Ephedra – Occurrence , Structure & Reproduction

Occurrence

Ephedra is an arid plant. It is found in Europe, Western and Central Asia and Central and South America. It is also found in arid areas of Pakistan. Ephedra is source of drug Ephedrine. It is used for the treatment of asthma, cough and hay-fever.

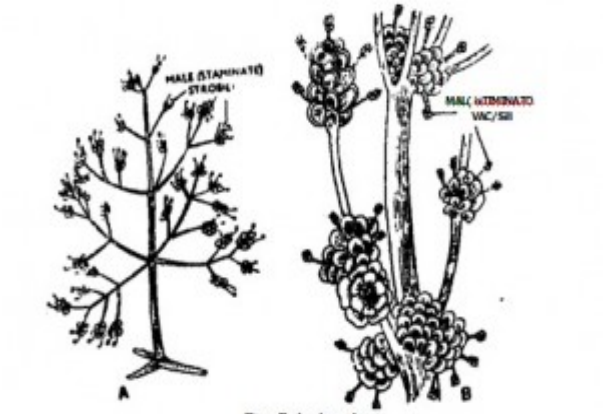

Fig: Ephedra plant

General structure

The plant body of Ephedra is sporophyte. It is a bushy plant. Sometimes, it becomes a climber. It height is ranging from I to 25 feet. The body is divided into root stems and leaves.

1. Stem: Stem and branches are slender and green in colour. It has longitudinal ridges and furrows. Stem becomes woody due to the limited secondary growth. In some cases, underground rhizomes are also produced. The branches arise from azillary buds. Their arrangement gives the plants characteristic bushy and broom-like appearance. Apical meristem produces nodes and internodes. Meristematic tissues are also present at the base of each internode. Their activity further increases the length of stem. Sometimes, meristematic tissue becomes hard at the end of the growing season. Thus many braches fall. These branches are replaced by axillary shoot. It gives bushy appearance to the plants. The ridges and furrows of the successive internodes alternate with each other.

2. Leaves: The leaves are scale like. They are opposite and arranged in pairs. The leaves of each pair are joined with each other at their bases. It forms a small sheath around the stem.
3. Roots: The primary root grows deep in the soil. It develops many secondary roots.

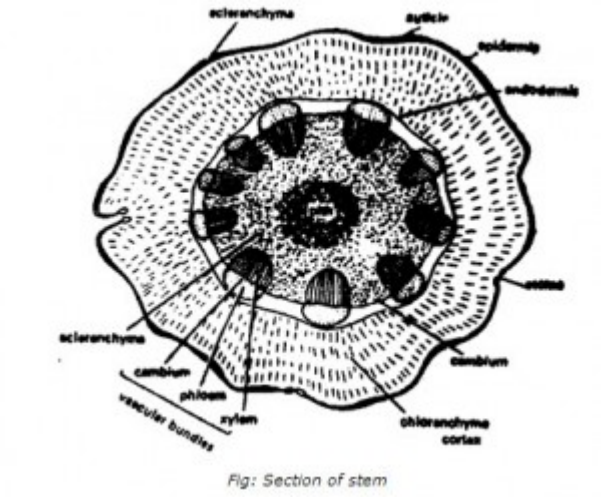

Fig: Section of stem

Internal Structure of Stem

The stem has ridges and furrows. So it has a wavy outline in transverse section.

1. Epidermis: Stem is covered by heavily cutinized epidermis. The epidermis has stomata. They are present in pits in the region of furrows. A group of sclerenchymatous cells is present below the epidermis in the region of each ridge.

2. **Cortex:** The cortex is wide. It is formed of parenchymatous cells. These cells have chloroplasts. Thus the cortex of stem is the main photosynthetic tissue of Ephedra. The cells of peripheral region of the cortex are loosely arranged and form **palisade** layer. The cells in the inner region of the cortex form the **spongy** tissue.
3. **Stele:** The central part of the stem is stele. It is surrounded by endodermis. Wide pith is present in the centre of the stele. The vascular bundles are collateral and endarch. They form a ring around the pith. The vascular bundles form a continuous ring due to narrowness of medullary rays. The xylem in Ephedra has true vessels like Angiosperms. Phloem consists of the usual phloem parenchyma and the sieve tubes. But they are without any companion cells. Secondary growth occurs due to the activity of cambium. It produces prominent annual rings.
4. **Cork: Phellogen (cork cambium) is produced** in the older stem. It forms periderm. The outer tissues of periderm are transformed into the bark.

Reproduction

Ephedra is a dioecious plant. But some monoecious plants are also fout.d. fun Homo

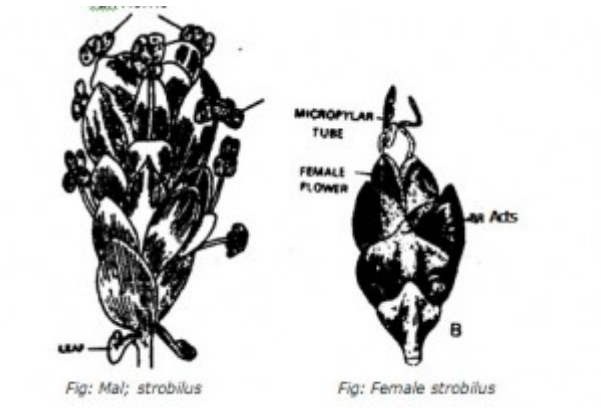

Fig: Mal; strobilus

Fig: Female strobilus

Male Strobllus

Each male cone arises in the axil of a leaf. The male cones are small. They are 1-2 cm in length. Each cone has a central axis. This axis bears 2-12 pairs of thick bracts. Bracts are arranged in an opposite manner. These bracts are closely set on the axis.A single male microsporophyll is present in the axil of each bract. Two small scales are present at the base of each sporophyll. It has a single stamen. Stamen has short stalk (filament). This stalk bears two to six microsporangia (anthers) at the top. The anthers are united in a Each anther has two or three lobes. Each lobe has a pore at its tip for releases of microspore (pollen grain).

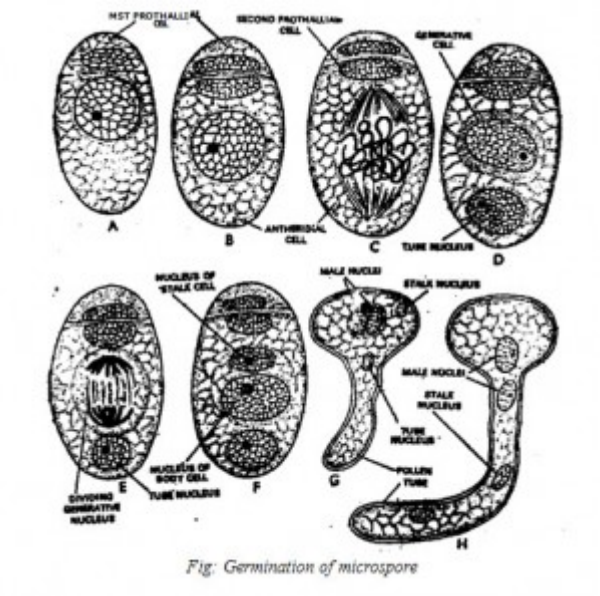

Fig: Germination of microspore

Germination of pollen grain

Germination of pollen grain started before the release of pollen grain. Pollen grain divides into two cells. The smaller cell again divides to form two prothalial cells. The larger cell becomes generative cell. Generative cell divides into lower stalk and upper body cell. The upper cell divides to form two male gametes. Pollen grain is released at this stage. Two prothalial cells disintegrate just after the release of pollen grains. The pollen grains are dispersed by wind and insects. Pollen grains lodge on the ovule. It grows rapidly. A pollen tube is produced. This tube carries the two male gametes, the tube nucleus and the nucleus of the stalk cell on its tip. Pollen tube passes through the neck cells and reaches the oospliere. It releases male gametes and one of them enters the oosphere. It fuses with the Ooshere oospore

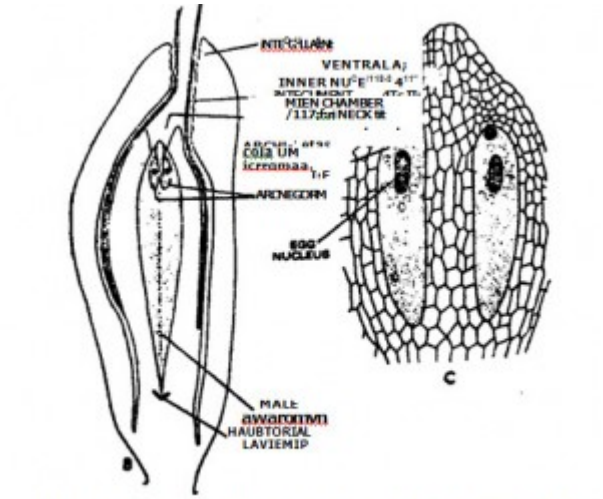

Fig: B-L.S of ovule showing female gametophyte. Cfemale gametophyte showing =begonia

Female Strobilus

Female cones are borne on young shoots in the axils of the leaves. The plants are full with these cones during the growing season. Each cone consists of a short axis. This axis bears two or three pairs of opposite bracts. Two or sometimes three megasporangia (ovule) are present at the tip of the axis. Each ovule consists of a central mass of nucellus. It is surrounded by two integuments. Inner integument is supplied by two vascular bundles. Outer integument has four lobes. It is supplied by four vascular bundles. The nucellus is free from the integument in the apical region. Inner integument elongated at the apex to form a long tube called **micropylar tube.** This tube is flattened at the tip and twisted spirally. A mucilaginous drop comes out at this flattened tip. **Female Prothallus** One of the central nucellus cells enlarges. It functions as the **megaspore mother cell.** This spore mother cell divides by meiosis to produce four **megaspores.** Three megaspores disintegrate. Only one remains functional. The functional megaspore increases in size. It divides into 256 or more cells. These cells produce **female prothallus.** Archegonia are produced in the micropylar region of the pro- thallus. Lower region of the nucellus is known as **nutritive region.** Each archegonium develops from a superficial cell of the prothallus. Initially the neck of each archegonium consists of three tiers of cells. But later neck becomes very long due to upward growth of the prothalial tissue. It becomes eight cells in height. The venter of the archegonium has no well defined wall. It contains a large **oosphere** and a ventral canal nucleus. It has no definite ventral canal cell.

Fertilization

The pollen tube enters the archegonium. It releases two male gametes. One gamete unites with the oosphere and form oospore. The other gamete fuses with the ventral canal nucleus to forms a layer of true endosperm. It is an approach to the process of **double fertilization** like Angiosperms.

Development of Embryo

I. The nucleus of the oospore divides into eight nuclei. The lower nuclei develop cell walls and act as **proembryonal cells.**

2. Each proembryonal cell produces a tube like outgrowth. This outgrowth swells at the tip. The nucleus migrates into this swollen
tip. A septum cut off this tip from the rest of the tube.

3. This apical cell now acts embryonal cell. It produces embryo by further divisions.
4. The tube elongates and acts suspensor. It pushes the developing embryo deep into the prothalial tissue. More than one proembryos may start developing into embryos. But only one of them reaches maturity. All others are aborted.

5. The upper one or two pairs of bracts become fleshy. The remaining bracts become woody to form a sort of fruit. The testa of the seed remains thin. The embryo becomes straight. It occupies most of fleshy endosperm. The embryo has two large cotyledons.
6. Seed germinate immediately. Cotyledons come above the ground and increase very much in size. They form major photosynthetic tissue of the early stages.

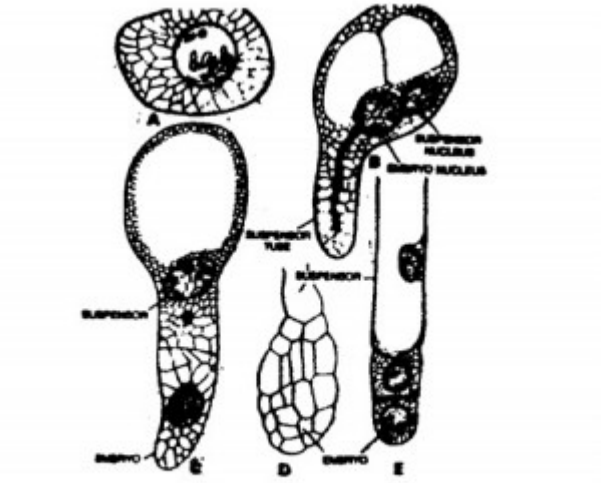

Fig: Development of embryo

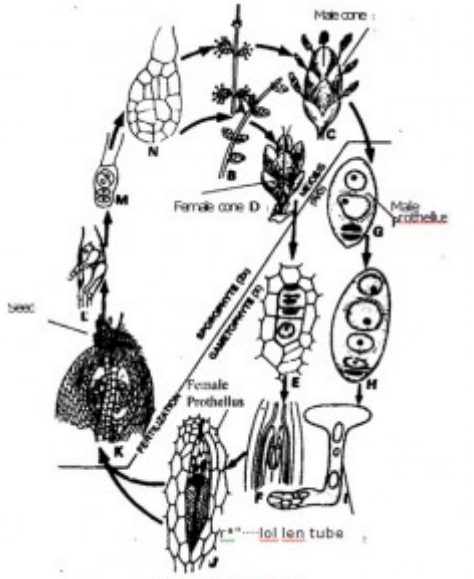

Fig: Life cycle of Ephedra