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Research Article

Location and Transmission of *Fusarium oxysporum*. F Sp. *Ricini*, and *Macrophomina*p *phaseolina* in Castor (*Ricinus communis* L.)

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ABSTRACT

Castor is one of the important non edible oilseed crops and considered as the ancient non edible oilseed crop. The crop is affected by number of diseases. Among them wilt caused by *Fusarium oxysporum* .f.sp. *ricini,* root-rot and charcoal rot caused by *Macrophomina phaseolina*, reduces the seed germination and yield up to 40-60%. Present study concentrated on location and transmission of *Fusarium oxysporum* .f .sp. *ricini,* and *Macrophomina phaseolina* in castor beans during 2007-2008 kharif seasons in Karnataka. A total of 130 seed samples were collected from farmers, retail shops, fields and APMC markets and were subjected to SBM method. Five seed samples showing higher incidence of seed borne fungi in SBM were selected for location and transmission of the pathogen. The results revealed that *F. oxysporum* .f.sp. *ricini,* (23-100%) and *M. phaseolina* (11-18%) in the SBM method. *F. oxysporum* .f.sp. *ricini* ranged from 12-48% in seed coat, 7-11% in cotyledons, while 0-2% in embryonic axis. *M. phaseolina* ranged from 3-9% in seed coat, 1-4% in cotyledons, while 0-1% in embryonic axis in kharif 2007. In kharif-2008 *F.oxysporum* .f.sp. *ricini* (31-55%) and *M. phaseolina* (13-21%) in the SBM method. *F. oxysporum* .f.sp. *ricini* ranged from 15-51% in seed coat, 9-12% in cotyledons, while 0-2% in embryonic axis. *M. phaseolina* ranged from 5-10% in seed coat, 2-8% in cotyledons, while 0-3% in embryonic axis. The seeds tested during kharif 2007-08 season harvested seeds favor the more number of pathogens in the seed coat & cotyledons than in the other components. The transmission of *F. oxysporum* .f .sp. *ricini* and *M. phaseolina* was 14.4% in kharif 2007. In kharif 2008, the transmission was 26.8% in all the five seed samples. The present study reveals that the disease transmission is more during kharif-2008 season than kharif-2007.

Key words- Castor, location, Transmission, *F. oxysporum* .f .sp. *ricini* and *M. phaseolina*

INTRODUCTION-

Castor (*Ricinus communis* L.) is one of the important non edible oilseed crops and considered as the ancient non edible oilseed crop. It is indigenous to eastern Africa and most probably originated in Ethiopia. Weiss (1971) [1]. This crop is widely distributed throughout the tropics and sub-tropics and is well adapted to the temperate regions of the world. Castor is cultivated over on area of 20161 hectares with a production 17493 tones and productivity 193 kg/ha in Karnataka. Anon (2006) [1]. Castor plant is affected by number of fungal diseases. The important diseases are wilt-*Fusarium oxysporum* f.sp.*ricini*, leaf spot & blight-*Alternaria ricini*, cercospora leaf spot-*Cercospora ricinella*, root rot, stem rot & charcoal rot-*Macrophomina phaseolina*, seedling blight-*Phytophthora parasitica*, capsule rot-*Cladosporium oxysporum*, fruit rot & Gray rot-*Botrytis ricini*, rust-*Melamspora ricini*, powdery mildew-*Leveillula taurica*, phyllosticta leaf spot-*Phyllosticta bosensis*, angular leaf spot-*Botrytis* sp., damping off-*Phythium aphanidermatum* Rangaswamy and Mahadevan (2005) [9]. These diseased reduces the germination and production. *Fusarium oxysporum* .f.sp. *ricini,* and *Macrophomina*

phaseolina are the causal agent of wilt and root-rot & charcoal rot diseases of castor. Nanda and Prasad (1974) [8], Svirdvi, (1989) [14]. In the present work the occurrence, Location, seed to seedling transmission, their frequency of mortality, recovery of pathogens and its significance were studied.

MATERIALS AND METHODS-

1. Collection of castor seed samples

A total of 130 samples were collected from castor during kharif, 2007-08. Seeds were harvested from mature castor plants, farmers, fields, retail shops and APMC markets in different agro climatic regions of Karnataka state. The collected seed samples were dried in sunlight to bring down the safe storage seed moisture and were subjected to standard blotter method (SBM).

2. Standard blotter method (ISTA.1993)

Seed samples were analyzed for the detection of seed-borne fungi by blotter method following ISTA, 1993 with some modifications. In this method three layers of blotter paper were soaked in sterilized and placed at the bottom of the Petri plates. 100 seeds were sterilized with 0.2% sodium hypo chloride solution for 2 to 3 minutes and seeds taken randomly from each sample and were placed in ten Petri plates (Ten seeds per plate).

The Petri plates with seeds were than incubated at room temperature for seven days in the laboratory. The plates were alternating cycles of 12 hrs light and 12 hrs darkness for seven days. Sterile distilled water was aseptically added to each Petri plates under incubation every third day in order to keep the blotter is sufficiently moist. Germination and fungi associated with the seeds were recorded during the incubation period. Each of the incubated seeds was examined under stereo binocular microscope to ascertain the presence of fungi.

Some times were not apparent even after seven days of the incubation. In such condition, the petri plates were allowed for further incubation. A temporary slide was prepared from each colony, which could not be identified stereo binocular microscope. Fungi were identified by preparing temporary slides and examined under labomed vision 2000 microscope.

In fewer cases the fungi from the incubated seeds were transferred to PDA medium in Petri plates aseptically and incubated under controlled temperature (28±1^{o}C) for 3 to 10 days and then examined under labomed vision 2000 compound microscope. The associated mycoflora were analyzed by using standard guides and manuals. Sigourd and Funder (1961 [11], Subramanian (1983) [13], Van Arx, (1981) [16].

Five seed samples showing higher incidence of *Fusarium oxysporum* .f.sp. *ricini,* and *Macrophomina phaseolina* in standard blotter method and were selected for location and transmission studies.

3. Location of the pathogen by component plating method

This method is adapted to know the location of the pathogen in different components of the seed Basak, (1998) [3]. The individual seed components were excised after soaking the surface sterilized seeds 0.2% sodium hypochloride (NaOCl) for three min, in sterile distilled water for five hours.

The seed coat, cotyledons and embryonic axis (Plumule and radicle) were dissected aseptically using forceps and needles on blotter. Each component was dipped separately in 0.2% sodium hypochloride solution (NaOCl) for 50 to 90 seconds and was placed on SBM method. One hundred seeds were dissected in each sample and ten replication were maintained.

The plates incubated at 25±2^{0}C for room temperature. All the components plated individualy. After eight day observation of these plates under stereobinacular microscope. Fungal infection in different seed components was determined based on the appearance of the fungus on the SBM and the percentage of infection was calculated.

4. Disease transmission studies in the field

Among the total seed samples, five samples shows a higher incidence of *Fusarium oxysporum*

.f.sp. *ricini,* and *Macrophomina phaseolina* were selected for disease transmission in experimental plot. The seed samples were sterilized by 2% sodium hypochloride solution (NaOCl) for 2-3 minutes and in the distilled water before sowing the seeds. Before sowing the seeds the experimental plot were prepared by 20 x 20 meter (row and columns) leveled and ploughed. Each sample selected 100 seeds in ten replicates. Sterilized seeds were directly sowing in the fields in the month of July -2007 and 2008. The proper agronomical practices were followed for raising the plants. All the seeds have germinated after 7-10 days. In experimental plots, 15 plants were randomly selected by selecting five leaves randomly in each plant. The severity of the disease was assessed by using 0-9 scale Mayee and. Datar (1986) [6] and percentage of diseases index was calculated by using the formula.

$$\text{\% of disease Index (PDI)} = \frac{\text{Sum of individual ratings}}{\text{No. of leaves examined} \times \text{Maximum disease grade (9)}}$$

Seed to seedling transmission of *Fusarium oxysporum* .f.sp. *ricini,* and *Macrophomina phaseolina* of pathogens were studied.

5. Recovery of pathogens from diseased plants

Seeds were collected from experimental plots in rabi and summer seasons, subjected for seed health testing methods. Again the seeds sown in kharif 2008 season in experimental plot for recovery of pathogens were studied. These seeds yielded the *F. oxysporum* f.sp.*ricini,* and *M. phaseolina.* The study shows that *F. oxysporum* .f .sp. *ricini,* and *M. phaseolina* are transmitted from seed to seedlings and to the seeds. Thippeswamy, et al (2006) [15].

EXPERIMENTAL RESULTS –

During the field survey the wilt and root-rot & charcoal rot of castor was noticed in all visited fields during kharif and rabi seasons in 2007-08. The severity of wilt and root-rot & charcoal rot was more in kharif-2008 then 2007.

Location of the pathogen in different seed components

Location of the pathogen in the seed is important to control seed borne pathogens.

Based on the location of the pathogen in the seeds, the chemicals are selected to prevent the seed borne pathogens. Majority of the seed borne pathogens are lodged on the seed coat, some pathogens are in the cotyledons and some are in embryonic axis (plumule and radical). Many researchers, Arya, et al (2004) [2], Ashish Kumar Dubey and Tribhuvan Singh (2005) [3], Basak (1998) [4]. reported the location of the pathogen in seed coat, cotyledons, endosperm and embryonic axis (plumule and radical) of various oil seed crops.

In Castor, *F. oxysporum* f.sp.*ricini* (23-100%) and *M. phaseolina* (11-18%) in the SBM method. *F. oxysporum* f.sp.*ricini* ranged from 12-48% in seed coat, 7-11% in cotyledons, while 0-2% in embryonic axis. *M. phaseolina* ranged from 3-9% in seed coat, 1-4% in cotyledons, while 0-1% in embryonic axis in kharif 2007.

In kharif-2008 *F. oxysporum* f.sp.*ricini* (31-55%) and *M. phaseolina* (13-21%) in the SBM method. *F. oxysporum* f.sp.*ricini* ranged from 15-51% in seed coat, 9-12% in cotyledons, while 0-2% in embryonic axis. *M. phaseolina* ranged from 5-10% in seed coat, 2-8% in cotyledons, while 0-3% in embryonic axis. The seeds tested during kharif 2007-08 season harvested seeds favors the more number of pathogens in the seed coat & cotyledons than in the other components.

The expression of *F. oxysporum* f.sp.*ricini* and *M. phaseolina* was more percentage in seed coat than other seed components. The seeds were harvested during kharif-2008 season favored for the more number of pathogens in the seed coat than other components.

The seeds harvested during kharif-2008 season shows a less incidence of mycoflora in the seed components when compare to the kharif 2007 season. This is due to the environmental factors in growth stages of the crop.

Place of collection	% infection of seed in SBM		In percentage					
			Seed coat		Cotyledons		Embryonic Axis	
	F.ric	M. ph	F.ric	M. ph	F.ric	M. ph	F.ric	M. ph
Jalahalli	97.0	11.0	41.0	6.0	11.0	1.0	2.0	0.0
Mylnalli	100	14.0	48.0	9.0	9.0	5.0	2.0	0.0
Hebbala	65.0	10.0	31.0	5.0	8.0	3.0	0.0	0.0
Nelamangala	44.0	14.0	12.0	4.0	7.0	2.0	0.0	0.0
Anekal	23.0	18.0	13.0	3.0	10.0	2.0	0.0	1.0
Mean	65.8	13.4	29	5.4	9	2.6	0.8	0.2
SD	29.83	2.8	14.51	2.059	1.414	1.356	0.979	0.4
SE	14.91	1.4	7.259	1.029	0.707	0.603	0.489	0.265

Table 1: Location of *F. oxysporum* f.sp. *ricini* and *M. phaseolina* in different seed components of castor in Kharif-2007

Place of collection	% infection of seed in SBM		In percentage					
			Seed coat		Cotyledons		Embryonic Axis	
	F.ric	M. ph	F.ric	M. ph	F.ric	M. ph	F.ric	M. ph
Jalahalli	55.0	13.0	49.0	10.0	12.0	3.0	2.0	0.0
Mylnalli	63.0	21.0	51.0	8.0	10.0	2.0	0.0	3.0
Hebbala	34.0	17.0	33.0	9.9	9.0	6.0	0.0	1.0
Nelamangala	46.0	19.0	18.0	5.0	10.0	5.0	1.0	0.0
Anekal	31.0	21.0	15.0	6.0	11.0	8.0	0.0	0.0
Mean	45.8	18.2	33.2	7.78	10.4	4.8	0.6	0.8
SD	12.15	2.993	15.02	2.018	1.019	2.135	0.8	1.166
SE	6.077	1.496	7.512	1.009	0.509	1.067	0.4	0.583

Table 2: Location of *F. oxysporum* f.sp. *ricini* and *M. phaseolina* in different seed components of castor in Kharif-2008

Data based on 100 seed for each samples. Each samples in ten replication.

F.ricin-*Fusarium oxysporum* f.sp.*ricini.* M. ph- *Macrophomina phaseolina*

Transmission studies

The transmission of *Fusarium oxysporum* f.sp.*ricini* and *M. phaseolina* was 14.4% in kharif 2007. In kharif 2008, the transmission was 26.8% in all the five seed samples. The present study reveals that the disease transmission is more during kharif-2008 season than 2007.

Place of collection	% of incidence in SBM			% of Mortality		% of Diseased Plants	% of Healthy Plants	Recovery of pathogen	
			Germ %	Pre-emergence	Post-emergence				
	F.ricini	M. ph						F.ricini	M. ph
Jalahalli	97.0	11.0	77.0	23.0	3.0	16.0	58.0	55.0	13.0
Mylnalli	100	14.0	70.0	30.0	2.0	19.0	49.0	63.0	21.0
Hebbala	65.0	10.0	76.0	24.0	1.0	13.0	62.0	34.0	17.0
Nelamangala	44.0	14.0	68.0	32.0	5.0	14.0	50.0	46.0	19.0
Anekal	23.0	18.0	65.0	35.0	6.0	10.0	49.0	31.0	21.0
Mean	65.8	13.4	71.2	28.8	3.4	14.4	53.6	45.8	18.2
SD	29.83	2.8	4.621	4.621	1.854	3.006	5.388	12.15	2.993
SE	14.91	1.4	2.310	2.310	0.927	1.503	2.694	6.077	1.496

Table 3: Seed transmission of *F. oxysporum* f.sp. *ricini* and *M. phaseolina* naturally infected in Castor beans during Kharif-2007

Recovery of the pathogen from seeds

Seed samples were collected from the experimental plot were subjected for seed health testing methods for recovery of diseases transmission. The seeds collected from disease transmitted plants, sown in again during kharif season, infection having (60.2%) of *Fusarium oxysporum* f.sp.*ricini* and *Macrophomina phaseolina* (19.0%) showed the (26.8%) transmission (Average of five seed samples, table, 4).

Place of collection	% of incidence in SBM		Germ %	% of Mortality		% of Diseased Plants	% of Healthy Plants	Recovery of pathogen	
				Pre-emergence	Post-emergence				
	F.ricin	M. ph						F.ricin	M. ph
Jalahalli	55.0	13.0	65.0	35.0	2.0	33.0	30.0	91.0	16.0
Mylnalli	63.0	21.0	63.0	37.0	1.0	23.0	29.0	78.0	20.0
Hebbala	34.0	17.0	71.0	29.0	5.0	19.0	47.0	61.0	16.0
Nelamangala	46.0	19.0	69.0	31.0	3.0	38.0	28.0	43.0	21.0
Anekal	31.0	21.0	68.0	32.0	1.0	21.0	46.0	28.0	22.0
Mean	45.8	18.2	67.2	32.8	2.4	26.8	36	60.2	19
SD	12.15	2.993	2.856	2.856	1.496	7.386	8.602	22.79	2.529
SE	6.077	1.496	1.428	1.428	0.748	3.693	4.301	11.54	1.264

Table 4: Seed transmission of *F. oxysporum* f.sp. *ricini* and *M. phaseolina* naturally infected in Castor beans during Kharif-2008

Data based on 100 seed for each samples. Each samples in ten replication.

F.ricin-*Fusarium oxysporum* f.sp.*ricini.* M. ph-*Macrophomina phaseolina*

Reduction of the seed yield is based on the environmental conditions and the severity of disease symptoms. The mode of seed to seedling transmission of the pathogen is depends on the aggressiveness of the pathogen and environmental conditions. Current study revealed that the transmission of the pathogens were more during kharif 2008 than kharif harvested seeds. But disease transmission is more in kharif 2008 than kharif 2007 season. The disease appeared in the first fortnight of July and gradually increased up to November, decline in disease severity with lowering the temperature and relative humidity up to December. Many researchers, Arya, et al (2004) [2], Ashish Kumar Dubey and Tribhuvan Singh (2005) [3], Basak (1998) [4], Naik, (1994) [7], Thippeswamy et al (2006) [15] have recorded the transmission of disease on different oil seed crops like sesame, safflower, sunflower, soyabean, mustard and ground nut and chilly seeds etc.

The present study reveals that the disease transmission is more during kharif-2007 than 2008 kharif season. The results shows that the kharif-2007 season favors more percentage of pathogens have transmission from the seed to seedling and to the seeds. Because, this is environmental factors are influenced for the transmission of the pathogen.

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