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GRAFT COMPATIBILITY BETWEEN BOTTLE GOURD GRAFTED ON ROOTSTOCKS OF BOTTLE GOURD AND PUMPKIN

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ABSTRACT

A study was conducted at All India Co-ordinated Research Project on Vegetable crops, Department of Horticulture, Mahatma Phule Krushi Vidyapeeth, Rahuri during the *Kharif* season 2024. This work aimed to study the graft compatibility between two hybrids of bottle gourd (Warad and Vinayak) and five rootstocks, in which three rootstocks are of bottle gourd (Arka Shreyas, Pusa Samridhi and Samrat) and two of pumpkin (Arka Chandan and Arka Suryamukhi). Graft compatibility was determined by evaluating the number of days taken to reach grafting stage, girth of scion and rootstock at time of grafting, days taken for graft healing, percent of grafting success and days required for transplanting. There was a significant difference in graft success among different graft combination. Among the rootstock pumpkin rootstock Arka Chandan recorded significantly less number of days to reach grafting stage (9.80). The minimum number of days to graft healing (6.22) and days required to transplanting (20.67) was recorded in Samrat grafted with Warad. Graft Success was recorded highest (83.12%) in rootstock Arka Shreyas when grafted on Vinayak.
Keywords **:** Compatibility, Bottle gourd, Cucurbitaceous, Rootstock, Scion.

Introduction

Bottle gourd (*Lagenaria siceraria* L.) is a member of the cucurbitaceous family and is commonly grown as a vegetable crop in tropical nations including Thailand, Japan, and India. The humid forests of Dehradun (North India) and the coastal regions of Malabar (North Kerala) have been identified as the center of origin of bottle gourd (Upaganlawar and Balaraman, 2009). Bottle gourd is white flowered, monoecious, annual climbing species with a chromosome number of 2n=2x=22. The common names of bottle gourd are Calabash, white flowered gourd, Doodhi (Marathi) and Lauki (Hindi). It is widely cultivated worldwide for its tender fruits, which vary in shape and size from globular, bottle shape to cylindrical (Gurcan *et al.,* 2015; Pandey *et al*., 2022; Srivastava *et al*., 2022). The leaves, seeds and tendrils of bottle gourd are utilized for many different purposes, mostly as a medicine.

Grafting is a promising tool which improves disease resistance, abiotic stress tolerance, yield and reduces reliance on chemical inputs. Grafting is the as union of two different plant parts such as rootstock and scion to form a single new plant. Grafting has become extremely important in the horticulture, at the same time the demand for grafted plants has increased due to their high yielding nature and enhanced tolerance to biotic and abiotic challenges (Rouphael *et al*., 2017). Compatibility is higher in intraspecific rootstock/ scion grafting than with interspecific grafting (Black *et al*., 2003). Thus, owing to the beneficial effects incurred by grafting on different rootstocks, the present experiment was planned to check the graft compatibility of bottle gourd with different rootstocks.

Materials and Method

Site of the experiment

The proposed experiment was conducted and carried out in Factorial Randomized Block Design (FRBD) at the farm of All India Co-ordinated Research Project on Vegetable crops, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth,

Rahuri. The experiment was conducted in the *Kharif* of 2024.

Experimental materials

The experimental materials consisted Bottle gourd (*Lagenaria siceraria*) and Pumpkin (*Cucurbita moschata*), which were used as rootstocks and two scions which are private sector hybrids viz., Warad from Mahyco seed company and Vinayak from Syngenta company. Bottle gourd (scion) varieties *i.e.* Warad and Vinayak seeds were sown 15 days earlier than the rootstocks seeds i.e. Pumpkin (var- Arka Chandan and Arka Suryamukhi) and Bottle gourd (var- Arka Shreyas, Pusa Samridhi and Samrat) in 70 cells protrays containing sterilized coco-peat. The rootstock seedlings took 7-10 days to attain the grafting stage. To synchronize diameter of scion and rootstock at grafting, the prior sowing of the scion was practised.

Procedure of single cotyledonary grafting in bottle gourd

The single cotyledon method of grafting was used for study. This method of grafting is widely used in cucurbits for grafting. The grafting was performed when rootstock reached cotyledonary leaf stage and scion reached true leaf stage. The rootstock was then given a cut at 60^0 angles with razor blade removing one cotyledon leaf and retaining the other leaf. Seedling of scion was given a slant cut (60^0 angles) below the cotyledons (this cut should match the cut made on the rootstock). Then the two cut surfaces were hold together with the help of grafting clip and grafted seedlings were supported using a small stick. After grafting the seedlings were placed in healing chamber for healing for 5-7 days. Relative humidity of 85-95 per cent and temperature of 28-32°C was maintained to allow the graft union to heal, then later the light was gradually increased. The grafted seedlings were hardened for 4-5 days before transplanting. The observations were recorded as given below.

(A) Rootstock and scion parameter

Days taken for germination

The observation was recorded at everyday by visual observation and date on which seedling emerged was noted, average days taken for germination were calculated.

Days taken to reach grafting stage

Seedlings were selected randomly and observation was recorded based on seedling diameter, number of leaves and days required to reach correct stage of grafting i.e., the seedling diameter of 2.39 to 2.45 mm for scion and 2.47 to 2.70 mm for rootstock.

Diameter of scion and rootstock at time of grafting

The stem diameter of scions and rootstock were measured by using of digital Vernier Caliper Scale at the time of grafting.

(B) Observation of grafted plant

Days taken for graft healing

Grafted plants were selected randomly and observation was recorded after 5 days of grafting by removing the grafting clips and average days it took to heal the graft union were noted.

Graft success (%)

Grafting success was recorded on 15 days after grafting (DAG). Grafting success was calculated for each graft combination. The percentage of success was recorded by the formula number of successful grafts.

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

Days required for transplanting

The observation was recorded by counting days required for transplanting from grafting and mean days required for transplanting was worked out.

Results and discussion

(A) Rootstock and scion parameters

Days to germination, days to reach grafting stage and diameter of scion and rootstock

The mean data about days to germination, days to reach the grafting stage, and diameter of scion and rootstock in bottle gourd are depicted in Table 1. The scion and rootstock showed significant differences for days to germination, days to reach the grafting stage and for the diameter of the scion and rootstock.

In scion, Vinayak (S_1) taken a minimum number of days to germination (4.64). Whereas, Warad (S_2) took the maximum number of days to germinate (4.96). In rootstock, Arka Chandan (R_4) showed a minimum number of days to germination (5.62). Whereas, a maximum (6.63) number of days was observed in Arka Shreyas (R_1). The germination of seeds is affected by temperature to greater extent. Cucurbits are warm season crops and requires 20-25°C temperature for germination, low temperature completely inhibit the seed germination of cucurbits. Similar results are obtained by Ibrahim *et al*. (2014), Dhivya (2013) and Balaji *et al*. (2021).

In scion, Vinayak (S_2) showed minimum days (19.80) to reach the grafting stage. Whereas, Warad (S_2) took a maximum number (20.33) days to reach the grafting stage. In rootstock, Arka Chandan (R_4)

showed minimum days (9.80) to reach the grafting stage. Whereas, the maximum number of days to reach the grafting stage (11.60) was observed in Arka Shreyas (R_1). In scion, Vinayak (S_2) showed a maximum diameter (2.33 mm). While, Warad (S_1) showed a minimum diameter in (2.21 mm). In rootstock, Pusa Samridhi (R_2) showed maximum diameter (2.52 mm). Whereas, Arka Shreyas (R_1) showed a minimum diameter (2.31 mm). The diameter of scion and rootstock is an important factor which determines the success of grafting which further decides growth and sustenance of grafts in the field.

(B) Observations of grafted plants

The observations of grafted plants were recorded after grafting and before the transplanting.

Days taken for graft healing

The mean data about the effect of bottle gourd scion varieties grafted on different rootstocks on days taken to graft healing is presented in Table 2.

The rootstock and scion varieties showed significant differences in days taken for graft healing. In scion, Warad (S_1) recorded the minimum number of days (8.25) for graft healing. Whereas, Vinayak (S_2) took a maximum number of days (8.86) for graft healing. In rootstock Samrat (R_3) taken a minimum of days (6.77) for graft healing. While the rootstock Arka Suryamukhi (R_5) took the maximum number of days (11.00) for graft healing.

The interaction effect of rootstock and scion showed a significant difference in days taken for graft healing. In interaction S_1R_3 recorded minimum days (6.22) for graft healing and which was followed by S_2R_3 (7.33) and S_1R_2 (7.00). While, maximum number of days (11.33) were recorded with the interaction S_2R_5.

The duration needed for graft healing varies based on the developmental stage of the rootstock and scion, as well as the prevailing atmospheric conditions. According to findings the formation of graft union beings with a number of events such as multiplication and proliferation of the callus from the scion and rootstock, formation of a callus bridge, vascular separation and production of the xylem and phloem (Hartman *et al*., 2011).

Graft success (%)

The mean data about the effect of bottle gourd scion varieties grafted on different rootstocks on days taken to graft success (%) is presented in Table 3.

The rootstock and scion varieties showed significant differences in graft success (%). In scion Vinayak (S_2) recorded highest (73.59 %) graft success. While, the lowest graft success (72.85 %) was recorded in Warad (S_1). In rootstock Arka Shreyas (R_1) recorded highest (81.83%) graft success. While, lowest were recorded in (R_5) Arka Suryamukhi (63.63%). The interaction effect of scion and rootstock showed a significant difference for graft success. In interaction S_2R_1 recorded highest (83.12 %) graft success and which was followed by S_2R_2 (81.61 %), S_1R_1 (80.54 %) and S_1R_2 (80.14 %) . While, lowest graft success (62.76 %) was recorded in interaction S_2R_5.

The survival rate of grafted plants depends on the union of the grafts (rootstock and scion), diameter of scion and rootstock, environment conditions, proper functional state of the rootstock and scion, maintenance of the grafted plants as well as skill of the grafter and compatibility of the rootstock and scion which are required to guarantee the success of the graft union. (Tamilselvi and Pugalendhi, 2015). The increased graft success could be due to favourable temperature, light and relative humidity in the healing chamber. The compatibility between scion and rootstock is due to callus formation at graft union, development of vascular connectivity between scion and rootstock and secondary growth due to cambium (Shehata *et al*., 2000).

Days required for transplanting

The mean data about the effect of bottle gourd scion varieties grafted on different rootstocks for days required for transplanting is presented in Table 4.

The rootstock and scion varieties showed significant differences for days required for transplanting. In scion, Warad (S_1) recorded lowest (22.51) days for transplanting. While, highest days for transplanting (23.45) was recorded in Vinayak (S_2). In rootstock Samrat (R_3) recorded minimum number of days (21.11) for transplanting. While, maximum number of days for transplanting were recorded in (R_5) Arka Suryamukhi (24.55).

The interaction effect of scion and rootstock showed a significant difference for days required for transplanting. In interaction S_1R_3 recorded minimum (20.67) days for transplanting and which was followed by S_2R_3 (21.56), S_1R_1 (22.00) and S_1R_2 (22.33). While, interaction S_2R_5 was recorded maximum (25.00) days for transplanting.

The rootstocks Arka Chandan and Arka Suryamukhi taken maximum number of days to graft healing and sprouting so that they were taken somewhat more number of days to attain transplanting when compared to other rootstocks. The results are similar to findings of Hossain *et al*. (2019), Maurya *et*

al. (2019), Shirisha *et al*. (2022) and Dolas *et al*. (2023).

Conclusion

From this study, it was concluded that bottle gourd scions were more compatible with bottle gourd rootstocks. It was reported that significantly lowest days for graft healing, graft success (%), and days required for transplanting were observed with rootstocks of bottle gourd when compared with pumpkin. Here it can be concluded that graft compatibility is higher with intraspecific grafting (grafting between similar species) when compared with interspecific grafting (grafting between different species).

Table 1: Number of days to germination, days taken to reach grafting stage and diameter of scion and rootstock (mm)

Varieties		Days to germination	Days to reach grafting stage	Diameter (mm)
A.	**Scion**			
S_1	Warad	4.96	20.33	2.21
S_2	Vinayak	4.64	19.80	2.33
	S.Em(±)	0.14	0.15	0.01
	CD at 5%	0.52	0.51	0.04
	Rootstock			
R_1	Arka Shreyas	6.63	11.60	2.31
R_2	Pusa Samridhi	6.20	10.70	2.52
R_3	Samrat	5.98	10.11	2.42
R_4	Arka Chandan	5.62	9.80	2.32
R_5	Arka Suryamukhi	6.04	10.20	2.43
	S.Em(±)	0.15	0.21	0.11
	CD at 5%	0.51	0.72	0.35

Table 2: Effect of grafting on days taken for graft healing

Scion / Rootstock	S_1 (W)	S_2 (V)	Mean
R_1 (AS)	7.33	7.89	7.61
R_2 (PS)	7.00	8.33	7.66
R_3 (S)	6.22	7.33	6.77
R_4 (AC)	10.00	9.67	9.83
R_5 (AS)	10.67	11.33	11.00
Mean	8.25	8.86	
	R	**S**	**RxS**
S.Em. (±)	0.08	0.12	0.27
C.D at 5%	0.23	0.36	0.79

Table 3: Effect grafting on graft success (%)

Scion / Rootstock	S_1 (W)	S_2 (V)	Mean
R_1 (AS)	80.54	83.12	81.83
R_2 (PS)	80.14	81.61	80.87
R_3 (S)	76.81	79.19	78.00
R_4 (AC)	67.25	66.25	66.75
R_5 (AS)	64.49	62.76	63.63
Mean	72.85	73.59	
	R	**S**	**RxS**
S.Em. (±)	0.13	0.21	0.27
C.D at 5%	0.39	0.61	0.79

Table 4: Effect grafting on days required for transplanting

Scion / Rootstock	S_1 (W)	S_2 (V)	Mean
R_1 (AS)	22.00	23.78	22.89
R_2 (PS)	22.33	23.22	22.77
R_3 (S)	20.67	21.56	21.11
R_4 (AC)	23.11	24.67	23.89
R_5 (AS)	24.11	25.00	24.55
Mean	22.51	23.45	
	R	S	RxS
S.Em. (±)	0.05	0.07	0.16
C.D at 5%	0.14	0.21	0.48

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