საქართველოს მეცნიერებათა აკადემიის მოამბე, 159, №1, 1999
BULLETIN OF THE GEORGIAN ACADEMY OF SCIENCES, 159, №1, 1999

BOTANY

M. Akhalkatsi, G. Gvaladze

The Ultrastructure of Ovule Sterile Tissues of *Peperomia caperata* (*Piperaceae*)

Presented by Corr. Member of the Academy G. Nakhutsrishvili, February 19, 1998

ABSTRACT. **The submicroscopic peculiarities of cells of nucellus integument of *Peperomia caperata* Yunker was revealed.**

Key words: ovule, integument, nucellus, fertilization, tissues.

The structure of ovule sterile tissues was studied in several species of *Peperomia* [1-3] and in some other genera of *Piperaceae* [4-7]. The ultrastructural study was carried out on reproductive tissue of ovule in one species - *P. blanda* [8]. In the present paper the ultrastructure of ovule sterile tissues of *Peperomia caperata* Yunker is investigated for the first time. The study is needed for comparative embryological investigation of the genus *Peperomia*.

The material was collected from plants growing in the greenhouse of the Tbilisi Botanical Gardens in 1988-1989 years. For light microscopy bits of inflorescences were fixed in Karnua's fluid, dehydrated in alcohol, embedded in paraffin and sectioned at 12-20 mkm thickness. Sections were stained separately with acid hemalaun. The material was examined with "Polyvar" microscope (firm Reichert, Austria). For electron microscopy material was pre-fixed in 3% glutaraldehyde at room temperature for 2 h in 0.1 M phosphate buffer at pH 7.2. After bufferwash the samples were post-fixed in 2% osmium tetroxide overnight. The fixed materials were then dehydrated through acetone series and embedded in epon. Ultrathin sections were cut with glass knives on LKB-V ultramicrome and stained with lead citrate. Sections were examined with a Tesla BS-500 transmission electron microscope.

The ovule (Fig. 1a) is orthotrpous, unitegmic and crassinucellate. The integument is 3-4-layered and forms a narrow long micropyle. Before fertilization the integument consists of highly vacuolated cells. The nucleus is located on the periphery (Fig. 1b). It has irregular outlines and contains one large nucleolus. The cytoplasm forms thin layer along the cell wall. A few free ribosomes and small lipid bodies occur. Plastids are numerous and show simple interior organization. Starch grains are absent. Mitochondria and dictyosomes are not abundant. ER is scarce. The central vacuole contains tannins. The plasma membrane borders thin polysaccharide cell walls which are penetrated by plasmodesmata.

The nucellus has more or less spherical outlines and consists of 15-16 cell layers on the median section. The outermost cell layer forms the epidermis. The inner nucellar cells don't differ in structure depending on their position in the ovule. Before fertilization they contain small vacuoles and are rich in cytoplasm (Fig. 1c). The nucleus is located in the

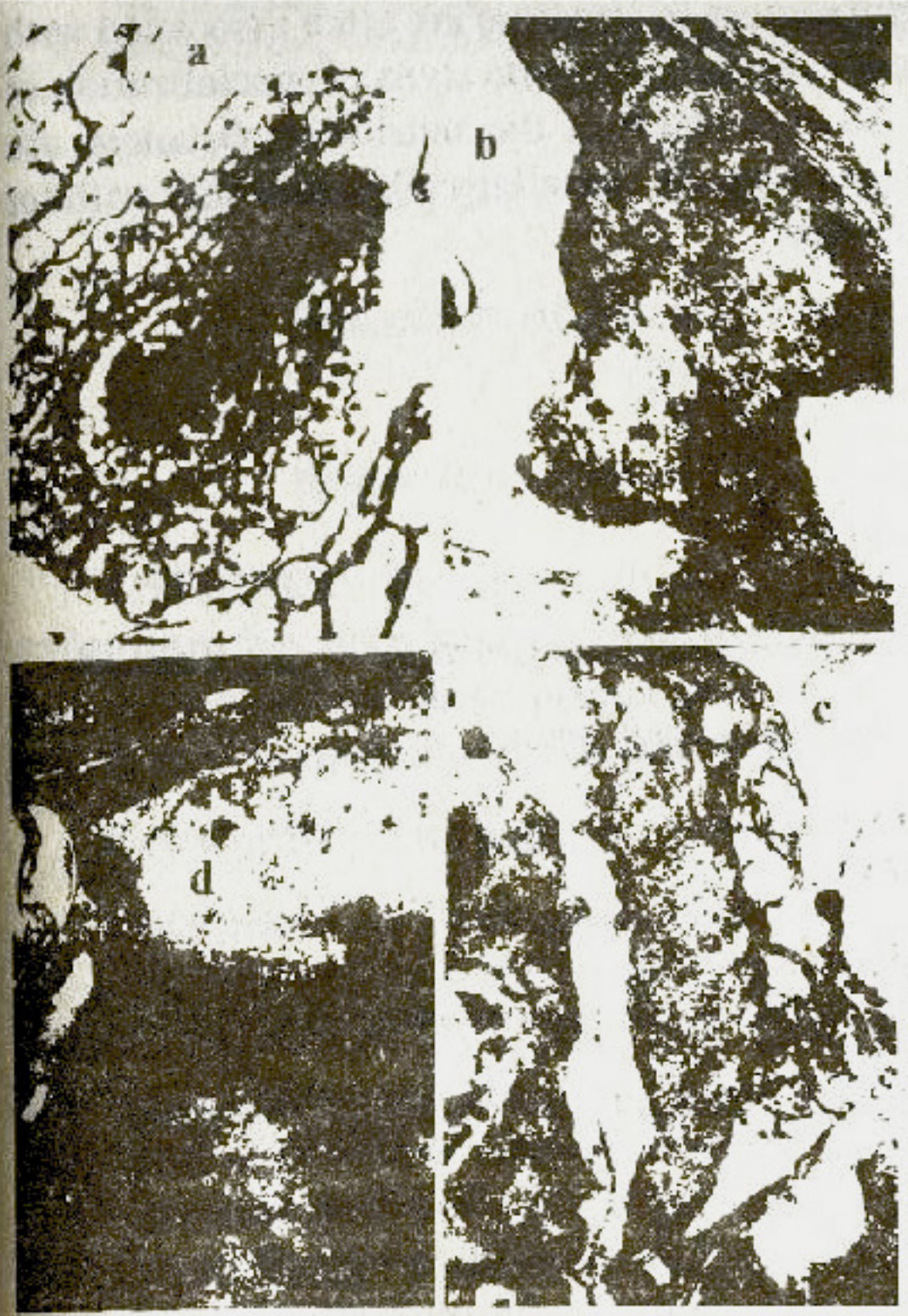

Fig. 1. a-The view of ovule of *Peperomia caperata*. x 230.
b-A part of integumentary cell showing peripherially located nucleus. x8000.
c-A part of nucellar cell. x8000.
d-Epidermal cell of nucellus. x6000.
in - integument, nc - nucellus, p - plastid.

center. It is spherical with one nucleolus. Free ribosomes are numerous. Lipid bodies are absent. Plastids are abundant. They have dense stroma and well developed interior membrane system (Fig. 1c). Mitochondria are also numerous with regular distributed cristae. Dictyosomes show moderate activity. ER is represented by a few cisternae of rough ER. Microbodies occur. Small vacuoles contain electron dense material. Polysaccharide cell walls possess plasmodesmata. The nucellar epidermis cells are more highly vacuolated (Fig.1d). Plastids containing starch are found in these cells.

After fertilization the ovule tissues undergo some transformations. The number and activity of organelles continue to decrease in the integumentary cells. Some large starch grains appear in the plastids (Fig. 2a). The amount of the tanninous substances increases in the vacuoles. Afterwards the cytoplasm gradually degenerates and cell lumen is filled in tannins. In the mature seed integument forms the seed coat. After fertilization the amount of storage substances increases considerably in the nucellar cells. Large starch grains appear in the plastids (Fig.2b). Vacuole becomes more prominent and electron dense material is accumulated in it. Gradually, the cytoplasm becomes reduced and the cells are occupied with storage starch. The nucellus is transformed into perisperm.

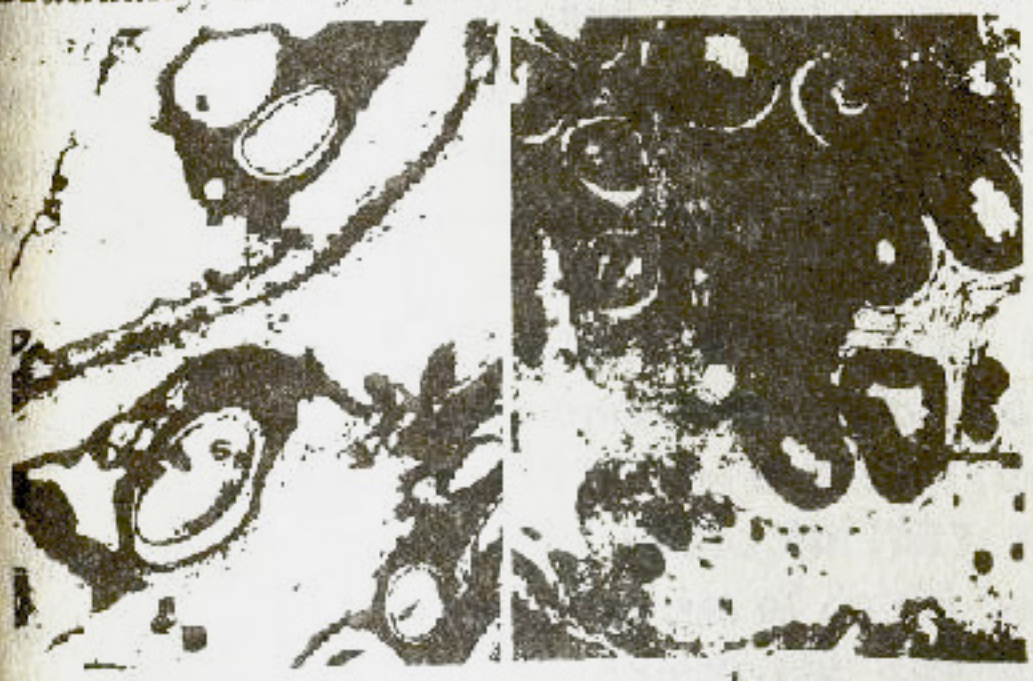

Fig. 2. a- A part of integumentary cell after fertilization. x10000.
b- A part of nucellar cell after fertilization. x10000.

The results of this study have shown that the ovule of *P. caperata* revcals low level of differentiation and characteristics to be considered as primitive for the ovules of angiosperms [1,3]. The ovule is covered with only integument which forms a seed coat. The inner nucellar cells have uniform structure in spite of their position. In a lot of angiosperm species [1,3,9] the crassinucellate ovules possess highly specialized cell layers of nucellar cells de-

pending on their position in ovule. These differences in structure are often associated with a function of substance transport in ovules [9]. In *P.caperata* no signs of specialization of nucellar cells were observed. It should be assumed that the nutritive substances are transported from funiculus to the embryo sac through nucellar cells uniformly without formation of special paths through the nucellus.

Georgian Academy of Sciences
N. Ketskhoveli Institute of Botany

REFERENCES

1. *Z. Nikiticheva.* Sravnitelnaya embbryologiya tsvetkovykh rastenii-*Winteraceae - Juglandaceae.* Leningrad, 1981, 84-90.
2. *B. Johri et al.* Comparative Embryology of Angiosperms. Berlin, 1992, 309-312.
3. *C. Sh. Tucker.* Amer. J. Bot. 67, 5, 1980, 686-702.
4. *A. C. Joshi.* Proc. Nat. Inst. Sci. India, 10, 1944, 105-112.
5. *Y. S. Murty.* Proc. Indian Acad. Sci. 49, 11, 1959, 52-65.
6. *K. Kanta.* Phytomorphology, 12, 3, 1962, 207-221.
7. *E. J. H. Corner.* The seeds of dicotyledons. Gambridge, London, 1976.
8. *T. Playushch.* Submikroskopicheskaya kharakteristika reproduktivnykh structur semyazachatka *Peperomia blanda.* Ph. Dr. Thesis. Leningrad, 1983.
9. *M. Chyamporova, M. Akhalkatsi, G. Gvaladze.* Bot. J. (Leningrad), 73, 12, 1988, 1722-1730 (Russian).