

These are supplementary notes for David Attenborough's "The Private Life of Plants" Video Series, The Birds and the Bees (Volume 3). Additional material pertaining to this subject can be found in the Pollination tutorial of *Digital Flowers*, and by accessing the Breeding Systems and Pollination web pages used during lectures.

Consider the boldfaced questions; similar questions may be asked on exams.

Wind Pollination

- each species of plant has its own characteristic pollen grains, and these are astonishingly varied and complex in shape.
- grasses (Poaceae) shed an enormous amount of pollen; these grains are picked up by large, feathery stigmas necessary to capture the pollen.
- hazelnuts (*Corylus* sp., Betulaceae) have staminate flowers clustered in catkins; the female flowers are few and only have one ovule per ovary.

Animal Pollination

- bright, showy petals are advertisements to attract animal pollinators.
- What are some advantages of cross-fertilization (i.e., outbreeding)?**
- wild geranium (*Geranium* sp., Geraniaceae) exhibits dichogamy. In this flower, the androecium matures before the stigma is receptive (protandry). When time comes for the stigma to open, the flower is ready to receive pollen from another plant.

Birds

- in the kangaroo-paw flower (*Anigozanthos* sp., Haemodoraceae), the flowers open in succession; pollen is transferred to honey eaters for movement to the stigmas of other flowers.
- many bird-pollinated flowers are red (and loaded with nectar).
- some plants have translucent patches of scarlet brilliance on their leaves, serving as signposts to attract pollinators.
- Why do most bird pollinated flowers have little or no smell?**
- In some *Aloe* (Liliaceae) species, the androecium and gynoecium mature simultaneously. **Why are these plants not in danger of fertilizing themselves (i.e., inbreeding)?**
- in proteas (Proteaceae), many small florets combine to form a capitulum inflorescence. The peripheral florets are showy (and sterile) to attract pollinators; the internal florets are perfect and fertile.

Mammals and other animals

- in other protea species, some inflorescences are found at ground level and point downwards. The flowers are brown and they have a yeasty smell at night.
- What pollinates these flowers?**
- the durian tree (*Durio zibethinus*) of Borneo, like many other tropical plants, is pollinated by fruit bats. The flowers open at night, and contain abundant nectar and pollen.
- giant ghekos in New Zealand and black lemurs in Madagascar also serve as pollinators for some tropical plants.

Insects

- insects are the most efficient pollinators.
- in the Indian balsam (*Impatiens* sp., Balsaminaceae), the nectar is held deep in the flower so the bee has to enter the flower. When all the pollen is removed, the stamens fall off to expose the sticky stigma.
- a gentian (*Gentiana* sp., Gentianaceae) offers edible pollen to carpenter bees; these bees vibrate the anthers to release the pollen (buzz-pollination)
- markings on flowers, such as those seen in some *Iris* species (Iridaceae), serve as nectar guides for hover flies with extraordinary long tongues.
- in orchids, the pollen is packaged into pollinia. These pollinia are glued onto unwary insects for movement to other flowers. This is a more economical way to distribute pollen. Fertilization begins when the pollinia are transferred to a sticky stigma in another flower.
- in addition to edible pollen and nectar rewards, some flowers offer edible nutritious oil; other oils serve as pheromones for males to attract females.
- each orchid species provides different oils (pheromones) for different bee species.
- trigger hairs in some orchids, when released, dump pollinia on insect visitors.

Figs and wasps. How are figs pollinated? Fig fruits (syconia) have openings (ostioles) by which fig wasps enter and leave. The small flowers inside are imperfect, and some female flowers are parasitized by female wasps that lay their eggs inside. Male wasps emerge first, search for parasitized female flowers that have unhatched female wasps and mate with them. The male wasp then dies, never leaving the fig. The female wasps then emerge, exit the syconia, but in doing so they pass the male flowers near the ostiole. These wasps get loaded with pollen as they leave. When these wasps enter another fig, cross-pollination occurs as these wasps lay their eggs.

Sexual deception. Some orchids mimic female insects (in look and in smell); pollination occurs when male insects try to mate with these orchids. The flightless thymid female wasp climbs up high to emit an odor when she wants to mate. Males are attracted to this smell, seek out their mate, and copulate with them in midair. An orchid mimics this behavior by resembling and smelling like a female wasp. However, the male wasp cannot fly away with the orchid. As it tries, its head hammers into the pollinia (or receptive stigma).

Imprisonment in the Mediterranean. The dead horse arum (Araceae) looks like a corpse. It is large, smelly, and covered in hairs. Blowflies find them quite attractive. On this inflorescence (spadix), the male flowers are above the female flowers. The flowers are separated by a barricade of spines. Blowflies enter the inflorescence looking for a place to lay their eggs. They get trapped in the flower, stay the night, and are showered with pollen. In the morning the spikes shrivel, the flies escape, only to enter another arum inflorescence.

"World's largest flower." In the forests of Sumatra lives a plant that only flowers once every 1,000 days (*Amorphophallus titanum*, the titan arum; Araceae). Its putrid smell attracts very tiny bees. **Why should the titan arum produce the biggest bloom to attract such tiny pollinators? Why is the "world's largest flower" a misnomer?**