Course- B.Sc. Part-II Botany Subsidiary

PAPER–II

Topic- Double Fertilization in Angiosperms (EMBRYOLOGY)

Prepared by – Prof.(Dr.)Shyam Nandan Prasad

Unambiguous proof of the actual fusion of the male and female gametes embodied in fertilization in angiosperms is traced to a monographic publication of Strasburger (1884). This work was mostly devoted to the nuclear cytology of pollen grains and pollen tubes of plants belonging to a wide range of families and to the fate of male gametes delivered by pollen tubes in the embryo sacs of Gloxinia hybrida (Gesneriaceae), Himantoglossum hircinum, Orchis latifolia (Orchidaceae), and Monotropa hypopitys (Monotropaceae). The most complete, illustrated details were provided on M. hypopitys in which it was shown that one of the two male gametes conveyed by the pollen tube fused with the nucleus of the egg. At that time the male gametes were known as the generative nuclei and it was also uncertain whether these gametes were true cells in their own right or just naked nuclei. However, the observation that a male gamete fused with the egg in the act of fertilization was contrary to a previous puzzling finding that this event was orchestrated by the diffusion of cytoplasmic contents of the pollen tube (Maheshwari, 1950). Although Strasburger's work identified the embryo as the resulting product of fertilization, understanding of the fate of the second male gamete discharged by the pollen tube and the source of origin of the endosperm (albumen) remained as major hurdles in gaining a complete insight into the dynamics of fertilization in angiosperms.

The breakthrough occurred when Nawaschin (1898, 1899) in Russia showed that in ovules of Lilium martagon and Fritillaria tenella (Liliaceae), both male gametes from the pollen tube penetrated the embryo sac; whereas one of them fused with the nucleus of the egg cell, the other fused with the polar fusion nucleus (at that time known as the definitive nucleus) floating in the central cell, initiating a second fertilization event. The results of this work were orally presented on August 24, 1898 to the
botanical section of the 'Naturforscherversammlung' held in Kiew and were published as an abstract in the following year (Nawaschin, 1899); the full paper, communicated for publication on September 30, 1898, appeared within a few months after the meeting (Nawaschin, 1898). Thus, reverant credit is due to Nawaschin for the discovery of the two fusion events during fertilization in flowering plants

The Process of Double Fertilization

Double fertilization is a major characteristic of flowering plants. In this process, two male gametes fuse with one female gamete wherein one male gamete fertilizes the egg to form a zygote, whereas the other fuses with two polar nuclei to form an endosperm.An ovary contains at least one ovule. Inside an ovule, cells divide to produce an egg and two other cells called polar nuclei. These three cells are haploid, which means they have one set of chromosomes, and is designated by n. Most cells in angiosperms are diploid, or have two sets of chromosomes. In diploid (2n) cells, one set of chromosomes comes from the male parent and the other set comes from the female parent.In addition to eggs and polar nuclei, sperm cells from a pollen grain are also haploid. Once the pollen tube reaches the micropyle, or the opening of an ovule, it releases two haploid sperm cells into the ovule. One sperm cell will fuse with the egg, resulting in a diploid zygote. The other sperm cell will fuse with the two polar nuclei, creating a triploid (3n) structure that will grow rapidly into the endosperm.: A pollen tube releases two sperm cells into an unfertilized ovule. 2: Double fertilization occurs when one sperm cell fuses with the egg to produce a zygote, and the other sperm cell fuses with the two polar nuclei to make the endosperm. 3: After double fertilization, a seed and fruit develop.