GENETIC RESOURCE EVALUATION OF GROUNDNUT (*Arachis hypogaea L.*) FOR RESISTANCE TO TIKKA LEAF SPOT

BY

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THESIS

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DECLARATION

I hereby declare that this thesis entitled 'GENETIC RESOURCE EVALUATION OF GROUNDNUT (*Arachis hypogaea* L.) FOR RESISTANCE TO TIKKA LEAF SPOT' is a bonafide record of research work done by me during the course of research work and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

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CERTIFICATE

Certified that the thesis entitled 'GENETIC RESOURCE EVALUATION OF GROUNDNUT (*Arachis hypogaea* L.) FOR RESISTANCE TO TIKKA LEAF SPOT' is a record of research work done independently by SRI.SAJIKUMAR, T.A. under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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Introduction

INTRODUCTION

Among the crops grown in India, oil seeds occupy a position next to cereals. The present production of edible oil in India is about four million tonnes. If current rates of market demand continue, by the turn of the century some 10 million tonnes of edible oils will be needed (Achaya, 1989). The grave situation due to inadequacy of edible oils, has already led us to import the same from other countries.

In India, among the annual edible oil seed crops, groundnut accounts for more than fifty per cent of total oil production. As far as total area under this crop and production are concerned, India ranks first among the groundnut producing countries of the world, with an area of 75,00,000 ha and total production of 73,00,000 mt (FAO, 1989). But when compared to other countries, productivity in India is comparatively low. One of the main reasons for low productivity, is high susceptibility of most of the cultivated varieties to the tikka disease. In Kerala, groundnut is cultivated mostly in Palghat district, where almost all the adapted varieties used by the farmers are seriously affected by the disease. Since this particular leaf spot disease can cause a severe yield reduction upto fifty per cent, this disease always cause great concern among the farmers.

Although tikka disease can be effectively controlled by fungicidial application, there are many serious disadvantages in relying too heavily on applications of chemicals for disease control, especially the potential danger of polluting the environment and the possibility of new fungicide resistant variants of the pathogen concerned. Besides this, the cost of chemicals, the time and labour involved in applying them also make problems to the farmers.

In this context, it is wise to think about the relevance of resistant varieties, which is perhaps the cheapest and most effective method of combating disease.

In a resistance breeding programme, a genetic resource evaluation study is always necessory, to find out a suitable source of resistance. The groundnut genetic resources now available are enormous. In this investigation, an attempt is made to collect and evaluate the available germplasm, that can be of use in achieving the objectives.

A total of 257 varieties of groundnuts, including all the three habit groups namely, hypogaea, vulgaris, fastigiata are used in this study. The indegenous, as well as exotic popular promising cultivars of these three groups were evaluated with the following objectives.

1) To select groundnut genotypes with resistance to tikka leaf spots.
2) To asses the yield potential of different genotypes.

Review of Literature

2. REVIEW OF LITERATURE

Resistance is an inherited characteristic of a host plant which lessens the effects of parasitism (Robinson, 1969). Resistance to diseases, is only one of many plant breeding objectives, and can be considered as a complementary objective because a high degree of susceptibility will generally result in decreased yield and quality.

2.1. Breeding for Disease Resistance

Breeding for resistance to diseases does not differ fundamentally from breeding for any other characters (Allard, 1960).

The most suitable methods to be used in a particular breeding project will depend largely on the breeding system of the plant and on the sources of resistance that are available (Russel, 1978). He also has reported that it is useful to know whether resistance is dominant or recessive, whether it is monogenic, oligogenic or polygenic or whether cytoplasmic inheritance is involved.

The first requirement of any programme of breeding for resistance must be to find a suitable source of resistance (Russel, 1978). Such sources may be present in existing, or wild varieties, in wild forms of the same species, or closely related species or even in different genera.

Genetic resources provide most of the gene sources for disease resistance (Russel, 1978). He reported that, if no suitable source of resistance to a disease has already been found, local and exotic varieties and related species have to be screened for resistance.

Genetic resource evaluation has been done in different crops, to find suitable source of resistance to many diseases.

During the early 1930's, all available tomato varieties were screened for resistance to leaf mould (Langford, 1937) and one of these, Sterling Castle was found to be resistant to the disease.

Matic (1970) evaluated the resistance of several varieties of beet-root from many parts of the world and identified some downy mildew resistant lines. A genetic resource evaluation study conducted by Saffeeulla (1976) consisting of 500 sorghum entries, revealed that only eighteen lines were resistant to downy mildew. Rao and Williams (1977) conducted a genetic resource evaluation study consisting of 6000 sorghum lines and they identified only forty three lines relatively less susceptible to grain mould of sorghum. Rao <u>et al</u>. (1978) conducted an evaluation study to find a suitable source of resistance to charcol rot of sorghum. They could identify three highly resistant cultivars.

A total of 98878 entries from different sources were tested in the International Rice Blast Nursery. Some lines showed high level of resistance to blast (IRRI, 1979a). Another genetic resource evaluation study conducted by IRRI (1979b), on 170 entries for resistance to backnae disease of rice showed that some entries were resistant to the disease.

ICRISAT (1979) conducted a genetic resource evaluation study on 1800 accessions of chickpea. Among the test entries, 140 have shown great promise in their resistance to wilt caused by Fusarium sp.

ICRISAT (1981) conducted a germplasm evaluation study on 433 lines of pigeon pea and found one line to be resistant to sterility mosaic diseases of pigeon pea. Singh and Brar (1982) conducted a germplasm evaluation study with 56 mung bean strains for resistance to yellow mosaic virus, bacterial blight and Cercospora leaf spot. The results showed that no strain was free from all the three diseases.

Sivaprakasam and Anbalgan (1983) conducted a germplasm evaluation study on 120 cowpea types for resistance to root rot disease. They could identify nine moderately resistant lines.

2.2. Genetic resource evaluation studies in groundnut

The world germplasm of groundnut comprising over 1000 varieties was screened under field conditions against tikka leaf spot, and it was found that none of the groundnut varieties tested proved highly resistant (Kripal et al., 1972). Kolte et al. (1977) obtained 16 resistant lines and 21 tolerent lines while screening 130 lines of groundnut to find out sources of resistance to tikka leaf spots. Twenty lines of groundnut which showed a high level of resistance to cercospora leaf spot in previous tests were screened along with wild species of Arachis by Prasad et al. (1979) and obtained a few types with good resistance eventhough not as resistant as the wild species.

A field screening study with 305 varieties of groundnut for resistance to cercospora leaf spots was done, and results showed that none of the varieties were highly resistant (Sharma and Mathur, 1979). Singh et al. (1979) conducted a field evaluation study with 399 lines, and he could identify some resistant lines. Hammons et al. (1980) obtained a long season line of groundnut with a spreading habit, which showed greater resistance to C. arachidicola under both natural and artificial infection.

In the 1980-81 rainy season, a screening study was conducted for resistance to late leaf spot disease and a new source of resistance was identified (ICRISAT, 1981). ICRISAT

(1981) conducted a screening study, simultaneously for resistance to rust and leaf spot diseases of groundnut, and one of the varieties evaluated showed a good level of resistance to early leaf spot. Sixteen lines of Arachis hypogaea plus nine other species from section Arachis was evaluated for resistance to early leaf spot by Foster et al. (1981). Results of this study revealed that wild species were generally more resistant than cultivated lines. Some ICRISAT groundnut accessions plus 22 USDA entries were evaluated for resistance to late leaf spot. All ICRISAT foliar disease resistant lines continued to perform well and some of the USDA varieties showed good resistance to late leaf spot (ICRISAT, 1981).

Coffell and Porter (1982) reported that they had screened several peanut lines for resistance to leaf spot disease and identified some lines having resistance to peanut leaf spot. Gorbel and Norden (1982) evaluated the performance of 12 peanut breeding lines and two cultivars, Florunner and Dixierunner against tikka leaf spots. They found that Florunner was more suceptible and Dixierunner was more resistant to disease.

Ghewande et al. (1983) reported that primary source of resistance to Cercosporidium personatum was identified from 3655 entries screened. In a field evaluation study, Panigbatan and Ilac (1984) identified the resistance of a cultivar against Cercosporidium personatum. Patil et al. (1984) observed that in field and glass house tests, 19 and 14 of the 250 cultivars respectively were moderately resistant to early and late leaf spot pathogens. An evaluation study was conducted on 151 peanut entries representing genotypes of cultivated Arachis hypogaea, wild species of Arachis and hybrids. Useful levels of resistance was found in seven genotypes (Melouk et al., 1984).

In a field evaluation study with 21 groundnut genotypes, three genotypes showed resistance to Cercosporidium personatum (Moraes and Godoy, 1985). Some early leaf spot resistant lines were evaluated for resistance to late leaf spot by Walls et al. (1985) and they identified some resistant lines.

Chiteka et al. (1986) conducted a study with 116 peanut genotypes for resistance to late leaf spot, and they could identify some resistant genotypes. Jogloy et al. (1987) evaluated the reactions of progenies of a disease resistance breeding programme for leaf spot resistance; and they found that a few progenies showed resistance. Gupta (1987) conducted a field evaluation study on 253 cultivars and identified some resistant types.

2.3. Distribution of tikka disease

Tikka leaf spots caused by C. arachidicola and C. personatum are probably the most serious foliar diseases of groundnut in the world (Jackson and Bell, 1969; Garren and Jackson, 1973).

The leaf spot diseases have often been collectively referred to as Mycosphaerella leaf spots, Cercospora leaf spots, brown leaf spots, peanut cercosporiosis, viruela and tikka (Jackson and Bell, 1969).

Leaf spot diseases of groundnut occur every where in the world, especially in India, U.S.A., most countries of Africa, Philippines, Indonesia, Ceylon, China, Malaysia and Australia (Rangaswamy, 1972).

Eventhough both leaf spots are commonly present together in the same geographical area or in the same leaf of a plant, the intensity and severity of each disease vary over localities and seasons and there can be short and long term fluctuations in their relative proportions (Gibbons, 1966; Garren and Jackson, 1973). According to Mehrotra (1980), one or both of the imperfect stages of leaf spot pathogens occur in all the groundnut growing areas of the world depending upon the type of groundnut grown and weather conditions.

C. arachidicola is the dominant species in Georgia in USA (Woodroof, 1933). Vanhoof (1950) reported that he could only discover C. arachidicola in the Southern province of Tanzania. [redacted]

In South India, late leaf spot is very severe and early leaf spot is much less important (Subrahmanyam *et al.*, 1980).

C. arachidicola is the dominant species in some states of U.S.A. (Woodroof, 1933). But now *C. personatum* is the dominant species in these states (Smith and Littrel, 1980; Smith, 1984). Purss (1962) reported that *C. arachidicola* was the dominant species in Queensland. Late leaf spot is common in Nigeria and Southern Senegal (Nevill, 1979; Gaustreu and Depins, 1980).

In many countries of the semi-arid tropics detailed information defining which leaf spot predominates, is lacking (Subrahmanyam *et al.*, 1982).

2.4. Loss due to disease

Most of the cultivated varieties of peanut, especially the spanish varieties are seriously affected by the two cercospora leaf spot diseases and causing severe reduction in yield of pods (Woodroof, 1933). Results of the study conducted by Garren and Jackson (1973) revealed that these two leaf spot diseases, caused yield reduction ranging from 15 per cent to 50 per cent.

Halim *et al.* (1980) and Porter *et al.* (1982) reported that leaf spots were the important foliar diseases of groundnut which reduced the crop yield significantly.

Bell (1986) conducted a study to assess the effects of leaf spot pathogens on growth and yield of virginia bunch varieties and found that there was severe defoliation and 30 per cent reduction in yield.

In a study, Ghuge *et al.* (1981) revealed that the losses due to tikka leaf spots were 43.01 per cent in pod yield, 15.95 per cent in 100 kernel weight and 31.90 per cent in drymatter weight. Buckman and Crawford (1984) conducted a study on florunner peanut and found that the yield potential was reduced by an average of 57 kg/ha for each per cent of defoliation. They concluded that there was no difference in loss in producing potential (yield loss per unit of disease) between *C. arachidicola* and *C. personatum*. Jayasekhar and Rajasekharan (1986) found that combined infection by both *P. arachidis* and *C. personatum* resulted in substantial losses in yield.

Robert Neundorfer and Robert (1982) reported that the disease losses in peanuts varied with genotypes.

Ramakrishna and Apparao (1968) pointed out that loss ranging from 15 to 50 per cent was reported from various places in India.

In West Africa tikka leaf spots caused an yield reduction of fifteen to twenty per cent (Mallimire, 1931). Malithano (1980) reported that in Mozambique leaf spot diseases reduced groundnut yield very much. A loss of thirty to forty per cent in total yield was reported from Senegal (Gaustreau and Depins, 1980). Misrai et al. (1980) reported that in Nigeria the leaf spot diseases caused twenty to fifty per cent pod losses. Several reports of severe yield reductions have been obtained from many countries such as Australia, Argentina, Zimbabwe etc. (Middleton, 1980; Pietrarelli, 1980; Hildebrand, 1980).

In addition to pod yield losses, reduced yield and quality of haulms is also attributable to epidemics of early and late leaf spots (Cumins and Smith, 1973).

Hamid (1980), Shokes et al. (1983) and Knauft et al. (1986) reported the yield reduction of more than 50 per cent if fungicides were not used.

Loss due to leaf spot pathogens can be significantly reduced by fungicide application (Patel and Vaishnav 1987). Garren and Jackson (1973) and Mixon et. al. (1983) reported that there were yield losses upto 10 per cent even when fungicides were applied to control the leaf spot diseases.

2.5. Casual organisms and symptamatology of the disease

Tikka disease occurs as two distinct types of leaf spots, such as early leaf spot and late leaf spot (Woodroof, 1933; Rangaswamy, 1972). Usually early leaf spot occurs early in the season and late leaf spot occurs later in the season.

According to the international nomenclature the valid names of the perfect stages of early leaf spot causing organism C. arachidicola and late leaf spot causing organism C. personatum and Mychosphaerella arachidicola and Mycosphaerella berkeleyii respectively.

Disease usually appears when the crop is between one and two months old. The lower leaves are the first to be attacked (Butler, 1918). He also pointed out that number of spots on a single leaf might be from one to a dozen or more.

Early symptoms of the two types of leaf spots are indistinguishable according to Jenkins (1938).

Woodroof (1933) and Jenkins (1938) reported that the spots caused by C. arachidicola are circular to irregular in out line measuring 1 mm to 1 cm and tending to coalesce later.

On the upper surface of leaves necrotic area are reddish brown to black, while on lower surface they are lighter in colour. The halos are indistinct or not present on the lower surface.

Jackson and Bell (1969) have reported that the color of the necrotic areas of C. arachidicola is brown.

The lesions produced by C. personatum are more circular than those C. arachidicola and the necrotic portions on both leaf surface, very early assume a very dark brown to almost black colour (Jenkins, 1938; Jackson and Bell, 1969).

Jenkins (1938) and Gibbons (1966) reported that in the case of C. personatum, yellow halo present on the adaxial surface of leaf let only on the mature spots.

Frezzi (1960) reported that identification of the two disease would be improper, if we mainly depended on the description based on necrotic lesions and yellow halo. Frezzi (1960), Mc Donald et al. (1981) and Subrahmanyam et al. (1982) pointed out that, when screening for disease resistance was conducted, detailed microscopic examination of lesions was necessary for accurate diagonosis.

The conidia of C. arachidicola is mostly confined to the upper leaf surface but are occasionally found on lower surface. They are sparse and are not formed in concentric circles. Conidophores of C. personatum are confined to the lower surface of the leaflets and appear as definitely raised; dark brown stromatic tufts usually arranged concentrically and easily visible to the unaided eye (Jenkins, 1938; Gibbons, 1966).

2.6. Genetics of resistance

A study conducted by Anderson *et al.* (1986) revealed that resistance of groundnut *C. arachidicola* and *C. personatum* inherited independantly. Nevill (1980) reported that resistance was quantitatively inherited in groundnut. Nevill (1982); Walls *et al.* (1985); Anderson *et al.* (1986); Jogloy *et al.* (1987) reported that resistance to *C. personatum* was controlled by additive genes.

Sharif *et al.* (1978) has reported that resistance to *C. personatum* is controlled by multifactorial genetic system. Nevill (1980) in a study revealed that genes at 3 or 4 loci might be controlling the disease reaction. The genetic control of resistance in diploid *Arachis* sp may be different from that in the cultivated tetraploids. Coffelt and Porter (1986) revealed that a cytoplasmic factor and additive genetic effects controlled the resistance to early and late leaf spots.

Materials and Methods

3. MATERIALS AND METHODS

The project was undertaken for screening the groundnut accessions for resistance to early leaf spot caused by *Cercospora arachidicola* Hori and late leaf spot caused by *Cercosporidium personatum* (Berk and Curt) Deighton. As the first step, a field screening study was conducted for the evaluation of groundnut accessions for resistance to leaf spots in the field conditions and to study the yield contributing characters of the accessions. Secondly a glass house screening study was conducted for evaluating the genotypes which performed well in the field conditions, against leaf spot diseases.

3.1. Field screening of groundnut accessions

The field screening was conducted at the College of Horticulture, Vellanikkara during the monsoon season (July to November) 1988. The field is located at 10° 32'N Latitude and 76° 10' E Longitude and at an altitude of 22.25 m above mean sea level. Geographically it falls on the warm humid climatic zone.

3.1.1. Cropping history of the field

The field selected for the evaluation of groundnut accessions was a place where groundnut was grown continuously for a few years. During those years, the crops were seriously affected by early and late leaf spots

3.1.2. Season and climate

The experiment was conducted during the period July 1988 to November 1988. Groundnut accessions were sown on 7th July 1988.

The crop received a total of 1880.4 mm rainfall which was evenly distributed during the actively growing period. The relative humidity ranged from 38.0 to 93.0 per cent. In general the weather conditions as a whole were congenial for the natural epidemic of the disease.

3.1.3. Experimental material

Two hundred and fifty six genotypes and a tikka susceptible variety TMV 2 were used for field screening studies. The details of the accessions used are furnished in Table 1. These accessions were obtained from ICRISAT germplasm collection, through Department of Agricultural Botany, College of Horticulture, Vellanikkara.

3.1.4. Methods

3.1.4.1. Layout of the experiment

The experiment was laid out in a simple randomised block

Table 1. Genotypes selected for field evaluation study, their identity, botanical variety and origin

Type No	Identity	Bot. var	Origin
1	2	3	4
1	RS 1	Hyg.	India
2	RS 114	Vul.	Unknown
3	RS 135	Vul.	Unknown
4	66-94	Hyg.	Unknown
5	RB-4	"	India
6	AH 7398	Fst.	Unknown
7	IARI 731	Vul.	India
8	69-9	Hyg.	Unknown
9	Big Japan	Hyg.	India
10	IARI 687	Vul.	India
11	Barberton	Vul.	South Africa
12	Cochin Red	Hyg.	India
13	Kopergaon	"	"
14	S.7.12-1	"	Sudan
15	S.7-2-2	"	"
16	HG 11	"	India
17	KR 50	"	"
18	6842	"	U.S.A.
19	Castle Carry (PC)	"	Nigeria
20	K-7-4-11	"	India
21	K.4-11-2R	"	"
22	Samrala-3 seeded	"	"
23	Talod 32-3	"	"
24	B 3	"	"
25	C 15	"	Unknown
26	C 22	"	"
27	C 38	"	India
28	C 87	"	Unknown

Contd.

Table 1. Continued

1	2	3	4
29	C 99	Hyg.	India
30	C 114	"	Unknown
31	C 117	"	"
32	C 118	"	"
33	C 125	"	"
34	C 129	"	"
35	C-145-12-P-14	"	India
36	C-147	"	"
37	C-151	"	Unknown
38	C-158	"	"
39	C-159	"	"
40	C-160	"	"
41	C-175	"	"
42	C-177	"	"
43	C-178	"	India
44	C-179	"	"
45	C-184	"	Unknown
46	Tesobunch	"	Kenya
47	Kanyoma Bunch	"	Tanzania
48	U-4-4-26	"	Unknown
49	U-2-1-6	"	Senegal
50	F-7	"	Unknown
51	F-11	"	"
52	G-37	"	India
53	RS-7	"	Unknown
54	AH 84	"	India
55	AH 262	"	U.S.A.
56	AH 731	"	Unknown
57	AH 6990	"	"
58	AH 7224	"	Nigeria

Contd.

Table 1. Continued

1	2	3	4
59	AH 8045	Hyg.	Unknown
60	AH 8048	"	"
61	145-12-12	"	India
62	648-4	"	"
63	3095	"	Unknown
64	AH 6950	"	India
65	AH 7010	"	"
66	Batani-9	Vul.	"
67	Chanclodi	"	"
68	Changja	Hyg.	Unknown
69	Kalamdi	Vul.	Kenya
70	AH 73	"	Tanzania
71	AH 7154	"	China
72	AH 7336	"	"
73	U-4-4-27	"	Zaire
74	NG 268	"	India
75	NG 337	"	"
76	SS 50	"	"
77	U-4-4-23	Fst.	Uruguay
78	U-4-4-29	Vul.	Zaire
79	AH 3583	"	U.S.A.
80	AH 259	Hyg.	Unknown
81	U-4-7-24	Vul.	Sudan
82	NG 423	"	India
83	Short-1	"	"
84	EC 6189	"	Unknown
85	TG-4	"	Tanzania
86	U-2-12-1	"	Zaire
87	1025	"	Unknown

Contd.

Table 1. Continued

1	2	3	4
88	RS 60	Vul.	Unknown
89	1-2	Hyg.	India
90	U-2-24-7	Fst.	Unknown
91	U-4-4-16	Vul.	India
92	AH 6481-1	"	"
93	Normal Seg DMC	Hyg.	U.S.A.
94	Normal Seg DMC	"	"
95	Virginia bunch'	"	Brazil
96	AH 62	"	India
97	AH 4354	"	"
98	AH 7620	"	Unknown
99	C-3	"	"
100	C-21	"	India
101	C-29	"	Unknown
102	C-37	"	"
103	C-38	"	India
104	C-41	"	Unknown
105	C-46	"	India
106	C-75	"	"
107	C-100	"	"
108	C-107	"	Unknown
109	C-140	"	"
110	C-145-12	"	India
111	C-146	"	Unknown
112	C-152	"	India
113	C-171	"	Unknown
114	C-175	"	"
115	C-179	"	India

Contd.

Table 1. Continued

1	2	3	4
116	Castle Chery	Hyg.	Nigeria
117	K-8-8-1	"	India
118	Madagascar	"	Malagasay
119	Samrala	"	India
120	US 73	"	U.S.A.
121	USA 69	"	"
122	UAR 28-2	"	Senegal
123	1-2	"	India
124	6-11-6	"	"
125	40-4	"	"
126	42-9	"	"
127	575-2	"	"
128	DH 3-30	Vul.	"
129	Dharwar-1	"	"
130	Azozorozo	"	Zaire
131	Robut 33	Fst.	Israel
132	R-7-47-10	Vul.	Sudan
133	AH 33-4-1	Hyg.	India
134	E 6919	"	Unknown
135	C-830	"	India
136	AH 3849	"	Sri Lanka
137	Punjab bold	"	India
138	Kaulikoro	"	Tanzania
139	Kongwa Runner	"	"
140	IC 22939	"	India
141	M-145	"	"
142	M-755	"	"
143	MD-351	"	Nigeria
144	Mixture	"	Unknown

Contd.

Table 1. Continued

1	2	3	4
145	NG 268	Hyg.	India
146	No 4354	"	Unknown
147	P 331	"	India
148	IC 22956	"	"
149	PB 71-17	"	"
150	IC 22945	"	"
151	R-7-4-5	"	Sudan
152	R-7-4-9	"	Tanzania
153	R-7-4-10	"	Sudan
154	R-7-24-4	"	"
155	R-7-24-7	"	Tanzania
156	R-7-24-8	"	Sudan
157	R-7-47-2	"	Senegal
158	R-7-47-3	"	Tanzania
159	Southern cross	Vul.	U.S.A.
160	Rosado	"	Praguag
161	RCM 525	"	"
162	San 92	Hyg.	Brazil
163	NCAC 17840	"	U.S.A.
164	NCAC 17287	"	"
165	4518	"	"
166	Florigiant	"	"
167	Mwitunde	"	Uruguay
168	Early runner	Vul.	U.S.A.
169	Spanhoma	"	"
170	A-5-46	Fst.	Liberia
171	C-12-P-28	"	India
172	No 1022	"	"
173	No 2402-1	"	"
174	AH 7787	"	Unknown

Contd.

Table 1. Continued

1	2	3	4
175	Florispan	Fst.	U.S.A.
176	F 1-5-1	Vul.	India
177	Go 133	"	"
178	U.S. 29	Fst.	U.S.A.
179	20-1-2	Vul.	India
180	AH 816	Fst.	Unknown
181	AH 7846	Vul.	U.S.A.
182	AH 8318	"	Unknown
183	AH 62	Hyg.	India
184	HC 234	Fst.	Argentina
185	NCAC 10477-B	Hyg.	U.S.A.
186	NC 17-S	"	"
187	Span Cross	Vul.	"
188	NCAC 434	"	Argentina
189	B-27	Hyg.	U.S.A.
190	Local spreading	"	Zimbabwe
191	43 G 44	"	South Africa
192	Rabat No.3	Vul.	Mauritius
193	WCG 166 B	Fst.	Brazil
194	NCAC-17615	Hyg.	U.S.A.
195	NCAC-17649	"	"
196	Sam Col 303	"	Unknown
197	Bambey 487	"	Senegal
198	Mwitunde Nahcigwea	"	Tanzania
199	Sam Col 86	Fst.	Unknown
200	Virginia bunch large	Hyg.	U.S.A.
201	Japanese	Vul.	Zimbabwe
202	Sam Col 217	Hyg.	Unknown

Contd.

Table 1. Continued

1	2	3	4
203	Sam Col 232	Hyg.	Unknown
204	NCAC 17659	"	U.S.A.
205	NCAC 17562	"	"
206	NCAC 17705	"	"
207	2/1	"	Unknown
208	NCAC 17606	"	U.S.A.
209	295/63	Fst.	Nigeria
210	308/75	Hyg.	Malawi
211	311/63	Fst.	Zimbabwe
212	404/64	"	"
213	LV-5	"	"
214	RCM 582	"	Brazil
215	Perdeniya	Vul.	Zimbabwe
216	M 1075-74(2)	Hyg.	Nigeria
217	M-6-76 M	"	"
218	Marabba Runner	"	Sudan
219	Variety 68	"	Zimbabwe
220	NCAC 17644	"	U.S.A.
221	NCAC 17690	"	"
222	NCAC 17754	"	"
223	M-145-75-5	"	"
224	Hung-Main chao	Vul.	China
225	VRR 352	"	India
226	VRR 365	"	"
227	Cord willow	Hyg.	U.S.A.
228	NCAC 17718	"	"
229	UF 71513	Fst.	"
230	F-1-17	Hyg.	Zimbabwe
231	NCAC 17780	"	U.S.A.

Contd.

Table 1. Continued

1	2	3	4
232	NCAC 17864	Hyg.	U.S.A.
233	Magale-1	"	Tanzania
234	NCAC 17591	"	U.S.A.
235	AM-2	"	Zimbabwe
236	Luwingu	"	"
237	NCAC 403	Fst.	U.S.A.
238	NC 10468	Hyg.	"
239	NC 10452	"	"
240	NC 90854	"	"
241	NC 7497	"	"
242	NC-9085-S	"	"
243	NC-6720	"	"
244	RG 363	Vul.	Bolivia
245	ZM 837	Hyg.	Zambia
246	58-41	"	Togo
247	75-74	Vul.	Nigeria
248	59-348	"	Senegal
249	75-51	"	Argentina
250	63-106	"	Senegal
251	PR 5290	"	Philippines
252	VRR 546	"	India
253	VRR 766	Hyg.	"
254	DSA-200	Vul.	Ghana
255	G 397-1	Oth.	India
256	Indonesia-2	Vul.	"
257	TMV 2	"	India

Hyg. - Hypogaea

Fst. - Fastigiata

Vul. - Vulgaris

design with two replications and two hundred and fifty seven treatments.

The two hundred and fifty six accessions along with the susceptible variety were sown on raised beds having a length of 1 m and width of 50 cm, at a distance of 20 cm between beds. Ten seeds of each entry were sown in each bed at a spacing of 30 cm x 20 cm. Susceptible cultivar TMV 2 was sown intermittantly after every plot rows and as border rows.

3.1.4.2. Fertiliser

Crop received the respective cultural and manurial practices as per the Package of Practices Recommendations of the Kerala Agricultural University (1986). Nitrogen, Phosphorus and Potassium were supplied through, Urea, Super phosphate and Murate of potash respectively.

3.1.4.3. Assessment of Disease Resistance

Disease resistance of test entries was rated based on the percentage of leaf area infected. A 7 point logarithamic disease scale (0-6) as shown below was used for rating the disease severity (Horsfall and Barrat, 1945).

Grades	Percentage of leaf area infected
0	No infection
1	0.1 - 12

2	12.1 - 25
3	25.1 - 50
4	50.1 - 75
5	75.1 - 87
6	87.1 - 100

Disease rating was done with the aid of a diagramatic chart and categorised into different grades, based on the per cent of infections on leaves, and the disease index was calculated by using the following formula

$$\text{Disease index} = \frac{\text{Sum of all the numerical ratings} \times 100}{\text{Total number of ratings} \times \text{maximum disease grade}}$$

3.1.4.4. Observations

Number of days taken for the first incidence of disease was noted in all genotypes. Disease scoring was done on the 45th and 90th day after sowing. Four plants were randomly selected within each plot. Fourth, fifth and sixth leaves from top of each randomly selected branch of the selected plants were labelled and used for taking observations on 45th and 90th day respectively. Disease intensity of each entry was calculated based on the percentage of area infected. The groundnut accessions listed were then grouped according to the standards (Table 2) adopted by Sharma and Mathur (1979).

Table 2. Standards used for grouping genotypes into different ranges of disease susceptibility

Groups	Disease intensity (%)
Immune	0
Highly resistant	0 - 10
Resistant	10.1 - 20
Moderately resistant	20.1 - 40
Moderately susceptible	40.1 - 60
Susceptible	60.1 - 80
Highly susceptible	80.1 - 100

3.1.4.5. Observations on yield attributing characters

The following characters were also studied on these accessions.

3.1.4.5.1. Days to first flowering

Number of days from sowing to the appearance of first flower on observational plants was recorded.

3.1.4.5.2. Days to 50% flowering

Number of days taken for flowering of the fifty per cent plants of each accession in each plot was observed.

3.1.4.5.3. Number of primary branches

Total number of primary branches was counted at the time of harvest.

3.1.4.5.4. Plant haulms yield

The dried haulms of each observational plant were weighed after removing pods at harvest.

3.1.4.5.5. Pod number/plant

The number of pods per plant was counted at the time of harvest.

3.1.4.5.6. Pod weight/plant

Weight of the pods per plant was recorded at the time of harvest.

3.1.4.5.7. 100 pod weight

A random sample of 100 dry pods was drawn from each accession per replication and weighed.

3.1.4.5.8. 100 kernal weight

Hundred kernels were drawn at random from a sample of dry kernels from each variety per replication and weight recorded.

3.1.4.5.9. Shelling percentage

The harvested pods were shelled and the kernels were weighed and the shelling percentage was calculated as follows.

$$\text{Shelling percentage} = \frac{\text{Kernel weight}}{\text{Pod weight}} \times 100$$

3.1.4.5.10. Number of kernels per pod

A random sample of 10 pods was drawn from each accession per replication. After shelling, kernels were counted and the number of kernels per pod recorded.

3.1.4.5.11. Days to maturity

Maturity of the observational plants was recorded from the date of sowing to the appearance of senescence in plants.

3.2. Glass house screening

Groundnut accessions with low disease intensity in field conditions combined with high/moderate yield were selected for glass house screening.

3.2.1. Experimental material

From the two hundred and fifty seven groundnut genotypes evaluated, twenty five were selected for glass house screening (Table 3).

The seeds of selected lines were sown in pots having a diameter of 12 inches. Each pot contained only one plant.

The crop was given the respective cultural and manurial practices as per the Package of Practices Recommendations of the Kerala Agricultural University (1986). Nitrogen, Phosphorus and Potassium were supplied through Urea, Super phosphate and Murate of potash respectively.

3.2.3. Methods

3.2.3.1. Layout of the experiment

The experiment was laid out in a completely randomised block design with twenty five treatments and four replications.

Table 3. Groundnut genotypes selected for glass house screening their Identity, Botanical variety and Origin

Selected type No.	Identity	Bot.var.	Origin	Disease intensity (%)	Yield (g)
1	T.8 (69-9)	Hyg.	Unknown	60.405	4.0
2	T.20 (K 7-4-11)	"	India	63.880	9.0
3	T.35 (C-145-12-P-14)	"	"	59.020	17.0
4	T.38 (C-158)	"	Unknown	61.105	7.0
5	T.65 (AH 7010)	"	India	63.580	15.0
6	T.73 (U-4-4-27)	Vul.	Zaire	63.550	7.0
7	T.75 (NG 337)	"	India	69.430	24.5
8	T.100 (C-21)	Hyg.	"	66.660	16.5
9	T.118 (Madagascar)	"	Malagasay Republic	70.830	27.0
10	T.89 (1-2)	"	India	52.070	4.0
11	T.135 (C-830)	"	"	62.490	10.0
12	T.136 (AH 3849)	"	Sri Lanka	63.150	6.5
13	T.143 (MD-351)	"	Nigeria	62.490	18.0
14	T.147 (P-331)	"	India	66.660	9.5
15	T.157 (R-7-47-2)	"	Senegal	62.490	11.0
16	T.162 (San 92)	"	Brazil	64.225	11.0
17	T.165 (4518)	"	U.S.A.	66.666	10.5
18	T.171 (C-12-P-28)	Fst.	Liberia	65.960	17.0
19	T.172 (No 1022)	"	India	65.270	2.5
20	T.173 (No 2402-1)	"	"	58.320	10.5
21	T.175 (Florispan)	"	U.S.A.	66.666	24.5
22	T.183 (AH 62)	Fst.	India	58.995	6.0
23	T.200 (Virginia bunch large)	Hyg.	U.S.A.	61.100	10.0
24	T.223 (M-145-75-5)	"	"	63.580	9.0
25	T.246 (58-41)	"	Togo	68.050	18.5

Hyg. - Hypogaea
Fst. - Fastigiata
Vul. - Vulgaria

3.2.3.2. Inoculation

The inoculum used in the glass house screening study was prepared according to the method adopted by Subrahmanyam *et al*. (1982).

The prepared spore suspension was sprayed on leaves of healthy test plants by using an atomizer. Spraying was done 15 days after sowing. The inoculated plants were provided with humid condition, congenial for the proper disease development.

3.2.3.3. Observations

Four branches from each plant were randomly selected and fourth, fifth and sixth leaves from top of each branch were labelled for taking observations. Observations were taken on 45th day and 90th day respectively as it was done in field evaluation study. The procedure used in the field evaluation study was used for estimating the disease intensity of selected lines.

3.2.3.4. Statistical analysis

Statistical analysis of the data was carried out by adopting the standard methods described by Panse and Sukhatme (1967).

Results

4. RESULTS

The experimental data collected were subjected to statistical analysis where ever required. The degree of disease resistance of the 257 genotypes studies under field condition and the yield attributing characters of these genotypes in relation to disease resistance are presented below.

4.1. Screening for tikka disease resistance in the field evaluation study

The data showing the number of days taken for first incidence of disease, and the degree of susceptibility of the evaluated genotypes on 45th and 90th days after sowing, are given in the Appendix I. Since it is difficult to locate a particular value from this 257 entries, a condensed table showing the range in the susceptibility to disease is presented (Table 4).

According to the data obtained, T_{220} (NCAC 17644) showed symptoms of disease within the shortest mean period of 25.5 days after sowing. The maximum time of 38.5 days was taken by T_{89} (1 - 2). T_{257} (TMV_2) showed the symptoms of disease 28.5 days after sowing.

On the forty fifth day after sowing, T_{38} (C-158) showed the minimum disease intensity of 11.10 per cent and the highest disease intensity of 31.2 per cent was recorded by T_{232} (NCAC 17864). The degree of disease intensity of T_{257} (TMV_2) was 18.04 per cent.

Table 4. Range in the susceptibility to disease

Range / Susceptibility to disease	Maximum	Minimum	Genotypes showing Maximum	Genotypes showing Minimum
Number of days taken for first incidence of disease	38.50	25.50	T_{89} (1-2)	T_{220} (NCAC 17644)
Disease intensity at 45th day	31.23	11.10	T_{232} (NCAC 17864)	T_{38} (C-158)
Disease intensity at 90th day	95.82	52.07	T_{3} (R.S. 135)	T_{89} (1-2)

Table 5. No. of days taken for the first incidence of disease and the degree of susceptibility to the disease of the selected genotypes under field conditions

Sl. No.	Identity	No. of days taken for the first incidence of disease(days)	Disease intensity	
			On 45th day (%)	On 90th day (%)
1	T_8 (69-9)	38.5	18.04	60.40
2	T_{20} (K 7-4-11)	31.5	17.35	63.88
3	T_{35} (C-145-12-P-14)	35.5	16.66	59.02
4	T_{38} C-158	37.0	11.10	61.11
5	T_{65} AH 7010	33.5	18.04	63.88
6	T_{73} U-4-4-27	36.0	16.66	63.88
7	T_{75} NG 337	31.5	16.66	69.43
8	T_{100} C-21	35.5	16.66	66.66
9	T_{118} Madagascar	33.0	17.35	70.83
10	T_{89} 1-2	38.5	18.74	52.07
11	T_{135} C-830	35.0	19.43	62.49
12	T_{136} AH 3849	34.5	17.35	63.18
13	T_{143} MD-351	33.5	15.27	62.49
14	T_{147} P-331	35.0	17.35	66.66
15	T_{157} R-7-47-2	34.5	17.35	62.49
16	T_{162} San 92	34.5	20.13	64.22
17	T_{165} 4518	34.5	16.66	66.66
18	T_{171} C-12-P-28	34.5	17.35	65.96
19	T_{172} No 1022	34.5	16.66	65.27
20	T_{173} No 2402-1	38.0	15.27	58.32
21	T_{175} Florispan	34.5	17.35	66.66
22	T_{183} AH 62	32.5	16.66	58.99
23	T_{200} Virginia bunch large	37.5	15.27	61.10
24	T_{223} M-145-75-5	35.0	14.57	63.88
25	T_{246} 58-41	31.0	15.27	68.05

T_{89} (1-2) showed the lowest disease intensity of 52.07 per cent on the 90th day after sowing. The highest disease intensity of 95.82 per cent was recorded by T_3 (RS 135). The disease intensity of T_{257} (TMV_2) on the 90th day was 85.55 per cent.

As per the data obtained, four genotypes were moderately susceptible; 197 susceptible and 56 highly susceptible to the disease. None of the varieties was immune, highly resistant or moderately resistant (Appendix I).

Considering the disease susceptibility in the field evaluation studies and yield, 25 genotypes showing comparatively less disease intensity with moderate yield were selected for the glass house study. The number of days taken for the first incidence of disease and degree of susceptibility to the disease under field conditions of these 25 genotypes are presented in the Table 5.

4.2. Evaluation of genotypes for yield attributing characters

The data obtained in relation to the yield attributing characters of the 257 genotypes are given in the Appendix II. A condensed table showing the range in the expression of all the 11 yield attributing characters under study are given in the Table 6.

4.2.1. Days to first flowering

The days to first flowering varied from 22.5 days for T_{27} (38) to 39 days for T_{64} (AH 6950), T_{39} (1-2), T_{130} (Azozorozo)

Table 6. Range in the expression of yield attributing characters

Characters	Range Maximum	Range Minimum	Genotypes showing Maximum	Genotypes showing Mimimum
1	2	3	4	5
Days to first flowering	39 days	22.5 days	T_{64} (AH 6950) T_{39} (1-2) T_{130} (Azozorozo) T_{193} (WCG 166 B)	T_{27} (C-38)
Days to 50% flowering	46.5 days	27 days	T_{130} (Azozorozo)	T_{26} (C-22)
Days to maturity	146 days	99.5 days	T_{32} (C-118) T_{100} (C-21) T_{96} (AH 62)	T_{83} (Short-1)
Number of primary branches	8	5.5	T_{6} (AH 7398) T_{11} (Barberton) T_{13} (Kopergaon) T_{25} (C-15), T_{26} (C-22) T_{32} (C-118), T_{37} (C-151) T_{43} (C-178), T_{49} (U-2-1-6) T_{57} (AH 6990) T_{63} (3095), T_{87} (1025) T_{91} (U-4-4-16), T_{100} (C-21) T_{109} (C-140), T_{126} (42-9) T_{129} (Dharwar-1) T_{142} (M-755) T_{170} (A-5-46) T_{190} (Local spreading) T_{191} (43 G 44) T_{196} (Sam Col 303) T_{197} (Bombey 487) T_{219} (Variety 68)	T_{165} (45-18)

Contd.

Table 6. Continued

1	2	3
Plant haulms yield	91.5 g	20 g
Pod number per plant	39	2.5
Pod weight per plant	37 g	2 g
100 pod weight	167.25 g	48.5 g
100 kernel weight	73.25 g	23 g
Number of kernels per pod	2.95	1.05
Shelling percentage	91.87 (Per cent)	55.96 (Per cent)

4	5
T_{226} (VRR 365) T_{233} (Magale-1) T_{238} (NC 10468) T_{246} (58-41) T_{248} (59-348) T_{252} (VRR 546)	
T_{214} (RCM 582)	T_{93} (Normal seg DMC)
T_{219} (Variety 68)	T_{14} (S-7-12-1)
T_{219} (Variety 68)	T_{14} (S-7-12-1)
T_{244} (RG 363)	T_{22} (Samrala 3 seeded)
T_{94} (Normal seg DMC)	T_{170} (A-5-46)
T_{173} (No 2402-1) T_{186} (NC 17-5) T_{193} (WCG 166 B) T_{209} (295/63) T_{249} (75-51) T_{256} (Indonesia 2)	T_{44} (C 179)
T_{252} (Indonesia 2)	T_{213} (L.V. 5)

and T_{193} (WCG 166 B). T_{257} (TMV_2) recorded 28 days to first flowering. Days to first flowering of the 25 genotypes selected for glass house scpeening are given in the Table 7.

4.2.2. Days to 50% flowering

The days to 50% flowering varied from 27 days for T_{26} (C22) to 46.5 days for T_{130} (Azozorozo). sT_{257} (TMV_2) recorded 29.5 days. Table 8 shows the performance of the selected genotypes.

4.2.3. Days to maturity

The minimum number of 99.5 days was taken by T_{83} (Short-1) for maturity whereas T_{32} (C 118), T_{100} (C-21) and T_{96} (AH 62) took the maximum of 146 days for maturity. T_{257} (TMV_2) matured in 114 days after sowing. Table 9 shows the performance of selected genotypes.

4.2.4. Number of primary branches

Minimum number of 5.5 primary branches was produced by T_{165} (4518) and the maximum number of 8 was recorded by 30 genotypes (Table 6). T_{257} (TMV_2) recorded a mean of 7.5 primary branches. The performance of genotypes under glass house study is given in the Table 10.

4.2.5. Plant haulms yield

The highest haulms yield per plant 91.5 g was recorded by T_{214} (RCM 582) closely followed by T_{15} (S 7-2-2) with 86.5 g,

Table 7. Days to first flowering of the selected genotypes under field conditions

Sl. No.	Identity	Days to first flowering (days)
1	69-9	26.0
2	K 7-4-11	37.5
3	C-145-12-P-14	36.5
4	C-158	38.5
5	AH 7010	28.5
6	U-4-4-27	34.0
7	NG 337	38.0
8	C-21	33.5
9	Madagascar	37.5
10	1-2	39.0
11	C-830	36.5
12	AH 3849	36.5
13	MD-351	37.0
14	P-331	32.5
15	R-7-47-2	34.5
16	San 92	35.0
17	4518	31.5
18	C-12-P-28	34.5
19	No 1022	36.5
20	No 2402-1	37.5
21	Florispan	33.0
22	AH 62	37.5
23	Virginia bunch large	38.5
24	M-145-75-5	37.0
25	58-41	35.5

Table 8. No. of days taken by the selected genotypes to 50% flowering, under field conditions

Sl. No.	Identity	Days to 50% flowering (days)
1	69-9	31.0
2	K 7-4-11	43.0
3	C-145-12-P-14	41.5
4	C-158	44.5
5	AH 7010	30.0
6	U-4-4-27	39.5
7	NG 337	43.5
8	C-21	37.0
9	Madagascar	43.0
10	1-2	39.0
11	C-830	40.0
12	AH 3849	39.5
13	MD-351	40.0
14	P-331	38.5
15	R-7-47-2	39.0
16	San 92	39.0
17	4518	36.5
18	C-12-P-28	39.5
19	No 1022	40.5
20	No 2402-1	39.0
21	Florispan	38.0
22	AH 62	41.5
23	Virginia buch large	43.5
24	M-145-75-5	41.5
25	58-41	39.5

Table 9. No. of days taken by the selected genotypes to mature under field conditions

Sl. No.	Identity	Days to maturity (days)
1	69-9	130
2	K 7-4-11	140
3	C-145-12-P-14	136
4	C-158	139
5	AH 7010	140
6	U-4-4-27	109
7	NG 337	107
8	C-21	146
9	Madagascar	142
10	1-2	140
11	C-830	140
12	AH 3849	134
13	MD-351	138
14	P-331	134
15	R-7-47-2	136
16	San 92	144
17	4518	144
18	C-12-P-28	142
19	No 1022	142
20	No 2402-1	142
21	Florispan	134
22	AH 62	146
23	Virginia bunch large	140
24	M-145-75-5	138
25	58-41	140

Table 10. No. of primary branches of the selected genotypes under field conditions

Sl. No.	Identity	Number of primary branches
1	69-9	6.5
2	K 7-4-11	6.5
3	C-145-12-P-14	7.0
4	C-158	6.0
5	AH 7010	7.5
6	U-4-4-27	7.0
7	NG 337	7.0
8	C-21	8.0
9	Madagascar	7.0
10	I-2	6.5
11	C-830	6.5
12	AH 3849	7.0
13	MD-351	7.5
14	P-331	6.5
15	R-7-47-2	7.0
16	San 92	6.5
17	4518	5.5
18	C-12-P-28	7.5
19	No 1022	6.0
20	No 2402-1	6.5
21	Florispan	7.5
22	AH 62	7.0
23	Virginia bunch large	7.0
24	M-145-75-5	7.0
25	58-41	8.0

while the lowest was recorded by T_{93} (Normal seg DMC) with 20 g. The haulms yield of TMV_2 was 76.5 g. Plant haulms yield of selected genotypes are presented in the Table 11.

4.2.6. Pod number/plant

T_{219} (Variety 68) gave the highest pod number of 39, followed by T_{87} (1025) with 37. Lowest pod number of 25 was recorded in the case of T_{14} (S 7-12-1). T_{257} (TMV_2) recorded 23.5. Pod number/plant of the selected genotypes is given in the Table 12.

4.2.7. Pod weight/plant

The highest yield of 37 g was recorded by T_{219} (Variety 68). T_{218} (Marraba Runner), T_{172} (No. 1022), T_{14} (S 7-12-1) gave the lowest pod weight of 2 g. T_{257} (TMV_2) recorded 25 g. The performance of the selected genotypes is given in the Table 13.

4.2.8. 100 pod weight

According to the data, weight of 100 pods ranged from 48.5 g to 167.25 g. Here the maximum was in the case of T_{244} (RG 363) and minimum in the case of T_{22} (Samrala 3 seeded). Hundred pod weight of T_{257} (TMV_2) was 91.0 g. Table 14 shows the performance of selected genotypes with respect to 100 pod weight.

Table 11. Plant haulms yield of the selected genotypes under field evaluation study

Sl. No.	Identity	Plant haulms yield (g)
1	69-9	26.0
2	K 7-4-11	54.5
3	C-145-12-P-14	43.0
4	C-158	34.0
5	AH 7010	48.5
6	U-4-4-27	43.5
7	NH 337	33.5
8	C-21	40.5
9	Madagascar	34.0
10	1-2	34.0
11	C-830	27.5
12	AH 3849	35.0
13	MD-351	34.5
14	P-331	35.0
15	R-7-47-2	29.5
16	San 92	40.5
17	4518	29.5
18	C-12-P-28	66.5
19	No 1022	36.5
20	No 2402-1	43.0
21	Florispan	57.5
22	AH 62	42.0
23	Virginia bunch large	30.5
24	M-145-75-5	56.5
25	58-41	86.5

Table 12. No. of pods per plant of the selected genotypes under field evaluation study

Sl. No.	Identity	Pod number/plant
1	69-9	5.5
2	K 7-4-11	10.0
3	C-145-12-P-14	19.5
4	C-158	8.0
5	AH 7010	15.0
6	U-4-4-27	7.0
7	NG 337	28.5
8	C-21	18.5
9	Madagascar	31.0
10	1-2	6.5
11	C-830	11.5
12	AH 3849	8.0
13	MD-351	21.0
14	P-331	9.5
15	R-7-47-2	12.0
16	San 92	12.0
17	4518	12.5
18	C-12-P-28	19.0
19	No 1022	3.5
20	No 2402-1	12.5
21	Florispan	28.0
22	AH 62	7.5
23	Virginia bunch large	10.0
24	M-145-75-5	11.5
25	58-41	21.5

Table 13. Pod weight/plant of the selected genotypes under field evaluation study

Sl. No.	Identity	Pod weight/plant (g)
1	69-9	4.0
2	K 7-4-11	9.0
3	C-145-12-P-14	17.0
4	C-158	7.0
5	AH 7010	15.0
6	U-4-4-27	7.0
7	NG 337	24.5
8	C-21	16.5
9	Madagascar	27.0
10	1-2	4.5
11	C-830	10.0
12	AH 3849	6.5
13	MD-351	18.0
14	P-331	9.5
15	R 7-47-2	11.0
16	San 92	11.0
17	4518	10.5
18	C-12-P-28	17.0
19	No 1022	2.5
20	No 2402-1	10.5
21	Florispan	24.5
22	AH 62	6.0
23	Virginia bunch large	10.0
24	M-145-75-5	9.0
25	58-41	18.5

Table 14. Hundred pod weight of the selected genotypes under field evaluation study

Sl. No.	Identity	100 pod weight (g)
1	69-9	84.25
2	K 7-4-11	127.75
3	C-145-12-P-14	113.00
4	C-158	94.25
5	AH 7010	150.75
6	U-4-4-27	74.25
7	NG 337	78.75
8	C-21	135.25
9	Madagascar	85.25
10	1-2	65.00
11	C-830	86.75
12	AH 3849	97.00
13	MD-351	67.25
14	P 331	130.25
15	R-7-47-2	107.75
16	San 92	69.25
17	4518	125.25
18	C-12-P-28	58.00
19	No 1022	125.00
20	No 2402-1	142.75
21	Florispan	97.00
22	AH 62	105.00
23	Virginia bunch large	95.25
24	M-145-75-5	111.75
25	58-41	70.25

4.2.9. 100 kernel weight

The hundred kernel weight of the genotypes ranged from as low as 23 g in T_{170} (A-5-46) to as high as 73.25 g in T_{94} (Normal seg DMC). T_{257} (TMV_2) recorded 48.5 g. Hundred kernel weight of the selected genotypes are given in the Table 15.

4.2.10. Number of kernels/pod

The number of kernels/pod ranged from 1.05 to 2.95. The highest was recorded by T_{173} (No. 2402-1), T_{186} (NC 17-5), T_{193} (WCG 166 B), T_{209} (295/63), T_{249} (75-51) and T_{256} (Indonesia 2). The lowest number was recorded by T_{44} (C-179). T_{257} (TMV_2) recorded 1.85 kernels/pod. Table 16 shows the performance of selected genotypes.

4.2.11. Shelling percentage

Maximum shelling percentage was recorded in the case of T_{256} (Indonesia 2) with 91.87 per cent followed by T_{38} (C 158) with 88.83 per cent. Minimum was recorded by T_{213} (L.U.5) with 55.96. T_{257} (TMV_2) recorded 74.83 per cent. Shelling percentages of the selected genotypes are given in the Table 17.

Analysis of covariance was done by taking pod weight/plant as main variable and disease intensity in ancilliary variable; disease intensity as main variable and number of primary branches as ancilliary variable and disease intensity as main variable and days to maturity as ancilliary variable. The estimate of regression

Table 15. Hundred kernel weight of the selected genotypes under field evaluation study

Sl.No.	Identity	100 kernel weight (g)
1	69-9	39.3
2	K. 7-4-11	43.0
3	C-145-12-P-14	44.5
4	C-158	41.3
5	A.H. 7010	54.5
6	U-4-4-27	38.3
7	NG 337	29.0
8	C-21	49.3
9	Madagascar	42.0
10	1-2	26.3
11	C-830	43.0
12	A.H. 3849	45.5
13	MD-351	28.0
14	P-331	47.8
15	R.7-47-2	53.0
16	San 92	31.3
17	4518	48.8
18	C-12-P-28	23.0
19	NO 1022	42.0
20	NO 2402-1	53.0
21	Florispan	40.8
22	A.H. 62	45.5
23	Virginia bunch large	42.0
24	M-145-75-5	42.3
25	58-41	31.8

Table 16. No. of kernels/pod of the selected genotypes under field evaluation study

Sl. No.	Identity	No. of kernels/pod
1	69-9	2.00
2	K 7-4-11	2.85
3	C-145-12-P-14	1.95
4	G-158	1.85
5	AH 7010	1.95
6	U-4-4-27	1.90
7	NG 337	1.95
8	C-21	2.00
9	Madagascar	1.75
10	1-2	1.15
11	C-830	1.85
12	AH 3849	1.60
13	MD-351	1.95
14	P-331	2.85
15	R-7-47-2	1.90
16	San 92	1.85
17	4518	1.55
18	C-12-P-28	1.95
19	No 1022	1.90
20	No 2402-1	2.95
21	Florispan	1.70
22	AH 62	2.00
23	Virginia bunch large	1.95
24	M-145-75-5	1.80
25	58-41	1.80

Table 17. Shelling percentage of the selected genotypes under field evaluation study

Sl. No.	Identity	Shelling percentage (%)
1	69-9	80.36
2	K-7-4-11	85.88
3	C-145-12-P-14	70.22
4	C-158	88.83
5	AH 7010	81.89
6	U-4-4-27	74.99
7	NG 337	63.06
8	C-21	76.68
9	Madagascar	77.69
10	1-2	70.50
11	C-830	87.85
12	AH 3849	81.96
13	MD-351	82.83
14	P-331	81.92
15	R-7-47-2	74.88
16	San 92	81.88
17	4518	72.80
18	C-12-P-28	81.87
19	No 1022	70.79
20	No 2402-1	85.27
21	Florispan	82.49
22	AH 62	84.00
23	Virginia bunch large	83.68
24	M-145-75-5	74.54
25	58-41	73.61

coefficients 0.01873, -1.00468 and -0.16877 respectively, were insignificant at 5% level of significance thereby showing that disease intensity has no effect on pod weight; and number of primary branches and days to maturity have no effect on disease intensity.

Correlations among some of the characters and disease intensity were worked out. From the analysis it was found that there existed significant correlation between disease intensity and pod no/plant at 1% level of significance. The coefficient of correlation was .3000 (T 1% = 1.96).

Correlation between disease intensity and shelling percentage was found to be highly significant at 1% level of significance. Coefficient of correlation was .3410 (T 1% = 1.96). The correlation between disease intensity and 100 pod weight was also highly significant at 1% level of significance, with a coefficient of correlation of 0.3322 (T 1% = 1.96). When disease intensity and 100 kernel weight were considered, there was significant correlation at 1% level of significance. The correlation coefficient was 0.6853 (T 1% = 1.96).

4.3. Glass house screening

Twenty five groundnut accessions with low disease intensity in field conditions combined with high/moderate yield were selected and evaluated again for disease resistance.

According to data obtained, the disease symptoms were first noticed on genotype S_{25} (58-41) ie. 25 days after inoculation. Maximum time of 29.75 days was taken in the case of genotypes S_{15} (R 7-47-2) and S_{23} (Virginia bunch large) (Table 18).

Genotypes S_9 (Madagascar) and S_{14} (P 331) recorded the minimum disease intensity of 17.52 per cent on 45th day. Highest disease intensity of 19.25 was recorded by S_1 (69-9) (Table 18).

According to the data, the disease intensity of the selected genotypes on 90th day ranged from 62.83 to 74.99 per cent. Genotype S_3 (C-145-12-P-14) showed the lowest disease intensity of 62.83 per cent followed by S_{20} (No. 2402-1), S_{22} (AH 62) and S_{23} (Virginia bunch large) with 63.53 per cent and highest was recorded by S_9 (Madagascar). Based on the degree of susceptibility on the 90th day, all the varieties were susceptible to the disease (Table 18).

Table 18. Number of days taken for the first incidence of disease and the intensity of disease on 45th day and 90th day after sowing under glass house conditions

Sl. No.	Identity	No. of days taken for the incidence of disease (days)	Disease intensity On 45th day (%)	Disease intensity On 90th day (%)
1	69-9	26.25	19.25	65.27
2	K 7-4-11	26.00	18.56	68.39
3	C-145-12-P-14	29.62	18.39	62.83
4	C-158	28.25	18.21	64.57
5	AH 7010	26.00	18.73	67.00
6	U-4-4-27	28.000	18.56	67.00
7	NG 337	26.25	19.08	73.25
8	C-21	28.00	18.39	69.78
9	Madagascar	25.75	17.52	74.99
10	1-2	28.75	18.56	67.70
11	C-830	29.00	17.87	64.92
12	AH 3849	26.00	19.08	67.35
13	MD 351	27.75	18.04	65.27
14	P-331	28.75	17.52	69.09
15	R-7-47-2	29.75	18.21	65.96
16	San 92	27.50	17.87	67.00
17	4518	28.75	17.87	69.78
18	C-12-P-28	27.25	18.21	68.05
19	No 1022	28.75	19.08	68.04
20	No 2402-1	29.00	18.04	63.53
21	Florispan	27.50	17.87	70.13
22	AH 62	29.50	18.91	63.53
23	Virginia bunch large	29.75	17.87	63.53
24	M-145-75-5	26.00	18.04	66.66
25	58-41	25.00	18.56	72.21
	CD (0.05)			2.3982

Table 19. Grouping of identical genotypes for disease reaction

Sl. No.	Conclusion
1	bcde
2	ghijk
3	a
4	abc
5	defgh
6	defgh
7	mn
8	ijk
9	n
10	fghi
11	abcd
12	efgh
13	bcde
14	hijk
15	cdef
16	defgh
17	ijk
18	fghij
19	fghij
20	ab
21	jkl
22	ab
23	ab
24	cdefg
25	lm

Treatments having the same letters are on par with reference to disease intensity

Discussion

5. DISCUSSION

Among the annual oil seed crops in our country, groundnut occupies an important place. Because of its manifold uses in the form of nuts, oil for edible purpose and industrial use, oil cake as feed for animals and for manuring its demand is always on the increase. But when compared to other groundnut growing countries, productivity in our country is comparatively very low. One of the reasons for decreased productivity is the incidence of diseases, especially tikka leaf spots, one of the major diseases of groundnut, wherever it is grown.

Although this disease can be successfully controlled by fungicidal application, the increased use of these chemicals has led to some resistant strains of leaf spot (Littrel, 1974; Littrel and Lindsey, 1975). So the best solution for this problem is the release of resistant varieties of good agronomic qualities.

In a planned tikka disease resistance breeding programme, a knowledge on the genetic variability present in the available germplasm in the case of resistance to this particular disease will provide the basic informations required to choose the appropriate breeding method. The present evaluation study has been undertaken with these objectives in mind.

5.1. Field evaluation of genotypes for disease resistance and yield attributing characters

According to the results obtained in the field evaluation study, the days to first incidence of disease on the evaluated genotypes ranged from 25.5 to 38.5 days. This was in confirmity with the reports of Butler (1918). The genotype NCAC 17644 had taken minimum days for disease infection, while the maximum was taken by the genotype 1-2. These two genotypes showed comparatively a minimum and maximum disease intensity respectively at later stages also. From this, it is evident that differences in the period for first incidence of disease, number of lesions and size of lesions, reflect the disease resistance ability of the genotypes. According to Vanderplank (1968), the difference in time taken for disease infection, may be due to difference in vertical resistance among genotypes. The present variability in the case of period for disease infection may be due to the differential responses of genotypes to penetration and establishment of fungal pathogen.

Among the genotypes evaluated, C-158, showed a low disease intensity of 11.10 per cent and NCAC recorded a maximum of 31.21 per cent, 45 days after sowing. But on the 90th day, genotype 1-2 showed the lowest disease intensity followed by No 2402-1. Highest disease intensity was recorded in the case of RS 135 followed by U-4-4-23 and PR-5290. Variation in disease severety ranged from 52.07 to 95.82 per cent. Similar results of, great varietal diversity for resistance to tikka disease were reported by Kripal et al. (1972), Kolte et al. (1977), Prasad et al. (1979), Sharma and Mathur (1979), Ghewande et al. (1983), Chiteka et al. (1986) and Jogloy et al. (1987).

A comparison between the disease severely on 45th day and 90th day, has revealed that, among the genotypes evaluated, many showing low susceptibility at early stages of plant growth performed just the reverse at later stages.

The expression and durability of host plant resistance to a pathogen depends to a large extent on the type of resistance mechanisms which operate in the host and the type of mechanisms in the parasite which might be able to circumvent the defence system of the host (Russel, 1978). As a general rule vertical resistance mechanisms reduce the effective amount of initial inoculum from which the epidemic starts, while the horizontal resistance mechanisms slows the growth of pathogen after it has started. Based on the reports of Vander Plank (1968) the differential responses of genotypes in the case of disease resistance may be due to the differential interaction of different races with the genotypes they affected. So based on the results of present investigation, the possibilities for such a reason cannot be neglected.

In the present field evaluation study four genotypes were moderately susceptible, 197 susceptible and 56 highly susceptible to the disease. None of the varieties was immune, highly resistant, resistant or moderately resistant. This much of high susceptibility or disease severity may be due to the congenial humid weather conditions, the crop received during the growth period. It has been observed by many scientists that in Central and South India maximum predisposing factors for disease occur in September (Sulaiman and Agashe, 1965). The present field evaluation study was also conducted during a period from July to November.

The success in plant breeding depends on the appropriate evaluation of variability in the different characters. Rao (1980) also has pointed out that the key to successful utilization of variability from broad genetic pools depends on the knowledge of desirable traits available in the germplasm through a systematic evaluation of the same. So in this study an attempt was done to study the yield attributing characters for which the genotypes exhibited high variability.

Significant variation among test entries for number of days to first flowering was observed in the field evaluation study. C 38 was the earliest to flower in this trial. The genotypes AH6950; 1-2, Azozorozo and WCG had taken longest duration. Significant variation between varieties for duration upto flowering was reported by Majundar et al. (1969), Ramachandran and Venketeswaran (1980) and Kuriakose (1981).

The differences in days for 50 per cent flowering among the varieties were highly significant. The varietal difference ranged from 27 days for C 22 to 46.5 days for Azozorozo.

Number of days to maturity exhibited high variability among the genotypes evaluated. It varied from 99.5 for Short-1 to 146 days for C 118, C 21 and AH 62. Basu and Ashokraj (1969), Majundar et al. (1969), Ramachandran and Venketeswaran (1980) and Rao (1980) had also reported significant variation between varieties in duration upto maturity.

Significant variation among varieties for number of primary branches per plant was observed. Wide variation in number of branches between varieties was reported by many workers such as Jaswal and Gupta (1967), Majundar et al. (1969), Sangha and Sandthu (1970) and Shettar (1974). The variation in this character ranged from 5.5 to 8.

The varietal differences in haulms yield were highly significant in this study. The high variability in this character was reported early by Chandramohan et al. (1967), Basu and Ashokraj (1969) and Kushwaha and Tawar (1973). The highest haulms yield per plant was 91.5 g in RCM 582 and lowest was 20 g in Normal seg DMC.

The varieties differed significantly in pod number/plant. It varied from 2.5 to 39. Variety 68 produced the maximum number of pods and the genotype S-7-12-1 produced the lowest number of pods. The varietal variation seen in the production of pods per plant was also reported by Chandramohan et al. (1967), Basu and Ashokraj (1969), and Sridharan et al. (1980).

Pod weight per plant exhibited high variability among the genotypes. It varied from 2 g to 37 g. Significant differences between varieties in pod yield were reported by a large number of investigators. Maximum yield was obtained in variety 68 and minimum in Marraba runner, No 1022 and S-7-12-1. This much of variability might be due to the difference in the genetic potential of the plant to produce pods.

The varieties showed significant variation for 100 pod weight. In consensus with the present result, differences between varieties in 100 pod weight were recorded by Venkateswaran (1966), Majundar et al. (1969), Dixit et al. (1970), Patel (1978) and Sridharan et al. (1980). In this study 100 pod weight ranged from as low as 48.5 g in Samrala 3 seeded to as high as 167.25 g in RG 363.

Highly significant differences were seen among the varieties with respect to 100 kernel weight. Similar to the present observation, significant differences between varieties in 100 kernel weight were reported by Venkateswaran (1966), Natarajan *et al.* (1978) and Sridharan *et al.* (1980). Hundred kernel weight was maximum in Normal seg DMC b with 73.25 g and minimum in A-5-46 with 23 g.

The differences between varieties in number of kernels/ pod were significant. The variability ranged between 1.05 to 2.95. The highest was recorded by No 2 402-1, NC 17-S, WCG 166 B, 295/63, 75/51 and Indonesia 2. The lowest was recorded by C-179.

Shelling percentage, one of the important economic traits in groundnut, exhibited high significant variability between varieties. The shelling percentage ranged from the minimum of 55.96 in LV 5 to maximum of 91.87 in Indonesia 2. Dixit *et al.* (1970), Khangrua and Sandhu (1973), Kumar and Yadav (1978) and Nigam *et al.* (1980) have also reported wide varietal diversity in shelling percentage.

The studies on correlation have provided information on the nature and extent of relationship of characters among themselves. Significant positive correlation of disease intensity with pod nuumber/plant was obtained in the present study and also disease intensity was significantly and positively correlated with 100 pod weight, 100 kernel weight and shelling percentage. Similar results were reported by Jogloy *et al.* (1987). The results of his study showed that the pod yield, seed yield and shelling percentage were positively correlated with plant susceptibility to disease. These results indicated that pod yield, seed yield and shelling percentage and disease susceptibility genes were associated.

When analysis of covariances was done by taking pod weight/plant as main variable and disease intensity as ancillary variable, disease intensity as main variable and number of primary branches as ancillary variable and disease intensity as main variable and days to maturity ancillary variable, the estimates of regression coefficients were insignificant.

Chiteka et al. (1986) reported that the disease resistance did not appear to be the major factor in yield determination among the genotypes evaluated. But in the present study, when correlation between disease resistance and yield was assessed, the result obtained was not in conformity with the results obtained for many other workers such as Garren and Jackson (1973), Halim et al. (1980), Porter et al. (1982), Shokes et al. (1983) and Knauft et al. (1986).

5.2. Glass house screening

Glass house screening revealed the significant variation among the genotypes, in the case of disease resistance. The days to first incidence of disease ranged from 25 in genotype 58-41 to 29-75 in R-7-47-2 and Virginia bunch large. The appearance of disease through artificial inoculation was inconformity with the reports of Butler (1918). According to Vanderplank (1968) the difference in the time taken for disease incidence of appearance might be due to the difference in the vertical resistance mechanisms operated in the genotypes evaluated. On 45th day Madagascar and P-331 recorded the lowest disease intensity of 17.52 per cent and highest disease intensity 19.25 per cent by the genotype 69-9. But on 90th day C-145-12-P-14 recorded the lowest intensity of 62.83 per cent and Madagascar recorded the highest of 74.99 per cent. Difference in the horizontal resistance mechanisms which operated in the genotypes evaluated might be the cause for such differential responses. This is in agreement with the reports of Vanderplank (1968).

Analysis of variance revealed that there was significant variation between genotypes and 18 groups were found based on the degree of susceptibility to disease.

The present genetic resource evaluation study revealed the absence of suitable source of resistance to tikka disease. In addition to this, assessment on yield attributing characters also has given some basic informations which are of great importance in future programmes for the genetic improvement of this crop.

Summary

SUMMARY

Genetic resource evaluation in groundnut (Arachis hypogaea L.) for resistance to tikka leaf spot was undertaken in the Department of Agricultural Botany, College of Horticulture, Vellanikkara during 1988-89, with a view to select groundnut genotypes resistant to tikka leaf spots and to assess the yield potential of the genotypes.

A field screening of groundnut accessions, using 256 genotypes available in the Department of Agricultural Botany, and a tikka susceptible variety - TMV-2 - as control, was conducted during July-November, 1988, in a randomised block design with two replications. Disease rating was done with the aid of a diagrammatic chart and categorised into different grades, based on the percentage of infection on leaves. The groundnut genotypes were then grouped into different categories viz. immune, highly resistant, resistant, moderate resistant, moderately susceptible, susceptible and highly susceptible.

Twenty five groundnut genotypes with low disease intensity in field conditions combined with high/moderate yield were selected for a glass house screening, where artificial inoculation of the disease was done, and the disease intcensity was estimated as in the field screening study.

The following conclusions were made in the study.

Out of the 257 genotypes used for screening studies, four genotypes were moderately susceptible, 197 susceptible and 56 highly susceptible to tikka leaf spot. None of the varieties was immune, highly resistant or moderately resistant.

In the glass house study, all the twenty five genotypes were found to be susceptible to the disease. The lowest percentage of disease intensity was shown by the genotype C-145-12-P-14 followed by No. 2402-1, AH 62 and Virginia bunch large.

Considering the performance of the genotypes in the field screening and glass house studies; from among the 257 accessions, the genotype C-145-12-P-14 was found to be having comparatively stable and less disease intensity along with moderate yield.

Significantly high variability among the 257 test entries was observed for all the eleven components of yield studied.

Disease intensity showed significant correlation with pod number per plant, shelling percentage, 100 pod weight and 100 kernel weight.

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* Originals not seen

Appendices

APPENDIX I

Mean values for first incidence of disease and the degree of susceptibility to the disease

Type No.	Identity	No.of days taken for the first incidence of disease (days)	Disease intensity on the 45th day (%)	Disease intensity on the 90th day (%)	
1	2	3	4	5	
1	RS 1	32.5	15.96	68.05	S
2	RS 114	32.0	16.66	73.605	S
3	RS 135	26.0	18.74	95.825	HS
4	66-94	33.5	18.04	72.91	S
5	RB-4	32.0	20.82	68.05	S
6	A.H. 7398	31.0	17.35	74.3	S
7	IARI 731	29.0	21.38	90.96	HS
8	69-9	38.5	18.04	60.405	S
9	Big Japan	36.5	16.66	66.66	S
10	IARI 687	33.0	27.76	84.02	HS
11	Barberton	27.5	24.29	89.575	HS
12	Cochin Red	33.5	13.86	70.825	S
13	Koper gaon	36.0	16.66	65.965	S
14	S 7-12-1	29.5	17.35	69.435	S
15	S 7-12-2	35.5	15.27	74.295	S
16	HG 11	34.0	15.96	68.05	S
17	KR 50	29.0	20.13	74.99	S
18	6842	36.0	15.97	63.88	S
19	Castle Carry (Pc)	32.5	16.60	70.83	S
20	K 7-4-11	31.5	17.35	63.88	S
21	K 4-11-2-R	31.5	15.96	70.825	S
22	Samrala-3 seeded	31.0	18.74	74.298	S
23	Talod 32-3	32.0	15.27	70.82	S
24	B 3	34.5	17.35	71.52	S

Contd.

Appendix I. Continued

1	2	3	4	5	
25	C 15	32.50	15.27	63.88	S
26	C 22	34.00	16.66	70.825	S
27	C 38	33.5	16.66	67.495	S
28	C 87	31.0	16.66	70.825	S
29	C 99	33.0	15.97	67.355	S
30	c 114	30.5	20.82	72.905	S
31	C 117	36.5	18.74	63.185	S
32	C 188	33.5	17.35	70.825	S
33	C 125	33.5	17.35	69.435	S
34	C 129	35.0	16.66	66.66	S
35	C-145-12-P-14	35.5	16.66	59.02	MS
36	C-147	37.0	17.35	62.495	S
37	C-151	34.0	18.04	73.605	S
38	C-158	37.0	11.10	61.105	S
39	C-159	31.0	14.58	84.023	HS
40	C-160	34.5	16.66	70.82	S
41	C-175	36.0	19.43	61.8	S
42	C-177	32.5	17.37	74.99	S
43	C-178	33.5	17.35	70.27	S
44	C-179	32.5	14.58	63.88	S
45	C-184	34.0	16.66	70.13	S
46	Tesobunch	34.5	17.35	62.49	S
47	Kanyoma Bunch	36.5	18.74	61.10	S
48	U-4-4-26	32.5	18.04	70.13	S
49	U-2-1-6	35.0	16.66	66.66	S
50	F-7	35.0	16.66	63.19	S
51	F-11	35.5	15.97	67.355	S
52	G-37	36.0	17.35	68.05	S
53	RS-7	34.5	16.66	70.13	S
54	AH 84	33.5	19.44	66.66	S

Contd.

Appendix I. Continued

1	2	3	4	5	
55	AH 262	34.5	16.66	66.66	S
56	AH 731	32.5	19.44	66.65	S
57	AH 6990	32.5	18.04	72.91	S
58	AH 7224	31.5	17.35	75.69	S
59	AH 8045	33.5	16.66	68.05	S
60	AH 8048	32.5	16.66	75.68	S
61	145-12-12	37.0	16.66	64.47	S
62	648-4	34.0	16.66	70.13	S
63	3095	32.0	20.82	79.85	S
64	AH 6950	32.5	15.97	69.43	S
65	AH 7010	33.5	18.04	63.88	S
66	Batani-9	28.0	17.35	86.10	HS
67	Chandodi	28.5	22.21	85.41	HS
68	Changja	33.0	21.52	72.91	S
69	Kalamdi	32.5	23.60	82.63	HS
70	AH 73	29.0	21.51	85.41	HS
71	AH 7154	31.5	22.21	74.99	S
72	AH 7336	27.0	17.35	89.57	HS
73	U-4-4-27	36.0	16.66	63.88	S
74	NG 268	31.0	22.21	76.38	S
75	NG 337	31.5	16.66	69.43	S
76	SS 50	30.5	18.04	79.16	S
77	U-4-4-23	29.5	18.74	94.43	HS
78	U-4-4-29	26.0	20.13	86.79	HS
79	AH 3583	29.5	20.13	83.32	HS
80	AH 259	30.5	18.02	73.60	S
81	U-4-7-24	30.5	18.02	81.24	HS
82	NG 423	32.0	28.29	74.99	S
83	Short-1	33.0	16.66	74.30	S

Contd.

Appendix I. Continued

1	2	3	4	5	
84	EC 6189	28.0	24.99	88.18	HS
85	TG-4	28.0	20.82	84.02	HS
86	U-2-12-1	29.0	20.13	84.71	HS
87	1025	31.0	16.66	77.07	S
88	RS 60	33.0	21.52	70.13	S
89	1-2	38.5	18.74	52.07	MS
90	U-2-24-7	31.5	21.52	84.71	HS
91	U-4-4-16	28.5	20.82	86.10	HS
92	AH 6481-1	29.5	20.13	84.71	HS
93	Normal Seg DMC(a)	30.5	19.43	77.08	S
94	Normal Seg DMC(b)	31.5	16.66	72.21	S
95	Virginia bunch	35.0	19.44	68.05	S
96	AH 62	35.5	18.04	68.74	S
97	AH 4354	30.5	18.04	70.82	S
98	AH 7620	34.5	16.66	70.93	S
99	C-3	31.5	16.66	80.54	HS
100	C-21	35.5	16.66	66.66	S
101	C-29	32.0	17.35	75.68	S
102	C-37	37.5	18.04	63.19	S
103	C-38	35.0	17.35	66.66	S
104	C-41	28.5	12.49	78.46	S
105	C-46	35.0	17.35	66.66	S
106	C-75	32.5	18.04	64.57	S
107	C-100	32.0	16.66	72.21	S
108	C-107	35.5	16.66	66.66	S
109	C-140	32.5	18.74	71.24	S
110	C-145-12	35.5	18.04	62.49	S
111	C-146	33.0	16.66	68.74	S
112	C-152	33.0	15.97	72.21	S
113	C-171	33.0	18.04	72.81	S

Contd.

Appendix I. Continued

1	2	3	4	5	
114	C-175	35.5	17.35	68.05	S
115	C-179	34.0	18.04	68.74	S
116	Castle chery	34.50	15.27	67.35	S
117	K-8-8-1	34.50	16.66	69.22	S
118	Madagascar	33.0	17.35	70.83	S
119	Samrala	35.0	20.13	68.05	S
120	US 73	32.5	15.97	79.16	S
121	USA 69	32.5	18.04	68.74	S
122	UAR 28-2	30.0	16.66	74.99	S
123	1-7	34.0	18.04	65.27	S
124	6-11-6	31.5	14.58	72.21	S
125	40-4	36.0	21.52	66.66	S
126	42-9	36.0	20.82	65.27	S
127	575-2	32.5	18.74	70.82	S
128	DH 3-30	29.5	22.20	81.24	HS
129	Dharwar-I	30.5	14.58	72.21	S
130	Azozorozo	28.5	20.82	88.18	HS
131	Robut 33	31.0	17.35	77.77	S
132	R 7-47-10	30.5	16.66	79.85	S
133	AH. 33-4-1	31.5	15.96	72.21	S
134	E 6919	33.5	16.66	68.02	S
135	C-830	35.0	19.43	62.49	S
136	AH 3849	34.5	17.35	63.18	S
137	Panjab bold	34.5	15.27	63.88	S
138	Kaulikoro	32.0	13.88	70.41	S
139	Kongwa Runner	32.0	15.97	68.74	S
140	IC 22939	27.5	18.74	88.185	HS
141	M-145	32.0	16.66	74.99	S
142	M-755	34.5	18.04	64.58	S

Contd.

Appendix I. Continued

1	2	3	4	5	
143	MD-351	33.50	15.27	62.49	S
144	Mixture	32.5	17.35	74.99	S
145	NG 268	34.5	22.21	65.27	S
146	No 4354	34.0	18.04	68.05	S
147	P 331	35.0	17.35	66.66	S
148	IC 22956	32	15.27	72.49	S
149	PB 71-17	33.5	15.27	66.65	S
150	IC 22945	31.5	18.74	76.38	S
151	R 7-4-5	34	16.66	63.18	S
152	R 7-4-9	36.5	15.97	68.74	S
153	R 7-4-10	31.5	15.97	73.88	S
154	R 7-24-4	32.5	17.35	70.13	S
155	R 7-24-7	33.0	17.35	63.18	S
156	R 7-24-8	34.5	14.58	65.27	S
157	R 7-47-2	34.5	17.35	62.49	S
158	R 7-47-3	32	16.66	70.55	S
159	Southern cross	26.5	21.52	86.10	HS
160	Rosado	27	25.68	90.96	HS
161	RCM 525	27	19.44	87.995	HS
162	San 92	34.5	20.13	64.225	S
163	NCAC 17840	29.5	17.35	77.77	S
164	NCAC 17287	32.5	17.35	70.825	S
165	4518	34.5	16.66	66.66	S
166	Florigiant	29.0	27.76	79.16	S
167	Mwitunde	35.5	15.97	63.18	S
168	Early runner	32.0	22.90	79.85	S
169	Spanhoma	30.5	19.43	79.85	S
170	A-5-46	32.0	19.43	74.99	S
171	C-12-P-28	34.5	17.35	65.96	S

Contd.

Appendix I. Continued

1	2	3	4	5	
172	No 1022	34.5	16.66	65.27	S
173	No 2402-1	38.0	15.27	58.32	MS
174	AH 7787	31.0	15.97	73.05	S
175	Florispan	34.5	17.35	66.66	S
176	F 1-5-1	34.0	22.35	73.60	S
177	Go 133	29.5	19.43	84.02	HS
178	US 29	27.5	20.83	92.35	HS
179	20-1-2	28.5	20.13	86.80	HS
180	AH 816	32.5	16.66	77.07	S
181	AH 7846	28	21.52	91.66	HS
182	AH 8318	31	18.74	77.07	S
183	AH 62	32.5	16.66	58.995	MS
184	HC 234	27.0	22.21	89.57	HS
185	NCAC 10477 B	34.0	15.97	68.05	S
186	NC 17-S	33.5	17.35	70.13	S
187	Span Cross	30.0	20.82	31.935	HS
188	NCAC 434	32.5	23.59	73.66	S
189	B-27	32	15.97	70.135	S
190	Local spreading	32	18.04	75.69	S
191	43 G 44	32	20.13	77.77	S
192	Rabat No.3	29.5	18.73	83.32	HS
193	WCG 166 B	32.5	20.12	90.27	HS
194	NCAC 17615	29.5	15.96	79.16	S
195	NCAC 17649	34.5	17.35	69.44	S
196	Sam Col 303	33	19.43	74.30	S
197	Bambey 487	30.0	15.96	81.24	HS
198	Mwitunde Nachigwea	32.0	18.74	75.69	S
199	Sam Col 86	30.5	24.29	79.855	S
200	Virginia bunch large	37.5	15.27	61.10	S

Contd.

Appendix I. Contined

I	2	3	4	5	
201	Japanese	28.5	22.21	86.10	HS
202	Sam Col 217	36.0	16.66	62.47	S
203	Sam Col 232	35.0	15.96	63.18	S
204	NCAC 17659	30.0	22.20	84.71	HS
205	NCAC 17562	32.0	14.57	72.91	S
206	NCAC 17705	30.5	27.74	79.15	S
207	2/1	34.5	20.13	72.21	S
208	NCAC 17606	35.5	21.63	67.35	S
209	295/63	31.0	24.98	80.55	HS
210	308/75	35.0	15.27	67.35	S
211	311/63	29.0	20.10	81.24	HS
212	404/64	32.0	16.66	72.91	S
213	L.V-5	28.5	19.43	87.49	HS
214	RCM 582	33.5	16.66	72.91	S
215	Perdeniya	29	20.12	81.94	HS
216	M 1075-74(2)	33.5	18.04	70.82	S
217	M-6-76 M	34.5	16.65	68.74	S
218	Marabba Runner	36.0	16.65	61.8	S
219	Variety 68	31.0	19.43	81.93	HS
220	NCAC 17644	25.5	18.73	90.96	HS
221	NCAC 17690	33.0	21.63	72.91	S
222	NCAC 17754	32.5	22.65	72.21	S
223	M-145-75-5	35.0	14.57	63.88	S
224	Hung-Mein Chao	33	18.73	71.52	S
225	URR 352	33	19.43	72.21	S
226	URR 365	29	22.21	90.27	HS
227	Cord willow	35	16.66	69.44	S
228	NCAC 17718	29	19.43	74.30	S
229	U.F. 71513	29.5	21.51	81.94	HS

Contd.

Appendix I. Continued

1	2	3	4	5	
230	F-1-17	34	17.35	81.94	HS
231	NCAC 17780	31.5	18.045	73.60	S
232	NCAC 17864	31.5	31.23	75.69	S
233	Magale-1	34	16.66	72.215	S
234	NCAC 17591	36	13.87	62.49	S
235	AM-2	35	20.82	65.96	S
236	Luwingu	30.5	20.82	77.07	S
237	NCAC 403	27.5	20.12	88.19	HS
238	NC-10468	31.5	16.66	72.21	S
239	NC-10452	33.0	17.35	71.52	S
240	NC-90854	34.0	18.04	66.65	S
241	NC-7497	35.5	18.04	62.49	S
242	NC-9085-S	29.5	19.43	81.94	HS
243	NC-6720	33.0	17.35	65.27	S
244	RG-363	33.5	19.43	71.52	S
245	ZM-837	31.5	17.35	76.38	S
246	58-41	31.0	15.27	68.05	S
247	75-74	28.0	24.29	85.41	HS
248	59-348	28.5	22.21	91.66	HS
249	75-51	29.5	17.35	80.54	HS
250	63-106	33.5	18.04	70.82	S
251	PR 5290	26.0	23.59	92.35	HS
252	VRR 546	29.5	13.88	65.96	S
253	VRR 766	31.5	17.35	66.63	S
254	DSA 200	28	16.65	81.94	HS
255	G 397-1	31	18.74	73.60	S
256	Indonesia-2	29	21.51	84.02	HS
257	TMV 2	28.5	18.04	80.55	HS

MS - Moderately susceptible
S - Susceptible
HS - Highly susceptible

APPENDIX II

Mean values for yield attributing characters in 257 groundnut genotypes

Type No.	Identity	Days to first flowering (days)	Days to 50% flowering (days)	Days to maturity (days)	No. of primary branches	Plant haulms yield (g)	No. of pods/ plant	Pod weight per plant (g)	100 pod weight (g)	100 kernels weight (g)	No. of kernels per pod	Shellin percent-age
1	2	3	4	5	6	7	8	9	10	11	12	13
1	RS 1	38.0	45.0	140.0	6.0	31.0	15.0	14.5	95.00	46.75	1.75	86.38
2	RS 114	31.0	34.5	109.0	6.5	35.5	4.0	3.0	65.50	34.00	1.45	78.49
3	RS 135	30.0	33.0	107.0	7.0	35.5	4.0	3.0	75.25	28.50	1.35	79.33
4	66-94	26.0	28.5	130.0	7.0	44.5	12.0	11.5	119.50	48.00	2.00	81.59
5	RB-4	30.5	34.5	136.0	6.0	33.0	11.5	10.5	101.75	48.25	1.80	84.23
6	AH 7398	31.0	34.0	103.0	8.0	32.5	12.0	11.5	90.50	35.25	1.80	71.27
7	IARI 731	28.5	30.5	128.0	7.5	50.5	4.0	3.5	81.00	45.00	1.95	80.27
8	69-9	26.0	31.0	130.0	6.5	26.0	5.5	4.0	84.25	39.25	2.00	80.36
9	Big Japan	25.5	30.5	126.0	6.5	38.5	7.0	6.0	112.50	45.00	1.90	72.41
10	IARI 687	35.5	41.5	111.0	7.5	29.0	7.5	6.5	107.50	48.00	1.80	76.27
11	Barberton	26.5	29.0	108.0	8.0	50.0	9.5	6.0	71.50	43.50	1.95	69.27
12	Cochin Red	31.0	33.5	135.0	7.5	44.5	7.0	6.5	97.25	48.25	1.9	84.55
13	Kopergaon	38.0	44.5	140.0	8.0	84.0	9.5	8.5	68.25	30.50	1.60	60.33
14	S-7-12-1	26.0	30.5	128.0	6.5	40.0	2.5	2.0	86.75	38.25	1.90	84.98

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
15	S-7-2-2	26.5	28.5	136.0	7.5	86.5	18.0	16.0	97.25	46.25	1.65	78.17
16	HG 11	38.0	43.0	140.0	7.0	30.0	7.0	6.0	91.75	42.75	2.00	79.78
17	KR 50	28.0	31.5	128.0	6.0	24.5	10.0	8.5	49.90	41.75	1.20	86.82
18	6842	24.5	28.5	134.0	7.5	42.5	12.5	12.0	133.00	54.25	2.00	83.46
19	Castle Carry (PC)	24.0	28.0	132.0	6.0	28.5	10.0	8.0	121.75	49.25	1.95	74.90
20	K-7-4-11	37.5	43.0	140.0	6.5	54.5	10.0	9.0	127.75	43.00	2.85	85.88
21	K-4-11-2 R	35.0	41.5	138.5	7.0	48.0	8.5	8.0	111.25	46.75	1.80	78.82
22	Samrala-3 seeded	36.5	42.5	128.0	7.0	44.0	8.5	7.5	48.50	42.25	1.10	85.44
23	Talod 32-3	36.0	40.5	136.0	7.5	51.0	10.5	9.5	73.25	38.25	1.90	79.44
24	B 3	35.5	38.5	134.0	7.0	50.1	15.5	12.5	121.25	51.00	1.95	74.79
25	C 15	36.5	39.5	132.0	8.0	79.0	6.0	6.0	97.00	45.25	1.90	78.89
26	C 22	25.0	27.0	128.0	8.0	43.5	6.5	6.0	83.75	47.75	1.80	73.65
27	C 38	22.5	27.5	130.0	7.5	30.0	9.5	7.5	129.25	59.75	2.00	70.15
28	C 87	35.5	40.5	136.0	6.5	33.5	13.0	11.5	108.75	51.75	1.85	80.64
29	C 99	37.0	39.5	137.0	7.0	37.0	7.5	6.0	97.00	43.00	1.90	64.96
30	C 114	33.5	40.5	128.0	7.0	33.5	14.0	11.5	131.75	53.25	1.95	73.00
31	C 117	33.5	40.5	142.0	7.0	33.5	12.0	10.5	63.75	41.25	1.75	71.61
32	C 118	34.0	41.5	146.0	8.0	47.5	16.0	14.5	78.50	42.25	1.65	79.61

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
33	C 125	35.5	43.5	136.0	7.5	34.5	10.5	10.0	120.75	48.75	1.90	72.62
34	C 129	37.5	44.5	138.0	6.5	38.5	9.5	9.0	100.25	38.75	2.00	72.49
35	C-145-12-P-14	36.5	41.5	136.0	7.0	43.0	19.5	17.0	113.00	44.50	1.95	70.22
36	C 147	36.0	39.5	136.0	6.5	32.5	9.5	8.0	112.5	56.25	1.85	68.89
37	C 151	26.0	37.5	138.0	8.0	55.0	13.0	11.0	65.25	28.75	1.55	74.23
38	C 158	38.5	44.5	139.0	6.0	34.0	8.0	7.0	94.25	41.25	1.85	88.83
39	C 159	29.0	32.5	136.0	6.0	26.0	6.5	5.5	80.25	37.25	1.95	80.34
40	C 160	30.5	36.5	132.0	6.5	29.0	3.5	3.0	65.25	31.50	1.80	78.48
41	C 175	25.5	29.5	132.0	7.5	40.0	8.5	9.0	69.00	28.00	1.80	78.83
42	C 177	24.5	30.5	128.0	7.0	31.5	10.0	8.5	83.75	48.25	1.90	87.42
43	C 178	23.5	27.5	132.0	8.0	43.5	15.0	13.0	97.00	47.50	2.00	88.59
44	C 179	36.5	41.5	134.0	7.0	64.5	8.5	7.5	107.75	41.75	1.95	81.39
45	C 184	28.5	30.5	134.0	7.0	25.5	10.0	8.5	71.75	31.00	1.50	88.53
46	Teso bunch	35.5	40.5	126.0	6.5	27.5	6.5	5.5	91.00	43.75	1.75	85.07
47	Kanyoma Bunch	36.0	39.5	136.0	7.0	51.0	6.0	5.5	130.75	54.75	1.95	73.29
48	U-4-4-26	35.0	38.5	140.0	7.5	37.0	10.0	8.5	87.00	37.25	2.00	80.92
49	U-2-1-6	36.0	40.5	136.0	8.0	59.5	17.5	16.0	131.75	48.75	2.85	81.37
50	F 7	35.5	38.5	137.5	7.0	42.0	11.5	11.0	118.00	51.50	2.00	69.79

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
51	F 11	34.0	39.5	144.0	6.5	27.5	6.5	5.5	65.50	29.00	1.80	78.64
52	G 37	35.5	39.5	134.0	7.0	74.5	10.5	8.0	93.00	43.75	1.75	87.64
53	RS-7	34.5	39.5	136.0	6.0	44.5	4.0	4.0	95.75	45.00	1.75	65.44
54	AH 84	35.0	39.5	136.0	7.0	29.5	9.0	8.0	83.75	39.75	1.90	76.05
55	AH 262	29.5	34.5	136.0	6.5	37.0	7.0	5.5	64.25	28.75	1.95	71.33
56	AH 731	35.0	40.5	132.0	7.5	27.5	12.0	12.5	98.14	49.25	1.95	74.81
57	AH 6990	36.0	40.0	136.5	8.0	39.5	11.5	10.5	73.25	54.00	1.75	71.96
58	AH 7224	32.5	37.5	139.5	6.5	29.0	11.5	10.0	98.75	43.25	2.00	81.22
59	AH 8045	37.0	40.0	138.0	7.0	36.0	12.0	10.0	112.25	47.00	2.00	78.55
60	AH 8048	38.5	44.5	138.0	7.0	62.5	12.0	11.0	119.25	49.00	1.90	79.13
61	145-12-12	37.0	40.5	136.0	6.5	43.0	10.0	8.5	62.75	27.75	1.70	76.80
62	648-4	36.5	39.5	134.0	7.5	33.0	12.0	11.0	77.75	29.25	1.75	61.43
63	3095	35.0	38.5	134.0	8.0	64.0	13.0	11.5	124.50	37.00	1.85	59.01
64	AH 6950	39.0	39.5	140.5	6.5	40.0	8.5	8.0	127.25	31.75	2.00	62.55
65	AH 7010	28.5	30.0	140.0	7.5	48.5	15.0	15.0	150.75	54.50	1.95	81.89
66	Batani-9	29.0	32.0	111.0	6.0	36.0	9.0	8.5	55.00	24.79	1.95	75.05
67	Chandodi	30.0	34.5	103.0	6.0	39.5	8.5	8.0	73.75	34.00	1.75	80.96
68	Changja	36.0	40.5	140.0	7.5	57.5	9.5	9.0	110.25	38.00	1.85	66.31

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
69	Kalamdi	31.0	34.5	105.0	6.0	41.0	6.0	4.0	95.50	41.25	1.90	83.77
70	AH 73	33.5	36.5	105.0	7.5	56.0	19.0	17.0	85.00	48.75	1.85	82.47
71	AH 7154	30.5	34.5	132.0	6.0	40.5	5.0	3.5	100.00	63.75	1.70	76.89
72	AH 7336	32.5	39.0	103.0	6.5	44.0	10.5	9.5	112.25	53.25	1.85	82.18
73	U-4-4-27	34.0	39.5	109.0	7.0	43.5	7.0	7.0	74.25	38.25	1.90	74.99
74	NG 268	30.0	34.5	111.0	7.0	26.5	3.5	3.0	85.50	34.75	1.95	75.38
75	NG 337	38.0	43.5	107.0	7.0	33.5	28.5	24.5	78.75	29.00	1.95	63.06
76	SS 50	33.0	39.5	107.0	6.0	53.0	10.0	7.5	65.00	31.50	1.95	88.37
77	U-4-4-23	37.0	41.5	113.0	6.5	53.0	8.5	6.0	74.25	29.5	2.00	68.24
78	U-4-4-29	37.0	42.5	117.0	6.5	29.0	7.5	5.5	113.25	64.00	1.90	75.22
79	AH 3583	33.0	38.5	116.0	6.0	43.5	4.0	3.0	98.00	46.00	1.65	83.59
80	AH 259	27.0	35.5	128.0	6.0	25.0	6.5	4.5	64.25	24.25	2.00	77.62
81	U-4-7-24	30.5	34.5	107.0	6.0	28.0	6.0	4.5	87.75	32.50	2.00	69.17
82	NG 423	37.0	40.5	103.0	7.0	52.0	21.0	17.0	110.75	49.25	1.95	62.67
83	Short-1	28.0	34.5	99.5	7.0	39.5	14.0	12.5	116.75	47.00	1.80	65.24
84	EC 6189	33.0	42.5	140.0	6.0	59.0	6.5	4.0	106.00	49.75	1.85	76.89
85	TG 4	37.0	42.5	103.0	7.0	23.0	5.0	4.5	112.75	45.00	1.90	77.78
86	U-2-12-1	31.0	36.5	111.0	7.0	43.5	8.5	7.5	85.00	38.00	1.50	65.65

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
87	1025	35.5	39.0	111.0	8.0	71.5	37.0	35.0	100.00	45.75	1.95	86.49
88	RS 60	37.0	40.5	113.0	7.5	42.5	14.0	12.5	85.75	38.25	1.55	71.96
89	1-2	37.5	41.5	138.0	4.5	26.0	5.0	4.0	141.50	57.00	1.90	77.67
90	U-2-24-7	38.0	43.5	111.0	7.0	61.5	8.0	6.0	87.00	34.25	1.75	82.18
91	U-4-4-16	37.5	40.0	109.5	8.0	38.5	13.5	12.5	112.25	53.25	1.85	82.69
92	AH 6481-1	34.0	37.5	111.5	6.5	33.5	7.5	6.0	81.25	47.75	1.75	78.41
93	Normal Seg DMC (a)	36.5	39.0	136.0	6.5	20.0	11.5	10.5	141.25	61.50	1.80	64.19
94	Normal Seg DMC (b)	36.0	41.0	138.0	6.5	42.0	13.0	12.0	125.75	73.25	1.90	70.92
95	Virginia bunch	36.0	41.5	136.0	6.0	34.0	11.0	9.0	88.25	42.00	1.90	80.67
96	AH 62	37.0	40.5	146.0	6.0	33.0	6.5	6.0	87.75	34.25	1.90	64.32
97	AH 4354	35.0	40.0	144.0	7.0	44.0	7.0	5.5	99.25	47.25	1.75	75.28
98	AH 7620	35.0	39.0	134.0	7.5	46.5	15.5	14.0	111.75	40.75	2.85	86.54
99	C-3	38.0	44.5	144.0	7.5	47.5	13.5	11.5	142.75	63.75	1.85	83.86
100	C-21	33.5	37.0	146.0	8.0	40.5	18.5	16.5	135.25	49.25	2.00	76.68
101	C-29	32.5	37.5	138.0	6.0	35.5	4.0	4.0	116.25	51.50	1.75	74.54
102	C-37	36.0	39.5	140.0	6.5	22.5	7.5	7.0	124.00	48.75	1.95	71.26
102	C-38	38.0	41.0	138.0	6.0	27.0	8.5	6.5	132.75	63.25	2.00	85.49
104	C-41	37.5	42.5	136.0	6.0	38.5	5.5	5.0	131.25	40.25	1.95	74.04

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
105	C-46	34.0	40.5	136.0	7.0	32.5	12.5	11.5	106.25	44.25	1.90	66.98
106	C-75	35.5	39.5	138.0	7.0	32.0	9.0	7.0	103.00	46.00	1.80	79.65
107	C-100	35.5	39.0	134.0	7.0	33.5	5.0	3.0	67.00	37.75	1.70	77.5
108	C-107	36.0	40.5	138.5	6.5	42.5	4.5	4.0	102.25	40.00	1.95	71.58
109	C-140	37.0	40.0	136.0	8.0	49.5	20.5	18.0	71.00	29.25	1.85	60.55
110	C-145-12	38.0	43.5	140.0	7.0	34.0	3.5	3.5	141.75	47.73	1.75	83.39
111	C-146	35.0	43.5	132.0	6.0	34.0	8.0	7.5	68.75	25.25	1.90	63.97
112	C-152	32.0	38.0	130.0	7.0	23.5	11.0	10.0	104.00	49.75	1.85	76.81
113	C-171	29.5	36.0	138.0	6.5	37.0	15.5	15.0	83.75	43.00	1.95	83.83
114	C-175	35.0	39.0	136.0	6.5	41.5	10.0	9.0	91.25	47.00	1.05	62.67
115	C-179	38.0	42.5	140.0	7.0	47.0	7.0	6.5	102.00	44.00	1.45	82.82
116	Castle chery	37.5	41.0	138.0	6.0	26.5	10.0	3.5	111.00	50.25	1.80	82.00
117	K-8-8-1	37.0	45.5	136.0	7.0	29.0	12.0	11.5	86.50	38.50	1.75	73.41
118	Madagascar	37.5	43.0	142.0	7.0	34.0	31.0	27.0	85.25	42.00	1.75	77.69
119	Samrala	36.0	41.5	144.0	6.5	43.0	10.5	9.5	92.75	41.25	2.00	80.16
120	US 73	36.5	40.0	136.0	6.0	22.5	9.5	7.5	111.00	51.75	1.90	81.90
121	USA 69	35.5	40.5	136.0	6.0	50.5	6.5	4.5	91.25	38.25	1.95	80.22
122	UAR 28-2	36.5	39.0	142.0	7.0	33.0	15.5	14.5	106.25	43.50	1.95	70.75

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
123	1-7	39.0	39.0	140.0	6.0	34.0	6.5	4.5	65.00	26.25	1.15	70.5
124	6-11-6	37.5	40.5	136.0	7.0	77.5	16.0	14.5	118.75	44.25	1.90	81.03
125	40-4	36.5	42.0	142.0	7.0	48.5	13.0	11.5	110.00	48.00	1.95	68.04
126	42-9	37.0	41.0	134.0	8.0	34.5	17.0	15.0	122.25	42.75	2.85	82.79
127	575-2	31.0	36.0	136.0	7.5	50.5	9.5	9.5	108.25	46.75	2.00	81.95
128	DH-3-30	29.5	37.5	111.0	6.0	30.5	13.5	13.5	132.75	51.00	1.80	69.82
129	Dharwar-1	30.5	34.0	107.0	8.0	45.5	14.0	13.0	128.00	52.25	1.95	65.24
130	Azozorozo	39.0	46.5	110.0	6.0	26.0	9.5	7.5	99.00	42.50	1.70	63.46
131	Robut-33	27.5	34.0	107.0	6.5	37.5	6.0	5.0	93.25	47.00	1.45	85.12
132	R 7-47-10	35.5	38.5	107.5	6.5	48.0	12.5	11.5	100.25	49.25	1.55	69.44
133	AH 33-4-1	37.0	39.0	144.0	6.0	40.5	10.0	9.0	94.25	40.25	1.65	67.55
134	E 6919	38.5	44.0	140.0	6.0	21.0	9.0	7.5	113.00	47.25	1.95	82.65
135	C-830	36.5	40.0	140.0	6.5	27.5	11.5	10.0	86.75	43.00	1.85	87.85
136	AH 3849	36.5	39.5	134.0	7.0	35.0	8.0	6.5	97.00	45.55	1.60	81.96
137	Panjab bold	35.5	38.0	142.0	6.5	39.5	12.5	11.5	96.75	46.75	1.80	79.78
138	Kaulikoro	36.5	41.0	132.0	6.5	30.5	13.5	12.5	85.00	31.75	1.95	78.80
139	Kongwa Runner	36.5	42.5	132.0	6.5	39.5	6.0	5.5	98.50	47.00	1.95	84.69
140	IC 22939	29.5	33.5	134.0	7.5	42.0	12.5	11.5	131.25	39.75	1.95	73.90
141	M-145	38.0	43.5	134.0	7.0	25.0	8.0	7.5	91.00	42.25	1.75	85.07
142	M-755	35.0	39.0	142.0	8.0	38.5	20.0	18.5	145.50	52.75	1.90	73.82

Contd.

Appendix II. Continued

1	2	3	4	5	6	7 8	8	9	10	11	12	13
143	MD-351	37.0	40.0	138.0	7.5	34.5	21.0	18.0	67.25	28.00	1.95	82.83
144	Mixture	36.0	41.5	136.0	7.0	37.5	14.5	13.5	87.75	32.25	1.70	77.15
145	NG 268	31.0	37.5	134.0	6.5	28.0	10.0	9.0	111.75	46.00	1.90	77.59
146	No 4354	31.5	35.5	140.0	6.5	31.0	9.5	10.0	142.00	42.50	2.90	84.45
147	P 331	32.5	38.5	134.0	6.5	35.0	9.5	9.5	130.25	47.75	2.85	81.92
148	IC 22956	38.0	40.5	132.0	6.0	26.5	8.0	6.0	62.75	29.75	1.95	85.57
149	PB 71-17	37.0	41.0	134.0	6.5	36.0	11.5	10.5	125.25	56.75	1.95	80.81
150	IC 22945	35.0	36.0	144.0	7.0	48.5	11.5	11.0	110.75	42.25	1.90	73.28
151	R-7-4-5	24.5	32.5	136.0	7.0	40.5	9.0	9.0	94.00	37.75	1.70	75.93
152	R-7-4-9	28.0	32.5	134.0	6.5	30.0	10.5	8.5	72.00	34.25	1.95	86.00
153	R-7-4-10	37.5	43.0	132.0	7.0	38.5	8.0	7.5	71.00	29.25	1.75	60.55
154	R-7-24-4	37.0	40.0	142.0	6.5	25.5	13.0	11.5	96.25	44.25	1.80	73.44
155	R-7-24-7	30.0	34.5	142.0	6.5	35.5	10.0	9.0	92.00	41.25	1.85	84.16
156	R-7-24-8	33.5	35.5	136.0	6.0	31.0	10.5	9.0	111.00	45.50	1.95	66.51
157	R-7-47-2	34.5	39.0-	136.0	7.0	29.5	12.0	11.0	107.75	53.00	1.90	74.88
158	R-7-47-3	34.0	38.0	138.0	6.0	34.5	10.5	10.0	130.00	47.50	1.70	66.53
159	Southern cross	37.0	41.0	107.0	6.5	61.0	30.5	25.5	139.00	43.75	2.85	80.14
160	Rosado	27.5	30.5	105.0	6.0	40.5	6.5	6.0	68.00	32.75	2.00	84.54
161	RCM 525	37.0	41.0	105.0	6.0	38.0	7.5	6.5	111.25	52.00	1.95	82.43

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
162	San 92	35.0	39.0	144.0	6.5	40.5	12.0	11.0	69.25	31.25	1.85	81.88
163	NCAC 17840	37.5	41.5	136.0	7.0	50.5	5.5	5.0	98.75	42.00	1.90	84.26
164	NCAC 17287	34.0	40.00	130.0	6.5	35.5	12.0	11.5	163.00	52.75	1.70	71.99
165	4518	31.5	36.5	144.0	5.5	29.5	12.5	10.5	125.25	48.75	1.55	72.80
166	Florigiant	31.0	39.0	128.0	6.0	40.5	15.5	14.5	99.75	44.25	1.95	81.90
167	Mwitunde	37.5	40.0	134.0	6.5	45.0	10.0	10.0	95.50	40.75	1.85	84.81
168	Early runner	36.5	41.0	107.0	7.0	42.5	12.5	11.5	84.00	39.00	2.00	87.43
169	Spanhoma	37.0	40.0	111.0	6.0	35.5	4.5	3.5	79.00	34.25	1.95	82.27
170	A-5-46	35.0	39.0	105.0	8.0	78.5	17.5	16.5	88.75	23.75	1.95	83.03
171	C-12-P-28	34.5	39.5	142.0	7.5	66.5	19.0	17.0	58.00	23.00	1.95	81.87
172	No 1022	36.5	40.5	142.0	6.0	36.5	3.5	2.5	125.00	42.00	1.90	70.79
173	No 2402-1	37.5	39.0	142.0	6.5	43.0	12.5	10.5	142.75	53.00	2.95	85.27
174	AH 7787	31.5	37.5	136.0	7.0	42.5	7.0	5.0	109.00	41.25	1.85	79.25
175	Florispan	33.0	38.0	134.0	7.5	57.5	28.0	24.5	97.00	40.75	1.70	82.49
176	F 1-5-1	28.0	34.0	105.0	7.0	32.0	8.5	5.5	73.75	40.75	2.00	71.45
177	GO 133	31.5	36.5	107.0	7.0	26.5	12.0	9.5	76.75	39.25	1.85	68.61
178	GS 29	29.5	35.5	101.0	6.5	35.5	17.0	14.5	111.25	46.75	1.85	82.45
179	20-1-2	38.0	42.5	107.0	6.0	27.5	5.5	5.0	123.00	44.00	2.00	73.68
180	AH-816	34.5	39.0	105.0	7.5	45.5	13.0	11.5	93.50	34.00	1.70	61.47
181	AH 7846	31.5	36.5	103.0	7.0	35.5	8.5	7.0	94.25	43.00	1.50	75.32

Contd.

‹ II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
182	AH 8318	38.0	42.5	113.0	7.5	52.5	11.5	11.0	70.25	31.50	2.00	68.36
183	AH 62	37.5	41.5	146.0	7.0	42.0	7.5	6.0	105.00	45.50	2.00	84.68
184	HC 234	27.5	32.5	105.0	6.0	25.0	8.0	7.0	111.25	47.75	1.55	77.92
185	NCAC 10477-B	35.5	38.5	140.0	6.0	33.0	11.0	10.5	163.50	64.00	1.80	77.97
186	NC 17-S	31.0	35.5	142.0	6.5	32.0	7.0	5.5	123.50	41.75	2.95	86.63
187	Span Cross	36.0	39.0	105.0	7.0	50.5	4.5	4.0	107.75	41.75	1.95	81.39
188	NCAC 434	36.0	38.5	107.0	6.5	30.0	11.0	10.0	73.25	31.25	1.95	81.50
189	B-27	36.0	40.5	132.0	7.0	51.0	8.5	9.0	101.00	45.25	1.90	79.10
190	Local spreading	37.5	38.5	132.0	8.0	67.0	9.0	8.5	134.00	53.00	1.70	65.36
191	43 G 44	37.5	42.5	140.0	8.0	42.5	8.0	6.5	105.00	47.75	1.85	82.30
192	Rabat No.3	30.5	35.5	105.0	7.5	30.5	12.5	12.0	95.25	41.75	1.60	79.56
193	WCG 166 B	39.0	43.5	109.0	6.5	26.0	5.0	4.0	137.75	42.00	2.95	86.54
194	NCAC-17615	36.5	39.5	138.0	6.0	31.0	8.0	7.5	74.50	32.75	2.00	84.45
195	NCAC-17649	37.5	40.0	142.0	7.0	41.0	11.0	10.5	100.00	44.50	1.85	65.33
196	Sam Col 303	28.5	31.5	128.0	8.0	51.0	19.0	18.0	96.75	38.00	1.85	74.47
197	Bambey 487	37.5	40.5	138.0	8.0	44.0	13.0	12.0	149.75	48.50	1.90	66.77
198	Mwitunde Nahcigwea	34.5	39.0	136.0	7.0	29.5	6.5	5.5	111.00	51.75	2.00	69.83
199	Sam Col 86	31.0	36.5	103.0	7.0	44.0	6.5	6.0	72.00	34.25	1.70	86.00
200	Virginia bunch large	38.5	43.5	140.0	7.0	30.5	11.0	10.0	95.25	42.00	1.95	83.68
201	Japanese	37.0	41.5	132.0	6.0	22.0	17.0	15.0	87.50	42.25	1.80	82.34

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
202	Sam Col 217	32.0	34.5	136.0	7.5	53.5	9.5	7.5	113.00	53.75	2.00	79.22
203	Sam Col 232	37.0	38.5	138.0	6.0	27.5	13.0	12.5	136.00	63.75	1.90	76.81
204	NCAC 17659	34.5	37.5	136.0	7.5	50.0	14.5	13.5	86.00	44.25	1.75	83.74
205	NCAC 17562	36.5	39.0	142.0	7.0	52.5	12.0	11.0	63.00	28.25	1.75	81.02
206	NCAC 17705	36.5	38.0	136.0	6.0	30.5	10.5	8.5	101.25	52.50	1.95	86.15
207	2/1	36.5	38.5	134.0	6.5	41.5	9.5	7.0	113.00	44.25	1.95	71.54
208	NCAC 17606	36.5	39.0	136.0	6.0	32.0	4.5	3.5	85.25	46.00	1.80	85.28
209	295/63	38.5	32.5	107.0	7.0	53.0	7.0	5.5	113.00	39.25	2.95	81.41
210	308/75	29.0	31.5	134.0	6.0	43.0	14.0	13.0	112.00	42.25	1.90	66.06
211	311/63	32.5	34.5	105.0	6.0	41.5	8.0	5.5	122.25	44.25	1.70	59.03
212	404/64	36.0	40.5	103.0	6.5	45.5	14.0	12.5	104.25	39.25	1.90	77.88
213	L.V - 5	35.5	39.0	130.0	6.0	32.0	5.5	4.0	146.75	56.25	1.95	55.96
214	R.C.M. 582	31.0	36.0	101.0	7.5	91.5	14.5	13.5	69.25	27.25	2.00	73.91
215	Perdeniya	28.0	32.0	101.0	7.0	28.5	13.0	12.5	72.75	48.25	1.15	71.73
216	M 1075-74(2)	37.5	42.5	144.0	7.5	33.5	18.0	15.3	136.00	64.75	2.00	80.37
217	M-6-76 M	37.5	43.0	130.0	6.5	24.0	18.5	17.0	93.00	45.25	1.90	81.18
218	Marabha Runner	37.0	41.5	134.0	6.0	45.5	3.5	2.0	75.75	35.50	1.90	77.82
219	Variety 68	32.0	37.5	132.0	8.0	78.0	39.0	37.0	102.75	46.75	1.90	72.16
220	NCAC 17644	35.0	38.0	142.0	7.0	29.0	8.5	6.5	107.00	47.00	1.90	80.48
221	NCAC 17690	36.0	39.0	136.0	6.5	37.0	10.0	8.5	71.75	39.25	1.95	70.31

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
222	NCAC 17754	36.5	39.5	134.0	7.0	42.5	17.5	14.5	84.75	40.50	1.75	74.10
223	M-145-75-5	37.0	41.5	138.0	7.0	56.5	11.5	9.0	111.75	42.25	1.80	74.54
224	Hung-Mein Chao	36.5	40.0	105.5	6.0	34.0	6.5	4.0	142.00	62.00	1.75	85.20
225	VRR 352	30.5	35.5	101.0	7.5	41.0	17.5	15.0	63.75	33.00	1.95	85.17
226	VRR 365	33.0	37.0	103.0	8.0	39.0	15.5	14.0	78.50	42.75	1.80	82.72
227	Cord Willow	35.5	38.0	132.0	7.5	52.5	14.0	12.5	141.75	60.75	1.95	75.26
228	NCAC 17718	36.5	40.5	138.0	7.5	56.5	19.5	16.0	68.25	41.75	2.00	62.47
229	U.F. 71513	30.5	32.5	109.0	7.0	40.0	8.0	7.0	71.75	44.00	1.95	69.24
230	F-1-17	36.0	38.0	132.0	6.0	23.5	5.5	5.0	131.00	54.25	1.90	74.71
231	NCAC-17780	35.0	38.5	136.0	6.0	24.0	13.5	12.0	134.00	53.00	1.70	65.36
232	NCAC-17864	29.0	31.5	126.0	6.0	21.0	6.5	5.0	63.00	27.00	1.75	76.81
233	Magale-1	36.0	39.5	109.0	8.0	81.5	20.5	19.0	90.00	43.00	1.95	82.68
234	NCAC-17591	35.5	38.5	142.0	6.5	23.5	11.5	10.5	104.25	39.25	1.90	77.88
235	AM-2	34.0	38.0	142.0	6.5	30.0	12.0	10.0	73.00	44.25	1.85	88.72
236	Luwingu	35.5	37.5	136.0	7.0	54.5	7.5	7.0	111.00	49.25	1.15	82.82
237	NCAC 403	28.5	34.0	105.0	6.5	45.0	13.0	9.5	111.25	47.75	1.55	77.92
238	NC 10468	30.5	32.5	142.0	8.0	54.0	13.0	11.0	111.25	52.00	1.95	82.43
239	NC 10452	30.5	33.5	134.0	7.5	44.0	6.5	5.5	151.25	85.00	1.80	70.52
240	NC 90854	34.0	35.5	130.0	7.0	50.0	18.0	17.0	128.75	54.75	2.00	71.59
241	NC 7497	38.0	41.5	138.0	7.0	36.5	9.0	8.5	153.75	62.75	1.90	81.75

Contd.

Appendix II. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13
242	NC 9085-S	30.5	33.5	132.0	7.0	31.5	10.0	9.0	157.5	45.00	1.90	79.05
243	NC 6720	37.0	42.5	138.0	7.5	60.5	11.5	10.0	111.00	61.00	2.00	87.78
244	RG 363	34.5	39.0	134.0	7.5	54.5	10.0	9.5	167.25	64.00	1.70	81.43
245	ZM-837	36.5	38.5	132.0	7.0	34.5	11.5	11.0	122.5	49.25	1.90	77.88
246	58-41	35.5	39.5	140.0	8.0	86.5	21.5	18.5	70.25	31.75	1.80	73.61
247	75-74	30.0	34.5	103.0	7.0	24.0	15.5	13.5	141.25	58.25	2.00	71.99
248	59-348	37.0	39.5	140.0	8.0	63.5	22.5	20.5	98.75	43.00	2.00	64.46
249	75-51	30.5	33.5	128.0	7.0	36.5	8.0	7.5	144.25	49.00	2.95	74.65
250	63-106	30.5	35.5	130.0	6.5	56.0	10.0	6.5	101.00	46.75	1.80	81.59
251	PR 5290	30.0	32.5	126.0	6.5	40.5	15.5	14.5	48.50	42.25	1.10	85.54
252	VRR 546	35.5	38.5	140.0	8.0	74.0	32.0	28.0	125.25	54.00	1.90	68.01
253	VRR 766	34.5	37.5	136.0	7.5	31.0	14.5	11.5	96.25	38.75	1.90	68.72
254	DSA 200	28.5	32.5	106.0	6.5	48.5	12.0	11.0	100.00	43.75	1.95	65.82
255	G 397-1	36.5	40.5	107.0	6.0	36.5	5.5	4.0	93.50	42.00	2.00	78.06
256	Indonesia-2	36.0	40.5	111.0	6.0	49.5	9.5	8.5	130.25	38.75	2.95	91.87
257	TMV 2	28.0	29.5	114.0	7.5	76.5	23.5	25.0	92.00	48.50	1.85	74.83

GENETIC RESOURCE EVALUATION OF GROUNDNUT *(Arachis hypogaea L.)* FOR RESISTANCE TO TIKKA LEAF SPOT

BY

SAJIKUMAR, T. A.

ABSTRACT OF THESIS
SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE

MASTER OF SCIENCE IN AGRICULTURE

FACULTY OF AGRICULTURE
KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF AGRICULTURAL BOTANY
COLLEGE OF HORTICULTURE
VELLANIKKARA, TRICHUR
KERALA

1989

ABSTRACT

The research project "Genetic resource evaluation of groundnut Arachis hypogaea L.) for resistance to tikka leaf spot was carried out at the College of Horticulture, Kerala Agricultural University, Vellanikkara, during 1988-89. Two hundred and fifty six groundnut genotypes available in the Department of Agricultural Botany were made use of for the study. A susceptible variety - TMV 2 - was used as control. A field screening study was conducted with the 257 genotypes during July - November 1988, in a randomised block design with two replications.

Disease rating was done with the aid of a diagrammatic chart and the groundnut accessions were grouped into different categories such as immune, highly resistant, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible, based on the percentage of infection on leaves. Out of the 257 genotypes used for screening studies, four genotypes were moderately susceptible, 197 susceptible and 56 highly susceptible to tikka leaf spot. None of the varieties was immune, highly resistant or moderately resistant.

From the 257 types of groundnut, twenty five types with low disease intensity in field conditions, combined with high/moderate yield were selected for a glass house screening where artificial inoculation of the disease was done, and the

disease intensity was estimated as in the field screening study. All the twenty five genotypes were found to be susceptible to the disease. The lowest percentage of disease intensity was shown by the genotype C-145-12-P-14.

Considering the performance of the genotypes in the field screening and glass house studies, the genotype C-145-12-P-14 was found to be having comparatively stable and less disease intensity along with moderate yield.

Significantly high variability among the 257 accessions was observed for all the eleven components of yield studied. Disease intensity had significant correlation with pod number per plant, shelling percentage, 100 pod weight and 100 kernel weight.