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Accepted May 22, 1993

Components of Resistance to an Indian Source of *Cercospora Arachidicola* in Selected Peanut Lines¹

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ABSTRACT

Cercospora arachidicola Hori is one of the most important foliar pathogens worldwide that limits peanut production in farmers' fields. Earlier screening trials allowed us to identify lines with field resistance to early leafspot. In order to determine the components of resistance of these lines and other lines reported to be resistant elsewhere, 19 peanut genotypes (*Arachis hypogaea* L.) were evaluated by the detached leaf technique using an isolate of *Cercospora arachidicola* from the ICRISAT Center in India. Significant differences were observed among genotypes for all components of resistance included in the study. With a few exceptions, early leafspot-resistant genotypes (ICG nos. 8298, 6902, 6284, 1703, 10900, 7878, 9989 and 10920) exhibited longer incubation periods, reduced sporulation, smaller lesion diameters and lower infection frequencies than susceptible lines. Genotypes ICG 8298 and ICG 6902 were the most resistant, while ICG nos. 221, 7827 and 6340 were the most susceptible to early leafspot. A few lines had resistant reactions to some components but susceptibility to others.

Key Words: *Arachis hypogaea*, early leafspot, *Cercospora arachidicola*, groundnut, peanut, disease resistance.

Early leafspot of peanut caused by *Cercospora arachidicola* Hori (CA) is an economically important foliar disease in

most countries where peanuts (*Arachis hypogaea* L.) are grown. This disease reduces the green leaf area available for photosynthesis and stimulates leaflet abscission leading to extensive defoliation (10). Damage is more serious when the crop is attacked by both early and late (*Cercosporidium personatum* (Berk. & Curt.) Deighton) leafspot pathogens. Pod yield losses due to both pathogens together may range from 10 to 60% (4,10,18). Although effective chemical control methods are available in many areas of the world, their applications are limited because of high costs and the possible existence of fungicide-tolerant strains of the pathogens in developing countries (2,9). Consequently, development of disease resistant cultivars is a high priority in international programs.

Screening peanut germplasm for resistance to the early leafspot pathogen is in progress in several areas of the world and genotypes with resistance or tolerance have been identified (1,3,7,10,11). Successful screening for resistance can partially be attributed to the regular occurrence of epidemics in those regions. Many studies on the components of resistance to *C. arachidicola* have been conducted (3,6,8,12,13,14.), but most of this work concerns pathogen isolates from the USA. Screening trials for resistance to early leafspot in India (Pantnagar), Nepal and Malawi (Lilongwe), where early leafspot epidemics occur annually, have shown that several cultivars and breeding lines reported as resistant elsewhere had variable reactions in these locations (19,20).

¹Paper submitted as Journal article No. 1305 by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

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Table 1. Components of resistance to *Cercospora arachidicola* in 19 peanut genotypes in detached leaf studies*.

ICG No.	Identity	IP	IF	SP	TLA (%)	LSRI	LD (mm)		LAD (%)	
							15 D	20 D	15 D	20D
6340	PI 350680	11.6e	3.97ab	3.07c-e	9.22c-e	28.40c-f	1.27cd	2.07b-e	1.43a	2.79ab
221	TMV 2	11.8e	3.76ab	4.33a	12.80bc	52.39ab	1.81a	2.73a	1.44a	2.83ab
6330	PI 270806	11.9de	4.98a	2.72d-g	10.03b-e	29.19d-g	1.38bc	2.01b-e	1.54a	3.02ab
2711	NC 5	12.3de	3.89ab	2.57e-g	10.38b-d	28.51c-g	1.22c-e	2.00b-e	1.31a	2.43bc
7827	JL 24	12.8c-e	3.78ab	4.33a	14.29ab	63.54a	1.64ab	2.98a	1.30a	3.08ab
10940	PI 476176	12.8c-e	3.19bc	2.96d-f	17.82a	51.57ab	1.36bc	2.33b	1.56a	3.16a
7878	NC Ac 10811A	12.9c-e	2.85b-d	1.70i	12.43bc	19.98c-g	0.98d-h	1.53f-i	0.63c	1.50d-f
-	ICGS 11	12.9c-e	3.71ab	3.85ab	10.96b-d	42.85bc	1.30cd	2.29bc	0.83bc	2.04cd
9294	58-295	13.0c-e	2.72b-d	2.90d-f	9.50c-e	25.41d-g	1.23c-e	1.84d-h	1.22ab	2.46bc
1710	NCAc 17135	13.1c-e	3.13bc	2.94d-f	10.65b-d	30.50d-f	1.14c-f	1.93c-f	1.19ab	2.52a-c
6284	NC Ac 17500	13.2b-e	2.61b-d	2.27gh	7.13de	15.20gh	0.90e-h	1.39i	0.63c	1.22ef
1703	NC Ac 17127	13.5bc	1.84cd	2.50fg	7.64de	20.16c-g	0.98d-h	1.45h-i	0.65c	1.19ef
9989	US 403 Red	13.5b-d	3.84ab	1.79hi	10.13b-e	19.61e-g	0.82f-h	1.55f-i	0.75c	1.40d-f
7885	PI 381622	14.0a-c	2.74b-d	2.94d-f	8.88c-e	24.14c-f	1.09c-g	1.81e-h	0.78c	1.76de
8339	NC Ac 18091	14.2a-c	3.04b-d	3.14cd	9.86c-e	33.40c-e	1.10c-g	1.88d-g	0.67c	1.39d-f
10900	PI 476033	14.8ab	2.83b-d	2.38g	8.82c-e	23.43d-g	0.99d-h	1.57f-i	0.76c	1.37d-f
6902	NC Ac 17894	15.2a	2.21cd	2.27gh	6.45de	15.00fg	0.80gh	1.48g-i	0.52c	1.03f
10920	PI 476152	15.3a	1.69d	3.50bc	10.41b-d	37.27b-d	1.13c-f	2.22b-d	0.73c	1.38d-f
8298	NC Ac 18045	15.6a	1.73d	1.81hi	5.75e	11.04g	0.69h	1.18i	0.39c	0.80f
SE±		0.51	0.41	0.15	4.45	1.29	0.10	0.12	0.13	0.22
CV%		13.1	46.6	18.6	49.8	43.9	29.9	22.6	47.9	38.0
DF		189	198	162	155	186	198	198	198	198

* Mean of 12 replications; means followed by same letters are not significantly different at = 0.05 level according to Duncan's Multiple Range Test. IP = Incubation period (days); IF = Infection frequency (lesion cm²); SP = Intensity of sporulation; TLA=Total lesion area; LSRI = Leaf spot reaction index (TLA % x SP); LD = Lesion diameter; LAD = Leaf area damage by early leaf spot.

however, were observed - e.g. ICG 7878 had the lowest intensity of sporulation, but its incubation period was short (12.9 days).

Ranking genotypes for number of lesions was inconsistent across repeated tests and does not form a reliable method of

detecting the resistant genotypes using the detached leaf technique(12). Although the effect of resistance on lesion number is difficult to measure due to inconsistencies from one experiment to another, it may still be important for disease progress. Similarly, infection frequency and percent leaf area damaged were correlated (as expected), but were inconsistent across repeated tests (Waliyar *et al.*, unpublished data).

Significant differences ($P < 0.001$) among genotypes were observed in these tests for sporulation intensity. Genotypic differences ($P < 0.001$) were also found for necrotic leaf area.

Table 2. Ranking of 19 peanut genotypes for incubation period (IP), intensity of sporulation (SP), infection frequency (IF), lesion diameter (LD) at 20 DAI, leaf area damaged (LAD) at 20 DAI.

ICG No	IP (days)	ICG No	ICG No	ICG No	LD20 (mm)	ICG No	LAD (%)		
6340	11.6	7827	4.3	6330	5.0	7827	3.0	10940	3.2
221	11.8	221	4.3	6340	4.0	221	2.7	7827	3.1
6330	11.9	ICGS11	3.8	2711	3.9	ICGS11	2.3	6330	3.0
2711	12.3	10920	3.5	221	3.8	10940	2.3	6340	2.8
10940	12.8	6340	3.1	7827	3.8	10920	2.2	221	2.8
7878	12.8	8339	3.1	9989	3.8	6340	2.1	1710	2.5
7827	12.9	7885	3.0	ICGS11	3.7	2711	2.0	9294	2.5
9294	13.0	10940	3.0	10940	3.2	6330	2.0	2711	2.4
ICGS11	13.1	1710	2.9	1710	3.1	1710	1.9	ICGS11	2.0
1710	13.1	9294	2.9	8339	3.0	8339	1.9	7885	1.8
6284	13.2	6330	2.7	7878	2.9	7885	1.8	7878	1.5
1703	13.5	2711	2.6	10900	2.8	9294	1.8	8339	1.4
13.5	1703	2.5	7885	2.7	1.6	9989	1.4		
7885	14.0	10900	2.4	9294	2.7	10900	1.6	10900	1.4
8339	14.2	6284	2.3	6284	2.6	1703	1.5	10920	1.4
10900	14.8	6902	2.3	6902	2.2	6902	1.5	1703	1.2
15.0	8298	1.8	1703	1.8	7878	1.5	6284	1.2	
10920	15.1	9989	1.8	8298	1.7	6284	1.4	6902	1.0
8298	15.7	7878	1.7	10920	1.7	8298	1.2	8298	0.8
SE±	0.51		0.15		0.12		0.22		
CV(%)	13.1		18.6		22.6		38.0		
DF	198 (9)		162(26)		198				

* Number of missing values

Table 3. Spearman rank correlation coefficients among components of resistance in 19 peanut entries to *C. arachidicola* measured in a detached leaf test.

	IP*	IF	SP	LSRI	TLA	LD15	LD20	LAD15	LAD20	FS
IP	1.00	-0.15	0.24	-0.11	-0.20	0.18	0.21	0.19	0.02	0.39
IF		1.00	0.64	0.60	0.67	0.70	0.73	0.74	0.82	0.63
SP			1.00	0.82	0.61	0.86	0.93	0.78	0.83	0.88
LSRI				1.00	0.85	0.53	0.71	0.46	0.67	0.57
TLA					1.00	0.50	0.65	0.46	0.68	0.47
LD15						1.00	0.95	0.97	0.92	0.92
LD20							1.00	0.91	0.91	0.92
LAD15								1.00	0.93	0.88
LAD20									1.00	0.85
FS										1.00

* IP = Incubation period (days); IF = Infection frequency; SP = Intensity of sporulation; LSRI = Leaf spot reaction index (TLA% x SP); TLA = Total lesion area; LD = Lesion diameter at 15 or 20 days after inoculation (DAI); LAD = Leaf area damage by early leaf spot at 15 or 20 DAI; FS = Field score on a 1-9 scale.

