Testing Forest Tree and Shrub Species

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ISTA Seminar on Purity Testing, Zürich
June 15, 2009
1. Importance of purity testing in forestry
2. Identification of the tested species
3. Pure seed definitions
4. PSD 47, 51
5. Winged seeds
6. ???
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Importance of purity testing in forestry

COUNCIL DIRECTIVE 1999/105/EC
of 22 December 1999
on the marketing of forest reproductive material

Annex II
1. Fruit and seed lots of the species … may not be marketed unless the fruit or seed lot reaches a **minimum species purity level of 99 %**.

2. Notwithstanding the provisions of paragraph 1, in the case of closely related species ... the **species purity** of the fruit or seed lot if it does not reach 99 % **shall be stated**.
Importance of purity testing in forestry

COUNCIL DIRECTIVE 1999/105/EC of 22 December 1999 on the marketing of forest reproductive material

Article 14
In the case of seeds, the supplier's label .. shall also include the following additional information, assessed, as far as possible, by internationally accepted techniques:

(a) **purity**: the percentage by weight of pure seed, other seed and inert matter of the product marketed as a seed lot;

.....
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Identification of the tested species

High variability (diversity) in colour, size and shape

In most coniferous species after processing, cleaning and dewinging, it is difficult or impossible to identify with certainty the seed species even if the seed sample contains winged seeds. 
*Abies, Pinus, Picea, Larix ...*

In broadleaves – seedlots can contain a mixture of different species (mixed stands) 
*Quercus (Q. robur, Q. petraea, Q. daleschampii...)*
Abies grandis
Abies koreana
Quercus petraea

Quercus robur
Only the **genus** name of tested seeds of forest tree species is reported on the certificate according the ISTA Rules.

Even if on the **master certificate** the tree **species** is reported - the purity analysis result can be based only on **laboratory evidence**

**Future solution - software with an database of images ??**
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20 PSDs = 70 tree and shrub genus (Table 2)

PSD 10 Aesculus, Cydonia, Euonymus, Ginkgo, Koelreuteria, Ligustrum, Malus, Pyrus, Sorbus
PSD 11 Caragana, Gleditsia, Juniperus, Laburnum, Robinia, Spartium, Taxodium
PSD 12 Populus, Salix
PSD 16 Malva
PSD 20 Sophora (Styphonolobium)
PSD 22 Amorpha
PSD 47 Picea, Pinus
PSD 48 Catalpa, Cedrella, Liquidambar, Syringa
PSD 49 Calocedrus, Chamaecyparis, Cryptomeria, Cupressus, Sequoia, Sequoiadendron, Thuja (Platycladus)
PSD 50 Acacia, Cytisus, Mahonia, Taxus
PSD 51 Abies, Cedrus, Larix, Pinus palustris, P. rigida, Pseudotsuga, Tsuga
PSD 52 Acer, Ailanthus, Fraxinus, Liriodendron, Ulmus
PSD 53 Alnus, Betula
PSD 54 Tectona
PSD 55 Cornus, Viburnum
PSD 56 Cotoneaster, Crataegus, Ilex, Prunus
PSD 57 Carpinus, Castanea, Corylus, Eleagnus, Fagus, Morus, Nothofagus, Quercus, Rosa, Tilia
PSD 58 Platanus
PSD 59 Zelkova
PSD 60 Eucalyptus
PSD 10 Aesculus, Cydonia, Euonymus, Ginkgo, Koelreuteria, Ligustrum, Malus, Pyrus, Sorbus

Seed, with or without testa.

Piece of seed larger than one-half the original size, with or without testa.

Ginkgo

Sorbus
PSD 11 *Juniperus, Taxodium*

Seed, provided a portion of the testa is attached.

Seeds and pieces of seed entirely without testa are regarded as inert matter.

Piece of seed larger …
PSD 48 **Catalpa, Cedrella, Liquidambar, Syringa**

Seed, with or without wing(s), unless it is obvious that no embryo is present, with or without testa.

Piece of seed larger than one-half original size…

**Catalpa**
PSD 52 Acer, Ailanthus, Fraxinus, Liriodendron, Ulmus

Samara (winged fruit), with or without wing(s).

Piece of samara larger … Seed with the pericarp /testa…

Fraxinus

Acer
PSD 53 *Alnus, Betula*

Samara (winged fruit), with or without wing(s), with or without attached styles.

Piece of samara larger … Seed with the pericarp /testa…

*Alnus*  

*Betula*
PSD 57 *Carpinus, Castanea, Corylus, Eleagnus, Fagus, Morus, Nothofagus, Quercus, Rosa, Tilia*

Nut, unless it is obvious that no seed is present.

Piece of nut larger … Seed with the pericarp /testa…

*Carpinus*  
*Tilia*

*Quercus*
**PSD 50 Acacia, Cytisus, Mahonia, Taxus**

Seed, provided a portion of the testa is attached, with or without aril.

Piece of seed larger …

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*Taxus*

D.G.W. Edwards
33 Families - 6 conifers, 24 broadleaves

PSD 10 Hippocastanaceae, Celastaceae, Ginkgoaceae, Malvaceae, Sapinaceae, Oleaceae, Rosaceae
PSD 11 Fabaceae, Cupressaceae, Taxodiaceae
PSD 12 Salicaceae
PSD 16 Malvaceae
PSD 20 Fabaceae
PSD 22 Fabaceae
PSD 47 Pinaceae
PSD 48 Bignoniaceae, Hammamelidaceae, Oleace
PSD 49 Cupressaceae, Taxodiaceae
PSD 50 Fabaceae, Taxaceae
PSD 51 Pinaceae
PSD 52 Aceraceae, Simaroubaceae, Oleaceae, Magnoliaceae, Ulmaceae
PSD 53 Betulaceae
PSD 54 Verbenaceae
PSD 55 Cornaceae, Adoxaceae
PSD 56 Rosaceae
PSD 57 Betulaceae, Fabaceae, Eleagnaceae, Fagaceae, Moraceae, Tiliaceae
PSD 58 Platanaceae
PSD 59 Ulmaceae
PSD 60 Myrtaceae
8 PSD cover species from > one family

PSD 10 Hippocastanaceae, Celastaceae, Ginkgoaceae, Malvaceae, Sapinaceae, Oleaceae, Rosaceae
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PSD 52 Aceraceae, Simaroubaceae, Oleaceae, Magnoliaceae, Ulmaceae
PSD 53 Betulaceae
PSD 55 Cornaceae, Adoxaceae
PSD 56 Rosaceae
PSD 57 Betulaceae, Fabaceae, Eleagnaceae, Fagaceae, Moraceae, Tiliaceae
PSD 58 Platanaceae
PSD 59 Ulmaceae
PSD 60 Myrtaceae
Species from 8 families belong to > one PSD

Betulaceae PSD 53, 57
Cupressaceae PSD 11, 49
Fabaceae PSD 11, 20, 22, 50, 57
Oleaceae PSD 10, 48, 52
Pinaceae PSD 47, 51 (*Pinus*)
Rosaceae PSD 10, 56
Taxodiaceae PSD 11, 49
Ulmaceae PSD 52, 59
1. Importance of purity testing in forestry
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**PSD 47 Picea, Pinus**
Seed, **without wing or integument**, provided a portion of the testa is attached.
Piece of seed larger than one-half the original size, **without wing or integument**, provided a portion of the testa is attached.

**PSD 51 Abies, Cedrus, Larix, Pinus palustris, P. rigida, Pseudotsuga, Tsuga**
Seed, **without wing, with** (but occasionally without) **integument**, provided a part of the testa is attached.
Piece of seed larger than one-half the original size, **without wing, with** (but occasionally without) **integument**, provided a portion of the testa is attached.

**Why are Pinus species in PSD 47 and 51?**
PSD 47 *Pinus*

N.B. – integument *is not* intimately associated with the seed and is usually removed in processing…

PSD 51 *Pinus palustris, P. rigida*

N.B. - integument *is intimately associated* with the seed and is rarely removed in processing…

Glossary

*Integument* – the envelope or an ovule which becomes the seed coat or testa (generally two integuments present. *In coniferous seeds integument also refers to the tissue attaching the wing to the seed.*
Seed, without wing or integument

integument = the tissue attaching the wing to the seed
**Pinus palustris**

Seed, **without wing, with (but occasionally without) integument**, provided a part of the testa is attached.
*Pinus palustris*

Seed, *without wing, with (but occasionally without) integument*, provided a part of the testa is attached.
Pinus rigida

No wing or integument

Seed, without wing, with (but occasionally without) integument, provided a part of the testa is attached.
PSD 47 *Pinus*

N.B. – integument *is not* intimately associated with the seed and is usually removed in processing

PSD 51 *Pinus palustris, P. rigida*

N.B. - integument *is intimately associated* with the seed and is rarely removed in processing

**REVISION ???: Change in seed de-winging?**
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Picea abies

Abies magnifica

Abies amabilis

inert matter

pure seeds

WINGED seeds

D.G.W. Edwards
PSD 47
N.B. ‘Integument’ refers to the tissue attaching the wing to the seed. In *Pinaceae*, with this definition, the integument is not intimately associated with the seed and is usually removed in processing, thus removing the wing. However, if an integument (with or without wing) is still attached to any seed during the purity analysis such seed will be regarded as ‘winged seed’ and must be left intact - neither the integument nor wing should be deliberately removed. **Winged seed** (i.e. seed with an attached integument with or without wing of any size) must be weighed and reported as a separate percentage from ‘pure seed’ according to paragraph 3.5.2.9 and 3.7. After weighing, the winged seed and pure seed fractions should be recombined and used in representative proportions for counting out the germination replicates.

PSD 51
N.B. ‘Integument’ refers to the tissue attaching the wing to the seed. In *Pinaceae*, with this definition, the integument is fused to the seed, is rarely removed in processing, and is impossible to consistently remove, without causing damage. Hence, seed with integument is considered to be ‘pure seed’. **Winged seed** (i.e. seed with an integument plus wing still attached) must be weighed and reported as a separate percentage from ‘pure seed’ according to paragraphs 3.5.2.9 and 3.7. After weighing, the winged seed and pure seed fractions should be recombined and used in representative proportions for counting out the germination replicates.
PSD 47
N.B…. the integument is not intimately associated with the seed and is usually removed in processing, thus removing the wing. However, if an integument (with or without wing) is still attached to any seed during the purity analysis such seed will be regarded as ‘winged seed’ and must be left intact - neither the integument nor wing should be deliberately removed. Winged seed (i.e. seed with an attached integument with or without wing of any size) …

PSD 51
N.B. …the integument is fused to the seed, is rarely removed in processing, and is impossible to consistently remove, without causing damage. Hence, seed with integument is considered to be ‘pure seed’. Winged seed (i.e. seed with an integument plus wing still attached) …

Simplification and clarification is needed
PSD 47
N.B…. the integument is not intimately associated with the seed and is usually removed in processing, thus removing the wing. However, if an integument (with or without wing) is still attached to any seed during the purity analysis such seed will be regarded as ‘winged seed’ and must be left intact - neither the integument nor wing should be deliberately removed. Winged seed (i.e. seed with an attached integument with or without wing of any size) …

PSD 51
N.B.….the integument is fused to the seed, is rarely removed in processing, and is impossible to consistently remove, without causing damage. Hence, seed with integument is considered to be ‘pure seed’. Winged seed (i.e. seed with an integument plus wing still attached) …

Simplification and clarification is needed
e.g.
Glossary

**Integument** – the envelope or an ovule which becomes the seed coat or testa (generally two integuments present. In coniferous seeds integument also refers to the tissue attaching the wing to the seed.

For seeds with PSD 47 the integument is not intimately associated with the seed and is usually removed in processing.
For seeds with PSD 51 the integument is fused to the seed, is rarely removed in processing, and is impossible to consistently remove, without causing damage.
PSD 47
N.B. Winged seed (…) must be weighed and reported as a separate percentage from ‘pure seed’ according to paragraph 3.5.2.9 and 3.7. After weighing, the winged seed and pure seed fractions should be recombined and used in representative proportions for counting out the germination replicates.

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<thead>
<tr>
<th>PSD 47 <em>Picea, Pinus</em></th>
<th>PSD 51 <em>Abies, Cedrus, Larix, Pinus palustris, P. rigida, Pseudotsuga, Tsuga</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PURE seed</strong></td>
<td></td>
</tr>
<tr>
<td>Seed, <em>without</em> wing or integument, provided a portion of the testa is attached.</td>
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<tr>
<td>WING</td>
<td>NO</td>
</tr>
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<td><strong>WINGED seed (PSD – N.B.)</strong></td>
<td></td>
</tr>
<tr>
<td>Seeds with an integument with or without a wing of any size</td>
<td>Seeds with an integument plus wing still attached (of any size???)</td>
</tr>
<tr>
<td>WING</td>
<td>YES</td>
</tr>
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<tr>
<td>WING INTEGUMENT</td>
<td>YES</td>
</tr>
<tr>
<td><strong>WINGED seed (3.5.2.9)</strong></td>
<td></td>
</tr>
<tr>
<td>…retain an integument, either with or without wing or a portion thereof</td>
<td>…retain the wing or a portion thereof</td>
</tr>
<tr>
<td>WING INTEGUMENT</td>
<td>YES</td>
</tr>
<tr>
<td>WING INTEGUMENT</td>
<td>YES</td>
</tr>
</tbody>
</table>
3.5.2.9 Winged seeds
For seeds with PSD 47, winged seeds are those which retain an integument, either with or without wing or a portion there of.
For seed with PSD 51, winged seeds are those which retain the wing or a portion there of.
Whenever present, such appendages must be left attached to the seed and the content of „winged“, seed reported according to 3.7.
3.5.2.9 Winged seeds
For seeds with PSD 47, winged seeds are those which retain an integument, either with or without wing or a portion there of.
For seed with PSD 51, winged seeds are those which retain the wing or a portion there of.
Whenever present, such appendages must be left attached to the seed and the content of „winged„ seed reported according to 3.7.

3.7. Reporting
When winged seed (as defined in pure seed definitions 47 and 51) is found, the percentage of such material must be shown on the ISTA Certificate.
3.5.2.9 Winged seeds
For seeds with PSD 47, winged seeds are those which retain an integument, either with or without wing or a portion there of.
For seed with PSD 51, winged seeds are those which retain the wing or a portion there of.
Whenever present, such appendages must be left attached to the seed and the content of „winged„ seed reported according to 3.7.

3.7. Reporting
When winged seed (as defined in pure seed definitions 47 and 51) is found, the percentage of such material must be shown on the ISTA Certificate. WHERE?

1.5.3 Reporting results
1.5.3.1 Purity
If required by the applicant, seeds with appendages attached must be reported as % seeds with appendages attached.
WHERE to report winged seeds?
## Analysis Results

<table>
<thead>
<tr>
<th>Pure seeds</th>
<th>Other seeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>99.7</td>
<td>0.3</td>
</tr>
</tbody>
</table>

### Pure seeds:
- **Species**: Picea sp.
- **Percent**: 99.7%
- **Other non seed matter**: 0.3%
- **Trace**: Larix

**Pure seeds contain 1.1% winged seeds**

**Dead seeds contain 1% empty seeds**

**TP 20 – 30°C**

**Weight per 1000 seeds: 7.25 g**

**PURE x WINGED SEED**
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Thanks for your kind attention