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Propagation of Tanasgol, a Natural Plum-Apricot Hybrid (*Prunus domestica-armenia*) Developed in Iran

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ABSTRACT

This research was carried out to study the effect of two propagating methods on rooting ability and propagation of Tanasgol, a natural plum-apricot hybrid (*Prunus domestica-armenia*) developed in Shahrood, Iran. The propagation methods were hardwood cuttings and *in vitro* culture of seeds, set up as two separate experiments based on Completely Randomized Designs (CRD) with three replications and 20 cuttings/seeds for each replicate. Hardwood cuttings were treated in IBA-containing solutions of various concentrations (2000, 2500, 3000 and 4000 ppm). For *in vitro* culture, seeds were isolated from ripen fruits, surface sterilized and cultured on MS medium supplemented with 500 mg L^{-1} adenine sulfate, 1.5 g L^{-1} activated charcoal, 2 mg L^{-1} BAP and various concentrations of NAA (0.5, 1.0, 1.5, 2.0 mg L^{-1}). After 60 days, the percentage of *in vitro* rooted seedlings was recorded. The results showed that the concentration of 3000 ppm IBA induced 47% rooting on hardwood cuttings and was better than other treatments significantly. The highest *in vitro* seed germination and rooting successfully (60%) was obtained on MS supplemented with 1.0 mg L^{-1} NAA. Therefore, more rooted plants (up to 1.3 times) would be obtained using *in vitro* culture techniques compared with hardwood cuttings.

Key words: Natural plum-apricot hybrid, hardwood cutting, *in vitro* culture, rooting ability, propagation

INTRODUCTION

Tanasgol is a natural cross between plum and apricot (*Prunus domestica*×*Prunus armenia*) developed in Shahrood, Iran. Some important regions of growing this hybrid in Iran are Tabriz, Shahrood, Mashhad, Karaj and Tehran. The Tanasgol trees show medium vigor and resistant to lime and heavy soil. Tanasgol fruits are uniform of medium size, with a sour-sweet taste. According to Broardford and Bradford (1991) the plum-apricot hybrid is characterized by a dense, medium size and vigorous tree that produces fruits similar to apricot in skin appearance by having pubescence, but differs from a typical apricot fruit by a globose shape and a very dark purplish red skin color over its entire surface when matures.

The black or purple apricot is usually the naturally occurring hybrid of *P. cerasifera* Ehrb and *P. armeniaca* L. (Mehlenbacher *et al*., 1990; Layne *et al*., 1996; Faust *et al*., 1998). In addition, new interspecific hybrids have been recently obtained by artificial cross-pollination. For instant, Plumcot is a putative hybrid between diploid plums (*Prunus salicina* Lindle) and apricots (*P. armenia* L.)

and Pluot and Aprium are complex hybrids resulted from interspecific crosses of plums and apricots with subsequent backcrossing with plum (Pluots) or apricot (Apriums) (Manganaris *et al*., 1999; Ahmad *et al*., 2004). Several works have been published on plum-apricot hybrid trees (Bartolini and Roselli, 1975; Barbeau and El-Bouami, 1980; Katoka, 1988; Broardford and Bradford, 1991; Arbeloa *et al*., 2003).

Although, the hybrid trees of plum-apricot produce high yields and enough seeds for propagating seedling rootstocks, but the germination of these hybrid seeds is often poor with low rooting ability. Propagation can be achieved through seed germination *in vitro* or vegetatively by hardwood cuttings. *In vitro* seed germination and multiplication allowed successful culture establishment of *Prunus cerasifera* hybrid seedlings (Haradam and Murai, 1996; Arbeloa *et al*., 2003; Ning *et al*., 2007). According to Szecskoviktoria *et al*. (2006), the advantages of propagation by hardwood cuttings are the ease of propagation, the ease of sipping, the possibility of long-term storage, better quality of liners and the less special instrument requirement. The aim of this research was to investigate the effect of these two propagating methods on rooting ability and plant propagation of Tanasgol, a natural plum-apricot hybrid (*Prunus domestica-armenia*).

MATERIALS AND METHODS

The research was conducted at the Department of Horticulture, Seed and Plant Improvement Research Institute, Karaj, IRAN during 2007-2008. To evaluate propagation and rooting ability of Tanasgol, two methods of propagation, hardwood cuttings (Exp. 1) and *in vitro* seed culture (Exp. 2) were evaluated. The experiments were set up as two separate Completely Randomized Designs (CRD) each consisting of 4 different treatments with 3 replications and 20 cuttings/seeds per each replicate.

The hardwood cuttings of 20-25 cm length were prepared from one-year-old dormant twigs of Tanasgol trees grown in Shahrood Horticulture Research Station after disinfecting with fungicide (Benomil) and by cutting the basal part of the twig just below a bud and distal part just above a bud. The cuttings were dipped in IBA-containing solutions of various concentrations (2000, 2500, 3000 and 4000 ppm) for about ten seconds. The treated cuttings were then cultured in a perlite bed and kept under a mist system for 7 weeks to root after which rooting parameters were recorded.

In the second experiment (*in vitro* culture), seeds from mature fruits of Tanasgol were harvested and after surface sterilization, their embryos were isolated and cultured on MS basal medium supplemented with 500 mg L^{-1} adenine sulfate, 1.5 g L^{-1} activated charcoal, 2 mg/BAP, 30 g L^{-1} sucrose and 7 g L^{-1} agar which contained 4 different concentrations of NAA (0.5, 1.0, 1.5, 2.0 mg L^{-1}) as rooting treatments. After 60 days, the percentage of seedlings rooted *in vitro* was recorded. Data were analyzed using GLM procedure of SAS software and means were separated using Duncan's multiple range test at alpha = 0.05.

RESULTS AND DISCUSSION

Fruits of a plum-apricot hybrid are usually different from typical apricot fruits by a globose shape and a very dark purplish red skin color over their entire surface when ripened (Fig. 1). Effects of IBA treatments on rooting of Tanasgol hardwood cuttings and the number of roots per each cutting are presented in Table 1, it is indicated that, treating Tanasgol hardwood cuttings with 3000 ppm IBA gave the highest rooting percentage (46.67%) with an average of 5 roots per cutting compared with other treatments (Fig. 2a-d), while root length was not affected significantly.

Fig. 1: A 5 year-old Tanasgol tree with its fruits

Table 1: Effects of various concentrations of IBA on rooting of Tanasgol hardwood cuttings

Root length (cm)	Roots/cutting	Rooting (%)	IBA (ppm)
1.37[a]	2[c]	40.0[a]	2000
1.80[a]	4[b]	6.67[b]	2500
1.87[a]	5[a]	46.67[a]	3000
1.63[a]	1[d]	6.67[b]	4000

Means followed by similar letter(s) are not significantly different at 5% level (Duncan's multiple range test)

Effects of different concentrations of NAA on germination of Tanasgol seeds *in vitro*, root length and plant growth quality index are shown in Table 2, increasing NAA concentration reduced germination rate as well as root length and growth quality index. The highest germination (60%) was obtained in MS medium supplemented with 1.0 mg L^{-1} NAA. The longest roots were also obtained in this treatment while the greatest growth quality index was achieved in 0.5 mg L^{-1} NAA.

Since, Tanasgol trees have shown resistance to lime and heavy soil under the ecological conditions of growing regions, there has been considerable interest for efficient propagation of this hybrid and improving its rooting ability. In the present work, two methods of propagation; hardwood cuttings and *in vitro* techniques were established. By *in vitro* culture techniques, 60% rooting was reached which can be considered a good rate for propagation of this difficult to propagate hybrid. It was found that more plants with successful rooting were obtained from *in vitro* cultures compared to hardwood cuttings.

Yildirim *et al.* (2007) presented an *in vitro* protocol for germination of apricot zygotic embryos and reported that even two months after sowing, only 50% of the seeds were germinated in glasshouse, while 75% of the seeds were germinated *in vitro* only 14 days after culture and 85% germination obtained when the isolated zygotic embryos were cultured. They observed that the frequency of germination rates was gradually decreased to 67, 44, 11 and 11%, respectively in Kin,

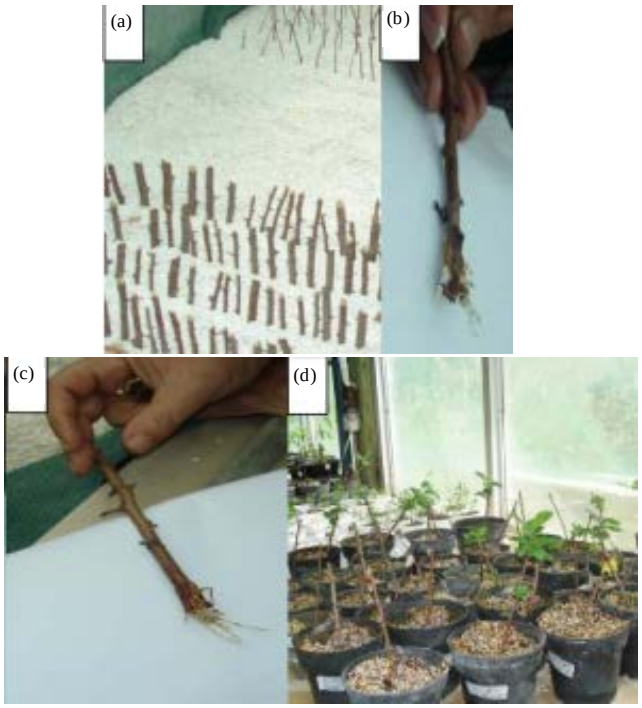

Fig. 2: (a) Tanasgol hardwood cuttings dipped in IBA-containing solutions and cultured in a perlite bed for 7 weeks to root (b and c), rooted cutting treated with 3000 ppm IBA-containing solution after 7 weeks and (d) tanasgol rootstocks propagated by rooted hardwood cuttings 3 months after re-culture in peat: perlite soil

Table 2: Effects of various concentrations of NAA on *in vitro* seed germination of Tanagol

Quality index	Root length (cm)	Germination (%)	NAA (mg L^{-1})
3.33[a]	5.15[a]	53[a]	0.5
3.19[a]	5.31[a]	60[a]	1.0
2.19[b]	3.31[b]	20[b]	1.5
2.56[b]	3.19[b]	20[b]	2.0

Means followed by similar letter(s) are not significantly different at 5% level (Duncan's multiple range test)

IAA, NAA and 2,4-D treatments. Present results on Tanasgol are partly in agreement with this study were better germination and mor plants were obtained using in vitro techniques.

Using immature embryos and cotyledons as explants, Ning *et al.* (2007) established a successful immature embryo culture and efficient regeneration via direct organogenesis for *Prunus mume* (Xue mei). High frequency of plantlet formation (89.5%) was obtained on half-strength MS medium supplemented with 13.2 μM BA and 2.7 μM NAA. Better results were achieved when embryo axes were removed from cotyledons and cultured on 1/2MS medium supplement with 13.2 μM BA, 2.7 μM NAA (72.9%) or 2.2 μM BA, 2.2 μM TDZ and 2.7 μM NAA (84.2%), respectively.

Although hardwood cuttings were recommended for propagation of apricot hybrid rootstocks by Reighard *et al.* (1990), but considering the number of plants produced in the present study by *in vitro* techniques compared to hardwood cuttings and the fact that this rate might be improved by further optimization, it can be concluded that employing *in vitro* culture techniques would be

better and more efficient for propagation of Tanasgol and similar interspecific hybrids. More efforts will be placed toward developing a reliable micropropagation protocol for this hybrid in our next research project.

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