Ls-8-P-2043 Study of storage compounds in beech embryos during dormancy breaking

Eliášová K.1, Vondráková Z.1

1Institute of Experimental Botany AS CR, Prague, Czech Republic

Email of the presenting author: eliasova@ueb.cas.cz

The common beech (Fagus sylvatica L.) is one of the most important broadleaved species in European forestry. At harvest, beechnuts are in deep physiological dormancy as seeds of many temperate trees. Dormancy as a mechanism preventing germination during unsuitable ecological conditions is controlled by the genetic factors and regulated by phytohormones. Seeds can be stimulated to dormancy breaking and to germination by cold stratification. The control of dormancy breaking is recently studied in the different levels - environmental, biochemical, molecular etc.

Our study is aimed to the changes in the amount and distribution of storage compounds in the beech embryos during stratification. Beechnuts belong to the group of non-endospermic seeds with reserves stored predominantly in the cotyledons. The major mobilization of storage compounds as starch, proteins and oils within storage tissues commences after protrusion of the radicle. Nevertheless, some partial mobilization of storage proteins starts with the uptake of water by imbibition of the dry seed.

Paraffin sections were observed under the transmission light microscope Jenaval, Zeiss. We detected the storage proteins using protein specific stains - Ponceau-xylidin, amido black 10B and Commassie brilliant blue R250. Storage proteins were deposited in the vacuoles predominantly in the cells of cotyledons. In dormant embryos the most intensive protein labelling was observed in storage vacuoles which filled up the cotyledon cells and partially also in the cytoplasm. After imbibition of the seeds, storage vacuoles in the external parts of the cotyledons diminished and their content exhausted. Later on the small vacuoles fused to form large central vacuoles. During stratification we observed strong labelling in the cytoplasm. The central vacuoles remained free of storage proteins.

Starch was stained using Lugol solution. Abundance of starch grains were observed in cotyledons, as well as in the embryo axes. We did not recognize any differences in the distribution or amount of starch grains in dormant and non-dormant embryos. Besides these storage compounds the immense amount of calcium oxalate (CaOx) crystals was observed under the polarized light. CaOx appeared as druses or small prismatic crystals in cotyledons excepting the region of vascular tissues. Small druses were rarely found also in the embryo axes.

According to our results, storage proteins localization and utilization only is linked with stratification. Other storage compounds will be probably used during germination.

Acknowledgement: The research was supported by the Ministry of Agriculture, project QI102A256.
Fig. 1: Storage tissue in cotyledon of dormant beech seed. Cells are filled with protein storage vacuoles (red colour). Paraffin section stained with Ponceau-xylidine / Azur II; scale bar = 50 µm.

Fig. 2: Storage tissue in cotyledon of beech seed released from dormancy. Proteins were present in small bodies or in the cytoplasm (red colour). Paraffin section stained with Ponceau-xylidine; scale bar = 50 µm.

Fig. 3: Starch grains (dark dots) in the cells of beech embryo cotyledon surrounding the vascular bundle. Paraffin section stained with Lugol (I/KI) and Azur II; scale bar = 50 µm.

Fig. 4: Druse crystals of calcium oxalate (arrow) in vacuoles of cotyledon storage cells of the beech embryo. Paraffin section in the polarized light; scale bar = 20 µm.