

## BETALAINS IN LONG-TERM CULTIVATED CALLUS CULTURE OF MAMMILLARIA MULTICEPS (CACTACEAE)

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Betalains are nitrogen-containing water-soluble pigments, which replace anthocyanins in the majority of families of the order Caryophyllales; the best known one is betanin – a main coloring compound of red beet *Beta vulgaris* L. Their coloring properties coupled with potent health benefits (e.g. antioxidative) and non-toxicity determine their existing and potential uses in food and pharmaceutical industries.

This group of pigments, however, remains insufficiently studied especially in comparison with more familiar anthocyanins. Only a minor group of all known betalain-producing species has been studied from structural and biosynthetic point of view and there are only a few species whose calli have been investigated. Meanwhile, callus culture is a good instrument for metabolic engineering because of the ability to easily modify the biosynthetic processes by changing the cultural conditions; and the obtaining of sufficient amount of biomass for investigations is rather easy which is particularly important in the case of slowly-growing plant species as cacti are.

To date only production of presumable betaxanthin was observed for a callus culture of *Mammillaria* species (*M.candida*) [1], but in this case, no identification of the pigments was made.

This study was undertaken to identify the betalains which are produced by the long-term cultivated callus culture of *Mammillaria multiceps* (Cactaceae). The presence of six betacyanins and their isoforms was detected by HPLC-MS and they were assigned as: betanin and isobetanin 1/1', phyllocactin (6'-O-malonyl-betanin)/isophyllocactin 2/2' and their isomers (4'-O-malonyl-betanin and 4'-O-malonyl-isobetanin) 2a/2a', 5''-O-E-feruloyl-2'-apiosyl-betanin and its isomer 3/3', 5''-O-E-feruloyl-2'-apiosyl-phyllocactin and its isomer 4/4', 2'-apiosyl-betanin and its isomer 5/5', and betanidin 5-O-(6'-O-malonyl)- $\beta$ -sophoroside (mammillarinin)/isomammillarinin 6/6'. Compounds 1-4 were the prevailing pigments of the *M.multiceps* callus accompanied only by traces of compounds 5-6. The observed production of considerable amounts of feruloylated apiosyl derivatives and only traces of mammillarinin are in contrast to betalain profiles in fruits of some *Mammillaria* species, in which the mammillarinin is one of the dominating compounds whereas the feruloylated derivatives are absent.

### Literature

1. Santos-Diaz M.S et al. Pigment production by callus of *Mammillaria candida* Scheidweiler (Cactaceae) // *Agrociencia*. – 2005. – V.39. – P 619–626.

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