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INTERACTIVE ANALYSIS OF MORPHOLOGICAL CHARACTERS OF GROUNDNUT WITH *CERCOSPORA* LEAF SPOT UNDER THE GWALIOR-CHAMBAL AGROECOLOGICAL ZONE OF MADHYA PRADESH, INDIA

Arun Garlapati, Shama Parveen* and Akash Barela

Department of Genetics and Plant Breeding, I.T.M. University, Gwalior, M.P., India.
*Corresponding author E-mail : shama.itmuniversity@gmail.com

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ABSTRACT

A total of thirty indigenous groundnut genotypes along with three standard checks were evaluated during the *Kharif* season of 2024 to investigate the interaction between *Cercospora* leaf spot infestation and various morphological traits. The results indicated that all morphological characters exhibited significant associations with disease response. Disease infestation levels were categorized into five classes: highly tolerant (1–10%), moderately tolerant (11–25%), tolerant (26–50%), susceptible (51–75%), and highly susceptible (76–100%). Genotypes such as ICG 76, ICG 721, ICG 862, ICG 928, ICG 3992, ICG 4538 and ICG 4598 were identified as highly tolerant, characterized by green leaf colour, dense pubescence on both leaf and stem, a semi-spreading growth habit, and medium plant height. In contrast, genotypes including ICG 434, ICG 1274, ICG 1519, and ICG 4670 exhibited a highly susceptible reaction, marked by the absence of leaf and stem pubescence, light green foliage and tall plant stature. The observed variation in disease response among the genotypes underscores the potential of these traits in future breeding programs aimed at developing disease-resistant groundnut varieties.

Key words : Groundnut, Morphology, Disease infestation, Interaction, Tolerance.

Introduction

Groundnut (*Arachis hypogaea* L.), a member of the family Leguminosae and subfamily Papilionaceae, is believed to have originated from regions spanning Brazil, Peru, Argentina, and Ghana. It was introduced to India during the sixteenth century, likely via the Pacific Islands and China. Groundnut is widely cultivated for its edible oil, which is commonly used as a cooking medium in the form of refined oil or Vanaspati Ghee. It is a segmental allopolyploid and a self-pollinated legume, often referred to as the 'King of oilseeds', 'Wonder nut' or the 'Poor man's cashew nut' (Thamarai Kannan *et al*., 2009).

Among the various biotic stresses that affect groundnut cultivation, foliar diseases, particularly early and late leaf spots, are the most devastating. Early leaf spot is caused by *Passalora arachidicola* (Hori) U. Braun [*Cercospora arachidicola* S. Hori], while *Nothopassalora personata* is responsible for late leaf spot (Bakhoum *et al*., 2023). These diseases can infect all aerial parts of the plant and are capable of causing yield losses of up to 50%. Moreover, plant responses to biotic stressors may vary, interacting in either synergistic or antagonistic ways (Mohammed *et al*., 2018; Kankam *et al*., 2022).

Given the economic significance of groundnut and the impact of tikka disease, particularly in major production zones, the present study was undertaken to identify disease-tolerant genotypes. The aim is to evaluate indigenously sourced germplasm for their resistance potential under the agro-climatic conditions of the Gwalior-Chambal region in Madhya Pradesh.

Materials and Methods

The present study was conducted at Crop Research Centre-I (CRC-I), ITM University, Gwalior, which is situated within the Gwalior-Chambal agro-ecological zone of Madhya Pradesh. The groundnut germplasm used in this investigation was procured from the International Crops Research Institute for the Semi-Arid Tropics

(ICRISAT), Patancheru, Hyderabad, Telangana. A total of 33 groundnut genotypes were evaluated using a Randomized Block Design (RBD). Based on the percentage of disease infestation, the genotypes were categorized into five distinct classes: highly tolerant (1–10%), moderately tolerant (11–25%), tolerant (26–50%), susceptible (51–75%) and highly susceptible (76–100%). Morphological traits such as plant height, stem pubescence, leaf pubescence, leaf colour and growth habit were recorded in accordance with the DUS (Distinctness, Uniformity and Stability) descriptors.

Results and Discussion

The current study highlights the reaction intensity of *cercospora* leaf spot on 33 genotypes (Indigenous Collection) of groundnut (*Arachis hypogea* L.) at Gwalior-Chambal agro-ecological zone of Madhya Pradesh. Out of the 33 genotypes, three are released varieties from Junagadh (GJG-32) and Kadari, Andhra Pradesh (Kadari-3 and Kadari-9), which were used as standard checks for the yield.

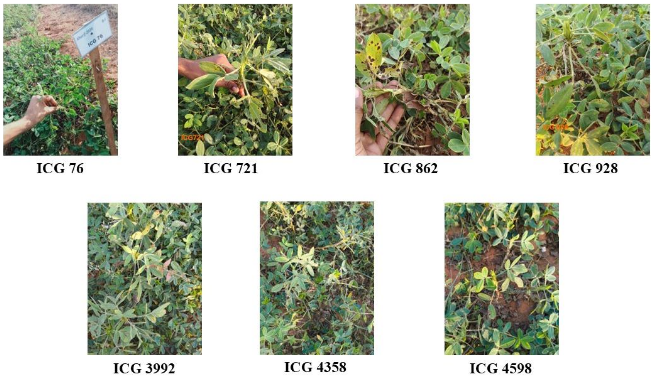
ICG 76, ICG 721, ICG 862, ICG 928, ICG 3992, ICG 4358, ICG 4598

Fig. 1 : Genotypes that shows high tolerance.


ICG 36, ICG 81, ICG 442, ICG 875, ICG 1668, ICG 4156, ICG 4343, ICG 4412, ICG 4527, KADARI 3

Fig. 2 : Genotypes that shows moderate tolerance.


ICG 115, ICG 118, ICG 392, ICG 1142

Fig. 3 : Genotypes that shows tolerance.

Among the evaluated genotypes, ICG 434, ICG 1274, ICG 1519, and ICG 4670 (Fig. 5) demonstrated a highly susceptible response to disease infestation. This observation underscores a pronounced association between the degree of susceptibility and specific morphological traits under investigation. Notably, these genotypes exhibited an absence of both leaf and stem pubescence, possessed light green foliage, and were characterized by relatively tall plant stature, as detailed in Table 1.

The highest number of genotypes (10) was recorded in the moderately tolerant category, exhibiting a disease infestation range of 11–25%. The genotypes grouped under this category include ICG 36, ICG 81, ICG 442, ICG 875, ICG 1668, ICG 4156, ICG 4343, ICG 4412, ICG 4527, and KADARI 3 (Fig. 2). These genotypes predominantly exhibited a semi-spreading growth habit, coupled with medium levels of leaf and stem pubescence. Leaf colour varied from green to dark green across this group. Furthermore, the majority of these genotypes displayed a plant height exceeding 30.00 cm, as summarized in Table 1.

The highly tolerant category comprised seven genotypes: ICG 76, ICG 721, ICG 862, ICG 928, ICG 3992, ICG 4538, and ICG 4598 (Fig. 1). A majority of these germplasms were characterized by green leaf colour, pronounced pubescence on leaf and stem


ICG 297, ICG 332, ICG 1399, ICG 1415, ICG 3775, ICG 4543, Kadari 9, GJG 32

Fig. 4 : Genotypes that shows susceptibility.

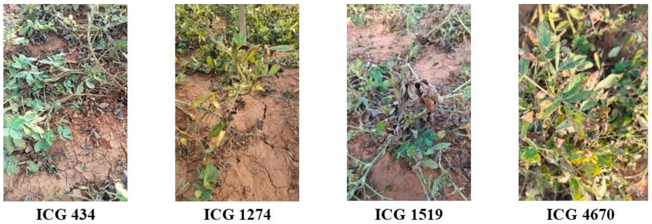
ICG 434, ICG 1274, ICG 1519, ICG 4670

Fig. 5 : Genotypes that shows high susceptibility.

Table 1 :

S. no.	Genotype	Growth habit	Leaf pubescence	Stem pubescence	Leaf colour	Plant hight	% of disease infestation
Highly tolerant							
1	**ICG 76**	semi- spreading	medium	medium	dark green	32.9	1-10%
2	**ICG 721**	semi- spreading	medium	medium	dark green	33.14	1-10%
3	**ICG 862**	spreading	sparse	sparse	green	32	1-10%
4	**ICG 928**	spreading	sparse	sparse	green	28.5	1-10%
5	**ICG 3992**	semi- spreading	medium	sparse	green	34.58	1-10%
6	**ICG 4538**	semi- spreading	medium	sparse	green	36.8	1-10%
7	**ICG 4598**	semi- spreading	medium	sparse	green	37.96	1-10%
Moderately tolerant							
1	**ICG 36**	erect	medium	medium	light green	42.94	11-25%
2	**ICG 81**	erect	medium	medium	light green	29.16	11-25%
3	**ICG 442**	semi- spreading	medium	medium	light green	44.82	11-25%
4	**ICG 875**	semi- spreading	sparse	sparse	dark green	30.8	11-25%
5	**ICG 1668**	erect	medium	medium	dark green	38.5	11-25%
6	**ICG 4156**	spreading	medium	medium	green	25.9	11-25%
7	**ICG 4343**	semi- spreading	medium	medium	green	38.02	11-25%
8	**ICG 4412**	semi- spreading	medium	sparse	green	38.36	11-25%
9	**ICG 4527**	semi- spreading	absent	sparse	green	36.2	11-25%
10	**C1 KADARI 3**	semi- spreading	medium	medium	dark green	35.63	11-25%
Tolerant							
1	**ICG 115**	semi- spreading	absent	sparse	green	61.6	26-50%
2	**ICG 118**	erect	medium	absent	light green	34.68	26-50%
3	**ICG 392**	erect	sparse	sparse	light green	41.86	26-50%
4	**ICG 1142**	semi- spreading	sparse	sparse	light green	44.22	26-50%
Susceptible							
1	**ICG 297**	erect	sparse	medium	light green	38.04	51-75%
2	**ICG 332**	semi- spreading	absent	medium	green	50.2	51-75%
3	**ICG 1399**	semi- spreading	absent	medium	light green	36.2	51-75%
4	**ICG 1415**	erect	absent	sparse	green	42.66	51-75%
5	**ICG 3775**	erect	medium	medium	green	43.24	51-75%
6	**ICG 4543**	semi- spreading	absent	medium	light green	38.86	51-75%
7	**C2 KADARI 9**	erect	medium	sparse	dark green	41.49	51-75%
8	**C3 GJG 32**	erect	absent	sparse	dark green	39.87	51-75%
Highly susceptible							
1	**ICG 434**	spreading	sparse	medium	light green	37.76	76-100%
2	**ICG 1274**	erect	absent	medium	light green	53.08	76-100%
3	**ICG 1519**	erect	sparse	medium	light green	40.82	76-100%
4	**ICG 4670**	semi- spreading	absent	medium	light green	54.8	76-100%

surfaces, a semi-spreading growth habit, and medium plant height. These traits collectively suggest a possible link to enhanced disease resistance, as outlined in Table 1.

The genotypes show the extreme variability of resistant reaction as it is fully conformed to Mushtaq *et al.* (2024), Gaikpa *et al.* (2015), Mohammed *et al.* (2018).

Conclusion

The evaluation of thirty indigenous groundnut genotypes along with three standard checks during the *Kharif* season of 2024 revealed a significant association between Cercospora leaf spot infestation and various morphological traits. Disease severity was categorized into five distinct classes: highly tolerant (1–10%

infestation), moderately tolerant (11–25%), tolerant (26–50%), susceptible (51–75%), and highly susceptible (76–100%). Among the evaluated germplasm, genotypes such as ICG 76, ICG 721, ICG 862, ICG 928, ICG 3992, ICG 4538 and ICG 4598 exhibited high levels of tolerance, which were commonly associated with green leaf coloration, dense pubescence on both leaves and stems, a semi-spreading growth habit, and medium plant height. Conversely, genotypes including ICG 434, ICG 1274, ICG 1519 and ICG 4670 displayed highly susceptible responses, typically characterized by the absence of pubescence on leaves and stems, light green foliage, and a tall plant stature. These findings highlight the considerable genetic variability in disease response among the genotypes and provide valuable insights for breeding programs focused on enhancing resistance to foliar diseases in groundnut.

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