Studies on the extent of genetic contamination in seed production of ridge gourd (*Luffa acutangula* Roxb.)

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ABSTRACT

Studies were conducted during 2002-2005 (Rabi season) to evaluate the extent of genetic contamination in round fruited ridge gourd (recessive) when grown for seed production under open field conditions. The round fruited ridge gourd was sown at 200 m, 400 m, 600 m and 800 m distance from Arka Sumeet (long fruited) which acted as the local marker (dominant). The highest percentage of genetic contamination was recorded at a distance of 200 m from the contaminator (Arka Sumeet) (28.62% and 88.1%, respectively, in the years 2003 and 2005). It was also observed that there was a gradual reduction in contamination level with increasing distance from 28.62 to 17.44% at 600 m distance in 2003 and 88.11% at 800 m to 74.23% in 2005. The lowest percentage of contamination was recorded at the highest isolation distance (at 600 m, 17.44% in 2003 and at 800 m, 74.24% in 2005), although it is not within the prescribed maximum permissible limit of genetic contamination (1 and 2% for foundation and certified seed respectively). In the present study, in all the isolation distances studied, the level of contamination is well above the permissible minimum seed certification standards (99 and 98 % genetic purity for Foundation and Certified seed respectively). Hence, any reduction in the isolation distance from the prescribed (800 m) isolation would drastically affect the genetic purity of ridge gourd for seed production under open field conditions.

Key words: Cucurbits, genetic purity, isolation, ridge gourd, seed production

INTRODUCTION

India is ranked as the highest producer of vegetables in the world accounting for 90 million tonnes in 6.2 million hectare area during 2003-04 (Economic Survey of India, 2004-05). The projected hybrid and open pollinated (OP) seed requirement for gourds by 2005 is highest (1012.5 tonnes and 2025 tonnes, respectively) compared to other vegetables (Ahmed *et al*, 2004). Being insect pollinated, cucurbitaceous crops require an isolation distance to prevent outcrossing in seed production by open pollination (Robinson, 1999; Singh and Dasgupta, 2005). Isolation distance in any seed production is a pre-requisite to prevent either mechanical mixture /cross pollination for the production of breeder/ foundation/ or certified seeds. However, this varies with the crop, wild species, wind breaks, barriers and geographical location of seed plot, *etc.*, which are crossable with the crop under study.

Ridge gourd is a cross - pollinated crop and pollination is effected mainly by honey bees. Under natural conditions, pollination by honey bees is upto 85-95% in *Cucumis* spp (Rosa,1924). Growing different ridge gourd varieties in the vicinity would enhance the chance of contamination. Tumwar and Singh (1988) have recommended 1000 m and 500 m isolation distance for Foundation and Certified seed production of ridge gourd, respectively. The prescribed minimum seed certification standards for all cucurbits, in general, is 800 m and 400 m isolation distance for foundation and certified seeds production, respectively (Agarwal and Dadlani, 1987). In the earlier studies of Radha Krishna Maiya *et al* (2001) in cotton, which is often a cross pollinated crop, 6m isolation was sufficient as against the prescribed minimum seed certification standards of 50 m and 30 m for foundation and certified seed respectively. Since a high proportion of natural crossing occurs in ridge gourd, it necessitates isolation between varieties/ gourds for maintenance of genetic purity. There is no information on the distance needed for effective isolation under Indian conditions. Hence, the present study was undertaken to determine genetic contamination in seed production of ridge gourd under open field conditions, so as to reduce the isolation distance.

MATERIAL AND METHODS

A field experiment was conducted at Indian Institute of Horticultural Research, Bangalore, in the Rabi season of 2002 to 2005 to facilitate natural crossing between round and long fruited ridge gourd. The recessive seed parent (round fruited type) was sown in isolation from other varieties/ gourds to avoid cross pollination. The different isolation distances used were 200 m, 400 m, 600 m and 800 m from the contaminator /marker, Arka Sumeet (dominant long fruited type). These distances are less than the prescribed 800 m for cucurbits in obtaining foundation seeds. It was ensured that there were no physical barriers upto 800 m to facilitate natural crossing during Rabi 2002 and 2004. The crop was raised using the recommended package of practices. Seeds of ridge gourd collected at various isolation distances from 200 m,400 m,600 m and 800 m from the contaminant plot (round type) were extracted and used for genetic purity evaluation by conducting field grow-out tests (GOT) during October 2003 and October 2005 following standard procedures (Agarwal,1993). The crop was sown in a randomised block design with seven replications per treatment.

The extent of genetic contamination in seed crop was recorded based on the number of plants with long fruits in the progeny and expressed as percentage. Statistical analysis of data was done using Analysis of variance (ANOVA) for various isolation distances after data were subjected to angular transformation.

RESULTS AND DISCUSSION

Data on frequency of contaminants and extent of genetic contamination in the progeny of seed crop (round fruited recessive type) at various isolation distances from the contaminator, Arka Sumeet (long fruited dominated type) are given in Tables 1 and 2, respectively. Results revealed that contamination in the progeny of round fruited type decreased with increasing isolation distance from the contaminator.The highest percentage of genetic contamination/outcrossing was recorded at a distance of 200 m from the contaminator (28.62% in 2003 and 88.11% in 2005). The lowest percentage of contamination was recorded at the highest isolation distance (at 600 m, 17.44% in 2003 and at 800 m, 74.24% in 2005), although it is not under the prescribed maximum permissible limit of genetic contamination. Statistical analysis of the transformed values of percentage of genetic contamination revealed that there were no significant differences among the various isolation distances studied for the extent of genetic contamination in the years 2003 and 2005.

Table 1. Frequency of round and long fruited types in the progeny of round fruited ridge gourd at various isolations (grow-out tests)

Isolation distance (m)	Number of round fruited types	Number of long fruited types	Total number of plants per treatment
2003			
200	173	59	232
400	188	49	237
600	158	33	191
800	*	*	*
2005			
200	11	86	97
400	13	59	72
600	15	58	73
800	34	80	114

*No fruit set observed

Table 2. Extent of genetic contamination at various isolation distances in ridge gourd

Isolation distance (m)	Genetic contamination (%) in the progeny of round fruited ridge gourd	
	2004	2005
200	28.62 (31.49)*	88.11 (69.80)*
400	20.14 (26.43)*	83.51 (66.01)*
600	17.44 (24.06)*	79.04 (63.23)*
800	–	74.23 (59.47)*
CD (0.05)	NS	NS

* = Angular transformed values; – No fruit set was observed

The present study revealed that as the isolation distance increased from 200 m to 800 m, per cent contamination in the progeny of round fruited ridge gourd decreased. The minimum genetic purity standards for Foundation and Certified seed are 99% and 98%, respectively. Cross-pollinated vegetable seed crops exhibit higher degree of variation as compared to self-pollinated vegetables. Also, genetic contamination in cross- pollinated vegetables affects in such a way that any specific character bred into a variety is likely to be lost (Prem Singh Arya, 1999). In the present study, although there were no significant differences between the isolation distances it is risky to reduce the prescribed isolation distance below 800 m. as the level of contamination is well above the permissible minimum seed certification standard. Differences in the levels of genetic contamination between the years 2003 and 2005 could be attributed to a relative abundance of pollinators which is variable based on the attractiveness to the adjacent field crop. Hence, any reduction in isolation distance from the prescribed 800 m would drastically affect the genetic purity of ridge gourd

for seed production under IIHR conditions at Bangalore. Thus, there is a need to standardize the isolation distance to ensure the genetic contamination of round fruited ridge gourd is well within the permissible limits so as to maintain the minimum genetic purity standards for Foundation and Certified Seed production under Bangalore conditions.

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