Biological Forum – An International Journal **15(12): 16-19(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Evaluation of Genotypes Against Late Leaf Spot and Rust Diseases in Groundnut (*Arachis hypogaea* L.)

K.A. Wagh[1*], M.S. Kamble[2], S.J. Waghmare[3], A.R. Thakre[1], M.S. Mote[2], N.A. Deore[4] and S.V. Khadtare[5]

[1]PG Scholar, Department of Genetics and Plant Breeding,
RCSM College of Agriculture, Kolhapur (Maharashtra), India
[2]Assistant Professor of Agril. Botany, RCSM College of Agriculture, Kolhapur (Maharashtra), India.
[3]Assistant Professor of Plant Pathology, RCSM College of Agriculture, Kolhapur (Maharashtra), India.
[4]PG Scholar, Department of Agril. Entomology, RCSM College of Agriculture, Kolhapur (Maharashtra), India.
[5]Associate Professor of Agronomy, AICRP on Agromet, ZARS, Solapur (Maharashtra), India.

(Corresponding author: K.A. Wagh)*
(Received: 05 November 2023; Revised: 25 November 2023; Accepted: 11 December 2023; Published: 20 December 2023)
(Published by Research Trend)

ABSTRACT: Foliar diseases, particularly late leaf spot (LLS) and rust, pose significant challenges to groundnut production in various regions worldwide. These foliar diseases not only diminish yield but also adversely affect seed quality. The screening of 31 genotypes of groundnut (*Arachis hypogaea* L.) was undertaken to evaluate the per cent disease incidence of late leaf spot and rust diseases. Several genotypes of different origins were subjected to screening for resistance against late leaf spot (LLS) and rust. The investigation demonstrated considerable variability among the genotypes in terms of their resistance to LLS and rust. The crops were cultivated and the occurrence of late leaf spot and rust in field was quantified. The results revealed diverse disease incidences among the genotypes, emphasizing the need for targeted measures to manage these production constraints. The percentage of disease incidence for late leaf spot ranged from 13.67 per cent to 55.33 per cent, while rust incidence varied from 10.33 per cent to 41.33 per cent across the studied genotypes. The identification of disease-resistant genotypes stands out as a highly effective strategy to enhance production of groundnut in diverse regions. This study aims to assess disease incidence and yield outcomes across various peanut genotypes with the goal of identifying the top-performing varieties concerning both yield and disease resistance.

Keywords: Groundnut, Late leaf spot, Rust, Disease, Incidence.

INRODUCTION

Groundnut (*Arachis hypogaea* L.) holds significant importance as an oilseed crop in India. It is also known as wonder legume (Dutta *et al*., 2021). It is self-pollinated, allotetraploid crop (2n= 40). The botanical name of groundnut *Arachis hypogaea* Linn. is derived from two Greek words, "*Arachis*" denoting a legume and "*hypogaea*" indicating beneath the ground, referring to the pod development within the soil. Globally, Groundnut covers 327 lakh hectares with the production of 539 lakh tonnes and productivity of 1648 kg per hectare (FAOSTAT, 2021). Most of the groundnut production in India is concentrated in seven states *viz.*, Gujarat, Rajasthan, Andhra Pradesh, Tamil Nadu, Karnataka, Madhya Pradesh and Maharashtra. In Maharashtra Dhule, Satara, Solapur, Pune, Kolhapur, Nashik, Parbhani and Jalgoan are the major groundnut growing districts. Late leaf spot and rust are serious diseases in groundnut. The role of groundnut diseases in reducing yield has been clearly demonstrated (Ghewande *et al*., 1983). Among the biotic stresses, late leaf Spot (LLS) and rust are the two major foliar fungal diseases results in yield loss up to 50% and 10–52% respectively based on the severity of their incidence (Killada *et al*., 2023). More than 55 pathogens including viruses have been reported to affect groundnut. Among diseases, late leaf spot (*Cercospora personata*) and rust (*Puccinia arachidis*) affects the groundnut crop both in *kharif* and *rabi-summer*. However, the incidence of these diseases may vary from season to season. Individual disease can lead to significant reduction in crop yield but when the diseases occur together the resulting losses become extensive. Both these foliar diseases results in heavy defoliation under severe condition which ultimately affect the pod growth and development and seed filling, there by yield losses (Chaudhari *et al*., 2017). Foliar diseases not only diminish yield but also adversely affect seed quality. Several sources of resistance to LLS and rust have been reported in *A. hypogaea* (Waliyar *et al*., 1993; Anderson *et al*., 1993). Recognizing the importance of identifying disease-resistant genotypes, this study aims to evaluate various genotypes for their resistance to foliar diseases, specifically late leaf spot and rust. This approach is considered one of the most effective and eco-friendly measures to enhance groundnut production across different regions.

MATERIAL AND METHODS

Thirty one genotypes of groundnut were screened for late leaf spot and rust disease during *kharif* 2022 at Post Graduate Research Farm, Rajarshi Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur (Maharashtra). The experimental material for the disease evaluation studies comprised of 31 groundnut genotypes which were sown and evaluated in a randomized block design in three replications. The material was made available for experiment by Agricultural Research Station, KasbeDigraj, Dist. Sangli (Maharashtra). All the recommended agronomic practices were followed for cultivation of crop as when required. The crop was grown and observations were recorded for late leaf spot and rust disease. Several genotypes were screened in natural disease conditions for resistance against late leaf spot (LLS) and rust disease. The number of late leaf spot and rust infected plants were counted physically in each genotype and in each replication. These observations were used to calculate the disease incidence for both rust and late leaf spot disease. The Per cent Disease Incidence (PDI) was estimated by using the following formula (Kanade *et al.*, 2015; Aslam *et al.*, 2018).

$$\text{Percent Disease Incidence (PDI)} = \frac{\text{Number of infected plants}}{\text{Total numbers of plants}} \times 100$$

RESULTS AND DISCUSSION

The results of evaluation of thirty one genotypes of groundnut against late leaf spot and rust diseases and mean performance of yield is presented in the Table.1. The results indicated that there is high differences among genotypes for late leaf spot and rust disease incidence. Evaluation of groundnut genotypes against late leaf spot disease under natural inoculum pressure of the pathogen implied that out of 31 genotypes GPBD -4 showed minimum (13.67%) per cent disease incidence followed by KDG-128 (16.00%), KDG-245 (16.67%) and KDG-160 (18.67%). While, genotype ICGV-181059 showed maximum per cent disease incidence (55.33 %) followed by JL-24 (49.00%), TPG-41 (44.33 %) and ICGV-181069 (41.00 %).

Groundnut genotypes evaluated against rust disease under natural inoculum pressure of the pathogen revealed that genotype GPBD -4 showed minimum (10.33%) per cent disease incidence followed by KDG-128 (13.67%) KDG-160 (15.00%) and KDG-245 (15.67%). While, genotype JL-24 (41.33%) showed maximum per cent disease incidence followed by ICGV-181059 (39.67%), ICGV-181069 (33.33 %) and TKG-BOLD (31.33 %).

A direct relationship was observed between the yield parameter of various genotypes and the incidence of diseases, indicating that increased disease incidence led to a reduction in yield. The heightened susceptibility of crops to diseases likely resulted in decreased yield, as these diseases often induce defoliation, thereby disrupting the nutritional processes and protective mechanisms of the crop. Notably, foliar diseases, which outnumbered root and stem diseases, exerted a more pronounced impact on reducing yield. The genotypes GPBD -4, KDG-128, KDG-123, KDG-222, KDG-218, KDG-160, ICGV-181051 and KDG-217 showing less per cent disease incidence, having higher pod yield per plant as compares to the genotypes which showing maximum per cent disease incidence. The pod yield per plant was ranged from 20.5 to 39.8 g. Highest pod yield was observed in KDG -123 (39.8 g) followed by KDG-160 (38.1 g), KDG-222 (37.4 g) and KDG-218 (36.8 g) as these genotypes exhibited less per cent disease incidence of LLS and rust. While, the lowest pod yield per plant observed in KDG-220 (20.5 g) followed by Jl-24 (22.3 g), ICGV-14421 (22.0 g), ICGV-181069 (25.7 g), ICGV-181059 (26.3 g) and TPG-41 (29.0 g) as these genotypes exhibited medium to maximum per cent disease incidence of both diseases.

Fungal species are more prevalent, potentially contributing to the elevated occurrence of fungal diseases in peanuts. Plant leaves, being significant nutrient sources for the entire plant, exhibit higher nutrient concentrations. This nutrient abundance may attract pathogenic microbes, leading to a higher susceptibility of leaves to foliar diseases compared to other plant parts. The results indicated that the genotypes which exhibit less per cent disease incidence had higher pod yield per plant as compare to the susceptible genotypes. The results are supported by the findings of Ashish (2014) where, foliar diseases formed largest percentage of diseases in groundnut. The study align with findings of Sudini *et al.* (2015) where, they highlighted the prevalence of foliar fungal diseases in peanuts. Gorbet *et al.* (1982) noted a negative correlation between the number of spots per leaf, leaf defoliation and yield. Das and Roy (1995) similarly found that *Cercospora* leaf spot disease resulted in reduced yield with every 1 per cent increase in disease severity.

The different genotypes showing varied per cent disease incidence for both LLS and rust disease. The results are supported by Bwala *et al*. (2019); Njoki *et al*. (2023) as they found varied disease incidence in groundnut genotypes. Hossain *et al*. (2007); Subramanayam *et al*. (1982); Dubey *et al*. (1995); Parbat *et al*. (2018) also attempted screening of groundnut genotypes for their severity and intensity for late leaf spot and rust diseases and observed varied reactions of groundnut genotypes to late leaf spot and rust diseases. Notably, none of the tested genotype demonstrated immunity against late leaf spot and rust disease. The results are supported by the findings of Saleh and Trustinah (1996) where, they reported that none of the groundnut genotype was resistant to late leaf spot and rust diseases.

Table 1: Per cent disease incidence of late leaf spot and rust disease and mean yield of groundnut genotypes.

Sr. No.	Genotype	Per cent disease incidence of LLS	Per cent disease incidence of rust	Pod yield per plant (g)
1.	KDG-216	29.67	24.33	29.7
2.	TPG-41	44.00	29.33	29.0
3.	KDG-266	23.67	18.67	23.9
4.	ICGV-14421	33.33	31.33	22.9
5.	KDG-244	23.67	19.67	28.8
6.	KDG-220	24.33	21.33	20.5
7.	ICGV-181024	24.67	23.67	29.3
8.	KDG-217	19.33	17.67	30.0
9.	KDG-215	35.67	30.33	25.8
10.	KDG-219	30.33	24.67	32.9
11.	ICGV-181051	19.67	22.33	34.3
12.	ICGV-181059	55.33	39.67	26.3
13.	KDG-128	16.00	13.67	31.8
14.	KDG-160	18.67	15.00	38.1
15.	KDG-245	16.67	15.67	20.5
16.	KDG-272	24.33	19.67	30.8
17.	JL-776	24.67	21.67	30.9
18.	JL-1255	25.67	18.33	30.7
19.	ICGV-13207	29.33	23.33	30.2
20.	ICGV-10698	26.33	20.33	26.4
21.	ICGV-171046	34.67	27.66	27.2
22.	GPBD-4	13.67	10.33	26.9
23.	ICGV-181057	22.67	24.33	27.5
24.	ICGV-181069	41.00	33.33	25.7
25.	KDG-218	20.67	18.67	36.8
26.	KDG-222	19.67	20.67	37.4
27.	KDG-123	18.67	16.33	39.8
28.	KDG-243	31.33	21.67	23.6
29.	JL-24	49.00	41.33	22.3
30.	TKG-BOLD	39.00	31.33	31.3
31.	JL-286	32.67	22.67	29.0

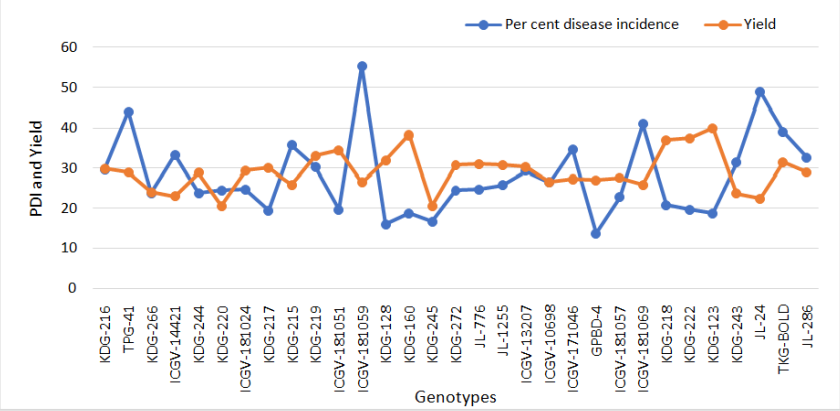

Fig. 1. Per cent disease incidence of late leaf spot disease on groundnut genotypes.

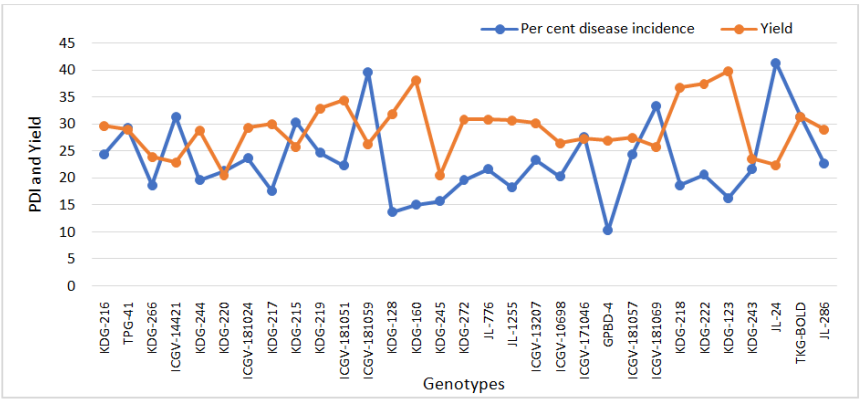

Fig. 2. Per cent disease incidence of rust disease on groundnut genotypes.

CONCLUSIONS

In the present study groundnut genotypes were evaluated for resistance to late leaf spot and rust. The study comprising 31 genotypes of different origin. In this experiment concluded that the identified genotypes resistant to LLS and rust under natural diseases conditions. Per cent disease incidence of late leaf spot and rust in the genotypes under study revealed that genotypes GPBD-4, KDG-128, KDG-160KDG-123, KDG-222, KDG-218, ICGV-181051 and KDG-217 exhibits less per cent disease incidence for both the diseases and these genotypes also had better yield. The results indicated that the genotypes which exhibits less per cent disease incidence, performs good and had higher pod yield per plant as compares to the genotypes which showing maximum per cent disease incidence. The resistant genotypes are also useful as elite parents in peanut breeding program. Understanding the mechanism of resistance in genotypes identified for specific adaptation and wide adaptation will enable the peanut breeders to diversify the genetic base of resistance to foliar fungal diseases. Identification and selection of resistant genotypes will lead to develop disease resistance with high yielding groundnut genotypes.

Acknowledgement. The Authors are thankful to Agricultural Research Station, KasbeDigraj, District- Sangli (Maharashtra) for providing groundnut genotypes to conduct the experiment.

REFERENCES

Anderson, W. F., Holbrook, C. C. and Brenneman, T. B. (1993). Resistance to *Cercosporidium personatum* within peanut germplasm. *Peanut Sci.*, *20*, 53–57.

Ashish, J., Nadaf, H. L., Gangadhara, K. (2014). Genetic analysis of rust and late leaf spot in advanced generation recombinant inbred lines of groundnut (*Arachis hypogaea* L.). *Int. J. Genet. Eng. Biotechnol.*, *5*, 109-114.

Aslam, M. and Rafique, K. (2018) Prevalence and incidence of Tikka disease (*Cercospora* spp.) of groundnut in Pothwar region of Punjab. *Asian J Agri & Biol*., *6*(4), 442-446.

Bwala, R. I., Ekhuemelo, C. and Zacharia, D. (2019). Incidence of *cercospora* leaf spot disease of groundnut (*Arachis hypogaea* L.) as influenced by sowing date in Makurdi, Benue state of Nigeria. *Sustainability, Agri, Food and Environmental Research*, *7*(4), 355-370.

Chaudhari, S., Khare, D., Sundravadana, S., Variath, M. T., Manohar, S. S. and Janila, P. (2017). Genetic analysis of foliar disease resistance, yield and nutritional quality traits in groundnut. *Electronic Journal of Plant Breeding*, *8*(2), 485-493.

Das, S. and Roy, T. K. (1995). Assessment of losses in groundnut due to early and late leaf spots. IAN. 15: 34 -36.

Dubey, L. N., Das, K. K. and Hazarika, D. K. (1995). Field evaluation of Groundnut against leaf spot and rust. *Indian Phytopathology*, *48*(1), 328.

Dutta, P., Deb, L., Gogoi, J., Mahanta, M., Kumari, A., Yasin, A. and Sharma, A. (2021). "UmTricho" a liquid bioformulation of indigenous strain of *Trichoderma harzianum* effectively managed the tikka disease (*Cercospora* spp.) of groundnut, *Arachis hypogea* L. under the agroecological condition of Meghalaya. *Biological Forum – An International Journal*, *13*(2), 529-535.

Ghewande, M. P. and Misra, D. P (1983). Groundnut rust: A challenge to meet. *Seeds and Farms*, *9*(6), 12-15

Gorbet, D. W., Shokes, F. M., and Jackson, L. F. (1982). Control of peanut leaf spot with combination of resistance and fungicide treatment. *Peanut Sci*., *9*, 87-90.

Hossain, M. D., Rahman, M. Z., Khatun, A. and Rahman, M. M. (2007). Screening of groundnut genotypes for leaf spots and rust resistance. *Int. J. Sustain. Crop Prod*., *2*(1), 07-10.

Kanade, S. G., Shaikh, A. A., Jadhav, J. D. and Chavan, C. D. (2015). Influence of weather parameters on tikka (*Cercospora* spp.) and rust (*Puccinia arachidis*) of groundnut (*Arachis hypogaea* L.). *Asian J. Envir. Sci.*, *10*(1), 39-49.

Killada, G. K., Akkareddy, S., Muga, S. D., Pinagari, A., Gundrathi, S. V. and Pesaleddula, J. P. (2023). Character Association studies on Foliar Disease Resistance with Yield and Yield Attributing Traits in Groundnut (*Arachis hypogaea* L.). *Biological Forum – An International Journal*, *15*(9), 640-643.

Njoki, L., Okoth, S., Wachira, P., Ouko, A., Mwololo, J., Rizzu, M., Oufensou, S., Amakhobe, T. (2023). Evaluation of Agronomic Characteristics, Disease Incidence, Yield Performance, and Aflatoxin Accumulation among Six Peanut Varieties (*Arachis hypogea* L.) Grown in Kenya. *Toxins*, *15*, 111.

Parbat, J. M., Nadare, M. Y.,Uikey, K. N. and Wankhede, H. K. (2018). Local Groundnut Genotypes Screened against Tikka Disease of Groundnut. *Int. J.Curr.Microbiol. App. Sci*., *7*(08), 3645-3650.

Saleh, N. and Tustinah (1996). Evaluating advanced groundnut lines for resistance to late leaf spot and rust in Indonesia. *International Arachis newsletter*, *16*, 15-17.

Subramanayam, P., Mc Donald, D., Gibbon, R.W., Nigam S. M. and Nevill, D. J. (1982). Resistance to rust and late leaf spot diseases in some genotypes of Groundnut (*Arachis hypogaea* L.). *Peanut Science*, *9*, 6-10.

Sudini, H., Upadhyaya, H. D., Reddy, S. V., Naga Mangala, U., Rathore, A., Vijay Krishna Kumar, K. (2015). Resistance to late leaf spot and rust diseases in ICRISAT's mini core collection of peanut (*Arachis hypogaea* L.). *Australas. Plant Pathol*., *44*, 557–566.

Waliyar, F., Bosc, J. P. and Bonkoungou, S. (1993). Sources of resistance to foliar diseases of groundnut and their stability in West Africa. *Oleagineux*, *48*, 283–287.

How to cite this article: K.A. Wagh, M.S. Kamble, S.J. Waghmare, A.R. Thakre, M.S. Mote, N.A. Deore and S.V. Khadtare (2023). Evaluation of Genotypes Against Late Leaf Spot and Rust Diseases in Groundnut (*Arachis hypogaea* L.). *Biological Forum – An International Journal*, *15*(12): 16-19.