



# Oil Palm Fruit Formation

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## Fruit Formation

- Flowering plants produce seeds within a fruit
- The scientific name for flowering plants is angiosperms
- We eat many different fruits, but how do they form?



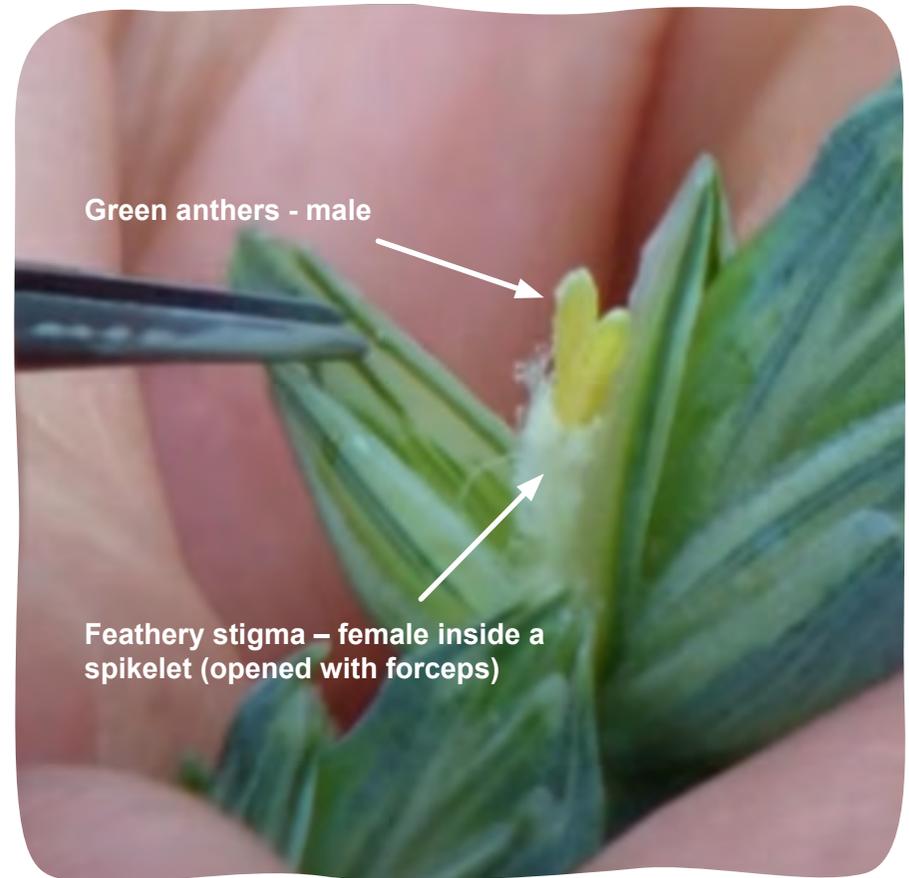
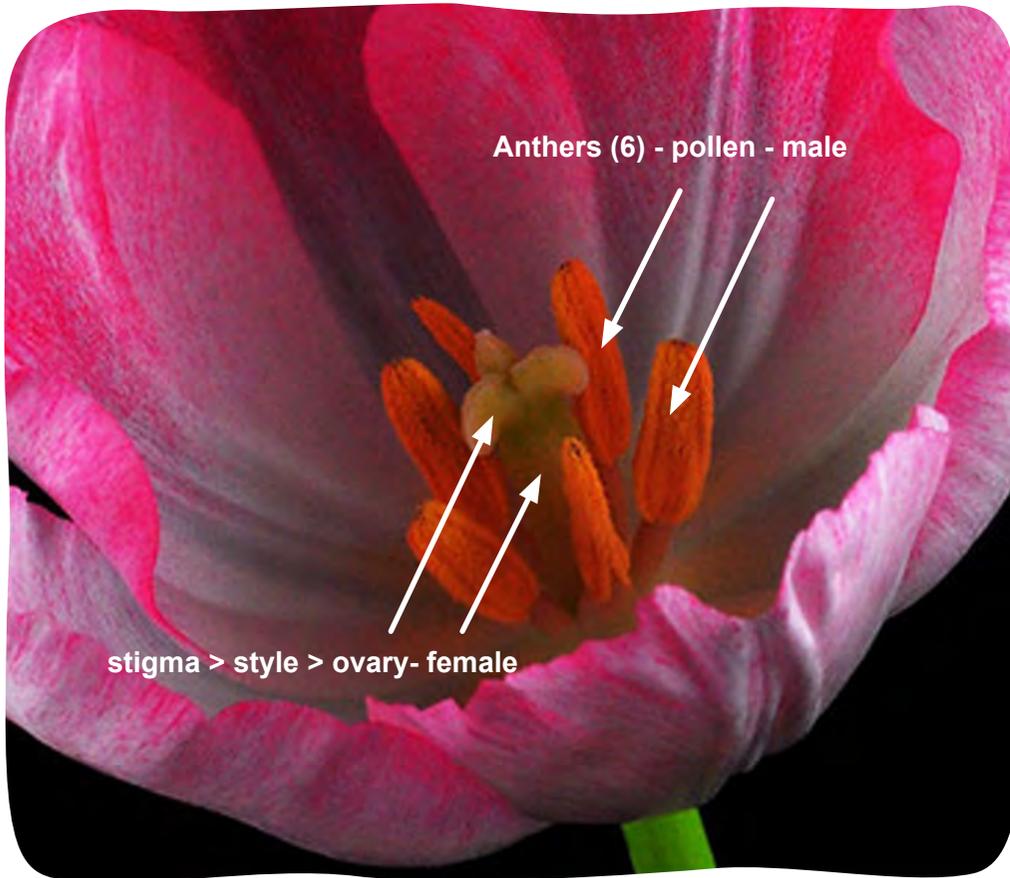
## Flower Structure

- The flowers are the reproductive organs of plants. Some flowers are obvious – bright and colourful others less so (e.g. grasses and cereals). Most are designed to entice and trap pollen-bearing insects



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## Flower Structure

- In the Tulip flower the ovary is found at the base of the of the style. The stigma is often 'sticky' to help capture the pollen produced on anthers
- A similar picture is seen with grasses although the Stigma is often 'feathery' (again to capture the pollen)

# The Wheat 'flower in detail'... an ear



Ear with Spikelets



Spikelets with anthers extruded



Anthers producing pollen



Inside spikelet, showing anthers and stigma (immature)



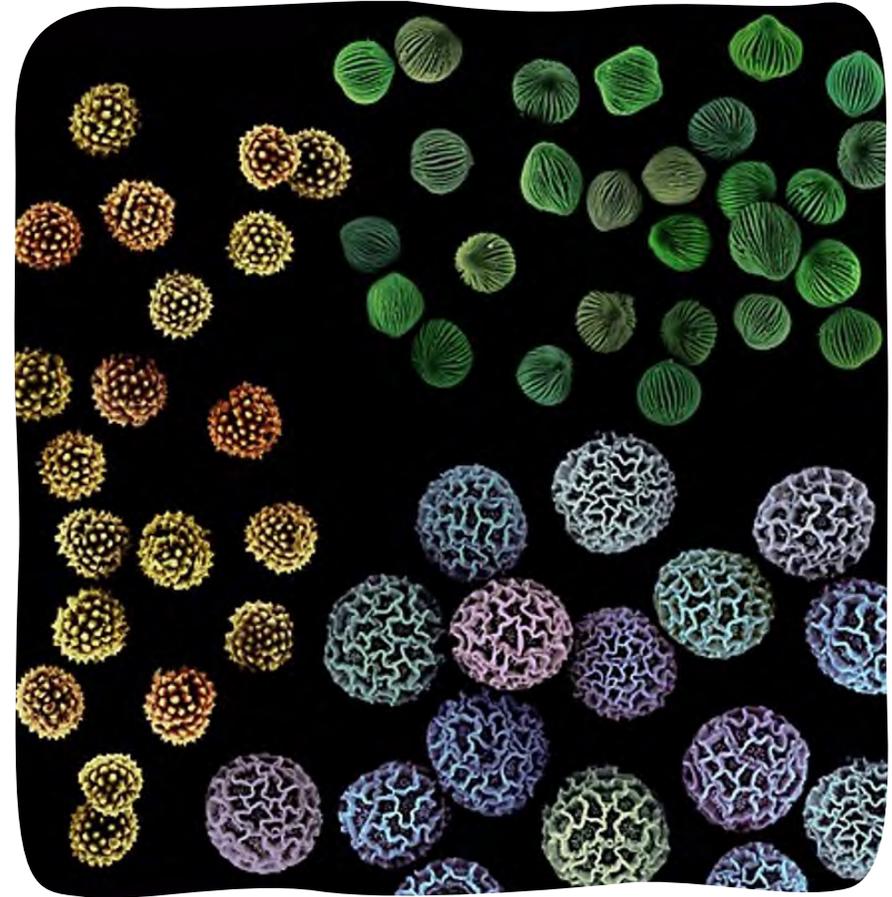
Ear with grain

# Fertilisation

- Pollen, produced by the anthers, is released and may land on a stigma.
- Pollen germinates, producing a pollen tube, which penetrates the stigma and travels via the style towards the ovule (or egg). Here fertilisation occurs (the nucleus of the pollen-tube fuses with the nucleus of the egg cell contained within the single ovule of the ovary). The resulting embryo develops into a seed.
- The pollen of some grasses is able to pollinate the ovaries from the same plant. This is called **self-pollination**. However, many grasses have a chemical mechanism, which prevents its own pollen from germinating on stigmas of the same plant. This ensures **cross-pollination**.

# Pollination

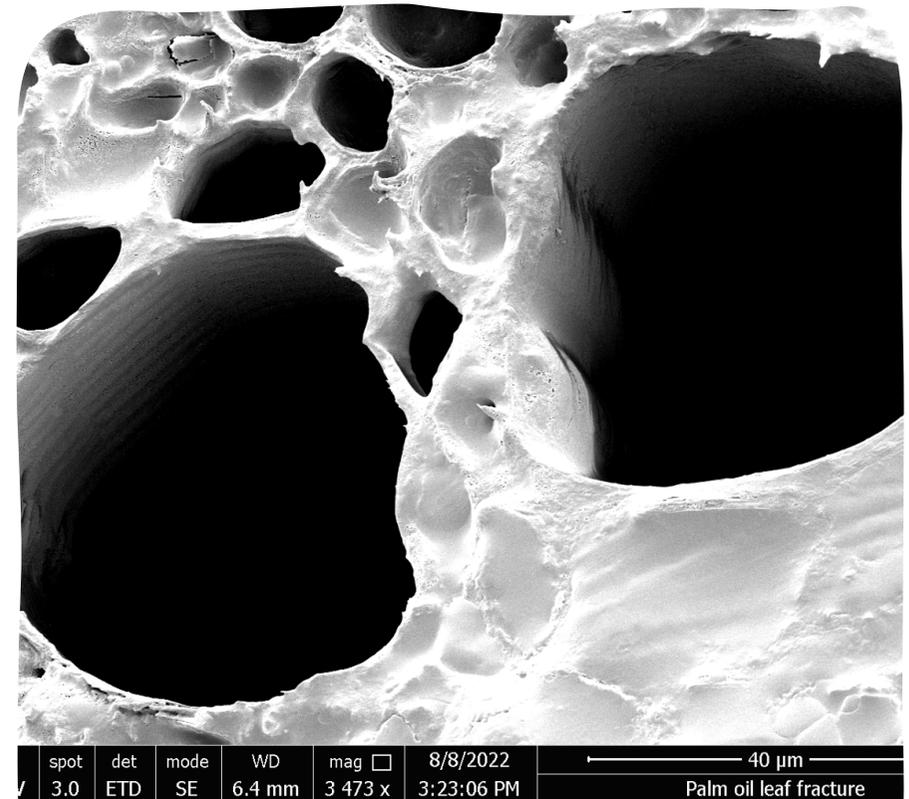
- Pollen grains (very small & light) are usually dispersed by wind and insects, water or animals.
- Insect-pollination of flowering plants is responsible for the majority of the world's flowering diversity and is an essential part of plant reproduction.
- Flowers have bright colours, smells and nectar which encourage pollinators to pay them a visit.
- Honeybees along with 1,500 other insect species pollinate plants in the UK.
- Initiatives to encourage us all to plant more pollinator-friendly plants are common because this process is vital for future food security



Pollen grains vary in size and shape. In this falsely coloured image. 3 examples are shown *Passiflora* (passionvine), *Spathiphyllum* (peace lily), *Aster* (daisy)

# Pollen Grains – Oil Palm

- In 2012, scientists from the Putra University in Malaysia published data about the different pollen types found in the foraging of a local honeybee (*Apis dorsata*) & examined samples using SEM
- With oil palm being such a dominant crop, and producing large quantities of pollen although honey is not made from it, bees readily collect it for food
- Its pollen size ranges from 31 - 32  $\mu\text{m}$ . The shape is triangular with rounded angles and 3-slit aperture
- Which of the 12 pollen grains shown do you think comes from oil palm?





## Seed Formation

- The ovary develops into a fruit.
- The ovary wall becomes the rest of the fruit.
- Each fertilised ovule forms a seed.
- Fruit comes from flowering plants

# Flower reproduction – different options

- The male sex cell (or gamete) is called pollen, the female sex cell is called the ovule.
- Tulips and many flowering plants and grasses are hermaphrodites i.e. they contain both male and female gametes in the same flower.
- However, some grasses are also monoecious which means the male and female gametes are on the same plant but present in different flowers e.g. maize.
- (Hardy) grasses are usually dioecious which means the two sexes are on different plants.



Maize plants - Male (top part of plant)



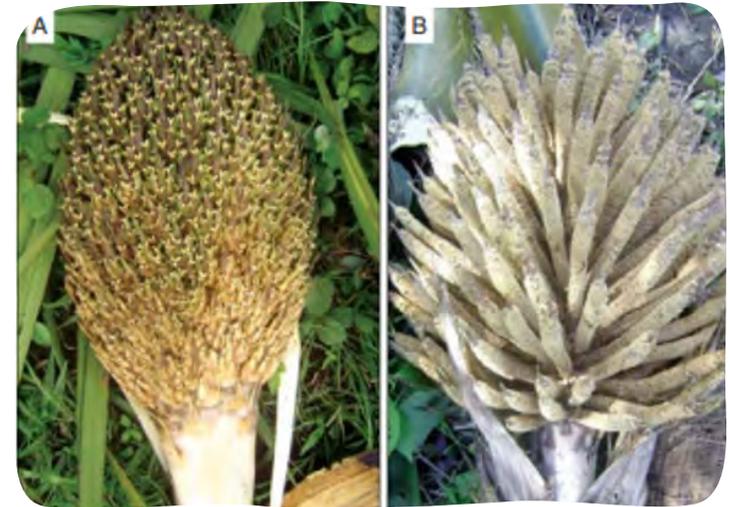
Maize plants - female (lower part)

# Monoecious Plants

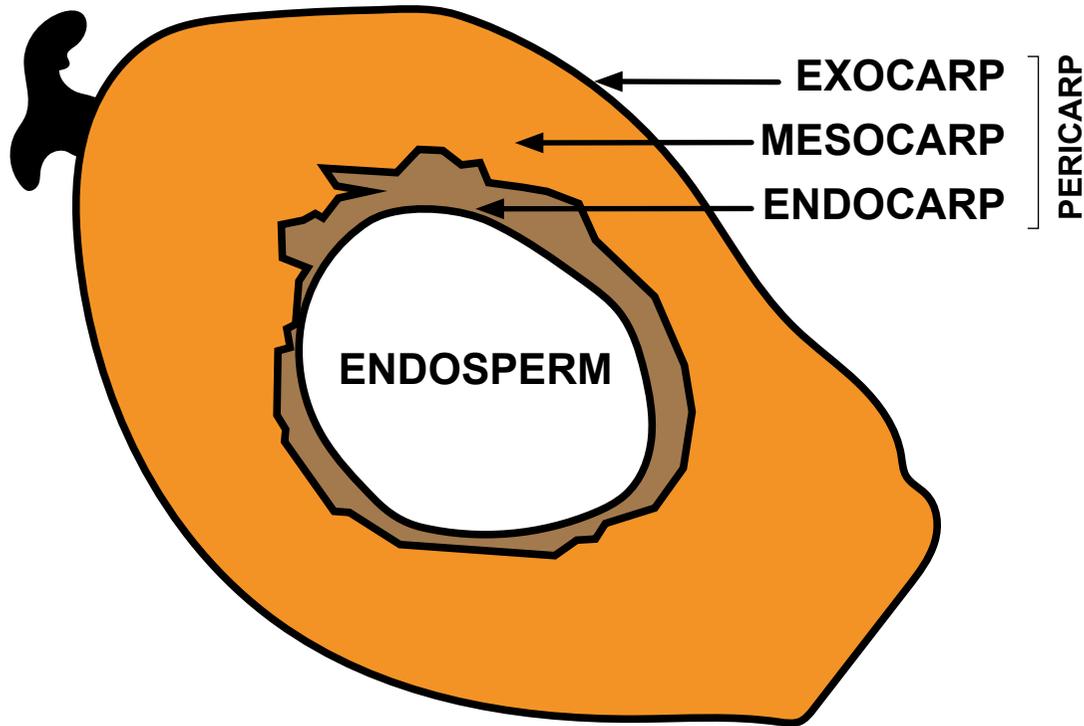
- Male and female parts in the same plant.
- Male and female parts can be on different flowers in the same plant - physical separation - so that pollen and egg don't come into contact - e.g. maize (top & lower respectively).
- Monoecious plants can also ripen at different times - ripening at different times. This is sometimes referred to as 'temporal dioecism'.
- This is the case in the African Oil Palm (*Elaeis guineensis*).

# Temporally Dioecious Oil Palm

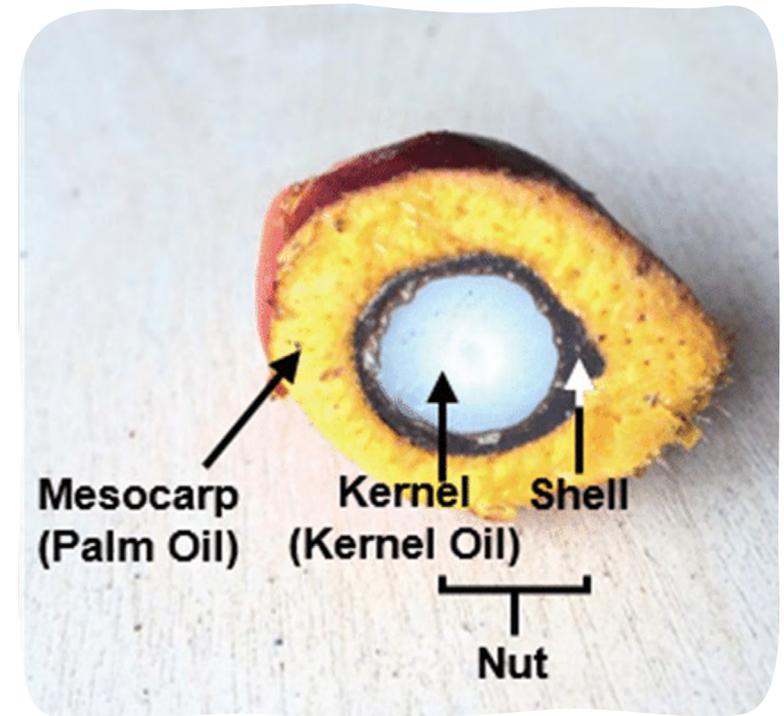
- When an oil palm plant reaches approx. 3 years old it becomes sexually mature.
- Male & female flowers form in the same plant, but they ripen at different times.
- Each structure is approx. 35 cm long and formed in the axil of the leaf.
- There are only male flowers for several months at first, and then there are only female ones. Oil palm fruit development happens in fertilized female flowers of the plant. Fruit bunches form 20 - 26 weeks after pollination.
- Pollination can use wind, but it is much more efficient when the weevil, *Elaeidobius kamerunicus* is used. Insects are released in the plantation after approx. 2.5 - 3 years.



# Temporally Dioecious Oil Palm



4-5cm diameter fruit



The pericarp of each fruit comprises three layers, namely outer exocarp or skin, mesocarp or pulp and endocarp or shell. In general, exocarp is included with mesocarp (giving rise to Crude Palm Oil) while Palm Kernel Oil is obtained from the kernel (endosperm).

# Fruits and Seeds

- Many fruits are eaten, in the case of palm oil, oil is extracted from both the Mesocarp and Kernel.
- However, these same fruits can be used to grow new plants (as they contain seeds)
- A fruit is a matured and ripened ovary of a plant, which is why it contains seeds for plant reproduction
- Seeds are mature, fertilised ovules of a plant consisting of three parts -

**embryo** - where the new plant forms if subject to the right conditions

**endosperm** - a food store for the young plant to use until it can photosynthesise

**seed coat** - a protective covering

- Plant breeders and seed producers collect the seeds, germinating them to produce young seedlings which are used to establish nurseries of young plants.
- It can take approx. 60 day to break the dormancy and germinate an oil palm seed (with a heat treatment).
- At about 12 months old, young plants can be transplanted to establish a new plantation.



# Seed Dispersal 'is'

- The transport of seeds from the plant to another area in order to grow.
- Typically - in the wild - seeds are dispersed using animals, explosion (of pods), wind and water.
- Seeds must be dispersed or spread away from each other and from their parent plant. This is to reduce competition between one another and increase their chances of survival.
- Some seeds or fruits are adapted to allow for different dispersal mechanisms. In England we see many 'Autumn fruits' adapted in these ways.

# Competition

- Plants compete with each other for resources including: light, water, space and minerals in the soil.
- This is important in the establishment of oil palm plantations so plants do not adversely compete with one another, nor are they in competition with natural foliage - hence why areas are cleared before the plantation is established.



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