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Multilocational Evaluation of Pigeonpea for Broad-Based Resistance to Fusarium Wilt in India

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Abstract

Nine-hundred and fifty-nine pigeonpea germplasm and breeding lines were evaluated for resistance to wilt caused by *Fusarium udum* Butler at 12 locations in India over a period of 7 years between 1984 and 1990. ICP 8863, 9174, 12745, ICPL 333, 8363, 88047, BWR 370, DPPA 85-2, 85-3, 85-8, 85-13, 85-14 and Bandapalera were resistant or moderately resistant at 7 to 10 out of 12 locations for 3 to 5 years with an average wilt incidence of less than 15%.

Introduction

Fusarium wilt of pigeonpea [*Cajanus cajan* (L.) Millsp.] caused by *Fusarium udum* Butler is one of the most widespread and destructive diseases in India. Surveys in farmers' fields have shown that average wilt incidence in Maharashtra, Bihar, and Uttar Pradesh states of India was; 22.6, 18.3, and 8.2%, respectively (Kannaiyan *et al.*, 1984). Of more than 11 000 entries screened in the wilt-sick plots at ICRISAT Center, 33 lines showed resistance to wilt (Nene and Kannaiyan, 1982). A collaborative multilocational trial to screen for resistance to fusarium wilt was jointly carried out by ICAR and ICRISAT from 1978 to 1983 at 15 wilt-endemic locations in India. ICP 7182 and ICP 8863 were identified to be stable across locations (Nene *et al.*, 1989). The main purpose of the present investigation was to test the newly identified pigeonpea germplasm and breeding lines at different locations for stability of resistance to fusarium wilt. This paper summarizes the results of evaluation of 959 germplasm and breeding lines at 12 locations in India for resistance to fusarium wilt between 1984 and 1990 in wilt-sick plots.

Materials and Methods

Lines for Multilocation Evaluation

Nine-hundred and fifty-nine pigeonpea lines were evaluated for fusarium wilt resistance in 4 sets of trials. In the 1st set, 145 lines of medium and long-duration (5 - 9 months), which were resistant to wilt at a few individual locations, were evaluated between 1984 and 1990. In the 2nd set, 24 medium-duration lines resistant to wilt and sterility mosaic at ICRISAT Center were evaluated between 1985 and 1986. In the 3rd set, 17 long-duration lines resistant to wilt and sterility mosaic at the Directorate of Pulses Research (DPR), Kanpur, were evaluated between 1988 and 1990. In the 4th set, 773 Coordinated Varietal Trial (CVT) lines comprising all the 5 duration groups (extra- extra early, extra early, early, medium and long duration) were evaluated between 1984 and 1990. Selfed seeds were used for evaluation in view of cross pollination in pigeonpea.

Selection of Locations

Multilocation screening was done in well-developed wilt-sick plots at 12 research centers of AICPIP and at ICRISAT. The number of seasons in which trials at each location were conducted varied from 4 to 7.

Multilocation Screening Procedure

Fifty seeds of each test entry were sown in a 5-m row with a spacing of 75 x 10 cm. Every 2 test entries were alternated by 1 row of susceptible check ICP 2376 (P 3888) to monitor wilt incidence in the field. The trials were laid out in a randomized block design with 2 replications. Wilt observations recorded at maturity and converted into percentage

of wilt incidence are reported here. Depending on the average wilt incidence, the test entries were categorized as resistant (R) (0 to 10%), moderately resistant (MR) (11 to 20%), tolerant (T) (21 to 30%), and susceptible (S) (31 to 100%). Since there was variation in wilt incidence of the lines between the seasons at the same location, mean wilt incidence over the seasons was calculated.

Results and Discussion

Screening of pigeonpea lines for resistance to fusarium wilt was carried out at 12 locations for 7 seasons between 1984 and 1990. Screening was done for 7 seasons at Badnapur and at ICRISAT Center; 6 seasons at Baroda, DPR, Kanpur, and Gulbarga; 5 seasons at Dholi, Rahuri, Ranchi, and Sehore; and 4 seasons at New Delhi and Vamban. Of the 145 wilt-resistant lines evaluated in the first set of the trials (based on 3-5 seasons testing), only five lines were resistant or moderately resistant at 9 or more locations out of the 11 locations in which they were evaluated (Table 1). These were ICP 8863, ICP 9174, ICP 12745, BWR 370, and Bandapalera.

Of the 24 medium-maturity wilt and sterility mosaic resistant lines from ICRISAT evaluated in the 2nd set of the trials, ICPL 333 and ICPL 8363 were resistant or moderately resistant at 7 out of 8 locations (Table 2). The average wilt incidence in these lines was between 9 and 18%. Of the 17 long-duration wilt and sterility mosaic resistant lines from DPR, Kanpur evaluated in the 3rd set of the trials, 2 lines, DPPA 85-13 and DPPA 85-14, were resistant or moderately resistant at all the 8 locations (Table 3). Three lines, DPPA 85-2, DPPA 85-3, and DP85-8 were resistant or moderately resistant at seven locations. Of the 773 newly bred and high-

Table 1. Wilt incidence (%) (average of 4-7 seasons) in promising pigeonpea lines at 11 locations in India from 1983 to 1990

Lines	Pedigree/ origin	Badnapur	Baroda	Dholi	Kanpur	Gulbarga	Patancheru	Delhi	Rahuri	Ranchi	Sehore	Vamban	Average
ICP 8863	15-3-3 sel	5	24	9	11	6	6	9	11	0	14	26	11
ICP 9174	JM 2467	15	10	20	5	10	2	6	5	9	12	32	11
ICP 12745	ICP 10157 sel	6	5	42	0	14	3	11	8	18	17	8	12
BWR 370	Badnapur	7	14	7	11	3	3	10	23	8	21	2	10
Bandapalera	Land race	19	2	10	-	2	2	19	27	6	17	0	13
ICP 2376	Susceptible check	100	57	82	96	87	100	100	93	82	97	90	89

Table 2. Wilt incidence (%) (average of 3 seasons) in two wilt and sterility mosaic resistant medium-maturity pigeonpea lines from ICRISAT at 8 locations during 1985-86

Entries	Badnapur	Baroda	Dholi	Kanpur	Gulbarga	Patancheru	Rahuri	Sehore	Average
ICPL 333	18	6	18	0	36	13	15	2	14
ICPL 8363	9	6	5	3	32	8	12	0	9
ICP 2376 (susceptible check)	100	87	70	96	95	100	85	100	92

Table 3. Wilt incidence (%) (average of 2 seasons) in five wilt and sterility mosaic resistant pigeonpea lines of Directorate of Pulses Research (DPR) at 8 locations during 1988 to 1990

Entries	Pedigree	Bangalore	Baroda	Dholi	Gulbarga	Kanpur	Patancheru	Rahuri	Vamban	Average
DPPA 85-2	Sel ICP 9174	0	8	7	27	4	13	4	2	8
DPPA 85-3	Sel ICP 12731	0	10	0	27	4	4	12	0	7
DPPA 85-8	Sel ICP 12751	0	4	5	26	15	16	12	4	10
DPPA 85-13	Sel ICP 88600	0	5	0	20	0	1	4	6	5
DPPA 85-14	Sel BSMR 294	2	6	0	20	0	0	7	5	5
ICP 2376	Susceptible check	1	38	78	98	100	100	100	92	82

yielding CVT lines evaluated in the 4th set, only one line ICPL 88047 was resistant or moderately resistant at all the seven locations (Bangalore, Baroda, Dholi, Kanpur, Gulbarga, Patancheru, and Rahuri) it was evaluated. The differential response of some pigeonpea lines to fusarium wilt at different locations could be due to the existence of physiologic specialization in the wilt pathogen *F. udum* (Baldev and Amin 1974).

'NPWR 15' (ICP 8859), 'BDN 1' (ICP 7182), 'BDN 2', 'C 11' (ICP 7118), and 'Maruthi' (ICP 8863) are the cultivars already released for general cultivation in India (ICAR 1988). Of these, Maruthi (ICP 8863) has shown broad-based resistance in the present study and may be more stable. Lines ICP 9174, ICP 12745, ICPL 333, ICPL 8363, ICPL 88047, BWR 370, DPPA 85-2, 85-3, 85-8, 85-13, 85-14, and Bandapalera also have broad-based resistance to wilt and are recommended as donor parents for breeding for resistance to fusarium wilt.

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