

Q. What do you mean by heterospory?
Discuss the seed habit with reference to the life history of Selaginella.

Ans → The condition of the production of two types of dissimilar spores, differing in size and shape and developmental patterns is termed heterospory. According to modern pteridologists the heterospory is found in 8 genera - Selaginella, Isoetes, Marsilea, Stylites, Salvinia, Azolla, Regnellidium & Pilularia.

The two different sizes of spores - small (microspore) and large (megaspore) are produced in microsporangium and megasporangium respectively. The microspores are produced in large numbers in comparison to megaspores. Megaspores are few in number per megasporangium.

The microspores germinate to produce the male gametophyte or the microgametophyte that bear male sex organ which produce antherozoids. The megaspores germinate to produce the female gametophyte or the megagametophytes that bear archegonium or the female sex organ which produce egg.

Origin of heterospory

As per experimental evidence, the heterosporous habit arose as a result of the disintegration of a certain number of spores and consequently better nutrition to the surviving one. Hence the nutritional factor is involved in the manifestation of heterospory.

In this context Goebel (1930) was of opinion that the heterosporous plants of Selaginella growing in shade produce only microsporangia bearing microspores.

Biological importance of heterospory

The most important aspect of heterospory is expression of sex determining process of the plant. It has brought about, along with its onset, a phenomenal shift of sex determining capacity from the gametophyte to the sporophyte. In all the homosporous individuals, the sex determinants exert their effect in the gametophytes during the formation of antheridia and the archegonia. In heterosporous individuals the sex determinants exert their influence during sporogenesis. In Selaginella sex is determined during the differentiation of spores.

Heterospory is the most important evolutionary development in the vascular plants because it has ultimately led to seed developments.

Heterospory has also freed the sporophyte from aquatic habitats, a significant evolutionary development during the struggle to conquer land.

Heterospory has resulted in the reduction of the gametophytic tissue, their endospermic nature, precocious germination of the spores, partial and ultimately complete retention of the megasporangium and female gametophyte

on the sporophyte, reduction in the number of megaspore to one, reduction in the number of male gamete and ultimately loss of mobility of the male gametes in angiosperms and organic union between the megaspore and megasporangium. These changes have gradually developed in vascular plants and led to seed habit.

Heterospory and seed habit -

Heterospory is considered to be a pre-requisite to seed formation. In addition to heterospory the seed plants show the following characteristics that have led to the formation of the seed.

- (a) Reduction in size of the male gametophyte.
 - (b) Formation of one megaspore within a megasporangium or the nucellus as we call it in the seed plants.
 - (c) The megasporangium is surrounded by an additional protective coat called the integument.
 - (d) The functional megaspore mother cell divides by meiosis and forms 4 haploid megaspore. The lower most megaspore gives rise to the female gametophyte whereas the rest degenerate.
 - (e) The male gametes reach the egg by means of a tubular pollen tube.
 - (f) Fertilization and formation of embryo takes place in megasporangium.
- In Selaginella, there is

remarkable approach to the seed habit, on account of the following important features —

(a) It shows heterospory.
 (b) The megaspore usually germinates within the megasporangium and is not shed for a time which may vary from species to species.

(c) The number of megaspores in S. rupestris and S. monosperma is reduced to one.

(d) In S. rupestris the megaspore is not shed and fertilization and development of embryo up to the formation of rhizophore, stem and cotyledon takes place within the megasporangium. This condition can be linked to vivipary in some angiosperm.

(e) The homologies of female reproductive organs of Selaginella have also been established to the spermatophytes as follows —

<u>Selaginella</u>		<u>Gymnosperms</u>
Megasporophyll	≡	Integument
Megasporangium	≡	Nucellus of ovule.
M.M.C	≡	M.M.C
Megaspore tetrad	≡	Megaspore tetrad.
Megaspore	≡	Megaspore
♀ prothallus	≡	Endosperm
Archegonium	≡	Archegonium
Egg	≡	Egg
Zygote	≡	Zygote
Embryo	≡	Embryo.

It becomes quite evident

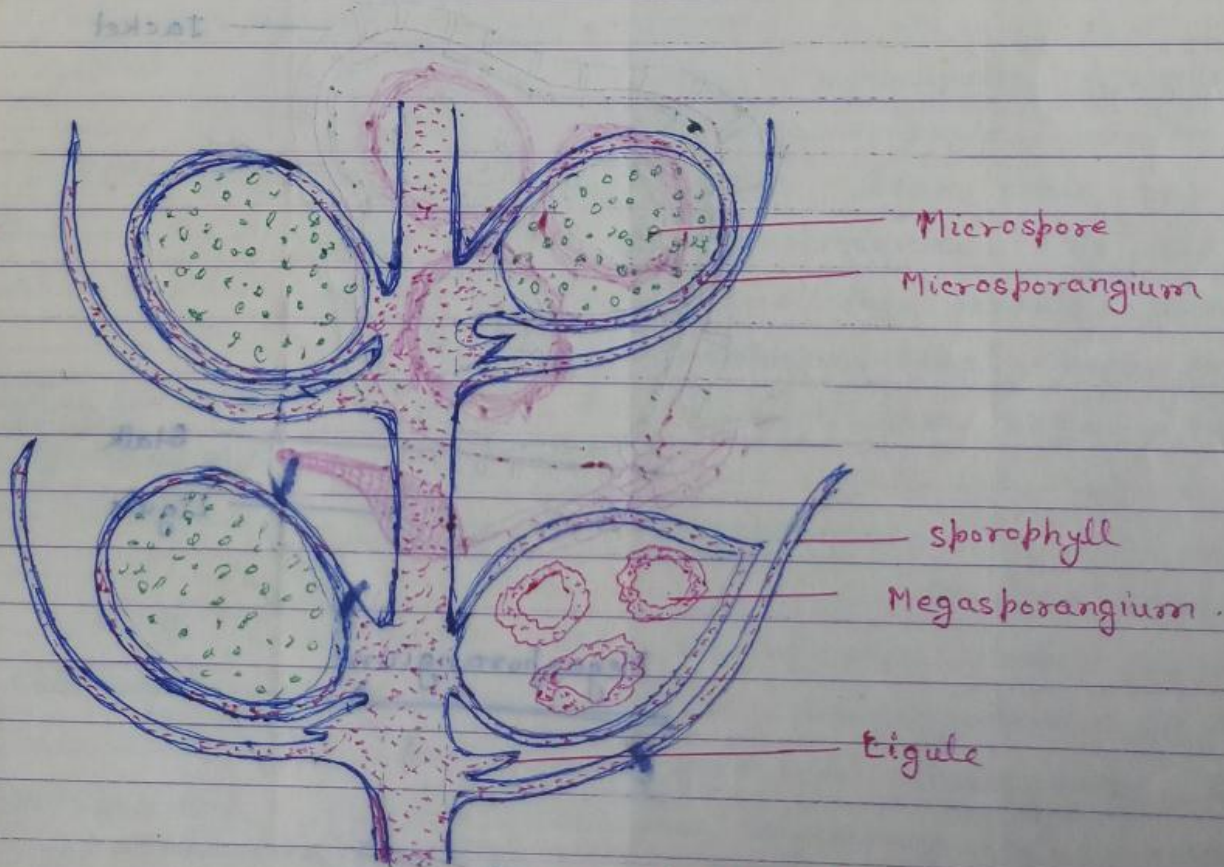
Selaginella has considerably advanced towards the seed habit in a few sps, but its approach to the true seed is not complete due to the following features -

(a) The megasporangium lacks an integument.

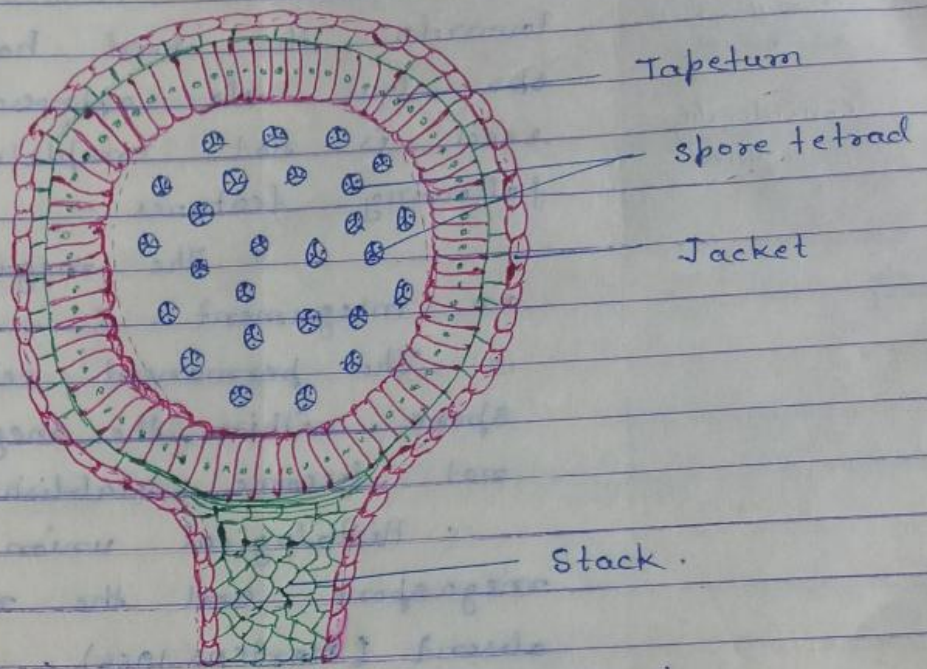
(b) The permanent retention of the megaspore within the megasporangium has not become established.

(c) Histological union between the megaspore and the megasporangium is absent (Martens 1966).

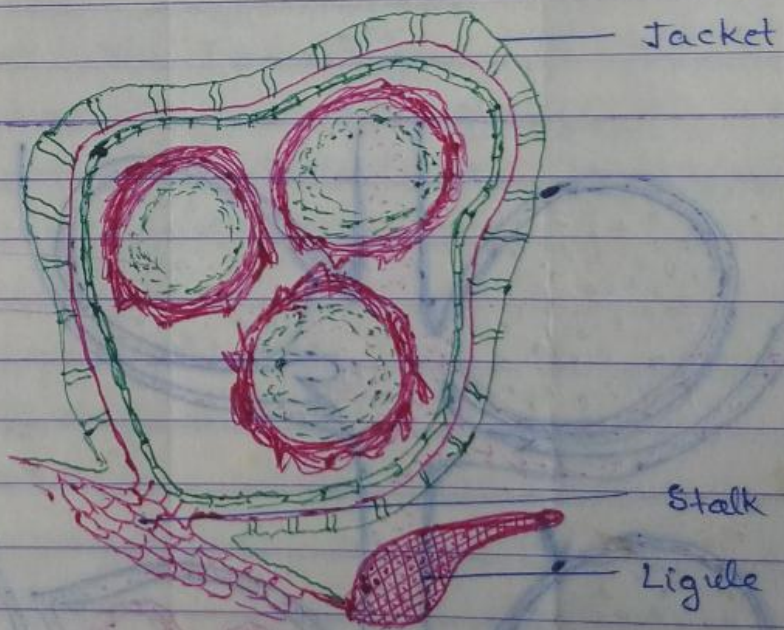
(d) Lack of resting period after the development of embryo.



L.S. of Strabellus



Microsporangium



Megasporangium