METABOLITE INVESTIGATIONS OF POINSETTIA CULTIVARS

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MAIN CONCLUSION

Different poinsettia varieties were analyzed for their anthocyanin pathway, in particular for the presence of enzymes or expression of genes. It could be shown that irrespective of the different bract colours, the main enzymes were active in all tested varieties.

INTRODUCTION

Poinsettias (*Euphorbia pulcherrima*) are commercially important indoor plants showing attractively coloured bracts particularly during the Christmas season. The bracts are associated with the relatively small and unimpressive reproductive structures and –as flowers - serve the function of attracting pollinators. Phylogenetically, they are leaves changing their function from photosynthesis providing assimilates for growth towards pollinator attraction. Various shades of red are the typcial colours of poinsettia bracts. However, white, cinnamon and yellow varieties are also available as well as bicoloured, scattered or marbled types. The red colouration of poinsettia bracts is caused by anthocyanins, which are widely distributed plant pigments causing red colouration of flowers, fruits and other plant tissues [1]. Their biosynthesis is well studied with respect to the enzymes and corresponding genes [2]. Acyanic mutants of originally red flowering ornamentals are often lacking the expression of an enzyme of the biosynthetic pathway and are not competent to form anthocyanins. We investigated poinsettia bracts for the presence of selected enzymes in the anthocyanin pathway.

MATERIALS AND METHODS

The analysis was carried out with young bracts of commercially available *Euphorbia pulcherrima* cv. Christmas Feelings Red, Christmas Feelings White, Santa Claus Red, Santa Claus White, Christmas Beauty Red and Christmas Beauty Pearl. The plant material was collected in December 2015, frozen in liquid nitrogen and stored at -80°C. Enzyme assays were performed as described previously using the protocol 1 [3].

RESULTS AND DISCUSSION

We tested different protocols [3] for enzyme preparations from poinsettia bracts. High enzyme activities could be generally observed for chalcone synthase/chalcone isomerase (CHS/CHI) and dihydroflavonol 4-reductase (DFR), whereas flavanone 3-hydroxylase (FHT) and flavonoid 3-*O*-glucosyl transferase (GT) showed rather low activities independently of the protocol used. However our results clearly showed that there were no significant

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differences in the activities of the selected enzymes in the red and white/ivory bracts (Table 1). For anthocyanidin synthase (ANS) and anthocyanidin reductase (ANR) no differences were observed either, when studied by standard PCR.

	Specific enzyme activity (nmol/s.g)			
Poinsettia cultivar	**CHS/CHI**	**FHT**	**DFR**	**GT**
Santa Claus Red	0.3	0.9	5.3	0.1
Santa Claus White	0.5	1.0	5.7	0.1
Christmas Feelings Red	0.6	1.0	6.7	0.1
Christmas Feelings Pearl	0.9	1.2	6.1	0.1
Christmas Beauty Red	0.6	1.1	6.4	0.1
Christmas Beauty White	0.5	1.0	6.3	0.1

Table 1 Activities of selected enzymes from the anthocyanin pathway in bracts of cyanic and acyanic coloured bracts

Several plant tissues are principally equipped with the complete machinery for anthocyanin biosynthesis including the expression of regulatory genes; nevertheless, they do not accumulate anthocyanins. Numerous studies have revealed a further reduction of the anthocyanidin to the colourless epicatechin by the enzyme anthocyanidin reductase (ANR) [4]. One striking example is a transgenic forsythia where the lacking genes for the anthocyanidin formation had been complemented by functional transgenes but a predominating epicatechin accumulation prevented red flower pigmentation [5]. Thus redirection of anthocyanins towards flavan 3-ols could be one of the reasons for the acyanic colour in poinsettia bracts, but also further factors like substrate competition between enzymes or distinct enzyme specificities. When comparing the polyphenol patterns of red bracts and green leaves, different proportions of anthocyanins, flavonols, hydroxycinnamic acids and three groups of so far not yet identified phenolic compounds were found. Future work will focus on the characterisation of these compounds.

REFERENCES

[1] Ø. M. Andersen and K. R. Markham, Flavonoids: chemistry, biochemistry, and applications, **2006**, CRC Press.

[2] K. Davies et al., *Recent Advances in Polyphenol Research* 1, **2009**, 139-166.

[3] H. Halbwirth et al., *J.Agric.Food Chem.*, **2009,** 57, 4983-4987.

[4] Fischer, T. C. et al. *New phytologist* 201, **2014,** 440-451.

[5] C. Rosati et al. *Plant molecular biology* 35, **1997**, 303-311.

ACKNOWLEDGMENT

This work has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 675657.