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VARIABILITY, HERITABILITY AND GENETIC ADVANCE FOR CERTAIN QUANTITATIVE CHARACTERS IN BLACK PEPPER

K. K. Ibrahim, V. Sukumara Pillai and S. Sasikumaran

Pepper Research Station, Panniyur, Taliparamba, Kerala

Potentiality of a crop to respond favourably to improvement programmes depends upon the nature and magnitude of variability and other genetic parameters of important quantitative characters. The breeder, on his part, should try to understand the crop he intends to improve, on such aspects. The present investigation is directed to work out the genotypic and phenotypic variability, heritability (broad sense), and genetic advance in pepper *(Piper nigrum* L,)

Materials and Methods

Data for this study were obtained from 28 hybrids and open-pollinated lines of pepper raised ss seedlings at the Pepper Research Station, Panniyur. Data on spike number, spike length (cm), berries per spike, 100 berry weight (g) and spike yield (g) during 1981-82, 1982-83 and 1983-84 were utilized for this purpose. Berries per spike and spike yield refer to the number of developed berries per spike and yield of green spikes respectively. The data on genotypes recorded over different seasons had been treated as two-way classified data and analyses of variance were done as in a randomised block design wherein treatments were replicated over seasons instead of blocks.

Genotypic variance was calculated from the relationship, $\sigma^2_v = \sigma^2_e + r\sigma^2_g$ where σ^2_v, σ^2_e and σ^2_g are varietal, error and genotypic variances and r is the number of seasons. Phenotypic variance was computed as $\sigma^2 + \sigma^2_e$. The coefficient of variation was estimated according to Burton (1952) and heritability (broad sense) by formula suggested by Hanson *et al.* (1956) white genetic advance was calculated by the formula suggested by Johnson *et al.* (1955). Genetic advance was calculated in this study at 5% selection intensity.

Results and Discussion

The spike yield, closely followed by spike number shows the maximum phenotypic coefficient of variation (Table 1). The lowest variability was shown by berry weight. The magnitude of change in the expression that can be achieved for a character will be related to the amount of variability shown by that character. In this regard, spike yield and spike number are the characters more amenable to improvement than other characters when selection is practised. However, it should be noted that the expression of a character as one observes in the field, is contributed partly by the genotype of the plant and partly by the environment. Only that part of the variation which is contributed by the genetic constitution, is heritable-

For a given genotype, the genetic contribution remaining the same, its variability will be governed by non-genetic factors. Hence, when heritability is high for a character, the variation shown by the character will be low, since, the contribution of non-genetic factor towards variability is in smaller proportion. As for such characters, expression can be predicted with reasonable level of reliability. Complex characters such as yield, the expression of which is modified by environment to a great extent, cannot be predicted with such reliability, if it is based only on its phenotypic performance. Therefore, it would greatly improve the precision in judging the expression of a character, if the concept of heritability is also considered simultaneously.

Table 1

Mean values and phenotypic variability for various characters

Character	Range	Mean	Phenotypic variance	Phenotypic coefficient of variation
Spike number	105.7 —1303.3	504.7	147972.08	76.22
Spike length (cm)	6.5 - 14.43	9.93	5.52	23.66
100 berry weight(g)	8.6 — 21.17	14.14	7.73	19.65
Berries per spike	16.96- 83.41	37.61	266,50	43.41
Spike yield (g)	486.0 — 6045.0	2089.0	3007393.0	83.02

Genetic coefficient of variation indicates the inherent variability of the character as unaffected by non-genetic factors. The spike yield and spike number are observed to have higher inherent variabiiity than other characters (Table 2), Berry weight shows the least variability in this regard also. The genetic gain will be more in characters such as spike yield and spike number than others.

Heritability indicates how much of the observed variation will be transmitted from parent to offspring. Heritability values ranged from 27.68 to 80.85 per cent. The maximum heritability was observed for berry weight followed by spike length. Spike yield shows very low value in this regard and is a shade better only to spike number. It suggests that these characters are considerably prone to the environmental fluctuations. A low estimate of heritability for yield was obtained also in crops like pearl millet by Burton (1951), soybean by Johnson *et al.* (1955), wheat by Sikka and Jain (1958) and cluster bean by Sanghi *et al.* (1964). From the view point of breeders, the character which are markedly influenced by environmental factors will not serve very useful as indices of selection. On the other hand Johnson *et si.* (1955) in their studies with soybeans pointed out that heritability estimates along with genetic gain were more useful than heritability alone in predicting the resultant effect of selection of superior genotypes. Heritability in association with the phenotypic variance determines the genetic advance for a character

Table 2

Genotypic variance, genetic coefficient of variation, heritability and genetic advance for various characters

Character	Genotypic variance	Genetic coefficient of variation	Herita-bility%	Genetic advance	Genetic advance as % of mean
Spike number	40964.44	40.10	27.68	219.34	43.46
Spike length	4.22 cm	20.69	76.45	3.70 cm	37.26
100berry weight	6.25g	17.67	80.85	4.63 g	32.73
Berries per spike	145.49	32,07	54.55	18.36	48.81
Spike yield	902674 g	45,48	30.02	1072.44g	51.34

at a given selection intensity. Genetic advance in pepper will mean the increase in the expression of a character in succeeding generation raised from the seeds collected from the selected genotypes. The expected improvement in the characters can be noted from the Table 2.

Genetic advance in per cent of mean values is given in Table 2. Spike yield showed the highest value with respect to this. Hence, there will be good scope for selection in this character in general, even though the predicted result may vary in tune with the environmental effects. Berry weight shows the lowest value, in spite of its high heritablIity. It suggests that the berry weight, unlike yield will produce only marginal improvement on selection. The range of variation of the predicted gain due to the interference of environment will be small in berry weight compared to other characters. On the other hand, the character, number of berries per spine combines medium heritability value and high genetic advance percent of mean, the value being next only to that of spike yield. This is a desirable point indeed and satisfies the concept of Johnson *et al.* (1955) in predicting the resultant effect of selection of superior genotypes.

Summary

Data on 28 genotypes of pepper recorded for three seasons, at the Pepper Research Station, Panniyur was utilized to estimate genotypic and phenotypic variability, heritability and genetic advance in certain quantitative characters of pepper. Spike yield and spike number have shown maximum genotypic and phenotypic variability, but lowest values for heritability. Berry weight has shown highest value for heritability and minimum genotypic and phenotypic variability. The character, spike yield was found to produce highest advance in the expression on selection, whereas only a marginal improvement need be expected for berry weight.

സംഗ്രഹം

പന്നിയൂർ കുരുമുളക് ഗവേഷണ കേന്ദ്രത്തിൽ, 28 കുരുമുളക് ജനുസ്സുകളിൽ നിന്ന് ശേഖരിച്ച ദത്തങ്ങളെ ആസ്പദമാക്കി, വിവിധ സ്വഭാവങ്ങളുടെ വ്യതിയാനം, പാരമ്പര്യാർജിനീയത, ജനിതക അഡ്വാൻസ് എന്നിവ വിശകലനം ചെയ്തിരിക്കുന്നു. തിരിയുടെ എണ്ണം, വിളവ് എന്നീ സ്വഭാവങ്ങളെ മറ്റുള്ളവയെ അപേക്ഷിച്ച് കൂടുതൽ വ്യതിയാനം കാണിക്കുന്നതായി അനുഭവപ്പെട്ടു. എന്നാൽ അതേസമയം അവയുടെ പാരമ്പര്യാർജിനീയത ഏറ്റവും കുറവായിരുന്നു. ജനിതക ഏറ്റവും കൂടുതൽ പ്രതീക്ഷിക്കാവുന്നത്, കുരുമുളകിന്റെ വിളവിലാണെന്ന് മനസ്സിലായി.

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