

INCIDENCE AND SEVERITY OF SUGARCANE RED ROT DISEASE IN SELECTED SUGARCANE GROWING AREAS OF KWARA STATE, NIGERIA

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ABSTRACT

Red rot disease caused by *Collectotrichum falcatum* is a major constraint of sugarcane production in Nigeria. A study was carried out in some sugarcane growing areas of Kwara state namely Tsaragi, Bacita, Shonga, Patigi, Lafiagi, Lade, Oke-Ero and Ilorin to determine the incidence and severity of the disease. The study was conducted between January and July 2019.

Farms were purposively selected from the eight sugarcane growing areas. Leaf and stem samples with the disease symptoms were taken to the laboratory for isolation using the agar plate technique and the isolated fungi were identified using morphological and microscopic features of the red rot pathogen. Confirmation of identity of the pathogen was carried out at the pathology laboratory of the International Institute for Tropical Agriculture (IITA) Ibadan, Oyo State, Nigeria. Data on the incidence and severity of the disease was analyzed using SPSS software version 21 and significantly different means were separated using LSD test at 5% probability level. The results showed that red rot disease incidence was highest in Shonga (36.10 %) and lowest in Ilorin (14.10%). The disease was rated as severe in Tsaragi (47.20%), moderately severe in Bacita, Egosi, Ilorin, Patigi and Shonga (31.25% - 40.70%) and mild in Lade (26.75%). The study revealed that red rot disease of sugarcane is prevalent in all the sugarcane growing regions of Kwara State and this shows the need to create awareness among sugarcane farmers on the importance of the disease and its management for increased sugarcane productivity.

Key words: Incidence; Severity; Red rot; Sugarcane.

INTRODUCTION

Sugarcane, *Saccharum officinarum* L., is a crop which provides sugar, biofuel, fibre, fertilizer, bagasse and molasses (National Sugar Development Council, 2003; Busari, 2004). The crop is also a strong contender in the current worldwide theme on biofuel campaign. Sugarcane is a member of the

Family *Poaceae*, tribe *Andropogoneae* and native to warm temperate to tropical regions of the old world (Wada et al, 2017). It has stout, jointed and fibrous stalks that are extensively rich in sugar. Varieties of sugarcane are highly heterogeneous and generally multiply vegetatively by stem cuttings (Richard, 2009). Matured cane may have green, yellow, purplish or reddish

colour and are considered ripe when sugar content is at its maximum (Onwueme and Sinha, 2003).

Sugarcane is vegetatively propagated with cuttings of 2-3 buds from mature stalks and subsequently from ratoon crops for some years as well as from true seed which is only used for breeding of new cultivars.

There are four Sugar Cane estates prominent in Nigeria:- Bacita, Numan, Sunti and Lafiagi. These estates grow sugarcane in relatively large scale while the majority of the small holder farmers grow soft sugar cane called Chewing Cane (Agboire *et al.*, 2002). The area put under cultivation is progressively increasing from 24,000 ha in 2000 to 49,000 ha in 2007 (FAO, 2008) largely due to the privatization of the sugar estates.

Today, sugar production is showing a downward trend as a result of reduced yield of sugarcane which should be considered serious in view of the transformation of the sugar industry into energy industry. Many factors are responsible for this, which include the increased incidence of phytopathogens of which fungi are an important group.

Red rot is the most common disease of sugarcane in Nigeria, caused by the fungus *Colletotrichum falcatum*. The fungus causes severe loss in yield and quality of the susceptible cultivars available (Satyavir, 2003; Duttamajumder, 2008). It can reduce

cane weight by up to 29% and loss in sugar recovery by 31% (Hussnain and Afghan, 2006). Red rot pathogen hydrolyzes the stored sucrose by producing the enzyme invertase which breaks the sucrose molecule into glucose and fructose. As a result the quantity of molasses increases (Sehtiya *et al.*, 2003). Information on the occurrence and distribution of the disease is paramount for adequate planning of improved and sustainable sugarcane production. The current study is therefore aimed at determining the incidence and severity of red rot disease in sugarcane growing areas of Kwara State with the view to providing information necessary for improved production of the crop.

MATERIALS AND METHODS

Selection of Study sites

Four Local Government Areas with history of sugarcane production in Kwara State were purposively selected for the determination of incidence and severity of red rot disease in the 2018/2019 growing season. The sampling was done on each farm based on one hundred sugarcane plants. This was achieved by walking across a 'Z' shaped path in a field with plants spaced at equal distance from each other. The sampled study locations are presented in Figure 1.

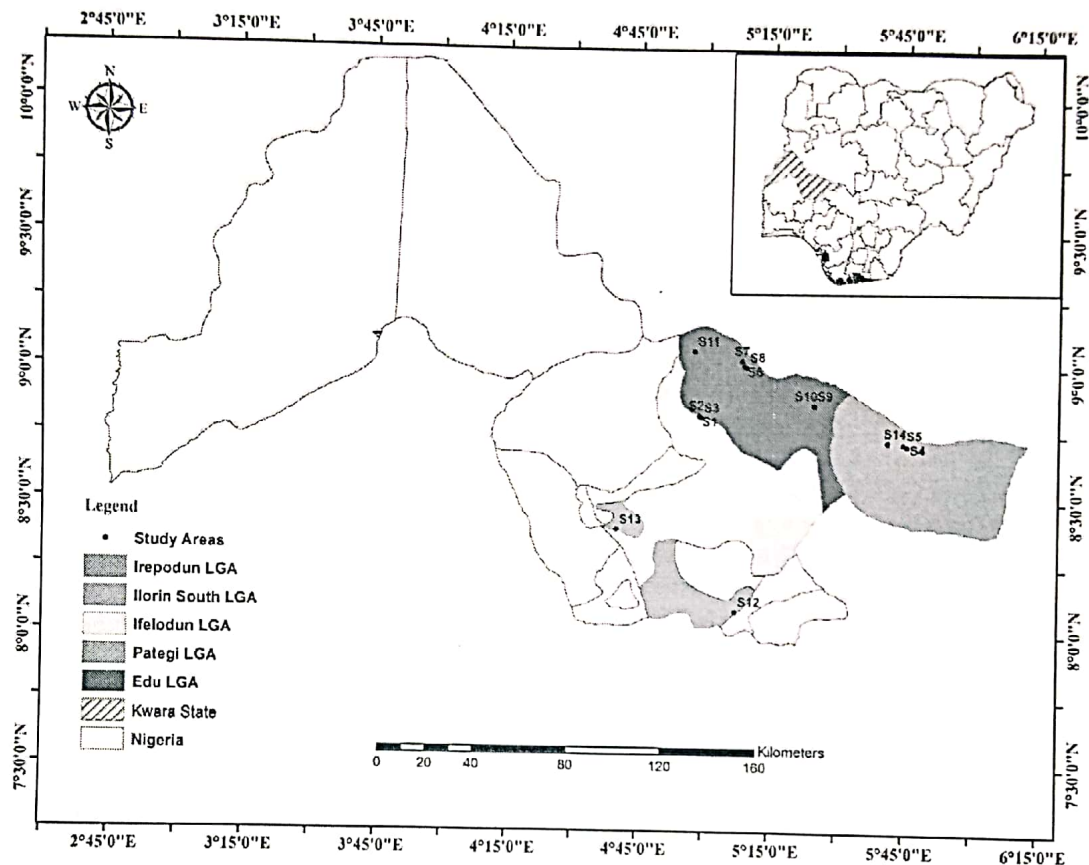


Figure 1: Map of Kwara State showing the selected study areas

Determination of Disease Incidence and Severity

The disease incidence and severity were calculated in Accordance with Allen *et al.*, (1983) formula;

$$\% \text{ Incidence} = \frac{\text{Number of infected (symptomatic) plants}}{\text{One hundred plants sampled}} \times 100\%$$

Red rot disease severity was determined by taking ten plants randomly from the population of plants showing the disease symptoms. Severity was scored on a developed scale of 1-10 based on number of symptomatic leaves relative to the total number of leaves per plant and expressed as a percentage.

$$\% \text{ Severity} = \frac{\text{Number of infected leaves on a plant}}{\text{Total no of leaves}} \times 100\%$$

on the plant sampled

- 1 = 1- 10% (very mild)
- 2 = 11- 20% (moderately mild)
- 3 = 21-30% (mild)
- 4 = 31-40% (moderately severe)
- 5 = 41-50% (severe)
- 6 = 51 - 60% (very severe)
- 7 = 61- 70% (highly severe)
- 8 = 71 - 80% (Extremely severe)*
- 9 = 81 -90 (almost dead)
- 10 = 91- 100% (totally dead)

Sample collection

Sugarcane plants were assessed visually for disease symptoms (spindle leaves, displaying drying and at later stage, stalks become discoloured and hollow) and leaf samples were collected from symptomatic plants. The leaf samples that were taken from each farm were placed in sample tube containing silica gel wrapped in paper and labeled. All samples were stored in an ice crest cooler for onward transportation to the laboratory of the Department of Crop Protection Faculty of Agriculture University of Ilorin where isolation and identification of the responsible pathogen was done.

Isolation and identification of Red rot fungus

The culture medium (Potato Dextrose Agar) used was prepared by dissolving 39g in 1 litre of distilled water in a 2 litre flask. Streptomycin (1g/litre) was also added to prevent the growth of bacteria. The mixture

was then sterilized in an autoclave at 121 °C and 15psi pressure for 15 minutes. Leaves and stem samples with symptoms were cut into smaller pieces (1cm²), surface sterilized using sodium hypochlorite (0.5%) and rinsed in several changes of sterile water. The plant parts were then plated on solidified medium in 9cm diameter petri dishes and incubated for 7 days at 25° C ± 2°C (modified ISTA 1996 procedure). Morphological characteristics of the fungal isolates on plates were observed using hand lens and under low power microscope. Temporary slides were prepared for the isolates. The slides were then observed under a compound microscope for the purpose of identification. The morphological and microscopic characteristics were matched with those described in standard reference (Barnett and Hunter, 1972). Samples of the fungal isolates were sent to the pathology laboratory of the International Institute for Tropical Agriculture (IITA), Ibadan, Nigeria for confirmation of identity.

Results

The results in Table 2 shows that all the sugarcane fields sampled were affected by the disease. There was significant difference ($p < 0.05$) in the percentage incidence of the disease in the different sampled sugarcane farms. The values ranged from 14.1 in Ilorin sugar research farm which was the least affected area to 36.1 in Shonga which was the place with the highest percentage incidence.

Table 1: % Incidence of red rot disease of sugarcane

Location	Number of farms	Mean % Incidence $\pm$ SD
Tsaragi	2	27.7 a $\pm$ 0.6
Shonga	2	36.1 b $\pm$ 0.8
Patigi	2	32.6 c $\pm$ 0.1
Lafiagi	2	15.1 d $\pm$ 0.1
Bacita	2	20.0 e $\pm$ 0.0
Egosi	2	18.5 e $\pm$ 0.0
Ilorin	2	14.1 d $\pm$ 0.1
Lade	2	15.0 d $\pm$ 0.0

Mean values in the same column not sharing the same letter are significantly different at $p = 0.05$. There was no significant difference ($p > 0.05$) in the percentage severity of red rot disease in all the sampled farms.

The results in Table 3 however showed that the disease was severe in Tsaragi (47.2%),

moderately severe in Ilorin, Egosi, Bacita, Shonga and Patigi with percentage severity ranging from 31.25 – 40.70. The disease was only mild in Lade with severity percentage of 26.75.

Table 3: Severity % and scaling of red rot disease of sugarcane

Location	Mean Severity% $\pm$ SD	Severity rating
Tsaragi	47.20 a $\pm$ 3.96	Severe
Shonga	40.40 a $\pm$ 5.66	Moderately Severe
Patigi	40.70 a $\pm$ 3.11	Moderately Severe
Lafiagi	18.75 a $\pm$ 8.84	Moderately Mild
Bacita	33.00 a $\pm$ 6.36	Moderately Severe
Egosi	31.25 a $\pm$ 8.84	Moderately Severe
Ilorin sugar research farm	31.25 a $\pm$ 8.84	Moderately Severe
Lade	26.75 a $\pm$ 2.47	Mild

Mean values in the same column not sharing the same letter are Significantly different at $p = 0.05$

With respect to the causal organism of the disease, two morphologically different *C. falcatum* were isolated on PDA from the diseased sugarcane plants obtained from the fields surveyed during the study. The identity of both isolates was confirmed in

IITA Ibadan, Nigeria. The description of the colony morphology of the isolates are shown in Table 4. The colony morphology were those of ten-day-old cultures of the isolated organisms.

Table 4: Morphological description of the isolated *C. falcatum*

Isolates	Colony characteristics				
	Colony colour	Substrate colour	Margin	Colony Topography	Colony Diameter (average)
1	Greyish white	Black	Smooth	Raised cottony	88.5mm
2	White	White	Smooth	Raised cottony	86.7mm

DISCUSSION

Red rot disease of sugarcane occurred in all the sampled study areas. The percentage incidence and severity however differed. The difference might be due to the fact that the farmers plant different sugarcane varieties. Information from the growers confirmed the fact that the farmers plant different varieties of sugarcane. This observation is therefore in line with the report of Vikash and Shukla (2017) that disease incidence depends partly upon the crop varieties but also partly upon localities as well as favourable environmental factors. Another possible reason for variability in the disease severity might be attributed to

differences in the strains of the isolated pathogens. The result implicated two morphologically different *C. falcatum* from all the sampled farms. This is in line with the finding of Abbas *et al.* (2010) who found remarkable morphological diversity among four isolates of *C. falcatum*. According to Bharti *et al.* (2014) variability in cultural and morphological characters as well as virulence of *C. falcatum* might be as a result of hybridization, mutation conidial and hyphal fusions. Other factors that might have caused differences in incidence and severity of the disease could be the differences in the agronomic practices of spacing and use of

fertilizers. Legard et al, (2000) showed that higher plant density in the farm can encourage splash dispersal of fungal conidia thereby helping quicker and more effective dispersal of the disease. The use of fertilizers is believed to encourage vigorous vegetative growth of plants and boost the ability of the plant to withstand and resist disease development. Lack of fertilizer usage makes plants weak and hence more susceptible (Khatun et al, 2011).

CONCLUSION AND RECOMMENDATIONS

The study shows that red rot disease of sugarcane is prevalent in Kwara State. The incidence and severity varied from one sampled farm to another. The disease is particularly severe in Tsaragi. It is recommended that awareness on the existence of sugarcane red rot disease be raised among the farmers as well as the consequences of the disease on general productivity of the crop so as to help the farmers imbibe the practices of preventing its spread.

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