

SPOTTED KNAPWEED

Centaurea biebersteinii DC.

Family: Asteraceae (Sunflower).

Other Scientific Names: *Centaurea maculosa*.

Other Common Names: None.

Legal Status: Provincial Noxious.



Identification

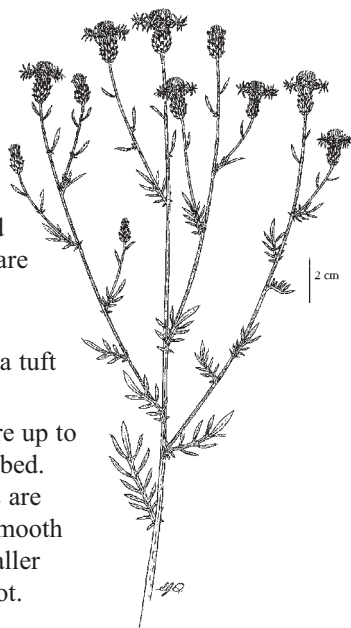
Growth form: Biennial or short-lived perennial forb.

Flower:

Flowering heads are solitary at the ends of branches. The floral bracts are stiff and tipped with a dark, comb-like fringe that gives a spotted appearance. The flowers are pinkish purple or, rarely, cream coloured.

Seeds/Fruit: Seeds have a tuft of persistent bristles.

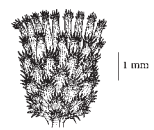
Leaves: Rosette leaves are up to 15 cm long and deeply lobed. The principal stem leaves are pinnately divided, have smooth margins, and become smaller toward the top of the shoot. Leaves are alternate.



Stems: Mature plants are 0.2–1.8 m tall with one or more erect stems.

Roots: Spotted knapweed has a stout taproot.

Seedling: Rosettes of spotted and diffuse knapweed are nearly indistinguishable. Leaves are narrow and 1–2 times pinnately divided (Stubbendieck et al. 1995).



Similar Species

Exotics: Other knapweeds include diffuse knapweed (*Centaurea diffusa*), which has a distinct terminal spine on the floral bracts; Russian knapweed (*Acroptilon repens*), whose flowers are smaller than those of spotted knapweed and do not have black mottling on the flower bracts; and squarrose (*C. virgata* var. *squarrosa*) and black (*C. nigra*) knapweeds.

Natives: None in Canada. Other native members of the sunflower family can resemble knapweed in the seedling/rosette stage.



Impacts

Agricultural: Spotted knapweed reduces or displaces desirable forage plant species and reduces carrying capacity for livestock and wildlife (Sheley and Jacobs 1997).

Ecological: Spotted knapweed is a highly competitive weed that invades disturbed areas and degrades desirable plant communities. It forms near monocultures in some areas of western North America,

including BC. Although spotted knapweed is usually found in disturbed areas, it may invade adjacent areas that are relatively undisturbed (Rutledge and McLendon. Undated).

Human: Spotted knapweed can cause skin irritation. Hands and exposed skin should be washed with soap and water following contact with this plant.

Habitat and Ecology

General requirements: Spotted knapweed is widespread at low- to mid-elevation grasslands and dry open forests. It is commonly found on roadsides, fields,

and disturbed areas. It is adapted to well-drained, light- to coarse-textured soils but is intolerant to dense shade. It tends to inhabit moister habitats than diffuse

knapweed, preferring areas that receive 30–50 cm annual precipitation, but it can survive in very dry climates such as those of Ashcroft and Osoyoos.

Distribution: Spotted knapweed is widely distributed throughout North America. In the US, it is especially prevalent in Washington, Idaho, Montana, and Wyoming (Sheley and Jacobs 1997). The weed is frequent in southern BC east of the Coast-Cascade mountains. It is regarded as a major concern in the Kootenay, Okanagan, Thompson, Cariboo, Omineca, and Peace River agricultural reporting regions and is present on the Mainland and Vancouver Island.

Historical: Introduced from Europe.

Life cycle: Spotted knapweed is a perennial plant that germinates in spring or autumn. Seedlings develop into rosettes that usually persist for one growing season while the plant develops a root system (FEIS 1996). Plants usually bolt for the first time in the spring of the second growing season and flower from August through September, depending on elevation and latitude. Individual flowers bloom 2–6 days (FEIS 1996). Plants are self-fertile and are also cross-pollinated by insects.

Management

Biocontrol: Twelve biocontrol agents have been released in the province for managing spotted knapweed: *Agapeta zoegana* (moth), *Chaetorellia acrolophi* (fly), *Cyphocleonus achates* (weevil), *Larinus minutus* (weevil), *Larinus obtusus* (weevil), *Metzneria paucipunctella* (moth), *Pelochrista medullana* (moth), *Puccinia jaceae* (stem and leaf rust), *Sphenoptera jugoslavica* (beetle), *Terrellia virens* (fly), *Urophora affinis* (fly), *Urophora quadrifasciata* (fly) (Powell et al. 1994). Currently, there is no single biological control agent that effectively manages this weed. The most promising agents thus far are the root-feeding insects *Agapeta zoegana* and *Cyphocleonus achates*. Other species, such as the seed head weevils, *Larinus minutus* and *Larinus obtusus*, and the seed head flies, *Urophora affinis* and *Urophora quadrifasciata*, may be having an impact on seed production. Cattle and sheep will graze spotted knapweed, although sheep appear to be the more effective control animal. Olson et al. (1997) found that sheep would graze on spotted knapweed rosettes and seedlings when associated grasses were dormant. No similar work has been done in the province, however.

Mechanical: Cutting, mowing, or pulling spotted knapweed before the plant sets seed can be effective on a local basis for small populations. However, spotted knapweed seeds can remain dormant in the soil for

Mode of reproduction: By seed.

Seed production: This species is a prolific seed producer, with individual plants producing up to 140,000 seeds/m² (Rutledge and McLendon. Undated). Most seeds are shed immediately after reaching maturity.

Seed bank: Spotted knapweed seeds exhibit 3 germination behaviours: dormant light-sensitive, dormant light-insensitive, and non-dormant (FEIS 1996). Dormant seeds form a seed bank and may remain viable in the soil for over 8 years (Rutledge and McLendon. Undated). Roze (1981) found that the average density of spotted knapweed seeds in the seed bank from 4 sites in BC ranged from 620 to 5,628 seeds/m².

Dispersal: Spotted knapweed seeds usually shed in the immediate area around the parent plant (Watson and Renney 1974). Seeds are often spread in hay and on vehicle undercarriages.

Hybridization: No information available.

long periods, so follow-up treatments will be required to make sure the plant has been controlled. Attempt to remove the entire root system so the plant will not resprout from the crown or remaining roots.

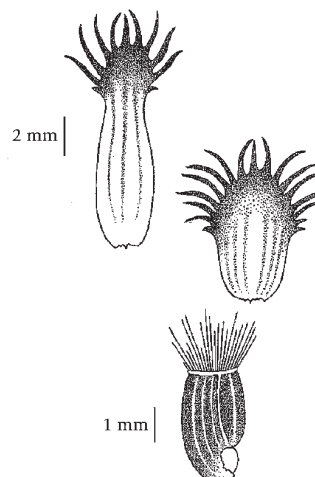
Fire: The role of fire as an effective management tool is unclear. Watson and Renney (1974) report that it was a successful control in Russia and grasses replaced it. No similar work has been conducted in the province.

Herbicides: Several herbicides are effective. Picloram has been most effective but persists in the soil and can damage non-target species (Harris and Cranston 1979; Watson and Renney 1974). Other effective herbicides such as dicamba, 2,4-D, clopyralid, and glyphosate are also effective (Beck 1997). On suitable terrain these can be broadcast-applied, but a backpack sprayer or wick may be more appropriate on small areas to minimize damage to non-target plants. Herbicides should be applied before the mature plants set seed to maximize effectiveness. Consult the most recent edition of BC Ministry of Agriculture, Food and Fisheries Crop Production Guides for specific recommendations. **Before applying herbicides, read the label for full use and precautionary instructions.**

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal. Seed all disturbed sites to provide soil cover and competition with weeds.

Integrated Management Summary

Spotted knapweed can spread readily by stems that are carried on vehicles or in infested hay or seed. Early detection and prompt control of small infestations are the best ways to manage this weed. Spotted and diffuse knapweed can be managed similarly (Beck 1997). They are readily controlled with herbicides but will re-invade unless cultural techniques are used (Beck 1997). Sheley and Jacobs (1997) found that a 90% reduction in diffuse knapweed was necessary to shift the competitive relationship in favour of bluebunch wheat grass.



References

- Beck, K. G. 1997. *Diffuse and spotted knapweed*. Colorado State University Cooperative Extension Natural Resource Series, No. 3. 110. <http://www.ext.colostate.edu/pubs/natres/03110.html> [24 Jan 00].
- Davis, E. S. 1990. Spotted knapweed (*Centaurea maculosa*) seed longevity, chemical control and seed morphology. MS thesis. Montana State University, Bozeman.
- 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/> [12 Mar 98].
- Fletcher, R. A., and A. J. Renney. 1963. A growth inhibitor found in *Centaurea* sp. *Canadian Journal of Plant Science* 43: 475–481.
- Harris, P., and R. Cranston. 1979. An economic evaluation of control methods for diffuse and spotted knapweed in western Canada. *Canadian Journal of Plant Science* 59: 375–382.
- Lacey, C. A., J. R. Lacey, P. K. Fay, J. M. Stry, and D. L. Zamora. 1995. Controlling spotted knapweed in Montana rangeland. Circular 311. Bozeman: Montana State University Cooperative Extension.
- Lacey, J. R., C. B. Marlow, and J. R. Lane. 1989. Influence of spotted knapweed (*Centaurea maculosa*) on surface water runoff and sediment yield. *Weed Technology* 3: 627–631.
- Mauer, T., M. J. Russo, and M. Evans. 1998. Element stewardship abstract for *Centaurea maculosa*. The Nature Conservancy, Wildland Weeds Management and Research Program.
- <http://tncweeds.ucdavis.edu/esadocs/documnts/centmac.html> [28 Jul 98].
- Olson, B. E., R. T. Wallender, and J. R. Lacey. 1997. Effects of sheep grazing on a spotted knapweed infested Idaho fescue community. *Journal of Range Management* 50: 386–390.
- Powell, G. W., A. Sturko, B. M. Wikeem, and P. Harris. 1994. *Field Guide to the Biological Control of Weeds in British Columbia*. Land Management Handbook No. 27. BC Ministry of Forests.
- Roze, L. D. 1981. The biological control of *Centaurea diffusa* Lam. and *C. maculosa* Lam. by *Urophora affinis* Frauenfeld and *U. quadrifasciata* Meigan (Diptera: Tephritidae). Ph.D. thesis. University of British Columbia.
- Rutledge, C. R., and T. McLendon. Undated. An assessment of exotic plant species of Rocky Mountain National Park. Department of Rangeland Ecosystem Science, Colorado State University. Northern Prairie Wildlife Research Center Home Page. <http://www.npwrc.usgs.gov/resource/othrdata/Explant/explant.htm> [15 Dec 98].
- Sheley, R. L., and J. S. Jacobs. 1997. “Acceptable” levels of spotted knapweed (*Centaurea maculosa*) control. *Weed Technology* 11: 363–368.
- Stubbendieck, J., G. Y. Friisoe, and M. R. Bolick. 1995. Spotted knapweed. *Weeds of Nebraska and the Great Plains*. Lincoln: Nebraska Department of Agriculture, Bureau of Plant Industry.

Watson, A. K., and A. J. Renney. 1974. The biology of Canadian weeds. 6. *Centaurea diffusa* and *C. maculosa*. *Canadian Journal of Plant Science* 54: 687–701.

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

