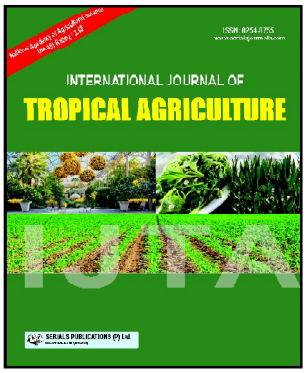

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Graft Compatibility of Pomegranate (*Punica granatum* L.) Rootstocks with cv. Phule Bhagwa Super

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Abstract: Graft compatibility of pomegranate (*Punica granatum* L.) rootstocks with cv. Phule Bhagwa Super by using wedge grafting was undertaken with a view to assess the graft compatibility of various rootstocks with cv. Phule Bhagwa Super by using wedge grafting.

The results revealed that the rootstocks Bedana Suri and Alandi took the minimum time for bud sprout (17.77 days). The highest bud sprout (80.00%) at 30 days after grafting (DAG) was recorded in Bedana Suri.

The maximum per cent survival (76.67%) of grafts at 90 DAG was recorded in Bedana Suri. The highest shoot growth rate was registered on Bedana Suri rootstock. Rootstock Bedana Suri gave the longest shoot length (90.00 cm), highest number of shoots and number of internodes. Shoot length and internodal length also showed significant increase with respect of time. The maximum girth at graft union (13.05 mm) was recorded in Bedana Suri. The highest stock/scion girth ratio (1.00) was recorded in the rootstocks, Ganesh, Bedana Suri and Kandhari with wedge grafting.

Bedana Suri rootstock produced longer shoot and root and also highest fresh shoot (66.40 g) and root weight (39.40 g). The highest shoot/root weight ratio (1.77) was recorded in Kandhari.

Key words: Compatibility, *Punica granatum* L., rootstocks, wedge grafting, scion.

INTRODUCTION

Pomegranate (*Punica granatum* L.) is one of the important fruit crops grown on commercial scale in Deccan Plateau of India and is gaining a lot of popularity worldwide in recent years owing to its high economic, nutraceutical and therapeutic values (Marathe *et al.* 2010). It is mainly propagated by air layering in Maharashtra, Karnataka and Andhra

Pradesh. Unlike other perennial fruit crops, multistem training system is very common in pomegranate (Chandra *et al.* 2008). Recently, wilt has emerged as an important threat in major pomegranate growing belts of India and to combat this problem neither any standard grafting/budding technique nor suitable rootstock is available.

Rootstocks have been used in fruit crops to protect against soil born diseases and pests since long time. The important characteristics in the selection of rootstocks are that they should be easily propagated, good graft compatibility with scion varieties and adoption to a range of soil conditions (Reisch *et al.,* 2012).

Development of tap and secondary root is possible through seedling propagation. This may help in minimising the root exposure in root rhizosphere and their by limiting infection of pathogen.

There is inadequate information in case of different rootstocks application in pomegranate.

Thus, with view to study the graft compatibility by using different rootstocks with wedge grafting the present investigations entitled "Graft compatibility of pomegranate (*Punica granatum* L.) rootstocks with *cv.* Phule Bhagwa Super" was conducted.

MATERIALS AND METHODS

The experiment was carried out during September 2014 to March 2015 under 50% green coloured shade net house at "Instructional-cum-Demonstration Farm," Department of Horticulture, MPKV., Rahuri, Maharashtra. The experiment was conducted in randomized block design. Wedge grafting and eleven rootstocks viz., Ganesh (T_1), Bedana Suri (T_2), Alandi (T_3), Kandhari (T_4), Jallore Seedless (T_5), Jodhpur Red (T_6), Patna-5 (T_7), Muscat (T_8), Yercaud (T_9), Bedana Sedana (T_{10}) and Daru (T_{11}) were used. Thus, total 11 treatments were replicated in 3 times. There were 20 grafts in each treatment and replication. About 15 cm long leafless scions of 6-9 months of Phule Bhagwa Super were used for grafting. Almost one year old seedlings of different rootstocks raised in black polythene bags (30 × 18″) filled with soil, sand, vermicompost and FYM mixture in 1:1:1:1 ratio. A long and smooth vertical slit of about 4 to 5 cm downward was given with sharp budding knife. Wedge shaped scion was inserted into vertical slit on rootstock without damaging the cambium layer and was tied with polythene strip.

Polythene cap of 100 gauge thickness in 3 cm × 15 cm size were used in to cover the grafts-scions. The number of days required for sprouting of grafts from the date of grafting were recorded treatment wise for each plant and average values were reported. The grafts in which the graft in which the growth of scion stick observed were considered as successful grafts. The sprouting of grafted scion was considered as initial success and percentage of sprouting was computed after 30 days after grafting. Survival of prepared grafts was also recorded at 60 and 90 days after grafting operation as a final survival percentage was computed. The number of sprouted shoots was counted treatment wise in each replication for each plant and the average number of shoots per plant was recorded after 180 days of grafting operation. The average number of internodes, length of shoot and length of internodes per shoot counted treatment and replication wise from each plant separately after 180 days of grafting operation. Statistical analysis of the data was done by standards described by Panse and Sukhatme (1987).

RESULTS AND DISCUSSION

Days Required for Sprouting

The data regarding mean numbers of days required for sprouting of grafts significantly, influenced by rootstocks and it is given in (Table 1). The minimum (15.53) days required for sprouting of grafts were recorded in T_2 and T_3 followed by (15.70) days in T_1 and T_5. Minimum number of days required for sprouting associated with more availability of food material in the scion. The bud sprouting was

Table 1
Effect of wedge grtafting and different rootstocks on sprouting and survival of grafts

			Survival of grafts percent (%)	
Treatments	*Days required for sprouting*	*Percentage of sprouting up to 30 DAG*	60 days	90 days
T_1	15.70	76.67	76.67	76.67
T_2	15.53	80.00	80.00	76.67
T_3	15.53	73.33	70.00	70.00
T_4	15.80	73.33	70.00	70.00
T_5	15.70	76.67	73.33	73.33
T_6	15.90	73.33	70.00	70.00
T_7	19.60	70.00	66.67	66.67
T_8	19.30	73.33	70.00	70.00
T_9	19.30	70.00	66.67	63.33
T_{10}	19.20	70.00	66.67	63.33
T_{11}	19.00	66.67	63.33	60.00
SEm (±)	0.75	2.12	1.12	2.75
CD at 5%	2.20	6.17	3.29	8.10

observed from 15.53 days in the scion grafted on Bedana Suri and Alandi rootstocks to 19.60 days in the Patna-5 rootstock combination. The variation in days required for sprouting might be due to the availability of storage material in the scion that has helped to supply for early bud sprout. These results confirm the obtained by Errea (1998), who reported insufficient growth of callus, defects in phloem differentiation, lignifications, or metabolic interaction.

Percentage of sprouting up to 30 days after grafting and survival of grafts 60 and 90 days after grafting

The data regarding percentage of sprouting up to 30 days after grafting significantly influenced by rootstocks that ranged from 66.67% to 80.00% and it is given in (Table 1). The maximum (80.00%) sprouting recorded in T_2 and T_3 slightly lower (76.67%) in T_1 and T_5. The maximum survival percentage were (80.00%) and (76.67%) recorded in T_1 on 60th and 90th days after grafting respectively. The variation in grafting success suggests the changes in amount and time taken for callus formation and also the use of rootstock. These results confirm the obtained by Errea (1998), who reported insufficient growth of callus, defects in phloem differentiation, lignifications, or metabolic interaction. Lu and Ren (2008) and Stino *et al.* (2009) emphasized variation in percentage success and survival of pomegranate grafting due to use of rootstocks. A higher percentage of survival might be active growing meristematic stage exhibited by both the rootstock and scion, which facilitates callus formation and thereby enhances grafting success (Stino *et al.,* 2011).

Average number of sprouted shoots 180 days after grafting

It is observed from (Table 2) that the effects of wedge grafting and different rootstocks on average number of sprouted shoot 180 days after grafting recorded statistically significant, the maximum numbers (4.53) of shoots were recorded in T_3.

Average length of sprouted shoots 180 days after grafting

It is observed from (Table 3) that the effects of wedge grafting and different rootstocks on average length of sprouted shoot 180 days after grafting recorded statistically significant, the maximum length of shoots (90.00 cm) was recorded in T_1.

Average number of internodes per plant 180 days after grafting

It is observed from (Table 3) that that the effects of wedge grafting and different rootstocks on average number of internodes per plant 180 days after grafting recorded statistically significant, the maximum number of internodes (24.62) per plant were recorded in T_2. Shoot length, number of shoots,

Table 2
Effect of wedge grafting and different rootstocks on growth parameters of grafts.

Treatments	*Average number of sprouted shoots 180 DAG*	*Average length of sprouted shoots (cm) 180 DAG*	*Average number of internodes per plant 180 DAG*	*Girth at graft/bud union (mm) 180 DAG*	*Stock/scion girth ratio 180 DAG*
T_1	4.53	88.50	24.50	12.24	1.00
T_2	4.07	90.00	24.62	13.05	1.00
T_3	4.60	82.65	23.50	12.25	0.99
T_4	3.73	84.60	23.85	12.36	1.00
T_5	3.60	79.00	22.73	12.39	0.99
T_6	3.73	75.00	22.26	12.04	0.99
T_7	3.73	70.50	20.25	11.88	0.99
T_8	4.07	74.50	21.00	11.63	0.99
T_9	4.20	74.50	21.00	11.58	0.98
T_{10}	3.93	74.00	20.85	11.78	0.99
T_{11}	3.40	72.00	20.50	11.64	0.98
SEm (±)	0.31	3.45	0.39	0.37	0.003
CD at 5%	0.91	10.19	1.16	1.10	0.009

Table 3
Effect of wedge grafting and different rootstocks on fresh root, shoot weight (g) and shoot/root weight ratio

Treatments	*Average fresh root weight (g) 180 DAG*	*Average fresh shoot weight (g) 180 DAG*	*Shoot/root fresh Gweight ratio 180 DAG*
T_1	37.67	63.87	1.70
T_2	39.40	66.40	1.69
T_3	36.77	61.00	1.66
T_4	35.27	62.53	1.77
T_5	36.60	60.53	1.65
T_6	37.13	63.60	1.71
T_7	33.70	52.00	1.54
T_8	35.40	55.33	1.56
T_9	34.45	55.00	1.60
T_{10}	33.67	54.50	1.62
T_{11}	33.67	52.00	1.54
SEm (±)	1.12	1.08	0.06
CD at 5%	3.31	3.19	0.19

number of internodes, length of internodes, number of leafs per shoot and leaf areas are the indications of vigor of the plant. Shoot length of the scion after grafting varied significantly among the rootstocks under study. The rootstock Bedana Suri imparted more vigor to the scion which is at par with the Ganesh, Kandhari and Alandi, while the lowest shoot length was recorded with Daru stionic combination. The increase vigor might be due to early callusing at the graft joint that has restored early supply of food material as suggested by Coombe (1999). A positive correlation between shoot length, internode length and leaf numbers indicated that vigorous rootstock greatly influences the shoot growth of scion (Hartman *et al.*, 2002).

Girth at graft/bud union (mm) 180 days after grafting

The interaction effects of propagation method and different rootstocks recorded statistically significant. The highest girths at graft/bud union (13.05 mm) were recorded in T_2 (Table 2).

Stock/scion ratio 180 days after grafting

Stock to scion ratio plays an important role in maintaining the uniformity of trunk thickness. This also indicates the easy flow of food material in the plant system thus predicting the longevity of the plant. The stock to scion ratio may have direct significance in the stock: scion compatibility. The stock to scion ratio nearing 1.0 will have uniform girth of both stock and scion. Higher stock to scion ratio was observed in rootstocks Bedana Suri, Ganesh and Kandhari followed by rest of the rootstocks.

Average fresh root weight (g) 180 days after grafting

It is observed from (Table 3) that that the effects of wedge grafting and different rootstocks on average fresh root weight 180 days after grafting recorded statistically significant, the maximum fresh root weight (39.40 g) was recorded in T_2. The maximum fresh root weight was recorded in Bedana Suri. This might be due to varietal characteristics of the rootstocks.

Average fresh shoot weight (g) 180 days after grafting

It is observed from (Table 3) that that the effects of wedge grafting and different rootstocks on average fresh shoot weight 180 days after grafting recorded statistically significant, the maximum fresh shoot weight (66.40 g) was recorded in T_2. The higher fresh shoot weight in the above mentioned graft combination could be pertained to sooner bud take possibly resulting in better connection between stock and scion and consequently better water and nutrient uptake. These results are similar to those reported by Kayane *et al.* (1981), Polat and Kaska (1992) and Hamdi *et al.* (2007) on other fruit crops.

Shoot/root weight ratio 180 days after grafting

It is observed from (Table 3) that that the effects of wedge grafting and different rootstocks on shoot/root weight ratio 180 days after grafting recorded statistically significant, the maximum shoot/root weight ratio (1.77) was recorded in T_4.

Number of secondary roots per graft 180 days after grafting

It is observed from (Table 4) that that the effects of wedge grafting and different rootstocks on number of secondary roots per graft 180 days after grafting recorded statistically significant, the maximum number of secondary roots per graft (16.50) was recorded in T_2.

Length of primary roots (cm) 180 days after grafting

It is observed from (Table 4) that that the effects of wedge grafting and different rootstocks on length of primary root 180 days after grafting recorded statistically significant, the maximum length of primary root (36.40) was recorded in T_2

Table 4
Effect of wedge grafting and different rootstocks on number of roots and length of primary root (cm)

Treatments	*Number of secondary roots*	*Length of primary root (cm)*
T_1	16.00	37.67
T_2	16.50	39.40
T_3	16.27	36.77
T_4	15.50	35.27
T_5	15.65	36.60
T_6	15.00	37.13
T_7	14.20	33.67
T_8	14.35	35.40
T_9	14.30	33.53
T_{10}	14.25	33.67
T_{11}	14.80	31.13
SEm (±)	1.57	0.42
CD at 5%	4.62	1.23

Thus, it can be concluded from the afore mentioned investigation that the better graft compatibility of cv. Phule Bhagwa Super was found with the rootstocks, Bedana Suri, Ganesh, Kandhari, Jallore Seedless and Alandi with higher percentage of success and better stionic growth of pomegranate grafts.

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