THE DEVELOPMENTAL FEATURES OF THE OVULE AND EMBRYO SAC IN THE HERMAPHRODITE FLOWERS OF *HELIANTHUS ANNUUS* L.

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INTRODUCTION

The inflorescence of *Helianthus annuus* L. has two types of flowers in a single capitulum; central hermaphrodite disc flowers and peripheral pistillate ray flowers (Herman, 2000; Cvejić et al., 2016). In the present study, the developmental features of the ovule and embryo sac were investigated.

MATERIAL AND METHODS

The capitulum at various stages of development were collected from Tekirdağ (Turkey). Firstly, the diameter of capitulum were measured, hermaphrodite flowers were morphologically analysed by stereomicroscope (Olympus 970931). The samples were prepared for light microscope analysis. The material was fixed in acetic-alcohol (1:3, v/v) and embedded in paraffin blocks. The blocks were sectioned at 8-15 μm by Leica RM2235 rotation microtome and sections were stained with hematoxylin. The preparations were photographed with an Evolution LC color camera and an Olympus BH-2 microscope, and the images were analyzed with Image-Pro Express Version 6.0 scientific image processing and analysis software. For SEM analysis, the plant material was fixed in 2.5% glutaraldehyde in 50 mM cacodylate buffer, pH 7.0 (Platt *et al.*, 1983) and then dehydrated with an increasing ethanol gradient: from 70% up to 100%. Then, the material for drying were kept in various percentages of ethanol-HMDS solution at room temperature (Topçuoğlu *et al.*, 2009). Then, coated with 11 nm of gold by using an automated sputter coater and then examined with a SEM (JEOL JMS-59 10LV).

RESULTS

In *Helianthus annuus* L., a hermaphrodite flower contains a pistil with inferior type of ovary which lies below the attachment of other floral parts. The ovule shows basal placentation. It differantiates as small and homogeneous mass on the ovary and consists of the cells with dense cytoplasm and small nuclei. The ovule is unitegmic type, namely have one integument. This situation occurs with the disappearance of one of the integuments or with the merge of the two integuments. Together with the differantiation of the integument and the megaspore mother cell, the funiculi which contacts the ovule to ovary begins to curl. The ovule becomes anatropous at megaspore tetrad stage. The micropyle is long and narrow.

The ovule is *tenuinucellate type. Namely,* megaspore mother cell differantiates just below the nucellar epidermis. The nucellar cells expand and create a loose tissue around the embryo sac. The nucellar tissue can be observe in the mature ovule.

The development of female gametophyte conforms to Polygonum type. Megaspore mother cell produces linear megaspore tetrad by regular meiosis. Functional megaspore which is the the largest one locates at the chalazal part. It undergoes three successive mitosis and forms 2, 4 and 8 nucleated embryo sac, respectively. Two nuclei locate the chalazal part and the other two nuclei locate the micropyle part in 4 nucleated embryo sac. The mature, 8 nucleated embryo sac

contains an egg cell, two polar nuclei, three synergid cells and three antipodal cells. The egg cell and two synergids locate the micropyllar part of the embryo sac and a cell wall is formed around the this cells. This structure is called egg aparture. The egg cell is bigger than the synergids and locate between the synergids. In the egg cell, there is a nucleus in the chalazal part and a big vacuole in the micropyle part of the cell. The cytoplasm is a thin layer and locate only on the periphery. The polarization in the synergid cells is the opposite. Althought the nuclei are found in the base, vacuoles are found in chalazal part. Antipodal cells are smaller than the other cells of the embryo sac. The synergids and the antipodal cells are ephemeral. They become blunt after the fertilization.

LITERATURE

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