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Full Length Research Paper

Effects of Temperature on the Incidence and Severity of Pre-Emergence and Post-Emergence Damping off of Cowpea (*Vignaunguiculata* L.) By *Pythium debaryanum*

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The focus of this study is on the effect of different temperature on the incidence and severity of pre-emergence and post-emergence damping off of cowpea *(Vignaunguiculata)* caused by *Pythium debaryanum.* This research was conducted using 130 viable cowpea seeds each for pre-emergence and post-emergence damping. Germinating and germinated seeds, as the case may be, were incubated in groups of 10 in three replicates at 20, 25, 30, 35 and 40^{0}C. A replicate of 10 samples each was observed as control for pre-emergence and post-emergence damping off. The findings of this research show clearly that the effect of temperature on the incidence and severity of damping off on Cowpea by *Pythium debaryanum* was significant for both pre-emergence and post-emergence damping off. In both cases, disease incidence for the lowest and highest treatment temperature was 70% and 96.7% respectively. This means that the incidence and severity of damping off increases with increased temperature in both seeds and seedlings.

Keywords: Pre-emergence, Post-emergence, Damping off, *Vignaunguiculata*, *Pythium Debaryanum*.

INTRODUCTION

Pythium species are “fungal-like” hemibiotrophic organisms and members of the family Pythiaceae. This family (phylum Oomycota, kingdom Stramenopila) includes many other economically important phytopathogens, including *Phytophthorainfestans*, the causal agent of tomato blight and culprit of the infamous Irish potato famine of the 1800’s. Both *Pythium* and *Phytophthora* are capable of moving through water as zoospores via flagella, and are commonly referred to as water molds. The genus *Pythium* contains species that range from non-pathogenic saprophytes, to highly pathogenic species with limited host ranges. *Pythium* these fungi occur in all soils, are water loving organisms, and thrive in wet or poorly drained soils. Slow-growing or weak plants are more susceptible to damping-off than vigorous fast-growing seedlings. If the plant can grow roots faster than the fungus can decay them, the plant will survive and be healthy. *Pythium* is a genus of parasitic oomycete *(*Ben-Yephet *et al*., 1996*).*

Cowpea (*Vignaunguiculata*) is an important grain legume in West Africa (Singh *et al*., 1985).Cowpea providing an in expensive source of protein for the poor urban and rural

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population (Aghali,1991). It is considered the most important legume crop in Africa (Langyintuo *et al*., 2003). Cowpeas are leguminous seeds widely produced and consumed in most developing countries of sub Saharan Africa (Ocloo *et al*., 2012). The world production of the cowpea was nearly 5.7 million tons in 2012, on the other hand, Africa accounts for about 94.7% of the world production. The cowpea is grown in an area of 10.6 million hectares in warm and hot areas (Faostat, 2013). The seeds are a major source of plant proteins and vitamins for man, feed for animals, and also a source of cash income. The young leaves and immature pods are eaten as vegetables (Dugje *et al*., 2009). Unfortunately cowpea yields in African countries are low due to various pest and disease, including pre-and post emergence seedling damping off, affecting production of the crops (Singh *et* al*., 1997*). Damping off of cowpea are the most important Diseases during cowpea cultivation, which start after natural flooding, the diseases result in yield losses ranging from 19% to 40 % damping off, (Singh *et at*., 1985). One of the major problems in coniferous nursery is diseases resulting in death of the young seedlings. The most serious of these diseases is commonly known as damping off or 'plant wilt. Is a horticultural disease or condition, caused by a number of different pathogens that kill or weaken seeds or seedlings before or after they germinate. It is most prevalent in wet and cool conditions (*Huang et al., 2011).* Damping-off is considered the most destructive disease in coniferous seedbeds. It occurs at many different climatic conditions and geographic situations. It is caused by a large number of soil born fungi. Host of the coniferous species grown in the Africans' countries are susceptible, to varying degrees, to the damping-off pathogen. Damping off of seedling is very common all over the world. It occurs in Agricultural and forest soils. In tropical and temperate climates and almost in every greenhouse disease or nursery damping off can be of two type, That is pre-emergence damping off in which the seed and radical rot before the seedling emerge from the soil and the post-emergence damping off in which the newly –emerge from seedlings are killed at ground level after they emerge from the soil. Causing them to collapse or topple over. This is a common symptom of post-emergence damping off. This disease is most noticeable in nursery beds greenhouse flats and row crops because symptoms develop suddenly killing large number of seedling in the vicinity. Among the pathogens in this class are species of *Pythium*, *Phytophthora*, *corticum* and *fusarium* (Machete R.S. and Ashok Aggaantal, 2006). Complexes involving a number of fungal pathogens or fungi are common in tropical situations. Interactions between pathogens and stress may also occur. Crops can become more susceptible in to pathogen infections when weakened by environmental stress such as drought, temperature extremes, and exposure to sunlight or wind (Agrios, 2005).

MATERIAL AND METHOD

Study Area

The research work was carried out in the biological sciences laboratory Federal University Dutse at latitude 11°c - 42°c north and longitude 9°c - 21°c east.

Experimental Design

The experiment was laid in a Completely Randomized Design (CRD) with 4 treatments replicated 5 items. The treatment includes subjecting the seedling to 20^0C, 25^0C, 30^0C and 35^0C temperature.

Collection of Sample

The seeds were collected from International Institute for tropical Agriculture (IITA) Kano, and soil sample from the farm land of the Federal University of Dutse that is suitable for cultivating the cowpea.

Seed Viability Test

By using flotation method to determine the viability of the seed, the seeds were put in a container of pure ethyl alcohol, and let them sit for about 2 minutes the viable seeds will sink down and the seed which float was counted and recorded as unviable seeds.

Seed Treatment

The seeds were treated with a chemical called "Apron plus SD" at a rate of 10g of the chemical.

Sourcing of Inoculums

Potato Dextrose Agar (PDA) was prepared using the method of Smith and Onion (1983) Instruction guide. Seven point five (7.5) grams of PDA powder was dissolved in (192) mil of distilled water in a sterile conical flask covered with cotton wool and aluminium foil paper. It was mixed thoroughly and autoclaved at 121^0C for 15 minutes under a pressure of 100kPa. The medium was cooled after autoclaving and dispensed aseptically into sterile Petri dishes. Streptomycin (30mg/l) was added to the medium to prevent the growth of bacteria.

The soil samples inoculated into media by the used of direct plate method. The method is as follows; the soil sample was spread gently into the prepared media and then was incubated at room temperature of 25^oC for 4-7 days.

Table 1: Effect of Temperature on Disease Incidence of Pre- and Post-Emergence Damping Off

Temperature (^{o}C)	Disease Incidence (%)	
	Pre-emergence	Post-emergence
20	70	70
25	76.2	76.2
30	90	90
35	96.7	96.7
(Control)	0	0
Mean	66.58	66.58

Table 2: Effect of Temperature on Disease Severity of Pre- and Post Emergence Damping Off

Temperature (^{o}C)	Severity Class	
	Pre-emergence	Post-emergence
20	7 .0	7 .0
25	7 .62	7.62
30	9 .0	9.0
35	9 .67	9.67
(Control)	0	0
Mean	6.658	6.658

Statistical Analysis

The MS-Excel was used to organize the data generated from the study and then subjected to Analysis of Variance (ANOVA) using one way in (CRD) and effects of treatment means where separated following factorial approach.

RESULTS AND DISCUSSION

The data displayed below is for pre-emergence and post-emergence damping off of *Vignaunguiculata* subjected to temperatures of 20^{0}C, 25^{0}C, 30^{0}C and 35^{0}C. For each

DISCUSION

The data presented above show a significant result for the effect of temperature on the inoculums of *Pythium debaryanum* on Cowpea on the three (3) replicates subjected under the specified temperature range as can be seen on Tables 1 above. Coincidentally, same number of infected and uninfected specimen for both germinating treatment, three (3) replicates in which ten (10) seeds each were cultivated and placed under close observation to detect any sign of damping off. This procedure was carried out for both pre-emergence and post-emergence damping off.

Disease Incidence

The disease incidence (DI) can be obtained from the following formula:

$$\mathrm{DI}(\%) = \frac{\text{No.of Infected Plant}}{\text{Total number of Plant}} \text{ X } 100$$

seeds (pre-emergence) and geminated seeds (post-emergence) were recorded for all temperature treatment as can be seen on Tables 2.

The effect of temperature on the inoculated replicates is significant with consideration to the temperature treatments as the number of infected seeds and seedlings increases with increasing temperature. This result is clearly displayed on Tables above. The mean of infected seeds for pre-emergence damping off for the lowest temperature

Table 3: Pre and Post Emergent Damping Off

ANOVA Table (No of infected seeds)					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	13.333	3	4.444	6.667	.014
Within Groups	5.333	8	.667		
Total	18.667	11			

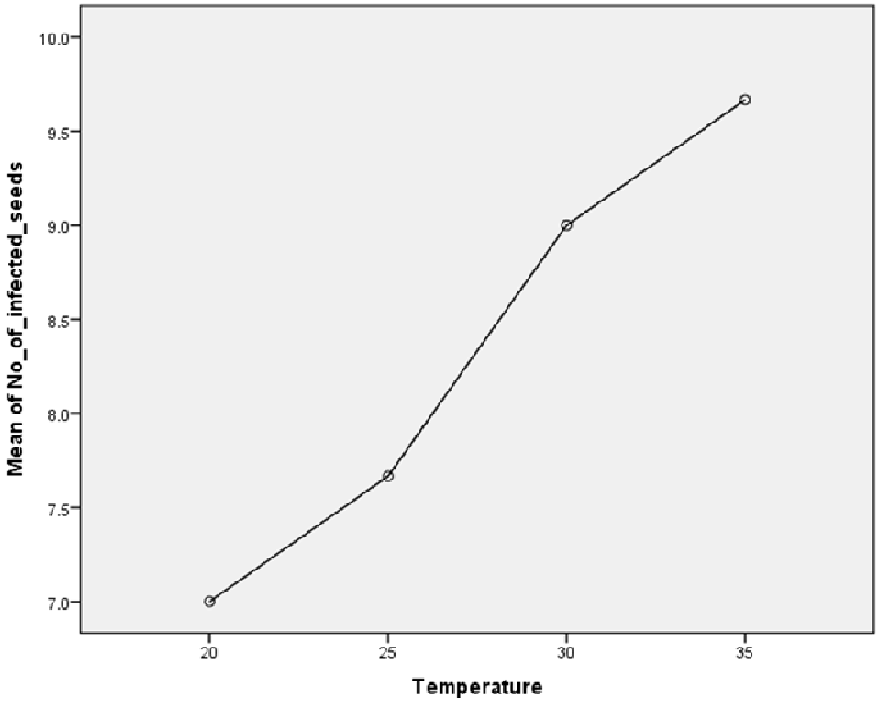
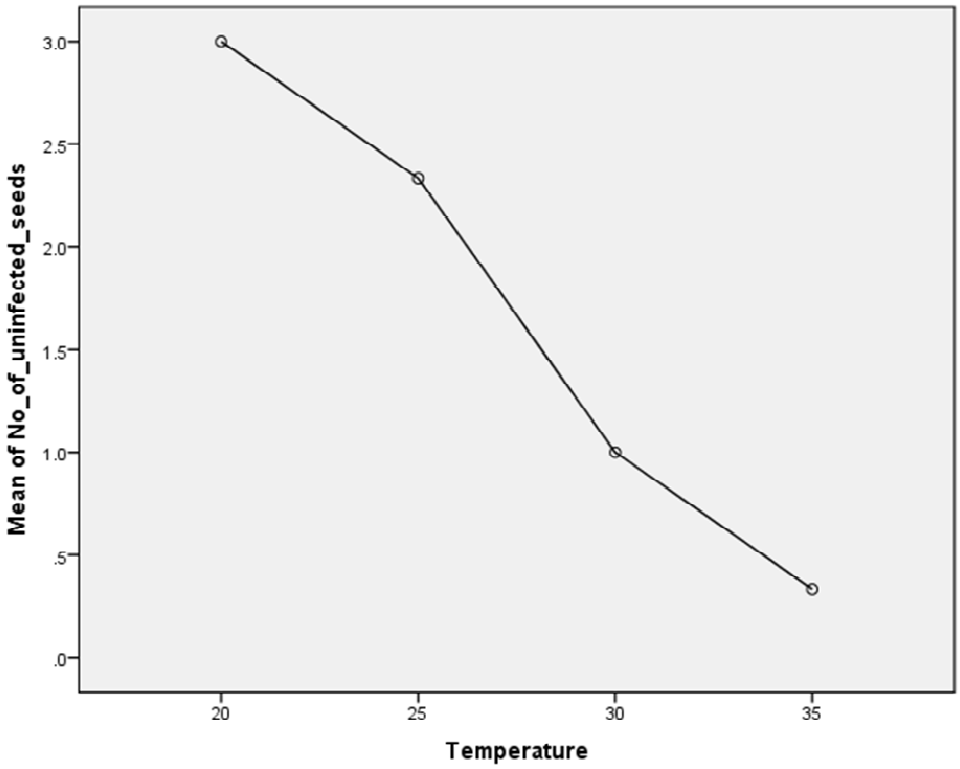


Table 4

ANOVA Table (No of uninfected seeds)					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	13.333	3	4.444	6.667	.014
Within Groups	5.333	8	.667		
Total	18.667	11			

treatment was 23, meaning that about 70% of the total number of seeds incubated at 20^0C were infected. The same result was obtained for the lowest temperature treatment for post-emergence damping off. 96.7% of the inoculated specimens for both pre-emergence and post-emergence damping off were observed to be infected for the highest temperature treatment (i.e. 35^0C). The obtained result validates the assertion that changes in temperature influences the severity of damping off. In other words, lower temperatures reduces the severity of disease infection and the higher the temperature the higher the severity of the infection. This finding is in line with a similar work carried out by Pahlavani *et al*., 2009 in which *Phythiumultimum* was inoculated in safflower (*Carthamustinctorius*) reported that the emergence of this pathogen increases with increasing temperature. Another similar research undertaken by Hwang*et al*., 2000 showed that in a controlled-environment study of the impact of



temperature on the infection of lentil seedlings by *Fusariumavenaceum*, root rot symptoms were most severe at warm temperatures.

The above finding refute the hypothesis stated earlier that temperatures have no effect on the incidence and severity of damping off of seedling of cowpea caused by *Pythiumdebaryanum*. Hence, going by the result obtained from this research, the earlier hypothesis has to be rephrased. The correct hypothesis, according to the findings of this research, is that temperature has an effect on the incidence and the severity of damping off of seeds or seedlings of cowpea caused by *Pythiumdebaryanum*. By considering the data presented on above table. The rewording of the earlier stated hypothesis is justified. The percentage of the disease incidence increases as temperature treatment increases for the inoculated specimen while the control replicates remain uninfected for both pre-emergence and post-emergence damping off.

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