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RESEARCH ARTICLE :

Traits association and variability study in blackgram [*Vigna mungo* (L.) Hepper]

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SUMMARY : The estimate of PCV was always higher than the GCV for all the observed traits. High GCV was observed for branches per plant (40.38), single plant yield (23.68) and clusters per plant (22.38). Likewise high PCV was recorded for branches per plant (83.83), single plant yield (50.80) and pods per plant (50.59). The high heritability estimate was observed for none of the traits while moderate heritability was recorded for 100 seed weight (32%) alone. Likewise, the estimated GA as % of mean was higher for branches per plant (40.07%), clusters per plant (26.98%) and single plant yield (22.74%). Association analysis revealed that the single plant yield exhibited direct positive and significant simple phenotypic correlation and higher direct association with pods per plant, branches per plant and seeds per pod. Single plant yield was increased with relative increases in these traits hence, emphasis had to be given on these traits in selection of genotypes for higher yield in blackgram.

KEY WORDS :
Variability, Blackgram, Rice fallow, Heritability, Association

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BACKGROUND AND OBJECTIVES

Blackgram [*Vigna mungo* (L.) Hepper], 2n=22) is a dual purpose legume which is widely grown in India and subcontinent over wide range of agro climatic conditions.This pulse crop is one of the rich source of vegetable protein and some essential mineral and vitamins for human body (Sohel *et al*., 2016). As its major portion of production presided in small and marginal landthis crop is succumbed to various biotic and abiotic stress. Terminal moisture is one among which cause major threats to blackgram production. Hence there is a need to adopt alternative strategy to meet out the sort fall in production.One of the potent alternatives is to exploitation of plant type suited for rice fallow condition (Kachave *et al*., 2015). Genetic variation presents in the base population forms the basis for extent of improvement made in the crop improvement programme. Understanding in nature of gene action and magnitude of genetic variability present in the crop played a crucial role in adapting effective crop improvement strategy (Gowsalya *et al*., 2016). Seed yield is the complex trait and is influenced by several component traits. Association studies dissect out the contribution of different component traits towards yield. The study on interrelationship between the component traits and seed yield provides basic for formulating effective breeding strategy. The prime objectives of present study was to understand the nature of genetic variability present in the F_2 population and inter-relationship among different component traits in blackgram to formulate effective breeding strategy for selection of better plant type suited for rice fallow condition.

RESOURCES AND METHODS

The experimental material comprised of 300 F_2 blackgram individuals of cross ADT 3 x PU 31 which were raised at Agriculture College and Research Institute, Madurai during *Rabi*,2015-16 season. Experiment was laid out in a Randomized Block Design with two replications. In each replication, seeds were sown in eight meter length plot with spacing of 30 x 10 cm. The standard package of practices recommended in the crop production guide was followed. Data on eleven quantitative traits *viz*., plant height, branches per plant, days to 50% flowering, days to maturity, clusters per plant, pods per cluster, pods per plant, pod length, seeds per pod, 100 seed weight and single plant yield were recorded for each of the plants in two replication. The statistical analysis and variance due to different sources was worked out according to Panse and Sukhatme (1967). Phenotypic and genotypic co-efficients of variation were calculated based on the method suggested by Burton (1952). Heritability and genetic advance as per cent of mean were estimated as per formula given by Johnson *et al.* (1955).The phenotypic and genotypic correlation co-efficients were calculated from phenotypic and genotypic variances and covariances and path co-efficients analyses were worked out as suggested by Dewey and Lu (1959).

OBSERVATIONS AND ANALYSIS

Genotypic co-efficient of variation (GCV) and phenotypic co-efficient of variation (PCV) are the good index of genetic variability and play an important role in understanding the extent and nature of genetic variability in the population studied. The estimate of genetic variability parameters is presented in Table 1. The proportion of PCV was always higher than the GCV for all the observed traits. High GCV observed in branches per plant (40.38) followed by single plant yield and clusters per plant with GCV of 23.68 and 22.38, respectively. Low GCV was registered by days to maturity followed by days to 50% flowering, pod length and 100 seed weight with GCV of 1.06, 3.01, 3.41 and 3.83 respectively. Similarly high PCV recorded for branches per plant (83.83) followed by single plant yield and pods per plant with 50.80 and 50.59, respectively. Moderate PCV recorded for plant height (16.58) and seeds per pod (15.74). Low PCV was noted for days to maturity (6.64), 100 seed weight (6.77) and days to 50% flowering (7.07).The PCV and GCV were high for number of pods per plant and single plant yield which indicated that these traits are under the control of additive gene action and highly responsive to early selection.

Table 1: Estimation of genetic parameters for yield and its component characters in F_2 for cross ADT 3 x PU 31

Traits / Parameters	Mean	Range	GCV	PCV	ECV	h^2 (Broad sense)	GA as % of mean
PH	21.01	13.60 – 32.50	8.18	16.58	14.43	24	8.31
BPP	1.40	0.00 – 3.50	40.38	83.83	73.46	23	40.07
DFF	34.35	31.5 – 41.5	3.01	7.07	6.40	18	2.65
DM	74.28	67.5 – 86.00	1.06	6.64	6.55	03	0.35
CPP	4.79	2.00 – 7.500	22.38	38.25	31.02	34	26.98
PPC	3.08	1.50 – 5.00	4.91	37.50	37.82	-2	-1.33
PPP	14.42	3.00 – 35.00	20.61	50.59	46.20	17	17.30
SPP	6.69	4.50 – 9.00	8.52	15.74	13.23	29	9.49
PL	4.33	3.65 – 4.80	3.41	8.41	7.69	16	2.84
100SW	3.35	2.95 – 3.85	3.83	6.77	5.59	32	4.45
SPY	3.18	0.45 – 7.90	23.68	50.80	44.94	22	22.74

PH: Plant height, BPP: Branches per plant, DFF: Days to 50% flowering, DM: Days to maturity, CPP: Clusters per plant, PPC: Pods per clusters, PPP: Pods per plant, SPP: Seeds per pod, PL: Pod length, 100SW: 100 seed weight, SPY: Single plant yield

Present study was in agreement with early report of Sohel *et al*., 2016 and Raturi *et al*., 2014 in blackgram.

Heritability along with genetic advance estimates is more helpful in predicting relative gain under selection. These are good index of transmission of characters from parents to offspring (Khan *et al*., 2005). None of the trait observed with high heritability while moderate heritability was recorded in 100 seed weight (32%) alone. Low heritability observed for pods per cluster (2%) followed by pod length and pods per plant with 16% and 17%, respectively. The estimated GA as % of mean was higher for branches per plant (40.07%) followed by clusters per plant and single plant yield with 26.98% and 22.74%, respectively. Moderate GA recorded in pods per plant (17.30%) alone and low GA was noted for days to maturity (0.35%), days to 50% flowering (2.65%) and pod length (2.84%). These results were in conformity with report of Baisakh *et al*. (2016) in greengram and Sohel *et al*., 2016 in blackgram.

Knowledge of the relationship among yield components is essential for the formulation of breeding programmes aimed at achieving the desired combinations of various components of yield.The relative magnitude of simple and phenotypic correlation prevalence among different characters relating with yield and inter relationship between different yield attributes were furnished in Table 2. Single plant yield exhibited direct positive and significant simple phenotypic correlation with pods per plant (0.81) followed closely by clusters per plant, pods per cluster, seeds per pod and plant height with the correlation co-efficient of 0.52, 0.48, 0.32 and 0.30, respectively.Single plant yield was increased with relative increases in these traits hence, emphasis had to be given on these traits in selection of genotypes for higher yield in blackgram under rice fallow. Similar results were furnished by Baisakh *et al*. (2016) in greengram;

Table 2 : Estimates of simple correlation co-efficient among different characters in F_2 for cross ADT 3 x PU 31

Characters	PH	BPP	DFF	DM	CPP	PPC	PPP	SPP	PL	100SW	SPY
PH	1.00	0.36*	-0.02	0.01	0.22*	0.16*	0.33*	0.01	-0.09	0.06	0.30*
BPP		1.00	0.01	-0.01	0.07	0.09	0.17*	-0.07	-0.12	-0.05	0.15
DFF			1.00	0.88*	0.01	-0.05	-0.02	-0.04	0.03	-0.01	-0.01
DM				1.00	0.03	-0.04	-0.01	-0.10	0.01	-0.03	-0.01
CPP					1.00	-0.24*	0.56*	0.06	-0.04	0.08	0.52*
PPC						1.00	0.56*	0.08	0.06	-0.04	0.48*
PPP							1.00	0.05	-0.09	0.00	0.81*
SPP								1.00	0.59*	0.06	0.32*
PL									1.00	-0.02	0.09
100SW										1.00	0.15
SPY											1.00

* indicate significance of value at P=0.05

Table 3: Direct and indirect effects of yield components on seed yield in F_2 for cross ADT 3 x PU 31

Characters	PH	BPP	DFF	DM	CPP	PPC	PPP	SPP	PL	100SW	SPY
PH	-0.33	0.20	0.03	-0.02	-0.03	-0.27	0.53	0.29	-0.03	0.02	0.40
BPP	-0.09	0.71	-0.05	0.03	0.11	-0.04	-0.39	-0.26	0.15	-0.37	-0.20
DFF	-0.07	-0.27	0.13	-0.05	0.03	0.36	-0.79	-0.18	0.01	0.20	-0.64
DM	-0.18	-0.70	0.19	-0.03	0.18	0.78	-2.13	-1.06	0.21	0.54	-2.21
CPP	-0.04	-0.31	-0.02	0.02	-0.25	0.05	1.14	-0.09	0.04	0.30	0.85
PPC	-0.42	0.12	-0.22	0.12	0.05	0.21	-0.77	1.01	-0.27	0.17	0.00
PPP	-0.15	-0.24	-0.09	0.06	-0.24	0.14	1.17	0.20	-0.01	0.09	0.93
SPP	-0.11	-0.21	-0.03	0.04	0.03	-0.24	0.27	0.87	-0.27	0.06	0.40
PL	-0.03	-0.34	0.00	0.02	0.03	-0.18	0.03	0.75	-0.31	-0.15	-0.18
100SW	-0.01	-0.39	0.04	-0.02	-0.11	-0.05	0.17	0.07	0.07	0.67	0.43

Residual effect = .5336

Pushpa Reni *et al.* (2013) and Vijay *et al.* (2014) in blackgram.The inter correlation between yield contributing characters may affect the selection of component traits in desirable direction.The inter correlation of yield and its components showed that plant height exhibited inter correlation with yield through branches per plant (0.36) followed by pods per plant, clusters per plant and pods per cluster with correlation co-efficient of 0.33, 0.22 and 0.16, respectively. Similarly days to 50% flowering inter correlated with yield through days to maturity (0.88) and clusters per plant with yield through pods per plant (0.56). Likewise clusters per plant with yield through pods per plant (0.56) and seeds per pod with yield through pod length (0.59). These results were in agreement with the report of Reddy *et al.* (2011) and Reena Mehra *et al.* (2016) in blackgram.

Path co-efficient analysis provides the nature of association on yield and yield components in portioning into direct and indirect effects to specify the cause and their relative importance.Partioning of correlation coefficient into direct and indirect effect for 11 yield components on single plant yield was performed in F_2 generation and is presented in Table 3. Podsper plant had very high direct effect (1.17), followed by seeds per pod (0.87), branches per plant (0.71) and 100 grain weight (0.67). Moderate direct effect of 0.21 was observed with pods per cluster and low direct effect of 0.13 was registered by days to 50% flowering.This suggested a true relationship between these traits with seed yield per plant and direct selection for these traits would be rewarding for yield improvement. Similar findings also reported by Baisakh *et al.* (2016) in mung beanand Punia *et al.* (2014)in urdbean. Plant height had high indirect effect with single plant yield *via* seeds per pod in cross days to 50% flowering had high indirect effect with yield through pods per cluster. Moderate indirect effect was noticed through 100 seed weight. Days to maturity had high indirect effect with single plant yield from pods per cluster (0.78) and 100 seed weight (0.54) and exhibited moderate indirect effect through pod length. Clusters per plant had very high indirect effect of 1.14 through pods per plant. Pods per plant had moderate indirect effect through pod length (0.20). Seeds per pod exhibited moderate indirect effect *via* pods per plant (0.27). Pod length exhibited high indirect effect with single plant yield throughseeds per pod (0.75). This indicated that these traits are the important yield contributing traits which play an important role in the selection of elite genotypes with desirable combination of competent traits. Similar finding on these indirect and cause of these yield promoting traits were reported early by Kanimoli *et al.* (2015) in urdbean.

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