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MORPHOLOGICAL, CULTURAL, PHYSIOLOGICAL AND NUTRITIONAL STUDIES OF NEW *Fusarium* WILT PATHOGEN OF BRINJAL

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ABSTRACT

A new species of *Fusarium* causing wilt on brinjal was identified as *F.oxysporum* f.sp. *melongenae* on the basis of morphological, cultural, physiological and nutritional studies. The fungus produces hyaline, septate, cottony white to pink mycelium. The macroconidia were oval, hyaline, mostly non- septate or with a single septa. The pathogen produces abundent pale brown chlamydospores either singly or in chains. Richard's agar as well as potato dextrose agar medium was the basal medium for growth and sporulation of the fungus. It utilises glucose, sucrose, lactose, xylose, sorbital and dextrin as a carbon sources while potassium and ammonium nitrate as a nitrogen sources. The optimum temperature and pH for the growth of fungus was 28 ± 1°C and 5.7 resepctively whereas the thermal death point for the fungus was 59 to 60°C.

KEY WORDS : *Fusarium*, wilt pathogen, brinjal

Brinjal (*Solanum melongenae* L.) is one of the most important vegetable crops grown throughout India. Among various pathogens infecting brinjal, *Fusarium* wilt is a serious one. The various species of *Fusarium* infecting brinjal are *F.oxysporum* Schl. (Ganacharya and Wankar, 1976), *F.solani* (Fournet and Jacqua, 1978) and a recently identified *F.oxysporum f.sp. melongenae* in India (Mandhare *et al*. 1989). However, causal agent of wilt of brinjal was first reported in the Netherlands (Steekelenbug and Van, 1976). Though the morphological, cultural, physiological and nutritional aspects of these various species are known, there is no literature on newly identified *F.oxysporum* f. sp. *melongenae*. It was, therefore, studied and presented herewith.

MATERIALS AND METHODS

Morphological studies

The *Fusarium* cultures used under study were obtained from single spore isolation. To determine size of conidia/chlamydospores, one hundred spores were measured under high power (45 X) using micrometers.

Cultural studies

Culture media *viz*., potato dextrose agar, Richards' agar, Ashbys' agar, oat meal agar,

Table 1. Cultural characters of *F.oxysporum* f.sp. *melongenae* on different media

Cultural media	Colony dia (mm)*	Dry mycelial wt.* (mg) in broth	Sporulation	Growth characters
Potato dextrose agar	85	92	++++	Circular colony, mycelium compact, Cottony white to pink with aerial hyphae.
Richards' agar	85	78	++++	Colony circular, concentric rings and growth raised at centre, colony white-pink.
Asbhys' agar	65	71	+	Circular colony with smooth margins, less aerial hyphae.
Oat meal agar	57	63	++	Circular colony, cottony white, flat growth with loose mycelium.
Kichaffs' agar	74	67	+++	Mycelium spreaded, showed concentric rings, whitish.
Proteose Peptone agar	72	66	++	Circular colony, whitish and flat growth.
Coons' agar	82	86	++++	Circular colony with entire margin, mycelium compact and raised at centre.
Czapecks' agar	76	76	++	Flat growth, mycelium compact and raisd at centre.
Host extract agar	85	88	++++	Circular colony with entire margin, raised at centre, cottony white, mycelium loose.
Leonian agar	74	70	++	Circular colony with raised at centre showed aerial hyphae, smooth mycelium.

Mean of three replications
+ : Poor / Scanty sporulation ; ++ : Moderate sporulation
+++ : Good sporulation ; ++++ : Profuse sporulation

Kirchoffs' agar, proteose peptone agar, Coons' agar, Czapecks' agar, Host extract agar and Leonion agar were tested for the growth and sporulation of the fungus.

Physiological studies

Temperature requirement, thermal death point (TDP) and hydrogenion concentration (pH) required for the fungus were studied by routine methods.

Nutritional studies

The utilisation of carbon *viz*., sucrose, lactose, dextrose, dextrin, sorbital, fructose, galactose, mannitol, glucose, xylose and nitrogen *viz*., sodium nitrate, potassium nitrate, ammonium nitrate, urea, ammonium tartarate, tyrosine, asparagin, peptone, ammonium acetate and ammonium sulphate by the fungus was studied by adopting routine procedures.

Table 2. Effect of temperature and pH on growth and sporulation of *F. oxysporum* f.sp. *melongenae*

Temperature				pH			
Incubation temp. (°C)	Colony dia (mm)*	Dry mycelial wt. (mg)*	Sporulation	Before sterilisation	After sterilisation	Dry mycelial wt. (mg)*	Sporulation
0	0	0	-	2.7	2.2	90	+
5	0	0	-	3.2	2.7	120	+
10	16	76	-	3.6	3.2	139	++
15	32	95	-	4.0	3.7	155	++
20	54	160	++	4.7	4.2	162	++
25	62	170	++	5.3	4.7	169	++
28 ± 1	81	220	++++	5.8	5.2	186	++++
30	74	182	+++	6.3	5.7	200	++++
35	56	142	++	6.8	6.2	181	+++
40	23	90	+	7.3	6.7	179	+++
45	0	0	-	7.8	7.2	140	++
				8.2	7.7	96	+
				8.6	8.2	90	+
				9.3	8.7	49	+
				9.8	9.2	30	-
S.E.		5.31				4.46	
C.D. at 5%		16.39				13.41	

++++ : Profuse sporulation ; +++ : Good sporulation ; ++ : Moderate sporulation ; + : Poor / scanty sporulation ; - : No sporulation

Table 3. Utilisation of carbon sources by *F. oxysporum* f.sp. *melongenae* on solid and liquid media

Source of carbon	Colony diameter (mm)*	Dry mycelial weight (mg)*	Sporulation
Sucrose	82	192	++++
Lactose	82	170	+++
Dextrose	79	180	+++
Dextrin	80	180	+++
Sorbital	82	175	+++
Fructose	78	166	++
Galactose	70	83	++
Mannitol	79	162	++
Glucose	85	195	++++
Xylose	80	185	+++
Control (with sugar)	-	-	-
S.E.		7.12	
C.D. at 5%		21.04	

* : Mean of three replications
++++ : Profuse sporulation ; +++ : Good sporulation ;
++ : Moderate sporulation ; + : Poor / scanty sporulation ;
- : No sporulation

Table 4. Utilisation of nitrogen sources by *F. oxysporum* f.sp. *melongenae* on solid and liquid media

Nitrogen source	Colony diameter (mm)*	Dry mycelial weight (mg)*	Sporulation
Sodium nitrate	82	220	++++
Potassium nitrate	80	190	++++
Ammonium nitrate	80	169	+++
Urea	59	121	++
Ammonium tartarate	65	160	+++
Tyrosine	56	130	++
Asparagin	62	100	+
Peptone	65	79	+
Ammonium acetate	33	109	+
Ammonium sulphate	20	72	+
Control (without 'N')	-	-	-
S.E.		6.63	
C.D.at 5%		17.95	

* Mean of three replications. ++++ : Profuse sporulation;
+++ : Good sporulation; ++ : Moderate sporulation;
+ : Poor / scanty sporulation; - : No sporulation

RESULTS AND DISCUSSION

Morphological studies

The growth of the fungus was noticed to be cottony white to pinkish in colour with hyaline, septate and profusly branched mycelium and measured 5.38-11.56 µm (average 8.27 µm) in diam. The conidia were variable in size. Macro-conidia were fusiform, fulcate/curved shaped, mostly 3-4 septate and measured 41.75 X 26.66 µm. Micro- conidia were oval, hyaline, mostly non-septate or with a single septa and measured 38.71 X 14.61 µm. Abundant chlamydospores (16.36 µm in dia.) were produced which were pale to brown either single or in chains.

Cultural studies

Profuse growth, sporulation and dry mycelial weight of *F.oxysporum* f.sp. *melongenae* were obtained on Richard's potato dextrose agar, Coons' agar and Host Extract agar medium (Table 1) as reported by Haymaker (1928) for *F.oxysporum F. hyanersici.*

Physiological studies

The fungus *F.oxysporum* f.sp. *melongenae* preferred to grow in the temperature range of 10-40°C (Table 2). Below and above this range, there was no growth. Maximum growth (on the basis of dry matter weight) and sporulation was observed at 28 ± 1°C. TDP for the fungus was in between 59° to 60° as also reported for *F.oxysporum* f.*lycopersici* (Domesh *et al.*, 1980). The fungus could grow in the presence of wide range of pH i.e. 2.2 to 9.2. However, the maximum mycelia growth was harvested at pH 5.7.

Nutritional studies

The fungus utilised all the carbon sources (Table 3). However, good growth, maximum dry mycelial weight and sporulation was recorded on glucose, sucrose, lactose, sorbital, fructose and dextrose. Similar results were obtained by Griffen (1970) for *F.solani.*

Among the N sources, good growth, maximum dry mycelial weight and sporulation were recorded on sodium nitrate, potassium nitrate and ammonium nitrate. Peptone, asparagin and ammonium tartarate found to be good and urea, was found to be moderately effective source of nitrogen (Table 4). These N sources were also reported to be the best for *F.oxysporum*, causal agent of potato wilt (Ganacharya and Wankar, 1976).

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SPLIT APPLICATION OF POTASSIUM IN RICE

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ABSTRACT

Field experiments were conducted to study the effect of potassium and its methods of application in rice. Application of potassium resulted in 33 and 26 per cent increase in grain yield over control for IR 50 and ADT 36 respectively. Positive influence on growth and yield parameters was observed when the recommended dose of potassium was applied in split doses equally at active tillering and panicle initiation stages.

KEY WORDS : Potassium, split application, uptake

Potassium (K), is one of the major plant nutrients. the application of which to rice as well as other field crops has received least attention albeit the quantities of K removed by crop plants. The present cultivation of high yielding varieties may result in depletion of soil K resources. The method of application of fertilizer and its efficiency are largely governed by the differences in the uptake pattern of the plant at different stages of growth (Sing *et al.* 1983). Sekhan *et al.* (1973) observed two peaks of K absorption rate, one at active tillering and second at flowering stages of rice. Therefore, a continuous availability of K in growing medium of the plant should be maintained. The present study was made with the objective to study the effect of K and its method of application to rice.

MATERIALS AND METHODS

Field experiments were conducted at the Agricultural Research Station, Aliyar Nagar, Tamil Nadu during 1992-93. The treatments included T_1 : blanket recommendation of 50 Kg K_2O/ha all basal ; T_2 : 50 Kg K_2O/ha at panicle initiation (PI) stage : T_3 : 25 Kg K_2O/ha each at basal and PI stages ; T_4 : 25 Kg K_2O/ha each at active tillering (AT) and PI stages ; T_5 : 12.5 Kg K_2O/ha each at AT and PI stages and T_6 : control (NO K_2O). The commonly cultivated varieties IR 50 (June to September) and ADT 36 (January to April) were raised. The seedlings were transplanted at 15x10 cm spacing. The experimental field was clay loam in texture with a pH of 7.2 and low in available N and K and medium in available P.

RESULTS AND DISCUSSION

There was no positive influence of K on the height of the plant in both the seasons. Split application of the K @ 25 Kg K_2O/ha each at AT and PI stages found to increase the yield and K uptake over other methods of K application. Application of K significantly increased the number of panicles per m^2. Significantly higher number of panicles per m^2 were obtained when the K was top dressed @ 25 Kg K_2O/ha each at AT and PI stages. Singh *et al.* (1983) observed a similar trend of increased number of panicles per m^2 when K was top dressed at AT and PI stages.

Positive influence on panicle length was observed for K application. In both the seasons, application of 50 Kg K_2O/ha all basal resulted in