MSU Extension Invasive Plants

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How locoweeds host a fungus that makes them toxic to livestock, but don't seem to care

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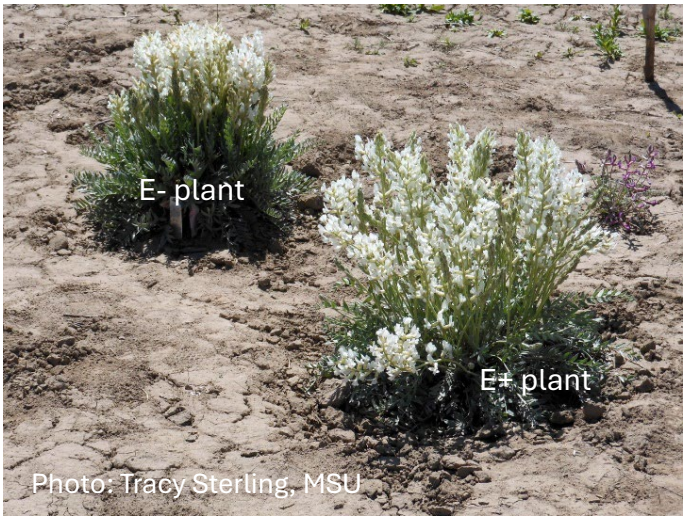

Introduction Locoweeds are a group of about 25 toxic legume species (*Astragalus* spp. and *Oxytropis* spp.) native to US western rangelands that can cause livestock poisoning. In Montana, the perennial white locoweed (*Oxytropis sericea*) (photo, right) is the most common species. Locoweed creates economic losses due to 'locoism,' a neurological disease of livestock caused by the alkaloid swainsonine. Swainsonine is made exclusively by a slow-growing fungus (*Undifilum oxytropis*), known as an "endophyte," which lives between cells in leaves so the plant does not see it as a pathogen. The fungus does not spread from plant to plant but can endure over locoweed generations because it first grows in the seed coat and then develops within emerged seedlings each spring. Livestock consume locoweeds especially when locoweeds are the first plants to green up each spring, yet it has been shown that swainsonine does not deter or attract insect or livestock feeding. Locoweeds with the endophyte do not appear affected by the fungus, unlike in tall fescue where its endophyte can improve fescue's stress tolerance and plant growth. Because the nitrogen-rich swainsonine is costly for locoweeds to produce, we were curious if its endophyte causes any growth benefit or penalty to the plant which might affect locoweed's ability to survive or compete with other plants. We also wanted to learn about any vulnerabilities that might help managers manage locoweed.

Methods We grew 150 pairs of locoweed plants with (E+) and without (E-) the fungus at the Montana State University Post Farm between 2011-2020 near Bozeman, Montana. For E- plants we removed the seed coat and sterilized the embryo, thus killing the fungal endophyte. We then grew E+ and E- seedlings in a greenhouse, transplanted them into the field as E+ and E- pairs, and measured survival, photosynthesis, flower and seed production, and seed viability and germination rates. For plants that survived until 2020, we measured leaf, flower stem, root and crown biomass.

Results Locoweed plants grew as perennials with winter survival, photosynthesis, and seed production and germination unaffected by the endophyte. This insensitivity to the endophyte at the embryo stage of locoweed's life cycle suggests future populations will contain similar proportions of E+ and E- plants to that of the parent generations, so swainsonine will remain a presence across western rangelands. Overall, plants did not pay a huge growth or reproductive penalty whether they hosted the endophyte or not, suggesting the endophyte is not providing a stress response benefit as seen in the fescue-endophyte symbiosis. However, we did find that E+ locoweed plants produced slightly more reproductive stems and flowers as well as slightly more biomass in reproductive stems and crowns compared to E- plants. These results suggest the endophyte may be affecting how carbohydrates produced from photosynthesis are distributed in locoweed plants with the endophyte improving below-ground reserves and regrowth potential after herbivory. Additionally, more reproductive stems and flowers in E+ plants suggest that pollinators may prefer those plants, improving their genetic diversity and hence their survival (photo, right). We plan to explore these questions in the coming years. Stay tuned!