Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (second year)

Subject: Botany

Course Code: BOC 103

Course Title: Plant Anatomy and Embryology

Unit: 07

Module Name: Endosperm types and functions

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Introduction

- Most common nutritive tissue for development of embryo in angiosperms
- It is the product of fertilization and **usually triploid**
- After fertilization, the fusion product of polars and the second male gamete is called **primary endosperm nucleus**
- Later give rise to almost a **form less tissue**, the **endosperm**
- Exceptions: Orchidaceae, Podostemaceae, Trapaceae

Development of endosperm

- Development occurs through the triploid cell.
- Fusion of secondary male gamete with the diploid secondary nucleus
- Secondary nucleus is formed by two polar nuclei to form PEN and triploid cell.
- Endospermic cells may be diploid (water lily) or polyploid (up to 15n) form.

Types of seeds based on endosperm

- The endosperm may be consumed by developing embryo in non-endospermic/exalbuminous seeds. e.g. pea, beans
- The endosperm may persist in mature seed in endospermic/ albuminous seeds e.g. cereals, castor-bean, coconut
- The primary endosperm nucleus undergo division almost immediately after its formation
- Depending on mode of development **3 types**
- 1. Nuclear endosperm
- 2. Cellular endosperm
- 3. Helobial endosperm
- Nuclear endosperm is more common than cellular monocots as well as dicot
- Cellular endosperm is largely restricted to dicots. (among monocots only Araceae has cellular)
- Helobial is quite rare in monocots

NUCLEAR ENDOSPERM

- Most important type of endosperm
- Represents humankind's most important renewable source of food, feed, and industrial raw materials
- Cereal species maize, rice, barley, and wheat
- The division of primary endosperm nucleus and a few subsequent nuclear divisions are not followed by wall formation
- Results in a condition having few to several thousand nuclei freely suspended in the central cell

- Such a condition of endosperm may persist until it is consumed by developing embryo or become cellular at later stage
- The extent of cellularization vary
- Some case complete and in some incomplete
- Occasionally endosperm produce haustoria at the chalzal end (*Grevillea robusta*)
- In *Lomatia*, the endosperm produce numerous single celled, finger-like projection all over endosperm
- *Scleria foliosa* -endosperm haustoria on both micropylar and chalazal end
- *Acalypha indica*, Coconut, areca nut
- In areca nut also as in coconut, but small embryo sac

Cellular endosperm

- Characterised by absence of free-nuclear stage
- Division of primary endosperm nucleus and a few subsequent nuclear divisions are regularly followed by wall formation
- Presence of haustoria is more common in this type
- Balsam, Petunia

Helobial endosperm

- Restricted largely to monocotyledons
- Primary endosperm cell moves to chalazal end where it divides forming a large micropylar chamber and a small chalazal chamber
- In micropylar chamber, as a rule, free-nuclear division and cell formation, start at much later stage
- In chalazal chamber the nucleus either remain undivided or divides few times

Ruminate endosperm

- Endosperm dissected by in growths of the seed coat.
- Caused by activity of seed coat due to infolding of it/by endosperm itself.
- Second type is common, found in Annonaceae, Aristolochiaceae, Myristicaceae.
- Rumination in Myristica is by its own activity:

where endosperm begin to increase in volume of seed

soon absorbs nucellus and comes in direct contact with seed coat

further irregular growth of inner surface of seed coat makes endosperm ruminate

Functions of endosperm

- Main source of food for the embryo as well as for humans.
- Embryonic growth by supplying nutrients, protecting the embryo and controlling embryo growth by acting as a mechanical barrier during seed development and germination
- Contains starch as a food reserve, but in some cases they contain fats, e.g. castor.
- Consists of hormones like cytokinins which help in cell differentiation process.
- Coconut water is one of the examples of a liquid endosperm.