J. Mycopathol. Res. **36**(1) :7-11 (1998) *Printed in India*
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Variability in *Fusarium udum*, the causal organism of wilt of pigeonpea

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Variability among six isolates of *Fusarium udum* Butl., obtained from different parts of India, in respect of some cultural characters, size and septation of conidia etc. and pathogenic reaction against six cultivars of pigeonpea was studied. Although variability was observed in the cultural characters of the test isolates, some features were common to all the isolates, namely abundant production of microconidia and formation of both terminal and intercalary chlamydospores. Macroconidia varied in size and were mostly hooked. Pathogenic variation was also established. Some cultivars which have been designated as resistant after tests at certain areas showed moderate to high degree of susceptibility and vice-versa. The results seem to suggest the existence of physiologic races within *F. udum*. In absence of an international set of differentials the races, however, could not be categorised in an international standard. Pathogenicity was not related to the growth rate of the fungal isolates.

Key words : *F. udum*, pigeonpea, variation, cultural and pathogenic characters

INTRODUCTION

A major obstacle to pigeonpea cultivation is wilt disease caused by *Fusarium udum* Butl. The disease was first reported by Butler in 1906. Continuous cropping of pigeonpea in the same field may lead to as much as 50% or more plant mortality due to wilt. In Bihar and Uttar Pradesh, 5-10% damage of standing crop is a common feature every year (Singh, 1990). In screening trials, it has been observed that a particular cultivar showing resistant reaction to the disease in certain areas may not show resistant reaction in other areas.

Variability among the isolates of *F. udum* in respect of their cultural and pathogenic reactions against host cultivars has been reported by several workers (Reddy and Basu Choudhary, 1985; Rajendra and Patil, 1992, 1993; Shit and Sen Gupta, 1980) suggesting the existence of physiologic races within the fungus. Variability in *F. udum* in respect of their cultural and pathogenic characteristics have been studied, the results of which are presented in this paper.

MATERIALS AND METHODS

For this experiment six isolates of *F. udum* Butl. obtained from F_1 (Jawaharlal Nehru Krishi Viswavidyalaya, Jabalpur, M.P.), F_2 (Birsa Agricultural University, Ranchi, Bihar), F_3 (AICRIP, Gulbarga, Karnataka), F_4 (Gujarat Agricultural University, Sardar

Krushinagar), F_5 (Trihut College of Agricultur, Dholi, Bihar), F_6 (Bidhan Chandra Krishi Viswavidyalaya, W.B.). Host cultivers used were ICP 8863, ICP 11290, ICP 11291, Pusa B22, ICP 2376, BSMR.

For mycelial dry weight, the isolates were grown in patato dextrose broth for 9 days at 28°C and mycelial dry weights were calculated in the usual procedure.

For plant inoculation the fungal isolates were multiplied in sterilised sand maize meal medium and inoculated in potted soil @ 5%. Surface sterilized pigeonpea seeds were sown and seedlings grown in sand culture supplemented with nutrient solution (Mc Lean and Cook, 1941). Fifteen day old seedlings were transplanted in inoculated pots @ four seedlings per pot. Six replications were taken for each treatment.

Pathogenicity of an isolate was assessed in a 0-4 scale (Chakraborty and Sen Gupta, 1995), where O = no symptom, 0.5 - yellowing or drooping of one of the lower leaves, 1.0 = yellowing or drooping of both the lower leaves, 1.5 = 0.5 + shedding of the other leaf, 2.0 = shedding of both the lower leaves, 2.5 = 2.0 + unhealthy appearance of the top leaves, 3.0 = 2.0 + top leaves showing symptom of drooping, 3.5 = 2.0 + drooping of top leaves, 4.0 = Total wilting.

Thus with the aid of visual observations disease indices for all the seedlings in a particular set were calculated. Finally, the average disease index per seedling in a particular set was obtained by summating all the disease indices in a set and dividing by the number of seedlings in a particular set.

RESULTS AND DISCUSSION

For study of cultural variability the isolates were grown on sterilized PDA medium in petridishes. Although variability was observed in cultural characters of the isolates under study in respect of amount of aerial mycelium, colour, texture, zonation, presence or absence of pinnotes and sporodochia, saltation etc. (Table 1) and size and septation of conidia (Table 2), some features were common to all the isolates, mainly abundant production of microconidia and formation of both terminal and intercalary chlamydospores which were characteristics of the section Elegans. Although the macroconidia varied in size, they were mostly hooked.

The isolates greatly varied in respect of total growth (mycelial dry weight, Table 3). It was significantly higher in isolates F_6 and F_4 as compared to other isolates.

The test isolates also greatly varied in respect to their pathogenic reactions towards six cultivars of pigeonpea (Table 4). Cultivar ICP 11290 and ICP 11291 which have been designated as resistant after tests at certain areas showed moderate to high degree of susceptibility against isolates F_3 and F_4 respectively. Similarly Pusa B22 which has been marked susceptible in certain areas indicated resistant reaction against isolate F_2, F_6 and F_1. Cultivar BSMR, however, showed fairly resistant reaction against all the fungal isolates tested. Pathogenic variation in *F. udum* has earlier been demonstrated by several workers (Shit and Sen Gupta, 1980; Rajendra and Patil, 1993). All these findings indicate the existence of pathotypes within *F.udum*.

Table 1. Macroscopic growth features of different isolates of *F. udum* on PDA at 28°C

Isolate No.	Macroscopic growth features
F_1	Abundant growth of white wooly mycelium, Substratum cream coloured. Pinnotes evenly distributed. Pink coloured small saltation area. Mycelial growth lesser in saltation area.
F_2	Aerial mycelium scanty, appressed, dull white, wooly. Substratum pale cream coloured. Pinnotes are rare.
F_3	Abundant growth of white wooly mycelium, Zonation at the peripheral region. Substratum dark pink coloured. Pinnotes evently distributed.
F_4	Abundant growth of white wooly mycelium. Substratum deep greenish coloured. Zonation at central region. Pinnotes throughout the growth.
F_5	Abundant growth of white mycelium. Substratum cream coloured with dark pink saltation area. Pinnotes throughout the growth.
F_6	Abundant growth of whitish, uniform, wooly mycelium. Substratum cream coloured. Pinnotes throughout the growth.

Table 2. Size and septation of conidia of different isolates of *F. udum* on PDA at 28°C

Isolate No.	No. septation	Conidia (%)	Average conidia			
			Range of length (μ)	Average lenght (μ)	Range of breadth (μ)	Average breadth (μ)
F_1	0	30	3.7-8.8		1.5-3.0	
	1	40	6.6-14.7	10.4	2.2-3.6	2.9
	2	20	13.2-23.5		2.2-4.4	
	3	10	13.2-17.6		2.2-4.4	
F_2	0	60	2.9-8.8	5.8	1.4-2.9	2.1
	1	30	11.7-16.1		2.2-2.9	
	2	10	11.7-16.1		2.2-2.9	
	3	0	-		-	
F_3	0	30	4.4-8.8		1.4-2.2	
	1	40	7.3-19.1	13.9	2.2-3.6	2.9
	2	20	16.1-20.5		2.2-3.6	
	3	10	19.1-25.0		2.2-4.4	
F_4	0	45	2.9-8.8	8.2	1.4-2.9	2.1
	1	30	8.8-17.6		2.2-4.4	
	2	17	10.2-17.6		2.2-4.4	
	3	8	23.5-32.4		2.9-3.6	
F_5	0	52	2.9-10.2	6.8	1.4-2.9	2.0
	1	30	8.8-16.1		1.4-3.6	
	2	18	13.2-23.5		2.2-4.4	
	3	0	-		-	
F_6	0	38	2.9-14.7	8.4	1.4-3.6	2.5
	1	25	11.7-19.1		2.2-5.1	
	2	28	20.5-26.4		2.9-5.1	
	3	9	23.5-32.3		2.9-5.8	
CD (P=0.05)				5.5		0.97

Table 3. Mycelial dry weight of different isolates of *F. udum*

Isolate No.	Average dry weight (in g)
F_1	0.257
F_2	0.141
F_3	0.138
F_4	0.347
F_5	0.209
F_6	0.361
C.D. (P = 0.05)	0.049

But as with some other workers studying different species of *Fusarium,* in the present study also no definite set of test cultivars were used. Thus the physiologic races or pathotypes within the species of *Fusarium* could not be categorised in an international standard. Development of an international set of differentials is, therefore, desirable. No correlation, however, could be established between the intensity of sporulation and growth rate of fungal isolates and their pathogenicity.

Table 4. Pathogenicity of different test isolates of *F. udum* against six pigeonpea cultivers

Isolate No.	Disease index in different pigeonpea cultivars					
	ICP 8863	ICP 11290	ICP 11291	Pusa B-22	ICP 2376	BSMR
F_1	1.30	1.16	0.58	0.95	1.33	0.37
F_2	1.00	0.70	1.08	0.00	0.16	1.54
F_3	0.50	2.79	0.16	3.16	3.50	0.16
F_4	0.83	1.66	3.20	2.58	2.00	0.33
F_5	0.66	0.25	0.12	1.79	2.66	0.70
F_6	1.00	0.41	0.00	0.91	0.08	0.33
C.P. (P = 0.05)						
V = 0.45						
V X F = 1.10						

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(Accepted for publication 30 May 1997)