

Ecology and Management of Blueweed (*Echium vulgare* L.)

By

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Figure 1. Farmer with blueweed plants over 36 inches in height (Photo courtesy of Stevens County, Washington, Noxious Weed Control Board, 2000).

Abstract

Blueweed is a European biennial or short-lived perennial in the Boraginaceae plant family. It grows from a taproot to over 36 inches tall (see Figure 1), is covered with bristly hairs, and has showy blue flowers with pink to red stamens. Spreading only by seed which disperse via hay/grain contamination, water transport, and on the fur of animals, it was first reported in Montana in 1916 and currently is known to occur in seven northwestern counties and in Yellowstone County. It grows well on disturbed sites with coarse, low-fertility soils, and is found along roads, waterways, vacant lots, farm fields, and rangeland. The plant is not considered palatable to livestock because of its coarse hairs and toxic alkaloids that can cause liver failure. Herbicide trials show metsulfuron, chlorsulfuron, or their combination is effective in reducing populations. Hand pulling that removes the taproot may be practical for managing small populations. Populations can re-establish from the seeds in the soil that can survive for three or more years.



Figure 2. Blueweed basal rosette (Photo courtesy of Stevens County Noxious Weed Control Board, 2000).

Plant Biology

Identification

Blueweed, or viper's bugloss, is a member of the borage family (Boraginaceae). It is an introduced species native to Europe. Blueweed can be a biennial or short-lived perennial. It has a significant rooting system comprised of a taproot and smaller fibrous roots. The taproot is black and can range in length from 12 to 32 inches (30.5 to 81 centimeters), allowing deep soil penetration. Vegetation forms initially as a basal rosette. Rosette leaves are simple, entire, oblanceolate, approximately 2.5 to 10 inches (6.5 to 25.5 centimeters) in length and 0.5 to 3 inches (1 to 7.5 centimeters) in width, with a single vein and a short petiole (see Figure 2). Stem leaves are alternate in arrangement becoming progressively smaller and bract-like towards the top of the stem. Mature plants grow one to many erect, branching flowering stems reaching over 36 inches (90 centimeters) in height. Both the stems and leaves are covered with stout, spreading hairs that have swollen, red, purple or black bases, underlain by smaller fine appressed hairs. The swollen bases of the spreading hairs give the stems a spotted appearance (see Figure 3).

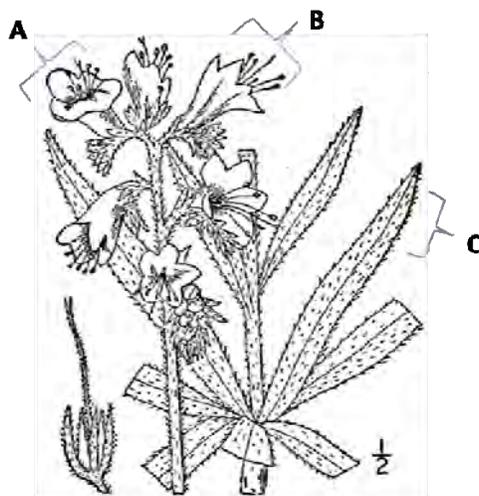


Figure 3. Blueweed drawing showing A) funnel-shaped corolla, B) 5 stamens with stigma, and C) leaf blade with bristly hairs (Modified line drawing courtesy of USDA-NRCS PLANTS database / Britton, N.L. and A. Brown. 1913. An illustrated flora of the northern United States, Canada, and the British Possessions. Vol. 3:94).

The stem terminates in a panicle inflorescence, each branch of the panicle forms a short helicoid cyme, shaped like a scorpions tail, subtended by an upper foliage leaf. There can be as many as 50 cymes per stem, and each cyme bears up to 20 flowers on the top side. The showy flowers range in size from 0.4 to 0.8 inch (1 to 2 centimeters). The funnel-shaped, five-lobed, pubescent flowers are typically bright blue, but may also be purple, pink, or rarely white. Flowers widen as they mature, and the upper lobes are noticeably longer. Another identifying characteristic is the five pink or red stamens, one of which is noticeably shorter than the four which are long-exserted beyond the corolla tube (see Figure 4). The superior ovary is four-lobed with the style arising from the center of the lobes.

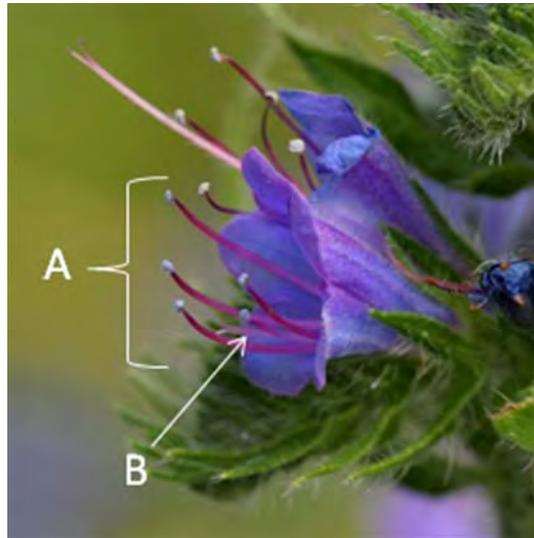


Figure 4. Blueweed flower showing A) 5 pink extruded stamens with B) 1 stamen shorter than the others (Photo courtesy of Dan Tenaglia).

The seeds of blueweed are called nutlets (see Figure 5). They are brown or gray with a rounded pyramid shape, and are very small, (< 0.10 inch long and wide, or 2.4 x 1.6 x 1.5 millimeters). The surface of the nutlets is rough and very hard. This characteristic provides blueweed seeds with moderate survival times in the seed bank, with a three year survival, typical at depths of 6 inches (15 centimeters) or more.



Figure 5. Nutlets of blueweed (Photo courtesy of Steve Hurst at USDA-NRCS PLANTS database).

Life History

Blueweed is a monocarpic perennial, meaning it flowers once and dies. This typically takes two years (biennial) but can take as long as five years. No blueweed plant that has flowered has been observed to survive and grow a secondary rosette. Populations of blueweed have been observed to be cyclic similar to yellow sweetclover; one year an infestation will be densely populated followed by one or more years of sparse population.

Typically, seedlings emerge in the spring. However, some seedlings emerge in the summer and autumn. Blueweed seeds (nutlets) have high viability at maturity (90%) and the thick nutlet wall provides some dormancy. Stratification increases germination. Seeds can remain viable for three years when buried in the soil, but seeds sown on the soil surface do not persist for more than one year. Vegetative reproduction of blueweed has not been observed.

Rosettes develop and increase in diameter throughout the growing season. During this time, blueweed forms a large root system that enables its survival in drought-prone habitats. The semi-succulent leaves and epidermal leaf hairs also provide drought tolerance. The older rosette leaves die after the onset of freezing in the autumn leaving a few small central rosette leaves to survive throughout the winter.

Rosettes must go through a cold vernalization period and reach a certain size before flowering. Bolting begins in early June for plants that meet these requirements. Flowers bloom beginning in early June and continue blooming until mid-September or until the first hard frost. Flowering commonly occurs in two phases, the first is from June to July with a second flowering phase occurring from August to October in later blooming plants. Blueweed is pollinated by insects and the ruby-throated hummingbird. More than 50 insect species visit the flowers including honeybees, bumblebees, halictid bees, and butterflies. Seeds mature about one month after bloom. Seed dispersal begins about one month after seeds mature, generally in early August, peaking in September, and continuing through early November. Plants produce from 500 to 2,000 seeds per plant.

Habitat

Blueweed is native to southern Europe. It is adapted to temperate areas with cool winters, warm summers, and a relatively moist climate. Arid regions including deserts, dry grasslands, and chaparral generally do not support blueweed populations. Abundant populations are found on coarse, sandy soils of limestone or dolomite parent material, although populations can also be found in areas with acidic soils and granitic parent material. It grows well on soils with poor fertility. It is a weed of sparsely vegetated and disturbed areas and typically is found in wastelands or disturbed areas, along roadsides and watercourses, and in overgrazed pastures. Blueweed does not grow well under dense vegetation.

Spread

Blueweed nutlets have no morphological adaptations for dispersal and most seeds fall to the ground passively near the parent plant resulting in a patchy distribution of plants. Nutlets weigh about 2.5 milligrams and can drift short distances on the wind. Nutlets float and are transported by floodwaters and rain-wash. Some nutlets remain within the calyx of the stiff-haired flower that can attach to animal fur. Detached nutlets can also be transported in animal fur and by ants.

Vehicles and equipment can also move seeds long distances. Because of its showy blue flowers, blueweed has been planted in gardens from which it can spread to adjacent lands.

Impacts

Blueweed reduces forage production and wildlife habitat. Grazing animals avoid foraging on blueweed because of the stiff hairs on the stems and leaves and because of the high concentrations of pyrrolizidine alkaloids contained in these plant parts. The alkaloids accumulate in the liver when ingested where they can cause liver disease. Skin contact with the hairs also causes dermatitis resulting in inflammation and itching in humans. Blueweed is an alternate host to wheat rust, is a natural host to alfalfa mosaic virus, tobacco mosaic virus, and cabbage black ring spot.

Management Alternatives

Herbicide ^{1/}

Herbicide trials on a rangeland site in Ravalli County, Montana, showed metsulfuron (1 ounce/acre product-Escort and others), chlorsulfuron (1 ounce/acre product-Telar and others), or their combination (0.5 + 0.5 ounce/acre) applied to rosettes in the spring or fall provided nearly 100 percent control of blueweed one year after treatment. Pasture formulations containing 2,4-D LVE at 1-2 quarts/acre have been used successfully on blueweed in the rosette stage during active growth. Multiple applications may be required to ensure complete control of this species. Blueweed is listed on the Crossbow® label (2,4-D + triclopyr) for control using a 1 percent mixture or 1 quart/acre applied during active growth. Always consult product labels and read them carefully to ensure correct species/land management usage, chemical application rates, and precautionary requirements.

Hand Pulling

Pulling or digging blueweed by hand works well for smaller infestation if the soil is moist. Care should be taken when hand pulling to ensure the taproot is removed because this plant can regenerate if the root remains. Pulling or digging should be done before the plants bloom to help prevent seed production. If blooming has already occurred, the plants should either be burned or bagged for disposal. A long-sleeve shirt and gloves are recommended for protection while pulling blueweed as the stiff hairs on the stems and leaves may irritate the skin.

Mowing

Mowing or cutting the plants can help reduce seed production on larger infestations in the short term, but re-sprouting and production of flowers or seeds below the blade level are common. Mowed areas should be carefully monitored.

^{1/} **Any mention of specific products in this publication does not constitute a recommendation by the NRCS. It is a violation of Federal law to use herbicides in a manner inconsistent with their labeling.**

Tilling

Research in Canada and Europe demonstrated that under cultivation blueweed was displaced by other plants. However, the disturbance of tillage can create a favorable environment for blueweed growth and reproduction by reducing competitive perennial plants. Tillage should be combined with herbicide management and followed by revegetation with desired, competitive plants.

Irrigation

Blueweed does well under moist conditions and therefore irrigation is not recommended as a control by itself. Where blueweed invades irrigated pastures and hayland, carefully planned irrigation management will stimulate the competitiveness of the forage crop and when combined with nutrient, forage harvest, and grazing management practices will help prevent the re-establishment of blueweed after other control practices are applied.

Fertilization

Blueweed does well on soils with low fertility. Also, flowering of blueweed is reduced under high nutrient conditions. On cultivated pastures and hay meadows, nutrient management is important to maintaining the competitiveness of desired perennial grasses. Nutrient management combined with judicious use of herbicides and crop rotation is recommended where blueweed invades non-native pastures and hay meadows.

Prescribed Burning

No specific information is available for prescribed fire effects on blueweed. Although flowering plants may be burned to control seed production and distribution, large-scale burning could create a disturbed environment favorable to blueweed and other invasive plant species. Areas within a prescribed burn where blueweed has invaded should be monitored and treated with herbicides where necessary.

Grazing Management

No information was found on grazing management of blueweed. Generally blueweed is avoided by large herbivores because of the stiff hairs on the foliage and toxic alkaloids. Prescribed grazing to maintain grazing land health will help prevent new populations of blueweed and re-establishment of populations after control measures are applied.

Biological Control

Currently, there are no biological control agents approved for management of blueweed. There are three North American insect species known to feed on the species: a lace bug (*Dictyla echii* Schrank), moth (*Ethmia bipunctella* Fabricus), and chrysomelid beetle (*Longitarsus melanurus* Melsheimer). These insects are not known to occur in Montana or the Northwest.

Revegetation

Blueweed is not shade tolerant and is seldom found on closed vegetative communities. Disturbance is favorable to blueweed and removal of natural vegetation provides opportunities for establishment. Revegetation of disturbances is therefore important to prevent blueweed invasion.

Species selected for revegetating disturbed sites and blueweed infestations should be appropriate for management objectives, adapted to site conditions, and competitive with the weed. Management objectives will determine if introduced species or native species are seeded and species mixture components. The environmental conditions of the site, including precipitation, soil texture and depth, slope and aspect, will affect species establishment. On native rangeland, a diversity of perennial grass and forb species that occupy many niches over time and space will most fully utilize available resources and compete effectively with blueweed. Refer to [Montana Plant Materials Technical Note 46](#), 'Seeding Rates and Recommended Cultivars,' and Extension Bulletin EB19 'Dryland Pasture Species for Montana and Wyoming' for seeding rate guidance and revegetation species selection. State, area, and field resource specialists can help determine the most appropriate, site-specific species mix and timing of seeding for local conditions.

Integrated Pest Management (IPM)

Blueweed thrives on disturbed ground with open sites in the plant community. New infestations of blueweed should be aggressively controlled using hand pulling and/or broadleaf herbicide. On pastures and rangeland, herbicide application should be combined with prescribed grazing. Roadways, trails, and irrigation ditches should be maintained weed-free.

References

Klemow, K.M., D.R. Clements, P.F. Threadgill, and P.B. Carvers. 2002. The biology of Canadian weeds. 116. *Echium vulgare* L. Canadian Journal of Plant Science. 82: 235-248.