SCREENING OF GENETIC MATERIALS OF PIGEONPEA AGAINST *F. udum* BUTLER

PATEL, S. I. * AND PATEL, R. L.

DEPARTMENT OF PLANT PATHOLOGY
S. D. AGRICULTURAL UNIVERSITY
SARDARKRUSHINAGAR-385 506, GUJARAT, INDIA

E-mail: gujrust@gmail.com

ABSTRACT

Promising maintainer lines and restorer lines of pigeonpea and few wild species along with cultivated susceptible check ICP 2376 were screened against *F. udum* using soil inoculation technique. Wilt incidence in various maintainer lines ranged from 14.58 to 38.75 per cent and nine lines were observed moderately resistant and eleven lines were moderately susceptible. Among different restorer lines, wilt incidence ranged from 13.39 to 35.71 per cent and seven restorer lines were moderately resistant and thirteen were moderately susceptible. Among different wild species *viz.*, *Rhyncosia bracteota*, *Cajanus platycarpus* and *Rhyncosia rufescence* were resistant with less than 10 per cent wilt incidence.

KEY WORDS: *F. udum*, maintainer line, pigeonpea, restorer line, wild species, wilt

INTRODUCTION

Wilt of pigeonpea caused by fungal pathogen *Fusarium udum* Butler, is the most devastating disease, reported most serious and widespread in different states of India (Kannaiyan *et al.*, 1981a). The yield loss of 7.9, 12.6 and 85.4 per cent in resistant, moderately resistant and highly susceptible genotypes, respectively in wilt sick plot were worked out (Chaudhary, 1998). The pathogen lives in the soil. Between crops it survives in residual plant debris as mycelium and in all its spore forms over a long period of time. It was detected up to 2.5 years in vertisols and up to 3 years in alfisols (Kannaiyan *et al.*, 1981b). The disease appears in early stage of plant growth (Nene *et al.*, 1979). The germ tube of the mycelium or spore penetrates seedlings through root tips, wounds or point of formation of lateral roots. The mycelium advances through the xylem causing vascular plugging followed by wilting of stems during flowering and pod-filling stages. Use of cultivars resistant to the fungus is the most effective measure for controlling the disease and hence, more emphasis is given on the development of varieties/hybrids resistant to wilt. Availability of diverse genetic material resistant to wilt is the basic requirement. The study was, therefore, focused on screening of genetic material of pigeonpea against *F. udum*.

MATERIALS AND METHODS

The seed of genetic materials (maintainer lines, restorer lines and wild species) used in the present studies were collected from Centre of Excellence for Research on Pulses, Saradarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat. The genetic material was selected based on preliminary information with respect to agronomic traits and availability of seed. The evaluation of genotypic reaction to *Fusarium* wilt was conducted using soil inoculation technique. The most virulent strain of *F. udum* on the basis of previous study was used for the preparation of mass inoculum on sand pigeonpea meal medium. Fifteen seeds each of restorer lines, maintainer lines and wild species were sown separately in plastic pots containing inoculum of *F. udum* in the proportion of 1:10 w/w. The experiment was conducted in the net house in completely randomized design. The observations on incubation period and wilt incidence were recorded up to 40 days. Based on wilt incidence, the lines were categorized as resistant (< 10 %), moderately resistant (11-20 %), moderately susceptible (21-40 %), susceptible (41-60 %) and highly susceptible (> 60 %) (Reddy and Raju, 1996).

RESULTS AND DISCUSSION

The results (Table 1) revealed significant difference in the wilt incidence of different lines. Wilt incidence in various maintainer lines ranged from 14.58 to 38.75 per cent. Minimum wilt incidence of 14.58 per cent was recorded in GT 402B, which was statistically at par with GT 306B (15.48 %), GT 100B (16.25 %) and GT 87B (16.25 %). Among different maintainer lines, maximum wilt incidence of 38.75 per cent was recorded in GT 302B. The wilt incidence recorded in the susceptible check i.e. ICP 2376 was 57.54 per cent. These entries were classified into various categories based on the reaction against *F. udum* and the data elucidated that none of the maintainer lines used in the present investigation was found either resistant (< 10 % wilt incidence) or susceptible (41-60 % wilt incidence) to highly susceptible (> 60 % wilt incidence). Nine lines (GT 404B, GT 405B, GT 100B, GT 402B, GT 87B, GT 288B, GT 308B, GT 303B and GT 306B) were observed moderately resistant (11-20 % wilt incidence) and eleven lines (GT 289B, GT 302B, GT 309B, GT 310B, GT 33B, GT 290B, GT 307B,GT 305B,GT 403B, GT 304B and GT 301B) were observed moderately susceptible (21-40 % wilt incidence).

Results of screening of twenty promising restorer lines indicated significant difference in the wilt incidence (Table 1). Wilt incidence in different restorer lines ranged from 13.39 to 35.71 per cent. Significantly lowest wilt incidence of 13.39 per cent was recorded in GTR 10, which was statistically at par with GTR 43 (14.29 %). The next best lines with respect to wilt incidence were GTR 41 (15.48 %), GTR 39 (15.50 %), GTR 32 (17.15 %), GTR 6 (19.64 %) and GTR 2 (19.64 %). Among different restorer lines, maximum wilt incidence of 35.71 per cent was recorded in GTR 42. The reaction of restorer lines against *F. udum* makes it cleared that none of the lines used in the present investigation was either resistant (< 10 % wilt incidence) or susceptible (41-60 % wilt incidence) to highly susceptible (> 60 % wilt incidence). Seven lines (GTR 6, GTR 10, GTR 32, GTR 43, GTR 2, GTR 41 and GTR 39) were observed moderately resistant (11-20 % wilt incidence) and thirteen lines (GTR 37, GTR 53, GTR 40, GTR 33, GTR 38, GTR 44, GTR 42, GTR 36, GTR 12, GTR 4, GTR 7 and GTR 31) were observed moderately susceptible (21-40 % wilt incidence).

Seven wild species of pigeonpea having desirable characters along with cultivated susceptible check ICP 2376 were screened against *F. udum* and the data are presented in Table 2. The results revealed that all the wild species were significantly superior with respect to wilt incidence compared to susceptible check. The wilt incidence in these wild species ranged from 7.61 to 32.78 per cent. Significantly the lowest wilt incidence (7.61 %) was observed in *Rhyncosia bracteota* followed by *Cajanus platycarpus* (8.94 %) and *Rhyncosia rufescence* (9.67 %). The wilt incidence in susceptible check *i.e*. ICP 2376 was 55.78 per cent. The characters like strong/hard stem are unique in *Rhyncosia bracteota* and *Rhyncosia rufescence,* which might have played role in lower wilt incidence. Further, low wilt incidence may also be ascribed due to lack of proper substrate in the root system or the action of some inhibitory substance in the xylem in a particular line/species. However, the biochemical constituents like phenols, flavanols *etc*., that play crucial role in imparting resistance may need to be further analyzed to draw valid inference.

Anatomical and morphological features of root like protoxylem and metaxylem number, their diameters and lateral root numbers were found associated with resistance in pigeonpea against *F.* udum (Anonymous, 2006-07). Screening of 950 genotypes of pigeonpea against *F. udum* revealed that none was free from the disease, but 19 had less than 10 per cent wilt incidence, which were graded as resistant (Agrawal *et al.*, 1991). A short duration genetic male sterile line ICPM 93003 was reported as resistant to wilt and sterility mosaic and could be used in developing short duration disease resistant pigeonpea hybrid. (Saxena *et al.*, 1998). The study on evaluation of new elite pigeonpea germplasm against wilt in three different countries using wilt sick plots revealed that the genotype ICEAP 00040 consistently showed a high (< 20.0 %) level of resistance to the disease in all the three countries compared to 87.5, 92.0 and 90.9 % wilt score for the susceptible genotype ICEAP 00068 in Kenya, Malawi and Tanzania, respectively (Gwata *et al.*, 2006). Nevertheless, the disease resistance observed in this study could be useful as a good source of resistance in pigeonpea breeding programmes in the state. The results obtained in the present study are in accordance with the earlier reports.

CONCLUSION

On the basis of the results, wilt incidence in various maintainer lines ranged from 14.58 to 38.75 per cent, whereas in restorer lines it ranged from 13.39 to 35.71 per cent. Among different wild species *viz*., *Rhyncosia bracteota*, *Cajanus platycarpus* and *Rhyncosia rufescence* were resistant with less than 10 per cent wilt incidence.

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Table 1: Screening of different maintainer and restorer lines of pigeonpea against *F. udum*.

Maintainer Line	Wilt Incidence (%)	Reaction	Restorer Line	Wilt Incidence (%)	Reaction
GT 289B	28.54^{bcd} (22.62)*	MS	GTR 37	34.08^{bc} (30.95)*	MS
GT 404B	25.73^{cd} (18.75)	MR	GTR 53	28.62^{bcd} (22.50)	MS
GT 405B	26.47^{bcd} (19.64)	MR	GTR 40	32.61^{bc} (28.57)	MS
GT 100B	24.02^{d} (16.25)	MR	GTR 6	26.47^{cd} (19.64)	MR
GT 302B	38.78^{ab} (38.75)	MS	GTR 33	30.01^{bcd} (25.00)	MS
GT 309B	37.80^{abc} (37.50)	MS	GTR 38	36.80^{b} (35.42)	MS
GT 310B	32.94^{bcd} (29.17)	MS	GTR 44	28.54^{bcd} (22.62)	MS
GT 33B	31.47^{bcd} (26.79)	MS	GTR 42	36.89^{b} (35.71)	MS
GT 290B	30.33^{bcd} (25.89)	MS	GTR 10	21.87^{d} (13.39)	MR
GT 40B	22.80^{d} (14.58)	MR	GTR 32	24.76^{cd} (17.15)	MR
GT 307B	27.61^{bcd} (21.43)	MS	GTR 36	31.47^{bcd} (26.79)	MS
GT 305B	31.47^{bcd} (26.79)	MS	GTR 12	27.40^{bcd} (20.83)	MS
GT 403B	31.47^{bcd} (26.79)	MS	GTR 4	28.54^{bcd} (22.62)	MS
GT 87B	24.01^{d} (16.25)	MR	GTR 7	31.47^{bcd} (26.79)	MS
GT 288B	26.47^{bcd} (19.64)	MR	GTR 43	22.61^{d} (14.29)	MR
GT 304B	28.54^{bcd} (22.62)	MS	GTR 5	30.01^{bcd} (25.00)	MS
GT 308B	26.47^{bcd} (19.64)	MR	GTR 2	26.47^{cd} (19.64)	MR
GT 303B	25.69^{cd} (18.33)	MR	GTR 41	24.47^{cd} (15.48)	MR
GT 306B	23.54^{d} (15.48)	MR	GTR 39	24.47^{cd} (15.50)	MR
GT 301B	31.47^{bcd} (26.79)	MS	GTR 31	32.61^{bc} (28.57)	MS
ICP 2376	49.37^{a} (57.54)				

Treatment means with the letter/letters in common are not significant by Duncan's New Multiple Range Test at 5 % level of significance.

* ***Retransformed values.*** ***MR : Moderately resistant,*** ***MS : Moderately susceptible.***

Table 2: Screening of wild species of pigeonpea against *F. udum*.

Wild Species	Wilt Incidence (%)	Reaction
Cajanus platycarpus	17.89 [ef] (8.94)	R
Cajanus scarabaeoides	19.62 [e] (10.84)	MR
Cajanus lanceolatus	29.56 [c] (23.89)	MS
Rhyncosia bracteota	16.53 [f] (7.61)	R
Rhyncosia aurea	35.21 [b] (32.78)	MS
Rhyncosia rothi	25.83 [d] (18.50)	MR
Rhyncosia rufescence	18.56 [ef] (9.67)	R
Cajanus cajan i.e. ICP 2376	48.59 [a] (55.78)	--

Treatment means with the letter/letters in common are not significant by Duncan's New Multiple Range Test at 5 % level of significance.

[*] ***Retransformed values.***

R : Resistant, MR : Moderately resistant, MS : Moderately susceptible.

[MS received:November 01, 2012] *[MS accepted: November 21, 2012]*