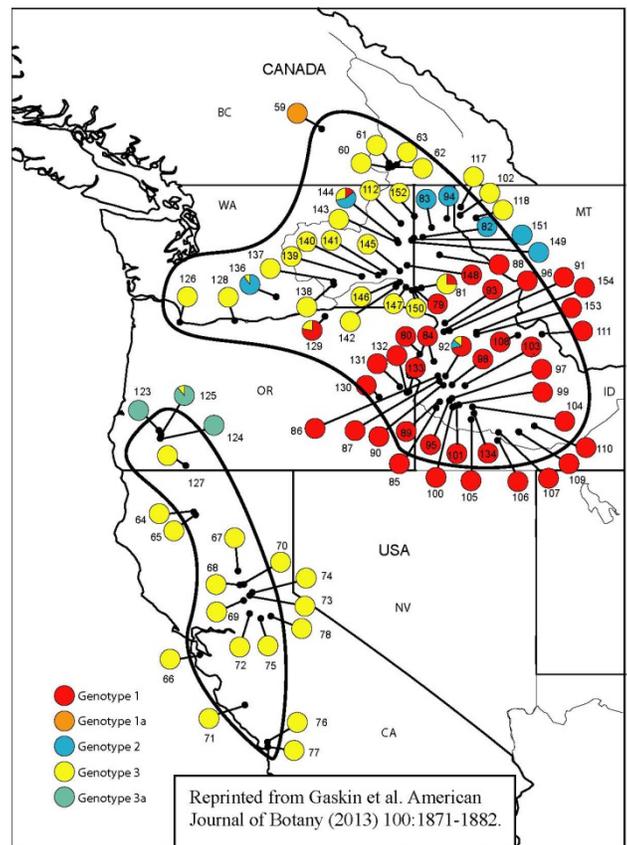# Genotyping rush skeletonweed to improve its biological control

Rush skeletonweed (*Chondrilla juncea*) is a tough plant to control. Idaho claims it as its worst invasive plant, and a large population recently found in MT isn't making things any better. This perennial species is "apomictic", meaning the mother plant does not need any pollen to create seeds; therefore, all seed is genetically identical (has same genotype) to the mother plant. This is good news for biological control, because all the plants in one lineage (all the generations of seed that came from the same mother plant) should react similarly to biological control.

How many lineages came over from the native range? Since the 1970s folks in the field have been pretty good at placing the plants into three biotypes: Banks biotype (named after Banks, ID), Washington early-flowering, and Washington late-flowering biotypes. While biotype designations are useful, timing of flowering can vary due to climate, so it is hard to compare plants in Canada or the USA with those in native Eurasia. Genotyping plants might be a better way to describe lineages, because phenotype (e.g. timing of flowering or plant height) varies over a plant's life, but genotype doesn't. DNA fingerprinting of 721 USA and Canada plants revealed only seven genotypes. Where are the genotypes distributed? Five of them are shown on the map (others occur only in the eastern USA). Each colored circle represents a population of about 10 plants. Genotype 1 (red circles = Banks biotype) is dominant throughout southern ID, genotype 2 (blue circles = Washington early-flowering) is mostly in northern ID and eastern WA, and genotype 3 (yellow circles = Washington late-flowering) is in MT, eastern WA, and CA. Genotypes 1a and 3a are rare but very similar to genotypes 1 and 3.

So how does this relate to the rust biocontrol agent *Puccinia chondrillina*? This rust is very host-specific, even to the point of liking one genotype more than another. One strain from Italy attacks genotypes 2 and 3, but not genotype 1. Another Italian strain attacks only genotype 1 but is heavily parasitized by another fungus, making the agent ineffective. Some of the current agents (rusts and arthropods) have impacts on rush skeletonweed, but none are doing a fantastic job, and additional agents may be needed. Plants from Bulgaria, Germany, France and Spain are genetically more similar (often identical) to our 3 major genotypes, so those locations may be better places than Italy to search for additional rust strains.

Genotype 1
Genotype 1a
Genotype 2
Genotype 3
Genotype 3a

Reprinted from Gaskin et al. American Journal of Botany (2013) 100:1871-1882.

For more info on rush skeletonweed genetics, see Gaskin et al. *American Journal of Botany* (2013) 100:1871-1882. Check out the rush skeletonweed management plan published by the Forest Health Technology Enterprise Team (FHTET-2009-03). Contact John Gaskin (John.Gaskin@ARS.USDA.GOV) or Mark Schwarzlaender (markschw@idaho.edu) if you need access to either publication. Also see the publication from WA on rush skeletonweed management
http://www.co.lincoln.wa.us/WeedBoard/controloptions/rushskeletonweedoptions.pdf.

Test your knowledge of Genotyping Rush Skeletonweed
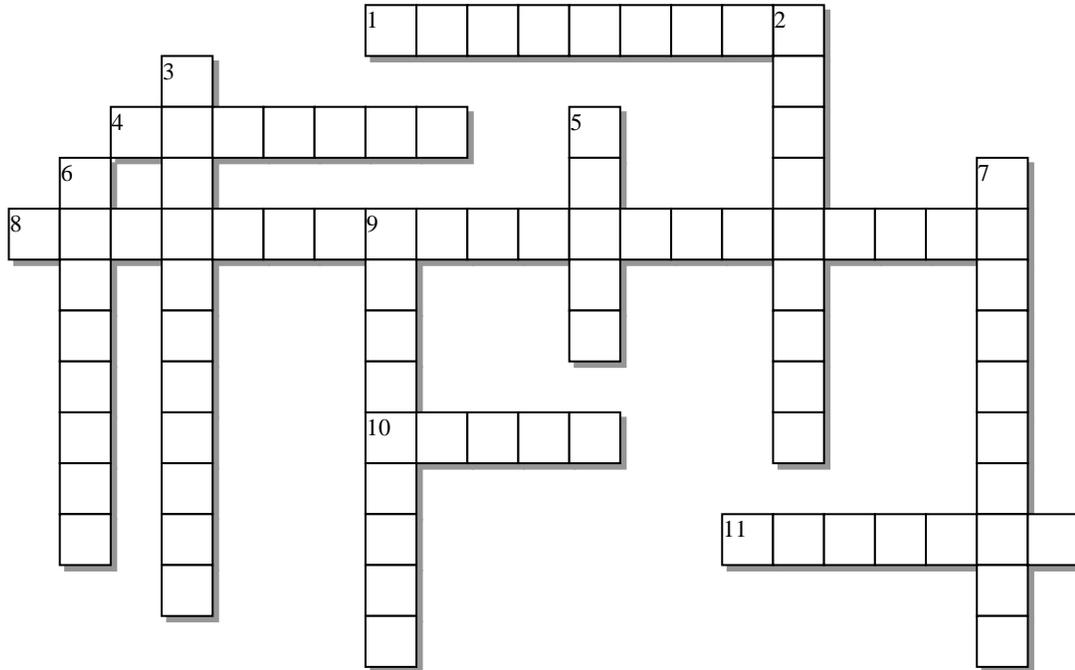
Across:

1 - Seven of these exist in the USA for rush skeletonweed

4 - Rush skeletonweed is native to this area of the world

8 - If your crossword puzzle skills are a bit "rusty", this clue may help: a biocontrol pathogen of rush skeletonweed

10 - Country of origin for the rust strain used as a biocontrol agent

11 - A new, large population of rush skeletonweed was recently found in this state

Down:

2 - *Rush skeletonweed is in the Asteraceae family, also commonly called this family

3 – *As opposed to self-pollinating, this promiscuous behavior can lead to millions of genotypes

5 - This genotype is named after a town in Idaho

6 - Searching for biocontrol pathogens in this country may improve results for rush skeletonweed control

7 - This state has only one genotype of rush skeletonweed

9 - Plants that don't need pollen to produce seed

*Refer to other publications for answer

Solutions are posted to the MSU Extension Invasive Rangeland Weed website:
http://www.msuextension.org/invasiveplantsMangold/extensionsub.html