Indian J. Genet., **66**(1): 61-62 (2006)

Short Communication

DBGy-201 and DBGy-202: Two gynoecious lines in bitter gourd (*Momordica charantia* L.) isolated from indigenous source

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(Received: October 2005; Revised: March 2006; Accepted: March 2006)

A wide range of variation in sex forms ranging from the primitive hermaphrodite to the advanced monoecious forms is observed in cucurbitaceous vegetable crops. Among these, the gynoecious sex form has been commercially exploited worldwide for cucumber breeding [1]. Since, the pure gynoecious inbred parent of a hybrid only has female flowers; the open pollinated seeds it produces are F_1 hybrids. This reduces the cost of male flower pinching and hand pollination as in case of cucumber [2]. In bitter gourd (*Momordica charantia* L.), reports on occurrence, availability and commercial utilisation of gynoecious lines are very meagre. Zhou *et al.* [3] reported gynoecism in bitter gourd from China and Ram *et al.* [4] isolated few gynoecious plants in India. Since, this crop has high male: female sex ratio which varied from 9:1 to 48:1 [5] and has very small flowers, it is difficult to pinch staminate flower buds and hand pollinate female flower buds. Thus, isolation and characterisation of gynoecism in bitter gourd has great significance for increasing yield potential either through developing cultivars with high proportion of pistillate flowers or using pure gynoeciuos line for cost effective hybrid seed production.

Two gynoecious plants namely DBGy-201 and DBGy-202 were observed from the Research Farm of the Division of Vegetable Science, Indian Agricultural Research Institute (IARI), New Delhi during spring-summer seasons of 2004 and 2005. These plants along with a variety, Pusa Do Mausami (check) were examined for 8 quantitative traits: (i) days to first female flower opening, (ii) node number of first female flower, (iii) days from sowing to first harvest, (iv) total number of fruits per plant, (v) average fruit length (cm), (vi) average fruit diameter (cm), (vii) average flesh thickness (cm) and (viii) average fruit weight (g). These plants were crossed with i) monoecious plants of the same population (sib-mating) and ii) monoecious plants of another population (out-crossing). The monoecious plants of sister lines (same population from which gynoecious plants were isolated) were also selfed to study the genetics of sex expression. Progenies of 6 such crosses were raised during spring-summer season of 2005 and F_1 plants were examined for the presence or absence of pistillate and staminate flowers.

The performance of two gynoecious plants was compared with the commercial variety, Pusa Do Mauasmi (monoecious check) and the data on eight horticultural traits have been presented in Table 1. These gynoecious lines did not produce staminate flower till their physiological maturity. With respect to days to first female flower opening, node number of first female flower and days from sowing to first harvest, both gynoecious plants, DBGy-201 and DBGy-202 were found to be early in fruiting habit. DBGy-202 and DBGy-201 showed 20 days and 11 days advance in fruit maturity compared to Pusa Do Mausami which indicated early bearing of female flowers at lower nodes. As per the yield and yield attributing characters, both these plants were also found promising. The number of fruits per plant, fruit diameter, fruit weight and flesh thickness were observed to be higher than the monoecious variety, Pusa Do Mausami.

For preliminary understanding of the genetics of sex expression in bitter gourd, few plants were selected for crossing to develop F_1 plants. They were examined for the presence or absence of pistillate and staminate flowers on the individual plant. The data on segregation behaviour of the gynoecism is presented in Table 2. Variable numbers of gynoecious and monoecious plants were obtained from the 6 different crosses. Interestingly, all crosses produced gynoeciuos plants in F_1 generation. The maximum number of gynoeciuos plants was obtained from the progenies of 7 plants in the cross between DBGy-201 (gynoeciuos plant) and DBMn-201 (monoecious sister line of DBGy-201). This cross also produced monoecious plants with higher percentage of female flowers ranging from 67.5 to 86.0%. Higher proportion of gynoeciuos plants was observed in F_1 population derived from sib-mating population compared

Table 1. Performance of gynoecious lines of bitter gourd for 8 horticultural traits

Characters	DTFFF	NTFFF	DTFH	Fruits per plant	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Flesh thickness (cm)
DBGy-201	42.00	9.07	55.00	19.47	68.93	8.87	4.11	1.45
DBGy-202	31.00	6.93	46.47	21.60	58.24	8.45	4.30	1.06
Pusa Do Mausami	53.87	18.80	66.07	18.13	54.94	10.50	3.77	0.63
SEm±	2.29	0.72	2.27	0.60	3.13	0.61	0.22	0.09

DTFFF - Days to first female flower opening, NTFFF - Node number of first female flower, DTFH-Days from sowing to first harvest

Table 2. Segregation of gynoecious plant(s) in F_1 generation of bitter gourd

Female parent	Male parent	Mating system	Sex expression in F_1 generation			
			No. of gynoecious plants	No. of monoecious plants	Total plants	Range of pistillate flower in monoecious plants (%)
DBGY-201	DBMn-201	Sib-mating	4	3	7	67.5-86.0
DBGY-201	DBMn-202	Out-crossing	1	3	4	54.3-68.3
DBGY-202	DBMn-201	Out-crossing	2	3	5	46.8-59.2
DBGY-202	DBMn-202	Sib-mating	3	4	7	72.3-80.5
DBMn-201	DBMn-201	Selfing	3	7	10	28.4-34.7
DBMn-202	DBMn-202	Selfing	2	6	8	22.5-29.6

to other crosses. Similar results pertaining to recovery of gynoeciuos plants in a very small F_1 population were also reported earlier by Ram *et al.* [6] indicating that gynoecism trait in these isolated plants is heritable and may have been controlled by certain major gene(s). Since all the crosses produced monoecious plants in F_1 generation but it is early to say the involvement of recessive gene(s) for controlling gynoecism in our material. However, gynoecious sex expression in cucumber is controlled by a single dominant gene, subject to considerable influence from modifying genes and environmental factors [7]. The variable segregation of gynoeciuos plants in F_1 population observed might due to heterozygous nature of the isolated plants or due to the role of modifying genes, which may be an additional cause for variable sex expression in bitter gourd.

All gynoecious and monoecious plants of F_1 families were used for developing F_2 plants and full-sib F_1 families. The stability of these lines in different environments is also important for utilising them in future breeding programme. The genetic materials (gynoecious lines) generated during this study will help in studying the genetics of sex expression and such lines will also help in developing cultivars with higher proportion of female flowers and their potential use in hybrid seed production.

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