Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8726

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2021) *9*(3), 217-223

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Variability Studies in Desi Cotton (*Gossypium arboreum* L.)

***Mahesh B., Valu M. G., Shaker C. and Surya T. T.**

Department of Genetics and Plant Breeding, College of Agriculture, Junagadh Agricultural University
Junagadh – 362 001, Gujarat, India

*Corresponding Author E-mail: maheshbandari3333gmail.com

Received: 3.05.2021 | Revised: 15.06.2021 | Accepted: 23.06.2021

ABSTRACT

The present Investigation was carried out to study the variability, heritability and genetic advance in desi cotton. The material was evaluated in a Randomized Block Design (RBD) with three replications during kharif 2019. In this experiment analysis of variance indicated that significant variation present among the accessions of the desi cotton for all the traits under study. The highest genotypic (GCV) and phenotypic coefficient of variation (PCV) were exhibited by the number of bolls per plant. High heritability with high genetic advance was observed in number of bolls per plant, the number of monopodia per plant, lint index, seed cotton yield per plant and number of sympodia per plant. The combination of the high heritability and high genetic advance provide the clear image of the trait in the selection process.

Keywords: *Genetic advance, heritability, GCV, PCV, coefficient of variability.*

INTRODUCTION

Cotton (*Gossypium arboreum* L.) 2n = 26), is one of the most importantfiber and cash crop of India. Cotton, the king of fibre, is one of the momentous and an important cash crop exercising profound influence on economics and social affairs of the world. Any other fibre crop cannot compare with cotton for its fibre quality. The commercial cotton is grown in 77 countries and 123 countries are involved in the cotton related activities. Specific areas of production include countries such as China, USA, India, Pakistan, Uzbekistan, Turkey, Australia, Greece, Brazil, Egypt etc. where climatic conditions suit the natural growth requirements of cotton, which includes periods of hot and dry weather and adequate moisture obtained through irrigation.

India is the only country in the world where all the four cultivated species are grown on commercial scale. In India, cotton is planted in about 122.38 lakh hectares of land and it occupies second position in production with 361.00 lakh bales (each of 170 kg) among all cotton producing countries in the world i.e. next to China.

Cite this article: Mahesh, B., Valu, M. G., Shaker, C., & Surya, T. T. (2021). Variability Studies in Desi Cotton (*Gossypium arboreum* L.), *Ind. J. Pure App. Biosci.* *9*(3), 217-223. doi: http://dx.doi.org/10.18782/2582-2845.8726

This article is published under the terms of the Creative Commons Attribution License 4.0.

Average productivity of India is 501 kg/ha which is low as compared to world average of 779 kg/ha. Gujarat is the second largest growing state with acreage of 27.09 lakh hectares and the highest cotton producing state of India with production of 92 lakh bales. The average productivity of cotton in state (577 kg/ha) is higher than the national average (Anon, 2018). There are four cultivated species of cotton *viz.*, *Gossypium arboreum*, *G. herbaceum*, *G. hirsutum* and *G. barbadense*. The first two species are diploid (2n = 26) and are native to old world. They are also known as Asiatic cottons because they are grown in Asia. The last two species are tetraploid (2n = 52) and are also known as New world cottons. *G. arboreum* isalso known as desi cotton or lowland cotton.

MATERIALS AND METHODS

Plant material

The present investigation carried out at Cotton Research Station, Junagadh Agricultural University, Junagadh during *kharif* 2019. The experimental material consisted of fifty diverse genotypes of cotton (*Gossypium arboreum* L.). The pure seeds of these genotypes were obtained from the Cotton Research Station, Junagadh Agricultural University,Junagadh.

Field trial

Fifty genotypes of cotton were sown on 26th June, 2019 in a Randomized Block Design (RBD) with three replications at Cotton Research Station, Junagadh Agricultural University,Junagadh. Each line was sown in a single row plot of 6.3 × 1.2 m length with each row spaced 120 cm apart and plant to plant distance within row was 45 cm. The genotypes were randomly allotted to the plots in each replication. Fertilizers at recommended doses were applied andother cultural practices were carried out at regular intervals during the course of experimentation. Application of N was split into two equal installments *i.e.*, basal and top dressing. All the recommended agronomical practices along with necessary plant protection measures were followed timely for the successful raising of the crop. The observations were recorded on five randomly selected plants from each genotype in each replication for days to first flowering, days to boll opening, plant height (cm), number of monopodia per plant, number of sympodia per plant, number of bolls per plant, boll weight (g), seed cotton yield per plant (g), ginning percentage (%), seed index (g), lint index (g) and oil content (%).

Statistical analysis

The analysis of variance forrandomized block design (RBD) was done for each character as per Panse and Sukhatme (1985). The genotypic and phenotypic coefficient variations were calculated as per the formula given by Burton (1952). Heritability and expectedgenetic advance as per cent of mean (GA as % of mean) was calculated for each character by adopting the procedure as suggested by Allard (1960).

RESULTS AND DISCUSSION

Variability is the prerequisite for organization of breeding programmes and its estimates helps in realization of response to selection as the progress in breeding depends upon its amount, nature and magnitude of variability (Singh & Narayanan, 2013).

Analysis of variance

The analysis of variance revealed that mean squares due to genotypes were highly significant for all the characters indicating the presence of sufficient amount of variability in the experimental used (Table-1). Similar results were obtained by Dhivya et al. 2014; Dahiphale et al. 2015; Handi et al. 2016 and Sunayana et al. 2017.

Genotypic and phenotypic coefficients of variation

Close relationship between genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) was observed for all the characters (Figure-I & Table-2). The magnitude of PCV was slightly greater than GCV revealed a very little influence of environmental variation for their expression. This indicated that phenotypic variability may be considered as reliable measure of genotypic variability. Similar results have also been

reported by Dhamayanathi et al. 2010; Dahiphale et al. 2015; Abdullah et al. 2016 and Sunayana et al. 2017.

The high GCV and PCV were observed for number of monopodia per plant followed by number of bolls per plant and boll weight. The high genotypic coefficient of variation indicated the presence of wide variation for the characters under study to allow selection for individual traits. High value of GCV and PCV for number of bolls per plant was also reported by Dahiphale et al. 2015 and Sunayana et al. 2017.

In the present study moderate value for phenotypic and genotypic coefficient of variation was observed for number of monopodia per plant were reported by Araujo et al. 2012 and Deshmukh et al. 2019; seed cotton yield per plant by Sunayana et al. 2017 and Deshmukh et al. 2019; lint index and in addition to this, two characters viz., number of sympodia per plant and boll weight. This finding is in accordance with Dhivya et al. 2014; Vinodhana et al. 2013 and Latif et al. 2015.

Days to first flowering, days to boll opening, plant height, ginning percentage, seed index, oil content, 2.5 % span length, fibre strength and fibre fineness exhibitedlow magnitude of both genotypic andphenotypic coefficient of variation. This finding is in accordance with Sunayana et al. 2017 for days to first flowering; Dhivya et al. 2014 for days to boll opening and plant height; Vinodhana et al. 2013 and Sunayana et al. 2017 for ginning percentage; Shahzad et al. 2015 for seed index and Dhamayanathi et al. 2010 for oil content, while, for 2.5 % span length, fibre strength and fibre fineness by Erande et al. 2014 and Chinchane et al. 2018.

Heritability

In present study, very high heritability in broad sense estimates were observed for days to boll opening (95.31 %), number of bolls per plant (95.05 %), days to first flowering (94.03 %), fibre strength (91.68 %), number of monopodia per plant (90.52 %), ginning percentage (90.25 %), lint index (88.23 %), seed cotton yield per plant (87.72 %), numberof sympodia per plant (86.20 %), fibre fineness (84.69 %) and 2.5 % span length (80.09 %). High estimate of heritability was observed for boll weight (78.24 %), plant height (72.63 %) and seed index (72.25 %). Very high heritability estimatesfor days to boll opening also recorded by Erande et al. 2014; Haritha et al. 2014and Handi et al. 2016; for number of bolls per plant by Sunayana et al. 2017 and Deshmukh et al. 2019; for days to first flowering by Dahiphale et al. 2015; Patil et al. 2014 and Deshmukh et al. 2019; for fibre strength by Sunayana et al. 2017; for number of monopodia per plant and ginning percentage by Dhamayanathi et al. 2010 and Handi et al. 2016; for lint index by Rajeev etal. 2014; Erande et al. 2014 and Sunayana et al. 2017; for seed cotton yield per plant by Haritha et al. 2014 and Deshmukh et al.2019; for number of sympodia per plant by Vinodhana et al. 2013 and Sunayana et al. 2017; for fibre fineness by Vinodhana et al. 2013 and Deshmukh et al. 2019; for 2.5 % span length by Dhivya et al. 2014 and Latif et al. 2015; for boll weight by Haritha et al. 2014 and Vinodhana et al. 2013; for plant height by Dhivya et al. 2014 and Patil et al. 2014; and for seed index by Shahzad et al. 2015 and Sunayana et al. 2017.

Genetic advance expressed as per cent of mean

The genetic advance expressed as per cent of mean was highest for number of bolls per plant (42.41 %), number of monopodia per plant (35.04 %), seed cotton yield per plant (32.91 %), lint index (27.04 %) and number of sympodia per plant (22.83). The highest values of genetic advance expressed as per cent of mean have been reported in cotton for number of bolls per plant by Dahiphale et al. 2015; Patil et al. 2014 and Deshmukh et al. 2019; for number ofmonopodia per plant by Sunayana et al. 2017 and Deshmukh et al. 2019; for seed cotton yield per plant by Vinodhana et al. 2013 and Deshmukh et al. 2019; for number of sympodia per plant by Dhivya et al. 2014 and Latif et al. 2015 and for lint index by Vinodhana et al. 2013.

The moderate estimate of genetic advance as per cent of mean was observed for the boll weight (19.77 %), plant height (12.16 %), days to first flowering (12.12 %), fibre strength (11.88 %) and seed index (11.71 %). The similar finding was also obtained by for boll weight by Sunayana et al. 2017; for plant height by Dhivya et al. 2014; for days to first flowering by Dahiphale et al. 2015; for fibre strength by Rajeev et al. 2014; for fibre fineness by Haritha et al. 2014 and for seed index by Shahzad et al. 2015.

The lower genetic advance as per cent of mean was observed for the ginning percentage (9.48 %), days to boll opening (9.29 %), fibre fineness (7.56 %), 2.5 % span length (6.95 %) and oil content (2.35 %). The similar finding was also obtained by Dhamayanathi et al. 2010; Vinodhana et al. 2013 and Sunayana et al. 2017.

In the present investigation, the estimates of high heritability coupled with genetic advance expressed as per cent of mean was observed for number of bolls per plant, number of monopodia per plant, seed cotton yield per plant, lint index and number of sympodia per plant. These characters may have contributed to preponderance of additive gene action and selection pressure could profitably be applied on these characters for their rationale improvement (Panse, 1957).

The very high heritability associated with moderate genetic advance expressed as per cent of mean was observed for days to first flowering. While, high heritability along with moderate genetic advance (% of mean) was expressed by boll weight, plant height and seed index. The very high heritability associated with low genetic advance (% of mean) was found for ginning percentage, days to boll opening and oil content. It may be inferred that these traits were regulated by non additive gene action and presence of high genotype × environment interaction. The heritability is being exhibited due to favourable influence of environmental factors rather than the genotypes alone and simple selection will not be rewarding. As such, progeny testing is to be practiced for amelioration of these traits. However, they can be improved either by development of hybrid varieties if commercially feasible or by utilization of transgressive segregants in segregating generations.

Table 1: Analysis of variance for all the characters in 50 genotypes of cotton

Source of variation	d.f.	Days to first flowering	Days to boll opening	Plant height (cm)	Number of monopodia per plant	Number of sympodia per plant	Number of bolls per plant	Boll weight (g)	Seed cotton yield per plant(g)
Replications	2	5.68	11.49	74.25	0.25	0.17	2.39	0.02	7.28
Genotypes	49	56.1**	81.53**	551.82**	0.97**	16.62**	149.01**	0.35**	705.69**
Error	98	3.35	3.82	151.03	0.09	2.29	7.38	0.08	85.51

Source of variation	d.f.	Ginning percentage (%)	Seed index (g)	Lint index (g)	Oil content (%)	2.5 % span Length (mm)	Fibre fineness (mv)	Fibre strength (g/tex)
Replications	2	0.02	0.14	0.04	0.01	0.15	0.004	2.78
Genotypes	49	10.03**	0.70**	0.79**	0.16**	3.37**	0.22**	12.22**
Error	98	0.98	0.19	0.09	0.01	0.67	0.03	1.02

*, ** Significant at 5 and 1% levels, respectively

Table 2: Mean, phenotypic range, σ^2g, σ^2p, σ^2e, GCV %, PCV %, heritability, genetic advance, genetic advance per cent of mean for all the charactersof cotton

Character	Mean±SE	Range		σ^2g	σ^2p	σ^2e	GCV (%)	PCV (%)	Heritability % in Broad Sense	Genetic advance	Genetic advance (% mean)
		Min.	Max.								
Days to first flowering	69.10±1.06	62.70	80.00	17.58	18.70	1.12	6.06	6.25	94.03	8.38	12.12
Days to boll opening	110.10±1.13	102.30	123.30	25.90	27.18	1.27	4.62	4.73	95.31	10.24	9.29
Plant height (cm)	166.90±7.10	133.70	195.70	133.59	183.94	50.35	6.92	8.12	72.63	20.29	12.16
No. of monopodia per plant	3.00±0.18	1.70	4.60	0.29	0.32	0.03	17.87	18.79	90.52	1.06	35.04
No. of sympodia per plant	18.30±0.85	11.50	21.60	4.77	5.54	0.76	11.93	12.85	86.20	4.18	22.83
No. of bolls per plant	32.50±1.57	19.40	55.70	47.21	49.67	2.46	21.11	21.66	95.05	13.80	42.41
Boll weight (g)	2.80±0.16	2.30	3.80	0.09	0.12	0.03	10.85	12.26	78.24	0.55	19.77
Seed cotton yield per plant(g)	84.30±5.38	51.50	128.80	206.72	235.66	28.93	17.05	18.21	87.72	27.74	32.91
Ginning percentage (%)	35.80±0.57	31.60	41.80	3.01	3.34	0.33	4.84	5.10	90.25	3.40	9.48
Seed index (g)	6.10±0.25	5.60	8.10	0.16	0.23	0.06	6.69	7.87	72.25	0.72	11.71
Lint index (g)	3.50±0.18	2.60	5.80	0.23	0.26	0.03	13.97	14.87	88.23	0.93	27.04
Oil content (%)	18.50±0.06	17.91	19.00	0.04	0.05	0.00	1.18	1.23	92.57	0.43	2.35

Where, σ^2g, σ^2p and σ^2e are the genotypic, phenotypic and environmental variance, respectively. GCV % and PCV % are genotypic and phenotypic coefficient of variation, respectively.

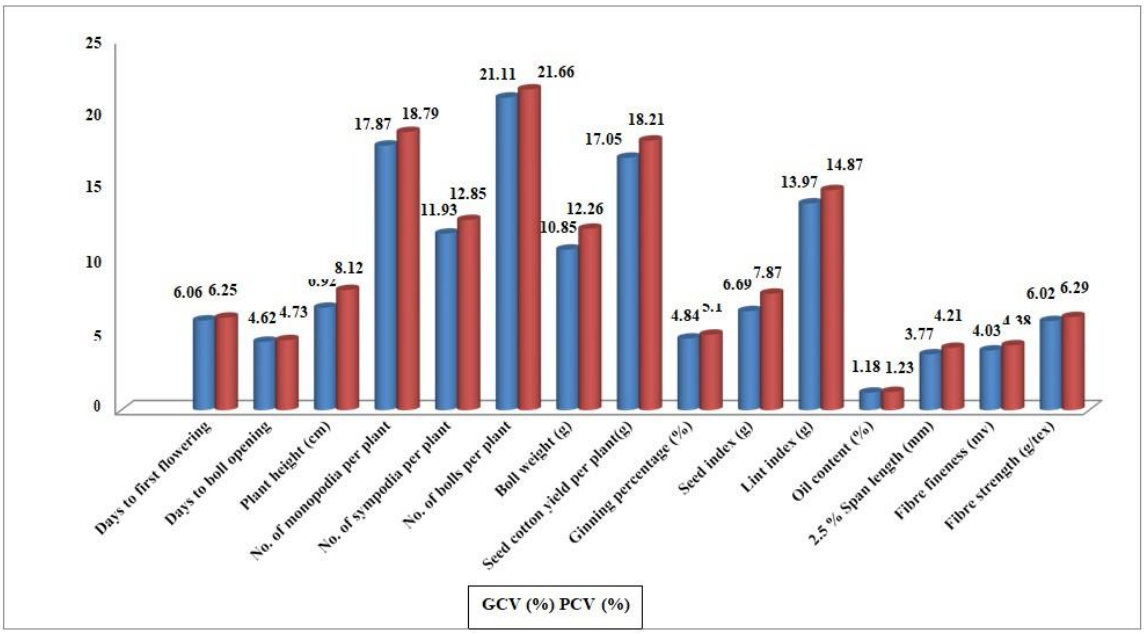

Figure-I: Graphical representation of phenotypic and genotypic coefficients of variation for various characters of cotton

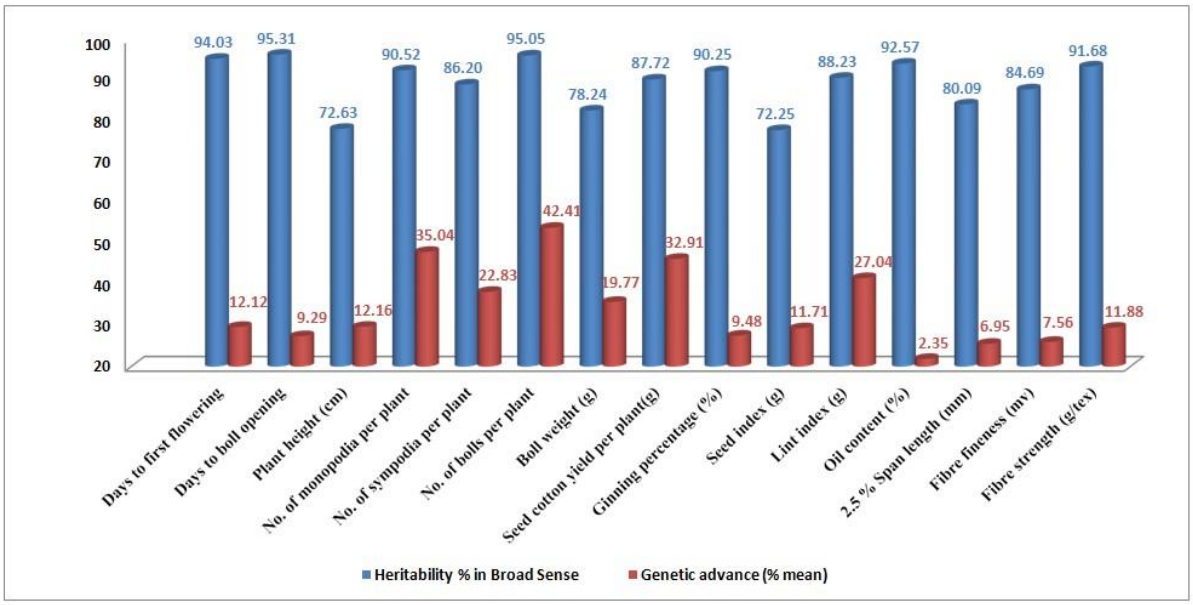

Figure-II: Graphical representation of heritability and genetic advance expressed as per cent of mean for various characters of cotton

CONCLUSION

It could be concluded from the present findings that additive gene action was operating for number of bolls per plant, number of monopodia per plant, seed cotton yield per plant, lint index and number of sympodia per plant as it showed high heritability coupled with high genetic advance. Therefore, due weightage should be given to these traits for genetic improvement in cotton.

REFERENCES

Abdullah, M., Numan, M., Shafique, M. S., Shakoor, A., Rehman, S., & Ahmad, M. I. (2016). Genetic variability and interrelationship of various agronomic traits using correlation and path analysis in cotton (*Gossypium hirsutum* L.). *Academia Journal of Agricultural Research*. *4*(6), 315-318.

Allard, R. W. (1960). Principles of plant breeding. *John Wiley and Sons*, New York. 8-481.

Anonymous, (2018). All India Coordinated Cotton Improvement Project. Annual Report, CICR, Regional station, Coimbatore.

Araujo, L. F. D., Almeida, W. S. D.,Bertin, C. H. C. D. M., Neto, F. D. C. V., & Bleicher, E. (2012). Correlations and path analysis in components of fiber yield in cultivars of upland cotton. *Bragantia, Campinas. 71*(3), 328-335.

Burton, G. W. (1952). Quantitative inheritance in grasses. *Proc. 6th Int. Grassland Cong.*, *1*, 277-283.

Chinchane, A., Ingole, D. G., & Avtade, A. V. (2018). Correlation and path coefficient analysis for seed cotton yield and its components in desi cotton (*Gossypium arboreum* L.). *Journal of Pharmacognosy and Phytochemistry*. *7*(5), 419-422.

Dahiphale, K. D., Deshmukh, J. D., Jadhav, A. B., & Bagade, A. B. (2015). Genetic variability, correlation and path coefficient analysis for yield and its attributing traits in cotton (*Gossypium hirsutum* L.). *Int. J. of Trop. Agri., 33*(1), 15-22.

Deshmukh, M. R., Deosarkar, D. B., Deshmukh, J. D., & Chinchane, V. N. (2019). Correlation and path coeeficient anaylsis of yield contributing and fibre quality traits in Desi cotton (*Gossypium arboreum* L.). *International Journalof Chemical Studies*, *7*(3), 585-589.

Dhamayanathi, K. P. M., Manickam, S., & Rathinavel, K. (2010). Genetic

variability studies in *Gossypium barbadense* L. genotypes for seed cotton yield and its yield components. *Electronic Journal of Plant Breeding*. *1*(4), 961-965.

Dhivya, R., Amalabalu, P., Pushpa, R., & Kavithamani, D. (2014). Variability, heritability and genetic advance in upland cotton (*Gossypium hirsutum* L.). *Afr. J. Plant Sci*., *8*(1), 1- 5.

Erande, C. S., Kalpande, H. V., Deosarkar, D. B., Chavan, S. K., Patil, V. S., Deshmukh, J. D., Chinchane, V. N., Kumar, A., Dey, U., & Puttawar, M. R. (2014). Genetic variability, correlation and path analysis among different traits in desi cotton (*Gossypium arboreum* L.). *Afr. J. Agric. Res*., *9*(29), 2278-2286.

Handi, S. S., Bhatti, H., & Katageri, I. S. (2016). Genetic diversity studies for fiber quality traits in upland cotton (*Gossypium hirsutum* L.). *Journal of Farm Science*. *29*(3), 322-326.

Haritha, T., Ahamed, M., & Rao, T. (2014). Genetic divergence for morpho physiological traits in upland cotton. *Journal of Cotton Research and. Development*, *28*(1), 34 -36.

Latif, A., Bilal, M., Hussain, S. B., & Ahmad, F. (2015). Estimation of genetic divergence, association, direct and indirect effects of yield with other attributes in cotton (*Gossypium hirsutum* L.) using biplot correlation and path coefficient analysis. *Trop. Plant Res*., **2**(2), 120–126.

Panse, V. G. (1957). Genetics of quantitative traits in relation to plant breeding. *Indian J. Genet*., *17*, 318-328.

Panse, V. G., & Sukhatme, P. V. (1985). Statistical methods for agricultural workers. 2nd edn, ICAR, *New Delhi, India: 381*.

Patil, M., Khadi, B. M., Kumari, B., & Katageri, I. S. (2014). Genetic variability and correlation analysis for fibre quality traits in diploid cotton (*Gossypium* spp). *American-Eurasian Journal of Agricultural* & *Environmental Sciences*. *14*(5), 392-395.

Rajeev, S., Patil, S. S., Ranganath, H. M., Srivalli, P., Manjula, S. M., & Pranesh K. J. (2014). Genetic diversity analysis in cotton (*Gossypium hirsutum* L.) based on morphological traits and microsatellite markers. *International journal of basic and applied biology*, *1*(1), 19 -22.

Shahzad, M. T., Ijaz, F., Khan, O., Saleem, B., & Hassan, U. (2015). Correlation, path analysis and heritability among some yield and fibre related traits of cotton (*Gossypium hirsutum* L.). *Cotton Genomics and Genetics*. *6*(4), 1-7.

Singh, P., & Narayanan, S. S. (2013). Biometrical techniques in plant breeding.*Kalyani publishers*, India.

Sunayana, Sangwan, R. S., & Somveer, N. (2017). Studies on association, path analysis and genetic parameters for seed cotton yield and it's contributing characters in desi cotton (*Gossypium arboreum* L.). *Int. J. Curr. Microbiol. App. Sci., 6*(11), 104-111.

Vinodhana, N., Gunasekaran, M., & Vindhiyavarman, P. (2013). Genetic studies of variability, correlation and path coefficient analysis in cotton genotypes. *Int. J. Pure App. Biosci., 1*(5), 6-10.