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Genotypic and phenotypic path coefficient analysis in okra

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Abstract
Plant height imparted no positive indirect effect was visible to be highest *via*. Fresh fruit weight (-0.1011), length of internode (-0.0872), days to 50 % flowering (-0.0579), days to first flowering (-0.0389), fruit length (-0.0273), number of branches per plant (-0.0169), days to first picking (-0.0153), number of fruits per plant (-0.0139), first fruiting node (-0.047). Number of branches per plant was recorded to have highest positive indirect effect on fruit yield per plant via plant height (0.0090).However, negative indirect effect was recorded on days to first flowering (-0.0403), days to first picking (-0.0399), first fruiting node (-0.0356), fruit length (-0.0307), length of internode (-0.0191), days to 50 % flowering (-0.0154), fresh fruit weight (-0.0141), number of fruits per plant (-0.0116). Length of internode had significant positive indirect effect on fruit yield per plant via fresh fruit weight (0.3261), plant height (0.2870), days to 50 % flowering (0.2845), fruit length (0.1828) days to first picking (0.1073), days to first flowering (0.0873), first fruiting node (0.0387).However, negative indirect effect was recorded on number of branches per plant (-0.01181), number of fruits per plant (-0.06858). Days to 50 % flowering had significant positive indirect effect on fruit yield per plant via. Number of branches per plant (0.0104), number of fruits per plant (0.001).However, negative indirect effect was recorded on length of internode (-0.0313), days to first picking (-0.0215), plant height (-0.0210), fruit length (-0.0191), days to first picking (-0.0181), first fruiting node (-0.0142). First fruiting node expressed highest positive indirect effect on number of branches per plant (0.1388), fruit length (0.1242), days to 50 % flowering (0.0680), fresh fruit weight (0.0693), days to first flowering (0.0680), days to first picking (0.0097).However, negative indirect effect was recorded on number of fruits per plant (-0.0442). Days to first flowering was recorded to have highest positive indirect effect on fruit yield per plant via. Number of branches per plant (0.0538), fresh fruit weight (0.0090), fruit length (0.0086).However, negative indirect effect was recorded days to first picking (0.0498), days to 50 % flowering (-0.0359), plant height (-0.0276), length of internode (-0.0189), first fruiting node (-0.0233), number of fruits per plant (-0.0178). Days to first picking were significant positive indirect effect on fruit yield per plant via. days to first flowering (0.0162), number of fruits per plant (0.0148), first fruiting node (0.0047), days to 50% flowering (0.0138), length of internode (0.008), plant height (0.035), fresh fruit weight (0.008).However, negative indirect effect was recorded through number of branches (-0.0173) and fruit length (-0.0004). Fruit length manifested highest positive indirect effect on fruit yield per plant via fresh fruit weight (0.0473), first fruiting node (0.0269), length of internode (0.0249), days to 50 % flowering (0.0238), number of fruits per plant (0.0137), plant height (0.0122).While, negative indirect effect was recorded number of branches per plant (-0.0259), days to first flowering (-0.0055), days to first picking (-0.007). Number of fruits per plant had positive indirect effect on days to first picking (0.0078), first fruiting node (0.0067), days to first flowering (0.0043), fresh fruit weight (0.22) while negative indirect effect on number of branches per plant (-0.0068). Fresh fruit weight had significant positive indirect effect on fruit yield per plant via. fruit length (0.1453), plant height (0.1394), length of internode (0.1367), days to 50 % flowering (0.0095), days to first picking (0.0049) while, negative indirect effect on days to first flowering (-0.0175).

Keywords: Okra, path analysis, significant, positive, negative, association

1. Introduction
Okra (*Abelmoschus esculentus* L.) is one of the highly nutritious vegetable, usually eaten while the pod is green, tender and immature botanically this perennial plant belongs to the Malvaceae family. The plant is cultivated throughout the tropical and warm temperature region around the world for its fibrous fruits or pods. Fruits of okra contain a mucilaginous substance that thickens the soup and stews. According to Gopalan *et al.* (2007) [3]. It has good nutritional value, particularly the high content of vitamin C (13.10mg/100g), calcium (66mg/100g), iron

(35mg/100g), magnesium (53g/100g), potassium (103g/100g) and carbohydrates (6.4g/100g) and is said to be very useful against genito-urinary disorders**.** Mucilage from the stem and roots of okra is used for clarifying sugarcane juice in jiggery production. Fully ripened fruits and stem containing crude fibre which is used in the paper industry. India leading first in world and it is grown throughout the country in almost all states covering an area about 0.53 million ha area and producing 6.35 million tonnes with productivity of 12.0 t ha^{-1}. In India, among fresh vegetables, 60 per cent share of export goes to okra (Anonymous 2014-15) [1]. West Bengal is a leading okra producing state (14%), followed by Bihar (12%), Gujarat (12%), Andhra Pradesh (10%), Odisha (9%), Jharkhand (7%), Chhattisgarh (7%), Telangana (6%), Madhya Pradesh (5%), Maharashtra (4%), Haryana (3%), Assam (3%)**,** Uttar Pradesh (2%), and others (6%) (Anonymous, 2014- 15) [1].

It is often cross pollinated crop and thus heterosis can be exploited in it. Breeding method for the improvement of a crop depends primarily on the nature and magnitude of gene action involved in the expression of quantitative and qualitative traits. Combining ability analysis helps in the identification of parents with high general combining ability (GCA) effects and cross combinations with high specific combining ability (SCA) effects. Additive and non additive gene actions in the parents estimated through combining ability analysis may be useful in determining the possibility for commercial exploitation of heterosis and isolation of purelines among the progenies of the heterotic F_1.Good nutritive value popularity, medicinal value and high export potential are the aspects in favour of okra. However, pest such as the jassids, bollworm and diseases like yellow vein mosaic, powdery mildew etc. pose problems in okra cultivation by reducing the quality of produce and increasing the cost of cultivation. Yellow vein mosaic, a viral disease is a serious challenge in cultivation of okra. Some good varieties are developed in India in okra, but many of them suffer from one or other drawback. Crop improvement in okra needs to focus on plant height, higher yield, early flowering, more branching, fruit length and tenderness, number of fruits, disease and pest resistance also.

Hence exploitation of hybrid vigour, understanding genetics of pest and disease resistance and improvements in quality aspects with eye on quality aspects and export potential need to be concerned upon in okra improvement programmes. Exploitation of hybrid vigour in okra has been recognized as a practical tool for increasing the yield. The knowledge of traits relationship in okra is very important to exploit the potentiality to develop heterosis. In a biological system, however the relationship may exist in a very complex form. It is therefore, essential to study the relationship among variable in a comprehensive way. Path coefficient analysis is a powerful tool, which enable portioning of the given relationships in its further components. In other words, it takes into account not only the relationship of component characters with the dependent character, but simultaneously takes care of its relationship with other component also. Thus, it helps in understanding the causal system in a better way because it enables portioning the total correlations coefficient into direct and indirect effects of various characters.

In the present investigation path coefficient analysis was carried out for characters under study using genotypic and phenotypic correlation coefficient and taking fruit yield per plant as dependable variables, in order to see the causal factor and so as to identify the components which are responsible for producing fruit yield per plant. In general the genotypic direct as well as indirect effects were slightly higher in magnitude as compared to corresponding phenotypic direct and indirect effects. Since the values of genotypic path are more reliable in predicting the correct idea about the direct and indirect effects of the components traits. There is a need to generate more information on path coefficient of one trait with others. Hence, present investigation was carried out to estimate the genotypic and genotypic path coefficient between yield and its component in okra.

2. Material and Methods

The experiment was conducted at Horticulture complex, Department of Horticulture, J.N.K.V.V. Jabalpur (M.P.) during *Kharif*-2016, summer-2017 and *Kharif*-2017. Jabalpur is situated in "Kymore plateau and Satpura Hills" agro-climatic region of Madhya Pradesh. It falls on 23.9° North latitude and 79.58° East longitudes with an altitude of 411.8 meters above mean sea level. The tropic of cancer passes through the middle of the district. Jabalpur is situated in the semi-arid region having sub-tropical climate with cool winter and hot dry summer. The fourteen diverse genotypes of okra selected on the basis of genetic variability.

Following are parental lines and tester

S No.	Lines	S No.	Testers
1.	JO-11	1.	Phule Utkarsha
2.	JO-4	2.	JO-15
3.	JO-9	3.	JO-14
4.	JO-7	4.	JO-12
5.	JO-3		
6.	JO-10		
7.	JO-6		
8.	JO-8		
9.	JO-13		
10.	Deepika		

3. Result and Discussion

3.1 Path coefficient analysis

To measure the direct as well as indirect association of one variable (cause) through another on the end product (effect), path coefficient was calculated at genotypic and phenotypic levels for the entire yield attributing traits. The observed correlation coefficient of yield with it components were partitioned into direct and indirect effects. In the present investigation, fruit yield per plant have been used as dependable variable with other traits. Since the values of genotypic path are more reliable in predicting the correct idea about the direct and indirect effects of the components traits, only this has been discussed as below. The results of pooled path coefficient analysis showing direct and indirect effects on fruit yield per plant (as dependable variable) have been presented a given below.

3.2 Direct Effect

Path coefficient analysis (genotypic) of different traits contributing toward fruit yield per plant showed that the length of internode (0.6258) showed that the highest positive direct effect on fruit yield per plant followed by first fruiting node (0.3945), fresh fruit weight (0.2623), number of branches per plant (0.1013), fruit length (0.0853), number of fruits per plant (0.0595), days to first picking (0.0441). Whereas plant height (-0.1901) has highest negative direct

effect on fruit yield per plant followed by days to 50 % flowering (-0.0687).

3.3 Indirect Effect

1. Plant Height

Plant height imparted no positive indirect effect was visible to be highest via. Fresh fruit weight (-0.1011), length of internode (-0.0872), days to 50 % flowering (-0.0579), days to first flowering (-0.0389), fruit length (-0.0273), number of branches per plant (-0.0169), days to first picking (-0.0153), number of fruits per plant (-0.0139), first fruiting node (-0.047). These results are in close harmony with the finding with Subrata *et al*. (2004) [15].

2. Number of branches per plant

Number of branches per plant was recorded to have highest positive indirect effect on fruit yield per plant via plant height (0.0090).However, negative indirect effect was recorded on days to first flowering (-0.0403), days to first picking (-0.0399), first fruiting node (-0.0356), fruit length (-0.0307), length of internode (-0.0191), days to 50 % flowering (-0.0154), fresh fruit weight (-0.0141), number of fruits per plant (-0.0116). These results are in close harmony with the finding with Saryam *et al*. (2015) [12]. For number of branches per plant

3. Length of Internode

Length of internode had significant positive indirect effect on fruit yield per plant via fresh fruit weight (0.3261), plant height (0.2870), days to 50 % flowering (0.2845), fruit length (0.1828) days to first picking (0.1073), days to first flowering (0.0873), first fruiting node (0.0387).However, negative indirect effect was recorded on number of branches per plant (-0.01181), number of fruits per plant (-0.06858). These results are in close harmony with the finding with Sarkar and Madrep (2004) [11].

4. Days to 50 % flowering

Days to 50 % flowering had significant positive indirect effect on fruit yield per plant via. Number of branches per plant (0.0104), number of fruits per plant (0.001).However, negative indirect effect was recorded on length of internode (-0.0313), days to first picking (-0.0215), plant height (-0.0210), fruit length (-0.0191), days to first picking (-0.0181), first fruiting node (-0.0142). These results are in close harmony with the finding with Magar *et al*. (2009) [6].

5. First fruiting node

First fruiting node expressed highest positive indirect effect on number of branches per plant (0.1388), fruit length (0.1242), days to 50 % flowering (0.0680), fresh fruit weight (0.0693), days to first flowering (0.0680), days to first picking (0.0097).However, negative indirect effect was recorded on number of fruits per plant (-0.0442). These results are in close harmony with the finding with Magar *et al*. (2009). [6].

6. Days to first flowering

Days to first flowering was recorded to have highest positive indirect effect on fruit yield per plant via. Number of branches per plant (0.0538), fresh fruit weight (0.0090), fruit length (0.0086).However, negative indirect effect was recorded days to first picking (0.0498), days to 50 % flowering (-0.0359), plant height (-0.0276), length of internode (-0.0189), first fruiting node (-0.0233), number of fruits per plant (-0.0178). These results are in close harmony with the finding with Ramanjinappa *et al.* (2011) [10].

7. Days to first picking

Days to first picking were significant positive indirect effect on fruit yield per plant via. days to first flowering (0.0162), number of fruits per plant (0.0148), first fruiting node (0.0047), days to 50% flowering (0.0138), length of internode (0.008), plant height (0.035), fresh fruit weight (0.008).However, negative indirect effect was recorded through number of branches (-0.0173) and fruit length (-0.0004). These results are in close harmony with the finding with Senapati *et al*. (2011) [13].

8. Fruit Length

Fruit length manifested highest positive indirect effect on fruit yield per plant via fresh fruit weight (0.0473), first fruiting node (0.0269), length of internode (0.0249), days to 50 % flowering (0.0238), number of fruits per plant (0.0137), plant height (0.0122).While, negative indirect effect was recorded number of branches per plant (-0.0259), days to first flowering (-0.0055), days to first picking (-0.007). These results are in close harmony with the finding with Sibsankar *et al*. (2012). [14].

9. Number of fruits per plant

Number of fruits per plant had positive indirect effect on days to first picking (0.0078), first fruiting node (0.0067), days to first flowering (0.0043), fresh fruit weight (0.22) while negative indirect effect on number of branches per plant (-0.0068). These results are in close harmony with the finding with Gangashetti *et al*. (2013) [2].

10. Fresh fruit weight

Fresh fruit weight had significant positive indirect effect on fruit yield per plant via. fruit length (0.1453), plant height (0.1394), length of internode (0.1367), days to 50 % flowering (0.0095), days to first picking (0.0049) while, negative indirect effect on days to first flowering (-0.0175). These results are in close harmony with the finding with), Mehta *et al*. (2006) [7]. And Mihretu *et al*. (2014) [8]. For fruit weight. Whereas plant height has highest negative direct effect on fruit yield per plant followed by days to 50 % flowering. The role of these traits in the contribution towards fruit yield cannot be ignored. These results are in close harmony with the finding with Niranjan RS and Mishra MN (2003) [9]. Fresh fruit weight had significant positive indirect effect on fruit yield per plant via. fruit length (0.1453), plant height (0.1394), length of internode (0.1367), days to 50 % flowering (0.0095), days to first picking (0.0049) while, negative indirect effect on days to first flowering (-0.0175). These results are in close harmony with the finding with), Mehta *et al*. (2006) [7]. And Mihretu *et al*. (2014) [8]. For fruit weight.

Whereas plant height has highest negative direct effect on fruit yield per plant followed by days to 50 % flowering. The role of these traits in the contribution towards fruit yield cannot be ignored. These results are in close harmony with the finding with Niranjan RS and Mishra MN (2003) [9].

11. Positive Indirect Effect

Plant height imparted no positive indirect effect was visible to be highest via., fresh fruit weight, length of internode, days to 50 % flowering, days to first flowering, fruit length, number of branches per plant, days to first picking, number of fruits

per plant, fruits per plant, first fruiting node. Number of branches per plant was recorded to have highest positive indirect effect on fruit yield per plant via plant. Length of internode had significant positive indirect effect on fruit yield per plant via fresh fruit weight, plant height, days to 50 % flowering, days to first picking, days to first flowering, first fruiting node. Days to 50 % flowering had significant positive indirect effect on fruit yield per plant via. Number of branches per plant, number of fruits per plant. First fruiting node expressed highest positive indirect effect on number of branches per plant, fruit length, days to 50 % flowering, fresh fruit weight, days to first flowering, days to first picking. Days to first flowering was recorded to have highest positive indirect effect on fruit yield per plant via. Number of branches per plant, fresh fruit weight, fruit length. Days to first picking was significant positive indirect effect on fruit yield per plant via. Days to first flowering, number of fruits per plant, first fruiting node, days to 50% flowering, length of internode, plant height, fresh fruit weight. Fruit length Fruit length manifested highest positive indirect effect on fruit yield per plant via fresh fruit weight, first fruiting node, length of internode, days to 50 % flowering, number of fruits per plant, plant height. Number of fruits per plant had positive indirect effect on days tofirst picking, first fruiting node, days to first flowering, fresh fruit weight. Fresh fruit weight had significant positive indirect effect on fruit yield per plant via. Fruit length, plant height, length of internode, days to 50 % flowering, days to first picking. These results are in close harmony with the finding with Kumar S, Annapurna and Yadav YC (2009) [5].

3.4 Negative indirect effect

Negative indirect effect was visible to be days to first flowering, days to first picking, first fruiting node, fruit length, length of internode, days to 50 % flowering, fresh fruit weight, number of fruits per plant. However, negative indirect effect was recorded on number of branches per plant, number of fruits per plant, days to 50 % flowering expressed a negative indirect effect was recorded on length of internode, days to first picking, plant height, fruit length, days to first picking, first fruiting node. First fruiting node expressed a negative indirect effect was recorded on number of fruits per plant. Days to first flowering expressed a negative indirect effect was recorded days to first picking, days to 50 % flowering, plant height, length of internode, first fruiting node, number of fruits per plant. Days to first picking expressed a negative indirect effect was recorded through number of branches and fruit length. Fruit length expressed a negative indirect effect was recorded number of branches per plant, days to first flowering, days to first picking. Number of fruits per plant expressed a negative indirect effect on number of branches per plant. Fresh fruit weight expressed a negative indirect effect on days to first flowering. Fresh fruit weight recorded to have while negative indirect effect on days to first flowering. These results are in close harmony with the finding with Kounodinya AV and Dhankhar SK, (2013) [4].

4. Conclusion

Path coefficient analysis of different traits contributing toward fruit yield per plant showed that the length of internode showed that the highest positive direct effect on fruit yield per plant followed by first fruiting node, fresh fruit weight, number of branches per plant, fruit length, number of fruits per plant, days to first picking. Whereas plant height has highest negative direct effect on fruit yield per plant followed by days to 50 % flowering. An overall observation of the above results of path coefficient analysis of fruit yield and its components revealed that number of fruits per plant, fresh fruit weight, fruit length, first fruiting node, plant height, number of branches per plant, length of internode were the most important traits contributing towards fruit yield per plant.

Table 1: Estimation of phenotypic path coefficient among yield and its contributing traits in okra (pooled)

Characters		Plant height (cm)	Number of branches per plant	Length of internode (cm)	Days to 50% flowering	First fruiting node	Days to first flowering	Days to first picking	Fruit length (cm)	Number of fruits per plant	Fresh fruit weight(g)	Yield per plant
Plant height(cm)	P	-0.1022	-0.0061	-0.0293	-0.0192	-0.0015	-0.0091	-0.0004	-0.0092	-0.0053	-0.0346	0.1350
Number of branches per plant	P	0.026	0.0436	-0.0073	-0.0054	-0.0137	-0.0095	-0.0147	-0.0073	-0.0045	-0.0055	-0.1847
Length of internode (cm	P	0.1692	-0.0986	0.5893	0.2605	00370	0.0644	0.0995	0.1033	-0.0651	0.2959	0.6475
Days to 50% flowering	P	-0.0127	0.0083	-0.0299	-0.0676	-0.0137	-0.0144	-0.0211	-0.0131	-0.0001	-0.0171	0.2809
First fruiting node	P	0.0060	-0.1245	0.0249	0.0801	0.3968	0.0563	0.0418	0.0760	-0.0452	0.0678	0.4222
Days to first flowering	P	-0.0140	0.0344	-0.0172	-0.0336	-0.0224	-0.1574	-0.0449	0.0083	-0.0138	0.0082	-0.0788
Days to first picking	P	0.0001	0.0005	-0.0002	-0.0004	-0.0001	-0.0004	-0.0014	0.0001	-0.0005	0.0001	0.0835
Fruit length (cm	P	0.0033	-0.0061	0.0064	0.0071	0.0070	-0.0019	0.0003	0.0365	0.0033	0.0114	0.2732
Number of fruits per plant	P	0.0033	-0.0066	-0.0070	0.0001	-0.0072	0.0056	0.0208	0.0057	0.0635	0.0025	-0.0585
Fresh fruit weight(g	P	0.0795	-0.0297	0.1179	0.0593	0.0401	-0.0123	0.0036	0.0729	0.0092	0.2348	0.5633

Residual effect = 0.5839 Note: Underlined and bold values denote direct effects

Table 2: Estimation of genotypic path coefficient among yield and its contributing traits in okra (pooled)

Characters		Plant height(cm)	Number of branches per plant	Length of internode (cm)	Days to 50% flowering	First fruiting node	Days to first flowering	Days to first picking	Fruit length (cm)	Number of fruits per plant	Fresh fruit weight(g)	Yield per plant
Plant height(cm)	G	-0.1901	-0.0169	-0.0872	-0.0579`	-0.0047	-0.0389	-0.0153	-0.0273	-0.0139	-0.1011	0.0067
Number of branches per plant	G	0.0090	0.1013	-0.0191	-0.0154	-0.0356	-0.0403	-0.0399	-0.0307	-0.0116	-0.0141	-0.1948
Length of internode (cm	G	0.2870	-0.1181	0.6258	0.2845	0.0387	0.0873	0.1073	01828	-0.0685	0.3261	0.6563
Days to 50% flowering	G	-0.0210	0.0104	-0.0313	-0.0687	-0.0142	-0.0183	-0.0215	-0.0191	0.0001	-0.0181	0.2944
First fruiting node	G	0.0097	0.1388	0.0244	0.0815	0.3945	0.0680	0.0416	0.1242	-0.0442	0.0693	0.4263
Days to first flowering	G	-0.0276	0.0538	-0.0189	-0.0359	-0.0233	-0.1352	-0.0498	0.0086	-0.0178	0.0090	-0.0762
Days to first picking	G	0.0035	-0.0173	0.0076	0.0138	0.0047	0.0162	0.0441	-0.0004	0.0148	0.0008	0.0908
Fruit length (cm	G	0.0122	-0.0259	0.0249	0.0238	0.0269	-0.0055	-0.0007	0.0853	0.0137	0.0473	0.4784
Number of fruits per plant	G	0.0043	-0.0068	-0.0065	0.0001	0.0067	0.0078	0.0199	0.0096	0.0595	0.022	-0.0035
Fresh fruit weight(g	G	0.1394	-0.0365	0.1367	0.0689	0.0461	-0.0175	0.0049	0.1453	0.0095	0.2623	0.1531

Residual effect = 0.5472 Note: Underlined and bold values denote direct effects

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6. References

1. Anonymous. Indian Horticulture Database, Gurgaon. Published by National Horticultural Board, Ministry of Agriculture, and Govt. of India, 2014-15, 152-159.
2. Gangashetti PI, Laxman Malakannavar, Satish Adiger. Breeding investigations in single and double cross F4 & F5 populations of Okra. Molecular plant breeding, 2013, 96-106.
3. Gopalan C, Rama Sastri BV, Balasubramanian S. Nutritive value of Indian foods. Published by National Institute of Nutrition (NIN), ICMR, 2007, 36.
4. Kounodinya AV, Dhankhar SK. Correlation and path analysis of seed yield components in Okra (*Abelmoschus esculentus* L.) Moench) Annuals of Horticulture. 2013; 6(1):145-148.
5. Kumar S Annapurna, Yadav YC. Correlation coefficient and path analysis studies in Okra (*Abelmoschus esculentus* (L.) Moench). Annuals of Horticulture. 2009; 2(2):105-108.
6. Magar RG, Madrap IA. Genetic variability, correlation and path coefficient analysis in Okra (*Abelmoschus esculentus* (L.) Moench).Journal of plant sciences. 2009; 4(2):498-501.
7. Mehta DR, Dhaduk LK, Patel KD. Genetic variability, correlation and path analysis studies in okra (*Abelmoschus esculentus* (L.) Moench). Agriculture Science Digest. 2006; 26(1):15-18.
8. Mihretu Yonas, weyessa Garedew, adugnadebela. Variability and association of quantitative characters among okra collection in south western Ethiopia. Journal of biological sciences. 2014; 14(5):336-342.
9. Niranjan RS, Mishra MN. Correlation and path analysis in okra (*Abelomoschus esculentus* (L.) Moench) Progressive Horticulture. 2003; 35(2):192-195.
10. Ramanjinappa V, Patil NG, Narayanswamy P, Ashok Hugar, Arukkumar KH. Genatic variability, correlation and path analysis in Okra. Environment and Ecology. 2011; 29(3A):778-782.
11. Sarkar S, Hazara P, Chattopadhyay A. Genetic variability, correlation and path analysis in Okra (*Abelmoschus esculentus* L. Moench) Horticultural Journal. 2004; 17(1):59-66.
12. Saryam DK, Mittra SK, Mehta AK, Prajapathi S, Kadwey S. Correlation and path co-efficient analysis of quantitative traits in Okra (*Abelmoschus esculentus* L. Moench). Supplement on Genetics and Plant Breeding. 2015; 10(2):735-739.
13. Senapathi N, Mishra HN, Beura SK, Dash SK, Prasad G, Patnaik A. Genetic analysis in Okra hybrids. Environment and Ecology. 2011; 29(3A):1240-1244.
14. Sibsankar Das, Chattopadhyay Arup, Chattopadhyay SB, Subrata Dutta, pranab Hajara. Genetics parameters and path analysis of yield and it's components in okra at different sowing date in Genetic plans of eastern African journal of biotechnology. 2012; 11(95):16132-16141.
15. Subrata S, Hazra P, Chattopadhyay A. Genetic variability, correlation and path analysis in Okra(*Abelmoschus esculentus* (L.) Moench.)Horticulture Journal. 2004; 17(1):59-66.