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EFFECT OF GROWTH REGULATORS FOR *EX VITRO* ROOTING DURING ADAPTATION OF *IN VITRO* PROPAGATED PLANTS TO NON-STERILE CONDITIONS

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Summary. The aim of the investigation was to study the effect of two growth regulators – the commercial chemical Charkor and IBA auxin on the induction of root formation when planting non-rooted *in vitro* propagated plants of GF 677 rootstock and kiwi. Two factors were studied – the duration of treatment with the growth regulator and stem basis processing. Very good root formation of GF 677 plants was obtained after treatment with both substances. More vigorous initial growth was established after treatment of the plants with Charkor without cutting the stem basis. The plants treated with IBA achieved the highest percentage of rhizogenesis and active growth after dipping them in the growth regulator for 30 sec. In kiwi plants, better root formation and development was obtained after treatment with IBA in comparison with those dipped in Charkor.

Key words: *in vitro* propagation, adaptacion, rooting, IBA, Charkor, GF 677, Kiwi.

INTRODUCTION

The major factor for optimal survival of micropropagated plants under non-sterile conditions and their further development is growing plants that have a well-developed root system while under *in vitro* conditions. Providing the opportunity to induce rhizogenesis under external conditions (Vasar, 2003) shortened the technological cycle and reduced the cost price of the produce. From the physiological point of view Borkowska (2001) established a similar photochemical activity in the leaves of both *in vitro* and *ex vitro* rooted plants.

One of the ways of inducing rhizogenesis after planting was treating the stem basis of the plants with a growth regulator, mainly the ones of the group of auxins (Nas and Read, 2003). The ability of kiwi green cuttings to be successfully

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rooted created the possibility of *ex vitro* planting of non-rooted plants (Stanica et al., 2003; Popov, Kornova, 2009).

The aim of the investigation was to study the effect of two growth regulators on the induction of rhizogenesis under *ex vitro* conditions when planting non-rooted micropropagated plants.

MATERIAL AND METHODS

The study was carried out in the Production Laboratory for *in vitro* propagation at the Fruit-Growing Institute – Plovdiv with the peach rootstock GF 677 and kiwi (*Actinidia chinensis*) – the male cultivar Tomuri. Two growth regulators were studied for the induction of rhizogenesis under *ex vitro* conditions: CHARKOR – root-formation stimulator, developed and produced in Ukraine, its content including growth regulators of natural origin and synthetic analogues of phytohormones, and, IBA – a regulator belonging to the group of auxins. Studies with Charkor were carried out by dipping the stem basis of the micropropagated plants of the two studied species (with and without cutting it) in 1 % solution of the chemical for 20 h. Then, the plants were planted *ex vitro*. Treatment with IBA was applied immediately before planting the microplants by dipping them for 15, 30, 45, 60 sec – for GF 677, and for 15 sec – for kiwi plants. Plants were planted and grown in a steel-and-glass house. The following characteristics were studied: percentage of survival, percentage of plants with initial vegetative growth, average stem height of GF 677. Statistical processing of the data was carried out using ANOVA.

RESULTS AND DISCUSSION

The most important condition for successful survival of the micropropagated plants planted without roots under *in vivo* conditions is to induce rhizogenesis in the soil substrate. That is a prerequisite for initial vegetative growth expressed in the increase of stem height and leaf mass. It means that survival, development and vital status of the planted plants depend on root-formation. Later, the non-rooted plants die.

Induction of rhizogenesis in GF 677 was very well influenced by the growth regulator Charkor – 82.3%-90.0% both for the uncut plants and those cut at the stem basis (A1, A2 – Fig. 1). A similar effect was established after dipping the plants in IBA. The best result concerning the period of treatment with the above auxin was reported after treatment for 30 seconds – 88.9% of rooting (A3 – Fig. 1). A typical characteristic of the adapted GF 677 plants was the often apex development blocking (Kornova et al., 2006). In that relation, it was established that 84.8% of the plants treated with Charkor and uncut at the stem basis started to grow intensively, while for the cut ones growth increment was reported only in 64.2%. That showed a physiological problem expressed in suppression of the apical growth in the variant. Concerning the effect of IBA, optimal proved to be the treatment for 30 seconds – stem growth was induced in 72.9% of the survived plants. The most intensive growth in height was established again in the plants uncut at the stem basis and treated with Charkor – 16.9 cm versus 7.8 cm in the control plants ($P \leq 0.001$).

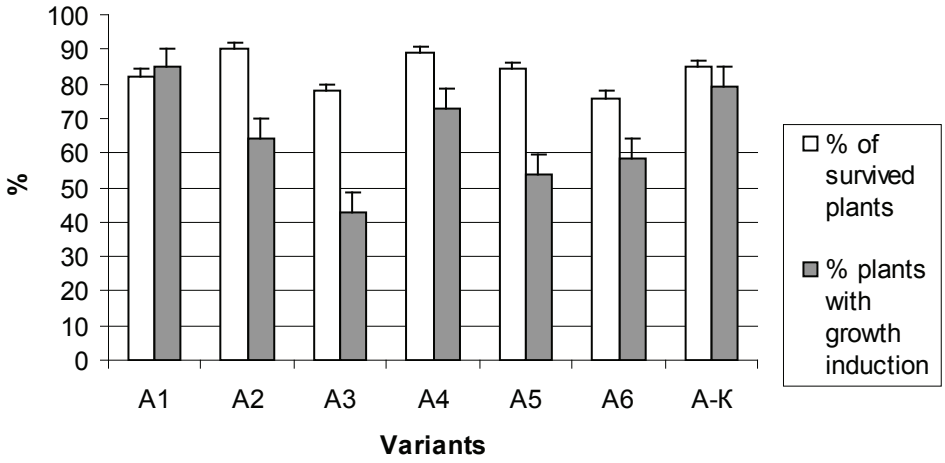

Fig. 1. Percentage of survived plants of GF 677 treated before planting for adaptation with: Charkor – without cutting the stem basis (A1), with cutting the stem basis (A2); IBA (seconds): - for 15 (A3), for 30 (A4), for 45 (A5), for 60 (A6). Control – *in vitro* rooted plants (A-K). The bars indicate the standard error.

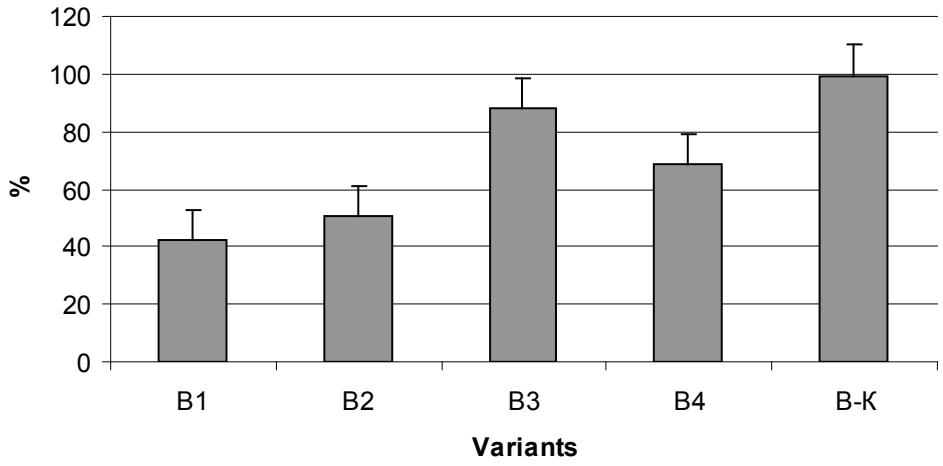

Fig. 2. Percentage of survived plants of kiwi treated before planting for adaptation with: Charkor – without cutting the stem basis (B1), with cutting the stem basis (B2); IBA – for 15 seconds (B3), after cutting the callus; Direct planting (B4). Control – *in vitro* rooted plants (B-K). The bars indicate the standard error.

In kiwi plants treated with Charkor, no matter whether the callus was cut or uncut, a low percentage of survival, i.e. root formation was established - 42.2% – 50.5% (B1, B2 – Fig. 2). The effect of IBA was better expressed, 88% of the planted microplants with cut callus survived and started to grow intensively (B3 – Fig. 2).

For the plants directly planted with the callus, the percentage of rooted plants was also high (68.5%). The best survival with active and homogeneous development of the liana-like stem was achieved in the microplants planted with roots (99.2%), which was a result of the faster reached autotrophic nutrition.

CONCLUSIONS

For GF 677 there are great possibilities for inducing rhizogenesis under *in vivo* conditions by applying the two studied growth regulators. Treatment with Charkor and dipping in IBA for 30 sec contributed to achieving a high percentage of rooting and survival, with initial vigorous apical growth. Very good rooting under *ex vitro* conditions for kiwi plants could be achieved by dipping in IBA solution for 15 sec. The established possibilities for the induction of rhizogensis in micropropagated plants of the studied species under *in vivo* conditions is a prerequisite for shortening the production process and reducing the cost price when applying that propagation method.

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