

# Persian Darnel: Identification, Biology and Ecology

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**This guide provides background on Persian darnel origin, distribution, biology and ecology. It explains the importance of identifying seedlings for successful management and includes information on Persian darnel identification and growth habits.**



## MontGuide

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### PERSIAN DARNEL (*LOLIUM PERSICUM* BOISS. &

Hoh.) is an introduced annual or winter annual grass that reproduces by seed. Throughout Montana, North Dakota and the Canadian Prairies it is possible to find Persian darnel plants infesting several crops, including small grains.

Traditionally, Persian darnel has been a weed of limited importance. However, during the last decade Persian darnel has become an increasingly troublesome weed in Montana cropland where it can completely smother patches of wheat or barley and go unnoticed until harvest. This tendency is particularly true in reduced tillage or direct seeding systems that leave weed seeds close to the soil surface.

Persian darnel management presents three main challenges:

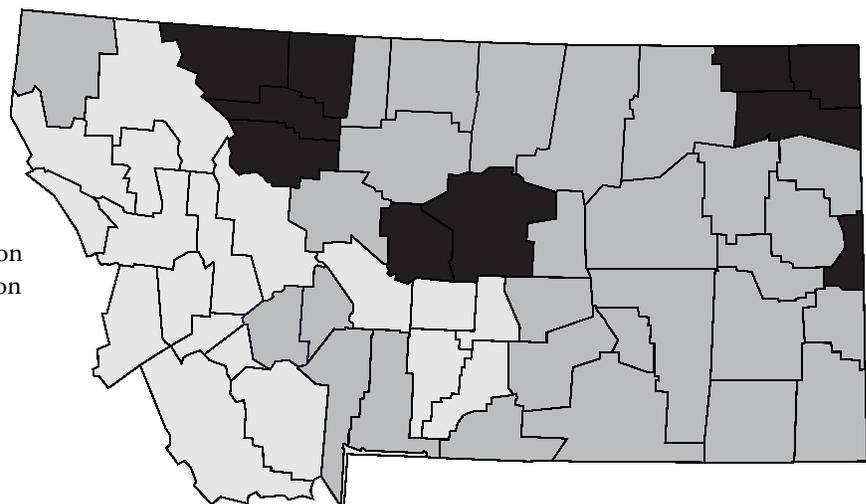
1. Unlike wild oat or kochia (*Kochia scoparia* L.), which grow above the crop canopy, Persian darnel is short in stature and difficult to see in maturing grain fields. Because of its short height, producers are usually unaware they have a Persian darnel infestation until harvest.
2. Persian darnel is often misidentified at the seedling stage. Achieve (tralkoxydim), Discover (clodinafop), Osprey (mesosulfuron methyl) and Hoelon (diclofop methyl) are selective post-emergence herbicides that effectively manage Persian darnel in small grains, but incorrect identification often leads to improper herbicide selection and unsatisfactory results.

3. Persian darnel biotypes have developed resistance to several acetyl-CoA carboxylase (ACCase) herbicides including Achieve, Discover and Hoelon. The first case of Persian darnel resistant to ACCase herbicides was reported in 1993, infesting wheat fields.

Successful long-term management of Persian darnel requires a comprehensive plan that integrates several control practices to reduce its abundance and competitive ability.

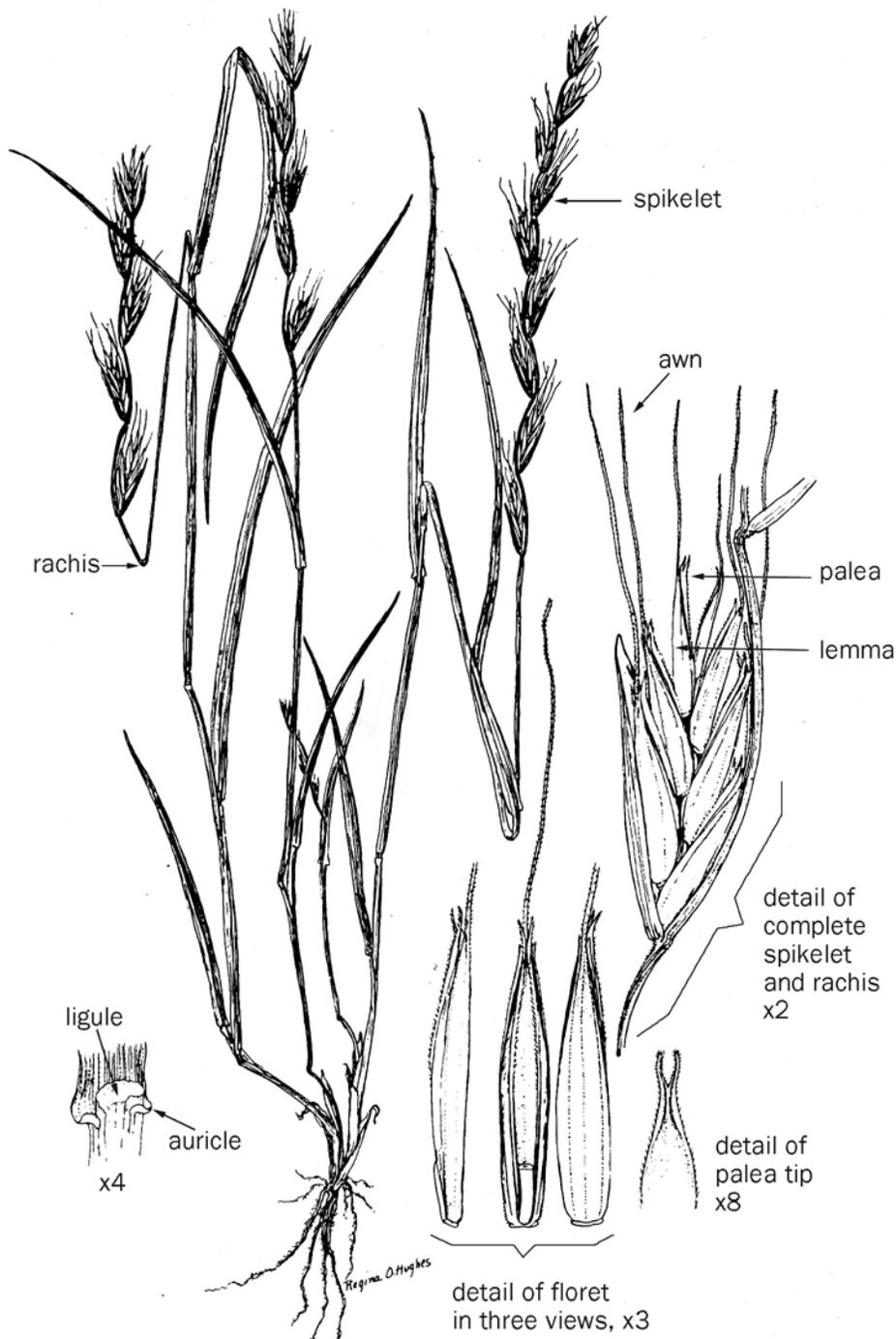
### Persian darnel origin and distribution in Montana

Persian darnel originated in central Asia, and was likely introduced to North America as a soil contaminant from a ship's ballast or as a seed contaminant of a harvested crop. It was first reported in Cavalier County, North Dakota, in 1911. In Montana, Persian darnel has been a prominent weed in small grain fields of Judith Basin County, northwestern Golden Triangle and northeast Montana. Minor infestations have been found throughout the Golden Triangle, upper Missouri River Valley, Hi-line and southeastern Montana (Fig 1).



**Figure 1. Distribution of Persian darnel across the state of Montana.**

■ prominent infestation    ■ minor infestation    □ no reports of Persian darnel



**Figure 2. Persian darnel plant, leaf, and seed characteristics.**

Source: USDA Technical Bulletin No. 1392

### Did you know that...

- In Montana, Persian darnel was first reported in 1954 in Daniels County. Today, it infests approximately 630,000 acres in 26 Montana counties.
- At high densities, Persian darnel could cause crop yield loss of up to 83 percent, 70 percent and 57 percent for spring wheat, canola and sunflower, respectively.
- Persian darnel biotypes have developed resistance to ACCase herbicides including Achieve, Discover and Hoelon.

### Persian darnel identification

Identification of Persian darnel lies at the heart of developing a successful integrated management program. Unfortunately, Persian darnel is often misidentified at the seedling stage as crop or wild oat, and as a result, is not properly managed. Knowing the plant's distinctive seed, seedling and mature plant characteristics can help producers correctly recognize Persian darnel. *Italicized terms in the following descriptions are defined in the glossary.*

**Seeds** The light-colored seeds of Persian darnel are smooth, have no hairs and resemble thin barley seed or the seeds of range grasses such as perennial ryegrass or intermediate wheatgrass. Seeds are 0.06 to 0.11 inches wide, usually 5 to 6.5 times longer than wide. The seed is enclosed in the lemma and palea that remain on the seed when threshed. The narrow lemma has a slender and more or less straight awn attached at the tip, and the awn is equal to the lemma in length.

**Seedlings** Persian darnel seedlings are difficult to differentiate from downy brome and wild oat seedlings. The key to differentiating Persian darnel from other grass seedlings is its red culm (the base of the stem near the soil surface). It has dark green leaves which are narrow, very smooth, and shiny on the bottom. The ligule is truncate, much like wheat, while wild oats have a large, paper-like ligule. Other key seedling characteristics are summarized in Table 1.

**Mature plants** Persian darnel plants have slightly roughened stems that tiller at the base. They stand erect and reach 6 to 18 inches in height (Fig. 2). Leaf blades are long and narrow (0.08 to 0.25 inches wide), light green and have a luminous appearance. Leaves are rough on the upper surface and margins, and smooth on the underside. Second- and later-emerging leaves have prominent veins above and a midrib below the leaf surface. The ligules are membranous and short (0.08 in long) with a smooth margin. They are generally present only on later-developing leaves. Spikelets are in two rows arranged dorsally to the rachis, giving the appearance that the plant has been pressed. Each spikelet contains five to seven seeds.

## Be Careful!

- During the growing season, Persian darnel often remains unnoticed below the crop canopy. Yet early–and late–maturing Persian darnel tillers retain seeds that are harvested with the crop, resulting in contamination.
- A delay in harvest might reduce seed dispersal in the field and dockage, but will not eliminate contamination.

## Growth habits

Understanding the ecological attributes that enable Persian darnel to thrive in croplands can help farmers reduce its abundance, competitive ability and economic impact.

## Seedbank dynamics

Persian darnel seeds are not long-lived: 90 percent left on the soil surface die within two years and less than two percent remain viable after three years. Because of Persian darnel's short seed life, minimizing seed inputs into the seedbank through enhancing seed and seedling mortality will reduce its abundance.

## Emergence dynamics

Managing Persian darnel is a challenge because it emerges at about the same time as spring cereals. Persian darnel emergence begins in mid–April to early May, ending in late May to early June. Since Persian darnel seedling emergence occurs from within the first 1.5 inches of soil depth and little to no emergence occurs at soil depths greater than 3 inches, deep tillage might be an effective weed management tool to

prevent Persian darnel from emerging. Unfortunately, this is not a feasible management option in no-tillage or reduced tillage systems.

## Important facts about Persian darnel

- Persian darnel emergence is related to soil temperature, initiating after soils warm to 43–45 degrees Fahrenheit and ceasing when soil temperatures reach 77–86 degrees Fahrenheit.
- Persian darnel can flourish in relatively dry areas.

## Persian root system

Understanding the importance of root distribution within the soil profile is a key component in reducing the impact of Persian darnel on crop yield. Persian darnel has a fine, fibrous, fairly shallow rooting profile. Its rooting depth is similar to spring wheat and canola, but shallower than sunflower. Thus, crops with deeper rooting depths than Persian darnel might tolerate competition for resources such as water and nutrients.

## Remember

- Despite its small size, Persian darnel is very competitive in early spring seeded crops.
- Prevention and early identification are the best tools to minimize Persian darnel problems in crops.
- Understanding the biology and environmental requirements of Persian darnel is necessary to develop a successful integrated management program.

**Table 1. Seedling characteristics of Persian darnel, downy brome and wild oat**

Plant Characteristics	Persian Darnel	Downy Brome	Wild Oat
Ligule	Membranous short, smooth margin	Membranous long, hairy margin	Membranous long, ragged margin
Auricle	Present only on later leaves; if present – short	None	None
<b>Leaf Blade</b>			
Color	Bright dark green, shiny	Dark green	Dark green
Width	Narrow	Narrow	Wide
Surface	Rough upper, smooth lower; prominent veins above, midrib below	Covered with soft, dense hair	Hair on leaf margin at base, prominent midrib
Sheath	No hair; sheaths closed, sometimes with overlapping margins	Densely hairy; margins separate	Generally no hair; margins overlapping

Source: P.K. Fay, unpublished data, and *Persian Darnel, a New Weed Problem*, Saskatchewan Agriculture and Food.

## Persian darnel competitive ability

In dryland production systems, Persian darnel is a very competitive weed. It can be as competitive with spring wheat as wild oat. Several competitive attributes enable Persian darnel to reduce crop yield. Among them:

- The early emergence and rapid development of Persian darnel enables it to compete early in the growing season with spring seeded crops.
- In many areas across Montana, crop growth is primarily dependent on stored soil moisture. Under moisture-limiting conditions, early season water use by Persian darnel can cause extensive crop yield loss while still enabling weed seed production.
- In dryland wheat production systems, Persian darnel is capable of reaching plant densities of 260 plants/ft<sup>2</sup>. At these high weed densities, extensive crop yield loss and high weed seed production can occur.

## Glossary

*Auricle* – A small ear-shaped lobe or appendage.

*Awn* – A slender, usually terminal, bristle.

*Bract* – A modified leaf or leaflike part just below and protecting an inflorescence.

*Lemma* – The lower bract of the floret that subtends the grass flower and palea.

*Ligule* – A thin, membranous outgrowth or fringe of hairs from the base of the blade of most grasses.

*Palea* – The upper bract of a grass floret.

*Rachis* – The axis of a compound leaf or inflorescence.

*Spikelet* – A small or secondary spike, the flower cluster in grasses.

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