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Incidence and severity of leaf blight caused by *Fusarium pallidoroseum* on varied age of Castor (*Ricinus communis*) inoculated using different methods

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ABSTRACT: Castor seeds were planted at three different times of seven days interval (11, 18 and 25 DAS) so as to have varying ages at inoculation date. The plants were inoculated at the same time using three methods (spray, smear and soil inoculation). Plants at 11 and 18 DAS had higher incidence and severity and were not significantly different (P=0.05), while plants at 25 DAS had the least disease and was not significantly different with the control (P=0.05).

Key Words: Blight; Castor seeds; *Ricinus communis; Fusarium pallidoroseum*.

Introduction

Castor, *Ricinus communis* L., a monotypic genus belong to the family Euphorbiaceae. It is widely cultivated in the tropics and sub tropics and warm regions for its seed from which castor oil is extracted (Purseglove, 1968, Weiss 1971).Castor can thrive well in dry arid climates as well as heavy rains and floods. In its natural growing area, the plant is perennial forming a tree stature, while commercially treated as annual or biennial and exhibits a bushy appearance (Atsmon, 1989, Moshkin ,1986, Weiss 1971).
The important part of the crop is the seeds which contains 50-55% oil (Duke, 1983; Adefris and Nigussie, 1993; Gobin *et. al.,* 2001). Traditionally, castor oil is used in lamps lighting and in medicine. The oil is used in industries as cosmetic base, high grade lubricant and in protecting coatings (Gobin *et al*., 2001; Duke, 1983; Purseglove, 1968;).

In recent, World production is about 25296 MT per annum with Africa producing 1863MT (FAOSTAT, 2003). The three largest importers of castor seeds and oil are the United States, France and United Kingdom with India (60%), China (17%) and Brazil (6%) being the largest growers and exporters (FAOSTAT 2005). In Nigeria, castor is an indigenous source of vegetable oil and for its high oil content under Nigerian conditions but these potentials are yet to be fully exploited (Yayock, 1985). In India, yield loss of 80-100% has been attributed to fungal diseases (Anjani *et. al.,* 2004).), thereby affecting farmers income.

In view of the importance of the crop and the effect of fungal diseases on yield, there is a need to identify at what age of plant does infection starts so as to find possible control measures.

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Materials and Methods

Raising of seedlings

Seeds of castor obtained from diseased plants were sown in plastic pots (12 cm diameter) containing sterile soil at three sowing dates of seven days interval in order to have plants of varying ages (25, 18 and 11 days) at inoculation date. Three methods (smearing, spraying and soil inoculation) were used. One stand per pot was planted and three pots were used for each inoculation method for the various age.

Inoculum preparation and inoculation of plants

Isolates of *F.pallidoroseum* were grown on PDAS in the laboratory for 14 days for the organism to sporulate. Ten millilitres of sterile distilled water was added to each petri dish and mycelia mat from the culture was harvested using a sterile scapel into an electric blender. After blending for 5 minutes, 200 ml of sterile distilled water (SDW) was added into 500 ml conical flask and filtered using a double layer muslin cloth.

To avoid contamination of plants, for each method of inoculation, plants were moved from glass house and inoculation was done outside the glass house. The seedlings of 25, 18 and 11 DAS plants were inoculated by spraying using a hand held atomizer. The next sets of plants were smeared by direct application of harvested mycelial mat on the leaves using fingertips. While the soil inoculation, was done by pouring 20 mls of inoculum suspension at the base of the stem into the soil for each plant. The seedlings for control were treated with sterile distilled water. Both the inoculated and controlled seedlings were covered with polythene bags to increase humidity around the plants. Labeled pots were arranged in completely randomized design. After 24 hours, the polythene, bags were removed for 20 minutes to aerate and water the plants. Two days after inoculation the polythene bags were finally removed. Leaves of plants showing typical symptoms of wilting, leaf spot and stems showing rotting were assessed.

Disease incidence was taken once at 7DAI and severity was assessed at weekly interval and scores were taken at 7, 14 and 21 days after inoculation. Disease incidence was determined by counting diseased leaves expressing it as a percentage of the total plants in 3 pots. Disease severity was carried out by scoring diseased plants using a 1-5 scale as described by (Tarr, 1981), where:

1 = All leaves without symptoms.
2 = 1- 25% total leaf number with symptoms.
3 = 26-50% total leaf number with symptoms.
4 = 51-75% total leaf number with symptoms.
5 = 75% or more – total leaf number with symptoms.

All data collected was subjected to statistical analysis using simple ANOVA (SAS 2002) and means were separated using the Least Significant Difference (LSD). All experiments were repeated once.

Results

The disease incidence taken at various days after inoculation (DAI) for the different age of castor using different inoculation methods are presented in (Table 1). For spraying method, there was significant difference (P = 0.05) in disease incidence between plants inoculated at different ages (DAS), though 11 and 18 DAS which recorded highest disease incidence were not statistically different from each other (Table 1). Control plants had significantly lower disease incidence than all the other treatments.

For smearing method, there was significant differences between the plants inoculated at 11, 18 and 25 DAS (P = 0.05), however, plants inoculated at 25 DAS were not statistically different from the control plants which had least disease incidence.

For soil inoculation, plants inoculated at 11 DAS had significantly more disease incidence than the other treatments (P =0.05). Control had the least disease and was not statistically different from plants inoculated at 25 DAS (P =0.05) (Table 1).

The severity index taken at various days after inoculation (DAI) for the different age of castor using different inoculation methods are presented in (Table 2). For both spraying and smearing at 7 DAI there was no significant differences between 11 and 18 DAS inoculation and between 25 DAS and control (P =0.05). Plants inoculated at 11 and 18 DAS had higher disease severity. For soil inoculation there were significant differences between the different plant ages. Those inoculated at 11 DAS recorded the highest disease severity, followed by those inoculated at 18 and 25 DAS respectively. The disease severity taken at 14 DAI were not statistically different (P =0.05) among 11 and 18 DAS inoculated plants for both spraying and soil inoculation methods. On the other hand, for smearing method, 25 DAS inoculated and control were not statistically different (P = 0.05), while plants inoculated at 11 and 18 DAS were not statistically different. At 21 DAI, the trend was similar for all the inoculation methods with 11 and 18 DAS inoculation, recording more severity index when compared with 25 DAS and control.

Table 1: Leafblight Incidence at 7 DAI on varied ages of castor inoculated using different methods.

Age of plant (DAS)	Incidence (%) using:		
	Spraying	Smearing	Soil inoculation
11	94.4	100.0	100.0
18	94.4	77.7	88.9
25	22.2	11.7	1.0
Control	1.0	1.0	1.0
LSD	72.69 *	19.86 *	9.1 *

*= Significantly different (P =0.05)
DAS = Days after sowing

Table 2: Leafblight severity on varied ages of castor inoculated using different methods.

Plant Age	Severity index %								
	7 DAI			14 DAI			21 DAI		
(DAS)	SP	SM	SI	SP	SM	SI	SP	SM	SI
11	4.7	4.0	6.0	6.7	7.3	7.3	9.3	10.0	10.0
18	3.3	3.3	4..0	5.3	6.0	8.0	10.0	10.0	10.0
25	1.3	1.3	1.0	1.0	2.7	1.0	2.0	1.0	1.0
Control	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
LSD	1.6*	1.2*	1.9*	1.5*	1.5*	2.2*	1.96*	0·0*	0.0*

*= Significantly different (P =0.05), DAI = Days after inoculation; SP – spray
SM – smear; SI – Soil inoculation

Discussion

In this study, age of plants played a significant role in disease infection. It was observed that the younger plants at 11 and 18 DAS were more susceptible to infection for all the inoculation methods than plants at 25 DAS. This agrees with Agrios (2005), who reported that plant age is important in disease infection and young plants are more susceptible. He also reported that Plants in their reaction (susceptibility or resistance) to disease depends largely on age and for instance infections caused by Pythium; damping off and root rots, downy mildews, bacterial blights and viral infections, the host plants are susceptible only

during the growth period and become resistant during the adult period. Also depending on the particular plant- pathogen combination, the age of the host plant at the time of arrival of the pathogen may affect considerably the development of infection and of an epidemic.

The greater the number of pathogen propagules within or near fields of host plants, the more inoculum reaches the hosts and at an earlier time. In a similar situation Shukla and Chand (1975) reported that younger leaves of sesame are more susceptible to infection due to more stomata, higher Nitrogen and moisture content than in older leaves. Hence this mechanism can be responsible for the low infection of plants inoculated at 25 DAS than those inoculated at 11 and 18 DAS. Also as a plant gets older, the tissues become more lignified therefore making it difficult for pathogen to penetrate into the tissues.

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