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Influence of indole butyric acid on propagability of clonal rootstock of *Prunus* species through cuttings and stooling

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Abstract
Propagability studies of three different clonal rootstocks (Myrocal (*P. cerasifera*), Julior (St. Julien x Pershore) and Jaspi (Methley x *P. spinosa*)) of *Prunus* species were undertaken in the Departmental field of Fruit Breeding at Dr. YSP UHF, Nauni-Solan (Himachal Pradesh). The experimental plant material was introduced from France and planted in the experimental farms. Hardwood cuttings, softwood cuttings and stooling methods were employed and the cuttings were treated with different concentrations of IBA. Observations recorded on different parameters reveals that with hardwood cuttings, among rootstocks, maximum sprouting (38.92%), rooting (26.75%), root length (27.17 cm) and number of roots per cutting (8.13) was obtained in Myrocal followed by Jaspi and Julior whereas among treatments maximum sprouting (31.30%), rooting (20.52%), root length (27.89 cm) and number of roots per cutting (8.30) was obtained with 5000 ppm IBA followed by 7500 ppm IBA for sprouting and rooting and 2500 ppm IBA for root length and number of roots per cuttings. Jaspi registered maximum sprouting (16.22%) and rooting (11.48%) whereas Myrocal registered maximum root length (16.04 cm) and number of roots per cutting (7.07) with softwood cuttings. In Myrocal and Julior very little rooting in cuttings treated with IBA was obtained while no rooting was observed in all the three rootstocks under study with control through softwood cuttings. Maximum rooted suckers (91.23%), number of roots per stool (17.20) and root length (29.99 cm) was observed in Myrocal treated with 2000 ppm IBA. Amongst all the rootstocks under study overall relatively higher success through hardwood cuttings and stooling was observed in Myrocal followed by Jaspi and Julior.

Keywords: IBA, propagability, clonal rootstock, *Prunus*, cuttings, stooling

Introduction
Rootstocks are an essential component in modern fruit production because of their capability of adapting a particular cultivar to diverse environmental conditions and cultural practices. Rootstocks can provide several or many traits that are absent in the scion, such as soil's pest and disease resistance, better anchorage, improved nutrient uptake, better tolerance to soils with high saline content or drought, as well as other limiting soil conditions (Gainza *et al.*, 2015) [4]. Like majority of fruit crops, stone fruits are also multiplied clonally by grafting the scion cultivar on the desired rootstock. The most important ability of the rootstock is its adaptability to variable environmental and geographical conditions and its compatibility (Costa *et al.*, 1981) [1]. Still wild seedlings of stone fruits e.g. wild peach (Kateru), wild apricot (Chulli) and Behmi have remained the first choice as rootstock in case of stone fruits on commercial level and have adapted for ages. Seedling rootstocks have been used by horticulturists for more than one millennia, but still we have little comprehension regarding their useful effects on the physiology, growth and cropping of fruit trees scions. Seedling rootstocks in vague, though well adapted, being hardy bear more heavily and long lived but lack certain important characteristics like short juvenility, uniformity in growth excessive vigorous, susceptible to seed borne disease and production of inferior quality fruits etc. On the other hand, clonal rootstocks possess requisite attributes such as uniformity, tree size control, precocity, cropping efficiency and resistance to various stresses (Hartmann, 1987; Webster, 2002) [5, 13]. Clonal rootstocks with desirable characteristics can only be brought under cultivation if ways and means are available to multiply them in bulk in a rapid manner. To achieve this, several advances have been made in various fruit species to propagate rootstocks by hardwood/softwood cuttings, stooling and micro-propagation. In the present study, an attempt has been made to evaluate three *Prunus* clonal rootstocks *viz*., Myrocal, Julior and Jaspi for their amenability to propagation through cuttings and stooling.

Material and Methods

Location and experimental site

The present investigations were carried out in the experimental block of the Department of Fruit Breeding and Genetic Resources, UHF, Nauni, Solan (Himachal Pradesh). Experimental farm is situated at an elevation of 1240 metres above mean sea level and lies between 30º50'N latitude and 77º08'E longitude. The soil of the experimental land exhibits sandy loam texture. Summer is moderately hot during May-June (31.8-34.8 ºC) while winter is cold during December-January (2.4-3.7 ºC). The average annual temperature ranges from 12.4 to 25.4 ºC. The average annual rainfall ranges from 100-130 cm, major portion of which is received during monsoon (July-August). Winter rains are usually of lighter intensity and of shorter durations.

Planting material

The experimental plant material comprised of 'Jaspi' ([Methley (*P. salicina*) x *P. spinosa*]), Myrocal (*P. cerasifera*) and Julior [St. Julien (*P. insititia*) x Pershore (*P. domestica*) clonal rootstock of *Prunus* species which were introduced from France in the year 2003 and planted in the experimental farm of Department of Fruit Breeding and Genetic Resources at a spacing of 3 x 3 metres.

Success rate of propagation was worked out for above mentioned three clonal rootstocks using different vegetative propagation methods (hardwood cuttings, softwood cuttings and stooling). For hardwood cuttings, dormant cuttings (20-25 cm long with pencil thickness) taken in January were treated with IBA (2500, 5000 and 7500 ppm) as quick dip and under control cuttings were dipped in distilled water. The experiment was laid out in randomized block design replicated thrice. For softwood cuttings, actively growing leafy cuttings along with few leaves (20-25 cm long with pencil thickness) taken in June were treated with IBA (1000 and 2500 ppm) as quick dip and under control cuttings were dipped in distilled water. The experiment was laid out in completely randomized design with five replications.

For stooling, mother stocks of clonal rootstocks were cut back to 5 cm height above the ground level during the month of January and stool beds were earthened up with nursery soil without any IBA treatment as control treatment and in second treatment the calculated quantity of IBA was mixed in lanolin paste and final strength was made to 2500 ppm of IBA concentration. The small portion of bark in the form of ring was removed below the bud at the base of the shoot and then IBA paste (2500 ppm) was applied at the point of bark removal. After applying IBA paste, the stool shoots were mounded up with the soil. Stool beds were irrigated to maintain adequate moisture in earthened up medium, so as to favour rooting.

Observations recorded and statistical analysis

Observations were recorded on sprouting percentage, rooting percentage, number of roots and root length. Root length was measured with the help of scale under both hardwood and softwood cutting experiments. Under stooling experiment, number of roots and root length was measured. Rooted suckers were calculated with the formula given below.

$$\% \text{ rooted suckers per stool} = \frac{\text{Total number of rooted suckers}}{\text{Total number of rooted \& unrooted suckers}} \text{ X } 100$$

The data generated from these investigations were computed, tabulated and pooled data of two years were analyzed by applying Randomized Block Design (Factorial). The level of significance was tested for different variable at 5 per cent (Panse and Sukhatme, 1995) [7]. Data were analysed using analysis of variance OPSTAT, HAU, Hissar, Haryana (India).

Results and Discussion

Hardwood cuttings

Significant results were obtained with respect to success of propagation of *Prunus* clonal rootstocks through hardwood cuttings and are presented in Table 1 and 2. Data from Table 1 reveals that maximum mean sprouting among IBA treatment was observed in 5000 ppm (31.30%) which was significantly higher than 7500 ppm (28.79%) and 2500 ppm (25.17%), however among rootstocks Myrocal (38.92%) recorded maximum sprouting which differs significantly from Jaspi (19.74%) and Julior (17.22%) even latter two were also significantly different from each other. The difference among interactions for sprouting of cuttings between IBA treatments and rootstocks was found to be significant. Maximum sprouting was obtained in Myrocal (51.10%) cuttings treated with IBA (7500 ppm) followed by 45.80 per cent sprouting in Myrocal treated with 5000 ppm IBA. The lowest sprouting was recorded with control in cuttings obtained from Julior (7.80%).

Among the treatments, maximum mean rooting was recorded with 5000 ppm IBA (20.52%) which was significantly different from 2500 ppm (14.07%) and 7500 ppm (14.18%) whereas minimum was recorded in control (4.80%) (Table 1). Similarly maximum mean rooting among rootstocks was recorded in Myrocal (26.75%) which was significantly different from Jaspi (7.90%) and Julior (5.53%). The interaction between IBA treatments and rootstocks was found to be significant. No rooting was recorded in Julior with control and 2500 ppm IBA and in Jaspi with 7500 ppm IBA treatment. Significantly maximum rooting was recorded in Myrocal (38.90%) with 5000 ppm IBA and minimum was recorded in Jaspi (5.20%) under control. Under 7500 ppm IBA, not even a single cutting of Jaspi rooted whereas only a few rooted in Julior. Higher dose of IBA might have resulted in toxic effect leading to low rooting of cuttings in these clonal rootstocks. Sato (1997) [10] also reported that per cent rooting decreased as the concentration of IBA increased. In Julior no rooting was obtained with control and 2500 ppm IBA and very little rooting was obtained in Myrocal and Julior with control. Dessy *et al.* (2004) [2] also obtained no rooting in Julior rootstock with control. This differential response with respect to rooting ability could be due to diverse genetic origin of these rootstocks. The present results are in general agreement with several previous studies of Rana and Chadha (1992) [8] and Sharma (2005) [12]. However, the extent of rooting achieved here is too low given the commercial standards and previous reports recording rooting success upto 90 per cent (Shaltout *et al.*, 1998 and Mayer *et al.*, 2001) [11, 6] in hardwood cuttings of *Prunus* species. Enhanced rooting observed in their reports might be due to use of rooting media, physical treatments, chemical regulators, bottom heat/mist, etc. under controlled environmental conditions unlike conventionally rooted cuttings grown in the open fields as was done in the present study.

Table 2 reveals that maximum root length (27.89 cm) and number of roots per cutting (8.30) was recorded from 5000 ppm IBA treatment and these values were significantly higher among all other IBA treatment whereas among rootstocks, significantly higher root length (27.17 cm) and number of roots per cutting (8.13) was recorded in Myrocal than Julior (5.10) and Jaspi (3.23). Interaction studies among IBA

treatment and rootstocks depicts that significantly higher values was observed with Myrocal cuttings for root length (30.67 cm) treated with 5000 ppm IBA whereas significantly higher number of roots per cutting was recorded in Myrocal cutting treated with 2500 ppm. Minimum root length was recorded with Julior (14.90%) cuttings treated with 7500 ppm IBA however number of roots per cutting was minimum in Jaspi (3.80) under control.

Table 1: Sprouting and rooting percentage of *Prunus* clonal rootstocks through hardwood cuttings using different IBA concentrations

Treatments rootstock	Sprouting (%)				Mean	Rooting (%)				Mean
	Control	2500	5000	7500		Control	2500	5000	7500	
Myrocal	21.50	37.30	45.80	51.10	38.92	9.20	26.80	38.90	32.08	26.75
Julior	7.80	9.00	29.50	22.60	17.22	0.00	0.00	11.66	10.45	5.53
Jaspi	17.50	28.20	18.60	12.67	19.74	5.20	15.40	11.00	0.00	7.90
Mean	15.93	25.17	31.30	28.79		4.80	14.07	20.52	14.18	
$CD_{0.05}$										
Treatment		0.51					0.62			
Rootstock		0.44					0.54			
T x R		0.88					1.07			

Table 2: Root length and number of roots per cutting of *Prunus* clonal rootstocks through hardwood cuttings using different IBA concentrations

Treatments rootstock	Root length (cm)				Mean	Number of roots per cutting				Mean
	Control	2500	5000	7500		Control	2500	5000	7500	
Myrocal	22.00	29.20	30.67	26.80	27.17	8.60	10.20	7.92	5.80	8.13
Julior	0.00	0.00	28.80	14.90	10.92	0.00	0.00	12.80	7.40	5.10
Jaspi	19.10	26.80	24.20	0.00	17.52	3.80	4.90	4.20	0.00	3.23
Mean	13.70	18.67	27.89	13.90		4.13	5.03	8.30	4.47	
$CD_{0.05}$										
Treatment		0.68					0.29			
Rootstock		0.59					0.25			
T x R		1.18					0.51			

Softwood cuttings

Data presented in Table 3 and 4 on sprouting, rooting, root length and number of roots per cutting in softwood cuttings revealed significant differences among rootstocks, treatments and interactions. Significantly maximum and minimum mean sprouting was recorded in Jaspi (16.22%) and Julior (6.72%), respectively among rootstocks while among treatments significantly maximum sprouting was recorded with 2500 ppm (17.45%) IBA followed by 1000 ppm (11.85%) IBA and minimum with control (3.87%). Among interactions, higher sprouting was recorded in Jaspi (21.95%) with 2500 ppm IBA which was significantly higher among all other interactions of treatment and rootstocks closely followed by Myrocal (18.25%) with 2500 ppm IBA. No sprouting was observed in Myrocal and Julior with control. Minimum sprouting was observed in Julior (8.00%) with 1000 ppm IBA.

Maximum mean rooting among rootstocks was recorded in Jaspi (11.48%) which was significantly higher than Myrocal (3.53%) and Julior (0.70%) whereas among treatments no rooting was observed in any of the rootstocks with control, whereas significantly higher mean rooting was observed with 2500 ppm IBA (9.58%) followed by 1000 ppm IBA (6.13%). Among interactions significantly maximum rooting was observed in Jaspi (18.44%) with 2500 ppm IBA followed by Jaspi (16.00%) with 1000 ppm IBA. No rooting was observed in Myrocal, Julior and Jaspi with control and in Julior with 1000 ppm IBA. Minimum per cent rooting recorded in Julior (2.10%) with 2500 ppm IBA. Results obtained through softwood cuttings were extremely low or zero in the present study and was not satisfactory. This can again be attributed to the fact that the softwood cuttings were grown under natural field conditions. Elsewhere, moderate to very high success i.e. 40 per cent to cent per cent rooting has been obtained in peach softwood cuttings under mist, peat moss, etc. by Fiorino and Mattii (1992) [3] and Sato (1995) [9].

Among treatment, significantly maximum root length (19.43 cm) and number of roots per cutting (8.29) was recorded with 2500 ppm IBA, however among rootstocks, maximum root length (16.04 cm) and number of roots per cutting (7.07) was recorded in Myrocal which was significantly higher than Jaspi (12.98 cm and 6.28) and Julior (4.87 cm and 1.60), respectively. Among interaction of treatment and rootstock significantly higher root length (27.37 cm) and number of roots per cutting (12.07) was recorded in Myrocal treated with 1000 ppm IBA, whereas minimum root length (14.60 cm) and number of roots per cutting (4.80) was observed in Julior rootstocks treated with 2500 ppm.

Table 3: Sprouting and rooting percentage of *Prunus* clonal rootstocks through softwood cuttings using different IBA concentrations

Treatments rootstock	Sprouting (%)			Mean	Rooting (%)			Mean
	Control	1000	2500		Control	1000	2500	
Myrocal	0.00	12.48	18.25	10.23	0.00	2.38	8.20	3.53
Julior	0.00	8.00	12.05	6.72	0.00	0.00	2.10	0.70
Jaspi	11.60	15.10	21.95	16.22	0.00	16.00	18.44	11.48
Mean	3.87	11.85	17.45		0.00	6.13	9.58	
$CD_{0.05}$								
Treatment		0.24					0.29	
Rootstock		0.24					0.29	
T x R		0.41					0.44	

Table 4: Root length and number of roots per cutting of *Prunus* clonal rootstocks through softwood cuttings using different IBA concentrations

Treatments rootstock	Root length (cm)			Mean	Number of roots per cutting			Mean
	Control	1000	2500		Control	1000	2500	
Myrocal	0.00	27.37	20.75	16.04	0.00	12.07	9.15	7.07
Julior	0.00	0.00	14.60	4.87	0.00	0.00	4.80	1.60
Jaspi	0.00	16.00	22.94	12.98	0.00	7.90	10.93	6.28
Mean	0.00	14.46	19.43		0.00	6.66	8.29	
$CD_{0.05}$								
Treatment		0.29					0.21	
Rootstock		0.29					0.21	
T x R		0.51					0.36	

Stooling

Data recorded on rooted suckers, roots per stool and root length through stooling treated with IBA treatment was presented in Table 5. Significant variation was recorded in three rootstocks with respect to rooted suckers, number of roots per stool and root length. Myrocal (68.58%) obtained significantly maximum rooted suckers as compared to Jaspi (19.82%) and Julior (13.85%). Among treatments, significant difference was recorded for mean rooted suckers between 2000 ppm IBA treatment (45.05%) and control (21.12%). Among interactions, significantly maximum rooted suckers were obtained in Myrocal (91.23%) treated with 2000 ppm IBA treatment followed by Myrocal (39.93%) with control. Minimum rooted suckers were observed in Julior (9.63%) with control. Maximum number of roots/stool (11.50) and root length (22.23 cm) among rootstocks was recorded in Myrocal which was significantly higher than Julior (5.10 and 14.78 cm) and Jaspi (4.90 and 12.95 cm), respectively whereas among treatments, 2000 ppm IBA recorded significantly higher values for number of roots/stool (9.07) and root length (18.98 cm) as compared to control. Among interactions, Myrocal cuttings treated with 2000 ppm IBA recorded significantly higher number of roots per stool (17.20) and root length (29.99 cm). Minimum number of roots per stool was obtained in Jaspi (4.60) with 2000 ppm IBA whereas Jaspi (11.60 cm) recorded minimum root length with control. Low to high success of propagation through stooling (mound layering) in *Prunus* species was also reported earlier by Shaltout *et al.*, (1998) [11] and Sharma (2005) [12].

Table 5: Rooted suckers, number of roots/stool and root length of *Prunus* clonal rootstocks through stooling using different IBA concentrations

Treatments rootstock	Rooted suckers (%)			Number of roots/stool			Root length (cm)		
	Control	2000	Mean	Control	2000	Mean	Control	2000	Mean
Myrocal	39.93	91.23	65.58	5.80	17.20	11.50	14.67	29.99	22.23
Julior	9.63	18.08	13.85	4.80	5.40	5.10	16.92	12.64	14.78
Jaspi	13.81	28.82	19.82	5.20	4.60	4.90	11.60	14.30	12.95
Mean	21.12	45.05		5.27	9.07		14.40	18.98	
$CD_{0.05}$									
Treatment		1.25			0.63			0.42	
Rootstock		1.53			0.78			0.51	
T x R		2.17			1.10			0.72	

Conclusion

Amongst all the rootstocks under study, overall relatively higher success through hardwood cuttings and stooling was observed in Myrocal followed by Jaspi and Julior. Softwood cuttings does not seems to be a viable method given the extent of per cent rooting (zero to extremely low) obtained without or with IBA. However, among all the three methods tested for propagability, stooling seems to be the viable methods for multiplication as compared to cuttings.

References

1. Costa GB, Marangoni B, Sansavini S, Bordini R. Six year results with two apricot cultivars on twelve rootstocks. Acta Horticulturae. 1981; 85:621-638.
2. Dessy S, Radice S, Andorno A, Ontivero M, Ferdor-Julior, Myran-Yumir *et al.* 665-2 rootstocks: Propagation by cuttings with growth regulators and bottom heat. Acta Horticulturae. 2004; 658:629-635.
3. Fiorino P, Mattii GB. Role of prunasin in collapse of rooted peach cuttings. Advances in Horticultural Science. 1992; 6(1):11-14.
4. Gainza F, Opazo I, Guajardo V, Meza P, Ortiz M, Pinochet J *et al*. Rootstock breeding in Prunus species: Ongoing efforts and new challenges. Chilean Journal of Agricultural Research. 2015; 75(1):6-17.
5. Hartmann W, Ishtara. An interesting rootstock for plums and prunes. Obstbau. 1987; 12(7):304-305.
6. Mayer NA, Pereira FM, Nachtigal JC. Propagation of Japanese apricot (*Prunus mume* Sieb, Zucc.) by herbaceous cuttings. Revista Brasileira De Fruticultura. 2001; 23(3):673-676.
7. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers, ICAR, 1995, 97-156.
8. Rana HS, Chadha TR. Studies on the clonal propagation of *Prunus* species and their relationship with some biochemical characters. Progressive Horticulture. 1992; 21(3-4):329-335.
9. Sato Y. Propagation of peach rootstocks by leafy stem cuttings. Journal of the Faculty of Agriculture Shinshu University. 1995; 32(1-2):1-9.
10. Sato Y. Propagation of the Japanese plum rootstocks (*Prunus salicina* Lindl.) by leafy stem cuttings. Journal of the Faculty of Agriculture Shinshu University. 1997; 34(1):19-24.
11. Shaltout AD, Salama M, El-Wakeel HF, Aziz MBA, Ismail OM. Propagation of Nemaguard peach by stem hardwood cuttings and layerings. Annals of Agricultural Science, Cairo. 1998; 3:865-879.

12. Sharma N. Seedling rootstock selection for peach, plum and apricot. Ph.D. Thesis, Dr. YS Parmar University of Horticulture and Forestry, Nauni-Solan, India, 2005, 117.
13. Webster T. Dwarfing rootstocks: Past, Present and Future. The Compact Fruit Tree. 2002; 35(3):67-72