

Performance of gynoecious × monoecious hybrids of bitter gourd (*Momordica charantia* L.)

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Bitter gourd (bitter melon; *Momordica charantia*) is an important cucurbitaceous vegetable crop grown in the tropics. It has rich nutritional and medicinal values. The monoecious bitter gourd accessions produce staminate flowers from the start of reproductive phase till crop maturity (1) and thus the staminate to pistillate flower sex ratio in this sex type is relatively high (9:1 to 48:1; 3). Moreover, it creates difficulty during commercial hybrid seed production due to its extremely small flower. Use of gynoecious line is an alternative to reduce the cost of hybrid seed production. Gynoecious lines evolve spontaneously in seedling population and once isolated can be exploited for hybrid development by eliminating hand pollination. Two gynoecious lines (DBGy 201 and DBGy 202) lines have been developed from natural population at IARI (1). Development of hybrids in bitter melon is expensive because of hand pollination but the utilisation of gynoecy is economical and easier for exploiting hybrid vigour in bitter gourd (2). The present study was undertaken to compare the per se performance of gynoecious × monoecious hybrids with monoecious × monoecious hybrids in bitter gourd.

The experiment was conducted to evaluate the performance of hybrids in bitter melon by making crosses on the tissue cultured raised gynoecious line, DBGY-201 with twelve other inbreds. The twelve different inbreds (Pusa Do Mausami, Pusa Vishesh, Sel 2, Nakhara Local, MC 84, S26, S29, S30, S41, S54, S57 and DBG 34) were crossed with DBGY-201 to produce 12 crosses. The F₁ hybrids along with three commercial monoecious × monoecious hybrids namely VNR 22, US 33, PH 2 were used as checks to compare the performance of gynoecious × monoecious hybrids. During wet season (July to September) season of 2010, these 12 hybrids along with the 3 checks were grown at Experimental Farm, Division of Vegetable Science, Indian Agricultural Research Institute, New Delhi, India. The experiment was laid out in randomised block design with 3 replications. The seedlings were transplanted on both sides of the channel with 2m between channel and 45 cm between plants. The recommended NPK fertilizer doses and cultural practices along with plant protection measures were followed to raise an ideal crop. The bitter gourd is mainly grown in long growing spring-summer season (February to May) in north Indian plains,

but this experiment was carried out in wet season in order to evaluate the performance of these hybrids in off season. Because of the short period growing season i.e. July-September only two harvests were taken.

Per se performance of hybrids

Time of harvest is a critical consideration for maximizing financial gain in commercial crops. Earliness in bitter gourd is attributed to node number to first female flower and time required for first female flower appearance. In the present findings it was found that gynoecious × monoecious hybrids, DBGy- 201 × S54 had first female flower at 3rd node followed by DBGy- 201 × DBG 34 at 5th node whereas monoecious × monoecious hybrids like VNR 22 showed first female flower at 11th node and Pusa Hybrid 2 at 9th node (data not presented). Minimum days required to first fruit harvest also depict the earliness of the crops. Minimum numbers of days were taken by DBGy- 201 × S54 with 41 days followed by DBGy- 201 × DBG 34 with 42 days whereas among the checks Pusa Hybrid 2 (monoecious × monoecious) required more days (48 days) for first fruit harvest and VNR 22 with maximum number of days of 51. Early picking is desirable to catch the early market for better remuneration and provides ample scope for crop rotation with other crops in the same field. This might have resulted due to the transfer of earliness character from the gynoecious parent to the hybrid. Like cucumber, earliness in bitter gourd is judged through appearance of female flower at lower node and days required for first picking.

Sex ratio determines fruitfulness of most crops in general and cucurbitaceous crops in particular (5). The higher the proportion of female flower greater is the productivity. Lowest sex ratio (male:female) was observed in DBGy- 201 × S26 (1.56) followed by DBGy- 201 × S29 (2.07) whereas highest sex ratio was found in DBGy- 201 × MC 84 (5.15) among all gynoecious × monoecious hybrids and among all hybrids PH2 (check) showed sex ratio as high as 10.22. DBGy- 201 × S54 was found superior than the other hybrids and even checks as the number of fruits per plant was maximum in this hybrid (12.79) followed by DBGy- 201 × DBG 34 with 8.85 fruits/plant and hybrid PH2 produced only 3.55 fruits. Numbers of fruits and fruit weight directly determine

bitter gourd yield (3). In cucumber, Fan et al. (4) identified a positive correlation between yield and sex expression. Hence, these aforesaid gynoecious hybrids of bitter gourd have high potential for commercial cultivation with respect to yield and earliness.

Fruit length and diameter are also important attributes to determine yield. The maximum fruit length was in DBGy- 201 x S54 with 11.07 cm followed by DBGy- 201 x Pusa Vishesh with 10.87 cm (Table 1). The maximum fruit diameter was registered in DBGy- 201 x Pusa Vishesh (11.87 cm) and DBGy- 201 x Nakhara Local (11.30 cm). The parents with the larger fruits might have contributed to increase the fruit length in hybrids. Among the checks VNR 22 recorded the maximum fruit diameter (12.20 cm). The maximum fruit weight was registered in hybrid Gy x S54 (39.18 g) and was at par with the check VNR 22 (39.43 g). DBGy- 201 x Pusa Vishesh hybrid had also larger fruit weight (38.43 g) while the minimum was in DBGy- 201 x S29 (23.77 g) and the monoecious x monoecious hybrid US 33 produced smallest fruit (15.07 g). Maximum yield per plant (245.86 g) was registered in hybrid DBGy- 201 x Pusa Vishesh with followed by DBGy- 201 x MC 84 (240.21 g). It was found that all the hybrids performed extremely well in comparison to checks in terms of yield. The gynoecious parent holds immense potentiality for exploitation of hybrid vigour with respect to yield and earliness (2). They also reported that DBGy-201 is a good combiner and it exhibited significantly GCA and SCA effects with most of the parents.

The gynoecious line DBGy- 201 taken in the present

study could be utilized for heterosis breeding for high yield and earliness. Besides this, it has been proved that this line has already shown high general combining ability (GCA), hence, selection in advanced generations is also equally awarding for development of predominantly gynoecious cultivars by using DBGy-201 as female parent in bitter gourd (2). The potentiality of gynoecious lines in term of yield and earliness was well recognized in cucumber and also in this present study on bitter gourd. Thus, from the above discussion it become clear that gynoecious parent incorporated in this study holds immense potentiality for utilization in hybrid bitter gourd.

References

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Table 1. Per se performance of hybrids of bitter gourd for yield and its related traits

Hybrids	No of fruits/plant	Fruit length(cm)	Fruit diameter(cm)	Yield/plant (g)
DBGy- 201 x PDM	5.87	10.53	10.63	223.25
DBGy- 201 x PV	6.88	10.87	11.87	245.86
DBGy- 201 x Sel 2	5.38	9.60	10.40	197.92
DBGy- 201 x Nakhra Local	7.55	8.70	11.30	207.75
DBGy- 201 x MC84	7.12	10.60	10.80	240.21
DBGy- 201 x S26	6.87	9.70	10.40	176.74
DBGy- 201 x S29	5.88	7.67	11.13	245.45
DBGy- 201 x S30	3.62	7.13	9.57	235.77
DBGy- 201 x S41	6.96	7.50	9.90	216.33
DBGy- 201 x S54	12.79	11.07	10.57	216.98
DBGy- 201 x S57	7.82	9.07	10.60	226.70
DBGy- 201 x DBG 34	8.85	7.70	11.07	164.49
VNR 22 (Check)	5.42	10.77	12.20	172.26
US 33	4.45	9.80	7.20	144.73
PH 2	3.55	7.63	9.17	151.84
SE(d)	2.19	1.73	1.32	29.49
SE(m)	1.07	0.84	0.64	14.32
CD (P=0.05)	0.75	0.59	0.46	10.13
CV	19.76	11.16	7.53	8.58