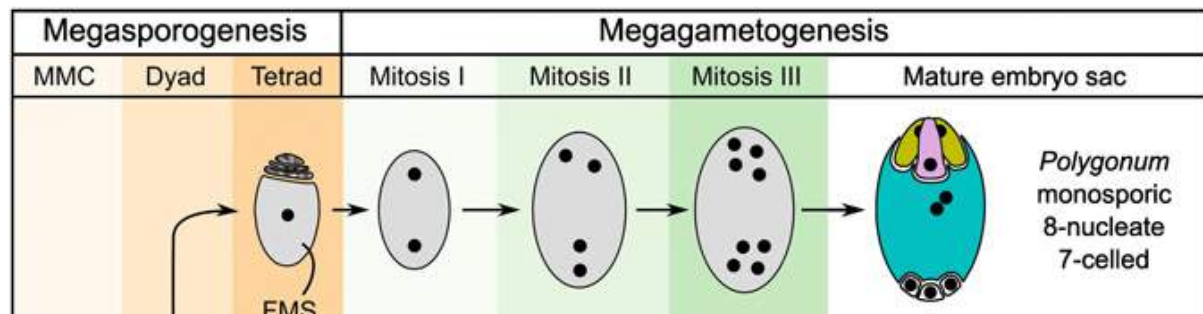


Department of Botany
Suri Vidyasagar College
Suri, Birbhum, WB
Study material for Sem-V (Hons) class
Paper: DSE-1 (Reproductive Biology of Angiosperms)
Dated: 27.08.2022 Teacher: SA sir

*Types of Female
gametophytes (Embryo sacs
practical)*

A) Study of Monosporic Female gametophyte:

1) Study of 8-nucleate,7-celled Monosporic Female gametophyte



Observations:

It shows following characters:-

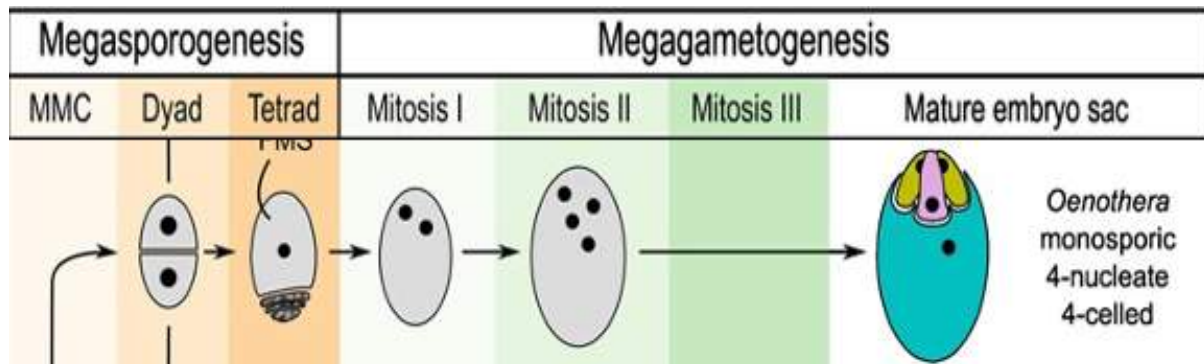
- 1) In the monosporic pattern, both meiotic divisions are accompanied by cell plate formation, resulting in four one-nucleate megaspores. Subsequently, here three megaspores, generally the micropylar-most megaspores, undergo cell death.
- 2) A single nucleus of the functional megaspore undergoes **two rounds of mitosis**, producing a **four-nucleate cell with two nuclei at each pole**.
- 3) During a **third mitosis**, phragmoplasts and cell plates form between sister and non-sister nuclei, and soon thereafter, the female gametophyte cells become completely surrounded by cell walls.
- 4) During cellularization, **two nuclei, one from each pole (the polar nuclei), migrate toward the center** of the developing female gametophyte and fuse together either before or upon fertilization of the central cell.
- 5) These events result in a **seven-celled** structure consisting of three antipodal cells, **one central cell, two synergid cells, and one egg cell**.

Therefore the embryo sac is known as monosporic, 8-nucleate, 7-celled **Polygonum-type embryo sac.**

Examples: *Polygonum* of Polygonaceae

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2) Study of 4-nucleate, 4-celled Monosporic Female gametophyte



Observations:

It shows following characters:-

- 1) In the monosporic pattern, both meiotic divisions are accompanied by cell plate formation, resulting in four one-nucleate megaspores. Subsequently, here three megaspores, generally the chalazal-most megaspores, undergo cell death.
- 2) In this type the usual linear tetrad of megaspores are formed, but instead of the innermost one, the **outermost megaspore** (which is present towards micropyle) remain **functional** and forms the embryo sac.
- 3) The functional megaspore undergoes two successive divisions and forms 4 nuclei.
- 4) All the nuclei remain towards the micropyle. Out of four nuclei, three form the egg apparatus (One egg & two synergids) and the remaining one forms a uninucleate central cell which contains a single polar nucleus.
- 5) Second polar nucleus and antipodal cells are absent.

Therefore the embryo sac is known as monosporic 4-nucleate, 4-celled

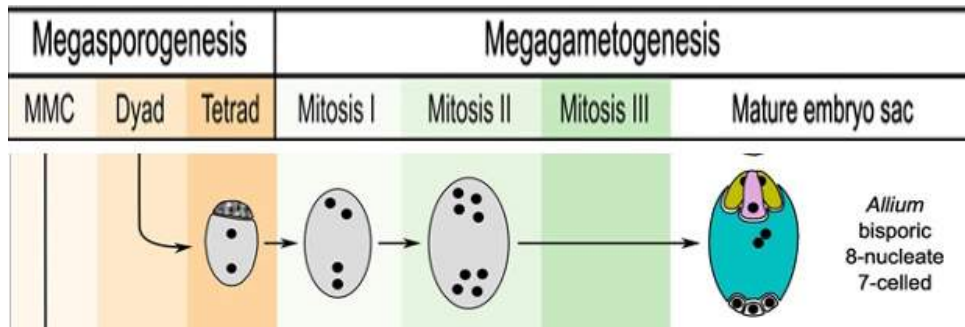
Oenothera-type of embryo sac.

This type is found in the genus *Oenothera* & other members of Onagraceae.

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B) Study of Bisporic Female gametophyte

1) Study of 8-nucleate,7-celled Bisporic Female gametophyte



Observations:

It shows following characters:-

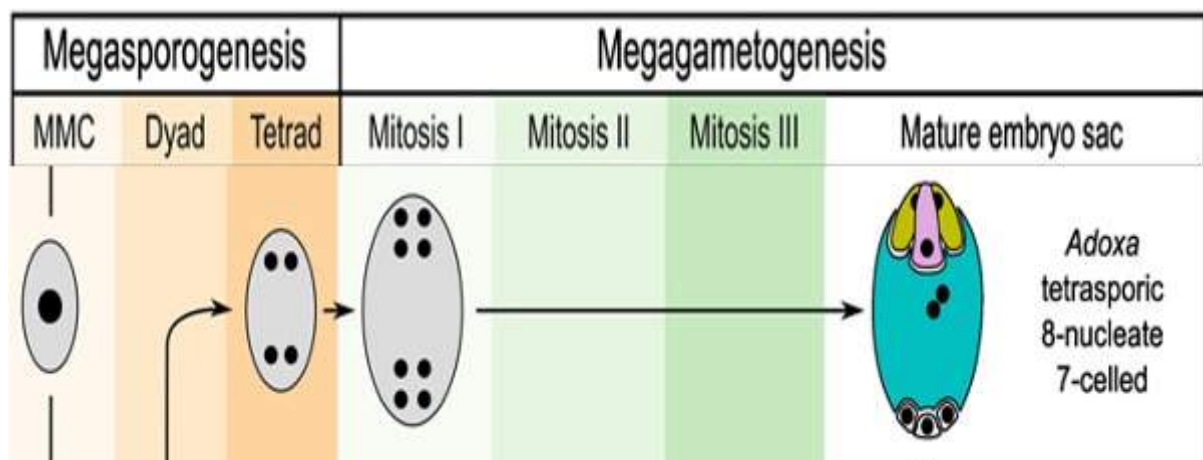
- 1) The megaspore mother cell divides meiotically to form two cells. Here, the **cell plates form after meiosis I but not meiosis II**. The result is **two two-nucleate megaspores** and the outer one (micropylar) quickly degenerates.
- 2) The inner one which is the **chalazal functional megaspore** distributes its two nuclei into the two poles. Later on, both the nuclei undergo **two successive mitotic divisions** and form usual **octant type of embryo sac**.
- 3) These events result in a **seven-celled** structure consisting of three antipodal cells, **one central cell, two synergid cells, and one egg cell**.

Therefore the embryo sac is known as bisporic, 8-nucleate, 7-celled **Allium-type embryo sac**.

Examples: *Allium, Scilla, Trillium*, etc., of Liliaceae

C) Study of Tetrasporic Female gametophyte where nuclear fusion lacking:

1) Study of 8-nucleate,7-celled Tetrasporic Female gametophyte



Observations:

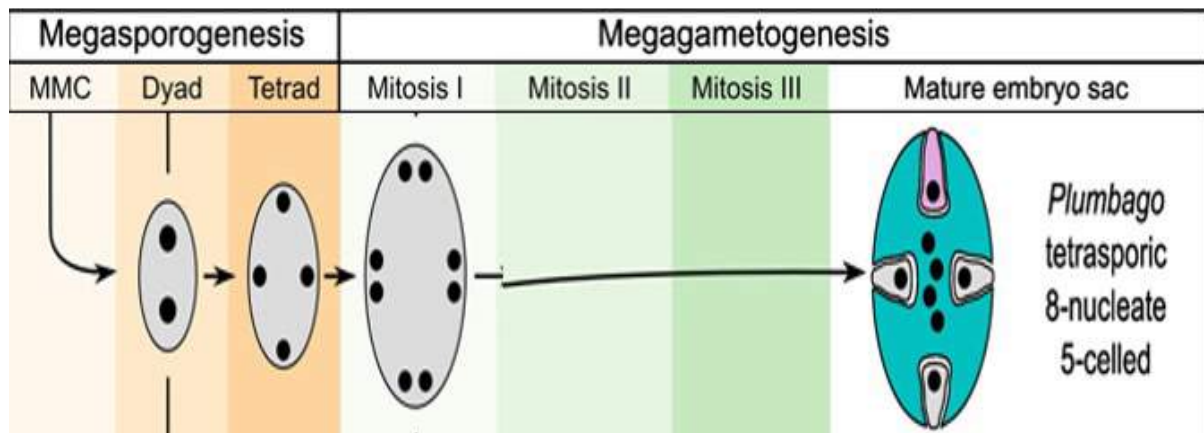
It shows following characters:-

- 1) Initially four megaspore nuclei are formed. Two megaspore nuclei remain towards the micropyle, and the rest two at the chalazal end.
- 2) All the nuclei undergo only one mitotic division and form 8 nuclei, out of which 4 nuclei remain towards the micropyle and the rest 4 at the chalazal end.
- 3) In the mature embryo sac, egg and two synergids remain towards the micropyle, 2 polar nuclei (one from each pole) at the centre (central cell) and three antipodal cells at the chalazal end.

Therefore, the embryo sac is known as tetrasporic, 8-nucleate, 7-celled **Adoxa-type embryo sac**.

Examples: *Adoxa*, *Sambucus* of Caprifoliaceae

2) Study of 8-nucleate,5-celled Tetrasporic Female gametophyte



Observations:

It shows following characters:-

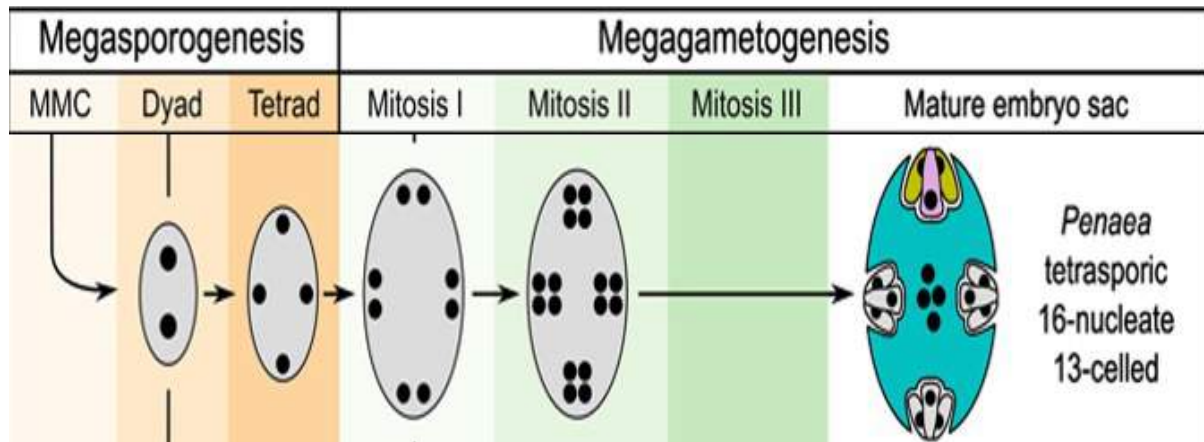
- 1) Initially four megaspore nuclei are formed. Two of the four megaspore nuclei remain situated parietally (lateral) while two others towards the micropyle, and the chalazal end respectively.
- 2) All the nuclei undergo only one mitotic division and form 8 nuclei, out of which 2 pairs of nuclei remain situated laterally while 1 pair at the micropyle and another pair remain at the chalazal end.
- 3) One nucleus from each pair migrates to the centre, thus forming a four-nucleate central cell and later all the four get fused to form a tetraploid secondary nucleus in the central cell.
- 4) The nucleus left at the micropylar end then form egg cell and that at the chalazal end forms **a single antipodal cell** which soon degenerates. **Synergids are absent.**
- 5) The two lateral nuclei become cut-off as **two peripheral cells** which later disappear.
- 6) Thus the mature embryo sac comprises **an egg cell** , **a single antipodal cell**, **two parietal cells** and **a four-nucleate central cell**.

Therefore, the embryo sac is known as tetrasporic, 8-nucleate, 5-celled

Plumbago-type embryo sac.

Examples: *Plumbago* of Plumbaginaceae

3) Study of 16-nucleate,13-celled Tetrasporic Female gametophyte



Observations:

It shows following characters:-

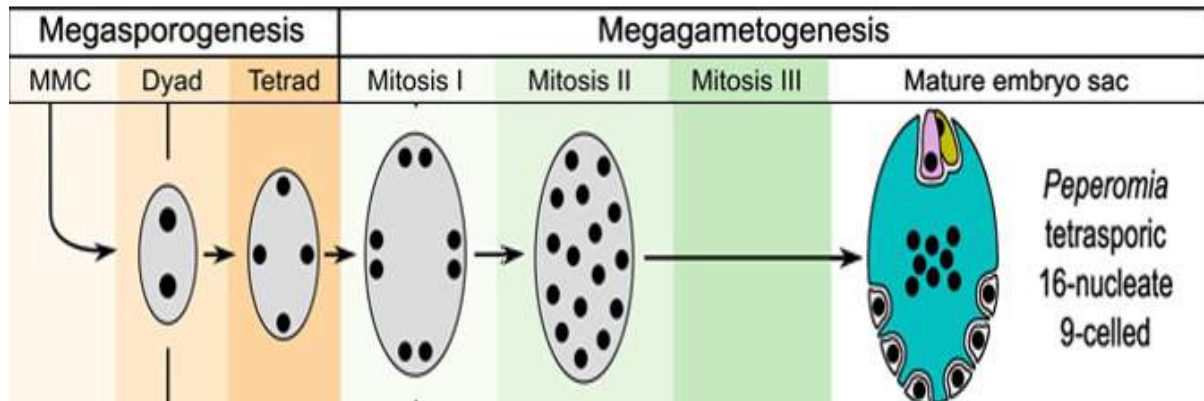
- 1) Initially four megaspore nuclei are formed. Two of the four megaspore nuclei remain situated parietally (lateral) while two others towards the micropyle, and the chalazal end respectively.
- 2) All the nuclei undergo two successive mitotic divisions and form 16 nuclei, out of which 4 pairs situated laterally while 2 pairs at the micropyle and another 2 pairs remain at the chalazal end.
- 3) Total four nuclei (2 from lateral position & 2 from each pole) migrates to the centre, thus forming a four-nucleate central cell and later all the four get fused to form a tetraploid secondary nucleus in the central cell.
- 4) The 3 nuclei left at the micropylar end then form egg cell & two synergids and 3 nuclei left at the chalazal end form **three antipodal cells**.
- 5) The rest 6 lateral nuclei form **six peripheral cells** which later disappear.
- 6) Thus the mature embryo sac comprises **an egg cell, two synergids, three antipodal cells, six parietal cells** and a **four-nucleate central cell**.

Therefore, the embryo sac is known as tetrasporic, 16-nucleate, 13-celled

Penaea-type embryo sac.

Examples: *Penaea* of Penaeaceae

4) Study of 16-nucleate, 9-celled Tetrasporic Female gametophyte



Observations:

It shows following characters:-

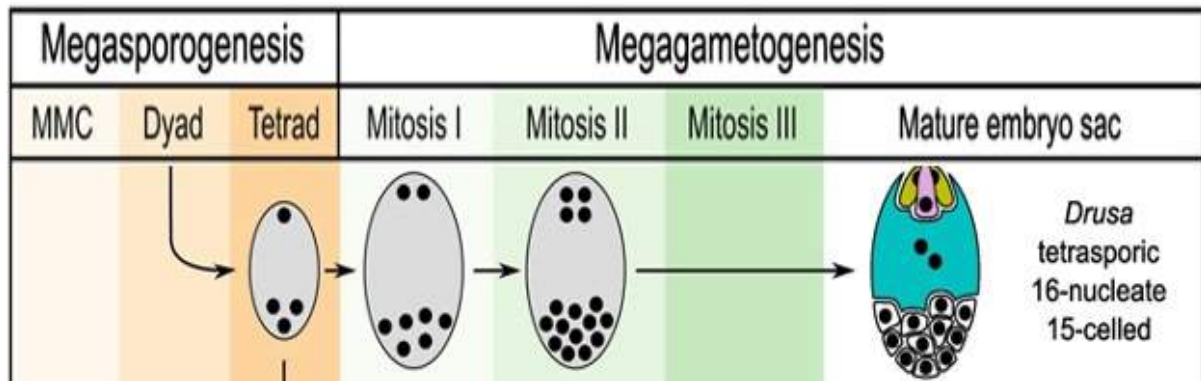
- 1) Initially four megaspore nuclei are formed. Two of the four megaspore nuclei remain situated parietally (lateral) while two others towards the micropyle, and the chalazal end respectively.
- 2) All the nuclei undergo two successive mitotic divisions and form 16 nuclei, unevenly distributed throughout the cell.
- 3) The organization of mature embryo sac is: an egg apparatus comprising an egg and **only one synergid, six antipodal cells** and **a central cell with eight polar nuclei**.

Therefore, the embryo sac is known as tetrasporic, 16-nucleate, 9-celled

Peperomia-type embryo sac.

Examples: *Peperomia* of Piperaceae

5) Study of 16-nucleate,15-celled Tetrasporic Female gametophyte



Observations:

It shows following characters:-

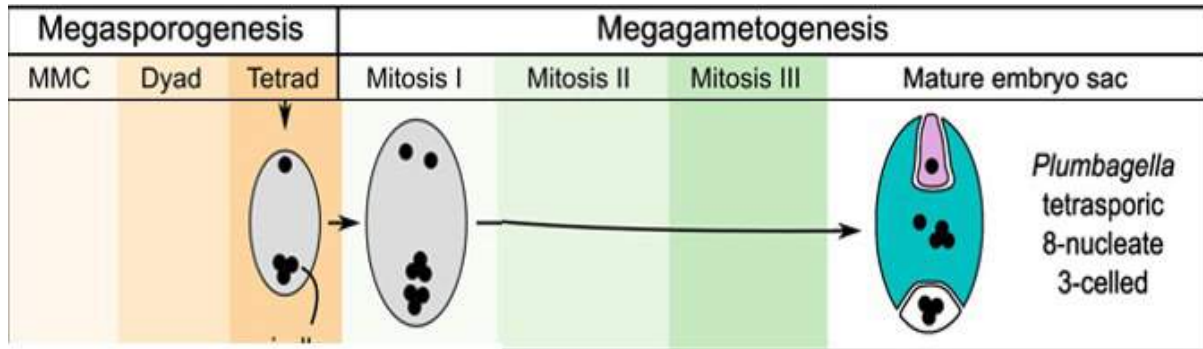
- 1) Initially four megaspore nuclei are formed, these are distributed in different ways. One megaspore nucleus remains towards the micropyle, and the rest three at the chalazal end.
- 2) All the nuclei undergo two successive mitotic divisions and form 16 nuclei, out of which 4 nuclei remain towards the micropyle and the rest 12 at the chalazal end.
- 3) In the mature embryo sac, egg and two synergids remain towards the micropyle, 2 (one from each pole) at the centre and the rest 11 at the chalazal end,

Therefore, the embryo sac is known as tetrasporic, 16-nucleate, 15-celled

Drusa-type embryo sac.

Examples: *Drusa oppositifolia* of Apiaceae.

2) Study of 8-nucleate,3-celled Tetrasporic Female gametophyte



Observations:

It shows following characters:-

- 1) Initially four megaspore nuclei are formed. Three of the four megaspore nuclei situated at the chalazal end. All the 3 nuclei at the chalazal end, then, fused to form one triploid nucleus/spindle ($3n$). The fourth nucleus at the micropylar pole remains haploid(n).
- 2) All the nuclei, then, undergo only a single mitotic division and form two haploid nuclei at micropyle pole, and two triploid nuclei/spindles at chalazal pole.
- 3) One haploid nucleus from the micropylar end and one triploid nucleus from the chalazal end migrate towards centre , thus forming **a central cell with two polar nucleus- one haploid and one triploid.**
- 4) Thus the mature embryo sac also comprises only an egg cell at micropylar end and **a single triploid antipodal cell** at the chalazal end.

Therefore, the embryo sac is known as tetrasporic, **8-nucleate, 3-celled**

Plumbagella-type embryo sac.

Examples: *Plumbagella* of Plumbagellaceae

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