

EB0215



# Weed Seedling Identification Guide

for Montana  
and the Northern  
Great Plains

by Hilary Parkinson, Jane Mangold and Fabian Menalled



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## TABLE OF CONTENTS

### Weed Seedling Identification

Principles of IWM . . . . .	iii
Tips on using this guide . . . . .	vi

### Broadleaf Weeds

Plant Parts . . . . .	2
Leaf Arrangement on Stem . . . . .	2
Cotyledon Leaf Shape . . . . .	3
Section 1 . . . . .	4 -29
Section 2 . . . . .	30 -93
Section 3 . . . . .	94 -111
Section 4 . . . . .	112 -123

### Grasses

Plant Parts . . . . .	126
Sheath Type . . . . .	126
Ligule Type . . . . .	127
Section 1: Absent . . . . .	128 - 129
Section 2: Hairy . . . . .	130 -135
Section 3: Membranous . . . . .	136 -153

Glossary . . . . .	154
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Index of Plants . . . . .	156
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Photo Credits . . . . .	158
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References . . . . .	160
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## 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



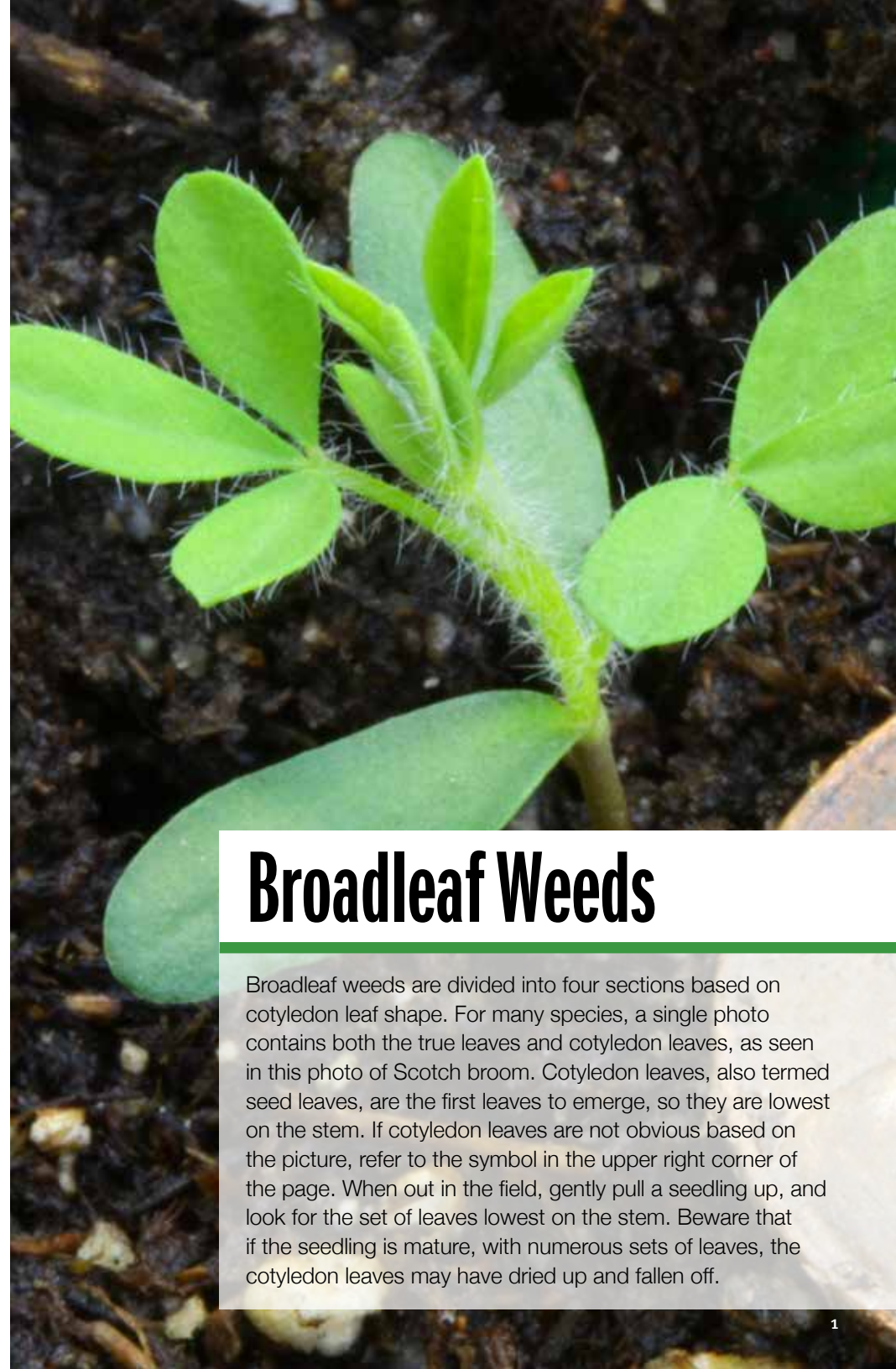
indicates the plant is a weed primarily of rangeland or non-cropland.



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.

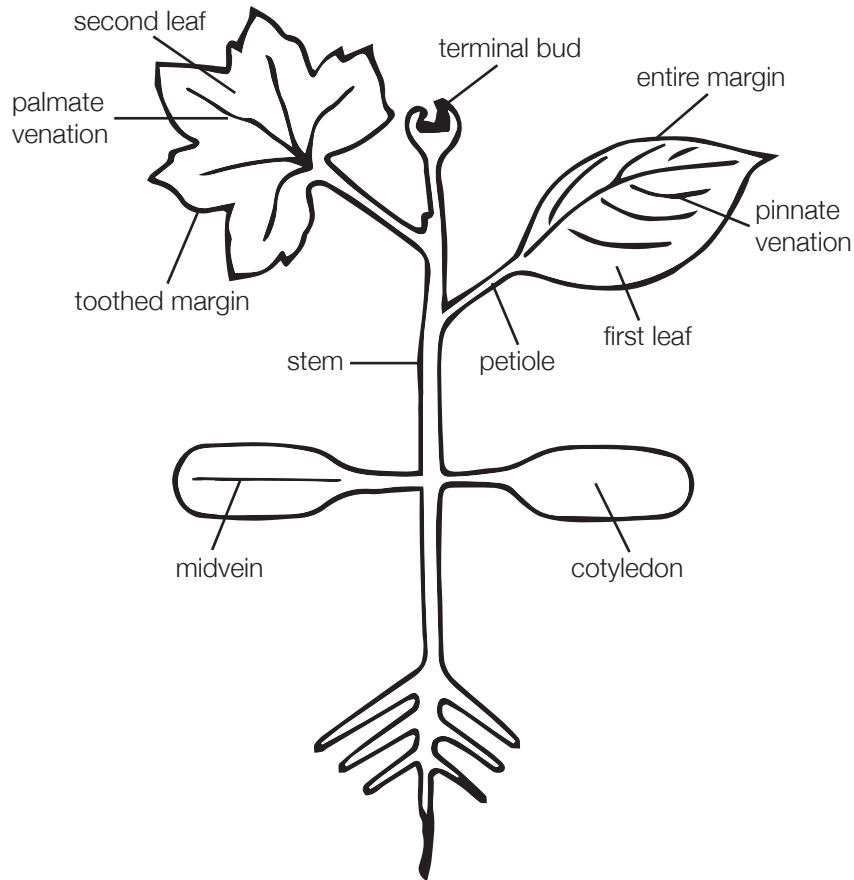
Broadleaf plants are divided into four sections based on cotyledon leaf shape and grasses are divided into three sections based on the ligule type. The cotyledon leaf shape or ligule type symbols are in the upper right corner. The sections are divided by color.



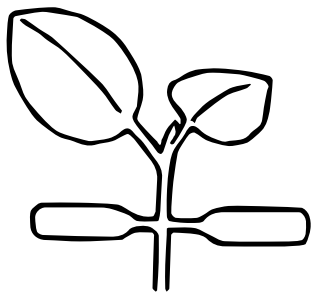
## Broadleaf Weeds

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.

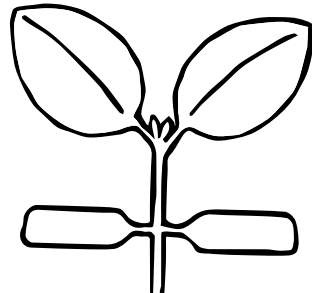
## Plant Parts



## 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

### SECTION 1 pages 4 to 29



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

### SECTION 2 pages 30 to 93



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

### SECTION 3 pages 94 to 111



round

### SECTION 4 pages 112 to 123



heart-shaped



oval with narrow tip



kidney-shaped



## 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

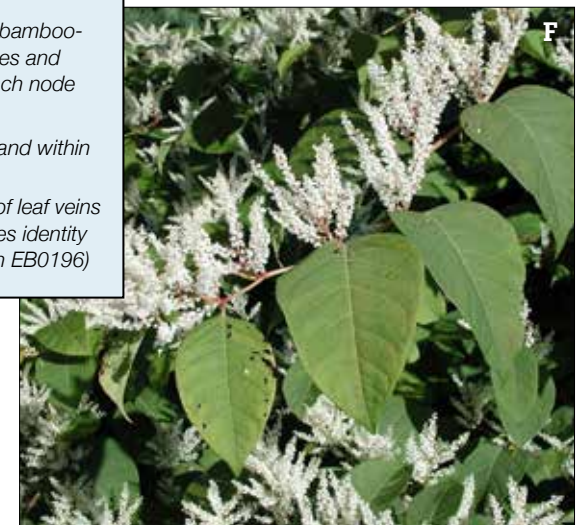
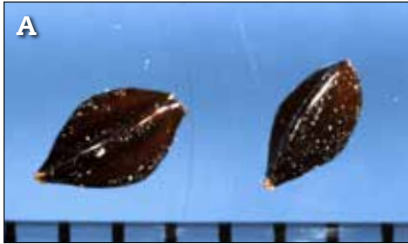
**surface:** glabrous

**margins:** entire

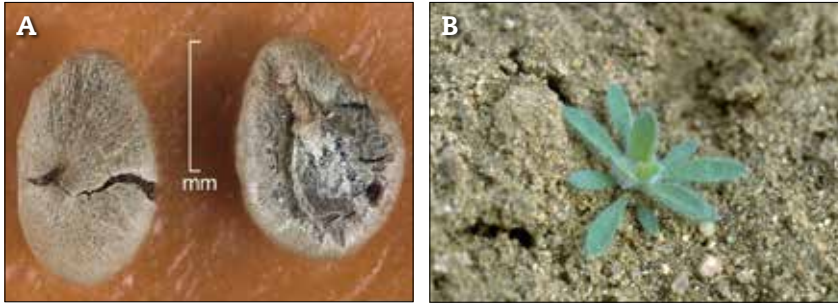
**NOTES** Photo B is giant knotweed, but Bohemian expected to have similar cotyledon leaf shape and Japanese is not known to reproduce by seed. At time of publication, only Bohemian knotweed known to occur in Montana.

### 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)

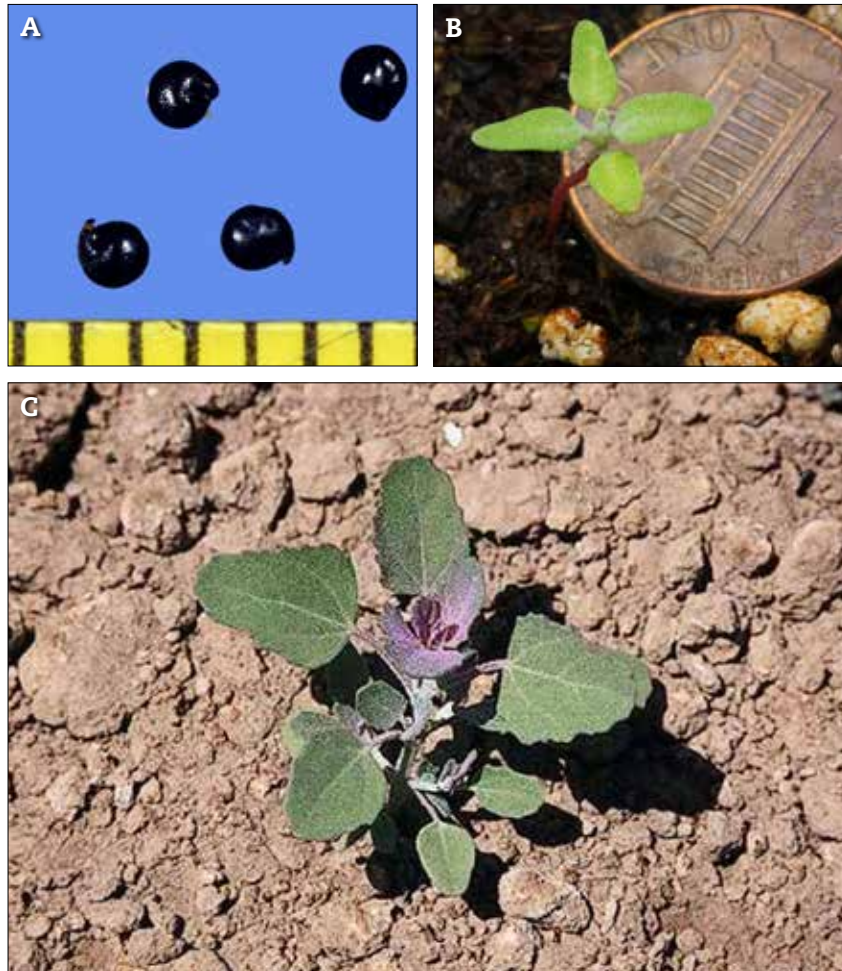
**margins:** entire

**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

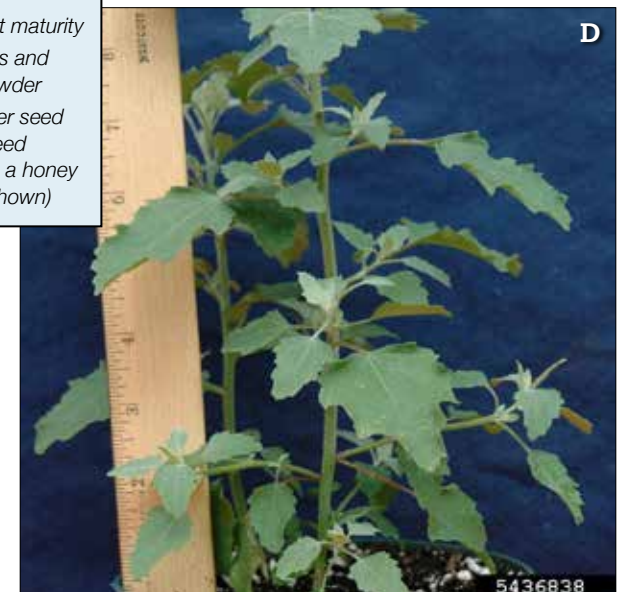
**surface:** first true and subsequent leaves with a mealy or powdery covering beneath and often above (C)

**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

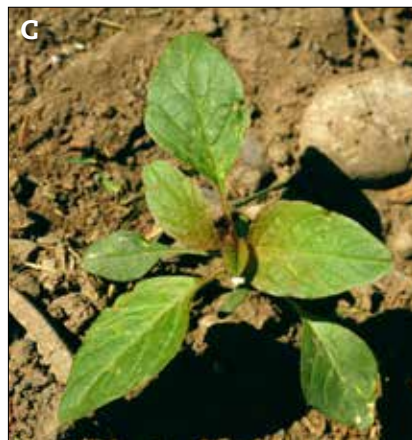
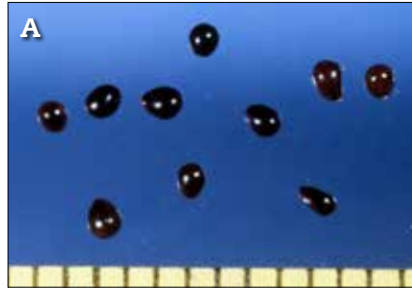
**margins:** entire

**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

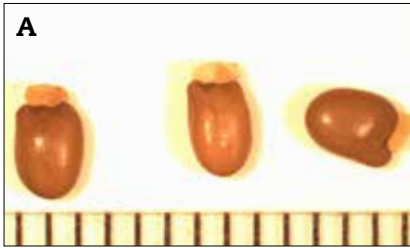
**NOTES** seedling often reddish-violet tinged

**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 convolvulus*\*) 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

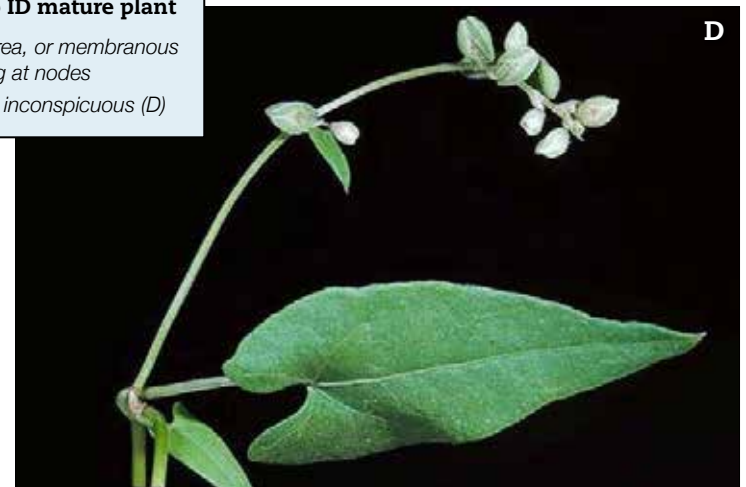
**surface:** first true and subsequent leaves glabrous to covered in very minute stiff hairs causing it to be rough to the touch

**margins:** entire

**NOTES** seedling often reddish-violet tinged (C)

**tips to ID mature plant**

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





## 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)

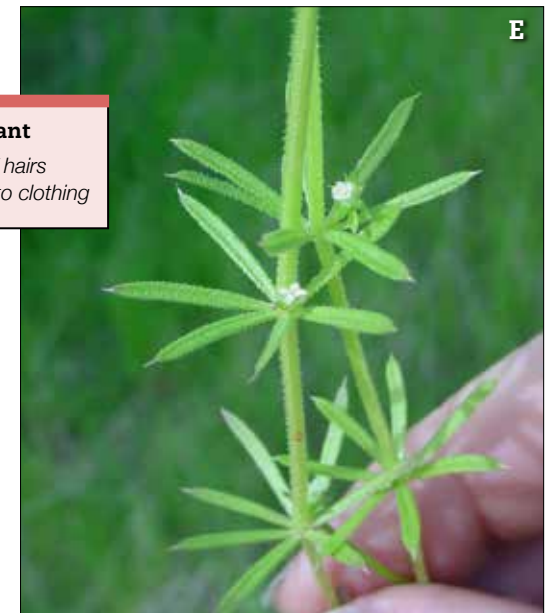
**arrangement:** whorled: 4-5 at first two nodes, 6-8 at third and subsequent nodes

**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)

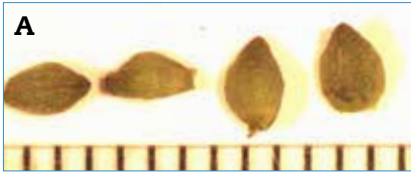
**arrangement:** alternate

**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**

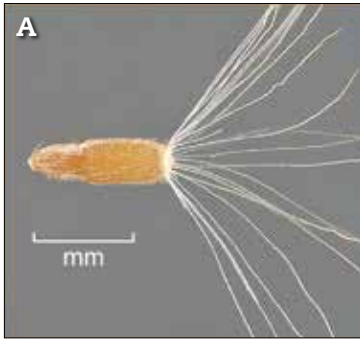
**shape:** first true leaves oblong to elliptic, becoming linear oblanceolate (C); stem leaves linear lanceolate (D)

**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 (scurrose 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-oblong 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

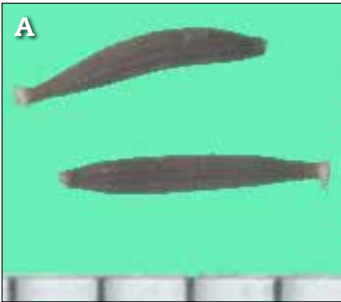
**arrangement:** basal rosette (C); flowering stem alternate

**attachment:** basal leaves petiolate, stem leaves sessile

**surface:** first true leaves glabrous or nearly so, subsequent leaves nearly glabrous to sparsely tomentose

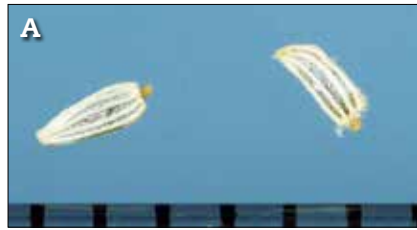
**margins:** first true leaves broadly dentate with barbs on margins (B); becoming dentate to shallowly lobed (C); stem leaves entire with inrolled margins

**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

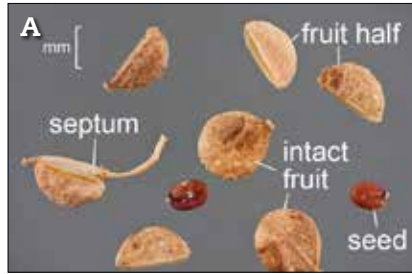
**surface:** no to few hairs

**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

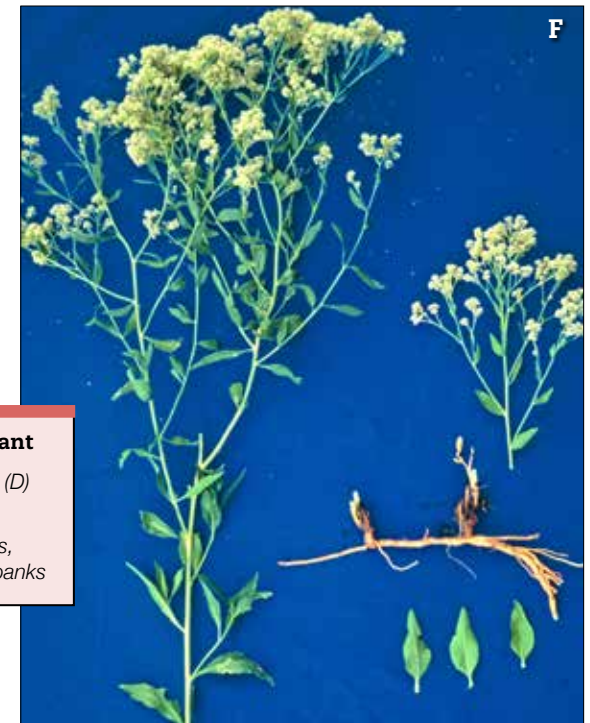
**shape:** first true leaves oval to round (B), becoming elliptic to lanceolate (C, D), but often withering by the time of flowering; stem leaves elliptic and smaller (F)

**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)

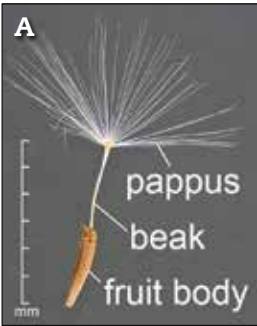
**arrangement:** basal rosette (D); flowering stem alternate

**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

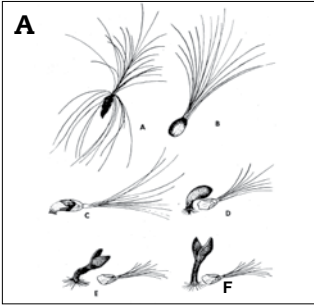
**arrangement:** alternate

**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

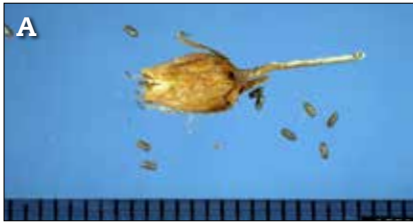
**shape:** first true leaves ovate to oval (C), becoming obovate (D), mature leaves lanceolate to elliptic (E)

**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 occurs 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**

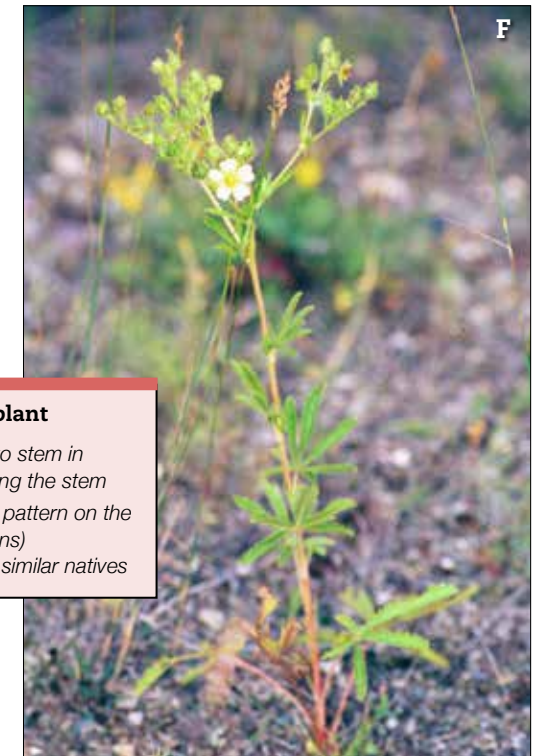
**shape:** first true leaves round with rounded teeth (C), becoming palmately compound with 3 leaflets (D), and ultimately 5 leaflets or more at maturity (E)

**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)

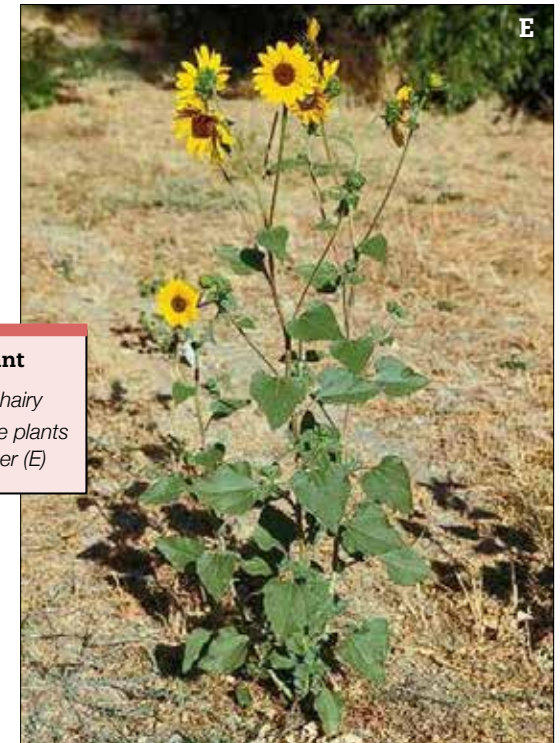
**arrangement:** lowest leaves opposite, above alternate

**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)

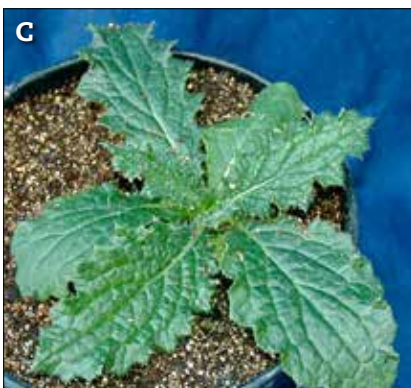
**arrangement:** basal rosette (D); flowering stem alternate

**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  $\frac{3}{4}$  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

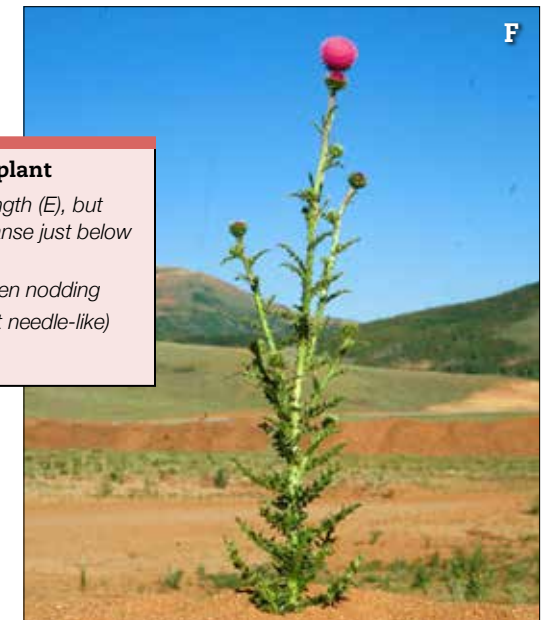
**attachment:** sessile

**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





## yellow starthistle

(*Centaurea solstitialis*) **ASTERACEAE**

**LIFE CYCLE** annual

**COTYLEDON LEAF** oval to oblong, tip blunt (B)

### TRUE LEAF

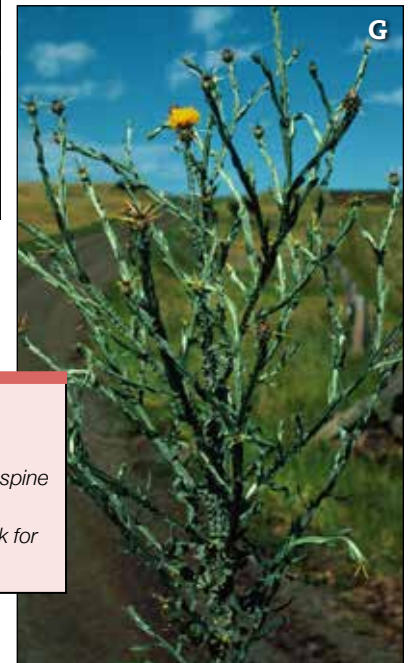
**shape:** first true leaves oblong to oval (B), becoming pinnately lobed (C); basal leaves pinnately divided, deltoid at tip (D); stem leaves linear-oblong

**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)

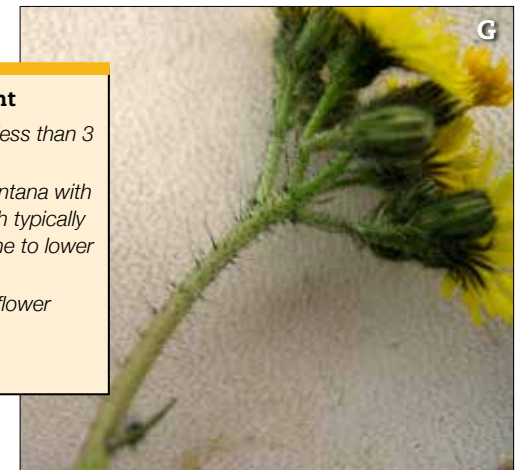
**arrangement:** basal rosette (E); flowering stem alternate but usually less than 3 stem leaves (F)

**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



## 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

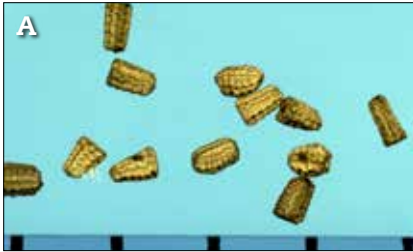
**shape:** first true leaves ovate to oval (C); basal leaves oblanceolate (D); stem leaves reduced upwards (E)

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

**attachment:** basal leaves petiolate, stem leaves sessile

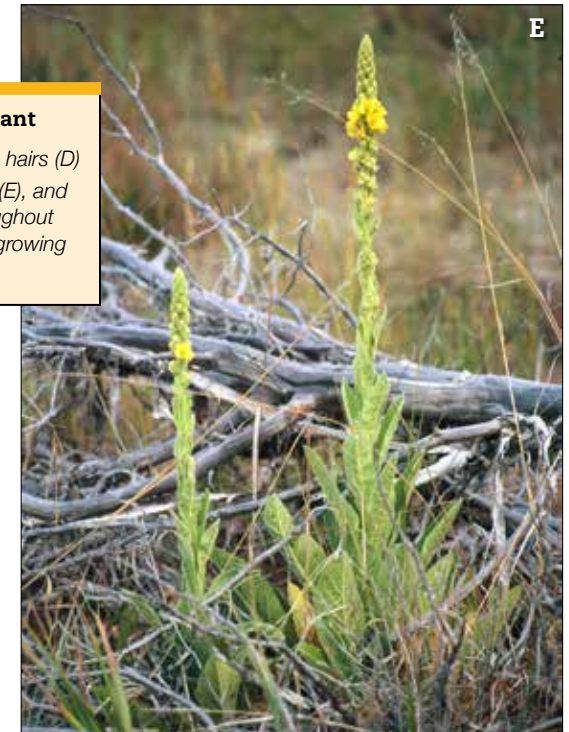
**surface:** first true leaves with short hairs, subsequent leaves covered with dense, soft, velvety hairs (D)

**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

(*Ranunculus acris*) RANUNCULACEAE

**LIFE CYCLE** perennial

**COTYLEDON LEAF** round (B)

### TRUE LEAF

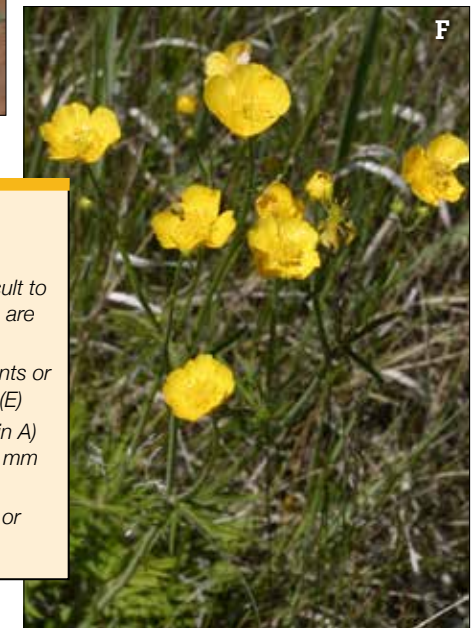
**shape:** leaf divisions gradually develop in first sets of true leaves (B), ultimately becoming pentagonal with multiple divisions (D)

**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**

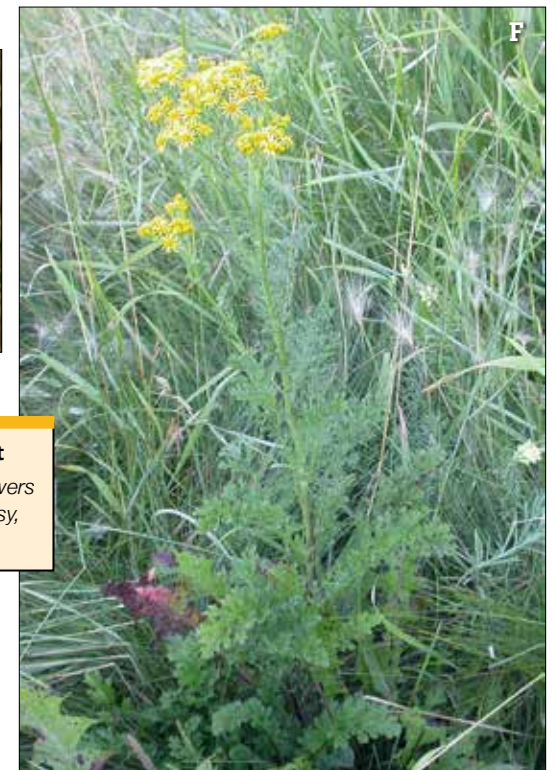
**shape:** first sets of true leaves ovate to oval in outline (B, C), becoming oblanceolate in outline (D)

**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*) CONVULVULACEAE

**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

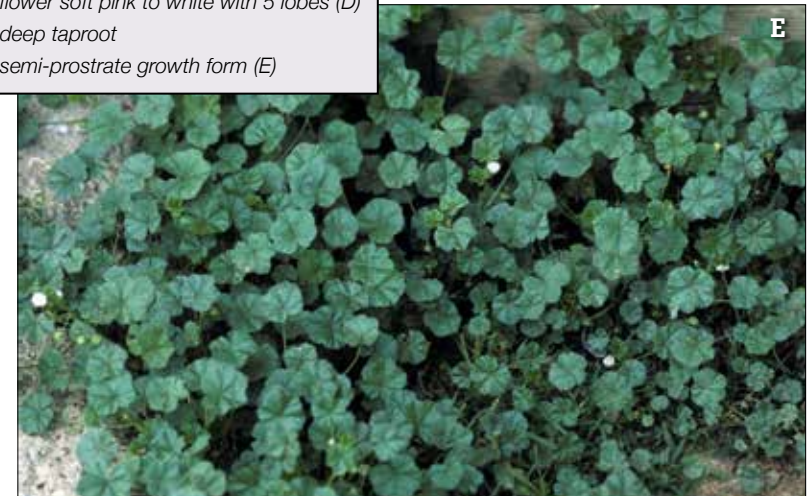
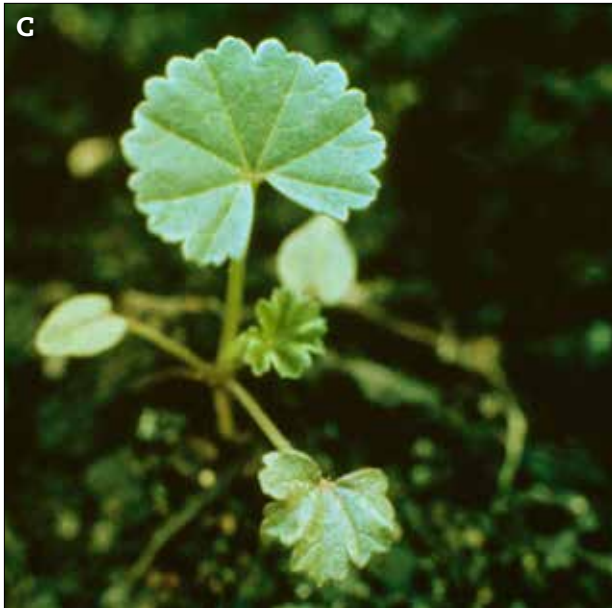
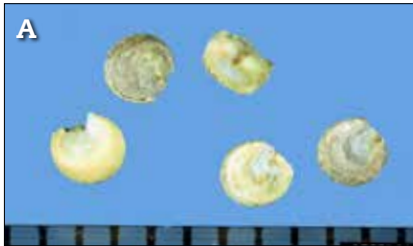
**attachment:** petiolate (petioles long, C)

**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

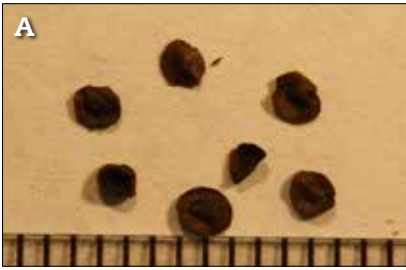
**attachment:** sessile

**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

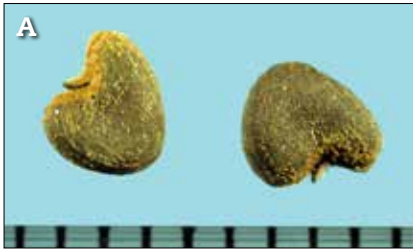
**shape:** first true leaves ovate to heart-shaped with blunt tip (C); stem leaves heart-shaped with acute tip (D)

**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)

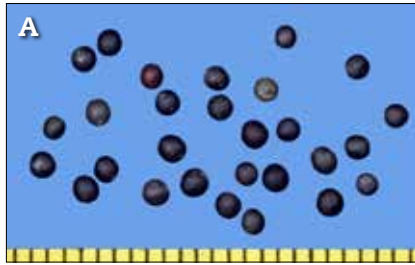
**arrangement:** alternate

**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)

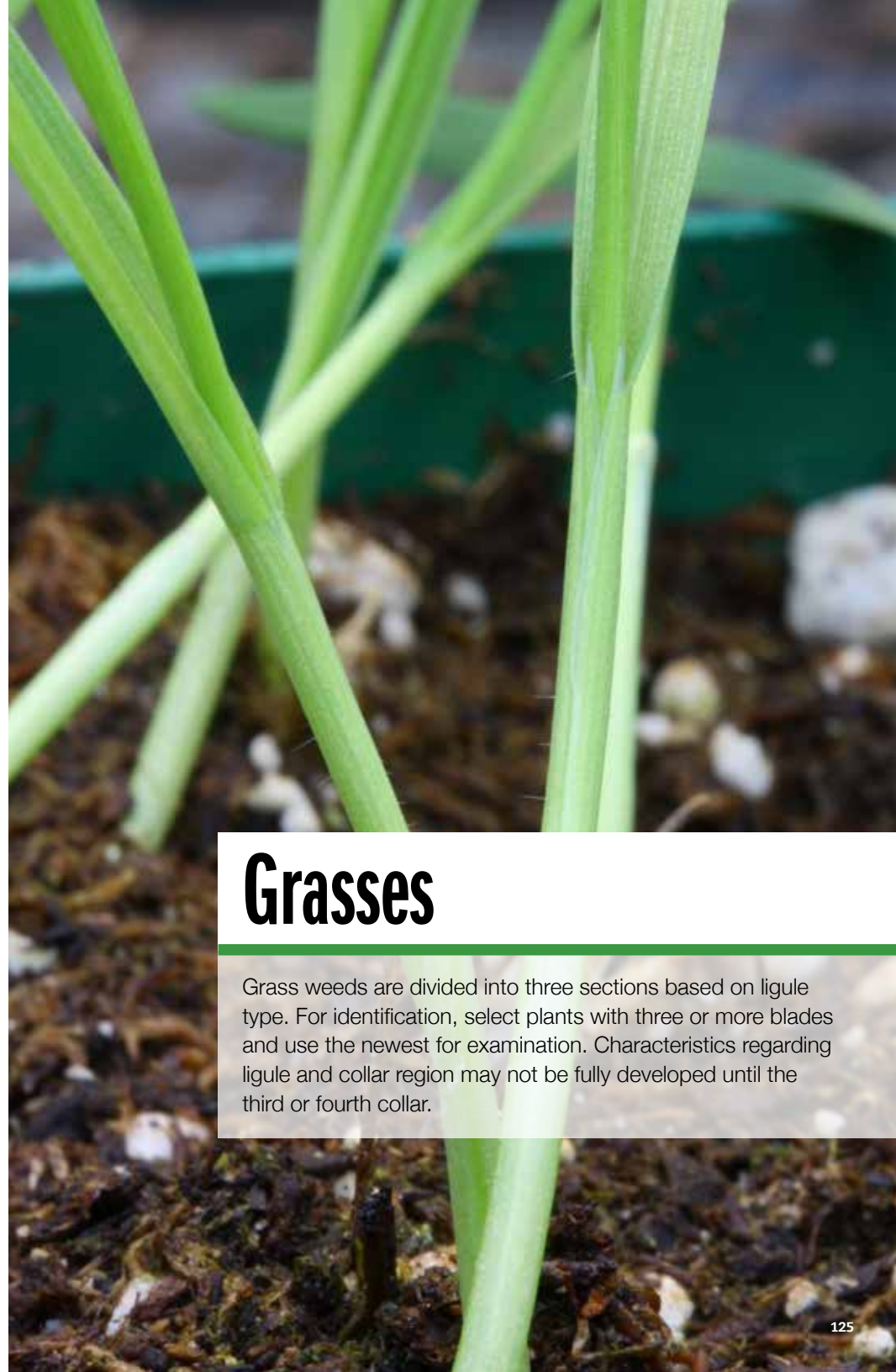
**NOTES** prominently pinnately veined (C)



**tips to ID mature plant**

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

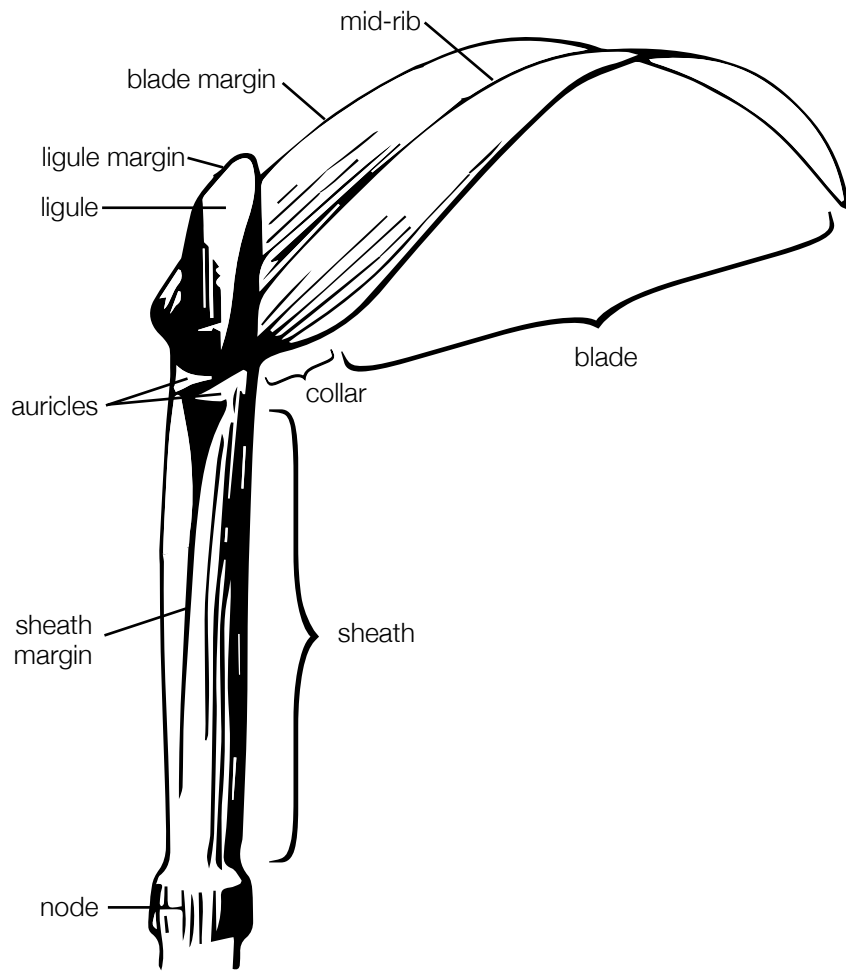
\*formerly *Brassica kaber*



# 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.

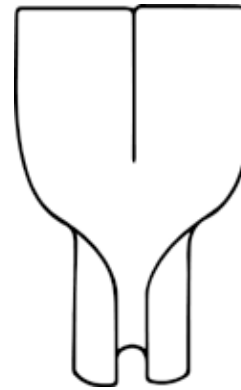
# Plant Parts



# Ligule Type

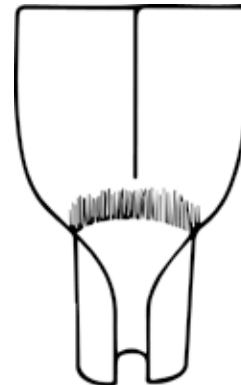
**SECTION 1: absent** pages 128 to 129

No ligule.



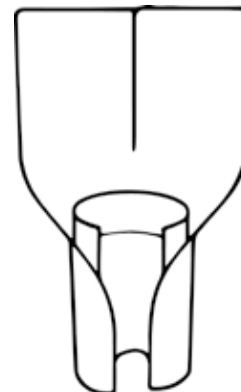
**SECTION 2: hairy** pages 130 to 135

Ligule consists of a fringe of hairs.

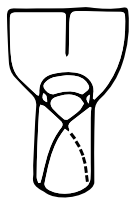


**SECTION 3: membranous** pages 136 to 153

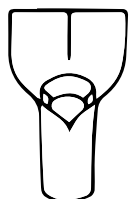
Ligule consists of a membrane. Not all membranous ligules have entire margins, some may be toothed or jagged; refer to descriptions and photos for each species.



## Sheath Type

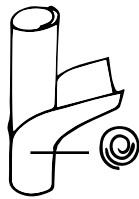


Split and Overlapping

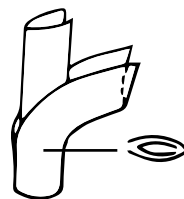


Closed

## Vernation



Round



Flat



## 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

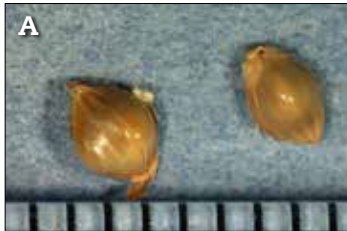
**MIDRIB** prominent below on third and later blades (D)

**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



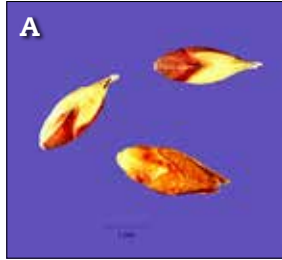
### tips to ID mature plant

- 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

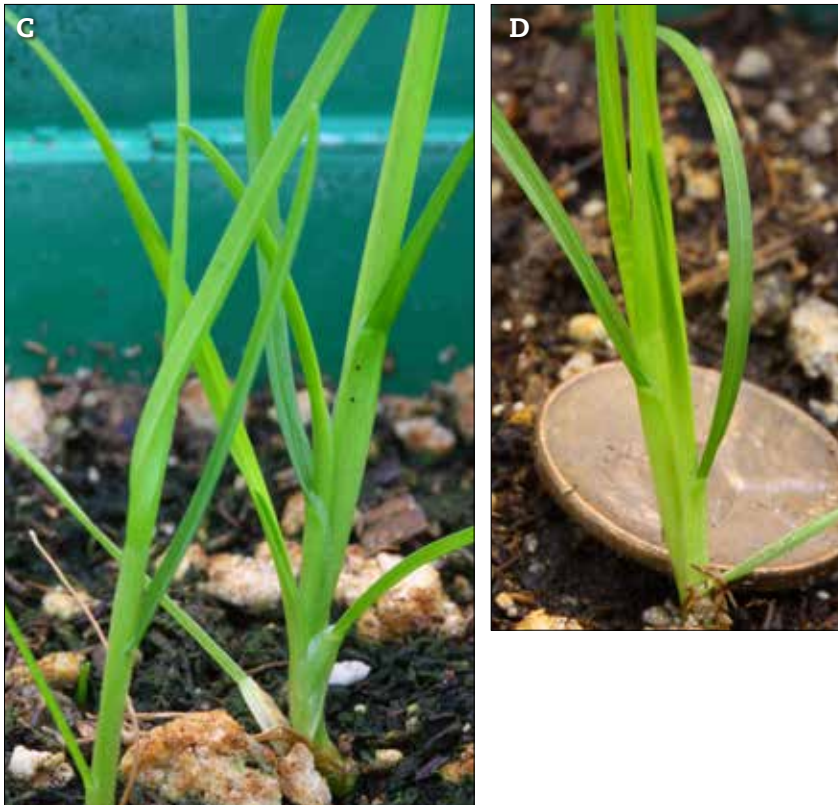
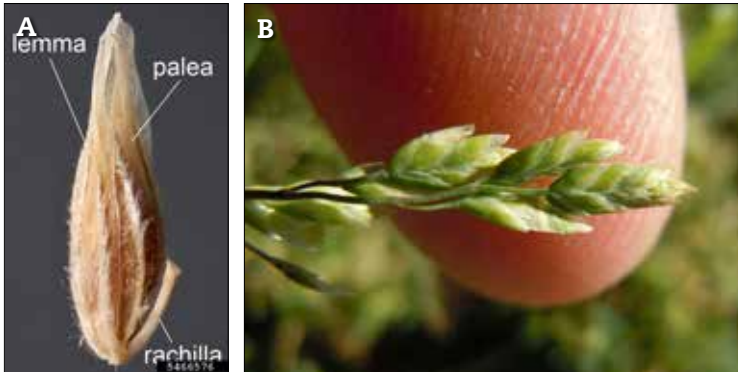
**MIDRIB** prominent midrib (D)

**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*)



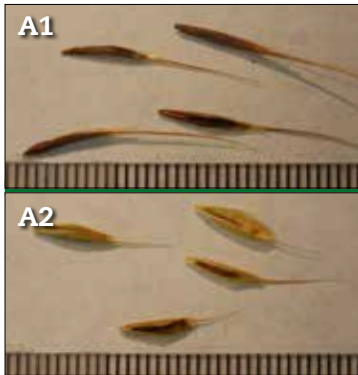
### tips to ID mature plant

- 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

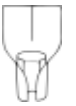
**LIGULE** prominent membranous, toothed margin (E1)

**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

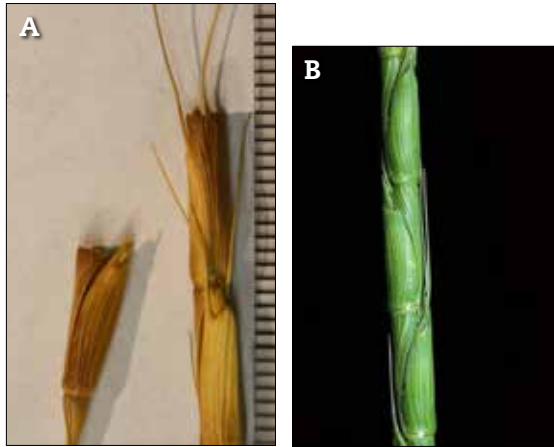
**MIDRIB** prominent veins above and midrib below

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

**VERNATION** round

**LIGULE** membranous, short with toothed margin (E)

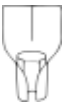
**NOTES** seedling leaves twist clockwise; later leaves have small auricles; collar is light green



### 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)

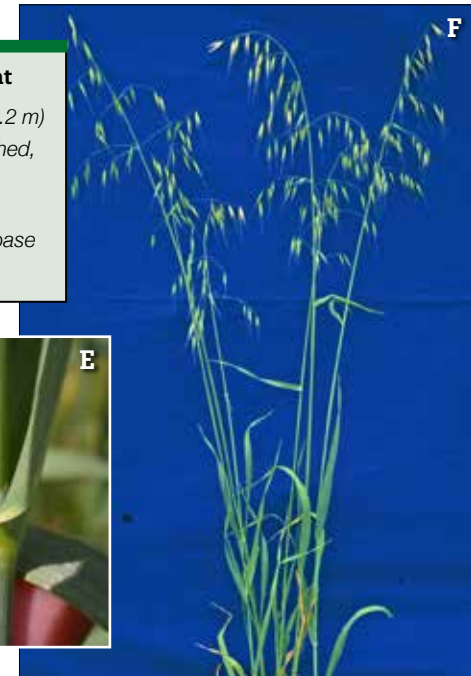
**VERNATION** round

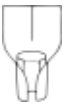
**LIGULE** membranous, tall and with slightly toothed margin (E), develops quickly in seedlings (D)

**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

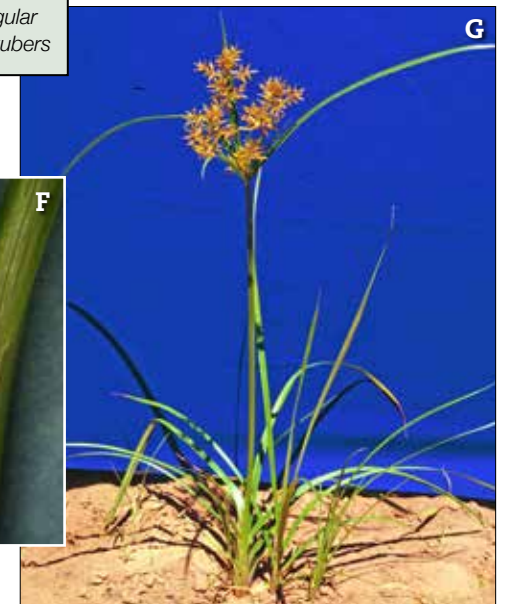
**LIGULE** nodeless and without ligule, collar or sheath (F)

**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 pedicellate (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

Abutilon theophrasti . . . . .	121	<i>Fallopia convolvulus</i> . . . . .	27	mallow, common . . . . .	115	<i>Setaria pumila</i> . . . . .	133
Acroptilon repens . . . . .	53	field bindweed . . . . .	113	<i>Malva neglecta</i> . . . . .	115	<i>Setaria viridis</i> . . . . .	131
<i>Aegilops cylindrica</i> . . . . .	145	field pennycress . . . . .	43	meadow hawkweed . . . . .	97	shepherds purse . . . . .	73
<i>Agropyron repens</i> . . . . .	149	field scabious . . . . .	95	mullein, common . . . . .	105	<i>Sinapis arvensis</i> . . . . .	123
<i>Amaranthus blitoides</i> . . . . .	15	foxtail barley . . . . .	143	musk thistle . . . . .	87	<i>Sisymbrium altissimum</i> . . . . .	111
<i>Amaranthus retroflexus</i> . . . . .	17	foxtail, green . . . . .	131	narrowleaf hawksbeard . . . . .	57	<i>Solanum triflorum</i> . . . . .	29
annual bluegrass . . . . .	137	foxtail, yellow . . . . .	133	<i>Onopordum acanthium</i> . . . . .	89	spotted knapweed . . . . .	55
<i>Arctium minus</i> . . . . .	37	<i>Galium aparine</i> . . . . .	31	orange hawkweed . . . . .	99	St. Johnswort . . . . .	75
<i>Avena fatua</i> . . . . .	151	green bristlegrass . . . . .	131	oxeye daisy . . . . .	59	sulfur cinquefoil . . . . .	77
baby's breath . . . . .	5	<i>Gypsophila paniculata</i> . . . . .	5	<i>Panicum capillare</i> . . . . .	135	sunflower . . . . .	79
barnyard grass . . . . .	129	hawkweed, meadow . . . . .	97	perennial pepperweed . . . . .	61	tall buttercup . . . . .	107
bedstraw . . . . .	31	hawkweed, orange . . . . .	99	Persian darnel . . . . .	147	<i>Tamarix</i> sp. . . . .	71
<i>Berteroa incana</i> . . . . .	45	<i>Helianthus annuus</i> . . . . .	79	pigweed, prostrate . . . . .	15	<i>Tanacetum vulgare</i> . . . . .	81
black henbane . . . . .	33	henbit . . . . .	101	pigweed, redroot . . . . .	17	tansy ragwort . . . . .	109
blue grass, annual . . . . .	137	<i>Hieracium aurantiacum</i> . . . . .	99	<i>Poa annua</i> . . . . .	137	tansy, common . . . . .	81
blueweed . . . . .	35	<i>Hieracium caespitosum</i> . . . . .	97	poison hemlock . . . . .	63	thistle, bull . . . . .	83
<i>Brassica kaber</i> . . . . .	123	<i>Hieracium praealtum</i> . . . . .	97	<i>Polygonum convolvulus</i> . . . . .	27	thistle, Canada . . . . .	85
brome, downy and Japanese . . . . .	139	<i>Hieracium pratense</i> . . . . .	97	<i>Polygonum cuspidatum</i> . . . . .	9	thistle, musk . . . . .	87
<i>Bromus tectorum</i> . . . . .	139	hoary alyssum . . . . .	45	<i>Polygonum sachalinensis</i> . . . . .	9	thistle, Scotch . . . . .	89
<i>Buglossoides arvensis</i> . . . . .	39	<i>Hordeum jubatum</i> . . . . .	143	<i>Polygonum x bohemia</i> . . . . .	9	<i>Thlaspi arvense</i> . . . . .	43
bull thistle . . . . .	83	horseweed . . . . .	47	<i>Portulaca oleracea</i> . . . . .	19	toadflax, Dalmatian . . . . .	117
burdock . . . . .	37	houndstongue . . . . .	49	<i>Potentilla recta</i> . . . . .	77	toadflax, yellow . . . . .	119
Canada thistle . . . . .	85	<i>Hyoscyamus niger</i> . . . . .	33	prickly lettuce . . . . .	65	<i>Tragopogon dubius</i> . . . . .	25
<i>Capsella bursa-pastoris</i> . . . . .	73	<i>Hypericum perforatum</i> . . . . .	75	prostrate pigweed . . . . .	15	tumblemustard . . . . .	111
<i>Cardaria draba</i> . . . . .	91	<i>Isatis tinctoria</i> . . . . .	41	purple loosestrife . . . . .	67	velvetleaf . . . . .	121
<i>Carduus nutans</i> . . . . .	87	Japanese brome . . . . .	139	purslane . . . . .	19	<i>Verbascum thapsus</i> . . . . .	105
<i>Centaurea diffusa</i> . . . . .	51	Japanese knotweed . . . . .	9	quackgrass . . . . .	149	western salsify . . . . .	25
<i>Centaurea solstitialis</i> . . . . .	93	jointed goatgrass . . . . .	145	<i>Ranunculus acris</i> . . . . .	107	whitetop . . . . .	91
<i>Centaurea stoebe</i> . . . . .	55	kingdevil hawkweed . . . . .	97	redroot pigweed . . . . .	17	wild buckwheat . . . . .	27
cereal rye . . . . .	141	knapweed, diffuse . . . . .	51	rush skeletonweed . . . . .	69	wild mustard . . . . .	123
<i>Chenopodium album</i> . . . . .	13	knapweed, Russian . . . . .	53	Russian thistle . . . . .	21	wild oat . . . . .	151
<i>Chondrilla juncea</i> . . . . .	69	knapweed, spotted . . . . .	55	rye . . . . .	141	wild tomato . . . . .	29
<i>Chrysanthemum leucanthemum</i> (see <i>Leucanthemum vulgare</i> )		<i>Knautia arvensis</i> . . . . .	95	salsify . . . . .	25	witchgrass . . . . .	135
<i>Cirsium arvense</i> . . . . .	85	Knotweed Complex: Japanese, Bohemian, Giant . . . . .	9	<i>Salsola tragus</i> . . . . .	21	<i>Xanthium strumarium</i> . . . . .	7
<i>Cirsium vulgare</i> . . . . .	83	kochia . . . . .	11	Salt cedar . . . . .	71	yellow bristlegrass . . . . .	133
cocklebur . . . . .	7	<i>Kochia scoparia</i> . . . . .	11	Scotch broom . . . . .	23	yellow mustard . . . . .	123
common tansy . . . . .	81	<i>Lactuca serriola</i> . . . . .	65	Scotch thistle . . . . .	89	yellow nutsedge . . . . .	153
<i>Conium maculatum</i> . . . . .	63	lambquarters . . . . .	13	<i>Secale cereale</i> . . . . .	141	yellow starthistle . . . . .	93
<i>Convolvulus arvensis</i> . . . . .	113	<i>Lamium amplexicaule</i> . . . . .	101	<i>Senecio jacobaea</i> . . . . .	109	yellow toadflax . . . . .	119
<i>Conyza canadensis</i> . . . . .	47	leafy spurge . . . . .	103				
corn gromwell . . . . .	39	<i>Lepidium draba</i> . . . . .	91				
<i>Crepis tectorum</i> . . . . .	57	<i>Lepidium latifolium</i> . . . . .	61				
<i>Cynoglossum officinale</i> . . . . .	49	<i>Leucanthemum vulgare</i> . . . . .	59				
<i>Cyperus esculentus</i> . . . . .	153	<i>Linaria dalmatica</i> . . . . .	117				
<i>Cytisus scoparius</i> . . . . .	23	<i>Linaria vulgaris</i> . . . . .	119				
dyer's woad . . . . .	41	<i>Lithospermum arvensis</i> (see <i>Buglossoides arvensis</i> )					
<i>Echinochloa crus-galli</i> . . . . .	129	<i>Lolium persicum</i> . . . . .	147				
<i>Echium vulgare</i> . . . . .	35	<i>Lythrum salicaria</i> . . . . .	67				
<i>Euphorbia esula</i> . . . . .	103						

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**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

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**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; **BFG** 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: [www.bugwood.org](http://www.bugwood.org))

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