Prickly Russian Thistle: History, Identification, Challenges and Management Strategies

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Overview

The goal of this SDSU Extension publication is to provide an introduction of the notorious invasive plant, prickly Russian thistle. It provides an overview of the history and spread of this invasive species into North America, identification, challenges, and management considerations.

Impact of Invasive Plants

Invasive plants are those that are non-native to the ecosystem and cause economic and environmental harm. They threaten biodiversity and often have traits that allow them to outcompete native species, such as large seed producing capacity, fast growth, and allelopathic effects (Bais et al., 2003). It is estimated that invasive species cost the United States ~$120 billion annually through decreased agricultural yield, mitigation efforts, and property damage (Pimentel et al., 2005). They may also restructure ecosystems through soil disturbance and an increase in fire regularity (Fusco et al., 2019). In some cases, these plants are intentionally introduced for forage, biocontrols, or horticultural/agricultural uses, while others are accidentally transported. With increasing global transportation of goods and services, the problem of invasive species has been growing, with one third of them first appearing between 1970 and 2014 (Seebens et al., 2017).

Prickly Russian thistle *(Salsola tragus)*

An Incredibly Fast Plant Invasion

The native range of prickly Russian thistle is in the arid steppes of eastern Russian and Ukraine through China, extending southward through northern Africa and the Middle East. The earliest documentation of Russian thistle in North America is from 1877 in Bon Homme county, South Dakota, with a suspected introduction with contaminated flax seeds from Russia brought by settlers to the area (Shinn, 1895). Its initial spread throughout the Great Plains states was catastrophic, fueling abandonment of infested land and anti-immigrant sentiment within the region (Young, 1988). It also directly informed public policy by prompting state laws regulating imported seeds and suggestions of statewide fencing to contain the spread (Young, 1988). The transcontinental railroad system greatly facilitated the spread of Russian thistle beyond the Great Plains, and within twenty years of the initial introduction, it was widespread in California. Consequently, its expansion has been noted as one of the fastest plant invasions on record (Rilke, 1999). As Russian thistle did not readily colonize untilled prairie, early agricultural reports made an association between infestation and environmental degradation due to poor farming/grazing practices. Molecular studies of plants from California show similarities with Russian thistle from Ukraine (Gaskin et al., 2006; Ryan et al., 2007), but since its initial appearance in South Dakota, it is likely that additional introductions from the native range have also occurred (Ayres et al., 2009). Although Russian thistle is most well-known from arid areas in western North America, it has been reported in all states with the exception of Alaska and Florida (Bernau and Eldredge, 2018).

Identification

Prickly Russian thistle, *Salsola tragus*, (Figures 1, 2), 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*. It is capable of quickly establishing an extensive root system that may extend 2 m deep and 5 m laterally before shoot expansion into the characteristic rounded growth form of the mature plants (Holm et al., 1977). The rounded growth form comes from multiple, erect, branching stems that bow outward. Stems are often striped with a red or pink color. When the plants are young, leaves are linear, fleshy, 2-5 cm in length, and with a soft point at the apex. Leaves lose their succulence later in the season and become shorter (to 6 mm) and harder, with a broad base (1-2 mm) and a sharp tip. The overall spinyness of the mature plants is a characteristic of *S. tragus*, but this feature is not as pronounced in young plants, making them more challenging to identify. Reproductive features of the plant (i.e. flowers, fruits) are very helpful in distinguishing between closely related species and genera. Flowers develop in the axils of the leaves, lack petals, with five sepals that form papery wings (4-8 mm across) appearing white, pale green, to pink. After senescence, the entire plant breaks above the ground to form a tumbleweed, which may contain thousands of seeds and are capable of traveling hundreds of miles (Shinn, 1895). This architecture is like that of kochia *(Kochia scoparia)* (Figure 3), but kochia tends to have leaves that are lighter green in color and lacking in spines.

Figure 1. Prickly Russian thistle. Photo credit: Maribeth Latvis.

Figure 2. Prickly Russian thistle. Photo credit: Maribeth Latvis.

Figure 3. Kochia. Photo credit: Maribeth Latvis.

Challenges and Consequences

There are several challenges associated with prickly Russian thistle. First, it uses the C4 photosynthetic pathway, has a high water-use efficiency, and is tolerant of arid, saline habitats, which helps it outcompete native species (Fowler et al., 1992). It is considered one of the worst agricultural weeds in North America, costing the United States $50 million annually. The economic harm is the result of lowered crop yield, higher production costs, injury to livestock, structural damage, environmental degradation (e.g., through water depletion) and related mitigation efforts. Dead plants have been noted to cause road accidents, and they are extremely flammable, exacerbating economic losses due to the promotion of wildfire, especially in the western U.S. (Bernau and Eldredge, 2018). Prickly Russian thistle is also a vector of the curly top virus that affects several crops, including beets, tomatoes, beans, and squash.

Management

Biological

Even though biological control agents have been established, there are not any significant control approaches for Russian thistle. There are biocontrol agents currently under development: an Eriophyid mite and two fungal pathogens (Bernau and Eldredge, 2018).

Mechanical

For small infestations, hand pulling is found to be effective, but mowing is not recommended as it might disseminate the seed. Although tillage helps in controlling larger plants and seedlings, it also increases disturbance, which may promote prickly Russian thistle's germination and growth (DiTomaso et al., 2013).

Prescribed Fire

As prickly Russian thistle is extremely flammable, prescribed fire is not considered an appropriate method. This might increase the risk of wildfire, especially considering the mobility of the tumbleweeds.

Grazing

Prior to reproductive maturity, prickly Russian thistle is considered a source of forage with ample nutrition. Seed production could be altered if grazing occurs earlier than the flowering stage. However, excessive consumption of Russian thistle might negatively affect animals due to the presence of oxalates, as has been noted in sheep (Boerboom, 1993).

Chemical

Preemergence herbicide treatments are effective in late winter to early spring. However, when the plants are hard and spiny, postemergence applications may not be effective in controlling prickly Russian thistle (DiTomaso et al., 2013). The chances of Russian thistle becoming established, and invading is higher if a non-selective herbicides negatively impacts non-target species. There should be strong competition from other vegetation in area to counter the recolonization of *Salsola* species.

Populations of *Salsola* have acquired resistance to herbicides in as little as a few generations. Thus, excessive use or overuse of a single herbicide over multiple years might contribute to the development of resistant populations. Previously, 2,4-D and glyphosate were found to be very effective for the control of Russian thistle (Young et al., 2008) but repeated application resulted in the development of resistant plants. Glyphosate-resistant Russian thistle were first reported in Choteau County, Montana (Kumar et al., 2017; Heap, 2021). Similarly, resistance has been noted or suspected in the following chemical herbicides: sulfonylurea (DiTomaso et al., 2013), sulfonylurea and imidazolinone (Morrisson and Devine, 1994), and triazines (DiTomaso et al., 2013). Because the genus *Salsola* has complex taxonomy, with several species that are difficult to differentiate, questions arise if the species reported to be resistant to certain herbicides are indeed prickly Russian thistle *(Salsola tragus)* or another closely related species.

A combination of approaches-- e.g. strategic tillage methods, rotating field and site-specific herbicide applications, weed sanitation, pre- and post-herbicide applications, competition from desired species-- may be effective for controlling and managing herbicide-resistant invasive plants like Russian thistle (Beckie and Harker, 2017). Promoting perennial plants with mycorrhizal associations in areas invested with Russian thistle can eliminate roots of young thistle seedlings through fungi (Barroso et al., 2019).

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