Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(5): 1772-1774
Received: 06-06-2020
Accepted: 04-08-2020

Pallavi
Department of Agriculture, DIBNS, Dehradun, Uttarakhand, India

Alankar Singh
College of forestry, Ranichauri, UUHF, Bharsar, Uttarakhand, India

Sumit Chaudhary
College of forestry, Ranichauri, UUHF, Bharsar, Uttarakhand, India

Corresponding Author:
Pallavi
Department of Agriculture, DIBNS, Dehradun, Uttarakhand, India

Study of nature and magnitude of heterotic response in cowpea (*Vigna unguiculata* (L). Walp) for yield and its attributing components

Pallavi, Alankar Singh and Sumit Chaudhary

Abstract
The diallel method of analysis was followed involving seven parental lines for study of heterosis for various yield characters in cowpea. The F1's and their parents were evaluated in randomized block design with three replications. Observation were recorded on number of pods /plant, number of seeds/pod, seed weight per plant, 100 seed weight and seed yield /plant. The best heterotic crosses identified were Pant Lobai-2 x Pant Lobia-1 for number of pods per plant, Pant Lobia-3 x Pant Lobia-2 for number of seeds per pod, Pant Lobia-5 x Pant Lobia-1 for seed weight per plant, Pant Lobai-3 x Pant Lobia-1 for 100-seed weight and Pant Lobia-2 x Pant Lobia-1 for seed yield per hectare.

Keywords: Heterosis, cowpea and seed yield

Introduction
Cowpea is well adapted crop, cultivated around the world primarily as a pulse, but also as a vegetable (both for the green peas and grain) and cover crop as well as for fodder. Cowpea is considered more tolerant to drought than even soybean and mungbean, due to its deep tap root. Heterosis is usually described in terms of the superiority of F_1 hybrid performance over some measure of parental performance that means definition of heterosis differs depending on the basis of comparison used. Heterosis is defined as improvement of F_1 over the mean of both parents (mid parent heterosis or relative heterosis) (Pickett, 1993, Stuber, 1999) [5, 6]; over the mean of the better parent or heterobeltiosis (Briggs and Knowles, 1967, Jinks, 1983) [1, 3]. These definitions coincide with that of Hayes *et al.*, (1955) [2], who defined heterosis as increased vigour of F_1 over the mean of its parents or over the better parent and this definition is generally accepted. From a commercial point of view, however, heterosis may also be described as the degree of hybrid performance over the best available variety and this is called standard heterosis (Virmani and Edwards, 1983) [7].

Materials and Methods
The present investigation was carried out at the Breeder Seed Production Center of G. B. Pant University of Agriculture & Technology, Pantnagar. The seven cowpea varieties exhibiting genetical diversity in respect of various morphological, development and quantitative characters were sown in crossing block and ploy house during kharif 2014/summer 2015.The emasculation and pollination were done as per method proposed by Krishnaswamy *et al*., (1945) [4]. The recommended agronomic practices and plant protection measures were adopted for raising a good crop. Observations were recorded on randomly selected five plants chosen at random in each entry for different quantitative traits viz., number of pods/plant, number of seeds/pod,seed weight per plant, 100 seed weight and seed yield per hectare. The data were analysed to compute heterosis (%) over better parent (BP) and standard check (SP) values.

Results and Discussion
In the present investigation, heterosis was explained as per cent increase (positive) or decrease (negative) in the average performance of hybrid over the mid parent (relative heterosis), better parent (heterobeltiosis) and check variety Pant Lobia-1 (economic or standard heterosis).
Estimate of heterosis regarding different characters are described in Table 1:

Number of pods per plant
All crosses exhibited the heterobeltiosis in positive direction, the highest value was expressed by Pant Lobia-2 x Pant Lobia-1 (180.00%) followed by PGCP-59 x Pant Lobia-5 (149.14%), PGCP-59 x Pant Lobia-5 (142.24%), Pant Lobia-5 x Pant Lobia-2 (87.08%) and PVCP-20 x

PGCP-63 (71.43%). The economic heterosis was significant for all the crosses. The range of economic heterosis was -10.60% to 201.32%. Crosses showed significant economic heterosis, Pant Lobia-2 x Pant Lobia-1 (201.32%), Pant Lobia-5 x Pant Lobia-2 (74.17%), PGCP-59 x Pant Lobia-5 (91.39%), PGCP-63 x Pant Lobia-5 (86.09%), PGCP-59 x Pant Lobia-2 (112.34%) and PGCP-63 x Pant Lobia-2 (62.25%).

Number of seeds per pod

The significant heterobeltiosis was shown by the entire cross which ranged from -45.32% to 24.28%, out of the seven cross combination showed heterosis in positive direction. The heterobeltiosis was noticed for Pant Lobia-3 x Pant Lobia-2 (24.28%) followed by PVCP-20 x Pant Lobia-2 (14.57%), PGCP-63 x Pant Lobia-5 (12.81%), PVCP-20 x Pant Lobia-3 (12.17%), Pant Lobia-5 x Pant Lobia-2 (9.09%), PGCP-59 x Pant Lobia-5 (7.64%) and PGCP-63 x Pant Lobia-2 (7.51%). The cross PGCP-59 x Pant Lobia-1 (-45.32%) showed heterosis in negative direction followed by PGCP-63 x Pant Lobia-1 (-36.04%), PVCP-20 x Pant Lobia-1 (-17.32%), Pant Lobia-5 x Pant Lobia-1 (-10.95%), PGCP-63 x PGCP-59 (-8.71%), Pant Lobia-2 x Pant Lobia-1 (-6.40%) and PVCP-20 x Pant Lobia-3(-4.55%).Significant economic heterosis was showed by the entire cross which range from -42.03% to 30.02%, out of these twelve cross combination showed heterosis in positive direction. The highest economic heterosis were notice for Pant Lobia-3 x Pant Lobia-2 (30.02%), followed by PVCP-20 x Pant Lobia-5 (26.10%), Pant Lobia-5 x Pant Lobia-2 (21.94%), PGCP-59 x Pant Lobia-5 (20.73%), PVCP-20 x Pant Lobia-2 (19.86%), PVCP-20 x Pant Lobia-3 (17.09%), Pant Lobia-5 x Pant Lobia-3 (14.48%), PGCP-63 x Pant Lobia-2 (12.47%), PGCP-59 x Pant Lobia-5 (9.24%), Pant Lobia-3 x Pant Lobia-1 (6.93%), PVCP-20 x PGCP-59 (6.89%) and PVCP-20 x Pant Lobia-5 (6.70%), whereas the cross PGCP-59 x Pant Lobia-1 (-42.03%) followed by PGCP-63 x Pant Lobia-5 (-34.41%) and PVCP-20 x Pant Lobia-1 (-16.32%) showed negative economic heterosis.

Seed weight per plant (g)

Out of twenty one, nineteen cross showed heterobeltiosis and seventeen in desired direction and the range was -15.49% to 44.57%. The best combination was Pant Lobia-2 x Pant Lobia-1 (44.57%) followed by PVCP-20 x PGCP-59 (42.58%), Pant Lobia-5 x Pant Lobia-1 (41.75%), Pant Lobia-2 x Pant Lobia-2 (40.73%) and PGCP-59 x Pant Lobia-5 (37.07%). The cross PGCP-63 x Pant Lobia-1 (-15.49%) followed by PGCP-63 x PGCP-59 (-12.98%) showed negative heterosis. Eighteen cross combinations exhibited significant economic heterosis, which ranged from 26.31% to 83.64%. The highest value was noticed for Pant Lobia-5 x Pant Lobia-1 (83.64%) followed by Pant Lobia-5 x Pant Lobia-2 (82.32%), PGCP-63 x Pant Lobia-5 (77.57%), Pant Lobia-2 x Pant Lobia-1 (75.46%) and Pant Lobia-5 x Pant Lobia-3 (74.67%).

100-seed weight (g)

Heterobeltiosis ranged from -17.13% to 30.97%. Seventeen crosses showed significant heterobeltiosis, out of which twelve crosses expressed heterobeltiosis in positive direction. The cross Pant Lobia-3 x Pant Lobia-1 (30.97%) followed by Pant Lobia-3 x Pant Lobia-2 (27.80%), PVCP-20 x PGCP-63 (18.43%), PGCP-59 x Pant Lobia-2 (17.34%), PGCP-59 x Pant Lobia-3 (17.24%) and PGCP-63 x Pant Lobia-3(12.56%). showed positive heterosis. The cross PGCP-63 x Pant Lobia-1 (-17.13%) followed by PGCP-63 x Pant Lobia-5 (-16.17%), PVCP-20 x Pant Lobia-3 (-15.49%), PVCP-20 x Pant Lobia-5(-4.08%) and PGCP-59 x Pant Lobia-5 (-4.02%) showed negative heterosis. Seventeen combinations showed significant standard heterosis which ranged from -25.43 to 34.31%, nine crosses combination showed economic heterosis in desired direction. Among which Pant Lobia-3 x Pant Lobia-1 (34.31%) had highest value followed by Pant Lobia-5 x Pant Lobia-1 (17.30%), Pant Lobia-5 x Pant Lobia-2 (10.21%) and PGCP-59 x Pant Lobia-1 (10.03%). The crosses PVCP-20 x Pant Lobia-3 (-25.43%) followed by PGCP-63 x Pant Lobia-1 (-15.43%) and PVCP-20 x PGCP-59 (-12.89%) showed negative economic heterosis.

Seed yield per hectare (q/ha)

Eighteen crosses exhibited significant hetrobeltiosis in desired direction,the range was 6.20% to 57.47%. The best combination was Pant Lobia-2 x Pant Lobia-1 (57.47%) followed by PVCP-20 x Pant Lobia-2 (47.73%), Pant Lobia-3 x Pant Lobia-2 (41.13%), PGCP-63 x Pant Lobia-5 (39.11%) and Pant Lobia-5 x Pant Lobia-3 (38.13%). Twenty combinations exhibited significant positive economic heterosis which ranged from 4.95% to 82.75%. The highest value was noticed for PGCP-63 x Pant Lobia-5 (82.75%) followed by Pant Lobia-5 x Pant Lobia-3 (81.47%), Pant Lobia-5 x Pant Lobia-1 (80.55%), Pant Lobia-3 x Pant Lobia-2 (79.45%), Pant Lobia-2 x Pant Lobia-1 (77.98%) and Pant Lobia-3 x Pant Lobia-1 (74.31%).

Table 1: Heterobeltosis & standard heterosis for yield and yield contributing characters in cowpea

S.N.	Name of crosses	No. of pods/plant		No. of seeds/pod		Seed wgt/plant		100 seed wgt		Seed yield /ha	
		Heterosis over		Heterosis over		Heterosis over		Heterosis over		Heterosis over	
		BP	SP	BP	SP	BP	SP	BP	SP	BP	SP
1	Pant Lobia-2 X Pant Lobia-1	180.00**	201.32**	-6.40**	-2.08*	44.57**	75.46**	3.98*	2.46**	57.47**	77.93**
2	Pant Lobia-3 X Pant Lobia-1	38.41**	39.41**	2.43	6.93**	28.85**	72.03**	30.97**	34.31**	37.09**	74.31**
3	Pant Lobia-5X Pant Lobia-1	49.01**	50.01**	-10.95**	-0.46	41.75**	83.64**	6.44**	17.30**	37.43**	80.55**
4	PGCP-59 X Pant Lobia-1	48.01**	49.56**	-45.32**	-42.03**	0	1	10.03**	10.97**	2.69**	4.95**
5	PGCP-63 X Pant Lobia-1	52.65**	54.87**	-36.04**	-34.41**	-15.49**	-2.11	-17.13**	.15.43**	-2.91	4.04
6	PVCP-20 X Pant Lobia-1	17.55**	19.43**	-17.32**	-16.32**	24.16**	36.94**	-1.38	-2.48**	29.39**	32.48**
7	Pant Lobia-3 X Pant Lobia-2	30.77**	40.73**	24.28**	30.02**	12.85**	50.66**	27.80**	2.60*	41.13**	79.45**
8	Pant Lobia-5 X Pant Lobia-2	87.08**	101.32**	9.09**	21.94**	40.73**	82.32**	0	10.21**	15.50**	51.74**
9	PGCP-59 X Pant Lobia-2	61.85**	74.17*	3.05	9.24**	5.87**	28.50**	17.34**	16.69	16.88**	32.11**
10	PGCP-63 X Pant Lobia-2	50.77**	62.25**	7.51**	12.47**	4.57*	26.31**	10.13**	11.59**	15.58**	30.64**
11	PVCP-20 X Pant Lobia-2	4.62*	12.57**	14.57**	19.86**	33.70**	62.27**	11.57**	10.59**	47.73**	66.97**
12	Pant Lobia-5 X Pant Lobia-3	16.38**	-10.60**	2.69	14.78**	30.83**	74.67**	9.73	8.30**	38.13**	81.47**
13	PGCP-59 x Pant Lobia-3	40.17**	6.29**	-4.14*	1.62*	14.03**	52.24**	17.24**	13.2	23.09**	56.51**
14	PGCP-63 X Pant Lobia-3	56.16**	13.25**	-1.55	2.77	1.19	35.09**	12.56**	11.46**	6.20**	35.05**

15	PVCP-20 x Pant Lobia-3	60.27**	16.23**	12.17**	17.09**	16.40**	55.41**	-15.49**	-25.43**	-1.59	25.14**
16	PGCP-59 X Pant Lobia-5	149.14**	91.39**	7.64**	20.30**	37.07**	77.578*	4.02**	5.71**	23.74**	62.57**
17	PGCP-63 X Pant Lobia-5	142.24**	86.09**	12.81**	26.10**	12.22**	45.38**	-16.17**	-7.61**	39.11**	82.75**
18	PVCP-20 X Pant Lobia-5	47.41**	13.25*8	-4.55**	6.70**	24.64**	61.48**	4.08*	5.64**	9.08**	43.30**
19	PGCP-63 X PGCP-59	63.32**	23.84**	-8.71**	-3.23	-12.98**	0.79	1.61	-12.80**	28.08**	37.25**
20	PVCP-20 X PGCP-59	46.39**	10.93**	0.87	6.93**	42.58**	57.26**	9.02**	,-3.81*	17.02**	20.73**
21	PVCP-20 X PGCP-63	71.43**	19.21**	-2.25	0.23	35.54**	56.99**	18.43**	4.50*	26.54**	35.60**

References

1. Briggs FN, Knowles PF. Introduction to Plant Breeding. Reinhold Publishing Corporation, New York, 1967.
2. Hayes HK, Immer FF, Smith DC. Methods of Plant Breeding, McGraw Hill Book Publishing Company, Inc., New Delhi, 1955.
3. Jinks JL. Biometerical genetics of heterosis. In: R. Frankel (ed.) Heterosis, A Reappraisal of Theory and Practice, Monographs on TAG. Springverlvy, Berlin, Heidelberg. 1983; 6:1-46.
4. Krishnaswamy N, Nambiar KK, Mariakulandai A. Studies in cowpea (*V. unguiculata*). Madras Agric. J. 1945; 33:145-160.
5. Pickett AA. Hybrid wheat results and problems, In: Advance Plant Breeding. Berlin Panlparey Sc. Publ., Berlin, 1993, 245.
6. Stuber CW, Lincoln SE, Wolff DW, Helentjaris T, Lander ES. Identification of genetic factors contributing to heterosis in a hybrid from two elite maize inbreds using molecular markers. Genetics. 1999; 132:823-839.
7. Virmani SS, Edwards IB. Current status and future prospects for breeding hybrid rice and wheat. Adv. Agron. 1983; 36:145-157.