RESEARCH ARTICLE

Studies on survey of *Fusarium* wilt of pea in Eastern Uttar Pradesh

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ABSTRACT

Thirty three villages of eight district of Eastern Uttar Pradesh, India, were surveyed for the occurrence of wilt of pea. The disease incidence ranged in between 3.6 to 14.42 per cent from village to village. Maximum percentage of wilt incidence (12.88) was found in Sant-Kabir Nagar district while Ballia, Balrampur, Deoria, Gonda Gorakhpur, Kushinagar and Sultanpur exhibited 6.48, 9.35, 8.28, 8.49, 6.74,7.27 and 7.82 per cent respectively. Thirty seven fungal species were isolated from root pieces of wilted pea plants collected from the field. Amongst them four species were identified as *Fursarium chlamydosporum, F. moniliforme, F. nivale and F. oxysporum.Fusarium oxysporum f. sp.pisi* was found to be most virulent during pathogenicity test.

Key words: Pea fields, *Pisum sativum*, Pathogenicity, *Fusarium oxysporum f. sp. pisi*.

INTRODUCTION

Pea (*Pisum sativum* L.) is native of South Europe and grown as garden or field crop throughout the temperate regions of the world. In India, the crop is grown on a field scale for its dry seeds and smaller scale for green peas. The most important state cultivating pea on a field scale in India is Uttar Pradesh. Which include about 83% of total area under crop in the country. The crop suffers due to various diseases of which vascular wilt caused by *Fusarium oxysporum f. sp. pisi* is the most important (Phal and Choudhary, 1983; Sharma *et al*., 1989; Lin, 1991; Kraft, 1994; Maheshwari and Gandhi, 1998).

In the present investigation eight pea growing districts of Eastern Uttar Pradesh viz.,Ballia, Balrampur, Deoria ,Gonda, Gorakhpur, Kushinagar,Sant-Kabir Nagar and Sultanpur were surveyed for the fungi causing wilt disease in pea. The pathogenicity of dominant fungi isolated from wilted specimens of pea were also evaluated.

MATERIALS AND METHODS

Survey of pea fields was carried out in 33 villages of eight districts of Eastern Uttar Pradesh to collect wilted plant at different stages of plant growth. Three to six villages were selected randomly in each

district and three plots per village were taken for collection of wilted plant specimen of pea. In each plot two spots of one meter square quadrat were taken at random and each spot having wilted as well as healthy plants were recorded. The per cent occurrence of wilted plants of each spot was calculated as following

$$\text{\% occurrence of wilted plants of each spot} = \frac{\text{Number of wilted plants of each spot}}{\text{Total number of plants of the same spot}} \text{X100}$$

Wilted samples of pea were brought to the laboratory for isolation of different fungi. The roots of the wilted plants sample were washed thoroughly in tap water in order to remove the sticking soil particles. These were then surface sterilized by dipping in 0.1 percent NaOCI (Sodium Hypochlorite) solution for two minutes. The roots were washed repeatedly in sterilized distilled water so as to remove the traces of Sodium hypochlorite. Thoroughly washed roots were kept in sterilized Petri plates lined with sterilized blotting paper and allowed to dry for some time. The roots were cut into small pieces and transferred in pre-sterilized Petri plates containing Potato Dextrose Agar medium. The Petri plates were incubated at 28±2^{0}C and root pieces were observed daily for appearing fungi from both cut ends upto 7 days. The fungal colonies developed in each Petri plate were isolated separately. The fungi were purified and identified by comparing their morphological & cultural characteristics with authentic cultures as well as with the help of available literature (Gilman, 1967; Booth, 1971; Ellis, 1971, 1976). The isolated fungi were numbered.

The pathogenicity of isolated four fungal species of *Fusarium* viz. *F.chalamydospuram*, *F. moniliforme*, *F. nivale* and *F. oxysporum* on the host plant- *Pisum sativum* was evaluated by pot culture and water culture technique (Singh and Tripathi, 1999).

In pot culture technique, plastic pots of 15cm size were washed with water and dipped in 5 per cent NaOC1 (Sodium hyprochlorite) solution. The pots were thoroughly rinsed with sterilized distilled water. Plastic pots were filled upto 10cm height with a mixture of sterilized soil, maize meal medium and fungal inoculum(8:1:1 w/w/w). The mixed soil in the pots was covered on the top with sterilized soil for 2cm height. Control sets contained all the contents except fungal inoculum. Five seeds of susceptible variety of pea were sown on the top layer (1 cm deep) of each pot separately and pots were irrigated with sterilized water from time to time. Observation were recorded on 30th day.

In water culture technique the spore suspensions (2.5%) were prepared separately by adding the requisite amount of sterilized distilled water and fungal spore of each of the four *Fusarium* species. The spore suspension of each of the *Fusarium* species was filled in culture tubes separately at equal level. 10 and 20 days old seedlings of pea were placed in culture tube (1 Plant/tube) separately. Only sterilized water was used in the place of suspension for control sets. Experiment was repeated twice and each set having five replicates. Observations were taken on 17th day.

RESULTS AND DISCUSSION

The disease incidence (wilting) ranged between 3.6 to 14.42 per cent from village to village (Table-1).

Table 1: Per cent occurrence of wilted pea plants in villages of different districts

District	Village	Per cent occurrence
Ballia (1-4)	1. Chachya	3.60
	2. Chintamanpur	7.38
	3. Jam	7.02
	4. Jam-Bashnahi	7.90
Balrampur (5-8)	5. Dushah	7.33
	6. Itiyathok	6.58
	7. SriduttGanj	9.45
	8. Uttraulla	13.75
Deoria (9-13)	9. Augustpar	11.25
	10. Baitalpur	7.25
	11. Gauri Bazar	5.37
	12. Haraiya	10.85
	13. Purwa	6.68
Gonda (14-16)	14. Pandtipurwa	7.68
	15. Sataipurwa	8.08
	16. Semra	9.73
Gorakhpur (17-22)	17. Bahrampur Thokar	7.18
	18. Bangai	4.48
	19. Bhainsahan	7.02
	20. Mohammadpur	4.35
	21. Ramnagar	9.65
	22. Ram LakhanaTola	7.78
Kushinagar (23-26)	23. Hata	5.65
	24. Hetimpur	6.68
	25. Kushinagar	10.97
	26. NaikaChhapra	6.67
Sant- Kabir Nagar (27-30)	27. Bhainsahiyan	13.87
	28. Khalilabad	14.42
	29. Maghar	12.62
	30. Sahjanwa	10.62
Sultanpur (31-33)	31. Belhari	6.47
	32. Chhitepatti	9.08
	33. Tirhut	7.92

The average percentage of wilted plants in Ballia District was 6.48; the minimum (3.6) being in chachya while maximum (7.9) in Jam Bashnahi. The average percentage of wilted plants in Balrampur district was 9.35; the minimum (6.85) being in Ityathok while maximum (13.75) in Uttraulla. Deoria district showed 8.28 average percentage of wilting, the minimum (5.37) being in Gauri Bazar maximum (11.25) in Augustpar. The average percentage of wilted plants in Gonda district was 8.49; the minimum (7.68) being in Panditpurwa while maximum (9.73) in Semra. Gorakhpur district exhibited 6.74 average percentage of wilting; the minimum (4.35) being in Mohammadpur while maximum (9.65) in Ramnagar. The average percentage of wilted plants in Kushinagar district.was 7.27; the minimum (5.65) being in Hata while maximum (10.97) in Kushinagar. District Sant-Kabir Nagarexhibited 12.88 percentage of wilting the minimum (10.62) being in Sahjanwa while maximum (14.42) in Khalilabad. The average percentage of wilted plants in Sultanpur district was 7.82; the minimum (6.47) being in Belhari while maximum (9.08) in Chhitepatti. Maximum percentage of wilt incidence (12.88) was found in Sant-Kabir Nagar district (Table-2).

Table.2-Average percentage and range of percentage of wilted pea plant in different districts

District	Average	Range of Percentage of wilting
Ballia	6.48	3.6 to 7.9
Balrampur	9.35	6.48 to 13.75
Deoria	8.28	5.35 to 11.25
Gonda	8.49	7.68 to 9.73
Gorakhpur	6.74	4.35 to 9.65
Kushinagar	7.27	5.65 to 10.97
Sant-Kabir Nagar	12.88	10.62 to 14.42
Sultanpur	7.82	6.47 to 9.08

Table.3-Percent wilting in pea plants by different species of *Fusarium* by Pot culture technique

Culture No.	Fungal Species	Per cent Wilting
7	*Fusarium moniliformae*	26.3
10	*F. chlamydosporum*	53.3
14	*F. nivale*	63.3
17	*F. oxysporum*	100.0
	Control	**0.0**

In all 150 isolates were obtained from wilted samples of pea. On the basis of morphological characters and growth pattern of fungal colony these isolates were grouped under thirty seven fungal species. These fungal species were numbered as 1-37. Out of these fungal cultures No. 7, 10 14 & 17 were identified as *Fusarium moniliforme*, *F. Chlamydosprum*,*F. nivale* and *F. oxysporum* respectively on the basis of characteristic feature of micro and macro conidia. These fungi were dominant and were found to be disease causing species during pathogenicity test.

In pot culture technique *Fusarium chlamydoporum* and *F. nivale* exhibited more than 50 percent wilting while *F. oxysporum* showed 100 percent wilting (Table-3) .In water culture technique also *F. oxysporum* was found to be most pathogenic. On 17th day it caused 100 and 75 percent wilting in 10 and 20 day old plants respectively. It is interesting to note that the 10 day old plants were found to be more responsive to *Fusarium nivale* and *Fusarium oxysporum* than 20 day old plants (Table-4). The pathogenicity recorded in terms of percent wilting was in following order *F. oxysporum* > *F.nivale* > *F. chlamydosporum* > *F moniliforme*.

The crop suffer heavy losses every year due to wilt disease, *Fusarium* wilt of pea is known since 1928 when Linford (1929) found it to be wide spread in the

Table.4-Per cent wilting in pea plants by different species of *Fusarium* by water culture technique

Culture No.	Fungal Species	Per cent wilting on 17th day	
		Plant age(days)	
		10	20
7	*Fusarium moniliformae*	**25**	**25**
10	*F. chlamydosporum*	**25**	**25**
14	*F. nivale*	**75**	**50**
17	*F. oxysporum*	**100**	**75**
	Control	**0.0**	**0.0**

U.S.A. In India *Fusarium* wilt in pea was reported for the first time by Sukapure *etal*. (1957). Maheshwari*et al*. (1983) surveyed pea growing area in Northern India assessment of losses was found to be 13.9-95% due to wilt complex (caused by *Fusarium solani f. sp. pisi* and *F. oxyporum f. sp. pisi*) in Hoshiarpur district of Punjab. During 1981-83 Sharma *et al*. (1989) surveyed 50 villages of 6 district in Madhya Pradesh for *Fusarium* wilt and wilt incidence was recorded upto 37.39 per cent. In the present investigation the wilt incidence of Eastern Uttar Pradesh ranged between 3.6 to 14.42 percent from Village to Village (198 spots) of eight districts. The variation in occurrence of percentage of wilting in different states my be due to climatic condition, variety of seeds sowing and soil constitutions.

Pucci (1976) isolated six fungal species viz. *Fusarium avenaecum*, *F.graminearum*, *F. oxysporum, f. sp. pisi*, *F. roseum*, *F. sambucinum* and *F. solani f.sp. pisi* from pea, while *Fusarium oxysporum f. sp. pisi* and *F. solani f. sp. pisi* were isolated by Maheshwari*et al.* (1983) from wilted pea specimen of Hoshiarpur district of Punjab. Further Czyzewaska (1984) reported seven fungal species viz. *Fusarium avenaceum*, *F.culmorum*, *F.equiseti*, *F.oxysporum f. sp. pisi*, *F.sambucinum*, *F. solani f. sp. pisi* and*F. sporotrichioides* from infected pea plants. In the present investigation 37 fungal species were isolated from roots of wilted specimens of pea plants. Out of these four spp. viz. *Fusarium moniliforme.F. Chlamydosporum*, *F. nivale* and *F. oxysporum* (culture No. 7, 10, 14 & 17 respectively) were dominant. These fungal species were selected for pathogenicity test in order to find out the most virulent causal organism of wilt of pea.

For pathogenicity test, various techniques such as water culture, loop, root dips, sand culture and pot culture have been adopted by different workers (Nalepia, 1971; Soran, 1975; Nene and Haware, 1980, Gupta 1983, Satichidanand, 1985), but the water culture and pot culture techniques were found to be more useful (Soran, 1975; Nene and Haware, 1980; Singh and Tripathi, 1999. Therefore, in the present investigation pot culture and water culture techniques were adopted for the pathogenicity test.

CONCLUSION

The findings of the present investigation indicates the various soil born pathogens attack to pea plants amongst them some *Fusarium* species are pathogenic and causing wilt disease in *Pisum sativum*. The farmers are can take precautions to ammend the pea fields for control of wilt disease.

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