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COMMUNICATIONS

EMBRYOLOGY OF *HELIANTHUS MAXIMILIANI* (ASTERACEAE)

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The Maximilian sunflower (*Helianthus maximiliani* Schrad.) is a perennial sunflower. There is practically no data on its embryology and reproductive biology, but the species is of interest for breeding as a source of CMS and other good properties for the cultivated sunflower. It was revealed that the development of the anther wall and the formation of pollen grains in *H. maximiliani* are similar to those in the other perennial *Helianthus* species. The anthers are tetrasporangiate, the anther wall development follows the dicotyledonous type. The formed anther wall is 4-layered, the mature anther wall is 2-layered. The tapetum is cellular with reorganization into syncytium in the postmeiotic period (according to the classification by Kamelina, 2002b, 2009) or typical periplasmodial (according to the classification by Shamrov et al., 2021). Microspore tetrads are formed in a simultaneous manner. Mature pollen grains are 3-celled, with an echinate exine. The average pollen diameter is 25.14 ± 0.11 μm, the total pollen fertility is about 98%. No disturbances in microsporogenesis, microgametogenesis, or anther wall development were found. Consequently, this species can be used in breeding programs and interspecific crosses as a good paternal parent.

The ovule is unitegmal with an integumental tapetum. The nucellus degenerates early and is represented by single cells by the formation of the embryo sac, but since lateral and basal regions are present in the nucellus development, it can be considered not as a tenuinucellate, but as a medionucellate (syndermal variation, single-layered subvariation) according to I.I. Shamrov, or incompletely tenuinucellar according to P.K. Endress. The archesporial cell is formed from the subepidermal (initial) cell after two periclinal divisions, and differentiates into a megasporocyte without separation of parietal cells. As a result of meiosis, a linear tetrad of megaspores is formed. The chalazal megaspore gives rise to the Polygonum-type embryo sac, the cell membrane between the chalazal antipodes is not formed, and two antipodes are formed, one of which is binuclear. Along with formation of embryos, a unique case of absence of the female gametophyte was noted, as well as aging and degenerating embryo sacs.

No significant deviations in the development of the male or female reproductive sphere were found, a sufficient amount of fertile pollen is formed and normal embryo sacs develop. The identified cases of the absence of a female gametophyte cannot be the reason of nearly absent seed reproduction.

Thus, as a result of the study, we concluded that poor seed set is not associated with abnormalities in the formation of male or female reproductive organs but is a consequence of violations of the pollination and fertilization process. Most likely, self-incompatibility takes place, when its own pollen does not germinate well on the stigma. This is also supported by several cases of deviations found during pollen germination, the formation of anomalous pollen tubes. With a limited number of plants and no cross-pollination, self-incompatibility can be the main reason for reduced seed set.

Keywords: Helianthus maximiliani, Asteraceae, microsporogenesis, macrosporogenesis, anther wall, pollen grain, ovule, female gametophyte, embryo, endosperm

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