Management Practices to Manipulate Populations of the Plant Bug *Labops hesperius* Uhler

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Highlight: Nitrogen fertilization of wheatgrass significantly increased populations of the plant bug *Labops hesperius* Uhler; applications of potassium and phosphorus did not. Paraquat applied to wheatgrass to cure the herbage prematurely (in early May) also reduced the population of plant bugs by starving them. Mechanical removal of herbage also effectively reduced the bug populations both in the spring and the summer. Heavy spring grazing significantly reduced the bug population the first year and also thereafter. Wheatgrass pastures that are not fully utilized will provide oviposition material, winter protection, and a habitat that favors survival of the bugs.

Dense infestations of the plant bug *Labops hesperius* Uhler[1] reduce both the quantity and quality of wheatgrass (Todd and Kamm 1974). The inherent productivity of a given pasture determines the carrying capacity of both domestic livestock and the plant bug. Therefore, management practices that maintain or increase forage production may also affect the bug population. For example, rest rotation grazing of infested pastures may increase the number of bugs since the population is directly correlated with the amount of old herbage present (Fuxa and Kamm 1976). On most rangeland, the use of cultural or management practices to manipulate bug populations would be preferable to and often more economical than the use of insecticides, which also affect nontarget organisms.

The present paper describes the impact of fertilization, chemical curing of forage, mechanical removal of herbage, and grazing by cattle on pastures infested with populations of *L. hesperius*.

Materials and Methods

The effect of fertilizers on the population of *L. hesperius* in crested wheatgrass (*Agropyron cristatum*) was determined by applying nitrogen, phosphorus, or sulfur alone or in combination at rates comparable to those used on Oregon rangeland (Pumphrey and Hart 1973). Each treatment was replicated four times in a randomized block of 9.3-m^2 plots. Applications were made October 6, 1973, and the density of bugs was determined in two random quadrats (0.09 m^2) of each plot from May 29 to June 1, 1974, with previously described methods (Todd and Kamm 1974).

Paraquat (1,1'-dimethyl-4,4'-bipyridinium ion salt), which can be applied to range grasses at low doses to chemically cure herbage for late season grazing (Sneva et al. 1973), might also deprive the bugs of plant sap (paraquat stops translocation of sap) and thereby starve them. We therefore applied paraquat at a rate of 0.23 kg/ha in 151 liters of water/ha plus 0.5% X-77^R spreader-sticker. Four plots (37.2 m^2) were arranged in a randomized block and sprayed: April 30, 1974 (during the 5th instar); May 13 (during the preoviposition period of adults); June 7 (during oviposition of adults). Immediately after each treatment, one cage (1 m^2) was placed on each plot to confine the bugs to prevent immigration and migration. Density of the bugs was then determined in two quadrats inside and three outside the cages. Also, the density of eggs laid was determined by dissection of the straw from two quadrats after the adults had died.

The effect of mechanical removal of herbage on the density of bugs was evaluated in a randomized block of 37.2-m^2 plots. The grass was mowed to a height of ca. 5 cm with a power scythe and the herbage raked off the plots. The first series of plots was mowed August 30, 1973, when the bugs were in the egg stage; a second series of plots was mowed on April 18, 1974, when 2nd instars were present; and still another series of plots was mowed May 14, 1974. One cage was placed on each mowed and each unmowed plot immediately after all but the August mowing. However, cages were installed in the plots mowed in August the following March 28, shortly after egg hatch. The density of bugs on all plots was determined May 22, 1974. The density of eggs inside the cages was determined June 26 after the adults had died.

The effect of grazing by cattle on the density of bugs was initiated in 1973 by installing five circular grazing exclosures (ca. 6.5-m diameter) in three crested wheatgrass pastures near Seneca and two 900-m^2 exclosures in a large pasture ca. 20 km from Vale, Ore. The pastures at Seneca were heavily grazed (to a height of 5 cm) in the spring; the pasture at Vale was moderately grazed (to a height of 15–20 cm) in 1974 and 1975; and none of the pastures were grazed in 1976 before the density of bugs was assessed. The density of bugs in four or more quadrats (0.09 m^2) both outside and inside each exclosure was determined each year.

During the research, authors were research entomologist and research assistant, Agricultural Research Service, U.S. Department of Agriculture, and the Department of Entomology, Oregon State University, Corvallis. Fuxa's present address is Department of Entomology, North Carolina State Univ., Raleigh 27607.

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This paper reports the results of research only. Mention of a pesticide in this paper does not constitute a recommendation for use by the U.S. Dep. Agr. nor does it imply registration under FIFRA as amended.

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[1] Hemiptera: Miridae.

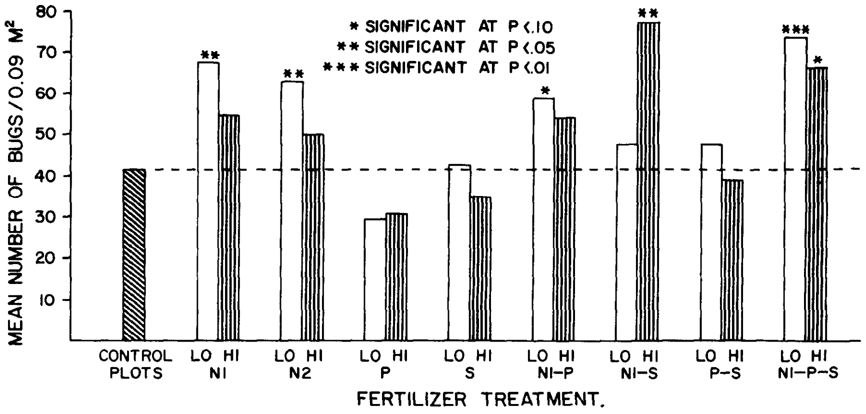

Fig. 1. *Mean number of* Labops hesperius *per 0.09 m² on control compared with test plots fertilized with: LO N1 = ammonium nitrate (33.6 kg N/ha); LO N2 = urea (33.6 kg N/ha); LO P = phosphate (44.8 kg P_2O_5/ha); LO S = sulfur (11.2 kg gypsum/ha); HI N1 = ammonium nitrate (67.2 kg N/ha); HI N2 = urea (67.2 kg N/ha); HI P = phosphate (89.7 kg P_2O_5/ha); and HI S = sulfur (22.4 kg gypsum/ha).*

Results

All plots treated with fertilizer containing nitrogen had more bugs than control plots, and six treatments were significantly different (Fig. 1). Phosphorus or sulfur alone or in combination had no significant effect. Since cattle grazed all plots to a height of 10 to 15 cm during the test, any increase in bug density cannot be attributed to an increased amount of foliage produced by the fertilizer. The bugs clearly preferred the wheatgrass fertilized with nitrogen at the rate of 33.6 kg/ha.

Paraquat significantly reduced the population of bugs ca. eight days after application both inside and outside the cages (Table 1). However, subsequent sampling indicated that bugs were reinfesting the plots as soon as new growth appeared at the base of plants. Approximately 95% of the leaves in sprayed plots turned brown three days after treatment, and the bugs migrated to unsprayed checks. However, numerous dead bugs were observed inside the cages in treated plots but not inside cages on the control plots. During the test, a sample of bugs was removed from the field and exposed to blotter paper soaked in the paraquat spray. No mortality was observed after 8 days, even though bugs were in direct contact with the paper. Thus, paraquat was not directly toxic to the bugs. Paraquat thus effectively reduced the bug population on all dates it was applied, and adult bugs laid significantly fewer eggs if paraquat was applied before or during the preoviposition period.

Mechanical removal of herbage likewise had a pronounced effect on the density of bugs (Table 2). For example, herbage removed in August, when only eggs were present, significantly reduced the density of bugs in cages since movement of the bugs was restricted by the cages the following spring. However, no significant reduction resulted outside the cages because bugs moved into plots the following spring. Also, spring removal of both green and weathered herbage significantly reduced the bugs outside (because bugs moved out of plots where food was more abundant) but not inside cages. However, the number of eggs laid was reduced significantly since food was in short supply and most oviposition sites had been removed. Nevertheless, removal of herbage did reduce the population of bugs.

The effect of grazing (to a height of 5 to 8 cm) by cattle on pastures in early spring significantly reduced bug populations since the cattle and bugs were direct competitors for the same herbage (Table 3). Even though none of the pastures were grazed in 1976 before counts of bugs were made, five of seven pastures had significantly fewer bugs outside the exclosures because the bug population had been reduced in 1975 by grazing and thereby reduced the food and oviposition sites of the bugs.

Discussion

Previously, ammonium nitrate applied to wheatgrass at a rate of 33.6 kg/ha over 13 years increased production of herbage 83% and increased the crude protein 54% (Sneva 1972). In our

Table 1. Number of *Labops hesperius* on plots treated with paraquat and untreated plots and number of eggs laid subsequently by adults.

Measurement and sampling dates	Date of application: April 30 — Paraquat	Check	May 13 — Paraquat	Check	June 7 — Paraquat	Check
Bugs/0.09 m²						
May 11	3.2**(0.6*)a	33.6(41.6)a				
May 16	9.3	25.0				
May 21			1.3**(0.6**)a	19.3(18.6)a		
May 24	4.3	14.0				
June 3			2.8	11.0		
June 14					0.4**(1.3**)	18.8(15.5)a
June 21					0.3*	8.3
Eggs/0109 m² inside cages						
June 22			57**	235.5		
June 25					82	178

*$P < 0.05$ (t-test).
**$P < 0.01$.
a Bugs/0.09 m² confined by cages on plots to avoid immigration and migration.

Table 2. Density (No./0.09 m²) of *Labops hesperius* inside and outside cages where herbage was mechanically removed and where left in place taken at three dates.

Date of herbage removal	Date of but sample	Outside cages: Herbage removed	Outside cages: Herbage left in place	Inside cages: Herbage removed	Inside cages: Herbage left in place
8/30/73	4/19/74	4.0	24.3	2.5**	15.1
4/18/74	5/3/74	17.5*	35.8		
5/14/74	5/22/74	1.8**	13.8	9.4 (0.0*)a	11.3 (72.8)a

*$P < 0.05$ (AOV).
**$P < 0.01$.
a Eggs/0.09 m² on 6/26/74.

Table 3. Mean number (no./0.09 m²) of *labops hesperius* found inside (ungrazed) and outside (grazed in spring by cattle) exclosures in wheatgrass pastures in indicated year.

Location of exclosure	1974		1975		1976	
	Inside	Outside	Inside	Outside	Inside	Outside
Seneca, Ore.						
A	28.4	6 **	35.8	8.5**	32.5	6.5**
B	12.5	1.8**	36	2.3**	12.0	1.0**
C	52.0	32.0	118	65.7	100.3	78.3
D	39.9	13.9*	176.5*	79.5*	221	98 *
E	312.4	40.6**	263.8	70.0*	225	91 *
Vale, Ore.						
A	62.2	46	44.6	17.8*	62.5	25 *
B	29.7	17.8	27.6	16 *	39.5	24.2

*$P < 0.05$; ** $P < 0.01$ Mann, Whitney U-test.

tests, nitrogen applied to wheatgrass increased the density of bugs because the fertilized grass was probably of better quality than was unfertilized grass. Thus, over a period of years, any increase in forage production would probably be accompanied by a corresponding increase in the bug population.

Paraquat effectively reduced the density of bugs by prematurely curing the grass and thereby starving a significant number of the insects. Also, the surviving population laid 76% fewer eggs, thereby reducing the population expected the following year. Although the application of paraquat increased the quality and reduced the yield of herbage, yearling heifers grazing on the chemically cured herbage gained significantly more weight than those grazing on naturally cured herbage (Sneva et al. 1973). However, when control of bugs is a consideraton, paraquat must be applied ca. 10 days earlier than when it is applied only to cure the herbage.

Spring grazing by cattle and mechanical removal of herbage both limited the feeding injury of the plant bugs and also reduced the number of eggs laid by surviving adults. (In effect, the herbage was harvested before the bugs could inflict damage, and the infestation the following year was significantly less.) Mechanical removal of herbage in late summer also reduced the bug population the next year by destroying the eggs; however, in this case the forage sustained the total impact of the feeding injury of the bug, and the yield for the current season was lower. Heavy fall grazing would probably produce a similar effect. Indeed, wheatgrass pastures not fully utilized (unless sprayed with paraquat) will provide winter protection and habitat that favors survival of bugs the following year. Clearly, *L. hesperius* and domestic livestock are direct competitors for the same food, and the management practices described can minimize the loss of herbage due to the feeding of bugs.

Literature Cited

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THESIS: OREGON STATE UNIVERSITY

Diet and Feeding Behavior of Cattle at Risk to Dietary Acute Bovine Pulmonary Emphysema (DABPE), by Jon Carner Elliott, MS, Rangeland Resources. 1976.

The objectives of this study were to determine the diets of cattle at risk to dietary acute bovine pulmonary emphysema (DABPE) on stress and inciting pastures and to determine if segregated feeding groups of cattle displayed differential susceptibility to DABPE.

Stress pastures were classified and mapped by plant communities and segregated feeding group areas. Cattle diets were determined for each segregated feeding group area. Cattle were marked to identify each individual as a member of a particular group. Major dietary species on the stress pastures were Kentucky bluegrass, Idaho fescue, bluebunch wheatgrass, elk sedge, yellow sweetclover, and American vetch. Major dietary species on the inciting pastures were alfalfa, common timothy, smooth brome, Kentucky bluegrass, and reed canarygrass.

Twenty cows whose activities could be traced back to a specific area on the stress pasture contracted DABPE during the study. Two similarities were common to 19 of the 20 cows stricken with the disease. Nineteen of these cows had grazed on areas of the stress pasture where the diet was lower in percent dry matter than the diets on the driest areas of the same stress pasture. The same cows all had grazed areas on the stress pasture where Kentucky bluegrass was the dominant dietary species. However, there was not sufficient evidence to conclude that Kentucky bluegrass was a causative agent of DABPE.

Forty-three cows between the age of 5 and 12 years showed signs of DABPE during the 2-year study. Thirty-two cows were stricken on the Izee inciting pasture in 1974 (20% overall morbidity) and seven died (22% mortality of those animals stricken). Only nine of the 32 stricken cows could be traced back to specific areas on the stress pasture. Thirty-three cows had grazed on the two stress pasture areas that appeared to be associated wth DABPE. The nine stricken cows accounted for a morbidity of 27% and a mortality of 33%. Nine cows showed signs of DABPE on the Rockpile inciting pasture in 1974 (17% overall morbidity) but none died. All nine were from two specific stress pasture areas. Twenty-five cows had grazed on the two stress pasture areas that appeared to be associated with DABPE. The nine stricken cows accounted for a morbidity of 36%. Cattle were drylotted and introduced over a period of 6 days to the Izee inciting pasture in 1975. No cases of DABPE were noted. Two cows showed signs of DABPE on the Rockpile inciting pasture in 1975 (2.8% overall morbidity) and one died. Both cows had grazed the same area on the stress pasture in a group of 20 cows.

When cattle were drylotted for 3 to 6 days while being gradually introduced to the inciting pastures, no mortality from DABPE was noted. Prior to drylotting, neither ranch had experienced zero mortality from DABPE for at least 10 years.

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