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Genetic Evaluation of Garden Pea (*Pisum sativum* L.) for Pod Yield and its Contributing Traits

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ABSTRACT: The study was conducted to evaluate the performance of different genotypes of garden pea during *Rabi*, 2019-20 at Regional Horticultural Research and Training Station, Dr. Y.S. Parmar University of Horticulture and Forestry, Himachal Pradesh. The experiment was layout in the Augmented Block Design (ABD). Examination of the characteristics revealed substantial variability in the genotypes, indicating that sufficient variance was present throughout the germplasm under study. The maximum plant height was recorded in EC-838238 whereas, the minimum plant height was recorded in EC-838152. The minimum number of node at which the first flower appear was recorded in three genotypes *viz.* EC-838152, EC- 838161, EC-838233, whereas EC-838232 recorded the highest node at which the first flower appear. The lowest days to 50% flowering were reported in EC-838216 while the highest were documented in EC-838206. The EC-838220 showed the lowest number of seeds per pod and the EC-838211 expressed the highest number. In EC- 838143 the highest length of the pod were reported whereas, EC-838229 recorded the lowest pod length. Also, the highest weight of 100-seeds was recorded in EC-838141 while the lowest value was obtained in EC-838188. The minimum number of days to marketable maturity was recorded in EC-838146 whereas, maximum days to marketable maturity was recorded in EC-838192. Further, the maximum shelling percentage was observed in EC-838192 whereas the minimum shelling percentage was observed in EC-838156. The highest pod yield (kg/plot) and pod yield (q/ha) were observed in EC-838201 whereas, minimum values for these traits were recorded in EC-838219. The genotype EC-838166 recorded the highest total soluble solids and it was lowest in EC-838199. The genotypes EC-838199 and EC-838200 were reported to be moderately susceptible to the incidence of pea leaf miner whereas, DMK-11 was reported to be susceptible. Therefore, considering the highest pod yield genotype EC-838201 may be selected for further evaluation and growing under the conditions of sub-tropical climate of Himachal Pradesh.

Keywords: Garden pea, Pod yield, Mean and genotypes, Genetic Evaluation.

INTRODUCTION

Garden pea (*Pisum sativum* L.), a member of Fabaceae family, is one of the principal legume vegetable crops grown throughout the world. It is second most important food legume worldwide after *Phaseolus vulgaris* (Tar'an *et al*., 2005). It is native of Mediterranean region with Near East and Ethiopia as secondary centres (Blixt 1970). It is quite palatable and nutritious for human consumption as it is a rich source of protein (25%), slowly digestive starch (50%), sugars (12%), amino acids, carbohydrates, vitamins (A and C), calcium and phosphorus, apart from having a small quantity of iron (Smykal *et al*., 2012). Besides, it also contains lysine, the limiting essential amino acid in cereals (Ceyhan and Avci 2005). It is eaten as fresh, canned, frozen or in dehydrated forms.

In India, it is grown as winter season vegetable in the central and northern plains and as a summer and autumn-winter crop in the hilly regions. It is cultivated in an area of about 540.0 thousand hectares with an annual production of 5422.0 thousand metric tonnes (Anonymous, 2018). The major production states are Uttar Pradesh, Bihar, Haryana, Punjab, Himachal Pradesh, Odisha, and Karnataka. In Himachal Pradesh, pea holds an important position as the leading off season vegetable grown over the state in an area of 23.65 thousand hectares with 277.20 thousand metric tones of yearly output (Anonymous, 2018). Hence, the present study was designed to evaluate performance of

garden pea genotypes in low hills of Himachal Pradesh so that the best genotype(s) was selected and recommended to the framers.

MATERIALS AND METHODS

The experiment was conducted during *Rabi*, 2019-20 at Regional Horticultural Research and Training Station, Dr. Y.S. Parmar University of Horticulture and Forestry, Jachh, situated at an altitude of 428 m above mean sea level, lying between 32°16′54.02″N latitude and 75°51′4.38″ E longitude under sub-mountain and low hill sub-tropical agro-climatic zone of Himachal Pradesh, India.The experiment was layout in the Augmented Block Design (ABD). Experimental material comprised of 109 diverse genotypes of pea along with 6 check varieties. The observations were recorded on five competitive plants for pod yield and other qualitative characters viz., days to 50% flowering, node at which first flower appear (number), plant height (cm), number of pods per plant, pod length (cm), number of seeds/grains per pod, 100- seed weight (g), shelling percentage, days to marketable maturity, pod yield (kg/plot), pod yield (q/ha), total soluble solids (°Brix) and pea leaf miner incidence (%). The analysis of variance was done using SPAD (Statistical Package for Augmented Design) software developed by IASRI, New Delhi.

RESULTS AND DISCUSSION

(i) Days to 50% flowering: The statistically important divergence variations were found between different genotypes. The value ranged from 47.50 to 80.40 days with general mean of 63.32 days as presented in Table 1. The days to 50% flowering were earlier in sixty-one genotypes along with checks as compared to the general mean. The least number of days to 50% flowering was reported in the EC-838216 (47.50 days) which was statistically identical to 27 genotypes along with checks *viz.* EC-838141 (56.30 days), EC-838145 (54.10 days), EC-838144 (54.90 days), EC-838147 (53.70 days) and EC-838154 (54.20 days). The highest number of days to 50% flowering was reported in EC-838206 (80.40 days). Seventy three genotypes took less number of days to 50% flowering among all the genotypes under the analysis than the best check Arkel (65.50 days). The results revealing considerable variability concerning this feature were reported by Gupta *et al.*, (2006); Kumari *et al.,* (2012); Pallavi *et al*., (2013); Jaiswal *et al.*, (2013); Sharma and Sharma (2013).

(ii) Node at which first flower appear (number): The statistically important divergence variations with regards to the node at which the first flower appears were found between different genotypes. The ranged value from 10.30 to17.60 with general mean 13.51 was observed during the studies (Table 1). Fifty three genotypes along with checks, were observed to have less number of node at which the first flower appear than the general mean. The least number of node at which the first flower appears were reported in the three genotypes *viz.* EC-838152 (10.30), EC-838161 (10.30) and EC- 838233 (10.30) which was statistically at par with 48 genotypes, along with checks *viz.* EC-838139 (11.85), EC-838161 (11.85), EC-838151 (11.60), EC-838161 (11.85) and EC-838154 (11.80). In EC-838232 (17.60) the highest number node at which the first flower appear was observed. The thirteen genotypes had less number of node at which the first flower appears among all the genotypes under the analysis than the best check HFP-4 (11.47). The variability concerning this attribute was reported by Mehta *et al*., (2005); Kumari *et al.,* (2012); Katiyar and Dixit (2009); Gupta *et al.,* (2006).

(iii) Plant height (cm): A significant variability between all the genotypes was observed for plant height as revealed from Table 1. The attribute's mean average output rating was 119.22 cm, whereas, it ranged from 82.40 to 179.80 cm including checks, the forty-three genotypes had more plant height than the populations mean 119.22 cm. The maximum plant height was recorded in EC- 838238 (179.80 cm) and minimum plant height was reported in EC-838152 (82.40 cm). Two genotypes, EC-838238 (179.80 cm) and EC-838235 (173.0 cm) acquired a plant height than the best check Rachna (170.12 cm). The significant variability in the plant height of the pea genotypes was also noted by Karayel and Bozoglu (2015); Georgieva *et al.,* (2016); Gudadinni *et al*., (2017); Gupta *et al.,* (2006); Thapa *et al.,* (2020).

(iv) Number of pods per plant: As shown in the Table 1, the outcome for the pods number per plant demonstrated strong variability across all genotypes. The overall mean performance value for this attribute was 16.86 and it ranged from 7.20 to 37.60. The forty-nine genotypes had more number of pods per plant than the population mean (16.86) including checks. In EC-838208 (37.60) largest pods number per plant were reported, whereas, the lowest number of pods per plant was reported in EC-838181 (7.20) which were statistically identical to 27 genotypes along with checks *viz.* EC-838143 (12.20), EC-838142 (11.30), EC-838144 (11.30) and EC- 838147(10.40). The results revealed that five genotypes produced more pods per plant than the best check DMR-7 (30.14). The consequences of the current examination are reliable with the observations recorded by Gupta *et al.,* (2006); Jaiswal *et al.,* (2013); Katiyar and Dixit (2009); Karayel and Bozoglu (2015); Pallavi *et al*., (2013); Mishra *et al.,* (2014); Thapa *et al.,* (2020).

(v) Pod length (cm): The mean results observed for pod length show large variability between all the genotypes as evident from the data presented in the Table 1. The overall mean performance value for the attribute was 6.89 cm and it ranged from 5.68 to 8.78 cm. The fifty-one genotypes including checks produced longer pod length than the population mean however EC-838143 (8.78 cm) recorded the highest pod length which was statistically equivalent to 10 genotypes *viz*. EC-838145 (7.77cm), EC-838141(8.57cm), EC-838148 (8.54cm) and EC-838139 (8.30 cm). While, in EC-838229 (5.68 cm) the lowest pod length was measured and it was statistically observed to be at par with 27 genotypes including all checks *viz*. EC-838176 (5.84 cm), EC-838162 (6.23 cm), EC-838169 (6.22 cm), EC-838158 (6.50cm), EC-838184 (6.22 cm) and EC-838214 (5.98 cm). Out of all the genotypes investigated, comparatively greater pod length was observed in eighteen genotypes than the best check Arkel (7.39 cm). This type of broad genetic variability has also been identified about this character by Singh *et al.,* (2011); Chaudhary and Sharma (2003); Jaiswal *et al.,* (2013).

Table 1: Mean performance of various garden pea genotypes with respect to different horticultural traits.

Sr. No.	Genotypes	Days to 50 % flowering	Node at which first flower appear (number)	Plant height (cm)	Number of pods/plant	Pod length (cm)	No. of seeds/ grains per Pod	100-seed weight (g)	Shelling percentage (%)
1.	**EC-838139**	62.50	11.85	110.90	18.90	8.30	5.90	35.00	45.15
2.	**EC-838140**	66.10	13.25	101.00	12.10	7.13	5.05	34.50	36.32
3.	**EC-838141**	56.30	13.05	116.90	20.20	8.57	5.20	37.50	35.76
4.	**EC-838142**	61.20	12.90	96.70	11.50	8.10	5.90	28.00	40.65
5.	**EC-838143**	68.30	13.20	93.30	12.20	8.78	6.50	27.00	42.37
6.	**EC-838144**	54.90	13.15	118.40	11.30	7.97	5.10	29.50	40.31
7.	**EC-838145**	54.10	12.70	91.30	8.30	7.77	4.85	31.50	49.74
8.	**EC-838146**	69.50	12.65	118.00	14.20	7.91	5.90	24.00	40.55
9.	**EC-838147**	53.70	12.30	106.90	10.40	7.70	6.35	23.50	41.06
10.	**EC-838148**	60.00	12.00	97.10	13.30	8.54	6.20	20.50	40.85
11.	**EC-838149**	59.60	13.60	93.80	14.80	7.94	5.65	17.50	41.02
12.	**EC-838150**	63.70	11.90	83.10	11.00	7.71	5.50	24.50	41.63
13.	**EC-838151**	61.70	11.60	97.20	14.10	6.85	4.90	29.00	43.97
14.	**EC-838152**	60.30	10.30	82.40	17.20	7.63	5.35	25.50	49.88
15.	**EC-838153**	64.60	12.30	110.50	8.40	7.04	5.20	20.50	49.97
16.	**EC-838154**	54.20	11.80	108.40	14.20	6.75	4.85	19.50	48.40
17.	**EC-838155**	67.20	14.50	109.10	15.70	7.09	5.05	18.00	45.70
18.	**EC-838156**	58.00	14.70	112.50	12.40	6.80	4.95	28.50	35.06
19.	**EC-838157**	55.60	16.50	128.30	15.90	6.99	5.80	26.00	51.65
20.	**EC-838158**	58.10	15.80	117.40	12.60	6.50	4.75	28.00	55.67
21.	**EC-838159**	60.30	14.60	112.40	24.30	6.99	5.15	28.50	51.34
22.	**EC-838160**	60.60	15.30	103.90	11.90	6.85	5.20	25.00	46.59
23.	**EC-838161**	51.00	10.30	114.90	20.40	7.00	5.55	25.50	45.73
24.	**EC-838162**	66.70	13.50	106.70	16.90	6.23	4.35	23.50	45.63
25.	**EC-838163**	68.40	14.95	154.00	19.60	6.85	5.60	22.50	37.97
26.	**EC-838164**	59.90	12.90	117.70	12.90	6.95	6.05	18.50	37.30
27.	**EC-838165**	66.60	11.45	135.20	15.20	7.32	6.55	14.50	45.34
28.	**EC-838166**	55.95	11.48	127.50	23.50	7.38	6.45	15.50	44.56
29.	**EC-838167**	61.80	12.77	112.80	12.70	7.24	6.30	19.00	42.51
30.	**EC-838168**	67.80	14.30	112.50	12.91	7.28	6.25	16.50	50.01
31.	**EC-838169**	55.00	13.35	120.00	12.50	6.22	4.75	16.00	48.29
32.	**EC-838170**	54.60	10.60	114.70	11.10	6.62	5.20	20.00	45.91
33.	**EC-838171**	67.70	11.57	108.30	12.90	6.52	5.25	14.00	41.00
34.	**EC-838172**	53.00	15.20	155.10	19.90	6.89	5.15	15.00	44.21
35.	**EC-838173**	60.30	15.03	131.70	27.40	7.01	5.40	14.00	38.00
36.	**EC-838174**	59.20	14.15	112.60	21.80	6.91	6.10	19.00	45.31
37.	**EC-838175**	67.60	10.65	104.40	13.60	7.05	6.15	16.00	47.15
38.	**EC-838176**	57.95	14.65	102.20	13.50	5.84	5.25	19.50	44.31
39.	**EC-838177**	57.00	13.55	118.00	26.70	6.70	5.40	22.00	55.51
40.	**EC-838178**	72.90	12.73	114.80	13.50	6.46	4.75	16.00	43.22
41.	**EC-838179**	53.50	14.57	130.60	16.20	6.44	5.15	19.50	40.80
42.	**EC-838180**	52.90	13.10	133.30	25.40	7.02	6.00	23.00	37.68
43.	**EC-838181**	57.80	13.65	102.60	7.20	7.85	5.55	22.50	49.50
44.	**EC-838182**	48.40	14.78	136.70	23.30	6.70	6.00	24.00	39.80
45.	**EC-838183**	64.30	14.55	121.30	20.60	6.89	5.85	22.50	42.50
46.	**EC-838184**	65.90	15.24	131.70	11.80	6.22	5.65	16.00	36.37
47.	**EC-838185**	63.70	16.15	124.30	14.70	6.48	5.40	16.50	43.76
48.	**EC-838186**	60.60	12.40	123.90	15.50	6.34	5.15	14.50	48.81
49.	**EC-838187**	72.45	15.12	128.40	14.90	6.59	4.90	15.00	36.77
50.	**EC-838188**	76.60	15.28	141.80	17.10	6.33	4.75	12.50	42.11
51.	**EC-838189**	61.60	12.92	164.60	32.70	7.08	6.00	17.00	42.37
52.	**EC-838190**	59.10	15.50	115.30	18.20	6.36	4.95	17.50	53.24
53.	**EC-838191**	58.85	12.75	115.70	15.50	6.17	4.95	19.00	50.93
54.	**EC-838192**	61.80	11.15	110.30	19.40	6.40	5.05	20.00	60.00
55.	**EC-838193**	60.40	12.35	112.90	17.60	7.10	5.75	20.50	41.91
56.	**EC-838194**	64.60	15.85	122.30	23.30	7.61	5.90	20.50	41.77
57.	**EC-838195**	55.20	13.95	138.40	24.50	6.79	4.90	23.00	45.00
58.	**EC-838196**	59.20	10.97	157.80	26.70	6.42	5.15	22.00	44.29
59.	**EC-838197**	66.20	12.10	128.10	17.20	6.82	4.95	20.00	55.06
60.	**EC-838198**	53.75	15.13	113.40	20.80	7.04	6.05	18.00	49.31
61.	**EC-838199**	60.00	15.35	113.60	27.60	6.92	5.70	21.00	37.12
62.	**EC-838200**	60.30	15.59	106.70	13.40	6.77	5.00	15.00	45.24
63.	**EC-838201**	52.90	14.60	109.70	32.90	7.57	6.35	26.00	52.06
64.	**EC-838202**	66.10	10.97	112.30	17.80	7.34	6.30	20.00	45.30
65.	**EC-838203**	72.20	13.88	119.00	27.50	7.05	6.20	26.50	40.63
66.	**EC-838204**	72.70	13.63	114.10	18.10	6.85	5.80	19.00	47.83
67.	**EC-838205**	76.60	12.10	111.50	25.70	6.78	5.80	22.00	47.30
68.	**EC-838206**	80.40	12.62	104.80	11.30	6.43	5.70	23.00	41.56
69.	**EC-838207**	71.60	12.64	109.10	18.40	6.21	4.90	20.00	47.18
70.	**EC-838208**	61.20	13.35	113.90	37.60	6.38	5.35	33.00	38.97
71.	**EC-838209**	63.70	12.09	118.60	21.20	6.65	5.50	28.00	50.01
72.	**EC-838210**	63.25	13.90	127.20	33.20	7.20	5.80	29.00	42.95

73.	**EC-838211**	61.60	13.23	115.10	21.00	7.08	6.60	28.50	42.94
74.	**EC-838212**	62.05	11.54	109.90	9.90	7.46	6.10	25.00	43.25
75.	**EC-838213**	58.80	15.42	144.30	9.70	6.10	5.00	27.50	35.32
76.	**EC-838214**	61.00	14.52	108.60	14.60	5.98	5.20	22.50	50.74
77.	**EC-838215**	72.00	13.27	101.70	9.70	6.27	5.55	31.00	44.60
78.	**EC-838216**	47.50	13.77	117.60	12.40	6.62	5.15	19.50	47.83
79.	**EC-838217**	57.30	14.11	107.70	12.40	6.61	5.00	18.50	54.90
80.	**EC-838218**	53.00	16.35	97.30	8.50	6.18	4.15	14.50	51.06
81.	**EC-838219**	49.85	16.04	100.00	8.00	6.68	5.30	15.00	55.12
82.	**EC-838220**	76.00	13.45	96.50	7.20	6.13	3.50	16.00	52.76
83.	**EC-838221**	72.05	13.36	103.50	8.90	6.78	5.55	17.50	48.91
84.	**EC-838222**	77.55	12.91	105.50	9.90	6.06	3.90	18.50	47.00
85.	**EC-838223**	75.30	11.15	105.90	12.20	7.00	5.10	16.50	46.00
86.	**EC-838224**	78.20	10.55	103.80	18.20	6.76	5.10	21.00	51.59
87.	**EC-838225**	65.60	14.15	118.50	14.70	7.40	6.25	16.50	50.97
88.	**EC-838226**	75.60	13.35	110.30	9.80	7.02	5.30	16.50	49.67
89.	**EC-838227**	65.70	14.80	121.50	11.30	6.82	5.15	17.00	58.15
90.	**EC-838228**	62.30	16.20	132.50	10.80	6.70	5.15	16.50	52.65
91.	**EC-838229**	68.50	15.60	117.50	9.30	5.68	5.65	14.50	46.81
92.	**EC-838230**	76.55	16.45	117.70	12.50	5.90	5.10	15.00	50.32
93.	**EC-838231**	78.15	15.50	131.30	12.20	6.99	5.70	14.00	50.60
94.	**EC-838232**	72.70	17.60	126.30	21.90	6.95	5.50	15.50	39.84
95.	**EC-838233**	66.10	10.30	147.80	23.80	6.76	5.50	17.00	47.38
96.	**EC-838234**	60.50	13.10	132.00	15.70	7.09	5.45	21.00	49.65
97.	**EC-838235**	56.20	11.55	173.00	10.40	6.38	4.55	19.00	47.00
98.	**EC-838236**	65.30	12.68	108.70	12.50	6.52	5.15	20.50	42.37
99.	**EC-838237**	65.35	11.30	113.30	9.50	6.88	5.60	23.50	49.40
100.	**EC-838238**	62.10	14.20	179.80	12.40	6.23	4.90	17.50	47.18
101.	**EC-838239**	60.85	14.75	108.70	9.30	6.66	5.25	21.00	53.26
102.	**EC-838240**	60.40	16.53	106.70	8.60	6.56	4.65	18.00	49.17
103.	**EC-838241**	65.20	13.75	112.60	8.80	6.87	4.85	21.50	46.34
104.	**EC-838242**	55.20	14.19	121.60	21.40	7.01	6.05	20.50	40.73
105.	**EC-838243**	72.15	13.55	126.40	28.60	6.96	5.80	23.50	37.67
106.	**EC-838244**	64.30	12.73	122.00	24.80	7.04	6.00	13.00	43.27
107.	**EC-838245**	69.70	14.08	120.20	34.50	7.16	6.35	24.00	48.68
108.	**EC-838246**	63.20	12.12	121.70	27.80	7.21	5.80	27.50	42.16
109.	**EC-838247**	65.35	11.15	143.80	26.80	6.60	5.85	21.50	43.63
110.	**DMK-11(Check)**	69.48	13.57	130.97	20.30	6.69	4.63	21.30	35.62
111.	**Arkel (Check)**	65.50	14.93	168.62	17.04	7.39	4.20	21.20	39.05
112.	**IC-279125 (Check)**	67.71	13.85	149.04	17.31	6.80	4.16	22.80	44.84
113.	**Rachna (Check)**	70.87	14.31	170.12	22.08	6.63	3.87	21.00	45.97
114.	**DMR-7 (Check)**	71.35	14.39	134.56	30.14	6.55	3.70	21.80	42.74
115.	**HFP-4 (Check)**	65.84	11.47	138.80	13.31	6.51	4.64	21.50	45.55
	General Mean	63.32	13.51	119.22	16.86	6.89	5.38	21.13	45.45
	Range minimum	47.50	10.30	82.40	7.20	5.68	3.50	12.50	35.06
	Range Maximum	80.40	17.60	179.80	37.60	8.78	6.60	37.50	60.00
	Genotypes Mean	63.04	13.49	117.59	16.69	6.90	5.44	21.11	45.62
	Check Mean	68.46	13.75	148.69	20.03	6.76	4.20	21.60	42.30
	Genotypes : SE	6.13	1.83	9.94	3.06	0.49	0.48	2.05	7.51
	C.D. (0.05)	12.64	3.77	20.48	6.30	1.02	0.99	4.23	15.48
	Checks : SE	2.74	0.82	4.45	1.37	0.22	0.21	0.92	3.36
	C.D. (0.05)	5.65	1.68	9.16	2.82	0.46	0.44	1.89	6.92
	Genotypes Vs Check : SE	5.13	1.53	8.32	2.56	0.41	0.40	1.72	6.29
	C.D. (0.05)	10.57	3.15	17.13	5.27	0.85	0.82	3.54	12.95

(vi) Number of seeds/grains per pod: The data observed for the number of seeds per pod show large variability between all the genotypes as shown in the Table 1. The overall mean performance value for the attribute was 5.38 and it ranged from 3.50 to 6.60. The fifty-five genotypes had more number of seeds per pod than the population mean (5.38) including checks.

The highest number of seeds per pod was reported in EC-838211 (6.60) which were statistically at par with 34 genotypes along with checks *viz*. EC-838203 (6.20), EC-838212 (6.10), EC-838225 (6.25), EC-838243 (5.80) and EC-838247 (5.85). The lowest number of seeds per pod has been found in EC-838181 (7.20) but was statistically equivalent to seven genotypes along with checks *viz.* Arkel

(4.20), IC-279125 (4.16), Rachna (3.87), DMR-7 (3.70), EC-838218(4.15), EC-838220 (3.50) and EC-838222 (3.90). The perusal of data revealed that one hundred and four genotypes generated more number of seeds per pod than the best check variety HFP-4 (4.64). The observations by Karayel and Bozoglu (2015); Katiyar and Dixit (2009); Pallavi *et al*., (2013); Jaiswal *et al.,* (2013); Thapa *et al.,* (2020) corresponded to the outcomes of the present analysis.

(vii) 100-Seed weight (g): The mean results observed for the weight (g) of 100-seeds show large variability between all the genotypes (Table 1). The overall mean performance value for the attribute was 21.13 g and it ranged from 12.50 to 37.50 g. The fifty genotypes had greater 100-seed weight than the population mean (21.13 g) including checks. The highest 100-seed weight was reported in EC-838141 (37.50g) which was statistically at par with genotypes EC-838139 (35 g) and EC-838140 (34.50 g). The lowest 100 seed weight (g) was observed in EC-838188 (12.50 g) which was statistically at par with 26 genotypes along with checks *viz*. EC-838226 (16.50 g), EC-838165 (14.50 g), EC-838229 (14.50 g), EC-838230 (15.00 g) and EC-83823 (14.00 g). Forty three genotypes analyzed during these studies produced greater 100 seed weight (g) than the best check DMR-7 (21.80 g) variety. These results are in conformity with the findings of Saxesena *et al.* (2014), Georgieva *et al.,* (2016); Katiyar and Dixit (2009); Pallavi *et al*., (2013).

(viii) Shelling percentage (%): The results observed for shelling percentage show large variability between all the genotypes as evident from the Table 1. The attribute mean performance value was 45.45 % and ranged from 35.06 to 60.00%. Among all the genotypes investigated, fifty-six genotypes had more shelling percentage than the population mean (45.45%) including checks. The highest shelling percentage was reported in EC-838192 (60%) which were statistically at par with 41 genotypes along with checks *viz.* EC-838219 (55.12%), EC-838152 (49.88%), EC- 838158 (55.67%), EC-838168 (50.01%) and EC-838197 (55.06%). The lowest shelling percentage was observed in EC-838156 (35.06%) which were statistically at par with 78 genotypes along with checks *viz.* EC-838140 (36.32%), EC-838142 (40.65%), EC-838144 (40.31%), EC-838148 (40.85%) and EC-838164 (37.30%). Lowest shelling percentage was observed in DMK-11 (35.62%) followed by Arkel (39.05%), DMR-7 (42.74%), IC-279125 (44.84%), HFP-4 (45.55%) and Rachna (45.97%). Fifty genotypes under the study produced greater shelling percentage than the best check Rachna (45.97%). The results observed in the present studies were consistent with the observations recorded by Chaudhary *et al.,* (2003); Pallavi *et al*., (2013); Katiyar and Dixit (2009).

(ix) Days to market able maturity: The statistically important divergence variations were found between different genotypes with respect to days to marketable maturity. The value ranged from 125 to 156.60 days with general mean of 143.09 days as shown in Table 2. The 49 genotypes along with checks were observed to have marketable maturity earlier than the general mean. The least number of days to marketable maturity was reported in the EC-838146 (125 days) that were statistically identical to 11 genotypes along with checks *viz.* EC-838141 (127.00 days), EC-838142 (129.50days), EC-838143(129.30 days), EC-838148 (128.70days) and EC-838149 (128.30). The highest number of days to marketable maturity was reported in EC-838192 (156.60 days) which were statistically at par with 14 genotypes *viz*. EC-838226 (151.60 days), EC-838228 (153.40days), EC-838229 (152.70 days), EC-838205 (153.10days) and EC-838211 (150.20 days). Seventy four genotypes took less number of days to marketable maturity in all the genotypes under the analysis than the best check DMK-7 (142.08 days). Considerable variability concerning this feature was reported by Chaudhary *et al.,* (2003); Jaiswal *et al.*, (2013); Katiyar and Dixit (2009).

(x) Pod yield (kg/plot): Perusal of data for pod yield show large variability among all the genotypes as evident from Table 2. The overall mean performance value for the attribute was 27.31 kg/plot and it ranged from 11.57 to 61.42 kg/plot. The fifty-two genotypes had more pod yield (Kg/plot) than the population mean (27.31 kg/plot) including checks. The highest pod yield was reported in EC-838201 (61.42 kg/plot) which was statistically at par with 34 genotypes along with EC-838208 (58.84 kg/plot), EC-838141 (52.18 kg/plot) and EC-838166 (56.21 kg/plot). The lowest pod yield was observed in EC-838219 (11.57 kg/plot) which was statistically at par with 12 genotypes along with checks *viz*. EC-838239(14.85 kg/plot), EC-838240 (13.39 kg/plot), EC-838241 (13.27 kg/plot), EC-838212 (12.53 kg/plot) and EC- 838213 (14.99 kg/plot). Eighty-four genotypes among study produced a greater pod yield than the best check HFP-4 (17.73 kg/plot) variety. The findings of the present study are consistent with the results of similar investigations by Kumar *et al.,* (2004); Rathi and Dhaka (2007); Sharma and Sharma and Sharma (2013); Gudadinni *et al*., (2017).

(xi) Pod yield(q/ha): The observations for pod yield (q/ha) showed large variability between all the genotypes as presented in Table 2. The overall mean performance value for this trait was 68.28q/ha and it ranged from 28.94 to 153.54q/ha. The fifty-three genotypes had more pod yield than the population mean (68.28 q/ha) including checks. The highest pod yield was reported EC-838201 (153.54 q/ha) which was statistically at par with EC-838166 (140.52 q/ha), EC-838205 (153.10 q/ha) and EC-838208 (147.10 q/ha). The lowest number of pod yield (q/ha) was observed in EC-838219 (28.94 q/ha) which was statistically at par with 17 genotypes along with checks *viz.* EC-838212 (31.33 q/ha), EC-838152 (34.06 q/ha), EC- 838213 (37.47q/ha), EC-838215 (35.73 q/ha) and EC-838159 (40.71 q/ha). Ninety-two genotypes among those studied, produced greater pod yield (q/ha) than the best check HFP-4 (44.32 q/ha) variety. Similar kind of results were reported by Gudadinni *et al*., (2017); Gupta *et al.,* (2006); Karayel and Bozoglu (2015); Thapa *et al.,* (2020) while studying various genotypes of pea.

Percentage of leaf infestation by leaf miner: Mean percentage of leaf infestation was recorded as 7.84 % with a range of 4.70 to11.03 %. Among the checks DMR-7 and HFP-4 showed the least percent of leaf infestation *viz*. 10.08 and 10.24 % respectively (Table 2). There were 2 genotypes *viz*. EC-838150 and EC-838174 with significantly more percent of leaf infestation than the

DMR-7, whereas, in 10 genotypes *viz.* EC-838141, EC-838142, EC-838143, EC-838148, EC-838165, EC-838166, EC-838172, EC-838189, EC-838190 and EC-838241 percentage of leaf infestation was significantly at par with DMR-7. All other genotypes showed significantly lesser per cent leaf infestation compared to DMR-7. Among the test genotypes the least percent leaf infestation (4.70 %) were recorded in EC-838199 which was significantly at par with EC-838200, EC-838224, EC-838236, EC-838201 and EC-838232.

Table 2: Mean performance of various pea genotypes with respect to different horticultural traits.

Sr. No.	Genotypes	Days to marketable maturity	Pod yield (kg/plot)	Pod yield (q/ha)	Total soluble Solids (°Brix)	Pea leaf miner infestation (%)	
						Percentage of leaf Infested by leaf miner	Number of maggots per 10 leaves of pea plant
1.	**EC-838139**	132.10	37.52	93.81	13.25	9.50	1.14
2.	**EC-838140**	135.00	23.72	59.30	13.17	9.20	1.04
3.	**EC-838141**	127.00	52.18	130.46	16.16	10.00	1.16
4.	**EC-838142**	129.50	26.87	67.17	14.75	9.65	1.12
5.	**EC-838143**	129.30	26.56	66.39	15.61	10.05	1.15
6.	**EC-838144**	132.40	16.80	41.99	14.23	8.70	1.03
7.	**EC-838145**	133.10	34.86	87.14	13.28	9.55	1.10
8.	**EC-838146**	125.00	23.05	57.62	14.42	9.40	1.10
9.	**EC-838147**	134.20	28.98	72.46	15.43	8.40	1.03
10.	**EC-838148**	128.70	30.27	75.68	15.63	9.85	1.17
11.	**EC-838149**	128.30	19.26	48.15	13.44	8.85	1.10
12.	**EC-838150**	127.30	24.71	61.78	15.09	10.85	1.23
13.	**EC-838151**	129.50	30.88	77.20	17.08	8.45	1.06
14.	**EC-838152**	134.10	13.62	34.06	14.51	6.25	0.73
15.	**EC-838153**	134.20	35.47	88.68	18.92	5.80	0.74
16.	**EC-838154**	129.00	27.54	68.86	18.77	6.60	0.84
17.	**EC-838155**	136.15	21.60	54.00	20.56	6.65	0.82
18.	**EC-838156**	137.30	32.86	82.16	20.96	6.85	0.85
19.	**EC-838157**	138.60	23.24	58.11	16.13	7.70	0.92
20.	**EC-838158**	139.00	29.57	73.93	20.64	7.20	0.90
21.	**EC-838159**	137.60	16.28	40.71	20.45	7.50	0.86
22.	**EC-838160**	136.50	27.02	67.55	16.85	8.95	1.05
23.	**EC-838161**	133.10	26.21	65.52	20.22	7.10	0.95
24.	**EC-838162**	134.95	32.60	81.51	15.45	8.45	0.99
25.	**EC-838163**	136.40	37.41	93.53	20.32	9.25	1.10
26.	**EC-838164**	138.70	20.55	51.38	16.00	9.55	1.12
27.	**EC-838165**	139.90	36.85	92.12	15.58	10.25	1.16
28.	**EC-838166**	140.90	56.21	140.52	22.90	9.95	1.14
29.	**EC-838167**	140.80	16.17	40.43	18.30	9.00	1.03
30.	**EC-838168**	141.20	20.75	51.87	19.25	8.70	1.07
31.	**EC-838169**	141.80	17.92	44.79	17.07	8.85	1.03
32.	**EC-838170**	138.10	23.19	57.98	20.17	7.40	0.88
33.	**EC-838171**	138.50	35.26	88.14	14.18	9.20	1.07
34.	**EC-838172**	139.90	33.49	83.73	17.01	9.90	1.13
35.	**EC-838173**	141.70	34.76	86.91	15.11	8.55	1.02
36.	**EC-838174**	141.60	36.84	92.09	16.75	10.60	1.23
37.	**EC-838175**	142.10	26.88	67.20	17.47	8.60	1.05
38.	**EC-838176**	141.80	42.73	106.83	16.53	8.70	1.06
39.	**EC-838177**	142.10	24.23	60.57	16.00	9.10	1.11
40.	**EC-838178**	140.60	29.87	74.67	16.75	6.65	0.89
41.	**EC-838179**	139.80	41.93	104.83	21.46	7.55	0.87
42.	**EC-838180**	140.10	19.04	47.61	14.56	9.30	1.11
43.	**EC-838181**	141.60	40.74	101.84	20.12	5.70	0.74
44.	**EC-838182**	142.20	32.08	80.20	16.48	6.50	0.81
45.	**EC-838183**	141.10	18.13	45.32	18.05	6.95	0.85
46.	**EC-838184**	140.50	20.32	50.81	12.60	7.05	0.93
47.	**EC-838185**	142.40	19.04	47.61	20.73	8.70	1.09
48.	**EC-838186**	141.90	19.24	48.10	15.50	8.25	1.00
49.	**EC-838187**	145.30	26.53	66.33	16.65	6.95	0.84
50.	**EC-838188**	144.90	31.31	78.28	17.75	8.20	0.98
51.	**EC-838189**	145.70	29.80	74.50	19.88	9.75	1.10
52.	**EC-838190**	144.60	13.93	34.83	18.20	9.60	1.08
53.	**EC-838191**	145.80	25.42	63.55	14.65	7.50	0.87
54.	**EC-838192**	147.40	32.92	82.29	17.93	9.30	1.07
55.	**EC-838193**	149.60	36.37	90.92	18.45	9.10	1.07
56.	**EC-838194**	147.20	40.20	100.50	19.65	7.75	0.89
57.	**EC-838195**	149.80	41.57	103.93	13.87	7.95	0.96
58.	**EC-838196**	146.85	27.86	69.66	19.35	5.45	0.75
59.	**EC-838197**	146.00	30.26	75.66	20.88	7.05	0.91
60.	**EC-838198**	146.30	35.86	89.65	18.50	5.55	0.77
61.	**EC-838199**	143.20	26.92	67.30	12.55	4.70	0.63
62.	**EC-838200**	144.00	19.55	48.87	16.35	4.80	0.64
63.	**EC-838201**	150.20	61.42	153.54	16.55	5.25	0.74

64.	**EC-838202**	150.50	30.08	75.21	17.36	6.05	0.78
65.	**EC-838203**	147.60	39.17	97.93	15.55	5.95	0.72
66.	**EC-838204**	148.00	41.45	103.62	21.03	6.10	0.78
67.	**EC-838205**	153.10	49.65	124.13	16.60	7.50	0.89
68.	**EC-838206**	147.80	19.74	49.35	14.30	7.80	1.00
69.	**EC-838207**	143.20	27.85	69.63	16.85	6.50	0.83
70.	**EC-838208**	144.55	58.84	147.10	21.27	7.60	0.89
71.	**EC-838209**	144.10	23.26	58.14	16.70	6.70	0.85
72.	**EC-838210**	149.80	31.99	79.99	14.61	5.95	0.84
73.	**EC-838211**	150.20	28.77	71.92	17.18	6.85	0.80
74.	**EC-838212**	148.40	12.53	31.33	16.65	8.15	1.03
75.	**EC-838213**	148.65	14.99	37.47	16.70	6.25	0.84
76.	**EC-838214**	145.70	17.77	44.43	15.33	7.20	0.91
77.	**EC-838215**	147.45	14.29	35.73	17.15	6.85	0.91
78.	**EC-838216**	147.10	17.77	44.43	20.05	6.85	0.85
79.	**EC-838217**	145.10	17.99	44.97	16.11	7.65	0.94
80.	**EC-838218**	145.60	14.43	36.07	16.89	6.95	0.87
81.	**EC-838219**	148.70	11.57	28.94	20.01	8.50	0.99
82.	**EC-838220**	144.40	15.68	39.19	13.96	6.60	0.83
83.	**EC-838221**	145.70	14.20	35.51	14.88	7.15	0.90
84.	**EC-838222**	147.45	16.64	41.60	13.75	7.85	0.98
85.	**EC-838223**	147.10	21.80	54.51	22.01	6.00	0.77
86.	**EC-838224**	150.00	29.15	72.86	18.55	5.15	0.64
87.	**EC-838225**	150.00	24.91	62.28	19.85	6.80	0.85
88.	**EC-838226**	148.40	21.77	54.43	17.75	8.00	0.99
89.	**EC-838227**	151.60	20.03	50.08	15.66	8.05	0.99
90.	**EC-838228**	153.40	16.22	40.56	14.37	7.30	0.93
91.	**EC-838229**	152.70	15.95	39.87	15.40	7.40	0.96
92.	**EC-838230**	145.70	17.57	43.94	18.40	6.80	0.84
93.	**EC-838231**	148.20	17.26	43.14	14.17	6.90	0.86
94.	**EC-838232**	146.20	33.29	83.22	19.80	5.30	0.71
95.	**EC-838233**	152.00	38.73	96.82	17.12	5.85	0.75
96.	**EC-838234**	151.50	18.90	47.25	15.85	6.30	0.86
97.	**EC-838235**	153.40	15.92	39.80	17.30	5.85	0.73
98.	**EC-838236**	147.50	17.00	42.50	14.11	5.15	0.70
99.	**EC-838237**	145.50	13.67	34.18	20.10	5.60	0.72
100.	**EC-838238**	148.60	16.78	41.96	13.80	6.40	0.77
101.	**EC-838239**	142.70	14.85	37.13	13.85	8.75	1.00
102.	**EC-838240**	143.50	13.39	33.49	17.10	8.90	1.08
103.	**EC-838241**	144.50	13.27	33.19	17.12	10.25	1.15
104.	**EC-838242**	148.40	34.77	86.93	20.10	6.95	0.83
105.	**EC-838243**	149.80	42.77	106.93	20.15	7.50	0.89
106.	**EC-838244**	155.15	36.04	90.10	14.35	8.10	0.92
107.	**EC-838245**	154.50	44.64	111.59	19.95	7.35	0.92
108.	**EC-838246**	156.60	40.77	101.92	12.25	8.30	1.04
109.	**EC-838247**	153.10	42.50	106.25	16.75	7.50	0.94
110.	**DMK-11(Check)**	146.28	29.37	73.41	18.32	11.03	1.27
111.	**Arkel (Check)**	145.46	21.69	54.23	16.39	10.37	1.25
112.	**IC-279125 (Check)**	144.32	32.99	82.48	16.94	10.50	1.24
113.	**Rachna (Check)**	145.16	29.25	73.13	18.34	10.78	1.25
114.	**DMR-7 (Check)**	142.08	24.19	60.47	15.39	10.08	1.23
115.	**HFP-4 (Check)**	143.97	17.73	44.32	16.84	10.24	1.24
	General Mean	143.09	27.31	68.29	17.01	7.84	0.95
	Range minimum	125.00	11.57	28.94	12.25	4.70	0.63
	Range Maximum	156.60	61.42	153.54	22.90	11.03	1.27
	Genotypes Mean	143.01	27.39	68.48	17.01	7.69	0.94
	Check Mean	144.55	25.87	64.67	17.04	10.50	1.25
	Genotypes : SE	3.74	2.59	6.48	1.79	0.30	0.03
	C.D. (0.05)	7.71	5.34	13.36	3.69	0.61	0.07
	Checks : SE	1.67	1.16	2.90	0.80	0.13	0.01
	C.D. (0.05)	3.45	2.39	5.97	1.65	0.27	0.03
	Genotypes Vs Check : SE	3.13	2.17	5.43	1.50	0.25	0.03
	C.D. (0.05)	6.45	4.47	11.18	3.09	0.51	0.06

CONCLUSION

From the present experimental findings it is concluded that the genotypes EC-838201, EC-838141, EC-838208 and EC-838166 were found to be superior for marketable pod yield and other significant characteristics based on overall performance. So these genotypes can be further use for evaluation or growing under the conditions of sub-tropical climate of Himachal Pradesh.

Conflict of Interest. Nil.

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