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Study of hetrosiss for yield and its component traits in bottle gourd (*Lagenaria siceraria* Mol. Standl.)

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Abstract
The present investigation entitled "Study of hetrosiss for yield and its component traits in bottle gourd (*Lagenaria siceraria* Mol. Standl.)" using diallel cross analysis was undertaken to find out the genetic architecture of various quantitative traits, heterosis and combining ability, heritability and genetic advance. The experimental material of seven diverse parents and 42 F_1s including reciprocals was sown in Randomized Block Design with four replications during September 1999 at Students Instructional Farm, N.D.U.A.&T., Kumarganj, Faizabad. The data were recorded on six randomly selected plants in each F_1, reciprocal and parents in each replication for 14 characters viz., days to anthesis of first male flower, days to anthesis of first female flower, node number of first male flower, fruit yield per plant (kg), node number for first female flower, days to first harvest, fruit length (cm), fruit diameter (cm), fruit weight (kg), number of fruits per plant, number of branches per plant, number of nodes per plant, internodal distance (cm), vine length (m).In general considerable heterosis over better parent and standard variety was observed for almost all the characters under study. For fruit yield per plant the maximum heterotic response was observed in the cross Pusa Naveen x NDBG-140 followed by NDBG-140 x L-22. The maximum heterosis over standard variety was observed in reciprocal cross NDBG-140 x Pusa Naveen.

Keywords: Bottle gourd, heterosis, yield

Introduction
Among the cucurbits, bottle gourd or calabash gourd [*Lagenaria siceraria* (Mol.) Standl. 2n = 22] is the only plant that was known to mankind in both the new and old world from prehistoric times (Esquinas-Alcazar and Gulick, 1983) [9]. It is a cosmopolitan cucurbitaceous vegetable grown widely throughout the tropics and sub-tropics of the world. In addition to its use as vegetable, tender fruits are used for making sweets, *rayta, etc.* Shells of mature and dry fruits are used for making containers, floats, utensils and musical instruments. The bottle gourd thrives well in hot humid weather conditions, but it can be grown in adverse low temperature conditions also (Seshadri, 1986; Sirohi and Sivakami, 1991; Maurya *et al.*, 1993 [28, 18, 23]. Under the North-Indian climatic conditions, it is cultivated both in spring summer (February-June) and rainy (July-November) seasons. The early maturing varieties sown by or before the middle of October can bear first edible fruit within 60 to 80 days (Maurya, 1991) [22]. There is also a common traditional practice among the villagers to grow few plants of bottle gourd near their residences, during rainy season (August), where growing plants are trained on thatches, huts or house roofs. These plants acquire sizable vegetative growth and start producing edible fruits in about 60 days (Singh, 1994). Farmers also plant the bottle gourd crop throughout the month of November as an inter-crop with potato in the plains or as pure crop in river bed (Seshadri, 1986) [28] to fetch high price from early summer produce.
In India although a wide range of variability is available in vegetative and yield attributing characters in this crop, very little attention has been given in genetic improvement of this crop (Tyagi, 1973; Sharma *et al.* 1983; Seshadri, 1986; Jankiram and Sirohi, 1987, 1988; Sivakami *et al.*, 1987; Maurya and Singh, 1994) 1973 [27, 22, 28, 18, 25]. However, research work done during the recent years has resulted in the development of several improved varieties in this crop in different parts of the country. A major breakthrough can be brought about by extensive evaluation of genetic variability and expl oitation of heterosis. Development of hybrid is an important proposition, which offers a big jump in increasing the productivity of the crop (Singh, 1994) 1973 [25].
The exploitation of heterosis is much easier in cross-pollinated vegetable crops. Bottle gourd being monoecious provides ample scope for the utilization of the hybrid vigour for yield improvement of this crop. The selection of suitable parents for hybridization on the basis of phenotypic performance alone is not a sound procedure as phenotypically superior lines may

phenotypically superior lines may yield poor recombinants in the segregating generations. It is, therefore, essential that parents should be selected on the basis of their genetic potential. Amongst several techniques for evaluation of different varieties/ strains, diallel cross analysis is most informative biometrical designs which has been used to estimate the genetic components of variation and combining ability of inbreds/parents in a series of crosses.

Material and Methods

The experiment was conducted at the Students' Instructional Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar, Faizabad (U.P.) in September sown early winter crop during the year 1999. Narendra Nagar is geographically situated at 26.47°N latitude 82.12° E longitude, and at an altitude of 113m above the mean sea level. This area falls in subtropical climatic zone. The climate of district Faizabad is semi-arid with hot summer and cold winter. The materials for the present investigation consisted of seven diverse parents *Viz* Pusa Naveen, NDBG-129-B, NDBG-140, NDBG-202 LF, NDBG-208, L-22, L-27, (inbreds/varieties of long fruited bottle gourd, their 21 F_1s and 21 reciprocals. The diverse parents/varieties were made available from the germplasm maintained in Department of Vegetable Science of the University. The experimental material comprising of 49 treatments i.e. 7 parents (including Pusa Naveen as standard check), their 21 F_1s and 21 reciprocals were grown in Randomized Block Design with four replications. Each treatment was grown in three metre long and two metre wide experimental plots. The approximate distance of 50 cm between the plants and two m between row to row was maintained. Recommended agronomic practices and plant protection measures were followed for raising a good crop.

The observation were recorded Days to first male flower, Days to anthesis of first female flower, Node at which first male flower appears, Fruit yield per plant (kg), Node at which first female flower appears, Days to first harvest, Fruit length (cm), Fruit diameter (cm), Fruit weight (kg), Number of fruits per plant, Number of branches per plant, Number of nodes per plant, Internodal distance (cm), Vine length (m).

Result and Discussion

The heterosis over better parent and standard variety for days to anthesis of first male flower ranged from –1.86 (NDBG-202 x NDBG-208) to 8.62% per cent (NDBG-129 x NDBG-102) and –1.04 (Pusa Naveen x NDBG-140) to 11.43 per cent (NDBG-129 x NDBG-202 and NDBG-208 x L-22), respectively. The heterosis over better parent ranged from –2.85 (NDBG-208 x L-27) to 14.82 per cent (NDBG-129 x NDBG-202) and over standard variety from –1.65 (Pusa Naveen x NDBG-140) to 21.97 per cent (NDBG-129 x NDBG-202), node number of first male flower varied from –12.57 (NDBG-208 xL-27) to 23.96 per cent (Pusa Naveen x NDBG-202) and heterosis over standard variety ranged from 5.34 (Pusa Naveen x NDBG-140) to 47.52 per cent (L-22 x L-27), fruit yield per plant was ranged from -24.91 (NDBG-129 x NDBG-140) to 38.68 (NDBG-129 x NDBG-208) and Heterosis over standard variety ranged from -31.85 (NDBG-202 x NDBG-208) to 35.68 per cent (Pusa Naveen x NDBG-140), Node number of first female flower varied from –11.37 (NDBG-208 x L-22) to 38.15 per cent (Pusa Naveen x L-22) and standard variety ranged from 0.01 (Pusa Naveen x NDBG-208) to 65.89 per cent (L-22 x L-27). The Days to first harvest Heterosis over better parent and standard variety ranged from –8.26 (NDBG-202 x L-22) to 12.56 per cent (Pusa Naveen x L-22) and 0.00 (Pusa Naveen x NDBG-129) to 16.91 per cent (L-22 x L-27), respectively, For fruit length heterosis over better parent and standard variety ranged from –10.33 (NDBG-208 x L-27) to 10.42 per cent and 5.43 (Pusa Naveen x NDBG-208) to 39.32 per cent (NDBG-140 x L-27, Fruit diameter Heterosis over better parent and standard variety ranged from –23.84 (NDBG-208 x L-22) to 3.08 per cent (Pusa Naveen x NDBG-129) and –13.20 (NDBG-208 x L-22) to 3.59 per cent (Pusa Naveen x NDBG-208), For fruit weight heterosis over better parent and standard variety ranged from –4.13 (NDBG-129 x L-22) to 34.85 per cent (NDBG-202 x NDBG-208) and –2.82 (NDBG-129 x L-22) to 25.35 per cent (NDBG-202 x NDBG-208), Number of fruits per plant varied from –30.91 (NDBG-129 x NDBG-140) to 29.82 per cent (NDBG-202 x L-22) amd –45.78 (NDBG-202 x NDBG-208) to 19.81 per cent (Pusa Naveen x NDBG-140), For number of branches per plant heterosis over better parent and standard variety ranged from –39.03 (NDBG-202 x L-22) to 31.45 per cent (Pusa Naveen x NDBG-129) and –30.22 (NDBG-208 x L-22) to 36.42 per cent (Pusa Naveen x NDBG-202), Number of nodes per plant ranged from –8.07 (NDBG-129 x L-27) to 15.62 per cent (NDBG-129 x NDBG-140) and 8.11 (NDBG-129 x L-27) to 34.52 per cent (NDBG-129 x L-22), For internodal distance heterosis over better parent and standard variety ranged from –16.74 (NDBG-129 x NDBG-140) to 32.47 per cent (NDBG-202 x L-27) and –4.21 (NDBG-129 x NDBG-140) to 50.63 per cent (NDBG-202 x L-27), vine length ranged from –17.86 (NDBG-129 x NDBG-208) to 13.97 per cent (Pusa Naveen x NDBG-129) and 28.63 (NDBG-129 x NDBG-140) to 90.52 per cent (NDBG-202 x L-27). All the above parameters was presented in Table. 1.

According to Griffing and Linstorn (1954) [12] and Paterniani and Lonnquist (1963) [24], the expression of heterosis is due to accumulation of desirable genes in hybrid plant through the crossing of parents in their genetic makeup and it was very often been related to the magnitude of genetic diversity.

In the present study, the heterosis for seed fruit yield per plant ranged from –24.91 (NDBG-129 x NDBG-140) to 38.68 per cent (NDBG-129 x NDBG-208) over better parent and from –31.85 (NDBG-202 x NDBG-208) to 35.68 per cent (Pusa Naveen x NDBG-140) over standard variety. The maximum heterosis of 38.68 and 35.68 per cent observed in NDBG-129 x NDBG-208 and Pusa Naveen x NDBG-240, respectively over better parent. Highest heterosis over standard variety was observed in Pusa Naveen x NDBG-240 (35.68%) followed by NDBG-140 x L-22 (25.09%) for fruit yield per plant.

In reciprocal crosses heterosis over better parent and standard variety ranged from –35.22 (NDBG-202 x NDBG-140) to 30.21 per cent (NDBG-140 x Pusa Naveen) and 35.31 (NDBG-202 x NDBG-140) to 30.21 cent (NDBG-140 x Pusa Naveen), respectively.

Some of the promising crosses with desirable heterosis for number of nodes per plant were NDBG-129 x NDBG-140 (15.62%) over better parent and NDBG-129 x NDBG-140 (34.14%) NDBG-202 x L-22 (29.58%), Pusa Naveen x NDBG-202 (29.70%) and NDBG-129 x L-22 (34.52%) over standard variety. Preponderance of dominance in the range of over dominance in these traits could be the reason for maximum heterosis for fruit yield per plant. Similar, findings were reported by Dhesi *et al.* (1964), Dhaliwal *et al.* (1983), Nath and Dutta (1970), Mishra and Seshadri (1985) and various other workers in bottle gourd.

Table 1: Estimates of per cent heterosis over better parent and standard variety of in 7x7 diallel cross of bottle gourd

Crosses (F_1s)	Days to anthesis of Ist male flower		Days to anthesis of first female flower		Node number of Ist male flower		Fruit yield per Plant (kg)		Node number of Ist female flower		Days to first harvest		Fruit length (cm)	
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1. Pusa Naveen x NDBG-129	0.05	0.05	1.67	1.67	22.14	22.14	11.57	11.57	22.04	22.04	0.00	0.00	-2.64	22.11*
2. Pusa Naveen x NDBG-140	-1.04	-1.04	-1.65	-1.65	5.34	5.34	35.68**	35.68**	9.29	9.29	1.45	1.45	-4.53	17.67
3. Pusa Naveen x NDBG-202	1.52	1.52	-0.32	-0.32	23.96*	23.96*	19.93	19.93	16.56	16.56	1.45	1.45	9.69	23.72*
4. Pusa Naveen x NDBG-208	3.87	3.87	0.07	0.07	17.06	17.06	20.24	20.24	0.01	0.01	2.42	2.42	5.43	5.43
5. Pusa Naveen x L-22	6.69	6.69	7.56	7.56	21.10	21.10	0.64	0.64	38.15	38.15	12.56*	12.56*	-1.71	24.59*
6. Pusa Naveen x L-27	7.05	7.05	5.14	5.14	10.29	10.29	-0.01	-0.01	19.02	19.02	5.80	5.80	-3.37	21.86*
7. NDBG-129 x NDBG-140	1.30	3.38	4.50	6.65	-1.65	16.54	-24.91	-27.33*	21.99	54.59**	1.40	5.31	-4.40	19.91
8. NDBG-129 x NDBG-202	8.62*	11.43**	14.82**	21.97**	7.13	29.04**	-6.17	-26.69*	23.12	56.04**	9.26	14.01*	-1.98	22.95*
9. NDBG-129 x NDBG-208	5.67	8.41*	3.19	9.62	1.83	22.65	38.68*	8.35	6.71	35.24	0.93	5.31	-5.93	17.98
10. NDBG-129 x L-22	5.18	7.90*	5.59	12.16*	-4.98	14.45	0.83	-21.22	8.91	38.04	4.17	8.70	5.80	34.11**
11. NDBG-129 x L-27	2.90	5.56	2.81	9.20	0.11	20.57	-2.87	-23.48	9.53	38.82	6.02	10.63	3.81	30.91**
12. NDBG-140 x NDBG-202	3.15	5.27	-1.35	0.61	4.94	24.35*	-16.95	-19.63	-0.26	28.19	0.00	3.86	-5.41	16.59
13. NDBG-140 x NDBG-208	6.39	8.57*	6.41	8.53	-5.17	12.37	21.26	17.35	2.52	31.77	3.26	7.25	-5.03	17.05
14. NDBG-140 x L-22	3.12	5.24	3.44	5.50	11.32	31.90**	-22.59	25.09*	9.49	40.72	0.47	4.35	5.06	33.18**
15. NDBG-140 x L-27	3.31	5.43	4.70	6.78	13.51	34.51**	-17.28	-19.94	7.22	31.81	2.33	6.28	10.42	39.32**
16. NDBG-202 x NDBG-208	-1.86	5.68	-2.37	11.99*	-7.14	15.23	-11.68	-31.85**	1.13	50.23*	0.00	11.11	8.71	22.63*
17. NDBG-202 x L-22	1.17	8.94*	2.14	17.73**	9.76	36.20	37.06	-13.19	3.83	57.61**	-8.26	7.25	-5.58	19.69
18. NDBG-202 x L-27	0.83	8.57	0.85	15.55**	-1.79	21.87	9.79	-13.50	-3.69	46.20*	1.30	12.56*	-0.10	25.99*
19. NDBG-208 x L-22	2.22	11.43**	0.06	14.78*	2.83	36.98**	12.49	-13.20	1.65	51.01*	1.30	12.56*	-3.06	22.88*
20. NDBG-208 x L-27	1.84	10.82**	-2.85	11.31	-13.57	21.88	7.74	-15.12	-11.37	31.66	0.00	11.11	-10.33	13.09
21. L-22 x L-27	-0.82	7.92*	3.24	18.29**	10.75	47.52**	9.38	-13.83	0.34	65.89**	5.22	16.91**	4.75	32.77**
S.E.	0.76	0.76	1.25	1.25	0.44	0.44	0.19	0.19	0.95	0.95	1.65	1.65	1.61	1.61

*,** significant at 5% and 1% probability levels, respectively.

Reference

1. Aksel R, Johnson LPV. Analysis of a diallel cross: a worked example. Advancing Frontiers in Pl. Sci. 1963; 2:37-53.
2. Allard RW. The analysis of genetic environmental interaction by means of diallel crosses. Genetics, 1956a; 41:305-308.
3. Allard RW. Estimation of prepotency from Limabean diallel cross data: Agron J. 1956b; 48:337-543.
4. Barna B. Improvement of watermelon varieties by heterosis breeding. Diss. Budapest, (c.f. Pl. Breed. Abst. 1961; 33: 116. Abst. 3815, 1963.
5. Bohn GW, Davis GN. Earliness in F_1 hybrid muskmelons and their parent varieties. Hilgardia, 1957; 26:453-471.
6. Chaderi A, Lower RL. Estimates of genetic variances for yield in pickling cucumber. Jr of Amer Soc for Hort Science. 1981; 106(2):237-238.
7. Chadha MML, Nandpuri KS, Singh S. Inheritance of quantitative characters in muskmelon. Indian J Hort. 1972; 29 (2):174-178.
8. Choudhary B, Roy HK. Indian Agricultural Research Institute, New Delhi. Agric. Res (ICAR). 1964; 4:213.
9. Esquinas Alcazar JT, Gulick PJ. Genetical resources of cucurbitaceae-a global report, 1983.
10. Griffing B. A generalized treatment of the use of diallel cross in quantitative inheritance. Heredity. 1956a; 10:31-50.
11. Griffing B. Concept of general and specific combining ability in relation to diallel crossing system. Aust. J. Biol. Sci. 1956b; 9:463-493.
12. Griffing B Lindstron. A study of combining ability in corn inbred having varying population of Corn Belt and non-Corn Belt germplasm Agron J. 1954; 46:545-552.
13. Hayes HK, Jones DF. First generation crosses of cucumber, Conn. Agril. Exp. Sta. Ann. Rept, 1916, 319-22.

14. Hayman BI. The theory and analysis of diallel crosses. Genetics. 1954; 3:789-809.
15. Hutchins AE. Some examples of heterosis in the cucumber (*Cucumis sativus* L) Proc Amer Sco Hort. Sci, 1938; 36:332-336.
16. Hutchins AE. Some examples of heterosis in the cucumber (*Cucumis sativus* L.). Proc. Amer. Soc. Hort. Sci. 1939; 36:660-664.
17. Jakimovic AD. Heterosis in cucumber. Fruit Veget Gro-Moscow, 1938; 12:17-19 (cf Plant Breed Abstr 9: 1234).
18. Janakiram T, Sirohi PS. Gene action in round-fruited bottle gourd. Veg. Sci. 1987; 14(1):27-32.
19. Khaizalian. Studies on the use of monoecious parents in heterosis breeding in muskmelon (*Cucumis melo* L) AM Sc thesis submitted to PG School, IRRI, New Delhi, 1984.
20. Koenvena V. Heterosis and the yield of cucumbers. Kartobeliovasei (potato and vegetable), 12: 48-49 (c.f. Pl. Breed. Abstr. 1962-1963; 33:3933.
21. Kohle AK. Exploitation of hybrid vigour in cucurbits. Indian J Hort. 1972; 29(1):77-80.
22. Maurya IB. Studies on heterosis and combining ability in bottle gourd [*Legernaria siceraria* (Molina) Standl] M Sc Thesis, NDUAT, Kumarganj Faizabad UP, 1991.
23. Maurya IB, Singh SP, Singh NK. Heterosis and combining ability in bottle gourd [*Legernaria siceraria* (Molina) Standl.]. Crop. Res. 1993; 8(1):100-104.
24. Paterniani F, Lonnquist TH. Heterosis in inter varietal crosses of corn (*Zea mays* L.) Crop Sci, 1963; 3:504-507.
25. Singh N. Scope of developing hybrids in vegetable crops in India. In: N. Singh and A.S. Kataria (Eds.) Heterosis in vegetable crops 1-5 IARI New Delhi, 1994.
26. Sirohi PS, Sivakami N. Genetic diversity in cucurbits - Bottle gourd. Indian Horticulture. 1991; 36(3):44-45.
27. Tyagi, I.D. Heterosis in bottle gourd. Indian J Hort. 1973; 33(4):393-400.
28. Seshadri VS. Cucurbits. In: Vegetable crops in India, (Eds.) T.K. Bose and M.G. Som. Naya Prakash, Calcutta, 1986.