INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY
Volume: 3: Issue-1: Jan - Mar-2012 IJABPT *ISSN 0976-4550*
Accepted: Jan-2012 *Research Article*

GENETIC VARIABILITY STUDIES FOR YIELD ATTRIBUTES AND RESISTANCE TO FOLIAR DISEASES IN GROUNDNUT *(ARACHIS HYPOGAEA* L.)

K. Mohan Vishnuvardhan[2], R.P. Vasanthi[2*], K. Hari Prasad Reddy[1] and B.V. Bhaskar Reddy

[1]S.V.Agricultural College, ANGRAU, Tirupati-517502, Andhra Pradesh, India
[2]Regional Agricultural Research Station, Tirupati-517502, Andhra Pradesh, India
[*]*E-mail:* vasanthi.rrs@gmail.com

ABSTRACT: Twenty eight F2 populations (crossed in an 8 × 8 diallel fashion without reciprocals) of groundnut were evaluated in randomized block design with three replications for variability, heritability and genetic advance during *rabi* 2009-10. Observations on sixteen characters were recorded. Analysis of variance revealed highly significant differences among the genotypes for all the characters except number of mature pods per plant and pod yield per plant. High GCV accompanied by high heritability and high GAM were obtained for percentage of leaves affected by foliar diseases per plant and number of immature pods per plant indicating predominant role of additive gene action and amenability for phenotypic selection in early generations. For late leaf spot and rust severities and harvest index moderate GCV and high heritability and GAM was observed. Moderate GCV, heritability and GAM were registered for plant height at harvest, number of primary branches per plant, number of leaves per plant at harvest, number of mature pods per plant, kernel weight per plant indicating that additive and non-additive gene actions have a role in their inheritance and phenotypic selection would be effective to some extent. For days to 50% flowering and days to maturity, GCV was low, heritability was high and GAM was low. For sound mature kernel percentage and shelling out-turn all the genetic parameters were low indicating larger role of non-additive gene action and selection would be effective in later segregating generations.
Key words: Genetic variability, heritability, genetic advance as percentage of mean and groundnut.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.), an important crop among oilseeds, is a self pollinated, allotetraploid (2n=2x=40) grown in tropical and sub-tropical regions of the world. Even though India ranks first in cultivated area (5.47 million hectares), its production (5.51 million metric tonnes) and productivity (1007.3 kg ha^{-1}) (FAO, 2009) are very low due to the major constraints of abiotic and biotic stresses. The low productivity of the crop is ascribed mainly due to two major foliar diseases namely late leaf spot (causal organism: *Phaeoisariopsis personata* [(Berk. and Curt.) Deighton]) and rust (causal organism: *Puccinia arachidicola* Speg.). These two diseases often occur together and causes up to 50-70% of yield losses in the crop (Subrahmanyam *et al.,* 1984). Development of cultivars resistant/tolerant to these diseases could be effective in decreasing the production costs, improving production quality and reducing the detrimental effects of chemicals on our ecosystem. Genetic variability is the basic requirement for crop improvement as this provides wider scope for selection. Thus, effectiveness of selection is dependent upon the nature, extent and magnitude of genetic variability present in material and the extent to which it is heritable. In the present study, variability and other genetic parameters were studied. Material generated by crossing eight parents in half-diallel manner and the parents. The crosses were made with the objective of development acceptable pod and seed characters.

MATERIAL AND METHODS

The field experiment was carried out at Regional Agricultural Research Station, Tirupati, Chittoor district of Andhra Pradesh during *rabi* 2009-10. The experimental material comprised of 28 F_2 populations involving parents of eight promising groundnut varieties *viz.,* Tirupati 1, Narayani, TPT 25, Kadiri 6, TLG 45, TCGS 876, GPBD 4 and ICG (FDRS) 79. Each F_2 plant population raised in 4m length plot with a spacing of 22.5 × 10cm.

The data were collected on 30 randomly chosen plants in each F_2 population and observations were recorded on days to 50% flowering, days to maturity, plant height at harvest (cm), number of primary branches per plant, number of secondary branches per plant, number of leaves per plant at harvest, percentage of leaves affected by foliar diseases, number of mature pods per plant, number of immature pods per plant, sound mature kernel percentage, kernel weight per plant (g), shelling out-turn (%), late leaf spot severity, rust severity, harvest index (%) and pod yield per plant (g).

Late leaf spot and rust severities were scored on the 1-9 point scale as described by Subrahmanyam *et al.* (1995). And then the score was transformed to percentage using arc-sine arc-sine transformation formula (Subrahmanyam *et al.,* 1982).

Analysis of variance was carried out as per the method suggested by Panse and Sukhatme (1979). Phenotypic and genotypic coefficients of variation were computed as per Burton (1952), heritability (broad sense) and genetic advance as followed as per Allard (1960).

RESULTS AND DISCUSSION

The analysis of variance for sixteen characters in F_2 populations during *rabi* 2009-10 showed significant differences for all the traits except number of mature pods per plant and pod yield per plant (Table 1). In the present investigation the genetic parameters, genotypic co-efficient of variation (GCV), phenotypic co-efficient of variation (PCV), heritability [h^2 (b)] and genetic advance as percentage of mean (GAM) were estimated for yield, yield attributes and late leaf spot and rust resistance traits among 28 F_2 population. Phenotypic co-efficient of variation was of higher magnitude than the genotypic co-efficient of variation for all the characters indicating the influence of environment in expression of the traits. Similar observations were also reported by Korat *et al.* (2009) and Savaliya *et al.* (2009).

Table 1 Analysis of variance (Mean squares) for 16 characters among 8 parents and 28 F_2 populations (*Rabi* 2009-10)

Character	Replications df = 2	Treatments df = 35	Error df = 70
Days to 50% flowering	0.62	4.54**	0.33
Days to maturity	0.75	18.05**	0.65
Plant height at harvest (cm)	19.70	35.93**	8.93
Number of primary branches per plant	0.04	3.22**	0.28
Number of secondary branches per plant	1.58	1.61**	0.43
Number of leaves per plant at harvest	64.19	108.33**	24.12
Percentage of leaves affected by foliar diseases	16.59	330.05**	12.12
Number of mature pods per plant	9.79	8.59	4.59
Number of immature pods per plant	0.68	2.75**	0.89
Kernel weight per plant (g)	1.10	8.46**	1.76
Sound Mature Kernel percentage	11.14	48.50**	11.33
Shelling out-turn (%)	105.78	298.24**	49.23
Late leaf spot severity	0.32	24.62**	1.28
Rust severity	2.04	26.25**	1.26
Harvest Index (%)	40.86	228.44**	43.14
Pod yield per plant (g)	7.39	15.05	10.37

* & ** Significant at 5% and 1 % level of probability respectively

High GCV was observed for number of secondary branches per plant (34.42%), percentage of leaves affected by foliar diseases (49.98%) and number of immature pods per plant (20.80%). Heritability was low for number of secondary branches per plant (7.47%) with moderate GAM (19.38%). For the other two traits, both heritability and GAM were high. Dixit *et al.* (1970), Lakshmaiah (1978), and Korat *et al.* (2009) for number of secondary branches per plant and Kulkarni and Albuquerque (1967) and Shinde *et al.* (2010) for number of immature pods per plant reported high GCV.

Nine characters namely, plant height at harvest (12.01%), number of primary branches per plant (13.19%), number of leaves per plant at harvest (11.90%), number of mature pods per plant (13.81%), kernel weight per plant (10.64%), late leaf spot severity (16.48%), rust severity (16.77%), harvest index (12.53%) and pod yield per plant (13.21%) recorded moderate GCV. Heritability and GAM was high for three characters, leaf spot severity (74.91% & 29.38%), rust severity (83.89% & 31.64%) and harvest index (69.80% & 21.56%). For remaining six characters, both heritability and GAM were moderate (Table 2).

Table 2 Estimates of genetic parameters for 16 characters among 28 F_2 populations (*Rabi* 2009-10)

Character	Mean	Genotypic Coefficient of Variation (%)	Phenotypic Coefficient of Variation (%)	Heritability (Broad Sense) (%)	Genetic Advance	Genetic Advance as percentage of mean
Days to 50% flowering	23.21	4.96	5.58	78.77	2.10	9.06
Days to maturity	97.67	2.43	2.66	82.91	4.44	4.55
Plant height at harvest (cm)	23.94	12.01	17.41	47.59	4.09	17.07
Number of primary branches per plant	5.82	13.19	18.05	53.46	1.16	19.87
Number of secondary branches per plant	0.38	34.42	125.93	7.47	0.07	19.38
Number of leaves per plant at harvest	45.54	11.90	20.08	35.10	6.61	14.52
Percentage of leaves affected by foliar diseases	19.60	49.98	52.39	91.01	19.25	98.21
Number of mature pods per plant	13.25	13.81	27.95	24.43	1.86	14.07
Number of immature pods per plant	3.24	20.80	35.70	33.96	0.81	24.97
Kernel weight per plant (g)	7.83	10.64	31.28	11.57	0.58	7.46
Sound mature kernel percentage	87.40	2.15	6.54	10.84	1.28	1.46
Shelling out-turn (%)	54.30	6.62	11.84	31.29	4.14	7.63
Late leaf spot severity	13.61	16.48	19.04	74.91	4.00	29.38
Rust severity	14.21	16.77	18.31	83.89	4.50	31.64
Harvest Index (%)	49.93	12.53	15.00	69.80	10.77	21.56
Pod yield per plant (g)	14.80	13.21	20.61	41.07	2.58	17.44

Moderate GCV for number of primary branches per plant was reported by Dixit *et al.* (1971), Patra (1975), Lakshmaiah (1978) and Verma *et al.* (2002) and by Majumdar *et al.* (1969), Deshmukh *et al.* (1986) and Verma *et al.* (2002) for pod yield per plant. High heritability coupled with high GAM for late leaf spot severity and rust severity obtained in the present study are in conformity with the reports of Venkataravana *et al.* (2008), Venkataravana and Injeti (2008) and Giri *et al.* (2009). For days to 50% flowering and days to maturity, GCV was low (4.96% & 2.43%), heritability was high (78.77% & 82.91%) and GAM was low (9.06% & 4.55%). For sound mature kernel percentage and shelling out-turn all the genetic parameters were low (Table 2).

REFERENCES

R.W. Allard (1960). Principles of Plant Breeding. *John Wiley and Sons, Inc.,* USA Wiley International Edition. Pp: 85.

G.W. Burton (1952). Quantitative inheritance in grass. *Proceedings of sixth international grassland congress*, 1: 227-283.

S.M. Deshmukh, M.S. Basu and P.S. Reddy (1986). Genetic variability, character association and path coefficient of quantitative traits in Virginia bunch varieties of groundnut. Indian Journal of Agricultural Science. 56: 816-821.

P.K. Dixit, P.D. Bhargava, D.K. Saxena and L.H. Bhatia (1970). Estimates of genotypic variability of some quantitative characters in groundnut (*Arachis hypogaea* L.). Indian Journal of Agricultural Sciences. 40: 197-200.

P.K. Dixit, P.D. Bhargava, D.K. Saxena, L.H. Bhatia and K.N. Sharma (1971). Variability in groundnut (*Arachis hypogaea* L.). Indian Journal of Agricultural Sciences. 41: 685-691.

FAO (2009). Statistical data on crops, groundnut, area, production and productivity of India & World, 2009. http://faostat.fao.org/site/567/default.aspx.#ancor.

R.R. Giri, V.N. Toprope and P.K. Jagtap, (2009). Genetic variability, character association and path analysis for yield, its component traits and late leaf spot, *Phaeoisariopsis personata* (Berk and curt), in groundnut. International Journal of Plant Sciences (Muzaffarnagar). 4(2): 551-555.

V.P. Korat, M.S. Pithia, J.J. Savaliya, A.G. Pansuriya and P.R. Sodavadiya (2009). Studies on genetic variability in different genotypes of groundnut (*Arachis hypogaea* L.). Legume Research. 32(3): 224-226.

G.N. Kulkarni and S.D.S. Albuquerque (1967). Study of variation in some quantitative characters of nine strains of groundnut evolved at Raichur. Mysore Journal of Agricultural Sciences. 1: 53-59.

B. Lakshmaiah (1978). Studies on the relationship between yield and its components in groundnut (*Arachis hypogaea* L.). M.Sc.(Ag.) Thesis, Andhra Pradesh Agricultural University, Bapatla.

P.K. Majumdar, Ramprakash and Md Fazlul Haque (1969). Genotypic and phenotypic variability in quantitative characters in groundnut. Indian Journal of Genetics and Plant Breeding. 29: 291-296.

V.G. Panse and P.V. Sukhatme (1979). Statistical methods for Agricultural workers. *ICAR Publication,* New Delhi.

G.J. Patra (1975). Heritability and genetic advance of some quantitative characters in groundnut hybrids in F_8 generation. Indian Journal of Agricultural Sciences. 45: 308-311.

J.J. Savaliya, A.G. Pansuriya, P.R. Sodavadiya and R.L. Leva (2009). Evaluation of inter and intraspecific hybrid derivatives of groundnut (*Arachis hypogaea* L.) for yield and its components. Legume Research. 32(2): 129-132.

P.P. Shinde, M.D. Khanpara J.H. Vachhani, L.L. Jivani and V.H. Kachhadia (2010). Genetic variability in Virginia bunch groundnut (A*rachis hypogaea* L.). Plant Archives. 10(2): 703-706.

P. Subrahmanyam, D. McDonald, R.W. Gibbons, S.N. Nigam and D.J. Nevill (1982). Resistance to rust and late leaf spot diseases in some genotypes of *Arachis hypogaea*. Peanut Science. 9: 6-10.

P. Subrahmanyam, D. McDonald, F. Waliyar, L.J. Raddy, S.N. Nigam, R.W. Gibbons, V. Rammanatha Rao, A.K. Singh, S. Pande, P.M. Reddy and P.V. Subba Rao (1995). Screening methods and sources of resistant to rust and late leaf spot of groundnut. ICRISAT Center, Patancheru, India.

P. Subrahmanyam, J.H. Williams, D. McDonald and R.W. Gibbons (1984). The Influence of foliar diseases and their control by selective fungicides on a range of Groundnut (*Arachis hypogaea* L.) genotypes. Annals of Applied Biology. 104: 467-476.

Y.P.A.K. Verma, Z.A. Haider and J.L. Mahto (2002). Variability studies in Spanish bunch groundnut (*Arachis hypogaea* L.). Journal of Research, Bisra Agricultural University. 14(1): 91-93.

P. Venkataravana and S.K. Injeti (2008). Assessment of groundnut germplasm and advanced breeding lines and isolation of elite foliar disease resistant genotypes for southern Karnataka. Journal of Soils and Crops. 18(2): 282-286.

P. Venkataravana, N. Jankiraman, D. Nuthan and V.L.M. Prasad (2008). Genetic enhancement of multiple resistance to foliar diseases in groundnut. Legume Research. 31(2): 155-156.