Effects of Leaf-Footed Bugs on Mesquite Reproduction

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Highlight: *Leaf-footed bugs,* Mozena obtusa *Uhler, were observed feeding on immature mesquite pods in the Rolling Plains of Texas. A sleeve cage study, using various population densities of these insects, showed that their feeding significantly increased the abortion of immature mesquite pods while decreasing the dry weight of pods and seeds and the germination percentage of seeds. Seedlings from seeds fed upon by this insect were significantly smaller and less vigorous than those from bug-free seeds. This insect may limit the reproduction of mesquite and may offer a possibility for the utilization of a native insect for the control of a native weed.*

Mesquite (*Prosopis glandulosa*) infests millions of acres of southwestern rangeland and is constantly invading or increasing in herbaceous plant communities. The migration and ecesis of mesquite is generally believed to be enhanced by overgrazing, reduction of naturally occurring fires, and the spread of seeds by livestock and certain rodents. Plant ecologists generally do not assign an important role to the insect fauna in determining composition of plant communities; however, research workers in biological control have demonstrated that introduced insects have a remarkable capacity to reduce the abundance of weeds, shrubs, and trees. Thus insects could be potent factors in influencing plant composition in their native habitats (National Academy of Sciences, 1969).

In the science of biological control of weeds, alien insects are usually imported into a country to combat an introduced plant that has been declared a noxious weed. However, the conservation of existing weed-feeding insects has been suggested by Andres (1971) as a method of controlling weeds by allowing native insects to increase in numbers and by utilizing these insects in controlling native weeds. Several examples of native insects controlling native weeds have been demonstrated. One concerns the native moth, *Aroga websteri* Clark (Lepidoptera: Gelechiidae), and its control of big sagebrush (*Artemisia tridentata* Nutt.) on thousands of acres in the western United States (Gates, 1964; Hall, 1965). Large acreages of rabbitbrush (*Chrysothamnus nauseosus* Fall.) were killed in western New Mexico in the late 1950's by a leaf beetle, *Trirhabda nitidicollis* Lec. (Coleoptera: Chrysomelidae) (Massey and Pierce, 1960). The blue cactus borer (*Melitara dentata* [Grote] [Lepidoptera: Pyralidae]) has been reported to be one of the most important native insects affecting pricklypear cactus. Bugbee and Reigel (1945) reported that this insect reduced stands of *Opuntia macrorrhiza* Engelm. by 50 to 75% in areas around Hays, Kans. It is believed that the scale insect *Orthezia annae* Ckll. and the moth *Eumysia idahoensis* Mackie may reduce the abundance of shadscale (*Atriplex confertifolia* Torr. and Frem.) in Central Idaho and thus lead to the invasion of the area by halogeton (*Halogeton glomeratus* (M. Bieb.) C. A. Mey) (Mackie, 1957). In a survey by Nord (1965) on the Klamath National Forest, it was discovered that up to 90% of the bitterbrush (*Purshia tridentata* (Pursh.) D. C.) had died on an area of 5,000 acres and that about 25% had died on another 45,000 acres, apparently due to insects. The Great Basin tent caterpillar (*Malacosoma fragilis* Strech. [Lepidoptera: Lasiocampidae]) geometrid larvae (Lepidoptera: Geometridae), and budworms (Lepidoptera: Tortricidae) are known defoliators of bitter-

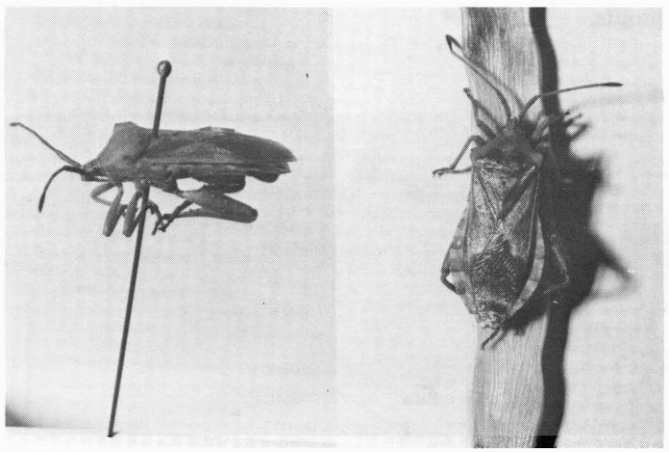

Fig. 1. *Leaf-footed bug. This insect sucks plant juices from mesquite pods (*left–*lateral view;* right–*dorsal view).*

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brush (Nord, 1965; Clark, 1956; Ferguson, et al., 1963). Insects are often blamed for reproduction failure of bitterbrush (Ferguson et al., 1963; Basile and Ferguson, 1964; Nord, 1965). It has been reported that mesquite (*Prosopis glandulosa*) is heavily attacked by a twig girdler (*Oncideres rhodosticta* Bates) in localized areas in Texas and that severe girdling killed about 40% of all limbs from 0.5 to 2.0 cm in diameter (Ueckert et al., 1971).

Leaf-footed bugs (*Mozena obtusa* Uhler [Hemiptera: Coreidae]) (Fig. 1), are often referred to as important native pests of mesquite. Werner and Butler (unpublished paper) considered *Mozena* spp. as the most important hemipteran to attack mesquite, but little or no damage could be associated with it. Swenson (1969) reported that mesquite pods were destroyed in large quantities by *M. obtusa* and a bean weevil (*Algarobius prosopis* [LeConte] [Coleoptera: Bruchidae]). Leaf-footed bugs were observed feeding on immature mesquite pods at relatively high population densities in the Rolling Plains of Texas during the summer of 1971. This insect feeds by inserting its piercing-sucking mouthparts into immature mesquite pods and withdrawing plant juices. The purpose of this study was to quantify the influence of these insects on mesquite pods, seed germination, and on young mesquite sprouts.

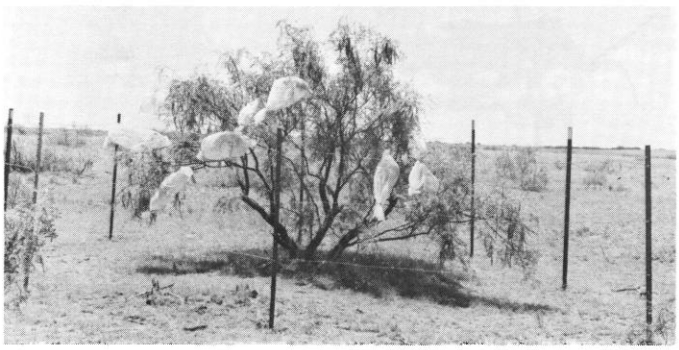

Fig. 2. *Mesquite tree upon which leaf-footed bugs were confined in sleeve cages.*

Methods and Materials

A sleeve cage study was conducted during early summer of 1971 on the Post-Montgomery Ranch in Garza County, Texas, to determine the influence of various population densities of this insect on the pods and germination of mesquite seeds. Nine replications of population densities of 0/pod, 1/pod, 2/pod, and 4/pod were introduced into sleeve cages, constructed of organdy, on June 18 (Fig. 2). On July 12 the numbers of aborted pods at each population level were counted; then all pods were collected and weighed and later oven-dried at 70°C for 72 hr and reweighed. The pods were hand-shelled, and the seeds were scarified then germinated between moist filter paper in petri dishes in an environmental chamber at 27 °C constant temperature with a 12-hr light period and a 12-hr dark period. Four-day-old sprouts were oven-dried at 70 °C for 72 hr and weighed. Data on pod weights, percent moisture in pods, seed weights, and sprout weights were analyzed with one way analyses of variance, completely random design. Duncan's new multiple range test was used to rank the treatment means. Chi square tests were used to analyze data on percentage abortion of pods and seed germination.

Table 1. Abortion (%) of immature mesquite pods, mean moisture (%) and dry weight (g) of mature pods, and mean dry weight (mg) of individual seeds after feeding by *Mozena obtusa* at four population densities.

	Population density			
Measurement	0/pod	1/pod	2/pod	4/pod
Abortion	0a[1]	33b	33b	89c
Mean percent moisture[2]	101a	52b	54b	26b
Mean pod weight	2.44a	1.89b	1.39c	1.00d
Mean seed weight	33.4a	14.4b	9.3c	4.5d

[1] Means followed by the same letter are not significantly different at the 5% confidence level.
[2] Calculated by the formula: (green weight–dry weight/dry weight) x 100.

Results

Feeding by leaf-footed bugs at the population densities studied had a significant influence on all characteristics of mesquite pods and seeds that were measured. Abortion of immature pods was increased in response to feeding by these insects, increasing from 0% in the control to 33% at the 1 bug/pod and 2 bug/pod densities, and to 89% at the 4 bug/pod density (Table 1). The ratio of percent abortion was not significantly different from 0:1:2:4 (5% confidence level) for the population densities of 0, 1, 2, and 4 bugs/pod, respectively. The percent moisture in mesquite pods was significantly lower at the 1, 2, and 4 bugs/pod densities than in the control. This decrease in moisture was due mainly to removal of plant juices from the pods by leaf-footed bugs; however, some reduction in moisture may have occurred from natural desiccation of aborted pods after they had dropped.

Feeding by leaf-footed bugs resulted in a significant reduction in the dry weight of mesquite pods at all population densities (Fig. 3 and Table 1). The mean dry weight of pods in the control cages was 2.44 g at the end of the feeding period, while that of pods at the 1, 2, and 4 bugs/pod densities was 1.89 g, 1.39 g, and 1.0 g, respectively. Individual seed weights were decreased from 33.4 mg in the control to 14.4 mg, 9.3 mg, and 4.5 mg at the 1, 2, and 4 bugs/pod densities, respectively.

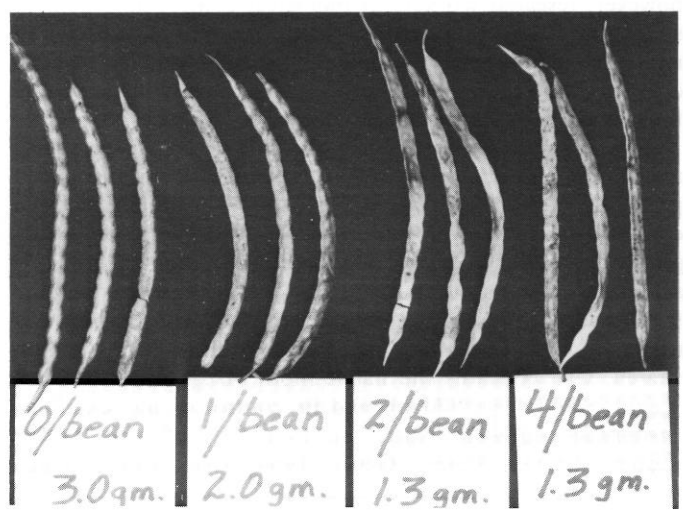

Fig. 3. *Mesquite pods in the control were well developed, whereas those fed upon heavily by leaf-footed bugs were severely shriveled, brittle, and discolored.*

Table 2. Germination (%) of mesquite seeds and mean dry weight (mg) of four-day-old mesquite sprouts from pods fed upon by *Mozena obtusa* at four population densities.

Measurement	Population density 0/pod	1/pod	2/pod	4/pod
Germination	64.7a[1]	40.8b	32.4b	4.3c
Mean sprout weight	19.7a	10.1b	6.9c	5.9c

[1] Means followed by the same letter are not significantly different at the 5% confidence level.

Germination of mesquite seeds was reduced due to feeding by leaf-footed bugs. About 65% of the seeds germinated in the control. Percent germination at the 1 bug/pod density (40.8%) and 2 bug/pod density (32.4%) was not different; however, germination at the 4 bug/pod density (4.3%) was significantly decreased. (Table 2).

The mean dry weight of four-day-old sprouts was reduced from 19.7 mg in the control to 10.1 mg at the 1 bug/pod density. Mean dry weights of sprouts at the two higher population densities (6.9 mg and 5.9 mg) were lower than at the 1 bug/pod density; however, they were not different from each other. Lengths of radicles and hypocotyls and the vigor of seedlings showed similar responses (Fig. 4); however, these data were not recorded.

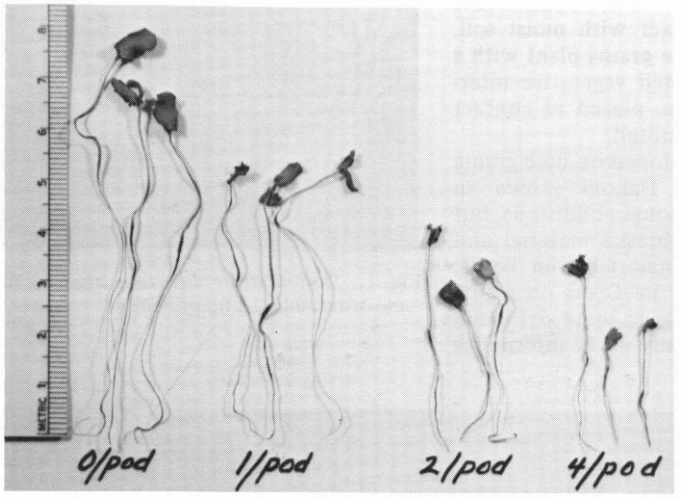

Fig. 4. *Four-day-old mesquite seedlings from seeds fed upon at varying population densities of leaf-footed bugs. Feeding by this insect reduced the dry weight, length of radicle and hypocotyl, and vigor of seedlings.*

Discussion and Conclusions

Leaf-footed bugs may play a significant role in limiting viable seed production of mesquite in areas where population densities of this insect are high. In this study viable seed production was reduced from 65% in the control to 4.3% at a population density of 4 bugs/pod. Although population densities of this magnitude are probably not common in nature, the intermediate population densities utilized in this study are certainly not uncommon. Since mesquite reproduces only by seeds, the action of this natural enemy may be significant in reducing the biotic potential and rate of spread of this noxious plant.

The survival rate of mesquite seedlings would be expected to be a function of the amount of stored food within the cotyledons. Feeding by leaf-footed bugs significantly reduced the total dry weight and thus the amount of stored food in the cotyledons necessary for the initial growth of mesquite seedlings. At the higher population densities of the insects, mesquite seeds usually consisted only of a papery seed coat containing very little or no embryonic tissue. Feeding by the insect should decrease the expected seedling survival of those seeds that contain sufficient carbohydrates, fats, and proteins for germination, thus decreasing the chances for successful establishment of new plants.

In areas of the southwestern United States, Mexico, and Central and South America where stockmen depend upon mesquite pods for emergency livestock feed, leaf-footed bugs would be considered an undesirable insect. Mesquite pods fed upon heavily by this insect were severely shriveled, brittle, and discolored. This study provides evidence that the total dry weight production of mesquite pods is reduced by about 23% at the population density of one insect/pod and by about 59% at the population density of four/pod. Thus the total amount of this source of energy-and protein-livestock feed would be significantly reduced by the insects if population densities should become high.

Population densities of leaf-footed bugs probably depend largely upon climatic conditions, predators, and parasites; however populations are undoubtedly reduced substantially by the widespread use of insecticides. This insect is apparently host specific upon mesquite and is not known as a pest of plants of economic importance. The ecology and biology of this insect and other native insect pests of mesquite should be studied in detail to discover ways to increase their populations in order to control this noxious plant or to decrease its rate of encroachment.

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