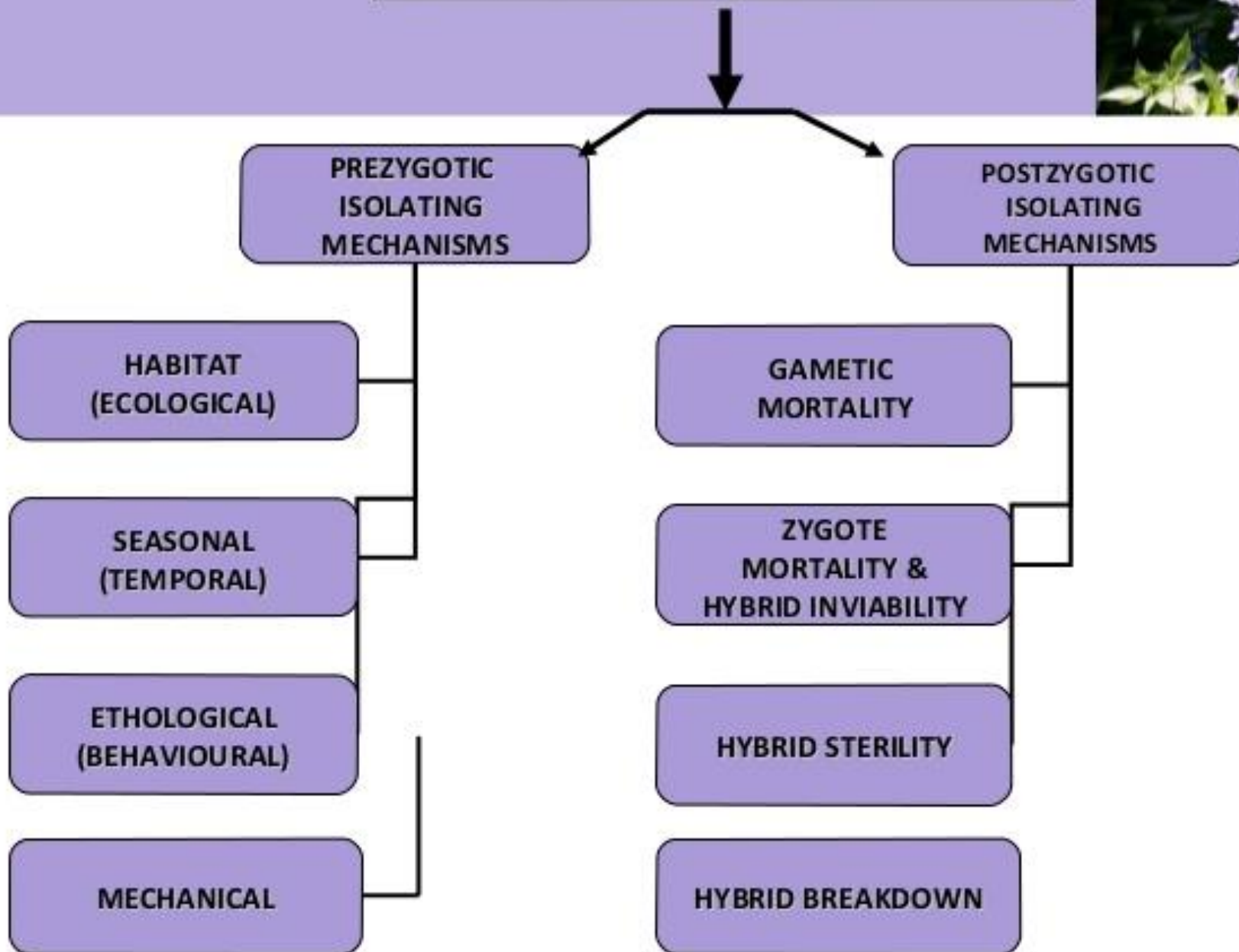


ISOLATING MECHANISMS



- Factors that prevent gene exchange among populations are called isolating mechanisms.
- Dobzhansky introduced the term 'isolating mechanism' to define any agents that hinders interbreeding of group of individuals.
- Mayr restricted this term to sympatric populations & defined it as '*biological properties of individuals which prevent interbreeding of populations that are actually or potentially sympatric*' (This definition excludes geographic barriers)

ISOLATING MECHANISMS



Geographical isolation

- **Geographical isolation** occurs when populations cannot mate because of physical barriers
- Geographically separated populations aren't necessarily distinct species.
- Example: Northern Spotted Owl and Mexican Spotted Owl.



Isolating mechanisms

- Isolating mechanisms prevent interbreeding and maintain reproductive isolation.
- Isolating mechanisms can be divide in to two different types.

Isolating mechanisms that occur before fertilization are called **Prezygotic isolating mechanisms**.

Isolating mechanisms that occur after fertilization are called **postzygotic isolating mechanisms**.

Pre-Zygotic Barriers

- **“Pre-zygotic barriers** are obstacles that are present before an egg can be fertilized.
- A **zygote** is an egg that has been fertilized by a sperm
- Premating isolating mechanisms include:
 - 1) Ecological isolation.
 - 2) Temporal isolation.
 - 3) Behavioral isolation.
 - 4) Mechanical incompatibility.
 - 5) Gametic isolation.

Ecological isolation

- Ecological isolation occurs when potential mates never meet because they live in different habitats.
- Ex. The mountain bluebird lives at high elevation while the eastern bluebird prefers low elevation.



http://www.bio.miami.edu/dana/dax/reproductive_isolation.html

HABITAT(ECOLOGICAL) ISOLATION

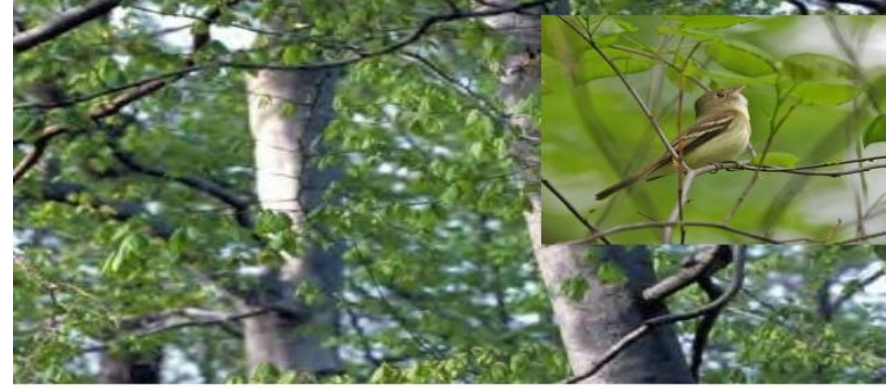


**Potential mates donot meet
because they flourish in different
habitats**

**Eg-5 species of Fly catchers of
North America**



Yellow bellied flycatcher (*E.flaviventris*)
• nests in conifer woods



Acadian fly catcher (*Empidonex virescens*)
• Found in deciduous forests particularly in beech trees and swampy woods



Alder fly catcher (*Empidonex alnorum*)
• seen in wet thickets of alder trees.



Yellow bellied flycatcher (*E.flaviventris*)
• nests in conifer woods



Willow fly catcher (*E.traillii*)

- **seen in bushy pastures and willow thickets.**

SEASONAL (TEMPORAL) ISOLATION



Differences in breeding season prevent meeting of potential individuals of different species.

Eg-Wood frog & Leopard frog

Seasonal isolation



Wood frog

(Rana sylvatica)

It usually mates in late March or early April when water temperature is about 7.2°C (45°F)



Leopard frog

(Rana pipiens)

It usually mates in mid-April when water temperature is 12.8°C (55°F)

ETHOLOGICAL(BEHAVIOURAL) ISOLATION



- **Differences in courtship behaviour prevent mating between individuals of different species**
- **Eg-chiff chaff, wood warbler & willow warbler**

ETHOLOGICAL
(BEHAVIOURAL)
ISOLATION



Chiff chaff, wood warbler & willow warbler are 3

different species which looks almost exactly same, but they don't interbreed due to difference in mating songs

MECHANICAL ISOLATION



- **Body parts of a species may not physically match with those of other species that could otherwise be mates or pollinators**
- **Eg-black sage & white sage**

Salvia mellifera
(Black sage)



Salvia apiana
(White sage)



Black sage & White sage grow in the same areas, but hybrids rarely form because flowers of 2 species have become specialized for distinct pollinators. Black sage flowers are pollinated by small bees & white sage flowers by large bees



Dufour's hypothesis

Genital armatures act like lock & key and prevent hybridization between individuals of different species. Eg-Drosophila

Karl Jordan's contradiction

Out of 698 species of sphingidae family of insecta, 48 were not different in genitalia from other species of family, while about 50% of species with geographic variation in colour, there was geographic variation in structure of genitalia. This indicates slight importance of genitalia as isolating mechanism.

GAMETIC MORTALITY



- **In this mechanism interspecific cross destroys either sperm or egg.**
- **Sperm encounter antigenic reaction in genital tract of female and will be immobilized and killed before it has a chance to reach egg. Eg- insemination reaction in *Drosophila* (Patterson)**



POSTZYGOTIC ISOLATING MECHANISMS

**Isolating mechanisms which operate
after fertilization**

Postmating Isolating Mechanisms

- Isolating mechanisms which operate after fertilization
- Prevents hybrid zygotes from developing into viable, fertile adults
- There are three likely cases that will occur to ensure that the hybrid does not reproduce

Postmating isolating mechanisms include:

1. Hybrid inviability
2. Hybrid infertility
3. Hybrid breakdown

ZYGOTE MORTALITY & HYBRID INVIABILITY



The egg is fertilized but zygote either doesn't develop or develop into an organism with reduced viability

Hybrid Inviability

- The term 'hybrid' refers to the offspring between two different species and 'inviability' refers to an organism that does not thrive. In hybrid inviability, mating occurs and a hybrid is produced, but Hybrid very weak and can't live outside the uterus.
- Ex. Several species of the frog live in the same habitats but hybrids do not complete development

HYBRID STERILITY



- **Hybrid has normal viability but is sterile.**
- **Hybrid sterility is common if 2 parent species have different chromosome number. Eg-Mule**

Hybrid Sterility

- Species mate and hybrid is viable but sterile.
- If chromosome numbers are different, meiosis cannot produce normal gametes

EX. Male donkey x Female horse \longrightarrow Mule

Mules:

- Healthy (viable)
- Sterile

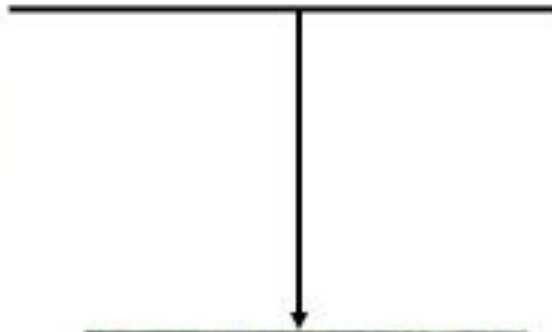




Female horse
($2n=64$)



Male donkey
($2n=62$)



Mule
($2n=63$)

Sterile, because synapsis and segregation cannot occur properly

HYBRID BREAKDOWN



- **Even though viable and fertile hybrids between 2 species are obtained, some barriers still exist if hybrids of second generation or from backcross of F1 hybrid to parental species are inviable.**
- **Eg-*Drosophila pseudoobscura* & *Drosophila persimilis***



D.pseudoobscura



D.persimilis

F1



Fertile female



Parent



Sterile male

F2



Hybrid weaker than parent and F1 hybrids