproduction probably not possible; heavy = reproduction destroyed.

Table 8 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Jun. 5-7	1	10	Bin	0	A	0	0	int.	85	7	7	1	0.0625
			Par	0	A	0	0	int.	85	3	2	10	0.1175
Jun. 10-12	1	20	Par	0.6	B	0.25	1.9	int.	10	88	2	0	0.23
			Ppr	0.2	B	0.25	0	int.	100	0	0	0	0
Jun. 10-12	1	20	Dgl	0.6	C	0.5	0.2	int.	95	5	0	0	0.0125
			Ppr	0.6	B	0.25	0	int.	100	0	0	0	0
Jun. 10-12	1	20	Asm	0	A	0	0.8	int.	90	10	0	0	0.025
			Eju	0.1	B	0.25	0.2	int.	70	10	5	15	0.20
Jun. 13-15	1	15	Asm	0	A	0	0.1	int.	96	4	0	0	0.01
			Dgl	1.2	C	0.5	2.3	int.	75	17	4	4	0.1025
Jun. 13-15	1	15	Far	0.6	B	0.25	0	int.	100	0	0	0	0
			Par	0	A	0	0.4	int.	40	60	0	0	0.15
Jun. 13-15	1	15	Bin	0.4	B	0.25	0.4	int.	95	5	0	0	0.0125
			Ppr	0.3	C	0.5	0	int.	100	0	0	0	0

Table 8. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jun. 19-21	1,2	15	Asm	0.1	B	0.25	0.2	int.	90	10	0	0	0.025
			Par	0.5	B	0.25	0.8	int.	20	55	15	10	0.285
Jun. 22-24	1,2	15	Eju	1.2	C	0.5	1.0	int.	43	39	18	0	0.1875
			Par	0.1	B	0.25	0.3	int.	80	20	0	0	0.05
Jun. 24-26	1,2	15	Dgl	*	D	1.0	0.5	int.	95	5	0	0	0.015
			Far	0.4	B	0.25	0.1	int.	95	5	0	0	0.015
Jun. 28-30	2,3	15	Eju	0.7	C	0.5	0.1	int.	90	0	0	10	0.10
			F_ar	0.2	B	0.25	0.6	int.	80	10	5	5	0.10
Jun. 28-30	2,3	15	Asm	*	D	1.0	0.2	int.	95	5	0	0	0.0125
			Far	0.4	C	0.5	0.5	int.	50	0	25	25	0.376
Jun. 28-30	2,3	15	Eju	*	D	1.0	1.9	int.	25	0	50	25	0.50
			Ppr	0.6	C	0.5	0.4	int.	75	25	0	0	0.0625
Jul. 1-3	2,3	15	Dgl	*	D	1.0	0.7	int.	40	30	20	10	0.275
			Par	*	D	1.0	0.7	int.	30	70	0	0	0.175

Table 8. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 1-3	2,3	15	Bcu	0.2	B	0.25	0.1	int.	95	5	0	0	0.0125
			Par	*	D	1.0	0.4	int.	20	80	0	0	0.20
Jul. 1-3	2,3	15	Dgl	*	D	1.0	0.8	int.	65	20	15	0	0.125
			Eju	*	D	1.0	1.1	int.	0	0	0	100	1.00
Jul. 4-6	2,3	15	Bcu	0.3	C	0.5	0.1	int.	80	20	0	0	0.05
			Eju	0.3	C	0.5	0.2	int.	70	10	15	5	0.15
Jul. 4-6	2,3	15	Bcu	*	D	1.0	0.3	int.	90	10	0	0	0.025
			Dgl	*	D	1.0	1.2	int.	30	50	15	5	0.25
Jul. 4-6	2,3	15	Bin	*	D	1.0	0.1	int.	88	7	0	5	0.0675
			Pvi	*	D	1.0	0.6	int.	93	7	0	0	0.0175
Jul. 4-6	2,3	15	Bcu	*	D	1.0	0.1	int.	75	20	0	5	0.10
			Asm	0	A	0	0.4	int.	96	4	0	0	0.01
Jul. 4-6	2,3	15	Bcu	*	D	1.0	0.3	int.	55	40	5	0	0.125
			Bin	*	D	1.0	0.4	det.	90	10	0	0	0.025
								int.	80	15	5	0	0.0625

Table 8. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 4-6	2,3	15	Ael	0.6	C	0.5	0	int.	100	0	0	0	0.0
			Par	0.1	B	0.25	0.7	int.	10	85	5	0	0.2375
Jul. 4-6	2,3	15	Bcu	0.7	C	0.5	0	int.	84	15	0	0	0.0375
			Ppr	*	D	1.0	0.3	int.	70	30	0	0	0.075
Jul. 7-9	3,4	10	Par	0.1	B	0.25	0.2	int.	10	90	0	0	0.225
			Pvi	0.4	C	0.5	0	int.	100	0	0	0	0.0
Jul. 7-9	3,4	10	Eju	*	D	1.0	0.5	int.	0	0	30	70	0.85
			Pvi	1.1	C	0.5	0.3	int.	97	3	0	0	0.0075
Jul. 7-9	3,4	10	Dgl	*	D	1.0	0.3	int.	60	10	15	15	0.25
			Pvi	0.3	B	0.25	0.4	int.	95	0	0	5	0.05
Jul. 7-9	3,4	10	Ael	*	D	1.0	0.1	int.	95	5	0	0	0.0125
			Pvi	0.6	B	0.25	0.3	int.	85	0	0	15	0.15
Jul. 7-9	3,4	10	Bcu	*	D	1.0	0	int.	80	15	5	5	0.1125
			Pvi	0.6	C	0.5	0.4	int.	95	0	0	5	0.05

Table 8 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 7-9	3,4	10	Asm	0	A	0	0.1	int.	97	3	0	0	0.0075
			Pvi	0.6	C	0.5	0.7	int.	95	0	5	0	0.025
Jul. 7-9	3,4	10	Ppr	0.5	C	0.5	0.1	int.	80	20	0	0	0.05
			Pvi	0.2	C	0.5	0.1	int.	95	5	0	0	0.0125
Jul. 9-11	3,4	10	Asm	0.3	B	0.25	0	int.	100	0	0	0	0.0
			Bin	*	D	1.0	0.3	int.	95	5	0	0	0.0125
Jul. 9-11	3,4	10	Ael	0.6	B	0.25	0	int.	100	0	0	0	0.0
			Ppr	*	D	1.0	1.0	int.	50	50	0	0	0.125
Jul. 9-11	3,4	10	Ael	0.4	B	0.25	0	int.	97	3	0	0	0.0075
			Dgl	*	D	1.0	0.2	int.	90	0	5	5	0.075
Jul. 9-11	3,4	10	Ael	*	D	1.0	0.1	int.	70	30	0	0	0.075
			Bin	*	D	1.0	0.3	int.	65	0	0	35	0.35
Jul. 14-16	3,4	10	Ael	0	A	0	0	int.	100	0	0	0	0.0
			Asm	0	A	0	0	int.	100	0	0	0	0.0

Table 8. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Jul. 14-16	3,4	10	Ael	*	D	1.0	0	int.	97	3	0	0	0.0075
			Bcu	*	D	1.0	0.2	int.	95	5	0	0	0.0125
Jul. 14-16	3,4	10	Bin	0.4	B	0.25	0.4	int.	90	5	5	0	0.0375
			Far	0.1	B	0.25	0.1	int.	96	0	0	4	0.04
Jul. 14-16	3,4	10	Far	0.1	B	0.25	0.6	det.	40	0	0	60	0.60
								int.	55	0	0	45	0.45
			Pvi	0.1	B	0.25	0	int.	100	0	0	0	0.0
Jul. 14-16	3,4	10	Bin	0.1	B	0.25	0	int.	90	5	5	0	0.0375
			Dgl	*	D	1.0	0.1	int.	90	0	5	5	0.075
Jul. 14-16	3,4	10	Bin	*	D	1.0	0.1	int.	90	7	3	0	0.0325
			Eju	*	D	1.0	0.3	int.	80	15	5	0	0.0625
Jul. 14-16	3,4	10	Ael	0.5	B	0.25	0.1	int.	95	5	0	0	0.0125
			Eju	*	D	1.0	0.8	int.	5	5	35	55	0.7375
Jul. 14-16	3,4	10	Far	0.3	B	0.25	0	int.	90	0	0	10	0.10
			Ppr	0.1	B	0.25	0.4	int.	79	18	0	3	0.075

Table 8. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Inflorescence and seed feeding: Index
Jul. 14-16	3,4	10	Dgl	*	D	1.0	0.2	int.	90	0	0	10	0.10
			Par	0.1	B	0.25	0.1	int.	40	60	0	0	0.15
Jul. 14-16	5,6	10	Ael	*	D	1.0	0	int.	97	3	0	0	0.0075
			Bcu	0.3	C	0.5	0.3	int.	95	5	0	0	0.0125
Jul. 18-20	5,6	10	Bin	*	D	1.0	0.3	det.	80	10	0	10	0.125
			Ppr	*	D	1.0	0.5	int.	40	5	20	35	0.4625
Jul. 18-20	5,6	10	Eju	*	D	1.0	0.3	int.	20	10	40	30	0.525
			Par	*	D	1.0	0.3	int.	20	80	0	0	0.20
Jul. 18-20	5,6	10	Bin	*	D	1.0	0.2	int.	90	3	5	2	0.0525
			Par	0.1	B	0.25	0.2	int.	15	70	15	0	0.25
Jul. 18-20	5,6	10	Asm	0.1	C	0.5	0	int.	100	0	0	0	0.0
			Par	0.4	B	0.25	0.5	int.	30	50	10	10	0.275
Jul. 18-20	5,6	10	Bcu	0.3	C	0.5	0.3	det.	90	10	0	0	0.025
								int.	30	20	0	0	0.05
			Par	0.3	B	0.25	0.5	int.	15	60	5	20	0.0375

Table 8. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 18-20	5,6	10	Par	0.1	B	0.25	0.5	int.	10	78	5	7	0.29
			Ppr	0.3	B	0.25	0.3	int.	50	30	5	15	0.25
Jul. 5,6	5,6	10	Eju	*	D	1.0	0.2	int.	50	40	10	0	0.15
			Ppr	0.3	B	0.25	0.2	int.	90	10	0	0	0.025
Jul. 18-20	5,6	10	Bin	*	D	1.0	0.4	det.	85	10	0	5	0.075
								int.	90	10	0	0	0.025
			Pvi	0.3	C	0.5	0.7	det.	90	0	0	10	0.10
								int.	80	0	10	10	0.15
Jul. 20-22	5,6	10	Asm	0.1	B	0.25	0.2	int.	95	0	0	5	0.05
			Bcu	*	D	1.0	0.3	det.	40	50	10	0	0.22
Jul. 20-22	5,6	10	Ael	*	D	1.0	0	int.	97	3	0	0	0.0075
			Par	0.2	B	0.25	0.4	int.	30	60	0	0	0.20
Jul. 20-22	5,6	10	Bcu	0.1	B	0.25	0.2	det.	95	5	0	0	0.0125
								int.	90	10	0	0	0.025
			Ppr	*	D	1.0	0.5	int.	50	40	10	0	0.15

Table 8. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Inflorescence and seed feeding: Index
Jul. 20-22	5,6	10	Bcu	0.2	C	0.5	0.2	int.	90	10	0	0	0.025
			Pvi	*	D	1.0	0.3	int.	95	0	5	0	0.025
Jul. 20-22	5,6	10	Bcu	*	D	1.0	0.5	int.	25	5	0	70	0.7125
			Bin	*	D	1.0	0.3	det.	0	50	10	40	0.575
Jul. 20-22	5,6	10	Bcu	*	D	1.0	0.3	det.	80	20	0	40	0.45
								int.	95	5	0	0	0.0125
			Eju	*	D	1.0	0.3	int.	20	10	30	40	0.575
Jul. 22-24	5,6	10	Par	*	D	1.0	0.3	int.	90	10	0	0	0.025
			Pvi	0.6	C	0.5	0.4	int.	95	5	0	0	0.0125
Jul. 22-24	5,6	10	Asm	*	D	1.0	0.1	int.	80	10	5	5	0.10
			Pvi	*	D	1.0	0.5	int.	90	10	0	0	0.025
Jul. 22-24	5,6	10	Ppr	*	D	1.0	0.7	int.	20	75	5	0	0.2125
			Pvi	*	D	1.0	0.3	int.	95	5	0	0	0.0125
Jul. 22-24	5,6	10	Asm	*	D	1.0	0	int.	90	10	0	0	0.025
			Ppr	*	D	1.0	0.6	int.	40	60	0	0	0.15

Table 8. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Jul. 22-24	5,6	10	Asm	*	D	1.0	0.2	int.	70	20	5	5	0.125
			Bin	*	D	1.0	0.2	det.	80	5	10	5	0.1125
Aug. 6-8	6	10	Age	*	D	1.0	0.1	int.	97	3	0	0	0.0075
			Ppr	0	A	0	0.1	int.	91	4	5	0	0.035
Aug. 6-8	6	10	Age	*	D	1.0	0	int.	100	0	0	0	0.0
			Bin	*	D	1.0	0.2	det.	85	15	0	0	0.0375
								int.	100	0	0	0	0.0
Aug. 6-8	6	10	Age	*	D	1.0	0	int.	100	0	0	0	0.0
			Pvi	0	A	0	0.6	det.	95	5	0	0	0.0125
								int.	95	5	0	0	0.0125
Aug. 6-8	6	10	Age	*	D	1.0	0.1	int.	95	5	0	0	0.0125
			Dgl	*	D	1.0	0.2	int.	65	5	15	15	0.2375
Aug. 6-8	6	10	Age	0.2	C	0.5	0	int.	100	0	0	0	0.0
			Far	0.1	B	0.25	0.2	int.	70	5	10	15	0.2125
Aug. 6-8	6	10	Age	*	D	1.0	0	int.	95	5	0	0	0.0125
			Asm	0	A	0	0.1	int.	95	5	0	0	0.0125

Table 8 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Orphulella speciosa (Scudder).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Inflorescence and seed feeding: Index
Aug. 6-8	6	10	Age	*	D	1.0	0	int.	100	0	0	0	0.0
			Par	0	A	0	0	int.	95	0	5	0	0.025
Aug. 6-8	6	10	Age	*	D	1.0	0	int.	100	0	0	0	0.0
			Bcu	*	D	1.0	0	int.	100	0	0	0	0.0
Aug. 7-9	6	10	Age	*	D	1.0	0.4	int.	90	10	0	0	0.025
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 7-9	6	10	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Ppr	0	A	0	0.2	int.	0	100	0	0	0.25
Aug. 7-9	6	10	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Par	0	A	0	0	int.	93	0	5	2	0.045
Aug. 7-9	6	10	Bin	*	D	1.0	0.2	int.	90	10	0	0	0.025
			Far	*	D	1.0	0.6	det.	40	10	15	35	0.45

(a) Stage of life history: 1 = first instar; 2 = second instar; 3 = third instar; 4 = fourth instar; 5 = fifth instar; 6 = adult.
(b) Table 1 identifies the species of grass by full scientific name.
(c) Leaf feeding: A = no feeding; B = trace to 1/2 of leaf eaten; C = 1/2 or more eaten; D = eaten entirely.
(d) * = plant consumed within 48 hours.
(e) Detached = stalk bearing inflorescence or seeds severed so that it fell to bottom of cage; intacted = not severed.
(f) None = no damage; slight = slight feeding but no appreciable injury; medium = injured so that reproduction probably no possible; heavy = reproduction destroyed.

Table 9. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. **Phoetaliotes nebrascensis** (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Jul. 21-23	2,3	10	Ael	*	D	1.0	0.3	int.	20	50	15	15	0.35
			Par	0	A	0	0.7	int.	75	10	10	5	0.125
Jul. 21-23	2,3	10	Ael	0.6	C	0.5	0.1	int.	90	5	5	0	0.0375
			Pvi	*	D	1.0	2.1	int.	85	5	5	5	0.0875
Jul. 23-25	2,3	10	Bcu	*	D	1.0	0.6	det.	80	15	5	0	0.0625
								int.	20	25	40	15	0.4125
			Ppr	*	D	1.0	0.7	int.	92	5	0	3	0.0425
Jul. 23-25	2,3	10	Asm	*	D	1.0	0.1	int.	93	0	7	0	0.035
			Par	*	D	1.0	0	int.	100	0	0	0	0.0
Jul. 23-25	2,3	10	Bin	*	D	1.0	0.3	int.	80	10	5	5	0.10
			Par	0	A	0	0	int.	100	0	0	0	0.0
Jul. 25-27	2,3	10	Asm	*	D	1.0	0.2	int.	95	0	0	5	0.05
			Bcu	0.3	B	0.25	0.3	det.	40	25	10	25	0.3625
								int.	20	80	0	0	0.20
Jul. 25-27	2,3	10	Par	0	A	0	0	int.	100	0	0	0	0.0
			Pvi	*	D	1.0	0.3	int.	75	10	5	10	0.15

Table 9. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Phoetaliotes nebrascensis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact	% None[e]	% Slight[e]	% Medium[e]	% Heavy[e]	Index
Jul. 28-30	3,4	10	Ael	*	D	1.0	0	int.	100	0	0	0	0.0
			Bcu	0	A	0	0	int.	90	10	0	0	0.025
Jul. 28-30	3,4	10	Ael	0.1	B	0.25	0.3	int.	45	50	10	0	0.175
			Ppr	0	A	0	0	int.	90	0	5	5	0.075
Jul. 28-30	3,4	10	Bcu	0.2	C	0.5	0.1	int.	85	10	5	0	0.05
			Bin	*	D	1.0	0	int.	100	0	0	0	0.0
Jul. 28-30	3,4	10	Ael	0.3	C	0.5	0.2	int.	95	5	0	0	0.0125
			Bin	*	D	1.0	0	int.	100	0	0	0	0.0
Jul. 28-30	3,4	10	Asm	0.1	B	0.25	0.2	int.	70	15	15	0	0.1125
			Ppr	0.3	C	0.5	0	int.	100	0	0	0	0.0
Jul. 28-30	3,4	10	Bin	*	D	1.0	0	int.	100	0	0	0	0.0
			Pvi	*	D	1.0	0.3	int.	90	0	0	10	0.10
Jul. 28-30	3,4	10	Age	*	D	1.0	0.1	int.	95	5	0	0	0.0125
			Ppr	0.1	B	0.25	0.1	int.	95	5	0	0	0.0125

Table 9. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Phoetaliotes nebrascensis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Inflorescence and seed feeding: Index
Jul. 28-30	3,4	10	Par	0	A	0	0.1	int.	90	10	0	0	0.025
			Ppr	0.1	B	0.25	0	int.	60	35	0	5	0.1375
Jul. 28-30	3,4	10	Age	*	D	1.0	0.4	int.	95	5	0	0	0.0125
			Pvi	*	D	1.0	0.2	int.	96	0	0	4	0.04
Jul. 28-30	3,4	10	Age	0.5	C	0.5	0	int.	95	0	0	5	0.05
			Bin	0.1	C	0.5	0	int.	100	0	0	0	0.0
Jul. 28-30	3,4	10	Ael	*	D	1.0	0.6	int.	65	30	5	0	0.10
			Age	0.1	C	0.5	0.6	int.	93	5	2	0	0.0225
Jul. 29-31	3,4	10	Age	*	D	1.0	0.1	int.	90	10	0	0	0.025
			Asm	0.1	B	0.25	0.3	int.	50	10	40	0	0.225
Jul. 29-31	3,4	10	Asm	*	D	1.0	0.1	int.	10	15	40	35	0.5875
			Bin	*	D	1.0	0	int.	100	0	0	0	0.0
Jul. 29-31	3,4	10	Bin	*	D	1.0	0.3	int.	35	45	15	5	0.2375
			Ppr	*	D	1.0	0.6	int.	5	15	15	65	0.7625

Table 9. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Phoetaliotes nebrascensis (Thomas).

Date	Stage[a]	No. speci-mens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or insect[e]	% None[f]	% Slight	% Medium	% Heavy	Index
Jul. 29-31	3,4	10	Ppr	*	D	1.0	0.5	int.	55	35	0	0	0.13
			Pvi	*	D	1.0	0.6	det.	90	0	5	5	0.075
								int.	80	0	6	14	0.17
Jul. 29-31	3,4	10	Bcu	0.2	B	0.25	0.1	int.	90	10	0	0	0.025
			Pvi	*	D	1.0	0.7	int.	20	10	10	60	0.675
Aug. 11-13	4,5	10	Age	*	D	1.0	0	int.	100	0	0	0	0.0
			Far	*	D	1.0	0.3	int.	20	0	35	45	0.625
Aug. 11-13	4,5	10	Far	*	D	1.0	0.4	det.	5	0	10	85	0.875
			Ppr	0	A	0	0.1	int.	95	0	0	5	0.05
Aug. 11-13	4,5	10	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	*	D	1.0	0.5	det.	70	0	0	30	0.30
								int.	80	10	0	10	0.125
Aug. 11-13	4,5	10	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Par	0	A	0	0	int.	100	0	0	0	0.0
Aug. 11-13	4,5	10	Bin	*	D	1.0	0	int.	100	0	0	0	0.0
			Far	0.1	B	0.25	0.6	int.	50	0	0	50	0.50

Table 9 . Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. **Phoetaliotes nebrascensis** (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Aug. 11-13	6	10	Far	*	D	1.0	*	int.	0	0	0	100	1.00
			Pvi	0.1	B	0.25	0.6	det.	97	0	0	3	0.03
								int.	80	10	0	10	0.125
Aug. 13-15	4,5	10	Bcu	0.2	B	0.25	0.1	det.	100	0	0	0	0.0
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 13-15	4,5	10	Asm	-	-		0	det.	100	0	0	0	0.0
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 13-15	4,5	10	Bcu	0.1	C	0.5	0	int.	100	0	0	0	0.0
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 13-15	6	10	Age	*	D	1.0	0.3	int.	57	40	0	3	0.13
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 15-17	6	10	Bcu	*	D	1.0	0.2	int.	40	40	20	0	0.20
			Pvi	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 17-19	6	10	Asm	-	-		0.3	int.	0	0	0	100	1.00
			Pvi	*	D	1.0	0.5	int.	0	0	0	100	1.00

Table 9. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1967. Phoetaliotes nebrascensis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Rating[d]	Index	Inflorescence and seed feeding: Av. No.[c] feeding	Detached or intact[e]	%[f] None	Slight	Medium	Heavy	Index
Aug. 21-23	6	10	Age	*	D	1.0	0.2	int.	95	5	0	0	0.0125
			Bcu	*	D	1.0	0.5	det.	0	0	0	100	1.00
Aug. 21-23	6	10	Age	*	D	1.0	0.1	int.	97	3	0	0	0.0075
			Pvi	*	D	1.0	0.4	det.	65	5	0	30	0.3125
Aug. 21-23	6	10	Bin	*	D	1.0	0	int.	83	5	0	12	0.1325
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 21-23	6	10	Bin	*	D	1.0	0.2	int.	95	5	0	0	0.0125
			Pvi	*	D	1.0	1.3	det.	60	5	5	30	0.3375
								int.	75	5	5	15	0.1875
Aug. 21-23	6	10	Bcu	*	D	1.0	0.3	int.	77	5	10	8	0.1425
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 23-25	6	10	Age	*	D	1.0	0.3	int.	30	10	20	40	0.525
			Asm	-	-		0.5	int.	0	0	0	100	1.00
Aug. 23-25	6	10	Bcu	0.1	B	0.25	0.2	det.	40	0	20	40	0.50
			Bin	*	D	1.0	0.7	int.	0	0	0	100	1.00

Table 9. Damage to leaves, inflorescence and seeds of paired species of grasses in cages during 48 hours. Manhattan, Kansas, 1937. Phoetaliotes nebrascensis (Thomas).

Date	Stage[a]	No. specimens	Grass[b]	Leaf feeding: Av. No.[c] feeding	Leaf feeding: Rating[d]	Leaf feeding: Index	Inflorescence and seed feeding: Av. No.[c] feeding	Inflorescence and seed feeding: Detached or intact[e]	Inflorescence and seed feeding: % None[f]	% Slight	% Medium	% Heavy	Index
Aug. 23-25	6	10	Asm	-	-		0.2	int.	40	30	15	15	0.30
			Bin	*	D	1.0	0.2	det.	20	55	5	20	0.3625
Aug. 23-25	6	10	Age	*	D	1.0	0.3	int.	65	20	5	10	0.175
			Bin	*	D	1.0	0.3	int.	10	50	10	30	0.475
Aug. 23-25	6	10	Asm	-	-		0.1	int.	0	30	20	50	0.675
			Far	*	D	1.0	*	int.	0	0	0	100	1.00
Aug. 25-27	6	10	Asm	-	-		0.2	int.	60	10	10	20	0.3125
			Bcu	*	D	1,0	0.1	int.	85	10	0	5	0.075

(a) Stage of life history: 1 = first instar; 2 = second instar; 3 = third instar; 4 = fourth instar; 5 = fifth instar; 6 = adult.
(b) Table 1 identifies the species of grass by full scientific name.
(c) Leaf feeding: A = no feeding; B = trace to 1/2 of leaf eaten; C = 1/2 or more eaten; D = eaten entirely.
(d) * = plant consumed within 48 hours.
(e) Detached = stalk bearing inflorescensce or seeds severed so that it fell to bottom of cage; intacted = not severed.
(f) None = no damage; slight = slight feeding but no appreciable injury; medium = injured so that reproduction probably no possible; heavy = reproduction destroyed.

Table 10. Summary of leaf feeding of adults of Ageneotettix deorum deorum (Scudder) on eight grass species (see Table 1 for identification of abbreviations).

Base plant		Age	Asm	Bcu	Bin	Far	Par	Ppr	Pvi
Age	(a) 1.0	(2.5)(b)	(2.5) 1.0(c)	(2.5) 1.0	(8) 0.05	(2.5) 1.0	(6) 0.25	(6) 0.25	(6) 0.25
Asm	1.0	(2) 1.0	(2)				(5) 0.007	(2) 1.0	(4) 0.25
Bcu	1.0	(2.5) 1.0		(2.5)	(2.5) 1.0		(6) 0.25	(2.5) 1.0	(5) 0.5
Bin	1.0	(1) 2.0		(3.5) 1.0	(3.5)	(3.5) 1.0	(7) 0.25		(3.5) 1.0
Far	1.0	(2) 1.0			(2) 1.0	(2)			(4) 0.25
Par	1.0	(4) 4.0	(1.5) 133	(4) 4.0	(4) 4.0		(6)	(1.5) 133	
Ppr	1.0	(1) 4.0	(3) 1.0	(3) 1.0			(6) 0.007	(3)	(5) 0.05
Pvi	1.0	(2) 4.0	(2) 4.0	(4.5) 2.0	(6.5) 1.0	(2) 4.0		(4.5) 2.0	(6.5)
Rank (preference)		(2.1)(d) 2	(2.2) 2	(3.3) 4.5	(4.4) 6	(2.5) 2	(6) 8	(3.2) 4.5	(4.8) 7

(a) Leaf feeding index of base plant is assumed to 1.0.
(b) Superscripts (in parentheses) are derived by horizonatal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 11. Summary of inflorescence and seed feeding of adults of Ageneotettix deorum deorum (Scudder) on eight grass species (see Table 1 for identification of abbreviations).

Base plant		Age	Asm	Bcu	Bin	Far	Par	Ppr	Pvi
	(a)	(7)(b)	(3)	(6)	(1)	(4)	(5)	(2)	(8)
Age	1.0		6.7(c)	1.67	14.0	5.0	2.0	8.5	0.56
			(4)	(7)	(2)	(3)	(6)	(1)	(5)
Asm	1.0			0.2	1.25	1.2	0.35	1.9	0.7
		(5)	(2)	(3.5)	(1)		(6)	(3.5)	(7)
Bcu	1.0	0.6	5.0		7.1		0.16	1.0	0.11
		(6)	(3)	(4)	(1.5)	(1.5)	(7)		(5)
Bin	1.0	0.07	0.8	0.14		1.0	0.05		0.13
		(4)	(3)		(1.5)	(1.5)			(5)
Far	1.0	0.2	0.83		1.0				0.1
		(6)	(3)	(2)	(1)		(4)	(5)	
Par	1.0	0.5	2.86	6.17	20.0			0.57	
		(5)	(4)	(2)			(1)	(3)	(6)
Ppr	1.0	0.12	0.5	1.18			1.75		0.02
		(6)	(2)	(4)	(5)	(3)		(1)	(7)
Pvi	1.0	1.77	16.6	9.09	8.0	10.0		46.7	
Rank (preference)		(5.7)(d) 7	(3) 4	(4) 5	(1.8) 1	(2.6) 2.5	(4.8) 6	(2.6) 2.5	(6) 8

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 12. Summary of leaf feeding of nymphs of Melanoplus bivittatus (Say) on ten grass species (see Table 1 for identification of abbreviations).

Base plant		Ael	Asm	Bcu	Bin	Dgl	Eju	Far	Par	Ppr	Pvi
	(a)	(10)(b)	(6.5)	(9)	(2.5)	(6.5)	(6.5)	(2.5)	(2.5)	(2.5)	(6.5)
Ael	1.0		4.0(c)	2.0	133.3	4.0	4.0	133.0	133.0	133.0	4.0
		(7.5)	(4)	(10)	(9)	(2)	(7.5)	(4)	(6)	(1)	(4)
Asm	1.0	0.25		0.03	0.05	2.0	0.25	1.0	0.5	133.0	1.0
		(10)	(4)	(9)	(1.5)	(1.5)	(6)	(6)	(3)	(6)	(8)
Bcu	1.0	0.05	33.0		133.0	133.0	4.0	4.0	66.0	4.0	2.0
		(9.5)	(2.5)	(9.5)	(5)	(5)	(1)	(5)	(2.5)	(8)	(7)
Bin	1.0	0.007	2.0	0.007		1.0	133.0	1.0	2.0	0.03	0.25
		(8.5)	(6)	(10)	(2.5)	(2.5)	(8.5)	(6)	(2.5)	(6)	(2.5)
Dge	1.0	0.25	0.5	0.007	1.0		0.25	0.5	1.0	0.5	1.0
		(7.5)	(1.5)	(7.5)	(10)	(1.5)	(4.5)	(6)	(9)	(4.5)	(3)
Eju	1.0	0.25	4.0	0.25	0.007	4.0		0.5	0.05	1.0	2.0
		(10)	(5.5)	(9)	(5.5)	(1.5)	(1.5)	(5.5)	(5.5)	(5.5)	(5.5)
Far	1.0	0.007	1.0	0.25	1.0	2.0	2.0		1.0	1.0	1.0
		(10)	(2.5)	(9)	(7.5)	(5)	(2.5)	(5)	(5)	(1)	(7.5)
Par	1.0	0.007	2.0	0.015	0.5	1.0	2.0	1.0		4.0	0.5
		(9.5)	(9.5)	(7.5)	(1)	(2)	(4)	(4)	(7.5)	(4)	(6)
Ppr	1.0	0.007	0.007	0.25	33.0	2.0	1.0	1.0	0.25		0.5
		(9)	(5.5)	(10)	(1)	(5.5)	(8)	(5.5)	(2.5)	(2.5)	(5.5)
Pvi	1.0	0.25	1.0	0.05	4.0	1.0	0.5	1.0	2.0	2.0	
Rank (preference)		(9.2)(d) 9.5	(4.9) 6	(9.1) 9.5	(4.6) 3.5	(3.3) 1	(5) 6	(5) 6	(4.6) 3.5	(4.1) 2	(5.6) 8

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 13. Summary of leaf feeding of adults of Melanoplus bivittatus (Say) on six grass species (see Table 1 for identification of abbreviations).

Base plant		Age	Bcu	Bin	Far	Ppr	Pvi
Age	(a) 1.0	(4)(b)	(4) 1.0(c)	(1) 4.0	(4) 1.0		(2) 2.0
Bcu	1.0	(5.5) 1.0	(5.5)	(2.5) 133.0	(2.5) 133.0	(2.5) 133.0	(2.5) 133.0
Bin	1.0	(4.5) 0.25	(6) 0.007	(2)	(2) 1.0	(2) 1.0	(4.5) 0.25
Far	1.0	(2.5) 1.0	(2.5) 1.0	(2.5) 1.0	(2.5)		(5) 0.5
Ppr	1.0		(4) 0.007	(2) 1.0		(2)	(2) 1.0
Pvi	1.0	(5) 0.5	(6) 0.007	(1) 4.0	(2) 2.0	(3.5) 1.0	(3.5)
Rank (preference)		(4.3)(d) 5.5	(4.7) 5.5	(2) 1	(2.6) 2.5	(2.5) 2.5	(3.3) 4

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 14. Summary of inflorescence and seed feeding of nymphs of Melanoplus bivittatus (Say) on ten grass species (see Table 1 for identification of abbreviations).

Base plant		Acl	Asm	Bcu	Bin	Dgl	Eju	Far	Par	Ppr	Pvi
	(a)	(8)(b)	(8)	(10)	(2)	(6)	(1)	(4)	(5)	(8)	(3)
Ael	1.0		1.0(c)	0.19	71.67	8.3	100.0	39.0	18.33	1.0	55.0
		(7.5)	(7.5)	(9)	(1)	(5.5)	(4)	(10)	(2)	(5.5)	(3)
Asm	1.0	1.0		0.65	47.67	1.67	2.0	0.41	16.5	1.67	2.3
		(5)	(7)	(8)	(2)	(6)	(1)	(9)	(3)	(10)	(4)
Bcu	1.0	5.2	1.55		48.2	1.8	72.0	0.3	11.0	0.03	9.5
		(9)	(7)	(8)	(1)	(4)	(2)	(10)	(3)	(6)	(5)
Bin	1.0	0.014	0.021	0.02		0.24	0.36	0.012	0.34	0.028	0.09
		(9)	(7)	(8)		(3.5)	(1)	(6)	(5)	(3.5)	(2)
Dgl	1.0	0.12	0.6	0.55			63.6	0.75	0.76	1.0	1.44
		(8)	(3)	(7)	(1)	(6)	(2)	(10)	(4)	(9)	(5)
Eju	1.0	0.01	0.5	0.014	2.8	0.016		0.008	0.38	0.009	0.023
		(10)	(5)	(4)	(2)	(7)	(1)	(8.5)	(3)	(8.5)	(6)
Far	1.0	0.026	2.47	3.33	83.0	1.33	133.3		43.5	1.0	2.03
		(9)	(7)	(6)	(1)	(4)	(2)	(10)	(5)	(8)	(3)
Par	1.0	0.055	0.06	0.09	2.92	1.3	2.6	0.023		0.057	1.89
		(7.5)	(10)	(4)	(3)	(7.5)	(1)	(7.5)	(5)	(7.5)	(2)
Ppr	1.0	1.0	0.06	32.0	36.0	1.0	110.0		17.67		46.67
		(10)	(7)	(9)	(2)	(4)	(1)	(6)	(5)	(8)	(3)
Pvi	1.0	0.018	0.43	0.105	10.6	0.69	44.4	0.48	0.528	0.214	
Rank (preference)		(8.3)(d) 10	(6.9) 6	(7.3) 7.5	(1.6) 1.5	(5.4) 5	(1.6) 1.5	(8.1) 9	(4) 4	(7.4) 7.5	(3.6) 3

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 15. Summary of inflorescence and seed feeding of adults of Melanoplus bivittatus (Say) on eight grass species (see Table 1 for identification of abbreviations).

Base plant		Age	Asm	Bcu	Bin	Far	Par	Ppr	Pvi
Age	(a) 1.0	(5.5)(b)	(2) 8.18(c)	(7) 0.02	(4) 2.77	(1) 11.4	(5.5) 1.0		(3) 4.43
Asm	1.0	(5) 0.12	(3)	(6) 0.01	(4) 0.24	(2) 1.73			(1) 40.0
Bcu	1.0	(5) 50.0	(4) 70.0	(7)	(3) 100.0	(1.5) 133.3		(1.5) 133.3	(6) 33.3
Bin	1.0	(5) 0.36	(3) 4.15	(6) 0.01	(4)	(1) 133.3			(2) 6.67
Far	1.0	(4) 0.076	(2) 0.59	(5.5) 0.0	(5.5) 0.0	(1)			(3) 0.08
Par	1.0	(2) 1.0					(2)		(1) 106.7
Ppr	1.0			(3) 0.013	(4) 0.0			(1)	(2) 0.4
Pvi	1.0	(4) 0.226	(7) 0.025	(6) 0.03	(5) 0.15	(1) 12.5	(8) 0.009	(2) 2.5	(3)
Rank (preference)		(4.4)(d) 6	(3.5) 4	(5.8) 8	(4.2) 5	(1.2) 1	(5.2) 7	(1.5) 2	(2.6) 3

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 16. Summary of leaf feeding of nymphs of Melanoplus differentialis (Thomas) on ten grass species (see Table 1 for identification of abbreviations).

Base plant		Ael	Asm	Bcu	Bin	Dgl	Eju	Far	Par	Ppr	Pvi
Ael	(a) 1.0	(9)(b)	(1.5) 133.0(c)	(10) 0.03	(4,5) 4.0	(4.5) 4.0	(1.5) 133.0	(7.5) 1.0	(7.5) 1.0	(6) 2.0	(3) 33.0
Asm	1.0	(10) 0.007	(6)	(9) 0.25	(2.5) 4.0	(6) 1.0	(2.5) 4.0	(1) 133.0	(6) 1.0	(6) 1.0	(6) 1.0
Bcu	1.0	(5) 33.0	(7) 4.0	(9)	(7) 4.0	(2.5) 133.0	(7) 4.0	(2.5) 133.0	(2.5) 133.0	(2.5) 133.0	(10) 0.25
Bin	1.0	(8) 0.25	(8) 0.25	(8) 0.25	(3.5)	(1) 2.0	(3.5) 1.0	(3.5) 1.0	(8) 0.25	(3.5) 1.0	(8) 0.25
Dgl	1.0	(6.5) 0.25	(3) 1.0	(9) 0.007	(5) 0.5	(3)	(6.5) 0.25	(1) 133.0	(8) 0.05	(3) 1.0	
Eju	1.0	(9) 0.007	(7.5) 0.25	(7.5) 0.25	(3.5) 1.0	(1) 4.0	(3.5)	(3.5) 1.0	(3.5) 1.0		(6) 0.5
Far	1.0	(3.5) 1.0	(9) 0.007	(9) 0.007	(3.5) 1.0	(9) 0.007	(3.5) 1.0	(3.5)	(3.5) 1.0	(3.5) 1.0	(7) 0.5
Par	1.0	(6) 1.0	(6) 1.0	(9) 0.007	(1) 4.0	(2.5) 2.0		(6) 1.0	(6)	(6) 1.0	(2.5) 2.0
Ppr	1.0	(8) 0.5	(4) 1.0	(9.5) 0.007	(4) 1.0	(4) 1.0	(4) 1.0	(4) 1.0	(4) 1.0	(4)	(9.5) 0.007
Pvi	1.0	(9) 0.03	(7.5) 1.0	(3.5) 4.0	(3.5) 4.0		(5.5) 2.0	(5.5) 2.0	(2) 33.0	(1) 133.0	(7.5)
Rank (preference)		9 (7.4)(d)	7 (5.9)	10 (8.4)	3 (3.8)	3 (3.7)	3 (4.1)	3 (3.8)	6 (5.1)	3 (4)	8 (6.6)

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 17. Summary of leaf feeding of adults of Melanoplus differentialis (Thomas) on seven grass species (see Table 1 for identification of abbreviations).

Base plant		Age	Asm	Bcu	Bin	Far	Par	Pvi
Age	1.0 (a)	(4)(b)	(4) 1.0(c)	(6) 0.25	(2) 2.0	(1) 133.3		(4) 1.0
Asm	1.0	(3) 1.0	(3)	(7) 0.25	(3) 1.0	(3) 1.0	(6) 0.5	(3) 1.0
Bcu	1.0	(3) 4.0	(3) 4.0	(5.5)	(1) 133.0		(5.5) 1.0	(3) 4.0
Bin	1.0	(5) 0.5	(2.5) 1.0	(6) 0.007	(2.5)	(2.5) 1.0		(2.5) 1.0
Far	1.0	(6) 0.007	(2.5) 1.0		(2.5) 1.0	(2.5)	(2.5) 1.0	(5) 0.25
Par	1.0		(1) 2.0	(3.5) 1.0		(3.5) 1.0	(3.5)	(3.5) 1.0
Pvi	1.0	(4) 1.0	(4) 1.0	(7) 0.25	(4) 1.0	(1) 4.0	(4) 1.0	(4)
Rank (preference)		(4.1)(d) 5.5	(3) 3	(6) 7	(2.5) 1.5	(2.3) 1.5	(4.4) 5.5	(3.4) 4

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 18. Summary of inflorescence and seed feeding of nymphs of Melanoplus differentialis (Thomas) on ten grass species (see Table 1 for identification of abbreviations).

Base plant		Ael	Asm	Bcu	Bin	Dgl	Eju	Far	Par	Ppr	Pvi
	(a)	(10)(b)	(6)	(7.5)	(5)	(2)	(1)	(3)	(4)	(9)	(7.5)
Ael	1.0		26.7(c)	13.3	27.0	36.6	120.0	36.0	32.0	9.33	13.3
		(10)	(4)	(8)	(1)	(3)	(2)	(7)	(6)	(9)	(5)
Asm	1.0	0.0		0.05	60.3	3.1	60.0	0.5	0.58	0.035	0.7
		(8)			(2)	(7)	(1)	(6)	(4)	(5)	(3)
Bcu	1.0	0.075			27.6	0.25	40.0	0.3	1.88	0.5	6.67
		(7)	(9)	(6)	(1)	(8)	(2)	(4)	(3)	(10)	(5)
Bin	1.0	0.04	0.017	0.04		0.017	0.74	0.59	0.67	0.01	0.53
		(9)	(7)	(3)	(1)	(4.5)	(2)	(4.5)	(6)	(8)	
Dgl	1.0	0.028	0.32	4.0	58.7		20.0	1.0	0.42	0.13	
		(9.5)	(7)	(6)	(1)	(5)	(2)	(9.5)	(4)	(8)	(3)
Eju	1.0	0.0	0.017	0.025	1.35	0.05		0.0	0.32	0.012	0.97
		(10)	(4)	(3)	(5)	(7.5)	(1)	(7.5)	(2)	(6)	(9)
Far	1.0	0.03	2.0	3.3	1.68	1.0	133.3		5.4	1.66	0.12
		(10)	(3)	(7)	(4)	(2)	(1)	(9)	(6)	(8)	(5)
Par	1.0	0.03	1.73	0.53	1.49	2.4	3.2	0.18		0.191	1.33
		(10)	(3)	(7)	(2)	(4)	(1)	(9)	(6)	(8)	(6)
Ppr	1.0	0.107	28.0	2.0	75.3	8.0	86.7	0.6	5.4		2.8
		(9)	(3)	(8)	(2)		(4)	(1)	(6)	(7)	(5)
Pvi	1.0	0.075	1.43	0.15	1.87		1.03	8.4	0.75	0.36	
Rank (preference)		10(9.3)(d)	5(5.2)	7.5(6.2)	2(2.4)	5(5.1)	1(1.7)	7.5(6.1)	3 (4.6)	9(8.5)	5 (5.4)

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(e) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 19. Summary of inflorescence and seed feeding in adults of Melanóplua differentialis (Thomas) on seven grass species (see Table 1 for identification of abbreviations).

Base plant		Age	Asm	Bcu	Bin	Far	Par	Pvi
Age	1.0 (a)	(4.5)(b)	(4.5) 1.0(c)	(6) 0.6	(1.5) 133.3	(1.5) 133.3		(3) 1.53
Asm	1.0	(2.5) 1.0	(2.5)				(4) 0.0	
Bcu	1.0	(6) 1.67	(3) 20.0	(7)	(4) 8.89		(5) 3.08	(2) 80.0
Bin	1.0	(5) 0.0		(4) 0.11		(2) 1.0		(2) 1.0
Far	1.0	(5) 0.0	(2.5) 0.6			(1)	(4) 0.17	(2.5) 0.6
Par	1.0		(2) 33.3	(5) 0.023		(3) 5.7	(4)	(1) 133.3
Pvi	1.0	(5) 0.65	(4) 0.9	(6) 0.015	(2.5) 1.0	(1) 1.67	(7) 0.007	(2.5)
Rank (preference)		(4.7)(d) 5.5	(3) 4	(6) 7	(2.5) 2.5	(1.7) 1	(4.8) 5.5	(2.2) 2.5

(a) Inflorescence-seed feeding index of base plant is assumbed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 20. Summary of leaf feeding of nymphs of Melanoplus femurrubrum-femurrubrum (DeGeer) on ten grass species (see Table 1 for identification of abbreviations).

Base plant		Ael	Asm	Bcu	Bin	Dgl	Eju	Far	Par	Ppr	Pvi
Ael	(a) 1.0	(6)(b)	(6) 6.0(c)	(6) 6.0	(2.5) 33.0	(6) 1.0	(2.5) 33.0		(6) 1.0	(1) 133.0	(9) 0.05
Asm	1.0	(6) 1.0	(6)	(10) 0.007	(2.5) 66.0	(2.5) 66.0	(4) 4.0	(8.5) 0.03	(6) 1.0	(1) 133.0	(8.5) 0.03
Bcu	1.0	(8.5) 1.0	(2) 133.0	(8.5)	(7) 4.0	(4) 66.0	(2) 133.0		(5.5) 33.0	(2) 133.0	(5.5) 33.0
Bin	1.0	(8) 0.03	(9.5) 0.015	(4.5) 0.25	(2)	(2) 1.0	(6.5) 0.05	(4.5) 0.25	(6.5) 0.05	(2) 1.0	(9.5) 0.015
Dgl	1.0	(3.5) 1.0	(8) 0.015	(8) 0.015	(3.5) 1.0	(3.5)	(3.5) 1.0	(6) 0.25	(8) 0.015	(1) 4.0	(10) 0.0075
Eju	1.0	(7.5) 0.03	(6) 0.25	(9.5) 0.007	(3) 2.0	(4.5) 1.0	(4.5)	(1.5) 4.0	(7.5) 0.03	(1.5) 4.0	(9.5) 0.007
Far	1.0		(1) 33.0		(4.5) 0.03	(4.5) 0.03	(3) 0.25	(2)	(6) 0.015		
Par	1.0	(7.5) 1.0	(7.5) 1.0	(10) 0.03	(5) 2.0	(2) 66.0	(4) 33.0	(2) 66.0	(7.5)	(2) 66.0	(7.5) 1.0
Ppr	1.0	(5.5) 0.015	(8) 0.007	(8) 0.007	(1.5) 1.0	(3.5) 0.25	(3.5) 0.25		(5.5) 0.015	(1.5)	(8) 0.007
Pvi	1.0	(7) 2.0	(6) 33.0	(10) 0.03	(4.5) 66.0	(2) 133.0	(2) 133.0	(4.5) 66.0	(8.5) 1.0	(2) 133.0	(8.5)
Rank (Preference)		(6.6)(d) 7.5	(6) 6	(8.3) 9.5	(3.6) 3	(3.5) 3	(3.5) 3	(4) 5	(6.7) 7.5	(1.5) 1	(8.4) 9.5

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 21. Summary of leaf feeding of adults of Melanoplus femurrubrum-femurrubrum (DeGeer) on five grass species (see Table 1 for identification of abbreviations).

Base plant		Age	Bcu	Bin	Far	Pvi
Age	1.0 (a)	(3.5)(b)	(5)	(3.5)	(1.5)	(1.5)
			0.25(c)	1.0	2.0	2.0
Bcu	1.0	(2)	(5)	(3.5)	(1)	(3.5)
		4.0		2.0	133.0	2.0
Bin	1.0	(2)	(4.5)	(2)	(2)	(4.5)
		1.0	0.5		1.0	0.5
Far	1.0	(3.5)	(5)	(1.5)	(1.5)	(3.5)
		0.5	0.007	1.0		0.5
Pvi	1.0	(5)	(4)	(1.5)	(1.5)	(3)
		0.05	0.5	2.0	2.0	
Rank (preference)		(3.2) 3.5	(4.7) 5	(2.4) 2	(1.5) 1	(3.2) 3.5

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 22. Summary of inflorescence and seed feeding of nymphs of Melanoplus femurrubrum-femurrubrum (DeGeer) on ten grass species (See Table 1 for identification of abbreviations).

Base plant		Ael	Asm	Bcu	Bin	Dgl	Eju	Far	Par	Ppr	Pvi
	(a)	(8.5)(b)	(2)	(5)	(4)	(7)	(1)		(3)	(6)	(8.5)
Ael	1.0		15.0(c)	3.33	13.0	1.67	133.3		13.33	2.67	1.0
		(9)	(6.5)	(6.5)	(1)		(2)	(3)	(4)	(6.5)	(6.5)
Asm	1.0	0.07		1.0	12.0		2.1	1.33	1.9	1.0	1.0
		(7)	(4.5)	(4.5)	(3)	(8)	(2)	(1)		(6)	(9)
Bcu	1.0	0.3	1.0		6.3	0.2	41.7	50.0		0.4	0.15
		(10)	(8)	(4)	(1.5)	(7)	(3)	(1.5)	(5)	(6)	(9)
Bin	1.0	0.077	0.08	0.16		0.09	0.47	1.0	0.11	0.1	0.078
		(8.5)		(3)	(2)	(6.5)	(1)	(4)	(5)	(6.5)	(8.5)
Dgl	1.0	0.6		5.0	11.3		37.5	4.8	3.0	1.0	0.6
		(10)	(4)	(8)	(1)	(6)	(3)	(2)	(5)	(7)	(9)
Eju	1.0	0.0	0.48	0.024	2.1	0.027		1.52	0.07	0.026	0.01
			(4)		(1.5)	(6)	(5)	(1.5)	(3)		(7)
Far	1.0		0.75		1.0	1.67	0.66		0.8		0.06
		(10)	(7)	(3)	(2)	(9)	(1)	(5)	(6)	(4)	(8)
Par	1.0	0.075	0.54	5.0	9.0	0.33	14.5	1.25		1.5	0.4
		(8)	(5)	(3)	(2)	(5)	(1)		(7)	(5)	(9)
Ppr	1.0	0.6	1.0	2.5	10.0	1.0	38.7		0.67		0.2
		(9)	(9)	(4)	(2)	(7)	(1)	(3)	(6)	(5)	(9)
Pvi	1.0	1.0	1.0	6.67	36.25	1.67	100.0	18.33	2.5	5.0	
Rank (preference)		(9)(d) 10	(5.5) 6	(4.5) 4	(2) 1.5	(6.8) 7	(2) 1.5	(2.6) 3	(5) 5	(7) 8	(7.4) 9

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 23. Summary of inflorescence and seed feeding of adults of Melanoplus femurrubrum-femurrubrum (DeGeer) on six grass species (see Table 1 for identification of abbreviations).

Base plant		Age	Asm	Bcu	Bin	Far	Pvi
Age	1.0 (a)	(4)(b)	(3) 2.17(c)	(6) 0.8	(1) 106.7	(2) 20.0	(5) 0.96
Asm	1.0	(5) 0.45	(4)	(6) o.15	(2) 0.14	(1) 4.44	(3) 1.2
Bcu	1.0	(4) 1.25	(2) 6.5	(4)	(3) 6.44	(1) 10.0	
Bin	1.0	(6) 0.01	(2) 7.0	(5) 0.16	(4)	(1) 9.5	(3) 5.33
Far	1.0	(6) 0.05	(2) 0.23	(4) 0.1	(3) 0.11	(1)	(5) 0.1
Pvi	1.0	(2) 1.04	(5) 0.83	(3.5) 1.0	(6) 0.19	(1) 10.0	(3.5)
Rank (preference)		(4.5)(d) 5	(3) 2	(4.8) 6	(3.1) 3	(1.1) 1	(4) 4

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 24. Summary of leaf feeding of nymphs of Melanoplus keeleri luridus (Dodge) on eight grass species (see Table 1 for identification of abbreviations).

Base plant		Age	Asm	Bcu	Bin	Far	Par	Ppr	Pvi
	(a)	(6.5)(b)	(3.5)	(8)	(5)	(3.5)	(6.5)	(2)	(1)
Age	1.0		4.0(c)	0.03	2.0	4.0	1.0	33.0	66.0
		(3.5)	(2)		(1)				(3.5)
Asm	1.0	0.25			4.0				0.25
		(3)		(5)	(1)		(6)	(3)	(3)
Bcu	1.0	33.0			133.0		0.03	33.0	33.0
		(4)	(5)	(6)	(3)	(1.5)		(1.5)	
Bin	1.0	0.5	0.25	0.007		4.0		4.0	
		(3)			(3)	(1)	(5)		(3)
Far	1.0	0.25			0.25		0.007		0.25
		(4.5)		(2.5)		(1)	(4.5)		(2.5)
Par	1.0	1.0		33.0		133.0			33.0
		(4)		(4)	(2)			(1)	(4)
Ppr	1.0	0.03		0.03	0.25				0.03
		(6)	(2.5)	(4.5)		(2.5)	(4.5)	(1)	
Pvi	1.0	0.015	4.0	0.03		4.0	0.03	33	
		(4.4)(d)	(3.2)	(5)	(2.5)	2	(5.3)	(1.7)	(3)
Rank (preference)		6	4	7.5	2	1	7.5	4	4

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 25. Summary of inflorescence and seed feeding of nymphs of Melanoplus keeleri luridus (Dodge) on nine grass species (see Table 1 for identification of abbreviations).

Base plant		Ael	Age	Asm	Bcu	Bin	Far	Par	Ppr	Pvi
Ael	(a) 1.0	(1)(b)		(3) 0.05(c)	(2) 0.053					
Age	1.0		(5)	(5) 1.0	(5) 1.0	(8) 0.6	(1) 58.7	(1) 0.8	(3) 9.3	(2) 15.0
Asm	1.0	(1) 20.0	(4.5) 1.0	(4.5)		(6) 0.8	(3) 1.67			(2) 6.67
Bcu	1.0	(2) 18.7	(5.5) 1.0		(5.5)	(5.5) 1.0		(3) 2.86	(1) 24.0	(5.5) 1.0
Bin	1.0		(3) 1.67	(4) 1.13	(5.5) 1.0	(5.5)	(1) 11.3		(2) 7.33	
Far	1.0		(5) 0.01	(3) 0.07		(2) 0.09	(1)	(4) 0.03		(6) 0.013
Par	1.0		(3) 1.25		(5) 0.35		(1) 38.33	(4)		(2) 6.67
Ppr	1.0		(4) 0.11		(5) 0.04	(2) 0.14			(1)	(2) 0.33
Pvi	1.0		(7) 0.07	(5.5) 0.15	(3.5) 1.0		(1) 80.0	(5.5) 0.15	(2) 3.0	(3.5)
Rank (preference)		(1.3)(d) 2	(4.6) 3	(4.1) 5	(4.5) 6	(5) 9	(1.3) 1	(4.8) 7	(1.8) 3	(3.3) 4

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 26. Summary of leaf feeding of nymphs of Melanoplus sanguinipes (Fabricius) on nine grass species (see Table 1 for identification of abbreviations).

Base plant		Ael	Asm	Bcu	Bin	Dgl	Eju	Far	Par	Ppr
Ael	(a) 1.0	(4.5)(b)			(1) 4.0(c)	(2.5) 2.0	(2.5) 2.0		(4.5) 1.0	
Asm	1.0		(3.5)		(3.5) 1.0	(3.5) 1.0	(3.5) 1.0		(3.5) 1.0	(3.50 1.0
Bcu	1.0			(6)	(2.5) 4.0	(2.5) 4.0	(5) 2.0		(2.5) 4.0	(2.5) 4.0
Bin	1.0	(8) 0.25	(3.5) 1.0	(8) 0.25	(3.5)	(3.5) 1.0	(3.5) 1.0	(3.5) 1.0	(8) 0.25	(3.5) 1.0
Dgl	1.0	(7) 0.5	(3.5)	(8) 0.25	(3.5) 1.0		(3.5) 1.0	(3.5) 1.0	(3.5) 1.0	(3.5) 1.0
Eju	1.0	(8.5) 0.5	(4) 1.0	(8.5) 0.5	(4) 1.0	(4) 1.0	(4)	(4) 1.0	(4) 1.0	(4) 1.0
Far	1.0				(3) 1.0	(3) 1.0	(3) 1.0	(3)	(6) 0.25	(3) 1.0
Par	1.0	(6) 1.0	(6) 1.0	(9) 0.25	(2) 4.0	(6) 1.0	(6) 1.0	(2) 4.0	(6)	(2) 4.0
Ppr	1.0		(3.5) 1.0	(7.5) 0.25	(3.5) 1.0	(3.5) 1.0	(3.5) 1.0	(3.5) 1.0	(7.5) 0.25	
Rank (preference)		(6.8)(d) 8	(4) 5.5	(9.5) 9	(3) 2.5	(3.5) 2.5	(4) 5.5	(3.2) 2.5	(5) 7	(3) 2.5

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 27. Summary of leaf feeding of adults of Melanoplus sanguinipes (Fabricius) on ten grass species (see Table 1 for identification of abbreviations).

Base plant	Ael	Age	Asm	Bcu	Bin	Eju	Far	Par	Ppr	Pvi
Ael 1.0	(a) (5)(b) 2.0		(2.5) 2.0	(5) 1.0	(1) 4.0	(2.5) 2.0			(5) 1.0	(7) 0.25
Age 1.0		(4)		(5) 0.007	(3) 1.0		(3) 1.0			(1) 4.0
Asm 1.0	(5.5) 0.5		(2.5)	(7) 0.25	(2.5) 1.0			(2.5) 1.0	(5.5) 0.5	(2.5) 1.0
Bcu 1.0	(7) 1.0	(1.5) 133.0	(3.5) 4.0	(7)	(3.5) 4.0	(5) 2.0	(1.5) 133.0			(7) 1.0
Bin 1.0	(7.5) 0.25	(2.5) 1.0	(2.5) 1.0	(7.5) 0.25	(2.5)		(2.5) 1.0		(5.5) 0.5	(5.5) 0.5
Eju 1.0	(3.5) 0.5			(3.5) 0.5		(1.5)				(1.5) 1.0
Far 1.0		(2) 1.0		(5) 0.007	(2) 1.0		(2)			(4) 0.25
Par 1.0			(2.5) 1.0					(2.5)	(2.5) 1.0	(2.5) 1.0
Ppr 1.0	(4) 1.0		(1.5) 2.0		(1.5) 2.0			(4) 1.0	(4)	
Pvi 1.0	(1.5) 4.0	(9) 0.25	(6) 1.0	(6) 1.0	(3) 2.0	(6) 1.0	(1.5) 4.0	(6) 1.0		(6)
Rank (preference)	(6)(d) 9.5	(3.8) 5.5	(3) 3	(6) 9.5	(2.2) 1.5	(4) 5.5	(2) 1.5	(4) 5.5	(4.5) 8	(4) 5.5

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 28. Summary of inflorescence and seed feeding of nymphs of Melanoplus sanguinipes (Fabricius) on ten grass species (see Table 1 for identification of abbreviations).

Base plant		Ael	Asm	Bcu	Bin	Dgl	Eju	Far	Par	Ppr	Pvi
Ael	(a) 1.0	(4.5)(b)			(2) 50.0(c)	(6) 0.6	(1) 68.3		(3) 6.9		(4.5) 1.0
Asm	1.0		(4)		(2) 3.33	(5) 0.02	(1) 4.4		(3) 3.2	(6) 0.01	
Bcu	1.0			(5)	(2) 26.0	(6) 0.27	(1) 133.3		(4) 3.5	(3) 10.0	
Bin	1.0	(8) 0.02	(3) 0.3	(6) 0.038	(1)	(7) 0.032	(2) 0.43		(4) 0.2	(5) 0.08	
Dgl	1.0	(6) 1.67	(1) 43.3	(4) 3.6	(2) 30.8	(7)	(3) 6.15	(8) 0.24	(5) 2.29	(9) 0.08	
Eju	1.0		(4) 0.225	(8) 0.0	(1) 2.33	(5) 0.16	(2.5)	(6) 0.1	(2.5) 1.0	(7) 0.03	
Far	1.0				(2) 4.88	(3) 4.11	(1) 10.0	(5)	(4) 1.19	(6) 0.01	
Par	1.0	(9) 0.15	(7) 0.31	(8) 0.29	(1) 4.21	(6) 0.44	(2.5) 1.0	(4) 0.84	(2.5)	(5) 0.8	
Ppr	1.0		(1) 86.7	(9) 0.1	(4) 12.0	(5) 11.7	(3) 28.6	(2) 76.3	(6) 1.25	(7)	(8) 0.12
Pvi	1.0	(4.5) 1.0			(2) 10.7	(6) 0.75	(1) 20.0			(3) 8.4	(4.5)
Rank (preference)		(6.4)(d) 9	(3.3) 3	(6.6) 10	(1.9) 2	(5.1) 6	(1.8) 1	(5) 5	(4) 4	(5.6) 7	(6) 8

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 29. Summary of inflorescence and seed feeding of adults of Melanoplus sanguinipes (Fabricius) on ten grass species (see Table 1 for identification of abbreviations).

Base plant	Ael	Age	Asm	Bcu	Bin	Eju	Far	Par	Ppr	Pvi
Ael (a) 1.0	(2)(b)		(4) 0.2(c)	(3) 0.17					(1) 80.0	
Age 1.0		(4.5)		(4.5) 1.0	(2) 32.0		(1) 83.3			(3) 16.4
Asm 1.0	(3) 1.67		(7)	(4) 1.57	(1) 3.08			(5) 1.43	(2) 2.75	(6) 1.3
Bcu 1.0	(5) 6.0	(6.5) 1.0	(8) 0.64	(6.5)	(3) 32.0	(1) 80.0	(2) 73.3			(4) 17.5
Bin 1.0		(6.5) 0.03	(4) 0.32	(6.5) 0.03	(3)		(2) 1.4		(1) 1.87	(5) 0.09
Eju 1.0	(3) 0.015			(4) 0.01		(1)				(2) 0.12
Far 1.0		(5) 0.012		(4) 0.014	(2) 0.68		(1)			(3) 0.5
Par 1.0			(3) 0.7					(2)	(1) 7.2	(4) 0.25
Ppr 1.0	(5) 0.012		(3) 0.36		(2) 0.53			(4) 0.14	(1)	
Pvi 1.0		(7) 0.06	(6) 0.47	(8) 0.057	(1) 8.33	(2.5) 4.0	(4) 2.0	(2.5) 4.0		(5)
Rank (preference)	(3.6)(d) 6	(5.9) 10	(5) 8.5	(5) 8.5	(2) 3.5	(1.1) 1	(2) 3.5	(3.3) 5	(1.3) 2	(4) 7

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 30. Summary of leaf feeding of nymphs of Orphulella speciosa (Scudder) on ten grass species (see Table 1 for identification of abbreviations).

Base plant		Ael	Asm	Bcu	Bin	Dgl	Eju	Far	Par	Ppr	Pvi
Ael	(a) 1.0	(5)(b)	(9) 0.03(c)	(5) 1.0	(5) 1.0	(2) 4.0	(2) 4.0		(8) 0.05	(2) 4.0	(7) 0.25
Asm	1.0	(4.5) 33.0	(7.5)	(1) 133.0	(6) 4.0	(2.5) 66.0	(4.5) 33.0	(9) 0.5	(7.5) 1.0		(2.5) 66.0
Bcu	1.0	(5) 1.0	(9) 0.007	(5)	(5) 1.0	(5) 1.0	(5) 1.0		(1) 4.0	(2) 2.0	(8) 0.5
Bin	1.0	(6) 1.0	(10) 0.25	(6) 1.0	(6)	(1.5) 2.0	(6) 1.0	(6) 1.0	(6) 1.0	(1.5) 2.0	(6) 1.0
Dgl	1.0		(9) 0.015	(3) 1.0	(5) 0.5	(3)	(3) 1.0	(6.5) 0.25	(1) 4.0	(8) 0.05	(6.5) 0.25
Eju	1.0		(9) 0.03	(2.5) 1.0	(2.5) 1.0	(2.5) 1.0	(2.5)	(7.5) 0.05	(7.5) 0.05	(5.5) 0.5	(5.5) 0.5
Far	1.0		(2.5) 2.0		(5.5) 1.0	(1) 4.0	(2.5) 2.0	(5.5)	(8) 0.03	(5.5) 1.0	(5.5) 1.0
Par	1.0	(3) 2.0	(7) 1.0	(10) 0.25	(7) 1.0	(7) 1.0	(3) 2.0	(1) 33.0	(7)	(7) 1.0	(3) 2.0
Ppr	1.0	(7) 0.25		(6) 0.5	(8) 0.05	(1.5) 2.0	(1.5) 2.0		(4) 1.0	(4)	(4) 1.0
Pvi	1.0	(1.5) 4.0	(10) 0.015	(3.5) 2.0	(6.5) 1.0	(1.5) 4.0	(3.5) 2.0	(6.5) 1.0	(9) 0.05	(6.5) 1.0	(6.5)
Rank (preference)		4(4.5)(d)	10(8)	4(4.7)	6.5(5.7)	1(2.7)	2(3.4)	8.5(6)	8.5(6)	4(4.7)	6.5(5.5)

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 31. Summary of leaf feeding of adults of Orphulella speciosa (Scudder) on eight grass species (see Table 1 for identification of abbreviations).

Base plant	Age	Asm	Bcu	Bin	Far	Par	Ppr	Pvi
	(a)	(2.5)(b)	(6.5)	(2.5)	(2.5)	(2.5)	(6.5)	(6.5)	(6.5)
Age	1.0		0.007(c)	1.0	1.0	1.0	0.007	0.007	0.007
		(1)	(4.5)	(2)	(4.5)		(7)	(4.5)	(4.5)
Asm	1.0	133.0		4.0	1.0		0.05	1.0	1.0
		(4)	(7)		(4)	(4)	(8)	(1)	(4)
Bcu	1.0	1.0	0.25		1.0	1.0	0.05	4.0	1.0
		(3.5)	(3.5)	(3.5)	(3.5)	(3.5)	(8)	(3.5)	(7)
Bin	1.0	1.0	1.0	1.0		1.0	0.25	1.0	0.5
		(3)		(3)	(3)	(3)	(6.5)	(6.5)	(3)
Far	1.0	1.0		1.0	1.0		0.007	0.007	1.0
		(1.5)	(4.5)	(4.5)	(3)	(1.5)	(6.5)	(6.5)	(8)
Par	1.0	133.0	2.0	2.0	4.0	133.0		1.0	0.5
		(1.5)	(5)	(8)	(5)	(1.5)	(5)	(5)	(5)
Ppr	1.0	133.0	1.0	0.25	1.0	133.0	1.0		1.0
		(1)	(6)	(6)	(2.5)	(6)	(2.5)	(6)	(6)
Pvi	1.0	133.0	1.0	1.0	2.0	1.0	2.0	1.0	
Rank (preference)		(2.2)(d) 1	(5.3) 6.5	(4.2) 4	(3.5) 2.5	(3.1) 2.5	(6.2) 8	(5) 5	(5.5) 6.5

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 32. Summary of inflorescence and seed feeding of nymphs of Orphulella speciosa (Scudder) on ten grass species (see Table 1 for identification of abbreviations)

Base plant	Ael	Asm	Bcu	Bin	Dgl	Eju	Far	Par	Ppr	Pvi
Ael (a) 1.0	(8.5)(b)	(8.5) 1.0(c)	(7) 1.67	(6) 4.66	(5) 10	(1) 59		(2) 31.67	(3) 16.67	(4) 12.0
Asm 1.0	(8.5) 1.0	(8.5)	(5) 3.4	(7) 1.67	(3) 10.25	(4) 8.0	(1) 30.0	(2) 11.6		(6) 3.33
Bcu 1.0	(7) 0.6	(9) 0.3	(5)	(6) 0.8	(2) 10.0	(3) 3.0		(1) 16.0	(4) 2.0	(8) 0.44
Bin 1.0	(10) 0.21	(7.5) 0.6	(4) 1.2	(6)	(3) 1.8	(1) 1.92	(5) 1.07	(2) 1.88	(7.5) 0.6	(9) 0.26
Dgl 1.0	(8.5) 0.1	(10) 0.098	(8.5) 0.1	(6) 0.53	(2)	(1) 8.0	(3) 0.83	(4) 0.64	(5) 0.6	(7) 0.2
Eju 1.0	(10) 0.017	(7) 0.13	(4) 0.33	(3) 0.52	(7) 0.13	(1.5)	(1.5) 1.0	(5) 0.27	(7) 0.13	(9) 0.02
Far 1.0	(7) 0.035	(8) 0.033		(5) 0.94	(2) 1.2	(3.5) 1.0	(3.5)	(1) 20.0	(6) 0.75	(9) 0.012
Par 1.0	(10) 0.032	(5) 0.086	(6) 0.06	(4) 0.53	(2) 1.57	(1) 3.75	(7) 0.05	(3)	(8.5) 0.03	(8.5) 0.03
Ppr 1.0	(9) 0.06		(7) 0.5	(3.5) 1.67	(3.5) 1.67	(2) 8.0	(5) 1.3	(1) 30.7	(6)	(8) 0.25
Pvi 1.0	(10) 0.08	(9) 0.3	(7) 2.25	(6) 3.8	(4) 5.0	(1) 85	(2) 66.7	(3) 30.0	(5) 4.0	
Rank (preference)	10 (10.2)(d)	8 (7.4)	7 (6)	5 (5.3)	3 (3.3)	1 (1.9)	4 (3.5)	2 (2.4)	6 (5.8)	9 (7.7)

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 33. Summary of inflorescence and seed feeding of adults of Orphulella speciosa (Scudder) on ten grass species (see Table 1 for identification of abbreviations).

Base plant	Ael	Age	Asm	Bcu	Bin	Eju	Far	Par	Ppr	Pvi
Ael 1.0 (a)	(3)(b) 0.6			(2) 1.67(c)				(1) 26.67		
Age 1.0		(8)	(8) 1.0	(8) 1.0	(3) 5.0		(1) 28.3	(5) 3.3	(4) 4.6	(6) 1.67
Asm 1.0		(4.5) 1.0	(4.5)	(3) 4.4	(9) 0.9			(1) 36.6	(2) 6.0	(7) 0.25
Bcu 1.0	(9) 0.6	(7) 1.0	(10) 0.02	(7)	(3) 14.0	(2) 38.0	(1) 40.0	(4) 7.5	(5) 6.0	(7) 1.0
Bin 1.0		(6.5) 1.0	(5) 1.1	(8) 0.07	(6.5)		(1) 18.0	(2) 4.76	(3) 3.7	(4) 2.27
Eju 1.0				(4) 0.02		(1)		(2) 0.38	(3) 0.17	
Far 1.0		(6) 0.03		(6) 0.03	(3) 0.056		(1)	(4) 0.05	(2) 0.25	(6) 0.03
Par 1.0	(10) 0.038	(7) 0.33	(11) 0.03	(9) 0.13	(8) 0.21	(2) 2.64	(1) 22.2	(3)	(4) 0.87	(6) 0.5
Ppr 1.0		(6) 0.21	(8) 0.17	(7) 0.2	(5) 0.27	(1) 6.0	(2) 4.0	(3) 1.16	(4)	(9) 0.06
Pvi 1.0		(7.5) 0.5	(3) 4.0	(5.5) 1.0	(7.5) 0.5		(1) 40.0	(4) 2.0	(2) 17.0	(5.5)
Rank (preference)	10 (9.5)(d)	8 (6.6)	9 (7)	7 (6.4)	5 (5.2)	2 (1.5)	1 (1.1)	3 (3.1)	4 (3.3)	6 (6.2)

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 34. Summary of leaf feeding of nymphs of Phoetaliotes nebrascensis (Thomas) on nine grass species (see Table 1 for identification of abbreviations).

Base plant	Ael	Age	Asm	Bcu	Bin	Far	Par	Ppr	Pvi
	(a)	(3)(b)	(4)		(5.5)	(1.5)		(5.5)	(7)	(1.5)
Ael	1.0		0.5(c)		0.0075	2.0		0.0075	0.03	2.0
	(1)		(3.5)	(6.5)		(3.5)	(3.5)		(6.5)	(3.5)
Age	1.0	2.0		0.25		1.0	1.0		0.25	1.0
		(1)	(3.5)	(6)		(3.5)		(5)	(2)	
Asm	1.0		4.0		0.25	1.0		0.5	2.0	
	(1)			(3)	(6.5)	(5)	(3)		(6.5)	(3)
Bcu	1.0	133		4.0		2.0	4.0		1.0	4.0
	(6.5)	(3)	(3)	(6.5)	(3)	(8)	(9)	(3)		(3)
Bin	1.0	0.5	1.0	1.0	0.5		0.25	0.0075	1.0	1.0
		(3)		(5)	(1)	(3)	(6.5)	(6.5)		(3)
Far	1.0	1.0		0.25	4.0		0.0075	0.0075		1.0
	(2.5)		(6)		(2.5)	(2.5)	(7)	(5)		(2.5)
Par	1.0	133	2.0		133	133		33		133
	(2)	(3)	(8)	(5.5)	(5.5)	(1)	(9)		(5.5)	(5.5)
Ppr	1.0	33	4.0	0.5	1.0	1.0	133	0.03		1.0
	(6)	(3)		(7)	(3)	(3)	(8)	(3)		(3)
Pvi	1.0	0.5	1.0		0.25	1.0	1.0	0.0075	1.0	
		(3)(d)	(2.9)	(5)	(6)	(3.2)	(3.2)	(7)	(5)	(3.1)
Rank (preference)		3	3	6.5	8	3	3	9	6.5	3

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 35. Summary of leaf feeding of adults of Phoetaliotes nebrascensis (Thomas) on five grass species (see Table 1 for identification of abbreviations).

Base plant		Age	Bcu	Bin	Far	Pvi
Age	1.0(a)	(3)(b)	(3)	(3)	(3)	(3)
			1.0(c)	1.0	1.0	1.0
Bcu	1.0	(3.5)	(3.5)	(1)	(3.5)	(3.5)
		1.0		4.0	1.0	1.0
Bin	1.0	(2.5)	(5)	(2.5)	(2.5)	(2.5)
		1.0	0.25		1.0	1.0
Far	1.0	(2.5)	(2.5)	(2.5)	(2.5)	
		1.0	1.0	1.0		
Pvi	1.0	(2.5)	(2.5)	(2.5)		(2.5)
		1.0	1.0	1.0		
Rank (preference)		(2.8)(d) 3	(3.3) 5	(2.3) 1	(2.8) 3	(2.8) 3

(a) Leaf feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the leaf feeding index (Table 2-9) of the base plant into that of the plant, to which it is being compared.
(d) Average of superscripts.

Table 36. Summary of inflorescence and seed feeding of nymphs of Phoetaliotes nebrascensis (Thomas) on nine grass species (see Table 1 for identification of abbreviations).

Base plant		Ael	Age	Asm	Bcu	Bin	Far	Par	Ppr	Pvi
Ael	(a) 1.0	(3)(b)	(7) 0.23(c)		(1) 3.33	(4) 0.6		(6) 0.36	(5) 0.43	(2) 2.33
Age	1.0	(3) 4.4	(5.5)	(2) 9.0		(6) 0.15	(1) 83.3		(5.5) 1.0	(4) 3.2
Asm	1.0			(3)	(2) 5.4	(6) 0.01	(1) 133.3	(4) 0.21	(5) 0.07	
Bcu	1.0	(5) 0.3		(3) 6.4	(4)	(6) 0.15	(1) 133.3		(7) 0.1	(2) 27.0
Bin	1.0	(6) 1.7	(4.5) 6.67	(1) 78.3	(4.5) 6.67	(7)	(2) 66.7	(8) 0.08	(5) 3.2	(3) 13.3
Far	1.0		(5) 0.01	(7) 0.0	(7) 0.0	(4) 0.02	(1)	(7) 0.0	(3) 0.06	(2) 0.23
Par	1.0	(6) 2.8		(5) 4.67		(3) 13.3	(1) 133.3	(7)	(4) 5.5	(2) 20.0
Ppr	1.0	(4) 2.3	(6.5) 1.0	(2) 15.0	(3) 9.7	(8) 0.31	(1) 17.5	(9) 0.18	(6.5)	(5) 1.3
Pvi	1.0	(4) 0.43	(5) 0.31	(6) 0.08	(8) 0.04		(1) 3.33	(7) 0.05	(3) 0.7	(2)
Rank (preference)		(4.4)(d) 5	(5.6) 8	(3.6) 3	(4.2) 4	(5.5) 7	(1) 1	(7) 9	(5) 6	(2.8) 2

(a) Inflorescence-seeding feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

Table 37. Summary of inflorescence and seed feeding of adults of Pho ›rascensis (Thomas) on six grass species (see Table 1 for identification of ab .

Base plant		Age	Asm	Bcu	Bin	Far	Pvi
Age	1.0 (a)	(6)(b)	(5) 1.91(c)	(2) 80	(4) 2.71	(3) 7.7	(1) 96.67
Asm	1.0	(4) 0.53	(3)	(5) 0.27	(2) 1.21	(1) 1.48	(3) 1.0
Bcu	1.0	(6) 0.01	(3) 3.7	(5)	(4) 2.0	(1) 7.02	(2) 5.0
Bin	1.0	(6) 0.37	(4) 0.83	(5) 0.5	(3)	(2) 7.6	(1) 20
Far	1.0	(6) 0.13	(2) 0.68	(4) 0.14	(5) 0.13	(1)	(3) 0.15
Pvi	1.0	(6) 0.01	(2.5) 1.0	(4) 0.2	(5) 0.06	(1) 8.0	(2.5)
Rank (preference)		(5)(d) 6	(3.2) 3	(4.1) 5	(3.8) 4	(1.5) 1	(2.3) 2

(a) Inflorescence-seed feeding index of base plant is assumed to be 1.0.
(b) Superscripts (in parentheses) are derived by horizontal ranking in order of preference; the smaller the number, the greater the preference.
(c) Numbers are derived by dividing the inflorescence-seed feeding index of the base plant (Table 2-9) into that of the plant, to which it is being compared.
(d) Average of superscript.

PLATE 1.

Fig. 1. Damage by Ageneottix deorum deorum on Panicum virgatum versus Festuca arundinacea (all of head of latter was destroyed).

Fig. 2. Damage by Ageneotettix deorum deorum on Phalaris arundinacea versus Bromus inermis (only stalk of latter remains).

PLATE I.

Fig. 1.

Fig. 2.

PLATE 11.

Fig. 3. Damage by *Melanoplus bivittatus* on *Panicum virgatum* versus *Phleum pratense* (only stalk of latter remains).

Fig. 4. Damage by *Melanoplus differentialis* on *Elymus junceus* versus *Phalaris arundinacea* (leaves of *E. junceus* consumed and only stalk of seeds and inflorescence remains).

PLATE II.

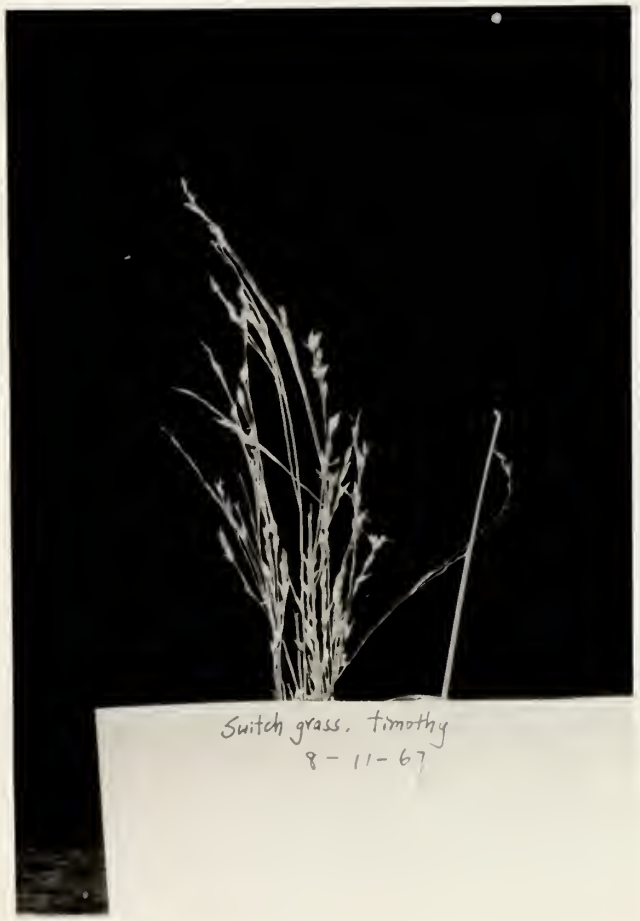

Fig. 3.

Fig. 4.

PLATE 111.

Fig. 5. Damage by *Melanoplus differentialis* on *Bromus inermis* versus *Bouteloua curtipendula* (only stalk of *B. inermis* remains).

Fig. 6. Damage by *Melanoplus femurrubrum-femurrubrum* on *Festica arundinacea* versus *Bouteloua curtipendula*.

PLATE III

Fig. 5.

Fig. 6.

PLATE lV.

Fig. 7. Damage by *Melanoplus femurrbrum-femurrbrum* on *Bromus inermis* versus *Andropogon gerardi*.

Fig. 8. Damage by *Melanoplus sanguinipes* on *Bromus inermis* versus *Agropyron smithii*.

PLATE IV.

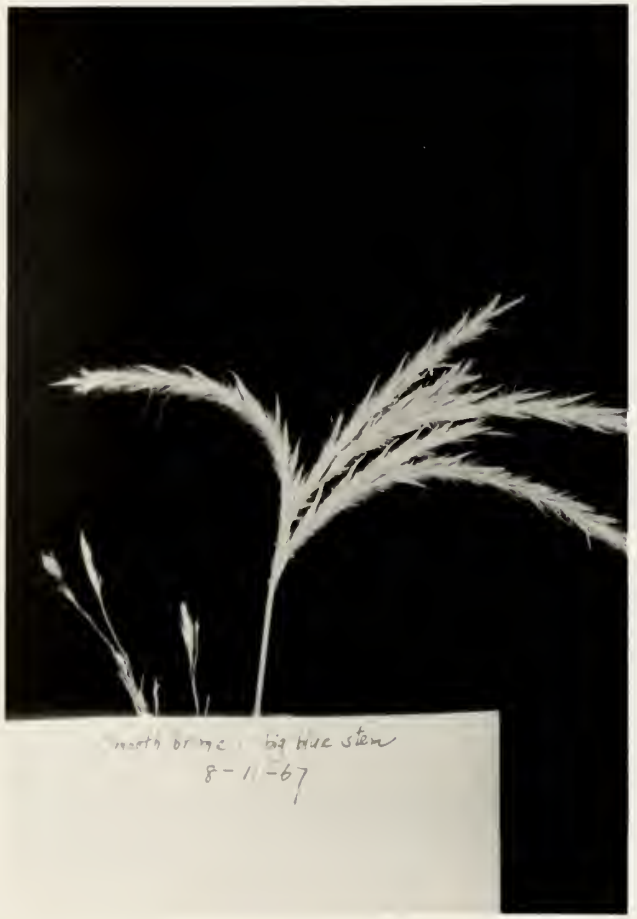

Fig. 7.

Fig. 8.

PLATE V.

Fig. 9. Damage by *Orphulella speciosa* on *Phalaris arundinacea* versus *Festuca arundinacea*.

Fig. 10. Damage by *Orphulella speciosa* on *Panicum virgatum* versus *Festuca arundinacea*.

PLATE V.

Fig. 9.

Fig. 10.

SUMMARY

This experiment was conducted to determine the relative food preferences and rates of ingestion and destruction to 11 cultivated grasses by 8 grasshopper species under laboratory conditions at about 25°C. Samples of two species of grasses were places in a cage with selected numbers of grasshoppers, to observe the effects of feeding both on the leaf, and inflorescence and seeds. When nymphs were evaluated, two consecutive instars were used in each cage.

There was little difference in food preference between nymphs and adults.

Heads in the milky stage rather than in the mature and dry parts were preferred, except Bromus inermis. In the milky stage, grasshoppers stripped or nibbled on the glume, paleas and lemma, and then they ate the kernels.

Adults of Ageneotettix deorum deorum preferred the leaves of Andropogon gerardi, Agropyron smithii, and Festuca arundinacea, and the inflorescence and seeds of Bromus inermis.

Nymphs of Melanoplus bivittatus preferred the leaves of Dactylis glomerata, and the inflorescences and seeds of Bromus inermis and Elymus junceus. Adults preferred the leaves of Bromus inermis, and the inflorescence and seeds of Festuca arundinacea.

Nymphs of Melanoplus differentialis preferred the leaves of Bromus inermis, Dactylis glomerata, Elymus junceus, Festuca arundinacea and Phleum pratense, and the inflorescence and seeds of Elymus junceus. Adults preferred the leaves of Bromus inermis and Festuca arundinacea, and the inflorescence and seeds of Festuca arundinacea.

Nymphs of Melanoplus femurrubrum-femurrubrum preferred the leaves of Phleum pratense, and inflorescence and seeds of Bromus inermis and Elymus junceus. Adults preferred the leaves and inflorescence of Festuca arundinacea.

Nymphs of Melanoplus keeleri luridus preferred the leaves and inflorescence of Festuca arundinacea.

Nymphs of Melanoplus sanguinipes preferred the leaves of Bromus inermis, Dactylis glomerata, Festuca arundinacea and Phleum pratense, and inflorescence and seeds of Elymus junceus. Adults preferred the leaves of Bromus inermis and Festuca arundinacea, and the inflorescence and seeds of Elymus junceus.

Nymphs of Orphulella speciosa preferred the leaves of Dactylis glomerata, and the inflorescence and seeds of Elymus junceus. Adults preferred the leaves of Andropogon gerardi, and inflorescence and seeds of Festuca arundinacea.

Nymphs of Phoetaliotes nebrascensis preferred the leaves of Agropyron elongatum, Andropogon gerardi, Bromus inermis, Festuca arundinacea and Panicum virgatum, and inflorescence and seeds of Festuca arundinacea. Adults preferred the leaves of Bromus inermis, and the inflorescence and seeds of Festuca arundinacea.

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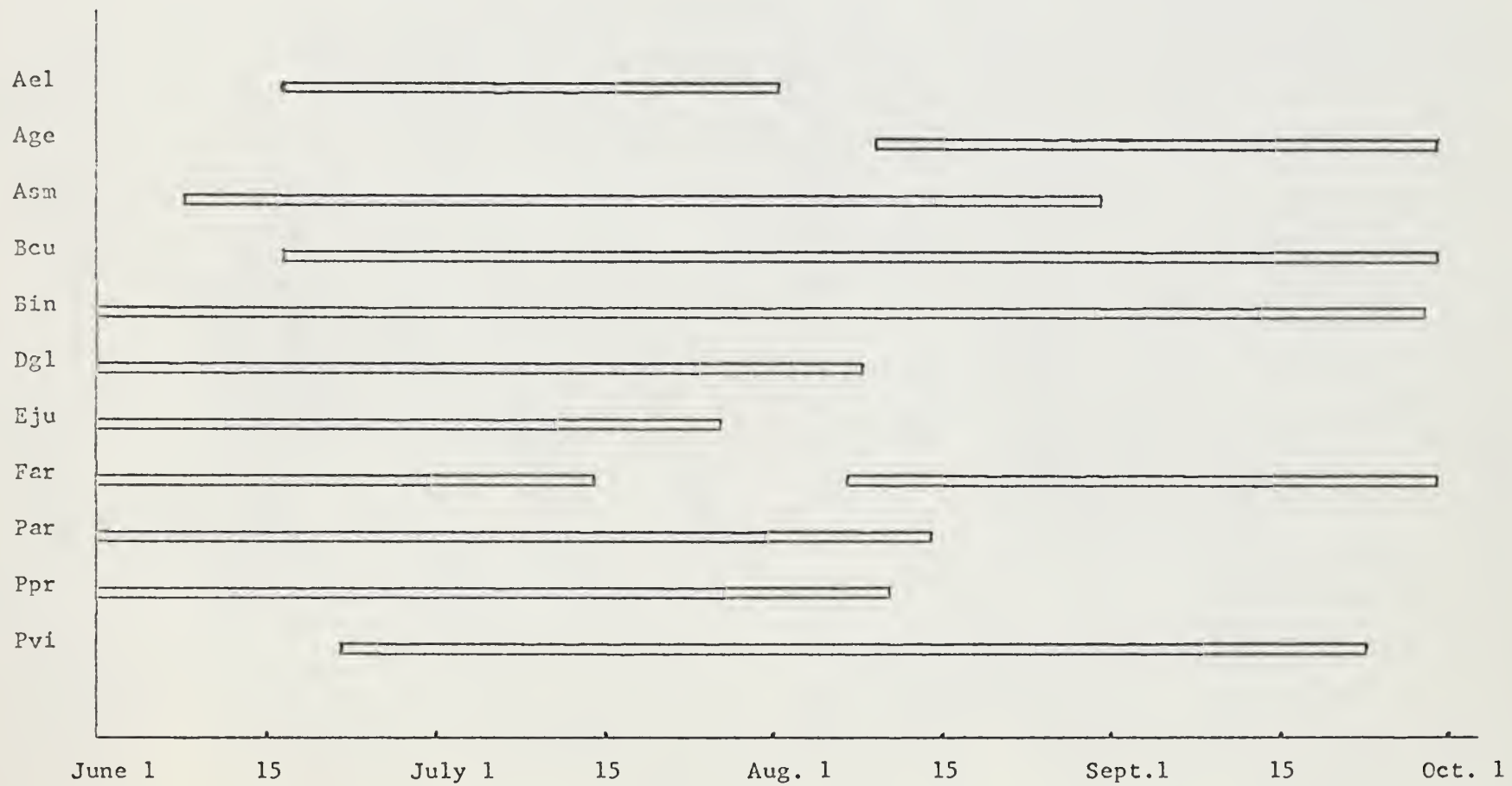
Appendix: AVAILABILITY OF INFLORESCENCE AND SEEDS OF SUCCULENT GRASSES



PREFERENCES OF SEVERAL GRASSHOPPER SPECIES (ACRIDIDAE:ORTHOPTERA) AMONG CERTAIN CULTIVATED GRASSES

by

I-WU CHU

B. S., National Taiwan University, 1966

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

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KANSAS STATE UNIVERSITY
Manhattan, Kansas

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ABSTRACT

This study was conducted to evaluate food prefereces of certain grasshoppers among selected species of grasses under laboratory conditions at about 25°C. Samples of two species of grasses were placed in a cage with selected numbers of grasshoppers of a particular species to observe the effects of feeding on the leaf, inflorescence and seeds. Eleven species of grasses were evaluated, each being paired against each other grass species. Eight grasshopper species were used. When nymphs were evaluated, two consecutive instars were used in each cage.

The number of grasshoppers feeding was recorded at 8:30 A.M., 10:30 A.M., 12:30 P.M., 2:30 P.M., and 4:30 P.M. After 48 hours, the plants were removed from the cage, photographed, and observed under the microscope. The intensity-of-leaf feeding was recorded by ranking the damage: no feeding; trace to 1/2 of leaf eaten; 1/2 or more eaten; and eaten entirely. The intensity-of-inflorescence and seed feeding was recorded as: no damage; slight feeding on the protective covering but no appreciable injury; medium, or injured so that reproduction probably not possible; and heavy, reproduction destroy.

There was little difference in food preference between nymphs and adults.

Heads in the milky stage rather than in the mature and dry parts were preferred, except with Bromus inermis. In the milky stage, grasshoppers stripped or nibbled on the glume, paleas and lemma, and then they ate the kernels

Adult of Ageneotettix deorum deorum preferred the leaves of Andropogon gerardi, Agropyron smithii, and Festuca arundinacea, and the inflorescence and seeds of Bromus inermis.

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Nymphs of Phoetaliotes nebrascensis preferred the leaves of Agropyron elongatum, Andropogon gerardi, Bromus inermis, Festuca arundinacea and Panicum virgatum, and inflorescence and seeds of Festuca arundinacea. Adults preferred the leaves of Bromus inermis, and the inflorescence and seeds of Festuca arundinacea.