Note

Distribution of Gibberellins in Bamboo Shoots

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We have previously reported that GA1, GA19, and GA20 occurred in shoots of three species of Bambusaideae and their levels were in the order of GA19 > GA20 > GA1, commonly in the three species. Most cell-free systems that biosynthesize GA are prepared from reproductive organs such as immature seeds and anthers, but not from vegetative tissues. The analysis of GA distribution in young bamboo shoots will give valuable information not only for rapid growth of bamboo shoots but also for vegetative tissues for the cell-free system. This note deals with the distribution of GA1, GA19, and GA20 in the young shoots of Phyllostachys edulis ("Moso").

Leaf sheaths and column stalks were cut into five zones as shown in Fig. 1. Zones I and II consist of brown outer and inner leaf sheaths respectively, Zone III, young white sheaths attached to the top of the column stalk. Zones IV and V correspond to the lower and upper parts of column stalk, respectively, the ratio of weight of each zone being about 1:1 (Fig. 1). Each zone was extracted with methanol using a blender, and the methanol extract was partitioned with ethyl acetate. The acidic ethyl acetate-soluble fraction was purified by preparative TLC (Kieselgel 60 F254 TLC plate, 20 x 20 cm; 1 mm thickness; solvent system, ethyl acetate:chloroform:acetic acid = 20:8:1). Adsorbents corresponding to Rf 0.2 and 0.3 and Rf 0.4 and 0.5 were combined, respectively, and extracted with ethyl acetate saturated with water. GA1 and GA19 migrated at Rf 0.2, 0.3, and GA20 at Rf 0.4 and 0.5 zones under these TLC conditions. Each TLC fraction was assayed by either ELISA or RIA to measure GA1, GA19, and GA20 as follows: Rf 0.2-0.3 zones for GA1 by ELISA using the antisem against GA1-Me and GA1-alkaline phosphatase, and for GA19 by RIA using an antisem against GA24, and Rf 0.4-0.5 zones for GA20 by ELISA using antisem against GA20-Me and GA20-alkaline phosphatase. The purification by HPLC before immunoassays was omitted in this experiment, because no disturbing immunoactive impurity was observed in all HPLC (ODS column) fractions after preparative TLC in our previous experiment. The concentrations of GA1, GA19, and GA20 in each zone are shown in Table I. GA19, GA10, and GA20 were found in all zones at different concentrations. GA19 was present in higher concentrations than other GAs, the highest concentration being found in zone II. GA1 is distributed in the highest concentrations in zone III (white young leaf sheaths) and GA10 in zones III and IV.

These results indicate that the rapid growing tissues contain higher concentrations of active GA, namely GA1, than those in other parts. 3β-Hydroxylase, which catalyzes the conversion of GA20 to GA1, seems to be found in higher concentrations in young white leaf sheaths than in other tissues. The young white leaf sheaths and the top part of column stalk might be suitable materials for the cell-free system containing 3β-hydroxylase and the enzyme that catalyzes the conversion of GA10 to GA1. The concentration of GA1 in zone III, 0.29 ng/g fr wt, is higher than that in the shoots of the normal rice cultivar Nihonbare at the 6th leaf stage, 0.16 ng/g fr wt. This suggests that the rapid growth in bamboo shoots may be correlated to the high concentration of active GA in a growing tissue. We must consider, however, the turn-over of active GA in the tissue, and sensitivity of bamboo-shoot cells to GA19 as suggested in the case of the rapid growth of the slender type pea.

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References