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Genetic Analysis of Rust and Late Leaf Spot in Advanced Generation Recombinant Inbred Lines of Groundnut (*Arachis hypogaea* L.)

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Abstract

An experiment was carried out at the Main Agricultural research station, University of Agricultural sciences, Dharwad during 2011 *kharif* for the estimation of genetic variability and genetic parameters of rust and late leaf spot in a randomized block design in two replications with 816 recombinant inbred lines were tested in the experiment. Highly significant variations were observed for both rust and late leaf spot for 80 days and 90days of disease score. Genetic variability for rust and late leaf spot recorded at 80 DAS and 90 DAS was high range with 3-6, 3-8 and 3-7, 3-9 in 2011 *kharif* on 1-9 scale indicating better resistance in the mapping population studied.
Genotypic and phenotypic coefficient of variation for were very also high in 2011 *kharif* (19.05, 19.25 and 31.60, 31.79) for rust and (28.9, 29.35 and 40.90, 41.23) for late leaf spot indicating presence of high genetic variability for this trait. Less difference between PCV and GCV for this character suggests that there is a least effect of environment. A high heritability (97.7 98.80 and 97.59, 98.87%) for both rust and late leaf spot and a high genetic advance as per cent mean (38.83, 64.71 and 59.00, 83.97%) recorded for this trait indicate that we can go for direct selection of the lines that are resistance to rust.

Keywords: late leaf spot, rust, recombinant inbred lines

1. Introduction

Annual production of groundnut (*Arachis hypogaea* L.) in the country is 5.62 m t from 4.19 million ha of land during 2012-13. Groundnut is mainly used as a bakery food in our country and is a source of edible oil, fodder and green manure crop for improvement of soil health. Ground nut oil contains 46 and 32 per cent of monounsaturated fatty acid (MUFA) and polyunsaturated fatty acid (PUFA) respectively (USDA, 2012). Groundnut oil is also used in many preparations like soap making, fuels, cosmetics, leather dressing, furniture creams, lubricants etc. Yield of groundnut is mainly influenced by many factors especially diseases like rust and late leaf spot.

Rust and late leaf spot (LLS) are the two most widely distributed and economically important foliar diseases of groundnut causing severe damage to the crop (Mc Donald et al, 1985 and Kokalis-Burette et al, 1997). They are commonly present wherever groundnut is grown but their incidence and severity vary between localities and seasons. Each disease alone is capable of causing substantial yield loss but when they occur together losses are further increased. These foliar diseases besides reducing the yield also have an adverse influence on seed quality and grade characteristics, deteriorate the quality of plant biomass and thus render the fodder unsuitable as animal feed. Further, control of these diseases through the application of plant protection measures will not only increase the cost of cultivation but also lead to environmental and health hazards. The seeds harvested from unsprayed plots will have significantly better quality than those treated with a fungicide used to control rust and LLS in groundnut (Hammonds et al, 1976). That is why, though chemical control is possible, development of resistant cultivars is considered to be the best strategy for reducing crop losses due to these diseases.

It is also essential to have knowledge regarding the amount of genetic variability created through hybridization in this derived recombinant inbreed lines (RILs) for various economic characters, since information on nature and magnitude of variability present for traits of interest is prerequisite for crop improvement. The phenotypic expression of the plant character is mainly controlled by the genetic makeup of the plant and also environment. So it is necessary to partition the observed phenotypic variability into its heritable and non-heritable components with suitable parameter such as phenotypic and genotypic coefficient of variation, heritability and genetic advance. Considering the above points, the present study was undertaken to evaluate the genotypes for resistance to rust and late leaf spot among 816 RILs.

2. Materials and Methods

An experiment comprising of 816 RILs of groundnut was conducted in a Randomized Block Design with two replications at the Main Agricultural research station, University of Agricultural sciences, Dharwad during June 15 *kharif* 2011 and July 10

2012 seasons. The unit of plot size was one row of 1.5 meters length for both seasons. Row to row and plant to plant spacing were maintained at 30 cm and 10 cm Recommended cultural practices were followed to ensure a good crop. The data on two diseases *viz.*, rust and late leaf spot for 80 days and 90 days were recorded.
The data were subjected to statistical analysis using WINDOSTAT software. Components of genetic parameters like genotypic and phenotypic variance, genotypic and phenotypic coefficient of variation, heritability, genetic advance, genotypic and phenotypic correlation coefficient were estimated using excel based computer software program following Singh and Choudhary (1979)

3. Results and Discussion

Genetic variability in the present study for rust resistance recorded at 80 DAS and 90 DAS was high, which ranges from 3-6 and 3-8 in 2011, 3-6 and 3-8 in 2012 *kharif*, 3-6 and 3-8 in pooled analysis over seasons with a mean score of 3.25 and 3.45 in 2011, 3.24 and 3.45 in 2012 *kharif* and 3.25 and 3.45 in pooled analysis over seasons on 1-9 scale indicating better resistance in the mapping population studied.

Genotypic and phenotypic coefficient of variation for rust were very high in 2011 *kharif* (31.60 and 31.79), 2012 *kharif* (31.37, 31.51) and in pooled analysis over seasons (31.44 and 31.44) and also were high for LLS in 2011 (40.09 and 41.23%), 2012 *kharif* (40.96 and 41.77%) and in pooled analysis over seasons (40.99 and 41.10%) for 90DAS disease score. Reaction to foliar diseases like rust and late leaf spot, both GCV and PCV recorded were very high, indicating wide range of variability for these characters in the population. The results of this study are in accordance with the results published by Khedikar et al. (2008), Reddy and Gupta (1992) Less difference between PCV and GCV for this character indicates that there is a least effect of environment, and a wide range of variability for rust and late leaf spot resistance is present in population to make desirable selections for this trait improvement.

A high heritability (98.80%, 99.08 and 98.64%) and a high genetic advance as per cent mean (64.71%, 64.33 and 63.89%) recorded for rust and High heritability (98.97 and 98.00%) with high genetic advance as per cent mean (83.97 and 83.93%) for LLS during kharif 2011 and 2012 respectively. Similar results of high genetic advance for reaction to rust and late leaf spot diseases in both the seasons were recorded by (Venkataravana et al, 2008, Vishnuvardhan et al, 2012). The high genetic advance coupled with high heritability estimates for these traits suggested the importance of additive genetic variance and improvement of these characters could be made by simple phenotypic selection.

Table 1. Mean, Range and Genetic parameters for rust and late leaf spot disease for 2011 kharif, 2012 kharif and pooled analysis over two seasons

No.										kharif			
	Trait / Genetic parameters	80 DAS		90 DAS		80 DAS		90 DAS		80 DAS		90 DAS	
		Rust	LLS	Rust	LLS	Rust	LLS	Rust	LLS	Rust	LLS	Rust	LLS
1	Mean	3.25	3.41	3.45	3.62	3.24	3.40	3.45	3.61	3.25	3.42	3.45	3.62
2	Range	3-6	3-7	3-8	3-9	3-6	3-7	3-8	3-9	3-6	3-7	3-8	3-9
3	GCV%	19.05	28.9	31.60	40.90	18.73	28.97	31.37	40.96	18.48	29.30	31.44	40.99
4	PCV%	19.25	29.35	31.79	41.23	19.00	29.28	31.51	41.17	18.80	29.30	32.00	41.10
5	h^2_{bs} (%)	97.92	97.59	98.80	98.87	97.30	97.86	99.08	98.00	96.56	98.86	98.64	99.45
6	Genetic advance	1.26	2.01	2.23	3.04	1.23	2.01	2.21	3.03	1.21	2.03	2.21	3.04
7	Genetic advance as per cent mean	38.83	59.00	64.71	84.00	38.10	59.04	64.33	83.93	37.40	59.67	63.89	84.21

4. Conclusion

Rust and LLS are major diseases that cause reduction in yield and other quality parameters. These can be controlled by chemical sprays but it has drastic effect on the polluting the environment and killing various useful micro organisms , so an alternative method is to develop genetic resistance in plants for these diseases so genetic analysis of rust and late leaf spot of a cross GPBD-4 X GM4-3 is done which showed high heritability and high genetic advance as per cent mean indicating that the characters are governed by additive gene action so we can practice selection for these characters as no further change in the genetic constitution of the recombinant inbred lines as they attain nearly homozygous condition in $F_{7:8}$

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