

The Potential of Two Insects for Controlling Broom Snakeweed

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The perennial shrub broom snakeweed causes problems to rangeland cattle producers throughout western U.S. through its induction of abortion and competition with higher quality forage. Snakeweed is widely distributed throughout North America, from central Texas to California and from southern Canada to northern Mexico (Stubbenieck et al. 1981).

Biomass productivity of perennial grass can be increased by as much as 833% as a result of complete snakeweed removal (McDaniel et al. 1982). Snakeweed-induced abortions in pregnant cattle have been as high as 60% under worst-case conditions in western U.S. (Sperry et al. 1964). These problems present a serious strain on an already depressed cattle industry, which continues to deteriorate financially. Therefore, any methods for controlling broom snakeweed must be accomplished with economic strategies in mind. An economical method of controlling broom snakeweed will be worth millions of dollars to rangeland cattle producers in western U.S.

Control using synthetic chemical pesticides has been noneconomical, noneffective, and/or ecologically undesirable (Ueckert 1979 and Wangberg 1982). Control using fire has experienced limited success (Dwyer 1967). The applied



Snakeweed infested area in San Miguel County, New Mexico.

biological control of broom snakeweed has been largely unexplored. In addition to the economic benefits to be experienced, an applied biological control method for broom snakeweed would most likely be void of nontarget effects common to chemical control methods and would provide knowledge applicable to the control of other rangeland weeds.

Numerous destructive and potentially destructive insects of snakeweed have been identified in New Mexico and Texas (Wangberg 1982 and Foster et al. 1981). The most damaging activity, as based on personal observation and review of several investigations (Wangberg 1982, Foster et al. 1981,

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Insects were identified by the Insect Identification and Beneficial Insect Introduction Institute, Northeastern Region Beltsville Agricultural Research Center, Agriculture Research Service, U.S. Department of Agriculture.

Photographs were taken by Danny R. Davis.

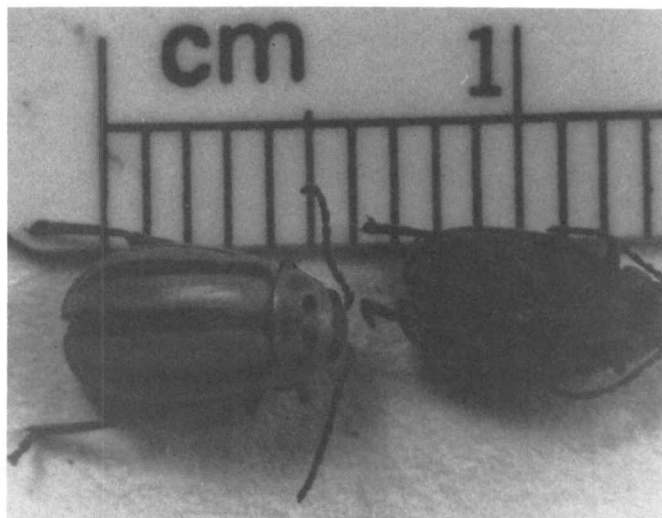


Damage to snakeweed by checkered beetle larva.

and Richman and Huddleston 1981), appears to occur as a result of root-boring by several insect larvae, therefore, this appears to be the most productive avenue of research into the applied biological control of broom snakeweed.

Materials and Methods

Broom snakeweed roots were examined for root-feeding insects at 4 sites in San Miguel County, New Mexico, in October, 1984, and May, 1985. Only dead or partially dead plants were sampled for this purpose. Initial observations suggested root-boring activity by larvae in the checkered beetle (Cleridae) family to be substantially more damaging to snakeweed than that of other insect species. Therefore, root surveys were limited to dealing with the checkered beetle (*Enoclerus coccineus*) larvae. Of 132 total plants examined, 81% of the plants above 6.25 inches in height contained the larvae or evidence of damage by this species. The lack of adult members of this insect in the field prevented using them in laboratory experiments.



Adult leaf beetle (*Disonycha latifrons*).

up to 17 days and retain up to an 80% hatch success rate.

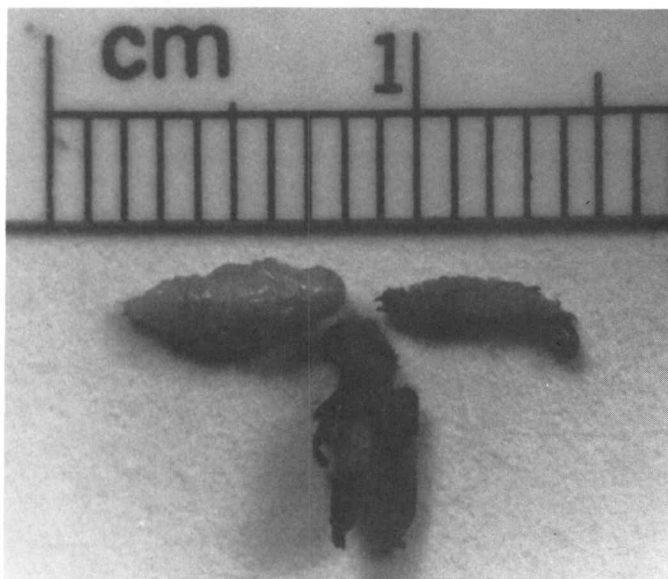
Observational field and lab studies on the leaf beetle have suggested several growth, developmental, and behavioral characteristics which may be useful in developing a strategy for their use in controlling broom snakeweed. These characteristics include the following:

- complete metamorphosis (egg, larva, pupa, adult).
- relatively short (3-8 weeks) adult stage.
- copulation exhibited.
- solar incubation of eggs within abdomen.
- aggressive behavior resulting in death when kept in closed captivity.
- egg laying was limited to a relatively short period of time (2-4 weeks) during the adult stage.
- egg laying was completed within 3-5 days after collection of adults from the field.
- adults were more abundant on larger snakeweed plants.

Discussion

There was a high correlation between dead or nearly dead snakeweed plants and the presence of the checkered beetle larvae in the root. This implies that this insect is very effective at killing broom snakeweed once root penetration has occurred. The apparent specificity in its host preference for broom snakeweed suggests that the checkered beetle has developed a single host source relationship with snakeweed. This could also suggest that the checkered beetle has evolved mechanisms to utilize or bypass the defense chemicals which snakeweed produces. Snakeweed produces a class of chemicals called saponins which destroy red blood cells in some herbivores including domestic cattle. Snakeweed is now an acceptable and possibly a required host for both the checkered beetle and the leaf beetle larvae, giving these insects an exclusive advantage over other insects that cannot feed on snakeweed. However, the fact still remains that the effectiveness of these two insect species at controlling snakeweed on a large-scale basis is presently suboptimal.

The time of collection of adult checkered beetles from the field was critical to the number of egg masses collected. The optimal temperature (91 ° F) for hatching eggs was too hot



Three stages of the checkered beetle (*Enoclerus coccineus*).

Adult beetles of a different family, Chrysomelidae (leaf beetles), emerged in large numbers in mid-May. This leaf beetle (*Disonycha latifrons*) showed a diet preference for snakeweed in the field. Adult beetles were collected during a six-week period and insect cages within environmental growth chambers were used to rear the adults. The influence of temperature on egg laying was evaluated. Initial results indicated that the stage of adult insect development at the time of their collection influenced egg production much more than ambient temperature.

Results

Experiments on the effects of temperature on hatching of the leaf beetle eggs were conducted. The results showed that a temperature of 91° F hatched the greatest proportion of eggs in the shortest period of time. This temperature soon (2 or more days after hatching) caused death of the larvae. Results from experiments with cold treatments showed that eggs could be stored at an average temperature of 32.9° F for

for rearing young larvae. The retained viability of eggs stored in cold (32.9° F) implies the ability to have some control of when eggs will hatch in the lab. This would allow for the release of masses of larvae and/or eggs into snakeweed pastures at strategic times.

The relatively short period of time (3-8 weeks) which the leaf beetles spent in the adult stage could be desirable from the standpoint of unwanted effects. The inconspicuousness of the leaf beetle larvae in the field and the conspicuousness of the adults may indicate that the adult stage is the dominant life form of this species.

Because the larval stage of the checkered beetle induces significant damage to snakeweed it would seem desirable to extend the larval stage of this species as long as possible. Contrary to the leaf beetle, the dominant life form of the checkered beetle in the field appeared to be the larval stage.

Developing either insect into an effective biological control of broom snakeweed may rest in the ability to mass produce them in the lab and/or to increase the rate at which they become adapted to the saponins produced by broom snakeweed. The first of these criteria has been explored superficially for the leaf beetle with encouraging results. Preliminary results on experiments with the checkered beetle indicated this insect to be very effective at killing snake-weed plants once root penetration had occurred. Both the leaf beetle and the checkered beetle have potential to be

developed into an effective biological control for broom snakeweed.

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Prickly Pear Control

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I read with great interest the article by Ibarra, Martin, Cox, and Prieto on their work to control walking stick cholla cactus (*Rangelands*, 7(2) 1985). I wish to relate some of my experiences when I was starting my professional career with the USDA, Soil Conservation Service, in Vega, Texas, concerning the control of prickly pear cactus that may be of interest and use.

Back in the dustbowl days of 1937 on the Soil Conservation Demonstration Project at Vega, we were experimenting with ways to control prickly pear cactus. This area, on the Southern Great Plains, buffalo-blue grama grasslands, had a small farm pasture where prickly pear clumps were so thick that a person could step from one clump to another over much of the area. Blowing soil from cultivated fields had formed a small hummock around each cactus clump.

It was observed that there was a strip of land between the house and a neighboring cultivated field that was completely clear of cactus. The farmer told us that he had eliminated the

cactus on that strip with his peg tooth harrow as he went back and forth to the cultivated field.

A small study was initiated to investigate this idea of cactus control. We decided to first cut off the cactus and level the hummocks with a railroad rail drag. Frequent checking after treatment showed, as we expected, that the cactus pads had only partially dried when rain moistened the ground and allowed the pads to root and form new plants. The farmer was asked to harrow the pasture a second time to break the roots. Careful timing of the two harrowings allowed the pads to dry out and die. As a result the pasture was almost completely free of cactus.

I suspect that a second cabling of cholla cactus will break the rooting cholla cactus pads from the ground and result in similar control. Ibarra et al. commented that rainfall the year of treatment was favorable to rooting, resulting in a tenfold increase of plants. Moving the newly rooted cholla pads and allowing them time to dry out might be feasible for cactus control even in a wet 'unfavorable' year.

Editor's Note: The author is a Life member of SRM living in Bogota, Columbia. He and his two sons have a ranch in the Llanos about 150 miles east of Bogota.