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Genetic variability of sponge gourd (*Luffa cylindrica* L. Roem.) and it's morphological characterization

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Abstract
Sponge gourd [*Luffa cylindrica* (L.) Roem.] is an important vegetable crop having chromosomes (2n=26). It is an annual climbing plant with cross pollinated nature. It is difficult to assign with accuracy the indigenous area of *Luffa* species. Sponge gourd is an annual climber and monoecious vegetable. There is wide variability in size of fruit; ranging from a few centimeters to one meter, fruit shape and colour as traits are complex and controlled by several genes. The experiment conducted on 15 genotypes of sponge gourd was subjected to evaluate parameters of variability, correlation and path analysis for fruit yield and its attributing traits. Significant variations were observed for all the character in all the genotypes used in the experiment. The analysis of variance revealed that mean sum of squares due to genotypes was highly significant for all characters except days to first fruit harvest. Highest genotypic and phenotypic variation were observed for fruit yield q/ha followed by fruit length, fruit yield per plot, vine length, number of fruit per plant and average fruit weight. The fruit yield q/ha followed by fruit yield per plot, number of fruit per plant, average fruit weight, days to 1st fruit harvest, fruit girth and fruit length showed high heritability coupled with high genetic advance. Hence, selection for these traits for improving fruit yield per plot in sponge gourd is suggested.

Keywords: Sponge gourd, genotypes, path analysis, heritability, traits

Introduction
Sponge gourd [*Luffa cylindrica* (L.) Roem.] is an important vegetable crop having chromosomes (2n=26). It is an annual climbing plant with cross pollinated nature. It is difficult to assign with accuracy the indigenous area of *Luffa* species. They have a long history of cultivation in tropical countries of Asia and Africa. Indo-Burma is reported to be the center of diversity for sponge gourd and is originated in subtropical Asian region particularly India (Kalloo, 1993) [4]. *Luffa* commonly called sponge gourd, loofah, vegetable sponge, bath sponge or dish cloth gourd, is a member of cucurbitaceous family.

The sponge gourd is now widely cultivated in Malaysia, Korea, Japan, Taiwan and China for medicinal purpose. In India the crop is widely grown in U.P., Bihar, W.B., Orrissa and Kerala (Arya and Prakash, 2002) [2]. In Chhattisgarh, sponge gourd is being grown on about 2597 ha with an annual production of 23447 MT (Anon 2017) [1] particularly in Mahasamund, Kanker, Raigarh, Korba and Koria district.

The tender fruit used as vegetable which is easily digestible and increases appetite when consumed. The edible fresh and tender fruit contains 94 percent moisture and large number of chemical components including 16Cal per 100g with 9.5g carbohydrates, 2g of protein, 0.25g of fat, 10ug of vitamin A. Besides being a vegetable, the mature, dry fruit consist of a hard shell surrounding a stiff, dense network of cellulose fibre (sponge) which is a good source of fiber used in industries for filler and cleaning the motor car, glass wares (Obah and Aluyor, 2009).

Sponge gourd is an annual climber and monoecious vegetable. There is wide variability in size of fruit; ranging from a few centimeters to one meter, fruit shape and colour as traits are complex and controlled by several genes (Beyer *et al*., 2002; Zalapa *et al*., 2006) [3]. Evaluation of genotypes to assess the exiting variability is considered as preliminary step in any crop improvement programme. In order to pursue an effective breeding programme, the present investigation was carried out to gather information on genetic variability, heritability, correlation and path analysis for different characteristics of sponge gourd.

Material and Methods
The genotype were sown using randomized block design with three replication at Horticulture Reaserch and Instruction farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during

summer season, 2016-2017. The present investigation comprised 15 genotypes of sponge gourd.

Observations

Observation on five randomly selected plants from each replication were recorded for days to male flower appears, days to female flower appears, 50% flowering, node number of male flower, node number of female flower, vine length (cm), number of branch per plant, days to 1st fruit harvest, number of fruit per plant, fruit length (cm), fruit girth (cm), average fruit weight (g), duration of crop (sowing to last harvest), fruit yield per plot (kg) and fruit yield (q/ha).

Results and Discussion

Genotypic and phenotypic coefficient of variation are simple measure of variability, these measures are commonly used for the assessment of variability. The relative value of these types of coefficients gives an idea about the magnitude of variability present in a genetic population. Thus, such as genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were computed. The phenotypic coefficient of variation was marginally higher than the corresponding genotypic coefficient of variation indicated the influence of environment in the expression of the character under study. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are categorized as low (less than 10%), Moderate (10-20%) and high (more than 20%) as suggested by Sivasubramanian and Madhavamenon (1973) [6].

Genotypic and phenotypic coefficients of variation of different characters are presented in Table 1-2. High magnitude of genotypic as well as phenotypic coefficient of variations were recorded for traits viz., fruit yield q/ha (23.87 to 31.87), fruit length (17.64 and 18.98), fruit yield per plot in kg (16.37 and 30.90), vine length (16.05 and 18.86), number of fruit per plant (12.95 and 20.18), and average fruit weight (11.66 and 17.27), suggested that substantial improvement on sponge gourd through selection for these traits. Moderate GCV and PCV were recorded for fruit girth (10.66 and 13.53), node number of male flower (8.29 and 9.30), node number of female flower (5.60 and 5.96), days to first female flower appears (4.96 and 5.91), number of branches per plant (4.29 and 6.07) and days to first male flower appears (4.05 and 7.83) suggested existence of considerable variability in the population. Selection for these traits may also be given the importance for improvement programme. Characters 1st like days to 50% flowering (2.26 and 3.23), days to fruit harvest (0.88 and 2.56) and duration of crop (1.21 and 1.87) had low genotypic and phenotypic coefficient of variation.

Table 1: Analysis of variance for fruit yield and its component characters in sponge gourd

S. no.	Character	Mean sum of square		
		Replication (2)	Treatment (14)	Error (28)
1.	Days to Ist male flower appearance	23.09	36.46*	17.39
2.	Days to Ist female flower appearance	3.35	35.65**	4.37
3.	Days to 50% flowering	1.28	12.86**	3.29
4.	Node number at 1st male node	0.05	1.27**	0.10
5.	Node number at 1st female node	1.44	1.89**	0.07
6.	Length of vine	565.25	4780.34**	532.75
7.	No. of branches	6.77	10.57**	2.64
8.	Days to first fruit harvest	4.04	5.81	4.13
9.	No. of fruit per plant	3.56	40.69**	13.13
10.	Average fruit weight	11263.89	13924.84**	3960.31
11.	Fruit length (cm)	0.41	40.31**	2.01
12.	Fruit girth (cm)	0.46	4.35**	0.73
13.	Duration of crop (sowing to last harvest)	2.03	12.32**	3.87

Table 2: Parameters of variability for fruit yield and its components in Sponge gourd

S. No.	Parameters	Range			Cofficient of Variation (%)		h^2(b) %	G.A. as % of mean
	Character	Minimum	Maximum	Mean	GCV	PCV		
1	Days to male flower	55.00	70.66	62.22	4.05	7.83	26.75	09.14
2	Days to female flower	56.00	69.33	65.11	4.96	5.91	70.41	28.52
3	Days to 50% flowering	75.00	82.66	78.93	2.26	3.23	49.24	07.06
4	Node no. of male flower	6.20	8.53	7.54	8.29	9.30	79.50	28.51
5	Node no. of female flower	12.46	15.06	13.89	5.60	5.96	88.50	25.26
6	Vine length (cm)	174.66	346.33	234.27	16.05	18.86	72.40	28.12
7	No. of branches per plant	32.86	40.46	37.87	4.29	6.07	49.98	6.25
8	Days to 1st fruit harvest	82.53	88.00	90.38	0.88	2.56	11.88	58.00
9	No. of fruit per plant	18.80	30.13	21.65	12.95	20.18	41.15	83.18
10	Fruit length (cm)	8.64	25.14	20.25	17.64	18.98	86.35	62.42
11	Fruit girth (cm)	6.40	11.69	10.30	10.66	13.53	62.12	56.12
12	Average fruit weight (g)	276.66	560.00	494.11	11.66	17.27	45.61	68.84
13	Duration of crop	135.00	146.66	138.28	1.21	1.87	42.05	8.85
14	Yield per plot (Kg)	10.28	23.70	15.13	16.37	30.90	28.05	83.93
15.	Yield (q/ha)	71.41	164.83	110.03	23.87	31.87	56.09	83.93

GCV, Genotypic coefficient of variation, PCV, Phenotypic coefficient of variation, h^2, heritability, GA, Genetic advance

Conclusion

Phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) for all the traits indicating that environmental factors were influencing the expression of traits. Wide difference between phenotypic and genotypic coefficient of variations indicated their

sensitiveness to environmental fluctuations whereas narrow difference showed less environmental interference on the expression of these traits. The traits which showed high phenotypic and genotypic coefficient of variations are of economic importance and there is scope for improvement of these traits through selection.

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