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INCIDENCE OF SMUT AND RED ROT DISEASES OF SUGARCANE IN SOUTHERN PART OF NIGER STATE, NORTH CENTRAL NIGERIA

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ABSTRACT
Sugarcane production is threatened globally by smut and red rot diseases, which farmers in the study area take for granted because they see the diseases as natural calamities associated with large-scale cultivation of sugarcane. Incidence of smut and red rot diseases of sugar-cane in the study area was assessed between October 2016 and June, 2017. Thirty-two sugarcanes (800 per farm) were assessed on forty farms randomly selected from 16 towns/villages in Southern part of Niger State. Each of the sugarcanes aged between 6 and 10 months were observed visually for symptoms of the diseases. Number of infected sugarcanes was used to determine the percentage incidence of the diseases on each farm. Percentage incidence of smut ranged from 25.0 to 35.0 (Bida LGA), 20.0 to 22.5 (Gbako LGA) and 20.0 to 30.4 (Lavun LGA), while percentage incidence of red rot ranged from 5 to 6.5 (Bida LGA), 6.1 to 12.0 (Gbako LGA) and 5.4 to 9.3 (Lavun LGA). Significant pairwise differences at $p \leq 0.05$ existed in the means of percentage incidence of smut in Bida and Gbako as well as Bida and Lavun LGAs. Significant pairwise differences at $p \leq 0.05$ also existed in the means of percentage incidence of red rot in Bida and Gbako as well as Gbako and Lavun LGAs in this study. The study concluded that smut is of higher incidence in the study area. It is recommended that the local farmers be sensitized to adopt effective control measures for these diseases.

Keywords: Disease, LGA, percentage incidence, red rot and smut

INTRODUCTION

Sugarcane, *Saccharum officinarum*L. was first introduced into Nigeria by European sailors in the 15th century, and it was initially planted by few villagers on the coast as a garden crop (Gana, 2010). Its local names are Ireke (Yoruba), Reke (Hausa), Mgboko (Igbo) and Kpansannako (Nupe). Sugarcane is an important cash/industrial crop with many medicinal, nutritional and cultural values. It is the major source of sugar in Nigeria and a rich source of ethanol. Fungal diseases such as smut and red rot are major constraints to increased sugarcane production worldwide (Raid, 2012). Smut disease caused by *Ustilago scitamineum* was first noticed in Natal (South Africa) in 1877 as reported by Luthra *et al.* (1940), cited by Sundar *et.al.* (2012). The most recognizable symptoms of smut disease is the emergence of an elongated whip (smut whip) whose morphology differs from short to long, twisted, multiple whips with the colour varying from gray to black (Rott and Comstock, 2015). It is known as "Lukombodu" in Nupeland. Red rot disease, caused by *Colletotrichum falcatum* is the oldest disease of sugarcane, and occurs in most sugarcane – growing countries (Chaube and Pundhir, 2009; Raid, 2012). It is known as "Tigyagi or "Shere" in Nupeland. Visible symptoms of red rot on the leaves of an infected plant are production of elongated red lesions on the midribs, reddish patches on the leaf sheaths and infrequently small dark spots on the leaf blades (Raid, 2012). Sugarcane farmers in the study area see smut and red rot diseases of sugarcane as natural calamities associated with large-scale cultivation of the plant, so they take the diseases for granted. This study was aimed at assessing the percentage incidence of smut and red rot diseases of sugarcane in Southern part of Niger State, North – Central Nigeria.

MATERIALS AND METHODS

The survey sample size was thirty-two thousand (32,000) sugarcanes from 40 farms randomly selected in 16 randomly selected towns/villages out of the 32 towns/villages where sugarcane is produced on a commercial scale in the study area. The 40 farm locations were: 1 each in Cirico, Efudzoge, Kakakpangi, Kanko and Ndagbachi; 2 each in Bangaie, Fakumba and Sachi; 3 each in Bida, Chanchaga, Darachita, Edozhigi and Ndaloke; 4 each in Dabarako and Gbadafu as well as 6 in Wuya (all within Southern part of Niger State, North Central Nigeria). An extensive disease survey was carried out on 800 sugarcanes (aged between 6 and 10 months) in each of the 40 farms between October 2016 and June, 2017 to determine the Percentage incidence of smut and red rot diseases of sugarcane. Percentage incidence of either of the 2 diseases on each of the farms was determined by counting 200 sugarcanes in 4 rows (in a zig – zag (W) pattern) making 800 plants. Each of the plants was examined for any of the visible symptoms peculiar to each of the diseases with the aid of a hand lens. The number of symptomatic sugarcanes peculiar to each of the two diseases out of the population (800 sugarcanes) was counted and recorded. The Percentage incidence of each of the 2 diseases was calculated using the formula adopted by Chaube and Pundhir (2009) i.e.

$$\text{Disease Incidence (\%)} = \frac{\text{No. of diseased plants}}{\text{Total no. of plants examined}} \times 100$$

Means, variance, standard deviation and confidence interval for the mean percentage incidence of smut and red rot diseases of sugarcane in each of the Local Government Areas (LGAs) were determined. They were then subjected to R-package version 3.12 statistics package for Mean Comparison Tests.

RESULTS AND DISCUSSION

Out of the 8000 sugarcanes surveyed in Bida LGA, 2,438 were infected with smut disease, while only 474 were infected with red rot disease; out of the 17,600 sugarcanes surveyed in Gbako LGA, only 3,696 were infected with smut disease, while 1,434 were infected with red rot disease, whereas, out of the 6,400 sugarcanes surveyed in Lavun LGA, 1,610 were infected with smut, while 376 were infected with red rot disease (Table 1). Percentage incidence of smut disease on 10 sugarcane farms ranged from 25.0 to 35.0 in Bida LGA; it ranged from 20.0 to 22.5 on 22 sugarcane farms in Gbako LGA, while it ranged from 20.0 to 30.4 on 8 farms in Lavun LGA (Table 1). Wada (2003) had earlier listed smut disease as one of the prevalent diseases of sugarcane in Nigeria. Values of the mean percentage incidence of smut disease in this study were not uniform; 29.9% (highest) for Bida LGA and 19.7% (lowest) for Lavun. These observations were similar to that of Ong'ala*et al.* (2015). In their study on determinants of sugarcane smut prevalence in the Kenya Sugar industry, they reported that different sugarcane zones experienced different level of sugarcane smut prevalence. Prevalence of sugarcane smut in sugarcane farms in Chamelil and Kibos was highest while sugarcane farms in Kwale recorded lowest prevalence of smut in Kenya Sugar Industry (Ong'ala*et al.*, 2015).

The sugarcane farms located in urban areas in this study which are usually flood – plains, receive high deposits of municipal wastes (both solid and liquid) through surface run – offs. Some of these municipal wastes serve as source of smut disease pathogen, *Ustilago scitamineum*. This may be the reason why the incidence of smut disease is higher in urban sugarcane farms than rural sugarcane farms in this study. The values of percentage incidence of smut disease reported in this study were higher than those obtained in previous studies. This may be as a result of the fact that sugarcane farmers in this study area used cane setts from self - grown source or their neighbours. Ong'ala*et al.* (2015) had earlier reported that source of cane setts for planting determines the prevalence or incidence of smut disease of sugarcane in a locality.

The percentage incidence of red rot disease in Bida LGA ranged from 5.0 to 6.5, it ranged from 6.1 to 12.0 in Gbako LGA, while it ranged between 5.4 and 6.3 in Lavun LGA (Table 1). These results corroborated the fact that red rot disease exists in all sugarcane-growing towns and villages in the world. There was a serious out–break of sugarcane red rot disease in the Northern part of Nigeria in 1954 which extended through Bacita, Kano, Katsina, Numan, Sokoto and Zaria (Awoderu and Okusanya, 1978). Olufolaji (1999) also reported that red rot is among the prevalent diseases of sugarcane in Nigeria.

There existed pair wise significant differences at p≤0.05 in the incidence of smut disease among farms in Bida and Gbako as well as Bida and Lavun LGAs (Table 2). Significant pairwise differences at p≤0.05 also existed in the incidence of red rot disease among farms in Bida and Gbako as well as Gbako and Lavun LGAs (Table 3).

Conclusion and Recommendation: Smut and red rot diseases of sugarcane occurred on all the farm locations surveyed in this study at different levels. It is therefore recommended that the local farmers be sensitized on the need to adopt effective control mechanisms for these diseases so as to curb their incidence in the study area.

Table 1: Percentage Incidence of Smut and Red Rot Diseases of Sugarcane in the Study Areas

LGA	Towns/Villages	No. of sugarcane plants sampled	No. of sugarcane plants with Smut symptoms	No. of sugarcane plants with Red rot symptoms	Percentage incidence of smut	Percentage incidence of red rot
Bida	Bangaie	1600	560	80	35.0	5.0
Bida	Cirico	800	200	40	25.0	5.0
Bida	Darachita	2400	736	156	30.7	6.5
Bida	EfuDzoge	800	200	50	25.0	6.3
Bida	Landzu	2400	736	148	30.7	6.2
				Mean	**29.3**	**5.8**
Gbako	Dabarako	3200	640	234	20.0	7.3
Gbako	Edozhigi	2400	504	246	21.0	10.3
Gbako	Fakumba	1600	320	180	20.0	11.3
Gbako	Gbadafu	3200	716	384	22.4	12.0
Gbako	Kakapangi	800	160	64	20.0	8.0
Gbako	Kanko	800	180	60	22.5	7.5
Gbako	Ndagbachi	800	160	74	20.0	9.3
Gbako	Wuya	4800	1016	292	21.4	6.1
				Mean	**20.9**	**9.0**
Lavun	Chanchaga	2400	730	146	30.4	6.1
Lavun	Ndaloke	2400	560	130	23.3	5.4
Lavun	Sachi	1600	320	100	20.0	6.3
				Mean	**24.6**	**5.9**
Mean Percentage Incidence for Niger State					**23.0**	**7.4**

Table 2: Mean Comparison Test for Smut Disease

Group	Differences	P values	LSD	LCL	UCL
Bida and Gbako	8.9	0	***	6.356765	11.44323
Bida and Lavun	10.2125	0	***	7.049392	13.37561
Gbako and Lavun	1.3125	1		-1.44063	4.065632

Table 3: Mean Comparison Test for Red Rot Disease

Comparison	Differences	P values	LSD	LCL	UCL
Bida and Gbako	-2.79091	0.000163	***	-4.43414	-1.14768
Bida and Lavun	0.05	1		-1.99374	2.09374
Gbako and Lavun	2.840909	0.000383	***	1.062061	4.619757

All pair-wise differences that have *** are statistically significant at P≤0.05

Keys: LCL = Lowest Confidence Level
UCL = Upper Confidence Level
LSD = Level of Significant Difference

Authors' contributions: This manuscript is from the corresponding author (Olahan, G.S.)'s doctoral thesis; the doctoral research was supervised by Professors Fatoba, P.O. and Balogun, O.S. respectively.

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