EB0215

Weed Seedling Identification Guide

for Montana and the Northern Great Plains

by Hilary Parkinson, Jane Mangold and Fabian Menalled

MONTANA STATE UNIVERSITY | EXTENSION

Hilary Parkinson Plant Identification Diagnostician and Research Associate
Jane Mangold Assistant Professor, Extension Invasive Plant Specialist
Fabian Manalled Associate Professor, Extension Cropland Weed Specialist

MONTANA STATE UNIVERSITY
EXTENSION

 EB0215

This project was funded in part by the Montana Department of Agriculture's Noxious Weed Trust Fund; Montana Wheat and Barley Commission; Extension Integrated Pest Management (EIPM) through the USDA; and USDA National Institute of Food and Agriculture through the Western Integrated Pest Management Center.

We would like to thank Susan Anderegg for her work designing and assembling this publication; Matt Lavin, Rose Malisani, Bobbie Roos and Steve Young for their reviews; and Bugwood.org for sharing their large collection of high quality photos.

TABLE OF CONTENTS

Weed seedling identification: A keystone component of integrated weed management (IWM).

Rapid and accurate identification of weeds at the seedling stage is the first step in the design of a successful weed management program that saves producers and land managers time and money, and reduces herbicide use. How does weed seedling identification provide these benefits? First, weed management is typically much easier, less costly, and more effective at the seedling or juvenile (e.g. rosette) stage than on mature plants. Second, controlling a weed during early growth stages allows desirable neighboring vegetation to grow better, thereby improving overall plant community vigor. Finally, improper identification can result in misapplication of a management tactic such as herbicides or failure to adequately control the weedy plant species at the time that it is most vulnerable.

Once a species has been correctly identified, an IWM program can be designed that combines the use of biological, cultural, mechanical, and chemical practices to manage weeds. The main goals of an IWM program are to:

- use preventive tools to maintain the crop or desired vegetation and limit weed density to a tolerable, non-harmful level,
- avoid shifts in the composition of plant communities towards other weeds that may be even more difficult to control,
- develop sustainable management systems that maximize environmental quality, productivity, and revenues.

Thus, designing a successful IWM program requires an understanding of the biological and ecological factors that influence the growth and development of weeds. Part of this understanding is the need to correctly identify all different kinds of weed species.

Principles of IWM

The following five principles of IWM should be practiced to effectively reduce the introduction and establishment of weeds.

1: Prevention is key
2: Increase natural weed mortality
3: Use cultural methods to put weeds at a disadvantage
4: Keep weeds off balance
5: Use as many “little hammers” as possible

1) Prevention is key. Limit seed introduction, production, and dispersal. Identify weeds and take appropriate action.

Preventing weeds from establishing is the most effective way to minimize weed problems. Using certified weed-seed free seeds and forage, as well as cleaning equipment are some simple sanitation practices that prevent weeds from entering or spreading through an area. Early detection of weeds and rapid response before they produce seeds can help prevent the spread of weeds.

2) Increase natural weed mortality. Minimize weeds' ability to germinate, grow and reproduce.

During the life cycle of a weed, many mortality factors threaten its survival. Since it is unlikely that all weeds can be prevented from establishing, it is important to maximize the effectiveness of the mortality factors that exist in nature. For example, delaying cultivation leaves weed seeds unprotected as opposed to being buried in the soil. These seeds are more prone to be destroyed by invertebrates, mice, fungi, bacteria or desiccation. Enhancing the abundance and effectiveness of natural enemies of weeds and other mortality factors can be an important component of a successful IWM program.

3) Use cultural methods to put weeds at a disadvantage. Maximize resource use by the desired vegetation.

Many weeds and the desired plant species we want to promote compete for the same basic resources: sunlight, nutrients and water. A key component in the design of a successful IWM program is to make sure that these resources are captured by the desired vegetation and not by the weeds. Several practices can help ensure that your desired plants have the advantage. Here are just a few:

- *Apply fertilizer appropriately*. Banding fertilizer and applying it at the appropriate time enhances the ability of a plant to compete with weeds. For example, in cropping systems, band placement of fertilizer close to the root zone has been shown to increase early plant growth and decrease weedy species size and abundance. Fertilization is not recommended in most non-crop settings because it is cost prohibitive and has little effect.
- *Adjust planting densities* to enhance the competitiveness of desired vegetation relative to the weeds (particularly early in the growing season) so that fewer resources are available to support weed growth.
- *Utilize competitive species and cultivars.* Plant species that differ in their ability to compete against weeds. For example, cereal crops such as barley are more competitive against weeds than pulse crops such as lentils. Moreover, within a given species, varieties differ in their ability to compete for resources and suppress weed growth. As a general rule, tall varieties with high leaf area have been shown to be more competitive than short varieties with low leaf area.
- *Use high quantity and quality seeds.* The use of higher seeding rates and larger seed size classes has been shown to improve plant competitive ability with weeds and increase economic returns.
- *Minimize the intensity and frequency of disturbance.* Weeds typically capitalize on open space in the plant community more quickly than slower-growing desired vegetation.

4) Keep weeds off balance. Prevent weeds from adapting to your weed management practices.

In cropping systems, using the same crop rotation over and over again generates predictable environmental conditions that are exploited by weeds. For example, jointed goatgrass and cheatgrass thrive in winter wheat-fallow rotations because they have growth requirements that are very similar to winter wheat. Likewise, early germinating weeds such as wild oat can be found in early-seeded cereals, and late germinating species such as pigweed can be a problem in late-seeded canola.

Managers can decrease the opportunities for weeds to establish and persist by ensuring that their systems favor the desirable species, either crops or native vegetation. Crop rotation is a powerful tool for disrupting weed life-cycles. Rotating crops means that different resources are available at different times during the season and over the course of several years. This makes it difficult for weeds to adapt to the different conditions likely to be encountered over the entire rotation.

In crop and non-crop settings, desired vegetation may be injured by repeated application of herbicides resulting in reduced vigor and competitive ability. Managing for the maximum health of desired vegetation will increase the longevity of your weed control.

5) Use as many "little hammers" or approaches and techniques as possible. Achieve maximum long-term weed management.

Often, we rely on one or two "large hammers", such as herbicides and tillage. Most often, these practices provide short-term control of weeds. Over the longer-term, these "large hammers" or heavily relied upon approaches and techniques are not entirely effective because weeds adjust to the events (e.g., herbicide resistance) or the current weeds are replaced by new species. Alternatively, long-term management means learning and adapting practices to manage weeds in the most responsive manner employing a multiplicity of techniques that are appropriate at the time and place. Examples of these "little hammers" are adjusting seeding rates, directed nutrient placement, use of biological control, and enhancing weed seed predation and decay.

In summary, weeds are well adapted to colonize and compete with the desired vegetation, but by developing and implementing IWM, which incorporates multiple techniques and approaches, the spread and impact of undesired species can be prevented or significantly reduced. Weed seedling identification is a required step in IWM, which ultimately will lead to more sustainable weed management in both crop and non-crop systems.

Tips on using this weed seedling identification guide

This guide is not a complete list of all the weeds to be found in croplands or rangelands. It is a selection of species targeted as being common and problematic by Extension specialists and researchers in Montana and the Northern Great Plains states. For broadleaf plants, this guide will be most useful if you have both cotyledon and first true leaves available. For grasses, choose plants with three or more blades and use the newest for examination; characteristics regarding ligule and collar region may not be fully developed until the third or fourth collar.

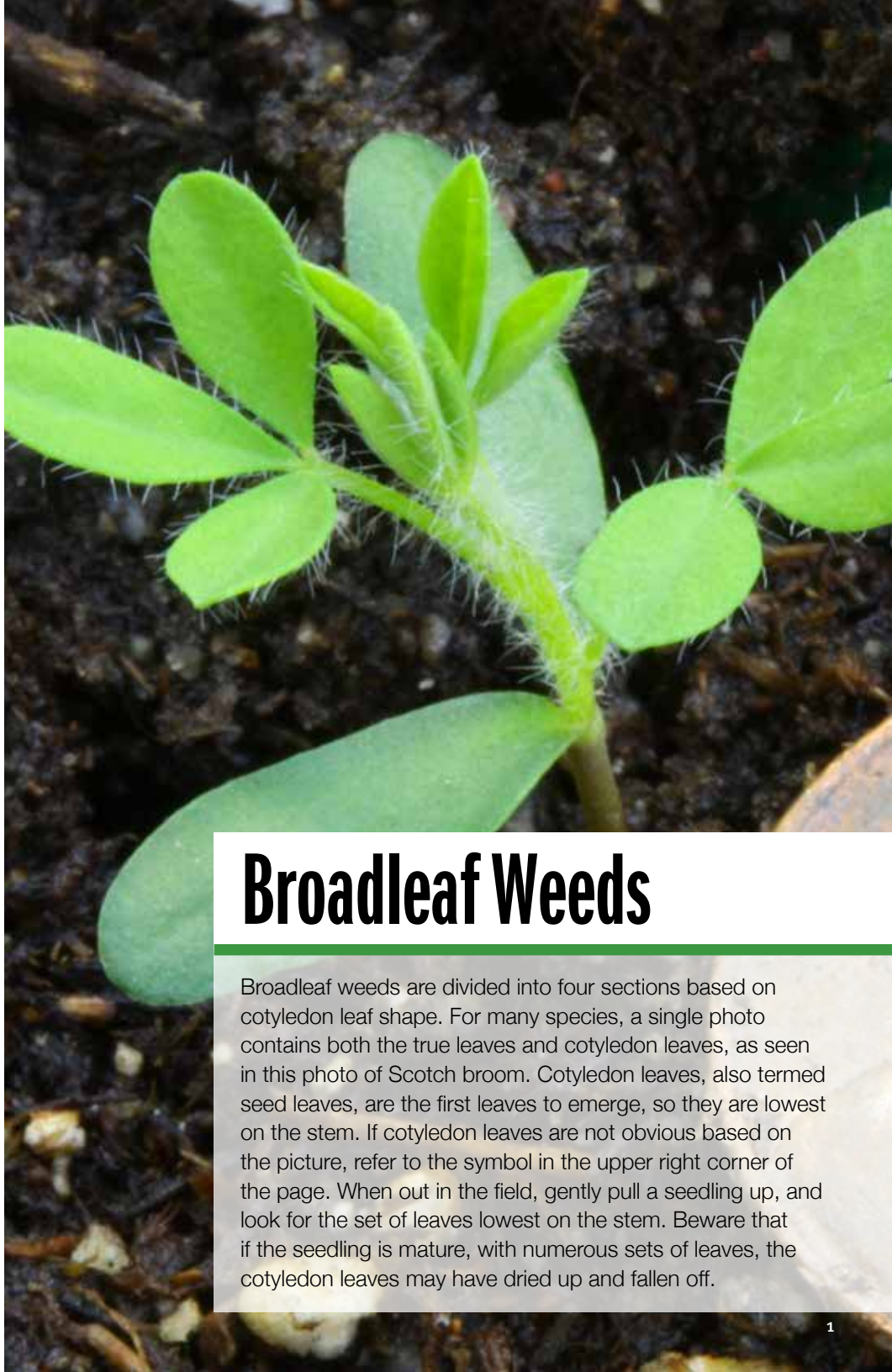
Organization and Symbols

 indicates the plant is a weed primarily of rangeland or non-cropland.

 indicates the plant is a weed primarily of cropland.

Both indicate the plant can occur in either system. These symbols are found in the upper left corner.

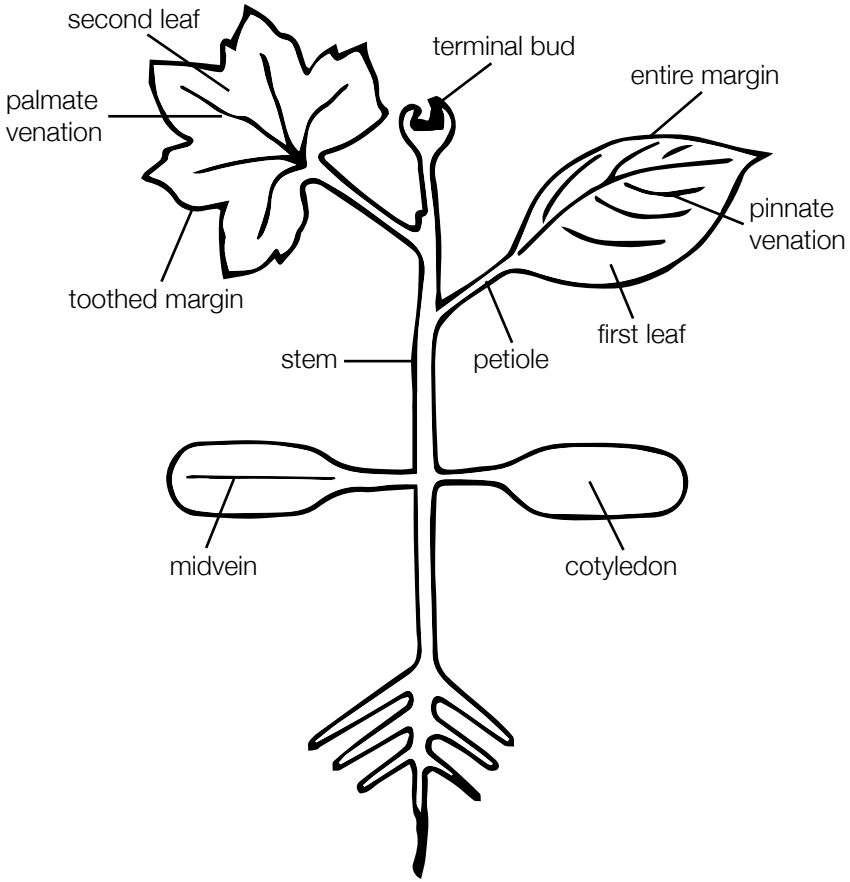
Broadleaf plants are divided into four sections based on cotyledon leaf shape and grasses are divided into three sections based on the ligule type. The cotyledon leaf shape or ligule type symbols are in the upper right corner. The sections are divided by color.



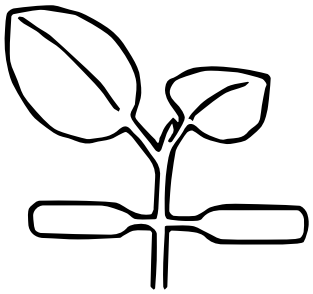
Broadleaf Weeds

Broadleaf weeds are divided into four sections based on cotyledon leaf shape. For many species, a single photo contains both the true leaves and cotyledon leaves, as seen in this photo of Scotch broom. Cotyledon leaves, also termed seed leaves, are the first leaves to emerge, so they are lowest on the stem. If cotyledon leaves are not obvious based on the picture, refer to the symbol in the upper right corner of the page. When out in the field, gently pull a seedling up, and look for the set of leaves lowest on the stem. Beware that if the seedling is mature, with numerous sets of leaves, the cotyledon leaves may have dried up and fallen off.

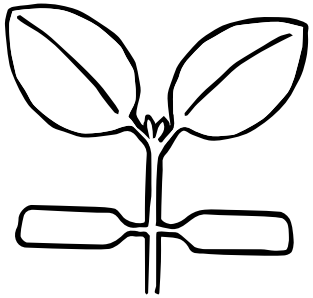
Plant Parts



Leaf Arrangement on Stem



Alternate Leaves
One leaf per node.
New leaf is smaller.



Opposite Leaves
Attached at same node on opposite sides of stem.
Leaves at the same node are of similar size.

Cotyledon Leaf Shapes

linear: resembling a line; long and narrow with more or less parallel sides

lanceolate: lance-shaped; much longer than wide, with the widest point below the middle; pointed, not round at tip

oval: broadly elliptic in outline, the width over one-half the length

oblong: two to four times longer than broad with nearly parallel sides

ovate: egg shaped in outline and attached at the broad end

obovate: inversely ovate, shaped like an egg, with the attachment at the narrower end

heart-shaped

oval with narrow tip

kidney-shaped

round

baby's breath

(Gypsophila paniculata) **CARYOPHYLLACEAE**

LIFE CYCLE perennial

COTYLEDON LEAF linear (B)

TRUE LEAF

shape: linear (C, D)
arrangement: opposite
attachment: sessile
surface: minute hairs initially (B), ultimately glabrous and with a whitish or bluish waxy or powdery film (D)
margins: entire

NOTES an escaped ornamental, common around cemeteries

tips to ID mature plant

- *stout taproot*
- *leaves barely united around the stem (D)*

cocklebur, common

(Xanthium strumarium) **ASTERACEAE**

LIFE CYCLE annual

COTYLEDON LEAF lanceolate, smooth and waxy (B)

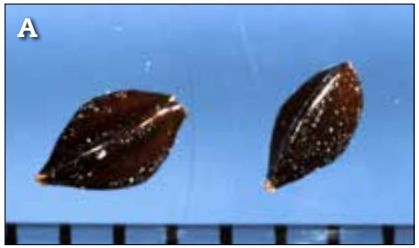
TRUE LEAF

shape: first true and subsequent leaves deltoid to ovate, bases truncate to deeply heart-shaped (C)
arrangement: alternate
attachment: petiolate
surface: rough, sandpaper feel, may have fine stiff hairs, more or less glandular
margins: first true leaves minutely and bluntly serrated, subsequent leaves coarsely serrate, and undulate or wavy (D)

NOTES to verify seedling identification, dig below soil: the coarse bur should remain attached to the root system

tips to ID mature plant

- *stems ridged, and may have maroon to black spots*
- *may reach 6 feet in height*
- *velcro-like bur conspicuous (A, E)*



Knotweed Complex Japanese | Bohemian | Giant

(Polygonum cuspidatum, x bohemica and sachalinensis)* **POLYGONACEAE**

LIFE CYCLE perennial

COTYLEDON LEAF linear to lanceolate (B)

TRUE LEAF

shape: first true leaves ovate with truncate or heart shaped base (C, D), subsequent leaf shape heart-shaped to deltoid, see tips to ID mature plant below

arrangement: alternate

attachment: petiolate

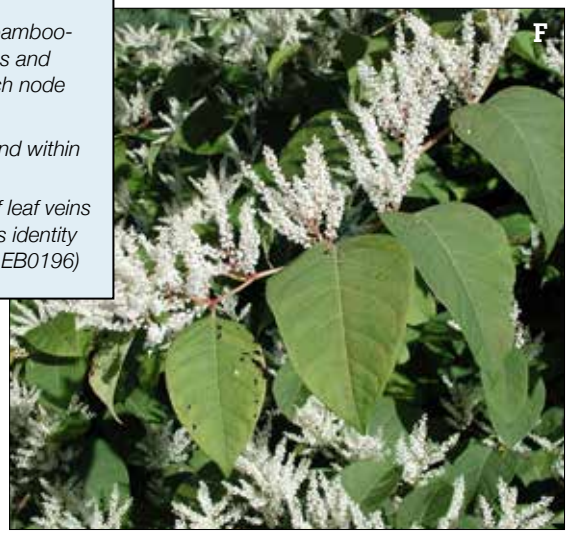
surface: glabrous

margins: entire

NOTES Photo B is giant knotweed, but Bohemian expected to have similar cotyledon leaf shape and Japanese is not known to reproduce by seed. At time of publication, only Bohemian knotweed known to occur in Montana.

tips to ID mature plant

- *shrubs with sprays of white to pink flowers (F)*
- *plants have erect, hollow bamboo-like stems with knobby nodes and membranous sheaths at each node*
- *growth rhizomatous*
- *leaf shape varies among and within species (E)*
- *texture on the underside of leaf veins needed to determine species identity (see MSU Extension bulletin EB0196)*



*Genus has recently been changed to *Fallopia*

kochia

(Kochia scoparia) AMARANTHACEAE

LIFE CYCLE annual

COTYLEDON LEAF linear to oblong (B), hairy, often bright pink underneath

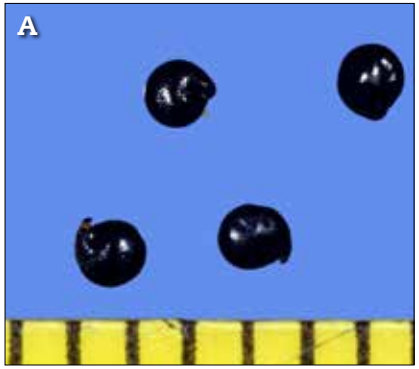
TRUE LEAF

shape: first true and subsequent leaves linear to lanceolate (C)
arrangement: alternate
attachment: sessile
surface: leaves and stem with long hairs (B, C)
margins: entire

NOTES stem often reddish-violet tinged (D, E)

tips to ID mature plant

- *flowers inconspicuous (E)*
- *forms a tumbleweed at maturity*



lambsquarter, common and netseed

(Chenopodium album and *Chenopodium berlandieri)* **AMARANTHACEAE**

LIFE CYCLE annual

COTYLEDON LEAF linear to bluntly lanceolate (B)

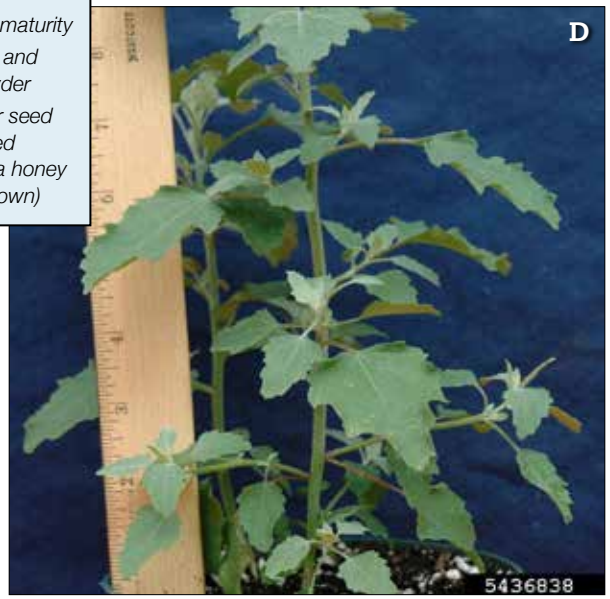
TRUE LEAF

shape: first true and subsequent leaves ovate to lanceolate (C)
arrangement: alternate
attachment: petiolate
surface: first true and subsequent leaves with a mealy or powdery covering beneath and often above (C)
margins: entire on first few sets of true leaves, then unevenly toothed

NOTES seedling often red-violet tinged, stems pink or purple (B)

tips to ID mature plant

- *stems often striped at maturity*
- *flowers inconspicuous and covered with mealy powder*
- *common lambsquarter seed is shiny black (A), netseed lambsquarter seed has a honey combed surface (not shown)*



pigweed, prostrate

(Amaranthus blitoides) **AMARANTHACEAE**

LIFE CYCLE annual

COTYLEDON LEAF linear to oblong (B)

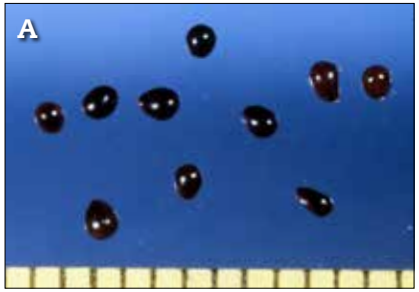
TRUE LEAF

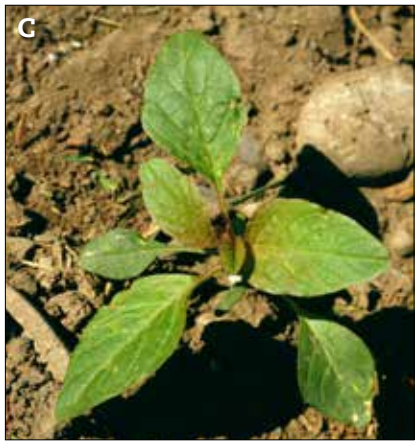
shape: first sets of true leaves oval, leaf tip blunt to indented and bristle tipped; stem leaves obovate, bristle tipped and typically longer than the petiole (C)
arrangement: alternate
attachment: petiolate
surface: first true and subsequent leaves shiny green above, glabrous
margins: entire

NOTES seedling often reddish-violet tinged

tips to ID mature plant

- *stems branched at base, prostrate (C) to upright growth form (D)*





pigweed, redroot

(Amaranthus retroflexus) AMARANTHACEAE

LIFE CYCLE annual

COTYLEDON LEAF linear to lanceolate, reddish tinged on upper surface (B)

TRUE LEAF

shape: first true leaves ovate and slightly notched at tip (B); subsequent leaves ovate to lanceolate, just longer than the petiole, small bristle at leaf tip (E)
arrangement: alternate
attachment: petiolate
surface: seedling leaves red on underside (B), hairs may occur along leaf margins and along veins, especially lower leaf surface
margins: entire to slightly wavy

NOTES leaves prominently veined (B, C, E)

tips to ID mature plant

- *flowers inconspicuous (D), often red tinged like lower stem (E)*

purslane, common

(Portulaca oleracea) **PORTULACACEAE**

LIFE CYCLE annual

COTYLEDON LEAF linear (B)

TRUE LEAF

shape: first true leaves lanceolate, becoming obovate to oblong (C)
arrangement: opposite
attachment: sessile
surface: glabrous
margins: entire

tips to ID mature plant

- *leaves are thick and fleshy, like a succulent (C, D)*

Russian thistle

(Salsola tragus) AMARANTHACEAE

LIFE CYCLE annual

COTYLEDON LEAF needle-like, flattened on upper side (B)

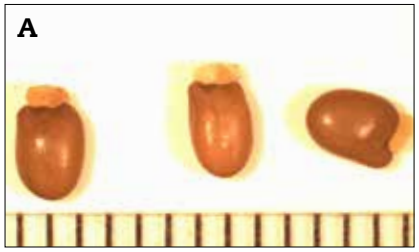
TRUE LEAF

shape: first true and subsequent leaves needle-like, spine tipped, flattened on upper side (C)
arrangement: alternate
attachment: sessile
surface: glabrous
margins: entire

NOTES seedling often reddish-violet tinged

tips to ID mature plant

- *stem often with reddish to purple striping (D)*
- *common tumbleweed of agricultural fields*



Scotch broom

(Cytisus scoparius) FABACEAE

LIFE CYCLE perennial

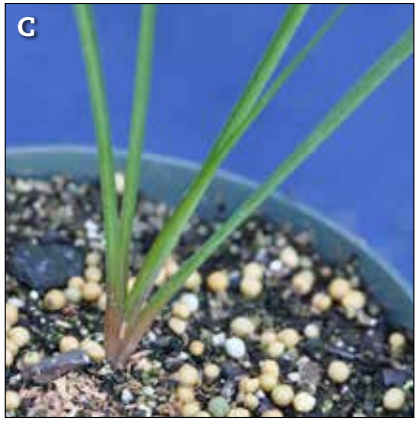
COTYLEDON LEAF linear to oblong (B)

TRUE LEAF

shape: first true leaves trifoliate, each leaflet oval (B, C); mature leaves at upper portions of stem simple
arrangement: alternate
attachment: first true and subsequent leaves at lower portion of shrub petiolate, leaves above sessile
surface: first true leaves with prominent white hairs on leaf margins and stem (B, C); more mature leaves glabrous to hairy
margins: entire

tips to ID mature plant

- *grows as a shrub (D)*
- *yellow pea-shaped flowers (E) followed by a smooth flat pod, hairy at pod margin (not shown)*



western salsify

(Tragopogon dubius) ASTERACEAE

LIFE CYCLE biennial or monocarpic perennial (may take more than one year to flower, but dies after flowering)

COTYLEDON LEAF linear (B)

TRUE LEAF

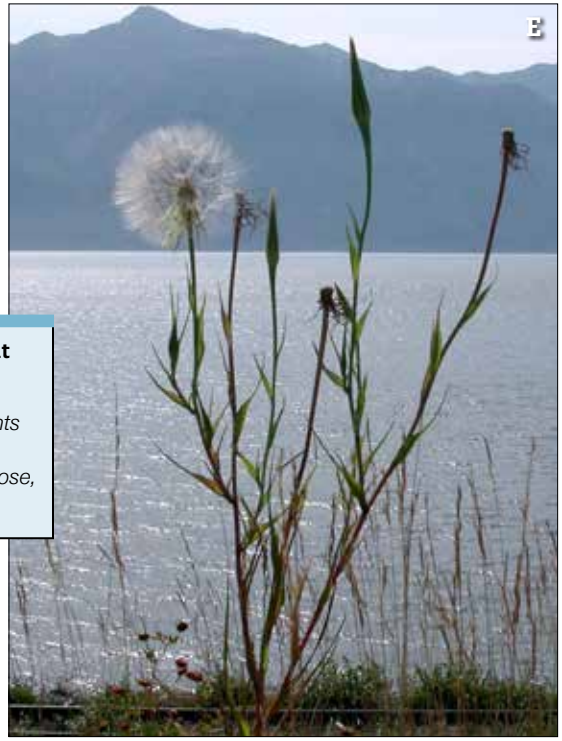
shape: first true and subsequent basal leaves linear (B, C), resembling a grass; stem leaves linear to narrowly lanceolate (E)

arrangement: basal rosette (C), flowering stem alternate (D)

attachment: sessile

surface: first true and subsequent basal leaves with long soft hairs near base (C); nearly glabrous above

margins: entire



tips to ID mature plant

- *milky sap when leaf broken*
- *resembles a grass until plants bolt and form large yellow flowers (D), followed by plumose, dandelion-like seeds (E)*

wild buckwheat

(Fallopia convolvuulus)* POLYGONACEAE

LIFE CYCLE annual

COTYLEDON LEAF linear to oblong (B)

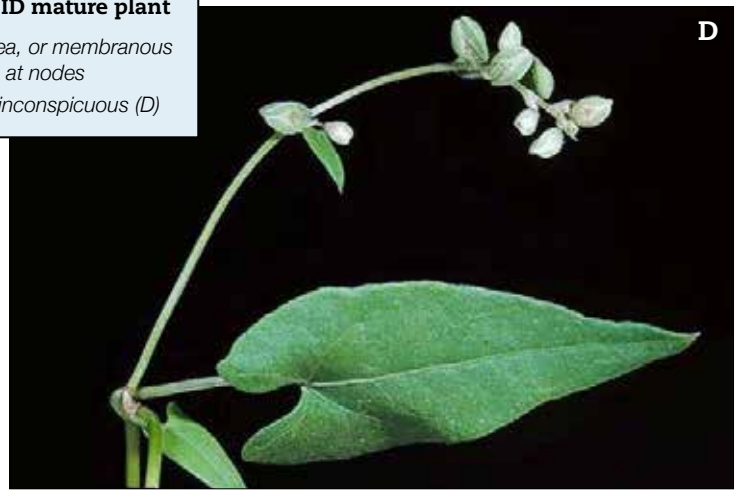
TRUE LEAF

shape: first true and subsequent leaves arrowhead to heart shaped (C)
arrangement: alternate
attachment: petiolate
surface: first true and subsequent leaves glabrous to covered in very minute stiff hairs causing it to be rough to the touch
margins: entire

NOTES seedling often reddish-violet tinged (C)

tips to ID mature plant

- *has ocrea, or membranous sheathing at nodes*
- *flowers inconspicuous (D)*



*formerly *Polygonum convolvulus*

wild tomato

(Solanum triflorum) SOLANACEAE

LIFE CYCLE annual

COTYLEDON LEAF linear (B)

TRUE LEAF

shape: ovate, pinnately lobed (C)
arrangement: alternate
attachment: petiolate
surface: scattered hairs on leaves and stem
margins: lobes are entire

NOTES seedling may be purple-tinged

tips to ID mature plant

- *this species is mat forming (D)*
- *other weedy* Solanum *species (particularly in gardens) have similar flowers but upright growth habit*

bedstraw

(Galium aparine) RUBIACEAE

LIFE CYCLE annual

COTYLEDON LEAF ovate to round (variable), apex indented (B), visible indented midvein

TRUE LEAF

shape: first true leaves oblanceolate (C), subsequent leaves linear with barb at tip (E)

arrangement: whorled: 4-5 at first two nodes, 6-8 at third and subsequent nodes

attachment: first true leaves with petioles, subsequent leaves sessile

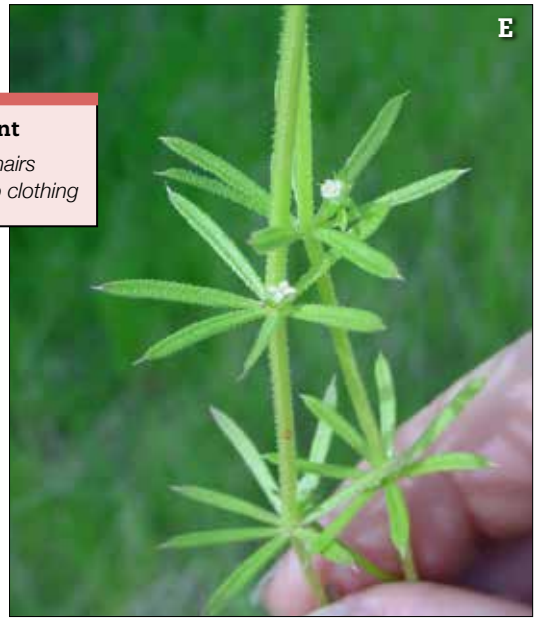
surface: first true and subsequent leaves with short, stiff hairs

margins: entire

NOTES can form dense patches (D)

tips to ID mature plant

- *square stems with short, stiff hairs point downwards (E), clinging to clothing*



black henbane

(Hyoscyamus niger) SOLANCEAE

LIFE CYCLE annual or biennial

COTYLEDON LEAF oval to oblong (B)

TRUE LEAF

shape: first true leaves ovate (C), subsequent leaves becoming pinnately lobed (D)
arrangement: basal rosette (D); flowering stem alternate
attachment: petiolate below, sessile above
surface: first true leaves with prominent hairs on petioles (C); subsequently plant has gummy, long, soft, hairs especially on petioles, stems and leaf veins
margins: first true leaves entire, becoming pinnately lobed to dentate

NOTES foliage is foul smelling

tips to ID mature plant

- *plants multi-branched (E)*
- *five-lobed, funnel-shaped flowers are brownish-yellow with dark purple veins (F)*
- *flowering stem curls like a scorpions tail, and bell-shaped structures (sepals) remain after flowers mature (F)*

blueweed

(Echium vulgare) BORAGINACEAE

LIFE CYCLE biennial

COTYLEDON LEAF oval (B)

TRUE LEAF

shape: first true leaves oblanceolate, tapering to base (C); basal leaves linear to oblanceolate (D)
arrangement: alternate
attachment: short petiolate, sessile above
surface: first true leaves with hairs (B); basal leaf hairs become stiff, straight, sharp, long and coarse with visible bumps at the base (E)
margins: entire

NOTES prominent central midvein (B, C, D); plants taprooted

tips to ID mature plant

- *flowers tightly coiled together, unfurl as they open (G)*
- *stem has dark spots at base of long hairs (G)*
- *funnel-shaped flowers with bright pink or red stamens that extend beyond petals (G)*

burdock, common

(Arctium minus) ASTERACEAE

LIFE CYCLE biennial

COTYLEDON LEAF obovate to oblong, visible midvein (B)

TRUE LEAF

shape: first true leaves ovate to oval (C), becoming cordate to arrowhead shaped (D)

arrangement: basal rosette (D), flowering stem alternate

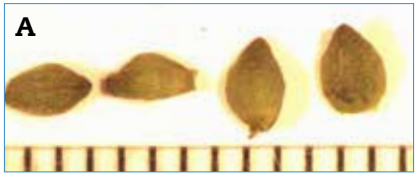
attachment: petiolate

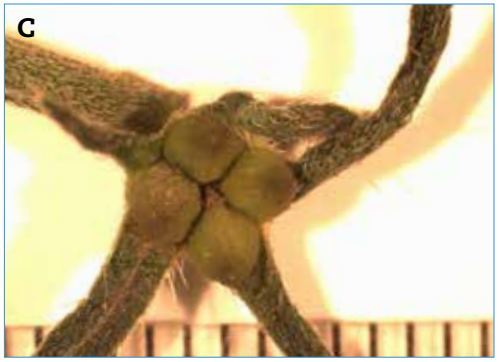
surface: cotyledons with a waxy surface; true leaves loosely hairy on the underside

margins: first true leaves with minute teeth (B), becoming serrate and with undulating margins (D)

tips to ID mature plant

- *produces a large basal rosette in first year (D), lower petioles are hollow*
- *fruit a velcro-like ball that adheres to clothing, animals (E)*





corn gromwell

(Buglossoides arvensis) BORAGINACEAE

LIFE CYCLE annual

COTYLEDON LEAF oblong, apex often notched, visible indented midvein (B)

TRUE LEAF

shape: first set of true leaves lanceolate (B), becoming linear (D)
arrangement: alternate
attachment: sessile
surface: stiff, straight, sharp hairs that lay parallel to the leaf surface on first and subsequent leaves (C)
margins: entire

NOTES prominent indented midvein on first true leaves (B) and mature leaves (D); flowers mature quickly and form seeds in a tight cluster of four (C)

tips to ID mature plant

- *small white tubular flowers (D), followed by fruits, consisting of four hard seeds (C)*

dyer's woad

(Isatis tinctoria) BRASSICACEAE

LIFE CYCLE perennial

COTYLEDON LEAF oval to oblong (B)

TRUE LEAF

shape: first true leaves oblong (B), becoming oval to ovate (C); basal leaves oblanceolate (D), stem leaves lanceolate, clasping

arrangement: basal rosette; flowering stem alternate

attachment: basal leaves petiolate, stem leaves sessile

surface: first true leaves sparsely hairy, becoming denser, upright, straight, and stiff (E); leaves bluish green in color

margins: entire

tips to ID mature plant

- *leaves with prominent white midvein (E)*
- *small yellow flowers with 4 petals*
- *fruit flattened, 3/8" long x 1/4" wide, slightly pear-shaped, and hanging like a tear drop*

field pennycress

(Thlaspi arvense) BRASSICACEAE

LIFE CYCLE annual

COTYLEDON LEAF oval with long petiole (B)

TRUE LEAF

shape: first 2-4 leaf sets oval, round to spatulate (variable, C); later leaves oblong to oval (D)
arrangement: basal rosette (D), withering early; first 2-4 leaves opposite, later alternate
attachment: first 2-4 tapering (C), subsequent leaves with long petiole (D); stem leaves sessile, clasping (F)
surface: without hair (in contrast to shepherd's purse, p.73, which is sparsely hairy)
margins: first 2-4 entire (C), later bluntly rounded to toothed (D)

NOTES forms an obvious rosette before flowering (D); prominent and shiny veins on underside; distinct, garlic-like odor when bruised

tips to ID mature plant

- *distinct, disc-shaped seed pods, indented at tip (E, F)*

hoary alyssum

(Berteroa incana) BRASSICACEAE

LIFE CYCLE annual, biennial or short-lived perennial

COTYLEDON LEAF oval to ovate (see small seedling above penny, B)

TRUE LEAF

shape: first sets of true leaves obovate (C), becoming narrowly oblanceolate (E)

arrangement: basal rosette (E), withers upon flowering; flowering stem alternate

attachment: sessile or short petiole

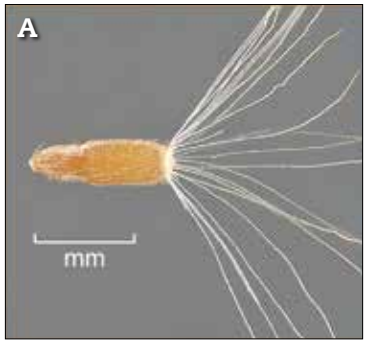
surface: first true leaves faintly tomentose (B); star-shaped hairs develop on subsequent leaves and stem, giving leaves a gray green color (D)

margins: first true leaves entire (C) to irregularly toothed (D), becoming entire, sometimes wavy margined

NOTES typically rangeland and disturbed areas, but may occur in alfalfa

tips to ID mature plant

- *flowers with four white petals that are notched like rabbit ears (G)*



horseweed

(Conyza canadensis) ASTERACEAE

LIFE CYCLE annual

COTYLEDON LEAF ovate (B)

TRUE LEAF

shape: first true leaves oblong to elliptic, becoming linear oblanceolate (C); stem leaves linear lanceolate (D)
arrangement: alternate
attachment: short petiolate
surface: first true and subsequent leaves glabrate to sparsely hairy
margins: first true leaves entire (B); subsequent leaves entire to bluntly dentate or shallowly lobed (C); stem leaves entire (D)

tips to ID mature plant

- *stems erect, usually unbranched (D)*
- *bracts short, in 2-4 series, weakly overlapping, with tan center and papery margins*
- *flowers white to yellow, inconspicuous (E)*

houndstongue

(Cynoglossum officinale) BORAGINACEAE

LIFE CYCLE biennial or short-lived perennial, dying after flowering

COTYLEDON LEAF oval to ovate (B)

TRUE LEAF

shape: first true leaves broadly elliptic to ovate, tip acute, not round (B, C), becoming oblanceolate to broadly lanceolate

arrangement: basal rosette (D); flowering stem alternate

attachment: first true leaves and subsequent basal leaves long petiolate; stem leaves sessile

surface: first true (B) and subsequent leaves covered with long soft, crooked hairs

margins: entire

NOTES prominently taprooted

tips to ID mature plant

- *flowers reddish-purple, 5 short lobes on petals (E)*
- *barbed seeds or nutlets (E) notoriously stick to fur, hair, clothing*

knapweed, diffuse

(Centaurea diffusa) ASTERACEAE

LIFE CYCLE annual to short-lived perennial

COTYLEDON LEAF oval (B)

TRUE LEAF

shape: oblanceolate (B), third to fifth set of leaves broadly, irregularly pinnately lobed (C); becoming pinnately to bipinnately divided, segments becoming narrower (D)

arrangement: alternate

attachment: petiolate

surface: first true leaves minutely hairy (B), subsequent leaves hairy to sparsely tomentose, giving a gray-green color

margins: first true leaves entire (B); lobes in subsequent leaves entire to bluntly serrate

tips to ID mature plant

- *diffuse knapweed bracts are cream to white, with comb-like fringe, and a single spine pointing upward or outward (F), but not curved down (squarrose knapweed)*

knapweed, Russian

(Acroptilon repens) ASTERACEAE

LIFE CYCLE perennial

COTYLEDON LEAF oval, visible midvein (B); underside of leaves with white powdery coating

TRUE LEAF

shape: first set of true leaves obovate (B); becoming elliptic (C); subsequent rosette leaves elliptic to oblanceolate in outline; upper leaves narrowly lanceolate to linear (E)

arrangement: basal rosette (D); flowering stem alternate

attachment: sessile

surface: upper and lower surface of first true and subsequent leaves often with a white powdery coating

margins: first true leaves serrate and tipped with small prickles (B); rosette leaves irregularly pinnately lobed with pronounced wavy margins, minutely serrate

tips to ID mature plant

- *flower bracts with papery membranous margins at tip (E), no comb-like fringe like spotted or diffuse knapweed*

knapweed, spotted

(Centaurea stoebe) **ASTERACEAE**

LIFE CYCLE perennial

COTYLEDON LEAF oval, tip blunt (B)

TRUE LEAF

shape: first true leaves lanceolate (B, C); lobes develop gradually, but ultimately becoming deeply pinnately divided into linear-oblanceolate lobes (D)

arrangement: basal rosette (D); flowering stem alternate

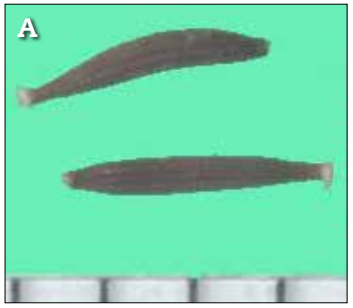
attachment: petiolate

surface: first true leaves with short hairs, tough hairs on margins (B); subsequent leaves sparsely tomentose, giving a gray green color (D)

margins: first true leaves entire, developing lobes are minutely to irregularly serrate (D)

tips to ID mature plant

- *outer bracts with comb-like fringe at tip and darkened border (F)*
- *fringes shorter than the bract is wide*



narrowleaf hawksbeard

(Crepis tectorum) ASTERACEAE

LIFE CYCLE: annual

COTYLEDON LEAF: oval to oblong (cotyledon photo not available)

TRUE LEAF

shape: first true leaves oval to oblanceolate (B); rosette leaves elliptic to lanceolate, shallowly pinnately lobed to divided (C); stem leaves linear to oblanceolate, entire
arrangement: basal rosette (C); flowering stem alternate
attachment: basal leaves petiolate, stem leaves sessile
surface: first true leaves glabrous or nearly so, subsequent leaves nearly glabrous to sparsely tomentose
margins: first true leaves broadly dentate with barbs on margins (B); becoming dentate to shallowly lobed (C); stem leaves entire with inrolled margins

NOTES: prominent midvein on basal leaves (B, C)

tips to ID mature plant

- *milky sap when leaves torn*
- *common to fields and roadsides*
- *heads with ray flowers only, no disc flowers (D)*

oxeye daisy

(Leucanthemum vulgare) ASTERACEAE

LIFE CYCLE perennial

COTYLEDON LEAF oval to oblong (B)

TRUE LEAF

shape: first sets of true leaves oval (C), becoming obovate in outline (D), may be irregularly lobed; stem leaves obovate to lanceolate, shallowly lobed (E)

arrangement: basal rosette (D); flowering stem alternate

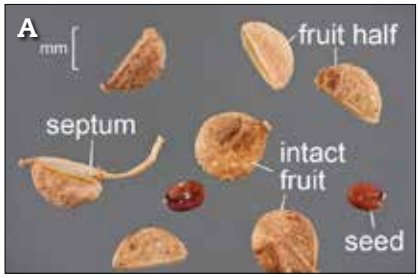
attachment: basal leaves long petiolate; stem leaves becoming sessile

surface: no to few hairs

margins: first true and subsequent sets of leaves roundly toothed

tips to ID mature plant

- *rhizomatous*
- *flowers like a typical daisy, but stems narrower and flowers smaller (F)*



perennial pepperweed

(Lepidium latifolium) BRASSICACEAE

LIFE CYCLE perennial

COTYLEDON LEAF oval (B, see smallest leaves at base)

TRUE LEAF

shape: first true leaves oval to round (B), becoming elliptic to lanceolate (C, D), but often withering by the time of flowering; stem leaves elliptic and smaller (F)

arrangement: basal rosette (D); flowering stem alternate

attachment: basal leaves petiolate, stem leaves becoming sessile

surface: no hairs

margins: first true leaves entire, becoming roundly dentate

tips to ID mature plant

- *prominent white midvein (D)*
- *flowers white, small (E)*
- *common in moister areas, especially stream or river banks*

poison hemlock

(Conium maculatum) APIACEAE

LIFE CYCLE biennial

COTYLEDON LEAF narrowly ovate (B)

TRUE LEAF

shape: first true leaves ovate in outline, trifoliate with lobes in each division (B); mature blades ovate in outline, tripinnate (C, D)
arrangement: alternate
attachment: petiolate
surface: glabrous
margins: lobes forming the divisions are entire (C)

NOTES highly poisonous: contact county Extension agent or qualified botanist for assistance with identification

tips to ID mature plant

- *stems stout, hollow, purple-spotted (E)*
- *flowers white (F)*

prickly lettuce

(Lactuca serriola) ASTERACEAE

LIFE CYCLE annual or biennial

COTYLEDON LEAF oval to round (B)

TRUE LEAF

shape: first few leaves oval to obovate, tapered to a base (B), becoming oblong to oblanceolate (C), may become deeply lobed, tip with a deltoid lobe (D)

arrangement: basal rosette (C, D); flowering stem alternate

attachment: sessile

surface: first true and subsequent leaves sparsely hairy, more mature leaves with a row of prickly spines on the back midvein (underside of leaf)

margins: first true leaves entire, subsequent leaves may be entire (C) or lobed with dentate margins (D), soft prickles on margins

NOTES

milky sap (E)

tips to ID mature plant

- *prominent midvein on basal and stem leaves (C, D, E)*
- *milky sap in leaves (E), yellow flowers small and with ray flowers only (F)*

purple loosestrife

(Lythrum salicaria) LYTHRACEAE

LIFE CYCLE perennial

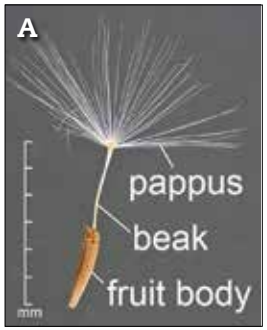
COTYLEDON LEAF ovate (B), prominent veining

TRUE LEAF

shape: first few leaves ovate (B), becoming narrowly lanceolate with heart-shaped base (C)
arrangement: opposite near base; alternate, opposite or whorled above
attachment: sessile
surface: nearly hairless to having short, soft hairs
margins: entire

tips to ID mature plant

- *showy purple flowers resemble the native fireweed* (Epilobium angustifolium)
- *purple loosestrife has fused sepals with tooth-like appendages (fireweed has 4 distinct linear sepals)*
- *stem angled or with ridges*



rush skeletonweed

(Chondrilla juncea) ASTERACEAE

LIFE CYCLE perennial

COTYLEDON LEAF oval to obovate (B)

TRUE LEAF

shape: first true leaves broadly elliptic (C); becoming pinnately lobed to divided with lobes pointing back towards the stem, often with a deltoid tip (E); stem leaves reduced and linear-oblong (F)

arrangement: basal rosette (D); flowering stem alternate

attachment: first true leaves sessile to short petiolate; basal petiolate; stem leaves reduced and sessile (F)

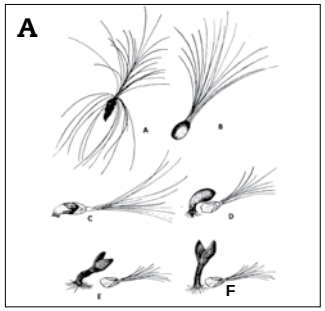
surface: first true leaves glabrous to nearly glabrous, subsequent leaves may have sparse, long straight hairs

margins: first true leaves with small, widely spaced teeth (B, C); pinnately lobed basal leaves sharply dentate (D); stem leaves entire

NOTES seedlings with long thin taproot (D)

tips to ID mature plant

- *lower 4-6 inches of stem with downwardly pointing hairs*
- *yellow ray flowers, no disc flowers (G)*



salt cedar

(Tamarix spp.) TAMARICACEAE

LIFE CYCLE perennial

COTYLEDON LEAF ovate (A-drawing F, cotyledon photo not available)

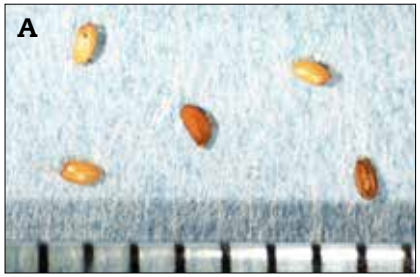
TRUE LEAF

shape: first true and subsequent leaves scale-like and clasping (B), short and broadly lanceolate
arrangement: alternate
attachment: sessile
surface: glabrous
margins: entire

NOTES North American plants are *Tamarix chinensis, T. ramosissima,* and hybrids of these two species; plants in Montana are more closely related to *T. ramosissima*

tips to ID mature plant

- *flowers light pink (D)*
- *deciduous shrub with reddish-brown bark (E)*
- *leaves 1-2 mm long and succulent*
- *common along rivers, streams and ponds*



shepherds purse

(Capsella bursa-pastoris) BRASSICACEAE

LIFE CYCLE annual

COTYLEDON LEAF ovate, apex may be indented (B)

TRUE LEAF

shape: first set of true leaves oval (B); subsequent basal leaves elliptic to oblanceolate in outline, most becoming pinnately divided (C, E); stem leaves lanceolate (E)

arrangement: basal rosette (C); flowering stem alternate

attachment: first few true leaves long petiolate, later rosette leaves taper to the base; stem leaves sessile and clasping

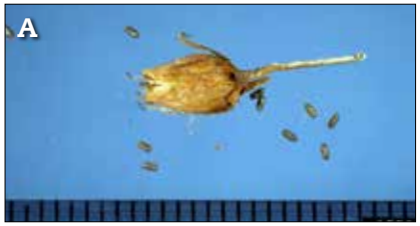
surface: first set of true leaves minutely hairy (B), subsequent leaves sparsely hairy, notable at leaf margins; hairs may be simple or star-shaped (in contrast to field pennycress, p. 43, without hairs)

margins: first sets of true leaves entire, later rosette leaves irregularly toothed or pinnately lobed (C), but margins occasionally entire; stem leaves dentate

NOTES prominent midvein on seedling and basal leaves (C)

tips to ID mature plant

- *long basal lobes clasp the stem (E)*
- *fruit triangular to heart-shaped and distinctive (D)*
- *the heart-shaped lobes at fruit tip contrast to white top with the heart-shaped lobes at the base*



St. Johnswort

(Hypericum perforatum) HYPERICACEAE

LIFE CYCLE: perennial

COTYLEDON LEAF: ovate (B)

TRUE LEAF

shape: first true leaves ovate to oval (C), becoming obovate (D), mature leaves lanceolate to elliptic (E)
arrangement: opposite
attachment: sessile
surface: first true leaves with black dots on margins (C), subsequent leaves with translucent dots when held up to sunlight (E)
margins: entire

tips to ID mature plant

- *stems turn orange and remain upright throughout the winter (F)*
- *plants taprooted and rhizomatous*
- *sepals with acute tips, unlike a native species,* Hypericum formosum, *with rounded sepal tips, and which typically occurrs in moist to wet soils, such as streambanks and meadows*

sulfur cinquefoil

(Potentilla recta) ROSACEAE

LIFE CYCLE perennial

COTYLEDON LEAF oval (B), with minute hairs, most visible on margins

TRUE LEAF

shape: first true leaves round with rounded teeth (C), becoming palmately compound with 3 leaflets (D), and ultimately 5 leaflets or more at maturity (E)
arrangement: basal rosette; flowering stem alternate
attachment: long petiolate
surface: long stiff hairs on leaves and stem
margins: first true leaves roundly toothed (C), becoming serrate (D, E)

tips to ID mature plant

- *hairs on stem at a right angle to stem in contrast to natives which lay along the stem*
- *seed with a web-like or netted pattern on the surface (A, visible with a hand lens) compared to smooth surface of similar natives*

sunflower

(Helianthus annuus) **ASTERACEAE**

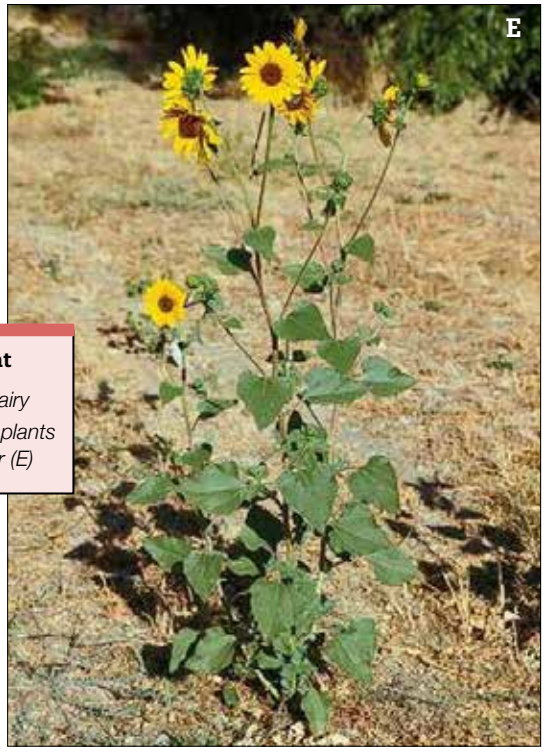
LIFE CYCLE annual

COTYLEDON LEAF oval (B), visible midvein

TRUE LEAF

shape: first true leaves narrowly ovate (C); becoming deltoid to heart-shaped (D)
arrangement: lowest leaves opposite, above alternate
attachment: petiolate
surface: first true and subsequent leaves with hairs and a rough bumpy texture
margins: first true leaves entire (C); becoming serrate (D)

NOTES first true leaves with 3 main veins (C), subsequent leaf venation pinnate (D)



tips to ID mature plant

- *stem and leaves rough and hairy*
- *identification is obvious once plants bloom from mid to late summer (E)*

tansy, common

(Tanacetum vulgare) ASTERACEAE

LIFE CYCLE perennial

COTYLEDON LEAF ovate (cotyledon leaf photo not available)

TRUE LEAF

shape: first true leaves obovate to oval in outline with indented margins (B), becoming pinnately divided (C, D)
arrangement: alternate
attachment: petiolate
surface: glabrate
margins: first true leaves dentate to shallowly lobed, subsequent leaves with serrate to sharply lobed leaflets (D, E)

NOTES plants strongly rhizomatous

tips to ID mature plant

- *yellow disc flowers (E), no ray flowers (in contrast to tansy ragwort, p.109, with disc and ray flowers)*

thistle, bull

(Cirsium vulgare) ASTERACEAE

LIFE CYCLE biennial

COTYLEDON LEAF oval (B), visible white midvein

TRUE LEAF

shape: first true leaves elliptic to broadly lanceolate (B, C), becoming lobed to pinnately divided (D, E)
arrangement: basal rosette (D); flowering stem alternate
attachment: sessile
surface: first true leaves with spreading hairs, some entangled; subsequent leaves similar, becoming cobweb-like; first true and subsequent leaves with prominent bumps at hair's base
margins: first true leaves with wavy-undulating, spine-tipped and irregularly toothed margins (B, C); mature leaves with dentate lobes and prominent spines (D)

NOTES leaves with prominent white midvein (C, D)

tips to ID mature plant

- *stems prominently spiny-winged the entire length (E)*
- *bracts needle-like or narrow at base, (not lanceolate like musk thistle, p.87)*
- *foliage not gray-green (like Scotch thistle, p.89)*

thistle, Canada

(Cirsium arvense) ASTERACEAE

LIFE CYCLE perennial

COTYLEDON LEAF oval to oblong (B), visible white midvein

TRUE LEAF

shape: first true leaves oval to broadly elliptic (C), becoming elliptic to lanceolate and dentate to deeply pinnate (D, E)

arrangement: basal rosette (D); flowering stem alternate

attachment: sessile

surface: inconspicuous hairs on first true leaves; subsequent leaves nearly glabrous, sometimes tomentose below

margins: first true leaves with small spines (B), subsequent lobes are dentate and wavy (D, E)

tips to ID mature plant

- *the only rhizomatous thistle*
- *whorl of bracts less than ¾ inch (2 cm) tall (F), much smaller than other common exotic thistles*

thistle, musk

(Carduus nutans) ASTERACEAE

LIFE CYCLE biennial, or sometimes annual

COTYLEDON LEAF oval to oblong (B), prominent white midvein

TRUE LEAF

shape: first true leaves oval (B), becoming oblanceolate to lanceolate (C), and ultimately deeply pinnately lobed (D), leaves reduced upwards on stem

arrangement: basal rosette (D); flowering stem alternate

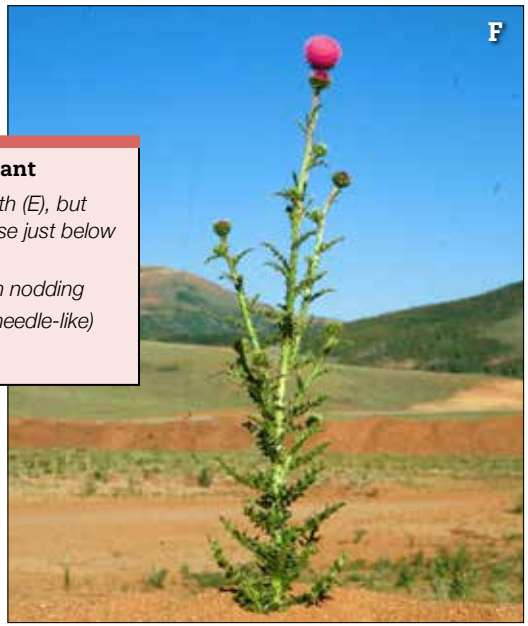
attachment: sessile

surface: first true leaves glabrous to nearly glabrous (C), subsequent leaves sparsely hairy; hairs long, soft and crooked

margins: small spines on margins of first true leaves (B), lobes dentate and spine tipped (D); 4th or 5th set of true leaves and those thereafter with silvery leaf margins (C, D)

tips to ID mature plant

- *stems spiny-winged entire length (E), but sometimes with a smooth expanse just below flower heads*
- *flowers usually solitary (F), often nodding*
- *bracts lanceolate at base (not needle-like) and spine-tipped*



thistle, Scotch

(Onopordum acanthium) ASTERACEAE

LIFE CYCLE biennial or short-lived perennial, dying after flowering

COTYLEDON LEAF oval (B), visible white midvein

TRUE LEAF

shape: first true leaves oval to ovate (B); becoming lanceolate in outline (C), ultimately clasping and deeply dentate to shallowly pinnately divided (D)

arrangement: basal rosette (D); flowering stem alternate

attachment: first true leaves almost petiolate (B), becoming sessile

surface: first true and subsequent leaves lightly to densely covered in a mat of woolly hairs giving the surface a gray-green or silvery appearance (B-E)

margins: first true leaves dentate with small barbs (B); lobes on mature leaves wavy, and with sharp yellow spines

tips to ID mature plant

- *prominent spiny wings run entire length of stem (F)*
- *leaves and foliage gray in appearance (E)*
- *plants may reach up to 12 feet in height*
- *heads solitary, not in clusters (F)*

whitetop

(Lepidium draba)* BRASSICACEAE

LIFE CYCLE perennial

COTYLEDON LEAF oval (B), visible white midvein

TRUE LEAF

shape: first true leaves broadly oblanceolate (C); basal leaves oblong to oblanceolate (D); stem leaves arrowhead-shaped, clasping (F)

arrangement: basal rosette (D); flowering stem alternate

attachment: basal leaves petiolate (small, nearly sessile), stem leaves sessile and clasping with auricles

surface: first true and subsequent leaves with soft white hairs; stem leaves more glabrous

margins: first true leaves entire to finely dentate, becoming dentate

tips to ID mature plant

- *fruit distinctively heart-shaped, with the lobes attached at the base (in contrast to shepherd's purse, p.73, with the heart-shaped lobes at the tip)*
- *Lepidium chalepense, another aggressive species referred to as whitetop, is quite similar but fruit is round, not heart-shaped*

*formerly *Cardaria draba*

yellow starthistle

(Centaurea solstitialis) ASTERACEAE

LIFE CYCLE annual

COTYLEDON LEAF oval to oblong, tip blunt (B)

TRUE LEAF

shape: first true leaves oblong to oval (B), becoming pinnately lobed (C); basal leaves pinnately divided, deltoid at tip (D); stem leaves linear-oblanceolate

arrangement: basal rosette (D); flowering stem alternate

attachment: basal leaves petiolate, stem leaves short petiolate

surface: first true leaves (B) and subsequent leaves and stem (E) tomentose

margins: first true leaves entire, becoming minutely toothed on lobes (C, D)

tips to ID mature plant

- *stem with prominent wings (E)*
- *flowers yellow and bracts with a long, sharp spine and several smaller bristles at base (F)*
- *basal rosette resembles many mustards, look for winged stem (E) when plant bolts*

field scabious

(Knautia arvensis) DIPSACACEAE

LIFE CYCLE annual or perennial
COTYLEDON LEAF round to oval, broadest above the middle (no cotyledon photo available)

TRUE LEAF

shape: first true leaves ovate to oval (B, lower left), becoming bluntly to roundly toothed and wavy (B, right); stem leaves oblanceolate, deeply pinnately lobed, the lobes linear lanceolate (C, D)
arrangement: basal rosette (B, right), flowering stem opposite
attachment: petiolate
surface: first true and subsequent hairs long and stiff; stem hairs darkened at base
margins: first true leaves entire (B, lower left), becoming bluntly to irregularly toothed at base (B, right); lobes on stem leaves irregularly toothed to entire (C, D)

tips to ID mature plant

- *escaped ornamental common in pasture land and rangeland*
- *flower head consists of hundreds of small flowers (like Asteraceae family), each purple, 4-lobed (E)*

hawkweeds, meadow and kingdevil

*(Hieracium caespitosum** and *H. praealtum)*

ASTERACEAE

LIFE CYCLE perennial

COTYLEDON LEAF round to ovate (B)

TRUE LEAF

shape: first true leaves round to oval (B); more mature leaves oblanceolate (C); rosette leaves lanceolate to oblanceolate (E); stem leaves reduced and lanceolate (F)

arrangement: basal rosette (E); flowering stem alternate but usually less than 3 stem leaves (F)

attachment: basal leaves short petiolate; stem sessile or nearly so (F)

surface: first true leaves with prominent hairs widely spaced, prominently visible on margins (B); long white hairs on upper and lower surfaces (D)

margins: entire to minutely toothed

NOTES photos are of meadow hawkweed, *H. caespitosum,* but seedling stage not known to be notably different for *H. praealtum* (another state-listed yellow-flowered hawkweed in Montana)

tips to ID mature plant

- *both species with basal leaves, less than 3 stem leaves (F)*
- *the only native hawkweed in Montana with few stem leaves is* H. gracile *which typically occurs at high elevations (subalpine to lower alpine)*
- *both species with dark hairs on flower heads and stem (G)*
- *milky sap when leaf torn*

*formerly *Hieracium pratense*

hawkweed, orange

(Hieracium aurantiacum) **ASTERACEAE**

LIFE CYCLE perennial

COTYLEDON LEAF round to ovate (B)

TRUE LEAF

shape: first true leaves round to oval (B); becoming oblanceolate (C); rosette leaves oblanceolate (E); stem leaves reduced and lanceolate (E, F)

arrangement: basal rosette (E); flowering stem alternate but less than 3 stem leaves (F)

attachment: basal leaves petiolate; stem sessile or nearly so (F)

surface: first true leaves with prominent hairs widely spaced, prominently visible on margins (B); long white hairs on upper and lower surfaces (D)

margins: entire

tips to ID mature plant

- *most leaves basal, less than 3 stem leaves (F)*
- *flowers orange (G), no other hawkweeds (native or exotic) have orange flowers*
- *prominent dark hairs at base of flowers (G)*
- *milky sap when leaf torn*

henbit

(Lamium amplexicaule) LAMIACEAE

LIFE CYCLE annual or biennial
COTYLEDON LEAF round, apex often indented, petiole long (B)

TRUE LEAF

shape: round to ovate in outline (B, C)
arrangement: opposite
attachment: first true leaves have petioles (B, C), later leaves sessile and clasping (D)
surface: hairs present
margins: first true and subsequent leaves with rounded teeth (C)

NOTES seedling often purple-tinged

tips to ID mature plant

- *stem square, hairy*
- *growth form semi-prostrate to upright (D)*
- *flowers purple, tubular, speckled*

leafy spurge

(Euphorbia esula) EUPHORBIACEAE

LIFE CYCLE perennial

COTYLEDON LEAF round to oval (B)

TRUE LEAF

shape: first true leaves round to nearly round (B), becoming oblanceolate (C); mature leaves linear to lanceolate (E)

arrangement: alternate

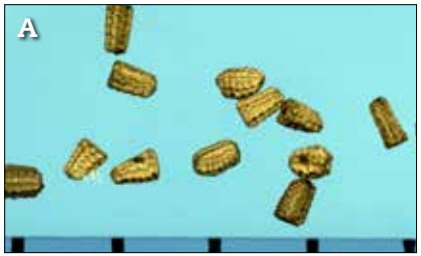
attachment: sessile (C)

surface: glabrous, gray-green to yellow-green (C, E)

margins: entire

tips to ID mature plant

- *strongly rhizomatous, exudes a milky sap when leaves are broken*
- *flowers surrounded by yellow-green showy bracts (D)*



mullein, common

(Verbascum thapsus) SCROPHULARIACEAE

LIFE CYCLE biennial

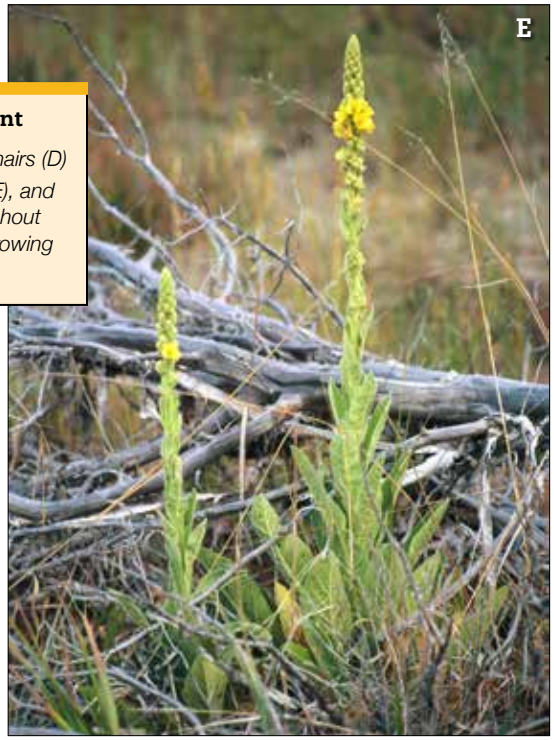
COTYLEDON LEAF round to bluntly ovate (B)

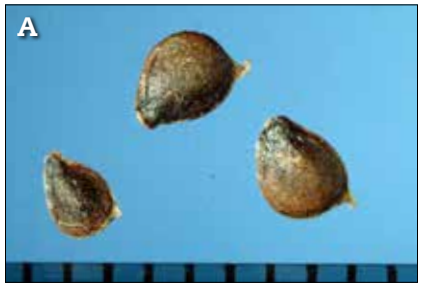
TRUE LEAF

shape: first true leaves ovate to oval (C); basal leaves oblanceolate (D); stem leaves reduced upwards (E)
arrangement: basal rosette (D), flowering stem alternate
attachment: basal leaves petiolate, stem leaves sessile
surface: first true leaves with short hairs, subsequent leaves covered with dense, soft, velvety hairs (D)
margins: first true leaves entire, becoming entire to shallowly serrate, wavy (D)

tips to ID mature plant

- *leaves silvery due to dense hairs (D)*
- *stems may be 6-8 feet tall (E), and typically remain upright throughout the winter and into the next growing season*





tall buttercup

(Rancunculus acris) **RANUNCULACEAE**

LIFE CYCLE perennial

COTYLEDON LEAF round (B)

TRUE LEAF

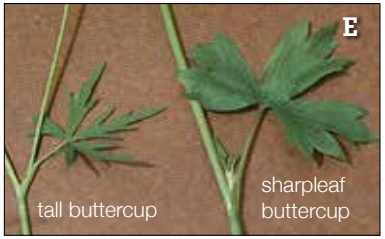
shape: leaf divisions gradually develop in first sets of true leaves (B), ultimately becoming pentagonal with multiple divisions (D)

arrangement: basal rosette, flowering stem alternate

attachment: petiolate

surface: hairs present

margins: initially bluntly lobed (first true leaf in B), becoming deeply divided, each division with a few blunt lobes or serrations (D)



tips to ID mature plant

- *shiny yellow, five-petaled flowers (F)*
- *the native sharpleaf buttercup is difficult to differentiate from tall buttercup (flowers are same color and shape)*
- *tall buttercup leaves have 4-5 segments or divisions, sharpleaf buttercup only 2-3 (E)*
- *tall buttercup seed beak (small hook in A) is 0.5 mm; sharpleaf's (not shown) is 1 mm or greater*
- *contact your county Extension agent or qualified botanist for assistance*

tansy ragwort

(Senecio jacobaea) ASTERACEAE

LIFE CYCLE perennial or biennial

COTYLEDON LEAF round to ovate (B)

TRUE LEAF

shape: first sets of true leaves ovate to oval in outline (B, C), becoming oblanceolate in outline (D)
arrangement: basal rosette (D); flowering stem alternate
attachment: petiolate
surface: cotyledon and first true leaves glabrous, more mature leaves sparsely covered in cobweb-like hairs
margins: first true leaves with round teeth (C), developing into pinnately lobed leaves with undulating or wavy margins (D)

tips to ID mature plant

- *flowers with disc and ray flowers (E) in contrast to common tansy, p.81, with disc flowers only*

tumblemustard

(Sisymbrium altissimum) BRASSICACEAE

LIFE CYCLE annual

COTYLEDON LEAF round with long petioles, apex often indented (no cotyledon photo available)

TRUE LEAF

shape: first true leaves oval to spatulate in outline (B); later rosette leaves oblong to spatulate in outline (C)
arrangement: basal rosette (C), flowering stem alternate
attachment: sessile (leaves taper to the base)
surface: hairs present on true leaves (B) and basal leaves, glabrous or sparsely hairy on stem leaves
margins: first two leaves entire, subsequent sets dentate (B); basal leaves irregularly toothed or incised, becoming pinnately lobed (C)

tips to ID mature plant

- *stem leaves alternate, pinnately lobed with long, linear, thread-like segments*
- *seed pods can be 10 cm long, but only 2 mm wide (D)*
- *forms a tumbleweed*

field bindweed

(Convolvulus arvensis) **CONVOLVULACEAE**

LIFE CYCLE perennial

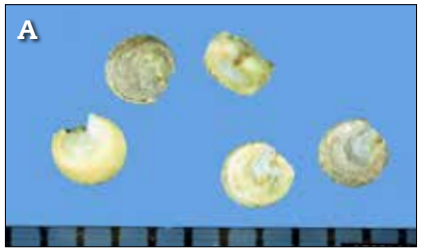
COTYLEDON LEAF kidney to round (B)

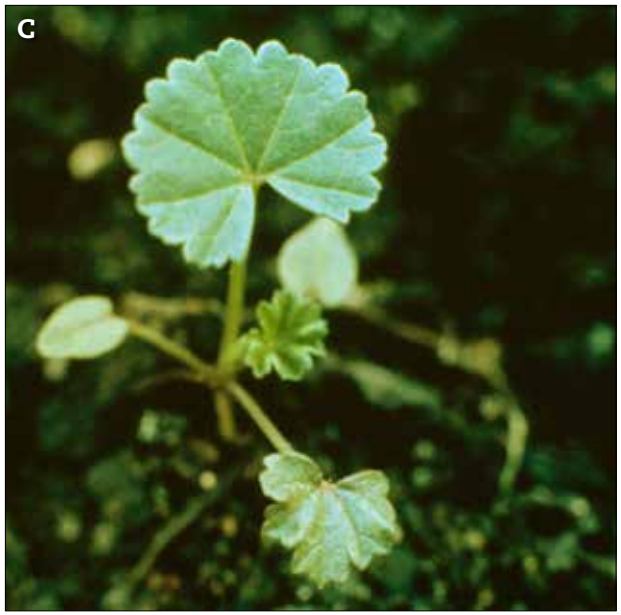
TRUE LEAF

shape: first true leaves heart-shaped, rounded at tip (C), becoming arrowhead shaped (D)
arrangement: alternate
attachment: petiolate
surface: glabrous
margins: entire

tips to ID mature plant

- *white, funnel-shaped flowers (D, E)*
- *rhizomatous vine, can rapidly cover surrounding vegetation or structures (E)*
- *no papery sheath at base of stem as with wild buckwheat, p.27*





mallow, common

(Malva neglecta) **MALVACEAE**

LIFE CYCLE annual or biennial

COTYLEDON LEAF heart-shaped (B)

TRUE LEAF

shape: first true leaves round with heart-shaped base (C)
arrangement: alternate
attachment: petiolate (petioles long, C)
surface: hairs present
margins: first true leaves with round teeth (C), becoming irregularly toothed, crinkled or wavy (D)

tips to ID mature plant

- *flower soft pink to white with 5 lobes (D)*
- *deep taproot*
- *semi-prostrate growth form (E)*

toadflax, Dalmatian

(Linaria dalmatica) **PLANTAGINACEAE**

LIFE CYCLE perennial

COTYLEDON LEAF lanceolate, but narrowed or pinched at tip (B, C, becomes more obvious as it matures)

TRUE LEAF

shape: first true leaves oval to lanceolate, becoming widely lanceolate, clasping at base

arrangement: alternate

attachment: sessile

surface: glabrous, waxy

margins: entire

tips to ID mature plant

- *rhizomatous, yellow snapdragon-like flowers unlike any native species (E)*

toadflax, yellow

(Linaria vulgaris) **PLANTAGINACEAE**

LIFE CYCLE perennial

COTYLEDON LEAF lanceolate, but narrowed or pinched at tip (B, becomes more obvious as it matures)

TRUE LEAF

shape: first true leaves ovate (B), becoming oblanceolate (C), and ultimately linear to narrowly oblanceolate (E)

arrangement: alternate

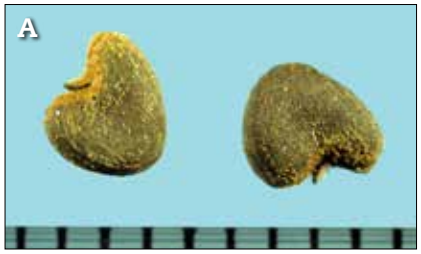
attachment: sessile

surface: glabrous, waxy

margins: entire

tips to ID mature plant

- *rhizomatous (D), yellow snapdragon-like flowers unlike any native species (E)*



velvetleaf

(Abutilon theophrasti) MALVACEAE

LIFE CYCLE annual

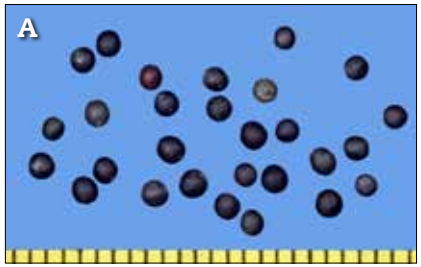
COTYLEDON LEAF one heart-shaped, one round (B)

TRUE LEAF

shape: first true leaves ovate to heart-shaped with blunt tip (C); stem leaves heart-shaped with acute tip (D)
arrangement: alternate
attachment: petiolate
surface: short, soft hairs on both sides, giving velvety appearance
margins: first true and subsequent leaves with shallowly and bluntly toothed margins (C, D)

tips to ID mature plant

- *leaves heart-shaped, surface soft and velvety, fruit divided into many sections (E)*



wild mustard or yellow mustard

(Sinapis arvensis)* **BRASSICACEAE**

LIFE CYCLE annual

COTYLEDON LEAF large, kidney-shaped, with prominent indent at tip (B)

TRUE LEAF

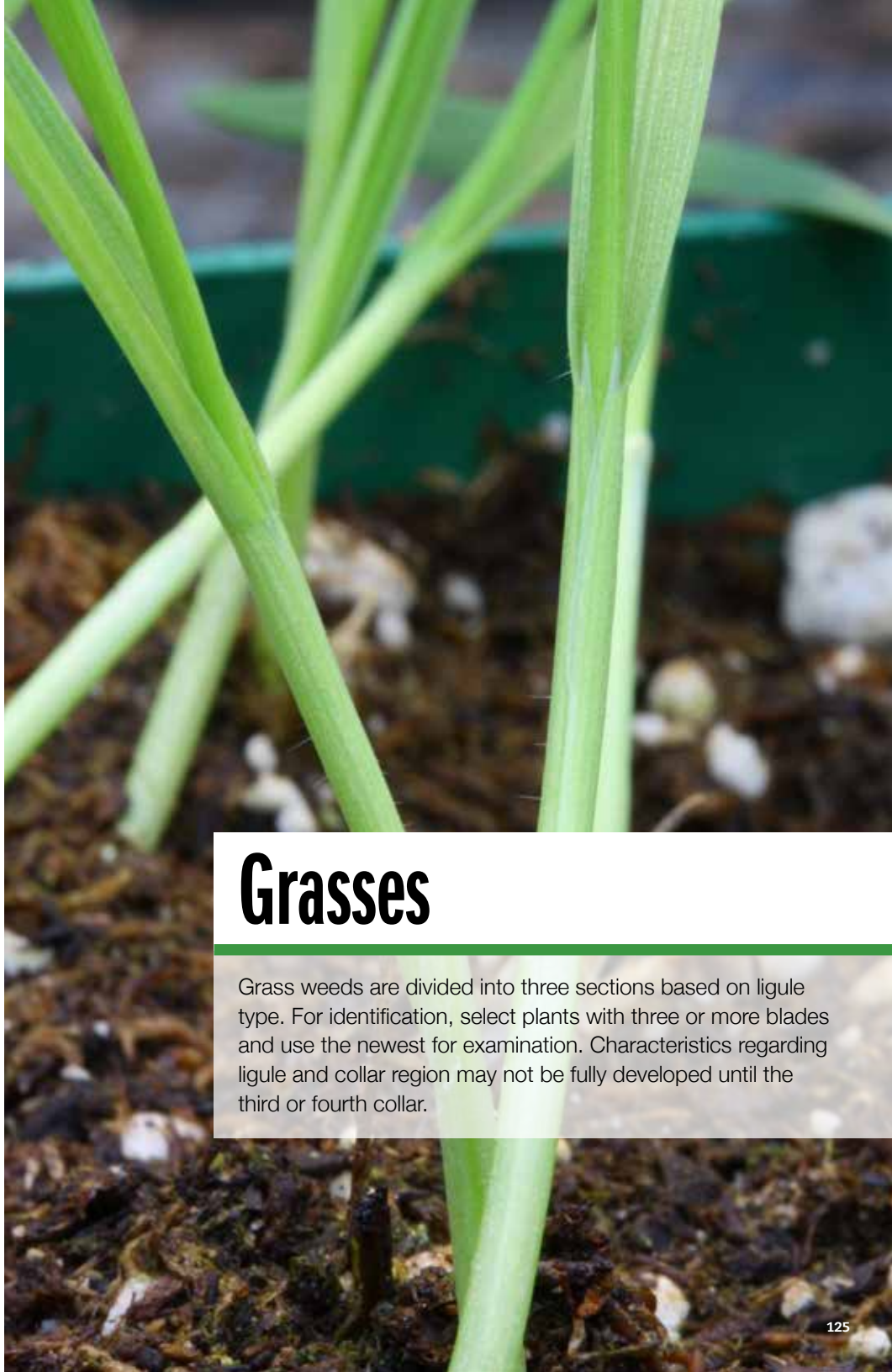
shape: first true leaves oval to oblong, subsequent leaves variable (C)
arrangement: alternate
attachment: petiolate at base, clasping or with short petioles above
surface: hairs on leaves and stems
margins: first true leaves with undulating margins (B, leaves at top and bottom), later leaves with wavy, irregular, blunt-toothed margins (C)

NOTES prominently pinnately veined (C)

tips to ID mature plant

- *beak of mature fruit is strongly flattened (D), and stems are hairy near the base*

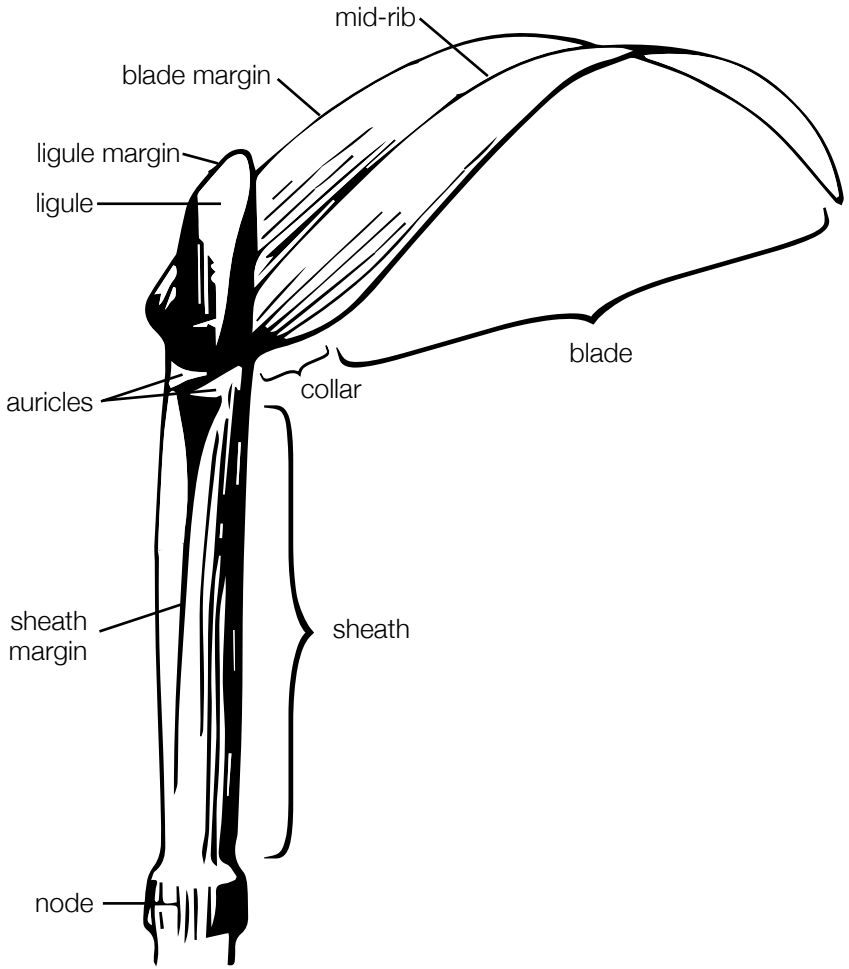
*formerly *Brassica kaber*



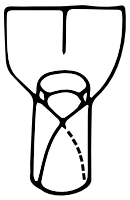
Grasses

Grass weeds are divided into three sections based on ligule type. For identification, select plants with three or more blades and use the newest for examination. Characteristics regarding ligule and collar region may not be fully developed until the third or fourth collar.

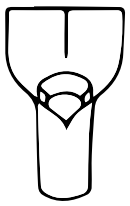
Plant Parts



Sheath Type

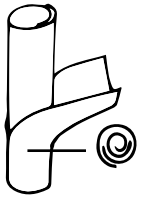


Split and Overlapping

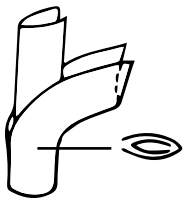


Closed

Vernation

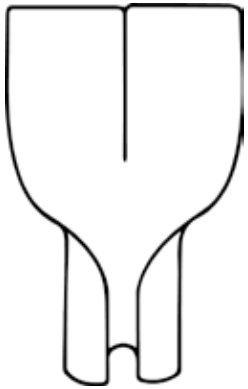


Round



Flat

Ligule Type

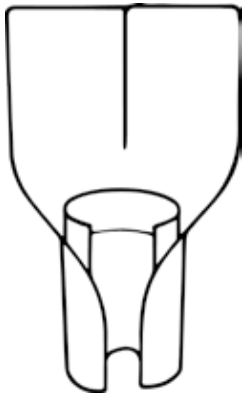


SECTION 1: absent pages 128 to 129

No ligule.

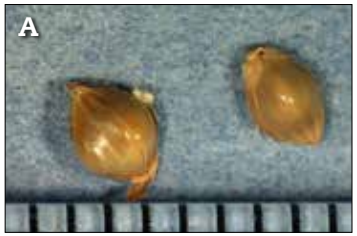
SECTION 2: hairy pages 130 to 135

Ligule consists of a fringe of hairs.



SECTION 3: membranous pages 136 to 153

Ligule consists of a membrane. Not all membranous ligules have entire margins, some may be toothed or jagged; refer to descriptions and photos for each species.



barnyard grass

(Echinochloa crus-galli) **POACEAE**

LIFE CYCLE annual

SEEDLING BLADE narrow and arched (C)

SHEATH without hair; first sheath closed and split partway, later sheaths split completely with overlapping margins, often overlapping on lower sheath only

MIDRIB prominent below on third and later blades (D)

SURFACE without hair, collar margins rarely hairy – some "whiskers"

VERNATION visibly flat by third leaf stage

LIGULE absent (F)

NOTES margins may be crinkled (D), often reddish at base of seedling

tips to ID mature plant

- *the only grass to have a completely absent ligule*
- *often reddish at base of plant*
- *leaves smooth and mostly hairless*
- *spikelets bristly hairy (B)*

green foxtail or green bristlegrass

(Setaria viridis) POACEAE

LIFE CYCLE annual

SEEDLING BLADE broad and arched (C)

SHEATH flat; first leaves without hair, rarely hairy (C); margin of second and later sheaths hairy (D); first sheath closed and split partway, later sheaths split completely, margins overlapping

MIDRIB prominent below on third and later blades

SURFACE blades without hair, but leaf margins and surface rough with fine upward pointing barbs

VERNATION round, in contrast to yellow foxtail (p.133)

LIGULE hairy (E)

NOTES seedling leaves broad, inrolled at base (C) and without keel, margins slightly sawtoothed (need a hand lens)

tips to ID mature plant

- *blades mostly hairless*
- *inflorescence a compact panicle*
- *spikelets crowded, each with 2-3 bristles at the base*
- *lemma not cross corrugated*

yellow foxtail or yellow bristlegrass

(Setaria pumila)* POACEAE

LIFE CYCLE annual

SEEDLING BLADE arched (C)

SHEATH round; without hair, split completely with overlapping margins, later sheath margins often overlapping on lower sheath only

MIDRIB prominent below on fourth and later blades

SURFACE blades with no or few hairs, later blades have long hairs near base just above the ligule (D)

VERNATION visibly flat by third leaf stage, in contrast to green foxtail (p.131)

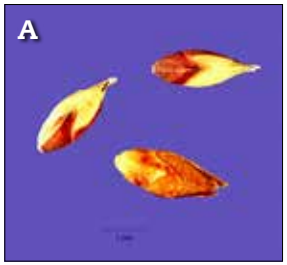
LIGULE hairy (E)

NOTES often reddish at base of plant

tips to ID mature plant

- *similar to green foxtail, but bristles on seed heads are yellow, and shorter*
- *lemmas cross corrugated*

*formerly *Setaria lutescens*



witchgrass

(Panicum capillare) POACEAE

LIFE CYCLE annual

SEEDLING BLADE arched (C)

SHEATH round; very hairy (D), first sheath closed and split partway; later sheaths split completely with overlapping margins

MIDRIB prominent below and often white above on later blades

SURFACE blades hairy above and below (C, D, E), rarely only hairy along blade margins and midrib below

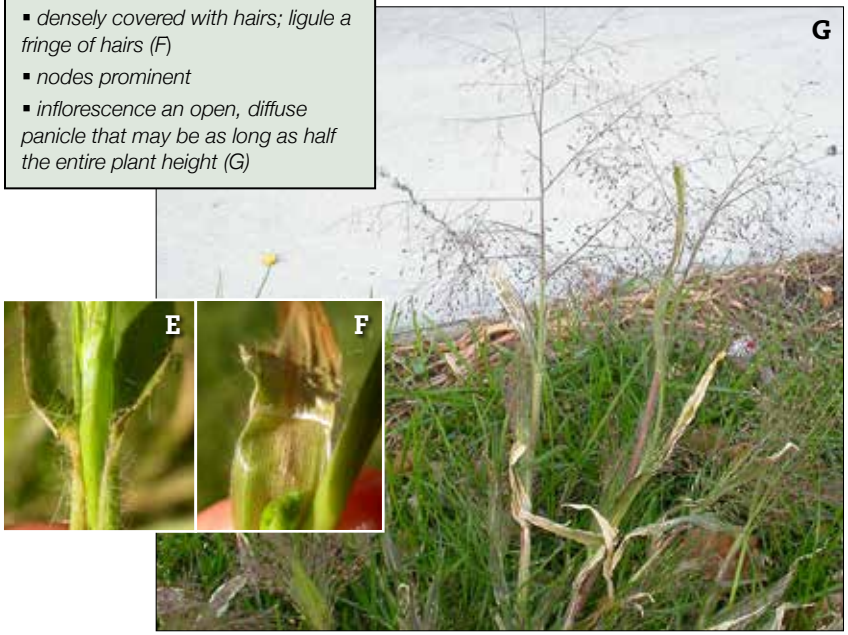
VERNATION round

LIGULE hairy (F)

NOTES long, stiff hairs at 90 degrees to stem and sheath; no auricles

tips to ID mature plant

- *densely covered with hairs; ligule a fringe of hairs (F)*
- *nodes prominent*
- *inflorescence an open, diffuse panicle that may be as long as half the entire plant height (G)*



blue grass, annual

(Poa annua) POACEAE

LIFE CYCLE perennial, but typically grows as an annual

SEEDLING BLADE short, lax to arched (C)

SHEATH compressed and slightly keeled (D), glabrous, green, split part way only

MIDRIB prominent midrib (D)

SURFACE hairless

VERNATION folded

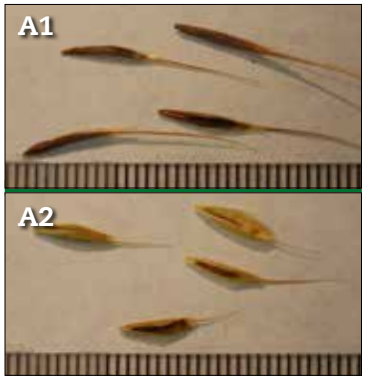
LIGULE membranous, white, 1-3 mm long, slightly pointed, entire (E), and visible from the side (C)

NOTES two distinct light lines seen along midrib when held up to light as plants mature, as in all species of bluegrass (*Poa*)

tips to ID mature plant

- *conspicuous ligule (C, E)*
- *blade tip prowlike or boat-shaped*
- *auricles absent*
- *leaves pale green and rippled or puckered (D)*
- *flat or v-shaped in cross section*

Downy brome, photos A1-F1
Japanese brome, A2-D2



brome, downy (cheatgrass) and Japanese

(Bromus tectorum and *B. japonicus)* POACEAE

LIFE CYCLE annual

SEEDLING BLADE first blade tall, narrow and vertical (C)

SHEATH hairy; closed and split partway, margins do not overlap

MIDRIB prominent below; prominent veins above on the second or third and later blades

SURFACE blades hairy above and below, hairs dense and soft and visible immediately upon emergence (C); Japanese brome tends to have denser, longer hairs (D2) compared to cheatgrass (D1)

VERNATION round

LIGULE prominent membranous, toothed margin (E1)

NOTES for both species: no auricles, seedling leaves twist clockwise, reddish-maroon at base; common to rangeland and cropland, difficult to differentiate in seedling stage, need seeds or flowers to identify (A, B)

tips to ID mature plant

- *flowers droop to one side and plants turn red as they mature in early summer*
- *downy brome lemmas are narrow and awns are 9-12 mm long (B1) in contrast to Japanese brome with broad lemmas and 2-6 mm long awns (B2)*

cereal rye

(Secale cereale) POACEAE

LIFE CYCLE annual

SEEDLING BLADE first blade tall and vertical (C)

SHEATH prominently covered with short hair (D), later sheaths often without hair; first two sheaths are closed and split partway, later sheaths split completely with overlapping margins

MIDRIB prominent veins above and midrib below (D)

SURFACE blade with short hairs (may need a hand lens to see)

VERNATION round

LIGULE membranous, toothed margin (E)

NOTES leaves twist clockwise (C); seedling distinctly red at base; auricles develop as seedling matures; collar is lighter green

tips to ID mature plant

- *seed head distinct with prominent stiff hairs on lemma margins, arranged like the teeth of a comb (B)*
- *seed heads fall apart as plants mature*

foxtail barley

(Hordeum jubatum) POACEAE

LIFE CYCLE perennial

SEEDLING BLADE first blade is tall, narrow and vertical

SHEATH covered with short hair (C); closed and split partway, later sheaths are split most of the way with overlapping margins

MIDRIB fine prominent veins above and midrib below on fifth and later blades

SURFACE blade covered with short hair

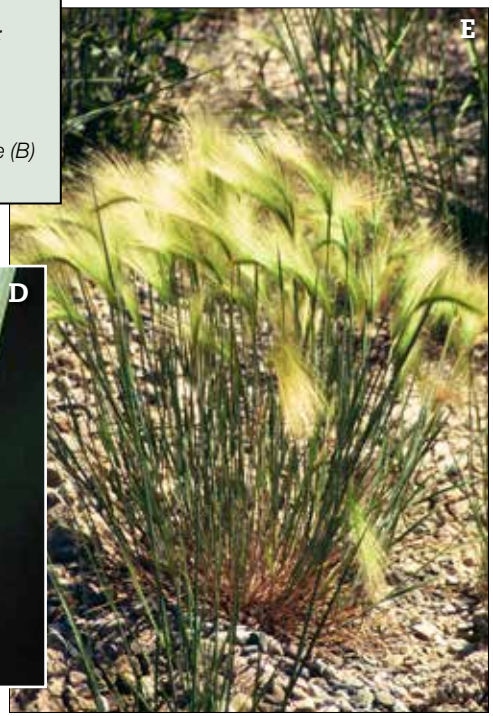
VERNATION round

LIGULE membranous, slightly toothed margin

NOTES leaves twist clockwise; bunchgrass; grayish-green color; no rhizomes

tips to ID mature plant

- *flower heads bushy like a foxtail (E); stems greenish purple*
- *leaves rough, grayish-green and predominantly ribbed*
- *flower heads mature to tan or white (B) and fall apart easily*



jointed goatgrass

(Aegilops cylindrica) POACEAE

LIFE CYCLE annual

SEEDLING BLADE first blade tall, narrow and vertical (C)

SHEATH margin with long hairs; first sheaths are closed (D) and split partway sometimes with overlapping margins, later sheaths split completely with overlapping margins

MIDRIB prominent veins above and midrib below

SURFACE blades with long hairs on margins of blade and collar (D)

VERNATION round

LIGULE membranous, short with toothed margin (E)

NOTES seedling leaves twist clockwise; later leaves have small auricles; collar is light green

tips to ID mature plant

- *once it flowers, seed head is unmistakable: a columnar spikelet with distinctive joints (B)*

Persian darnel

(Lolium persicum) POACEAE

LIFE CYCLE annual

SEEDLING BLADE first blade narrow and upright (C), becoming wavy along margins and bent to side (D)

SHEATH first three sheaths closed and split partway, sometimes with overlapping margins, later sheaths split completely with overlapping margins

MIDRIB second and later blades have prominent veins above and midrib below

SURFACE blades without hair; rough on upper surface, shiny and waxy below

VERNATION round

LIGULE membranous, short with smooth margin (E)

NOTES bright red culm or sheath at seedling base, hairless (C), waxy surface below (D); seedling leaves do not twist or may twist one-half to one turn counter clockwise

tips to ID mature plant

- *fifth and later blades have small auricles*
- *stem is rough*
- *seed head distinctive (B): narrow lemma and straight awn equal in length to lemma*

quackgrass

(Agropyron repens) POACEAE

LIFE CYCLE perennial

SEEDLING BLADE first blade tall, narrow and vertical (C)

SHEATH upper sheaths without hair, often hairy on lower sheaths; split completely with overlapping margins

MIDRIB veins not prominent above (in contrast to Persian darnel, preceding page)

SURFACE blades without hair or sparsely hairy below

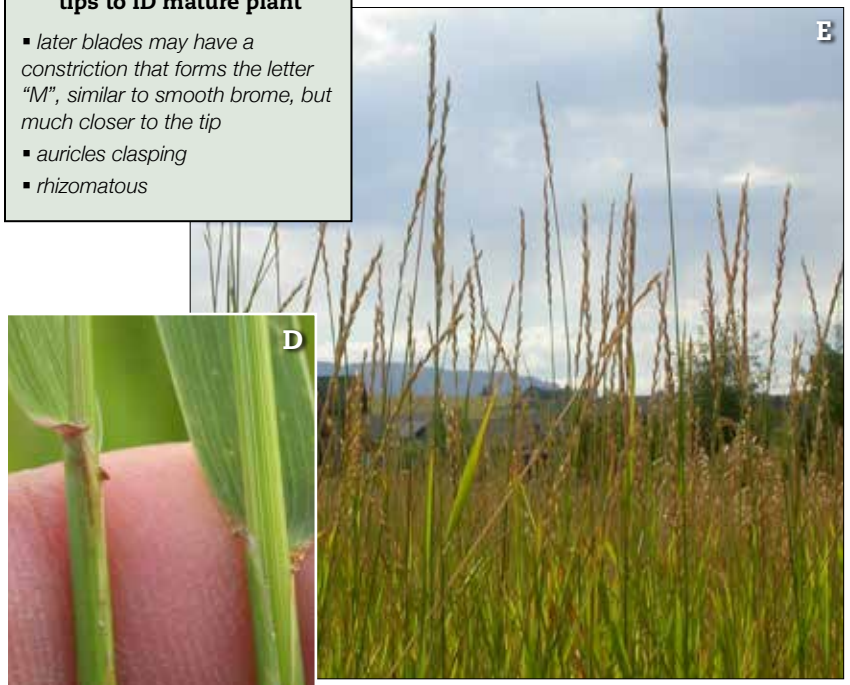
VERNATION round

LIGULE short, membranous, slightly toothed margin

NOTES seedling leaves twist clockwise

tips to ID mature plant

- *later blades may have a constriction that forms the letter "M", similar to smooth brome, but much closer to the tip*
- *auricles clasping*
- *rhizomatous*



wild oat

(Avena fatua) POACEAE

LIFE CYCLE annual

SEEDLING BLADE first blade tall, narrow and vertical (C)

SHEATH first few sheaths sparsely hairy, later sheaths without hair; first sheath closed and split partway, later sheaths split completely with overlapping margins

MIDRIB prominent below

SURFACE blades with long hair on margins of blade and collar (second and later blades)

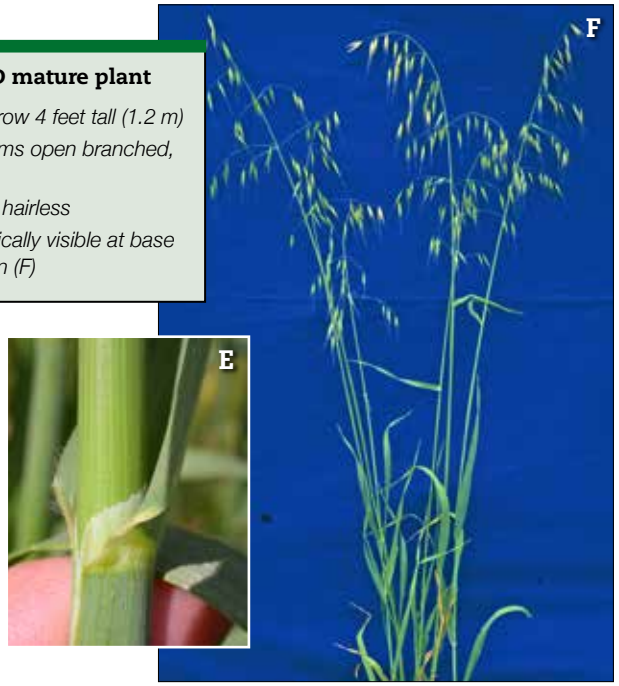
VERNATION round

LIGULE membranous, tall and with slightly toothed margin (E), develops quickly in seedlings (D)

NOTES seedling leaves twist counter-clockwise; seed clings to seedling from which it grows for some time and seed is distinctive (A)

tips to ID mature plant

- *plants may grow 4 feet tall (1.2 m)*
- *flowering stems open branched, nodding (F)*
- *stems nearly hairless*
- *few hairs typically visible at base of blade margin (F)*



yellow nutsedge

(Cyperus esculentus) CYPERACEAE

LIFE CYCLE perennial

SEEDLING BLADE leaves arched and radiate in 3 directions (D), in contrast to grasses which radiate in two directions

SHEATH a member of the sedge family (Cyperaceae), not grass family, no true sheath (F)

MIDRIB leaves are deeply keeled, felt as a strong ridge on the back side, and indentation on the inside of the blade (D)

SURFACE leaves smooth, hairless; yellowish to pale green

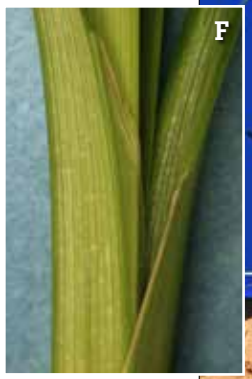
VERNATION folded

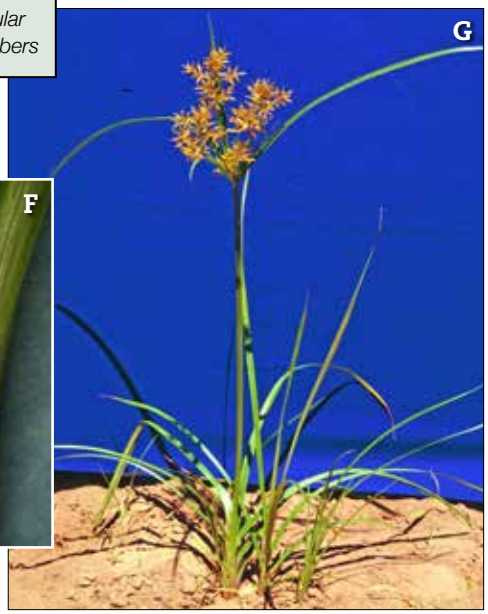
LIGULE nodeless and without ligule, collar or sheath (F)

NOTES leaves solid (not hollow); rhizomatous and produces tubers (C); most nutsedge plants emerge from tubers, not seed; nutlets or tubers at tips of rhizomes

tips to ID mature plant

- *leaves distinctly shiny, stems triangular in cross section (E), and producing tubers*





Glossary

alternate leaves attached singly at each node, compare to opposite

apex the tip, the point farthest from the point of attachment

auricle a small, ear-shaped appendage, often referring to a pair of appendages that may protrude from the side of the grass leaf at the junction of the blade and sheath

basal positioned at or arising near the base, as leaves arising from the base of the stem

bipinnate twice pinnate; having the leaflets themselves divided into smaller leaflets

bracts a small leaf or leaf-like structure at the base of a flower

campanulate bell-shaped

clasping wholly or partly surrounding the stem

collar the area on the outside of a grass leaf at the juncture of the blade and sheath

corolla collective name for all the petals of a flower

cordate with the shape of a heart

deltoid with the shape of an equilateral triangle

dentate toothed along the margin, the teeth pointing outwards rather than forward (see serrate)

disc in the Asteraceae or Compositae family, small tubular flowers, termed florets, in central portion of flower head (e.g. central yellow portion of a daisy are disc florets); the white 'petals' are actually ray florets

divided bearing lobes which are cut to the base or to the midrib (compare to 'lobed')

elliptic a narrow oval, broadest at the middle, narrower at the two equal ends, round at the tip

entire referring to a leaf margin (edge that is smooth, not toothed or notched)

floret a small flower that is part of a larger inflorescence, such as those of the grass family or Asteraceae family

glabrate almost glabrous, but with some infrequent or sparse hairs

glabrous smooth, hairless

glume one of the paired bracts at the base of a grass spikelet

heart-shaped shaped like a heart, with two lobes on either side of where the petiole attaches, often with a pointed tip

inflorescence the flowering part of a plant; a flower cluster

keel a prominent longitudinal ridge, like the keel of a boat

kidney shaped like a kidney bean, with a notch where the tip would be

lanceolate lance-shaped; much longer than wide, with the widest point below the middle; pointed, not round at tip

lemma the lower of two bracts (lemma and palea at the base of a grass floret), often partially surrounding the palea

ligule membranous or hairy appendage arising from the inner surface of the leaf at the junction with the leaf sheath in many grasses and some sedges

linear resembling a line; long and narrow with more or less parallel sides

lobed bearing lobes which are cut less than half way to the base or midvein (compare to divided)

node the point on a stem where a leaf is attached

oblanceolate inversely lanceolate, with the widest part above the middle

oblong two to four times longer than broad with nearly parallel sides

obovate inversely ovate, shaped like an egg, with the attachment at the narrower end

opposite leaves attached opposite from each other, one on each side of the stem, compare to 'alternate'

oval broadly elliptic, the width over one-half the length

ovate egg-shaped in outline and attached at the broad end

palmate lobed, veined or divided from a common point, like the fingers of a hand

panicle a branched, elongated inflorescence with stalked flowers maturing from the bottom upwards (compare to 'raceme' and 'spike')

petiolate with a petiole, meaning a leaf stalk

pinnate resembling a feather, as in a compound leaf with leaflets arranged on opposite sides of an elongated axis

raceme an unbranched, elongated inflorescence with pedicillate (stalked) flowers maturing from the bottom upwards

ray the petal-like florets of the Asteraceae or Compositae family, see 'disc' for more details

rhizomatous a horizontal, underground stem that sends out roots and shoots from its nodes, enabling the plant to spread vegetatively

sepals typically green, leaf-like structures at the base of a flower or the outermost whorl of structures on a flower

serrate toothed along the margin, the teeth pointing forward rather than outward (see dentate)

sessile leaves that attach directly to the stem, the petiole absent

sheath the portion of a plant which at least partly surrounds another portion, as the leaf base of a grass surrounds the stem

spatulate like a spatula in shape, with a rounded blade above, gradually tapering to the base

spike an unbranched, elongated inflorescence with sessile (no stalk) flowers or spikelets maturing from the bottom upwards (compare to 'panicle' and 'raceme')

spikelet the ultimate flower cluster of grasses and sedges, consisting of one to many flowers, at the base of which are two bracts (glumes)

tomentose with a covering of short, matted or tangled soft, wooly hairs

tripinnate pinnately compound three times

truncate with the apex or base squared off at the end, as if cut off

undulate wavy at the leaf margin

vernation the arrangement of leaves within the bud; for grasses it is visible inside the leaf sheath as either folded or rolled

winged a thin, flat margin extending from a structure

Index of plants

Photo credits

FORBS

baby's breath **ABC** H. Parkinson; **D** J.M. DiTomaso, UC Davis, BW; **EF** S. Dewey, USU, BW

bedstraw **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **B** B. Ackley, The OSU, BW; **C** J.M. DiTomaso, UC Davis, BW; **DE** R. Old, www.xidservices.com

black henbane **ABD** J. Samanek, State Phytosanitary Admin., BW; **C** J.M. DiTomaso, UC Davis, BW; **EF** S. Dewey, USU, BW

blueweed **ABCE** H. Parkinson; **D** Ravalli County Weed District; **F** R. Vidéki, Doronicum Kft., BW: **G** Stevens County WA Weed Control Board

burdock, common **A** S. Hurst, USDA NRCS PLANTS Database, BW; **B** B. Ackley, The OSU, BW; **C** C. Herms, OH State Weed Lab Archive, The OSU, BW; **DF** M.E. Harte, BW; **E** OH State Weed Lab Archive, The OSU, BW

cocklebur, common **A** S. Dewey, USU, BW; **B** P. Westra, CSU, BW; **C** B. Ackley, The OSU, BW; **D** D.J. Moorhead, UGA, BW; **E** F. & K. Starr, Starr Environmental, BW

corn gromwell **AC** H. Parkinson; **B** J.D. Byrd, MS State University, BW; **D** R. Old, www.xidservices.com

dyer's woad **A** www.ipe.csic.es/floragon; **CDF** S. Dewey, USU, BW; B J.M. DiTomaso, UC Davis, BW; **E** H. Parkinson

field bindweed **AB** B. Ackley, The OSU, BW; **C** J.M. DiTomaso, UC Davis, BW; **D** T. Heutte, USDA Forest Service, BW; **E** H.F. Schwartz, CSU, BW

field pennycress **AD** B. Ackley, The OSU, BW; **B** OH State Weed Lab Archive, The OSU, BW; **C** S. Dewey, USU, BW; **E** C. Evans, IL Wildlife Action Plan, BW; **F** M.E. Harte, BW

field scabious **A** H. Parkinson; **BCDF** S. Garske, Great Lakes Indian Fish & Wildlife Commission, http://wisplants.uwsp.edu/; **E** S. Dewey, USU, BW

hawkweed, orange **A** K. Chamberlain, The OSU, BW; **BCD** H. Parkinson; **EFG** M. Shephard, USDA Forest Service, BW

hawkweeds, meadow and kingdevil **ABCD** H. Parkinson; **E** WA State University Archive, BW; **FG** T. Heutte, USDA Forest Service, BW

henbit **A** B. Ackley, The OSU, BW; **B** S. Dewey, USU, BW; **C** OH State Weed Lab Archive, The OSU, BW; **D** J.M. DiTomaso, UC Davis, BW

hoary alyssum **A** S. Hurst @ USDA-NRCS PLANTS Database; **BCD** H. Parkinson; **E** J. Jacobs, NRCS; **FG** M. Lavin

horseweed **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **B** B. Ackley, The OSU, BW; C J.M. DiTomaso, UC Davis, BW; **D** J.H. Miller & T. Bodner, Southern Weed Science Society, BW; **E** B. Tokarska-Guzik, University of Silesia, Bugwood.org

houndstongue **A** H. Parkinson; **BCE** J.M. DiTomaso, UC Davis, BW; **DF** R. Vidéki, Doronicum Kft., BW

knapweed, diffuse **A** The OHU; **B** J.M. DiTomaso, UC Davis, BW; **CDE** R. Old, www.xidservices.com; **F** C. Roche, BW

knapweed, Russian **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **B** L.L. Berry, BW; **C** J.M. DiTomaso, UC Davis, BW; **D** B. Million, National Park Service, BW; **E** S. Dewey, USU, BW

knapweed, spotted **AB** H. Parkinson; **CD** L.J. Mehrhoff, UConn, BW; **E** B. Ackley, The OSU, BW; **F** M. Shephard, USDA Forest Service, BW

knotweed complex **A** K. Chamberlain, The OSU, BW; **B** F. Grevstad, OSU; **CEF** L.J. Mehrhoff, UConn, BW; **D** OH State Weed Lab Archive, The OSU, BW

kochia **A** J. Scher, USDA APHIS PPQ Identification Tech Program; **BC** P. Westra, CSU, BW; **DE** L.J. Mehrhoff, UConn, BW

lambsquarter, common **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **B** H. Parkinson; **C** J.M. DiTomaso, UC Davis, BW; **D** B. Ackley, The OSU, BW

leafy spurge **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **BC** B. Ackley, The OSU, BW; **DE** L.J. Mehrhoff, UConn, BW

mallow, common **A** K. Chamberlain, The OSU, BW; **BE** OH State Weed Lab Archive, The OSU, BW; **C** J.D. Byrd, MS State University, BW; **D** J.M. DiTomaso, UC Davis, BW

mullein, common **A** K. Chamberlain, The OSU, BW; **B** OH State Weed Lab Archive, The OSU, BW; **C** J.M. DiTomaso, UC Davis, BW; **D** C. Minteer, UGA, BW; **E** S. Dewey, USU, BW

narrowleaf hawksbeard **A** The OHU; **BCD** Randall G. Prostak, U MA-Amherst

oxeye daisy **A** K. Chamberlain, The OSU, BW; **BC** H. Parkinson; **D** MT Statewide Noxious Weed Awareness and Education Program Archive, MSU, BW; **E** M. Shephard, USDA Forest Service, BW; **F** M.E. Harte, BW

perennial pepperweed **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **B** J.M. DiTomaso, UC Davis, BW; **C, F** S. Dewey, USU, BW; **DE** L.J. Mehrhoff, UConn, BW

pigweed, prostrate **A** B. Ackley, The OSU, BW; **BCD** J.M. DiTomaso, UC Davis, BW

pigweed, redroot **A** K. Chamberlain, The OSU, BW; **B** H. Parkinson; **C** S. Dewey, USU, BW; **D** R. Vidéki, Doronicum Kft., BW; **E** M.E. Harte, BW

poison hemlock **A** K. Chamberlain, The OSU, BW; **B** OH State Weed Lab Archive, The OSU, BW; **C** B. Ackley, The OSU, BW; **D** Barry Rice, sarracenia.com, BW; **E** J. Samanek, State Phytosanitary Admin., BW; **F** S. Dewey, USU, BW

prickly lettuce **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **B** B. Ackley, The OSU, BW; **C** S. Dewey, USU, BW; **DF** OH State Weed Lab Archive, The OSU, BW; **E** T. Heutte, USDA Forest Service, BW

purple loosestrife **A** K. Chamberlain, The OSU, BW; **B** B. Ackley, The OSU, BW; **C** OH State Weed Lab Archive, The OSU, BW; **D** J.D. Byrd, MS State University, BW; **E** L.J. Mehrhoff, UConn, BW

purslane, common **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **B** H. Parkinson; **C** L. Sosnoskie, UGA, BW; **D** USU Archive, USU, BW

rush skeletonweed **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **BCD** H. Parkinson; **E** J.M. DiTomaso, UC Davis, BW; **F** R. Vidéki, Doronicum Kft., BW; **G** S. Dewey, USU, BW

salt cedar **A** USDA NRCS Plants Database; **B** J.M. DiTomaso, UC Davis, BW; **C** J. Gaskin USDA, ARS; **DE** L.J. Mehrhoff, UConn, BW

Scotch broom **ABC** H. Parkinson; **D** E. Coombs, OR Dept of Ag, BW; **E** L.J. Mehrhoff, UConn, BW

sheperds purse **AB** B. Ackley, The OSU, BW; **CE** S. Dewey, USU, BW; **D** M.E. Harte, BW

St. Johnswort **A** K. Chamberlain, The OSU, BW; **BCD** H. Parkinson; **E** S. Dewey, USU, BW; **F** N.E. Rees, USDA Agricultural Research Service - Retired, BW; **G** J. Cardina, The OSU, BW

sulfur cinquefoil **A** K. Chamberlain, The OSU, BW; **BCD** H. Parkinson **EF** S. Dewey, USU, BW

sunflower **A** B. Ackley, The OSU, BW; **BC** P. Westra, CSU, BW; **D** S. Dewey, USU, BW; **E** J.M. DiTomaso, UC Davis, BW

tall buttercup **A** K. Chamberlain, The OSU, BW; **B** OH State Weed Lab Archive, The OSU, BW; **C** H. Parkinson; **DE** D. Brink; **F** MT Statewide Noxious Weed Awareness and Education Program Archive, MSU, BW

tansy ragwort **AB** Crop Protection Online(www.ipmdss.dk; **C** USU Archive, BW; **DE** L.J. Mehrhoff, UConn, BW; **F** M. Shephard, USDA Forest Service, BW

tansy, common **A** H. Parkinson; **B** J.M. DiTomaso, UC Davis, BW; **C** R. Old, www.xidservices.com; **DE** M.E. Harte, BW

thistle, bull **A** K. Chamberlain, The OSU, BW; **BC** B. Ackley, The OSU, BW; **D** M. Shephard, USDA Forest Service, BW; **E** C. Evans, Illinois Wildlife Action Plan, BW

thistle, Canada **A** The OHU; **B** K. Chamberlain, The OSU, BW; **C** P. Westra, CSU, BW; **D** R. Vidéki, Doronicum Kft., BW; **EF** L.J. Mehrhoff, UConn, BW

thistle, musk **ABC** B. Ackley, The OSU, BW; **D** L.T. Kok, VA Polytechnic Institute and State U, BW; **E** D. Tenaglia, Missouriplants.com, BW; **F** S. Dewey, USU, BW

thistle, Russian **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **B** S. Dewey, USU, BW; **C** J.M. DiTomaso, UC Davis, BW; **D** M.E. Harte, BW

thistle, Scotch **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; B R. Old, www.xidservices.com; **CDE** L.J. Mehrhoff, UConn, BW; F S. Dewey, USU, BW

toadflax, Dalmatian **ABC** H. Parkinson; **D** L. Wilson, U of ID, BW; **E** USU Archive, USU, BW

toadflax, yellow **A** K. Chamberlain, The OSU, BW; **BC** H. Parkinson; **D** S. Dewey, USU, BW; **E** M. Shephard, USDA Forest Service, BW

velvetleaf **A** K. Chamberlain, The OSU, BW; **B** OH State Weed Lab Archive, The OSU, BW; **C** B. Ackley, The OSU, BW; **D** S. Dewey, USU, BW; **E** B. Ackley, The OSU, BW

western salsify **A** OH State Weed Lab Archive, The OSU, BW; **B** J.M. DiTomaso, UC Davis, BW; **C** B. Ackley, The OSU, BW; **D** H.F. Schwartz, CSU, BW; **E** M. Rasy, University of Alaska, BW

whitetop **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **BDE** M. Schwarzlander, U of ID, BW; **CF** S. Dewey, USU, BW

wild buckwheat **A** K. Chamberlain, The OSU, BW; **B** B. Ackley, The OSU, BW; **C** P. Westra, CSU, BW; **D** J.M. DiTomaso, UC Davis, BW

wild mustard or yellow mustard **A** K. Chamberlain, The OSU, BW; **B** IA State U Extension; **CDE** J.M. DiTomaso, UC Davis, BW

wild tomato **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **B** J.D. Byrd, MS State University, BW; **C** J.M. DiTomaso, UC Davis, BW; **DE** M.E. Harte, BW

yellow starthistle **A** C. Roche, BW; **BE** H. Parkinson; **C** C. Roche, BW; **DFG** S. Dewey, USU, BW

GRASSES

annual blue grass **A** J. Scher, USDA APHIS PPQ Identification Tech Program; **BF** M. Lavin; **CDE** H. Parkinson

barnyard grass **A** B. Ackley, The OSU, BW; **BFG** M. Lavin; **CDE** H. Parkinson

brome, downy and Japanese **A1,2** H. Parkinson; **B1,2** M. Lavin; **C1-D2** H. Parkinson; **E1** S. Dewey, USU, BW; **F1** L.J. Mehrhoff, UConn, BW

cereal rye **ACDE** H. Parkinson; **BF** M. Lavin

foxtail barley **AB** M. Lavin; **CD** Government of Manitoba; **E** S. Dewey, USU, BW

green foxtail **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **BF** M. Lavin; **CDE** H. Parkinson

jointed goatgrass **A** H. Parkinson; **B** J.M. DiTomaso; UC Davis, BW; **CDE** H. Parkinson; **F** M. Lavin

Persian darnel **ACDF** H. Parkinson; **B** M. Lavin

quackgrass **AC** H. Parkinson; **BDE** M. Lavin

wild oat **A** S. Dewey, USU, BW; **BE** M. Lavin; **CD** H. Parkinson; **F** S. Dewey, USU, BW

witchgrass **A** T. Slotta, USDA-NRCS PLANTS Database; **BEFG** M. Lavin; **CD** H. Parkinson

yellow foxtail **A** J. Scher, USDA APHIS PPQ, Identification Tech Program, BW; **B** M. Lavin; **CDE** H. Parkinson; **F** L. Sosnoskie, UGA, BW

yellow nutsedge **A** J. Scher, USDA APHIS PPQ Identification Tech Program, BW; **B** S. Dewey, USU, BW; **C** OSU; **D** J.M. DiTomaso, UC Davis, BW; **E** J. LaForest, UGA, BW; **F** B. Ackley, The OSU, BW; **G** S. Dewey, USU, BW

(BW: wwwbugwood.org)

References

Chomas, A., J. Kells and J. Carey. 2001. *Common Weed Seedlings of the North Central States*, North Central Regional Extension Publication No. 607. Department of Crop and Soil Sciences, Michigan State University.

Hanf, Martin. (Publication date not listed) *Weeds and their seedlings.* BASF United Kingdom Limited, Ipswich, England.

Lesica, Peter. 2012. *Manual of Montana Vascular Plants.* Botanical Research Institute of Texas, Fort Worth, Texas.

Montana Weed Seedling Guide. Bulletin 1333. Reprinted March 1993. Montana State University.

Weed Seedling Identification Guide. MG 6907. Agdex 640. Reprinted February 2008 by government of Manitoba.


MONTANA
STATE UNIVERSITY
EXTENSION