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Seed Identification Basics 2: Distinguishing Seeds of Selected Families

September 26th, 2012

Jennifer Neudorf, SSTS, CFIA

Canada

Goals

- This 60 minute webinar is presented by Jennifer Neudorf, Technologist, National Seed Herbarium and Special Projects, Canadian Food Inspection Agency (CFIA).

- The goal of this webinar is to recognize seeds/fruits of the Mustard, Grass and Daisy families and distinguish selected species.

- Builds on those basic tools and resources for seed identification that were presented in February 2012.

Training Expectation and Outcomes

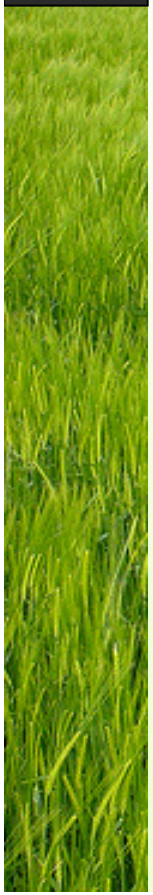
- Enhance ability to recognize seeds from 3 families: Mustard (*Brassicaceae*), Grass (*Poaceae*) and Daisy (*Asteraceae*).

- Increase capacity to visually distinguish seeds/fruits of selected species that are often misidentified.

Introduction: Morphology of Seeds/Fruit

Morphology: The observable physical characteristics of a seed or fruit: size, shape, surface, hilum. (SSSH)

Introduction: Morphology of Seeds/Fruit



- **Size**: Often used to distinguish species within a family rather than as a family feature.
- **Shape**: Many plant families have uniquely shaped seeds that help to quickly recognize them.
- **Surface**: The surface of seeds aid in recognizing the family and/or species: oil tubes in Apiaceae, reticulation in Brassicaceae.
- **Hilum:** The attachment point of the seed contains many features to recognize the family and/or species.

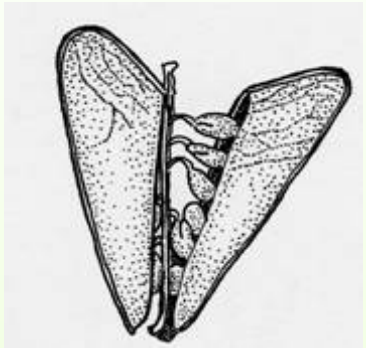
Family *Brassicaceae*: Mustard family

a.k.a *Crucifereae*

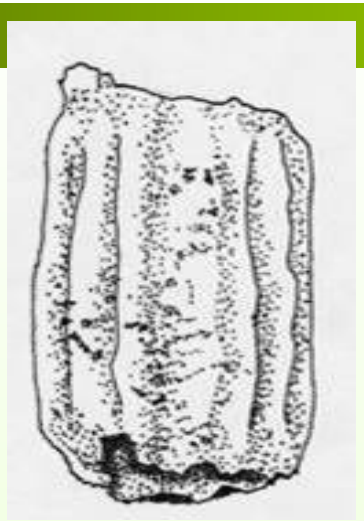
Fruit: -**silicle** (short, broad pod) or **silique** (long, narrow pod),
-usually with a thin wall down the middle (**replum**),
-sometimes the fruit is indehiscent, remaining intact or breaking up into segments.

Seed: -**Shape:** elongate, ellipsoidal, usually flattened
-**Surface:** seed coat minutely roughened by fine reticulations or small tubercles
-**Hilum:** surrounded by tissue, has associated features that aid in identification
- **Bounce**: with annoying height and trajectory

Family *Brassicaceae*: Mustard family

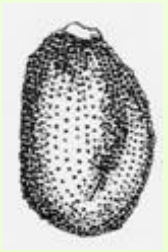


Capsella bursa-pastoris
silicle with seeds



Raphanus raphanistrum
segment of silique

Neslia paniculata
indehiscent silicle



Camelina microcarpa

Erucastrum gallicum

Thlaspi arvense

Nasturtium officinale

QUIZ # 1

What type of fruit does the mustard family have?

1. Pod
2. Legume
3. Capsule
4. Berry

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Distinguishing Selected Mustard species

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Capsella bursa-pastoris (Shepherd's Purse)

- **Shepherds purse seeds:**
  - seed is 1.25 mm long, 0.75 mm wide
  - oblong with rounded ends
  - usually a red-brown, can be rusty red with a darker hilum area
  - distinct, large-celled net pattern (reticulum) of squares or longer-than-wide cells

Descuraina sophia (Flixweed)

- **Flixweed seed:**
  - seed is 1.5 mm long and 0.5 mm wide
  - oblong with rounded ends
  - usually a red-orange, can be rusty red with a darker hilum area
  - distinct pattern of wider-than long cells (reticulum); look like corn on the cob

Small Mustards Comparison

	Shepherd's purse	Flixweed
Seed Size	•1.2 mm x 0.7 mm	•1.0 mm x 0.5 mm
Seed Shape	•Oblong	•Oblong
Colour	•Reddish - brown	•Reddish - orange
***Surface Texture**	•Reticulum of square or longer-than-wide pits, larger than flixweed	•Reticulum of wider-than-long pits, like corn on the cob

QUIZ # 2

Which species is this?

1. Shepherd's purse
2. Flixweed
3. It's too early in the day for miracles.

Family Poaceae: Grass family
Subfamily: Poöideae

Fruit: -spikelets usually several-flowered
-grain (caryopsis) oblong, usually with a ventral furrow
-usually enclosed within woody lemma and palea
-lemma may be awned
-tends to be longer than wide

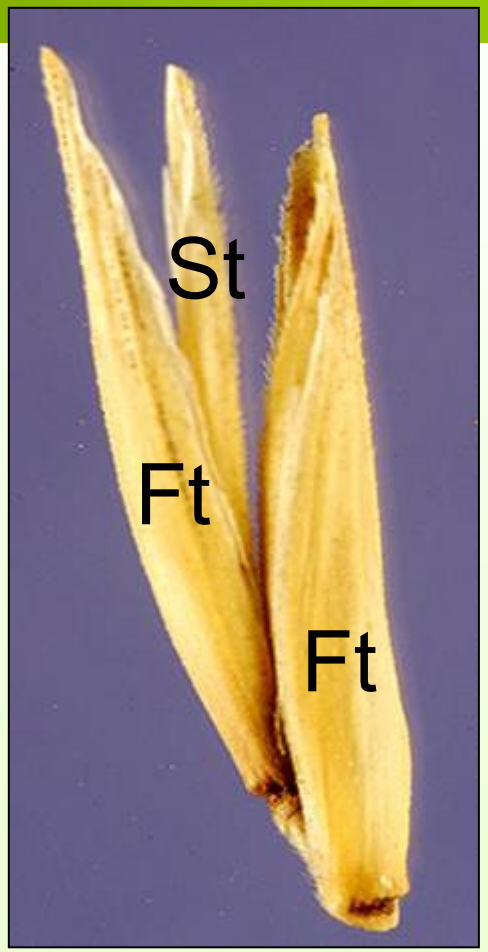
Important Genera: *Agrostis, Avena, Bromus, Dactylis, Festuca, Lolium, Phalaris, Phleum*, *Poa*

Subfamily Poöideae (Wheat Grass Group)

- **From top to bottom:**

1. ***St*** woody sterile (sometimes staminate) floret on top
2. ***Ft*** woody fertile floret(s) below;
3. ***G*** two glumes that usually remain behind on the stem;

– Rachillas (floret stalks) are generally obvious and used in identification.



Elymus albicans, Side view

Photo by Jose Hernandez@USDA-NRCS PLANTS Database

QUIZ # 3

How many seeds can a wheatgrass produce in a year?

1. 3000
2. 5000
3. 30,000
4. This is a trick question, grasses do not have seeds!

Family Poaceae: Grass family
Subfamily: Panicoideae

Fruit:- grain (caryopsis) enclosed in a single-seeded spikelet or a cluster of spikelets.
-enclosed by hard lemma and palea and an outer papery sterile lemma and sometimes small leathery/papery glumes.
- tends to be as long as wide

Important Genera: *Andropogon, Cenchrus, Digitaria, Echinochloa, Eriochloa, Panicum, Paspalum, Setaria, Sorghastrum, Sorghum, Zea*

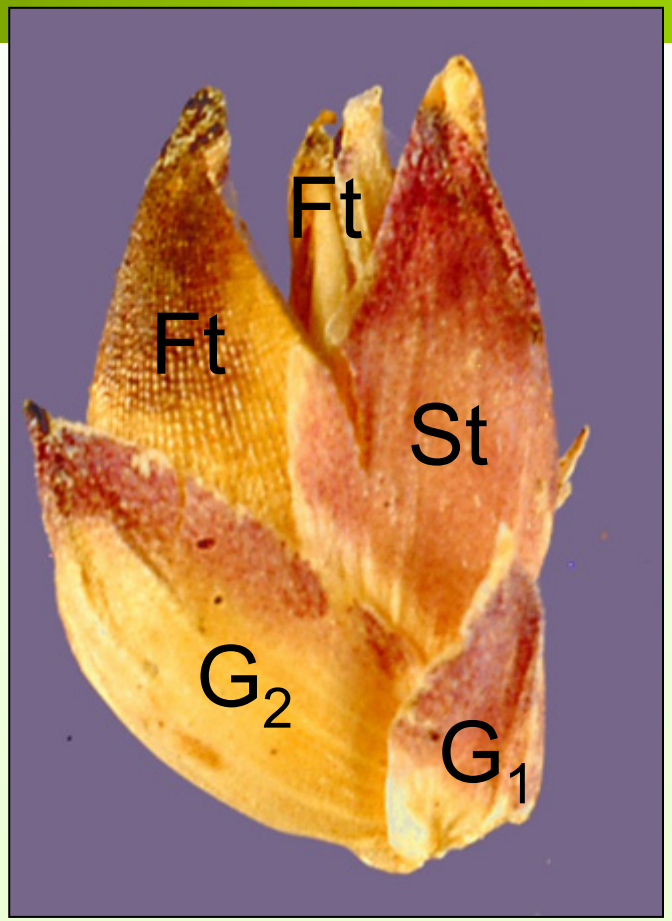
Subfamily Panicoideae (Panic Grass Group)

- **From top to bottom:**

1. ***Ft*** a hard fertile floret(s) above a;
2. ***St*** papery sterile (sometimes staminate) floret;
3. ***G*** two glumes shed with the floret;

– ***G_1*** first glume may be modified;

– rachilla is not obvious.



Setaria nigrirostris, Side view

Photo by Tracey Slotta@USDA-NRCS PLANTS Database

QUIZ # 4

In which grass subfamily can the rachilla be used as an identification aid?

1. Poöideae (Wheatgrass Group)
2. Panicoideae (Panic Grass Group)

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Distinguishing Quackgrass-Wheatgrass species

Canada

Elymus (=Elytrigia) repens (Quackgrass)

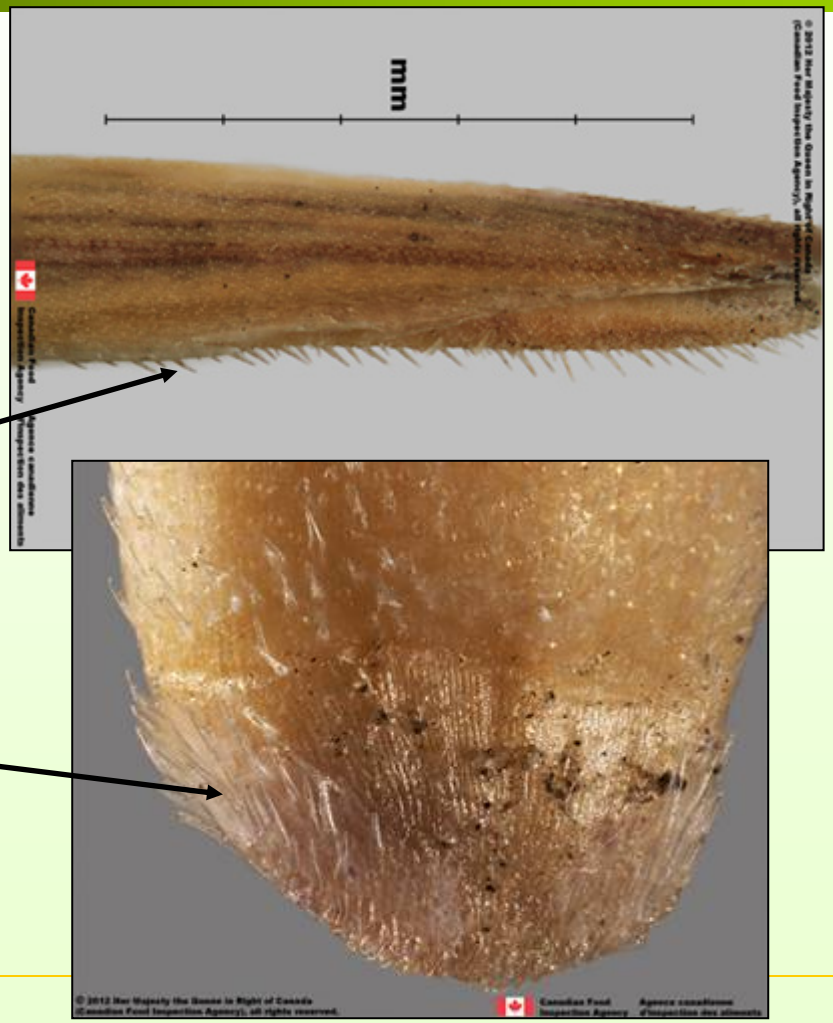
- Quackgrass or Couchgrass was introduced to North America in the early 20th century for forage and erosion control.
- Quackgrass is an effective invader due to strong rhizomes, rapid tillering, and also through release of inhibiting chemicals in the rhizomes.
- A Primary Noxious weed in the *Weeds Seed Order* (2009).

Elymus repens (Quackgrass)

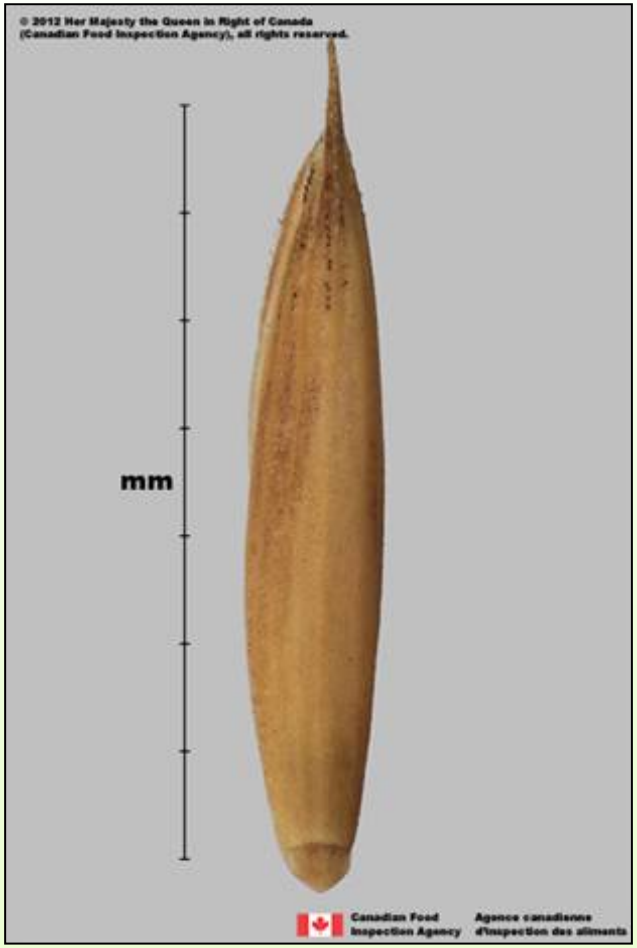
- The size of the floret is 8-10 mm x 1.25 – 2 mm.
- One of the most obvious features are the coarse, widely-spaced palea teeth that look like shark's teeth.
- There is also a shiny bump on the lemma above the callus.
- The rachilla is smooth or with short hairs; it is parallel-sided and flattened to palea from a U-shaped sinus.

Pascopyrum smithii (Western Wheatgrass)

- The floret is: 8.0 -10.0 mm x 1.25 – 2.0 mm. Is a pale colour with the dark grain often visible
- The palea is covered in fine hairs and is scurfy with a groove down the middle
- The distinctive palea teeth are mixed long and short; close together
- The rachilla is conical; protrudes and covered in short hairs, from a V-shaped sinus
- The back of the callus has 2 lines of hairs, hairless in middle.
- A deep groove between the callus and the lemma looks like a fingernail mark

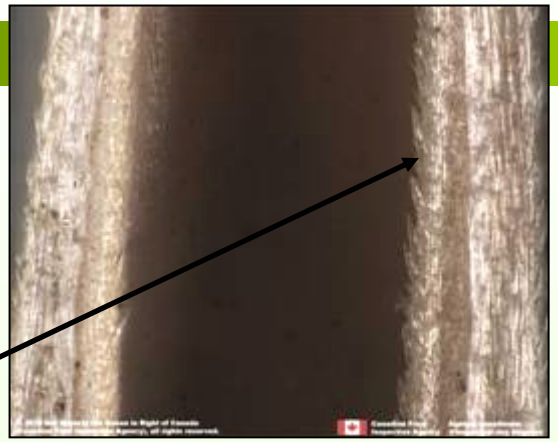


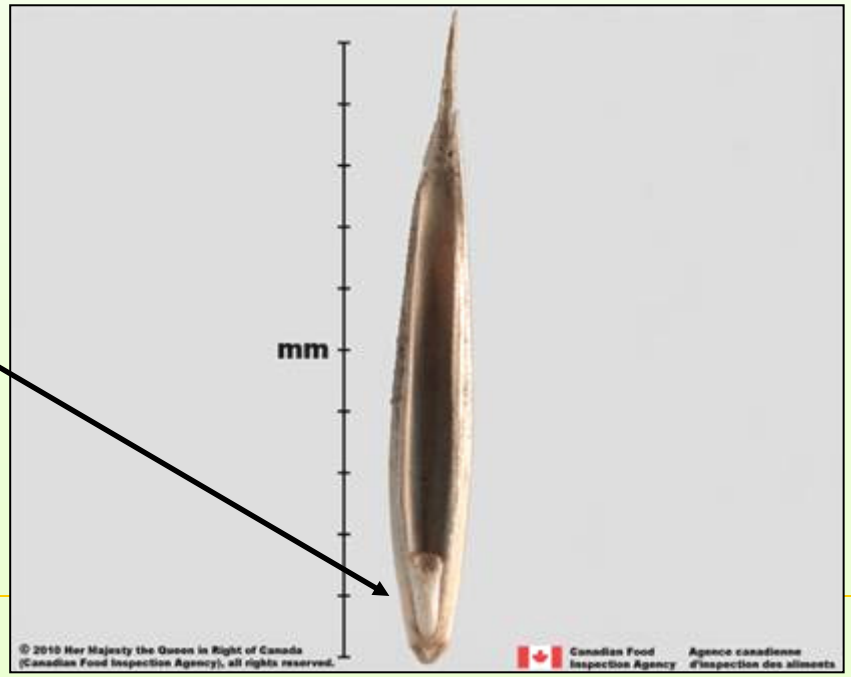
Pascopyrum smithii (Western Wheatgrass)



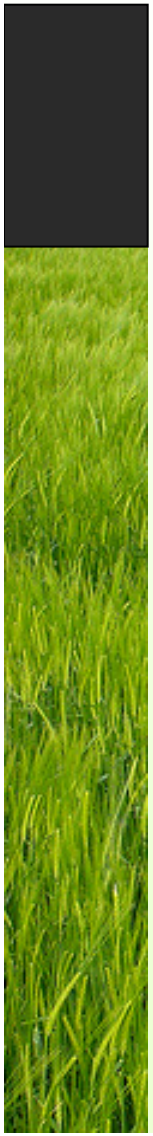
Elymus trachycaulus (Slender Wheatgrass)

- The floret is: 8.0-10.0 mm x 1.25 – 2.0 mm and overall slender-looking, asymmetrical, with a slight twist.
- Fluoresces under UV light.
- The palea is smooth except for fine hairs near the top. The teeth along the edge are fine and close together.
- The rachilla is slightly conical with long hairs and comes from a V-shaped sinus.
- A line of hairs extends across the back of the callus and is pointed at the base; slight bump on lemma above





Comparison of Wheatgrasses



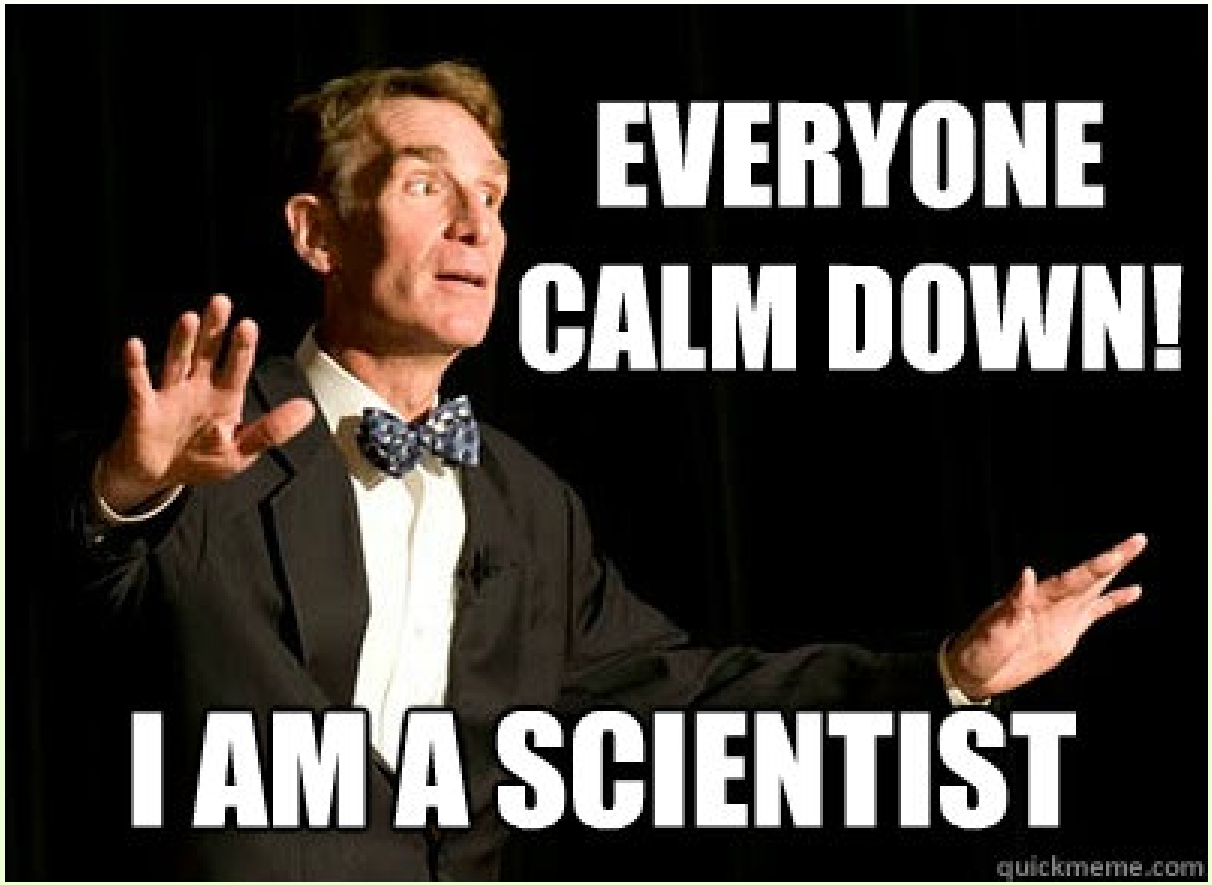
	Quackgrass *(Elymus repens)*	Western wheatgrass *(Pascopyrum smithii)*	Slender wheatgrass *(Elymus trachycaulus)*
***Rachilla**	• Lies flat against palea, • sides parallel or slightly • divergent, smooth	• Stands away from palea, sides divergent, flares out towards top	• Sides divergent • long hairy
Sinus	• U-shaped	• V-shaped	• V-shaped
Palea	• Slight ridge down centre	• Scurfy, slight groove down centre, dark grain	• Slight groove down centre
***Palea Teeth**	• Coarse and widely-spaced	• Long and short mixed, close together	• Fine and regular, close together
***Lemma**	• Distinctive bulge above base; often slightly keeled just above bulge, smooth and shiny	• Sharp indentation above base; never keeled above indentation, pale	• Slight bulge above base, pointed at base, slender looking
Callus	• No hairs across callus	• Line of hairs with break in middle	• Line of hairs across callus

QUIZ # 5

Which species is this?

1. Slender wheatgrass
2. Quackgrass
3. Western wheatgrass

Why are there so many scientific names for the same plant?



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Distinguishing Selected Foxtail species

Canada

Setaria faberi (Giant foxtail)

- **Giant foxtail spikelets:**
  - outer covering extends ¾ to the top;
  - 2.5 mm long by 1.5 – 2.0 mm wide;
  - floret egg-shaped with a wide pointed tip;
  - top has a distinct hump towards the base;
  - bottom has 2 shiny crescents along the outside.

Setaria faberi, Giant foxtail floret

Setaria italica subsp. *viridis* (Green foxtail)

- **Green foxtail spikelets:**
  - outer covering extends to the top;
  - 1.75 mm long by 1.0 mm wide;
  - floret elliptical-shaped with a wide pointed tip;
  - profile is evenly arched;
  - bottom has 2 shiny crescents along the outside.

Setaria italica subsp. viridis, Green foxtail floret

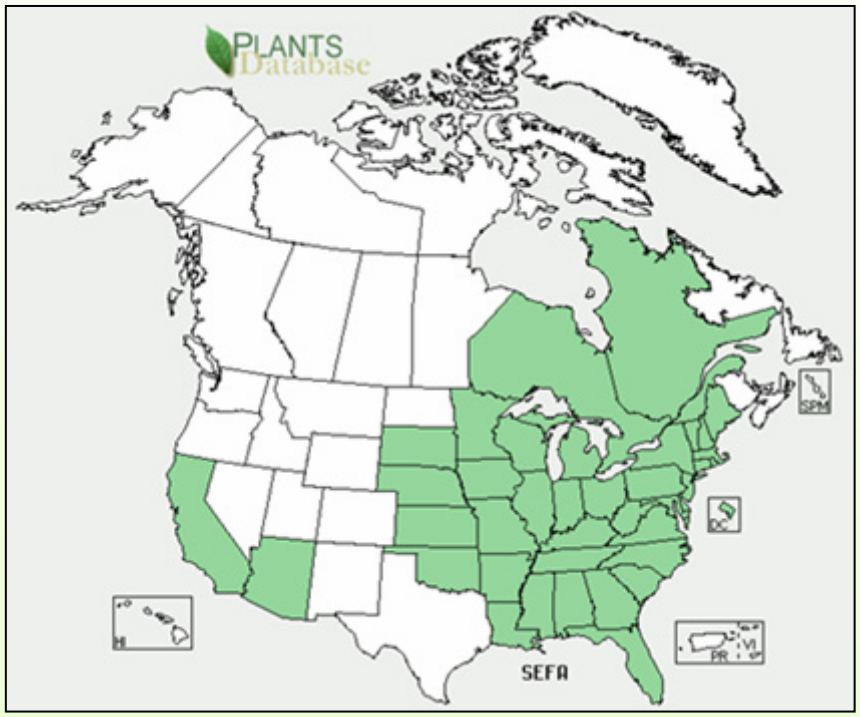
Setaria pumila (Yellow foxtail)

- **Yellow foxtail spikelets:**
  - outer covering extends ½ way to the top;
  - 3.0 mm long by 2.0 mm wide;
  - floret wide elliptical shaped with a wide pointed tip;
  - profile shows a distinct hump in the middle;
  - bottom does not have 2 shiny crescents.

Setaria pumila Yellow foxtail floret

Giant Foxtail Distribution

- **Giant foxtail (*Setaria faberi*):**
  - Annual;
  - Native to eastern Asia;
  - Introduced in the 1920's;
  - Competitive with corn.



Map from USDA-NRCS PLANTS Database

Comparison of Foxtails

	Giant foxtail *(Setaria faberi)*	Yellow foxtail *(Setaria pumila)*	Green foxtail *(Setaria italica subsp. viridis)*
2nd (Upper) Glume	• ½ - ¾ the length of the lemma	• ½ the length of the lemma	• covers the lemma
***Lemma**	• transverse ridges diminish at the tip	• transverse ridges remain thick at the tip • 3-pronged awn	• thin ridges form a grid pattern
***Palea**	• glossy edges exposed	• glossy edges covered	• glossy edges exposed
Notes	• wide ovate (egg) shape, strong dip at the palea tip • S-shaped profile • 2.5 X 1.5 mm	• wide elliptical shape • 3.0 X 2.0 mm • humped profile	• narrow elliptical shape • 1.75 X 1.0 mm • evenly arched profile • mottling

QUIZ # 6

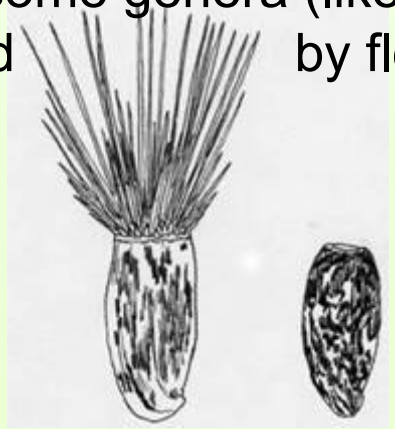
Which foxtail is this?

1. Yellow foxtail
2. Green foxtail
3. Giant foxtail

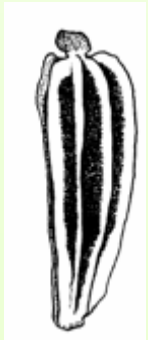
Family Asteraceae: Aster family

a.k.a. Compositae

- **Fruit:** an achene, a dry single seeded fruit that does not split open
- **Shape**: longer than wide, straight or curved, cylindrical to flattened
- **Surface:** woody texture, usually ribbed, occasionally shiny, often topped by a pappus.
- 2 attachment points: top has a peg + pappus, bottom has a ring or notch
- **Seed:** enclosed in achene, with a very thin seed coat.
- **Note:** some genera (like knapweeds) have dissimilar achenes produced by florets in the same flower head.



Centaurea solstitialis



Leucanthemum vulgare

Tripleurospermum maritimum

QUIZ # 7

How many attachment points on the Asteraceae achene can be used for identification?

1. One
2. None
3. Two

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Distinguishing Selected Thistle species

Canada

Thistle species

Nodding thistle (*Carduus nutans*)

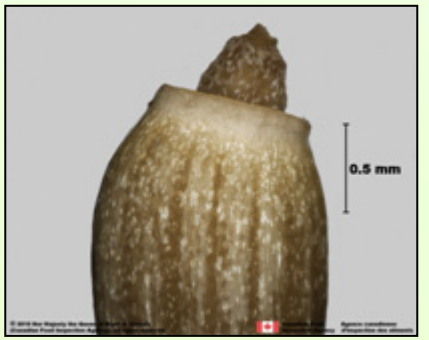
Plumeless thistle (*Carduus acanthoides*)

Bull thistle (*Cirsium vulgare*)

Nodding thistle (*Carduus nutans*):

- **The fruits of Nodding thistle (*Carduus nutans*):**
  - 4.0 mm long,1.5 mm wide;
  - rectangular and slightly flattened,
  - **glossy surface, looks like varnish;**
  - golden colour, base is yellow, may also be yellow band under collar;
  - **transverse waves and longitudinal lines;**
  - wide and short top peg.

Nodding thistle (*Carduus nutans*) achene



Nodding thistle (*Carduus nutans*) achenes and top view

Canada thistle (*Cirsium arvense*):

- **Canada thistle (*Cirsium arvense*):**
  - 3.0 mm long and 1.0 mm wide;
  - flattened rectangular;
  - **glossy-woody surface**;
  - dark golden;
  - **faint long lines on surface**;
  - small, thin top peg.

Canada thistle (*Cirsium arvense)* achenes

Plumeless thistle (*Cirsium acanthoides*):

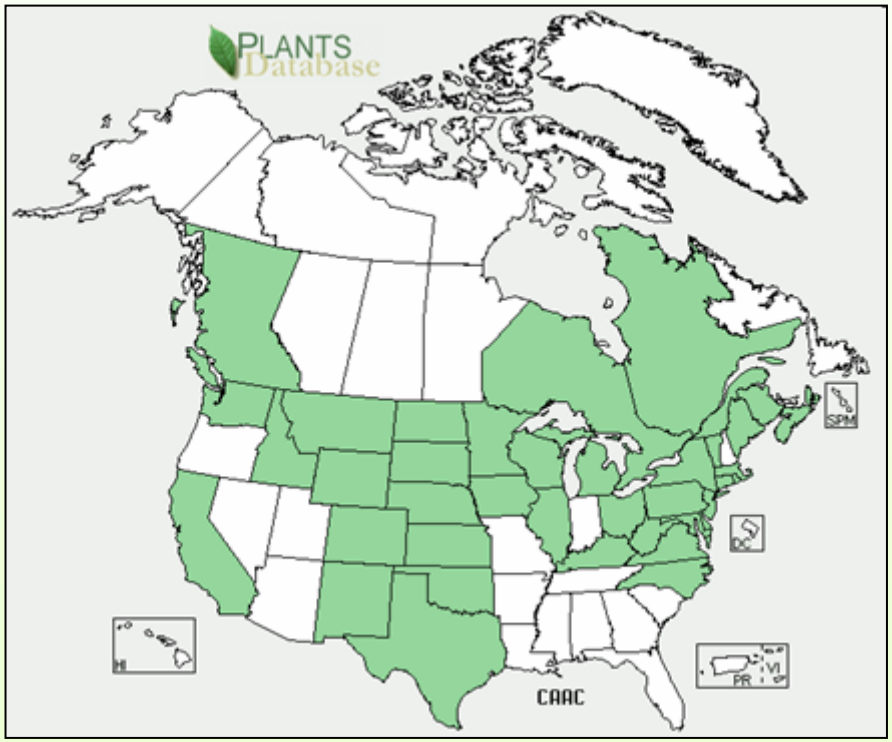
- **Plumeless thistle (*Cirsium acanthoides*):**
  - 3.0 – 4.0 mm long and 1.5 mm wide;
  - rectangular and slightly flattened, can be a small hump to one side of collar;
  - glossy surface;
  - pale pinkish to golden;
  - transverse wrinkles on surface;
  - collar is pale or bright yellow.

Bull thistle (*Cirsium vulgare)*

- **Bull thistle (*Cirsium vulgare*):**
  - 4.0 – 4.5 mm long and 1.5 – 2.0 mm wide;
  - flattened rectangular, humped on one side of collar;
  - glossy-woody surface;
  - pale to dark golden with purple streaking;
  - collar is pale;
  - small top peg.

Asteraceae distribution

- **Plumeless thistle (*Cirsium acanthoides*):**



Map from USDA-NRCS PLANTS Database

Comparison of Thistles

Species	*Surface texture	Width of top peg	*Colour	Collar colour
Nodding thistle	smooth wrinkled	wide	golden, base is bright yellow	golden, same as base colour
Canada thistle	fibrous, wood grain	narrow	dark golden	paler than rest of fruit
Plumeless thistle	wrinkled	wide	pale; pinkish to golden	yellowish
Bull thistle	smooth, fibrous	narrow	straw-coloured with purple streaks	paler than rest of fruit