Frontiers in Crop Improvement, Vol. 6 (1) : 64-68 (2018)
Print ISSN : 2393-8234, Online ISSN : 2454-6011

ASTHA FOUNDATION
Meerut (U.P.) INDIA

GENETIC DIVERGENCE AND PATH COEFFICIENT ANALYSIS IN PEANUT STEM NECROSIS TOLERANT GROUNDNUT GENOTYPES (*Arachis hypogaea* L.)

P. Dharani Niveditha, M. Sudharani, A. Prasanna Rajesh, P.J. Nirmala
Department of Genetics and Plant Breeding, Agricultural College, Mahanandi, Andhra Pradesh, India
E-mail : *Dharani Niveditha* prathakotadharani12@gmail.com

ABSTRACT

Fifty peanut stem necrosis tolerant groundnut varieties were evaluated for their genetic diversity with respect to kernel yield, yield attributing characters and qualitative traits at Agricultural Research Station, Kadiri during kharif, 2015. The genotypes were classified into eight clusters, based on Mahalanobis D^2 statistic. Results on inter-cluster distances revealed maximum diversity between genotypes of cluster IV and VIII. Intra-cluster distance was highest for cluster VIII, indicating the existence of high variability within this cluster. A perusal of the results on cluster means revealed high for pod yield per plant, kernel yield per plant, haulm yield and 100 kernel weight for cluster II, while days to 50 per cent flowering, number of filled pods per plant, sound mature kernel per cent and protein content were more for cluster IV. Similarly, high SPAD Chlorophyll Meter Reading (SCMR) for cluster V indicated the desirability of genotypes from these clusters for improvement of kernel yield and disease resistance. Further, SCMR at 60 days after sowing, protein content, harvest index per cent and 100 kernel weight accounted for 80.98 per cent of the total genetic divergence indicating their importance in the choice of parents for hybridization programme. Results of path analysis revealed haulm yield per plant, shelling per cent, harvest index per cent and 100 kernel weight were the major contributors of kernel yield by way of their positive and high direct effect. Hence there is much scope for selecting high yielding genotypes with peanut stem necrosis tolerance (PSND), if selection pressure is exerted on above traits.

Key words : *D^2 analysis, genetic divergence, path coefficient analysis, grain yield, quality characters.*

Groundnut (*Arachis hypogaea* L.) is an important oil and protein producing legume crop and belongs to family *Fabaceae*. India is the largest grower and second producer after China and occupies an area of 44.46 lakh ha with a production of 71.81 lakh tones and yield of 1615 kg/ha. Andhra Pradesh occupies third place in production in India and productivity is very low against Indian productivity of 1615 kg/ha and world productivity of 1675.9 kg/ha (1). The low productivity can be attributed to factors *viz.,* erratic rainfall, incidence of pests and diseases in addition to cultivation of low yielding varieties. Peanut stem necrosis disease (PSND) is a severe manace in Anantapuramu district of Andhra Pradesh causing severe economic losses. In view of severity of the disease, high yielding groundnut varieties with improved performance are being developed. For bringing about further improvement in yield and resistance to biotic stresses, it is essential to know the divergence among released and pre-release cultures of germplasm lines for yield, yield components and other quality attributes. Path co-efficient analysis provides an effective means of finding out the direct and indirect causes of association and presents a critical examination of the specific forces acting to produce a given correlation and also measures the relative importance of each causal factor.

MATERIALS AND METHODS

Experimental material for the present investigation comprised of 50 PSND tolerant groundnut genotypes which were evaluated at Agriculture Research Station, Kadiri during *Kharif',* 2015 in a randomized block design with two replications. Seeds were sown in the two-row plots of 5m at spacing of 30 cm between the rows and 10 cm between the plants within the row. All recommended practices were followed to raise a healthy crop. Observations were recorded on days to50 per cent flowering, plant height, number of filled pods per plant, total pods per plant, number of seeds per pod, sound mature kernel per cent, haulm yield per plant, pod yield per plant, kernel yield per plant, shelling per cent, harvest index per cent, 100 kernel weight, SPAD Chlorophyll Meter Reading at 60 days after sowing, oil content, protein content. The observations for all the characters mentioned above were recorded from five randomly selected plants for each genotype in each replication, while observations on days to fifty per cent flowering were recorded on plot basis. The data obtained were analyzed using Mahalanobis D^2 statistic and the varieties were grouped into different clusters according to Tocher's method. The direct and indirect effects of various characters on kernel yield were calculated through path coefficient analysis as suggested by (2) and applied to plants by (3).

RESULTS AND DISCUSSION

Genetic diversity is a pre-requisite for a breeding programme to obtain desirable segregants. Analysis of variance revealed highly significant differences for all characters studied indicating the existence of sufficient variability for effective selection. Further, the 50 varieties studied were grouped into eight clusters (Table-1) based

Table-1 : Distribution of 50 groundnut varieties into different clusters

Cluster No.	No. of Genotypes	Name of Genotype
I	15	03 x 427-088, 03 x 427-107, 03 x 397-031, 03 x 427-091, JL-24, K 1809, K 1650, 03 x 427-109, 04 x 479-002, K 1811, K 1799, K 1535, 03 x 461-019, 03 x 482-036, 04 x 479-005
II	22	K 1577, K 1574, 03 x 485-001, 04 x 477-021-2, 04 x 480-007, K 1563, K 1621, K 1647, K 1643, 04 x 477-030, K 1501, K 1576, 04 x 477-031, K 1715, K 1735, 04 x 477-024-1, K 1717, K 1641, K 1725, 04 x 477-021-1, 04 x 479-012, 04 x 477-018
III	8	03 x 427-082, 03 x 427-094, 03 x 398-067, Anantha, 03 X 427-086, Harithandhra, Kadiri 6, Kadiri 9
IV	1	K 1800
V	1	04 x 477-010
VI	1	03 X 485-024-01
VII	1	04 x 481-023
VIII	1	04 x 481-005

Table-2 : Average inter and intra cluster distances for 50 groundnut varieties

	cluster I	cluster II	cluster III	cluster IV	cluster V	cluster VI	cluster VII	cluster VIII
cluster I	65.28	112.08	122.47	86.33	129.48	86.07	107.70	177.02
cluster II		77.86	206.67	176.81	124.52	115.08	112.83	122.22
cluster III			78.11	184.18	229.41	216.15	225.78	184.53
cluster IV				0.00	214.63	92.12	113.76	307.39
cluster V					0.00	149.35	130.89	151.26
cluster VI						0.00	61.07	247.91
cluster VII							0.00	199.92
cluster VIII								0.00

on the relative magnitude of D^2 values. Among the eight clusters, cluster II consisted of maximum number of varieties (22), cluster I had fifteen, cluster III had eight, while IV, V, VI, VII and VIII were comprised of single variety in each cluster, indicates the presence of maximum degree of divergence and genetic heterogeneity among cultivars. The mode of distribution of varieties from the same eco-geographical region were observed to be present in different clusters as well as in the same cluster.

An analysis of the inter and intra cluster distances (Table 2) revealed maximum inter-cluster distances between clusters IV and VIII (307.39) followed by VI and VIII (247.91) and III and V (229.41) followed by clusters III and VII (225.78) indicating that varieties from these clusters were highly divergent and selection of parents for hybridization from these clusters is rewarding. Minimum inter-cluster distance was observed between the clusters, VI and VII (61.07) indicating their close relationship and similarity with regard to the characters studied for most of the varieties in the two clusters. Further, intra-cluster distance was observed to be minimum for cluster I (65.28), followed by cluster II (77.86) and maximum for cluster III (78.11), while it was zero for the monogenotypic clusters, namely, clusters IV, V, VI, VII and VIII as they included single variety. The varieties included in cluster III exhibiting maximum intra-cluster distance inferred to be more divergent than those in other clusters.

A perusal of the results on cluster means for yield and yield components (Table 3) revealed considerable differences between the clusters for all characters under study. The genotypes of cluster II registered highest values for haulm yield per plant, pod yield per plant, kernel yield per plant and 100 kernel weight , whereas the genotypes of cluster III exhibited highest cluster mean for shelling per cent, harvest index and low values for SCMR at 60 DAS. Similarly, genotypes of cluster IV recorded the highest values for days to 50 per cent flowering, number of filled pods per plant, sound mature kernel per cent & protein content and recorded minimum values for plant height and 100 kernel weight. While genotypes of cluster V recorded the highest values for SCMR and minimum

Table-3 : Cluster means for different yield and yield attributing traits in 50 groundnut varieties

	Days to 50% flowering	Plant height (cm)	No. of filled pods per plant	Total pods per plant	No. of seeds per pod	Sound mature kernels (%)	Haulm yield per plant (g)	Pod yield per plant (g)	Kernel yield per plant (g)	Shelling percentage (%)	Harvest index (%)	100 kernel weight (g)	SPAD at 60 DAS	Oil content (%)	Protein content (%)
cluster I	32.37	20.47	13.70	15.53	1.58	79.13	15.08	10.73	7.11	67.06	0.55	37.99	37.96	49.61	31.00
cluster II	31.84	21.37	13.68	16.16	1.58	78.95	19.18	14.24	9.22	65.25	0.54	42.04	43.87	50.68	25.84
cluster III	32.13	25.24	13.76	15.32	1.59	81.50	14.20	9.95	6.82	69.07	0.57	35.33	31.95	50.46	24.69
cluster IV	37.50	19.40	16.00	17.00	1.56	82.00	14.60	10.11	6.84	68.29	0.52	29.40	37.55	50.97	39.50
cluster V	33.00	21.65	10.80	11.50	1.58	80.00	14.15	9.80	5.03	51.74	0.49	38.38	46.25	42.52	24.50
cluster VI	34.00	22.30	15.10	20.30	1.72	77.00	15.08	10.44	6.65	65.07	0.41	45.83	41.25	50.87	35.50
cluster VII	31.00	26.00	10.50	12.70	1.60	75.00	14.60	9.74	5.74	59.03	0.31	33.42	44.15	51.91	35.00
cluster VIII	31.50	20.85	10.40	14.80	1.54	81.00	12.57	8.38	5.13	60.99	0.40	29.69	43.40	51.49	12.50

values for total pods per plant, kernel yield per plant, shelling per cent and oil content. The genotypes of cluster VI recorded higher values for total pods per plant and number of seeds per pod. The genotypes of cluster VII had high values for plant height, oil content and low values for days to 50 per cent flowering, sound mature kernel per cent, harvest index, indicating the importance of selection of genotypes from the corresponding clusters in hybridization programmes for effective improvement of the respective traits.

Similar results of maximum contribution of SCMR at 60 DAS was reported by (4) for harvest index per cent; (5) for oil content; (4) for 100 kernel weight; (6) for number of filled pods per plant.

Partitioning the genotypic correlation coefficients into direct and indirect effects through path analysis revealed high (>0.30) positive direct effects of haulm yield per plant (P_P=0.8434 and P_G=0.6272), shelling per cent (P_P=0.9365 and P_G=1.0877), harvest index per cent (P_P=0.9838 and P_G=0.8560) and 100 kernel weight (P_P=0.1468 and P_G=0.3404), on kernel yield per plant. The genotypic and phenotypic path coefficients for yield and various yield components studied in the present investigation are presented in Table-4. The results are in conformity with the findings of (7) for haulm yield per plant, (8) for shelling per cent and satish (2014) for 100 kernel weight. The character number of filled pods per plant recorded moderate positive direct effect (P_P=0.2492 and P_G=0.2029) on kernel yield per plant. These findings are in conformity with the reports of (9). The character plant height recorded negligible direct effect (P_P=0.0226 and P_G=0.1601) on kernel yield per plant. These results are in conformity with the earlier reports of (10). The traits *viz.,* Number of filled pods per plant (r_p=0.5785** and r_g=0.6102**), shelling per cent (r_p=0.2226* and r_g=0.2496*), harvest index (r_p=0.4804** and r_g=0.5217**) and 100 kernel weight (r_p=0.4092** and r_g=0.4418**) recorded significant and strong positive association with kernel yield per plant. High direct effects of these traits therefore appear to be the main factor for their strong association with kernel yield. Hence, these traits could be considered as an important selection criteria in all groundnut improvement programmes and direct selection for these traits is recommended for improvement of kernel yield. Further, plant height and haulm yield per plant also recorded direct positive effects in addition to non-significant associations in general with kernel yield per plant, indicating the role of indirect effects and the need for consideration of indirect effects of these traits in PSND tolerant groundnut kernel yield improvement programme.

Table-4 : Genotypic and phenotypic path coefficients of yield components and qualitative characters on kernel yield per plant in PSND tolerant groundnut.

Character		DFF	PH	FP	TP	S/P	SMK%	HY	PY	S	HI%	100KW	SCMR	OC	PC
DF	Pp	0.0256	0.0021	0.0043	0.0047	0.0005	-0.0007	-0.0032	0.0018	0.0010	0.0047	0.0011	-0.0054	0.0001	0.0058
	Pg	-0.0013	-0.0001	-0.0004	-0.0004	0.0001	0.0001	0.0002	-0.0032	-0.0003	-0.0003	0.0000	0.0003	0.0001	-0.0003
PH	Pp	0.0018	0.0226	0.0035	0.0032	0.0021	0.0021	0.0010	0.0033	0.0013	0.0017	-0.0008	-0.0057	-0.0031	-0.0024
	Pg	0.0118	0.1601	0.0331	0.0266	0.0185	0.0259	0.0094	-0.0284	0.0281	0.0133	-0.0219	-0.0434	-0.0282	-0.0197
FP	Pp	0.0422	0.0391	0.2492	0.2273	0.0112	0.0023	0.0066	0.0164	0.0528	0.0752	-0.0040	-0.0225	0.0369	0.0128
	Pg	0.0622	0.0419	0.2029	0.1938	0.0309	-0.0199	-0.0059	-0.0803	0.0730	0.0828	-0.0073	-0.0186	0.0521	0.0180
TP	Pp	-0.0136	-0.0105	-0.0678	-0.0744	-0.0119	0.0027	-0.0088	-0.0253	-0.0095	-0.0181	-0.0071	0.0007	-0.0124	0.0035
	Pg	0.0201	0.0119	0.0681	0.0713	0.0177	-0.0083	0.0053	-0.0495	0.0221	0.0230	0.0047	0.0004	0.0195	-0.0009
S/P	Pp	-0.0016	-0.0070	-0.0034	-0.0122	-0.0761	0.0009	-0.0090	0.0005	0.0026	0.0066	-0.0093	-0.0007	0.0082	0.0042
	Pg	0.0240	-0.0314	-0.0414	-0.0675	-0.2716	0.0104	-0.0476	-0.0095	0.0878	0.0414	-0.0358	0.0004	0.0241	0.0219
SMK	Pp	0.0005	-0.0016	-0.0002	0.0006	0.0002	-0.0177	0.0007	-0.0001	-0.0016	-0.0002	-0.0007	0.0023	0.0022	-0.0007
	Pg	0.0053	-0.0079	0.0048	0.0057	0.0019	-0.0489	0.0021	-0.0015	0.0029	-0.0003	-0.0050	0.0107	0.0041	-0.0021
HY	Pp	-0.1059	0.0383	0.0223	0.1000	0.1002	-0.0332	0.8434	0.0642	-0.2021	-0.5837	0.1037	0.4423	0.1506	0.0759
	Pg	-0.0890	0.0367	-0.0181	0.0465	0.1100	-0.0272	0.6272	-0.0231	-0.2963	-0.4632	0.1096	0.3496	0.1528	0.0798
PY	Pp	0.0845	0.0947	0.3225	-0.0253	-0.0295	-0.0336	0.0642	0.7569	0.6338	-0.2045	0.3643	0.3625	0.2602	0.0163
	Pg	-0.0662	-0.0571	-0.2593	-0.0495	0.0174	0.0196	-0.0231	-0.4755	-0.4671	0.0434	-0.2023	-0.2103	-0.1845	0.0043
S%	Pp	0.0154	0.0235	0.0867	0.0523	-0.0142	0.0368	-0.0979	0.0966	0.9365	0.0085	-0.0563	-0.1092	0.0749	-0.0187
	Pg	-0.0338	-0.0251	-0.0514	-0.0442	0.0461	0.0084	0.0675	0.0032	1.0877	-0.0515	-0.0113	0.0708	-0.0691	-0.0022
HI%	Pp	0.1810	0.0744	0.2970	0.2401	-0.0851	0.0113	-0.6809	0.1707	0.0204	0.9838	0.2005	-0.2413	-0.0795	-0.0612
	Pg	0.1997	0.0710	0.3493	0.2755	-0.1303	0.0048	-0.6322	-0.1526	0.3088	0.8560	0.1143	-0.2292	-0.0697	-0.1074
100KW	Pp	0.0066	-0.0052	-0.0024	0.0140	0.0180	0.0057	0.0180	0.0237	-0.0202	0.0299	0.1468	0.0445	-0.0204	-0.0039
	Pg	0.0099	-0.0466	-0.0123	0.0225	0.0448	0.0349	0.0595	-0.1534	0.0270	0.0455	0.3404	0.1195	-0.0471	-0.0223
SCMR	Pp	-0.0244	-0.0292	-0.0104	-0.0010	0.0011	-0.0152	0.0607	0.0131	-0.0309	-0.0284	0.0351	0.1158	0.0022	-0.0092
	Pg	0.0035	0.0037	0.0013	-0.0001	0.0000	0.0030	-0.0077	-0.0222	0.0068	0.0037	-0.0048	-0.0138	-0.0004	0.0012
OC	Pp	0.0000	0.0001	-0.0001	-0.0001	0.0001	0.0001	-0.0001	0.0049	-0.0001	0.0001	0.0001`	0.0000	-0.0006	0.0000
	Pg	-0.0192	-0.0479	0.0699	0.0744	-0.0242	-0.0227	0.0663	-0.0587	0.1317	-0.0222	-0.0376	0.0087	0.2721	-0.0158
PC	Pp	-0.0011	0.0005	-0.0003	0.0002	0.0003	-0.0002	-0.0004	0.0000	0.0002	0.0003	0.0001	0.0004	0.0002	-0.0049
	Pg	0.0135	-0.0062	0.0045	-0.0006	-0.0041	0.0022	0.0064	0.0008	0.0008	-0.0064	-0.0033	-0.0043	-0.0029	0.0507
Correlation Kernel yield	Pp	0.1266	0.1471	0.5785**	0.5548**	-0.0537	-0.0052	0.1301	0.8374**	0.2226*	0.4804**	0.4092**	0.2212*	0.1593	0.0014
	Pg	0.2067	0.1601	0.6102**	0.6035**	-0.1601	-0.0372	0.1504	0.9825**	0.2496*	0.5217**	0.4418**	0.2512*	0.3074	0.0007

Residual effect (Phenotypic) = 0.3570; Residual effect (Genotypic) = 0.1631; Diagonal values = Direct effects; Off-Diagonal values = Indirect effects; *, ** Significant at 0.05 and 0.01 levels, respectively

DFF=Days to 50% flowering., PH=Plant height., FP=Number of filled pods per plant., TP=Total pods per plant.,S/P=Seeds per pod., SMK=Sound mature kernel per cent., HY=Haulm yield per plant., PY=Pod yield per plant.,S%=Shelling per cent.,HI%=Harvest index per cent., 100 KW=100 Kernel weight., SCMR=SPAD Chlorophyll Meter Reading.,OC=Oil content., PC=Protein content

REFERENCES

1. Annual report (2014-15) Directorate of Groundnut Research, Junagadh, Gujarat.
2. Wright, S. (1921). Correlation and causation.*Journal of Agricultural Research, 20:* 557-585.
3. Dewey , D. R., and Lu, K. H (1959). A Correlation and path coefficient analysis of components crusted wheat grass seed production. *Agronomy Journal, 51:* 515-518.
4. Venkateswarlu. O., Sudhakar, B. V. G., Sekhar, M.R. and Sukhakar, P. (2011). Geneticdivergencein confectionary types of groundnut (*Arachishyogaea* L.). *Legume Research; 34(1):* 1-7.
5. Sonone, N.G and Thaware, B.L. (2009). Analysis of genetic diversity for pod yield and other characters in groundnut (*Arachishypogaea* L.). *Green Farming, 2(11):* 742-744.
6. Golakia, P.R and Makne, V.G. (1991). Genetic diversity in Spanish bunch groundnut. *Journal of Maharashtra Agricultural University, 16(3):* 337-339.
7. Vange, T and Maga, T. J. (2014). Genetic characteristics and path coefficient analysis in ten groundnut varieties (*Arachis hypogaea* L.) evaluated in the Guinea Savannah agro-ecological zone. *African Journal of Agricultural Research. 9 (25):* 1932-1937.
8. Dolma, L.; Reddisekhar, M. and Raja Reddy, K. (2010). Genetic variability, correlation and path analysis for yield, its components and late leaf spot resistance in groundnut (*Arachishypogaea* L.).*Journal of Oilseeds Research, 27(2):* 154-157.
9. Shanthala, J and Siddraju, R. (2012). Path effects as influenced by recombination and induced mutation in F2 and F2M2 populations of groundnut.(*Arachishypogeae* L.) *International journal of plant sciences(Muzaffarnagar), 7(1):* 39-42. 9 ref.
10. Siddique, M.N.H.; Haque, M.M.; Ara, M.J.F.; Ahmed, M.R. and Roknuzzaman, M. (2006). Correlation and path analysis of groundnut (*Arachis hypogaea* L.). *International Journal of Sustainable Agricultural Technology. 2 (7):* 6-10.

Received : November-2017 Revised : November-2017 Accepted : December-2017