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STIMULATION OF ROOT INITIATION IN HARDWOOD SWEET AND SOUR CHERRY ROOTSTOCKS *(Prunus mahaleb* L.*)*

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Summary. Comparative studies were conducted for the purpose of assessing the rooting of four mahaleb species hardwood rootstock cuttings (SL-64, P-1, IK-M9 and T-36). In case no growth regulators were applied only callus or single rootlets were observed. Indole-3-butyric acid in concentration of 2 g/l greately stimulated root initiation which was considerably higher in IK-M9 and T-36 cuttings than in the SL-64 rootstock.

Single application of vitamin K_3 caused a slight induction of root initiation (10–15%) in the SL-64 rootstock. A pronounced synergistic effect was found after combined treatment with indole-3-butyric acid and vitamin K_3, root initiation in the hardwood cuttings reaching up to 93%.

Key words: rooting, hardwood cuttings, mahaleb, indole-3-butyric acid, vitamin K_3.

Abbreviations: IBA – indole-3-butyric acid; Vitamin K_3 – 2-methyl-1,4-naphthol quinone or menadione

Introduction

Rootstocks used for grafting sweet and sour cherry species are propagated both generatively and vegetatively. One of the contemporary accelerated methods of vegetative propagation is rooting of hardwood cuttings. Most of the widely used rootstocks,

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however, do not initiate roots easily and their propagation in this way is possible only in case of optimizing the parameters of the main factors which have an influence on root initiation. Previous investigations of the authors regarding root formation on hardwood cuttings of various mahaleb forms, which are the main rootstock for sweet and sour cherries in the Kyustendil region and Bulgaria in general, have assessed the proper dates of rooting and the optimal concentrations of indole-3-butyric acid (IBA) treatment (Koleva 1980, 1983). Stimulation of root initiation is provoked not only by IBA, but also indole-3-acetic acid, naphthaleneacetic acid and other auxins specific for the individual species (Turetskaya and Polikarpova, 1968; Bartolini and Briccoli-Bati, 1974; Howard, 1978; Trachev et al., 1984).

It was found that in many plants root initiation of cuttings is improved by supplementing vitamin C or vitamin B_1 to the growth regulators (Turetskaya and Polikarpova, 1968). A slight rhizogenic effect was observed also in vitamin K_3 applied to stem cuttings of beans (Rama Rao et al., 1985). But we are not informed whether it was ever used in rooting fruit-tree plants. The aim of the present study was to assess the effect of IBA in combination with vitamin K_3 on root initiation in hardwood rootstock cuttings for sweet and sour cherries.

Materials and Methods

The investigations were conducted in 1990–1992 at the Institute of Fruitgrowing, Kyustendil, with hardwood cuttings of the mahaleb rootstock SL-64, P-1, IK-M9 and T-36. The cuttings were collected at the beginning of February from annual branches 8–10 mm thick at the base, which were cut with a length of 25 cm. Treatment was made by dipping the lower end of the cuttings for 5–7 s in 50% ethanol solution of the tested substances. IBA was used in a 2 g/l concentration, which was assessed in our former studies (Koleva, 1980, 1983) as the optimal one. Vitamin K_3 (menadione or 2-methyl-1,4 naphthol quinone) was applied in concentrations of 2 to 20 g/l, taking into account the studies of Rama Rao et al. (1985). The mahaleb rootstock SL-64 was used in the investigation which included the following treatments: 1. control – 50% ethanol; 2. IBA 2 g/l; 3. IBA 2 g/l +vit. K_3 2 g/l; 4. IBA 2 g/l + vit. K_3 10 g/l; 5. IBA 2 g/l +vit. K_3 20 g/l; 6. Vit. K_3 2 g/l; 7. Vit. K_3 10 g/l.

After treatment the cuttings were placed to root in moist and heated substratum (river sand) with constant temperature regime 20±2 °C maintained at their base. The substratum was disinfected yearly with fundazol in a concentration of 0.1% applying 5 l/m^2. Each treatment included 80 cuttings, distributed in 4 replications, grown in the cultivating premises for 15–17 days, after which the number of rooted rootstock and the number of rootlets were counted.

Results and Discussion

Results concerning the initiation of first rootlets on hardwood cuttings treated with IBA are presented in Table 1. It is evident that the percentage of rooted cuttings differs in the individual rootstocks and varies from 26% to 72% in 1991 and from 42% to 53% in 1992. The highest mean percentage for the two years is observed in mahaleb IK-M9, followed by T-36 and P-1. These rootstocks have higher rooting ability than SL-64 and produce 3 to 4 rootlets per rooted cutting. The difference found in percentage of rooted cuttings between IK-M9 and the rootstocks SL-64, P-1 are statistically significant in favour of IK-M9.

Table 1. Root initiation in hardwood cuttings of sweet and sour cherry rootstocks treated with indole-3-butyric acid (2 g/l) in rooting percentage

Rootstocks	1991		1992		Average %	
	control	IBA	control	IBA	control	IBA
SL-64	5.0	28.8	0	41.5	2.50	35.0
P-1	0	26.3	4.1	52.5	2.04	39.4
IK-M9	8.33	71.5	2.5	50.0	5.41	60.6
T-36	1.7	51.5	0	50.0	0.83	50.6
CD 5%		25.95		NS		19.75
1%		37.28				

The control cuttings produce only callus and single roots on an insignificant percentage of them – up to 8% for IK-M9. This fact shows that the propagation of the rootstocks studied by hardwood cuttings requires stimulation of their rhizogenesis by IBA or some other agent.

In the process of seeking for more efficient means than IBA for stimulating root initiation of hardwood rootstocks, it was found that its combination with vitamin K_3 results in higher percentage of rooting than in case of supplemented vitamin C. Data in Table 2 show that treatment with IBA only induced rooting in 48% of the cuttings. Single application of vitamin K_3 led to 10–15% root initiation. The combined treatment with IBA and vitamin K_3, however, produced a considerable synergistic effect. Despite the high variation in percentage of rooting in the individual years there was a clear and statistically significant trend in favour of the combination IBA (2 g/l) and vitamin K_3 (2 g/l). This stimulating effect of the combination was confirmed also in case of rooting softwood cutting of the rootstock SL-64 and of hardwood cuttings of P-1 which was made during the last year (unpublished data). Increasing the concentration of K_3 above 10 g/l reduced the stimulating effect of the combination. Thus participation of K_3 in the combination with 20 g/l resulted in only 10–20% rooting of the cuttings placed to root.

The physiological processes leading to induction of root initiation are not yet fully elucidated. An increase of free auxins was found in the bases of the cuttings before the beginning of root initiation (Nordstrom et al., 1991). It was been postulated that easily rooting species, as opposed to those which were difficult to root, have an ability to hydrolyze auxin conjugates at the appropriate time to release free auxins which may promote root initiation (Epstein and Ludwig-Muller, 1993). The observed pronounced synergistic effect of K_3 with IBA is most probably due to the fact that vitamin K_3 causes an enhancement of the endogenous content of the indole-3-acetic acid in plant tissue decreasing activities of the enzymes involved in its oxidation (Rama Rao et al., 1985). In this way a more favourable ratio is created between free endogenous auxins in the tissues. Besides, it is possible that it contributes for a better uptake, transport and stabilization of IBA ensuring a longer time of action.

These results show a higher rooting ability of the hardwood mahaleb rootstocks IK-M9 and T-36, than that of SL-64 following treatment with IBA. A considerable synergistic effect of the combination IBA and K_3 on root initiation was found in hardwood cuttings of sweet and sour cherry rootstocks.

References

Bartolini, G., C. Briccoli-Bati, 1974. Moltiplicazione del pesco per talea con la tecnica del sacchetto di polietilene. Rivista della ortoflorofrutticoltura Italiana, 58, 360–366.

Epstein, F., J. Ludwig-Muller, 1993. Indole-3-butyric acid in plants: occurrence, synthesis, metabolism and transport. Physiologia Plantarum, 88, 382–389.

Howard, H., 1978. Field establishment of apple rootstock hardwood cuttings as influenced by conditions during a prior stage in heated bins. J. Horticul. Sci., 53, 31–37.

Koleva, A., 1980. Possibility for rooting of hardwood mahaleb cuttings. Fruitgrowing, 49(11), 29–33 (In Bulg.).

Koleva, A., 1983. Effect of indole-butyric acid on rooting hardwood mahaleb cherry (*Prunus mahaleb* L.) cuttings. Horticultural and Viticultural Science, 20(3) , 22–29 (In Bulg.).

Nordstrom, A., F. Jakobs, L. Eliasson, 1991. Effect of exogenous indole-3-acetic acid and indole-3-butyric acid on internal levels of the respective auxins and their conjugation with aspartic acid during adventitions root formation in pea cuttings. Plant Physiology, 96, 856–861.

Rama Rao, A., K. Ravichandran, S. David, S. Ranade, 1985. Menadione sodium bisulphite: a promising plant growth regulator. Plant Growth Regulation, 3, 111–118.

Trachev, D., L. Kavardjikov, K. Kornova, 1984. New technologies in the production of fruit planting material. Publ. Agric. Academy, Sofia (In Bulg.).

Turetskaya, R., F. Polikarpova, 1968. Plant propagation using plant growth regulators. Publ. Science, Moscow (In Rus.).