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Genetic Analysis of Green Pod Yield in Table Pea [*Pisum sativum* var. *hortense*]

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ABSTRACT

Background: Garden pea (*Pisum sativum* L. var. *hortense*) belongs to family leguminosae is an important legume vegetable grown throughout the world during cool season. It is self pollinated pulse crop with chromosome number 2n = 2× = 14. Based on genetic diversity its primary centre of origin is Mediterranean region. It is used as fresh vegetable and processed frozen vegetable in India and abroad. It is good source of vegetarian protein (6.8%-7.2%) which is consumed as green seed. The experiment was carried out to estimate the GCA effect of parents and SCA effect of 28 hybrids for green pod yield and its related traits using eight parents in crossing programme.

Methods: In this experiment crosses was made in 2018-2019 using diallel mating design (excluding reciprocal crosses) and the data investigated in 2019-2020 at Vegetable Research Farm of C.S. Azad University of Agriculture and Technolgy, Kanpur.

Result: In our investigation combining ability analysis revealed significant GCA and SCA for all characters. On the basis of gca effect of parents AP_1, KS111, KS282 were good general combiners. Based on SCA effect crosses KS282 × Kashi Nandani, KS280 × Kashi Nandani, AP_3 × KS282 were good specific combination for pod yield per plant. Such crosses could be further exploited to obtain transgressive segregants in future breeding programme.

Key words: Diallel analysis, General combining ability, Specific combining ability, Table pea.

INTRODUCTION

Garden pea [*Pisum sativum* (L.*) var. hortense*] belongs to family leguminosae sub family Fabaceae is an important legume vegetable grown throughout the world during cool season. Pea is a self pollinated crop. It is normal diploid crop with chromosome number 2n = 2×= 14. Based on genetic diversity its primary centre of origin is Mediterranean region, Western Asia. Central Asia as secondary centre of origin. It is highly nutritious and capable of using atmospheric nitrogen through symbiosis. It is used as fresh vegetable and processed frozen vegetable in India and abroad. It is good source of vegetarian protein (6.8%-7.2%) which is consumed as green seed. It is a rich source of essential amino acids particularly lysine which is low in cereals. Among the pulses, peas have the highest protein digestibility, being 93.3% as compared to 59.5% to 90.7% in other pulses. It is also rich in carbohydrate, vitamin A and C, calcium and phosphorus. Combining ability is the ability of a genotype to transmit superior performance to its crosses. It is an important plant breeding tools in the selection of suitable parents for hybridization and also helps in the identification of superior cross combination for commercial exploitation of heterosis. The present experiment was conducted to revealed nature of gene action and combinig ability in Diallel mating design to identify potent parents and superior hybrid combination in vegetable pea.

MATERIALS AND METHODS

The experimental material comprised 8 diverse genotypes of vegetable pea (*Pisum sativum* var. *hortense*) *viz*. AP-3, KS-280, KS-282, KS-111 AP-1 obtained from vegetable department of, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Kashi Mukta, Kashi Nandani and Pant Uphar was obtained from IIVR, Varanasi and GBPUAT, Pant Nagar. A set of 28 crosses were attempted during *rabi* 2018-2019. Quite good number of crosses were attempted to produce sufficient F_1 seed in each cross. The 28 crosses along with their 8 parents were grown in randomized block design with 3 replications during *rabi* 2019-2020. The field chosen was as homogenous as possible. Recommended agronomic practices were adopted to raise a good crop. Each treatment was sown in single row plot of 4 m length. The inter and intra rows spacing was kept 25 cm and 15 cm, respectively. The data were recorded on randomly selected ten plants in each replication for the

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trait namely days to 50% flowering, plant height (cm), number of branches per plant, Inter-nodal length (cm), first fruiting node, number of pod per cluster, number of pods, green pod yield per plant, pod length, pod width, number of seed per pod and shelling %. The genetic component variance analysed by Hayman (1954a). The combining ability analysis was carried out by the procedure suggested by Griffing's (1956 b) Method 2, Model 1.

RESULTS AND DISCUSSION

The analysis of variance for parent and F_1's for all 12 characters was carried out for testing the significance among the treatments. The mean square for all the traits are presented in Table 1. The variance due to treatments were further partitioned into components namely replication, parents, F_1's and parents Vs F_1's. Highly significant differences for all the characters were observed among parents and F_1's. The significant of replication occurs due to moisture stress during growth and development stage of crop. The variances were also noted for parents v/s F_1's for days to 50% flowering, plant height, inter-nodal length, number of pods per plant, number of first fruiting node, number of grain per pod, pod yield per plant while the characters namely, number of branches per plant, number of pods per cluster, pod width and shelling (%) were non-significant. The significant variance indicating better scope for further improvement of breeding material by selection of promising genotype in crop improvement programme. The significant variance also observed by earlier workers *viz.* Singh *et al.* (2017), Lal *et al.* (2018) and Gupta *et al.* (2020) for all the characters in table pea.

Table 1: Analysis of Variance for parents and F1 for 12 yield character derived from 8 × 8 diallel cross in table pea.

Source of variation	D.F.	Mean sum of square											
		Days to 50% flowering	Plant height (cm)	No of branch/ plant	Inter-nodal length (cm)	No. of pod/ cluster	No. of pod/ plant	No of first fruiting node	No of grain/ pod	Pod length (cm)	Pod width (cm)	Shelling %	Pod yield/ plant (g)
Replication	2	4.77	3.22	0.01	0.77**	0.009	0.22	0.86**	0.009	0.424**	0.04*	3.211	65.04**
Treatments	35	90.44**	1482.80**	0.09**	3.05**	0.06**	15.16**	6.41**	1.812**	1.540**	0.04**	74.26**	500.39**
Parents	7	43.08**	2420.47**	0.07**	1.92**	0.05*	31.85**	4.17***	2.26 **	4.014**	0.06**	63.08**	831.09**
F1s	27	86.89**	1284.36**	0.10**	3.40**	0.07**	9.14**	6.72**	1.63 **	0.757**	0.04**	79.91**	417.86**
Parent Vs. F1s	1	518.00**	276.85**	0.02	1.67**	0.001	60.76**	13.67**	3.54 **	5.379**	0.01	0.15	413.60**
Error	70	1.23	5.65	0.008	0.06	0.016	0.08	0.08	0.029	0.038	0.006	5.75	4.670
Total	107	30.48	488.79	0.035	1.06	0.032	5.01	2.16	0.61	0.536	0.020	28.11	167.951

*Significant level at 5%, **Significant level at 1%.

Analysis of variance for combining ability

The analysis of variance for combining ability for 12 characters presented in Table 2, revealed highly significant for all yield and its related attributes under study except number of branches per plant and number of pod per cluster. Gupta and Singh (2004) and Kumar *et al.* (2020) also observed same result in pea. One should proceed for diallel analysis only if the crosses mean sum of square are significant. The further partitioning of mean sum of square into parents, F_1 and parents Vs. F_1 revealed that days to 50% flowering, plant height, inter-nodal length, number of pods per plant, number of first fruiting node, number of grain per pod, pod yield per plant, pod width and shelling (%) were highly significant ($P \leq 0.01$).

General combining ability effect

General combining ability is a measure of additive gene action. GCA is primarily a function of additive genetic variance and additive × additive type epistasis. GCA effect include both additive and additive × additive type of gene action (Griffing, 1956a, b) and Sprague (1966), which represents fixable genetic variance. Based on comparison of GCA effect with mean performance, good general combiners were KS111 and AP-1 for pod yield per plant, AP-3 and KS280

Table 2: Analysis of variance for combining ability for 12 character in table pea.

Source of variation	D.F.	Days to 50% flowering	Plant height (cm)	No of branch/plant	Inter-nodal length (cm)	No. of pod/cluster	No. of pod/plant	No of first fruiting node	No of grain/pod	Pod length (cm)	Pod width (cm)	Shelling %	Pod yield/ plant (g)
GCA	7	70.51**	1437.64**	0.03**	2.53**	0.01*	3.51**	0.51**	0.71**	0.81**	0.02**	32.77**	342.59**
SCA	28	20.05**	258.42**	0.03**	0.63**	0.02**	5.43**	2.54**	0.57**	0.43**	0.01**	22.75**	122.84**
Error	70	0.41	1.88	0.003	0.02	0.005	0.02	0.02	0.01	0.01	0.002	1.91	1.55
s^2g		7.01	143.57	0.003	0.251	0.001	0.34	0.05	0.07	0.08	0.02	3.08	24.10
s^2s		19.64	256.53	0.03	0.61	0.02	5.40	2.51	0.56	0.42	0.01	20.83	121.29
g/s		0,35	0.56	0.09	0.40	0.05	0.06	0.02	0.12	0.18	0.14	0.14	0.28
$(s/g)^{0.5}$		1.67	1.33	0.96	1.56	4.24	3.98	7.16	2.80	2.29	2.44	2.60	1.88

*Significant level at 5%, ** Significant level at 1%.

for days to 50 percentage flowering; AP-3 and Kashi Nandani for plant height; Kashi Nandani and AP-3 for number of first fruiting node; AP-3 and Kashi Mukta for inter-nodal length; Pant Uphar and KS282 for number of branches per plant; KS282 for number of pod per cluster; KS280 and KS282 for number of pods per plant; AP-3 and Kashi Nandani for number of grains per pod; AP-3 and KS280 for pod length; Pant Uphar and KS111 for shelling percentage. It is supported by Bhardwaj and Kohali (1998), Sharma *et al* (2000), Gupta and Singh (2004), Kumar *et al.* (2020) and Amin (2020). Consistent general combining ability effects data presented in Table 3. Varieties KS111 and AP-1S and KS282 showing good general combining ability for yield appear to be worthy of exploitation in practical plant breeding.

Specific combining ability effect

Specific combining ability effects representing non additive component of genetic variance would contribute much for improvement of crops. SCA is function of dominance variance, additive × dominance variance and dominance × dominance type epistasis. Specific combining ability represent dominance and epistasis component of variance which are non fixable and hence, its exploitation in case of commercial exploitation of heterosis is only feasible. On the basis of significant SCA effects data presented in Table 4, showed the good cross combination namely AP-3 × KS282, AP-3 × Pant Uphar and KS282 × Kashi Mukta for days to 50 percentage flowering while Kashi Mukta × Kashi Nandani, Kashi Mukta × Pant Uphar and KS111 and KS111 × AP-1 swere good cross combination for plant height. The good cross combination for inter-nodal length were Kashi Mukta × Pant Uphar, Kashi Mukta × Kashi Nandani and KS280 × AP-1; KS111 v AP-1, KS280 × KS282 and KS280 × AP-1 for number of first fruiting node, while KS282 × Kashi Mukta , KS111 × Pant Uphar and AP-3 × Pant Uphar for number of grains per pod. The good cross combination for pod length were AP-1, AP-3 × Kashi Mukta and KS111 × Pant Uphar and AP-3 × Kashi Nandani, KS111 × Kashi Mukta and KS282 × Kashi Nandani for pod width, while KS280 × Kashi Mukta, AP-1 × Kashi Mukta and AP-1 × Pant Uphar for shelling percentage.

The good cross combinations for pod yield per plant were KS282 × Kashi Nandani, KS280 × Kashi Nandani and AP-3 × Kashi Nandani. A perusal of these crosses observed for pod yield per plant showed that cross combination KS282 × Kashi Nandani and KS280 × Kashi Nandani had positive and significant SCA effect and high *per se* performance, the gca effect of parents involved in the cross showed that KS282 had positive and significant GCA status (high) while Kashi Nandini the second parent showed negative and significant GCA status (low) means high × low genetic combination. It indicated that if additive component is good combiners and complementary epistatic effect present in poor combiners act in same direction can produce transgressive segregants in advance generation which can harvest in terms of yield.

Table 3: General combining ability effect and corresponding mean performance of eight parents in table pea.

Parent	Days to 50% flowering		Plant height (cm)		No of branch per plant		Inter-nodal length (cm)		No. of pod/cluster		No. of pod per plant	
	Mean	GCA	Mean	GCA	Mean	GCA	Mean	GCA	Mean	GCA	Mean	GCA
AP-3	37.00	-5.18**	64.50	-19.42**	2.00	0.002	4.84	-0.86**	1.46	-0.003	13.23	0.22**
KS-280	38.00	-1.58**	92.00	-2.12*	1.66	-0.05**	5.40	-0.27**	1.46	0.06*	15.63	0.59**
KS-282	41.00	1.25**	97.33	2.65**	1.86	0.05*	6.16	0.34**	1.33	0.01	16.16	0.52**
KS-111	43.00	2.61**	122.83	13.90**	1.86	-0.03	6.33	0.47**	1.33	-0.01	12.70	-0.37**
AP-1	45.00	3.08**	115.33	14.94**	1.70	-0.008	5.50	0.59**	1.33	0.03	15.40	0.20**
Kashi Mukta	36.00	-0.41*	133.00	6.12**	1.83	-0.02	4.66	-0.33**	1.13	-0.07**	14.40	0.32**
Kashi Nandini	33.66	-0.85**	53.83	-12.15**	1.50	-0.03	4.26	-0.22**	1.53	0.004	7.83	-1.18**
Pant Uphar	40.66	1.08**	75.50	-3.92**	1.70	0.10**	6.36	0.28**	1.53	-.009	8.23	-0.31**
SE (gi)+		0.44**		0.96**		0.03**		0.10**		0.05**		0.11**
SE (gi-gj)+		0.67**		1.45**		0.05**		0.16**		0.07**		0.17**

Parent	No of first fruiting node		No of grains per pod		Pod length (cm)		Pod wid		Shelling %		Pod yield per plant(g)	
	Mean	GCA	Mean	GCA	Mean	GCA	Mean	GCA	Mean	GCA	Mean	GCA
AP-3	8.90	-0.28**	8.20	0.38**	9.80	0.33**	1.80	-0.03	51.00	0.58	92.20	-1.92**
KS-280	11.03	0.13*	7.66	-0.08*	10.26	0.23**	2.06	-0.07**	47.00	1.05	109.90	-0.43
KS-282	11.30	-0.08	6.6	-021**	8.40	0.12**	1.80	-0.002	52.66	0.60	108.73	2.87**
KS-111	11.33	0.01	6.06	-0.21**	8.33	-0.21**	1.73	-0.05**	54.00	1.81**	121.40	5.61**
AP-1	13.16	0.27**	8.40	0.04	8.43	-0.01	1.93	0.02	40.33	-2.66**	114.06	3.95**
Kashi Mukta	11.43	1.11	8.33	0.33**	8.53	-0.08	2.03	0.030	46.00	-0.93	106.86	1.77**
Kashi Nandini	10.53	-0.36**	7.13	0.36**	7.33	-0.54**	1.76	0.002	47.16	-2.43**	70.43	-13.24**
Pant Uphar	10.76	0.19**	7.33	0.11**	10.73	0.18**	1.63	-0.04**	52.66	1.98**	118.73	1.37**
SE (gi)+		0.11**		0.06**		0.07**		0.03**		0.96**		0.87**
SE (gi-gj)+		0.17**		0.10**		0.11**		0.04**		1.46**		1.31**

*Significant level at 5%, **Significant level at 1%.

Table 4: Specific combining ability effect and corresponding mean performance of eight parents in table pea.

Parent	Days to 50% flowering		Plant height (cm)		No of branch per plant		Inter-nodal length (cm)		No. of pod/ cluster		No. of pod per plant	
	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA
AP3 × KS280	36.00	-0.622	72.67	-3.070*	1.67	-0.019	4.40	-0.134	1.53	0.080	15.03	-0.141
AP3×KS282	35.00	-4.456 **	73.50	-7.02**	1.73	-0.059	4.53	-0.624**	1.27	-0.137*	16.23	1.133**
AP3×KS111	38.33	-2.489 **	87.83	-3.937**	1.37	-0.342**	4.60	-0.690**	1.40	0.026	15.43	1.233**
AP3×AP1	41.00	-0.289	90.83	-1.970	1.83	0.101*	5.47	0.060	1.47	0.043	14.67	-0.117
AP3×Kashi Mukta	37.00	-0.789	96.00	12.013**	1.50	-0.212**	4.43	-0.040	1.33	0.016	13.90	-1.007**
AP3×Kashi Nandini	41.00	3.644 **	63.33	-2.370	1.70	-0.002	4.80	0.210	1.13	-0.264**	13.50	0.103
AP3×Pant Uphar	36.33	-2.956 **	68.17	-5.770**	1.87	0.018	4.47	-0.627**	1.47	0.083	16.20	1.933**
KS280×KS282	46.00	2.944 **	104.67	6.846**	1.70	-0.036	5.50	-0.247	1.73	0.266**	15.47	-0.007
KS280×KS111	42.00	-2.422**	110.00	0.930	1.83	0.181**	5.93	0.053	1.33	-0.104	16.20	1.626**
KS280×AP1	43.00	-1.889**	111.33	1.230	1.87	0.191**	5.17	-0.830 ***	1.30	-0.187**	15.50	0.343*
KS280×Kashi Mukta	46.67	5.278**	94.33	-6.954 **	1.33	-0.322**	5.00	-0.064	1.53	0.153*	12.83	-2.447**
KS280×Kashi Nandani	42.00	1.044	84.33	1.330	1.53	-0.112*	5.57	0.38**	1.27	-0.194**	13.80	0.029
KS280×PPant Uphar	43.00	0.111	93.00	1.763	1.83	0.041	5.97	0.283*	1.53	0.086	15.07	0.426**
KS282×KS111	54.67	7.411**	111.17	-2.687*	1.67	-0.092	5.93	-0.570**	1.30	-0.087	14.40	-0.101
KS282×AP1	51.67	3.944**	94.67	-20.220**	1.50	-0.282**	6.43	-0.187	1.63	0.196**	15.63	0.549**
KS282×Kashi Mukta	41.33	-2.889**	110.50	4.430**	1.83	0.071	6.80	1.113**	1.47	0.136*	13.53	-1.674**
KS282×Kashi Nandani	46.00	2.211**	108.83	21.046**	1.83	0.081	6.50	0.696**	1.33	-0.077	12.70	-0.997**
KS282×Pant Uphar	46.33	0.611	104.17	8.146**	2.17	0.268**	6.53	0.226	1.27	-0.130	14.13	-0.434**
KS111×AP1	56.33	7.244**	105.50	-20.637**	1.53	-0.166**	6.57	-0.187	1.47	0.060	13.37	-0.817**
KS111×Kashi Mukta	45.00	-0.589	109.83	-7.487**	1.67	-0.012	6.23	0.413**	1.53	0.233**	12.30	-2.007**
KS111×Kashi Nandani	47.00	1.844**	118.50	19.463**	1.67	-0.002	6.83	0.896**	1.47	0.086	12.13	-0.664**
KS111×Pant Uphar	47.33	0.244	126.17	18.896**	1.87	0.051	7.13	0.693**	1.20	-0.167*	16.20	2.533**
AP1×Kashi Mukta	48.33	2.278**	125.67	7.313***	1.83	0.131**	7.30	1.363**	1.33	-0.017	15.57	0.676**
AP1×Kashi Nandini	44.33	-1.289*	131.50	31.430**	1.83	0.141**	7.57	1.513**	1.60	0.170*	14.40	1.019***
AP1×Pant Uphar	46.67	-0.889	134.83	26.530***	1.77	-0.072	7.57	1.010***	1.40	-0.017	11.33	-2.917**
Kashi Mukta×Kashi Nandani	45.00	2.87***	57.67	-33.587***	1.70	0.028	4.10	-1.020**	1.27	-0.057	17.00	3.496**
Kashi Mukta×Pant Uphar	51.00	6.944***	76.83	-22.654**	1.83	0.014	4.53	-1.090***	1.07	-0.244***	18.50	4.126***
Kashi Nandani×Pant Uphar	49.33	5.711***	82.16	0.963	2.00	0.191***	5.00	-0.740***	1.46	0.076	18.20	5.336**
SE (sij)		1.19		2.55		0.09		0.28		0.13		0.31
		1.76		3.78		0.14		0.41		0.20		0.46

Table 4: Continue...

Parent	No of first fruiting node		No. of grains per pod		Pod length (cm)		Pod width(cm)		Shelling %		Pod yield per plant (g)	
	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA
AP3×KS280	10.27	0.017	8.07	0.656***	8.79	-0.338**	2.03	0.125**	50.00	-0.559	123.37	16.772***
AP3×KS282	9.60	-0.426**	6.47	-0.808***	8.60	-0.419***	1.80	-0.031	51.00	0.891	110.87	0.966
AP3×KS111	12.67	2.537***	7.30	0.019	8.53	-0.143	1.67	-0.111*	48.83	-2.493	106.90	-5.738***
AP3×AP1	8.73	-1.649***	6.43	-1.098***	8.50	-0.376***	1.87	0.005	42.50	-4.343**	110.63	-0.351
AP3×Kashi Mukta	10.47	0.241	7.47	-0.361***	9.43	0.621***	1.73	-0.131**	54.00	5.424***	114.87	6.062***
AP3×Kashi Nandini	11.40	1.651***	7.13	0.006	8.13	-0.213*	2.07	0.232***	43.00	-4.076**	105.63	11.852***
AP3×Pant Uphar	9.80	-0.506**	8.53	0.929***	8.80	-0.276*	1.70	-0.085	54.83	3.341*	104.63	-3.768**
KS280×KS282	8.33	-2.109***	7.40	0.586***	9.43	0.517***	1.83	-0.105*	50.33	-0.243	83.17	-28.231***
KS280×KS111	10.50	-0.046	7.23	0.412***	7.77	-0.806***	1.93	0.049	50.33	-1.459	109.13	-5.001***
KS280×AP1	8.93	-1.866***	6.13	-0.938***	8.57	-0.206	1.93	-0.035	40.00	-7.309***	114.20	1.719
KS280×Kashi Mukta	10.80	0.157	6.53	-0.834***	8.00	-0.709***	1.73	-0.238***	58.00	8.957***	118.87	8.566***
KS280×Kashi Nandani	12.47	2.301***	6.20	-0.468***	7.73	-0.509***	1.90	-0.041	51.50	3.957**	113.70	18.422***
KS280×Pant Uphar	11.53	0.811***	6.30	-0.844***	8.53	-0.439***	2.03	0.142**	56.67	4.707***	94.03	-15.864***
KS282×KS111	12.27	1.944**	7.43	0.749**	8.23	-0.234*	1.73	-0.075	55.00	3.657**	118.10	0.659
KS282×AP1	12.47	1.891**	6.40	-0.534**	9.40	0.733***	1.87	-0.025	43.50	-3.359*	123.00	7.212**
KS282xKashi Mukta	9.47	-0.953**	8.57	1.336**	8.87	0.263*	1.97	0.072	43.17	-5.426**	117.90	4.292***
KS282xKashi Nandani	8.53	-1.409**	6.33	-0.198*	8.30	0.163	2.03	0.169**	45.00	-2.093	123.07	24.482**
KS282x Pant Uphar	9.40	-1.099**	6.30	-0.708**	8.67	-0.201	1.93	0.119**	53.00	1.491	115.77	2.562*
KS111 x AP1	8.50	-2.179**	6.40	-0.541 **	8.73	0.409**	1.83	-0.005	55.00	6.924**	123.00	4.476**
KS111xKashi Mukta	9.53	-0.989**	7.00	-0.238 *	8.17	-0.094	2.07	0.225**	46.17	-3.643**	118.13	1.789
KS111xKashi Nandani	8.53	-1.513**	6.20	-0.338 **	8.37	0.573**	1.80	-0.011	44.50	-3.809**	95.47	-5.854**
KS111xPant Uphar	9.03	-1.569**	8.20	1.186 **	8.40	-0.124	1.73	-0.028	50.67	-2.059	123.17	7.226**
AP1 x Kashi Mukta	9.67	-1.1*	7.37	-0.12	8.73	0.27*	1.93	0.01	53.00	7.26*	114.27	-0.42
AP1xKashi Nandini	10.27	-0.033	7.53	0.746 **	8.40	0.406**	1.90	0.005	46.00	2.174	90.23	-9.434**
AP1xPant Uphar	11.33	0.477**	7.33	0.069	7.67	-1.057**	1.87	0.022	53.00	4.757**	116.70	2.412*
Kashi Mukta x Kashi Nandani	8.33	-1.809**	6.33	-0.751 **	8.30	0.369**	1.70	-0.198**	44.83	-0.726	88.60	-8.888**
Kashi Mukta x Pant Uphar	13.53	2.834**	7.43	-0.128	7.66	-0.994***	1.90	0.052	39.83	-10.143**	112.00	-0.108
Kashi Nandani x Pant Uphar	9.30	-0.923**	6.36	-0.494 **	7.66	-0.527**	1.86	0.049	46.83	-1.643	S90.56	-6.518**
SE (sij)		0.30		0.18		0.20		0.08		2.57		2.32
SE (sij-sik)		0.44		0.26		0.30		0.12		3.81		3.43

*Significant level at 5%, **Significant level at 1%.

The cross combination AP-3 × KS280 was good for four characters *viz.* plant height, number of grains per pod, pod width and pod yield per plant and genotype KS282 was common in both good general combining ability and good specific combining ability so it can be utilized for further crop improvement programme and may be used for selection of transgressive segregants. It is supported by Borah (2009), Guleria *et al.* (2009), Singh *et al.* (2013), Kalia and Shood (2009), Kumar *et al*. (2017), Sigh and Dhall (2018).

Conflict of interest: None.

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