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Physiological Evaluation of different Genotypes and their F_1 Progenies in Bottle Gourd (*Lagenaria siceraria* Mol. Standl

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Abstract
Variability is the most important characteristic feature of any population therefore estimation of genetic variability is an important prerequisite for realizing response to selection as the progress in breeding depend upon its amount, nature and magnitude. The breeder should have the capability of distinguishing the genetic and non-genetic components of variation occurring in a population. In the present investigation, a similar analysis of variability along with the findings of mean and Range was carried out for 13 physiological traits in eight parental lines and twenty eight crosses derived from these parental lines. Significant variations in all the traits were obtained except Stomatal conductance. Among the 8 parental lines and 28 crosses, Narendra Dharidar, Pusa Santushti, Samrat and several crosses derived from these parents exhibited higher values for most of the physiological traits.

Keywords: Genetic variability, Mean, Range, Physiological traits

1. Introduction

Bottle gourd is botanically known as *Lagenaria siceraria* (Mol.) Standl. (Synonyms *L. vulgaris* scr. *L. leucantha* (Duch) Rusby.) and its chromosome No. is 2n = 24.Bottle gourd belongs to the genus *Lagenaria* that is derived from word *lagena*, meaning the bottle. In the older literature it is often referred to as *Lagenaria vulgaris* (common) or *Lagenaria leucantha* (white flowered gourd), but now it is known as *Lagenaria siceraria***.**

Crop productivity is dependent on its inherent capacity for photosynthesis, photosynthetic area and availability of PAR within the canopy. Thus the genotypic variation in productivity of a crop may be related to physiological parameters by the canopy and partitioning to total photosynthates into economic and non-economic sink. The productivity in crops is limited by genotypic, environmental and physiological interactions. It is essential to investigate the constraints of productivity in soybean in relation to various morpho-physiological parameters and structural yield components. In order to delimit the constraints an analysis of Eco physiological complex is a prerequisite and it is necessary to investigate the extent to which macro and micro fluctuations that change the physiological processes and affect the productivity of plant. It is also essential to determine the transfer and sink utilization of assimilates in crop community. Photosynthetic efficiency and its relationship with various environmental parameters enable determination as well as prediction of the productivity potential of the genotypes. Reduction in transpiration rate and stomatal conductance and concomitant increase in intercellular CO_2 concentration suggests that both stomatal factors were involved in the reduction of photosynthesis (Zhao *et al.,* 2003) [8] Higher WUE are often found to maintain lower leaf internal CO_2 concentration (c_i), as estimated by carbon isotope discrimination. However, lower c_i may result from reduced stomatal conductance, increased mesophyll (non-stomatal) conductance, or a combination of both. When genotypic variation for WUE is found, it may be important for plant breeding purposes to define whether such variation arises from differences in stomatal or non-stomatal restrictions to CO_2 uptake (Earl 2002) [4] Thus, the present study is done to study the variation, mean and range in the (Given in material and method) genotypes and their F_1s.

2. Material and Methods

The experimental materials for the present study comprised of eight promising and diverse genotypes of bottle gourd selected on the basis of genetic variability.

The selected parental lines *i.e.* (P_1) Arka Bahar, (P_2) Kashi Ganga, (P_3) Narendra Dharidar, (P_4) Samrat, (P_5) Pusa Naveen, (P_6) Pusa Santushti, (P_7) Punjab Komal, (P_8) Pusa Summer Prolific Long were crossed in the all possible combinations in diallel technique, excluding reciprocals to get 28 F_1 hybrids for the study of various Physiological parameters. The experimental material was sown in Randomized Block Design with three replications and spacing of 1.80 m x 0.90 m at horticultural farm JNKVV, Jabalpur.

2.1 Analysis of variance
The data were statistically analyzed on the basis of method described by (Panse and Sukhatme 1967) [7] to work out existing variance of observed traits.

1. Genotypic variance (σ^2_g) = $\frac{M_2 - M_3}{r}$
2. Phenotypic variance (σ^2_p) = $\frac{M_2 - M_3 + M_3}{r}$
3. Environmental variance (σ^2_e) = M_3

Skeleton of Analysis of Variance for Randomized Complete Block Design

Source of variation	d.f.	Sum of square	Mean sum of square	Expected MSS	F value
Replication	(r-1)	RSS	M_1	$\sigma^2e + g\sigma^2r$	RMS/ EMS
Genotype	(g-1)	TSS	M_2	$\sigma^2e + r\sigma^2g$	TMS/ EMS
Error	(r-1) (g-1)	ESS	M_3	σ^2e	
Total	**(rg - 1)**				

R = Number of replications
g = Number of genotypes
df = Degrees of freedom
RSS = Replication sum of square
TSS = Treatment sum of square
ESS = Error sum of square
M_1 = Mean square due to replication
M_2 = Mean square due to genotypes
M_3 = Mean square due to error

A significant value of F-test 5% and 1% level indicates that the genotypes differ significantly among themselves, which requires computing the critical difference (CD).

$$\text{Standard error of difference} \quad SE(d) = \sqrt{\frac{2\,EMS}{r}}$$

Critical difference (CD) = $t_\alpha \times SE_{(d)}$
where,
t_α = t-value at 1% and 5% probability level

2.2 Mean and Range
The average of recorded observation was calculated by dividing the Sum of all observation by total number of observations i.e. $\sum x_i / N$ while, Range was calculated to assess the smallest and the greatest term of a series of observation and thus provides the information about the variability present in the genotypes.

3. Result and Discussion
The ANOVA indicated that the mean sum of squares due to genotypes were highly significant for most of the traits under study viz., Photosynthetic rate, Ci, Transpiration rate, PARi, Water use efficiency, Carboxylation efficiency, Chlorophyll Content Index, Dry matter Production and Partitioning (Leaf), Dry matter Production and Partitioning (stem), Dry matter Production and Partitioning (branches), Dry matter Production and Partitioning (Reproductive Parts) and Dry matter Production and Partitioning (Total) except Stomatal conductance. The analysis of variance for the characters under study has been given in table 1.

The study of mean and range revealed that the degree of dispersion for photosynthetic rate ranged from 10.70µmol/m^2/s (Kashi Ganga x Pusa santushti) to 62.67 µmol/m^2/s (Narendra Dharidar) with mean of 29.14 µ mol/m^2/s and CV as 5.32%. Stomatal conductance recorded minimum of 0.10 mol/m^2/s (N. Dharidar, Pusa Santushti, Punjab Komal, Kashi Ganga x PSPL, N. Dharidar x Pusa Naveen,Pusa Naveen x Punjab komal, Punjab komal x PSPL) and maximum of 0.467mol/m^2/s (Kashi Ganga x Punjab komal) with mean value of 0.205 mol/m^2/sand CV as 22.14%. The Ci ranged from 78.87 g/m^2 (Arka Bahar x Kashi Ganga) to 959 g/m^2 (Narendra Dharidar) with mean value of 394.76 g/$m^2$and CV as 4.73%. The Transpiration rate ranged from 2.27m mol/m^2/s (Narendra Dharidar x Pusa santushti) to 5.33 m mol/m^2/s (Kashi Ganga) with mean value of 3.77 m mol/m^2/sand CV as 5.09%. PARi varied from1042.00(µmol/m^2/s) (samrat x Pusa summer prolific long) to 1864.00(µmol/m^2/s) (Samrat x Punjab Komal) with mean value of 1211.32(µmol/m^2/s) and CV as 2.23%, Water use efficiency ranged from 2.17µmol/m mol (Kashi Ganga x Pusa Santushti) to 26.37 µmol/m mol(Narendra Dharidar x Pusa Santushti) with mean value of 8.42 µmol/m moland CV as 11.16%, Carboxylation efficiency ranged from 216.13 µmol m^2 s^{-1}(Arka Bahar x Kashi Ganga) to 8145.03 µmol m^2 s^{-1}(Narendra Dharidar) with mean value of 2365.64 µmol m^2 $s^{-1}$and CV as 15.44%. The Chlorophyll Content Index recorded minimum of 52.60 (Kashi Ganga x Pusa Santushti) and maximum of 91.23 (Narendra Dharidar x Pusa Santushti) with mean value of 73.69 and CV as 2.05%. Dry matter Production and Partitioning (Leaf) varied from 116.87 g (Arka Bahar x Punjab Komal) to 150.90 g (Samrat x PSPL) with mean value of 132.03 g and CV as 3.82%. The average value of Dry matter Production and Partitioning (Stem) was recorded as 119.71 g with degree of dispersion from 114.37 g (Arka Bahar) to 121.17 g (Kashi Ganga x Punjab Komal) and 6.28% CV, Dry matter Production and Partitioning (Branches) had mean value of 119.73 g with CV 5.31% and range from 114.77g (Kashi Ganga x PSPL) to 139.77 g (Samrat x Pusa Santushti). Dry matter Production and Partitioning (Reproductive Parts) varied from 115.13 g (Pusa Santushti) to 185.10g (Samrat) while recording mean of 162.94 g and 5.10% CV and dry matter Production and Partitioning (Total) recorded minimum of 1037.57 g (Arka Bahar x Pusa Naveen) while maximum of 1272.93 g (Samrat) with mean value of 1124.39 g and CV 2.92%. The Mean and Range for the characters under study has been given in table 2. Similar findings in Bottle Gourd and related crops have been reported by (Bonner 1952) [3] for chlorophyll content index, (Anitha *et al.,* 2015) [2] for stomatal conductance, (Gupta *et al.,* 2012) [5] and (Anitha *et al.,* 2015) [2] for transpiration rate, (Hayatu *et al.,* 2010) [6] for carboxylation efficiency, (Ackerson *et al.,* 1980) [1] and (Anitha *et al.,* 2015) [2]

Table 1: Analysis of variance for physiological traits in Bottle gourd

Source of variation	d.f	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13
Replications	2	0.53	0.01	20.50	0.05	609.90	0.59	443941.70	11.07	9.53	6.62	4.27	1.12	74.79
Treatments	35	574.40 **	0.03	144123.80 **	1.65	56909.61 **	83.31 **	8744530.88 **	398.20 **	431.99 **	30.32 **	293.36 **	8603.18 **	9628.90 **
Error	70	2.40	0.00	348.74	0.04	735.91	0.88	133429.19	2.30	1.50	0.37	1.10	10.30	13.24
S. Ed ±	-	0.88	0.03	10.63	0.11	15.44	0.54	207.94	0.86	0.70	0.35	0.60	1.83	2.07
CD 5%	-	1.76	0.05	21.20	0.22	30.80	1.07	414.73	1.72	1.39	0.69	1.19	3.64	4.13
CD 1%	-	2.34	0.07	28.15	0.29	40.89	1.42	550.62	2.28	1.84	0.92	1.58	4.84	5.48

Table 2: Mean and Range for physiological traits in Bottle gourd

S. No.	Character	Mean	Range	
			Minimum	**Maximum**
X1	Photosynthetic rate µmol/m^2/s	29.14	10.70	62.67
X2	Stomatal conductance mol/m^2/s	0.20	0.10	0.47
X3	Ci g/m^2	394.76	78.87	959.00
X4	Transpiration rate m mol/m^2/s	3.77	2.27	5.33
X5	PARi (µmol/m^2/s)	1211.32	1042.00	1864.00
X6	Water use efficiency µmol/m mol	8.42	2.17	26.37
X7	Carboxylation efficiency µmol m^2 s^{-1}	2365.64	216.13	8145.03
X8	Chlorophyll Content Index (SPAD)	73.70	52.60	91.23
X9	Dry matter Production and Partitioning (Leaf) g	132.03	116.87	150.90
X10	Dry matter Production and Partitioning (Stem) g	119.71	114.37	121.17
X11	Dry matter Production and Partitioning (Banches) g	119.73	114.77	139.77
X12	Dry matter Production and Partitioning (Rep. Parts) g	162.94	115.13	185.10
X13	Dry matter Production and Partitioning (Total) g	1124.40	1037.57	1272.93

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5. Reference

1. Ackerson RC, Krieg DR, Sung JM. Leaf conductance and osmoregulation of field grown sorghum genotype. *Crop Science* 1980; 20(1):10-14.
2. Anitha YM, Vanaja V, Sunitha P, Sowmya P, Sathish G, Vijay Kumar. Performance of Blackgram Genotypes under Moisture Deficit Stress - Variability in Physiological and Yield Contributing Attributes. International Journal of Current Science 2015; 17:E82-89.
3. Bonner E. Formation of nodules on S. lispicta M. and devoid of specific strain of Rhizobium. Bull Institute of Agron Genentics Bloux 1952;18:218-219
4. Earl HJ. Stomatal and non-stomatal restrictions to carbon assimilation in soybean (Glycine max) lines differing in water use efficiency. Environmental and Experimental Botany. 2002; 48(3):237-246.
5. Gupta Sunita, Gupta NK, Arora Ajay, Agarwal VP, Purohit AK. Effect of water stress on photosynthetic attributes, membrance stability and yield in contrasting wheat genotypes. Indian Journal of Plant Physiology. 2012; 17(1):22-27.
6. Hayatu M, Mukhtar FB. Physiological Responses of Some Drought Resistant Cowpea Genotypes (*Vigna unguiculata* (L.) Walp) to Water Stress. Bayero Journal of Pure and Applied Sciences. 2010; 3(2):69-75.
7. Panse VG, Shukhatme PV. Statistical methods for agriculture workers (2ndeds.). Indian Council of Agriculture Research, New Delhi, 1967.
8. Zhao DKR, Reddy VG, Kakani J, Reddy J. Sullivan Growth and physiological response of cotton (*Gossypium hirsutum* L.) to elevated carbon dioxide and ultra violet-B radiation under controlled envirment condition. Plant cell Environ. 2003, 771-782.