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VARIABILITY STUDIES FOR BIOCHEMICAL TRAITS IN BITTER GOURD*

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The importance of bitter gourd has long been recognised due to its high nutritive value and medicinal properties. It ranksfirst among the cucurbits with regard to the nutritive value of fruits particularly relating to Vitamin C, protein, phosphorus, potassium and iron contents (Choudhury, 1967). The variability among bitter gourd varieties for the various biochemical traits was ascertained in the present studies.

Materials and Methods

A total of 25 diverse types of bitter gourd maintained in the germplasm collection of the Department of Olericulture, College of Horticulture were raised in a randomised block design with three replications during 1977–78. The various biochemical constituents were analysed by randomly selecting fruits from every plant on the 18th day of flowering (at commercial maturity). Total soluble solids were estimated by refractometer, vitamin C content by the 2,6 dichlorophenol-indophenol visual titration method and protein content by the macro-kjeldahl method (AOAC, 1961). Phosphorus content was analysed colorimetrically by the vanadomolybdo-phosphoric yellow colour method, potassium content by the flame photometer and iron content colorimetrically by the orthopenanthroline red ferrous complex method (Jackson, 1973).

The variance components, genotypic coefficient of variation, heritability, genetic advance and genetic gain werecalculated according to the methods of Burton and Devane (1953). The genotypic, phenotypic and environmental correlation correlation coefficients were estimated as per the methods of A1-jibouri *et at.* (1955) and Johnson *et. al.* (1955 b).

Results and Discussion

The range, mean, standard error and, genotypic and phenotypic variances for different quality factors are given in Table 1. Except in total soluble solids, the range of variation was found to be quite wide and the differences among the types **were** highly significant.

This indicates that the available germplasm has sufficient amount of variation for these traits for which selection wilt be effective. From the estimates of phenotypicand genotypic variances (Table I), it may be seen that the major portion of total variation in all characters is constituted by the genotypic variance. Similar

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observations were also made by Srivastava and Srivastava (1976) in bitter gourd and Arya and Saini (1676) in chilli.

The variance components do not reveal the heritable portion of variability which is ascertained through the estimates of genotypic coefficient of variation and heritability. Apart from this, heritability and genetic advance should be jointly considered for arriving at reliable conclusions (Gandhi *et al.* 1964), Johnson *et al.* (1955a) have suggested that the heritability along with genetic gain is more useful in predicting the resultant effects for selecting the best individuals. Therefore, genotypic coefficient of variation, heritability and expected genetic advance and genetic gain were estimated and are presented in Table 2. The genotypic coefficients of variation estimated for vitamin C content, phosphorus content and soluble solids are above 15%. This indicates that the genetic variability for these traits is relatively higher among the varieties.

The estimates of heritability were generally high for all the traits except in protein content and iron content, where moderate estimates were obtained. The expected genetic advance estimated in absolute values has shown that by selecting five per cent superior plants from the available germplasm, it may be possible to improve the total soluble solids by 1.21 g, vitamin C content by 83.38 mg, protein content by 3.69 g, phosphorus content by 1 60.23 mg, potassium content by 74.44 mg and iron content by 6.27 mg per 100 g of fruit. The genetic gain estimate was high for vitamin C content (70.72%), iron content (51.81%), phosphorus content (40.80%) and total soluble solids (35.94 X), while it was low for protein content and potassium content. The quality factors such as vitamin C content, phosphorus content, iron content and total soluble solids, which showed high or moderate estimates of heritability and high genetic gain may be suggested to be due to the action of additive genes (Panse, 1957). Hence these traits can be improved directly through selection for obtaining superior varieties with improved quality traits. The rest of the quality factors, namely, potassium content and protein content may be controlled by the action of non-additive genes (Panse, 1957). There is thus only limited scope for improvement of these traits by selection.

In order to find out the association among biochemical traits, the genotypic, phenotypic and environmental correlation coefficients were worked out and are presented in Table 3. Robinson *et al.* (1951) had pointed out that the estimation of genotypic and phenotypic correlations are useful in crop improvement programmes over simple correlations. In the present study, it may be seen that the genotypic correlation coefficients were higher than the phenotypic correlation coefficients.

This indicates that there is a strong inherent association of the characters under study, but their expressions are impeded by the influenceof environmental factors. Srivastava and Srivastava (1976) obtained higher values of genotypic correlation coefficients between different pairs of characters in bitter gourd.

The study of intercorrelations among the biochemical traits showed that the total soluble solids had highly significant positive correlation with phosphorus content in the fruit (G=0.6303; P=0.5376]. Positive genotypic correlation detected between total soluble solids and vitamin C contenf was aiso highly significant [G=0.5011], but the phenotypic correlation was only signficant at five per cent level. Total soluble solids also had significant association with potassium

Table—1

Range, mean. standard error, phenotypic and genotypic variances for different quality factors

Character	Range	Mean	SE (m)	Pheno-typic variance	Geno-typic variance
Total soluble solids	2.07— 4.70	3,44	0 03	0.53	0.44
Vitamin C content [mg/100g]	60.71—223.02	117,90	0.23	1649.94	1644,12
Protein content [9/100 g]	14.26— 23.93	17.81	0.22	8.77	5.31
Phosphorus content [mg/100 g]	247.50—550.67	392·68	2.13	6715.31	6373.92
Potassium content [mg/100 g]	274.00—436.00	357.85	0.83	1589.32	1537.30
Iron content [mg/100 g]	6.77— 21.58	12.10	0.23	16.20	12.25

Table—2

Genotypic coefficient of variation [GCV] heritability [H], genetic advance [GA] and genetic gain [GG] for different quality factors

Character	Genotoplc coefficient of variation [GCV]	Heritability [H]	Expected genetic advance (GA)	Genetic gain [GG]
Total soluble solids	19.19	82.64	1.21	35.94
Vitamin C content	34.39	99.65	83.38	70,72
Protein content	12.94	60,55	3.69	20.74
Phosphorus content	20.33	94.9n	160.23	40.80
Potassium content	10.96	96.73	84,44	22.20
Iron content	28.92	75.65	6.27	51.81

Table 3

Genotypic (G), Phenotypic (P) and Environmental (E) correlation coefficients for different pairs of characters

Character		Vitamin C	Protein content	Phosphorus content	Potassium content	Iron content
Total soluble solids	G	0.5011**	0.3062	0.6303**	0 4669*	0.0259
-	P	0.4495*	0.2652	0.5376**	0.4116*	0.0486
	E	-0.1859	0.1859	-0.2202	-0.0797	0 1404
Vitamin C content	G		0.1846	0.1603	0.0795	-0.0065
	P		0.1469	0.1575	0.0751	-0.0068
	E		-0.0953	0.0174	-0.2688	-0.0462
Protein content	G			0.2334	0.5888**	0.1261
	P			0.1745	0.3654	0.0930
	E			-0.0174	-0.7468**	0.0247
Phosphorus content	G				0.5784**	0.2542
	P				0.5522**	0.2288
	E				-0.0481	0 1206
Potassium content	G					0.0985
	P					0 0811
	E					-0.0351

** Significant at 1% level

* Significant at 5% level

content. Highly significant, positive, genotypic correlation [G=0.5888] was also observed between protein and phosphorus contents in the fruit. Phosphorus content in turn was found to exhibit highly significant and positive association both at phenotypic and genotypic levels with potassium content [G=0.784: P=0.5522]. The environmental correlation coefficient was highly significant and negative only for the association between protein content and potassium content.

The association analysis among the different biochemical traits has thus revealed that the improvement of various quality factors is possible simultaneously. The results, therefore, indicated that breeding for the improvement of total soluble solids will definitely improve the vitamin C content and potassium content in the fruits, and yet maintain a reasonably high protein content [Weber and Moorthy, 1952; Kirti Singh *et al.*, 1972; and Varma *et al.*, 1976]. However forthe 1
improvement of iron ontent in the fruits, breeding has to be taken up seperately.

Summary

Genetic variability was estimated for various biochemical traits in a collection of 25 diverse types of bitter gourd at the College of Horticulture, Vellanikkara, Trichur. The differences among the types were highly significant for all the traits, The characters such as vitamin C content, phosphorus content total soluble solids and iron content having high or moderate estimates of heritability and high genetic gain are suggested to be controlled by additive genes and the rest of the traits by non-additive genes. The association analysis among the quality factors has indicated that the improvement of total soluble solids will improve the vitamin C content, phosphorus content and potassium content in the fruits and yet maintain a reasonably high protein content.

സംഗ്രഹം

ഇരുപത്തിഅഞ്ച് വ്യത്യസ്ത പാവയ്ക്ക (കയ്പ്പയ്ക്ക) ഇനങ്ങളിലെ ജൈവ രാസ ഗുണങ്ങൾ പഠനവിധേയമാക്കിയതിൽ ഈ വിവിധ ഗുണങ്ങളിലുള്ള വ്യത്യാസം സാർത്ഥകമാണെന്നു തെളിഞ്ഞു. ജീവകം C, ആകെ ഘരവസ്തുക്കൾ, ഭാവകം, ഇരുമ്പ് എന്നിവ മെച്ചപ്പെട്ട ആനുവംശിക സ്വഭാവവും ജനിതകനേട്ടവും കാഴ്ചവെച്ചതിനാൽ അവയെ അഡിററീവ് ഘടകങ്ങളാണ് നിയന്ത്രിക്കുന്നതെന്ന് കാണുകയുണ്ടായി. ജൈവരാസഗുണങ്ങൾ തമ്മിലുള്ള സഹബന്ധപഠനങ്ങളിൽനിന്നും പ്രജനനമാർഗ്ഗങ്ങളിലൂടെ മെച്ചപ്പെട്ട ഇനങ്ങൾ വികസിപ്പിച്ചെടുക്കുന്നതിനു സാദ്ധ്യതുള്ളതായി കണ്ടു.

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