DISTRIBUTION OF AROMATIC CARBOXYLIC ACIDS IN *LUPINUS ANGUSTIFOLIUS* L. SEEDLINGS

E. V. Vlasova, S. M. Motyleva, M. E. Mertvischeva
All-Russian Horticultural Institute Breeding, Agrotechnology & Nursery, Moscow, Russia

Keywords: *blue lupine, chlorogenic acid, gallic acid, ferulic acid, cotyledons*

Introduction. Lupine seed germination is epigeal. The cotyledons emerge above the soil surface and become the first photosynthetic organs. The growing tissues of the seedlings are supplied with carbon from both sources, such as products of decomposition of the seed reserve substances and products of photosynthesis. The processes of the polysaccharide, protein, lipid and amino acid mobilization [1-3] during germination are accompanied by the less studied metabolism of the phenolic compounds.

Aim of the study. A comparative assessment of the aromatic carboxylic acids content in the cotyledons and first palmate leaves of blue lupine seedlings.

The objects of investigation were genetically related samples of narrow-leaved lupine differing in alkaloid content and branching peculiarities: cv. Nemchinovsky 846 (indeterminate habit, medium-alkalod level), both the highly restricted branching mutants: cv. Ladny (low-alkaloid level) and the sample Nemchinovsky 846 x Mut1 (high-alkaloid level).

Methods. The plants were grown in the field trial in Moscow region conditions. The four-day seedlings at the stage of the cotyledon opening - the first palmate leaves appearance were taken for analysis. The seed leaves and the first palmate leaves were taken at the same time at 10 am and were dried to an air-dry state in a thermostat at temperature 55°C. The samples of 0.2 g dry matter were extracted with a 10 ml methanol. The chromatographic quantification of the phenolic compounds was performed by HPLC-method. Detection was made at a wavelength of 254 nm. The solvent system consisted of a mixture of acetonitrile: 0.03% trifluoroacetic acid (15:85, *v*/*v*). All contents were expressed as milligram per 100 g DW.

Results and discussion. HPLC chromatograms contained 13 characteristic peaks corresponding to the retention time of various substances, of which four peaks were higher in chromatograms of cotyledons extracts and four peaks were higher in chromatograms of leaves extracts in all three blue lupine stocks.

Based on the availability of the chemical reference standards, the quantitative content of chlorogenic, gallic and ferulic acids was determined by the results of HPLC analysis. The general pattern of aromatic acids distribution in the studied samples was as follows.

The content of gallic acid was in the range of 0.9-2.0 mg, ferulic acid was from 76.5 to 197.7 mg both in cotyledons and leaves. The gallic acid content in the cotyledons was 1.3 times higher than in the leaves. On the contrary, the ferulic acid content in the cotyledons was 1.2-1.7 times less than in the leaves.

The chlorogenic acid was found mainly in the cotyledons (60.3-242.8 mg). The presence of chlorogenic acid in young leaves was found only in the one sample (4.1 mg).

The established regularities were probably associated with the participation of the aromatic acids in the hormonal regulation of both the growth processes and the polysaccharide breakdown as well as the formation of phenolic polymers during germination and seedling development [4-7].

The discovered features of the distribution of aromatic acids in seedlings depend on both the time of day and the age of cotyledons and leaves, but are not related to the alkaloid content and branching type.

BIBLIOGRAPHY

1. Parker M. L. *Cell wall storage polysaccharides in cotyledons of Lupinus angustifolius L. II. Mobilization during germination and seedling development* // Protoplasma – 1984.- Vol.120.-Issue 3.-P. 233–241.
2. Borek S., Pukacka S., Michalski K. *Regulation by sucrose of storage compounds breakdown in germinating seeds of yellow lupine (Lupinus luteus L.), white lupine (Lupinus albus L.) and Andean lupine (Lupinus mutabilis Sweet). II. Mobilization of storage lipid* // Acta Physiol Plant. -2012.- Vol.34.-P. 1199–1206.
3. James A., Jayasena V. *Effect of Germination on the Nutritional and Protein Profile of Australian Sweet Lupin (Lupinus angustifolius L.)*// Food and Nutrition Sciences. - Vol. 3 No. 5.-2012.-P. 621-626.
4. Tuli V., Moyed H. S. The *Role of 3-Methyleneoxindole in Auxin Action.* // The Journal of Biological Chemistry. - 1969-Vol. 244, No. 18, - P. 4916-4920.
5. Aerts R. J., Baumann T. W. *Distribution and utilization of chlorogenic acid in Coffea seedlings*// J. Exp. Bot.-1994.-45 (4). -P. 497-503.
6. Hensel A., Brummell D. A., Hanna R., Maclachlan G. *Auxin-dependent breakdown of xyloglucan in cotyledons of germinating nasturtium seeds* // Planta. -1991.-183.-P.321-326
7. Upadishev M. T. *The role of phenolic compounds in the processes of life garden plants*. - Moscow. - 2008.- 320 p. (in Russ.).