

# EPHEDRALES Part-2

## Reproduction

Ephedra is dioecious, and the two sex organs are present on different plants. *E. foliata* however, monoecious individuals are also common. Occasionally, an ovulate flower may be replaced by a staminal flower, and thus the strobilus becomes bisporangiate as in *E. Campylopoda*. In the bisporangiate strobili the male flowers are present in the lower region while the female flowers at the top of the strobilus.

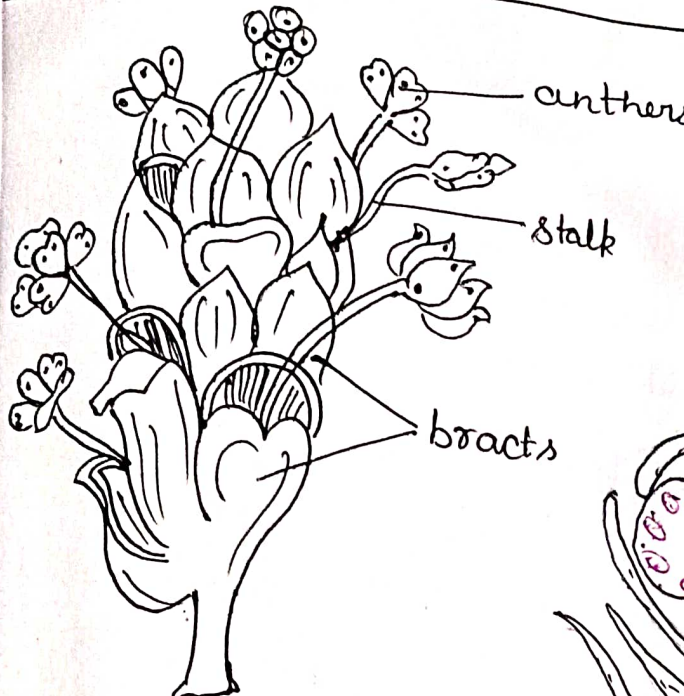
Ephedra is heterosporous, i.e. two types of spores are present. The male & female flowers are present in the form of cone-like, compound male & female strobili respectively. It is only at this stage that the distinction between the male & female plants can be made because there is no well-marked morphological difference in the vegetative stage of the male & female plants of Ephedra.

### Male strobilus

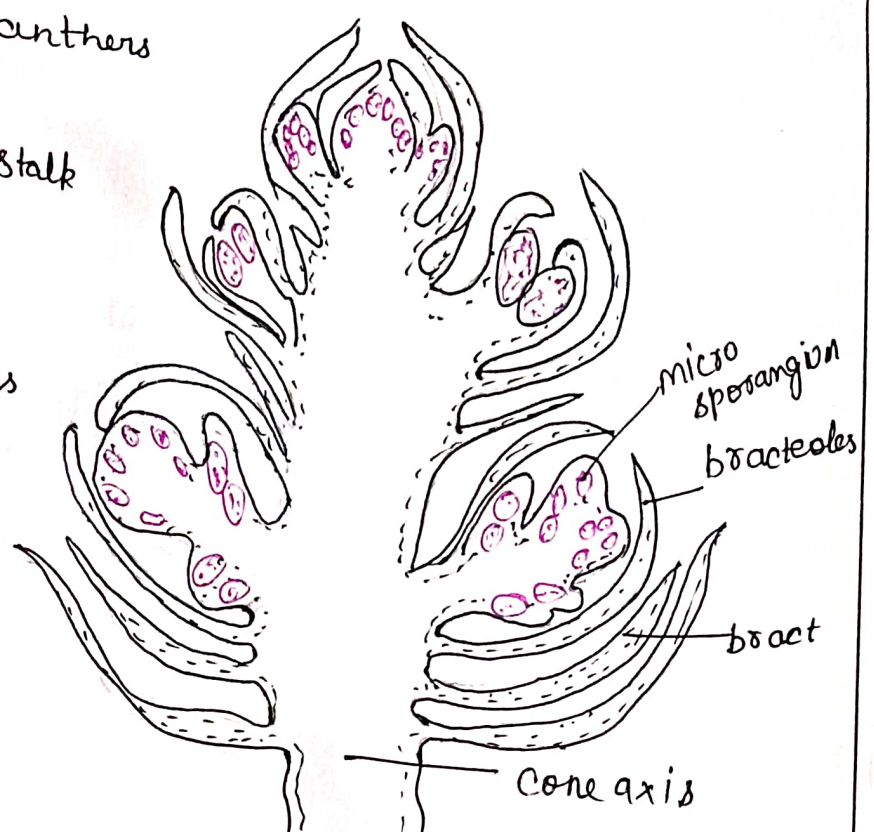
The male strobili are compound structures arising in clusters from the nodes of the branches. Each strobilus develops in the axil of a scaly leaf.

A male strobilus is a rounded or ovoid body with a strobilus axis in its centre. Two to eight pairs of bracts remain arranged in opposite decussate manner on the strobilus axis. All the bracts are fertile except a few on the lower side. A single male or staminate flower arises in the axil of each bract.

Each male flower consists of two bracteoles and a stamen. Bracteoles are thin opposite scales united at the base. They have been interpreted as perianth. Each stamen is a stalked structure.

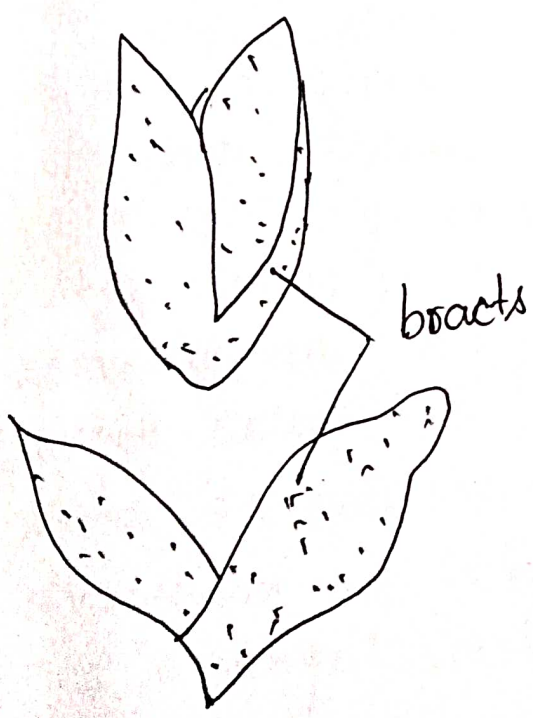


A

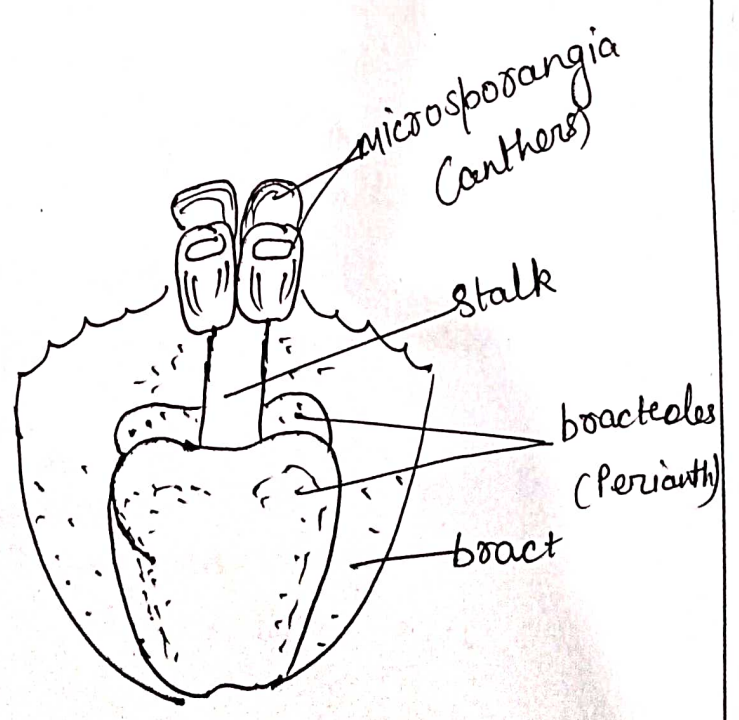


B

*Ephedra Viridis* A, Compound male strobilus  
B, L.S. Male strobilus



*Ephedra* Bracts



*Ephedra* → A single male flower

The stalk continues into a shoot axis or microsporangiothorse which bears two to eight or more microsporangia terminally. Microsporangia are sessile structures. Each microsporangium is bilocular or trilocular. The male flower is called a simple strobilus.

### Development of microsporangium

The microsporangium starts to develop from a group of hypodermal cells which function as archesporium.

The archesporial cells are larger in size with more dense cytoplasm and quite prominent nuclei in comparison with the other adjacent cells.

These cells divide periclinally into outer primary parietal cells and inner primary sporogenous cells.

The parietal cells divide repeatedly and form one-celled thick wall and also the tepalum. But according

to Singh and Maheshwari the primary wall layer functions directly as the outermost wall of the sporangium while the primary sporogenous cells form a middle wall layer, an inner tepetal layer and sporogenous cells. The sporogenous cells divide several times irregularly and form many microspore mother cells. The latter divide meiotically to form

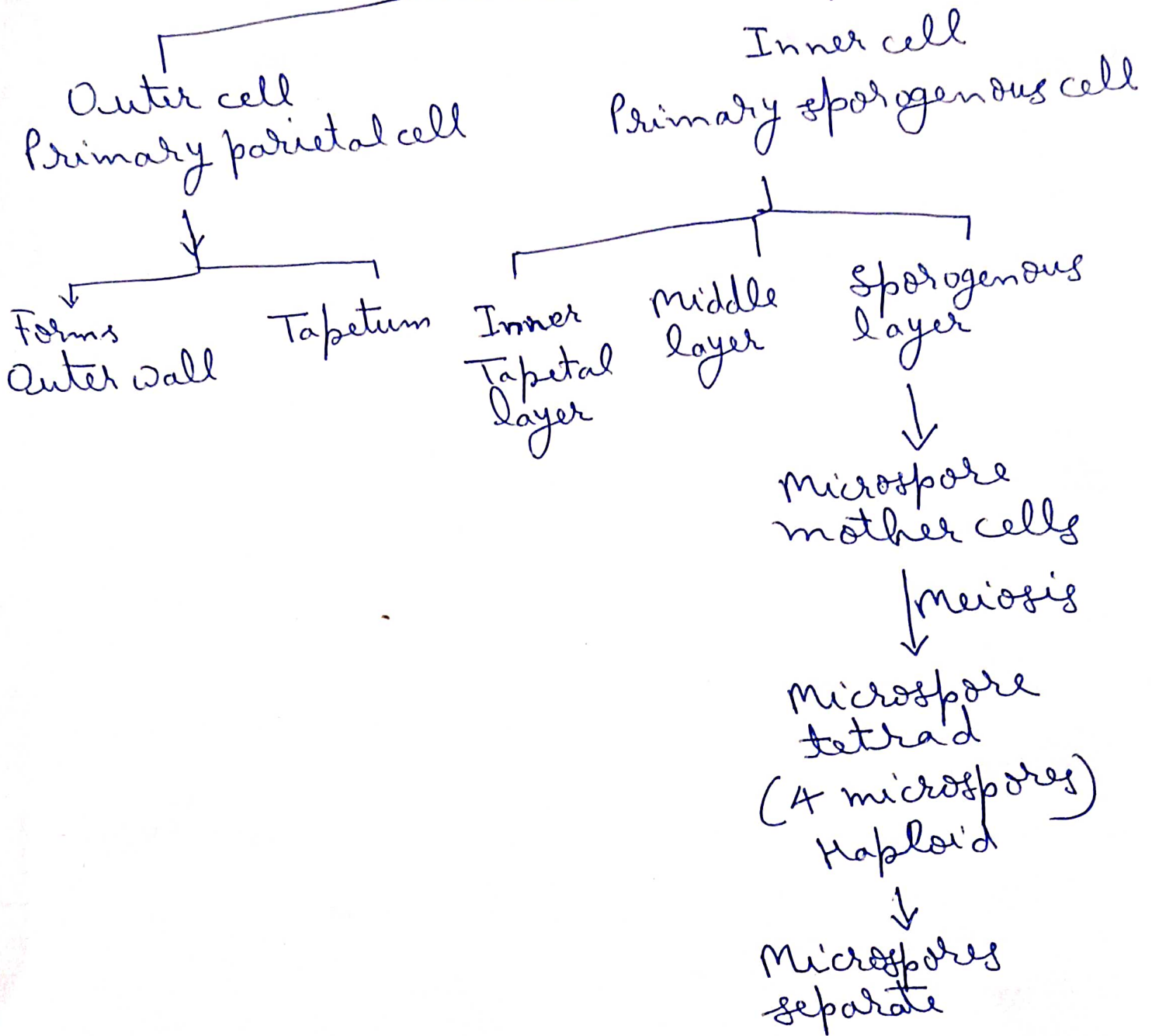
spore tetrads arranged tetrahedrally. The haploid microspores are later on separated. Rarely, the spores are arranged isobilaterally.

It is observed that one layer of crushed wall cells is present in between the outermost layer and tepalum layer of sporangium. The tepalum cells are very large.

# Development of Microsporangium of Ephedra

A group of hypodermal cells

↓  
Functions as Archisporial cells  
↓ Periclinal division



## Female Strobilus

The ovulate or female strobili are elongated and pointed structure. Similar to male strobili they also develop in the axil of leaves in the whorls of 2, 3 or 4 at the nodes of small green branches. Each female strobilus is sessile and smaller than male strobilus. Pairs of bracts are more in number in female strobilus than male strobilus. Bracts are arranged in opposite decussate manner. All bracts, except the uppermost pair, are sterile. Two ovules are present in the axil of uppermost pair of bracts, out of which generally only one survives. The female strobili appear on the plants in the month of April and the mature seeds are seen in September in *Ephedra gerardiana*.

## Ovule

The ovule remains covered by a cup-shaped outer integument and an inner integument. The outer integument remains attached at the basal portion of the ovule. The inner integument protrudes out in the form of a long tubular micropyle. The integuments enclose the nucellus. A small pollen chamber develops near the micropyle in the nucellus. Pollen chamber in *Ephedra* is deepest known among the gymnosperms. The female gametophyte is centrally located, and the archegonia are present in the female gametophyte near the micropylar end.

A hypodermal archesporial cells gets differentiated in the parenchymatous nucellus of the young ovule. The megaspore mother cell is pushed quite deep into the nucellar tissue and divides meiotically to form four haploid megaspores.

T-shaped megaspore tetrads have been observed in *Ephedra foliata* by Maheshwari.

Generally the lowermost megaspore, situated near the chalazal end, remains functional and develops into the female gametophyte.