

# SEED CONTAMINANTS OF IMPORTED SPICES

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Plant Safeguarding and Pest Identification  
National Identification Services



Information on contaminants was collected from the PestID database on seed importations of the following spices:

- **cumin** – *Cuminum cyminum* (Apiaceae)
- **black-cumin** – *Nigella sativa* (Ranunculaceae)
- **oregano** – *Origanum vulgare* (Lamiaceae)
- **rosemary** – *Rosmarinus officinalis* (Lamiaceae)
- **sage** – *Salvia officinalis* (Lamiaceae)
- **perilla** – *Perilla frutescens* (Lamiaceae)
- **mint** – *Mentha* spp. (Lamiaceae)
- **thyme** – *Thymus vulgaris* (Lamiaceae)
- **dill** – *Anethum graveolens* (Apiaceae)
- **coriander** – *Coriandrum sativum* (Apiaceae)
- **basil** – *Ocimum basilicum* (Lamiaceae)
- **fenugreek** – *Trigonella foenum-graecum* (Fabaceae)
- **poppy seed** – *Papaver somniferum* (Papaveraceae)
- **anise** – *Pimpinella anisum* (Apiaceae)
- **caraway** – *Carum carvi* (Apiaceae)
- **celery seed** – *Apium graveolens* (Apiaceae)
- **fennel** – *Foeniculum vulgare* (Apiaceae)

# Seeds of Spices



Perilla

Dill

Caraway

Coriander

Fennel

Mint



Spearmint

Basil

Poppy seed

Rosemary

Cumin

Anise



Black cumin

Celery seed

Fenugreek

Sage

Thyme

Oregano

# Countries of Origin

Most of the shipments in this study came from **India**. Other countries with numerous shipments include India's neighbor **Pakistan**; the Middle Eastern countries of **Turkey, Iran, Syrian Arab Republic, and Egypt**; and **Mexico**.

Other origins of spices include:

- **Asia:** China, Singapore, Sri Lanka, Thailand, Malaysia, Bangladesh, Hong Kong, Nepal, Indonesia, Taiwan, Japan, Myanmar, Uzbekistan
- **Middle East:** Morocco, Lebanon, Saudi Arabia, United Arab Emirates, Israel, Jordan, Kuwait, Afghanistan, Bahrain, Cyprus
- **Europe:** Netherlands, Greece, Italy, United Kingdom, Germany, France, Bulgaria, Hungary, Spain, Belgium, Albania, Czech Republic
- **Africa:** Kenya, Ethiopia, South Africa, Nigeria, Tunisia, Tanzania, Eritrea, Togo, Zambia
- **New World:** Peru, Guatemala, Trinidad and Tobago, Canada, Venezuela, Ecuador, Jamaica, Brazil, El Salvador, Belize
- Also, Australia and the Pacific Island nation of Fiji

# Federal Noxious Weed Seed Contaminants of Imported Spice Seed

The most commonly intercepted Federal noxious weed seeds in spice seed shipments are:

- *Asphodelus fistulosus* (Liliaceae)
- *Cuscuta* spp. (Convolvulaceae)

Other noxious weed seeds found include:

- *Alternanthera sessilis* (Amaranthaceae)
- *Heracleum mantegazzianum* (Apiaceae)
- *Crupina vulgaris* (Asteraceae)
- *Ipomoea aquatica* (Convolvulaceae)
- *Avena sterilis* (Poaceae)
- *Oryza* sp., red rice (Poaceae)
- *Paspalum scrobiculatum* (Poaceae)
- *Urochloa panicoides* (Poaceae)
- *Emex spinosa* (Polygonaceae)
- *Solanum torvum* (Solanaceae)

# *Asphodelus fistulosus*

OAK 002177a  
Tent. ID: *Asphodelus fistulosus*  
Det: Arthur Berlowitz  
Host: *Cuminum cyminum*  
Origin: India  
Date: 29-June-2006  
Coll: Doug Wong



typically  
colored  
seeds:



*Asphodelus fistulosus* L. - white seeded variant

# *Cuscuta* spp.

*C. australis*



*C. chinensis*



# *Alternanthera sessilis*

fruit:

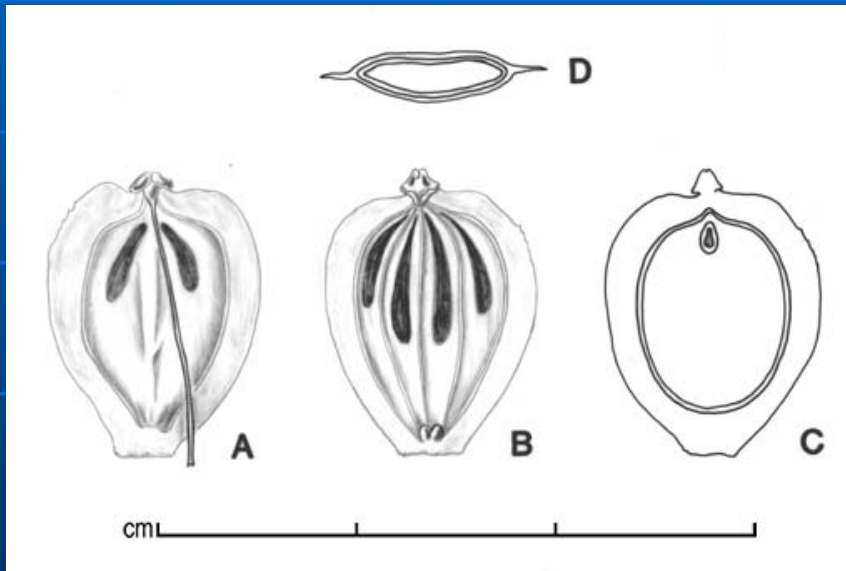


seed:

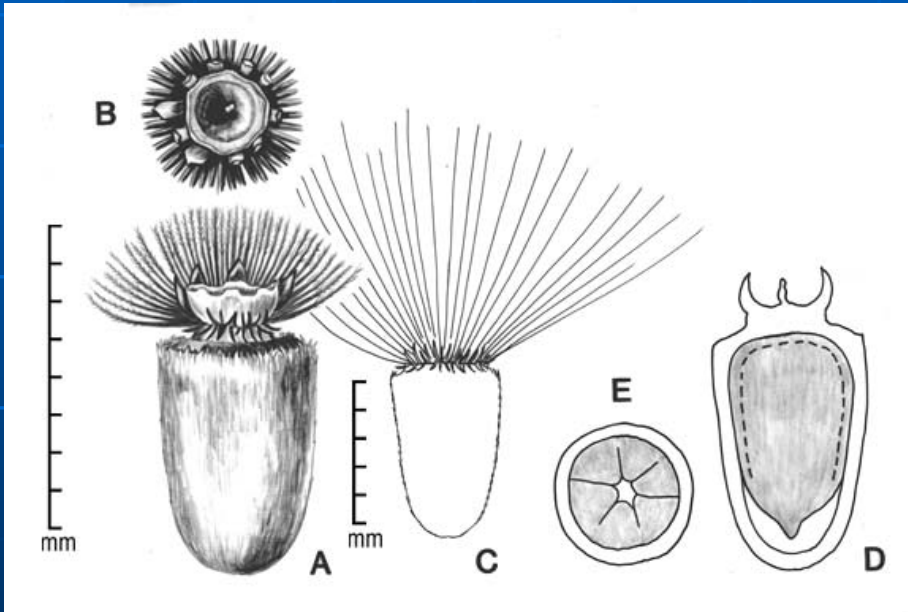




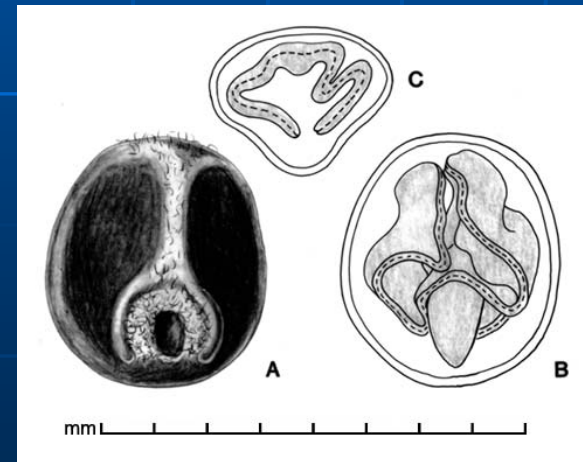
# *Heracleum mantegazzianum*



# *Crupina vulgaris*



# *Ipomoea aquatica*



# *Avena sterilis*



# *Oryza* sp., red rice



*O. longistaminata*



*O. rufipogon*

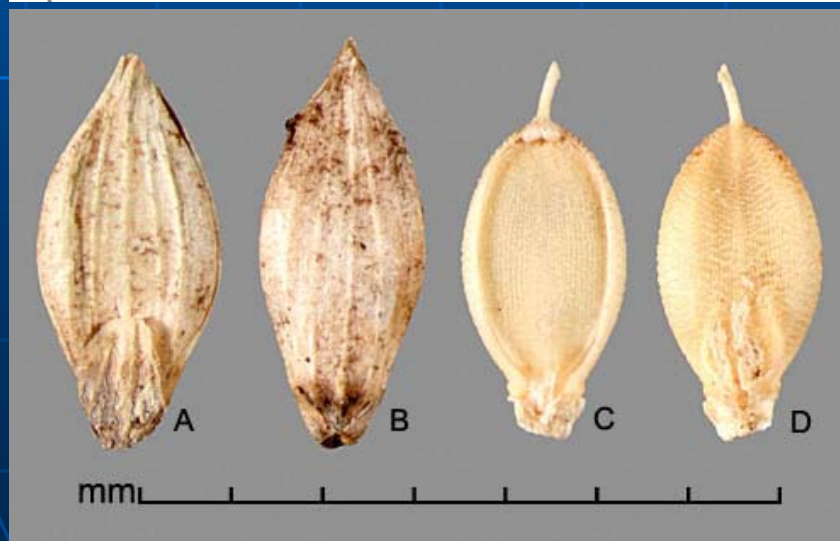
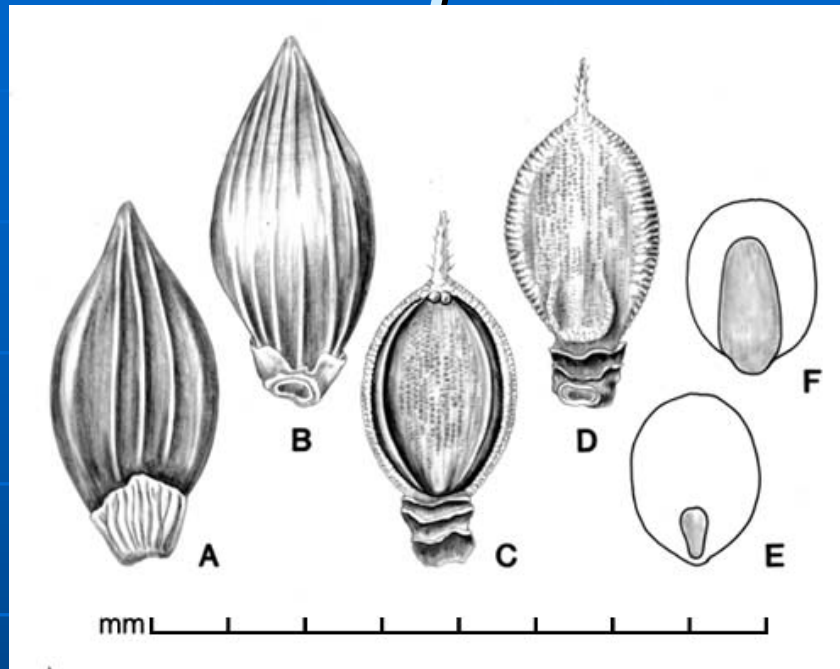


*O. rufipogon*, grains

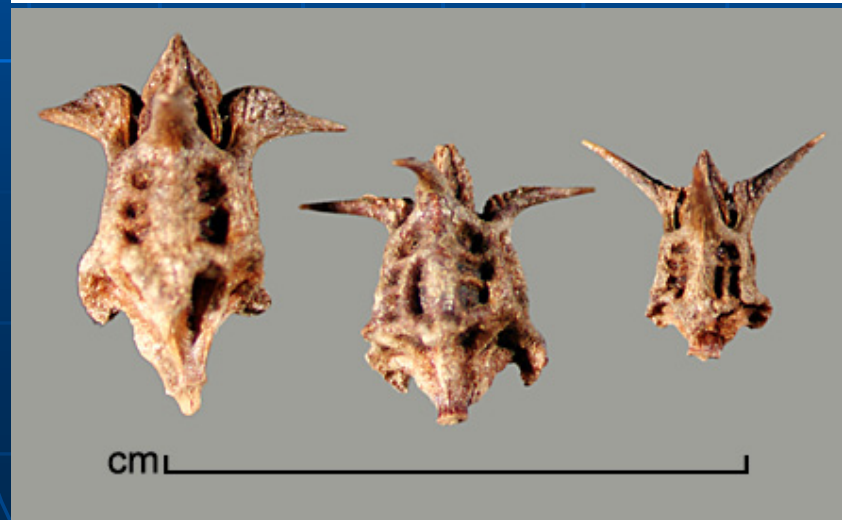
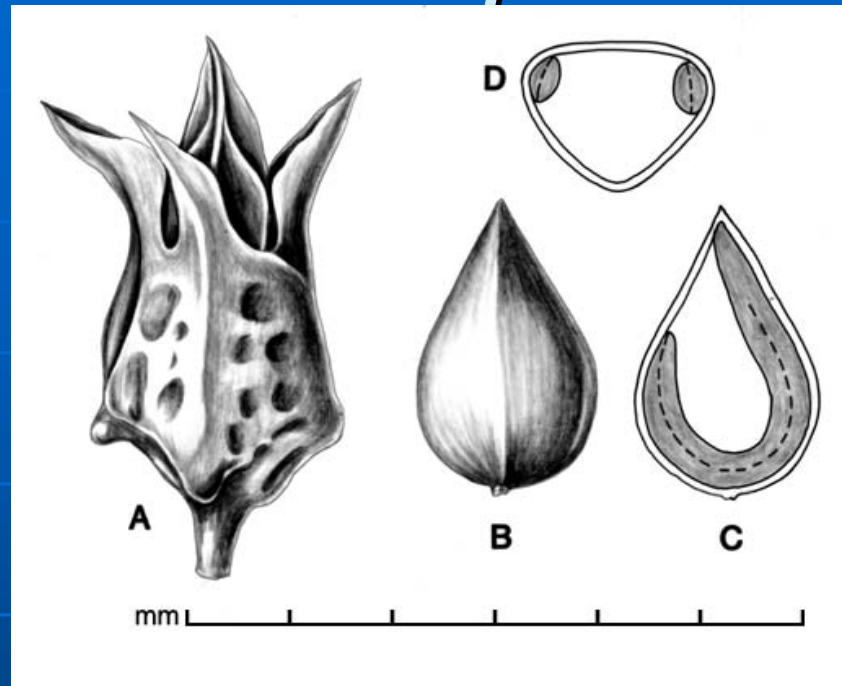
# *Paspalum scrobiculatum*



# *Urochloa panicoides*



# *Emex spinosa*

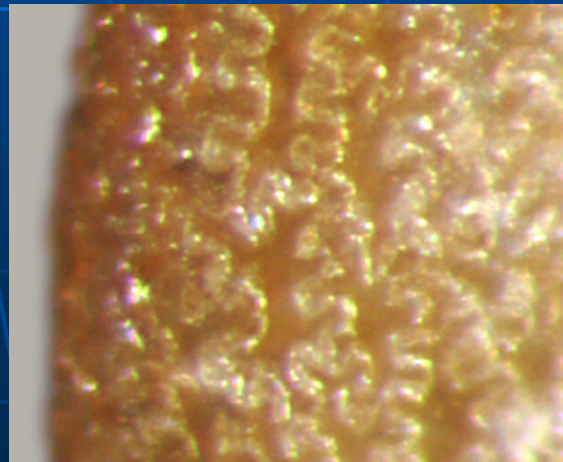




# *Solanum torvum*



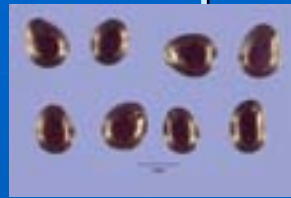
Detail of seed  
coat texture:



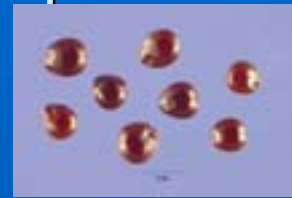
# Non-Federal Noxious Weed Seed Contaminants of Imported Spice Seed

## AMARANTHACEAE

- *Amaranthus* sp.
- *Digera arvensis*



*Amaranthus hybridus*



*A. palmeri*



*Digera arvensis*

## APIACEAE

- *Biflora* sp.
- *Caucalis* sp.
- *Scandix* sp.
- *Torilis* sp.
- *Turgenia* sp.



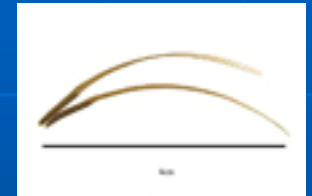
*Biflora testiculata*



*Caucalis microcarpa*



*Scandix pecten-veneris*



*S. pecten-veneris*



*Torilis arvensis*



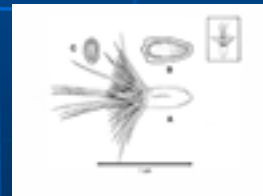
*Turgenia latifolia*

## ASTERACEAE

- *Carthamus* sp.
- *Centaurea depressa*
- *C. melitensis*
- *Lactuca* sp.
- *Sonchus* sp.
- *S. asper*



*Carthamus lanatus*



*Centaurea depressa*



*C. melitensis*



*Lactuca canadensis*



*L. serriola*



*Sonchus asper*



*S. oleraceus*

# Non-Federal Noxious Weed Seed Contaminants (Cont.)

## BORAGINACEAE

- *Anchusa* sp.
- *Asperugo* sp.
- *Buglossoides arvensis*
- *Heliotropium* sp.
- *Trichodesma* sp.



*Anchusa officinalis*



*Asperugo procumbens*



*Buglossoides arvensis*



*Heliotropium indicum*



*Trichodesma zeylanicum*

## BRASSICACEAE

- *Brassica juncea*
- *B. rapa*
- *Conringia orientalis*
- *Eruca sativa*
- *Iberis* sp.
- *Lepidium sativum*
- *Neslia paniculata*
- *Sisymbrium* sp.



*Brassica juncea*



*B. rapa*



*Conringia orientalis*



*Eruca sativa*



*Lepidium densiflorum*



*L. sativum*



*Neslia paniculata*



*Sisymbrium altissimum*



*S. irio*

# Non-Federal Noxious Weed Seed Contaminants (Cont.)

## CANNABACEAE

- *Cannabis sativa*



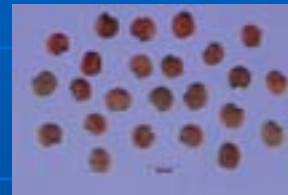
*Cannabis sativa*

## CARYOPHYLLACEAE

- *Agrostemma githago*
- *Arenaria* sp.
- *Gypsophila* sp.
- *Silene conica*
- *Stellaria media*
- *Vaccaria hispanica*



*Agrostemma githago*



*Arenaria serpyllifolia*



*Gypsophila elegans*



*Silene conica*

## CHENOPODIACEAE

- *Atriplex* sp.
- *Chenopodium* sp.



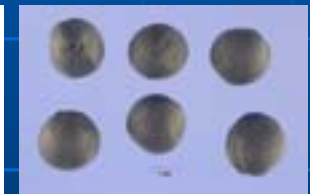
*Silene gallica*



*Stellaria media*



*Stellaria holostea*



*Vaccaria hispanica*

## COMMELINACEAE

- *Commelina* sp.



*Atriplex confertifolia*



*Commelina communis*



*Chenopodium album* *Chenopodium botrys*



# Non-Federal Noxious Weed Seed Contaminants (Cont.)

## CONVOLVULACEAE

- *Convolvulus arvensis*
- *Convolvulus* sp.
- *Ipomoea* sp.
- *I. triloba*



*Convolvulus arvensis*



*C. sepium*



*Ipomoea lacunosa*



*I. triloba*



*Cucumis melo*



*Carex simulata*

## CUCURBITACEAE

- *Cucumis melo*

## CYPERACEAE

- *Carex* sp.



*Euphorbia dracunculoides*



*E. marginata*



*E. prunifolia*

## EUPHORBIACEAE

- *Euphorbia dracunculoides*
- *E. prunifolia*
- *Euphorbia* sp.
- *Phyllanthus maderaspatensis*
- *Phyllanthus* sp.



*P. maderaspatensis*



*P. urinaria*

# Non-Federal Noxious Weed Seed Contaminants (Cont.)

## FABACEAE

- *Astragalus* sp.
- *Coronilla scorpiodes*
- *Coronilla* sp.
- *Crotalaria* sp.
- *Cyamopsis* sp.
- *Glycine max*
- *Medicago lupulina*
- *M. polymorpha*
- *M. sativa*
- *Melilotus indicus*
- *Melilotus* sp.
- *Scorpiurus* sp.
- *Trifolium pratense*
- *Vicia* sp.
- *Vigna* sp.



*Astragalus cicer*



*A. purshii*



*Coronilla scorpiodes*



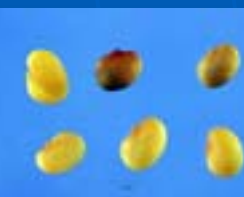
*Crotalaria mucronata*



*Cyamopsis tetragonoloba*



*Glycine max*



*Medicago lupulina*



*Medicago polymorpha*



*Medicago sativa*



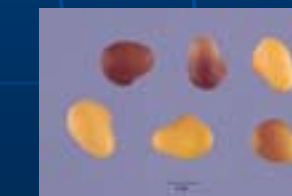
*Melilotus albus*



*Melilotus indicus*



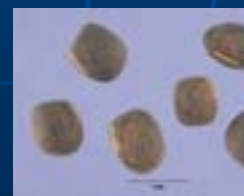
*Scorpiurus muricatus*



*Trifolium pratense*



*Vicia hirsuta*



*Vicia sativa*

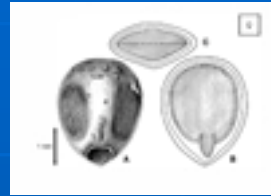


*Vigna radiata*

# Non-Federal Noxious Weed Seed Contaminants (Cont.)

## LAMIACEAE

- *Galeopsis* sp.
- *Lallemantia* sp.
- *Lamium amplexicaule*



*Galeopsis speciosa*



*G. tetrahit*



*Lallemantia iberica*



*Lamium amplexicaule*

## MALVACEAE

- *Lavatera* sp.
- *Malva parviflora*
- *Malva* sp.



*Lavatera assurgentiflora*



*Malva parviflora*



*M. sylvestris*

## PAPAVERACEAE

- *Argemone* sp.
- *Fumaria* sp.



*Argemone hispida*



*Fumaria indica*

## PEDALIACEAE

- *Sesamum indicum*



*Sesamum indicum*

# Non-Federal Noxious Weed Seed Contaminants (Cont.)

## PLANTAGINACEAE

- *Plantago lanceolata*
- *P. psyllium*
- *Plantago* sp.



*P. lanceolata*



*P. psyllium*



*P. aristata*



*P. major*

## POACEAE

- *Aegilops cylindrica*
- *Avena fatua*
- *Brachiaria* sp.
- *Bromus danthoniae*
- *Digitaria* sp.
- *Echinochloa crus-galli*
- *Echinochloa* sp.
- *Eragrostis cilianensis*
- *Festuca rubra*
- *Hordeum* sp.
- *H. vulgare*



*Aegilops cylindrica*



*Avena fatua*



*A. sativa*



*Brachiaria eruciformis*



*Bromus danthoniae*



*Digitaria bicornis*



*Echinochloa crus-galli*



*E. oryzoides*



*Eragrostis cilianensis*



*Festuca rubra*



*Hordeum stebbinsii*



*H. vulgare*



# Non-Federal Noxious Weed Seed Contaminants (Cont.)

## POACEAE (Cont.)

- *Lolium multiflorum*
- *L. persicum*
- *Paspalum* sp.
- *Pennisetum glaucum*
- *Phalaris aquatica*
- *P. minor*
- *P. paradoxa*
- *Poa bulbosa*
- *Setaria pumila*, non-rep.
- *Setaria* sp.
- *Sorghum halepense*
- *Triticum aestivum*
- *Triticum* sp.



*Lolium multiflorum*



*L. persicum*



*Paspalum conjugatum*



*P. notatum*



*Pennisetum glaucum*



*Phalaris aquatica*



*P. minor*



*P. paradoxa*



*Poa bulbosa*



*Setaria pumila*, non-rep.



*S. italica*



*Sorghum halepense*



*Triticum aestivum*

# Non-Federal Noxious Weed Seed Contaminants (Cont.)

## POLYGONACEAE

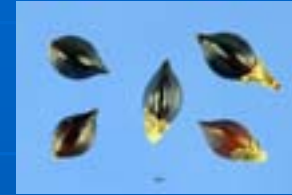
- *Fallopia convolvulus*
- *Polygonum aviculare*
- *Polygonum* sp.
- *Rumex crispus*
- *R. pulcher*
- *Rumex* sp.



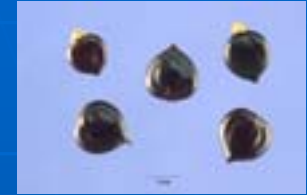
*Fallopia convolvulus*



*Polygonum aviculare*



*P. hydropiperoides*



*P. pensylvanicum*



*Rumex crispus*



*R. obtusifolius*



*R. pulcher*

## PORTULACACEAE

- *Portulaca oleracea*



*Portulaca oleracea*

## PRIMULACEAE

- *Anagallis arvensis*



*Anagallis arvensis*

# Non-Federal Noxious Weed Seed Contaminants (Cont.)

## RANUNCULACEAE

- *Adonis* sp.
- *Delphinium* sp.
- *Ranunculus arvensis*



*Adonis chrysocyathus*



*Delphinium carolinianum*



*Ranunculus arvensis*

## RESEDACEAE

- *Reseda lutea*
- *Reseda* sp.



*Reseda lutea*



*R. luteola*

## ROSACEAE

- *Sanguisorba* sp.



*Sanguisorba minor*



*S. officinalis*

## RUBIACEAE

- *Galium aparine*
- *Galium* sp.



*Galium aparine*



*G. mollugo*

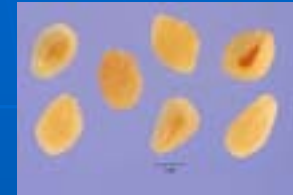
# Non-Federal Noxious Weed Seed Contaminants (Cont.)

## SCROPHULARIACEAE

- *Veronica* sp.



*Veronica agrestis*



*V. persica*

## SOLANACEAE

- *Solanum elaeagnifolium*



*Solanum carolinense*



*S. elaeagnifolium*



*S. nigrum*

## ZYGOPHYLLACEAE

- *Peganum harmala*
- *Tribulus* sp.



*Peganum harmala*



*Tribulus terrestris*

# PHOTO CREDITS

- All images of line drawings are from Gunn, Charles R. and Carole A. Ritchie. 1988. Identification of disseminules listed in the Federal Noxious Weed Act. USDA, Technical Bulletin No. 1719, 331 pp: *Heracleum mantegazzianum*, *Crupina vulgaris*, *Ipomoea aquatica*, *Urochloa panicoides*, *Emex spinosa*, *Centaurea depressa*, *Trichodesma zeylanicum*, *Phyllanthus maderaspatensis*, *Scorpiurus muricatus*, *Galeopsis speciosa*, *Echinochloa oryzoides*
- Kirkbride, J. H., Jr., C. R. Gunn, and M. J. Dallwitz. 2006. Family guide for fruits and seeds, vers. 1.0, URL: <http://nt.ars-grin.gov/sbmlweb/OnlineResources/frsdfam/Index.cfm>. Accessed April 17, 2007: caraway, basil, *Digera arvensis*, *Biflora testiculata*, *Scandix pecten-veneris*, *Eruca sativa*, *Gypsophila elegans*, *Stellaria holostea*, *Chenopodium album*, *Cucumis melo*, *Cyamopsis tetragonoloba*, *Lallemantia iberica*, *Malva sylvestris*, *Argemone hispida*, *Fumaria indica*, *Sesamum indicum*, *Hordeum vulgare*, *Portulaca oleracea*, *Adonis chrysocyathus*, *Delphinium carolinianum*, *Reseda luteola*, *Galium mollugo*, *Peganum harmala*
- Scher, Julie. Federal Noxious Weed Disseminules of the U.S. (Lucid v. 2 and 3.2), USDA, APHIS, PPQ, CPHST and the California Department of Food and Agriculture. Accessed April 20, 2007. <http://www.lucidcentral.org/keys/FNWX/>: *Cuscuta australis*, *C. chinensis*, *Alternanthera sessilis* (fruit and seed), *Heracleum mantegazzianum*, *Crupina vulgaris*, *Ipomoea aquatica* (2X), *Oryza longistaminata*, *O. rufipogon* (2X), *Paspalum scrobiculatum* (4X), *Urochloa panicoides*, *Emex spinosa*, *Solanum torvum* (2X)
- USDA, NRCS. 2007. The PLANTS Database (<http://plants.usda.gov>, 19 April 2007), National Plant Data Center, Baton Rouge, LA 70874-4490 USA.: perilla, dill, coriander, fennel, mint, spearmint, poppy seed, rosemary, *Amaranthus hybridus*, *A. palmeri*, *Scandix pecten-veneris*, *Torilis arvensis*, *Carthamus lanatus*, *Lactuca canadensis*, *L. serriola*, *Sonchus asper*, *S. oleraceus*, *Anchusa officinalis*, *Asperugo procumbens*, *Heliotropium indicum*, *Brassica juncea*, *B. rapa*, *Conringia orientalis*, *Lepidium densiflorum*, *L. sativum*, *Neslia paniculata*, *Sisymbrium altissimum*, *S. irio*, *Cannabis sativa*, *Agrostemma githago*, *Arenaria serpyllifolia*, *Silene conica*, *S. gallica*, *Stellaria media*, *Vaccaria hispanica*, *Atriplex confertifolia*, *Chenopodium botrys*, *Convolvulus arvensis*, *Ipomoea lacunosa*, *Carex simulata*, *Euphorbia marginata*, *Phyllanthus urinaria*, *Astragalus cicer*, *A. purshii*, *Crotalaria mucronata*, *Glycine max*, *Medicago lupulina*, *M. polymorpha*, *M. sativa*, *Melilotus albus*, *M. indicus*, *Trifolium pratense*, *Vicia hirsuta*, *V. sativa*, *Vigna radiata*, *Lamium amplexicaule*, *Lavatera asurgentiflora*, *Plantago lanceolata*, *P. aristata*, *P. major*, *Aegilops cylindrica*, *Avena fatua*, *A. sativa*, *Digitaria bicornis*, *Festuca rubra*, *Hordeum stebbinii*, *Lolium multiflorum*, *L. persicum*, *Paspalum conjugatum*, *P. notatum*, *Phalaris aquatica*, *P. minor*, *Poa bulbosa*, *Setaria pumila*, *S. italica*, *Sorghum halepense*, *Triticum aestivum*, *Polygonum hydropiperoides*, *P. pennsylvanicum*, *Rumex obtusifolius*, *Ranunculus arvensis*, *Sanguisorba minor*, *S. officinalis*, *Galium aparine*, *Veronica agrestis*, *V. persica*, *Solanum carolinense*, *S. elaeagnifolium*, *S. nigrum*, *Tribulus terrestris*
- Rodney W. Young: cumin, anise, black cumin, celery seed, fenugreek, sage, thyme, oregano, *Asphodelus fistulosus* – white seed variant, *Avena sterilis* (2X), *Caucalis microcarpa*, *Turgenia latifolia*, *Centaurea melitensis*, *Buglossoides arvensis*, *Commelina communis*, *Convolvulus sepium*, *Ipomoea triloba*, *Euphorbia dracunculoides*, *E. prunifolia*, *Coronilla scorpiodes*, *Galeopsis tetrahit*, *Malva parviflora*, *Plantago psyllium*, *Bracharia eruciformis*, *Bromus danthoniae*, *Echinochloa crus-galli*, *Eragrostis cilianensis*, *Pennisetum glaucum*, *Phalaris paradoxa*, *Fallopia convolvulus*, *Polygonum aviculare*, *Rumex crispus*, *R. pulcher*, *Anagallis arvensis*, *Reseda lutea*
- Image of *Asphodelus fistulosus* submitted to author for identification from port of Oakland CA