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INFLUENCE OF ROOTING STIMULATORS OF CUTTINGS OF SELECTED WILD PEAR GENOTYPES (*Pyrus communis L.*) FROM THE AREA OF POLIMLJE

SUMMARY

There are many genotypes of the wild pear (*Pyrus communis* L.) in the Balkan Peninsula. The large genetic variability of the wild pear is due to century-old adaptation of local populations to certain agro-ecological and soil conditions. Vegetative reproduction using cuttings is one way of clonal multiplication of higher plants. On a theoretical level today, researchers are investigating the regulatory role of phytohormones in rhizogenesis.

On a practical level, they are making efforts to identify optimal conditions for the rooting of cuttings and investigating the possibility of using cuttings in a greater number of different plant species, particularly those in which rhizogenesis hardly occurs. Vegetative rooting with known methods can successfully help the production of the rootstocks of the wild pear (*P. communis* L.).

The quality of the root system of 30 genotypes was conditioned with Indole Butyric Acid (IBA) stimulators of different concentrations. With an increase in the IBA concentration from 1,000 to 3,000 ppm, the presence of fibres in the wild pear cuttings increased. The introduction of the genotypes BP 06, BP 07, BP 12, BP 20, BP 40 and BP 41 into nursery production, all of which showed a satisfactory ability to form adventive roots, would eliminate the high variability in generative rootstocks in nursery gardens, in addition to the incompatibility with many noble varieties.

Keywords: pear, cutting, fibre, phytohormone, genotype

INTRODUCTION

Humans have played an important role in that process by using seeds to reproduce new specimens. Therefore, the Balkan Peninsula can be considered a secondary centre of pear diversity.

The most important vegetative rootstocks for wild pear are different types of quince rootstocks (*Cydonia oblonga Miller*). However, recently, there have been significant problems with the cultivation of pears using these rootstocks, particularly if the plantings were not maintained according to the highest agro-technical demands. A more important problem is its incompatibility with many noble varieties. Therefore, it has to be grafted through intermediaries.

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Other methods of cloning or asexual reproduction of higher plants (Mišić, 1984) are already in commercial use. However, from a practical and a commercial aspect, cuttings remain the most important method for the production of seedlings of ornamental bushes and trees (Kastori et al., 1988). Thus, problems associated with the rooting of cuttings are the subject of numerous theoretical and practical studies. Some researchers are investigating the regulatory role of phytohormones in rhizogenesis, whereas others are making efforts to identify the optimal conditions for the rooting of cuttings and to determine the possibility of using these in a greater number of different plant species, particularly those in which rhizogenesis hardly occurs (Armson et al., 1980, Kastori et al., 1984, Vlašić, 1972, Subotin, 1983, Egorova, 1951, Bartolini et al., 1979, Keffort and Goldacre, 1961, Kastori, 1986, Jovanović and Gigić, 1976, Uzunov, 1987, Hartmann and Hansen, 1958, Kapetanović and Hanić, 1975, Breviglieri, 1958, Ericson, 1952, Kalmar, 1971, Hartmann et al., 1990, etc.)

The aim of this work was to obtain rootstocks from vegetative reproduction that were adapted to particular environmental, soil and climate conditions (frost and drought) and resistant, or at least tolerant, to diseases and pests and that could be reproduced easily via vegetative reproduction and be compatible with noble varieties.

MATERIAL AND METHODS

Thirty genotypes of the wild pear, which had been selected by Jovančević (1994) from the natural population of Cite geographic location of this area (Bijelo Polje, North-East of Montenegro), were used in this study.

The ‘heads’ of the parent bushes were pruned and covered at the end of March and the beginning of April (Kapetanović et al., 1971). During vegetation the shoots were covered twice.

After uncovering, about 100 mature cuttings of each genotype were taken in the spring from the basal area of the one-year increment of biannual and triennial parent bushes. The cuttings were from 23 to 28 cm long, all of which were all of which were healthy and thick (7–10 mm), healthy and mechanically undamaged (Veličković and Jovanović, 1986). Immediately below the lowest node, a cross-section was made on the cutting, and the cutting was immersed in a solution of phytohormones for 10 seconds.

The cuttings were treated with different concentrations (1,000, 2,000 and 3,000 ppm) of β-indole butyric acid (IBA) and pure water (control). The phytohormone was dissolved first in 2 cm^3 96% of alcohol, and then poured into appropriate amounts of a solution of 96% alcohol and distilled water in a 1:1 ratio. The treated cuttings were then dried for 30 minutes at room temperature (Jovanović and Gigić, 1976). The cuttings were rooted in tubs, which were maintained at room temperature in an illuminated room. A mixture of sand and compost in a 3:1 ratio was used as the rootstock (Kapetanović et al., 1971).

After six weeks, the rooted cuttings were sorted on the basis of the number and the length of the fibres according to the method of Jovanović and Gigić (1976) into four quality groups:

a) Unrooted cuttings;

b) Cuttings with one to three fibres less than 5 cm long;

c) Cuttings with four to five fibres long from 5 to 8 cm;

d) Cuttings with over five fibres over 8 cm long.

The investigations were performed in an experimental field and in the laboratories of the Centre for Fruit Growing in Bijelo Polje (1999–2001).

RESULTS AND DISCUSSION

The average number of cuttings with four–five fibres and that were 5–8 cm long was 3.28%. In the control variant, there were no cuttings with four–five fibres and 5–8 cm in length. In the treatment with different concentrations of phytohormones, the highest number was in the treatment with 3,000 ppm, 9.69%, and the lowest in the treatment with 1,000 ppm IBA, 1.57%, (Table 1).

There were a few cuttings with over five fibres that were more than 8 cm long. These were present in the genotype BP 12 in the variant exposed to a phytohormone concentration of 1,000 ppm (3.33%), as well as in the genotype BP 06 (5.0%) and in the genotype BP 40 (8.33%) exposed to a concentration of 3,000 ppm (data not shown). The properties of the cuttings of genotype BP 40 in the 3,000 ppm treatment are presented in Figure 1.

Two types of cytogenetic hypotheses have been proposed to explain the origin of *Maloideae*: Darlington and Moffet (1930) claimed that pears and apples are autopolyploids, which originated from the *Rosoideae* members with seven chromosomes. Dermen (1949) argued that apples and pears are derived from a cross between *Rosaceae* members with eight and nine chromosomes and that their number was then doubled. On the basis of morphological and biochemical investigations, Stebbins (1950) and Challice (1981) concluded that *Maloideae* is the result of hybridisation in the ancient past between primitive members of *Spiraeoideae* (X = 9) and *Prunoideae* (X = 8) and that their number was then doubled. In addition, Wanscher (1929), Gaigneu (1974), Mišić and Tešović (1968) and Spirovska and Dimitrovski (1976) reported male or female sterility in apples and pears, whereas Stanković and Jovanović (1987) reported that the rooting of shoots is possible with quince, M apple types, plums and Melbourne cherry. Altogether, it demonstrates that vegetative reproduction is an inherited trait in the wild pear. This ability has been confirmed using mature cuttings, conserved during ontogenesis under the influence of the environment, choosing generative reproduction.

Compared with the results of Jovanović and Gigić (1976), Veličković et al. (1985) and Veličković and Jovanović (1986), our method yielded a higher number of rooted cuttings of wild pear but not a higher number of well-rooted cuttings with the Maling rootstock of apples (M9, M26 and M106). However, the named rootstocks were very successfully reproduced by covering. Therefore, they exhibit better potential for vegetative reproduction

Table 1. Number of genotype cuttings with four–five fibres over 5 to 8 cm treated with different IBA concentrations (%)

Genotypes	IBA Treatmens				Average
	Control	1000 ppm	2000 ppm	3000 ppm	
BP 02	0.00	1.64	0.00	8.33	2.49
BP 06	0.00	3.33	0.00	16.67	5.00
BP 07	0.00	1.64	0.00	43.37	11.26
BP 08	0.00	0.00	0.00	13.33	3.33
BP 10	0.00	1.67	3.33	5.00	2.50
BP 11	0.00	0.00	15.17	12.33	6.88
BP 12	0.00	11.67	6.67	11.67	7.50
BP 13	0.00	0.00	0.00	0.00	0.00
BP 14	0.00	0.00	0.00	0.00	0.00
BP 15	0.00	0.00	3.33	3.33	1.67
BP 20	0.00	13.67	4.87	52.33	17.72
BP 22	0.00	0.00	3.47	0.00	0.87
BP 25	0.00	0.00	5.00	0.00	1.25
BP 26	0.00	0.00	0.00	3.33	0.83
BP 31	0.00	0.00	1.67	0.00	0.42
BP 33	0.00	0.00	0.00	6.67	1.67
BP 34	0.00	13.43	6.67	0.00	5.03
BP 35	0.00	0.00	0.00	0.00	0.00
BP 40	0.00	0.00	0.00	52.43	13.11
BP 41	0.00	0.00	0.00	31.67	7.92
BP 44	0.00	0.00	0.00	3.33	0.83
BP 46	0.00	0.00	0.00	0.00	0.00
BP 47	0.00	0.00	0.00	0.00	0.00
BP 51	0.00	0.00	0.00	0.00	0.00
BP 55	0.00	0.00	0.00	0.00	0.00
BP 62	0.00	0.00	0.00	0.00	0.00
BP 63	0.00	0.00	1.67	12.00	3.42
BP 65	0.00	0.00	0.00	6.67	1.67
BP 67	0.00	0.00	0.00	5.00	1.25
BP 68	0.00	0.00	3.33	3.33	1.67
Average	0.00	1.57	1.84	9.69	3.28

In the control variant, the presence of fibres depended on the inherited genotype base. However, the exposure to the phytohormones resulted in more intensive cell division and, therefore, the formation of a greater number of fibres.

The number of fibres in the cuttings of the wild pear genotypes increased with an increase in the concentration of IBA from 1,000 to 3,000 ppm.

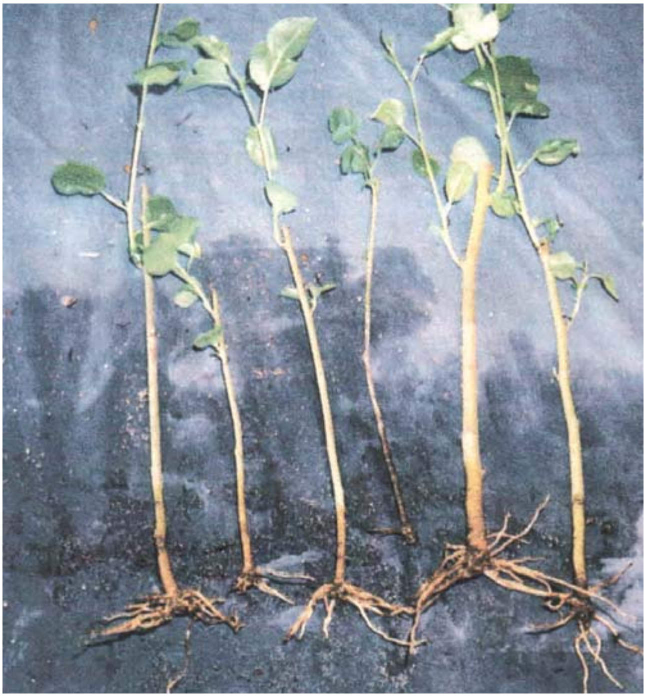

Figure 1. The illustration of the properties of BP 40 cuttings in the treatment with 3,000 ppm IBA

Veličković et al. (1985) obtained the highest number of medium-rooted cuttings, 23.0 %, and well-rooted cuttings, 14.0%, from M9 rootstock with a concentration of 2,500 ppm, whereas Veličković and Jovanović (1986) obtained, at the same IBA concentration, 8.5% of weakly rooted, 44.0% of medium-rooted and 32.0% of well-rooted cuttings from M26 rootstock. These results show that within rooted cuttings, in all treatments, there is a quite a low number of well-rooted cuttings, as well as in the M9 rootstock from 31.67% to 51.43% (Veličković et al., 1985), whereas the number of medium-rooted cuttings, from 31.67% to 51.43%, is good with four genotypes. It was also higher than the number of medium-rooted cuttings from the M9 and M26 rootstocks. Given that the period of rooting of the cuttings was six weeks, or 43 days, and that, according to the rules, cuttings with at least three fibres over 5 cm long can be used, we think that genotypes BP 06, BP 07, BP 12, BP 20, BP 40 and BP 41 would satisfy current regulations and have a higher number of well-rooted cuttings. Therefore, they would be more suitable for grafting

These findings indicate that vegetative rooting can aid the production of rootstocks. Clonal reproduction would eliminate variability in the vegetative and generative components of cultural varieties used in production plantings.

CONCLUSION

Vegetative rooting can aid the production of the wild pear rootstock of *P. Communis L.*

The quality of the root system in the genotypes studied was conditioned using different concentrations of the IBA stimulator. An increase in the concentration of IBA from 1,000 to 3,000 ppm resulted in a greater number fibres in cuttings of wild pear genotypes.

The introduction into nursery production of genotypes BP 06, BP 07, BP 12, BP 20, BP 40 and BP 41, all of which show a satisfactory ability to form adventive roots, would eliminate the high variability in generative rootstocks in nursery gardens, as well as the incompatibility with many noble varieties.

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UTICAJ STIMULATORA NA OŽILJAVANJE REZNICA SELEKCIONISANIH GENOTIPOVA DIVLJE KRUŠKE *(Pyrus communis L.*) POLIMLJA

SAŽETAK

Na Balkanskom poluostrvu kruška (*Pyrus communis* L.) predstavlja populaciju različitih genotipova. Velika genetička varijabilnost divlje kruške je rezultat vjekovnog prilagođavanja lokalnih populacija određenim agroekološkim i zemljišnim uslovima.

Vegetativno razmnožavanje putem reznica je jedan od načina klonske multiplikacije viših biljaka. Zato se danas, sa teoretskog stanovišta, pored ostalog, izučava regulatorna uloga fitohormona u rizogenezi, a sa praktičnog čine se napori u pravcu iznalaženja optimalnih uslova za ožiljavanje reznica i mogućnosti njihove primjene u sve većeg broja različitih biljnih vrsta, posebno u onih u kojih teže dolazi do rizogeneze. Vegetativnim ožiljavanjem, poznatim metodama, mogu se uspješno proizvoditi podloge divlje kruške *P. communis* L.

Kvalitet kojrenovog sistema, u ispitivanih genotipova, uslovljen je koncentracijom IBA stimulatora. Sa povećanjem koncentracije IBA od 1000 do 3000 ppm dolazi i do povećanja zastupljenosti žila po reznici u genotipovima divlje kruške. Uvođenjem u rasadničku proizvodnju genotipove BP 06, BP 07, BP 12, BP 20, BP 32, BP 40 i BP 41, koje imaju zadovoljavajuću sposobnost obrazovanja adventivnih korijenova, isključila bi se visoka varijabilnost generativnih podloga u rasadnicima i inkompatibilnost sa mnogim plemenitim sortama.

Ključne riječi: kruška, reznica, žila, fitohormon, genotip