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Correlation studies and path analysis in bottle gourd [*Lagenaria siceraria* (Molina) Standl.]

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Abstract
The present investigation was carried out at Horticultural Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The experiment conducted on nine genotypes of bottle gourd was subjected to evaluate parameters of evaluation of bottle gourd [*Lagenaria siceraria* (Molina) Standl.] genotypes in Chhattisgarh plain. Correlation analysis revealed that fruit yield showed the high positive and significant correlation with days to first male flower, fruit girth, vine length, number of fruit per plant, average fruit weight and duration of crop. The path analysis revealed that positive and direct effect of fruit yield on average fruit weight, node number at first female flower, days to first female flower, node number at first male flower, first fruit harvest and fruit girth. Hence, direct selection for these traits may lead to the development of high yielding genotypes of bottle gourd.

Keywords: Bottle gourd, genotypes, genetic variability, path analysis, heritability, traits

Introduction
Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] belongs to the family Cucurbitaceae having chromosome number 2n = 22, originated in Southern Africa. Bottle gourd or white flowered gourd is commonly known as Lauki, it is one of the important cucurbitaceous vegetable cultivated in India. It is a monoecious, diploid, climbing or prostrate plant, solitary flowers and strictly cross pollinated due to its monoceious nature. Numerous health benefits are reported in bottle gourd including its anti-cancerous, cardio protective, diuretic, aphrodisiac, general tonic, antidote to certain poisons and scorpion stings, alternative purgative and cooling effects (Badmanaban and Patel, 2010). The fruit make delicious supplement to the human diet and 100 g of fruits contain nearly 96g water, 0.2g protein, 0.1g fat, 2.5g carbohydrate, 0.6g fiber, 0.5g minerals, 20mg calcium, 10mg phosphorus, 0.7mg iron, 0.3mg thiamine, 0.01mg riboflavin and 0.2 mg niacin and energy 1.2 cal. Genotypic correlation coefficient provides a measure of genotypic association between the characters and reveals the characters that might be useful as an index of selection. The path analysis facilitates the partitioning of correlation coefficients into the direct and indirect effects of component characters on yield and any other attributes. Keeping in this view, the present investigation was conducted to determine the characters and their direct and indirect effects on yield.

Materials and Methods
The present investigation was carried out at the Horticulture Research and Instruction farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during summer season, 2016-2017. The experiment was laid out in a randomized block design with three replications. Nine bottle gourd genotypes were evaluated for different quantitative characters. All the recommended cultural practices were adopted to raise a healthy crop. Data were recorded on five randomly selected plants with respect to characters *viz*., days to first male and female flower appear, node number at which first male and female flower appear, days to 50% flowering, number of branches per plant, vine length, days to first fruit harvest, fruit length (cm), average fruit weight (kg), fruit girth (cm), number of fruits per plant, fruit yield (q/ha) and crop duration. The data were subjected to statistical and biometrical analysis (Singh and Chaudhary, 1985).

Results and Discussion
Correlation coefficient is a statistical measure which is used to find out the degree and direction of relationship between two or more variables. In breeding, correlation coefficient analysis measures the mutual relationship between various characters and determines the component characters on which selection can be based for genetic improvement. Correlation analysis revealed that fruit yield per plot showed the high positive and significant correlation

with days to first male flower, fruit girth at both genotypic and phenotypic level, vine length, number of fruit per plant, average fruit weight and duration of crop at genotypic level only.

The path coefficient analysis which splits total correlation coefficient of different characters into direct and indirect effects on fruit yield per plant in such a manner that the sum of direct and indirect effects is equal to total genotypic correlation as presented in Table 2. The path coefficient analysis revealed that positive and direct effect of fruit yield on average fruit weight (2.96), node number at first female flower (2.76), days to first female flower (1.06), node number at first male flower (1.37), first fruit harvest (0.60) and fruit girth (0.23). Fruit length, days to first male flower, number of branch, days to 50% flowering, duration of crop, number of fruit per plant and fruit length showed negative and direct effects on fruit yield. In this analysis, fruit yield was taken as dependent variable and the rest of the characters were considered as independable variables.

Table 1: Genotypic and phenotypic correlation coefficient between fruit yield and its component traits in bottle gourd

S. no.	Character	Days to first male flower	Days to first female flower	50% flowering	Node number at first male flower	Node number at first female flower	Fruit length	Fruit girth	Vine length	First fruit harvest	No. of fruit per plant	No. of branch	Average weight (kg/fruit)	Duration of crop	Yield (kg)
1.	G		0.929**	0.458*	0.201	0.808**	0.071	-0.217	0.531**	0.907**	0.325	0.620**	-0.095	0.544**	0.544**
	P		0.851**	0.248	0.203	0.720**	0.054	-0.133	0.204	0.580**	0.302	0.460*	-0.115	0.515**	0.515**
2.	G			0.658**	0.458*	0.899**	0.037	-0.293	1.170**	0.603**	0.068	0.431*	-0.290	0.715**	0.078
	P			0.376*	0.426*	0.775**	0.086	-0.195	0.303	0.531**	0.080	0.385*	-0.276	0.709**	-0.028
3.	G				0.983**	0.843**	-0.045	-0.540 **	1.103**	-0.027	-0.740**	0.238	-1.067**	-0.071	-0.526**
	P				0.688**	0.568**	-0.054	-0.483	0.063	-0.009	-0.609**	0.170	-0.621**	-0.078	-0.297
4.	G					0.498**	0.140	-0.689**	0.616**	-0.382*	-0.768**	0.036	-0.620**	0.113	-0.281
	P					0.431*z	0.140	-0.271	0.153	-0.093	-0.690**	0.057	-0.564**	0.145	0.161
5.	G						0.272	-0.707**	0.598**	0.534**	-0.182	0.240	-0.551**	0.399**	-0.533**
	P						0.252	-0.472**	0.117	0.259	-0.186	0.198	-0.512**	0.79*	-0.330
6.	G							-0.969**	-1.256**	-0.343	-0.186	-0.641**	0.234	0.191	-0.689**
	P							-0.480**	-0.364	-0.127	-0.180	-0.315	0.227	0.200	-0.436*
7.	G								0.687**	0.130	0.680**	0.224	0.371*	-0.022	0.918**
	P								0.061	0.318	0.449*	0.195	0.197	0.025	0.523**
8.	G									-0.502**	-0.369*	0.894**	-0.609**	1.030**	1.894**
	P									0.168	-0.084	-0.035	-0.120	0.309	0.299
9.	G										0.940**	0.905**	0.088	0.349	0.075
	P										535**	0.670**	0.042	0.325	0.033
10.	G											0.514**	0.661**	0.284	0.471**
	P											0.265	0.588**	0.278	0.222
11.	G												-0.155	0.090	0.135
	P												-0.101	0.078	0.211
12.	G													0.238	0.546**
	P													0.167	0.333
13.	G														0.425*
	P														0.268
14.	G														
	P														

Table 2: Direct and indirect effect of component character on fruit yield in bottle gourd

Character	Days to first male flower	Days to first female flower	50% flowering	Node number at first male flower	Node number at first female flower	Fruit length	Fruit girth	Vine length	First fruit harvest	No. of fruit per plant	No. of branch	Average weight (kg/fruit)	Duration of crop
Days to first male flower	-2.30	0.98	-0.27	0.27	2.23	-0.18	-0.05	-0.08	0.55	-0.12	-0.53	-0.28	-0.24
Days to first female flower	-2.13	1.06	-0.39	0.62	2.48	-0.09	-0.06	-0.19	0.36	-0.02	-0.36	-0.86	-0.32
50% flowering	-1.05	0.70	-0.59	1.34	2.33	0.11	-0.12	-0.18	-0.01	0.29	-0.20	-3.16	0.03
Node number at first male flower	-0.46	0.48	-0.58	1.37	1.39	-0.35	-0.15	-0.10	-0.23	0.30	-0.30	-1.84	-0.05
Node number at first female flower	-1.85	0.94	-0.50	0.68	2.76	-0.69	-0.16	-0.10	0.32	0.07	-0.20	-1.63	-0.18
Fruit length	-0.16	0.03	0.02	-1.95	0.75	-2.54	-0.22	0.21	-0.20	0.07	0.54	0.69	-0.08
Fruit girth	0.49	-0.31	0.32	-0.94	-1.95	2.46	0.23	-0.11	0.07	-0.26	-0.19	1.12	0.01
Vine length	-1.22	1.24	-0.65	0.84	1.65	3.19	0.15	-0.16	-0.30	0.14	-0.72	-1.80	-0.46
First fruit harvest	-2.08	0.64	0.015	-0.52	1.47	0.87	0.03	0.08	0.60	-0.37	-0.77	0.26	-0.15
No. of fruit per plant	-0.74	0.07	0.44	-1.05	-0.50	0.47	0.15	0.06	0.57	-0.39	-0.44	1.96	-0.12
No. of branch	-1.42	0.45	-0.14	0.04	0.66	1.63	0.05	-0.14	0.55	-0.20	-0.85	-0.45	-0.04
Average weight (kg/fruit)	0.21	-0.30	0.63	-0.85	-1.52	-0.59	0.08	0.10	0.05	-0.26	0.13	2.96	-0.10
Duration of crop	-1.25	0.76	0.64	0.15	1.10	-0.48	-0.005	-0.17	0.21	-0.11	-0.07	0.70	-0.45

Residual effect- 0.00767

Conclusion

Correlation analysis revealed that fruit yield showed the high positive and significant correlation with days to first male flower, fruit girth, vine length, number of fruit per plant, average fruit weight and duration of crop. The path analysis revealed that positive direct effect of fruit yield on average fruit weight, node number at first female flower, days to first female flower, node number at first male flower, first fruit harvest and fruit girth. Hence, direct selection for these traits may lead to the development of high yielding genotypes of bottle gourd.

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