Biology Notes

Topic: **Reproduction II – Sexual reproduction in plants**

Objectives: **At the end of this topic, the students should be able to:**

1. ***Recall the meaning of sexual reproduction.***
2. ***State the advantages and disadvantages of sexual reproduction.***
3. ***Describe the structure and function of a dicotyledonous flower.***
4. ***Define pollination and differentiate between self-pollination and cross-pollination.***
5. ***Identify the agents of pollination and the ways in which they act.***
6. ***Describe the different structural adaptations of insect and wind-pollinated flowers.***
7. ***Describe the growth of the pollen tube and the process of fertilization.***
8. ***Describe the formation of seeds and fruits.***
9. ***Describe the structure of a leguminous seed.***
10. ***Describe the dispersal of fruits and seeds.***

What is sexual reproduction?

Sexual reproduction involves two individuals normally a male and a female each contributing a sex cell or gamete to the process. The resulting offspring will have features that are characteristic of both individuals. In plants the sex cells are ovules (female) and pollen grain (male). In humans they are ova or eggs (female) and spermatozoa (male).

Advantages / disadvantages of sexual reproduction

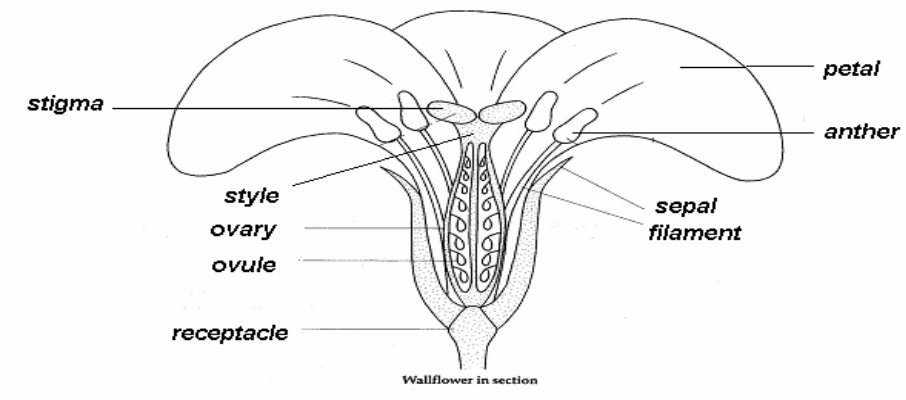
Advantages

- produces variations, adaptability and increased vigor in the offspring which enhances their ability to survive.
- gives rise to new material or new varieties of organisms.

Disadvantages

- some form of physical contact is necessary between the two individuals.
- undesired qualities may be produced resulting in the elimination of that individual.

Structure and function of a dicotyledonous flower



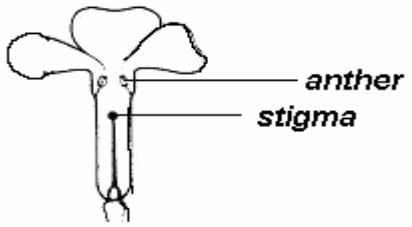
petal – brightly colored part of the flower; attracts insects to the flower for pollination
anther – produces pollen, the male gametes (sex cell)
filament – supports the anther , holding it upright

The anther and the filament both make up the male part of the flower called the stamen.

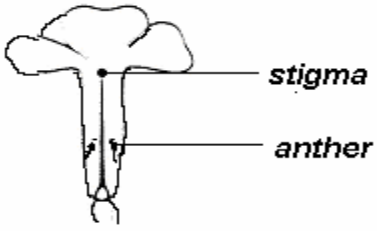
sepal – small, green leaf-like structure at the base of the flower; protects the flower in the bud stage
receptacle – forms the base of the flower
ovule – the female gamete (sex cell) in the plant; the ovules develop into seeds after fertilization
ovary – produces and contain the ovules; the ovary develops into the fruit after fertilization.
stigma – the part of the plant that receives the male sex cell or pollen
style – holds up the stigma; provides the connection between the stignma and the ovary

The stigma, style and ovary all make up the female part of the flower called the pistil.

What is pollination?
Pollination is the transfer of pollen from the anther to the stigma of a flower of the same species.
There are two types of pollination:
1. **self pollination**: transfer of pollen from the anther to the stigma of the same plant
   Plants that self pollinate usually have their anthers and stigmas ripen at the same time and the stigma being located below the anthers as shown in the diagram below:



2. **cross pollination**: transfer of pollen from the anther of one plant to the stigma of a another plant of the same species.
   Plants that cross pollinate usually have their stigmas and anthers ripen at different times and the stigma being located above the anther. See diagram below:



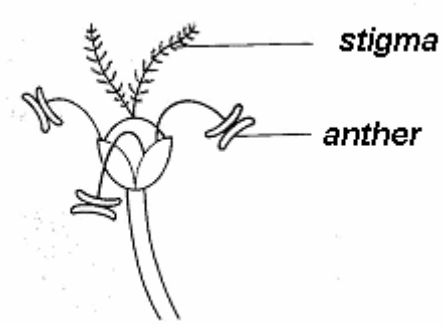
Agents of pollination

Self pollination may be brought about by gentle breeze shaking the anther causing the pollen grains to be shed onto the stigma below or insects may carry the ripe pollen grains to the stigma as they pass by in search of nectar or on their way out of the flower.

Cross pollination may be brought about by insects, water, wind, birds, snails and other animals. Bees, butterflies and moths are the insects which most commonly bring about cross pollination. This is called **insect pollination**. The insects fly about from one flower to another, usually in search of nectar (sugary liquid at the base of the flower), and in doing so, pick up pollen grains from one flower and distribute them to other flowers.
In **wind pollinated** flowers, the wind carries the pollen grains to the stigma of the appropriate flower.

Comparison of insect and wind pollinated flowers

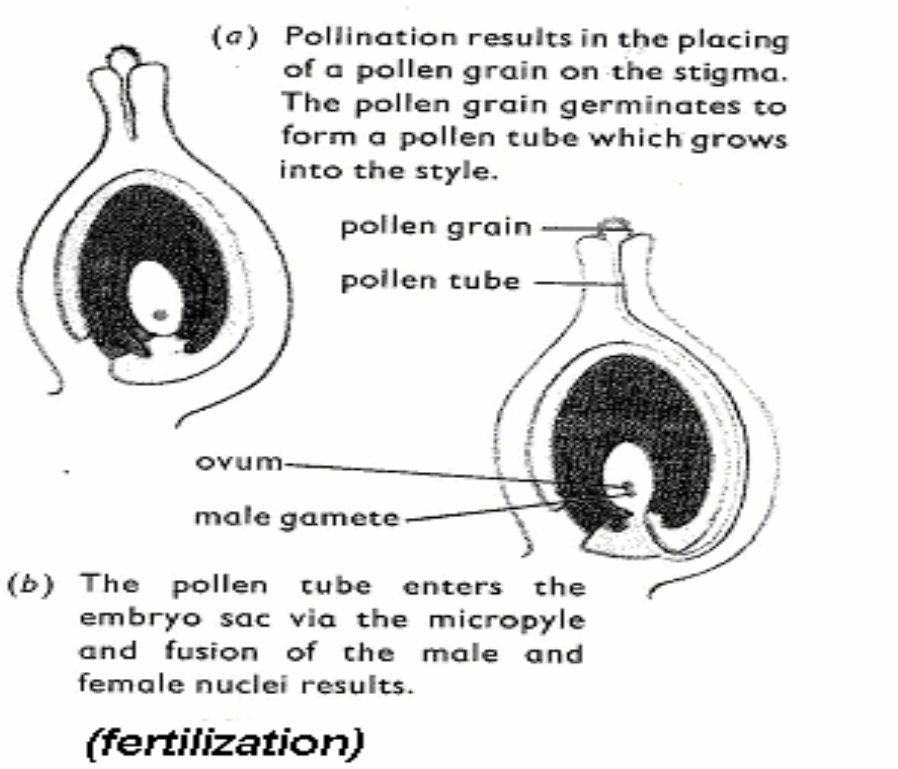
FEATURE	INSECT POLLINATED	WIND POLLINATED
Size	Generally large	Generally small
Colour	Petals brightly coloured	Petals green or dull in colour
Nectar	Produces nectar	Does not produce nectar
Floral arrangement	Flowers face upwards	Flowers hang down for easy shaking
Stamens and stigmas	Enclosed inside ring of petals	Hang out of ring of petals
Pollen grains	Small number produced / heavy and sticky	Large number produced / light with smooth surface
Stigma	Pinhead shaped with no branches	Feathery branches for catching pollen



A wind pollinated flower

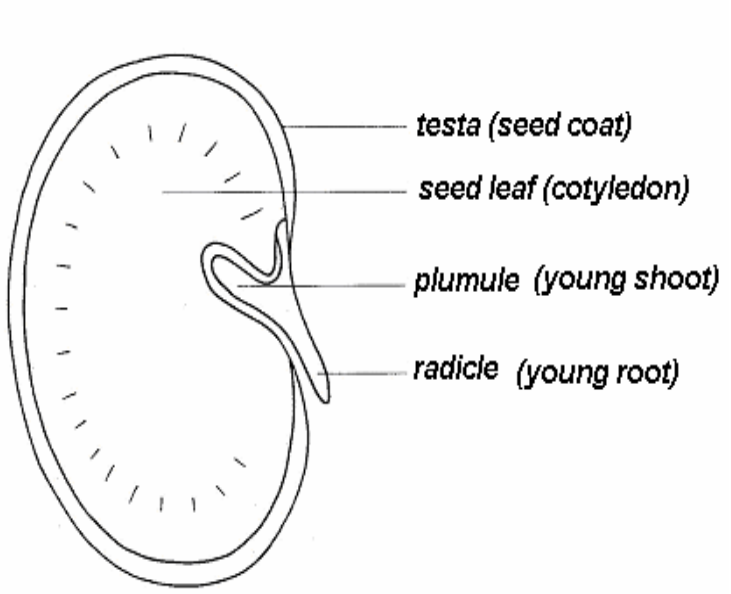
Examples of insect pollinated flowers: buttercups, roses, wallflowers, sunflowers, Orchids, Tecoma (yellow elder)
Examples of wind pollinated flowers: grasses, hazel, willow, corn (Zea mays)

Pollination and fertilization



Following fertilization, the petals, sepals, stigma, style, anther and filament wither and fall off leaving only the ovary behind. This gradually ripens into a **fruit** with the ovules becoming the **seeds**.

Seed structure (leguminous seed)



Half of a broad bean seed

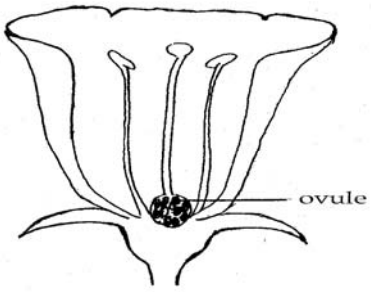
Seed and fruit dispersal

Dispersal is the scattering of seeds and fruits away from their parent plant. This ensures their survival and a wide distribution of the species. The common agents that bring about dispersal are wind, water, animals and explosive mechanisms. For each method of dispersal the fruit or seed is adapted to be dispersed by that method.

e.g. - fruits and seeds dispersed by wind are usually very small and light e.g. cotton, poppy, Tecoma (yellow elder)
The seeds of Tecoma have wings covering the seeds that enable them to fly long distances.
- fruits and seeds dispersed by water have spongy or fibrous coats which enclose large air chambers e.g. coconut
- fruits and seeds dispersed by animals may occur by eating the flesh and throwing away the seed or by their sticking to the body of the animal which they remove later

Question

1. The diagram shows the reproductive structures of *Tecoma* (yellow elder)



Tecoma (yellow elder)

(a) Give TWO advantages of asexual reproduction compared to sexual reproduction. (2)

(b) (i) Give TWO advantages of sexual reproduction compared to asexual reproduction. (2)

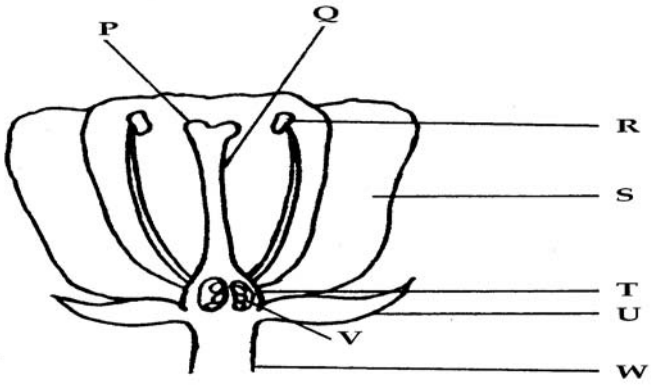
(ii) State the process that produces the gametes in the ovule. (1)

(c) Describe ONE structural adaptation of Tecoma for insect pollination. (1)

(d) With reference to the diagram, state a reason in support of the possibility of Tecoma being self-pollinated. (1)

(e) Which method/agent is used to disperse the seeds of Tecoma and how are the seeds adapted to it? (3)

2. The drawing shows a half flower.



(a) (i) Name the parts labeled P, Q and S. (3)
(ii) Give the function of the parts labeled R and U. (2)
(b) (i) What is fertilization? (2)
(ii) Use letters in sequence to trace the path through which pollination and fertilization occur. (1)
(iii) Which structure becomes the fruit? (1)
(c) Explain the difference between self-pollination and cross-pollination. (3)

3. (a) State FOUR ways in which insect pollinated flowers are different in structure to wind-pollinated flowers. (4)
(b) Describe the process in a leguminous plant which would occur after pollination up to the time fertilization is completed. (8)
(c) (i) Differentiate between the terms “sexual reproduction” and “asexual reproduction”. (2)
(ii) Give TWO examples of artificial vegetative reproduction and explain why each of these methods is advantageous to the growers. (6)