Int.J.Curr.Microbiol.App.Sci (2018) *7*(5): 1643-1650

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 05 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.705.194

Search for Superior Fruit Characters of Pumpkin Genotypes from Various Parts of India and Evaluation under Eastern Himalayan Region

Ravi Kiran Thirumdasu[1*] and Ranjit Chatterjee[2]

[1]Department of Vegetable Science, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, Tadepalligudem, Andhra Pradesh – 534101, India
[2]Department of Vegetable and Spice Crops, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar - 736 165, West Bengal, India

**Corresponding author*

Keywords

Average fruit weight, Fruit length, Fruits per plant, Fruit yield, Genetic diversity of pumpkin, Seeds per fruit

Article Info

Accepted:
12 April 2018
Available Online:
10 May 2018

A B S T R A C T

Utilization of genetic diversity has been considered as the most important approach for nutritional security and crop improvement. Henceforth, thirty pumpkin genotypes from different parts of India were collected and evaluated for fruit characteristics, yield and quality to diversify the food basket and crop improvement under eastern Himalayan region during three consecutive years (2014-15, 2015-16 and 2016-17). The experimental findings recorded significant variation for days to first harvest (100.53-130.39), ridges per fruit (13.03-24.22), fruit diameter (13.15-27.04 cm), fruit length (11.17-44.76 cm), average fruit weight (1.08-10.46 kg), fruits per plant (1.77-8.50), flesh thickness (2.21-5.38 cm), seed cavity diameter (8.29-19.71 cm), seeds per fruit (249.99-453.44), test weight (27.73-12.12 g) and fruit yield (4.67-22.83 kg/plant and 7.78-38.05 t/ha). The genotypes PCP-22, PCB-28 and PCB-29 can be promoted for commercial cultivation considering the yield potential (>35 ton fruit yield per hectare). To fulfil the small family requirement and for kitchen garden, PCP-9, PCB-10, PCT-12, PCM-16 and PCM-18 should be recommended.

Introduction

Although pumpkin (*Cucurbita moschata* Duch. ex Poir.; Cucurbitaceae; 2n = 40) was introduced from South America it was well accepted and wide spread in India due to the delicious young leaves, flowers, fruits and long storability. Moreover, the kitchen gardens of North-east India were well known for diverse collection of potential species. In which continuous selection has been done for superior quality and fruit yield since time immemorial. This caused the development of ample variability in cross pollinated pumpkin. Utilization of such genetic diversity has been considered as the most important approach for nutritional security and crop improvement. This will go forward with collection, documentation, evaluation and characterization which will build the strong primitive pace for crop improvement programme. Henceforth, the widespread pumpkin genotypes from West Bengal, Meghalaya, Andhra Pradesh, Manipur, Tripura and Arunachal Pradesh were collected and evaluated to record the fruit characters

and yield to diversify the food basket and crop improvement under eastern Himalayan region.

Materials and Methods

The present study was carried out at Instructional farm, Uttar Banga Krishi Viswavidyalaya, West Bengal, India for three consecutive years during November-April of 2014-15, 2015-16 and 2016-17. The experimental material was comprised of 30 pumpkin genotypes (Table 1), including local genotypes of West Bengal and other parts of the country. The experiment was laid out in a Randomized Block Design with three replications. Each bed was prepared with 6m width keeping 50 cm spacing between the beds. In each bed, pits with 30 cm width and depth were prepared on bund of the raised bed at 2 m spacing along the side of irrigation channel for ease during irrigation and seedlings were transplanted to main field at 2-4 leaf stage. All the recommended cultural practices were adopted to raise a healthy crop.

Four plants were randomly selected in each genotype from each replication and observations on fruit characters were recorded for days to first harvest, ridges per fruit, fruit diameter at the largest part, fruit length from the base of stalk end to blossom end, average fruit weight, fruits per plant, flesh thickness at the widest part of the fruit, seed cavity diameter at the widest part of the fruit, seeds per fruit, test weight of 100 seeds, fruit yield per plant and total fruit yield per hectare.

The experimental findings were analyzed statistically adopting the method suggested by Panse and Sukhatme (1967).

Results and Discussion

The observations recorded on various fruit characteristics, seed characters, yield and quality of pumpkin genotypes in three consecutive years (2014-15, 2015-16 and 2016-17) reported highly significant differences. However, the result based on the pooled analysis was only discussed hereunder.

Fruit characters

The pooled data of three consecutive years (2014-15, 2015-16 and 2016-17) recorded wide range of variation (Table 2 and 3) for days to first harvest (100.53-130.39), ridges per fruit (13.03-24.22), fruit diameter (13.15-27.04 cm), fruit length (11.17-44.76 cm), average fruit weight (1.08-10.46 kg), fruits per plant (1.77-8.50), flesh thickness (2.21-5.38 cm) and seed cavity diameter (8.29-19.71 cm) with the mean performances of 120.26 days, 18.90 ridges, 21.29 cm, 22.28 cm, 4.57 kg, 3.90 fruits, 3.69 cm and 13.89 cm, respectively.

Among the pumpkin genotypes, PCP-2 collected from Pundibari, West Bengal displayed earliness (100.53 days) to first harvest from days after transplanting whereas maximum duration for first harvest was recorded for PCB-24 (130.39). The genotype PCA-23 recorded maximum ridges per fruit (24.22) and the genotype PCM-17 recorded minimum ridges per fruit (13.03). The highest fruit diameter was recorded in genotype PCP-5 (27.04 cm) and smallest fruit diameter was observed in PCM-20 (13.15 cm). The longest pumpkin fruits were recorded in PCB-22 (44.76 m) and smallest in PCA-23 (11.17 cm).

Average fruit weight was extremely important character for improvement of pumpkin yield. The highest average fruit weight (10.46 kg) was found in PCB-22 and lowest in PCT-13 (1.08 kg). As per the requirement, genotypes with small, medium and big sized fruits can be selected for crop improvement. In recent days, small to medium fruits gained importance in marketplace due to ease of handling, storability and consumption in small families.

The maximum number of pumpkin fruits was recorded in PCM-15 (8.50) and minimum number of fruits in PCP-1 (1.77). The flesh thickness was superior in PCB-29 (5.38 cm) and inferior in PCT-13 (2.21 cm). The widest seed cavity diameter was reported in PCM-26 (19.71 cm) and slender in PCM-20 (8.29 cm). The interaction between the fruit diameter and flesh thickness might have influenced seed cavity diameter to establish significant variation among pumpkin genotypes. These experimental findings revealed distinctiveness of every single genotype under study, for various fruit characters. Such potential performance of pumpkin genotypes was also reported by Mohanty (2000) for average fruit weight, Muralidhara (2009) for days to first harvest and number of fruits per plant, Balkaya *et al.*, (2010b) for fruit diameter, fruit length and flesh thickness.

Table.1 List of 30 pumpkin genotypes evaluated over three years (during 2014-15, 2015-16 and 2016-17)

S. No.	Code	Name of the genotype	Source of collection
1	PCP-1	Pumpkin Collection Pundibari-1	Pundibari, Cooch Behar, West Bengal
2	PCP-2	Pumpkin Collection Pundibari-2	Pundibari, Cooch Behar, West Bengal
3	PCP-3	Pumpkin Collection Pundibari-3	Pundibari, Cooch Behar, West Bengal
4	PCP-4	Pumpkin Collection Pundibari-5	Pundibari, Cooch Behar, West Bengal
5	PCP-5	Pumpkin Collection Pundibari-6	Pundibari, Cooch Behar, West Bengal
6	PCP-6	Pumpkin Collection Pundibari-7	Pundibari, Cooch Behar, West Bengal
7	PCK-7	Pumpkin Collection Komatipalli	Komatipalli, Vizianagaram, Andhra Pradesh
8	PCG-8	Pumpkin Collection Gagan Sardar Para-1	Gagan Sardar Para, Sepahijala, Tripura
9	PCP-9	Pumpkin Collection Pasighat-1	Pasighat, East Siang, Arunachal Pradesh
10	PCB-10	Pumpkin Collection Bukkarayasamudram	Bukkarayasamudram, Ananthapur, Andhra Pradesh
11	PCM-11	Pumpkin Collection Mankar-1	Mankar, Bardhaman, West Bengal
12	PCT-12	Pumpkin Collection Thangmeiband-1	Thangmeiband, Imphal West, Manipur
13	PCT-13	Pumpkin Collection Thangmeiband-2	Thangmeiband, Imphal West, Manipur
14	PCM-14	Pumpkin Collection Meghalaya-1	Ampati-1, Meghalaya
15	PCM-15	Pumpkin Collection Meghalaya-2	Anugre, Meghalaya
16	PCM-16	Pumpkin Collection Meghalaya-3	Dakopgre, Meghalaya
17	PCM-17	Pumpkin Collection Meghalaya-4	Ampati-2, Meghalaya
18	PCM-18	Pumpkin Collection Meghalaya-5	Sansak, Meghalaya
19	PCM-19	Pumpkin Collection Meghalaya-6	Rongram, Meghalaya
20	PCM-20	Pumpkin Collection Meghalaya-7	Baagmara, Meghalaya
21	PCK-21	Pumpkin Collection Baidyabati-1	Baidyabati, Hoogly, West Bengal
22	PCB-22	Pumpkin Collection Baidyabati-2	Baidyabati, Hoogly, West Bengal
23	PCA-23	Pumpkin Collection Alipurduar	Alipurduar, West Bengal
24	PCB-24	Pumpkin Collection Beldanga	Beldanga, Murshidabad, West Bengal
25	PCR-25	Pumpkin Collection Raiganj	Raiganj, U/Dinajpur, West Bengal
26	PCB-26	Pumpkin Collection Baidyabati-3	Baidyabati, Hoogly, West Bengal
27	PCB-27	Pumpkin Collection Baidyabati-4	Baidyabati, Hoogly, West Bengal
28	PCB-28	Pumpkin Collection Baidyabati-5	Baidyabati, Hoogly, West Bengal
29	PCB-29	Pumpkin Collection Baidyabati-6	Baidyabati, Hoogly, West Bengal
30	PCB-30	Pumpkin Collection Baidyabati-7	Baidyabati, Hoogly, West Bengal

Table.2 Fruit characters of pumpkin genotypes over three years (during 2014-15, 2015-16 and 2016-17)

Genotypes	Days to first harvest				Ridges/fruit				Fruit diameter (cm)				Fruit length (cm)			
	Y1	Y2	Y3	Pooled	Y1	Y2	Y3	Pooled	Y1	Y2	Y3	Pooled	Y1	Y2	Y3	Pooled
PCP-1	122.79	103.70	115.81	114.10	20.62	20.59	19.44	20.22	21.83	20.14	20.59	20.85	35.27	37.63	33.27	35.39
PCP-2	114.19	79.70	107.70	100.53	16.02	12.49	15.11	14.54	18.00	14.43	16.98	16.47	21.28	22.63	20.07	21.33
PCP-3	129.62	103.37	122.26	118.42	16.02	22.27	15.11	17.80	23.06	19.06	21.75	21.29	41.46	38.80	39.10	39.79
PCP-4	113.80	98.70	107.33	106.61	17.32	17.55	16.33	17.07	19.91	21.35	18.78	20.01	12.01	18.33	11.33	13.89
PCP-5	128.13	106.37	120.85	118.45	19.20	22.95	18.11	20.09	31.04	20.80	29.27	27.04	28.28	23.40	26.67	26.11
PCP-6	132.76	107.37	125.22	121.78	18.73	19.91	17.67	18.77	27.22	19.47	25.68	24.12	29.51	21.07	27.83	26.14
PCK-7	129.74	113.04	122.37	121.72	21.44	22.95	20.22	21.54	22.95	17.40	21.65	20.66	13.39	17.17	12.63	14.40
PCG-8	133.16	75.04	125.59	111.26	16.61	19.91	15.67	17.40	21.04	26.42	19.84	22.43	12.86	19.40	12.13	14.80
PCP-9	130.92	115.04	123.48	123.15	19.67	17.89	18.56	18.70	22.84	19.62	21.54	21.33	29.76	25.66	28.07	27.83
PCB-10	127.27	104.37	120.04	117.23	21.79	18.22	20.56	20.19	28.69	20.43	27.06	25.39	18.76	10.63	17.70	15.70
PCM-11	133.63	97.37	126.04	119.01	19.67	19.57	18.56	19.27	21.60	19.73	20.37	20.57	24.39	25.00	23.00	24.13
PCT-12	125.15	74.37	118.04	105.85	19.79	18.56	18.67	19.01	26.52	14.54	25.01	22.02	16.19	9.10	15.27	13.52
PCT-13	125.50	99.37	118.37	114.41	18.50	16.20	17.44	17.38	14.62	13.69	13.80	14.04	12.90	12.03	12.17	12.37
PCM-14	132.18	112.37	124.67	123.07	11.78	18.90	11.11	13.93	23.74	30.24	22.39	25.45	14.95	21.00	14.10	16.68
PCM-15	130.69	108.37	123.26	120.77	21.44	16.87	20.22	19.51	16.82	18.67	15.86	17.12	12.90	15.10	12.17	13.39
PCM-16	127.39	114.37	120.15	120.63	19.08	18.22	18.00	18.44	20.63	24.72	19.46	21.61	11.31	26.13	10.67	16.04
PCM-17	134.34	116.04	126.70	125.69	11.78	16.20	11.11	13.03	19.35	19.95	18.25	19.18	12.33	16.80	11.63	13.59
PCM-18	132.45	104.37	124.93	120.58	20.62	18.56	19.44	19.54	19.46	18.36	18.36	18.73	14.24	13.87	13.43	13.85
PCM-19	123.62	109.37	116.59	116.53	19.91	16.87	18.78	18.52	16.09	17.19	15.17	16.15	10.14	19.87	9.57	13.19
PCM-20	126.05	107.70	118.89	117.55	19.67	14.17	18.56	17.47	14.62	11.04	13.79	13.15	18.09	23.57	17.07	19.58
PCB-21	123.26	119.09	116.26	119.54	19.44	18.78	18.33	18.85	22.50	21.74	21.22	21.82	16.15	15.60	15.23	15.66
PCB-22	127.98	123.64	120.70	124.11	24.27	23.45	22.89	23.53	27.45	26.52	25.89	26.62	46.16	44.60	43.53	44.76
PCA-23	132.33	127.85	124.81	128.33	24.97	24.13	23.56	24.22	19.12	18.48	18.04	18.55	11.52	11.13	10.87	11.17
PCB-24	134.45	129.90	126.81	130.39	19.32	18.67	18.22	18.74	26.10	25.22	24.62	25.31	16.08	15.54	15.17	15.59
PCR-25	131.04	126.60	123.59	127.08	23.09	22.31	21.78	22.39	20.70	20.00	19.52	20.07	28.74	27.76	27.10	27.87
PCB-26	131.04	126.60	123.59	127.08	20.73	20.03	19.56	20.11	22.95	22.17	21.65	22.26	39.34	38.00	37.10	38.15
PCB-27	130.29	125.88	122.89	126.35	22.27	21.51	21.00	21.59	27.11	26.19	25.57	26.29	28.10	27.15	26.50	27.25
PCB-28	131.51	127.06	124.04	127.53	19.79	19.12	18.67	19.19	25.09	24.23	23.66	24.33	27.88	26.94	26.30	27.04
PCB-29	133.87	129.33	126.26	129.82	19.67	19.01	18.56	19.08	22.50	21.74	21.22	21.82	40.93	39.54	38.60	39.69
PCB-30	134.34	129.79	126.70	130.28	17.55	16.96	16.56	17.02	24.75	23.91	23.34	24.00	30.39	29.36	28.67	29.47
Mean	**128.78**	**110.54**	**121.46**	**120.26**	**19.36**	**19.09**	**18.26**	**18.90**	**22.28**	**20.58**	**21.01**	**21.29**	**22.51**	**23.09**	**21.23**	**22.28**
S.Em (±)	**2.06**	**2.57**	**1.94**	**2.56**	**0.41**	**0.44**	**0.39**	**0.55**	**0.97**	**0.75**	**0.92**	**0.80**	**1.52**	**1.44**	**1.44**	**1.11**
CD(P=0.05)	**5.83**	**7.26**	**5.50**	**7.12**	**1.17**	**1.25**	**1.10**	**1.55**	**2.75**	**2.11**	**2.60**	**2.24**	**4.32**	**4.08**	**4.07**	**3.08**
Minimum	**113.80**	**74.37**	**107.33**	**100.53**	**11.78**	**12.49**	**11.11**	**13.03**	**14.62**	**11.04**	**13.79**	**13.15**	**10.14**	**9.10**	**9.57**	**11.17**
Maximum	**134.45**	**129.90**	**126.81**	**130.39**	**24.97**	**24.13**	**23.56**	**24.22**	**31.04**	**30.24**	**29.27**	**27.04**	**46.16**	**44.60**	**43.53**	**44.76**

Y 1: 2014-15, Y2: 2015-16, Y3: 2016-17

Table.3 Fruit characters of pumpkin genotypes over three years (during 2014-15, 2015-16 and 2016-17)

Genotypes	Average fruit weight (g)				Fruits/plant				Flesh thickness (cm)				Seed cavity diameter (cm)			
	Y1	Y2	Y3	Pooled	Y1	Y2	Y3	Pooled	Y1	Y2	Y3	Pooled	Y1	Y2	Y3	Pooled
PCP-1	5.34	5.77	5.04	5.38	1.69	2.04	1.59	1.77	3.75	4.02	3.53	3.77	13.43	12.10	12.67	12.73
PCP-2	2.09	2.03	1.97	2.03	4.59	3.04	4.33	3.99	2.93	1.46	2.77	2.39	11.73	11.50	11.07	11.43
PCP-3	5.37	6.20	5.06	5.54	4.52	2.37	4.26	3.72	3.89	3.09	3.67	3.55	13.22	12.87	12.47	12.85
PCP-4	2.50	3.68	2.36	2.85	3.46	3.37	3.26	3.36	3.43	4.06	3.23	3.57	13.39	13.23	12.63	13.09
PCP-5	6.41	3.61	6.06	5.36	2.28	3.37	2.15	2.60	3.85	3.11	3.63	3.53	20.43	14.57	19.27	18.09
PCP-6	6.12	3.97	5.77	5.29	3.89	2.37	3.67	3.31	3.04	3.79	2.87	3.23	14.98	11.90	14.13	13.67
PCK-7	3.45	1.86	3.26	2.86	2.36	4.04	2.22	2.87	3.96	3.03	3.73	3.57	14.49	11.33	13.67	13.16
PCG-8	2.38	4.81	2.25	3.14	5.69	3.37	5.37	4.81	3.60	5.78	3.40	4.26	12.76	14.87	12.03	13.22
PCP-9	4.68	2.31	4.42	3.80	4.04	2.70	3.81	3.52	3.53	3.17	3.33	3.35	14.10	7.77	13.30	11.72
PCB-10	5.65	2.28	5.33	4.42	3.10	3.37	2.93	3.13	4.28	3.88	4.03	4.06	19.33	12.67	18.23	16.74
PCM-11	6.17	3.66	5.82	5.21	3.46	2.37	3.26	3.03	3.68	5.80	3.47	4.32	17.03	9.13	16.07	14.08
PCT-12	4.44	0.91	4.19	3.18	3.34	4.04	3.15	3.51	3.60	2.07	3.40	3.02	13.01	10.40	12.27	11.89
PCT-13	1.17	0.96	1.11	1.08	4.99	5.70	4.70	5.13	2.40	1.96	2.27	2.21	10.18	9.77	9.60	9.85
PCM-14	3.88	7.11	3.66	4.88	6.01	3.37	5.67	5.01	3.39	5.60	3.20	4.06	9.26	19.03	8.73	12.34
PCM-15	1.25	2.35	1.18	1.60	10.36	5.37	9.78	8.50	2.97	3.62	2.80	3.13	11.24	11.43	10.60	11.09
PCM-16	3.29	4.67	3.11	3.69	5.81	5.70	5.48	5.66	3.08	5.44	2.90	3.81	11.87	15.10	11.20	12.72
PCM-17	2.05	3.12	1.93	2.36	5.97	5.04	5.63	5.55	3.57	4.31	3.37	3.75	12.09	11.33	11.40	11.61
PCM-18	2.14	3.18	2.01	2.44	7.30	5.37	6.89	6.52	3.15	2.74	2.97	2.95	12.02	12.50	11.33	11.95
PCM-19	1.29	1.59	1.22	1.37	8.05	5.70	7.59	7.12	2.76	3.53	2.60	2.96	13.18	10.13	12.43	11.92
PCM-20	1.52	3.22	1.44	2.06	6.28	5.70	5.93	5.97	2.93	2.12	2.77	2.61	9.12	7.17	8.60	8.29
PCB-21	6.57	6.34	6.20	6.37	2.55	1.78	2.41	2.25	4.03	3.89	3.80	3.91	13.50	13.04	12.73	13.09
PCB-22	10.78	10.42	10.17	10.46	2.32	1.75	2.18	2.08	4.88	4.71	4.60	4.73	18.55	17.93	17.50	17.99
PCA-23	2.44	2.35	2.29	2.36	4.24	3.57	4.00	3.94	3.99	3.86	3.77	3.87	13.78	13.32	13.00	13.37
PCB-24	6.11	5.90	5.76	5.92	3.10	2.43	2.93	2.82	3.85	3.72	3.63	3.73	17.25	16.66	16.27	16.73
PCR-25	9.08	8.78	8.56	8.81	2.16	2.32	2.04	2.17	4.14	4.00	3.90	4.01	17.28	16.70	16.30	16.76
PCB-26	6.90	6.67	6.51	6.69	2.94	2.28	2.78	2.67	3.75	3.62	3.53	3.63	20.32	19.63	19.17	19.71
PCB-27	7.20	6.95	6.79	6.98	2.83	3.30	2.67	2.93	4.52	4.37	4.27	4.39	18.27	17.65	17.23	17.72
PCB-28	6.85	6.62	6.46	6.64	3.57	3.45	3.37	3.47	5.44	5.26	5.13	5.28	16.61	16.05	15.67	16.11
PCB-29	8.37	8.08	7.89	8.11	2.95	3.00	2.78	2.91	5.55	5.36	5.23	5.38	16.05	15.50	15.13	15.56
PCB-30	6.40	6.18	6.03	6.20	2.87	2.77	2.70	2.78	3.85	3.72	3.63	3.74	17.71	17.11	16.70	17.17
Mean	**4.73**	**4.52**	**4.46**	**4.57**	**4.22**	**3.50**	**3.98**	**3.90**	**3.73**	**3.84**	**3.51**	**3.69**	**14.54**	**13.41**	**13.71**	**13.89**
S.Em (±)	**0.37**	**0.23**	**0.35**	**0.31**	**0.30**	**0.24**	**0.28**	**0.26**	**0.26**	**0.32**	**0.25**	**0.22**	**0.51**	**0.35**	**0.48**	**0.61**
CD(P=0.05)	**1.04**	**0.65**	**0.98**	**0.87**	**0.85**	**0.67**	**0.80**	**0.72**	**0.74**	**0.89**	**0.70**	**0.61**	**1.45**	**0.99**	**1.37**	**1.74**
Minimum	**1.17**	**0.91**	**1.11**	**1.08**	**1.69**	**1.75**	**1.59**	**1.77**	**2.40**	**1.46**	**2.27**	**2.21**	**9.12**	**7.17**	**8.60**	**8.29**
Maximum	**10.78**	**10.42**	**10.17**	**10.46**	**10.36**	**5.70**	**9.78**	**8.50**	**5.55**	**5.80**	**5.23**	**5.38**	**20.43**	**19.63**	**19.27**	**19.71**

Y 1: 2014-15, Y2: 2015-16, Y3: 2016-17

Table.4 Seed characters and fruit yield of pumpkin genotypes over three years (during 2014-15, 2015-16 and 2016-17)

Genotypes	Seeds/fruit				Test weight (g)				Fruit yield (kg/plant)				Total fruit yield (t/ha)			
	Y1	Y2	Y3	Pooled	Y1	Y2	Y3	Pooled	Y1	Y2	Y3	Pooled	Y1	Y2	Y3	Pooled
PCP-1	437.38	392.37	412.52	414.09	17.89	12.29	16.88	15.69	8.33	7.02	7.86	7.74	13.88	11.69	13.10	12.89
PCP-2	348.02	176.04	328.25	284.10	17.28	16.73	16.30	16.77	9.01	3.65	8.50	7.06	15.03	6.09	14.17	11.76
PCP-3	338.58	393.70	319.34	350.54	22.73	14.22	21.44	19.46	22.74	14.79	21.45	19.66	37.90	24.65	35.75	32.77
PCP-4	306.34	233.37	288.92	276.21	16.99	17.36	16.03	16.79	8.16	7.42	7.70	7.76	13.60	12.36	12.83	12.93
PCP-5	293.88	322.37	277.17	297.81	26.64	16.82	25.12	22.86	13.89	13.26	13.10	13.42	23.14	22.11	21.83	22.36
PCP-6	385.92	422.04	363.99	390.65	26.94	12.98	25.41	21.78	22.25	17.66	20.98	20.30	37.08	29.43	34.98	33.83
PCK-7	510.45	354.37	481.44	448.75	13.91	10.08	13.12	12.37	7.69	4.57	7.26	6.51	12.82	7.62	12.09	10.84
PCG-8	322.78	138.04	304.44	255.09	18.48	11.06	17.43	15.66	12.75	9.69	12.02	11.49	21.25	16.15	20.04	19.15
PCP-9	483.96	307.04	487.89	426.29	17.32	7.79	16.34	13.82	17.62	15.68	16.61	16.64	29.36	26.13	27.69	27.72
PCB-10	430.91	292.70	406.42	376.68	18.64	12.93	17.58	16.38	16.67	16.57	15.72	16.32	27.78	27.62	26.20	27.20
PCM-11	329.52	364.70	310.79	335.01	27.53	15.66	25.97	23.05	20.22	17.22	19.07	18.84	33.69	28.70	31.78	31.39
PCT-12	304.04	314.37	286.76	301.72	18.43	8.62	17.39	14.81	14.02	14.19	13.22	13.81	23.37	23.66	22.04	23.02
PCT-13	355.10	382.04	334.91	357.35	16.58	10.18	15.63	14.13	5.52	3.28	5.20	4.67	9.19	5.48	8.67	7.78
PCM-14	299.37	381.37	282.35	321.03	22.98	14.71	21.68	19.79	21.90	14.36	20.66	18.97	36.51	23.93	34.43	31.63
PCM-15	246.67	322.04	232.65	267.12	18.32	16.07	17.28	17.22	12.24	13.51	11.54	12.43	20.40	22.51	19.24	20.72
PCM-16	267.22	250.04	252.04	256.43	17.66	14.39	16.66	16.23	18.04	15.96	17.02	17.01	30.07	26.60	28.36	28.35
PCM-17	232.49	332.04	219.28	261.27	18.63	11.60	17.57	15.93	11.53	10.51	10.88	10.97	19.23	17.50	18.13	18.29
PCM-18	220.91	320.70	208.35	249.99	20.31	12.02	19.15	17.16	15.03	14.84	14.17	14.68	25.04	24.74	23.62	24.47
PCM-19	291.10	390.04	274.56	318.57	14.69	8.98	13.86	12.51	9.81	8.01	9.25	9.02	16.35	13.35	15.42	15.04
PCM-20	427.33	404.70	403.04	411.69	15.50	11.08	14.62	13.73	9.02	11.03	8.51	9.52	15.03	18.38	14.18	15.86
PCB-21	347.30	335.54	327.57	336.80	15.25	14.73	14.38	14.79	15.44	14.91	14.56	14.97	25.73	24.86	24.27	24.95
PCB-22	467.58	451.74	441.01	453.44	23.88	23.07	22.52	23.16	23.54	22.75	22.20	22.83	39.24	37.91	37.01	38.05
PCA-23	406.96	393.17	383.82	394.65	12.49	12.07	11.78	12.12	9.72	9.39	9.17	9.43	16.20	15.65	15.28	15.71
PCB-24	346.97	335.22	327.25	336.48	26.32	25.43	24.82	25.52	17.85	17.25	16.84	17.31	29.76	28.75	28.07	28.86
PCR-25	283.83	274.21	267.70	275.25	28.60	27.63	26.97	27.73	18.40	16.78	17.35	17.51	30.66	27.96	28.92	29.18
PCB-26	421.94	407.65	397.96	409.19	21.11	20.39	19.91	20.47	19.29	16.63	18.19	18.04	32.15	27.72	30.32	30.06
PCB-27	346.77	335.03	327.06	336.29	21.54	20.81	20.31	20.89	19.16	17.52	18.08	18.25	31.94	29.20	30.13	30.42
PCB-28	446.89	431.75	421.49	433.38	22.53	21.77	21.25	21.85	23.06	19.28	21.75	21.37	38.44	32.14	36.26	35.61
PCB-29	457.87	442.36	431.85	444.03	25.24	24.38	23.81	24.48	23.30	20.51	21.98	21.93	38.83	34.18	36.63	36.55
PCB-30	458.84	443.30	432.76	444.96	24.25	23.43	22.87	23.51	16.96	16.38	15.99	16.44	28.26	27.30	26.66	27.41
Mean	**360.56**	**344.80**	**341.12**	**348.83**	**20.29**	**15.64**	**19.14**	**18.36**	**15.44**	**13.49**	**14.56**	**14.50**	**25.73**	**22.48**	**24.27**	**24.16**
S.Em (±)	**22.75**	**27.54**	**22.30**	**18.18**	**1.78**	**1.55**	**1.68**	**1.08**	**1.48**	**0.94**	**1.42**	**0.75**	**1.43**	**0.90**	**1.36**	**0.71**
CD(P=0.05)	**64.41**	**77.96**	**63.13**	**50.65**	**5.05**	**4.39**	**4.76**	**3.00**	**4.20**	**2.65**	**4.01**	**2.08**	**4.04**	**2.55**	**3.86**	**2.00**
Minimum	**220.91**	**138.04**	**208.35**	**249.99**	**12.49**	**7.79**	**11.78**	**12.12**	**5.52**	**3.28**	**5.20**	**4.67**	**9.19**	**5.48**	**8.67**	**7.78**
Maximum	**510.45**	**451.74**	**487.89**	**453.44**	**28.60**	**27.63**	**26.97**	**27.73**	**23.54**	**22.75**	**22.20**	**22.83**	**39.24**	**37.91**	**37.01**	**38.05**

Y 1: 2014-15, Y2: 2015-16, Y3: 2016-17

Table.5 Grouping of genotypes based on fruits per plant, size and yield

Character	Group	Count	Genotype
Fruits/plant	Less (<3)	11	PCP-1, PCP-5, PCK-7, PCB-21, PCB-22, PCB-24, PCR-25, PCB-26, PCB-27, PCB-29, PCB-30
	Medium (3-7)	17	PCP-2, PCP-3, PCP-4, PCP-6, PCG-8, **PCP-9, PCB-10,** PCM-11, **PCT-12,** PCT-13, PCM-14, **PCM-16,** PCM-17, **PCM-18,** PCM-20, PCA-23, PCB-28
	More (>7)	2	PCM-15, PCM-19
Fruit size	Small (< 2kg)	3	PCT-13, PCM-15, PCM-19
	Medium (2-5 kg)	12	PCP-2, PCP-4, PCK-7, PCG-8, **PCP-9, PCB-10, PCT-12, PCM-16,** PCM-17, **PCM-18,** PCM-20, PCA-23
	Big (>5 kg)	15	PCP-1, PCP-3, PCP-5, PCP-6, PCM-11, PCM-14, PCB-21, PCB-22, PCB-24, PCR-25, PCB-26, PCB-27, PCB-28, PCB-29, PCB-30
Fruit yield (t/ha)	Limited (<21 t/ha)	11	PCP-1, PCP-2, PCP-4, PCK-7, PCG-8, PCT-13, PCM-15, PCM-17, PCM-19, PCM-20, PCA-23
	Medium (21-30 t/ha)	10	PCP-5, **PCP-9, PCB-10, PCT-12, PCM-16, PCM-18**, PCB-21, PCB-24, PCR-25, PCB-30
	Heavy (>30 t/ha)	9	PCP-3, PCP-6, PCM-11, PCM-14, PCB-22, PCB-26, PCB-27, PCB-28, PCB-29

Seed characters

The pooled data recorded wide range of variation (Table 4) for seeds per fruit (249.99-453.44 seeds) and test weight (27.73-12.12 g) with the mean performances of 348.83 seeds and 18.36 g, respectively. Highest seeds per fruit were recorded in genotype PCB-22 and lowest number of seeds per fruit was recorded in PCM-18 whereas maximum test weight (27.73 g) was recorded in PCR-25 and minimum test weight (12.12 g) was observed in PCA-23. In line with the present findings Selvi *et al.*, (2012) and Balkaya *et al.*, (2010a) also reported profound variation for the seed characters in pumpkin genotypes.

Fruit yield

The data pertaining to fruit yield of pumpkin genotypes for the year 2014-15, 2015-16 and 2016-17 has been presented in Table 4. Fruit yield of pumpkin genotypes was ranged from 4.67 kg to 22.83 kg with an average of 14.50 kg per plant and 7.78 ton to 38.05 ton with an average of 24.16 ton per hectare. The highest fruit yield of pumpkin was recorded in PCB-22 (22.83 kg/plant and 38.05 t/ha) and lowest fruit yield in PCT-13 (4.67 kg/plant and 7.78 t/ha). Fruit yield was a complex character which was shaped through various yield attributing characters. Of which average fruit weight (10.46 kg) played vital role to harvest high fruit yield in pumpkin genotype PCB-22, collected from Baidyabati, West Bengal. The variation in fruit yield (kg/plant) and fruit yield (t/ha) was also documented by Mohanty (2000) and Selvi *et al.*, (2012), respectively in pumpkin genotypes.

The genotypes in bold format were suitable for kitchen gardening owing to its medium performance in fruits per plant, size and yield. The genotypes in underlined were suitable for commercial cultivation owing to its heavy yielding potential (>35 t/ha).

On the basis of mean performances of yield and yield attributing characters, PCB-22 performed better than all other genotypes for five characters viz., total fruit yield, fruit yield, average fruit weight, fruit length and seeds per fruit. However the genotype PCP-2 was earliest for days to first harvest. However the data classified in Table 5 revealing that genotypes PCP-9, PCB-10, PCT-12, PCM-16 and PCM-18 recorded medium performance throughout the characters, fruits per plant (3-

7), size (2-5 kg) and yield (21-30 t/ha). Henceforth these genotypes could be promoted for kitchen gardening whereas the other genotypes namely PCP-22, PCB-28 and PCB-29 can be promoted for commercial cultivation on account of high yielding potential (>35 ton fruit yield per hectare).

Findings of three consecutive years (2014-15, 2015-16 and 2016-17) research suggested that considering the yield potential (>35 ton fruit yield per hectare) the genotypes namely PCP-22, PCB-28 and PCB-29 can be promoted for commercial cultivation. To fulfil the requirement of small family needs and for kitchen garden the medium yielding (21-30 t/ha) genotypes having medium sized multiple fruits (3–7 fruits per plant weighing 2–5 kg each) namely, PCP-9, PCB-10, PCT-12, PCM-16, PCM-18 should be recommended. The findings also showed that the genotypes PCB-10, PCM-14, PCM-17, PCB-22, PCA-23 and PCB-30 can be utilized for future breeding programmes as they are superior with more than one desirable trait.

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How to cite this article:

Ravi Kiran Thirumdasu and Ranjit Chatterjee. 2018. Search for Superior Fruit Characters of Pumpkin Genotypes from Various Parts of India and Evaluation under Eastern Himalayan Region. *Int.J.Curr.Microbiol.App.Sci.* 7(05): 1643-1650.
doi: https://doi.org/10.20546/ijcmas.2018.705.194