LIGHT MICROSCOPIC STUDIES OF PARENCHYMA CELLS FROM PEA COTYLEDONS DURING SEED DEVELOPMENT

Gaul, E. Institute of Genetics
University of Bonn, Federal Republic of Germany

During pea seed development a mass of storage proteins is synthesized and accumulated within the cotyledon parenchyma cells (1). This biosynthesis is correlated with dramatic changes in the subcellular organization of the storage parenchyma cells.

In order to get a general view of the morphological characteristics at different developmental stages, a series of light microscopic studies was performed. Plants of Pisum sativum cv. 'Dippes Gelbe Viktoria' were grown in a greenhouse under controlled conditions and pods were harvested 13, 15, 17, 20, 23, 27, and 31 days after flowering. The ripening seeds were fixed with glutaraldehyde, embedded in Spurr's resin, and semin-thin sections were cut.

Cell divisions in the cotyledon parenchyma tissue had ceased 13 days after flowering. At this time the parenchyma cells contained a single large vacuole (Fig. 1). At day 15 the cells had increased in size (Fig. 2). Dense aggregates were visible at the periphery of the vacuoles (arrows). This material has been immunohistochemically identified as storage protein by Craig and Goodchild (2). A few starch grains were detectable in the cytoplasm (arrowheads). The vacuoles of some cells were subdivided by cytoplasmatic strands and invaginations. As shown in the light micrograph of day 17 these invaginations led to a fragmentation of the large vacuoles (Fig. 3). Three days later vacuole fragmentation had begun, accompanied by deposition of increasing amounts of storage protein aggregates at the tonoplast membranes (Fig. 4, arrows). Furth i more, starch production had increased markedly. At day 23 numerous small vacuoles were detectable in the parenchyma cells (Fig. 5). In some cells the protein deposits were still clumped and lining the fragmentated tonoplast membrane (arrows). However, in other cells the reserve protein was spread within the vacuoles (arrowheads), a trend which continued thereafter. An homogenous dispersion of the vacuolar matrix became apparent in the light micrograph of day 27 (Fig. 6). The morphological characteristic of the cotyledon parenchyma cells at this developmental stage is the irregular shaped appearance of the vacuolar profile. Subsequently, spherical storage organelles, the protein bodies, were formed (Fig. 7). The results of these light microscopic studies indicate the vacuolar origin of the protein bodies.

1. Bain, J. M. and F. V. Mercer. 1966. Aust. J. Biol. Sci. 19:49-67.
2. Craig, S. and D. J. Goodchild. 1982. Eur. J. Cell Biol. 28:251-256.

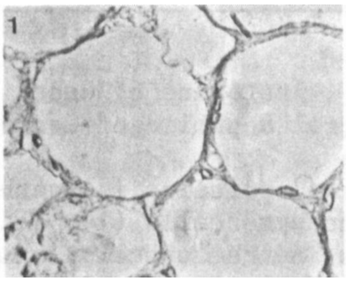

Fig. 1. Light micrograph of 13-day-old cotyledon tissue.

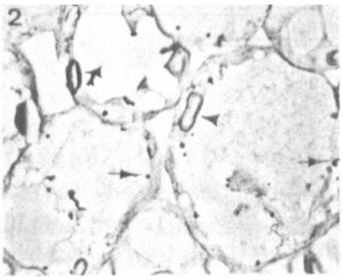

Fig. 2. Light micrograph of 15-day-old cotyledon tissue

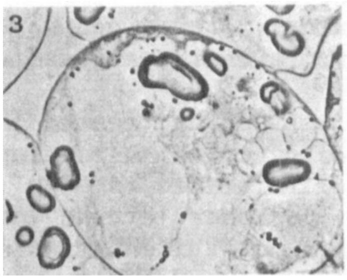

Fig. 3. Light micrograph of 17-day-old cotyledon tissue.

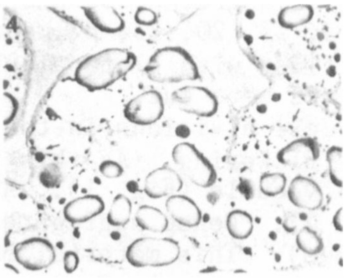

Fig. 4. Light micrograph of 20-day-old cotyledon tissue

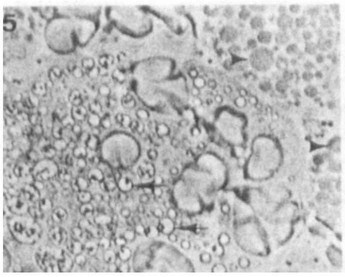

Fig. 5. Light micrograph of 23-day-old cotyledon tissue.

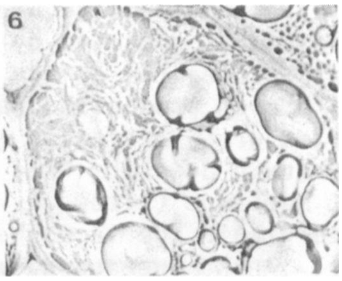

Fig. 6. Light micrograph of 27-dav-old cotyledon tissue

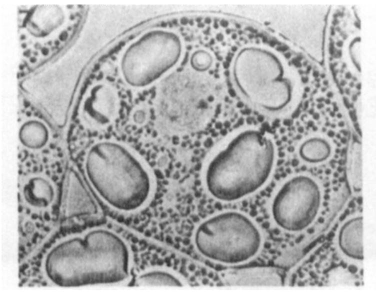

Fig. 7. Light micrograph of 31-day-old cotyledon tissue.