

Unusual Types of Seed Development

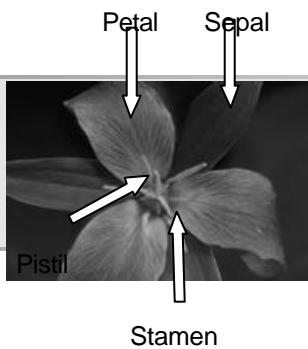
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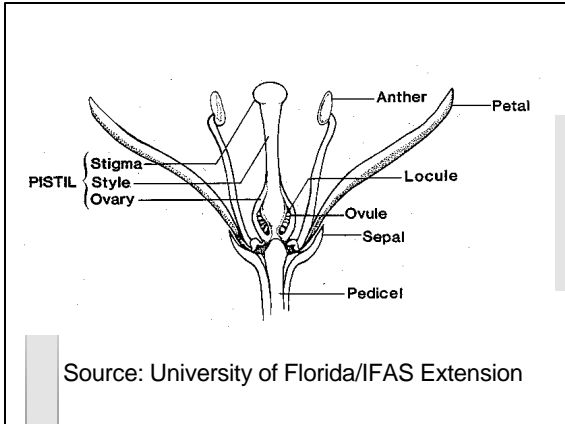


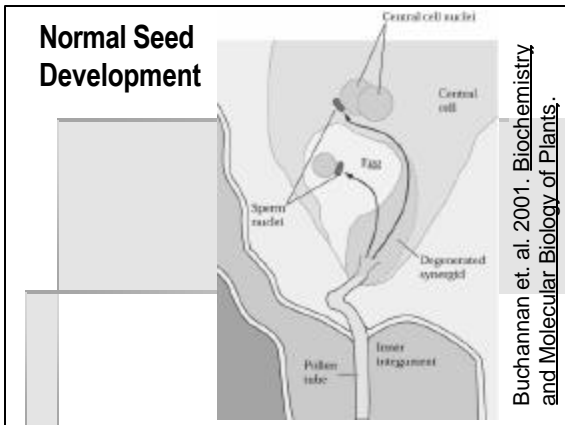


**“Before the seed there
comes the thought of
bloom.”**

—E.B. White
(1899-1985)
American Writer







"Convince me that you have a seed there, and I am prepared to expect wonders." —Henry David Thoreau
(1817-1862) American Writer

Unusual Seed Development

- Apomixis
- Polyembryony

Apomixis

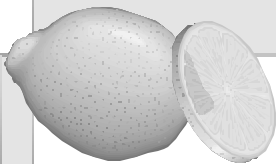
- *apo* “without” + *mixis* “mixing”
- Asexual seed production
- Results in embryo formation that uses other than normal meiotic events
- Genotype of embryo will be identical to that of the seed parent
- Obligate or Facultative Apomixis
- Occurs in 35 families and 300 species of plants

Why is the concept of apomixis important?

- Depending on the plant species it may allow a plant breeder to permanently fix the genes of a superior selection in seed
- Apomixis, although relatively uncommon occurs often enough to make it important to horticulturalists and agronomists

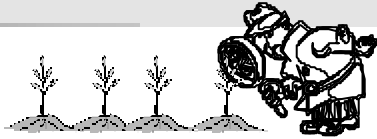
Plants with apomictic seed development

- | | |
|--------------|----------------------|
| ▪ Citrus | ▪ Kentucky bluegrass |
| ▪ Mango | ▪ Dallisgrass |
| ▪ Mangosteen | ▪ Buffelgrass |
| | ▪ Bahia grass |
| | ▪ Sorghum |



When do you suspect apomixis?

- seedlings appear identical to parent
- Multiple seedlings per seed
- Use DNA analysis to confirm suspicions



Apomixis (continued)

1. Nonrecurrent
2. Gametophytic
 - *Diplospory*
 - *Apospory*
3. Sporophytic

Apomixis in Citrus

- 2 cotyledons
- 1 or zero sexual embryos
- 1 to >6 nucellar embryos
- nucellar embryony is very rare in plants

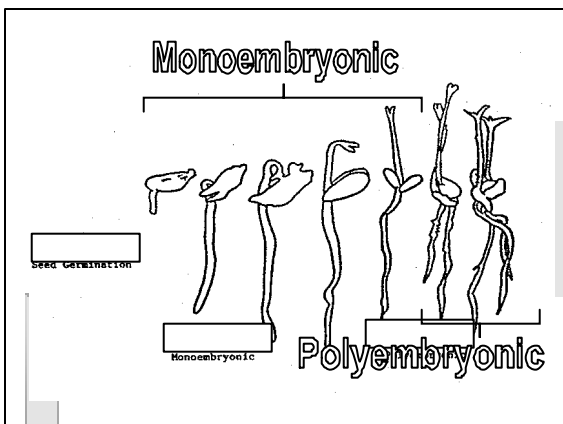


Polyembryony

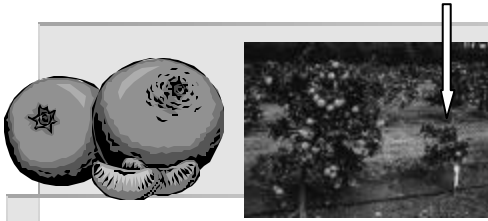
- Refers only to individual seeds that have more than one embryo
- Four types of polyembryony are recognized in angiosperms.

4 Types of Polyembryony

1. Additional embryos 'bud-off' from normal sexual embryo
2. Additional embryos formed from cells in nucellar tissue or integuments
3. Multiple embryo sacs can be formed within a single ovule
4. Additional embryos result from a synergid functioning as an egg cell



Scion on zygotic (off-type) rootstock.



<http://www.hortnet.co.nz/publications/science/kk0991.htm>

How do you tell a zygotic seedling from a nucellar seedling when the species also displays polyembryony?

- Plant breeders have dealt with this in citrus for sometime.
- If there are more than 2 embryos the breeder will cull the “runts” and “bulls”
- Seedlings that are much smaller than the majority or much larger are likely the zygotic seedlings and won't be true to type.

Future Research

- Using molecular biological techniques to introduce apomixis into purely sexual plant species
- This could make apomicts possible in a variety of plant species that don't have the trait.



For More: van Dijk, P. and J. van Damme. 2000. Apomixis technology and the paradox of sex. *Trends in Plant Science*. 5(2): 81-84.

Questions you may want to ponder?

- What implication would an apomixis have on a plant species evolution over time?
- Can you think of a situation when a citrus breeder might save the runts or bulls rather than cull them?
- For each of the four 'roads' to polyembryony make a guess as to the genotype for the embryos (identical to seed parent or different)

Other Sources With Detailed Information on Apomixis and Polyembryony

- Jackson, L.K. and F.S. Davies. 1999. Citrus Growing in Florida. University Press of Florida: Gainesville, FL.
- Hartman, H.T., D. E. Kester, F.T. Davies, Jr., and R.L. Geneve. 2002. Plant Propagation: Principles and Practices. 7th ed. Prentice Hall: Upper Saddle River, NJ.
- Poehlman, J.M. and D. A. Sleper. 1995. Breeding Field Crops. 4th ed. Iowa State University Press: Ames, IA.
