Conservation Issues

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The Impact of Nonindigenous Crested Wheatgrasses on Native Black Grass Bugs in North America: A Case for Ecosystem Management

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INTRODUCTION

Grasslands are a major natural resource wherever they occur. Worldwide, there are over 7 billion ha of grassland, including rangeland and pastures (Turner and Meyer 1992). Such resources receive enormous pressures from wild and domestic animals (Wells et al. 1983).

Over the years, a variety of nonindigenous grasses have been introduced into North America to improve rangeland and pasture. This paper deals with one such case, the introduction of several species of crested wheatgrass (*Agropyron* spp.) to western North America and their effect on some of the native insect fauna.

HISTORY

Plant explorers have searched the world for many years to locate agricultural and horticultural species. Today, most of our crops and many of our ornamental plants are nonindigenous. N.E. Hansen of the U.S. Department of Agriculture encountered several grasses being tested for cultivation near St. Petersburg, Russia, in the late 1890s. Seeds of *Agropyron cristatum* (L.) Gaertn. and *A. desertorum* (Fisch.) Schult were shipped to the United States in 1897–98 and again in 1906 (Dilman 1946) and were divided among several agricultural experiment stations in the western United States (Dilman 1946).

The success of these early plantings demonstrated the value of the introduced *Agropyron* species as supplements to the native grass rangeland at many locations. Breeding programs were developed to increase the agronomic qualities of these nonindigenous grasses (Hewitt 1980), while there was little attempt to do the same with the native grass species (Hansen et al. 1985). Although the native range grasses were adapted to the climate and soil conditions of different localities through natural selection, many species were unable to withstand heavy grazing pressure. Central Asian species of *Agropyron*, which were apparently better able to withstand grazing pressure, were introduced.

As these nonindigenous grasses were being planted over ever-increasing areas from New Mexico to the Canadian border and from the Dakotas to California, Oregon, and Washington, species of at least two genera of plant bugs (Miridae), *Irbisia* Reuter and *Labops* Burmeister, the so-called black grass bugs, expanded their feeding habits to include the newly arrived grasses (Jensen 1971). Not only did the grass bugs extend their feeding to include the crested wheatgrasses, they did so in a dramatic fashion, often severely damaging planted stands (Knowlton 1945, 1951; Denning 1948; Armitage 1952; Pepper et al. 1951, 1953, 1956, 1958; Higgins et al. 1977; Kamm et al. 1978). The problem grew as the plantings expanded and still exists today (E.W. Evans, Biology Dept., Utah State University, Logan; pers. com. 1993). Such host shifts should not be surprising, since there is at least one species of *Labops* found in Central Asia that feeds on *Agropyron* species (Kerzhner 1973).

Even before species of *Irbisia* and *Labops* were found to damage these nonindigenous range grasses, they had been reported attacking other crops (Vosler 1913; Childs 1914; Essig 1915, 1926; Herms 1926; Tavernetti 1933; Mills 1939, 1941). These bugs, especially species of *Irbisia*, often move to nongraminoid host plants of many types when the grasses or grains lose their moisture (Schwartz 1984). The movement of other plant bugs, such as *Lygus* species, from alfalfa into cotton after the alfalfa is cut is well known (Butler et al. 1971).

THE CONSERVATION DILEMMA

The example discussed here presents a dilemma with respect to insect conservation. Certainly, the introduction of *Agropyron* species into North America has greatly enhanced the populations of many species of *Irbisia* and at least three species of *Labops* to levels classed as "epidemic" by those trying to increase the carrying capacity of rangelands. One might consider this a case of reverse conservation where unintentional "conservation" efforts far exceeded expectations.

THE SOLUTION

A review of the substantial literature on black grass bugs and wheatgrasses reveals the gradual increase in the extent of plantings and a corresponding increase in problems with grass bugs (Ansley and McKell 1982). Early efforts to control the bugs relied on pesticides. As more information accumulated on the biology and ecology of the insect species, management recommendations were made utilizing timing of grazing in relation to the phenology of the grasses as a method of controlling the bugs (Haws and Bohart 1986). Further work showed that greater species diversity of grass plantings was an effective way to reduce losses to the bugs; this also created conditions that more closely resembled the original state of the grasslands (Spangler and Macmahon 1990, Araya and Haws 1991). Environmental concerns over the widespread use of pesticides (Wells et al. 1983) and the removal of compounds registered for use coincided with increased interest in Integrated Pest Management (IPM) (Kogan 1986). Watts et al. (1982) suggested that IPM was an effective way to approach many problems on grasslands, as did Araya and Haws (1991). Such emphasis is appropriate to conservation efforts to maintain and increase biological diversity in managed ecosystems (Kogan and Lattin 1993).

The situation described here demonstrates why we should evaluate the environmental consequences of importing nonindigenous plant species. A recent publication by the U.S. Congress, Office of Technology Assessment (1993), provides extensive documentation on the impact of nonindigenous species in the United States. As the OTA report points out, inadequate preliminary study of organisms at their point of origin may lead to very costly consequences. Special care is essential when the nonindigenous species will replace or supplement existing native species — organisms already adapted to local conditions.

Finally, increased work on the impact of habitat manipulation in managed ecosystems will surely disclose ways to enhance species richness of indigenous plant species and reduce the reliance on nonindigenous species. The restoration of grasslands offers some exciting opportunities for research; for example, it would be valuable to further examine the findings that increased diversity of grass species reduces bug problems. Greater effort in breeding of native grasses for improvement in characteristics such as nutritive quality and insect resistance is promising. Additional work on ecosystem management is required to maintain the diversity and resilience of grasslands and rangelands.

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