PULSE PATHOLOGY
Progress Report-15

SOURCES OF RESISTANCE TO SELECTED CHICKPEA DISEASES

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I. INTRODUCTION

Chickpea (*Cicer arietinum* L.) is an important grain legume crop of dryland agriculture in Asia, Africa, and Central and South America. Chickpea is known by other names such as Bengal gram, gram, Egyptian pea, Spanish pea, Chestnut bean (all English), *pois chiche* (French), *chana* (Hindi), *homos* (Arabic), *grao-de-bico* (Portuguese), *garbanzo* or *garavance* (Spanish), etc. About 50 pathogens have so far been reported on chickpea from different parts of the world, but fortunately only a few of them are of economic importance. These include Fusarium wilt (*Fusarium oxysporum* Schlecht. emend. Snyd. & Hans. f. sp. *ciceri* [Padwick] Snyd. & Hans.), dry root rot (*Rhizoctonia bataticola* [Taub] Butler), black root rot (*Fusarium solani* [Mart] Sacc.), stem rot (*Sclerotinia sclerotiorum* [Lib.] de Bary), foot rot (*Operculella padwickii* Kheswalla), collar rot (*Sclerotium rolfsii* Sacc.), Ascochyta blight (*Ascochyta rabiei* [Pass.] Lab.), Botrytis gray mold (*Botrytis cinerea* Pers. ex Fr.), Stemphylium blight (*Stemphylium sarciniforme* [Cav.] Wilts), rust (*Uromyces ciceris-arietini* [Grogn.] Jacz & Beyer), and stunt (pea leaf-roll virus). Reports on the identification of resistance to Ascochyta blight have appeared in the literature during the last 50 years. Many of these reports were based on observations made during natural epidemics while some were based on artificial inoculation tests in the field or in greenhouse. The majority of the reports are from the Indian sub-continent (Ahmed *et al.* 1949; Anonymous 1963; Aziz 1962; Bedi and Athwal 1962; Grewal and Vir 1974; Luthra *et al.* 1938; Padwick 1948) and a few from other regions (Ganeva and Matsov 1977; Kaiser 1972; Radkov 1978; Solel and Konstrinski 1964). Limited screening and identification of sources of resistance to Fusarium wilt (Singh *et al.* 1974), foot rot (Singh and Bedi 1975), and Botrytis gray mold (Joshi and Singh 1969) was done in India. Information on resistance to other diseases does not exist. In 1975 at ICRISAT Center we intensified research on the development of efficient screening techniques and on the identification of sources of resistance to Fusarium wilt, dry root rot, black root rot, Ascochyta blight, and stunt and this report includes lists of sources of resistance to these diseases. The seed

of resistant lines is available on request from ICRISAT's Genetic Resources Unit. We sincerely hope this information will be useful to breeders and pathologists in chickpea growing countries.

We wish to add a note of caution. Multilocation tests carried out by ICRISAT have indicated that different strains of some of these pathogens exist. There is thus no guarantee that these lines will hold resistance at every location. Local testing of these lines is essential before any of these are used in the breeding program.

II. FUSARIUM WILT (*FUSARIUM OXYSPORUM* F. SP. *CICERI*)

After Padwick described chickpea wilt from India in 1940, its occurrence was reported in other countries such as Bangladesh, Burma, Ethiopia, Malawi, Mexico, Pakistan, Peru, Tunisia, and USA (Nene 1980). It is a serious problem in chickpea growing areas of Burma, India, Mexico, Pakistan, and USA.

The characteristic symptoms of the disease are (i) sudden drooping of leaves and petioles, (ii) no external rotting of roots, and (iii) black internal discoloration involving xylem and pith.

1. Screening techniques adopted

We have standardized three techniques called (i) sick plot technique for mass scale field screening, (ii) pot screening technique for greenhouse screening, and (iii) water culture technique for laboratory screening. The details of these techniques have been published (Nene and Haware 1980). A line was considered resistant if it showed less than 10% mortality in at least 2 consecutive field screenings (this mortality is usually due to causes other than the wilt pathogen) and no mortality in subsequent pot and/or water culture screenings.

2. Sources of resistance

Prior to reports by ICRISAT, the only report of a line (WR-315) resistant to *F. oxysporum* f. sp. *ciceri* was made by Singh *et al.* (1974) from Kanpur in India.

Sources of resistance to Fusarium wilt have been listed in Table 1.

Table 1. Some characteristics of the chickpea lines resistant to Fusarium wilt.[a]

Sl. No.	ICC No.	Pedigree	Maturity[b]	Habit	Seed color	Origin
1	2	3	4	5	6	7
1.	537	P-422	112	Semispreading	White	India
2.	2083	P-1679-2	134	Semispreading	White	Mexico
3.	2299	P-1954	121	Semierect	White	Spain
4.	5727	C-16-1	105	Semierect	White	India
5.	8446	JM-466/D-10-4	108	Semierect	White	Ethiopia
6.	8454	JM-473	121	Semierect	White	Ethiopia
7.	8622	WP-2984 B	108	Semierect	White	Ethiopia
8.	10466	Coll.No. 570	99	Semispreading	White	India
9.	11311	ICC-WR-202	110	Semispreading	Light brown	India
10.	11312	ICC-WR-391	100	Spreading	Brown	India
11.	11313	ICC-WR-658	97	Semierect	Yellow	India
12.	11314	ICC-WR-858	110	Semispreading	Brown	India
13.	11315	ICC-WR-1443	110	Semierect	Light brown	India
14.	11316	ICC-WR-1450	101	Semierect	Yellow	India
15.	11317	ICC-WR-1611	101	Semierect	Brown	India
16.	11318	ICC-WR-3439	95	Semierect	Brown	Iran
17.	11319	ICC-WR-4552	97	Semierect	Light brown	India
18.	11320	ICC-WR-6098	103	Semispreading	Brown	India
19.	11321	ICC-WR-6671	104	Semierect	Light brown	Iran
20.	11322	ICC-WR-8933	104	Semispreading	Yellow	India

contd.

1	2	3	4	5	6	7
21.	11323	ICC-WR-10130	93	Semispreading	Brown	India
22.	11324	ICC-WR-11088	97	Semispreading	Brown	India
23.	12233	ICC-WR-229	120	Semierect	Brown	India
24.	12234	ICC-WR-338	120	Semierect	Yellow	India
25.	12235	ICC-WR-516	130	Semispreading	Dark brown	India
26.	12236	ICC-WR-519	128	Semispreading	Brown	India
27.	12237	ICC-WR-554	132	Semispreading	Dark brown	India
28.	12238	ICC-WR-867	118	Semispreading	Dark brown	India
29.	12239	ICC-WR-1891	133	Semierect	Brown	India
30.	12240	ICC-WR-2072	134	Semispreading	Yellow brown	India
31.	12241	ICC-WR-2086	121	Semispreading	Yellow brown	Mexico
32.	12242	ICC-WR-2089	121	Semispreading	Yellow	Mexico
33.	12243	ICC-WR-2104	109	Semispreading	Yellow brown	Mexico
34.	12244	ICC-WR-2566	121	Semispreading	Yellow brown	Iran
35.	12245	ICC-WR-2660	107	Semispreading	Yellow	Iran
36.	12246	ICC-WR-2883	106	Semispreading	Yellow	Iran
37.	12247	ICC-WR-3099	104	Semispreading	Brown	Iran
38.	12248	ICC-WR-3103	121	Semispreading	Yellow brown	Iran
39.	12249.	ICC-WR-3539	132	Semierect	Yellow	India
40.	12250	ICC-WR-3684	120	Semispreading	Yellow	Iran
41.	12251	ICC-WR-4519	120	Semispreading	Yellow	India
42.	12252	ICC-WR-4918	95	Semispreading	Reddish brown	India
43.	12253	ICC-WR-5864	121	Semispreading	Brown	India
44.	12254	ICC-WR-6880	121	Semispreading	Yellow	Iran
45.	12255	ICC-WR-7111	107	Semierect	Yellow	Iran
46.	12256	ICC-WR-7248	120	Semispreading	Yellow	Lebanon
47.	12257	ICC-WR-7681	128	Semispreading	Brown	India
48.	12258	ICC-WR-9001	119	Semispreading	Brown	Iran
49.	12259	ICC-WR-10104	118	Semispreading	Yellow brown	India
50.	12267	ICC-WR-267	113	Semispreading	Dark brown	India

contd.

1	2	3	4	5	6	7
51.	12268	ICC-WR-1910	108	Semispreading	Yellow brown	India
52.	12269	ICC-WR-1913	93	Semierect	Yellow	India
53.	12270	ICC-WR-2461	109	Semispreading	Yellow	Iran
54.	12271	ICC-WR-6366	105	Semispreading	Yellow	Iran
55.	12272	ICC-WR-6494	104	Semierect	Light brown	Iran
56.	12273	ICC-WR-6926	107	Semierect	Yellow	Iran
57.	12274	ICC-WR-8982	106	Semispreading	Light brown	Iran
58.	12275	ICC-WR-11531	120	Semierect	Yellow brown	India

a. The first 8 lines showed less than 20% mortality in repeated field tests; all others showed 0 to 10% mortality. The first 8 lines are included especially because these are *kabuli* (white seeded) types.

b. Maturity in days at ICRISAT Center.

III. DRY ROOT ROT (*RHIZOCTONIA BATATICOLA*)

The first report on the occurrence of dry root rot was published by Dastur (1935) from central India. Dastur called the disease as Rhizoctonia wilt. Dry root rot has been reported from Australia, Ethiopia, India, Iran, Pakistan, and USA (Nene 1980). The disease is serious in areas where the ambient day temperatures are around 30°C at the seedling or at the flowering stage. In India this disease occurs mainly in the central and southern states where a lot of rtality at the flowering and podding stages is due to this disease.

Symptoms are (i) dry root rot, making the roots brittle, (ii) sudden drying of the plant without drooping of leaves and petioles, and (iii) presence of ash-colored mycelium and sclerotia in the pith cavity in the collar region.

1. Screening techniques adopted

We followed two procedures: sick plot technique and blotting paper technique. The former involves making a soil sick by incorporating diseased plant stubble and growing susceptible cultivars such as BG-212 or ICC-229 for at least 2 seasons. It is not possible to develop a sick plot only for *R. batatiocla* because other soil fungi like *F. oxysporum* f. sp. *ciceri* will also multiply. However, one can develop a multiple disease sick plot by encouraging multiplication of several soil-borne pathogens through growing cultivars susceptible to specific pathogens. At ICRISAT Center we have developed a multiple disease sick plot in which *F. oxysporum* f. sp. *ciceri* and *R. batatiocla* predominate. Lines which show less than 10% mortality in 2 consecutive seasons are then screened for resistance to *R. batatiocla* by following the blotting paper technique.

In the blotting paper technique, roots of seedlings are dipped in a suspension of fungal growth, wrapped by a moist blotting paper, and incubated at 35°C for 8 days. At the end of the incubation period seedlings are examined for the extent of root damage and scored on 1-9 scale; 1 meaning no damage and 9 complete root damage. Lines that showed a rating of 3 (very few small lesions on roots) or less in two screenings were considered resistant.

2. Sources of resistance

There is no report on the resistance of chickpea to dry root rot. Through screenings done at ICRISAT Center we have identified over 40 resistant lines. These have been listed in Table 2.

Table Some characteristics of the chickpea lines resistant to dry root rot.

Sl. No.	ICC No.	Pedigree	Maturity[a]	Habit	Seed color	Origin
1	2	3	4	5	6	7
1.	435	P-319-1	116	Semispreading	Orange brown	India
2.	444	P-332	110	Semispreading	Brown	India
3.	537	P-422	112	Semispreading	Beige	India
4.	554	P-436-2[b,c]	111	Semispreading	Yellow brown	India
5.	909	P-812	110	Semierect	Brown	Mexico
6.	1443	P-1265[c]	113	Semierect	Light brown	India
7.	1910	P-1542[c]	108	Semispreading	Yellow brown	India
8.	1913	P-1546[c]	93	Semispreading	Yellow	India
9.	1918	P-1549-1	95	Semispreading	Yellow brown	India
10.	2086	P-1683[c]	112	Semispreading	Yellow brown	Mexico
11.	2450	P-2230	102	Semispreading	Yellow	Iran
12.	2461	P-2249	109	Semispreading	Yellow	Iran
13.	2874	P-3230	111	Semierect	Yellow brown	Iran
14.	3181	P-3730-1	109	Semierect	Gray	Iran
15.	3392	P-4079	105	Semierect	Yellow	Iran
16.	3428	P-4102-2	118	Semierect	Light brown	Turkey
17.	4716	P-6308	112	Semierect	Brown	India
18.	4902	P-9789	108	Semierect	Yellow brown	Turkey
19.	4948	G-130	129	Semierect	Brown	India
20.	4994	Radhey	112	Semispreading	Brown	India
21.	4954	H-208	112	Semispreading	Brown	India
22.	5901	T-32	113	Semierect	Orange brown	India
23.	6051	JG-57	112	Semierect	Brown	India
24.	6366	NEC-312	116	Semispreading	Yellow	Iran
25.	6411	NEC-384	112	Semierect	Yellow	Iran
26.	6455	NEC-460	115	Semierect	Yellow	Iran

contd.

1	2	3	4	5	6	7
27.	6501	NEC-539	104	Semierect	Yellow	Iran
28.	6570	NEC-646	115	Semierect	Yellow brown	Iran
29.	6608	NEC-691	112	Semierect	Light brown	Iran
30.	6668	NEC-774	100	Semierect	Brown	Iran
31.	6687	NEC-815	110	Semierect	Yellow	Iran
32.	6772	NEC-934	112	Semierect	Yellow	Iran
33.	6816	NEC-986	109	Semierect	Yellow	Iran
34.	6840	NEC-1026	104	Semispreading	Beige	Iran
35.	6926	NEC-1166[b,c]	107	Semierect	Yellow	Iran
36.	6939	NEC-1179	112	Semispreading	Brown	Iran
37.	7681	P-1179[c]	98	Semispreading	Brown	India
38.	7777	NEC-1639	118	Semispreading	Brown	Pakistan
39.	8970	NEC-318	110	Semierect	Yellow	Iran
40.	8971	NEC-319	109	Semispreading	Yellow brown	Iran
41.	9018	NEC-480	105	Semispreading	Yellow	Iran
42.	9023	NEC-497	108	Semispreading	Yellow	Iran
43.	9042	NEC-540	107	Semierect	Yellow	Iran
44.	10466	Coll.No.570	99	Semispreading	Beige	India
45.	10500	Coll.No.231	168	Semierect	Yellow brown	India
46.	10539	RPSP-270	103	Semispreading	Brown	India
47.	10630	H-362	112	Semispreading	Yellow brown	India
48.	11550	DA-1	-	-	Yellow brown	India

a. Maturity in days at ICRISAT Center.

b. Highly resistant (rating 1.5 to 2 on 1-9 scale); all other lines showed 3 rating.

c. These lines are also resistant to Fusarium wilt.

IV. BLACK ROOT ROT (*FUSARIUM SOLANI*)

Kraft (1969) first reported that *F. solani* f. sp. *phaseoli* can infect chickpea. Westerlund *et al.* (1974) reported it to be one of the root-rotting fungi of chickpea in California. The same year Grewal *et al.* (1974) reported *F. solani* from northern India. The disease has been reported from Chile, India, Mexico, and USA (Nene 1980). Although the fungus has been isolated from diseased chickpea plants from different areas of India, it is restricted mainly to northern India.

Typical symptoms are (i) slow yellowing and wilting of above ground parts, (ii) black root rotting below the cotyledons with finer roots rotting away completely, and (iii) rotting restricted to root cortex initially.

1. Screening technique adopted

At ICRISAT Center we have screened only the known Fusarium wilt resistant lines against *F. solani*. The greenhouse procedure followed to screen these lines involved inoculating chickpea seedlings, raised in autoclaved sand + soil mixture (1:1) in pots, by pouring diluted spore suspension of *F. solani* around the base of the seedlings. Twenty-five days after inoculation, seedlings were removed and root system washed for examination. A 1-9 rating scale was followed with 1 indicating clean roots and 9 indicating complete root rotting accompanied by death of seedlings. Seedlings showing a rating up to 3 (plants healthy-looking, slight infection in hypocotyl region along with restricted lesions on few roots) in two screenings were considered resistant.

2. Sources of resistance

There is no report on the resistance of chickpea specifically to black root rot. Through screenings done at ICRISAT Center, we have

identified 18 lines that are resistant to black root rot and which are also resistant to Fusarium wilt. These lines have been listed in Table 3.

Table 3. Some characteristics of the chickpea lines resistant to black root rot.[a]

S.No.	ICC No.	Pedigree	Maturity[b]	Habit	Seed color	Origin
1.	519	P-394	128	Semispreading	Brown	India
2.	554	P-436-2	111	Semispreading	Yellow brown	India
3.	658	P-517	97	Semierect	Yellow	India
4.	1450	P-1270	101	Semierect	Yellow	India
5.	1611	P-1353	101	Semierect	Brown	India
6.	1891	P-1514	133	Semierect	Brown	India
7.	1913	P-1514	93	Semispreading	Yellow	India
8.	2089	P-1684	121	Semispreading	Yellow	Mexico
9.	2660	P-2686-2	107	Semispreading	Yellow	Iran
10.	3539	P-4237	132	Semierect	Yellow	India
11.	6098	JG-74	103	Semispreading	Brown	India
12.	7111[c]	NEC-1470	107	Semierect	Yellow	Iran
13.	7248	NEC-1621	120	Semispreading	Yellow	Lebanon
14.	8982	NEC-346	106	Semispreading	Light brown	Iran
15.	9001	NEC-426	119	Semispreading	Brown	Iran
16.	10104	P-6131	118	Semispreading	Yellow brown	India
17.	11088	BG-212	97	Semispreading	Brown	India
18.	11531	ICCC-10	120	Semierect	Yellow brown	India

a. All lines are also resistant to Fusarium wilt.

b. Maturity in days at ICRISAT Center.

c. Rating 1.5 on 1-9 scale; all other lines showed 2.5 to 3 ratings in two greenhouse screenings.

V. ASCOCHYTA BLIGHT (Ascochyta spp.)

The disease has been reported in Indian subcontinent, southern Russia, Middle East, North and East Africa, southern Europe, and North America (Nene 1980). The earliest report of its occurrence is from the "North-West Frontier Province" of India (now in Pakistan) where it was observed in 1911 (Butler 1918).

The disease causes heavy losses fairly frequently. All the green parts of the plant are attacked. Dark lesions appear on the stems and leaves first and then on pods. Oval or elongated lesions are produced on the stem, and round lesions occur on leaves and pods. When well developed, the margin of the lesions is dark brown and the center is light brown and full of small pycnidia of the fungus. The pycnidia in leaf and pod lesions are usually arranged in concentric rings. In severe cases, lesions surround the stem, causing blighting of the parts above. As the stems are frequently attacked near the ground level, death of whole plants is common. The young shoots are also prone to infection, and the infection may spread from top to bottom in a plant. Developing seeds in the pods are infected and may show lesions.

1. Screening techniques adopted

Two screening procedures were followed. The field screening procedure described by Reddy *et al.* (1980) was followed mostly and for confirming field results, the greenhouse procedure described by Reddy and Nene (1979) was followed. The field screening procedure involved (i) planting of a row of susceptible line after every 2-4 test rows to serve as an indicator-cum-infector row, (ii) scattering infected debris collected in the previous season, (iii) spraying plants with a spore suspension prepared from diseased plants whenever necessary, and (iv) maintaining high humidity through sprinkler irrigation. The greenhouse screening procedure involved the use of Isolation Plant Propagator (Burkard Manufacturing Co. Ltd., Rickmansworth, Herts, England). Ten

seedlings of each germplasm line were grown in one pot. Two-week old seedlings were inoculated by spraying them with an aqueous suspension of spores (20,000 spores/ml). Humidity was maintained by covering the plants with plastic covers for 10 days.

Nine point rating scales were followed in both the procedures. Rating of 1 meant no disease and 9 meant severe disease leading to death of 50 to 100 percent plants. Lines showing a 3 or less rating in at least two field screenings were considered resistant.

2. Sources of resistance

As pointed out in Introduction, majority of earlier reports are from the Indian subcontinent. One of the cultivars identified earlier as resistant was 4F32 (renamed F-8 by Luthra *et al.* 1938). Subsequently C-12/34 became a popular resistant cultivar and was obtained by crossing F-8 with Pb-7. Padwick (1948) noted that resistance of F-8 remained effective. Around 1950, C-12/34 'lost' its resistance, but another resistant cultivar C-235 was developed and made available to farmers (Anonymous 1963). Aziz (1962) reported C-727 to be resistant, Grewal and Vir (1974) identified P-1528-1-1 (from Morocco) as immune and I-13 (from Israel) as resistant, and Singh (1978) reported resistance in Galben (from Rumania), EC-26414, -26435, and -26446.

There are reports from regions other than the Indian subcontinent. Solel and Konstrinski (1964) identified the cultivar "Bulgarian" as immune and Kaiser (1972), working in Iran, found one black seeded accession from Israel highly resistant to Iranian isolates of the fungus, but not to isolates from Pakistan. Radkov (1978) reported from Bulgaria no. 180 and no. 307 to be resistant, high yielding, and suitable for mechanical cultivation. Also from Bulgaria; Ganeva and Matsov (1977) reported the cultivars Sovkhoznyi 14, Kubanskii 199, Vir-32, no. 222 (from the USSR) and Resuisi 216 to be highly resistant.

Through extensive field screenings carried out at ICARDA, Syria by K.B. Singh and M.V. Reddy and greenhouse screenings carried out at ICRISAT Center, we have been able to identify a large number of resistant and tolerant lines. Also lines have been identified resistant/tolerant through screening in Isolation Plant Propagators. These have been listed in tables 4 thru 7.

Table 4. Some characteristics of kabuli chickpea lines resistant to Ascochyta blight at ICARDA, Syria.

S.No.	ILC No.	Pedigree	Maturity	Habit	Seed color	Origin
1.	72	Lot No. 4	Late	Tall, erect	Light orange	Spain
2.	182	Armenia 1207	Medium	Semierect	Light orange	USSR
3.	183	Armenia 1207	Medium	Semierect	Light orange	USSR
4.	187	Uzbekistan 16	Late	Semierect	Light orange	USSR
5.	191	Krasvadar Territory 1286	Late	Semierect	Beige	USSR
6.	194	Krasvadar Territory 1286	Medium	Semierect	Beige	USSR
7.	200	Krasvadar Territory 1335	Late	Semierect	Light orange	USSR
8.	201	Krasvadar Territory 1403	Late	Tall, erect	Light orange	USSR
9.	202	Krasvadar Territory 1403	Late	Tall, erect	Light orange	USSR
10.	236	Coll.No.K1713 Kabul Bazar	Late	Semierect	Beige	Afghanistan
11.	482	Acc.No.26780-68 Adapazari	Early	Semierect	Beige	Turkey
12.	484	Acc.No.26783-68 Bursa	Early	Semierect	Beige	Turkey
13.	2380	P-9655	Medium	Semierect	Beige	USSR
14.	2506	Uzbekistan 16	Late	Semierect	Light orange	USSR
15.	2548	P-9657	Medium	Semierect	Beige	USSR
16.	2956	12-071-10032	Late	Tall, erect	Light orange	USSR
17.	3001	Collection No. 731 C	Medium	Semierect	Yellow green	Afghanistan
18.	3279	Krasvadar Territory 1335	Late	Tall, erect	Light orange	USSR
19.	3340	S.N. 166 (PI-315781)	Late	Semierect	Beige	India
20.	3342	S.N. 88 (PI-212595)	Late	Semierect	Beige	Afghanistan
21.	3346	Unknown	Late	Tall, erect	Light orange	USSR
22.	3400	Unknown	Late	Semierect	Beige	ICARDA

Table 5. Some characteristics of desi chickpea lines resistant to Ascochyta blight at ICARDA, Syria.

S.No.	ICC No.	Pedigree	Maturity[a]	Habit	Seed color	Origin
1.	76	P-60-1	107	Semispreading	Black	India
2.	187	P-152-1	110	Semierect	Dark brown	India
3.	607	P-479	160	Semierect	Black	India
4.	1069	P-919	155	Semierect	Black	USSR
5.	1121	P-1004	113	Semispreading	Black	Iran
6.	1136	P-1034	113	Semierect	Brown	India
7.	1305	P-1193	112	Semispreading	Brown	India
8.	1416	P-1252-1	112	Semierect	Light brown	India
9.	1467	P-1279-1	114	Semispreading	Black	India
10.	1468	P-1279-2	118	Semispreading	Black	India
11.	1754	P-1441	111	Semierect	Brown	India
12.	1781	P-1453-1	112	Semierect	Brown	India
13.	1762	P-1443-3	111	Semierect	Brown	India
14.	1903	P-1528-1	128	Erect	Black	India
15.	2160	P-1741-1	116	Semierect	Black	Mexico
16.	2162	P-1742-1	157	Semierect	Black	Iran
17.	2165	P-1747-1	130	Semierect	Black	Mexico
18.	2270	P-1872	120	Semispreading	Black	Iran
19.	2342	P-2031-1	113	Semierect	Black	Iran
20.	2441	P-2221-1	183(H)	-	Beige	Iran
21.	2506	P-2383	118	Semierect	Brown	Iran
22.	3440	P-4117	176(H)	Semierect	Brown	Iran
23.	3597	P-4267	116	Semispreading	Black	Iran
24.	3598	P-4268	118	Semispreading	Black	Iran
25.	3634	P-4289	115	Semispreading	Black	Iran
26.	3843	P-4491	113	Semispreading	Black	Iran
27.	3916	P-4603	117	Semispreading	Black	Iran
28.	3918	P-4605	116	Semispreading	Black	Iran

cont.

a. Days to maturity at Patancheru unless (H = Hissar) mentioned otherwise.

1	2	3	4	5	6	7
29.	3919	P-4607	116	Semispreading	Black	Iran
30.	3921	P-4610	116	Semispreading	Black	Iran
31.	3932	P-4630	116	Semispreading	Black	Iran
32.	3969	P-4671	110	Semierect	Black	Iran
33.	4018	P-4722	117	Semispreading	Black	Iran
34.	4020	P-4724-2	117	Semispreading	Black	Iran
35.	4030	P-4739	116	Semispreading	Black	Iran
36.	4045	P-4758	114	Semispreading	Black	Iran
37.	4083	P-4821	117	Semispreading	Black	Iran
38.	4093	P-4848	123	Semierect	Brown	Iran
39.	4174	P-5002	116	Semierect	Black	Iran
40.	4181	P-5009	118	Semispreading	Black	Iran
41.	4187	P-5016	112	Semispreading	Black	Iran
42.	4188	P-5017	122	Semispreading	Black	Iran
43.	4192	P-5023	114	Semierect	Dark brown	Iran
44.	4472	P-5491	117	Semispreading	Black	Iran
45.	4475	P-5496	122	Semispreading	Black	Iran
46.	4616	P-6207	112	Semispreading	Black	India
47.	5035	C-8	120	Erect	Black	India
48.	5313	LG-2526	111	Semispreading	Black	India
49.	5566	V-136	128	Semierect	Yellow	Mexico
50.	6103	JG-87	120	Erect	Black	India
51.	6250	NEC-123	164	Semierect	Black	Morocco
52.	6304	NEC-206	155	Semierect	Black	USSR
53.	6306	NEC-208	124	Semierect	Black	USSR
54.	6336	NEC-252	123	Semierect	Black	India
55.	6781	NEC-945	181(H)	-	Yellow brown	Iran
56.	6813	NEC-983	121	Semierect	Black	Iran
57.	6988	NEC-1243	139	Semierect	Black	Iran
58.	6989	NEC-1244	138	Semierect	Black	Iran
59.	6999	NEC-1254	111	Semispreading	Black	Iran
60.	7000	NEC-1255	112	Semispreading	Black	Iran

Table 6. Some characteristics of chickpea lines resistant to Ascochyta blight in the Isolation Plant Propagator screening at ICRISAT Center.

S.No.	ICC No.	Pedigree	Maturity[a]	Habit	Seed color	Origin
1.	120	P-97	106	Semierect	Yellow	India
2.	468	P-351	115	Semispreading	Brown	India
3.	2600	P-2614	116	Semierect	Beige	Iran
4.	3259	P-3840-1	100	Semispreading	Brown	Iran
5.	3277	P-3871	100	Semispreading	Brown	Iran
6.	3531	P-4232-2	103	Semierect	Yellow	Iran
7.	4826	P-6594	118	Semispreading	Beige	Iran
8.	4827	P-6595	117	Semierect	Beige	Iran
9.	4855	P-9624	123	Semispreading	Beige	USA
10.	4856	P-9625	118	Semierect	Beige	USA
11.	4857	P-9630	107(H)	Semierect	Beige	USA
12.	4861	P-9648	134	Semierect	Beige	Yugoslavia
13.	4864	P-9651	123	Semierect	Beige	Ethiopia
14.	5124[b]	EC-26446	142	Semierect	Beige	Israel
15.	6045	JG-12	118	Semispreading	Beige	India
16.	6314	NEC-216	140	Semierect	Beige	Spain
17.	6354	NEC-280	134	Semierect	Beige	Turkey
18.	6840	NEC-1026	93	Semispreading	Beige	Iran
19.	6843	NEC-1029	103(H)	Semispreading	Beige	Iran
20.	6847	NEC-1033	100	Semispreading	Beige	Iran
21.	6887	NEC-1108	129	Semierect	Beige	Iran
22.	6888	NEC-1109	131	Semierect	Beige	Iran
23.	7559	P-9625	132	Semierect	Beige	USA
24.	7562	P-9628	169(H)	Semierect	Beige	USA
25.	7567	P-9657	134	Semierect	Beige	USSR
26.	7589	P-9717	134	Semierect	Beige	Ethiopia
27.	7592	P-9720	133	Semierect	Beige	Ethiopia
28.	7609	P-9742	142	Semierect	Beige	Turkey
29.	7655	P-9817	140	Semierect	Beige	Turkey
30.	7676	P-9875	142	Semierect	Beige	Portugal
31.	7773	(Giza) NEC-1566	112	Semierect	Beige	Egypt

a. Days to maturity at Patancheru unless (H = Hissar) mentioned otherwise.
b. Also resistant at ICARDA, Syria.

Table 7. Some characteristics of chickpea lines tolerant to Ascochyta blight in the Isolation Plant Propagator screening at ICRISAT Center.

S.No.	ICC No.	Pedigree	Maturity[2]	Habit	Seed color	Origin
1	2	3	4	5	6	7
1.	130	P-104-1	129	Semierect	Beige	India
2.	204	P-167	115	Semispreading	Dark brown	India
3.	229	P-180-1	109	Semierect	Brown	India
4.	377	P-280	115	Semispreading	Beige	India
5.	462	P-347	112	Semispreading	Brown	India
6.	539	P-424	112	Semispreading	Brown	India
7.	559	P-440-1	117	Semispreading	Orange brown	India
8.	567	P-449	100	Semispreading	Yellow	India
9.	595	P-471	112	Semispreading	Brown	India
10.	599	P-474	115	Semispreading	Light brown	India
11.	600	P-474-1	117	Semispreading	Black	India
12.	693	P-542	113	Semispreading	Light brown	India
13.	703	P-553-1	132	Semierect	Beige	India
14.	704	P-554	112	Semispreading	Light brown	India
15.	724	P-570	116	Semispreading	Light brown	India
16.	781	P-620	108	Semispreading	Yellow	India
17.	816	P-642-1	110	Semispreading	Yellow brown	India
18.	838	P-661	111	Semierect	Yellow	India
19.	931	P-737	110	Semispreading	Orange	India
20.	1009	P-840	114	Semierect	Brown	Morocco
21.	1465	P-1278-2	111	Semierect	Orange	India
22.	1911	P-1542-1	171(H)	Semispreading	Yellow brown	India
23.	1915	P-1548	142	Semierect	Black	India
24.	2153	P-1728	110	Semierect	Yellow brown	Mexico
25.	2156	P-1732	106	Semispreading	Yellow brown	Mexico
26.	2160	P-1741-1	116	Semierect	Black	Mexico

contd.

1	2	3	4	5	6	7
27.	2257	P-1810	118	Semierect	Black	USA
28.	3252	P-3829	109	Semierect	Brownish beige	Iran
29.	3287	P-3910	107	Semispreading	Dark brown	Iran
30.	3330	P-3975	109	Semispreading	Yellow brown	Cyprus
31.	3346	P-4022	147	Semierect	Beige	Iran
32.	4784	P-6450	124	Semispreading	Beige	Iran
33.	4785	P-6453	125	Semispreading	Beige	Iran
34.	4787	P-6456-1	124	Semispreading	Beige	Iran
35.	4882	P-9693	134	Semierect	Beige	Morocco
36.	4899	P-9763	145	Semierect	Beige	Turkey
37.	3046	C-161	115	Semispreading	Beige	India
38.	5106	EC-26421	137	Semierect	Beige	Israel
39.	5119	EC-26439	142	Semierect	Beige	Israel
40.	5122	EC-26443	145	Semierect	Beige	Israel
41.	5123	EC-26445	137	Semierect	Beige	Israel
42.	6235	NEC-108	146	Erect	Light yellow	Greece
43.	6293	NEC-190	111	Semispreading	Black	Italy
44.	6312	NEC-211	115	Semierect	Beige	Iran
45.	6345	NEC-266	129	Semierect	Beige	India
46.	6837	NEC-1022	125	Semierect	Beige	Iran
47.	6838	NEC-1023	136	Semierect	Beige	Iran
48.	7198	NEC-1571	100	Semierect	Beige	Egypt
49.	7212	NEC-1585	100	Semierect	Beige	Egypt
50.	7243	NEC-1616	128	Semispreading	Beige	Lebanon
51.	7246	NEC-1619	130	Semierect	Beige	Lebanon
52.	7249	NEC-1622	149	Semierect	Beige	India
53.	7251	NEC-1624	128	Semierect	Beige	India
54.	7287	NEC-1669	142	Semierect	Beige	Tunisia
55.	7353	M-43	135	Semierect	Beige	Israel
56.	7359	2098	127	Semierect	Beige	India

contd.

1	2	3	4	5	6	7
57.	7653	P-9778	144	Semierect	Beige	Turkey
58.	7658	P-9793	144	Semierect	Beige	Turkey
59.	7653	P-9813	142	Semierect	Beige	Turkey
60.	7668	P-9845	126	Semierect	Beige	USSR
61.	7718	NEC-131	137	Semierect	Beige	USSR
62.	8920	K-1170	146	Erect	Orange	USSR
63.	10136	Pant G-114	114	Semispreading	Yellow	India

a. Days to maturity at Patancheru unless (H = Hissar) mentioned otherwise.

V. STUNT (PEA LEAFROLL VIRUS)

The disease was first reported on chickpea by Kaiser and Danesh (1971) from Iran. The disease has been observed in Algeria, Bangladesh, Ethiopia, India, Iran, Lebanon, Morocco, New Zealand, Pakistan, Sudan, Syria, Tunisia, and Turkey (Nene 1980). Although the natural incidence is generally less than 5%, we have occasionally come across farmers' fields with 50-90% incidence.

The characteristic symptoms are stunting, yellowing or browning (yellowing in kabuli and browning in desi cultivars), proliferation and phloem browning, particularly in the collar region.

No source of resistance was reported earlier. We have been carrying out screening at Hissar in northern India, taking advantage of the high natural incidence of the disease. Lines that showed less than 10% incidence for at least 3 consecutive seasons were considered promising and have been listed in table 8.

Table 8. Some characteristics of chickpea lines found promising against stunt for at least 3 seasons under natural epiphytotic conditions at Hissar in India.

S.No.	ICC No.	Pedigree	Maturity	Habit	Seed color	Origin
1.	403	P-298-1	113	Semispreading	Brown	India
2.	591	P-466	113	Semierect	Light brown	India
3.	685	P-537	108	Semispreading	Dark brown	India
4.	2585	P-2151-1	106	Semierect	Yellow	Iran
5.	2546	P-2512	114	Semierect	Brown	Iran
6.	3718	P-4341-2	114	Semispreading	Yellow brown	Iran
7.	6435	NEC-417	111	Semierect	Brown	Iran
8.	6934	NEC-1174	111	Semierect	Brown	Iran
9.	10495	RPSP-226	126	Semispreading	Yellow	India
10.	10596	Coll.327	112	Semierect	Yellow	India
11.	4949	G-24	118	Semierect	Dark brown	India

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