

Variability and Heritability in M₃ Mutants of *Vicia faba* L

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Abstract:- Twenty six mutant lines of *Vicia faba* L. were evaluated to assess range, PCV, GCV, ECV, Heritability, genetic advance and net genetic gain. The analysis revealed that there were wide range for all characters under study. Phenotypic coefficient of variability was found to be higher than genotypic and environmental coefficient of Variability for all the characters. Highest heritability was found for days to flower with highest genetic advance and net genetic gain. It is followed by Plant height. Where as lowest heritability was found for test weight for 100 seeds and lowest genetic advance and genetic gain was found for seeds/pod.

Keywords:- Heritability, Genetic Advance, Genetic Gain, Faba Bean.

I. INTRODUCTION

Vicia faba L. is one of the important Crops of Rabi season grown for its fruits and seeds. The plant also fixes atmospheric nitrogen in its roots increasing soil fertility. It is an important source of protein in the diet of many people in some countries like China, Syria, Egypt, Ethiopia, Sudan and Morocco.

Successful breeding programme depends on the magnitude of genetic variation in the population. Genetic variation can be induced through random mutagenesis which produces better crops varieties. Variation available, heritability of that variation and intensity of selection pressure that can be applied are the three main factors required for success in any breeding programme. In *Vicia faba* there is a lack of variation for most agronomic traits. Variability and heritability are important in plant breeding to improve agronomic characters and to develop new varieties. For this reason estimation of heritability coupled with genetic advance is essential for breeding programme [1], [2]. The present study has been undertaken to determine the estimates of variability, Heritability and genetic advance for yield and its components in 26 selected mutants of *Vicia faba* L.

II. MATERIALS AND METHODS

Seeds of a local cultivar of *Vicia faba* was subjected to 5Kr, 10Kr, 15Kr doses. The Seeds also treated with 0.75% aqueous solution of diethyl sulphate (DES). The seed were sown in the field to raise M₁. Seeds of M₁ Plant were sown in a plant to family manner to raise M₂ generation. The M₂ population were screened regularly in search of desirable mutations. Twenty Six mutants were selected for the present study. The M₃ populations of these mutants were raised in randomized block design. Observations on days to flower, plant height, number of branches, pods/plant, seeds/pod, seeds/plant, test weight of 100 seeds and yield/plant were recorded. Coefficient of variability were calculated according to Burton & Devane [3]. Genetic advance was worked out by adopting the formula [4]. The genetic advance as per cent of mean was categorized as a low (<10%), moderate (10-20%) and High (>20%).

III. RESULTS AND DISCUSSION

The mean values, range, coefficient of variability, Heritability, genetic advance and net genetic gain for yield and its components in 26 elite mutant lines of faba bean are presented in Table-1. It is apparent from the table that wide ranges among the mutant lines for seed yield and its components indicated the extent of variability present among the selected mutants for characters under the investigations, hence the wide range is desirable for breeders point of view. Days to flower ranged from 72.25 to 121.25, plant height ranged from 9.93 to 32.20, number of branches from 1.75 to 7.50, Pods/plant from 1.50 to 14.50, Seeds/pod from 1.25 to 2.81, seeds/plant from 2.00 to 27.75 and Test weight from 4.18 to 10.33. The yield/plant was ranged from 0.11 to 2.74. In the present study high PCV was found all characters. It was noticed that the values of PCV for yield/plant was maximum. Similar results were found [5]; [6]; [7]; [8]; [9].

Heritability and Genetic advance estimates interpret progress due to selection. In the present study highest estimates of heritability in broad sense was recorded for days to flower (92.79%). The moderate estimate of heritability (50-75) was recorded for Plant height (57.30%) whereas number of branches, pods/plant, seeds/pod, seeds/plant, test weight of 100 seed and yield/plant showed low estimate of heritability. Some also evaluate and supported the above findings [10]; [11]; [12] where as some

have reported high heritability values for all the characters studied [8].

Highest genetic advance (22.27) and net genetic gain (286.27) was recorded for days to flower while number of seeds/pod showed lowest value for both these parameters which were 0.25 and 3.21. Similar trend for genetic advance and net genetic gain was recorded for other traits also. The eight characters under study could be arranged in descending order for these two parameters as days to flower, plant height, seeds/plant, pods/ plant, number of branches, yield/plant, test weight of 100 seeds and seeds/pod. Genetic advance was also worked out in terms of percentage of mean values. These values ranged from 5.64 for test weight to 47.01 for yield/plant. Plant improvement in actual terms was worked out by subtracting the mean values for the control variety from the grand mean of M_3 generations. These values were expressed as percentage of increase or decrease over the control. The estimate of actual increase or decrease shows that for only two traits i.e. plant height and seeds/pod have a positive improvement of 5.83% and 3.72% respectively was recorded. Yield/plant, test weight and pods/plant showed tremendous decrease i.e. 29.52%, 27.88% and 23.18% respectively while seeds/plant and Number of branches showed medium order decrease is 14.29% and 9.54%. Days to flower had marginal decrease of 3.97%. It was observed that higher values of heritability for days to flower, plant height and seeds/plant were coupled with higher genetic advance indicating a better scope for improvement for these characters through straight selection. But direct selection seed yield, test weight and seeds/pod will not be much effective as indicated by low genetic advance for these traits. Similar results were supported in faba bean [12]

IV. CONCLUSION

Existence of sufficient variability in a crop is an important requirement for an effective crop improvement. In the present study high phenotypic coefficient of variability were recorded for all the traits than the Genotypic and environmental coefficient of variability indicate that environment plays a role in the expression of these traits. High heritability and genetic advance for days to flower and plant height indicate that these traits are controlled by additive gene action and can be improved through selection where as low heritability coupled with low genetic advance except days to flower and plant height indicate that selection is not effective because the traits are controlled by non-additive genes.

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Table 1. Summarising Mean Values, Range, Variability, Heritability, Genetic Advance and Net Genetic Gain for Yield and its Components in 26 Mutant Lines of faba bean (*Vicia faba* L.)

	Days to flower	Plant Height (cm.)	No. of Branches	Pods/Plant	Seeds/Pod	Seeds/Plant	Test wt. of 100 seed (g)	Yield/Plant (g)
General Mean \pm S.E.	87.15 \pm 2.21	18.15 \pm 2.66	2.94 \pm 0.99	6.53 \pm 2.76	2.23 \pm 0.45	14.57 \pm 6.74	7.45 \pm 1.80	1.17 \pm 0.58
Range	72.25 – 121.25	9.93 - 32.50	1.75 – 7.50	1.50 – 14.50	1.25 - 2.81	2.00 – 27.75	4.18 – 10.33	0.11 – 2.74
PCV	13 . 37	31 . 72	58 . 74	71 . 10	31 . 19	73 . 71	35 . 47	81 . 74
GCV	12 . 88	24 . 01	34 . 37	38 . 42	13 . 10	33 . 95	9 . 90	43 . 05
ECV	3 . 59	20 . 73	47 . 70	59 . 81	28 . 33	65 . 44	34 . 08	69 . 70
Heritability (%)	92 . 79	57 . 30	34 . 24	29 . 20	17 . 56	21 . 21	7 . 78	27 . 72
Genetic Advance	22 . 27	6 . 80	1 . 22	2 . 79	0 . 25	4 . 69	0 . 42	0 . 55
Genetic Advance as % of Mean	25 . 55	37 . 47	41 . 50	42 . 73	11 . 21	32 . 19	5 . 64	47 . 01
Actual improvement as % of Control	-3 . 97	5 . 83	-9 . 54	-23 . 18	3 . 72	-14 . 29	-27 . 88	- 29 . 52
Net genetic Gain	286 . 27	87 . 13	15 . 60	35 . 78	3 . 21	60 . 24	5 . 45	6 . 94