

Screening Chickpea for Resistance to Wilt

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ABSTRACT

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Extensive field screening and supplementary tests showed that 14 chickpea (*Cicer arietinum*) lines were resistant to the wilt caused by *Fusarium oxysporum* f. sp. *ciceri*. Of nine wild *Cicer* spp. tested, *C. judaicum* was resistant.

After Padwick (8) described chickpea wilt (caused by *Fusarium oxysporum* Schlecht. emend. Snyder & Hans. f. sp. *ciceri* (Padwick) Snyder & Hans.) from India in 1940, its occurrence was reported in other countries (1-7). In India it causes a 10% annual yield loss (11). Resistant varieties would be the best way to control this disease. Although limited screening and identification of resistance sources have been done in India (10) and Mexico

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(5), large-scale systematic screening of the world germ plasm collection has only recently been conducted. At the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), we initiated such screening in 1976, and this article reports our findings.

MATERIALS AND METHODS

Field screening. Uniform disease nurseries were developed in 2 yr in 4 ha of deep black soil of the Vertisol group by incorporating chopped wilted plants and growing susceptible cultivars. Since 1976 every third row was planted to susceptible cultivar JG-62 so that the performance of

germ plasm accessions could be evaluated and disease in the plots maintained. Germ plasm accessions obtained from ICRISAT's Genetic Resources Unit were screened. Plantings were done in mid-October and data on wilt incidence (percent mortality) were taken 2 wk before harvest (usually the first week of January).

Pot screening. To verify the results of field screening, a pot screening procedure was followed. Unsterile black soil of the Vertisol group was placed in 30-cm earthen pots. Single-spored culture of *F. oxysporum* f. sp. *ciceri* was multiplied on 100 g of 9:1 sand maize meal medium in 250-ml conical flasks for 15 days at 25-30 C. The fungus on medium from five flasks was added to one pot containing 10 kg of soil. Ten seeds of susceptible cultivar JG-62 were planted in each pot. Wilted plants that appeared within 3 wk were incorporated into the same pot. After one more planting of JG-62 and incorporation of wilted plants, the pots were used for evaluating the germ plasm accessions that

Table 1. Some characteristics of the chickpea lines resistant to wilt^a

ICC No.	Pedigree	Growth habit	Seed color
202	P-165	Semispreading	Light brown
391	P-289	Spreading	Brown
658	P-517	Semi erect	Yellow
858	P-678	Semispreading	Brown
1443	P-1265	Semi erect	Light brown
1450	P-1270	Semi erect	Yellow
1611	P-1353	Semi erect	Brown
3439	P-4116-1	Semi erect	Brown
4552	P-6099	Semi erect	Light brown
6098	JG-74	Semispreading	Brown
6671	NEC-790	Semi erect	Light brown
8933	WR-315	Semispreading	Yellow
10130	CPS-1	Semispreading	Brown
11088	BG-212	Semispreading	Brown

^aICC-3439 and ICC-6671 originated in Iran; all others originated in India.

appeared promising in the field.

Collections belonging to nine wild species of *Cicer* also were screened in pots. The species were *C. bijugam*, *C. chorassanicum*, *C. cuneatum*, *C. echinospermum*, *C. judaicum*, *C. microphyllum*, *C. pinnatifidum*, *C. reticulatum*, and *C. yamashitae*. Final observations were made 2 mo after sowing. All the pot screenings were done in a screenhouse (60-mesh brass wire) to protect seedlings from damage by birds, rats, etc.

Laboratory screening. A water-culture technique was followed to confirm the performance of germ plasm accessions that were promising in field and pot screenings. The technique is similar to procedures described earlier (9,12). Single-spored cultures of *F. oxysporum* f. sp. *ciceri* were multiplied on 100-ml potato-dextrose broth in 250-ml flasks on a rotary shaker for 10 days at 25–30 C. Because culture filtrates were not toxic to chickpea seedlings, entire contents of each flask were diluted with sterilized distilled water to a final inoculum concentration of 2.5% (spore concentration 6.5×10^5).

Chickpea seedlings 14–18 days old, grown in sterile riverbed sand, were transferred to glass tubes containing 20 ml of inoculum. Seedlings were held in position by cotton plugs. Sterilized distilled water was filled in tubes every 48

hr to make up the loss of water. Ten seedlings were used for each accession, and an uninoculated seedling was kept as a check for each accession. Susceptible check cultivar JG-62 was also inoculated for comparison and usually wilted in 7–10 days. Data were recorded 15 days after inoculation. Uninoculated seedlings normally remained healthy for more than 3 wk.

RESULTS AND DISCUSSION

Since 1976, more than 7,000 germ plasm accessions have been screened in disease nurseries. Three field screenings, two pot screenings, and one water-culture screening showed no wilt in 14 lines (Table 1). Only ICC-8933 (WR-315) had been reported resistant earlier (10). Screening by different methods has confirmed the performance of these lines, which are now being used extensively in crossing programs at ICRISAT and elsewhere.

Of the wild *Cicer* spp. tested in pots, only *C. judaicum* collections showed resistance. Resistance of *C. judaicum* was confirmed in a repeated test. *C. judaicum* is also resistant to the blight caused by *Colletotrichum capsici* (M. V. Reddy, personal communication). Except for one collection (No. 188) of *C. pinnatifidum*, which showed 73.6% mortality, all others showed 100% mortality.

In addition, 122 chickpea accessions with less than 10% wilt for at least two seasons have been identified in the disease nurseries. Lines that appear promising are tested every year at a large number of locations through a worldwide network of cooperating institutions. In 1978, for example, 63 promising lines were sent for testing at 37 locations in 19 countries. Multilocation tests followed by pot tests indicate that physiologic races of *F. oxysporum* f. sp. *ciceri* exist. These results will be published separately.

Seeds of resistant lines are maintained by ICRISAT's Genetic Resources Unit and are available on request.

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