Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2017; 6(6): 376-378
Received: 15-09-2017
Accepted: 17-10-2017

Ankit Kumar
Department of Genetics & Plant Breeding, G. B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India

KS Nirania
Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar, Haryana, India

Chhavikant
Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar, Haryana, India

AH Bankar
Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar, Haryana, India

Correspondence
Ankit Kumar
Department of Genetics & Plant Breeding, G. B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India

Combining ability for seed cotton yield and attributing traits in American cotton (*Gossypium hirsutum* L.)

Ankit Kumar, KS Nirania, Chhavikant and AH Bankar

Abstract
The present Line x tester analysis was attempted to obtain information on the magnitude of gca and sca variances and gca and sca effects for individual parents and crosses in respect of eight traits through combining ability analysisMaterial for this investigation comprised of forty American cotton hybrids developed on four female parents (testers) using ten male parents (lines) in line x testers mating design and one standard check (HHH 223).The experimental material was grown at CCS Haryana Agricultural University, Cotton Research Station Sirsa, during *Kharif* 2014-2015 in a randomized block design with three replications. Observations were recorded for eight characters namely, plant height, number of monopods, number of bolls, boll weight, ginning outturn, seed index, lint index and seed cotton yield/plant. Combining ability analysis revealed that additive variance was more than non-additive variance in the expression of all the traits. For seed cotton yield high sca effects shown crosses H1098 × RED 5-7, H1300 × RED 5-7, H1300 × PUSA-180, H1226 × FM 531B LINE-7 and H1300 × HS-60 were cross combinations of poor combining parents. The study of gca effects revealed that male parents HS-180 and PUSA-1803 were best general combiner for seed cotton yield, number of bolls, ginning out turn, seed index, lint index and number of monopods. The respective best combiners for various traits could be used for improvement in that trait. However, considering the economic important of various characters HS-180, GS-10, PUSA-1803 and RED 5-7 among the male and H1117 among female may be used for future breeding programme.

Keywords: American cotton, *Gossypium*, Combining ability

Introduction
Cotton (*Gossypium hirstum* L.) as a crop as well as commodity plays an important role in economy of the nation and consistently influenced our economy through its production and processing sectors as it is responsible for livelihood of 60 million people including 4.5 million farmers in India. Among all the 80 cotton growing countries in the world, India occupies the fore most position in cotton acreage. Even after devoting so much land to cotton than any other country India lag behind in production due to its low productivity. Among the many genetic approaches being explored Combining ability is most widely used biometrical genetical approach in plant breeding, which has been proved one of the potential option for breaking this yield plateau in cotton, for increasing its production and productivity. For successful hybridization programme parents should be selected not only on the basis of their diversity but also on the basis of their combing ability. Hence information on combining ability will help the breeder in developing the future breeding programme to be adopted for exploiting additive and/or non-additive components present in the material. In the present investigation an attempt was made to obtain information on the magnitude of gca and sca variances and gca and sca effects for individual parents and crosses.

Material and Methods
Forty American cotton hybrids, developed during *kharif* season 2014 on four female parents (testers) using ten male parents (lines) in line x tester mating design along with one standard check (HHH 223) constituted the present experiment material. The experiment was conducted in a RBD with three replications at CCS Haryana Agricultural University, Cotton Research Station, Sirsa. A spacing of 67.5 cm between rows and 60cm within the row was adopted. Hand emasculation was followed for crossing work. Data was collected on 5 randomly selected plants in each replication on 8 characters *viz.*, plant height, monopods/plant, bolls/plant, boll weight (g), seed cotton yield/plant (g), ginning outturn, seed index (g) and lint index (g).General combining ability and specific combining ability variances were estimated with method suggested by Kempthorne (1957) for Line x Tester analysis.

Results and Discussion

For the success of any hybridization programme selection of parents is critical and should be with appropriate care, based on their combining ability. The parents that combine well with each other are most desirable ones. In spite of genetic diversity, combining ability also play an important role in development of better heterotic hybrids. Data presented in Table 1 revealed that mean sum of squares due to specific combining ability variance were significant for almost all the characters. This indicated that both additive and non-additive variances were present with the predominance of additive variance for most of the characters. These findings were akin to the findings of Manish *et al.*, (2013), Rajmani *et al.*, (2014), Swakar *et al*., (2015), Monicashree *et al*., (2017) [4] and Sivia *et al*., (2017) [9].

Table 1: Combining ability analysis for different characters in upland cotton

Source of variation	D.F	Plant height	No. of monopods	No. of bolls	Boll weight	Seed cotton yield/plant	Ginning out turn	Seed index	Lint index
Replication	2	188.90	4.22	1.72	0.03	173.13	1.01	3.02	0.92
Lines	9	646.34*	2549.23*	572.89*	1.05*	6481.13*	154.07*	1570.31*	173.73*
Testers	3	1249.76*	5454.59*	336.00*	1.41*	6036.57*	2120.59*	12975.24*	3509.42*
Lines x Testers	27	1300.09*	2384.63*	78.54*	0.79*	1231.60*	170.35*	1597.60*	161.55*
Error	78	60.86	4.85	17.16	0.09	79.52*	1.17	4.39	0.50

*Significance at 5% level of significance.

General Combining Ability

Best combining male and female parents for various traits are presented in Table 2. The perusal of table revealed that among female parents H1117 was the best combiner for the characters *viz.,* Seed cotton yield per plant, plant height, ginning out turn, number of bolls and number of monopods. Female parent H1098 was second best combiner, which combined best for seed index, lint index, boll weight and dwafness followed by female parents H1300 and H1226, which were best combiners for ginning out turn and number of monopods.

Male parent PUSA-180 was best combiner for ginning out turn and number of monopods. For increased plant height Delcero was the best combiner followed by RED 5-7. However for dwarfness GS-10 was found to be best combiner. Among male parents, HS-180 was best general combiner for seed cotton yield, number of bolls, ginning out turn, number of bolls and number of monopods. The second best combiner for seed cotton yield was GS-10, which was also found to be best combiner for dwarfness, number of bolls, seed index and lint index followed by PUSA-1803 which was best combiners for seed index, seed cotton yield and boll weight.

Male parents HS-180 and GS-10 were best combiners for number of bolls. While male parents Delcero and Tamcot SP-23 were found to be best combiner for lint index and seed index followed by male parents GS-10, HS-60 and PUSA-180.

Table 2: Best general combining parents and best specific combining hybrids on the basis of their combining ability

S. No.	Characters	Best general Combiner			Best specific crosses	
		Male		Female		
		1st Best combiner	2nd Best combiner	1st Best Combiner	1st	2nd
1	Plant height	Delcero (9.34*)	RED 5-7 (4.58*)	H1117 (8.04*)	H1226 × GS-10 (37.36*)	H1098 × RED 5-7 (32.73*)
2	No. of monopods	HS-180 (1.48*)	FM 531B LINE-7 (0.72*)	H1117 (0.54*)	H1117 × PUSA-180 (1.45*)	H1226 × RED 5-7 (1.29*)
3	No. of bolls	HS-180 (13.32*)	GS 10 (7.43*)	H1117 (3.61*)	H1300 × PUSA-180 (7.53*)	H1098 × Tamcot SP-23 (7.13*)
4	Boll weight	PUSA-1803 (0.46*)	HS-2 (0.21*)	H1098 (0.23*)	H1098 × GS-10 (1.22*)	H1098 × Tamcot SP-23 (1.07*)
5	Seed cotton yield per plant	HS-180 (35.54*)	GS 10 (32.82*)	H1117 (19.64*)	H1098 × RED 5-7 (37.19*)	H1300 × RED 5-7 (27.09*)
6	Ginning out turn	PUSA-180 (4.85*)	RED 5-7 (3.65*)	H1117 (4.38*)	H1098 × PUSA-180 (14.44*)	H1098 × HS-180 (13.16*)
7	Seed index	PUSA-1803 (18.62*)	Tamcot SP-23 (12.24*)	H1098 (31.20*)	H1098 × PUSA-1803 (57.62*)	H1098 × Tamcot SP-23 (36.24*)
8	Lint Index	Delcero (2.86*)	Tamcot SP-23 (2.81*)	H1098 (16.22*)	H1098 × HS-60 (8.23*)	H1098 × GS-10 (7.51*)

*Significant at 5% level of significance.

Specific Combining Ability

Best specific cross combinations for different characters have also been presented in Table 2whichrevealed that for plant height, hybrids H1226 × GS-10 and H1098 × RED 5-7 respectively exhibited highest sca effects. The cross combination H1098 × GS-10 showed highest sca for dwarfness. These all were combinations of poor x poor indicating non-additive type of gene action in expression of this trait. Similar results were also confirmed by earlier workers. For number of monopods best specific cross combinations H1117 × PUSA-180 and H1226 × RED 5-7 involved both the parents as good combiners.

For number of bolls, cross combinations H1300 × PUSA-180 and H1098 × Tamcot SP-23 which showed high sca effects were a combination of poor x poor combining parents and therefore due to dominance effect which is non-additive in nature and hence non fixable. Similar results were also reported by earlier workers

The cross combinations H1098 × GS-10 and H1098 × Tamcot SP-23 recorded highest sca effect for boll weight cross which

was a combination of good general combiner into poor general combiner. Hence, sca effect of these crosses is mainly additive which is fixable.

The cross which registered maximum sca effect for ginning out turn was H1098 × PUSA-180 succeeded by H1098 × HS-180 and H1098 × FM 531B LINE-7. All the crosses were combinations of poor x good combining parents; hence sca effect of these crosses is due to non-additive.

For seed index, crosses H1098 × PUSA-1803, H1098 × Tamcot SP-23 and H1098 × Delcero exhibited high sca effects. All these were combination of good x good combiner parents. High sca effects for lint index were depicted by hybrids H1098 × PUSA-180, H1098 × GS-10 and H1098 × Tamcot SP-23, H1098 × PUSA-180 and H1098 × Delcero. These crosses were combination of both good combining parent, indicating that dominance variance were important for this character.

Parent HS-180 and GS-10 has been identified as best combiner for seed cotton yield. High performance of cross combination can also be due to non-additive or epistatic gene action. The results have been discussed in the light of their usefulness in the future breeding programmes. The *per se* performance of the hybrids was not necessarily associated with the gca effects of the parents. These findings are in agreement to the findings of Senthil *et al*., (2014) [8], Memon *et al.*, (2016) [3], Sajjad *et al*., (2016) [6] and Kumar (2017) [2].

Conclusion

From the above discussion, it is clear that, both additive and non-additive variances were present with the predominance of additive variance for grain yield and its component traits observed in the present study, favoring hybrid breeding programme. The cross combinations showing highest sca effects for seed cotton yield *viz.*, H1098 × RED 5-7, H1300 × RED 5-7, H1300 × PUSA-180, were generally not having high *per se* for yield and its component traits. However, considering the economic important of various characters HS-180, GS-10, PUSA-1803 and RED 5-7 among the males and H1117 among females may be used commercially by proper evaluation through multi-location evaluation trials.

Acknowledgement

I am grateful towards the authorities and workers of CCS Haryana Agricultural University, Cotton Research Station, Sirsa for providing material and necessary help for conducting the research leads to completion of my master's degree, especially to Dr. N.K. Yadav for his support and proper guidance from time to time.

References

1. Kumar M, Nirania KS, Sangwan RS, Yadav NK. Combining ability studies for yield and quality traits in upland cotton (*Gossypium hirsutum*L.). J Cotton Res. Dev. 2013; 27(2):171-174.
2. Kumar SK, Nidagundi JM, Hosamani AC. Genetic analysis for yield and its component traits in upland cotton (*gossypium hirsutum* L.) Int. J Agric. Sci. Res. 2017; 7(2):469-476.
3. Memon MJ, Kumbhar MB, Rind MJ, Keerio MI, Memon S. Combining ability estimates for yield and fiber quality parameters in *Gossypium hirsutum* L. hybrids. J Appl. Sci. 2016; 12:53-58.
4. Monicashree C, Balu PA, Gunasekaran M. Combining Ability and Heterosis Studies on Yield and Fibre Quality Traits in Upland Cotton (*Gossypium hirsutum* L.) Int. J Curr. Microbiol. App. Sci. 2017; 6(8):912-927.
5. Rajamani S, Gopinath M, Reddy KHP. Combining ability for seed cotton yield and fibre characters in upland cotton (*Gossypium hirsutum* L.). J Cotton Res. Dev. 2014; 28(2):207-210.
6. Sajjad M, Azhar MT, Malook S. Line × tester analysis for different yield and its attributed traits in Upland Cotton (*Gossypium hirsutum* L.) Agric. Biol. JN. Am. 2016; 7(4):163-172.
7. Sawarkar M, Solanke A, Mhasal GS, Deshmukh SB. Combining ability and heterosis for seed cotton yield, its components and quality traits in *Gossypium hirsutum* L. Indian J Agric. Res. 2015; 49(2):154-159.
8. Senthil Kumar, Kumar KA, Ravi Kesavan R. Genetic effects of combining ability studies for yield and fibre quality traits in diallel crosses of upland cotton (*Gossypium hirsutum* L.). Afr. J Biotechnol. 2014; 13(1):119-126.
9. Sivia SS, Siwach SS, Sangwan O, Lingaraja L, Vekariya RD. Combining Ability Estimates for Yield Traits in Line x Tester Crosses of Upland Cotton (*Gossypium hirsutum*). Int. J Pure App. Biosci. 2017; 5(1):464-474.