SUMMARY

Reproductive biology of Sesamum cultivated and wild includes collection of germplasm, embryology, histochemistry of wild species, embryology of interspecific crosses and seed morphology.

Sesamum alatum, S. laciniatum, S. mulayanum, S. prostratum are the wild species collected from different parts of Tamil Nadu and S. radiatum is a Nigerian species procured from Tamil Nadu Agricultural University, Coimbatore. Taxonomic characters of these species are enumerated and an identification key is attempted. Taxonomic position of S. mulayanum is critically analysed.

Embryological studies are carried out in S. alatum (2n = 26), S. laciniatum (2n = 32), S. radiatum (2n = 64). Development of anther, ovule, embryo and endosperm is similar in all the three species except very few variations.

Anther is tetrasporangiate. Anther wall follows basic type of development. Wall layers consist of epidermis, endothecium, 2 or 3 middle layers and the tapetum. Epidermis degenerates when the anther matures. Endothecium elongates radially with the degeneration of tapetum and middle layers. Fibrous thickenings develop along their radial wall.

Tapetum is secretory and dual in origin. Its cells are uni-, or binucleate with vacuolated cytoplasm and dimorphic in S. laciniatum. Microspore mother cells are pherical with their callose wall, dense cytoplasm and prominent nuclei. Simultaneous meiotic division results in tetrahedral, isobilateral and opposite decussate type of tetrads. Ubisch granules appear when the tapetal cells degenerate. Mature pollen grains are binucleate.

Ovule is unitegmic, tenui-nucellate and anatropous. The single layered nucellus at the micropylar pole degenerates and the inner most layer of the integument forms a protective layer, the endothelium. When the embryo and the endosperm enlarge in size, this layer degenerates and the remnants form a thick
lining layer along the embryo sac. A group of cells at the chalazal end have thick walls and faint cytoplasm and functions as hypostase.

A single hypodermal archesporial cell enlarges to become the megaspore mother cell which after meiosis results in linear tetrad of megaspore. Embryo sac is of Polygonum type.

Pollination and fertilization leads to the formation of primary endosperm nucleus and zygote. Endosperm is of cellular type and consists of chalazal and micropylar chambers. Chalazal endosperm consists of 4 elongated cells. Micropylar endosperm consists of 4 regions and grows beyond the zygote as a haustorium. Few cells enlarge and invade the integumentary cells. The region of the micropylar endosperm which surrounds the embryo forms the endosperm proper. In the mature seed except a few layers, all the tissues of the endosperm are used up by the embryo.

Embryo follows Onagrad type of development.

Histochemical localization of RNA, protein and insoluble polysaccharides in the anther, ovule, embryo and endosperm are studied in *S. orientale*, *S. alatum*, *S. laciniatum* and *S. radiatum*. With very few deviations among the species, the distribution pattern of the above said metabolites is same in all the four species.

Male archesporial cells are rich in RNA and proteins. The cell walls show positive reaction for insoluble polysaccharides, but cytoplasm shows moderate staining. The wall layers show faint staining for RNA, protein and insoluble polysaccharides in their cytoplasm, but their walls react positively for PAS. The tapetal cells are rich in RNA, protein and polysaccharides in their vacuolated cytoplasm. Microspore mother cells are also rich in these macromolecules in their cytoplasm but their callose walls show negative reaction for RNA, protein and faintly staining for polysaccharides. The same intensity is maintained even after tetrad formation. Except proteins, RNA and polysaccharides show positive reaction in the mature pollen grains. Ubisch granules react negatively for proteins and polysaccharides but positively for RNA giving bluish green colour.
The ovule primordium is rich in RNA and protein. Walls are PAS positive and the cytoplasm has moderate polysaccharides. The archesporial cell also shows the same condition. But in the megaspore mother cell cytoplasmic RNA, proteins and insoluble polysaccharides decrease. The condition of the megaspore mother cell is maintained in the tetrads also. In the embryo sac the RNA, proteins and insoluble polysaccharides are at moderate level in the central cell, egg and the synergids. But the antipodals are rich in RNA and proteins. Central cell and the integument near the micropyle contain large number of starch grains. The hypostase cells have PAS positive walls with faint staining cytoplasm for RNA, protein and insoluble polysaccharides. Endothelial cells have PAS positive walls and moderate RNA, protein and polysaccharides in the cytoplasm.

Pollen tube and zygote are rich in RNA, protein and insoluble polysaccharides. But the intensity declines before zygote divides. The globular embryo is rich in RNA, protein and polysaccharides and the intensity is maintained till maturation. The suspensor cells have low amount of proteins, RNA and insoluble polysaccharides. Protein bodies are scattered in the hypocotyl and in cotyledons.

The cells of the chalazal endosperm have rich RNA, protein and insoluble polysaccharides. In the micropylar chamber, the enlarged haustorial cells and the endosperm surrounding the embryo contain very low amount of RNA, protein and insoluble polysaccharides, but the cells in between the haustorium and endosperm proper have rich amount of these metabolities.

Interspecific crosses and reciprocal crosses are carried out as follows:

\[ S. \text{orientale} (2n = 26) \, \bigcirc \, x \, S. \text{alatum} (2n = 26) \bigslant \]
\[ S. \text{laciniatum} (2n = 32) \]
\[ S. \text{radiatum} (2n = 64) \]

In vivo studies on self-pollination, in crosses and reciprocal crosses show ungerminated pollen grains, pollen tube inhibition on the stigma and bursting of pollen tubes at different levels of the style. Abnormalities like, branching of pollen tube, twin tubes, non-directional growth of the pollen tube are also observed.
However there are successful pollen tubes which enter the ovule effecting fertilization.

Embryo development/degeneration is studied at 24 hrs interval upto 15th day. Observations show degeneration of unfertilized/fertilized ovules, degeneration of endosperm leading to the abortion of the hybrid zygote. Such ovules develop into sterile seeds. In some of the ovules hybrid embryos develop normally as in parents. The cross *S. orientale* x *S. alatum* is a complete failure. But seeds are obtained in the reciprocal cross. Pod and seed set are obtained in other two crosses and reciprocal crosses.

F$_1$ hybrids obtained in *S. orientale* x *S. laciniatum* are sterile. Embryological studies reveal both male and female sterility. The back cross with both the parents reveals inhibition at different levels from stigma to ovary.

Amphidiploid obtained by treating the F$_1$ plants with colchicine (0.4%) is partially fertile. The flowers have both normal and sterile anthers and ovules. Fertilization occurred in some of the ovules and embryo develop normally. In some of the ovules the endosperm and zygote show signs of degeneration.

Embryological studies on interspecific crosses of *Sesamum* reveal a high degree of incongruity among the cultivated and wild species.

**Seed Morphology**

Employing the parameters size, shape, number and weight/200 pods the seeds are described. Development and structure of the seed coat are investigated in *S. orientale, S. alatum, S. laciniatum* and *S. radiatum*. Seed coat surface is studied in *S. orientale, S. alatum, S. malayanum, S. laciniatum, S. prostratum* and *S. radiatum* under light and scanning electron microscopy which show variations among the species. Based on surface characters an identification key is given.