

Cypress spurge

Euphorbia cyparissias L.

Family: *Euphorbiaceae* (Spurge)

Other Names: graveyard spurge

USDA Code: EUCY2

Legal Status: Colorado Noxious List C (not yet widespread in Colorado – call your county weed supervisor!)

Identification

Growth form: Semi-woody perennial forb.

Flower: The tiny, lime green to white flowers are clustered in small, cup-like structures.

Seeds/Fruit: The three-capsuled fruits of cypress spurge explode at maturity, ejecting the seeds.

Leaves: Leaves are stalkless, alternate, narrow, linear to lance-shaped.

Stems: Mature plants are about 1-1.5 feet tall.

Roots: The root system consists of long indeterminate roots, which spread both in horizontal and vertical planes, and short determinate roots, which spread in a strictly horizontal plane.

Seedling: No information available.

Other: The entire plant exudes white, milky sap that can be irritating to the skin.

Similar Species

Exotics: Can be distinguished from leafy spurge (*Euphorbia esula*) by its slender stems with numerous, crowded, narrow leaves.

Natives: None known.

Impacts

Agricultural: Its milky latex is toxic, but it is rarely consumed in quantities sufficient to cause serious injury. It does not tolerate intensive cultivation and is not a problem in crops.

Ecological: Cypress spurge is weedy plant that invades disturbed areas. Cypress spurge can reproduce rapidly, and quickly invade an area. Its ability to spread vegetatively is a major factor contributing to its success.

Human: Humans should be careful to avoid contacting the latex with bare skin.

Habitat and Distribution

General requirements: Cypress spurge commonly occurs in dry to moderately moist meadows, pastures, forest edges, roadsides, rights-of-way, cemeteries, and gardens. Cypress spurge generally does not occur on intensively cultivated soils (Stavevitch et al. 1988).

Distribution: Not yet widespread in Colorado, this species is typically found around residential areas and local open spaces.

Historical: Native to Europe, an escaped ornamental.

Keys to Identification:

- Stem leaves are narrow and dark-green.
- Tiny flowers are clustered in small, cup-like structures.
- Stems exude a milky sap when broken.



Biology/Ecology

Life cycle: Plants overwinter as seed or root and crown tissue. Perennating buds develop on the indeterminate roots (Stahevitch et al. 1988). New shoots emerge, and seeds germinate, each spring soon after the snow cover melts. Flowering begins the first or second week of May. Seeds may mature as early as the third week in June. A second flowering often occurs in late summer or early fall.

Mode of reproduction: Cypress spurge reproduces by vegetative propagation or seed.

Seed production: Cypress spurge generally produces between 30-900 seeds per plant, which exhibit germination rates of 85% (Stahevitch et al. 1988).

Seed bank: No information available.

Dispersal: No information available.

Hybridization: No information available.

Control

Biocontrol: Sheep and goats are usually good biocontrol for spurges.

Mechanical: Repeated mowing can be used to eliminate seed production and exhaust the nutrient reserves in the root system.

Fire: No information available.

Herbicides: Cypress spurge is often lumped into the “leafy spurge complex”, and treatment is similar to that for leafy spurge.

Picloram at 0.5 lb, picloram+2,4-D at 0.25+1.0, dicamba or 2,4-D at 1 lb. ai/acre, or glyphosate at 1.5 lb. ai/acre will control cypress spurge. Apply herbicides with a wick to minimize damage to adjacent desirable plants.

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Keys to Control:

- Mow or spray infestations in order to eliminate seed production and exhaust the plants nutrient reserve.
- Re-seed controlled areas with desirable species.

Integrated Management Summary

This species is not yet widespread in Colorado, and should be a priority for immediate eradication if found. Control of cypress spurge can be hard to achieve due to its extensive root system and highly efficient seed dispersal. As with other perennial rhizomatous species, an integrated control strategy should focus on eliminating seed production while depleting the nutrient reserves in the root system. Mechanical and/or chemical control should be combined with land management practices which maintain healthy native plant communities.

References

Stahevitch, A.E., C.W. Crompton, and W.A. Wojtas. The biology of Canadian weeds. 85. *Euphorbia cyparissias* L. *Canadian Journal of Plant Science* 68:175-191.

Whitson, T.D.(ed.), L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, R. Parker. 1996. *Euphorbia* spp. *Weeds of the West*. Western Society of Weed Science, in cooperation with the Western United States Land Grant Universities Cooperative Extension Services, Newark, CA.

Leafy spurge

Euphorbia esula L.; *Tithymalus esula* (L.) Scopoli

Family: *Euphorbiaceae* (Spurge)

Other Names: none widely accepted

USDA Code: EUES

Legal Status: Colorado Noxious List B (top ten worst)

Identification

Growth form: Perennial forb.

Flower: Flowers are yellowish-green, small, arranged in numerous small clusters and subtended by paired heart-shaped yellow-green bracts.

Seeds/Fruit: Seeds are oblong, grayish to purple, contained in a 3-celled capsule.

Leaves: Leaves are alternate, narrow, 1-4 inches long.

Stems: Mature plants are up to 3 feet tall. Stems are thickly clustered.

Roots: Extensive lateral root system.

Seedling: Seed leaves (cotyledons) are linear to lanceolate, with entire margins.

Other: The entire plant contains white, milky latex. Foliage of the plant is smooth and hairless.

Similar Species

Exotics: None known.

Natives: Leafy spurge is distinguished from native spurges such as *Euphorbia brachycera* by its long linear leaves.

Impacts

Agricultural: Leafy spurge can invade rangeland that is in excellent condition, making it worthless for cattle and horse grazing and reducing land values (Lajeunesse et al. 1999).

Ecological: Leafy spurge is an aggressive, long-lived, perennial weed that tends to displace all other vegetation in rangeland, pasture, and native habitats (Biesboer 1998). Leafy spurge decreases rangeland diversity, threatens native plants and degrades wildlife habitat (Lajeunesse et al. 1999). It produces a large number of seeds and underground shoot buds. These two reproductive techniques allow it to rapidly displace native species, and form a leafy spurge monoculture. Rapid re-establishment of treated stands often occurs after an apparently successful management effort because of the large nutrient reserve stored in the roots of leafy spurge plants. Also, leafy spurge produces an allelopathic compound that inhibits the growth of other plants (Butterfield et al. 1996).

Human: The milky latex associated with leafy spurge can cause irritation, blotching, blisters, and swelling in sensitive individuals.

Habitat and Distribution

General requirements: Leafy spurge grows in a wide range of habitats.

Keys to Identification:

- Flowers are yellowish-green and have a pair of heart shaped yellow-green bracts below each inconspicuous flower.
- The entire plant contains white, milky latex.



It is most aggressive in semi-arid areas, but can be found in xeric to subhumid and subtropic to subarctic habitats (Butterfield et al. 1996). Leafy spurge occurs most commonly on untilled, non-crop areas such as rangeland, pastureland, woodland, prairies, roadsides, stream and ditches, and waste sites. It grows on all kinds of soils, but is most abundant in coarse-textured soils and least abundant on clayey soils (Butterfield et al. 1996).

Distribution: In Colorado, leafy spurge is common on disturbed soils between 5,000 to 6,500 feet (Rutledge and McLendon 1998), but can be found up to 9,000 feet.

Historical: No information available.

Biology/Ecology

Life cycle: Leafy spurge is one of the earliest plants to emerge in the spring, usually in mid-April to late May (Butterfield et al. 1996). The development of terminal flower clusters begins 1 to 2 weeks after stem emergence. Flower clusters have 8 to 16 branches. Each branchlet forms a greenish yellow bract in May. Flowering generally ends in late June to mid-July as the plants do not usually flower, and growth is reduced, during the hotter portion of the summer. However, if conditions are favorable, leafy spurge may produce a few lateral flowers throughout the summer and in the fall. Thus, it is possible for the plant to produce seed until frost. Seeds mature about 30 days following pollination. Peak germination occurs from late-May to early June. If adequate moisture is present, germination can occur throughout the growing season.

Mode of reproduction: Despite being a successful seed producer, leafy spurge primarily reproduces vegetatively through its extensive lateral root system. Long roots have the capability to produce shoots and can reach nearly 15 feet laterally, and about 30 feet in depth. As many as 300 buds have been counted on these long roots (Butterfield et al. 1996).

Seed production: Each flowering stem produces from 10-50 capsules with a seed yield range of 200-250 seeds per flowering shoot (Best et al. 1980). A large plant may produce up to 130,000 seeds (Rutledge and McLendon 1998).

Seed bank: Seeds can remain viable in the soil for 5-8 years although 99% of the viable seeds will germinate in the first two years (Butterfield et al. 1996).

Dispersal: The three-sided capsules explode when ripe, sending the enclosed seeds up to 15 feet from the parent plant. Seeds float on water, and can be transported and deposited by flood water.

Hybridization: No information available.

Control

Biocontrol: Currently, there is extensive research on biological control agents for leafy spurge with over 15 insects being studied (Biesboer 1998). However, control of leafy spurge by insects is often limited by the thick milky latex, which tends to clog the mouth or sucking parts of most insects (Butterfield et al. 1996). Successful biological control will most likely require a combination of insects and a long-term management program to establish them. The Division of Plant Industry's Biological Pest Control Section has released eight species in an effort to control leafy spurge. Three of these species, *Aphthona nigriscutis*, *A. cyparissiae*, and *A. czwalinae/lacertosa*, have become established and may be available for distribution from the Insectary. The most effective biological control agents seem to be six species of root- and foliage-feeding beetles in the genus *Aphthona*, and a stem- and root-boring beetle *Obera erythrocephala* (Lajeunesse et al. 1999).

Keys to Control:

- Develop a management scheme that uses several control methods that are compatible with your site.
- Persistently monitor your area and quickly control new infestations.

Grazing sheep on infested areas has been used successfully to control spurge on ranches in Montana, but ranchers agree that once the sheep were removed the spurge would quickly return (Biesboer 1998). Sheep grazing is likely to be most effective in the spring and summer when the spurge plants are succulent and when sheep tend to prefer forbs over grasses, rather than in fall when sheep forage more on grasses (Lajeunesse et al. 1999). Two grazing periods during the spring-summer with a recovery period (for the grasses) between are recommended rather than season-long grazing. Fall grazing by goats followed by application of picloram and 2,4-D (each 1 qt./ac) can provide good control (Lajeunesse et al. 1999). A recent study near Denver found that sheep grazing for a short period in early July every year for 5 years reduced leafy spurge density by 90%. This study also produced excellent results by combining sheep with *Aphthona* beetles (Beck and Rittenhouse, 2000).

Mechanical: Tillage is not generally a practical control method for areas where leafy spurge grows. Mowing can actually increase the density of leafy spurge, and may not be effective even when combined with herbicide (K.G. Beck, pers. comm.). Pulling leafy spurge is ineffective, even for small infestations because of the deep root system and the presence of numerous root buds.

Fire: Burning alone will not likely provide adequate control of leafy spurge due to regeneration from the root system. However, combinations of burning and herbicide application 5 weeks later might provide adequate control (Biesboer 1998). In one study, plots of leafy spurge were sprayed with a mix of 2,4-D and picloram in September and burned the following April. The plots were sprayed again in June and burned again in October (Biesboer 1998). This process is designed to exhaust the nutrient reserves in the root system of the plant and hinder its ability to compete with other species. Therefore, reseeding desirable species is also necessary.

Herbicides: Herbicides can provide some control of leafy spurge. However, due to its extensive root system and general hardiness, follow up applications are necessary for herbicides to be effective. Picloram is recommended for eradication of small infestations, with herbicide application extending for 10-15 feet beyond the leafy spurge patches (Lajeunesse et al. 1999). A combination of picloram and 2,4-D (1-1.5 pints of picloram with 1-1.5 quarts of 2,4-D) was shown to provide the best control when applied in the spring when flowers emerge (Beck 1996). Research in North Dakota has shown that a tank mix of picloram (1 pt./ac) and 2,4-D (1 qt./ac) (based on concentrate of 4 pounds active ingredient / gallon) applied 2 weeks after the yellow bracts appear and applied annually is a cost effective treatment for leafy spurge (Lym et al. 1993). Picloram at 1 qt./ac for 2-3 consecutive years is also effective, but more expensive. An annual combination of dicamba plus 2,4-D (4-8 oz + 0.5-1 quart/acre) also provided good control (Beck 1996). Glyphosate is most effective when applied sequentially at 1 quart/acre at one-month intervals, coupled with fall grass seeding (Beck 1996).

Cultural/Preventive: Long-term control of leafy spurge requires, among other things, a competitive plant community dominated by desirable species. For reseeding, select a mixture of grass species with early-, mid-, and late-season growth, and with shallow-, intermediate-, and deep-rooting depths. The resulting plant community will maximize the use of water and nutrients by the desirable species and will effectively compete with leafy spurge. After reseeding, it is imperative to manage grazing animals carefully so as to invigorate and not harm perennial grasses. Consider grazing sheep or goats with cattle so the former can graze spurge plants.

Note of Caution: The milky latex associated with leafy spurge can cause irritation, blotching, blisters, and swelling in sensitive individuals. The eyes should never be rubbed until after the hands are thoroughly washed. Gloves should be worn while pulling or coming into contact with this plant.

Integrated Management Summary

Persistent monitoring of areas with known or potential infestations is crucial to managing leafy spurge. New infestations are much more easily controlled than established infestations. 100% eradication of leafy spurge is rarely achieved, but infestations can be reduced to manageable levels. Herbicides are most commonly used to control leafy spurge. However, damage to non-target species is always a concern. Sheep and goats can be used to control leafy spurge. Leafy spurge is extremely difficult to control by chemical means and is almost impossible to control by cultural or physical methods. Therefore a management scheme that combines control methods over four to five years is recommended (Beck 1996). Lym (1998) recommends combinations of re-seeding with competitive grasses, biological control insects, sheep or goat grazing and herbicide (2,4-D + picloram) treatment. Grazing animals and biological agents are generally appropriate only for larger infestations. Although leafy spurge can be poisonous to cattle, sheep can be taught to feed on it and goats will seek it out. For an example of one rancher's integrated approach to leafy spurge control, see page 61.

References

- Best, K.F., G.G. Bowes, A.G. Thomas, and M.G. Maw. 1980. The biology of Canadian Weeds .39 *Euphorbia esula* L. *Canadian Journal of Plant Science* 60: 651-663.
- Beck, K.G. 1996. Leafy spurge. Colorado State University Cooperative Extension Natural Resource Series, No. 3.107. <http://www.colostate.edu/Depts/CoopExt/PUBS/NATRES/03107.html> [24 Jan 00].

- Beck, K.G. and L.R. Rittenhouse. 2000. Managing leafy spurge with sheep grazing and flea beetles. *Proc. Wes. Soc. Weed Sci.* In press.
- Biesboer D.D. 1998. Element stewardship abstract for *Euphorbia esula*. The Nature Conservancy, Wildland Weeds Management & Research Program. <http://tncweeds.ucdavis.edu/esadocs/euphesul.html> [28 Jul 98].
- Butterfield, C., J. Stubbendieck, and J. Stumpf. 1996. Species abstracts of highly disruptive exotic plants. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. <http://www.npwrc.usgs.gov/resource/othrdata/exoticab/exoticab.htm> [Version 16 Jul 97].
- Lajuenesse, S., R.L. Sheley, R. Lym, D. Cooksey, C. Duncan, J. Lacy, N. Rees, and M. Ferrell. 1994. Leafy spurge: biology, ecology and management. Extension Bulletin EB 34, Montana State University, Bozeman, MT.
- Lajuenesse, S., R.L. Sheley, R. Lym, and C. Duncan. 1999. Leafy Spurge. In R.L. Sheley and J.K. Petroff, eds. *Biology and Management of Noxious Rangeland Weeds*. Oregon State University Press, Corvallis, OR.
- Lym, R.G., K.E. Messersmith, and R. Zollinger. 1998. Leafy spurge identification and control. North Dakota State University Extension Service Publication W-765. <http://www.ext.nodak.edu/extpubs/plantsci/weeds/w765w.htm> [20 Jan 00].
- Lym, R.G. 1998. The biology and management of leafy spurge (*Euphorbia esula*) on North Dakota rangeland. *Weed Technology* 12: 367-373.
- Rutledge, C. R. and T. McLendon. No Year. An Assessment of Exotic Plant Species of Rocky Mountain National Park. Department of Rangeland Ecosystem Science, Colorado State University. 97pp. Northern Prairie Wildlife Research Center Home Page. <http://www.npwrc.usgs.gov/resource/othrdata/Explant/explant.htm> [Version 15 Dec 98].
- Whitson, T.D.(ed.), L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, R. Parker. 1996. Leafy spurge. *Weeds of the West*. Western Society of Weed Science, in cooperation with the Western United States Land Grant Universities Cooperative Extension Services, Newark, CA.

Myrtle spurge

Euphorbia myrsinites L.

Family: *Euphorbiaceae* (Spurge)

Other Names: creeping spurge, donkeytail

USDA Code: EUMY2

Legal Status: Colorado Noxious List A (general weeds)

Identification

Growth form: Perennial forb.

Flower: Yellow-green flower-like bracts appear in early spring.

Seeds/Fruit: No information available.

Leaves: The plant produces trailing stems of fleshy, blue-green alternate leaves.

Stems: Mature plants are 4-6 inches tall and spread up to 18 inches laterally.

Roots: Taproot.

Seedling: No information available.

Other: The plant exudes a milky sap that can be irritating to the skin.

Similar Species

Exotics: None known.

Natives: None known.

Impacts

Agricultural: Myrtle spurge plants exude a milky sap that is considered toxic and may cause skin irritations and in extreme cases, livestock poisoning. Livestock and animals generally avoid myrtle spurge and large infestations can reduce forage production. Myrtle spurge does not tolerate frequent cultivation and therefore is not a problem in crops.

Ecological: Although not a particularly aggressive invader, myrtle spurge can inhabit disturbed ground and exclude native plants.

Human: Milky latex can cause minor skin irritation.

Habitat and Distribution

General requirements: Myrtle spurge prefers dry to moist, well-drained soils, in areas that receive partial shade to full sun. It is an escaped ornamental that inhabits disturbed areas and waste places and is primarily found in municipal areas and nearby wildlands.

Distribution: Myrtle spurge is increasingly common in Colorado, particularly in residential areas and local open spaces where it has escaped cultivation as an ornamental species.

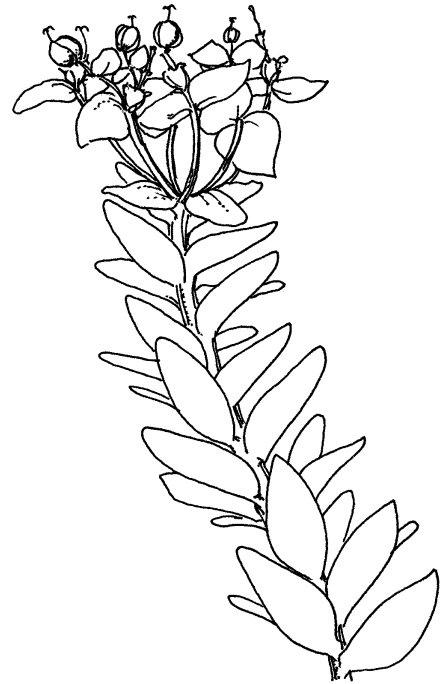
Historical: Native to Eurasia.

Biology/Ecology

Life cycle: Myrtle spurge is a perennial that produces new stems from the center (taproot) each year. Plants flower in early spring.

Keys to Identification:

- Myrtle spurge can be identified by its trailing stems of fleshy, blue-green leaves.
- Yellow-green flower-like bracts appear in early spring.
- When broken, plants exude a milky latex that can be irritating to the skin.



Mode of reproduction: Myrtle spurge spreads by seed.

Seed production: No information available.

Seed bank: No information available.

Dispersal: No information available.

Hybridization: No information available.

Control

Biocontrol: None known.

Mechanical: Small infestations can be dug or pulled, depending upon the size of the infestation.

Fire: No information available.

Herbicides: 2,4-D or dicamba at 1 lb. ai/acre, and glyphosate at 1.5 lb. ai/acre should provide adequate control of myrtle spurge (Stahevitch et al. 1996). Picloram at 0.5 lb ai/acre is another possible control. Apply herbicides with a wick to avoid damage to adjacent desirable plants. The seedling stage is generally the best time to apply herbicides.

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Keys to Control:

- Eliminate seed production of existing plants and destroy any new seedlings that emerge.
- Re-seed controlled areas with desirable species.

Integrated Management Summary

This species is not yet widespread in Colorado, and should be a priority for immediate eradication if found. As with other plants which reproduce solely by seed, integrated management efforts of myrtle spurge must include the elimination of seed production and the depletion of the seed bank. Combine herbicide or mechanical removal of rosettes with removal of flowering parts from any plants that have bolted.

References

Stahevitch, A.E., C.W. Crompton, and W.A. Wojtas. 1996. The biology of Canadian weeds. 85. *Euphorbia cyparissias* L. *Canadian Journal of Plant Science* 68:175-191.

Whitson, T.D.(ed.), L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, R. Parker. 1996. *Euphorbia* spp. *Weeds of the West*. Western Society of Weed Science, in cooperation with the Western United States Land Grant Universities Cooperative Extension Services, Newark, CA.

Camelthorn

Alhagi pseudalhagi (Bieb) Desv. ex B. Keller & Schaparenko;
Alhagi camelorum Fisch.

Family: *Fabaceae* (Pea)

Other Names: Camels thorn, Camel-thorn, Caspian manna, Persian manna

USDA Code: ALPS3, ALCA

Legal Status: Colorado Noxious List C (new in Colorado – call your county weed supervisor!)

Identification

Growth form: Perennial shrub.

Flower: Flowers are small, pea-like, pinkish purple to maroon. They occur on the short, spine tipped branches along the upper portion of the plant.

Seeds/Fruit: The reddish-brown, jointed seed pods are curved upward, deeply indented, with 5-8 seeds clearly outlined in the pod.

Leaves: Single leaves are alternate, wedge-shaped, 0.25 to 1.25 inches long, and 0.13 to 0.5 inch wide.

Stems: Mature plants are between 1.5 to 4 ft tall with greenish stems that are striate, glabrous, with 0.25 to 1.75 inch long spines.

Roots: Mature plants have deep vertical and horizontal roots that branch extensively.

Seedling: No information available.

Similar Species

Exotics: None known.

Natives: None known.

Impacts

Agricultural: No information available.

Ecological: Camelthorn has been described as one of the most dangerous weeds and one of the most difficult to eradicate (Zimmerman 1996). It will aggressively invade disturbed areas. Once established, the extensive root system of camelthorn plants makes it extremely hard to manage. Camelthorn can spread up to ten meters a year through vegetative propagation.

Human: No information available.

Habitat and Distribution

General requirements: Camelthorn thrives in areas that receive little rainfall, but have a relatively high water table such as in saline meadows, sandbars, riverbanks, canals, and irrigated cropland (Zimmerman 1996). Camelthorn is able to grow in many soil types including sand, silt, clay, and even in rock crevices. It will also grow in soils that contain high levels of carbonate.

Distribution: Not yet known to be present in Colorado but expected to first invade the southern reaches of Colorado, particularly along the New Mexico border.

Keys to Identification:

- Camelthorn is a very distinctive plant that can be identified by its spiny, intricately branched appearance.
- Flowers are small, pea-like, purplish to maroon and are protected by spines along the branches.



Historical: Camelthorn is a native of the Turanian desert and Iranian Plateau (Zimmerman 1996). In the Bible, Isaiah 7:15 and 55:13 state that “Alhagi shrubs had to be hoed down” (Zimmerman 1996).

Biology/Ecology

Life cycle: Seedling root growth is rapid. The root system of camelthorn consists of both roots and spreading rhizomes. Seedling shoot growth is very slow. Foliage leaves require up to three months to fully develop (Zimmerman 1996). Typically, camelthorn flowers in June and produces seeds in July. After the plant goes to seed, the branchlets become persistent spines. Once established, camelthorn mainly spreads by vegetative propagation. Vertical underground stems grow from buds on the roots and once a bud is exposed, a leafy shoot is produced. Camelthorn is deciduous and dies back to the ground each winter and remains dormant until spring.

Mode of reproduction: Reproduces by seeds, spreads primarily by vegetative propagation.

Seed production: No information available.

Seed bank: The seeds turn dark brown when ripe and can remain viable in the soil for several years.

Dispersal: No information available.

Hybridization: No information available.

Control

Biocontrol: There is no evidence of any biological control agent that attacks camelthorn.

Mechanical: Mechanical control is nearly futile although repeated top removal might exhaust root reserves. Hand pulling is hindered by the spiny nature of the weed. (information on mowing and hand pulling or other manual control methods, including timing of control).

Fire: No information available.

Herbicides: Picloram at 1 lb. ai/acre or glyphosate at 1.5 lb. ai/acre are two herbicides that are used to control camelthorn. However, repeated applications will probably be necessary to provide long-term control.

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Keys to Control:

- Control methods should focus on depleting the nutrient reserves of its extensive root system.
- Mechanical control should aim at removing as much of the root system as possible.
- Livestock should be kept away from infestations to prevent the dispersal of camelthorn seeds.

Integrated Management Summary

This species is not yet widespread in Colorado, and should be a priority for immediate eradication if found. Permanent control of camelthorn must focus on depleting the nutrient reserves of its extensive root system. Camelthorn has a large root system that is capable of storing a large nutrient reserve. This reserve allows camelthorn plants to rebound quickly after most attempts at control. Managers must persistently attack camelthorn infestations in order to deplete the nutrient reserves held in the root system, and kill the plants. Land management practices should include methods of preventing the dispersal of camelthorn seeds.

References

Whitson, T.D.(ed.), L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, R. Parker. 1996. Camelthorn. *Weeds of the West*. Western Society of Weed Science, in cooperation with the Western United States Land Grant Universities Cooperative Extension Services, Newark, CA.

Zimmerman, J.A.C. 1996. Ecology and distribution of *Alhagi maurorum* Medikus, Fabaceae. USGS Colorado Plateau Field Station, Southwest Exotic Plant Mapping Program.
http://www.usgs.nau.edu/swemp/Info_pages/plants/Alhagi/alhagititle.html [28 Jul 98].

Redstem filaree

Erodium cicutarium (L.) L'Her.

Family: *Geraniaceae* (Geranium)

Other Names: storksbill, cranesbill, cutleaf filaree

USDA Code: ERCI6

Legal Status: Colorado Noxious List A (general weeds)

Identification

Growth form: Winter annual or biennial forb.

Flower: Flowers are in an umbrella-like cluster at the end of long, slender stalks arising from the leaf axils. Flowers are purplish-pink and generally born in clusters of two or more (Whitson et al. 1996). The persistent styles of this plant are 1 to 2 inches long and coil together at maturity, enveloping the fruit at the base.

Seeds/Fruit: Fruits are five-lobed and long-beaked, with each lobe splitting away at maturity.

Leaves: The leaves of young plants form a basal rosette. Older leaves grow up to 12 inches long and are divided into narrow feather-like lobed or toothed segments. Both leaves and stems are hairy.

Stems: Mature plants have stems that are 1 in to 2 feet long.

Roots: The slender taproot is about 3 inches long, and there are secondary fibrous roots.

Seedling: No information available.

Similar Species

Exotics: None known.

Natives: None known.

Impacts

Agricultural: Redstem filaree is a problem in many crops, particularly in the San Luis Valley.

Ecological: Redstem filaree is a pioneer species on disturbed sites and is considered an indicator of recent or frequent disturbance.

Human: No information available.

Habitat and Distribution

General requirements: Redstem filaree grows in well-drained, clayey, loamy, or sandy soil. It will tolerate a broad range of climates and can grow in areas that experience harsh, snowy winters because its short growing season allows it to complete its life cycle before the onset of freezing weather (FEIS 1996). Redstem filaree will tolerate partial shade, but plant vigor is reduced.

Distribution: Redstem filaree is common throughout North America. In Colorado, redstem filaree occupies a variety of habitats between 4,500 - 7,000 feet.

Historical: It was one of the first exotic species to invade North America, and was apparently introduced in California in the early 1700s by Spanish explorers (FEIS 1996).

Biology/Ecology

Life cycle: Germination is triggered by seasonal rains and soil temperatures that range between approximately 69 degrees F during the day to 40 degrees F at night (FEIS 1996). Typically, plants will germinate in late fall and

Keys to Identification:

- Fruits are five-lobed and long-beaked, with each lobe splitting away at maturity.
- Purplish-pink flowers are generally borne in an umbrella-like cluster at the end of slender stalks arising from the leaf axils.



Flowers and fruits

develop a few leaves by December. The following spring the plant resumes growth and flowers in March-April. Seeds ripen in May-June and are soon disseminated. In cold climates, growth is continuous from spring or summer until plant death in early fall.

Mode of reproduction: Reproduces by seeds.

Seed production: No information available.

Seed bank: Seeds of redstem filaree can remain viable for many years, and form extensive seed banks (FEIS 1996).

Dispersal: When moist, the coiled styles enveloping the seed expand, uncoil, and drive the arrow-shaped fruit into the ground.

Hybridization: No information available.

Control

Biocontrol: None known.

Mechanical: Mowing or burning after flowering but before seed set can be used to eliminate seed production.

Fire: See above.

Herbicides: Redstem filaree is most often controlled with herbicides. 2,4-D, or dicamba at 1 lb. ai/acre can be applied to rosettes in the late fall or early spring. However, redstem filaree is tolerant of glufosinate (Ehlhardt and Stracham 1993).

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Keys to Control:

- Eliminate seed production and deplete the soil seed bank.
- Maintain a healthy cover of native perennial plants.

Integrated Management Summary

Redstem filaree is a native of Eurasia and is common worldwide. It has been grown for forage and is considered noxious only when it crowds out more valuable species (Whitson et al. 1996). Because of its abundance and high forage value, redstem filaree can be an important plant on rangeland during a short period in the spring. It provides forage for rodents, big game animals, and livestock (FEIS 1996). As with other plants which reproduce solely by seed, integrated management efforts must include the elimination of seed production and the depletion of the seed bank. Combine herbicide or mechanical removal of rosettes with removal of seed heads from any plants that have flowered.

References

- Ehlhardt, M.H. and W.F. Stracham. 1993. Orchard and vineyard weed control with glufosinate. *West Soc. Weed Sci.* 46: 44-45.
- FEIS - Fire Effects Information System . 1996. Prescribed Fire and Fire Effects Research Work Unit, Rocky Mountain Research Station (producer), US Forest Service. <http://www.fs.fed.us/database/feis/> [Version 12 Mar 98].
- Whitson, T.D.(ed.), L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, R. Parker. 1996. Redstem filaree. *Weeds of the West*. Western Society of Weed Science, in cooperation with the Western United States Land Grant Universities Cooperative Extension Services, Newark, CA.

Mediterranean sage

Salvia aethiopsis L.

Family: *Lamiaceae* (Mint)

Other Names: African sage

USDA Code: SAAE

Legal Status: Colorado Noxious List A (general weeds)

Identification

Growth form: Biennial or short-lived perennial forb

Flower: Flowers are two-lipped, yellowish-white and born in a candelabra-like inflorescence.

Seeds/Fruit: Each flower develops four nutlets that are smooth with dark veins.

Leaves: First-year rosette leaves are large, grayish, and woolly. Lower stem leaves have stalks are lobed, with coarsely-toothed blades 0.3-1 foot long. Upper stem leaves are smaller and clasp the stem.

Stems: Mature plants are 2-3 feet tall and highly branched above.

Roots: No information available.

Seedling: No information available.

Similar Species

Exotics: Meadow sage (*S. pratensis*) resembles Mediterranean sage, but usually has blue flowers, and is more coarsely hairy.

Natives: No information available.

Impacts

Agricultural: It is unpalatable to grazing animals and it reduces the amount of forage available for livestock.

Ecological: Mediterranean sage spreads rapidly into disturbed pasture, rangeland, meadows, and other open areas.

Human: No information available.

Habitat and Distribution

General requirements: Mediterranean sage usually invades disturbed pasture, rangeland, meadows, riparian areas, along roadsides, and other open areas. It prefers well-drained soils and dry conditions. In the western states, Mediterranean sage grows in sagebrush steppe and ponderosa pine zones.

Distribution: In Colorado, Mediterranean sage is currently found only in Boulder County. It is also found in Pacific coastal states.

Historical: Mediterranean sage is a native of the Mediterranean and northern Africa.

Biology/Ecology

Life cycle: Mediterranean sage is a biennial that produces a large

Keys to Identification:

- Rosettes have large, wooly, blue-green, felt-like leaves that are aromatic when crushed.
- Like all members of the mint family, it has square stems and opposed leaves.
- Meadow sage (*S. pratensis*) resembles Mediterranean sage, but usually has blue flowers, and is more coarsely hairy.



rosette the first year. During the second year, the plant bolts, producing multi-branched stems with white to blue-green, woolly, felt-like leaves. Plants flower from June to August. During the hottest part of the summer, the plant becomes dormant (Roché and Wilson 1999).

Mode of reproduction: Mediterranean sage reproduces solely by seed.

Seed production: A single plant may produce thousands of seeds

Dispersal: Seeds are spread easily because the mature plant forms a tumbleweed (Whitson et al. 1996).

Hybridization: No information available.

Control

Biocontrol: *Phrydiuchus tau*, a root crown weevil, has been used in California as a biological control for Mediterranean sage (Calweed 1997). Damage from the weevil in conjunction with competitive vegetation reduced the density of Mediterranean sage in Oregon and Idaho (Roché and Wilson 1999). Long-term effects of the weevil are unknown.

Keys to Control:

- Eliminate seed production.
- Re-seed controlled areas with desirable species.

Mechanical: Pull or dig first year rosettes. Cut the taproot 2-3 inches below the crown when plants are bolting to prevent resprouting (Roché and Wilson 1999). Mature plants can be cut before flowering and seed production.

Fire: No information available.

Herbicides: Herbicides should be applied to seedlings or rosettes. Picloram applied at a rate of 0.5 lb. ai/ac before bolting will kill existing plants, and its residual activity will kill seedlings that subsequently germinate. A surfactant should be used so the herbicide can penetrate the dense hairs on the leaves. A mixture of 1oz./acre. of metsulfuron (Escort®) alone or with 1 lb. of a 4 lb. gallon of 2,4-D is also very effective (C. Owsley, pers. comm.).

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Integrated Management Summary

The tumbleweed nature of this plant allows it to distribute seed efficiently over a large area, so preventing seed dispersal is a key factor in controlling Mediterranean sage. As with other plants which reproduce solely by seed, integrated management efforts must include the elimination of seed production and the depletion of the seed bank. Combine herbicide or mechanical removal of rosettes with removal of seed heads from any plants that have bolted.

References

- Calweed Database. 1997. California Noxious Weed Control Projects Inventory. Natural Resource Projects Inventory, Information Center for the Environment, University of California, Davis. <http://endeavor.des.ucdavis.edu/weeds/> [6 Jan 99].
- Roché, C.T. and L.M. Wilson. 1999. Mediterranean sage. In R.L. Sheley and J.K. Petroff, eds. *Biology and Management of Noxious Rangeland Weeds*. Oregon State University Press, Corvallis, OR.
- Whitson, T.D.(ed.), L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, R. Parker. 1996. Mediterranean sage. *Weeds of the West*. Western Society of Weed Science, in cooperation with the Western United States Land Grant Universities Cooperative Extension Services, Newark, CA.

Purple loosestrife

Lythrum salicaria L.

Family: *Lythraceae* (Loosestrife)

Other Names: purple lythrum

USDA Code: LYSA2

Legal Status: Colorado Noxious List A (general weeds)

Identification

Growth form: Perennial forb or woody sub-shrub.

Flower: Flowers are purple with 5-7 petals arranged in long vertical racemes.

Seeds/Fruit: Fruits are many-seeded capsules, seeds are small and ovoid.

Leaves: Leaves are simple, entire, and opposite or whorled (Whitson et al. 1996).

Stems: Annual stems arise from a perennial rootstock (Mal et al. 1992). Stems are erect, and often grow 6-8 feet tall. Plants become taller and bushier over the years as the rootstock matures.

Roots: Short rhizomes and taproot.

Seedling: No information available.

Similar Species

Exotics: Sometimes confused with Dame's rocket (*Hesperis matronalis*), an exotic mustard.

Natives: Sometimes confused with fireweed (*Epilobium* spp.), which has 4-petaled flowers.

Impacts

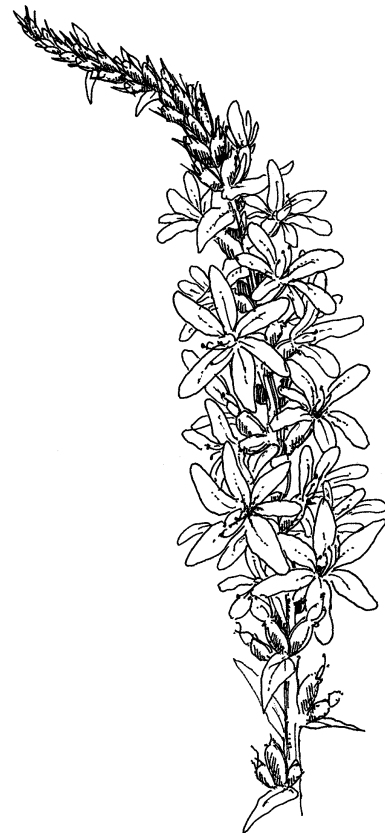
Agricultural: No information available.

Ecological: Purple loosestrife is an ornamental species that often escapes to sites such as streambanks or shallow ponds. The invasion of purple loosestrife leads to a loss of plant diversity, which also leads to a loss of wildlife diversity (Bender and Randall 1987). Purple loosestrife germinates at such high densities that it outcompetes native seedlings. Dense infestations can impede water flow in canals and ditches. When placed under moisture stress, purple loosestrife may produce additional roots, which may give it a competitive advantage over other species. It is an aggressive invader of wetlands. Once it is established, it often displaces native wetland species and degrades wildlife habitat. If purple loosestrife is left unchecked, the wetland eventually becomes a monoculture of loosestrife (Bender and Randall 1987). Where purple loosestrife is competing with cattails, it is favored by fluctuating water levels because marsh drawdown aids in seedling establishment (FEIS 1996). However, where water levels remain constant and relatively deep, cattails may be able to outcompete purple loosestrife (FEIS 1996).

Human: No information available.

Keys to Identification:

- Showy rose-purple flowers bloom in long vertical racemes.
- Lance-shaped leaves have smooth edges.



Habitat and Distribution

General requirements: Purple loosestrife usually occurs in marshes, wet meadows, stream margins, shores of lakes and wetlands. A few of its most common associates include cattail, reed canarygrass (*Phalaris arundinacea*), sedge (*Carex* spp.), bulrush (*Scirpus* spp.), rush (*Juncus* spp.), and willow (*Salix* spp.). Purple loosestrife can tolerate a wide range of conditions (up to 50% shade), can grow on calcareous and acidic soils (Rutledge and McLendon) and will even grow in standing water.

Distribution: In Colorado, purple loosestrife is known to occur in the Denver/Boulder area and along the South Platte River, in Mesa County along the Colorado River, in Montrose County near Nucla, in Otero County near the Arkansas River, and in Colorado Springs. It is not known if purple loosestrife has upper elevational limits, but since it grows successfully in Canada, it should be considered a threat at higher elevations in Colorado.

Historical: Purple loosestrife is a native of Eurasia and was first recorded in America in 1814 (Bender and Randall 1987).

Biology/Ecology

Life cycle: Purple loosestrife begins its growth about a week to 10 days after cattail and reed canarygrass. Spring established seedlings grow rapidly and produce flowers 8 to 10 weeks after germination. After flowering, each stem supports a dense spiraling row of dark-brown seed capsules.

Mode of reproduction: Purple loosestrife is a perennial that reproduces by seeds and rhizomes. The rootstalk of purple loosestrife is the main organ of local propagation; therefore, wide vegetative spread is unlikely. However, detached root or stem fragments can take root and develop into flowering stems (FEIS 1996).

Seed production: A single flowering stalk can produce 300,000 seeds, and densities as high as 80,000 stalks per acre have been recorded (FEIS 1996).

Seed bank: Purple loosestrife seeds may remain viable for up to 20 years.

Dispersal: Seeds are mainly distributed by water, but can also be dispersed by animals and humans. Seeds do not drop from capsules until the air temperature becomes cold in the early fall.

Hybridization: No information available.

Control

Biocontrol: There are several biological control agents that show potential for controlling purple loosestrife (Rutledge and McLendon). The root-boring weevil (*Hylobius transversovittatus*), can seriously damage the root system of purple loosestrife, stunt growth, and reduce seed production (Rutledge and McLendon). This species is being reared at the Division of Plant Industry's Insectary, but is currently unavailable for general redistribution. Two leaf-eating weevils *Galerucella californiensis* and *G. pusilla* also show potential as biological control agents (Rutledge and McLendon). Experimental releases of *Galerucella* in the Denver area by the Bureau of Reclamation have become established and appear to be providing effective control of purple loosestrife (D. Weber, pers. comm.). These two species may be available for redistribution upon request.

Mechanical: Hand removal of isolated individuals can be effective on a small scale. Pulling should be conducted prior to seed set. It is important to remove the entire rootstalk of the plant to avoid regrowth from root fragments.

Fire: No information available.

Herbicides: Purple loosestrife is found in very wet soils, thus great care should be used when using herbicides as these may endanger other water plants (Rutledge and McLendon). Glyphosate (in an aquatic formulation such as Rodeo) is commonly used to control purple loosestrife (Rutledge and McLendon). A non-ionic surfactant must be mixed with the Rodeo prior to spray application. The safest method is to cut off all stems about 6 inches from the bottom of the plant and then spray or drip glyphosate (20-30% solution) onto the cut surface (Rutledge and McLendon), however, it is more effective to spray individual plants using a backpack sprayer (D. Weber, pers. comm.). Colorado research by the Bureau of Reclamation has shown that loosestrife plants sprayed with glyphosate will still produce viable seeds if the flowers are 50% or more developed on the stalk when spraying occurs. Therefore, flower heads must be cut and hauled away to prevent seed spread if they are mature when sprayed (D. Weber, pers. comm.).

Keys to Control:

- Prevent new seeds from being added to the seed bank.
- Maintain a healthy cover of perennial plants.
- Any control effort should be followed up the same growing season and for several years afterwards.

Broadleaf herbicides (2,4-D based) can be effective on loosestrife if applied to young plants in late May or early June (Bender and Randall 1987). The herbicide Garlon 3A is effective on purple loosestrife and like 2,4-D is specific to broadleaved plants. It is currently only approved in Colorado for experimental use, but may soon be approved for general use (D. Weber, pers. comm.).

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal.

Integrated Management Summary

Loosestrife populations which extend over three acres are difficult to eradicate and may be a better target for containment rather than control (Rutledge and McLendon). The key to effective control is early detection when infestations are small. It is fairly easy to control small numbers of loosestrife plants when the seed bank in the soil is small. Eradicating large populations with huge populations is much more difficult. Biological control should primarily be considered when populations of loosestrife have become large or are inaccessible. Small loosestrife infestations should be eradicated by hand-pulling or herbicide application. For an example of purple loosestrife control efforts, see page 64.

References

- Bender, J. and J. Randall. 1987. Element Stewardship Abstract for *Lythrum salicaria*, Purple loosestrife. The Nature Conservancy, Wildland Weeds Management & Research Program. <http://tncweeds.ucdavis.edu/esadocs/lythsali.html> [5 Feb 99].
- FEIS - Fire Effects Information System . 1996. Prescribed Fire and Fire Effects Research Work Unit, Rocky Mountain Research Station (producer), US Forest Service. <http://www.fs.fed.us/database/feis/> [Version 12 Mar 98].
- Mal, T.K., J. Lovett-Doust, L. Lovett-Doust, and G.A. Mulligan. 1992. The biology of Canadian weeds. 100. *Lythrum salicaria*. *Canadian Journal of Plant Science* 72:1305-1330.
- Rutledge, C. R. and T. McLendon. No Year. An Assessment of Exotic Plant Species of Rocky Mountain National Park. Department of Rangeland Ecosystem Science, Colorado State University. 97pp. Northern Prairie Wildlife Research Center Home Page. <http://www.npwrc.usgs.gov/resource/othrdata/Explant/explant.htm> [Version 15 Dec 98].
- Whitson, T.D.(ed.), L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, R. Parker. 1996. Purple loosestrife. *Weeds of the West*. Western Society of Weed Science, in cooperation with the Western United States Land Grant Universities Cooperative Extension Services, Newark, CA.