Pulse Pathology
Progress Report-17

Pulse Pathology (Chickpea) Report of Work

(June 1980-May 1981)

ICRISAT
International Crops Research Institute for the Semi-Arid Tropics
ICRISAT Patancheru P.O.
Andhra Pradesh 502 324, India

This report has been prepared to share the information with scientists having interest in chickpea improvement. This is not an official publication of the Institute and should not be cited.

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PULSE PATHOLOGY SUB-PROGRAM (CHICKPEA)

STAFF

Dr. Y.L. Nene	Leader, Pulses Improvement Program and Principal Plant Pathologist
Dr. M.V. Reddy	Plant Pathologist
Dr. M.P. Haware	Plant Pathologist
Mrs. Sheila Vijayakumar	Research Technician
Mr. J. Narayan Rao	Technical Assistant
Miss E. Deena	Technical Assistant
Mr. K. Prabhakar Reddy	Field Assistant
Mr. G. Musala Reddy	Field Assistant
Mr. A. Chandar	Secretary I
Mr. R. Narsing Rao	Stenographer
Mr. Mohd. Sharfuddin Khan	Driver-cum-General Assistant II
Mr. M.M.S. Ali Baig	Driver-cum-General Assistant I

PULSE PATHOLOGY SUB-PROGRAM (CHICKPEA)

LIST OF APPROVED PROJECTS

(1978-1980)
Sub-program Leader: Y.L. Nene

No.	Title	Project Scientist	Cooperators
CP-Path-1	Studies on Fusarium wilt of chickpea	M.P. Haware	J. Kumar S.C. Sethi C.L.L. Gowda O. Singh
CP-Path-2	Studies on stem and root rots of chickpea	M.P. Haware	J. Kumar S.C. Sethi C.L.L. Gowda O. Singh
CP-Path-3	Studies on chickpea stunt and other viral diseases	M.V. Reddy	J.P. Verma (HAU, Hisar) J. Kumar C.L.L. Gowda O. Singh W. Reed
CP-Path-4	Studies on Ascochyta blight	M.V. Reddy	O. Singh J. Kumar K.B. Singh (ICARDA)
CP-Path-5	International chickpea disease nurseries	Y.L. Nene	M.P. Haware M.V. Reddy L.J.G. van der Maesen

CONTENTS

PROJECT: CP-PATH-1(78): STUDIES ON THE FUSARIUM WILT OF CHICKPEA

PROJECT: CP-PATH-2(78): STUDIES ON STEM AND ROOT ROTS OF CHICKPEA

Page No.

PROJECT: CP-PATH-4(78): STUDIES ON ASCOCHYTA BLIGHT

PROJECT: CP-PATH-5(78): INTERNATIONAL CHICKPEA DISEASE NURSERIES

PROJECT : CP - PATH-1(78) : STUDIES ON THE FUSARIUM WILT OF CHICKPEA

I. SUMMARY

1. Of the 4520 additional germplasm accessions screened, 62 were found promising against the wilt by showing less than 20% mortality. These will be tested again.

2. Of the 133 germplasm selections made during 1979-80, 18 lines were found resistant to wilt, showing less than 10% mortality.

3. ICCC-10, a wilt resistant line, was also found promising against the stunt. In addition 3 stunt promising lines viz., NEC-472, Coll. 238 and GNG-85 were also found promising against wilt.

4. Of the 48 entomology selections (less susceptible to Heliothis) ICC-1403, 1981, 5800, 7320-11-1-HB and 7320-11-2-HB were found promising against wilt.

5. Chickpea entries from other locations were tested. Four lines from Gujarat and three lines from Badnapur were found promising. Chickpea lines viz., GW-7, GW-8, GW-13, and BA-1 were found promising. Two selections from Hissar were also found promising

6. Extensive field screening of chickpea germplasm in wilt sick nurseries, followed by pot and laboratory screening helped in identifying altogether 50 chickpea lines resistant to wilt. Many of these lines are being extensively used in breeding program at ICRISAT Center and also at pulse research centers in the semi-arid tropics.

7. Wilt resistant breeders' material - F_7 and more advanced bulks were screened thoroughly in wilt sick plot. Out of these, 20 lines were included in the International Chickpea Root Rots/Wilt Nursery (ICRRWN) 1981-82.

8. The wilt fungus is able to survive up to 39 months in host tissues buried in soil. It was isolated after 24 months from disintegrating host tissues buried up to 24-inch depth in soil.

9. Chickpea lines resistant to wilt at Hyderabad, were tested against the Kanpur race. Of the 14 wilt resistant lines, 4 were susceptible to Kanpur race (ICC-519, 867, 3439, and GL-799). Further F_1, F_2, and F_3 progenies of cross P-436-2 x JG-62 were also tested against Hyderabad and Kanpur races.

10. Seed dressing with Benlate-T was effective in eradicating internal seed-borne F. oxysporum f.sp. ciceri, at least for a year after the seed treatment.

11. In a yield trial with 14 resistant cultivars and 4 check cultivars conducted at Hyderabad, BDN 9-3 was on the top, WR-315 second and CPS-1 third.

II. INTRODUCTION

The project became operative from January 1978 with the following objectives:

1. Study survival and spread of the pathogen (Fusarium oxysporum f. sp. ciceri)
2. Study the situation on pathogenic races, if any.
3. Further improve the screening techniques, and
4. Screen germplasm/breeding material for disease resistance.

Work carried out during 1980-81 is presented in this report.

III FIELD SCREENING FOR WILT RESISTANCE

Material was planted in a wilt-sick plot (M-5C and BT-6[illegible]) in 4 meter rows, 75 cm apart. Susceptible check JG-62 was planted after every 4 test rows. Periodic observations on wilt incidence were recorded. The material screened were:

Germplasm	4520
Germplasm selections (1979/80)	133
Stunt - promising lines	72
Ascochyta blight promising lines	31
Entomology selections	48
Lines received from other locations	
Dahod (Gujarat)	5
Arnej (")	65
Badnapur	30
Ludhiana	2
Kanpur	4
Hissar	5
Delhi	26
GCVT entries	7

A. Germplasm

The following 62 accessions showed less than 20% wilt.

ICC-3935, 4348, 4436, 4490, 4533, 4579, 5009, 5018, 5020, 5071, 5113, 5126, 5186, 5535, 5536, 5581, 5618, 5710, 5715, 5800, 5911, 5921, 6010, 6027, 6077, 6095, 6136, 6350, 6636, 6647, 6724, 7280, 7744, 7757, 7765, 8937, 9046, 9095, 9120, 9915, 9927, 10016, 10177, 10178, 10181, 10204, 10208, 10405, 10616, 10655, 10932, 10936, 10957, 10963, 10977, 10989, 10998, 11011, 11020, 11021, 11033, and 11039.

B. Germplasm selections (1979-80)

Last year 133 chickpea lines were selected from germplasm showing less than 20% wilt. These lines were tested again and 18 lines were selected which showed less than 10% wilt.

ICC-871, 925, 933, 1155, 1451, 1491, 1664, 1755, 1756, 1901, 1987, 2034, 2036, 2246, 3072, 3457, 3545, and 2243.

C. Stunt promising lines

Of the 72 stunt promising lines tested NEC-472, Coll. 238 and GNG-85, were found promising in addition to ICCC-10, a wilt resistant line.

D. Ascochyta blight promising lines

Of the 31 Ascochyta blight promising lines tested, none was found promising.

E. Entomology selections

Of the 48 selections (less susceptible to Heliothis), ICC-1403, 1981, 5800, 7320-11-1-HB, and 7320-11-2-HB were found promising.

F. Chickpea lines received from other locations

Out of 5 lines received from Dahod (Gujarat) one line - Maswadi was found promising (less than 20% wilt).

From Arnej (Gujarat), 65 lines were tested in wilt sick plot and 3 lines; viz., Varetha, Pawi and Punia were found promising.

Badnapur : Of the 30 lines tested, 3 showed less than 20% wilt. They were BDNG 77, BDNG 87, and BDNG 93.

Ludhiana : Of the two lines tested, none was found promising.

Kanpur : All the 4 lines tested were promising; viz., GW-7, GW-8 GW-13, and BA-1.

Bikaner : Of the five lines tested 2 were found promising. F_3 HR-218 x P-1179 and F_3 P-517 x F_5 (H-208 x GW 7/5).

Delhi : Of the 26 lines tested, none was found promising.

All these lines found promising will be retested next year in the wilt-sick plot.

G. Sources of resistance to wilt

Extensive field screening of chickpea germplasm in wilt sick nurseries, followed by pot and laboratory screenings, has helped in identifying 50 chickpea lines resistant to wilt caused by F. oxysporum f. sp. ciceri. In addition to wilt the lines have general resistance to several root rots in a multiple disease sick plot.

Table 1. Variety, names, origins, and characteristics of chickpea lines resistant to wilt

ICC No.	Pedigree	Growth habit	Seed color	Origin
11311	ICC/HR-202	Semispreading	Light brown	India
11312	-391	Spreading	Brown	India
11313	-658	Semierect	Yellow	India
11314	-858	Semispreading	Brown	India
11315	-1443	Semierect	Light brown	India
11316	-1450	Semierect	Yellow	India
11317	-1611	Semierect	Brown	India
11318	-3439	Semierect	Brown	Iran
11319	-4552	Semierect	Light brown	India
11320	-6098	Semispreading	Brown	India
11321	-6671	Semierect	Light brown	Iran
11322	-8933	Semispreading	Yellow	India
11323	-10130	Semispreading	Brown	India
11324	-11088	Semispreading	Brown	India
12233	-229	Semierect	Brown	India
12234	-338	Semierect	Yellow	India
12235	-516	Semispreading	Dark brown	India
12236	-519	Semispreading	Brown	India
12237	-554	Semispreading	Dark brown	India
12238	-867	Semispreading	Dark brown	India
12239	-1091	Semierect	Brown	India
12240	-2072	Semispreading	Yellow brown	India
12241	-2086	Semispreading	Yellow brown	[illegible]

Contd.

Table 2. Contd.

ICC No..	Pedigree	Growth habit	Seed Color	Origin
12242	ICC/WR-2089	Semispreading	Yellow	Mexico
12243	-2104	Semispreading	Yellow brown	Mexico
12244	-2566	Semispreading	Yellow brown	Iran
12245	-2660	Semispreading	Yellow	Iran
12246	-2883	Semispreading	Yellow	Iran
12247	-3099	Semispreading	Brown	Iran
12248	-3103	Semispreading	Yellow brown	Iran
12249	-3539	Semierect	Yellow	India
12250	-3684	Semispreading	Yellow	Iran
12251	-4519	Semispreading	Yellow	India
12252	-4918	Semispreading	Reddish brown	India
12253	-5864	Semispreading	Brown	India
12254	-6880	Semispreading	Yellow	Iran
12255	-7111	Semierect	Yellow	Iran
12256	-7248	Semispreading	Yellow	Lebanon
12257	-7681	Semispreading	Brown	India
12258	-9001	Semispreading	Brown	Iran
12259	-10104	Semispreading	Yellow brown	India
12267	-267/P 212-1 WR	Semispreading	Dark brown	India
12268	-1910/P 1542 WR	Semispreading	Yellow brown	India
12269	-1913/P 1546 WR	Semierect	Yellow	India
12270	-2461/P 2249 WR	Semispreading	Yellow	Iran
12271	-6366/ NEC 312 WR	Semispreading	Yellow	Iran
12272	-6494/ NEC 529 WR	Semierect	Light brown	Iran
12273	-6926/ NEC 1166 WR	Semierect	Yellow	Iran
12274	-8982/ NEC 346 WR	Semispreading	Light brown	Iran
12275	-11531/ ICCC-10 WR	Semierect	Yellow brown	India

H. Breeders' material

The material from F_2 generation through F_4 generation, including more advanced bulks was planted in a wilt-sick plot. Progenies considered superior by the pathologist had been advanced by the breeders by individual plant selections or they were bulked. The materials screened were the following:

Table 2: The numbers of populations and progenies screened in a wilt-sick plot at ICRISAT

Generation	Grown	No. Selected	
		Plants	Bulks
F_2	8	85	-
F_3	4612	1630	153
F_4	579	98	201
F_4, F_5 bulks	118	77	122
F_7 and more advanced bulks	81	(in 3 replications) table attached	
BC1 and BC2 F_4	118	121	3
BC2 F_5 bulks	19	6	-

In addition 33 advanced bulks were screened in wilt-sick plot. The data are given in Table 3.

Table 3. Testing of breeding material for wilt resistance 1980-81

(F_7 and more advanced bulks and progenies for wilt resistance)

Year 1980-81 4 row plot

S.No.	Pedigree	Percent wilt			
		RI	RII	RIII	Average
1	2	3	4	5	6
1.	74524-3P-1P-1P-1P-BP F2 (850-3/27 x GM 5/7) x F2(H-208xAnnigeri)	29.16	2.00	7.86	13.00
2.	74349-5P-1P-4P-1P-BP F2 (P-1786 x C-214) x F2(F-496 x L-550)	12.50	6.06	6.93	8.50

Table 3. Contd.

1	2	3	4	5	6
3.	75278-1P-2P-BP-BP (NEC 1640 x NEC 1639) x (Chafa x P-472)	8.10	13.20	12.50	11.30
4.	741568-3P-1P-BP-BP 850-3/27 x P-2774	15.60	5.35	6.14	9.10
5.	74513-3P-1P-2P-1P-BP F_2 (L-550 x T-3) x F2 (G-130 x JG-24)	17.34	24.00	6.25	15.99
6.	74349-6P-1P-2P-1P-BP F2 (P-1786 x C-214) x F2 (P-496 x L-550)	20.00	5.76	8.82	11.50
7.	7552-3P-2P-BP-BP K-4 x WR-315	5.43	5.00	4.16	4.90
8.	74356-3P-1P-3P-1P-BP F2(P-1786 x C-214) x F2 (C-104 x L-550)	9.63	5.97	2.98	6.20
9.	741568-3P-2P-BP-BP 850-3/27 x P-2774	9.89	18.96	0.00	9.60
10.	741579-1P-2P-1P-BP F378 x WR-315	29.99	25.39	29.48	28.30
11.	741568-3P-4P-1P-BP 850-3/27 x P-2774	13.75	18.18	9.72	13.90
12.	7552-1P-1P-1P-BP K-4 x WR-315	6.41	4.34	4.31	5.00
13.	75419-3P-1P-1P-BP (P-99 x NEC-108) x Radhey	20.00	31.57	10.47	20.70
14.	7547-1P-1P-1P-BP G-130 x WR-315	18.42	8.53	11.11	12.70
15.	75268-3P-1P-1P-BP (NEC-1640 x P-493) x (850-3/27 x NEC-249)	32.50	24.17	14.41	23.70
16.	75419-4P-1P-1P-BP (P-99 x NEC-108) x Radhey	10.66	16.30	11.11	12.70
17.	75278-1P-2P-1P-BP (NEC-240 x NEC-1639) x (Chafa x P-472)	30.55	20.79	7.31	19.55
18.	75286-3P-2P-1P-BP (NEC-1640 x P-493) x (850-3/27 x NEC-249)	24.69	11.11	22.09	19.30
19.	752296-6P-1P-BP-BP F3 (850-3/27 x BG-1) x K-4 x F3 (P404 x L-550) GW-5/7	14.92	4.87	6.57	8.88
20.	7447-1P-1P-BP-BP F4 (JG-62 x P-496) x (850-3/27 x Radhey)	13.40	8.86	3.22	8.50
21.	741533-5P-4P-BP-BP	21.35	14.70	27.84	21.30
22.	741196-1P-1P-BP-BP P-3090 x G-130	54.94	90.42	80.23	75.20
23.	752296-7P-BP-BP-BP F3(850-3/27 x BG-1) x K-4 x F3 (P-404 x L-550) GW-5/7	10.20	18.82	8.43	12.50
24.	741533-5P-1P-BP-BP P-5409 x 850-3/27	22.22	40.47	26.66	29.80
25.	75419-11P-2P-BP-BP (P-99 x NEC-108) x Radhey	13.41	17.30	21.60	17.40
26.	752296-7P-BP-BP-BP F3 (850-3/27 x BG-1) x K-4 x F3 (P-404 x L-550) GW-5/7	10.47	6.55	10.58	9.20
27.	741533-4P-1P-BP-BP P-5409 x 850-3/27	43.38	19.29	22.11	28.30

Contd.

Table 3. Contd.

1	2	3	4	5	6
28.	75419-7P-3P-1P-BP (P-99 x NEC-108) x Radhey	3.41	1.38	10.20	4.99
29.	75419-11P-2P-1P-BP (P-99 x NEC-108) x Radhey	9.67	13.79	13.63	12.40
30.	75419-11P-3P-1P-BP (P-99 x NEC-108) x Radhey	18.08	35.10	24.65	25.90
31.	75419-6P-1P-1P-BP (P-99 x NEC-108) x Radhey	13.08	10.66	11.34	11.70
32.	752296-5P-1P-BP-BP P3(850-3/27 x BG-1) x K-4 x P_3 (P-404 x L-550) GW-5/7	22.35	28.12	16.66	22.37
33.	75886-1P-2P-BP-BP PRR-1 x P-1265	14.70	12.22	25.74	17.50
34.	75889-2P-3P-BP-BP P-1100 x WR-315	15.78	15.78	6.12	12.60
35.	75419-7P-2P-1P-BP (P-99 x NEC-108) x Radhey	7.21	4.92	6.81	6.50
36.	75889-3P-2P-1P-BP P-1100 x WR-315	5.37	9.72	8.88	7.99
37.	74632-5P-1P-2P-1P-BP (H-355 x BEG-482) x (JG-62 x P-1387)	2.88	5.76	10.93	6.50
38.	74527-4P-1P-1P-1P-BP F2 (G-130 x B-108) x F2 (NP-34 x GW-5/7)	10.63	9.76	27.00	15.08
39.	74514-22H-1P-1P-1P-BP F2 (BG-2 x P-1480) x F2 (GW-5/7 x H-233)	3.84	4.96	2.00	3.60
40.	74518-6P-1P-BP-1P-BP F2(G-130 x P-5409) x F2 (Radhey x L-550)	3.70	5.61	2.06	3.8
41.	74540-21H-1P-3P-1P-BP F2(850-3/27 x T-3) x F2 (JG-62 x BEG-482)	11.92	9.87	6.31	9.4
42.	74540-21H-1P-1P-1P-BP -do-	9.47	10.28	5.22	8.30
43.	74606-5P-1P-BP-1P-BP (G-130 x JG-221) x (H-100 x H-355)	21.97	7.31	2.43	10.6
44.	74527-4P-1P-3P-1P-BP F2 (G-130 x B-108) x F2 (NP-34 x GW-5/7)	26.66	17.80	6.45	16.9
45.	74729-2P-1P-BP-1P-BP NEC-240 x (H-355 x 850-3/27)	7.24	7.21	9.85	8.1
46.	741663-2-1P-1P-1P-BP-BP (H-208 x RS-11) x (JG-221 x L-550)	6.25	8.10	11.42	8.6
47.	74632-1P-LB-BH-BP-BP-BP (H-355 x RBG-482) x (JG-62 x P-1387)	13.00	4.49	1.81	6.40
48.	741663-6-1P-1P-2P-BP-BP (H-208 x RS-11) x (JG-221 x L-550)	33.80	25.88	23.07	27.6

Contd.

Table 3. Contd.

1	2	3	4	5	6
49.	741663-3-1P-1P-2P-BP-BP (H-208 x RS-11) x (JG-221 x L-550)	23.33	7.44	7.35	12.70
50.	741663-1-3P-BH-1P-BP-BP (H-208 x RS-11) x (JG-221 x L-550)	5.17	3.57	1.40	3.40
51.	74632-1P-4B-BH-2P-BP-BP (H-355 x BEG-482) x (JG-62 x P-1387)	17.07	11.21	2.17	10.10
52.	741663-2-1P-1P-2P-BP-BP (H-208 x RS-11) x (JG-221 x L-550)	17.94	12.26	2.94	11.04
53.	74798-2P-LB-1H-BP-BP-BP P-2974 x (P-2974 x C-235)	17.04	4.34	19.26	13.50
54.	73190-B-2P-1P-3P-BP-BP (F-378 x Chafa)	10.71	24.76	20.51	18.66
55.	74540-22H-1P-1P-BP-BP (F2 x 850-3/27 x T-3) x F2 (JG-62 x BEG-482)	9.31	9.90	6.77	8.60
56.	74594-23H-1P-2P-BP-BP (G-130 x K-4) x (RS-11 x No.42)	32.39	9.21	25.00	22.20
57.	74729-2P-1P-2P-BP-BP (NEC-240 x (H-355 x 850-3/27)	20.00	11.88	18.94	16.90
58.	74729-2P-1P-1P-BP-BP (NEC-240 x (H-355 x 850-3/27)	11.81	4.70	5.55	7.30
59.	74540-21H-1P-1P-BP-BP F2 (850-3/27 x T-3) x F2(JG-62 x BEG-482)	9.43	7.50	9.70	8.90
60.	74731-5P-1P-1P-BP-BP F2 (850-3/27 x BEG-482) x F2(JG-62 x JG-221)	2.77	24.65	4.42	10.60
61.	74729-2P-1P-3P-1P-BP NEC-240 x (H-355 x 850-3/27)	5.82	8.04	5.50	6.40
62.	74527-4P-1P-3P-BP-BP F2 (G-130 x B-108) xF2(NP-34 x GM-5/7)	8.60	13.72	10.86	11.10
63.	74524-3P-1P-3P-BP-BP F2 (850-3/27 x GM-5/7) x F2 (H-208 x Annigeri)	9.80	2.81	5.00	5.90
64.	741663-3-3P-BH-3P-1P-BP (H-208 x RS-11) x (JG-221 x L-550)	3.66	7.21	2.70	4.50
65.	74190-B-2P-1P-2P-1P-BP F-61 x F-378	13.08	3.26	7.86	8.06
66.	74223-B-4H-1P-BP-BP-BP No.42 x H.223	19.81	13.91	6.48	13.40
67.	74540-21H-1P-BP-BP-BP F2 (850-3/27 x T-3) x F2(JG-62 x BEG-482)	5.50	15.06	0.00	6.80

Contd.

Table 3. Contd.

1	2	3	4	5	6
68.	741663-3-3P-BH-3P-1P-BP (H-208 x RS-11) x (JG-221 x L-550)	12.04	9.37	11.86	11.10
69.	74540-21H-1P-3P-BP-BP F2 (850-3/27 x T-3) x F2(JG-62 x BEG-482)	7.69	5.43	4.81	5.97
70.	74273-B-9H-1P-BP-BP-BP (850-3/27 x H-223) x P-82	11.22	6.48	9.09	8.90
71.	74132-B-4H-1H-1P-BP-BP G-130 x BG-1	11.49	14.13	11.11	12.20
72.	73190-B-2P-1P-1P-BP-BP F378 x Chafa	1[illegible].81	[illegible].60	7.89	8.40
73.	7334-8-3-1P-1P-1P-BP-BP H-208 x No. 56	19.00	[illegible].39	9.09	13.20
74.	Annigeri	23.68	[illegible].11	15.06	16.60
75.	73105-14-2-1P-1P-2P-BP-BP 850-3/27 x B-108	31.08	[illegible].65	12.26	18.60
76.	CPS-1	0.00	[illegible].61	4.76	3.40
77.	7339-1-8-1-1P-BH-1P-BP H-208 x B-100	2.66	[illegible].60	7.60	4.60
78.	73166-9-3-1H-BH-1P-BP-BP JG-62 x Pant 104	13.63	[illegible].49	7.14	9.70
79.	73105-14-2-2P-1P-1P-BP-BP 850-3/27 x B-108	10.25	[illegible].76	7.19	7.40
80.	WR-315	5.95	5.95	7.59	6.50
81.	73105-14-2-2P-1P-2P-BP-BP 850-3/27 x B-108	38.46	6.42	3.40	16.10

Lines showing less than 20% wilt will be retested in wilt sick plot and will be evaluated by breeders for yield in a normal field.

IV. SURVIVAL OF THE FUNGUS

A. Longevity

An experiment was initiated in March 1978 to find out how long F. oxysporum f. sp. ciceri survives in different parts of chickpea plant. In this experiment, roots with 5 - cm stem base from naturally infected plants were buried in 45 - cm pots (bottom removed) in soil. The pots were buried in soil in such a way that top of the pots was in level with soil surface. All the roots were weighed before burial. Four roots were removed carefully after every 3 months from the pots dried and weighed.

After washing in running water, the tissues were surface sterilised in 2.5% sodium hypochlorite for 2-3 minutes and isolations were attempted. Pathogenicity of the fungus was checked.

In the last year's report we reported that the fungus could be isolated from these roots for 27 months. The isolations were continued further from the disintegrating root tissues up to 33 months. The wilt pathogen was isolated and pathogenicity proven. After 33 months, it was impossible to take out the remnents of the roots from the soil. Soil from the pot was, therefore, transferred into a new pot and carried to a net house. Seed of JG-62, collected from healthy plants and surface sterilized with 2.5% sodium hypochlorite were sown in the pots and watered.

The seedlings were observed for any possible wilt symptoms. Within 30 days after sowing, the plants wilted in both the pots. The fungus, F. oxysporum, was isolated from the roots of infected plants.

This way, the chickpea wilt pathogen was traced from the soil in which the infected roots were buried 39 months earlier. The experiment is continuing. How does the fungus survive in the soil in absence of the host tissues? We propose to investigate this aspect.

Table 4. Survival of F. oxysporum f. sp. ciceri in buried roots[a/]

	Original weight of root (g)	Weight at the time of isolation (g)	Isolation
10-6-1980 (reported earlier)	7.35	0.06	+
	2.19	0.02	+
	3.82	0.03	+
	3.24	0.06	+
10-9-1980	11.27	0.03	+
	6.93	0.03	+
	11.62	0.02	+
	7.72	0.01	+
10-12-1980	4.40	0.02	+
	7.34	0.01	+
	5.32	-	+
	5.10	-	+
10-3-1981[b/]	Pot-1	-	+
	Pot-2	-	+
10-6-1981[b/]	Pot-1	-	+
	Pot-2	-	+

a/ Roots were buried on 10 March 1978.
b/ Based on the wilting of seedlings of JG-62.

B. Longevity as influenced by depth of burial

Roots of chickpea wilted plants were collected in March 1979. They were air dried and cut into small pieces of 20 to 25 mm. Each sample consisted of 10 pieces and placed in nylon mesh after weighing. Diseased samples were kept at various depths in soil in earthen pot (45 cm) which itself was buried in soil after removal of bottom. Top of the pot was in level with soil. After every 3 months, samples from one pot were assayed for chickpeas wilt pathogen. The experiment has been planned for 5 years.

After 12 months of burial, the host tissues disintegerated completely at all depths except near surface. However because of nylon mesh, we were able to collect disintegrating tissues, which were sprinkled on the selective medium (modified Czapek's Dox agar). The fungus was identified as F. oxysporum and pathogenicity proved. The studies are continuing.

Present studies indicated that chickpea wilt Fusarium could be isolated after 24 months from disintegrating host tissues buried up to 24" depth in soil.

Table 5. Survival of F. oxysporum f. sp. ciceri in host tissues buried at different depths of soil.

Date of isolation		OBSERVATION				
		Surface	6"	12"	18"	24"
1-9-1980	1	2.58	2.42	2.34	2.47	2.49
	2	1.05	0.39	0.47	ONLY IN TRACES	0.12
	3	+	+	+	+	+
1-9-1980	1	2.27	2.42	2.39	2.37	2.57
	2	1.98	ONLY IN TRACES			
	3	+	+	+	+	+
1-12-1980	1	2.75	2.49	2.64	2.44	2.25
	2	0.95	ONLY IN TRACES			
	3	+	+	+	+	+
1-3-1981	1	2.55	2.41	2.55	2.45	2.75
	2	0.85	ONLY IN TRACES			
	3	+	+	+	+	+
1-6-1981	1	2.33	2.34	2.51	2.50	2.35
	2	0.90	ONLY IN TRACES			
	3	+	+	+	+	+

1 = Original weight of root pieces
2 = Weight of root pieces at the time of isolation
3 = Isolation results (+ yes, - No)

C. Survival in wet soil

We do not know about the ability of the fungus to survive in the wet soil as well as in the water which may get contaminated with the fungus present in field soil. Diseased tissues harbor the pathogen and rain water may carry such tissues in the water storage tanks. Such contaminated water if used for irrigating fields may introduce the fungus in new areas.

To answer these questions, the present experiment was planned. Small root pieces of 2 - 3 cm length from wilted chickpea plants were mixed in soil (Vertisol) in pots (30 cm). The soil in 2 pots was always flooded with water, 4-5 cm above soil surface. In another set of pots, soil was kept constantly wet. Isolations from infected tissues from these pots, were attempted every week. The data is presented in Table 6.

Chickpea wilt fungus could not survive in the flooded soil within the host tissues for more than 65 days, however the fungus could survive over 200 days in the soil which was constantly wet.

Table 6. Survival of F. oxysporum f. sp. ciceri in wet and flooded soil[1]

Date of isolation	Detection of the fungus	
	Flooded soil	Wet soil
16-4-1980	+ + +	+ + +
24.4.1980	+ + +	+ + +
2-5-1980	+ + +	+ + +
9-5-1980	+ + -	+ + +
16-5-1980	+ + -	+ + +
23-5-1980	+ - -	+ + +
30-5-1980	+ + -	- - +
6-6-1980	+ - -	+ + -
13-6-1980	+ - -	+ + -
20-6-1980	- - -	+ + +
From 27-6-1980 to 7-10-1980	- - -	+ + +
14-10-1980		+ - +
21-10-1980		- - +
27-10-1980		- - +
5-11-1980		- - -
12-11-1980		- - -

[1]The experiment was set on 16-4-1980.

V. FURTHER STUDIES ON RACES

On the basis of our two-year studies, it was concluded that there are at least 3 physiological races of the chickpea wilt fungus (Pulse Pathology (chickpea) Report of Work 1978-79, 1979-80).

The isolates from Hyderabad, Kanpur and Gurdaspur gave distinct reactions and were used in race study. We believe that the Hyderabad and Kanpur isolates are more widespread and further studies were confined to these two isolates. Fourteen resistant and two susceptible lines (JG-62, C-104) to the Hyderabad isolate were used.

The inoculum was multiplied on sand maize meal medium (9:1) in 250 ml flasks for 14 days. One hundred g of inoculum was mixed in a plastic pot (15-cm dia) containing 2 kg of autoclaved soil (Vertisol) sand mixture (1:1). All the plastic pots were washed in running water, dipped in 5% $CuSO_4$ solution and then air dried before use.

Seeds, surface sterilized with sodium hypochlorite, were sown in pots. Five seedlings were allowed to grow in each pot. Twenty seedlings were tested against each isolate. Pots were irrigated with sterilized water and utmost care was taken to avoid cross contamination.

A critical look at the data in Table 7 indicates that out of the 14 resistant lines at Hyderabad 4 were susceptible to Kanpur isolate (ICC-519, 867, 3439, and GL-799). ICC-10104 was moderately susceptible to Kanpur isolate.

Further, cross P-436-2 x JG-62 was also tested against Hyderabad and Kanpur race (Table 8).

Cv. P-436-2 was resistant to Hyderabad and Kanpur race while JG-62 was susceptible. The F1s were susceptible, while F2s segregated. There was excess of susceptible progenies in F3 generation. Our experience is that with JG-62 there were usually an excess of susceptible plants. However there are some progenies in F3 like 71, 72 and 106 which showed differential reactions to Hyderabad and Kanpur races indicating the difference between the two races. Further studies are in progress.

VI SEED TREATMENT STUDIES

Influence of storage on the efficacy of Benlate-T in eradicating Fusarium oxysporum f. sp. ciceri from chickpea seed.

The chickpea wilt fungus Fusarium oxysporum f. sp. ciceri is internally seed-borne and seed dressing with the fungicide Benlate-T eradicates

Table 7. Reaction of chickpea cultivars to two isolates of F. oxysporum f. sp. ciceri[a]

Cultivars	Reaction to isolate[b]	
	Hyderabad	Kanpur
ICC-229	R	R
-338	R	R
-516	R	R
-519	R	S
-554	R	R
-867	R	S
-3439	R	S
-10104	R	M
-7254	R	R
-3684	R	R
ICCC-10	R	R
PPK	R	R
DA - 1	R	R
GL - 779	R	S
L - 550	S	S
JG - 62	S	S

[a] Readings were taken 60 days after sowing, 20 seedlings for each cultivar were sown.

[b] R = Resistant (0-20% wilt), M = Moderately susceptible (21-50% wilt) S = Susceptible (51 - 100% wilt).

Table 8. Testing of cross P-436-2 x JG-62 against Hyderabad and Kanpur isolate.

Particulars	Hyderabad isolate		Kanpur isolate	
	No. of plants	No. of plants wilted	No. of plants	No. of plants wilted
P-436-2 P_1	10	-	10	-
JG-62 P_2	11	11	10	10
F_1 P-436-2 x JG-62	2	2	4	4
F_2	16	14	22	18
F_3- R - 61	8	8	9	9
- 62	7	7	9	9
- 64	8	8	7	3
- 65	6	6	9	9
- 66	2	2	10	10
- 67	4	4	4	2
- 68	9	7	9	3
- 69	4	4	7	7
- 70	9	0	5	0
- 71	9	9	8	0
- 72	10	0	6	5
- 73	10	10	10	4
- 74	9	9	7	7
- 75	7	7	6	6
- 76	9	9	6	6
- 77	10	10	10	10
- 78	10	10	6	6
- 79	-	-	2	2
- 80	10	10	10	10
- 81	10	10	9	9
- 82	9	9	9	9
- 83	10	8	9	9

Contd.

Table 8. Contd.

Particulars	[illegible]erabad isolate		Kar[illegible]ur isolate	
	No. of plants	No. of plants wilted	No. of plants	No. of plants wilted
3 -84	5	5	5	5
-85	9	9	10	10
-86	10	10	10	10
-87	10	10	9	9
-88	9	9	9	9
-89	7	4	10	5
-90	10	0	7	0
-92	8	8	10	10
-93	9	9	7	7
-94	9	7	9	9
-95	7	7	9	9
-96	8	8	10	10
-97	3	3	1	1
-98	9	3	7	2
-99	4	4	2	2
-100	7	7	9	9
-101	5	5	6	5
-102	7	7	10	10
-103	9	9	9	9
-104	9	9	7	7
-105	10	4	7	7
-106	7	0	8	8
-107	4	3	5	5
-108	10	3	8	0
-109	9	9	6	2

the fungus (Haware et al 1978)†. Since all ICRISAT's chickpea seed is now routinely treated with Benlate-T before export and there is a time gap between seed dressing and actual planting, we wanted to know how long Benlate-T remains effective in storage.

Seed of cv JG-62 was treated in March 1980 with Benlate-T (benomyl 30% + thiram 30%; Du Pont's product) at the rate of 2.5 gm/kg seed. The treated as well as non-treated seed (check) was stored in polythene bags at room temperature (22-25°C). Every month until March 1981, four hundred treated and non-treated seeds were plated on modified Czapek's Dox Agar to detect F. oxysporum f. sp. ciceri in seed.

The data are presented in Table 9. The fungus could be detected in non-treated seeds during the entire period of experiment though the percentage of seed yielding the fungus was lower towards the end (18% in March 1980 and 5% in March 1981). In contrast, at no time the fungus was detected in the treated seed, proving thereby that the seed dressing with Benlate-T is effective in eradicating inoculum at least for a year after the seed treatment. The fungicide may be effective for a longer duration, but we did not consider it necessary to carry this study for more than one year.

VII. YIELD TRIAL

In order to study the yield potential of wilt resistant lines, a field trial was conducted at ICRISAT Centre and at Hissar sub-centre with the help of breeders. This was the second year of testing of these lines. Sixteen wilt resistant lines and 4 checks were included. The trial was planted in B2 (Vertisol) on 17th October 1980 at ICRISAT Centre. The trial was planted in 4 replications, each plot had 4 rows of 4 m length and 30 cm apart. Forty seeds were sown in each row.

Of the 18 lines tested, BG-203, H-208, BDN 9-3 and Annigeri were the checks. This year BDN 9-3 was the top yielding cultivar. WR-315, a wilt resistant cultivar was second in rank followed by CPS-1, another wilt resistant line (Table 10).

VIII. INFLUENCE OF CROP ROTATION AND INTERCROPPING

These studies were initiated in close cooperation with crop scientist with the following objectives:

1. To study the effect of breaking the sequence of chickpea crops by cereals on the wilt incidence in chickpea.

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†Haware, M.P., Y.L. Nene, and R. Rajeshwari. 1978. Eradication of Fusarium oxysporum f. sp. ciceri transmitted in chickpea seed. Phytopathology 68: 1364-1367.

Table 9. Effect of Benlate-T on chickpea seed borne *F. oxysporum* f. sp. *ciceri* in storage.

Month	Benlate-T treated % infection	Non-treated % infection
March 1980	0	18
April 1980	0	17
May 1980	0	10
June 1980	0	8
July 1980	0	7
August 1980	0	10
September 1980	0	11
October 1980	0	10
November 1980	0	6
December 1980	0	7
January 1981	0	9
February 1981	0	5
March 1981	0	5

Table 10. Yield testing of wilt resistant chickpea lines at Hyderabad

Line	100 gm seed weight	Yield kg/ha	Rank
[illegible]-9-3	14.4	1666	1
P-165	13.7	1422	11
P-289	11.7	1238	15
P-517	13.2	1440	10
Annigeri	18.3	1577	4
P-678	12.5	1452	8.5
P-1265	13.6	982	16
P-1353	12.6	1488	6
[illegible]-208	11.4	851	18
P-4116-1	12.5	1452	8.5
P-6099	18.8	1357	13
PG-74	16.5	1369	12
[illegible]-790	22.2	1517	5
BG-203	10.9	910	17
[illegible]-315	14.5	1624	2
P-270	12.1	1327	14
CPS-1	17.0	1612	3
BG-212	12.6	1482	7
Mean	14.4.	1376	
Range	10.9 - 22.2	851 - 1666	
CV%	4.67	17.67	
CD	0.95	344.92	

2. To determine the length of such a break necessary to reduce the wilt incidence in chickpea.

3. To study the effect of intercropping chickpea with cereals on the wilt incidence in chickpea.

The studies were initiated in June 1981, in a part of the wilt sick plot (0.4 ha in BIL-2B). The following treatments were planned for four years:

Treatments :

1. Continuous chickpea after kharif fallow.
2. Chickpea as a second crop after sorghum
3. Chickpea as a second crop after maize
4. Chickpea in alternate years rotated with rabi sorghum (rotation starts with sorghum)
5. Chickpea in alternate years rotated with rabi sorghum (rotation starts with chickpea).
6. Chickpea in alternate years rotated with wheat (rotation starts with wheat).
7. Chickpea in alternate years rotated with wheat (rotation starts with chickpea).
8. Chickpea in alternate years with three cereal crops in between.
9. Chickpea once in three years with five cereal crops in between.
10. Continuous sorghum/chickpea intercrop.
11. Continuous wheat/chickpea intercrop.
12. Continuous sorghum/chickpea intercrop from second year after one year of cereal crops.

Year 1		Year 2		Year 3		Year 4	
Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
Fallow	Chickpea	Fallow	Chickpea	Fallow	Chickpea	Fallow	Chickpea
Sorghum	Chickpea	Sorghum	Chickpea	Sorghum	Chickpea	Sorghum	Chickpea
Maize	Chickpea	Maize	Chickpea	Maize	Chickpea	Maize	Chickpea
Fallow	Sorghum	Fallow	Chickpea	Fallow	Sorghum	Fallow	Chickpea
Fallow	Chickpea	Fallow	Sorghum	Fallow	Chickpea	Fallow	Sorghum
Fallow	Wheat	Fallow	Chickpea	Fallow	Wheat	Fallow	Chickpea
Fallow	Chickpea	Fallow	Wheat	Fallow	Chickpea	Fallow	Wheat
Sorghum	Ratoon or wheat	Fallow	Chickpea	Fallow	Chickpea	Fallow	Chickpea
Sorghum	Ratoon or Wheat	Sorghum	Ratoon or Wheat	Fallow	Chickpea	Fallow	Chickpea

Year 1		Year 2		Year 3		Year 4	
Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
Fallow	Sorghum/ Chickpea	Fallow	Sorghum/ Chickpea	Fallow	Sorghum/ Chickpea	Fallow	Sorghum/ Chickpea
Fallow	Wheat/ Chickpea	Fallow	Wheat/ Chickpea	Fallow	Wheat/ Chickpea	Fallow	Wheat/ Chickpea
Sorghum	Ratoon	Fallow	Sorghum/ Chickpea	Fallow	Sorghum/ Chickpea	Fallow	Sorghum/ Chickpea

Cultivars : Sorghum - CSH6
Chickpea - JG62
Maize - SB23

Plant population and spacing : Row spacing 37.5 cm 75 cm in kharif
37.5 cm in rabi (two rows on 75 cm ridges) in all the treatments.

Sorghum - 180,000 pl/ha
Maize - 50,000 "
Chickpea- 444,000 "

In the intercrop every alternate row of chickpea is replaced by either a sorghum or a wheat row.

Location : BIL -2B

Design : Randomized block design with four replicates

Plot size : 9m x 6.5m

In the first year of experiment (1980-81) the wilt incidence in chickpea was recorded. There was no difference under different treatments. There was complete mortality in chickpea in all the treatments.

PROJECT: CP - PATH -2(78): STUDIES ON STEM AND ROOT ROTS OF CHICKPEA

I SUMMARY

1. Rhizoctonia bataticola, the dry root rot fungus, survived in the soil on infected tissues for at least 36 months.

2. Wilt resistant lines were screened for their resistance to dry root rot by using blotting paper technique. The infected roots were scored on 1 to 9 scale.

3. Of the 50 wilt resistant lines, ICC-554 and -6926 were highly resistant (2 rating) and ICC-1443, -1910, -1913, -2086, and -7681 were resistant (3 rating).

4. Screening technique was developed to identify resistance to black root rot (Fusarium solani). Clear differences between susceptible and resistant lines of chickpea were observed. The infected roots were scored on 1 to 9 scale.

5. Following this technique 50 wilt resistant chickpea lines were screened. ICC-7111 showed very little infection (1.5 rating). ICC-554, -1450, -3539, and -11088 were also highly resistant (2.5 rating). Those which showed 3 rating were ICC-519, -658, -1611, -1891, -1913, -2089, -2660, -6098, -7248, -8982, -9001, -10104 and -11531. ICC-3539 is also promising against Ascochyta blight.

6. During the year under report 195 selections (1979-80) from preliminary screening were tested in multiple disease sick plot. Of these 95 lines showed less than 10% wilt and root rots.

7. Out of 133 germplasm selections for wilt resistance (1979-80), 63 lines were found promising in the multiple disease sick plot.

8. Thirty three advanced bulks (wilt resistant) were screened in multiple disease sick plot. Of them, 16 showed less than 10% mortality, and 11 showed between 11 to 20% mortality.

9. Following pathogens were present in the multiple disease sick plot: F. oxysporum f. sp. ciceri, Rhizoctonia bataticola, Sclerotium rolfsii, R. solani and F. solani.

II. INTRODUCTION

The project was initiated in January 1978 with the following objectives:

1. Collect more precise information on the prevalence of stem and root rots in the chickpea growing areas.
2. Study the etiology of pathogens leading to the understanding of epiphytology of these diseases, and
3. Develop efficient techniques to screen for resistance.

After the chickpea wilt, dry root rot caused by Rhizoctonia bataticola is widely prevalent in chickpea growing areas in the semi-arid tropics. We developed a laboratory screening technique for this disease (1979-80 annual report). Wilt promising lines were screened by this technique.

We also initiated the work on black root rot of chickpea caused by Fusarium solani and we attempted to screen wilt-promising lines.

For field screening we depended on the natural ...dence of various pathogens in the multiple disease sick plot.

III. DRY ROOT ROT (Rhizoctonia bataticola)

A. Survival of Rhizoctonia bataticola on host debris

Since April 1978 we were attempting isolations of R. bataticola from the infected stems and roots buried in Vertisol-filled earthen pots and from material kept in laboratory. Isolations were attempted every month starting from April 1979 on the CMR medium described by Meyer et al (Phytopathology 68: 613-620, 1973).

The composition of the medium is as follows:

Polished rice	-	10 gm
Agar	-	20 gm
Chloroneb	-	300 mg
Mercuric chloride	-	7 mg
Rose bengal	-	90 mg
Streptomycin sulphate	-	40 mg
Potassium penicillin	-	60 mg

Polished rice is boiled for 5 min in one litre water and strained through cheese cloth. Agar is added and the medium is autoclaved. The remaining ingredients are mixed after autoclaving and the pH adjusted to 6.0 with lactic acid.

The results so far indicate that the fungus is able to survive at least 36 months in the soil. The experiment is continuing.

B. Laboratory screening

Blotting paper technique (Pulse Pathology (Chickpea) Report of Work 1979-80) is being successfully used to screen the chickpea wilt resistant lines for dry root rot resistance.

Inoculated seedlings in paper towel are incubated at 35°C for 8 days. After incubation, seedlings are examined for the extent of root damage on the following scale.

Disease rating

1 - Clean root, no infection
3 - Infection slight, small lesions on a few roots
5 - Infection moderate, lesions on 50 percent roots
7 - Infection severe, extended lesions on about 75 percent roots, shoots remain green
9 - Completely rotted roots, extended lesions on all roots, shoots show yellowing and drying.

Of the 50 wilt resistant lines reported in the CP-Path-1 Project (Table 1) the following lines were resistant:

Highy resistant (2 rating) ICC 554 and ICC 6926
Moderately resistant (3 rating) ICC-1443, -1910, -1913, -2086 and -7681.

Other lines which showed 3 rating in repeated tests were:

ICC-435, 444, 537 (K), 999, 1918, 2450, 2461, 2874, 3181, 3392, 3428, 4716, 4902, 4948, 4994, 4954, 5901, 6081, 6366, 6411, 6455, 6501, 6570, 6608, 6668, 6687, 6772, 6816, 6840, 6939, 7681, 7777, 8970, 8971, 9018, 9023, 9042, 10466 (K); 10500, 10539, 10630, 11550, ICCL - 80001.

IV. BLACK ROOT ROT

The black root rot of chickpea caused by Fusarium solani is not widespread but can be important locally. It is of particularly important in Mexico, Chile and in north India.

A. Laboratory screening

Fusarium solani isolated from chickpea roots was multiplied on potato dextrose broth (100 ml medium in 250 ml flask) for 7 days at 25°C. Seedlings were raised in plastic pots (6") in autoclaved sand soil (Vertisol) mixture (1:1). Inoculations were carried out on 7-10 day old seedlings.

The inoculum was multiplied on a shaker for 7 days. It was diluted by adding 100 ml of sterilised water and mixed thoroughly.

About 3 cm soil around the seedling was removed and 5 ml of inoculum was poured near collar region. The soil surface was relevelled. Soil was kept moist before and after inoculation.

B. Symptom development

About 10 days after inoculation, plants in susceptible cultivar show slight stunting and older leaves become pale. Black lesion is seen in hypocotyl region. Within 15 days stunting is conspicuous. Older leaves turn yellow. Root lesion extends downward causing rotting of roots and retarding development. Within 24 days after inoculation the external symptoms on susceptible checks are conspicuous. Seedlings may collapse after turning yellow. Blackening was evident at the base of the seedlings.

External symptoms were not clearly evident on many of the lines/plants inoculated, probably since the cotyledons in many of the plants were intact.

Twenty-five days after inoculation, the seedlings were carefully removed from each pot and the soil was washed from the roots. All seedlings were rated by using 1 - 9 scale with 1 indicating no disease and 9 indicating a completely rotted root accompanied by death of the seedling.

C. Disease rating (Black root rot)

1 - Plant healthy, no root infection
3 - Plant healthy, slight infection in hypocotyl region along with restricted lesions on few roots
5 - Plant stunted, black root rotting on 50 percent roots
7 - Plant stunted accompanied by yellowing of leaves, 75 percent roots affected
9 - Plant with severe stunting and yellowing of leaves, completely rotted roots

D. Reaction of wilt promising lines against F. solani

The wilt resistant lines were screened in the glass house with the method described above. The disease was rated on 1 - 9 scale.

The test was conducted twice. In each test 10 seedlings were inoculated. The results given below are the averages of two tests.

Disease rating	Wilt resistant lines
1.5	ICC-7111
2.5	ICC-554, 1450, 3539, 11088
3.0	ICC-519, 658, 1611, 1891, 1913, 2089, 2660, 6098, 7248, 8982, 9001, 10104, 11531
4.0	ICC-3103, 3439, 6926
5.0	ICC-202, 229, 1443, 2072, 2086, 2566, 3099, 3684, 4552, 6366, 7681, 8933
6.0	ICC-338, 867, 2104, 6671
7.0	ICC-391, 858, 2461, 4519, 4918, 5864, 10130
8.0	ICC-1910, 6880
9.0	ICC-267, 516, 2883, 6494

V. FIELD SCREENING

At ICRISAT Centre, we have developed a multiple disease sick plot wherein different soil-borne pathogens have been encouraged to build up through incorporation of dead plant debris every year. Chick-pea lines found promising against the wilt were planted in this multiple disease sick plot in 2 rows (4 m). Wilt susceptible check (JG-62) was planted after every 4 rows.

A. Multiple disease sick plot selections (1979-80):

During 1979-80, 195 lines were selected from multiple disease sick plot in preliminary screening (20% or less mortality). Out of these, 95 lines showed less than 10% wilt and root rots. These were:

ICRISAT- ICC-434, 537, 595, 606, 1338, 1376, 1910,1913, 2450, 2664, 2835, 2858, 3354, 3415, 3428,3528, 3782, 4485, 4716, 4843, 4847, 4850, 5901, 6384, 6385, 6411, 6440, 6455, 6474, 6480, 6488, 6494, 6501, 6570, 6668, 6687, 6730, 6772, 6774, 6800, 6815, 6816, 6817, 6926, 7481, 7489, 8166, 8170, 8446, 8585, 8622, 8971, 8979, 8988, 8999, 9023, 9025, 9029, 9032, 9033, 9035, 9039, 9041, 9043, 9103, 9112, 9127, 10309, 10382, 10384, 10394, 10399, 10537, 10539, 10630, 10802, 10803, 10809, 10823, 11531, 11554, RAVP-52, GW-9, P-496.

Kanpur: Out of 9 lines tested, KW-4, KW-2B, KW-17B, BA-1, GW-3-1, and PPK-1 showed resistance against wilt and root rots in second year.

Gurdaspur: GL-779 was again found resistant.

GIET (1979-80) Out of 4 entries tested, JG-2260 and JG-1259 were promising.

Delhi: Out of the 100 lines received from Dr. Jain during 1979-80 season, MCK-43 was promising.

Ascochyta promising line: ICC - 3935 was found resistant.

B. Wilt promising selections (1979-80) from germplasm

Last year 133 germplasm lines showing less than 20% wilt were selected from a wilt-sick plot. These lines were tested in multiple disease sick plot in 2 rows (4 m). Sixty three lines which showed less than 10% wilt/root rots were selected. They were:

ICC - 184, 268, 301, 573, 594, 871, 925, 933, 1132, 1279, 1296, 1297, 1298, 1314, 1316, 1330, 1405, 1434, 1435, 1437, 1441, 1451, 1477, 1550, 1567, 1587, 1712, 1719, 1753, 1755, 1756, 1758, 1795, 1870, 1901, 1984, 1987, 2034 2061, 2243, 2246, 2250, 2484, 2520, 2580, 2595 2831, 3075, 3076, 3208, 3219, 3274, 3328, 3407 3448, 3457, 3458, 3504, 3508, 3536, 3537, 3538 3768.

C. Breeders' material

Table 11. Reaction of wilt resistant lines developed at ICRISAT in the multiple disease sick plot in 1980-81.

Sl. No.	Pedigree	MDSP Percent mortality
1.	ICCL-80001 Segregating white and pink flowered	7.3
2.	ICCL-80002 Kabuli	-
3.	ICCL-80003 Desi	8.6
4.	ICCL-80004 (WF)	8.3
5.	75866-1P-2P-BP-BT-BP PRR-1 x P-1265	6.4
6.	75419-5P-2P-BP-BT-B? (P99 x NEC-108) x Radhey	2.1
7.	74533-5P-4P-BP-BT-BP P-5409 x 850-3/27	56.2
8.	75899-2P-3P-BP-BT-BP P-1100 x WR-315	12.9
9.	741568-3P-2P-BP-BT-BP 850-3/27 x P-2774	3.1
10.	752296-6P-1P-BP-BT-BP F3 (850-3/27 x BG-1) K4 x F3 (F404 x L-550) GW 5/7	26.4
11.	752296-7P-BP-BT-BP F3 (850-3/27 x BG-1) K4 x F3 (F404 x L-550) GW 5/7	12.5
12.	74371-5P-1P-1P-BP-BT-BP (850-3/27 x BEG-482) x (JG-62 x JG-221)	16.6
13.	741663-2P-1P-1P-1P-BP-BT-BP (H-208 x RS-11) x (JG-221 x L-556)	20.0
14.	741663-3P-1P-1P-2P-BP-BT-BP (H-208 x RS-11) x (JG-221 x L-556)	13.8
15.	74729-2P-1P-1P-BP-BT-BP (H-355 x 850-3/27) x NEC-240	17.3
16.	74540-22H-1P-BP-BP-BT-BP F2 (850-3/27 x T-3) x F2 (JG-62 x BEG-482)	4.3
17.	74729-2P-1P-2P-BP-BT-BP (H-355 x 850-3/27) x NEC-240	30.0
18.	74540-21H-1P-BP-BP F2 (850-3/27 x T-3) x (JG-62 x BEG-482)	19.2
19.	741663-2-1P-1P-2P-BP-BT-BP (H-208 x RS-11) x (JG-221 x L-550)	3.1
20.	73105-14-2-2P-1P-1P-BP-BT-BP (850-3/27 x B 708)	0.0
21.	75278-1P-2P-1P-BP (NEC-240 x NEC-1639) x (Chafa x P-472)	15.0
22.	75278-1P-2P-BP-BP (NEC-240 x NEC-1639) x (Chafa x P-472)	21.8
23.	74524-3P-1P-1P-1P-BP F2 (850-3/27 x GM-5/7) x F2 (H-208 x Annigeri)	2.0
24.	74527-4P-1P-1P-1P-BP F2 (G-130 x B-108) x F2 (NP-34 x GM-5/7)	12.9

Con't.

Table 11. Contd.

Sl. No.	Pedigree	MDSP percent mortality
25.	74514-22H-1P-1P-1P-BP F2 (BG-2 x P-1480) x F2 (GW-5/7 x H-223)	4.8
26.	74540-21H-1P-1P-BP-BP F2 (850-3/27 x T-3) x F2 (JG-62 x BEG-482)	4.3
27.	74540-22H-1P-1P-BP-BP F2 (850-3/27 x T-3) x F2 (JG-62 x BEG-482)	7.1
28.	74540-21H-1P-3P-BP-BP F2 (850-3/27 x T-3) x F2 (JG-62 x BEG-482)	4.9
29.	74190-8-2P-1P-2P-1P-BP F61 x P-378	38.8
30.	74257-5-1P-1H-BP-1P-BP JG-62 x (H-208 x T-3)	7.3
31.	741663-3-1P-1P-2P-BP-BP (H-208 x RS-11) x (JG-221 x L-550)	15.7
32.	7385-12-2-1H-1H-BP-CP-BP L-550 x L-2	15.3
33.	7369-2-2-1P-1P-1P-BP-BP L-550 x USA-613	4.0

VI. PERIODIC ISOLATIONS FROM WILTED/DRIED PLANTS COLLECTED FROM MULTIPLE DISEASE SICK PLOT

To monitor the presence of different root pathogens from October through February (chickpea season at Hyderabad) we made periodic isolations from diseased plants. The results are presented in Table 12.

Table 12. Periodic isolations from wilted/dried plants of chickpea collected from multiple disease sick plot[a].

Date of collection[b]	F. oxysporum f. sp. ciceri	R. bataticola	S. rolfsii	R. solani	F. solani	Others
27-11-80	51	16	25	3	-	-
17-12-80	67	13	4	-	8	-
6-1-81	41	40	6	8	4	-
29-1-81	42	46	1	4	5	-
18-2-81	40	38	4	2	10	-

[a] Figures are percentage of isolations

[b] Date of [illegible]

Table 13: Ambient temperature data from October 1980 thru February 1981

Standard week	Dates	Average temperature (°C)		Rainfall (mm)
		Maximum	Minimum	
42	15 October - 21 October 1980	30.4	18.7	6.3
43	22 October - 28 October 1980	31.9	17.5	0.0
44	29 October - 4 November 1980	31.2	14.7	0.0
45	5 November - 11 November 1980	30.4	15.2	0.0
46	12 November - 18 November 1980	28.7	20.7	0.3
47	19 November - 25 November 1980	30.3	17.1	0.0
48	26 November - 2 December 1980	28.5	12.7	0.0
49	3 December - 9 December 1980	28.2	14.0	0.0
50	10 December - 16 December 1980	29.5	11.4	0.0
51	17 December - 23 December 1980	28.9	13.4	0.0
52	24 December - 31 December 1980	27.1	16.6	0.2
1	1 January - 7 January 1981	28.5	12.3	0.0
2	8 January - 14 January 1981	24.6	14.5	7.6
3	15 January - 21 January 1981	25.0	12.8	8.0
4	22 January - 28 January 1981	28.9	16.2	0.0
5	29 January - 4 February 1981	30.5	14.0	0.0
6	5 February - 11 February 1981	31.45	15.15	0.0
7	12 February - 18 February 1981	32.74	14.95	0.0
8	19 February - 25 February 1981	33.2	17.85	0.0

PROJECT: CP - PATH-3(78): STUDIES ON CHICKPEA STUNT AND OTHER VIRAL DISEASES

I. SUMMARY

1. The work on chickpea stunt was confined to the screening of germplasm and breeding materials for resistance at Hissar in North India where the natural incidence of the disease is high.

2. The nursery was planted on 25th September about one month in advance of the normal sowing date as the early plantings were found to get more infection in the previous seasons. A mixture of the hosts of the virus and vectors was planted around and through the field to serve as reservoir hosts for the virus and vectors. A row of a susceptible variety of chickpea (WR-315) was planted after every two test rows to serve as an indicator cum spreader rows.

3. Advance planting of the nursery by about one month of the normal sowing time resulted in very high disease build up in the nursery compared to earlier seasons. The average incidence of the disease in the indicator rows (WR-315) was 74% with a range of 43 to 100%.

4. Some germplasm lines that have shown less than 10% infection (promising) for 3 to 5 seasons were identified. Two lines, ICC-6433 and ICC-10495 were found promising for 5 consecutive seasons. Four lines: ICC-403, ICC-591, ICC-688, and ICC-2546 were promising for 3 consecutive seasons.

5. Similarly, some of the crossing block entries were found promising for 2 to 4 seasons. These were Coll. 327 and ICC-5 (for 4 seasons) and HNS-8, H-550, NEC-2404 and P-2202-2 x Pant G-114 (for 2 seasons).

6. Some of the Ascochyta blight promising lines have been found promising for stunt for 3-4 years. The lines that were found promising for 4 consecutive seasons are ICC-1012 and ICC-4989. One line: ICC-1202 was promising for 3 consecutive seasons. Two of the lines; ICC-1525 and ICC-1754 that were resistant to blight at ICARDA, Syria were also found promising.

7. Many of the ICCC materials that are being developed at Hissar Center were found promising for stunt. This is probably due to the high natural incidence of stunt at Hissar and automatic elimination of susceptible types from the breeding populations.

8. In order to help the breeders in developing stunt resistant varieties screening of limited amount of breeding materials involving stunt and wilt resistant lines and stunt resistant x resistant or promising lines has been carried out. The materials screened included 60 F_3 progenies, 9 F_2 and 3 F_2 bulks. Some of the F_3 progenies were found to be highly promising.

9. Quite a few of the GIET and GCVT entries especially those originating from Hissar and Delhi Centers where the natural incidence of the disease is comparatively higher are found promising for stunt.

10. Typical baciliform particles characteristic of Alfalfa mosaic were observed under electron microscope in partially purified preparations from mosaic affected plants in the field.

11. Two more viruses: cucumber mosaic virus and bean yellow mosaic virus were found to infect chickpea naturally.

II. INTRODUCTION

The work on stunt was confined to the screening of different materials including germplasm and breeding materials for resistance at Hissar in north India. Two other viruses namely cucumber mosaic virus and bean yellow mosaic virus have been found to occur on chickpea. A Ph.D. student, Mr. T.V. Chalam, Assistant Professor, Department of Plant Pathology, Andhra Pradesh Agricultural University, Rajendranagar, Hyderabad, India is working on characterisation and strain identification of these two viruses.

III. SCREENING NURSERY

Screening was carried out in 0.5 ha plot at Haryana Agricultural University farm, Hissar, in north India, where the natural incidence of the disease has been found to be quite high (around 20%). Based upon the information obtained from the previous seasons in which early planting (September 15) was found to encourage more disease incidence, the nursery was planted on 25th September 1980. The layout of the nursery is given in Fig 1. The field was ridged 75 cm apart. A mixture of the hosts of pea leaf roll virus and aphid vectors (alfalfa, berseem, cowpea, mung, urd, peas, beans, groundnut, lentil, chickpea, Lathyrus, broad bean) was planted around and through the field (4.5 m apart every 6th row) to serve as reservoir hosts for the virus and vectors. A row of a susceptible variety of chickpea (NR-315) was planted after every two test rows to serve as indicator-cum-spreader rows. Very high incidence of disease developed in the nursery as indicated by the indicator rows (Average 74%; range 43 to 100%). This was much higher than that observed in the previous seasons.

IV. SCREENING FOR RESISTANCE

A. Germplasm selections:

Since 1976-77 season, the process of selecting the lines with < 10% infection under natural conditions in the germplasm evaluation block, planted by Genetic Resources Unit, and testing them in the stunt nursery in the subsequent seasons has been practiced. The results of the screening of the selections made during 1976-77, 1977-78, 1978-79, and 1979-80 seasons are summarised below:

1. 1976-77 Selections:

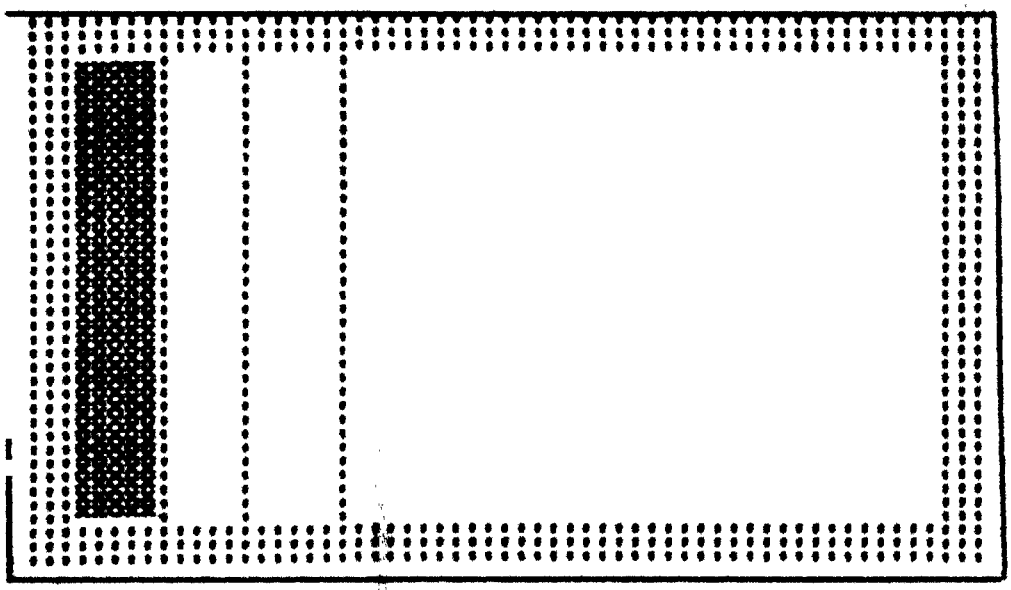
Eighteen lines that were selected during the 1976-77 season and found to show < 10% infection during the subsequent three seasons were retested. Each entry was planted in four 5-meter rows (100 seeds). Final observations on disease incidence were recorded 3 months after planting. The results are presented in Table 14.

None of the lines was found free from infection. Two lines ICC-6433 and ICC-10495 showed less than 10% infection. Another seven lines: ICC-2385, ICC-3718, ICC-3735, ICC-6934, ICC-10490, ICC-10508, and ICC-10587 showed less than 20% infection. Others showed more than 20% infection but none of them showed higher infection than the susceptible check planted after every two test rows to serve as indicator rows. The higher incidence (i.e. more than 10% infection) in many of the test lines this season appears to be due to the overall higher disease pressure created in the nursery by advance planting.

Table 14: Results of screening of 1976-77 germplasm selections to stunt at Hissar during 1980-81 season.

ICC No.	Total plants	Infected plants	% Infection
2233	80	19	23.7
2385	73	8	10.9
2430	72	15	20.8
2925	74	16	21.6
3034	73	23	31.5
3133	72	27	37.5
3718	77	8	10.3
3735	70	10	14.2
6433	77	5	6.4
6934	74	8	10.8
10490	72	11	15.2
10495	67	4	5.9
10508	78	9	11.5
10586	73	22	30.1
10587	69	10	14.4
10592	78	22	28.2
10594	72	18	25.0
10800	72	20	27.7

Fig. 1 : Field layout of the stunt screening nursery at Hissar during 1980-81 season.



Legend

Reservoir hosts (Mixture of legumes)

Susceptible check

Test materials

2. 1977-78 Selections:

The results of screening of five germplasm lines that have been selected during the 1977-78 season and tested in the past two seasons are presented in Table 15. Each entry was planted in four 5-meter rows. This season all the lines showed more than 10% infection. One line, ICC-2356, showed less than 20% infection and all others had more infection.

Table 15: Results of screening of 1977-78 germplasm selections to stunt at Hissar during 1980-81.

S.No.	ICC No.	Total plants	Infected plants	% infection
1.	613	74	29	39.1
2.	2356	52	8	15.3
3.	2617	57	17	29.8
4.	7003	55	12	21.8
5.	10597	38	5	31.1

Table 16: Results of screening of 1978-79 germplasm selections to stunt at Hissar during 1980-81 season.

ICC No.	Total plants	Infected plants	% Infection
575	74	13	17.5
577	66	17	25.7
678	69	16	23.1
690	75	10	13.3
767	51	12	23.5
787	55	20	36.3
981	72	17	23.6
1067	58	18	31.0
1876	71	29	40.8
1881	68	17	25.0
2090	71	12	16.9
2226	72	13	18.0
2277	47	13	27.6

Contd.

Table 16. Contd.

ICC No.	Total plants	Infected plants	% Infection
2534	68	16	23.5
2546	58	4	6.8.
2572	67	8	11.9
2604	56	12	21.4
2713	54	16	29.6
5012	74	14	18.9
130	68	26	38.2
159	69	20	28.9
248	66	12	18.1
279	71	21	29.5
403	78	4	5.1
526	72	25	34.7
539	69	14	20.2
591	72	7	9.7
599	72	18	25.0
685	64	13	20.3
705	64	13	20.3
706	70	15	21.4
735	74	19	25.6
773	62	30	48.3
774	65	31	47.6
817	55	24	43.6
912	73	20	27.3
913	75	26	34.6
926	68	20	29.4
1004	74	30	40.5
1510	78	37	47.4
1563	72	18	25.0
1864	74	32	43.2
1882	55	32	58.1
1893	73	19	26.0
1963	75	21	28.0
2039	65	32	49.2
2089	80	23	28.7
2092	62	20	32.2
2108	73	24	32.8
2191	70	27	38.5
2212	67	21	31.3
2228	76	26	34.2
2236	66	29	43.9
2267	65	29	44.6
2276	77	29	37.6
2289	42	16	38.0
2292	72	8	11.1
2388	70	18	25.7
2516	74	19	25.6

Contd.

Table 16: Contd.

ICC No.	Total plants	Infected plants	% Infection
2521	75	21	28.0
624	76	34	44.7
1578	80	22	27.5
8930	66	22	33.3

Table 17: Results of screening of 1979-80 germplasm selections to stunt at Hissar during 1980-81 season.

ICC No.	Total plants	Infected plants	% Infection
614	46	22	47.8
628	41	19	46.3
660	35	8	22.8
827	42	14	33.3
845	39	20	51.2
881	40	15	37.5
947	41	14	34.1
1020	43	16	37.2
1022	40	16	40.0
1023	25	7	28.0
1044	38	4	10.5
1061	42	9	21.4
1130	32	19	59.3
1216	40	22	55.0
1404	41	20	48.7
1416	37	20	54.0
1421	38	17	44.7
1447	36	15	41.6
1563	35	18	51.4
1576	35	13	37.1
1581	39	23	58.9
1817	38	15	39.4
1821	35	13	37.1
1867	33	16	48.4
1868	37	16	43.2
1962	38	25	65.7
1971	40	15	37.5
1972	40	19	47.5
1973	40	11	27.5
1974	33	19	57.5
1977	41	7	17.0
2009	36	11	30.5
2013	36	14	38.8
2175	33	4	12.1
[illegible]27	38	4	10.5

Contd.

Table 17. Contd.

ICC No.	Total plants	Infected plants	% Infection
2229	33	11	33.3
2254	35	15	42.8
2258	26	9	34.6
2264	39	6	15.3
2265	32	9	28.1
2273	34	8	23.5
2292	37	9	24.3
2294	35	9	25.7
2304	37	9	24.3
2306	34	14	41.1
2307	34	16	47.0

3. 1978-79 Selections:

The results of screening of germplasm lines selected in 1978-79 season and tested last season are presented in table 16. Each entry was planted in 4, 5 meter rows. Four lines; ICC-403, ICC-591, ICC-685, and ICC-2546 showed less than 10% infection. Another eight lines; ICC-248, ICC-575, ICC-690, ICC-2090, ICC-226, ICC-2292, ICC-2572, and ICC-5012 showed less than 20% infection. All others showed more infection.

4. 1979-80 Selections:

The results of screening of 46 germplasm lines that have been selected during last season are presented in table 17. Each entry was planted in 2-five meter rows (50 seeds). None of the lines showed less than 10% infection. Five lines; ICC-1044, -1977, -2175, -2227, and -2264 showed less than 20% infection. All others had more infection.

5. Proposals for 1981-82 season:

The germplasm lines that have shown less than 20% infection for the past 2 to 5 seasons will be tested in a replicated trial in the 1981-82 stunt nursery both for their disease reaction and yield potential. The germplasm lines that have shown < 10% infection for the past 3 to 5 seasons have been recommended for inclusion in the crossing block of disease resistance breeding program. Selection of the lines with less than 10% infection in new germplasm lines planted by the Genetic Resources Unit at Hissar will be continued.

B. Crossing block selections:

As in the case of germplasm, observations on stunt incidence in the crossing block of breeding program at Hissar are being recorded every season. Stunt incidence in the crossing block has usually been found to be higher than in other nurseries because of its early planting as compared to the other materials. In seasons of high natural disease incidence, lines with less than 10% incidence are selected and tested in the stunt nursery in the subsequent seasons. The reaction of the lines that have been selected during 1977-78 and 1979-80 season are presented below:

Table 18: Results of screening of 1977-78 crossing block selections to stunt at Hissar during 1980-81.

S.No.	Particular	Total plants	Infected plants	% Infection
1.	NEC-2368	69	18	26.0
2.	C-235	104	12	11.5
3.	R-11	70	21	30.0
4.	Coll-327	83	7	8.4
5.	P-1774	71	15	21.1
6.	P-2202-2	74	10	13.5
7.	P-4353-1	65	18	27.6
8.	G-24	65	7	10.7
9.	G-130	72	23	31.9
10.	G-543	64	7	10.9
11.	Pant G-115	70	15	21.4
12.	NEC-472	77	16	20.7
13.	NEC-701	72	11	15.2
14.	NEC-746	80	21	26.2
15.	NEC-1135	81	12	14.8
16.	2296	83	23	27.7
17.	BG-482	77	22	28.5
18.	F-61	65	17	26.1
19.	F-370	75	14	18.6
20.	P-1092	74	17	22.9
21.	P-1781	78	13	16.6
22.	P-2019-1	73	14	19.1
23.	T-3	72	30	41.6
24.	Coll.-238	73	11	15.0
25.	ICCC-5	68	6	8.8

Table 19: Results of screening of 1979-80 crossing block selections to stunt at Hissar during 1980-81.

S.No.	Particular	Total plants	Infected plants	% Infection
1.	850-3127	14	6	42.8
2.	7311-8-2-B x 850-3/27	14	3	21.4
3.	JM-485	17	3	17.6
4.	GL-629	12	3	25.0
5.	HMS-8	11	0	0.0
6.	HMS-19	10	2	20.0
7.	L-550	15	0	0.0
8.	7378-18-5-2H-B-BP (L-550 x H-223)	13	1	7.6
9.	NEC-2404	12	0	0.0
10.	No.-501	17	2	11.7
11.	NEC-240 x BG-203	18	3	16.6
12.	P-2202-2 x Pant G-114	11	0	0.0

1. 1977-78 Selections:

The results of screening of 1977-78 crossing block selections are presented in table 18. Each entry was planted in 4, five meter rows (100 seeds). None of the entry was found free from infection. Two entries; Coll. 327 and ICCC-5 showed less than 10% infection. Ten entries: C-235, P-2202-2, G-24, G-543, NEC-701, NEC-1135, F-370, P-1781, P-2091-1 and Coll. 238 showed less than 20% infection. Others showed higher infection but none showed very high susceptibility.

2. 1979-80 Selections:

The results of screening of 12 entries that have been selected in the last season are presented in table 19. Each entry was planted in one, 5 meter row (25 seeds). Four entries, HMS-8, L-550, NEC-2404, and P-2202-2 x Pant G-114 did not show any infection. One entry; 7378-18-5-2H-B-BP (L-550 x H-223) showed less than 10% infection. Three entries: JM-485, No. 501 and NEC-240 x BG-203 showed less than 20% infection and others had higher infection.

3. Proposals for 1981-82 season:

As in the case of germplasm selections, the entries that showed less than 20% infection during the past 2 to 4 seasons will be

tested in a replicated trial both for their disease reaction and yield potential. Additional crosses involving the lines that have shown less than 10% infection have been suggested.

C. Ascochyta blight promising lines:

In an attempt to identify lines with multiple disease resistance since 1977-78 season, screening of the germplasm lines, that have been found promising to blight in isolation plant propagator screening at ICRISAT Center Hyderabad, against stunt at Hissar has been initiated. In addition lines that have been found promising to blight at Gurdaspur in Punjab state of India and ICARDA, Aleppo, Syria have been screened.

1. 1977-78 Selections:

The results of screening of blight promising germplasm lines (Isolation plant propagator screening) selected for resistance to stunt in 1977-78 season and tested in the subsequent two seasons are presented in table 20. For each entry two, 5 meter rows were planted (50 seeds). One line; ICC-4989 was completely free from infection and another line; ICC-1012 showed less than 10% infection. Four entries; ICC-539, ICC-1005, ICC-1583, and ICC-4939 showed less than 20% infection.

Table 20: Results of screening of 1977-78 Ascochyta blight resistant selections to stunt at Hissar during 1980-81.

ICC No.	Total plants	Infected plants	% Infection
539	38	7	18.4
8383	31	8	25.8
1005	32	5	15.6
1012	32	3	9.3
1272	35	7	20.0
1583	30	5	16.6
1911	27	6	22.2
4939	37	7	18.9
4989	33	0	0.0

Table 21: Results of screening of 1978-79 Ascochyta blight resistant selections to stunt at Hissar during 1980-81 season.

ICC No.	Total plants	Infected plants	% Infection
666	34	6	17.6
667	30	11	36.6
693	26	3	11.5
954	30	12	40.0
1003	35	13	37.1
1006	39	9	23.0
1024	29	3	10.3
1202	27	2	7.4
1283	25	8	32.0
1504	28	6	21.4
2294	27	3	11.1
3330	32	13	40.6
4935	33	13	39.3

Table 22. Results of screening of lines found promising to Ascochyta blight at Gurdaspur to stunt at Hissar during 1980-81 season.

S.No.	Particular	Total plants	Infected plants	% Infection
1.	C-235	35	9	25.7
2.	G-588	35	10	28.5
3.	G-679	38	7	18.4
4.	G-543	12	4	33.3
5.	G-570	33	7	21.2
6.	GG-677	38	4	10.5

2. 1978-79 blight resistant selections:

The results of screening of 1978-79 blight resistant selections to stunt and tested in the last season also are presented in table 21. Each entry was planted in 2, 5 meter rows. None of the lines was free from infection. One line; ICC-1202, showed less than 10% infection. Four lines; ICC-666, ICC-693, ICC-1024 and ICC-2294 showed less than 20% infection and others had higher infection.

3. 1979-80 Selections:

One line; ICC-3587 that was selected during last season showed 94.1% infection.

4. Gurdaspur promising lines:

The results of screening of lines that have been found promising to Ascochyta blight at Gurdaspur in the Punjab State of India against stunt are presented in the table 22. Each entry was planted in two 5 meter rows. None of the entries showed less than 10% infection; two lines; G-679 and GG-677 showed less than 20% infection.

5. ICARDA resistant lines

Desi germplasm lines that have been found resistant to Ascochyta blight at ICARDA, Syria during 1979-80 have been screened against stunt. For each of the 39 entries 2, five meter rows were planted (50 seeds). None of the entries was found free from infection. Two lines; ICC-1525 and ICC-1754 showed less than 10% infection. Nine entries; ICC-478, ICC-758, ICC-799, ICC-801, ICC-1136, ICC-1809, ICC-1881, ICC-1963, and ICC-4935 showed less than 20% infection. Others had higher infection.

6. Proposals for 1981-82 season:

All the blight resistant/promising lines that have shown less than 20% infection will be tested in a replicated trial both for their disease reaction and yield potential. The additional lines that have been found resistant to blight at ICARDA during 1980-81 season will be screened in a non-replicated trial.

C. Wilt and root rot resistant lines:

As in the case of Ascochyta blight, the lines that have been found resistant to wilt and root rots at ICRISAT Center, Hyderabad are being screened against stunt since 1978-79 season. The entries screened each year usually comprised those lines included in the International Chickpea Root Rot and Wilt Nursery (ICRRWN).

Table 23: Results of screening of germplasm lines found resistant to blight at ICARDA, Syria to stunt at Hissar during 1980-81 season.

ICC No.	Total plants	Infected plants	% Infection
76	19	14	73.6
94	37	8	21.6
280	37	24	64.8
292	33	19	57.5
478	30	3	10.0
607	15	14	93.3
641	16	16	83.7
758	34	5	14.7
799	35	4	11.4
800	36	8	22.2
801	38	4	10.5
1052	31	14	45.1
1121	31	20	64.5
1136	30	4	13.3
1158	19	17	89.4
1416	14	9	64.2
1487	24	20	83.3
1488	20	13	65.0
1585	33	3	9.0
1591	26	15	57.6
1784	30	2	6.6
1782	14	14	100.0
1772	24	9	37.5
1809	36	6	16.6
1854	21	5	23.8
1871	26	24	92.3
1848	37	9	24.3
1963	35	7	20.0
1978	40	8	20.0
1983	34	9	26.4
2160	7	7	100.0
4935	30	6	20.0
5127	21	13	61.9
7711	30	17	56.6
7717	30	24	80.0
7721	32	17	53.1
9214	21	19	90.4
9239	29	28	96.5

1. 1978-79 Selections:

None of the two lines; ICC-7254 (70%) and ICC-3426 (12.8%) selected for resistance to stunt in 1978-79 season was found free from infection. ICC-3426, which showed less than 20% infection for 3 consecutive seasons has been recommended for inclusion in the crossing block of disease resistance breeding program.

2. 1979-80 Selections:

The results of screening of the selections made during the last season are presented in table 24. None of the lines was found promising.

3. 1980-81 ICRRWN entries:

The results of screening of 1980-81 International Chickpea Chickpea Root Rot and Wilt Nursery entries against stunt at Hissar are presented in table 25. For each entry one, five meter row was planted. None of the 57 entries tested was free from infection. One line; ICC-11088 showed less than 10% infection. However, this line had shown susceptibility at ICRISAT Center. Four entries; ICC-434, ICC-999, ICC-8622, and ICC-8933 showed 20% or less infection. ICC-8933, however is known to be susceptible. Others had higher infection.

4. Proposals for 1981-82 season:

The lines that have shown less than 20% infection so far will be tested in a replicated trial. The entries included in 1981-82 ICRRWN will also be screened in a non replicated trial to see their reaction against stunt.

Table 24: Results of screening of 1978-79 wilt and root rot selections to stunt at Hissar during 1980-81.

ICC No.	Total plants	Infected plants	% Infection
516	37	22	59.4
1891	37	31	83.7
2089	35	14	40.0
6880	38	23	60.5
8982	35	23	65.7
10104	31	10	32.2

Table 25: Results of screening of 1980-81 ICRISAT entries against stunt at Hissar during 1980-81 season.

ICC No.	Total plants	Infected plants	% Infection
102	16	6	37.5
267	17	7	41.1
434	20	4	20.0
438	18	4	22.2
519	19	5	26.3
858	19	9	47.3
999	20	4	20.0
1910	16	7	43.7
1913	17	6	35.2
1918	15	4	26.6
2083	22	7	31.8
2354	17	8	47.0
2450	19	4	21.0
2461	19	5	26.3
2566	18	5	27.7
2660	19	7	36.8
2858	20	5	25.0
2862	20	9	45.0
3103	16	7	43.7
3781	13	6	46.1
4139	19	7	36.8
4847	21	7	33.3
4850	20	15	75.0
4866	17	4	23.5
5381	11	3	27.2
6111	10	10	100.0
6455	17	11	64.7
6474	22	5	22.7
6489	15	15	100.0
6494	17	9	52.9
6570	21	11	52.3
6608	19	8	42.1
6730	16	12	75.0
6743	20	7	35.0
6816	20	10	50.0
6926	18	14	77.7
7481	14	10	71.4
8585	16	16	100.0
8622	17	3	17.6
8933	15	3	20.0
8971	16	8	50.0
8979	16	13	81.2
8980	18	16	88.8

Contd.

Table 25. Contd.

ICC No.	Total Plants	Infected plants	% Infection
8982	21	14	66.6
8985	18	6	33.3
8988	14	11	78.5
9006	17	5	29.4
9023	18	5	27.7
9032	15	8	53.3
9033	19	6	31.5
9055	15	9	60.0
10803	21	12	56.1
10823	18	4	22.2
11088	18	1	5.55
11531	19	4	21.0
11550	15	5	33.3
11551	15	6	40.0

Table 26: Results of screening of ICCC- materials to stunt at Hissar during 1980-81.

ICC No.	Total plants	Infected plants	% Infection
2	29	2	6.8
3	38	8	21.0
5	37	6	16.2
9	34	5	14.7
11	38	8	21.0
12	35	7	20.0

E. Breeding materials:

Among the viral diseases of chickpea, stunt caused by pea-leaf roll virus is the major problem. But at present its occurrence is not so high that necessiates incorporation of high levels of resistance against it in the breeding materials. The main objective is to see that - - tibility is not bred into the breeding materials. The high

natural incidence of the disease at Hissar results in the automatic elimination of the highly susceptible materials in the breeding populations. But with the identification of certain lines with good levels of resistance, it was felt advisable to initiate a small breeding program to develop lines with resistance to stunt. Further, the higher incidence of stunt in other Desi chickpea growing countries such as Pakistan makes it necessary to incorporate higher levels of resistance in the breeding materials developed at ICRISAT.

Screening of the breeding materials is carried out in close collaboration with chickpea breeding subprogram. Since 1979-80 season, limited screening of the breeding materials was initiated. The materials screened in the season included ICCC and ICCL materials, F_3 progenies, F_3 bulks, F_2 bulks, GCVT and GIET materials.

1. ICCC materials:

The data are presented in table 26. ICCC-1 showed less than 10% and ICCC-5, 9, 12 showed between 11 - 20%.

2. ICCL materials:

None of the three ICCL-materials tested was found promising. These were ICCL-80001, (93.3%), ICCL-80003(75.0%) and ICCL-80004 (58.8%). Each entry was planted in a single five meter row (25 seeds).

3. F_3 progenies:

Sixty F_3 single plant progenies of a cross between P-4353+1, germplasm line that has been found to be promising to stunt for the past five seasons and WR-315, a wilt resistant line were screened. Each progeny was planted in a single, five meter row (25 seeds). The results are presented in table 27. Two progenies; 77603-15P and 77603-16P did not show any infection. Four progenies; 77603-10P, 77603-51P, 77603-53P and 77603-55P showed less than 10% infection. Eight progenies; 77603-2P, 77603-14P, 77603-19P, 77603-23P, 77603-24P, 77603-29P, 77603-47P, and 77603-54P showed 20% or less infection. All these will be retested in 1981-82 season.

Table 27: Results of screening of F_3 progenies to stunt at Hissar during 1980-81 season.

S.No.	Progeny No.	Total plants	Infected plants	% Infection
1.	77603-1P F_3	19	5	26.3
2.	2P	18	3	16.6
3.	3P	19	5	26.3
4.	4P	19	4	21.0
5.	5P	12	5	41.6

Contd.

Table 27. Contd.

S.No.	Progeny No.	Total plants	Infected plants	% Infection
6.	77603-6P F_3	14	4	28.5
7.	7P	9	7	77.7
8.	8P	15	8	53.3
9.	9P	17	7	41.1
10.	10P	16	1	6.2
11.	11P	19	5	26.3
12.	12P	20	11	55.0
13.	13P	16	5	31.5
14.	14P	20	4	20.0
15.	15P	18	0	0.0
16.	16P	20	0	0.0
17.	17P	19	8	42.1
18.	18P	16	5	31.2
19.	19P	19	2	10.5
20.	20P	18	7	38.8
21.	21P	16	5	31.2
22.	22P	17	6	35.2
23.	23P	16	2	12.5
24.	24P	20	4	20.0
25.	25P	17	5	29.4
26.	26P	20	5	25.0
27.	27P	19	4	21.0
28.	28P	18	4	22.2
29.	29P	18	2	11.1
30.	30P	16	7	43.7
31.	31P	18	12	66.6
32.	32P	19	4	21.0
33.	33P	17	5	29.4
34.	34P	18	4	22.2
35.	35P	20	7	35.0
36.	36P	20	5	25.0
37.	37P	18	4	22.2
38.	38P	20	8	40.0
39.	39P	20	8	40.0
40.	40P	17	5	29.4
41.	41P	20	6	30.0
42.	42P	16	9	56.2
43.	43P	18	12	66.6
44.	44P	19	4	21.0
45.	45P	18	7	38.8
46.	46P	19	4	21.0
47.	47P	12	2	16.6
48.	48P	16	6	37.5
49.	49P	20	5	25.0
50.	50P	17	4	23.5

Contd.

Table 27. Contd.

S.No.	Progeny No.	Total plants	Infected plants	% Infection
51.	77603-51P F_3	18	1	5.5
52.	52P	17	4	23.5
53.	53P	20	2	10.0
54.	54P	19	3	15.7
55.	55P	19	1	5.2
56.	56P	20	10	50.0
57.	57P	19	7	36.8
58.	58P	16	6	37.5
59.	59P	15	5	33.3
60.	60P	17	4	23.5

4. F_3 bulks:

The results of the screening of 9 F_3 resistant bulks selected from the last season's F_2 screening are presented in table 28. For each F_3 bulk, eight five meter rows (200 seeds) were planted. The resistant plants were selected and bulked and will be replanted in 1981-82 screening nursery Except for cross No. 77603 (P-4353-1 x WR-315) which involves a resistant and a susceptible parent all others involve either resistant x resistant or promising lines.

5. F_2 bulks:

The results of screening of 3 F_2 bulks are presented in table 29. All the resistant plants were bulked and will be planted in 1981-82 screening nursery.

F. Gram coordinated varietal trials:

Every season, the entries included in the GIET and GCVT are screened for their reaction to stunt at Hissar. It has been observed that entries coming from Hissar and Delhi, where the natural incidence of the disease is high, do not usually show high susceptibility.

Table 28: Results of screening of F_3 bulks to stunt at Hissar during 1980-81 season.

S.No.	Cross No.	Pedigree	Total plants	Infected plants
1.	78183	P-992 x K-468	181	34
2.	78184	NEC-240 x BG-203	157	17
3.	78185	P-2202-2 x Pant G-114	144	13
4.	78186	P-992 x Rabat	140	19
5.	77603	P-4353-1 x WR-315	140	36
6.	77604	P-4353-1 x 850-3/27	145	25
7.	77605	P-4353-1 x F-61	121	23
8.	77606	P-4353-1 x F-370	137	19
9.	77607	P-4353-1 x K-468	152	15

Table 29. Results of screening of F_2 bulks to stunt at Hissar during 1980-81 season.

S.No.	Cross No.	Pedigree	Total plants	Infected plants
1.	77601	P-4353-1 x Pant G-114	143	17
2.	77603	P-4353-1 x WR-315	461	158
3.	77604	P-4353-1 x 850-3/27	92	21

1. GIET entries:

The results of screening of GIET entries that showed less than 10% infection in the last season are presented in table 30. Each entry was planted in two 5-meter rows. None of the entries was free from infection. Three entries; ICCC-17, HHS-6, and BG-404 showed less than 10% infection. Seven entries; ICCC-19, JG-1261, BG-402, BG-405, BG-235, H-208 and JG-1260 showed less than 20% infection and others had higher infection.

2. GCVT entries:

Both of the entries (ICCC-10 and ICCC-13) which showed less than 10% infection last season also showed similar reaction this season. ICCC-10 showed 5.8% and ICCC-13 showed 8.3% infection.

3. Proposals for 1981-82 season:

The entries that have shown less than 20% infection will be retested in a replicated trial. The fresh entries included in the 1981-82 GIET and GCVT will be tested for their reaction to stunt. Additional crosses with HMS-6, which showed good promise and is already in the crossing block, have been suggested.

Table 30: Results of screening of GIET entries to stunt at Hissar during 1980-81.

S.No.	Particular	Total plants	Infected plants	% Infection
1.	H-76-105	33	13	39.3
2.	ICCC-19	33	4	12.1
3.	JG-1261	34	4	11.7
4.	ICCC-17	29	2	6.8
5.	GNG-88	29	11	37.9
6.	BG-402	36	7	19.4
7.	BG-239	14	9	64.2
8.	GG-588-2509	37	15	40.5
9.	GNG-84	14	6	42.8
10.	ICCC-14	37	19	51.3
11.	ICCC-15	36	10	27.7
12.	HMS-6	37	3	8.1
13.	HMS-23	38	11	28.9
14.	FG-1258	35	16	45.7
15.	BG-405	36	6	16.6
16.	ICCC-18	37	14	37.8
17.	BG-235	39	6	15.3
18.	H-208	38	7	18.4
19.	BG-234	36	9	25.0
20.	H-772	35	10	28.5
21.	BG-404	35	3	8.5
22.	BG-204	34	9	26.4
23.	JG-1260	39	7	17.9

V. OTHER VIRAL PROBLEMS

Identification of the various viruses occurring on chickpea is the other major objective under this project. Mr. T.V. Chalam, Assistant Professor, Department of Plant Pathology, Andhra Pradesh Agricultural University (APAU), Rajendranagar, Hyderabad, India is working on characterisation and strain identification of cucumber mosaic virus and bean yellow mosaic virus occurring on chickpea for his Ph.D. thesis.

A. Alfalfa mosaic virus:

Earlier, based on the information on symptomatology, host range, insect transmission and serology the causal agent of chickpea mosaic was identified as Alfalfa mosaic virus (AMV). During the course of investigations on the other viral problems, further information on the symptomatology and electron microscopy of the virus particles was obtained.

1. Symptomatology:

The characteristic symptoms of alfalfa mosaic virus after initial apical necrosis is proliferation of branches with smaller leaflets having mosaic mottle symptoms. It is differentiated from cucumber mosaic (CMV) and bean yellow mosaic viruses (BYMV) based on complete lack of secondary proliferation in CMV and shoe-string symptoms in BYMV. Initially all three viruses cause similar symptoms i.e. apical necrosis but are differentiated on secondary symptoms.

2. Mixed infections:

It appears that mixed infections are possible under natural conditions as a mixture of AMV and BYMV could be isolated from the same plant with apical necrosis symptoms in the field.

3. Electron microscopy:

In partially purified samples of chickpea plants with apical necrosis symptoms in the field typical bacilliform particles, characteristic of AMV were observed under electron microscope.

B. Summary of work on CMV and BYMV:

Initial symptoms of CMV and BYMV on chickpea are same as AMV i.e. twisting of the terminal bud followed by chlorosis and necrosis. In CMV, there is no secondary proliferation and the apical necrosis usually progresses downwards resulting in the death of the plant. In BYMV, the apical necrosis is followed by proliferation of branches with shoe-string symptoms. The procedure for purification of CMV has been

standardised and typical particles of CMV were observed under electron microscope. The procedure for purification of BYMV has been partially standardised and typical particles of BYMV were observed under electron microscope in both the partially purified and leaf dip preparations. Limited screening for identification of sources of resistance to CMV and BYMV was carried out and a line promising for BYMV was identified. Further work on RNA and protein characterisation and strain identification is in progress.

PROJECT: CP-PATH-4(78): STUDIES ON ASCOCHYTA BLIGHT

I. SUMMARY

1. The project on Ascochyta blight of chickpea that has been in operation for the past five years at ICRISAT Center has been terminated and the major work on this problem is now being carried out at ICARDA, Aleppo, Syria. ICRISAT will soon appoint a chickpea pathologist.

2. Thirty three additional germplasm lines that showed 3 to 5 rating in the repeated plant propagator screenings were identified.

3. Most of the 31 desi germplasm lines that were found resistant to blight at ICARDA, Aleppo, Syria showed susceptibility to the IARI-isolate of the fungus in the propagator screening indicating that these two isolates could be different races.

4. Out of the sixty wilt and root-rot resistant lines that were checked for blight reaction, one line, ICC-519 showed 3-rating. Four lines; ICC-1913, -3181, -8622, and -8988 showed 5-rating.

5. Six of the 151, F_3 progenies screened were found to show 3-rating. Forty-four progenies showed 5-rating.

6. Two F_1s and their F_2 bulks along with their parents provided by the breeders were screened against the IARI isolate and the results were made available to them.

7. A large amount of desi and kabuli germplasm and breeding materials were screened in the field at ICARDA under severe artificial epiphytotics and many additional resistance sources and materials were identified. Some of the wilt and stunt resistant lines were also found resistant to blight. In many lines there was no strong correlation between vegetative resistance and pod resistance and the pods in many cases were found to be more susceptible than the vegetative parts.

II. INTRODUCTION

Since the major work on Ascochyta blight of chickpea is being carried out at ICARDA, Aleppo, Syria, the project that has been in operation at ICRISAT Center for the last five years has been terminated from 1st January 1981. The work on this problem at ICRISAT will be carried out under the projects CP-Path-8(81) (Multiple disease resistance) and CP-Brd-Path-16 (81) (Breeding for disease resistance). The results of the experiments carried out during June 1980 to May 1981 are summarised below. The summary of the work carried out at ICARDA during 1980-81 season is also included.

III. SCREENING FOR RESISTANCE

A. Rechecking of the promising lines:

The germplasm lines that were found to show 3 to 5 rating in the preliminary screening in the Isolation plant propagators were re-checked against IARI isolate. For each of the 54 lines, two pots were sown (about 10 seeds each). The reaction of these lines on 9-point scale is presented in table 31. Three lines; ICC-3377, ICC-4762, and ICC-6843 showed 3-rating. Twenty lines showed 4-rating. These were ICC-3378, -3580, -3586, -3582, -3738, -4751, -7563, GG-570, -578, -580, -588, -589, -612, -677, -679, -684, -685, -686, H-75-35 and ICCC-11. Fifteen lines showed 5-rating. These were ICC-3497, -3577, -3581, -3585, -3737, -3739, -3740, -4907, -5252, -6354, -7589, -7611, G-543, G-549, and GG-575. The remaining showed higher ratings.

B. Lines found resistant at ICARDA:

Thirty-one desi germplasm lines that were found to show 3-rating at ICARDA during 1979-80 season were screened against the IARI isolate. For each line about 20 seedlings were grown in 2 pots. The reaction of the lines is presented in table 32. Only one line, ICC-1881 showed 3-rating. Two lines; ICC-76 and ICC-1416 showed 4-rating. Eight lines showed 5-rating. These were ICC-1062, -1121, -1754, -1762, -1809, -1854, -1963, and -9214. Others had higher rating. The higher susceptibility of the lines against the IARI isolate indicates that it is different from the isolate at ICARDA.

C. 1980-81 ICRRWN entries:

Sixty entries of 1980-81 ICRRWN entries were tested in the propagator for their reaction against Ascochyta blight (IARI - isolate). The results are presented in table 33. One line; ICC-519, showed 3-rating. Eight lines; ICC-1913, -3181, -8622, -8988, -9055, -11550, ICCL-80001 and ICCL-80004 showed 5-rating. Others had higher ratings.

D. F_3 progenies:

One hundred and forty-nine F_3 progenies of two crosses; ICC-1903 x Pant G-114 (82) and ICC-1903 x BG-203 (69) involving a resistant parent (ICC-1903) and agronomically good lines were screened against the IARI isolate. The seeds were provided by the breeders. For each progeny about 10 seeds were sown in a single pot. The reaction of these progenies is presented in table 34. The results were provided to the breeders. Three progenies in each of the two crosses were found resistant (3-rating). Thirty-three progenies of cross ICC-1903 x Pant G-114 and 11 progenies of cross ICC-1903 x BG-203 were found to show a rating of 5. Other progenies showed higher rating.

Table 31: Reaction of promising lines rechecked against IARI isolate of *A. rabiei* in Isolation Plant Propagator.

S.No.	Particular	% Infection	% Killed	Average recovery* rating (9-point scale)
1	2	3	4	5
1.	ICC-3377	95.1	0.0	3
2.	-3378	100.0	10.0	4
3.	-3432	100.0	9.1	6
4.	-3495	100.0	27.8	7
5.	-3496	100.0	4.5	6
6.	-3497	100.0	0.0	5
7.	-3509	100.0	36.4	7
8.	-3577	90.0	0.0	5
9.	-3578	100.0	20.0	7
10.	-3580	100.0	0.0	4
11.	-3581	100.0	4.5	5
12.	-3585	100.0	0.0	5
13.	-3586	100.0	0.0	4
14.	-3587	100.0	10.0	6
15.	-3573	100.0	21.1	6
16.	-3582	89.5	0.0	4
17.	-3737	100.0	0.0	5
18.	-3738	100.0	10.5	4
19.	-3739	100.0	10.0	5
20.	-3740	100.0	0.0	5
21.	-3744	100.0	28.6	6
22.	-4751	100.0	5.6	4
23.	-4762	100.0	0.0	3
24.	-4765	100.0	16.7	7
25.	-4907	100.0	0.0	5
26.	-5252	100.0	10.5	5
27.	-6330	100.0	20.0	7
28.	-6354	100.0	5.9	5
29.	-6843	89.5	5.3	3
30.	-6856	100.0	42.1	7
31.	-7560	100.0	38.1	6
32.	-7563	100.0	5.0	4
33.	-7589	100.0	0.0	5
34.	-7611	95.5	0.0	5
35.	-7633	100.0	0.0	6
36.	-7674	100.0	26.3	7
37.	BG-216	100.0	4.8	6
38.	C-235	95.5	4.5	6
39.	G-543	100.0	20.0	5

Contd.

Table 31: Contd.

1	2	3	4	5
40.	G-549	100.0	8.7	5
41.	GG-570	86.4	4.5	4
42.	GG-575	100.0	0.0	5
43.	GG-578	100.0	9.5	4
44.	GG-580	100.0	9.1	4
45.	GG-588	90.9	0.0	4
46.	GG-589	86.4	0.0	4
47.	GG-612	81.0	4.8	4
48.	GG-677	87.0	0.0	4
49.	GG-679	87.5	0.0	4
50.	GG-684	85.7	0.0	4
51.	GG-685	100.0	0.0	4
52.	GG-686	91.7	0.0	4
53.	H-75-35	95.0	0.0	4
54.	ICCC-11	95.5	4.5	4
	Pb-7	100.0	0.0	6

*Average of two replications; about 10 seedlings per replication.

Table 32: Reaction of chickpea lines found resistant at ICARDA to IARI isolate of A. rabiei in Isolation Plant Propagator.

S.No.	ICC No.	% Infection	% Killed	Average recovery* rating (9-point scale)
1	2	3	4	5
1.	ICC-76	100.0	0.0	4
2.	-94	100.0	0.0	6
3.	-280	100.0	0.0	6
4.	-292	100.0	38.1	7
5.	-478	100.0	0.0	6
6.	-607	100.0	28.6	7
7.	-641	100.0	25.0	6
8.	-758	90.5	42.9	7
9.	-799	100.0	57.1	8
10.	-800	90.0	45.0	8
11.	-801	100.0	9.5	6
12.	-1062	90.9	0.0	5
13.	-1121	100.0	0.0	5
14.	-1136	100.0	50.0	9

Contd.

Table 32: Contd.

1	2	3	4	5
15.	ICC-1168	95.0	20.0	7
16.	-1416	100.0	0.0	4
17.	-1467	100.0	4.8	7
18.	-1468	100.0	22.7	7
19.	-1525	100.0	33.3	8
20.	-1591	100.0	50.0	7
21.	-1754	100.0	0.0	5
22.	-1762	100.0	0.0	5
23.	-1809	100.0	4.5	5
24.	-1854	100.0	14.3	5
25.	-1881	73.9	0.0	3
26.	-1963	100.0	0.0	5
27.	-1973	100.0	0.0	6
28.	-1983	100.0	45.5	8
29.	-2160	100.0	36.4	8
30.	-7717	100.0	100.0	9
31.	-9214	28.6	0.0	5
	-Pb-7	95.8	4.2	7

* Average of two replications; about 10 seedlings per replication.

Table 33: Reaction of ICRISAT (1980-81) entries to IARI isolate of *A. rabiei* in Isolation Plant Propagator.

S.No.	Particular	% Infection	% Killed	Recovery rating (9-point scale)
1.	2	3	4	5
1.	ICC-102	100.0	0.0	7
2.	-267	100.0	11.8	7
3.	-434	100.0	0.0	7
4.	-438	100.0	14.3	7
5.	-519	14.3	0.0	3
6.	-858	95.2	4.8	7
7.	-999	100.0	0.0	7
8.	-1910	100.0	42.1	7
9.	-1913	100.0	0.0	5
10.	-1918	100.0	0.0	8
11.	-2083	100.0	40.9	8
12.	-2354	100.0	5.0	6
13.	-2450	100.0	25.0	7
14.	-2461	100.0	9.5	7
15.	-2566	100.0	18.2	7

Contd.

Table 23: Contd.

1	2	3	4	5
16.	ICC-2660	100.0	4.8	7
17.	-2858	100.0	20.0	7
18.	-2862	100.0	10.0	7
19.	-3103	100.0	14.3	7
20.	-3181	90.0	0.0	5
21.	-3439	100.0	14.3	7
22.	-4847	100.0	55.0	8
23.	-4850	100.0	0.0	7
24.	-6366	100.0	14.3	7
25.	-6381	100.0	0.0	7
	Pb-7	100.0	0.0	8
26.	-6411	100.0	0.0	7
27.	-6455	100.0	76.2	9
28.	-6474	100.0	33.3	8
29.	-6489	100.0	0.0	7
30.	-6494	100.0	13.0	7
31.	-6570	100.0	23.8	7
32.	-6608	100.0	0.0	6
33.	-6703	100.0	9.1	7
34.	-6743	100.0	0.0	7
35.	-6816	100.0	0.0	6
36.	-6926	100.0	0.0	7
37.	-7481	100.0	47.6	6
38.	-8585	100.0	18.2	7
39.	-8622	100.0	0.0	5
40.	-8933	100.0	59.1	8
41.	-8971	100.0	50.0	7
42.	-8979	100.0	10.5	6
43.	-8980	100.0	26.3	7
44.	-8982	100.0	0.0	7
45.	-8985	90.9	36.4	7
46.	-8988	100.0	0.0	5
47.	-9006	100.0	13.0	7
48.	-9023	100.0	0.0	7
49.	-9032	100.0	0.0	7
50.	-9033	100.0	0.0	7
51.	-9055	60.0	0.0	5
52.	-10803	100.0	0.0	7
53.	-10823	100.0	9.1	7
54.	-11088	100.0	22.2	7
55.	-11531	100:0	0.0	7
56.	-11550	100.0	14.3	5
57.	-11551	100.0	0.0	7
58.	ICCL-80001	100.0	0.0	5
59.	-80003	100.0	60.0	7
60.	-80004	100.0	0.0	5
	Pb-7	100.0	20.0	6

Table 34: Summary of results of screening of F_3 progenies against Ascochyta blight in Isolation Plant Propagator.

Cross	No.of progenies screened	No. of progenies showing rating							Reaction (No. of progenies)			
		1	3	5	6	7	8	9	Resistant	Segregating	Intermediate	Susceptible
ICC 1903 x Pant G-114	80	0	3	33	15	18	0	11	10	43	17	10
ICC 1903 x BG-203	69	0	3	11	8	40	2	5	12	15	33	9

E. F_2 bulks:

The F_2 bulks of the above two crosses were also screened against IARI isolate. For each bulk about 100 seeds were sown in 10 pots. The segregation of the plants for blight susceptibility is presented in table 35. The results were provided to the breeders for further analyses.

Table 35: Ascochyta blight on F_2 bulks.

Cross	No. of plants with a rating of				
	1	3	5	7	9
ICC-1903 x Pant G-114	0	3	39	58	1
ICC-1903 x BG-203	1	0	36	49	9

F. Parents and F_1s

The parents and F_1s of the above two crosses were screened against the IARI-isolate. For each of the parents and F_1s 10-20 seeds were sown in 1-2 pots. The reactions are presented in table 36.

Table 36: Ascochyta blight reaction of parents and F_1s.

Particular	No. of plants with a rating of				
	1	3	5	7	9
ICC-1903	0	5	3	2	0
Pant G-114	0	0	0	4	18
BG-203	0	0	0	5	5
ICC-1903 x Pant G-114	0	0	0	7	3
ICC-1903 x BG-203	0	0	2	7	0

G. Race studies

The reaction of 12 lines which consisted of lines tolerant at ICRISAT and resistant at ICARDA, resistant at ICARDA but susceptible at ICRISAT, tolerant at ICRISAT but susceptible at ICARDA and susceptible both at ICARDA and ICRISAT was studied against IARI and Lahaul isolates. The results are presented in table 37. The disease development somehow was not severe and hence no firm conclusions could be drawn. The lines that were found tolerant to IARI isolate also showed tolerant reaction against Lahaul isolate. As indicated previously the lines that were found resistant at ICARDA showed susceptibility to both the isolates.

Table 37: Reaction of some chickpea lines to IARI and Lahaul isolates of the fungus in the Isolation Plant Propagator.

Particular	Reaction on 9-point scale	
	IARI isolate	Lahaul isolate
Tolerant at ICRISAT and resistant at ICARDA		
ICC-1903	6	5
-2160	5	6
-4935	5	5
Tolerant at ICRISAT and susceptible at ICARDA		
ICC-2153	5	5
-2156	6	4
-3259	6	6.5

Table 37: Contd.

Particular	Reaction on 9-point scale	
	IARI isolate	Lahaul isolate
Resistant at ICARDA and susceptible at ICRISAT		
ICC-6286	7	6
-6288	7	6
-6291	7.5	8
Susceptible both at ICRISAT and ICARDA		
ICC-36	7	7
-75	8	8.0
-100	6.0	6.0

IV. SUMMARY OF WORK DONE AT ICARDA

1. A large scale screening of germplasm and breeding materials was carried out in the field (8.0 ha) under severe artificial epiphytotic conditions and several new sources of resistance materials were identified.

2. Three hundred and fifty five new kabuli germplasm lines were screened and 4 of them were found resistant. With this the entire kabuli germplasm collection of over 3500 lines available at ICARDA has been screened and 22 resistant lines identified.

3. A total of 3954 additional desi germplasm lines obtained from ICRISAT was screened and 34 lines with both vegetative and pod resistance were identified.

4. Some of the wilt and stunt resistant lines were also found to be resistant to blight.

5. A large amount of breeding material in F_1 to F_7 generation generated for the development of blight resistance and high yielding conventional cultivars for winter and spring sowing tall blight resistant and high yielding cultivars for mechanical harvesting and large seeded blight resistant and high yielding cultivars for southern Europe were screened. Several blight resistant and superior yielding materials were identified for all the above characters.

6. The age of the plant was found to have no effect on the reaction of chickpea to blight.

7. The eradicating effect of Calixin-M of the seedborne inoculum of Ascochyta rabiei from chickpea was confirmed.

8. Deep sowing of the chickpea seed was found to reduce seed transmission of Ascochyta blight.

9. The PH of the exudates of the pods was found to be lower than the PH of the vegetative parts. The pods of many vegetatively resistant chickpea lines were found to get badly infected with blight.

10. Stem lesion type was found to be highly correlated with the disease rating of the plant.

11. An isolate of Ascochyta rabiei capable of killing of resistant ILC-482 was found in a badly infected patch.

CP-PATH-5(78) : INTERNATIONAL CHICKPEA DISEASE NURSERIES

I. SUMMARY

1. The International Chickpea Root Rots/Wilt Nursery (ICRRWN) 1980-81 was sent to 35 locations in 17 countries. The nursery had 60 entries. A separate report on the performance of these entries will be prepared.

2. Several nursery locations were visited in India, Nepal and Bangladesh.

3. A large number of scientists from several countries visited chickpea pathology program to see the work and exchange information.

4. Lines from ICRRWN are being used in local breeding program at several locations.

II. INTRODUCTION

The first cooperative chickpea disease nursery with 30 entries was sent to cooperators during 1976-77. In January 1978 we formally initiated a project on nurseries with the following objectives:

1. Share promising material with cooperators in different countries.

2. Identify stable sources of resistance for use in breeding program at ICRISAT, and

3. Get a feed-back on reaction of the entries to other locally serious diseases.

Since 1977-78 two separate nurseries were organized. These are (i) International Chickpea Root Rots/Wilt Nursery (ICRRWN), and (ii) International Chickpea Ascochyta Blight Nursery (ICABN). The reports for 1977-78, 1978-79 and 1979-80 nurseries were compiled and circulated (ICRISAT Pulse Pathology Progress Reports 4, 7, & 11). We have now integrated our ICABN with the one operated from ICARDA. It is called Chickpea International Ascochyta Blight Nursery (CIABN). Results of ICRRWN 1980-81 have come from most of the locations. A separate report will be prepared and circulated.

III. ICRISAT 1980-81

A. List of countries and cooperators

Country	Cooperator(s)
Peru	The Director Centro Regional Investigacion Agraria de Norte APTDO 116, Chiclayo.
Ethiopia	Mr. Alemu Mengistu Plant Pathologist Agricultural Experiment Station Addis Ababa University P.O. Box. 32, Debre Zeit
Kenya	The Director ARD-KARI P.O. Box. 30148 Nairobi
Egypt	Dr. Ali Abdel Aziz Head, Food Legume Section Field Crops Institute Agricultural Research Center Giza, Orman, Cairo
Mexico	Ing. Santiago Sanchez, INIA Auxiliar de Leguminosas Comestibles Apartado Postal No. 6-882 Y 6-883 Mexico 6 D.F.
Bangladesh	Dr. A.K. Kaul Pulse Breeder & Joint Coordinator Pulses Improvement Project Bangladesh Agricultural Research Institute P.O. Chandana Joydebpur, Dacca
Iraq	Mr. Issam Majjar Food Legumes Programme Directorate General of Field Crops Abu-Ghraib Baghdad

Country	Cooperator(s)
Nepal	Mr.R.P. Sah Asst. Agronomist (Pulses) Parwanipur Agril. Station Birganj, Parwanipur Narayani Zone
Pakistan	Dr. Bashir Ahmed Malik Coordinator (Pulses) Pakistan Agril. Research Council National Agril. Research Center P.O. National Health Labs. National Park Road Islamabad
Sudan	Dr. Farouk Ahmed Salih Agricultural Research Corporation Hudeiba Research Station P.O. Box. 31 Ed-Damer
Italy	Mr. K.M. Ahmed Pest Control Assistant (FAO) Central Agricultural Research and Training Center UNDP/FAO Project Post Box. 4788, Taiz
Republica Argentina	Ing. Agr. Susana Garcia Medina Mejoramiento de Legumbres Institute Nacional de Tecnologia Agropecuaria Estacion Experimental Regional Agropecuaria Salta Cerrillos (Salta)
Chile	Dr. Gabriel Bascur B. Programa de Leguminosas de Grano Estacion Experimental la Platina Instituto de Investigaciones Agropecuarias Casilla 114-D, Santiago
Syria	Dr. K.B. Singh ICRISAT Chickpea Breeder The International Center for Agricultural Research in the Dry Areas (ICARDA) P.O. Box. 5466, Aleppo

Country	Cooperator(s)
USA	Dr. John C. Philips Asst. Professor Crop Science Department California Polytechnique State University San Luis, Obispo California 93407
USA	Dr. Walter J. Kaiser Research Plant Pathologist USDA Regional Plant Introduction Station 59 Johnson Hall Washington State University Pullman, Washington 99164
USA	Dr. Ken Foster Asst. Professor Department of Agronomy University of California Davis, California 95616
USA	Dr. Joseph L. Troutman Plant Pathologist Yuma Experiment Station 6425, W. 8th Street Yuma, Arizona 85364
Australia	Dr. R.B. Brinsmead Hermitage Research Station Via Warwick 4370 Queensland
Australia	Dr. G.J. Berry Grain Legume Breeder Victoria Wheat Research Institute Private Bag No. 260 Horsham, UIC 3400
India	Dr. R.V. Hiremath Gulbarga Dr. S.R. Kotasthane Jabalpur Mr. M.D. Gupta Gwalior Dr. J.S. Grewal New Delhi

Country	Cooperator(s)
India	Dr. P. Shukla Kanpur
	Dr. R.N. Singh Faizabad
	Dr. M. Mahmood Muzaffarpur
	Dr. K. Sen Gupta Berhampore
	Dr. B.L. Jalali Hissar
	Dr. Gurdip Singh Ludhiana
	Dr. R.N.S. Tyagi Durgapura
	Dr. B.G. Desai Banaskantha
	Dr. R.S. Annappan Coimbatore
	Dr. M.P. Haware/ Dr. Y.L. Nene Patancheru

8. Entries

Following were the entries:

S.No.	ICC No.	Pedigree	Origin
1.	102	P-79	India
2.	267	P-212-1	India
3.	434	P-319	India
4.	438	P-324/12-069-00324	India
5.	519	P-394	India
6.	858	P-678	India
7.	999	P-812	Mexico
8.	1910	P-1542	India
9.	1913	P-1546	India
10.	1918	P-1549-1	India
11.	2083	P-1679-2	Mexico
12.	2354	P-2069-1	Iran
13.	2450	P-2230/12-071-02230	Iran
14.	2461	P-2249	Iran
15.	2566	P-2559	Iran
16.	2660	P-2686-2	Iran
17.	2858	P-3166-1	Iran
18.	2862	P-3181/12-071-03181	Iran
19.	3103	P-3617	Iran
20.	3181	P-3730-1	Iran
21.	3439	P-4116-1	Iran
22.	4847	P-6832/12-071-06832	Iran
23.	4850	P-8050	Unknown
24.	6366	NEC-312	Iran
25.	6381	NEC-340	Iran
26.	6411	NEC-384	Iran
27.	6455	NEC-460	Iran
28.	6474	NEC-488	Iran
29.	6489	NEC-518	Iran
30.	6494	NEC-529	Iran
31.	6570	NEC-646	Iran
32.	6608	NEC-691	Iran
33.	6730	NEC-875	Iran
34.	6743	NEC-900	Iran
35.	6816	NEC-986	Iran
36.	6926	NEC-1166	Iran
37.	7481	GC-5 (Berhampore) P-50-C-1	India
38.	8585	SL-915	Ethiopia
39.	8622	WP-2984-B	Ethiopia
40.	8933	WR-315	India
41.	8971	NEC-319	Iran
42.	8979	NEC-339	Iran
43.	8980	NEC-342	Iran
44.	8982	NEC-346	Iran

S.No.	ICC No.	Pedigree	Origin
45.	8985	NEC-352	Iran
46.	8988	NEC-390	Iran
47.	9006	NEC-438	Iran
48.	9023	NEC-497	Iran
49.	9032	NEC-515	Iran
50.	9033	NEC-516	Iran
51.	9055	NEC-569	Iran
52.	10803	H-552-1	India
53.	10823	Bada Chafa	India
54.	11088	BG-212	India
55.	11531	ICCC-10	ICRISAT
56.	11550	DA-1	India
57.	11551	PPK-1	India
58.	ICCL-80001	(P-99 x NEC-108) x Radhey	India
59.	ICCL-80003	K-4 x WR-315	India
60.	ICCL-80004	L-550 x USA-613	India
61.	4951*	JG-62	India

* Wilt susceptible check

IV. TOURS

Dr. M.P. Haware toured the chickpea growing areas in Himachal Pradesh and Punjab States during February 1981. The most common diseases in Himachal Pradesh were, Ascochyta blight, Sclerotinia stem rot and wilt. The places visited were Daula Khuan, Solan, Bilaspur, Palampur, and Dharamshala.

In Gurdaspur and Pathankot districts of Punjab, wilt, root rots and Ascochyta blight were observed in Farmers' fields. Many of the chickpea fields observed were close to Pakistan border. The occurrence of blight was probably favored by the winter rains.

Pulse and Oilseed research station, Berhampore in West Bengal was visited in early March 1981. Most of the entries from ICRSWN were resistant in the wilt sick plot. Early mortality in chickpea was due to collar rot (Sclerotium rolfsii).

Visited Parwanipur Agricultural Research Station, Birganj in Nepal on March 2 and 3. Parwanipur Agricultural Research Station is located in the Tarai region of Nepal. The center is mainly engaged in Rice Improvement. Rice is the main crop in kharif and is followed by wheat, lentil and chickpea in rabi.

International chickpea root rots/wilt nursery was sown in a normal field. All the fields were sown in last week of November. ICRSWN consisted of 60 resistant lines with JG-62 as susceptible check, planted after every two rows in 2 replications. Wilt was present in all the chickpea fields in susceptible lines. JG-62 was showing nearly 20-50% wilting. All the test lines were free from wilt.

In wilt-sick plot initial evaluation trial with 4 replications was sown. It has 10 entires, four from ICRISAT, ICCL-78122, 78158, ICC-4948, and 6098. ICC-6098 was selected from ICRISAT (1979-80) and was free from wilt in all the four replications. The locally developed lines G-0332 was highly susceptible to wilt.

The coordinated varietial trial which is composed at Kathmandu is being planted at Nepalganj, Parwanipur and Janakpur. This year it has 10 entries: ICC-6098, ICC-4948, IC-7332-7-3-13-BH, IC-73167-5-3-1P-BH, BG-203, Pant 113, IC-7310-3-2-BH, G-0332, G-0332-10, and G-0226. The locally developed lines G-0332 and G-0226 were looking impressive along with ICC-6098.

Two chickpea cultivars developed, G-0332 and G-0226 are being multiplied for seed. This seed will be handed over to Agriculture Input Corporation (AIC) for distribution to farmers.

In general wilt is a major problem at Parwanipur. The early mortality in chickpea is due to collar rot (S. rolfsii).

At present they do not have the breeding program in chickpea. All the lines are developed through selection process.

St... was present, but sporadic. No leaf disease was observed.

On 3rd March visited Farmers' fields in Bara district. In one of the fields (village Parsoni) we saw a farmer's field (nearly 0.5 ha) looking very impressive. It was sown with small white seeded chickpea. Wilt was present in 3 out of 5 fields observed (2 to 5%). Stunt was observed in one field. Chickpea is sown mostly in Janakpur area. Perennial pigeonpea was seen on the bunds. Popular crops (rabi) were wheat, lentil and chickpea.

APPENDIX-I

LIST OF PUBLICATIONS

1. Haware, M.P., Kumar, J., and Reddy, M.V. 1980. Disease resistance in kabuli-desi chickpea introgression. Pages 67-69 in Proceedings, International Workshop on Chickpea Improvement, ICRISAT, Hyderabad India, February 28 - March 2, 1979.

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13. Reddy, M.V., and Singh, K.B. 1980. Effect of inter-row spacing on the reaction of chickpea lines to Ascochyta blight. International Chickpea Newsletter 3: 12-13.

14. Singh, K.B., Reddy, M.V., and Nene, Y.L. 1981. Sources of resistance to Ascochyta blight of chickpea. International Chickpea Newsletter 4: 116-117.

YLN:Ac