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Screening of groundnut (*Arachis hypogaea* L.) genotypes for rust (*Puccinia arachidis* Speg.) and late leaf spot (*Phaseoisariopsis personata* (Berk & Curt)) diseases in field condition

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Abstract

Hundred groundnut genotypes were subjected to field screening during *kharif* 2016 and 2017 for rust and late leaf spot reaction using spreader row technique in which the disease susceptible genotype (SBXI) was sown at regular interval after 10 test genotypes in Augmented design manner. Response of genotypes on disease severity of leaf spots and rust were scored at 80 and 90 DAS using a modified 1-9 point scale (Subrahmanyam *et al.*, 1995). None of the genotype except Phule Unnati was rust or late leaf spot resistant since high levels of resistance to late leaf spot and rust were often reported in wild peanut species and one of the parent which was used in development of Phule Unnati was wild species. ICG-4406, ICG-4494 and ICG-9064 were moderately resistant to both rust and late leaf spot diseases whereas, ICG-5001, ICG-5320, ICG-8062 and ICG-8353 were moderately resistant to only late leaf spot disease.

Keywords: Groundnut, rust, late leaf spot, screening

Introduction

Groundnut is grown mainly as rain-fed crop and there is high level of fluctuation in the production because of biotic and abiotic factors such as drought stress, high incidence of foliar fungal diseases, and attack by the insect pests. The major disease constraints in groundnut production are rust (*Puccinia arachidis* Speg.) and late leaf spot (*Phaseoisariopsis personata* Berk. & Curtis) (Mondal and Badigannavar, 2010) [6]. They are commonly present wherever groundnut is grown but their incidence and severity vary between localities and seasons. These diseases damage the plant by reducing the leaf area available for photosynthesis and by stimulating leaflet abscission leading to heavy defoliation (McDonald *et al.*, 1985) [5]. Both diseases occur together and cause yield loss as high as 70% (Subrahmanyam *et al.*, 1984) [8]. Symptoms of the groundnut rust appear as orange red to chestnut brown colored pustules (uredinia) on the lower surface (abaxial) of the leaves. Leaves infected with rust may become necrotic and dry up but tend to remain attached to the plants (Ghewande, 2009) [2]. Leaf spot can increase rapidly under favorable conditions as several secondary cycles may occur per season. The first appearance of leaf spot and its continuous progress throughout the growing season are heavily dependent upon weather conditions (Tshilenge-Lukanda. *et al.*, 2012) [11]. Though several effective fungicides are available to control the diseases but host-controlled resistance is considered the best. 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 (Vishnuvardhan *et al.*, 2012) [14]. Therefore, it is important to identify sources of resistance that can be used to evolve resistant varieties. The present study was undertaken to screen hundred groundnut genotypes to identify sources of resistance for both diseases.

Materials and Methods

The field experiment was carried out at the AICRP on Summer Groundnut, MPKV Rahuri, during *kharif* 2016 and 2017. Experimental materials for the present study comprised of hundred genotypes of groundnut including check varieties Phule Unnati and SBXI. Genotypes were subjected to field screening for rust and late leaf spot reaction using spreader row technique (Subrahmanyam *et al.*, 1995) [9] in which the disease susceptible genotype (SBXI) was sown at regular interval after 10 test genotypes in Augmented design manner. Each genotype was sown in single row of 4 m length with spacing of 30 X 10 cm.

Susceptible check served as infector row for uniform rust inoculum buildup to create artificial epiphytotic condition.

To enhance disease development leaves of previous groundnut crop were also scattered in the experimental plots. Five plants from each test genotype plot were randomly selected and response of genotypes on disease severity of leaf spots and rust were scored at 80 and 90 DAS using a modified 1-9 point scale (Subrahmanyam *et al.*, 1995) [9]. The visual scores (1-9) and the extent of leaf area destroyed (0-100%) are linearly related (1= No disease, 2= 1-5%, 3= 6-10%, 4= 11-20%, 5= 21-30%, 6= 31-40%, 7= 41-60%, 8= 61-80%, 9= 81-100%). The resistance level of genotypes was classified based on the disease severity recorded at 90 DAS as per Mau and Ndiwa, 2018 (1= Resistant, 2-3= Moderately Resistant, 4-5= Moderately Susceptible, 6-7= Susceptible, 8-9= Highly Susceptible)

Results and Discussion

Rust

During *kharif* 2016, only one genotype i.e. Phule Unnati was found resistant to rust with mean score of 1.40 at 90 DAS whereas, ICG-4406 (3.40), ICG-4494 (3.20) and ICG-9064 (3.00) exhibited moderately resistant reaction. Phule Unnati was also resistant during *kharif* 2017 with mean score of 1.00 at 90DAS, while ICG-4406 (3.40), ICG-4494 (2.60), ICG-8062 (3.40) and ICG-9064 (2.60) were moderately resistant (Table 1).

Thus, none of the genotype except Phule Unnati was rust resistant and this may be attributed because high levels of resistance to late leaf spot and rust were often reported in wild peanut species of groundnut compared to *A. hypogaea* (Mondal and Badigannavar, 2015). ICG-4406, ICG-4494 and ICG-9064 showed consistently moderate resistance in both

the years. Subrahmanyam *et al.*, 1983 reported that rust resistance was stable over various locations and years. Several rust resistant groundnut genotypes were identified previously by (Mondal and Badigannavar, 2010; Vasanthi *et al.*, 2014; Sudini *et al.*, 2015; Chaudhari *et al.*, 2017) [6, 10, 12]. Genotype ICG-8062 showed moderately resistant reaction to rust disease in one year, whereas susceptible reaction in next year, which indicated that this genotype was not true tolerant.

Late leaf spot

During *kharif* 2016 and *kharif* 2017, only resistant check variety Phule Unnati was found resistant to late leaf spot with mean score of 1.00 and 1.20 at 90 DAS in respective year. Genotypes ICG-4406 (3.00, 3.40), ICG-4494 (3.40, 3.60), ICG-5001 (3.40, 3.60), ICG-5320 (3.40, 3.80), ICG-8062 (3.80, 3.40), ICG-8353 (3.60, 3.80) and ICG-9064 (3.20, 3.60) were moderately resistant during both Years *kharif* 2016 and *kharif* 2017 (Table 1). Several Late leaf spot resistant groundnut genotypes were identified previously by Hossain *et al.*, 2007 and Shivaleela *et al.*, 2014 [7].

ICG-4406, ICG-4494 and ICG-9064 were moderately resistant to both rust and late leaf spot diseases. These genotypes can be studied further to evaluate yield potential so that, they can either be used as donor for the resistance in the future breeding programme or as a new variety.

Some genotypes were moderately susceptible in one year and susceptible or highly susceptible in next year and vice-versa, which indicated that the reaction of the genotypes to the rust and late leaf spot diseases is highly influenced by the environmental factors such as temperature, humidity, rainfall, inoculum density. In natural condition, some genotypes may get favored by environmental factors and show less symptoms.

Table 1: Mean disease score and reaction of genotype to the Rust and Late leaf spot diseases

S. No.	Genotype	Rust (2016)			Rust (2017)			LLS (2016)			LLS (2017)		
		MDS 80DAS	MDS 90DAS	D R	MDS 80DAS	MDS 90DAS	D R	MDS 80DAS	MDS 90DAS	D R	MDS 80DAS	MDS 90DAS	D R
1	ICG-1282	6.40	7.80	S	7.60	8.60	HS	3.40	5.60	MS	7.40	8.40	HS
2	ICG-1978	4.80	7.40	S	4.20	6.80	S	5.20	7.60	S	4.80	7.00	S
3	ICG-2186	6.20	7.80	S	6.00	7.20	S	6.60	8.00	HS	6.00	7.20	S
4	ICG-2252	6.00	8.20	HS	6.20	8.00	HS	6.40	8.00	HS	6.20	8.00	HS
5	ICG-2280	4.20	7.20	S	5.20	7.40	S	4.40	7.40	S	5.20	7.40	S
6	ICG-2320	5.20	6.80	S	4.80	6.20	S	5.40	7.00	S	4.80	7.20	S
7	ICG-3136	5.60	7.40	S	4.80	6.80	S	5.40	7.40	S	6.00	7.20	S
8	ICG-3188	3.40	5.20	MS	4.80	6.00	S	3.60	5.60	MS	4.60	6.20	S
9	ICG-3218	6.20	8.20	HS	6.00	7.20	S	6.00	8.20	HS	6.60	8.00	HS
10	ICG-3292	3.20	5.80	MS	3.80	5.20	MS	4.00	6.00	S	4.20	6.40	S
11	ICG-3515	4.60	6.80	S	4.40	6.80	S	3.60	7.00	S	4.20	6.80	S
12	ICG-3623	5.00	6.80	S	6.20	7.40	S	5.20	7.20	S	6.40	7.60	S
13	ICG-3692	5.40	7.60	S	4.80	6.60	S	5.60	7.60	S	4.20	6.60	S
14	ICG-3744	4.20	7.20	S	5.20	7.20	S	3.40	6.60	S	6.40	7.20	S
15	ICG-3758	5.20	7.80	S	4.80	6.80	S	5.40	7.80	S	4.20	6.20	S
16	ICG-3785	3.40	5.80	MS	4.40	6.20	S	3.20	5.40	MS	5.00	7.40	S
17	ICG-3899	4.20	7.40	S	5.20	6.80	S	4.80	7.80	S	5.00	6.80	S
18	ICG-4062	7.20	9.00	HS	6.80	7.80	S	7.60	9.00	HS	7.00	9.00	HS
19	ICG-4406	2.00	3.40	MR	1.60	2.80	MR	2.60	3.00	MR	1.60	3.40	MR
20	ICG-4466	2.80	5.40	MS	4.60	6.20	S	3.00	5.80	MS	4.20	6.80	S
21	ICG-4494	2.20	3.20	MR	2.00	2.80	MR	2.20	3.40	MR	2.40	3.60	MR
22	ICG-4508	6.40	7.40	S	5.60	6.40	S	3.80	5.80	MS	5.20	6.60	S
23	ICG-4975	2.60	5.40	MS	4.20	6.40	S	4.80	4.80	MS	4.20	6.60	S
24	ICG-5001	2.80	4.80	MS	3.60	5.40	MS	2.40	3.40	MR	2.80	3.60	MR
25	ICG-5222	2.40	4.20	MS	3.40	5.60	MS	2.80	4.40	MS	3.80	5.00	MS
26	ICG-5310	3.40	5.80	MS	4.20	6.40	S	4.00	6.00	S	4.20	6.80	S
27	ICG-5320	6.40	8.00	HS	3.60	7.80	S	2.20	3.40	MR	2.00	3.80	MR
28	ICG-5387	4.40	6.20	S	6.20	7.20	S	3.40	5.80	MS	6.20	7.40	S
29	ICG-5490	4.20	6.80	S	5.20	6.60	S	4.40	6.80	S	5.00	6.40	S
30	ICG-5636	5.40	6.80	S	5.40	6.20	S	5.40	6.80	S	5.40	6.60	S

31	ICG-5963	5.20	8.20	HS	4.80	7.60	S	6.40	8.40	HS	6.20	7.60	S
32	ICG-6029	4.40	6.20	S	3.20	5.60	MS	2.40	5.60	MS	3.20	5.40	MS
33	ICG-6080	4.40	7.20	S	5.20	7.20	S	3.20	6.80	S	5.40	7.20	S
34	ICG-6223	4.20	5.60	MS	5.20	6.00	S	3.80	5.40	MS	5.20	6.60	S
35	ICG-6224	4.60	6.80	S	5.40	7.20	S	4.60	7.00	S	6.40	7.60	S
36	ICG-6238	5.40	6.80	S	5.80	7.00	S	4.60	6.40	S	5.80	6.80	S
37	ICG-6249	3.40	6.40	S	4.20	6.40	S	3.60	6.20	S	4.40	6.80	S
38	ICG-6263	4.60	6.80	S	5.20	7.20	S	4.20	6.40	S	5.40	7.60	S
39	ICG-6357	3.80	6.80	S	4.00	6.20	S	4.00	6.60	S	4.00	6.40	S
40	ICG-6372	3.80	5.80	MS	5.20	6.60	S	3.60	6.00	S	5.40	6.80	S
41	ICG-6375	3.40	6.20	S	5.40	6.60	S	4.20	7.20	S	5.20	6.60	S
42	ICG-6381	3.80	6.80	S	4.20	5.80	MS	3.60	6.80	S	4.60	6.00	S
43	ICG-6388	4.40	6.60	S	3.80	5.80	MS	3.20	6.40	S	3.40	6.00	S
44	ICG-6466	4.20	6.80	S	5.40	6.60	S	3.80	6.60	S	5.60	7.00	S
45	ICG-6497	4.80	7.60	S	4.20	7.80	S	5.60	8.20	HS	6.40	7.80	S
46	ICG-6552	5.60	7.20	S	4.20	6.60	S	2.40	4.80	MS	5.20	6.00	S
47	ICG-6638	3.60	6.40	S	3.60	5.40	MS	3.00	6.40	S	3.20	5.60	MS
48	ICG-7292	6.80	8.80	HS	6.40	8.00	HS	6.40	8.40	HS	6.80	8.40	HS
49	ICG-7406	3.60	6.80	S	4.60	7.20	S	2.40	5.60	MS	4.20	6.80	S
50	ICG-7815	3.40	5.60	MS	5.60	6.60	S	4.20	6.80	S	5.40	7.00	S
51	ICG-8002	5.80	6.80	S	5.60	6.40	S	3.40	6.40	S	5.60	6.40	S
52	ICG-8008	4.20	7.20	S	5.60	7.40	S	2.80	5.40	MS	5.60	7.20	S
53	ICG-8014	3.40	5.20	MS	4.20	6.40	S	3.20	6.20	S	5.80	7.40	S
54	ICG-8017	4.80	6.40	S	5.20	6.60	S	4.60	6.40	S	5.40	6.80	S
55	ICG-8022	5.20	7.20	S	5.80	6.80	S	5.40	7.00	S	6.20	7.40	S
56	ICG-8034	4.40	6.60	S	4.40	6.80	S	2.60	4.80	MS	4.40	6.80	S
57	ICG-8035	7.20	8.60	HS	7.20	8.20	HS	6.80	7.80	S	7.20	8.40	HS
58	ICG-8054	6.40	8.20	HS	6.80	7.80	S	6.00	8.00	HS	6.60	8.40	HS
59	ICG-8062	2.80	4.20	MS	2.40	3.40	MR	2.40	3.80	MR	2.80	3.40	MR
60	ICG-8064	4.60	6.20	S	4.20	5.60	MS	4.80	7.20	S	4.40	6.40	S
61	ICG-8066	3.80	6.20	S	3.20	5.40	MS	3.80	6.20	S	3.60	5.80	MS
62	ICG-8069	4.80	7.60	S	4.80	7.00	S	4.40	7.40	S	5.40	7.80	S
63	ICG-8125	3.40	4.80	MS	4.20	5.40	MS	4.80	7.00	S	4.20	6.20	S
64	ICG-8269	5.40	8.00	HS	5.60	7.80	S	6.40	7.80	S	6.40	7.60	S
65	ICG-8301	4.80	7.60	S	5.40	8.00	HS	5.20	7.80	S	6.20	8.20	HS
66	ICG-8304	4.80	6.80	S	5.80	6.80	S	5.20	7.00	S	6.00	7.00	S
67	ICG-8307	5.20	7.80	S	5.20	7.40	S	5.20	7.80	S	5.00	7.20	S
68	ICG-8320	6.00	8.20	HS	6.20	8.20	HS	6.60	8.20	HS	6.40	7.80	S
69	ICG-8322	5.20	8.40	HS	5.20	7.40	S	4.60	8.40	HS	5.60	7.80	S
70	ICG-8324	5.40	7.60	S	6.40	7.20	S	5.20	7.40	S	6.40	7.60	S
71	ICG-8333	3.80	6.60	S	5.20	6.40	S	3.80	6.80	S	6.00	7.20	S
72	ICG-8334	5.40	7.20	S	5.20	7.00	S	6.20	7.40	S	5.60	7.40	S
73	ICG-8336	6.00	7.20	S	5.60	7.00	S	6.40	8.20	HS	6.00	7.40	S
74	ICG-8339	3.60	7.80	S	5.80	8.00	HS	5.20	8.20	HS	5.80	8.20	HS
75	ICG-8346	6.00	7.60	S	6.20	7.40	S	6.00	8.00	HS	6.20	7.60	S
76	ICG-8348	4.40	6.80	S	5.60	6.80	S	3.40	6.00	S	4.20	6.40	S
77	ICG-8353	2.60	4.80	MS	3.60	4.80	MS	2.40	3.60	MR	3.00	3.80	MR
78	ICG-8357	4.60	6.80	S	4.20	6.60	S	4.60	6.60	S	4.40	6.60	S
79	ICG-8358	4.40	6.40	S	5.20	7.40	S	5.80	7.00	S	5.20	7.40	S
80	ICG-8421	4.20	6.60	S	4.60	6.20	S	4.20	6.40	S	4.60	7.00	S
81	ICG-8425	5.40	7.20	S	5.20	7.40	S	5.20	7.40	S	5.40	7.20	S
82	ICG-8437	3.40	6.60	S	4.00	6.40	S	3.80	6.60	S	5.20	6.40	S
83	ICG-8440	5.20	8.20	HS	6.00	8.20	HS	6.20	8.40	HS	6.20	8.40	HS
84	ICG-8443	5.20	7.40	S	6.20	8.20	HS	6.00	7.80	S	6.00	7.80	S
85	ICG-8445	4.40	5.60	MS	4.20	6.40	S	4.20	5.40	MS	5.20	6.60	S
86	ICG-8446	4.80	7.00	S	5.20	6.80	S	4.40	6.80	S	5.40	7.00	S
87	ICG-8467	6.80	7.80	S	6.00	7.40	S	6.80	7.80	S	5.60	7.40	S
88	ICG-8496	6.40	7.80	S	6.40	7.60	S	6.40	7.60	S	6.40	7.60	S
89	ICG-8498	3.80	6.60	S	5.20	6.80	S	4.40	7.00	S	5.00	7.00	S
90	ICG-8510	2.20	5.80	MS	3.40	5.80	MS	4.00	5.00	MS	3.60	6.00	S
91	ICG-8521	5.20	6.80	S	6.40	7.00	S	4.80	6.80	S	6.20	7.00	S
92	ICG-8532	5.80	7.00	S	5.20	6.60	S	5.60	7.20	S	5.20	6.40	S
93	ICG-8536	6.20	8.40	HS	5.60	7.80	S	6.40	8.40	HS	5.60	7.40	S
94	ICG-8542	3.60	5.40	MS	3.20	5.20	MS	3.40	5.40	MS	3.40	5.40	MS
95	ICG-8545	5.20	7.20	S	5.40	7.40	S	5.00	7.40	S	5.60	7.20	S
96	ICG-8695	5.60	7.20	S	5.40	7.80	S	4.80	6.60	S	5.40	7.20	S
97	ICG-8787	4.40	5.60	MS	4.00	5.20	MS	4.40	5.40	MS	4.00	5.00	MS
98	ICG-9064	2.00	3.00	MR	1.80	2.60	MR	2.60	3.20	MR	2.20	3.60	MR
99	Phule unnati	1.00	1.40	R	1.00	1.00	R	1.00	1.00	R	1.00	1.20	R
100	SBXI	5.20	7.80	S	6.20	8.40	HS	5.60	8.00	HS	6.20	8.20	HS

DAS- Days after sowing, MDS- Mean Disease Score, DR- Disease Reaction

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