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Incidence and Severity of *Cercospora* Leafspot of Groundnut as influence by inoculum levels in Mubi, Adamawa State, Nigeria

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Abstract

The Study was conducted at the Teaching and Research Farm of the Department of Agricultural Technology, Federal Polytechnic, Mubi to determine the influence of different inoculum concentrations of *Cercospora. arachidiocola* causal organism of Cercospora Leafspot (CLS) on the incidence, severity and yield components of groundnuts during the 2016 cropping season. Five inoculum concentrations (T1=10^7spore/ml, T2=10^6spore/ml, T3=10^5spore/ml, T4=10^4spore/ml, T5=10^3spore/ml) were prepared by serial dilution technique and T6=Distilled water which serves as control. The experiment was laid out in Randomized Complete Block Design (RCBD) and replicated four (4) times. Results obtained revealed that plants inoculated with 10^4spore/ml suspensions of the inoculums recorded the highest incidence (100%) and severity (57.77%) of the disease at 10 WAS and also the lowest yields of haulms (108 kgha^{-1}), pods (202.20 kg/ha^{-1}) and 170.62 kg/ha of groundnut seeds while significantly lower incidence (27.74%), severity (5.77%) and higher yields of haulms (262.66 kg/ha^{-1}), pods 299.22 kg/ha^{-1} and seeds (240.51 kg/ha^{-1}) were recorded against the control (T6).This study have therefore demonstrated the influence of inoculum concentration of 10^4 spore/ml in giving higher incidence and severity of CLS disease in the study area. Further studies should be conducted

by incorporating more groundnut cultivars using different inoculum concentrations with a view to determine their susceptibility in other locations.

Keywords; *Cercospora,* Inoculum concentration, incidence, severity and Groundnut.

Introduction

Groundnut, *Arachis hypogea* L is one of the most important and widely cultivated leguminous oil crops in the tropical and semi-tropical regions of the world. In Nigeria, groundnut production is adapted to the northern part of the country where prevailing environmental factors are favourable for its production which gave rise to the then famous groundnut pyramids in Kano in the early 1960s and also as a major foreign exchange earner for the country during that period. However, like any other crop, its production is constraint by a number of factors amongst which are diseases caused by fungal, bacterial and viral pathogens which affects the crop both in the field and in storage. The degree of infection or severities of these diseases has been reported to be influenced by inoculum quantity, crop variety and environmental factors during period of crop growth (Agrios, 1997; Crous *et al.,* 2006). Important diseases of groundnut include Sclerotium wilt, Rossete diseases, Leafspot diseases and Aspergillus flavus and of all these, leafspot disease caused by *Cercospora spp* (C. *arachidiocola and C. pernosata)* are among the most important field diseases causing severe crop losses (Middleton *et al.,1994*).Species belonging to this genus are widely distributed worldwide from tropical and subtropical to warm and cool regions causing leafspot diseases on most major plant families (Crous and Brown, 2003). Cercospora leaf spot has been reported to be an important disease of Cowpea (Amadi, 1994), Maize and sunflower (Crous *et al., 2006*), , Sugar beet (Hashem and Farrag, 2005), Okro (Chauham *et al., 1980;*Dhaukar and Duhan, 1980), *Hibiscus canabicus* (Parsad *et al., 1960*), Sesame (Emikoumehin, 2005) and Groundnut (Bliya 2007).

Symptoms of the disease are characterized by small chlorotic spots on leaflets which appeared ten days after infection and develop into mature sporulating lesion fifteen days

later (McDonald *et al., 1985*). Severely infected plants display stunting and leaf distortion while yield loss of upto 50% and hualms of upto 30% have been recorded against the disease (Bdliya, 2007). This study was therefore conducted with the aim of determining the effects of different concentrations of *Cercospora arachidiocola.* and there effects on incidence, severity and yield of Ex-Dakar variety of Groundnut in the study area,

Materials and Methods.

Laboratory experiment was conducted in the Biological Science Department of the Federal polytechnic Mubi in 2016, Mubi is located between latitude 10^{o} 11′ N and 9^{o} 26′ N and longitude 13^{o} 1′ and 13^{o} 44′ E (Adebayo, 1999). Infected groundnut plants showing severe symptoms of leafspot disease were collected from fields cultivated with groundnuts and taken to the laboratory in clean polythene bags. Thereafter, the medium for isolation and purification of the fungal pathogen (*C. arachidiocola*) using Potato Dextrose Agar (PDA) was prepared according to the methods of Fawole and Oso (1987). Microscopic examination of the colony and identification was done by comparing with structures in Johnston and Booth (1983). Serial dilution technique as described by (Fawole and Oso, 1987)) was used to prepare the various concentrations of inoculum (10^{7}spore/ml=T1, 10^{6}spore/ml=T2, 10^{5}spore/ml=T3, 10^{4}spore/ml=T4, 10^{3}spore/ml=T5 while distilled water=T6 serves as control) which serves as treatments during the studies. Pathogenicity test and reisolation of the organism was performed according to the procedures in Crous *et al* (2006). Ex-Dakar variety of groundnut seeds were purchase from Maiduguri Monday market and treated with seed dressing fungicide fanasan D at $50g/ha^{-1}$. The field study was carried out at Teaching and Research Farm of the Department of Agricultural Technology of the same institution. The experimental field was cleared of all debris, ploughed, harrowed and demarcated into plots and subplots. The experiment was laid in Randomized Complete Block Design (RCBD) and replicated four (4) times The treated groundnuts were sown onto the prepared plots and all agronomic/cultural practices appropriate for groundnut production such as regular weeding, fertilizer application, insect pest control were performed Inoculation of the plants with the various treatments (inoculum concentrations) suspended in distilled water (1litre) was done at 3 weeks after sowing under the surface of the leaves in the evening using a pressurized hand sprayer. Data collected during

the study were on incidence and severity of *Cercespora* leafspot disease at 4-10 WAS and yields (kg/ha^{-1}) of groundnut haulms, pods and seeds. Disease incidence was calculated using the formula;

$$\text{Disease incidence} = \frac{\text{No.of infected plants}}{\text{Total No.of plants assessed}} \text{ x } 100$$

While disease severity was calculated using a scale of 0-6 according to the method of Poswal (1988) and the formula used was;

$$\text{Disease severity} = \frac{\text{Sum of individual ratings}}{\text{Total No.of plants assessed x 6}} \text{ x } 100$$

The data collected were analyzed using the Generalized Linear Model (GLM) procedure of Statistical Analysis System (SAS, 1996) appropriate for Randomized Complete Block Design (RCBD) and means were separated using Duncan Multiple Range Test (DMRT) at 5% level of significance

Results:

Results on influence of inoculum concentrations on incidence of *Cercospora* leafspot presented on Table 1 reveals a gradual and steady progression in incidence of the disease from 4 -10 WAS and with significantly differences ($P< 0.05$) among the treatments. At 4 WAS, T4 had the highest disease incidence of 30.42%, followed by T3 with 28% while T6 being the control recorded least incidence of 7.18%. Similar trend was observed at 7 WAS with T6 recording significantly ($P< 0.05$) lower incidence of 17.69% while higher incidence of 60.17% was recorded against T4. At 8-10 WAS, T4 had higher disease incidence of 100%, followed by T3 with 60.30% at 10 WAS while the least disease incidence of 27.74% was obtained by T6 (control) during the same period. Similarly, results on severity of the disease in Table 2 also showed significant differences ($P<.0.05$) between the treatments under study with T4 recording significantly higher ($P< 0.01$) disease severity of 57.73% at 10 WAS, followed by T2 (27. 48%) whereas, least disease severity of 5.77% was recorded by T6 (control) at the same period. Results on the yield components of groundnut presented on Table 3 revealed significant differences ($P< 0.05$) in yield amongst the treatments with low haulms quantity of 108kg/ha^{-1}, pods yield of 202.01kg/ha^{-1} and groundnuts seed yield of 170.62kg/ha^{-1} recorded against T4 while higher values of 212.63kg/ha^{-1} of haulms, 241.09kg/ha^{-1} of pods and 232.00kg/ha^{-1} of groundnut seeds were obtained by T1, followed byT2 having 200. 40kg/ha^{-1} of haulms, 231.61kg/ha^{-1} of pods and 212.24kg/ha^{-1} while the

highest mean values of 262.66 kg/ha of haulms, 299.20 kg/ha of pods and 240.51 kg/ha of seeds were harvested from T4 respectively.

Discussions:

The development of disease epidemics on plants depends on several factors relating to the susceptibility of the host plant, pathogen/inoculum concentration, the environment and the complex interactions of these factors (Crous *et al.*, 2006). The significantly higher incidences and severities of *Cercospora* leafspot disease recorded against T4 in this study, might be due to the right spore concentration and its infectivity, coupled with the influence of favourable environmental factors such as dew/moisture, relative humidity and temperature and also length of time or duration of these factors during initial period of infection which might have favoured the sporulation and rate of spread of the fungus. Similar findings were reported on *Cercospora beticola* by Schuh (1991) who assayed that spore concentration, temperature and duration of leaf wetness were found all to influence the pathogen incubation period, progression and disease severity.

On the yield components of groundnuts (haulms, pods and seeds), higher and variable severity of the disease *amongst* the treatments most especially on T4 was observed to have adverse negative effects on these components. Being a foliar disease, the fungus was noted during the study to cause spots and defoliation of leaves which distorts production and distribution of assimilates within the plant thereby resulting into decrease in leaf-stem ratio and yield of the crop. Pande and Rao (2003) similarly observed that high infection of groundnut by late leafspot pathogens reduces yield and haulm quantity and quality. According to Bdliya.(2007), *Cercospora* leafspot causes severe damage to groundnuts particularly towards the pod formation stage of the crop leading to lower seed and haulms yield. The disease also induces false maturity, low yields and adversely affected the quality of groundnut (Kapooria and Zulu, 1982, Meddleton *et al.*, 1994) premature defoliation can occur in severe cases while petioles and stems may also become infected (Bliya 2007).

Conclusion

This study had therefore demonstrated the influence and relationship between inoculum concentration of cercospora leafspot disease of groundnut and its

progression and severity over time and also its ultimate effects on yield and yield components in the study area.

Recommendation

It is therefore recommended that similar experiments need to be carried out on inoculum concentrations of other pathogens on other crops with a view to ascertain there levels of infectivity in other locations.

Table 1. Effect of Inoculum Concentration on Incidence (%) of Cercospora Leafspot Disease at 4-10 weeks after sowing.

	Weeks After Sowing						
Inoculum conc.	4	5	6	7	8	9	10
10^7spore/ml=T1	10.05c	18.03c	20.14c	22.29ab	24.88c	27.98c	37.33ab
10^6spore/ml=T2	20. 42b	31.21ab	43.53a	45.61a	50.13a	59.20ab	60.19a
10^5spore/ml=T3	28.00a	30. 41ab	40.32b	46.11a	49.08a	60.11a	60.30a
10^4spore/ml=T4	30. 42a	41.31a	59.81a	60.17a	100.00a	100.00a	100.00a
10^3spore/ml=T5	11.14c	14.30b	17.11c	21.81ab	29. 47b	30.39c	31. 46ab
Water(cont)=T6	7.18c	9.20b	11.28c	17.69ab	22.94b	24.63c	27.74ab
Means	17.86	23.91	32.03	35.50	46.08	50.38	52.83
S.E	10.92	8.16	19.08	10.66	18.23	15.33	12.18
P of F	*	*	*	*	*	*	*

Means having the same letters in a column are not significantly different according to DMRT

Table 2. Effect of inoculum Concentration on Severity (%) of Cercospora Leafot Disease at 4-10 weeks after sowing.

	Weeks After Sowing						
Inoculum conc.	4	5	6	7	8	9	10
10^7spore/ml=T1	3. 42b	6.13b	12.00ab	13.69ab	17.91ab	20.11ab	20.99ab
10^6spore/ml=T2	3.81b	8.78ab	10.18b	11.38ab	14.76ab	16.28b	27. 48ab
10^5spore/ml=T3	4.12b	6.92b	11.29b	14. 41ab	16.59ab	18.17b	23.61ab
10^4spore/ml=T4	8. 40a	10.03a	22.20a	34. 46a	48.00a	55.82a	57.73a
10^3spore/ml=T5	2.22b	3. 42b	3.66c	7. 41c	9.01c	10.11c	13.00b
Water(cont.)=T6	1.92b	3.00b	3. 41c	4.21c	4.58c	4.96c	5.77c
Means	3.98	6.38	10.45	14.26	18,47	20.90	24.76

S.E	4.48	3.11	10.68	8.22	13.66	20.22	18.61
P of F	*	*	*	*	*	*	*

Means having the same letters in a column are not significantly different according to DMRT

Table 3. Effect of Inoculum Concentration of Cercospora Leafspot Disease on Yields of Haulms (kg/ha^{-1}), Pods (kg/ha^{-1}) and Seeds (kg/ha^{-1}) of Groundnuts.

Inoculum conc.	Haulms.	Pods.	Seeds.
10^7spore/ml =T1	**212.63b**	**241.09b**	**232.00b**
10^6spore/ml=T2	**200. 40b**	**231.62b**	**212.22b**
10^5spore/ml=T3	**180.82b**	**221.11b**	**201.24b**
10^4spore/ml=T4	**108.00d**	**202.01c**	**170.62c**
10^3spore/ml=T5	**142. 44c**	**232.32b**	**215.11b**
Water(cont.)=T6	**262.66a**	**299.20a**	**240.51a**
Means	**184.49**	**237.89**	**211.95**
S.E	**40.13**	**33.88**	**43.02**
LSD	*	*	*

Means having the same letters in a column are not significantly different according to DMRT

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