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Atypical embryo sacs in *Allium cepa* L.

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Abstract
Atypical embryo sacs have been revealed in *Allium cepa* L. The structural changes in Allium type embryo sac in this species take place in all three groups of cells – egg apparatus, central cell and antipodals. The following atypical developmental patterns have been observed: 1. Variation in the number of egg cells (1-3), synergids (1-6), polar nuclei (2-4) and antipodals (3-5); 2. Transformation of synergids and antipodals into additional egg cell; 3. Hypertrophy of more than one synergid and antipodals. It is assume that increase in the number of hypertrophic synergids and antipodals may improve nutrition of the developing embryo. And, the formation of additional egg cells derived from synergids or antipodals may increase probability that the ovule produces a seed. The additional embryos might be formed from egg-like synergids and antipodal cells. The increase in the number of cells in the embryo sac may be explained by mutations leading to the normal mitotic divisions in synergids and antipodals instead of endomitosis occurring during hypertrophy. In general, the female gametophyte in this species shows tendency in increase of structures responsible for seed formation.

Key words: Antipodals, embryo sac, onion, synergid.

Introduction

Some species of genus *Allium* are characterized by constraints in sexual reproduction. This is expressed in suppression of seed production and increase in formation of vegetative propagules. In general, individuals of this genus have very different allocation patterns to three modes of reproduction: sexual flowers, aerially produced asexual bulbils, and belowground asexual offsets. It is known that in many cultivars of onion (*A. cepa*) seed production is very low and is substituted by vegetative propagation by bulbs (1,2,3). Garlic (*A. sativum*) is a completely sterile plant and is, therefore, propagated only vegetative (4). It might be assume that sexual reproduction in this genus proceeds with constraints which might be expressed in anomalous structural development of reproductive organs.

Embryo sac in the genus *Allium* develops according to Allium type. It is bisporic and contains eight nuclei originated by two mitotic divisions during megagametogenesis (2,5,6). Newly formed embryo sac possesses three celled egg apparatus containing egg cell and two similar synergids, central cell with two polar nuclei and three ephemeral antipodals. Mature embryo sac, before fertilization, contains only four cells as antipodals degenerate (2,5). However, in some embryo sacs antipodals remain longer, undergo structural changes and become similar to egg apparatus (2,3,5,7). As usual, one of the synergid in the mature embryo sac of some species of genus *Allium* is hypertrophic and contains polyploid nucleus (1,2,3,5,7). Sometimes, however, the number of hypertrophic synergids may increase. These anomalies do not cause the lack of fertilization and such embryo sac may develop embryos either from antipodal cell or synergid (8). It is suggested (3) that such structural peculiarities should be considered as atypical development of the embryo sac and not as anomalies. Therefore, it is interesting to study this phenomenon for better understanding of the function of separate components of a megagametophyte.

According to literature data (3), *A. cepa* is characterized by atypical development of the embryo sac. We have decided to study megagametophyte development in this species to reveal and analyze atypical development patterns and to explain possible role of the structural changes.