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Chapter 42, Tansy Ragwort (Senecio jacobaea): Importance, Distribution, and Control in Oregon

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Tansy Ragwort (*Senecio jacobaea*): Importance, Distribution, and Control in Oregon

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Abstract

Tansy ragwort (*Senecio jacobaea*, Asteracaeae) is one of the most serious noxious weed problems in western Oregon. The pyrrolizidine alkaloids in ragwort are toxic to cattle and horses and less so to sheep. Livestock losses associated with ragwort poisoning were estimated at over $4,000,000 annually in the 1970s. Tansy ragwort infested over 300,000 km^2 in 17 counties in western Oregon in 1987. Traditional control practices in pastures, including chemical, mechanical, and cultural control, have provided localized results. Biological control of ragwort was implemented on range and forest lands where other weed control methods were ineffective or too costly. Since 1960, three natural enemies of ragwort (the cinnabar moth, ragwort flea beetle, and ragwort seed fly) were introduced from Europe as biological control agents. In 1974, an intensive biological control program was initiated by the Oregon Department of Agriculture. By 1987, the density of ragwort in western Oregon was reduced by over 90%. Data from intensive research studies and regional surveys demonstrated that biological control was an effective method of reducing tansy ragwort infestations in western Oregon.

Introduction

Tansy ragwort is a biennial or short-lived perennial weed that is native to Europe. The flowers of tansy ragwort are yellow and daisy-like, usually with 13 ray flowers. The leaves are light to dark green and deeply lobed. Single plants, which range from 0.4 - 1.5 m tall, are capable of producing over 150,000 seeds, which can remain viable in the soil for three years or longer. Its native range extends from Norway south through Asia Minor and from Great Britain east to Siberia. Ragwort infests the northwest coast of the United States, the maritime provinces of Canada, New Zealand, Australia, and in Argentina (1). It was first recorded in western North America in British Columbia in 1913 (2). Tansy ragwort was first collected in Oregon in 1922 (3). Tansy ragwort has since become widely established throughout Oregon west of the Cascades. New infestations in eastern Oregon are becoming more frequent despite intensive eradication efforts. In 1987, it was estimated that in the 17 western Oregon counties, over 300,000 km^2 were infested with tansy ragwort (4).

The toxic properties of tansy ragwort, along with its ability to invade and displace desirable vegetation in pastures, have characterized ragwort as a serious noxious weed. Tansy ragwort causes chronic toxicity in cattle, horses, and swine when pyrrolizidine alkaloids are converted to pyrroles in the liver and results in hepatic dysfunction or failure (5). Death can occur when animals have ingested three to seven percent of their body weight in ragwort. Sheep and goats are less susceptible to poisoning caused by the ingestion of ragwort (6).

In the 1970s, it was estimated that losses to the livestock industry in western Oregon exceeded $4,000,000 annually (4). This figure estimates only the direct loss due to animal mortality and does not include weight loss, decline in animal condition, health care, and costs associated with traditional weed control methods including herbicides. Some ranchers suffered annual losses of five to ten percent of their herds and some dairy operations were forced out of business. As a result of these losses, the Oregon State Legislature classified tansy ragwort as a noxious weed, mandated control measures, and required the Oregon State Department of Agriculture to start an intensive biological control program in 1975.

Control

The Oregon Department of Agriculture in cooperation with Oregon State University initiated an intensive integrated tansy ragwort control

program in 1975 which included chemical, physical, cultural, preventative, and biological methods of weed control (7-9).

In 1975, tansy ragwort was classified as a noxious weed by legislative action. State laws and local county regulations describe warranted actions against tansy ragwort infestations. Regulations may vary from complete eradication of any ragwort detected in a county, to supporting an intensive biological control program. Guidelines that require cleaning logging equipment when it is moved from ragwort-infested sites to uninfested sites have been established. In some counties, weed supervisors cite landowners who allow ragwort to go to seed.

Chemical Control

The use of herbicides to control tansy ragwort has been successful in some locations (10). Treated areas must not be grazed until the label requirements for reentry by livestock have been satisfied. The use of 1.12 - 2.24 kg/ha of 2,4-D LV ester or amine has been used in pasture situations and works best before flowers appear. Treatments in the fall after seedling germination are also effective. Retreatment is often required for plants that germinate from the ragwort seed bank in the soil. Picloram (Tordon), a restricted use herbicide in Oregon, has been used during the flowering stage at 0.28 kg/ha on rangelands and permanent pastures, but should not be used near sensitive crops. Dicamba (Banvel) at 1.12 kg/ha can also be used up to the flowering stage. Two combination herbicides [2,4-D + dicamba (Weedmaster) at 2.17 kg/ha and triclopyr + 2,4-D (Crossbow) at 1.26 - 1.68 kg/ha] have also been successful in controlling tansy ragwort. The use of herbicides requires specific conditions, equipment, and licensing to be used in range and pasture lands. Labeling changes and local regulations vary, so always consult local authorities. Read all labels and comply with all appropriate regulations before using herbicides.

Physical Control

Physical methods of controlling tansy ragwort by physically or mechanically removing or altering the plants have had variable success. In areas where tansy ragwort occurs as occasional scattered plants, hand pulling may be a useful method of control. In 1984 a court order imposed a ban on the use of herbicides on federal lands in Oregon and Washington, and hand pulling of tansy ragwort in satellite infestations was used more frequently. Successful control occurred primarily where plants were only recently established. In areas where tansy had been established, the seed bank was sufficient to warrant periodic retreatment.

Also, pulling can cause micro-disturbances where tansy seeds can germinate.

Mowing ragwort removes the upper parts of tansy plants and prevents them from going to seed, but plants may become short-lived perennials. After mowing, regrowth of plants may occur, particularly if soil moisture conditions are conducive. Seed viability of late flowering plants appears to be lower.

Cultural Control

Various cultural practices have been utilized to control tansy ragwort infestations. Competitive plantings of aggressive grasses in disturbed areas can reduce seedling survival and establishment. Type of livestock utilized in pastures may assist in controlling ragwort. Sheep grazing in heavily infested pastures has been successful in western Oregon. Grazing cattle and horses in pastures that are heavily infested with tansy ragwort is not recommended in the spring when the ragwort rosettes are small and often accidentally ingested while feeding on grass. When ragwort plants are tall and in flower, cattle and horses seem to be able to avoid consuming ragwort, unless the pasture is severely overgrazed. Heavy grazing during early fall rains tends to promote ragwort seedling establishment.

Using fertilizers and irrigation in conjunction with managing the class, season, and intensity of livestock has been shown to be successful in controlling tansy ragwort (7).

Preventative

In eastern Oregon in Wallowa county, a hay quarantine on western Oregon hay went into effect in 1983. Hunters bringing hay from western Oregon were required to exchange their hay for locally grown hay. As part of this program, the Oregon Department of Fish and Wildlife has included a section on tansy ragwort in the hunting proclamation, informing western Oregon hunters to avoid moving contaminated hay into eastern Oregon. Since the start of the hay quarantine, the number of new tansy ragwort sites in Wallowa county has decreased 85%, despite increased efforts in the ragwort detection program (Figure 42.1). The success of the biological control program on tansy ragwort in western Oregon was becoming evident at the time the hay quarantine was imposed. With the drastic reduction of tansy ragwort in western Oregon, hay taken into eastern Oregon may have been less likely to cause new infestations.

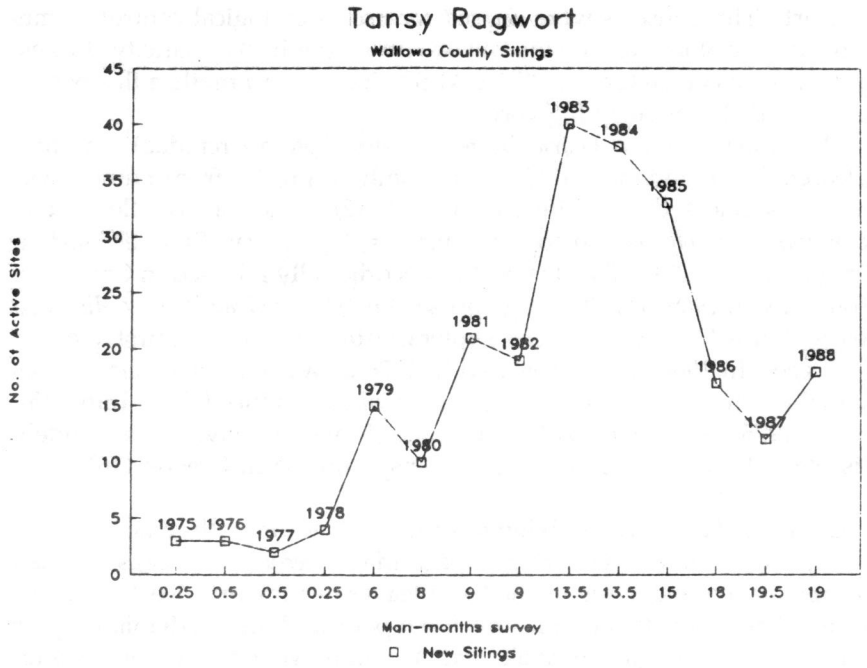

FIGURE 42.1 Number of new tansy ragwort sites detected each year in Wallowa County, Oregon. In 1983, a hay embargo was enforced to prevent hay from western Oregon from entering the county.

Biological Control

Biological control is the most successful method of controlling tansy ragwort in western Oregon. Classical biological control involves the introduction and management of selected natural enemies of a pest. We do not include sheep grazing as a form of biological control because sheep are not natural enemies nor are they host specific to ragwort, but rather as a method of cultural control. In the 1970s, economic losses caused by tansy ragwort poisoning were having a major impact on the livestock industry in the western part of the state. Similar problems were also occurring in northwestern California and western Washington. In western Oregon, some ranchers were losing from five to ten percent of their herds each year to ragwort poisoning. By 1975, when the state biological control program was funded, cooperation with USDA-ARS and other states was already in progress. The Oregon Department of Agriculture in cooperation with Oregon State University and USDA-ARS began an interdisciplinary program that emphasized the introduction, collection, distribution, and study of the biological agents of tansy

ragwort. Three insects were cleared for use as biological control agents in the Pacific Northwest by the USDA-ARS. After host specificity studies, approval was given for the USDA-ARS to introduce a moth, a flea beetle, and a seed fly on tansy ragwort.

The cinnabar moth (*Tyria jacobaeae*, Lepidoptera:Arctiidae) was first released in Oregon in 1960 (11). The moth, originally from France, was originally released in California in 1959 (12). The ragwort flea beetle (*Longitarsus jacobaeae*, Coleoptera:Chrysomelidae) was first released in Oregon in 1971 (13). The flea beetle was originally released in California from Italy in 1969 (14). The ragwort seed fly (*Pegohylemyia seneciella*, also referred to as *Hylemyia seneciella*, Diptera:Anthomyiidae) was first released in Oregon in 1966, and re-released in 1976 because the first release was thought to have failed (4). The seed fly was introduced from Italy (15). Since 1975, all three biological control agents have been widely distributed throughout the range of tansy ragwort in Oregon (16).

Cinnabar Moth. The striking red and black adult moths emerge in the late spring from overwintering pupae. Mated females lay eggs in small groups on the underside of the basal leaves of ragwort. Starting at the terminal buds, the larvae consume floral parts and leaves, defoliating the plant, often leaving a bare stalk. Larvae will move to nearby plants after stripping a plant. Plants defoliated by cinnabar larvae may reflower if adequate moisture becomes available in the late summer, and may even become short-lived perennials. After five instars, the larvae pupate in soil debris. The moth has only one generation a year. A more in-depth biology of the cinnabar moth is presented by Dempster (17).

Collection of larvae for distribution usually occurs when the larvae are nearly full grown. The larvae can be shaken into a paper sack and given some plant material for food. If the larvae are small, the stalk can be clipped below the group of caterpillars and placed into a sack. The paper sack must be taped shut and corners and seams taped, or larvae will escape during transit. Releases are generally made with 1000 larvae which are gently dumped out onto tansy plants at the new site. Care should be taken to insure that the insects do not become overheated or too damp while being stored and transported. The cinnabar moth alone is not an effective biological control agent at most sites. It is usually released with the flea beetle and the seed fly.

Flea Beetle. The tiny golden ragwort flea beetle has one generation per year. This insect is unique in that both the larvae and the adults feed on the plant. The adults emerge in the early summer, feed somewhat, and enter a reproductive diapause until the fall when they begin to lay eggs. Eggs are laid on the plants and the larvae tunnel into the leaf

petioles and the roots. Extensive damage to roots can often lead to plant mortality. The adults feed on the leaves, making a characteristic "shot hole" appearance. The life cycle and biology of the ragwort flea beetle is presented by Frick and Johnson (18).

Collection of the ragwort flea beetle generally begins in the fall when they are mating. Adults become more active following rains. The insects are collected with a gas-powered vacuum apparatus which sucks the adults off the rosettes. The adult flea beetles are then sorted and counted and put into paper cups in groups of 250-500. Some tissue paper is added to give the beetles a place to crawl around and also to absorb extra moisture. Some leaf material is also added for food. The flea beetles are then shipped to various areas around the state and released onto rosettes in infested areas.

The ragwort flea beetle has proven to be the most effective biological agent against tansy ragwort in Oregon (19). Intensive studies at research plots studied by scientists at Oregon State University coupled with regional surveys at 42 sites in western Oregon (Figure 42.2) conducted by

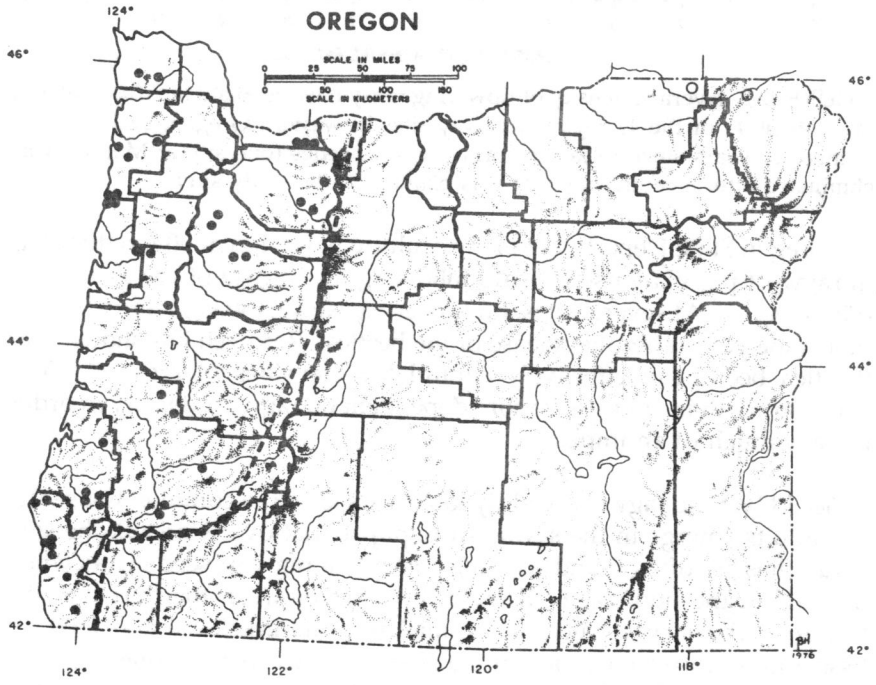

FIGURE 42.2 Map of Oregon showing major tansy ragwort infestation area (dotted line), several infestations in the northeastern counties (open circles), and the 42 regional survey sites (solid dots).

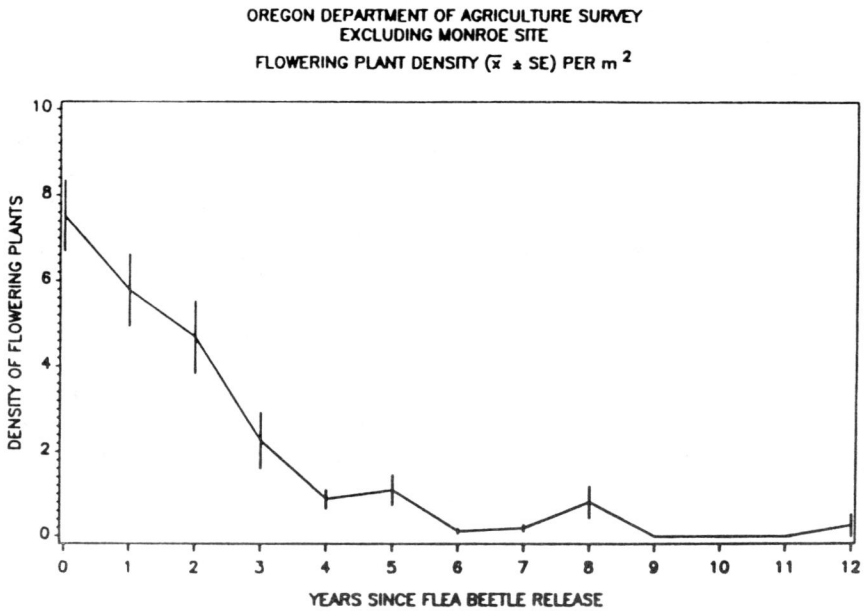

FIGURE 42.3 Average density of flowering tansy ragwort plants m^2 from 50 0.25 m^2 plots at 41 of the 42 regional survey sites in western Oregon, based on the number of years since release of ragwort flea beetles (one site at Monroe was eliminated after a conifer nursery was planted on the study site).

the Oregon State Department of Agriculture have shown 90% reductions in ragwort populations six years following the release of the flea beetle (Figure 42.3). At several sites, no flowering ragwort was observed in the plots nine years after the release of the beetles. Research has shown that the flea beetle can effectively control low densities of ragwort. The cinnabar moth in contrast is more dependent on ragwort density in order to have much of an impact.

Seed Fly. The ragwort seed fly looks similar to the common house fly. The adults emerge in the spring from pupae that overwinter in the soil. Adult flies are often found walking around on ragwort seed heads when they are at the bud stage. Females lay eggs between the florets in the flowers. The larvae hatch and tunnel into the involucre and feed on tissues and cause a reduction of the seeds. There is usually one larva per flower. A flower infested with a seed fly larva often exhibits a frothy exudate emanating from the flower disc, or the disc may be discolored and appear darker than normal. After the larva completes its cycle

within the flower, it emerges and drops to the ground and pupates in the soil . The biology of the seed fly is covered by Cammeron (20).

Collection and distribution of the ragwort seed fly is accomplished by transplanting flowering plants infested with larvae to new locations. This is now unnecessary in most cases because of the fly's ability to widely distribute itself. The seed fly has been found in satellite infestations in eastern Oregon over 200 km away from any known release sites.

Summary and Conclusions

The integrated control of tansy ragwort has been one of the most successful weed control programs for improving infested pastures and rangelands in Oregon. The interdisciplinary application of integrated pest management methods is saving over $4,000,000 a year in direct losses of livestock due to tansy ragwort poisoning. Biological control is the primary method of weed control that keeps this toxic pest in check. The cinnabar moth, flea beetle, and seed fly have been widely distributed throughout the ragwort-infested areas in western Oregon through an intensive collection and distribution program implemented by the Oregon Department of Agriculture. Research studies have demonstrated that the flea beetle is the primary driving force of the regional reduction of tansy ragwort, exceeding 90% in most areas.

The success of the biological control program is not without problems. In eastern Oregon, where eradication programs are ongoing, tansy ragwort continues to persist. Attempts to establish the biological agents in the eastern counties have failed, with the exception of the seed fly. A search for additional biotypes or cold hardy strains may be required if biological control is going to be implemented in the eastern part of the state. This problem is also manifested by the difficulty of maintaining the biological agents at elevations exceeding 1000 m.

In recent years, periodic resurgences of ragwort have occurred at numerous locations. In most cases, by the time the problem was evident to land managers, the biological agents were beginning to control the outbreak. Most of the sporadic reinfestations are manifestations of a management problem that existed two years before the observed resurgence. Apparently, the biological agents are able to maintain a presence in the community so that when outbreaks occur, there are sufficient numbers of agents to eventually control them.

Studies are needed to determine an economic threshold level, the amount of ragwort to warrant control for rangeland and pastures. Experienced observers generally consider a threshold level of one to two percent cover in tansy ragwort a threat to susceptible species of livestock.

In some instances, after the biological control agents have controlled ragwort infestations, heavily grazed sites may become dominated by other noxious weeds. An understanding of the ecological principles of vegetation management is crucial in maintaining pastures and rangeland in proper condition for livestock use.

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