Prickly Russian Thistle: Classification and Related Species in South Dakota and the United States

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Overview

The goal of this SDSU Extension publication is to provide expanded information on the notorious invasive plant, prickly Russian thistle. It provides an overview of the classification (i.e. taxonomy) and related species of Russian thistle found in South Dakota, as well as the United States. Prickly Russian thistle, *Salsola tragus*, (Figure 1), is an herbaceous annual species that is one of the earliest emerging weeds in the spring. The species is now recognized as part of a broader definition of amaranth family, Amaranthaceae, where it is related to other invasive rangeland plants such as *Halogeton* (i.e. saltlover) and *Kochia*.

Figure 1. Prickly Russian thistle. Credit: Maribeth Latvis.

What's In a (scientific) Name? *Kali* vs. *Salsola* and the Salsola tragus "species complex"

Plants known as "prickly Russian thistle" have also been called Russian cactus, burning bush, windwitch, tumbleweed, and common saltwort, and their taxonomic classification has been the subject of much rearrangement and confusion. For example, the species is recognized in some databases as *Salsola tragus* (e.g. iNaturalist, USDA Plants, Integrated Taxonomic Information System) and *Kali tragus* in others (e.g. Global Biodiversity Information Facility, Wikipedia) based on an updated (yet controversial) classification schemes (Akhani et al., 2007; Akhani et al., 2014).

The Flora of North America currently recognizes 6 species of Salsola within the United States, Canada, and Mexico *(S. collina, S. kali, S. paulsenii, S. soda, S. tragus,* and *S. vermiculata)* (FNA, 2020). At the species level, pricky Russian thistle *(Salsola tragus)* is highly polymorphic, with some forms appearing to be geographically distinct, while others appear to be morphological variants with no taxonomic significance (Mosyakin, 2004). A survey of 600 Canadian herbarium records revealed differences in plant size and growth form from plants collected from different environments (Beckie and Francis, 2009). In 1996, one study (Mosyakin, 1996) represented S. tragus as a broader

name for all the existing tumbleweeds in North America, lumping together *S. tragus, S. australis, S. iberica, S. kali, S. pestifera,* and *S. runthenica* as synonyms of each other.

In addition to morphological variation within prickly Russian thistle, hybridization between species appears to be common (Beatley, 1972; Hrusa and Gaskin, 2008; Welles and Ellstrand, 2020), which makes identification challenging and further complicates taxonomic classification. Additionally, differing chromosome numbers (i.e. 2n= 18, 36, and 54) between populations of prickly Russian thistle suggests that whole genome doubling, or polyploidy, may play a role in the biology of these plants. This process alters the genetic makeup of plants by hiding recessive mutations and may affect physiology and morphology within as little as one generation. This may allow polyploids to colonize new ranges and increase their invasive potential (Ellstrand and Schierenbeck, 2000; te Beest et al., 2012). Polyploid species also tend to have higher survival rates and fitness in early stages of adaptation and this might play a crucial role by restoring sexual reproduction after hybridization (te Beest et al., 2012).

A Closely Related Species in South Dakota

Slender Russian thistle (*Salsola collina*; also spineless Russian thistle, slender saltwort)

Slender Russian thistle (Figure 2) tends to be slender and soft when the plant is younger and is either spineless or weakly spined compared to prickly Russian thistle. The two species more closely resemble each other when they are younger, before spiny leaves develop on prickly Russian thistle. When the plants are reproductive, slender Russian thistle will lack the membranous sepal wings that are characteristic of prickly Russian thistle. The two species both produce tumbleweeds following senescence. Slender Russian thistle is native to arid regions of Central Asia, easternmost Europe and southern Siberia. It was first reported from Dakota County, Minnesota in 1937 (Moore, 1938). Currently, it is mostly distributed across central North America and is not as widespread as prickly Russian thistle (Figure 3).

Figure 2. Slender Russian thistle *(Salsola collina)*. Credit: bugwood.org

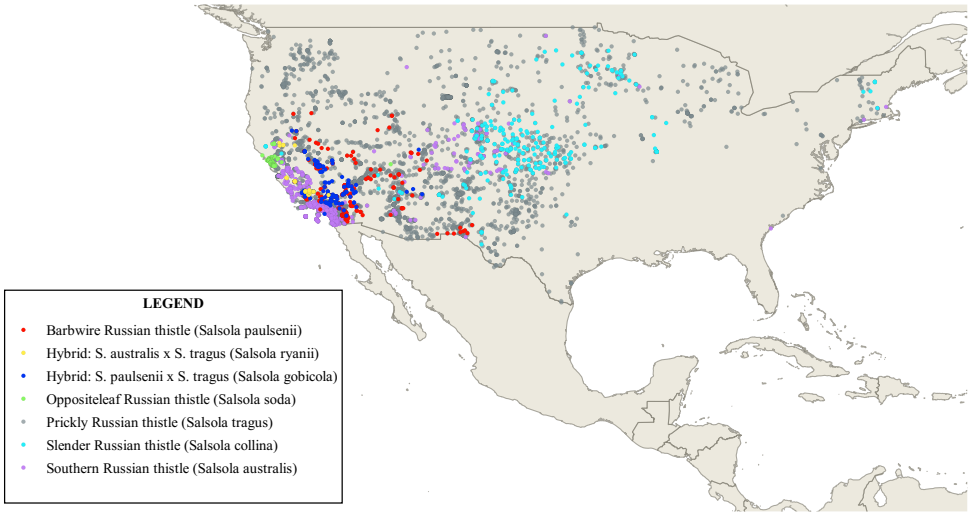

Figure 3. Occurrence map showing different species of *Salsola* in the U.S. from 1870 to 2021 (Credit: Deva Raj Khanal). Data points were taken from Global Biodiversity Information Facility (GBIF.org). Numerous species and hybrids overlap in Southern California, which obscures some of the data points.

Other Described Species of Salsola in the U.S.

Barbwire Russian thistle *(Salsola paulsenii)*

Barbwire Russian thistle was first collected in 1913 near Barstow, California; however, that collection had gone unrecognized until it was first reported in 1968 (Munz, 1968; Mosyakin, 1996). This species is commonly found in arid and semi-arid ecosystems in Texas, New Mexico, Colorado, Arizona, Utah, Nevada, California, and Oregon. Native to central Asia to southwest Russia (Rilke, 1999), it has been recently documented as an introduced species in Ukraine in 2017 (Mosyakin, 2017). This species readily hybridizes with *S. tragus*, forming the species *S. gobicol*a (Rilke, 1999), which is recognized by the Jepson Manual of the Vascular Plants of California.

Hybrid: *S. australis* x *S. tragus (Salsola ryanii)*

S. ryanii is a recently formed polyploid hybrid between *S. tragus* and *S. australis* and has a chromosome number of 2n= 54. This new species is thought to have formed recurrently over the last 25-100 years (Ayres et al., 2009). Polyploidy produces plants of a larger size, which produce an even larger seed set, sparking concerns that *S. ryanii* may become the next "super weed" (Welles and Ellstrand, 2020). Since its formation, S. ryanii has rapidly expanded its distribution in California.

Hybrid: *S. paulsenii* x *S. tragus (Salsola gobicola)*

S. gobicola was reported to be a hybrid species formed between *S. tragus* and *S. paulsenii* (Rilke, 1999), which have fruits with wings at some or all lower nodes like *S. australis* differing in other morphological characteristics (Hrusa and Gaskin, 2008). A native species to Eurasia, *S. gobicola* is mostly found in sandy and disturbed places of California Floristic Province, Great Basin Province and Desert Province (Hrusa, 2012).

Oppositeleaf Russian thistle *(Salsola soda)*

S. soda is a native species to Eurasia and North Africa and was first reported in Alameda County, California in 1971 (Thomas and JH, 1975). With the existence in several locations of central California, it was expected to scatter in the coastal saline habitats but its distribution is mostly concentrated in central California.

Southern Russian thistle *(Salsola australis)*

S. australis, native to Australia and South Africa, have been found throughout the San Joaquin valley in disturbed places and railway tracks but was previously reported as *S. kali* L. subsp. *austroafricana* and *S. kali* subsp. *pontica* (Pall) (Hrusa and Gaskin, 2008). While this species is recognized by the Jepson Manual of the Vascular Plants of California, it is considered a synonym of *S. tragus* in Flora of North America. However, *S. australis* is considered a diploid (2n= 18), while the widespread *S. tragus* is considered to be a tetraploid (2n= 36) (Ayres et al., 2009).

Conclusion

Overall, the information provided on the classification of *Salsola* species sheds light on the importance of identification, and often, genetic testing, to help distinguish between species. It also reveals that scientists are always learning and classifying species correctly helps guide research. There are several related species to *Salsola tragus* (pricky Russian thistle) that are found in South Dakota and throughout the U.S. Understanding nuances – morphology, genetics, distribution – about each related species aids in its identification, enhances knowledge of invasion, and informs management strategies.

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