

Seed Dormancy

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Organic Seed Dormancy

- **Endogenous**

- embryo characteristic prevents germination-epicotyl, hypocotyl, radical



- **Exogenous**

- characteristic of structures - seed coats, fruit walls, including endosperm or perisperm prevents germination

Types of Seed Dormancy

- Physiological
- Morphological
- Morphophysiological
- Physical
- Physical & physiological
- Chemical
- Mechanical



Physiological Dormancy

- **Nondeep**
- **Intermediate**
- **Deep**



Causes of Physiological Dormancy

- Covering restricts oxygen
- Inhibitors in coverings
- Embryo cannot break through physical barrier
- Endosperm restrict embryo growth
- Interaction between embryo and covering
- *Abies alba*, *Castanea sativa*, *Corylus avellana*, *Euonymus europaeus*, *Juglans nigra*, *Juglans regia*, *Juniperus*, *Prunus avium*, *Rhamnus frangula*, *Vaccinium myrtillus*
- *Carpinus* requires warm followed by cold stratification
- *Elaeagnus umbellata*- chemicals shortened prechilling & increase germination



Nondeep Physiological Dormancy

- Germinate over a narrow range of temperatures
- Excised embryos usually grow
- Broken by short periods of prechilling
- Require germination temperature above 15°C
- Broken by chemicals- potassium nitrate, thiourea, kinetin, ethylene, gibberellins
- Light required for germination
- *Arbutus unedo* –can germinate in dark
- *Ulmus glabra*- no prechill
- *Vaccinium*- long period of light required, GA reduces length of light



Intermediate Physiological Dormancy

- Excised embryos will grow
- As much as 6 months prechilling needed
- Gibberellins, kinetin, thiourea can shorten prechilling requirement
- *Acer negundo*, *Acer pseudoplatanus*, *Acer saccharum*, *Corylus avellana*, *Fraxinus americana*, *Fraxinus pennsylvanica*
- *Fagus sylvatica* – ethylene accelerated and increased germination at 15°C, at 5°C chemicals no better than water soak on germination, GA₃ increased germination of unchilled seeds at 15°C, 10 weeks prechill negate chemical effect (Seed Sci 2004, p21-33)

Deep Physiological Dormancy

- Excised embryos do not grow or produce abnormal seedlings (*Prunus will*)
- Long prechill requirement
- Chemicals do not affect germination of intact seeds
- *Sorbus aucuparis* – secondary dormancy induced above 20°C, germinates best at 1-3°C
- *Acer platanoides*, *Acer tartaricum*, *Malus domestica*,
- *Prunus persica* – 90 days prechill
- *Prunus mahaleb* – 100 days prechill
- 3 to 5°C best germination temperature for *Prunus mahaleb*, *Prunus padus*



Morphological Dormancy

- Morphology of embryo not developed
- Temperate families- *Apiaceae*,
Ranunculaceae
- Tropical families – *Annonaceae*,
Arecaceae, *Degeneriaceae*,
Lactoridaceae, *Monimiaceae*,
Myrasticaceae, *Winteraceae*



Morphophysiological Dormancy

- Underdeveloped embryos
- Embryo growth and dormancy break required
- Embryo grows first then dormancy broken or both at same time
- Vary warm, moist and cold stratification periods
- *Viburnum*- epicotyl dormancy, warm for radical then cold for epicotyl
- *Fraxinus excelsior*, *Magnolia acuminata*



Physical Dormancy

- Present in 15 angiosperm families
- Large embryos with food reserve in embryo not endosperm
- Hilum impermeable in *Cercis siliquastrum*
- Impermeable in seed coats- micropyle, hilum, chalazal area, impermeable palisade cells
- Embryo is not dormant
- Air drying during development intensifies hardness
- *Cytisus scoparius* – dry heat(65°C) for 2 minutes, or acid for 30 minutes
- *Crataegus* in warm climates only endocarp dormant
- *Robinia pseudoacacia*, *Laburnum anagroides*

Physical & Physiological Dormancy

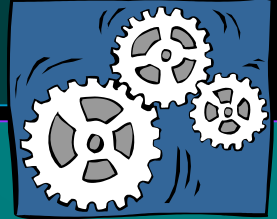
- Embryo dormancy usually broken first
- Germinate at low temperatures (5, 10, 15°C)
- Prechilling breaks physiological dormancy
- Hot water, acid, or mechanical scarification effective before prechilling
- *Cercis siliquastrum* – 16 weeks prechilling = 77% germination(Jordan source)(2004 Seed Sci p 255-260)
- *Cercis canadensis*, *Cotinus coggygria*, *Cotinus obovatus*, *Sambucus*
- *Tilia*- endosperm is inhibitor, excised embryos grow
- *Crataegus* – 3 month periods of cold-warm-cold-warm-cold=55% germination, apomixis common

Chemical Dormancy

- Inhibitors in embryo, endosperm, seed coat
- Leaching or seed coat removal
- Seed may have physiological dormancy too so need prechilling
- Abscisic acid inhibits germination when applied exogenously
- Nickel (20 mg/liter) increased germination of *Picea abies*



Mechanical Dormancy



- **Stony endocarps**
- **Embryos with deep physiological dormancy - require long prechilling**
- ***Anacardiaceae, Cornaceae, Juglandaceae, Nyssaceae, Oleaceae***
- ***Cornus sanguinea* – 94% germination at 12 weeks prechilling, 81% germination at 12 weeks warm + 12 weeks cold stratification(2004 Seed Sci p 1-4)**
- ***Cornus mas*- 18 week warm + 15-18 weeks cold stratification (Tylkowski 1991)**
- ***Cornaceae* not morphologically dormant**
- ***Elaeagnus angustifolia* – snip both ends**
- ***Rosaceae* - warm maturation temperature prior to collection reduced dormancy**



Mattoral Germination Conditions

- **Mean optimum germination temperature for trees about 21°C – during cool season when soil is moist**
- **Mean optimum germination temperature for shrubs about 19°C**
- **Shrub seed germinate in light and dark**
- **No shrub seed has morphological dormancy (underdeveloped embryos)**

THANK YOU
FOR YOUR ATTENTION