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Screening of Groundnut varieties and different types of host species against Dry root rot disease

MANOJ KUMAR BADANA[1*], D.S. KELAIYA[2] AND A. H. JADAV[1]
[1]Department of Plant Pathology, Junagadh Agricultural University, Junagadh – 362001, Gujarat
.[2]Main Oilseed Research Station, Junagadh Agricultural University, Junagadh – 362001, Gujarat

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Dry Root rot caused by *Macrophomina phaseolina* in groundnut is a serious disease in district Junagadh. The groundnut varieties and different types of crops (hosts) were evaluated to identify the sources of resistance to dry root rot (*Macrophomina phaseolina*) diseases. A total of 15 popular groundnut varieties were screened under pot condition at green house, JAU, Junagadh. Out of 15 varieties screened, none of the variety was found as a resistant. Three varieties *viz.,* GG-7 (20.36 %), GG-5 (23.38 %), GG-8 (21.49 %) showed as moderately resistant. Three varieties *viz.,* GG-6 (42.12 %), GG-20 (46.13 %), GJG-18 (45.61 %) found as a susceptible and Nine varieties *viz.,* GG-2 (80.11 %), GJG-32 (60.42 %), GJG-HPS-1 (62.81%), GAUG-20 (63.36 %), GJG-19 (61.44 %), GG-4 (63.84 %), J-11 (82.31 %), GJG-9 (78.22 %), GJG-17 (81.44 %) showed highly susceptible reaction. And eight different plant species were evaluated against root rot *viz.,* soybean, cowpea, castor, mungbean, black gram, pigeon pea, cotton, and groundnut were grown in pots. All eight plant species including groundnut were found as a host of *Macrophomina phaseolina* where root rot (drying) symptoms were developed.

Key words: Dry root rot, Groundnut, screening, varieties, hosts

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a cultivated annually belonging to the plant family Leguminosae and sub family Papillionaceae. It is believed to be originated from Brazil in South America and introduced into India in 16th century. It is cultivated in tropical and sub tropical countries of the world. It contains 48-50 % oil and 26-28 % protein. It provides 12 % recommended nutrients and has dietary fibre that reduce the risk of some kinds of cancer and helps control blood sugar. The major groundnut producer countries of the world are India, China, USS, Senegal, Sudan, Nigeria and Burma. Cultivation of groundnut has also considerably increased in Australia, Japan and South America. Among the groundnut producing nations, India shows the highest area under this crop and is second largest producer next to China.

Groundnut is cultivated in most of the states of India, but the major groundnut growing states are Andhra Pradesh, Gujarat, Karnataka, Tamil Nadu and Maharashtra. These five states together account for about 90 per cent of the area and production of groundnut in the country (Khatana *et al*., 2001). Among the major groundnut growing states, gujarat is the most important one accounting for 32 per cent of the total area. Groundnut crop is affected by several soil borne destructive diseases. Among them, dry root rot caused by *Macrophomina phaseolina* (Tassi.) Goid has been serious and destructive disease and also causes seviour yield losses in groundnut. (Moradia,2012) observed that bunch varieties were more susceptible compared to spreading varieties. Detection, identification and morphological characterization of *Macrophomina phaseolina* has been reported by Almomani *et. al* (2013).

Chemical method have been the predominant measures used in the past to control soil-borne pathogens but persistence of the pathogen in the soil and its wide host range often limits the effectiveness of the chemical control of the soil borne diseases. Moreover, partial resistant varieties in comparison to susceptible one, has better resistance efficiency (Gopal *et al.* 2006). Use of resistant va

*Correspondence : manojnaidu9000@gmail.com

rieties is an ideal, simplest and cheapest method for the control of plant diseases. Moreover, it does not disturb natural eco-system and avoids hazards of environmental pollution as well as it stabilizes the yield. Unfortunately high degree of resistance to these soil borne diseases is not available among cultivable varieties, different crops varieties and the identification of the source of resistance is a basic need in breeding for disease resistance. Hence, the present study were conducted to screen the groundnut varieties and different types of crops species (hosts) against dry root rot pathogens for the identification of resistance.

MATERIALS AND METHODS

Screening of groundnut varieties against M. phaseolina in vivo

The experiment were conducted at Junagadh Agricultural university, Junagadh during *Kharif*-2016 and 2017, fourty five sterilized pots were filled with sterilized soil and the mass culture of *M. phaseolina* were mixed (@ 1:9 proportion) in upper 4-5" layer of sterilized soil in each fourty five pots and two pots were not inoculated with the *M. phaseolina* they were served as check pots. Fifteen popular groundnut varieties were obtained from the Main oilseeds research station, JAU Junagadh. Ten seeds of each variety (replicated thrice) were sown in pot for screening in artificial condition against root rot. Before sowing each seeds were surface sterilized with 0.1 % $HgCl_2$ solution for 1 minute. All the pots including checks were bought to green house conditions. Regular irrigations were given to each pot. Final disease observations in terms of the per cent disease incidence (PDI) for dry root rot incidence was recorded at 45, 60 and 90 DAS using the following formula:

$$\text{Disease incidence} = \frac{\text{No.of infected plants}}{\text{Total plants}} \times 100$$

The varieties were screened further and grouped as according to disease rating scale 0 to 4 scales as given by Moradia (2012) in Table-1

Host range of M. phaseolina

To study the ability of root isolate of *M. phaseolina* to parasitize other crop plants, eight different plant species *viz.* soybean, cowpea, castor, mungbean, black gram, pigeon pea, cotton, and groundnut were grown in pots and groundnut served as a check host.

Five plants of each crop species grown in pot filled with sterilized soil which was already inoculated with mass culture of *M. phaseolina* @ 1: 9 proportion in upper 4-5 layer of sterilized soil. Each crop species were replicated thrice, similarly, five plants of same crop species grown in other pot kept as *i.e.* without inoculation of fungus which served as checks. All these plants were subjected to humid conditions for 72 hours. The observation on disease reaction was recorded by examining the plant having blighting of leaves, wilting and drying of plant.

RESULTS AND DISCUSSION

Screening of groundnut varieties against *M. phaseolina in vivo*

Host plant resistance is the one of the effective methods in managing the soil borne diseases. Identification of resistant sources is an important factor in breeding methodology in selecting the resistant donors for incorporation of resistance into cultivars and it is simplest and cheapest method for the control of plant diseases. Moreover, it does not disturb natural eco-system and avoids hazards of environmental pollution as well as it stabilizes the yield. Considering these facts, Fifteen popular groundnut varieties were obtained from the Main oilseeds research station, JAU junagadh sown in (Table 2) and sown in the pot for screening against groundnut root rot disease under artificial condition (Fig 1) and the observation on root rot incidence was recorded at interval of 45, 60, and 90, DAS. The percent disease incidence and reaction of different varieties are presented in (Table 3).

Table 1: Interpretation of scores and disease rating

Scor ing scale	Per cent infection	Reaction
0	No symptoms on the plant	Immune
1	1-10 % root rot incidence	Resistant
2	11 -25 % root rot incidence	Moderately Resistant
3	26 -50 % root rot incidence	Susceptible
4	51 -100 % root rot incidence	Highly Susceptible

Out of 15 varieties screened, none of the variety was found as a resistant. Three varieties *viz.,* GG-7 (20.36 %), GG-5 (23.38 %), GG-20 (21.49 %) showed as moderately resistant behaviour. Three varieties *viz.,* GG-6 (42.12 %), GG-8 (46.13 %), GJG-18 (45.61 %) found as a susceptible and Nine varieties *viz.,* GG-2 (80.11 %), GGJ-HPS-1 (62.81%), GJG-32 (60.42 %), GAUG-20 (63.36 %),

Table 2: Groundnut varieties used for screening against dry root rot disease

Groundnut varieties	Total number
GG -2, GG -4, GG -5, GG -6, GG -7, GG -8, GG -20, GJG -17, GJG - 18, GJG -19, GJG -32, J -11, GJG -HPS -1, GAUG -20, GAUG -20.	15

GJG-19 (61.44 %), GG-4 (63.84 %), J-11 (82.31 %), GJG-9 (78.22 %), GJG-17 (81.44 %) showed highly susceptible reaction. The result reveled that bunch varieties were showed more susceptible reaction against *M. phaseolina* then spreading varieties of groundnut. Similarly Moradia (2012) also reported in groundnut against dry root rot, 28 varieties showed resistant and 6 varieties were moderately resistant and rest 37 varieties were found susceptible. Shakil et al., (2012) also reported that no groundnut varieties shows completely resistance against *M. phaseolina.*

Table 3: Categorization of groundnut varieties against dry root rot disease incidence under pot conditions

Varieties	Disease incidence (%)*	Disease reaction
GG-2	80.11	Highly susceptible
GJG-32	60.42	Highly susceptible
GG-7	20.36	Moderately resistant
Gg-5	23.38	Moderately resistant
GJG-HPS-1	62.81	Highly susceptible
GG-6	42.12	Susceptible
GG-20	21.49	Moderately resistant
J-11	82.31	Highly susceptible
GG-8	46.13	Susceptible
GAUG-20	63.36	Highly susceptible
GJG-9	78.22	Highly susceptible
GJG-18	45.61	Susceptible
GJG-19	61.44	Highly susceptible
GJG-17	81.44	Highly susceptible
GG-4	63.84	Highly susceptible

Host range study of Macrophomina phaseolina

To study the ability of root isolate of *M. phaseolina* to parasitize other crop plants, eight different plant species *viz.,* soybean, cowpea, castor, mungbean, black gram, pigeon pea, cotton, and groundnut were grown in pots. Groundnut served as a check host. Five plants of each crop species grown in pot filled with sterilized soil which was already inoculated with mass culture of *M. phaseolina*. Each crop species was replicated thrice, similarly, five plants of same plant species grown in other pot kept as such *i.e.* without inoculation of fungus which served as checks. All these plants were subjected to humid conditions. The observations on disease reaction were recorded by examining the plant having blighting of leaves, wilting and drying of plant.

From the observation presented in Table 4 it is seen that all eight plant species including groundnut were found as a host of *Macrophomina phaseolina* where root rot (drying) symptoms were developed. Similar results were showed by Moradia (2006) they conducted a host range study and reported that out of twenty one plant species tested, nineteen plant species including groundnut found to be the host while bajra and wheat were as non- host of *M. phaseolina*. Similar result showed by Jayati-Bhowal *et al.* (2006) they observed the phytopathogenic fungus *M. phaseolina* infects many plants, e.g. jute (*Corchorus capsularis*), soybean (*Glycine max*) and groundnut (*Arachis hypogaea*).

When cross inoculation methods of different isolates of *M. phaseolina* tested, it was found that groundnut isolates gave almost equal pathogenic reaction on groundnut and pigeonpea and also pathogenic on chickpea and safflower. Moradia (2006) conducted a host range study and reported that out of twenty one plant species tested, nineteen plant species including groundnut found to be the host while bajra and wheat were as non-host of *M. phaseolina.*

CONCLUSION

Based on present investigation, it can be concluded that groundnut (*Arachis hypogaea* L.) is susceptible to *Macrophomina phaseolina* (Tassi) Goid. Pathogen is soil and seed borne in nature and has wide host range hence its elimination from soil may be problematic and challenging and the groundnut varieties *i.e.,* GG-7(20.36 %), GG-5 (23.38 %) and GG-20 (21.49 %) were regarded as moderately resistant.

Table 4: Host range of *Macrophomina phaseolina*

Family	Crop	Scientific name	No of plant tested	Infection
Euphorbiaceae	Castor	*Richinus communis L.*	5	+
Malvaceae	Cotton	*Gossypium hirsutum L.*	5	+
Fabaceae	Mung bean	*Vigna radiata L.*	5	+
Fabaceae	Cowpea	*Vigna sinensis Endi.*	5	+
Fabaceae	Pigeonpea	*Cajanus cajan L.*	5	+
Fabaceae	Soyabean	*Glycine max Merr.*	5	+
Fabaceae	Groundnut	*Arachis hypogaea L.*	5	+
Fabaceae	Blackgram	*Vigna mungo* L.	5	+

+ = infected, - = uninfected

Fig. 1 : Screening of groundnut varieties against root rot caused by *M. phaseolina.*

Fig. 2 : Host range of *Macrophomina phaseolina.* **(**A) Uninoculated control (B) Host plants inoculated with *M. phaseolina*

REFERENCES

Almomani, F., Alhawatema, M. and Hameed, K. 2013. Detection, identification and morphological characteristic of *Macrophomina phaseolina*: the charcoal rot disease pathogens isolated from infected plants in Northern Jordan. *Archives of Phytopath and Pl. Protec*. **46** : 1005-1014.

Gopal, K., Ahamed, S. K. and Babu, G. P. 2006. Relative resistance in groundnut genotypes to pod rot disease. *Legume-Research.* **29**: 205-208.

Jayati-Bhowal, Ghosh, Sumita, Guha, A. K. and Chatterjee, B. P. 2006. Infection of jute seedlings by the phytopathogenic fungus *Macrophomina phaseolina* mediated by endogenous lectin. *Res. J. Microbio.* **1:** 51-60.

Khatana, V. S., Lanting, H. and Naidu, J. S. 2001. Ground realities about groundnut cultivation with special reference to the semi-arid tropics of India.*Asian Agri., History* **5**: 123-135.

Moradia, A. M. 2006. *Assessment of yield losses due to Root Rot of groundnut caused by M. phaseolina and their management*. Ph.D thesis submitted to J.A.U. Junagadh.

Moradia, A. M. 2012. Effect of source of varietal resistance against of *Macrophomina phaseolina* on groundnut. *Int. J. Pl. Protec.* **5**: 438-439.

Shakil, A., Noor, Z. and Salik, N. K. 2012. Response of groundnut genotypes against root rot disease in district mianwali. *Pak. J. Bot*. **44**: 383-386.