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FACTORS RESPONSIBLE FOR HARD SEEDEDNESS IN *VICIA FABA* L.

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ABSTRACT

Phenological, physiological and chemical factors were observed in 25 genotypes of faba bean during rabi 1983-84 and 1984-85. Hard seededness was correlated positively with hull percentage (r = 0.766; 0.886), tannin (r = 0.543; 0.422), and phenol content (r = 0.415, 0.475), but negatively with days from flowering to maturity (r = –0.608; –0.688) and hydration coefficient (r = –0.832; 0.945). Their importance is supported by coheritability, correlated response to selection and path coefficient analysis.

Key words: Faba bean, hard seed, phenological, physiological, chemical factors.

Hard seededness is one of the important characters of *Vicia faba* L. as it adversely affects cooking quality but increases seed viability. Seed coat thickness [1] and structure [2] are associated with hard seededness and both are influenced by environment [3] and heritable factors [4]. Hard seededness of *Vicia faba* can be improved by direct or indirect selection through component characters with sound genetic information. Hence, it is essential to study the variation for hard seededness and its associated traits in order to know the factors responsible for hard seededness in *Vicia faba* L.

MATERIALS AND METHODS

Twenty five genotypes of faba bean were planted in rabi 1983-84 and 1984-85 in randomized complete block design with four replications at Jabalpur (23.9°N, 79.58°E, altitude 411.87 m, soil type typical chromustent, soil texture clayey, pH 7.5, fertilizer level N 20 : P_2O_5 80 kg/ha, and spacing 15 x 30 cm). Observations were recorded on days to flowering, days from flowering to maturity, 100-seed weight (g), hull percentage (oven dry weight), hydration coefficient (percentage increase in seed weight after soaking in distilled water for 8 h), hard seed percentage [5], tannin mg/g [6], phenol mg/g [7], phytic acid mg/g [8], protein [9], oil [9], and phosphorus content [10]. Data were analysed for coheritability,

phenotypic correlation, correlated response to selection, and the direct effect of each character was estimated by keeping hard seed percentage as the dependent variable [11]. Metroglyph and index score analyses were also carried out to study the pattern of variation [12].

RESULTS AND DISCUSSION

A considerable amount of variation was observed among the cultivars for all the observed traits in both the years, 1984-85 and 1985-86. The mean value and range for various characters are presented in Table 1. For almost all the observed attributes there were at least two-fold, and in some instances up to six-folds, differences. Hull percentage and, to a lesser degree, tannin and phenol content, were highly and positively correlated with hard seededness (Table 1). Coheritability values show that they are linked with hard seed percentage. Correlated response to selection confirms that the selection for any of these characters will significantly increase the hard seededness.

Table 1. Mean and range of the observed characters and their relationship with hard seed percentage of *Vicia faba*

Character	Mean	Range	Year	Coheri-tability	Corre-lated res-ponse to selection	Pheno-typic corre-lation	Direct effect
Days from flowering to maturity	52.16	37.25-68.50	1984-85	-0.196	-2.954	-0.608**	-0.198
			1985-86	-0.133	-1.972	-0.688**	-0.110
100 seed weight (g)	19.36	12.0-29.75	1984-85	-0.352	-2.102	-0.343	-0.226
			1985-86	-0.462	-1.401	-0.290	-0.284
Hull (%)	13.79	9.00-19.52	1984-85	0.819	5.103	0.776**	0.219
			1985-86	0.604	3.514	0.886**	0.198
Hydration coefficient	17.50	48.50-225.50	1984-85	-0.864	-37.933	-0.832**	-0.572
			1985-86	-0.783	-40.638	-0.945**	-0.631
Tannin (mg/g)	0.62	0.37-0.95	1984-85	0.507	0.198	0.543**	0.324
			1985-86	0.241	0.088	0.422**	0.202
Phenol (mg/g)	0.61	0.14-1.00	1984-85	0.433	0.229	0.415**	0.289
			1985-86	0.352	0.178	0.475**	0.312
Protein (%)	23.52	17.32-30.12	1984-85	-0.226	-1.687	-0.245	-0.371
			1985-86	-0.203	-1.534	-0.219	-0.282
Phosphorus (%)	0.65	0.42-0.90	1984-85	-0.393	-0.117	-0.325	-0.411
			1985-86	-0.229	-0.066	-0.245	-0.322
Oil (%)	1.32	0.91-2.01	1984-85	-0.112	-0.071	-0.119	0.337
			1985-86	-0.110	-0.068	-0.117	0.302
Hard seed (%)	65.36	27.75-94.75	1984-85	—	—	—	—
			1985-86				

**Significant at 1% level. Residual effects: 1984-85 = 0.0768, and 1985-86 = 0.0962.

Days from flowering to maturity and hydration coefficient had negative direct effect and a negative correlation with hard seededness. This indicated that longer period from flowering to maturity and increase in hydration coefficient reduce hard seededness with increase in water absorption capacity of the seed. The correlated response to selection shows that hard seed percentage can be reduced significantly if selection is based on these characters.

Protein and phosphorus content and 100-seed weight had nonsignificant correlation with negative coheritability and correlated response to selection. Hence selection on the basis of 100-seed weight and protein content may also reduce hard seededness. Oil is the only component which had a positive direct effect on hard seededness, but negative correlation, coheritability and correlated response to selection for this character. The metroglyph analysis confirms this relationship (Fig. 1).

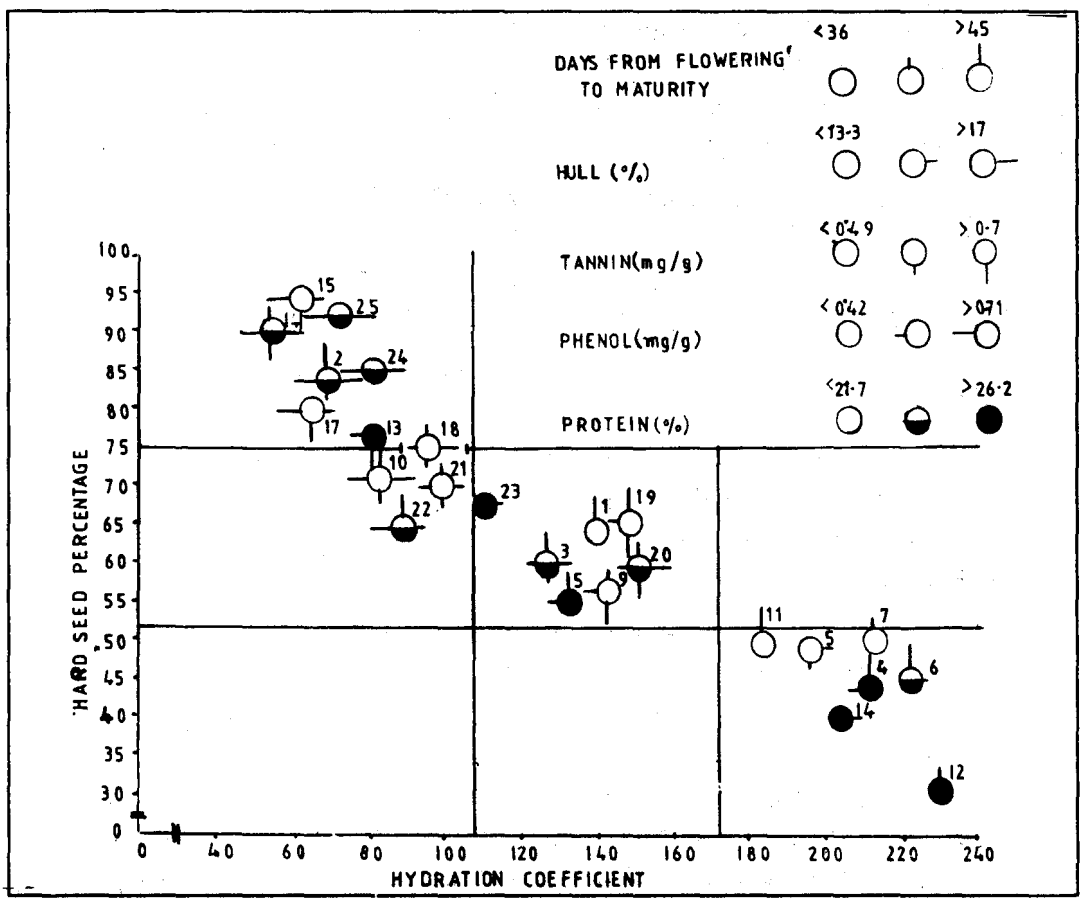

Fig. 1. **Metroglyph analysis showing the relationship of hard seededness with other characters in *Vicia faba* L.**

Genotypes with lower percentage of hard seed (< 50%) had the longest period from flowering to maturity with lower phenol, tannin and hull content, resulting in high hydration coefficient which ultimately creates favourable condition for germination. The genotypes with 50-75% hard seed and medium hydration coefficient took more days from flowering to maturity (50 $\pm$ 5). In such genotypes, at least one factor, i.e. hull percentage, tannin or phenol content, was high. The present investigation shows that reduction in the period from flowering to maturity with increase in hull percentage and quantity of tannin and phenol may cause more than 75% hard seed.

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