PLANT PROPAGATION

SEXUAL OR SEED PROPAGATION: pollination and seed production

SEXUAL OR SEED PROPAGATION

INTRODUCTION:

- **Production of seeds is the result of sexual reproduction process.**
- **This implies occurrence of genetic variation within a seedling population under natural conditions.**
- **Except where reproduction is controlled by man or in cases of autogamy (self-pollination, selfing), nearly all seeds are heterozygous.**

SEXUAL OR SEED PROPAGATION

INTRODUCTION:

- **Heterozygosity (having alternative form of genes- genetic diversity) allows species survival under changing climatic and edaphic conditions.**
- **While heterozygosity is a must under natural conditions, homozygosity (having similar genes- genetic uniformity) is of the essence in agricultural crops.**
- **Most woody ornamentals show some morphological variability when seed grown, with the majority considered "typical" for the species.**

SEXUAL OR SEED PROPAGATION

INTRODUCTION:

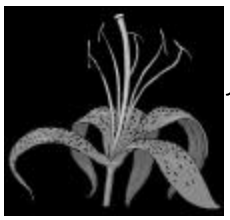
- **In man made seedling populations, such as field crops and bedding plants, the primary cause of variation can usually be attributed to the pollination method.**
- **It may be either the result of xenogamy (outcrossing) in an otherwise autogamous (self-pollinatiing) species. OR**
- **The result of hybridization between related species, such as *Ilex* spp. or *Quercus spp.***

SEXUAL OR SEED PROPAGATION

SEED SOURCES:

- **It is for this reason that for commercially produced timber trees, for example, there is well-controlled seed orchards.**
- **Seeds may be collected from a particular known source, or purchased from commercial seed companies that produce their own seeds.**
- **To produce seeds of known source one must artificially pollinate flowers and be familiar with natural pollination process. And to do that, one must know the floral structure and understand how pollination and fertilization occurs.**

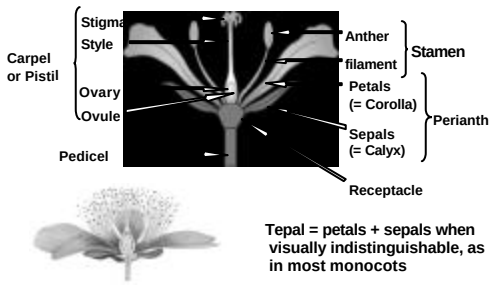
FLOWER FUNCTION



Reproductive Organs

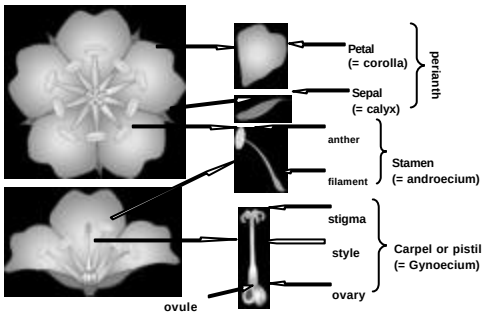
Accessory Organs

FLOWER STRUCTURE



Tepal = petals + sepals when visually indistinguishable, as in most monocots

FLORAL STRUCTURE : How seeds are produced



SEXUAL OR SEED PROPAGATION

B. The Reproductive Organs

- **Stamens: pollen-bearing structure – the male reproductive organ - consists of anther and filament.**
- **Carpel: the female reproductive organ - consists of stigma, style, and ovary (+ ovule).**
- **When pollinated and fertilized, the ovary becomes the fruit and the ovule, that in angiosperms is located within the ovary, becomes the seed.**
- **In gymnosperms there is no ovary and the ovule is born directly on the sporophylls (seed leaves), hence the "naked seeds".**

PLANT GENDER *

Monoclinous - Flowers perfect (hermaphroditic = bisexual)

Monoecious - Flowers imperfect (unisexual), on same plant

Dioecious - Flowers imperfect (unisexual), on different plants

Polygamous - Flowers uni- or bisexual, on same or different plants

* These terms specifically refer to plants <u>not</u> to flowers or cones

FLOWER CHARACTERISTICS:
GENDER

Jatropha wedeliana

Pistillate (= Female)

Staminate (= Male)

Unisexual flowers

FLOWER CHARACTERISTICS:
GENDER

Paeonia 'Sweet May'

Magnolia grandiflora

Bisexual (= Hermaphroditic) flowers

FLOWER CHARACTERISTICS:

SHAPES

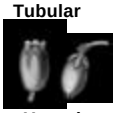
Parts free

Rotate

Tubular

Campanulate

Papilionaceous



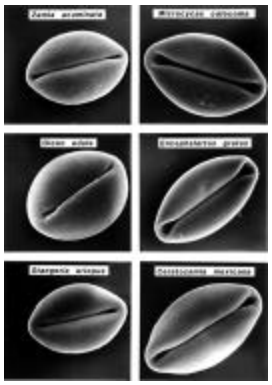
Urceolate

Funnelform

Salverform

Bilabiate

Scanning electron micrographs of some cycad pollen



POLLINATION BIOLOGY

Definition: **Transfer of pollen from the male stamen (anther) to the female carpel (stigma) in flowering plants and from the male cones to female ovule in gymnosperms**

POLLINATION BIOLOGY

How Pollen is Transferred:

A. Wind - Gymnosperms and some flowering plants (grasses and many trees)

B. Water - A few floating aquatics

C. Insects - Beetles, bees, wasps, flies, butterflies, and moths, and very infrequently ants

D. Birds - Hummingbirds, honey creepers, and honeyeaters

E. Mammals – Bats, Rodents

Bat pollination

From American Journal of Botany

Moth pollination

Nectar guides

Ruby-Throated Hummingbirds Pollinating red tubular flowers of *Campsis radicans*

Ulmus scabra

Betula verrucosa

Poa alpina

Wind pollination

[Is there any need for wind pollinated plants to produce nectar?]

Rosa cinnamomea

Tulipa sylvestris

Papaver radicatum

BUTTERFLY AND BEE POLLINATION

Nuphar luteum

Nymphaea candida

Stachys sylvatica

Linaria vulgaris

LONG-TONGUED BUTTERFLIES

Bee Pollination

Cypripedium calceolus

Orchis masculus

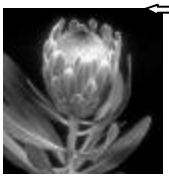
Orchis maculatus

PSEUDOCOPULATION

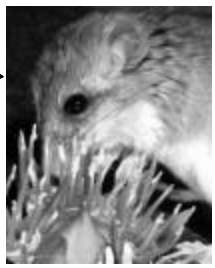
BEE AND BUMBLEBEE POLLINATION

[PSEUDOCOPULATION]

Ophrys muscifera



Rodent pollination in the African lily *Massonia depressa* (Hyacinthaceae). Most members of the family Proteaceae are also rodent pollinated



From American Journal of Botany

WATER POLLINATION

Potamogeton perfoliatus

Summary of pollination Syndromes and Characteristics

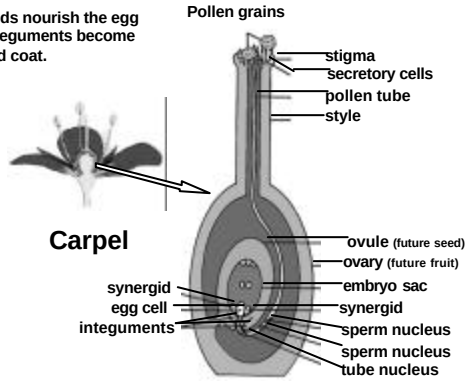
Strategies	*Birds*	*Bees*	*Beetles*	*Butterflies*	*Moth*	*Bats*	*Wind*	*Water*
Activity Time	Usually day	Day	Day or night	Day	Night	Night	Any time	Any time
Reward	Nectar	Nectar and/or pollen	Pollen	Nectar	Nectar	Nectar	NA	NA
Land or Hover	Hover	Land	Land	Land	Land	Hover	Carried	Float
Vision	See all colors	Do not see red	Poor	See colors	See white	Poor	NA	NA
Odors	Minimal	Sweet/musty	Sweet/musty (?)	Fruity scents	Fruity scents	Fruity scents	NA	NA
Tongue Length	Usually long	Short	Chew	Varies	Varies	Varies	NA	NA
Locating flowers	Vision	Odor/ vision	Odor	Odor/ vision	Odor/ vision	Odor	NA	NA
Pollination Method	Pollen on body and beak	Pollen collected from body to baskets on legs	On body	On Body	On body	On head	Lands with contact or calm	Currents

SEXUAL OR SEED PROPAGATION

Pollination and Fertilization

- **Seed is produced as a result of the union of two gametes: one provided by the carpel and one by the pollen.**
- **Using this knowledge, seed producers control all features of a new plant by hybridization and selection.**

Synergids nourish the egg cell. Integuments become the seed coat.



GYMNOPSERMS

Cycas revoluta
(Sago Palm)

In cycads pollination usually involves beetles

GYMNOSPERMS (CONIFERS)

Pinus taeda

Male cones

Conifers are usually wind pollinated

Female cone

THE END