

Influence of Different Light Intensities on the Content of Diosgenin, Lipids, Carotenoids and Fatty Acids in Leaves of *Dioscorea zingiberensis*

Huming Li^a, Alfons Radunz^a, Ping He^b and Georg H. Schmid^{a,*}

^a Lehrstuhl für Zellphysiologie, Fakultät für Biologie, Universität Bielefeld, Postfach 10 01 31, 33501 Bielefeld, Bundesrepublik Deutschland.

Fax: +49 (521) 1066410. E-mail: G.Schmid@Biologie.Uni-Bielefeld.de

^b Central South Forestry University, Zhuzhou/Hunan 41206, People's Republic of China

* Author for correspondence and reprint requests

Z. Naturforsch. **57c**, 135–143 (2002); received October 19/November 11, 2001

Dedicated to Professor Wolfgang Kowallik on the occasion of his 70th birthday

Dioscorea zingiberensis, Diosgenin, Carotenoids, Fatty Acids

Cultivation of the climbing plant *Dioscorea zingiberensis* at a light intensity of $100 \mu\text{E} \cdot \text{m}^{-2} \cdot \text{sec}^{-1}$ yields three different phenotypes. Most of the plants grow as green phenotype (DzW). Two further forms differ in their leaf shape and leaf color. Whereas one type exhibits a more pointed leaf shape in the upper part of the plant with leaves appearing yellow-green with white stripes or hatchings (DzY), the other type shows a more round leaf shape with an intensive yellow-green color (DzT). These three plant types differ in their diosgenin content not only in their rhizomes but also in the chloroplasts. In the rhizomes the diosgenin content in the green form is 0.4%, in the DzY-form 0.6% and in the DzT-form even 1.3% of the dry weight. Furthermore, even in chloroplasts of the green DzW-form and of the DzY-form the presence of diosgenin was demonstrated. It occurs there as the epimeric form yamogenin. The DzT-form contains no yamogenin in its chloroplasts. Besides this, these plant forms differ in their chlorophyll and carotenoid content and in their fatty acid composition. Carotenoids increase from 1.3% of total lipids in the green phenotype to 3.3% in the DzY- and to 4.2% in the DzT-form. This increase refers to β -carotene as well as to lutein and neoxanthin. The chlorophyll content in the green type is 8.1% and lower in the DzY-form with 7%. The highest chlorophyll content is found in the DzT-form with 12%. Fatty acids in the DzY-form and in the DzT-form have a more unsaturated character than in the green phenotype. The content of the monoenoic acid trans-hexadecenoic acid is considerably lower in both phenotypes when compared to the green phenotype. In both phenotypes the quantity of fatty acids with 16 carbon atoms is reduced, whereas fatty acids with 18 carbon atoms occur in higher concentration.

Cultivation of the green phenotype (DzW) at the three light intensities of 10, 100 and $270 \mu\text{E} \cdot \text{m}^{-2} \cdot \text{sec}^{-1}$ leads to changes of the diosgenin content in rhizomes, to an increase of leaf dry weight, to a reduction of the grana structure in chloroplasts and therewith to a decrease of the chlorophyll content. The total lipid content is highest under the cultivation at $100 \mu\text{E} \cdot \text{m}^{-2} \cdot \text{sec}^{-1}$ and reduced by 30% at 10 and $270 \mu\text{E} \cdot \text{m}^{-2} \cdot \text{sec}^{-1}$. Carotenoids, however, are highest in shaded plants ($10 \mu\text{E} \cdot \text{m}^{-2} \cdot \text{sec}^{-1}$) and plants grown under high light conditions of $270 \mu\text{E} \cdot \text{m}^{-2} \cdot \text{sec}^{-1}$. At $100 \mu\text{E} \cdot \text{m}^{-2} \cdot \text{sec}^{-1}$ a decrease of saturated fatty acids is observed in comparison to plants grown under shaded conditions.