Ascorbate and Carotenoid Content in an Indian Collection of Pumpkin (*Cucurbita moschata* Duch. ex Poir.)

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Cucurbita moschata Duch. ex Poir. (pumpkin) is grown throughout tropical and sub tropical countries. In India, pumpkin is the principal ingredient of several culinary vegetables utilized at the immature and mature fruit stage. Pumpkin provides a valuable source of carotenoids and ascorbic acid that have a major role in nutrition in the form of provitamin A and vitamin C as antioxidants, when used at ripening stage or after storage. Content of caroteniods in Spanish pumpkin was higher than that of other pumpkin varieties and even higher than that of beta carotene in carrots (5). In India, consumers prefer dark yellow color, round shape fruit with thick and deep yellow internal flesh colour (personal communication). Indian farmers generally grow their own saved seeds of land races because commercially produced seed is not easily available. Therefore, exploration and collection of pumpkin germplasm was done from main pumpkin growing areas of India with the objective of screening the pumpkin lines having high ascorbic acid and caroteniod content for further improvement in pumpkin quality (6).

After collection, all the germplasm was maintained by hand sib mating/selfing through two seasons. Seeing the homozygosity in the populations, a total of seventy accessions of pumpkin were selected from the genetic pool and grown in a randomized block design with three replications during July to November 2002. All recommended agronomical practices were adopted for good growth of the crop. Most of the fruit and plant characters were also observed during the cropping period. All the lines were monoecious. Number of fruits per plant varied from 1 to 3.5 and weighed from 1.25 to 9 kg each. Polar circumference of fruit ranged from 43 to 85 cm. Similarly equatorial circumference ranged from 43.33 to 95 cm. Fruit shape varied from round, flat round oval and oblong type. The fruit flesh of mature fruit varied in colour as several shades of vellow, deep yellow to orange with 2-5 cm thick flesh. For analysis of ascorbic acid and caroteniod, fruits were harvested at the fully matured stage. The ascorbic acid (mg/100g) content was estimated titrimatically using 2, 6- dichlorophenol dye method of Ranganna (7). Total carotenoids were extracted and partitioned in acetone and petroleum ether, respectively and estimated spectrophotometrically as described by Gross (1).

Data were averaged and statistically analyzed. The analysis of variance indicated highly significant differences between germplasm for ascorbic acid and carotenoids (3). This suggests that there is a considerable amount of variation among the germplasm. Mean, range, phenotypic (PCV) and genotypic (GCV) coefficient of variation is presented in Table 1. The variability estimate, in general, reveal that the phenotypic coefficient of variance (PCV) was higher than the genotypic coefficient of variance (GCV) but the differences was relatively low for ascorbic acid and beta-carotene (2). The estimates of PCV and GCV indicated the existence of a fairly high degree of variability for ascorbic acid and carotenoid content. The differences in PCV and GCV were minimum for beta carotene and ascorbic acid, indicating that these traits are least affected by environment. The range of ascorbic acid content was 1.53mg to 6.74mg with an overall average of 2.89 mg/100g of fresh weight. Similarly total carotenoid ranged from 2.34 mg to 14.85 mg with a population mean of 9.29 mg/100g of fresh weight. Carotenoid concentration in tropical pumpkin compares favorably with those summarized by Paris (4) for butternut squash. The highest ascorbic acid content was recorded in IVPK-222 (7.4mg) followed by IVPK-224-4 (4.61mg), SA-90(4.08mg), DR/SP-132(4.57mg) and IVPK-225(4.55 mg). The germplasm SA-90 with the maximum content of carotenoid (14.85mg) was considered as a promising line for carotenoid followed by Pumpkin-111 (14.19mg), BP-14(13.61mg), IVPK-225(13.29mg) and IVPK-226(13.08mg). The two constituents under study generally constitute the major portion of pumpkin quality.

Characters	Ascorbic acid (mg/100g)	Beta carotene (mg/100g)
Range	1.53-6.74	2.34-14.85
Population mean	2.89	9.29
GCV	31.73	33.19
PCV	32.13	33.97
CV (%)	19.84	7.5
CD at 5%	0.98	1.07
High value accessions	IVPK-222, IVPK-224-4, SA-90, DR/SP-132, IVPK-225	SA-90, Pumpkin-111, BP-14, IVPK- 225, IVPK-226

Table 1: Total carotenoids and ascorbate value of 5 most important accession out of 70, based on maximum value.



Figure 1. Carotenoid variability in the pumpkin collection.

Among the evaluated germplasm the genotype SA-90 was found to have superior beta carotene as well as ascorbic acid and favorable values for yield, equatorial and polar circumference of fruit, number of fruits per plant and average fruit weight. Therefore, SA-90 is the most promising genotype for beta carotene and ascorbic acid. The significant

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aspect of this work is that the lines with high ascorbic acid and carotenoids may be utilized for further quality improvement of pumpkin for these traits during the development of hybrids and varieties. These materials may be also utilized for study of gene action. All materials used for this study are maintained as inbreds.

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