THE EFFECT OF DEUTERIUM DEPLETED MEDIUM ON PLANT TUMORS

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1. ABSTRACT

Deuterium in the natural, ca. 150 ppm concentration is essential for plants. A change in deuterium content of the medium in the direction of either lower or higher concentrations hinders the plant growth through the inhibition of mitosis. Healthy cells can adapt themselves to deuterium deficiency, and within 10-16 days catch up with the control in growth. As a contrast to this, tumors can not tolerate deuterium deficiency. In 20 ppm D containing medium, the tumor growth slows down with respect to the control (150 ppm D). This effect can be explained by the influence of deuterium on the Na/H antiport.

Keywords: deuterium, tumor, magnesium, cell cultures, Na/H antiport

2. INTRODUCTION

Several biological and biochemical studies investigated the hindering effect of increased deuterium concentration on the plant growth[1-3]. Somlyai et al.[4] was the first to describe the hindering effect of deuterium depleted water on the growth of mammalian cells, especially tumors. It has been also shown, that the D-depleted water (20 ppm D) hinders the plant growth[5-7].
The present study investigates the different reaction of healthy cells and tumors to D-depleted medium.

3. MATERIALS AND METHODS

The effect of 20 ppm D water on the growth of healthy plant parts was monitored by measuring the growth of coleoptyls of germinating Furio type corn (Zea mays) seeds. The experiments were carried out in six repetitions on 50-50 seeds in each series. Coleoptyl lengths were measured daily.
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The experiments on tumors were conducted at two hungarian research institutes in parallel: NÖVIKI (Research Institute for Plant Protection, Budapest) and Institute of Pharmacognosy of SOTE (Semmelweis Medical University, Budapest). The plant tumors were induced on *Nicotiana tabacum* (Hevesi 276) organised cultures maintained in S solid medium (0.7% agar) containing 20 g/l sucrose (Reanal), 10 mg/l Ca-pantothenate (Reanal), 1.13 g/l Murashige and Skoog basal medium (Sigma), pH 5.6 and in IVS solid medium containing similar components with 1 mg/l indol-butyric-acid (Reanal). The cultures were incubated at 26°C in light (12 hours of light per day).

The tumors were obtained by micro-injection on leaves and stems with *Agrobacterium tumefaciens* strain A348. The isolated tumor was maintained in Murashige and Skoog (MS) solid medium (1% agar) containing 20 g/l sucrose (Reanal), 4.703 g/l Murashige and Skoog basal medium (Sigma), pH 5.6 and 500 mg/l Claforan (Roussel). The tumor cultures were grown in dark. Subcultures were made at 6-weeks intervals (100 ml flask containing 40 ml medium) with cultures being maintained under the same conditions for 18 weeks. The Claforan content was reduced to 250 mg/l. After 12 weeks the cultures were subcultivated in Claforan free MS medium. First the cultures seemed more compact later turned to slack.

Pieces from 4 weeks old tissue cultures were placed on MS medium containing distilled water with 20 ppm D content (35 ppm D in the experiments made at NÖVIKI). The control contained 150 ppm D in distilled water. Tumor pieces were reweighed three times a week, fresh weight and dry weight (80°C drying) were measured and the factor fw/dw (%) was calculated. The dried samples were also taken under microwave aided digestion with a HNO₃-H₂O₂ acid mixture and then inductively coupled plasma atomic emission spectrometric (ICP-AES) analysis in order to record their Na, K, Mg and Ca content.

4. RESULTS

The growth of healthy corn coleoptyls in length was found to be different in 20 and 150 ppm D containing medium. The initial big difference (10-14 mm) in length was seen to diminish with the days, and on the 12th day the difference practically disappeared (Figure 1.)

Experiments made at NÖVIKI showed, that in the 22 days old culture the tumor growth was smaller with 30-40% in the 35 ppm D containing medium than in the medium containing the natural D concentration (ca. 150 ppm). In the SOTE experiments it was found, that the difference between the tumor growth in the two media increased with the time. At the end of the investigated 22 days period 10-14% growth hindering effect was registered in the 20 ppm D medium (Figure 2.). The elemental analysis of tumors showed, that the decrease in D concentration caused the Mg and Na concentration to decrease in the tissues (Table 1.).