V.4 Utilization of Nonnative Rangeland Plants by Grasshoppers on the Snake River Plains of Idaho

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The Intermountain region of Idaho is highly susceptible to invasions by exotic plant species. At many locations in southern Idaho, exotic plant species comprise 70 to 90 percent of the plant biomass. Cheatgrass *(Bromus tectorum),* medusahead wildrye *(Taeniantherum asper),* knapweeds *(Centaurea* spp.), tumblemustard *(Sisymbrium altissimum),* and Russian-thistle *(Salsola kali)* are widely distributed annual or biennial weeds. Other introduced weeds threatening rangelands in southern Idaho include leafy spurge *(Euphorbia esula)* and rush skeletonweed *(Chondrilla juncea).* The area infested by exotics continues to increase each year. Also, people intentionally have established crested wheatgrass *(Agropyron cristatum),* an exotic perennial bunchgrass, over vast acreages of the Intermountain West.

To learn about the relationship between such exotic plant species and grasshoppers, we investigated the food habits of the most common grasshopper species in southern Idaho. We wanted to gain some insight into the following questions: How palatable are these exotic plant species to native grasshoppers? Do these exotics provide a significant new resource for grasshoppers? Might grasshoppers limit the spread of these new weeds?

We used microscopic analysis of the crops of grasshoppers to learn about their food choices. By examining the contents of a grasshopper's crop under a microscope and comparing the surface characters (hairs, hair structure, arrangement of cells, etc.) of the plant fragments with known reference material, we were able to measure accurately the relative proportion of different plant species and parts of plants (stems, flowers, and leaves) ingested by the grasshopper.

Diffuse Knapweed

Diffuse knapweed *(Centaurea diffusa)* has spread rapidly and widely across Idaho. Knapweeds contain a chemical, cnicin, that is repellent to many herbivores. Concentrations of cnicin vary within the plant: leaves surrounding the flowers have the highest concentrations, and the stem epidermis and flowers have only trace quantities. Because of the unpalatibility of knapweed, infested rangeland has greatly reduced forage value for livestock and wildlife.

We used microscopic analysis to determine the use of diffuse knapweed by the common grasshopper species *Melanoplus sanguinipes.* A spurthroated grasshopper, *M. sanguinipes* is a very opportunistic feeder. Egg hatch in this species often spreads out over a long period, resulting in a highly variable life history. Much of a population of this species typically matures during late summer droughts common in southern Idaho. At such times, most late-maturing plant species that retain some greenness will be a primary food item for *M. sanguinipes.*

Our results showed that *M. sanguinipes* readily consumes knapweed but not in proportion to its availability. The insect prefers other plants, such as cheatgrass and tumblemustard, over knapweed. In late summer, though, when most other plant species are dead, knapweed comprises up to 50 percent of that species' crop contents (table V.4–1). Other plants that are still green then, such as rabbitbrush *(Chrysothamnus* spp.), sagebrush *(Artemesia* spp.), and certain lupine *(Lupinus)* species, also serve as food sources. After autumn rains caused cheatgrass, an exotic annual, to sprout in October, this grass comprised the bulk of *M. sanguinipes'* diet.

Cheatgrass and Crested Wheatgrass

Cheatgrass and another exotic grass species, crested wheatgrass, dominate much of the landscape at lower elevations on the Snake River Plains (figs. V.4–1 and –2). Crested wheatgrass, a perennial bunchgrass, stays green longer in the season than does cheatgrass. We investigated the food habits of *M. sanguinipes* and another common grasshopper species, *Aulocara elliotti,* regarding these two grasses.

A. elliotti, a slantfaced grasshopper, is mostly limited in its diet to grasses but is not selective among grasses. In southern Idaho, populations of *A. elliotti* hatch early and mature at the same time as the grasses on which they feed. In early summer, that species eats crested wheatgrass and cheatgrass equally (table V.4–2). However, as the season progresses and the cheatgrass dries, the diet of *A. elliotti* consists of proportionally greater amounts of crested wheatgrass.

Figure V.4–1—Cheatgrass, an introduced annual grass, can dominate disturbed sites and is widespread across Idaho and in other Pacific Northwest States (Photo by Dennis Fielding, University of Idaho).

Figure V.4–2—Land managers and ranchers often have used crested wheatgrass to reseed areas of Idaho rangeland to enhance forage for livestock and in doing so, sometimes create food sources for pest species of grasshoppers. (U.S. Department of the Interior, Bureau of Land Management photo by Mike Pellant.)

In contrast, *M. sanguinipes* eats mostly cheatgrass in the early summer. As the cheatgrass dries, the insect consumes greater proportions of weedy forbs, such as tumblemustard and Russian-thistle (table V.4–2). Crested wheatgrass did not comprise more than 20 percent of the insect's diet at any time.

Table V.4–1—Crop contents of *M. sanguinipes*, by percentage, on knapweed-infested rangeland east of Jerome, ID, on five different dates in 1989. Grasses were primarily cheatgrass with less than 5 percent western wheatgrass *(Agropyron smithii)*

	June 30	July 20	Aug. 14	Sept. 6	Oct. 13
Diffuse knapweed	18	30	32	55	12
Other forbs	65	48	29	31	1
Grasses	8	13	27	7	86
Litter, detritus	9	9	13	7	1

Note: Percentages may exceed 100 due to rounding.

Table V.4–2—Crop contents of *A. elliotti* and *M. sanguinipes*, by percentage, on a crested wheatgrass seeding north of Bliss, ID, in 1990

	Aulocara elliotti		*Melanoplus sanguinipes*		
	May 18	July 2	May 25	July 9	Aug. 13
Crested wheatgrass	37	75	16	16	19
Cheatgrass	60	17	56	22	17
Forbs	0	7	12	42	50
Litter, detritus	3	2	16	20	14

Note: Percentages may exceed 100 due to rounding.

Conclusions

The manner in which evolutionary history has molded a grasshopper's food habits and other life-history traits decides how a grasshopper will respond to exotic plants. On the Snake River Plains, the most abundant grasshopper species—the ones most likely to achieve outbreak densities—accept a variety of plants and will adapt readily to exotic plant species.

Certain introduced weeds, especially tumblemustard and cheatgrass, may represent a significant new resource for generalist feeders, such as *M. sanguinipes* and *Oedaleonotus enigma.* Rangeland dominated by these plants may provide a more favorable habitat for these grasshoppers, compared to rangeland dominated by native perennial grasses (see section IV, Modeling and Population Dynamics). Less palatable weeds, such as the knapweeds, probably do not provide a significant new resource for native grasshopper populations in southern Idaho; our findings indicate that diffuse knapweed may serve mostly as a survival food during summer droughts.

Our study of grasshopper food habits suggests that land managers should not count on these insects to slow the spread of noxious weeds. While it is conceivable that at high densities grasshoppers may eat large amounts of noxious weeds and reduce seed production, grasshoppers also will eat other plants at the same time, reducing competition to the weeds.

Grasshoppers with specialized feeding habits may offer a better chance of controlling certain weeds. *Hesperotettix viridis,* for example, feeds on broom snakeweed *(Gutierrezia sarothrae).* Such specialist feeders probably would eat mainly native weeds or exotics that are very close relatives of native plants. Specialist feeders would not recognize novel plants as potential food items.

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