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CORRELATION AND PATH-COEFFICIENT STUDIES IN BRINJAL

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ABSTRACT

Correlation and path analysis studies were studied in F3 and biparental progenies (North Carolina Design -1) of three inter-varietal crosses, viz. KS-352 x Pb. Barsati, Punjab Neelam x Pb. Barsati and Punjab Sada Bahar Baingan x Pb. Barsati in brinjal. Total yield per plant was significantly and positively correlated with number of fruits per plant, fruit weight, total yield and plant height both in biparental as well as F_3 progenies in all the crosses. Maximum contribution towards total yield was made by number of fruits per plant and fruit weight both through direct and indirect effects, in all the crosses. Therefore, selection criterion based on number of fruits per plant and fruit weight can give better results for improvement of total yield in brinjal.

Key words : *Correlation, path analysis, brinjal, biparental progenies, north carolina design-1.*

Brinjal (*Solanum melongena* L.) is one of the most widely grown vegetable in India. Breeding work with an objective of increasing productivity and quality of brinjal, has a wide scope due to availability of wider genetic diversity. Heterosis is also being used and BH-1 and BH-2 have been developed by Punjab Agricultural University, Ludhiana, in brinjal, but the production of F_1 hybrid seed is cumbersome, because both emasculation and pollination are done manually. Therefore development of superior performing pureline varieties holds promise. Yield is a complex character, its direct improvement is difficult. Knowledge in respect of the nature and magnitude of associations/correlation of yield with various component characters is a pre-requisite to bring improvement in the desired direction. But the correlation studies reveals only the general relationship between two variables without the possible cause of such association. The associations become complex when many correlated characters effect a particular trait. In such situation, path analysis enables the breeder in tracing the actual path of association of two such variables and correlation co-efficients are partitioned into direct and indirect effects. Therefore, knowledge about the nature and extent of inter-relationship and path-analysis will be of great value to the breeder to increase the intensity of desirable characters like yield per plant through indirect selection of easily observable associated characters.

MATERIALS AND METHODS

Present studies were conducted at Vegetable Research Farm, PAU, Ludhiana. The experimental material comprised of F_3 and Biparental progenies (BIP's) developed in already available F_2 populations of two inter-varietal crosses, viz. KS-352 x Punjab Barsati and Punjab Sada Bahar Baingan x Punjab Barsati using the North Carolina Design-1 as suggested by (1, 2). In this design , biparental progenies were produced by designating four F_2 plants from each population as male parents and crossing each of these to four plants selected as females. The plants used as males and females were chosen at random for the development of progenies and no seed parent was used in more than one mating. The plants involved in biparental matings were also selfed to develop F_3 families. Thus the biparental progenies consisted of sixteen progenies (four per male group). Twenty F_3 families were developed by selfing (4 males and 16 females). Sixteen BIP's and twenty F_3 families constituted one set. Seed of two such sets were sown in nursery beds on 15th June, 2004 in a Randomized Block Design (RBD) with two replications in each cross. Row and plant spacings were maintained at 60cm and 45cm, respectively and there were 12 plants in each row. All the agronomic practices and plant protection measures were followed as per Punjab Agricultural University, Ludhiana (3). Data were recorded for six characters viz. number of fruits per plant, fruit weight (g), fruit length (cm), fruit diameter (cm), total yield (kg), plant height (cm).

RESULTS AND DISCUSSION

The major causes underlying association are either due to pleiotropic gene action or linkage or both. The phenotypic correlations are normally of genetic and environmental interaction which provides information

Table-1: Phenotypic correlation coefficient between different pairs of characters in Biparental and F3 progenies in cross KS-352 x Punjab Barsati

Character		Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Total yield (kg/plant)	Plant height (cm)
No. of fruits per plant	BIP's	0.250	0.1552	-0.0454	0.4338**	-0.0003
	F_3	-0.1952	-0.0057	-0.0174	0.5944**	0.5944
	Z- value	1.99*	0.71	-0.12	-0.96	-0.53
Fruit weight (g)	BIP's		0.0871	0.3199**	0.4879**	0.1206
	F_3		0.5584**	0.2269**	0.6564	0.3717**
	Z- value		-2.38*	-0.48	-1.11	-1.18
Fruit length (cm)	BIP's			0.2450	0.3999**	0.3929**
	F_3			-0.2163	0.4697**	0.1547
	Z-value			2.06*	-0.37	1.14
Fruit diameter (cm)	BIP's				0.1451	0.0624
	F_3				0.1662	0.0622
	Z-value				-0.09	-0.01
Total yield (kg/plant)	BIP's					0.0085
	F_3					0.4054**
	Z-value					-1.85

*, **, Significant at 5 and 1% levels, respectively.

about the association between the two characters. Genotypic correlation provides a measure of genetic association between the characters and normally used in selection, while environmental as well as genetic architecture of a genotype plays a great role in achieving higher yield combined with better quality. Results pertaining to inter-relationship among various economic characters for crosses, viz. KS-352 x Punjab Barsati and Punjab Sada Bahar Baingan x Punjab Barsati are presented in Table-1 and Table-2.

In both biparental as well as F_3 progenies, number of fruits per plant showed no correlation with fruit

Table-2 : Phenotypic correlation coefficient between different pairs of characters in Biparental and F3 progenies in cross Punjab Sada Bahar Baingan x Punjab Barsati

Character		Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Total yield (kg/plant)	Plant height (cm)
No. of fruits per plant	BIP's	-0.2300	0.1109	-0.0248	0.7834**	0.4793**
	F_3	-0.2071	0.0413	-0.0943	0.5838	0.1774
	Z-value	0.17	0.30	0.31	1.69	1.50
Fruit weight (g)	BIP's		0.4826**	-0.350	0.6719**	0.1491
	F_3		0.4793	0.1016	0.6044	0.5777
	Z-value		0.01	-2.05*	0.50	-2.23*
Fruit length (cm)	BIP's			-0.3602**	0.2988**	0.2597
	F_3			-0.2359	0.4741	0.3305
	Z-value			-0.60	-0.90	-0.34
Fruit diameter (cm)	BIP's				0.1945	0.0382
	F_3				-0.0334	0.1561
	Z-value				1.01	0.86
Total yield (kg/plant)	BIP's					0.4750**
	F_3					0.5284
	Z-value					-0.31

*, **, Significant at 5 and 1% levels, respectively.

Table-3: Path co-efficient analysis showing direct (bold values) and indirect effects of different plant characters on total yield at phenotypic levels in Biparental and F_3 progenies in cross KS-352 x Punjab Barsati

Character		No. of fruits per plant	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Plant height (cm)
No. of fruits per plant	BIP's	0.6517	-0.1283	0.0369	-0.1265	0.0000
	F_3	0.7472	-0.1527	-0.0002	0.0001	0.0000
Fruit weight (g)	BIP's	-0.2361	0.6984	0.0207	-0.0051	0.0000
	F_3	-0.1459	0.7822	0.0215	0.0015	0.000
Fruit length (cm)	BIP's	0.1012	0.0613	0.2377	-0.0002	0.0000
	F_3	-0.0043	0.4368	0.0385	-0.0014	0.0000
Fruit diameter (cm)	BIP's	-0.0296	0.0843	0.0910	-0.0006	0.0000
	F_3	-0.0130	0.1775	-0.0066	0.0083	0.0000
Plant height (cm)	BIP's	0.0002	0.0848	0.0934	0.0000	0.0002
	F_3	0.0897	0.2907	0.0060	0.0004	0.0195

weight, fruit length and fruit diameter in cross KS-352 x Punjab Barsati and Punjab Sada Bahar Baingan x Punjab Barsati indicating that these characters will respond independently to selection. Absence of any correlation of number of fruits per plant with fruit weight and fruit diameter was also reported by (4). Significant positive association of number of fruits per plant with total yield in both crosses, indicated that with an increase in number of fruits per plant there will be corresponding increase in total yield. This might be due to the fact that these variables probably are governed by tightly linked genes. Therefore, to bring improvement in total yield, selection for higher number of fruits per plant will be more effective in both the crosses. Positive association of number of fruits per plant with total yield was also earlier reported by (5). Significant positive correlation of fruit weight with fruit length was observed in F_3 progenies in cross KS-352 x Punjab Barsati, but the intermating in F_2 population rendered correlation between fruit weight and fruit length to non-significant level in biparental progenies. Correlation of fruit weight with fruit diameter was significantly positive in both F_3 and biparental progenies in cross KS-352 x Punjab Barsati. This suggested that selection of genotypes on basis of both fruit length and fruit diameter will result in significant improvement in fruit weight in F_3 progenies. Whereas, in biparental progenies significant improvement can be made when selection is based only on fruit diameter. Similar correlation of fruit weight with fruit diameter was reported by (6). Fruit weight was positively correlated with total yield in all the crosses. Therefore, with increase in fruit weight, there will be corresponding increase in total yield either through fruit length or fruit

Table-4 : Path co-efficient analysis showing direct (bold values) and indirect effects of different plant characters on total yield at phenotypic levels in Biparental and F3 progenies in cross Punjab Sada Bahar Baingan x Punjab Barsati

Character		No. of fruits per plant	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Plant height (cm)
No. of fruits per plant	BIP's	0.6528	0.1330	0.0031	-0.0012	0.0005
	F_3	0.7249	-0.1464	0.0042	0.0012	0.0000
Fruit weight (g)	BIP's	0.1648	0.4897	0.0135	-0.0173	0.0001
	F_3	-0.1501	0.6939	0.0491	0.0130	0.0001
Fruit length (cm)	BIP's	0.0725	0.2083	0.0258	-0.0178	0.0104
	F_3	0.0299	0.3388	0.1059	-0.0030	0.0001
Fruit diameter (cm)	BIP's	0.0162	-0.1714	0.0101	-0.0494	0.0000
	F_3	-0.0684	0.0718	-0.0242	-0.0128	0.0000
Plant height (cm)	BIP's	0.3134	0.0730	-0.0073	-0.0019	0.0978
	F_3	0.1286	0.4084	0.0338	0.0020	-0.0443

diameter. Similar results were reported by (6). Absence of any correlation between fruit length and fruit diameter in both biparental and F3 progenies in cross KS-352 x Punjab Barsati indicated that genetic improvement in these traits can be made simultaneously by exercising selection pressure independently . Significant negative correlation of fruit length with fruit diameter in both biparental and F3 progenies in cross Punjab Sada Bahar Baingan x Punjab Barsati suggested that selection of genotypes with more fruit length. This negative correlation was reported earlier by (7). Non significant correlation of fruit diameter with total yield and plant height was observed in both the crosses., indicated that selection of genotypes with good fruit diameter will not effect total yield and both these characters respond independently to selection. Positive and significant correlation of total yield with plant height in all the crosses indicated that selection of plants with good height will be effective in increasing the yield. Similar results were reported by (8).

When we compare the significance of difference between correlation co-efficients of biparental and F3 progenies by Z-test, significant 'Z' values were observed for the character pair-number of fruits per plant and fruit weight (1.99), fruit weight and fruit length (2.38) and fruit length and fruit diameter (2.06) in cross KS-352 x Punjab Barsati and fruit weight and fruit length (2.05), fruit weight and plant height (2.23) in cross Punjab Sada Bahar Baingan x Punjab Barsati. The significant differences in correlation coefficients between the biparental and F_3 progenies might be due to the reason that intermating in F_2 generation breaks the linkages between different genes or breaks the linkage blocks, which lead to change in nature, extent and even direction of association between different traits. Therefore, its not only the nature and extent, but also the direction of correlation that can be changed by inter-mating in segregating generations.

Path co-efficient facilitates the partitioning of correlation co-efficients into direct and indirect effects of various characters on yield, and thus will be of great value to the plant breeders in yield improvement programmes Table-2 and Table-3. It was observed that maximum contribution towards total yield via direct effect was made by number of fruits per plant and fruit weight in both BIP's and F_3 progenies in both the crosses, by fruit length and plant height in BIP's in cross KS-352 x Punjab Barsati. This suggests that emphasis should be given on these characters in selecting good genotypes for improvement in yield (8) also observed that number of fruits per plant and fruit weight had maximum direct effect on yield. Positive direct effect of plant height on total yield was reported by (5). When we take indirect effects into consideration, it was observed that number of fruits per plant and fruit weight contributed maximum towards total yield via their indirect effects through different component characters, in both the crosses. Therefore, selection criterion based on number of fruits per plant and fruit weight can give better results for improvement of total yield in brinjal.

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