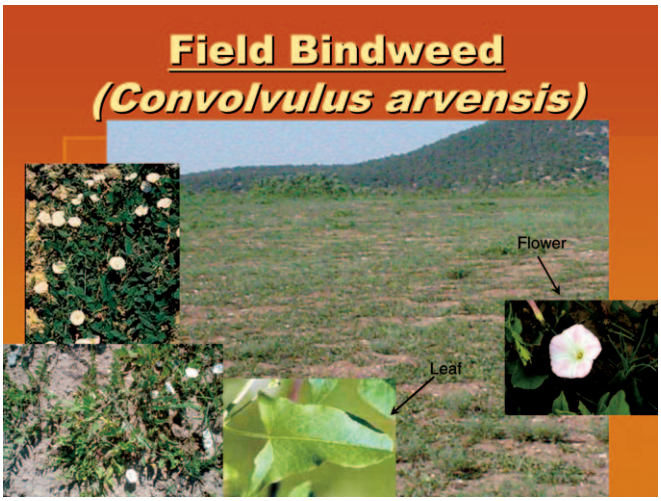
# Youth Forum

## One "Mite-y" Mission: Compensation Suppression of *Convolvulus arvensis* After Implementing Host-Specific *Aceria malherbae*

**By Kaitlyn Lingus**

*Editor's Note: This paper is the 3rd Place winner of the High School Youth Forum contest at the Society for Range Management Annual Meeting, February 2006, Vancouver, British Columbia, Canada.*

At a glance, field bindweed (*Convolvulus arvensis)* is a very attractive plant. Behind the facade of its striking appearance, however, field bindweed is an agricultural disaster. So, how do we address this problem? Biological control methods may prove to be the best chance to suppress this rapidly increasing invader.[1] A minute mite, commonly known as a bindweed gall mite (*Aceria malherbae*), is giving bindweed a run for its "land."



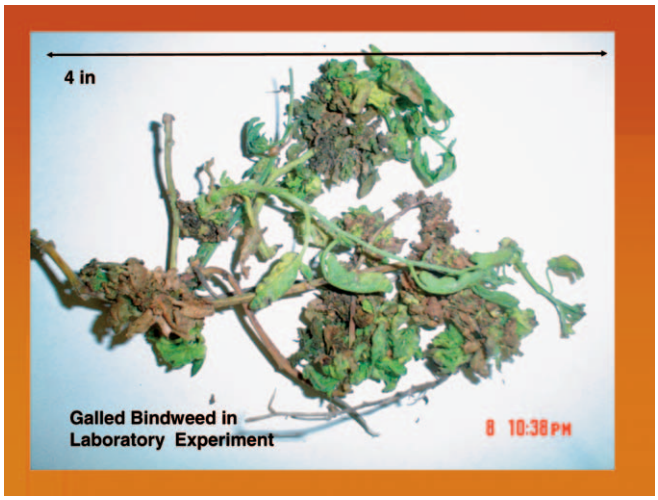

Field bindweed, known as creeping Jenny, possession vine, or wild morning glory, originated in Europe and poses major threats to the environment and rangeland (R. Hammon, personal communication, December 2004). It is one of the most competitive perennial weeds in the United States.[2,3] It's easily recognized by its arrow-shaped leaves and trumpet-shaped flowers. Flower color can vary from white to pink.[4] With its aggressive root system, bindweed is hard to control using mechanical control agents or chemical applications.[5] Its deep, penetrative tap root reaches 20 feet into the ground and removes the limited moisture from neighboring plants that are usually native to the land, thus killing them. Because their roots store 2 to 3 years worth of food, bindweed is very difficult to suppress or kill.[6]

An average bindweed plant produces approximately 500 seeds. These seeds are protected by a very hard coating that allows them to stay viable in the soil for up to 40 years (M. Henry,

personal communication, March 2004). Because 500 seeds are produced annually, the problem is increasing at an unbelievable rate; think of it as cells multiplying by the minute.

Long roots and numerous seeds are not the only problem. Field bindweed stems stretch out as far as 15 feet in diameter with an average stem length of 3 feet from the base. Some plants have 40 to 50 stems. Nothing is seen but bare ground underneath the dense mat of stems. It is not an unusual sight to see this type of futile land. It is rapidly becoming a significant concern for farmers, ranchers, developers, and landscapers because yield to field crops are decreasing and rangeland coverage is quickly diminishing.[7] The bindweed gall mite feeds on the plant and may actually help the ranchers and farmers to control if not rid this devastating weed.

Bindweed gall mite is a small microscope mite, approximately 0.2 mm in length. They are a yellowish color and resemble worms. Like field bindweed, they originated in Europe.[8] The adult mites are active from May to November, and 1 mite can produce over 200 eggs annually. The mites move an average of 400 feet per year, and are dispersed by wind, root systems, or other moving foliage (T. Locke, personal communication, November 2004).




The bindweed gall mite is host specific to field bindweed.[9] The mite feeds along the center of the upper surface of the bindweed leaves causing the leaves to fold and fuse along the middle vein. As the feeding progresses the plant cells thicken and develop a rough surface.[10] It produces a "fuzzy" feeling. These galls can form on the rhizomes, stems, buds, and deeper roots. The mites retard the growth of the plant, causing a reduction in seed production, a stunted root system, and fewer stems created, each having shorter lengths (G. J. Michels, personal communication, December 1999). Eventually the mites can suppress the bindweed. Current researchers' studies conclude that the mite winters in the root system of the weed and thus totally restrains the plant's further development.[11] Dispersing from one plant to another, the mite has a large impact on a vast area of land that is infested with field bindweed.

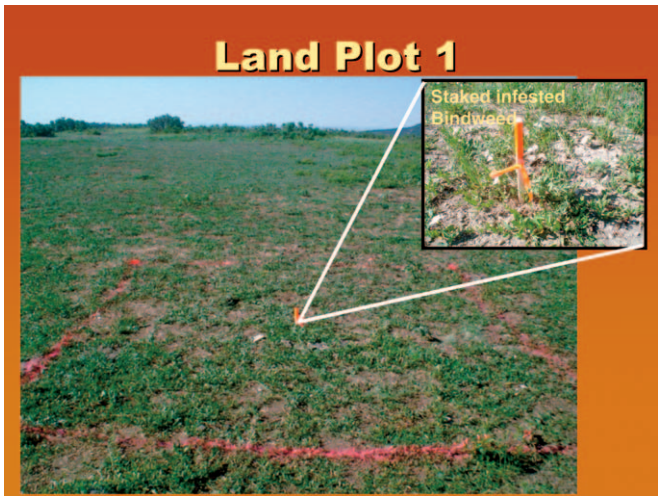
Realizing the effect that field bindweed was having on our rangeland, I set up a project to address the problem using a bindweed gall mite. The purpose of my experiment was to determine what effects the bindweed gall mite would have on field bindweed, and how the mite affected the bindweed's growth rate and seed production. I also wanted to identify the physical effects of the mite on the bindweed and how easily the mites spread.

It is hypothesized that if *Convolvulus arvensis* is infested with *Aceria malherbae*, then growth rate, seed/flower production, and bindweed coverage will be affected enough that it would prove to be a potential biological control agent to be used across Colorado.

This double experiment project began by collecting information on field bindweed and its effects on rangeland productivity. To find a biological control agent I went to Palisade, Colorado, to meet with scientist Terri Locke, who is rearing the bindweed gall mite. After sufficient information was gathered, 2 experiments followed. One experiment was based in the laboratory environment, where I had control over climate, moisture content, amount of light, and soil. The other was a range experiment where I utilized the bindweed's natural setting.

For my laboratory controlled experiment, I took 2 matured bindweed plants and recorded stem length, stem count, and seed production as my dependent variables. I measured these variables over a 2-month period.

For my range experiment that took place in the 2005

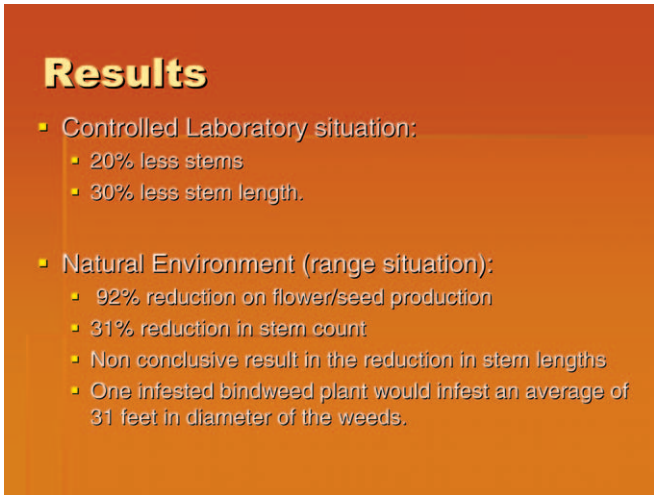



growing season, I staked out two 10- × 10-foot plots. I infested the 1 center bindweed plant with the mites. For my dependent variables I recorded plant concentration, stem length, stem count, seed/flower production, and movement of mites, as well as physical signs of suppression.

After analyzing the data on my laboratory experiment, the mite-infested bindweed plants had 20% less stems and the stem length grew 30% less than the average noninfested field bindweed plant.

In the natural environment setting, there was a 92% reduction in flower/seed production and a 31% reduction in stem count. I could not reach a conclusive result in physical measurements in stem length because of the gall effect exhibited by the mites. However, there was a large visible reduction in stem lengths. Mites from 1 infested bindweed plant would infest an average of 31 feet in diameter of the surrounding weeds.

After finding a possible control agent for a weed that is threatening our rangeland productivity I was able to establish 2 parts of an experiment to find the conclusiveness on a biological control agent. After using a controlled environment and a natural environment for infesting the bindweed with the mites I was able to compare 2 sets of data to test the effectiveness of the control agent.




From the results of my experiment, I can conclude that biological control using the bindweed gall mite, *Aceria malherbae*, will be an option using biological methods to control field bindweed that threatens productivity on rangelands throughout the state of Colorado.

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## Additional Reading


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