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Effect of different Arbuscular Mycorrhizal fungi on vegetative parameters of jamun rootstock and graft success

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ABSTRACT : Cultivated jamun rootstocks inoculated with *Glomus fasciculatum* recorded significantly highest rootstock height at 90 DAS (33.31 cm), while uninoculated rootstocks recorded significantly minimum height at 90 days after sowing (26.61 cm). Wild jamun rootstocks inoculated with *Glomus fasciculatum* recorded significantly highest rootstock height at 90 days after sowing (30.91 cm). The uninoculated wild rootstocks recorded significantly lowest height at 90 days after sowing (23.92 cm). However, higher diameter of rootstock was observed in mycorrhiza inoculated plants compared to uninoculated seedlings. Wild jamun rootstocks inoculated with *Glomus fasciculatum* recorded significantly highest diameter of rootstock at 90 days after sowing (4.81 mm). The uninoculated rootstocks recorded significantly minimum diameter of rootstock at 90 days after sowing (3.94 mm). The number of leaves on rootstocks indicated that cultivated jamun rootstocks inoculated with *Glomus fasciculatum* recorded significantly maximum leaves at 90 days after sowing (19.07), while rootstock inoculated with *Glomus intraradices* at 30 (5.87), uninoculated rootstock at 60 (8.33) and 90 days after sowing (12.27) recorded significantly minimum leaves. Wild jamun rootstock inoculated with *Glomus fasciculatum* recorded significantly more number of leaves at 90 days after sowing (23.07), while significantly least number of leaves were recorded in uninoculated rootstock at 90 days after sowing (19.87 The grafting success indicated that, cultivated grafts on rootstocks inoculated with *Glomus fasciculatum* registered significantly highest grafting success (63.33%), while uninoculated grafts registered significantly least grafting success 30.00 per cent. Wild jamun rootstocks inoculated with *Glomus fasciculatum* registered significantly highest grafting success (60.00%), while uninoculated grafts registered significantly least grafting success of 10.00 per cent. The graft survival revealed that there was no significant result among the cultivated jamun grafts for graft survival. However, higher graft survival was observed in mycorrhiza inoculated grafts compared to uninoculated grafts. Wild jamun grafts inoculated with *Glomus fasciculatum* registered significantly highest graft survival (94.44%), while uninoculated grafts registered significantly least graft survival (65.50%).

KEY WORDS : Cultivated jamun rootstock, Wild jamun rootstock, Arbuscular Mycorrhizal fungi, Grafting success, Grafting survival

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The jamun (*Syzygium cuminii* Skeels), a member of family Myrtaceae is one of the important underutilized fruit crops. It is highly valued in India for a number of medicinal properties in its fruit, seeds and leaves. The vinegar prepared out of juice extracted from slightly unripe fruits is stomachic, carminative and diuretic, apart from having cooling and digestive properties (Thaper, 1958). The global demand for organic food/fruits is steadily increasing at an average growth rate of 20 per cent (Singh *et al.*, 2005). This shift in the scenario necessitates raising the seedlings/rootstocks organically from the nursery itself to ensure better growth particularly more stem girth development which is of paramount importance for early grafting and higher graft-take. Early grafting would be able to meet ever increasing demand for elite planting materials. Jamun trees being exist in wild form in nature without much care growing by organic is very

appropriate and use of mycorrhiza in the nursery may be highly beneficial. It is also necessary to enhance the growth of the rootstock with suitable bioagents for better success of grafts. This refers that an attempt should be made by using different mycorrhizae to enhance the growth of the rootstock and graft success. Therefore, a study was conducted using different mycorrhizae to enhance the growth of rootstock and graft success.

RESEARCH METHODS

An experiment was conducted in the Department of Fruit Science, K.R.C. College of Horticulture, Arabhavi in Gokak taluk of Belgaum district, Karnataka during 2009 and 2010. The experiment was conducted in a factorial completely randomized block design with three replications. In the present investigation the non-descriptive uniform size jamun seeds were obtained from a single tree in the farmers' field of Kaitnal area. Seeds were extracted and then cleaned to get the seeds free from adhering pulp and then sown in the polybags of 8 x 12 cm size of 300 gauge thickness containing potting mixture of soil, sand and FYM in the ratio of 1:1:1. AM fungi inoculation was done by spreading five grams of inoculum uniformly at five centimetre depth after putting a thin layer of soil on the inoculum. Jamun seeds were placed and covered with soil (2-3 cm). The polybags of respective treatments were labelled and kept apart enough from each other to avoid AM fungal cross contamination. The polybags were watered daily and weeding and other cultural operations were done as and when required. Uniform, healthy, disease and pest free AM fungal inoculated vigorous grown rootstocks were selected and used for softwood grafting. Scions were collected from a selected genotype located at Bategeri area of Gokak taluk. The vigorously grown rootstocks of four months old were selected and top growth was decapitated with sharp knife. Care was taken while selecting the scion material to match the girth of the stock. The softwood of stock was split vertically in the form of cleft to a length of two centimetres downward with a sharp knife. The cleft looked like a fork or letter 'V'. The scion was prepared by giving a cut into gently sloping wedge of about two centimetres to the morphological base of the scion by removing the bark and little wood from opposite sides of scion. Care was taken to retain some bark on the remaining two sides of the scion. The wedge shaped scion thus prepared was inserted into the 'V' shaped split of the stock. After insertion of wedge shaped scion into the cleft of stock plant, precautions were taken to see that scion and the stock come in close contact with each other. The joint was then tied firmly with 1.5 cm wide and 15 cm long polythene strip of 200 gauges. The grafts were covered with polytube, covering the joint completely. Then the grafts were kept in the shade net (75 %). Rootstock height was recorded at monthly intervals and was measured from a marked point just above the collar region up to the tip and was expressed in centimetres. Stem diameter of the rootstock were recorded at monthly intervals on marked point with the help of digital vernier calipers and was expressed in millimetres. Leaves on the rootstock were counted and recorded at monthly intervals.

Grafting success was recorded one month after grafting by following formula and expressed in percentage.

$$\text{Graft success} = \frac{\text{Number of successful graft}}{\text{Total number of grafts}} \times 100$$

Survival of the grafts was calculated by the following formula and was expressed in percentage. This observation was recorded three months after grafting operation.

$$\text{Survival percentage} = \frac{\text{Number of graft remained alive}}{\text{Number of successful grafts}} \times 100$$

RESEARCH FINDINGS AND DISCUSSION

The data pertaining to height of rootstocks, diameter of rootstocks and number of leaves were recorded and presented in Table 1. Cultivated jamun rootstocks inoculated with *Glomus fasciculatum* recorded significantly highest rootstock height at 30 (14.34 cm), 60 (22.61 cm) and 90 DAS (33.31 cm), while uninoculated rootstocks recorded significantly minimum height at 30 (10.32 cm), 60 (17.87 cm) and 90 DAS (26.61 cm).

Wild jamun rootstocks inoculated with *Glomus fasciculatum* recorded significantly highest rootstock height at 30 (12.81 cm), 60 (21.11 cm) and 90 DAS (30.91 cm), where the rootstocks height at 30 DAS was at par with rootstocks inoculated with *Glomus intraradices*. The uninoculated rootstocks recorded significantly lowest height at 30 (8.52 cm), 60 (16.75 cm) and 90 DAS (23.92 cm).

Interaction effect between cultivated and wild jamun rootstocks for height of rootstock at 30, 60, and 90 DAS was found to be non-significant (Table 1).

The data on diameter of rootstock revealed that there was no significant result among different types of jamun seedlings at 60 and 90 DAS. However, higher diameter of rootstock was observed in mycorrhiza inoculated plants compared to uninoculated seedlings.

Wild jamun rootstocks inoculated with *Glomus fasciculatum* recorded significantly highest diameter of rootstock at 30 (1.92 mm), 60 (3.28 mm) and 90 DAS (4.81 mm). The diameter of rootstocks inoculated with *Glomus fasciculatum* at 30 DAS was at par with rootstocks inoculated with *Glomus leptotichum* at 30 (1.76 mm) and *Glomus intraradices* at 30 DAS (1.64 mm). Further, the diameter of rootstocks inoculated with *Glomus fasciculatum* at 60 DAS (3.28 mm) was at par with rootstocks inoculated with *Glomus leptotichum* at 60 (3.20 mm) and *Glomus intraradices* at 60 DAS (2.93 mm). The uninoculated rootstocks recorded significantly minimum diameter of rootstock at 30 (1.27 mm), 60 (2.60 mm) and 90 DAS (3.94 mm) which was at par with

Table 1 : Effect of different AM fungi on height, diameter and number of leaves of jamun rootstocks

Treatments	Rootstock height (cm)			Rootstock diameter (mm)			Number of leaves		
	30 (DAS)	60 (DAS)	90 (DAS)	30 (DAS)	60 (DAS)	90 (DAS)	30 (DAS)	60 (DAS)	90 (DAS)
T_1	10.32	17.87	26.61	1.34	2.77	3.59	6.07	8.33	12.27
T_2	14.34	22.61	33.31	2.26	3.81	4.97	8.00	12.04	19.07
T_3	13.18	21.67	31.46	2.01	3.21	4.61	7.20	9.93	17.07
T_4	11.74	20.27	28.51	1.88	2.96	4.34	5.87	9.15	15.27
T_5	8.52	16.75	23.92	1.27	2.60	3.94	9.87	13.80	19.87
T_6	12.81	21.11	30.91	1.92	3.28	4.81	11.00	17.74	23.07
T_7	11.28	19.63	28.71	1.76	3.20	4.34	10.10	16.20	20.93
T_8	9.91	17.87	26.36	1.64	2.93	3.98	9.93	15.33	21.07
S.E± A	0.344	0.188	0.156	0.069	0.106	0.078	0.07	0.06	0.07
B	0.487	0.265	0.220	0.097	0.149	0.110	0.10	0.09	0.10
AB	0.689	0.375	0.312	0.138	0.211	0.155	0.14	0.13	0.15
C.D. (P=0.05) A	1.00	0.56	0.44	0.21	NS	NS	0.21	0.19	0.20
B	1.43	0.78	0.64	0.30	0.43	0.32	0.30	0.26	0.30
AB	NS	NS	NS	NS	NS	NS	0.42	0.39	0.45

A - Cultivated type B - Wild type AB - Interaction effect
DAS - Days after sowing NS -Non-significant
Treatment details:
T_1 - Cultivated control T_2 - Cultivated + *Glomus fasciculatum*
T_3 - Cultivated + *Glomus leptotichum* T_4 - Cultivated + *Glomus intraradices*
T_5 - Wild control T_6 - Wild + *Glomus fasciculatum*
T_7 - Wild + *Glomus leptotichum* T_8 - Wild + *Glomus intraradices*

rootstocks inoculated with *Glomus intraradices* (3.98 mm).

Interaction effect between cultivated and wild jamun rootstocks for diameter of rootstock at 30, 60, and 90 DAS was found to be non-significant (Table 1).

The data on number of leaves on rootstocks indicates that cultivated jamun rootstocks inoculated with *Glomus fasciculatum* recorded significantly maximum leaves at 30 (8.00), 60 (12.04) and 90 DAS (19.07), while rootstock inoculated with *Glomus intraradices* at 30 (5.87), uninoculated rootstock at 60 (8.33) and 90 DAS (12.27) recorded significantly minimum leaves.

Wild jamun rootstock inoculated with *Glomus fasciculatum* recorded significantly more number of leaves at 30 (11.00), 60 (17.74) and 90 DAS (23.07), while significantly least number of leaves were recorded in uninoculated rootstock at 30 (9.87), 60 (13.80) and 90 DAS (19.87), where the number of leaves in uninoculated rootstock at 30 (9.87) was at par with rootstock inoculated with *Glomus leptotichum* at 30 DAS (10.10) and *Glomus intraradices* (9.93).

Interaction effect between cultivated and wild jamun rootstocks for number of leaves on rootstock at 30, 60, and 90 DAS was found to be significant. Significantly highest number of leaves were recorded in wild jamun rootstock inoculated with *Glomus fasciculatum* at 30 (11.00), 60 (17.74) and 90 DAS (23.07). Cultivated jamun rootstock inoculated with *Glomus fasciculatum* recorded comparatively more number of leaves at 30 (8.00), 60 (12.04) and 90 DAS (19.07). The cultivated jamun rootstocks inoculated with *Glomus intraradices* recorded significantly least number of leaves at 30 (5.87), uninoculated rootstock at 60 (8.33) and 90 DAS (12.27). Similar results were recorded in jamun Devachandra *et al.* (2008) and mango (Bassangowda, 2005).

The data on grafting success indicated that, cultivated grafts on rootstocks inoculated with *Glomus fasciculatum* registered significantly highest grafting success (63.33%), while uninoculated grafts registered significantly least grafting success 30.00 per cent (Table 2).

Wild jamun rootstocks inoculated with *Glomus fasciculatum* registered significantly highest grafting success (60.00%), while uninoculated grafts registered significantly least grafting success of 10.00 per cent (Table 2).

Interaction effect between cultivated and wild jamun grafts for grafting success was found to be significant. Cultivated jamun grafts inoculated with *Glomus fasciculatum* registered significantly highest grafting success (63.33%) which was at par with wild jamun grafts inoculated with *Glomus fasciculatum* (60.00%). The uninoculated wild control (10.00%) registered significantly lowest grafting success.

The data on graft survival revealed that there was no significant result among the cultivated jamun grafts for graft survival. However, higher graft survival was observed in mycorrhiza inoculated grafts compared to uninoculated grafts (Table 2).

Wild jamun grafts inoculated with *Glomus fasciculatum* registered significantly highest graft survival (94.44%), while uninoculated grafts registered significantly least graft survival

Table 2 : Effect of AM fungi on success and graft survival of jamun grafts

Treatments		Per cent graft success	Per cent graft survival
T_1 (Cultivated control)		30.00	66.66
T_2 (Cultivated+*Glomus fasciculatum*)		63.33	94.74
T_3 (Cultivated+*Glomus leptotichum*)		56.66	88.23
T_4 (Cultivated+*Glomus intraradices*)		53.33	75.00
T_5 (Wild control)		10.00	65.50
T_6 (Wild+*Glomus fasciculatum*)		60.00	94.44
T_7 (Wild+*Glomus leptotichum*)		33.33	80.00
T_8 (Wild+*Glomus intraradices*)		32.10	77.77
S.E.±	A	0.60	0.48
	B	0.85	0.67
	AB	1.21	0.95
C.D. (p=0.05)	A	1.80	NS
	B	2.53	2.01
	AB	3.62	2.86

NS=Non-significant A - Cultivated type B- Wild type AB - Interaction effect

(65.50%) as shown in Table 2.

Interaction effect between cultivated and wild jamun grafts for graft survival was found to be significant. Cultivated jamun grafts inoculated with *Glomus fasciculatum* registered significantly highest graft survival (94.74%) which was at par with wild jamun grafts inoculated with *Glomus fasciculatum* (94.44%). The uninoculated wild control (65.50%) registered significantly lowest graft survival which was at par with uninoculated cultivated grafts (66.66%).

The higher graft-take observed in the present investigation may be attributed to the better growth and healthiness of rootstock (Table 2). The cultivated and wild jamun rootstocks inoculated with *Glomus fasciculatum* had significantly more number of leaves, stem diameter and rootstock height before grafting (Table 1). Further the photosynthetic capacity of plant depends upon leaves. Increase in nutrient concentration including phosphorus as a result of AM fungal inoculation had been reported for horticultural crops *viz.* citrus (Kleinschidt and Gerdmann, 1972; Usha *et al.*, 2004 and Venkat, 2004), mango (Santosh, 2004 and Bassangowda, 2005), papaya (Adivappar *et al.*, 2004 and Duragannavar, 2005) and in banana (Balakrishna, 2003 and Ustad *et al.*, 2005). Photosynthetic rates might be an indirect effect of 'P' on ATP or a direct action on RuBP carboxylase activity (Johnson, 1984).

With the foregoing discussion, it can be concluded that *Glomus fasciculatum*, *Glomus leptotichum* and *Glomus intraradices* enhanced the growth and development of jamun seedlings/rootstocks and finally increased the success and survival percentage of grafts.

Conclusion:

From the above experiment it can be concluded that wild jamun rootstocks inoculated with *Glomus fasciculatum* registered significantly highest grafting success (60.00%), while uninoculated grafts registered significantly least grafting success of 10.00 per cent. The graft survival revealed that there was no significant result among the cultivated jamun grafts for graft survival.

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