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SHORT COMMUNICATION

Preliminary Evaluation of Some Cape Gooseberry (*Physalis peruviana* L.) Genotypes under Jammu Plains

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The present investigation aimed to assess 10 genotypes of cape gooseberry at SKUAST Jammu. A evaluation was conducted using a randomized complete block design in three replications. The significant amount of variation was observed among the genotypes for all the studied traits. High magnitude of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) values were observed for resistance against fruit cracking, acidity, pectin, total sugar, number of days to fruit set, fruit length, fruit breadth, yield per plant which indicates the presence of high genetic variation. The PCV was estimated to be higher than the GCV for all the observed traits. However, close estimates of GCV and PCV revealed that genetic variance played a major role in the phenotypic expression of most of the traits. As a result phenotypic selection is both effective and desirable. The magnitude of heritability ranged from 35.47% to 95.88% indicating the presence of additive gene action and the need for population improvement through selection. Considerable amount of genetic variability among the genotypes indicating greater potential of the genotypes for their exploitation to improve yield and its component traits. The genotypes have great potential for further improvement.

Key Words: Cape gooseberry, GCV, Genetic diversity, Heritability, PCV

Introduction

Cape gooseberry (*Physalis peruviana* L.) is a herbaceous under-exploited, exotic fruit crop grown for edible fruits. The genus *Physalis* belonging to the family Solanaceae is among the largest genera in subfamily Solanoideae with about 100 species. Cape gooseberry has entered the small fruits ranking and has also shown great promise for the national and international markets, with a high value as a fresh fruit with a unique flavour that appeals to the consumers for this berry (Rodrigues *et al*., 2014). It is also known as Jam fruit due to high pectin content, flavour, aroma, colour as well as nutritional importance and various health benefits (Puente *et al*., 2011). In India, it is grown successfully in some states like Madhya Pradesh, Uttar Pradesh, Haryana, Punjab, Nilgiri hills, West Bengal, and in some other parts of country. There is good scope and potential of this nutritive annual berry to be grown under the subtropical conditions of Jammu plains. This berry is gaining special attention particularly due to its high productivity, availability in lean period, wider adaptability, quick growing in nature, non-perennial occupation of land and luscious fruit with pleasant acidic taste. Introduction and evaluation is one of the important methods for bringing improvement in any fruit crop and for the selection of parents in a viable hybridization programme. The degree of genetic diversity influences the planning and execution of any breeding effort aimed at improving quantitative characters. As a result, plant breeding success is entirely dependent on the presence of genetic variability in desired traits and plant breeder selection skills (Tiwari *et al*., 2018). Hence, the knowledge of genetic variability, genetic advance and heritability are the key foundations for the improvement of the traits. Therefore, the present investigation was carried out to study the genetic variability, genetic advance and heritability in different genotypes of cape gooseberry under Jammu plains.

Materials and Methods

The present investigation was conducted at Research Farm, Division of Fruit Science, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu during the year 2020-2021. The experimental site is located at an elevation of 260 m above mean sea level in subtropical zone at 32º39᾽ N latitude

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and 74º48' E longitude. The climate of the experimental site is subtropical with hot and dry summer, hot and humid rainy season and cold winter months. The mean annual maximum temperature during summer rises up to 43^0C and minimum temperature during winter falls up to 2.4 ºC. Annual precipitation in this area is about 1,000-1,200 mm mostly during July to October (about 70 per cent). The experiment was laid down in Randomized Block Design with three replications. The experimental material consists of ten genotypes of cape gooseberry (*Physalis peruviana* L.) viz. CITH CGB Sel-1, CITH CGB Sel-2, CITH CGB Sel-3, CITH CGB Sel-4, CITH CGB Sel-5, CITH CGB Sel-6, CITH CGB Sel-7, CITH CGB Sel-8, CITH CGB Sel-9 and CITH CGB Sel-10 exotic material procured by ICAR-Central Institute of Temperate Horticulture (CITH) Srinagar. The seeds sown in the month of June in well prepared and raised seed beds and partially covered with paddy straw. The beds were irrigated on alternate days. When the plants attained the height of about 20 cm, the transplanting of seedlings was done in well prepared seed beds in each replication. Plant to plant and row-row spacing was 1m×1m. The transplanting was done on rainy season on 25th July, 2020. A total of 22 traits were analyzed. Five plants were randomly selected and tagged in each replication of the treatment for data collection. The data obtained were statistically analyzed using software Windostat ver. 9.3.

Genotypic and Phenotypic Coefficient of Variation

According to the formula given by Burton and Devane (1952) the genotypic and phenotypic coefficient of variation were calculated:

$$GCV\ (\%) = \frac{(\text{Genotypic variance})^{1/2}}{X} \times 100$$

$$PCV\ (\%) = \frac{(\text{Phenotypic variance})^{1/2}}{X} \times 100$$

GCV = Genotypic coefficient of variation

PCV = Phenotypic coefficient of variation

X = Mean of the character

Heritability

Heritability in broader sense (h^2b) defined as the proportion of the genotypic variance to the phenotypic variance. It was calculated using the following formula given by Allard (1960).

$$h^2b = \frac{\sigma^2g}{\sigma^2p} \times 100$$

σ^2g = genotypic variance

σ^2p = phenotypic variance

Genetic Advance (GA)

Genetic Advance was calculated by following formula given by Miller *et al*. (1958).

$GA = K\ \sigma p\ h^2$

K = Constant (standard selection differential) having value of 2.06 at 5% selection intensity

σp = Phenotypic standard deviation

h^2 = Heritability estimates

3.9.5 Genetic advance (per cent of mean)

$$\text{Genetic advance (\% of mean)} = \frac{\text{G.A.}}{X} \times 100$$

GA = Genetic advance

X = Mean of the character

Results and Discussion

The extent of variability among the different parameters in 10 genotypes of cape gooseberry are presented in Table 1. The results revealed that highest genotypic variance was observed for date of harvest (200.91) followed by date of initial fruit set (92.58), date of initiation of flowering (78.26), plant height (46.15), ascorbic acid (11.17), leaf area (10.94), total sugar (3.86), TSS (1.18), reducing sugar (1.06), non reducing sugar (0.94), fruit volume (0.94), shoot number (0.74), resistance to viral infection (0.44), fruit weight (0.38), resistance to fruit cracking (0.27), fruit length (0.12), acidity (0.05), pectin (0.04), carotenoids (0.01), yield (0.01) and the lowest was observed for stem thickness (0.003). The phenotypic variance was also highest for date of harvest (273.42) followed by date of initial fruit set (122.83), date of initiation of flowering (94.28), plant height (81.28), leaf area (30.84), ascorbic acid (14.73), total sugar (4.23), fruit volume (1.85), TSS (1.65), shoot number (1.45), reducing sugar (1.12), non reducing sugar (0.98), fruit weight (0.95), resistance to viral infection (0.48), resistance to fruit cracking (0.28), fruit breadth (0.24), fruit length (0.18), acidity (0.05), pectin (0.04), carotenoids (0.02), yield (0.01) and the lowest was recorded in stem thickness (0.01). Genotypic and Phenotypic coefficient of variability were higher in case of resistance against fruit cracking (39.40 and 39.77 respectively) followed by titratable acidity (33.50 and 34.31), non reducing sugar (24.66 and 25.18), reducing

Table 1. Descriptive statistics for extent of variability in traits among different genotypes of Cape Gooseberry (*Physalis peruviana* L.)

Parameters	Range			Coefficient of variation (%)		Heritability (h^2 %)	Genetic Advance	Genetic Advance (% of Mean)
	Minimum	Maximum	Mean value	GCV	PCV			
Stem thickness (cm)	2.95	3.15	3.03	1.78	2.91	37.31	0.07	2.24
Shoot number	13.61	16.07	14.77	5.82	8.17	50.75	1.26	8.54
Plant height (cm)	90.33	114.66	98.51	6.90	9.15	56.78	10.55	10.71
Leaf area (cm^2)	51.40	62.02	57.32	5.77	9.69	35.47	4.06	7.08
Time to initiate flowering (days)	31.69	62.20	54.24	16.31	17.90	83.00	16.60	30.61
Time of fruit set (days)	38.48	72.07	62.32	15.44	17.78	75.38	17.21	27.61
Time of harvesting (days)	86.50	134.28	119.08	11.90	13.89	73.48	25.03	21.02
Fruit weight (g)	11.10	13.37	12.29	5.34	7.94	40.27	0.81	6.59
Fruit length (cm)	2.00	3.04	2.42	14.60	17.57	69.10	0.61	25.01
Fruit breadth (cm)	2.31	3.47	2.82	15.21	17.52	75.39	0.77	27.20
Fruit volume (cc)	11.15	14.71	12.53	7.73	10.86	50.72	1.42	11.35
Yield (kg/plant)	0.88	1.26	1.11	8.87	12.55	49.99	0.14	12.92
TSS (º Brix)	9.48	12.61	11.15	9.74	11.54	71.27	1.89	16.94
Acidity (%)	0.41	1.10	0.71	33.50	34.31	95.37	0.48	67.40
Carotenoids (mg/100g)	1.13	1.60	1.39	9.81	12.33	63.32	0.22	16.09
Pectin (%	0.53	1.02	0.83	24.46	25.52	91.84	0.40	48.28
Ascorbic acid (mg/100g)	22.41	31.12	26.40	12.66	14.54	75.81	5.99	22.70
Reducing sugar (%)	2.68	5.48	4.22	24.47	25.13	94.85	2.07	49.10
Non reducing sugar (%)	2.55	5.27	3.94	24.66	25.18	95.88	1.96	49.74
Total sugar (%)	5.22	10.75	8.15	24.10	25.26	91.07	3.86	47.39
Resistance to viral infection (%)	0	3.70	2.94	22.55	23.79	89.86	1.29	44.03
Resistance to cracking (%)	0	2.00	1.33	39.40	39.77	98.18	1.07	80.43

sugar (24.47 and 25.13), pectin (24.46 and 25.52), total sugar (24.10 and 25.26), resistance to viral infection (22.55 and 23.79), date of initiation of flowering (16.31 and 17.90), date of initial fruit set (15.44 and 17.78), fruit breadth (15.21 and 17.52), fruit length (14.60 and 17.57), ascorbic acid (12.66 and 14.54), date of harvest (11.90 and 13.89), carotenoids (9.81 and 12.33), TSS (9.74 and 11.54), yield (8.87 and 12.55), fruit volume (7.73 and 10.86), plant height (6.90 and 9.15), shoot number (5.82 and 8.17), leaf area (5.77 and 9.69) whereas, the minimum GCV and PCV was observed in stem thickness (1.78 and 2.91). Similar results were also obtained by Prajapati *et al*. (2015) in tomato. Kerketta and Bahadur (2019) also reported that highest magnitude of GCV and PCV in tomato was observed in acidity (28.21 and 42.89 respectively) followed by TLCV incidence (28.04 and 40.51, respectively). The PCV was higher than GCV for all the traits. Results showed that there is a narrow difference between genotypic and PCV for traits such as stem thickness, date of initiation of flowering, date of harvest, TSS, titratable acidity, pectin, ascorbic acid, reducing sugar, non reducing sugar and total sugar which indicates that environment has less influence on expression of these traits. Hence, it can be concluded that genotypic variability had more contribution towards total variance indicating the good scope for crop improvement and selection among the genotypes. Higher GCV and PCV was observed for traits like shoot number, plant height, leaf area, fruit weight, fruit length, fruit breadth, fruit volume, yield indicating the higher magnitude of variability among these parameters. Robinson (1966) classified the estimate of heritability into three categories i.e. low (5-10%), medium (10-30%) and high (30% and above). In the present investigation all the traits showed high estimate of heritability which ranged from 35.47 per cent to 98.17 %. The high magnitude of heritability estimate in broad sense is useful in selection of superior genotypes but heritability combined with genetic advance are more effective for selection of best genotype than the heritability values alone. The traits of resistance to fruit cracking, titratable acidity, pectin, reducing sugar, non reducing sugar, total sugar and resistance against viral infection showed high heritability along with high genetic advance as percent of mean indicating that these traits are controlled by additive gene action which is a very important tool for selection and crop improvement while the traits including date of initiation of flowering, date of initial fruit set, date of harvest, yield, fruit length,

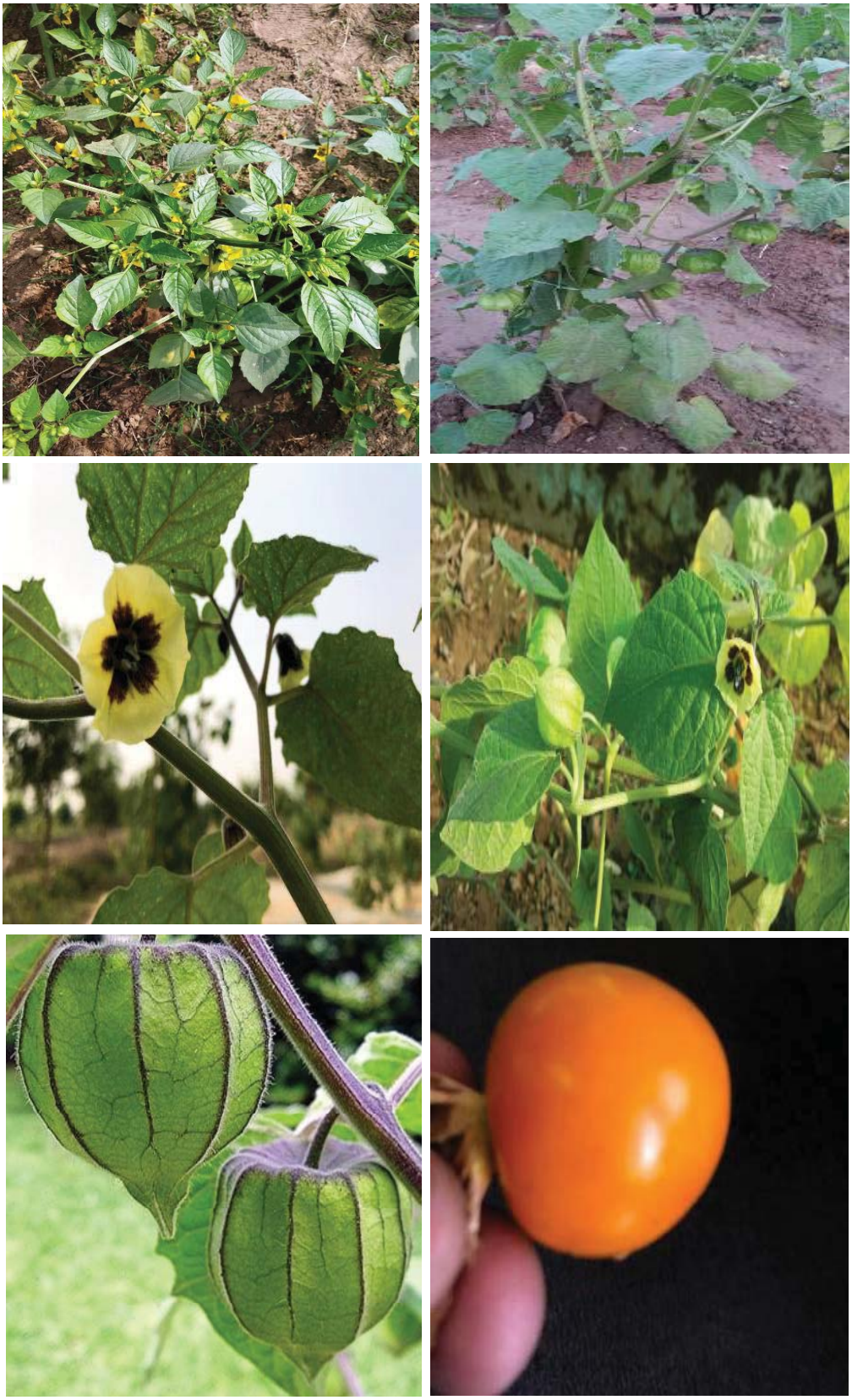

Fig. 1. Vegetative, flowering and fruiting in CITH CGB Sel-10 genotype

fruit breadth and fruit volume showed high heritability along with moderate genetic advance as percent of mean which indicates the presence of additive and non additive action of the genes and the phenotypic expression might be largely affected by the non additive genes. Heritability values were higher than those of genetic advance for all traits which indicated that they were least influenced by environment changes and showed that genotypes were true representative of their genotypes and selection based on phenotypic performance would be reliable. Similar results were also reported by Meena *et al*. (2018) in tomato. In conclusion it is evident that considerable genotypic variation among the genotypes indicating greater potentiality for their exploitation to improve yield and its component traits. There was a good scope for selection also. The overall performance in relation to fruit yield and weight was best in CITH CGB Sel-9 and CITH CGB Sel-10 genotypes. However further work is warranted in this regard.

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