Biology, Ecology and Management of

Blueweed

(*Echium vulgare* L.)

Melissa Graves, MSU Extension Integrated Pest Management and Weeds Specialist, Department of Land Resources and Environmental Sciences

Jane Mangold, MSU Extension Invasive Plant Specialist, Department of Land Resources and Environmental Sciences

Jim Jacobs, Plant Materials Specialist, Natural Resources Conservation Service

MONTANA STATE UNIVERSITY | EXTENSION

EB0195 Revised September 2018

Table of Contents

Terms in bold can be found in the glossary on page 10.

Common chemical and trade names are used in this publication for clarity of the reader. Inclusion of a common chemical or trade name does not imply endorsement of that particular product or brand of herbicide and exclusion does not imply non-approval.

MONTANA STATE UNIVERSITY EXTENSION

The U.S. Department of Agriculture (USDA), Montana State University and Montana State University Extension prohibit discrimination in all of their programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital and family status. Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Cody Stone, Director, Montana State University Extension, Bozeman, MT 59717.

Blueweed *(Echium vulgare)*, a member of the Boraginaceae family, was introduced from southern Europe and is now widely distributed throughout North America. It is a biennial to short-lived perennial. Blueweed has bright blue flowers with pink-to-red stamens and is covered with bristly hairs. It reproduces by seed. This species is typically found in disturbed areas and overgrazed range or pastureland. It thrives in sandy, well-drained soils with low nutrient levels and tolerates dry conditions. It has also been found in irrigated, well-maintained pastures. The plant is not considered palatable to livestock, and it has toxic alkaloids that can cause liver failure. Early detection of new plants is very important. Small infestations can be managed by hand-pulling or digging, while larger infestations can be treated with herbicides.

PLANT BIOLOGY

Identification

Blueweed, or viper's bugloss, is a member of the borage family (Boraginaceae). 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 with a reddish cast, ranging in length from 12 to 32 inches (30.5 to 81cm). Vegetation forms initially as a **basal rosette** (Figure 1). Rosette leaves are simple, entire, **oblanceolate**, approximately 2.5 to 10 inches (6.5 to 25.5 cm) in length and 0.5 to 3 inches (1 to 7.5 cm) in width with a single vein and a short **petiole**. Stem leaves are alternate in arrangement, **sessile**, linear-lanceolate in shape, and become progressively smaller toward the top of the stem. Mature plants grow one-to-many erect, branching, flowering stems reaching over 36 inches (90 cm) in height. Both stems and leaves are covered with stout, spreading hairs that have a swollen red, purple or black base, underlain by smaller hairs. The swollen bases of the spreading hairs give stems a spotted appearance (Figure 2).

FIGURE 1. Blueweed basal rosette. (Stevens County, Washington, Noxious Weed Control Board)

FIGURE 2. Blueweed stem showing hairs and spotted bases. (Jane Mangold, Montana State University).

The stem terminates in a **panicle** inflorescence, and each branch of the panicle forms a short **helicoid cyme**. There can be as many as 50 cymes per stem, and each cyme bears up to 20 flowers. The showy flowers range in size from 0.4 to 0.8 inch (1 to 2 cm). The funnel-shaped, five-lobed flowers are typically bright blue, but may also be purple, pink or rarely, white (Figure 3). Flowers become wider as they mature and the upper lobes are longer. Another identifying characteristic is the five pink or red **stamens**, one of which is noticeably shorter than the other four, which extend beyond the flower tube (Figure 4).

The seeds of blueweed, which typically mature about one month after flowering begins, are called nutlets (Figure 5). They are brown or gray with a rounded pyramid shape, and are very small, less than 0.10 inch in diameter. The surface of the nutlets is rough and hard.

Life History

This species is typically a biennial or short-lived **monocarpic** perennial. Vegetative growth begins as a basal rosette, overwintering with only a few small leaves and a bud in the center. Exposure to cold temperatures is required before plants can flower. Flowering normally occurs in two separate phases. The early flowering plants bloom between June and July, but later blooming plants may flower during a second phase from August to October. Plants normally flower in their second year, but research indicates environmental conditions may delay reproduction until the plant is three to four years old.

FIGURE 3. Pink, purple and white forms of blueweed are possible (photo by Ravalli County Weed District).

FIGURE 4. Blueweed flower showing four long, pink stamens. (photo by Matt Lavin, Montana State University)

Reproduction in blueweed occurs by seed with no vegetative reproduction reported. Blueweed flowers are pollinated by insects, typically bees and butterflies. Seeds are viable for up to 36 months, depending upon how deep they are buried: seeds found at six inch (15 cm) depths have a 70 percent germination rate, while those at shallow depths show reduced germination rates. Seed production per plant varies with environmental conditions but averages about 1800 seeds per plant.

FIGURE 5. Nutlets of blueweed, magnified to show detail.(photo courtesy of Steve Hurst, USDA-NRCS Plants database)

SpeedyWeed ID

Blueweed is fairly easy to identify, but could be mistaken for the native species threadleaf phacelia (Figure 6a, *Phacelia linearis,* which has purple/blue flowers with white stamens), non-native common bugloss (Figure 6b, *Anchusa officinalis,* which has purple/blue flowers but no visible stamens), or non-native houndstongue (Figure 6c, *Cynoglossum officinale,* which has reddish-purple flowers). None of these other species have spotted stems. Check for the following characteristics, all of which are exhibited by blueweed:

- basal rosette of long lance-shaped leaves
- leaves and stem are covered with long and short hairs
- stem has dark spots at the bases of the long hairs
- bright blue funnel-shaped flowers located on the top of a curled cyme
- bright pink or red stamens, four long and one short, extending beyond petals

FIGURE 6a. Threadleaf phacelia. (photo by Matt Lavin, Montana State University)

FIGURE 6b. Common bugloss. (photo by Matt Lavin, Montana State University)

FIGURE 6c. Houndstongue. (photo by Stacy Davis, Montana State University)

Current Status and Distribution

Blueweed is native to southern Europe. Based on herbarium specimens, it was introduced to the United States in the early 1800s. This species is currently found in most states, with the exception of Alabama, Arizona, Florida, Hawaii, Nevada, and North Dakota. It is listed as a noxious weed in Montana, Washington, and Wyoming (Big Horn, Laramie, and Uinta counties). The first report of blueweed in Montana occurred in Ravalli County in 1925, although an earlier specimen with no location dates to 1916. Blueweed is a priority 1B noxious weed in Montana and has infested over 8,800 acres as of 2016. It has been found in 11 counties in Montana (Figure 7).

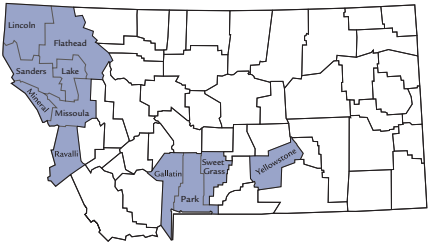

FIGURE 7. Counties in Montana where blueweed has been reported. (Compiled records from EDDMapS West, Consortium of Pacific Northwest Herbaria, Intermountain Region Herbarium Network, and MSU Schutter Diagnostic Lab)

ECOLOGY

Habitat

Blueweed is adapted to temperate areas with cool winters and warm summers. Blueweed is typically found in wastelands or disturbed areas, along roadsides and watercourses, and in overgrazed pastures. It is often found in alkaline soils with a dolomite or limestone base material, although it can also be found in areas with more acidic soils. While blueweed exhibits a preference for sandy, well-drained soils, it does not do well in very arid regions. Research in Canada and Europe demonstrated that under cultivation, blueweed was easily displaced by other plants, and flower production was inhibited when soil nutrient levels were increased. Most reports indicate blueweed does not grow well under dense vegetation; however, it has been found in well-maintained pastures in Ravalli County.

Spread and Establishment Potential

Seeds are dispersed via wind, water, animals, and humans. Wind can distribute seeds up to 16 feet (5 m) from the parent plant, or longer distances as the stems can break off and roll like a tumbleweed. Some seeds will remain inside the flower, which can then become attached to animal fur. Blueweed seeds float and may be dispersed by water. Humans are the most common means of dispersal: seeds may be

transported longer distances as hay and grain contaminants or when they become lodged in vehicles and equipment. Humans also aid plant establishment through habitat disturbance and improper range and pasture management.

Damage Potential

Blueweed can cause dermatitis in humans if individuals touch the leaves or stems, so gloves should be worn if handling this plant. Blueweed can infest pasture and rangeland, causing potential impact to livestock. Several members of the borage family, including blueweed, contain pyrrolizidine alkaloids, which can be toxic to horses and cattle when ingested. Sheep and goats have shown resistance to alkaloid toxicity. Paterson's curse (*Echium plantagineum*), a closely-related species problematic in Australia and New Zealand, has contributed to a reduction in pasture productivity and native plant populations. Livestock poisoning involving Paterson's curse has been documented in Australia and New Zealand. Very few poisonings have been documented with blueweed, but some cases have been reported in Spain.

In addition to the physical damage to livestock, blueweed is also a known host for several plant diseases including alfalfa mosaic virus, cabbage black ring spot virus, and tobacco mosaic virsus. Research in Europe also indicates this species can act as a secondary host for three types of wheat rust. Blueweed is an important pollen source for pollinators. However, it is a major source of pyrrolizidine alkaloid contamination in European honeys. Contamination usually does not pose a risk to consumers.

Toxicity

Alkaloid toxicity occurs when plants containing pyrrolizidine alkaloids are ingested. While these plants are not considered highly palatable, chances of ingestion increase if the surrounding vegetation is limited or in poor condition. Poisoning may be either acute or chronic, and onset of symptoms may take several weeks. Symptoms can include constipation or diarrhea, anorexia, lethargia, and a general loss of condition with the animal getting progressively weaker. More severe symptoms are changes in behavior, wandering, and liver failure. A complete list of symptoms may be found through veterinary consultation or in The Merck Veterinary Manual. Consult a veterinarian immediately if livestock exhibit symptoms of pyrrolizidine alkaloidosis.

MANAGEMENT ALTERNATIVES

Mechanical control

Pulling or digging blueweed by hand works well for smaller infestations if the soil is moist (Figure 8). Care should be taken when hand pulling to ensure the tap root 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.

FIGURE 8. Large blueweed found in Ravalli County. (photo by Ravalli County Weed District)

Mowing or cutting the plants can provide short term control by reducing seed production. However, re-sprouting and production of flowers or seeds below the blade level are common. Mowed areas should be carefully monitored for re-sprouting and continued flowering.

Cultural Control

Proper maintenance of vegetation and soil is the best way to prevent the invasion and establishment of blueweed. This species prefers areas with low soil fertility and sparse vegetation. Overgrazing creates gaps in vegetation, favoring emergence of blueweed and other weeds. Proper management of lawn, pasture, and rangeland keeps desirable plants in a healthy condition and helps minimize habitat disturbance. Fertilization of lawn and pasture areas can maintain nutrient levels, increase plant health and vigor, and prevent blueweed establishment.

Revegetation may be necessary when an area is severely infested. Herbicide application followed by reseeding may be necessary to allow the establishment of seeded species. Herbicide application alone may create open areas favorable not only for blueweed but also for numerous other weed species, so establishing desirable, competitive vegetation in a timely manner is crucial.

Biological Control

No biological control agents have been established in the United States for use on blueweed; however, three insect species known to feed on blueweed are found in the northeastern United States: a lace bug (*Dictyla echii*), moth (*Ethmia bipunctella*), and chrysomelid beetle (*Longitarsus*

melanurus). The lace bug feeds on reproductive and vegetative parts of blueweed, causing considerable damage and reducing seed production. The larvae of *E. bipunctella* feed on vegetative blueweed. The chrysomelid beetle, limited to only four states in the Northeast, also causes damage to blueweed plants. These insects are not known to occur in Montana or the Northwest.

Studies in Australia with Paterson's curse, indicate some success using a combination of intensively managed grazing with sheep, goats, and cattle combined with chemical application. The practice, called spray-grazing, involves herbicide application followed by periods of intensive grazing by sheep or goats to reduce or eliminate broadleaf weed species. This is typically followed by a rest period, after which cattle are returned to the pasture. The practice of spray-grazing is not recommended if only horses or cattle will be grazed in the treated area immediately, as certain herbicides can make plants more palatable to livestock and increase the risk of poisoning.

Prescribed Burning

Very little information is available for prescribed fire effects on blueweed. Burn trials conducted in Ravalli County, Montana, indicate blueweed does not dry out well and therefore does not burn very well. Plants had to be hand pulled and air dried for several days before successful burning occurred. Although flowering plants may be burned to control seed production and distribution, large scale burning could create a disturbed environment that is favorable to other invasive plants.

Chemical Control

Herbicide trials on a rangeland site in Ravalli County, Montana, showed metsulfuron (e.g., Escort®) at one ounce product/acre, chlorsulfuron (e.g.,Telar®) at one ounce product/acre, or their combination (one half ounce each product/acre) applied to rosettes in the spring or fall provided nearly 100 percent control of blueweed one year after treatment. Resistance of Paterson's curse to such sulfonylurea herbicides has been documented in Australia. Pasture formulations containing 2,4-D LVE at one to two quarts/acre have been used successfully on blueweed in the rosette stage. Multiple applications may be required to ensure complete control of this species. Crossbow® (2,4-D + triclopyr), another herbicide approved for pasture use, is labeled for blueweed control when foliar broadcast as a one percent mixture applied at one quart/acre during active growth. Always consult product labels and read them carefully to ensure correct species/land management usage and chemical application rates.

INTEGRATED WEED MANAGEMENT (IWM)

- Prevention is key. Maintain pasture fields at optimum quality levels. This is especially effective with blueweed, which performs well in soils with poor nutrients, but can be outcompeted when desirable plants are properly managed. In the event blueweed plants are found, immediate treatment is necessary to prevent spread.
- Disturbance will facilitate weed establishment. Routinely monitor fields, especially after a disturbance, and remove weeds as soon as possible. Continue monitoring following removal.
- Small infestations may be controlled by hand pulling or digging.
- In the event of larger infestations, control using the following options:
  - Spot treat with herbicide following label instructions.
  - Broadcast treat dense infestations with herbicide following label instructions.
  - Re-seeding of fields may be necessary in cases of severe infestation (refer to *Revegetation Guidelines for Western Montana*, EB0170, under References on page 11).
  - If field is used for grazing livestock, follow label directions regarding time between chemical application and grazing.

GLOSSARY

Basal - located at bottom of stem.

Cyme - short, flat-topped cluster of flowers in which the upper most flower opens first.

Helicoid - curled like a scorpion's tail.

Monocarpic - plant flowers once during its life cycle, and then dies following seed production.

Oblanceolate - lance-shaped, both ends tapered but wider towards the leaf tip.

Panicle - branched, indeterminate inflorescence, produces blooms from the bottom toward the top.

Petiole - leaf stem or stalk.

Rosette - circular cluster of leaves, compact and basally arranged.

Sessile - without a stem or stalk.

Stamen - pollen-producing part of the plant.

REFERENCES

Holzworth, L., Mosley, J., Cash, D., Koch, D., and K. Crane. 2003. *Dryland pastures in Montana and Wyoming.* Montana State University Extension, Bozeman, Montana. EB0019. 34 pp. https://store.msuextension.org/Products/Dryland-Pastures-in-Montana-and-Wyoming__EB0019.aspx

Huwer, R.K., Debriese, D.T., Dowling, P.W., Kemp, D.R., Lonsdale, W.M., Michalk, D.L., Neave, M.J., Sheppard, A.W., and T.L. Woodburns. 2005. *Can an integrated management approach provide a basis for long-term prevention of weed dominance in Australian pasture systems?* Weed Research 45: 175-192.

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

Moyano, M.R., Garcia, A., Rueda, A., Molina, A.M., Mendez, A., and F. Infante. 2005. *Echium vulgare and Senecio vulgaris poisoning in fighting bulls.* Journal of Veterinary Medicine 53: 24-25.

The Merck Veterinary Manual. 2018. https://www.merckvetmanual.com/toxicology/pyrrolizidine-alkaloidosis/overview-of-pyrrolizidine-alkaloidosis

Goodwin, K., Marks, G., and R. Sheley. 2006. *Revegetation Guidelines for Western Montana: Considering Invasive Weeds.* Montana State University Extension, Bozeman, Montana. EB0170. 45 pp. http://msuextension.org/publications/AgandNaturalResources/EB0170.pdf

ACKNOWLEDGMENTS

Funding assistance provided by the Montana Department of Agriculture Noxious Weed Trust Fund and USDA-NIFA.

The authors would like to thank Hilary Parkinson, Dave Brink, Kellianne Morris, and Stacy Davis for reviewing this publication.