BREEDING SYSTEMS PLAN HAND-POLLINATION EXPERIMENTS

MAIN GOAL Pass their genes to the progeny



What is polination?







FLOWER ANCESTRAL CONDITION

hermaphroditic

*ANDRODIOECY MONOECY **GYNOMONOECY ANDROMONOECY SUBDIOECY** SEPARATED SEXES* 17% % GYNODIOECY <u>/</u>% DIOECY

HERMAPHRODITE

promoting cross-pollination and selfpollination



AUTO-POLLINATION

CROSS-POLLINATION

ADVANTAGES

Mechanism that ensures the production of seeds without pollinators Ensures well-adapted genotypes Allows the colonization of new habitat/sites (Baker's law)

Increases genetic variability

Great evolutionary potential It increases the capacity of adaptation to changing environments

DISADVANTAGES

Reduces the genetic variability (inbreeding depression)

Decreases the adaptability to unstable environments **AUTO-POLINATION** Depends on efficient pollinators (e.g., disadvantage in fragmented habitats and in times of scarcity of pollinators) Loss of well adapted genotypes

> **CROSS-**POLLINATION



AUTO-POLLINATION

CROSS-POLLINATION

HOW TO AVOID self-pollination?



SEPARATE SEXES SPATIAL SEPARATION of male and female roles in different flowers e.g., Monoecy, dioecy

HOW TO AVOID self-pollination?





HOW TO AVOID self-pollination?

DICHOGAMY

TEMPORAL SEPARATION of female and male roles through sequential maturation of stigma and anthers i.e., Protandry, Protogyny



HOW IS IT STUDIED?



HOW TO AVOID self-pollination?

HERCHOGAMY

SPATIAL SEPARATION of male and female roles within the corolla e.g., Heterostyly (*Primula* sp., *Oxalis* sp.)





HOW IS IT STUDIED?

HOW TO AVOID self-pollination?

SELF-INCOMPATIBILITY SYSTEM

Recognition mechanism between pollen and pistil that occurs after pollination and determines the fertilization; and it may prevent self-fertilization.

gametophytic

Common in many families of angiosperms. Incompatibility is controlled by the haploid allele of the pollen grains.

sporophytic

Common in Brassicaceae.

Rejection of the pollen grain is controlled by the genotype of the sporophyte (diploid).





HOW TO DETERMINE THE breeding system?





- Work in GROUPS OF TWO
- Define POLLINATION TREATMENTS
- Identify METHODS and possible CONSTRAINTS



EXPERIMENT 1 CONSTRAINTS Plan a hand-pollination experiment



Acacia sp.

Oxalis pes-caprae

Polygala myrtifolia

Vaccinium myrtillus

Prunus sp.

- Work in GROUPS OF TWO
- **Define POLLINATION TREATMENTS**
- Identify **METHODS** and possible



QUESTIONS

- Work in GROUPS OF TWO
- Define POLLINATION TREATMENTS
- Identify METHODS and possible CONSTRAINTS

- Does the plant reproduce asexually?
- Does the plant rely on pollinators for fruit and seed production?
- How does pollen source impacts plant fitness?
- Is the plant fitness limited by pollen or pollinator availability?

Acacia sp.

Polygala myrtifolia

Vaccinium myrtillus

Prunus sp.



QUESTIONS

- Work in GROUPS OF TWO
- Define POLLINATION TREATMENTS
- Identify METHODS and possible CONSTRAINTS
- Where the pollen comes from?
- Who is depositing the pollen?

- Does the plant reproduce asexually?
- Does the plant rely on pollinators for fruit and seed production?
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Acacia sp.

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- Work in GROUPS OF TWO
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- Identify METHODS and possible CONSTRAINTS



Acacia sp.

- Complex
 inflorescences
- Pollen in polyads

Oxalis pes-caprae

- Tristylous species
- Heteromorphic incompatibility

Polygala myrtifolia

- Pollen release before opening
- Secondary pollen presentation

- Vaccinium myrtillus
- Prunus sp.

• Buzz pollination



- 1. APOMIXY assessing the ability of asexual reproduction through seeds bagged and emasculated flowers
- 2. SPONTANEOUS SELFING assessing ability of self-pollination and degree of pollinator dependence non-manipulated and bagged flowers
- **3. SELFING** quantifying incompatibility system bagged flowers pollinated with their own pollen
- 4. **GEITONOGAMY** indirectly evaluate and avoid dichogamy bagged flowers pollinated with pollen of other flower of the same plant
- **5. OUTCROSSING** determining the optimum fitness bagged flowers pollinated with pollen mixture from other individuals
- 6. SUPPLEMENT quantifying pollen and pollinators limitation open pollinated flowers and supplemented with pollen
- 7. **CONTROL** open pollinated flowers unmanipulated flowers

RESPONSE VARIABLES Pollen tubes Fruit set Seed production

... HANDS-ON!

EXPERIMENT 1 Plan a hand-pollination experiment

INTERPRETATION OF SOME RESULTS

- **1. APOMIXY**
- 2. SPONTANEOUS SELFING
- 3. SELFING
- 4. **GEITONOGAMY**
- 5. OUTCROSSING
- 6. SUPPLEMENT
- 7. CONTROL















HAND-POLLINATION EXPERIMENT Framework for greenhouse experiment

STUDY SYSTEM: Prunus sp.

AIMS:

- Test self-incompatibility
- Test cross-ability between varieties

RESPONSE VARIABLE: pollen tube development

... HANDS-ON!





