DEVELOPMENT OF ENDOSPERM, EMBRYO AND SEED IN *SOLANUM KHASIANUM* CLARKE

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ABSTRACT

The development of endosperm in *Solanum khasianum* Clarke is of the Cellular Type. The first division in the primary endosperm cell is transverse producing primary micropylar and primary chalazal endosperm chambers. The division in both the primary endosperm chambers is longitudinal. Later, the divisions become irregular. Variations in the plane of divisions have also been observed. The embryogeny conforms to the Solanad Type. Mature seed comprises seed coat, persistent endosperm and mature curved dicotyledonous embryo.

INTRODUCTION

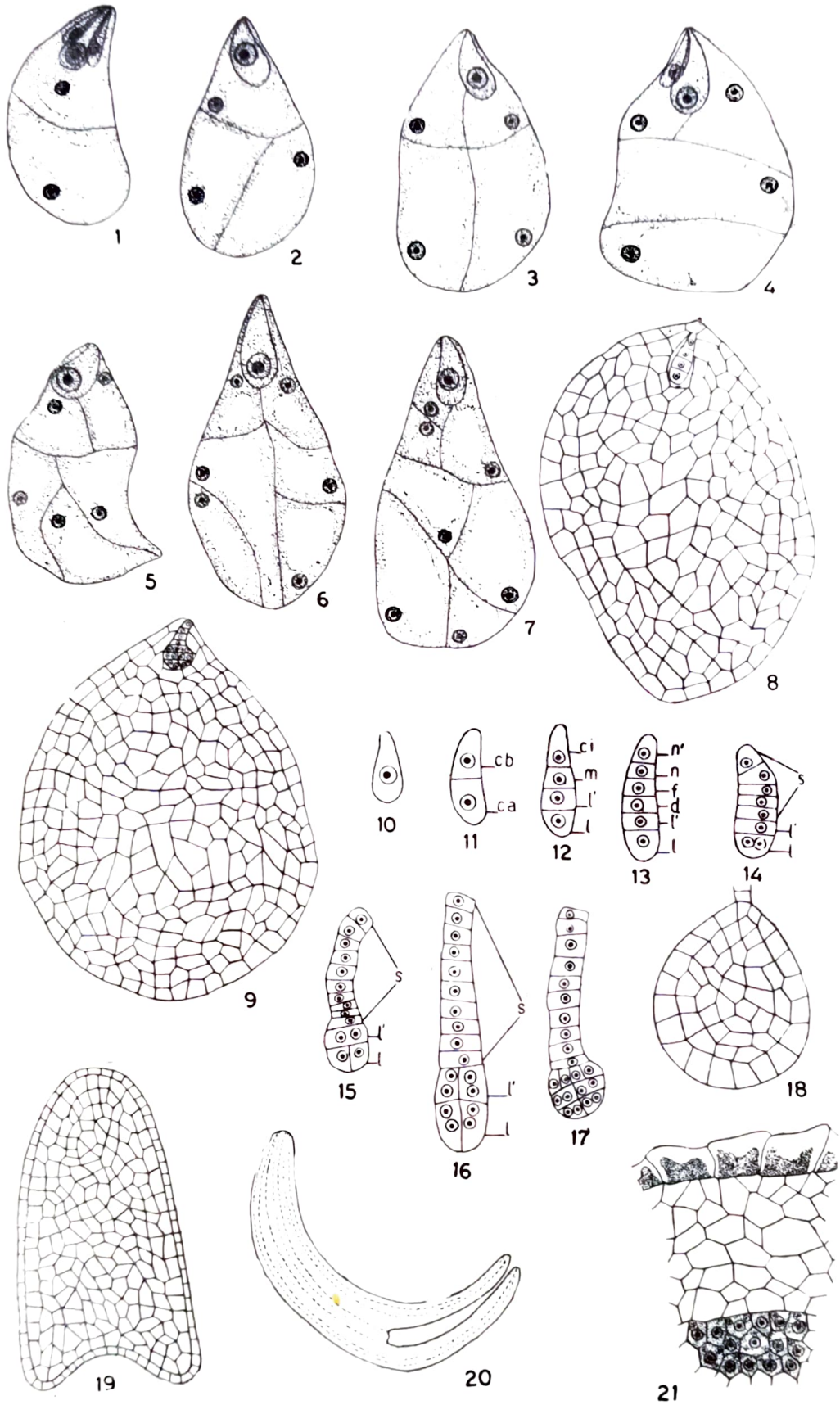
The development of male and female gametophytes in *Solanum khasianum* Clarke has been described by KHAN AND SIDDIQUI (1981). The remaining aspects are described in the present communication.

Fruits of different developmental stages were collected and fixed in FAA. The material was dehydrated in alcohol-xylol-series and embedded in paraffin wax. Sections were cut at 10-12 μm thickness, and stained with safranin and fast-green combination.

OBSERVATIONS

Endosperm—The development of endosperm is *ab initio* cellular. The first division of the primary endosperm nucleus is transverse which divides the embryo sac into two chambers—the primary micropylar and primary chalazal endosperm chambers (Fig. 1). The division in primary chalazal endosperms, chamber precedes that in the micropylar chamber (Fig. 2). The division in both the primary endosperm chambers is longitudinal forming 4-celled endosperm (Fig. 3). Sometimes the primary chalazal chamber divides transversely (Fig. 4). Subsequent divisions in the endosperm cells are quite irregular forming multicellular endosperm (Figs. 5-9). At the early stages of development the endosperm cells are highly vacuolated, but at later stages the vacuoles disappear and the cytoplasm becomes rich in starch grains (Fig. 21). The division in the peripheral cells of the endosperm are more frequent as compared to the central cells.

Figs. 1—21. *S. khasianum*.—1. 2-celled endosperm; 2. 3-celled endosperm; 3. 4-celled endosperm; 4. 4-celled endosperm; the primary micropylar endosperm chamber has divided longitudinally and primary chalazal chamber transversely; 5-7. 5-, 6- and 7-celled endosperms, respectively; 8. Cellular endosperm, the linear proembryonic tetrad is seen embedded in the endosperm; 9. Cellular endosperm with globular proembryo; 10. Zygote; 11. 2-celled proembryo; 12. Linear proembryonic tetrad; 13. 6-celled proembryo showing 1, 1, *d*, *f*, *n* and *n'*; 14. 8-celled proembryo, the tier 1 has divided vertically; 15. Quadrant stage; 16. Octant stage. Fig. 17. Post octant stage; 18. Globular proembryo; 19. Heart-shaped embryo; 20. Mature dicotyledonous embryo; 21. A portion of seed coat showing epidermis, 4-6-celled layers of integument and cellular endosperm.



50μ 50μ 50μ 50μ 50μ

1-7, 10-18 — 8, 9 — 19 — 20 — 21

Figs. 1—21

Embryogeny—The embryogeny conforms to the Solanad Type. The zygote undergoes a short resting period and enlarges considerably (Fig. 10). It remains undivided up to about 8-10-celled endosperm stage. The first division in the zygote is transverse resulting into a terminal cell, *ca* and a basal cell, *cb* (Fig. 11). The cell *ca* divides transversely producing tiers 1 and 1′. The cell *cb* also divides in the similar plane producing the cells, *m* and *ci*. Thus the four-celled proembryo has linear disposition of its cells (Fig. 12). The cells *m* and *ci* divide transversely producing *d*, *f*, *n* and *n*′, which constitute the suspensor of the embryo (Fig. 13). The tiers *l* and *l*′ divide longitudinally forming quadrant stage having two tiers of two cells each (Figs. 14, 15). The quadrant cells divide longitudinally forming octant stage (Fig. 16). The octant stage by its repeated divisions form globular proembryo (Figs. 17, 18). The globular proembryo differentiates into heart-shaped embryo (Fig. 19) and finally into a mature curved dicotyledonous embryo which is completely surrounded by cellular endosperm.

Seed—The seeds are small, often flattened, discoid and brownish yellow in colour. During the development of seed the cells of the integument divide and become 15-20 layered at globular stage of embryo. Later the cells of the integument are consumed by the endosperm and at mature seed stage 4-6 layers of integument persist. Anatomically the seed comprises seed coat, persistent endosperm and mature curved dicotyledonous embryo. The seed coat consists of an epidermis and 4-6 layers of integument. Epidermis is the only mechanical layer which forms an inner sclerotic and outer thin-walled zone with thickenings on inner tangential walls (Fig. 21).

DISCUSSION

The development of endosperm in the investigated species of *Solanum* is of the Cellular Type (Dnyansagar & Cooper, 1960 ; Saxena & Singh, 1969 ; Karuna, 1970) except *S. triquetrum* (Ahmad & Siddiqui, 1981) where it is free nuclear. However, Nuclear Type of endosperm development has also been reported in other genera of Solanaceae viz., *Schizanthus pinnatus* (Samuelsson, 1913), *Salpiglossis picta*, *Hyoscyamus orientalis* and *Scopolina atropoides* (Hofmeister, 1858) and *Capsicum annuum* (Crete, 1961). The first division in the primary endosperm nucleus is transverse in the described Solanaceae. The division in primary micropylar and primary chalazal chambers is longitudinal in *S. khasianum*, while it is usually transverse in *Withania somnifera* (Mohan Ram & Kamini, 1964) and *S. macranthum* (Karuna, 1970).

The embryogeny in the investigated Solanaceae conforms to the Solanad Type (Bhaduri, 1936 ; Beamish, 1955 ; Mohan Ram & Kamini, 1964 ; Karuna, 1970 and Ahmad & Siddiqui, 1981). However, in *Capsicum annuum* the proembryonic tetrad is T-shaped and the embryogeny conforms to the Onagrad Type.

The seeds are endospermic in the investigated species of *Solanum* (Saxena & Singh, 1969 ; and Ahmad & Siddiqui, 1981). The seed coat of *S. khasianum* consists of epidermis and 4-6-layered integument, while in *S. nigrum*, *S. americanum*, *S. sarachoides*, *S. luteum* and *S. villosum* (Saxena & Singh, 1969) the seed coat consists of an epidermis and persistent thick-walled endothelium.

It may thus be concluded that the general pattern of development of endosperm, embryo and seed in *S. khasianum* resembles greatly with other investigated species of *Solanum*, but it has its own distinctive features in which it resembles with certain species while showing differences with the other species.

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