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DIAGNOSTIC SURVEY OF PINEAPPLE HEART ROT DISEASE IN LAKE VICTORIA CRESCENT OF UGANDA

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ABSTRACT

Pineapple (*Ananas comosus* L. Merrill) is a key horticultural crop in tropical and sub-tropical countries valued for its economic and nutritional importance. However, the recent outbreak of pineapple heart rot disease (PHRD) in Uganda is a serious threat to production. Yet, information on the prevalence, incidence and severity is limited and scanty. This study, therefore, assessed the prevalence, incidence and severity of pineapple heart rot disease in the districts of Masaka, Luwero, Kayunga and Mukono in the Lake Victoria crescent of Uganda in 2015. Semi-structured questionnaires were used to solicit information from 216 respondents. Data collected was analyzed using descriptive statistics of SPSS computer package versions 16.0. Varying incidences and severities of pineapple heart rot disease was observed in all fields surveyed. The disease was more prevalent in Kayunga than Masaka districts, respectively. Overall, 48% and 05% pineapple fields were infected with pineapple heart rot disease in Kayunga and Masaka district, respectively. Similarly, the highest and the lowest disease incidence were recorded in Kayunga and Masaka district, respectively. Overall, the incidence and severity varied from field to field. The findings have therefore shown that pineapple heart rot disease is widespread and devastating in central Uganda. Therefore, there is a need for the policymakers to priorities resources to develop an appropriate disease management strategy to combat this devastating epidemic to save the pineapple industry.

Keywords: Heart rot disease, incidence, pineapple, prevalence, severity.

INTRODUCTION

Pineapple (*Ananas comosus* L. Merrill) is the most important economic species from the family *Bromeliaceae* (Rodríguez *et al.*, 2015; Ocwa *et al.*, 2018). According to FAO (2013), the global pineapple production was estimated at over 19 metric tons in 2011 with Thailand ranked as the leading producer followed by Brazil and Costa Rica, respectively. In fact, pineapple contributes over 20% of the world production of tropical fruits (Coveca, 2002). In Uganda, pineapple is grown mainly in the central region in the districts of Mukono, Kayunga, Luwero and Masaka around the Lake Victoria crescent as well as in Ntungamo and Kabale in southwestern Uganda (Bua *et al.*, 2013). According to Willer *et al.* (2014) and Kwikiriza *et al.* (2016), Uganda is reported to have the second largest number of certified organic pineapple farmers in the world after India. However, in Uganda pineapple production is under a

threat from a diversity of constraints including lack of improved pineapple technologies, declining soil fertility, pests and diseases infestation among others. Notable among the diseases ravaging pineapple production in Uganda are pineapple heart rot disease and pineapple mealybug wilt disease (NARO, 2012; Bua *et al.*, 2013). Elsewhere, pineapple heart rot disease also has been reported to be widespread and devastating with an incidence ranging from 25 – 30% (Shen *et al.*, 2013). Accordingly, the alarming rate of spread of pineapple heart rot disease is not only a threat to food security, livelihoods and loss of biodiversity but also the future of pineapple industry (Rodríguez *et al.*, 2015). Pineapple heart rot disease manifest as water-soaked lesions with and soft rot of the base of heart leaves which are easily pulled out. The rotting tissues are characterized by foul smell (NARO, 2012). Pineapple heart rot disease is caused by *Phytophthora cinnamomi* and *Phytophthora nicotianae*

(Rohrbach and Schenck, 1985; Rodríguez *et al.*, 2015).

Unless managed, the disease can cause 100% yield loss (Rohrbach and Schenck, 1985). However, in Uganda, there is scanty and limited documentation on the status of pineapple heart rot disease. Therefore, this study was conducted to assess the status of pineapple heart rot disease in central Uganda.

MATERIALS AND METHODS

This diagnostics survey was conducted in 2015 in the major pineapple growing districts of Masaka, Luwero, Mukono and Kayunga in the Lake Victoria crescent of central Uganda. Multi-stage random sampling techniques were used to identify the districts and respondents. Three sub-counties from each district based on the intensity of production and size of the district were surveyed based on the advice from the district agricultural officials. Two to three parishes were purposively sampled from each sub-county according to the level of pineapple production. Five to ten farmers were selected from each village/parish with the help of the local council registers giving a total of 20 farmers per parish. Overall, Semi-structured questionnaire was used to solicit information from the respondents. In total 240 respondents were interviewed.

Pineapple heart rot disease incidence was determined as described by Bua *et al.* (2013) while severity was scored using the scale of 0-3 where 0= no leaf rot, 1= slight leaf rot up to 10%, 2 = moderate leaf rot 10-70% and 3 = severe leaf rot 71-100% (Rohrbach and Schenck, 1985). The other data collected included pineapple varieties grown and source of planting material, the season of major occurrence of pineapple heart rot disease, the source of planting materials and year when the outbreak was first noted. All the data collected was cleaned coded and entered in Excel spreadsheet and analyzed using descriptive statistics of the SPSS computer package (version 16.0).

RESULTS

Pineapple heart rot disease was widespread and devastating in all fields surveyed though with varying incidence and severity in all the districts. The highest and lowest pineapple heart rot disease incidence was 76% and 5%, respectively. However, the highest and lowest severity was 2 and 0, respectively (Table 1).

Correspondingly, the highest and lowest prevalent was recorded in Kayunga and Masaka districts, respectively (Table 2).

Interestingly, Pineapple heart rot disease was more

common during the wet season as opposed to dry season (Table 3).

Table 1. Incidence and severity of pineapple heart rot disease in Masaka, Luwero, Kayunga and Mukono districts, 2015.

Incidence	Frequency (%)
5-25	42.4
25-50	23.1
51-75	20.9
76-100	13.6
Severity	
0	0.0
1	27.7
2	65.1
3	7.2
Total	100

Table 2. Prevalence of pineapple heart rot disease in Masaka, Luwero, Kayunga and Mukono districts, 2015.

District	Frequency (%)
Masaka	6.1
Luwero	41.6
Kayunga	47.3
Mukono	5.0
Total	100

Table 3. Seasonal occurrence of pineapple heart rot disease in Masaka, Luwero, Kayunga and Mukono districts, 2015.

Season	Frequency (%)
Wet season	71.3
Dry season	15.1
Both wet and dry season	13.6
Total	100

Pineapple heart rot disease manifested as water-soaked lesions with the soft rot of the base of heart leaves which are easily pulled out (Figure 1).

The common varieties of pineapple grown and their level of resistance are presented in Table 4. Smooth Cayenne was the most commonly grown variety compared to the others. However, all the variety grown was reportedly susceptible to pineapple heart rot disease (Table 4). All the varieties of pineapple grown were accessed from own's field as opposed to the other sources (Table 5). The year of pineapple outbreak is presented in Table 6. Pineapple heart rot disease was first noticed as early as 2012 although the reports were intense up to 2014. However, a significant proportion of the respondents

could not tell with precision when the disease first appeared in the districts between 2008-2011.



Figure 1. Symptoms of pineapple heart rot disease collected from central Uganda, 2015.

Table 4. Varieties of pineapple grown and level of resistance to pineapple heart rot disease in Masaka, Luwero, Kayunga and Mukono districts, 2015.

Variety	Frequency (%)
Smooth Cayenne	82.2
Red Spanish	1.8
Sasirimu	1.0
Didn't know the name	15
Total	100
Resistance	Yes
Smooth Cayenne	0.0
Red Spanish	0.0
Sasirimu	0.0
Total	0.0

Table 5. Source of planting materials for pineapple growing in Masaka, Luwero, Kayunga and Mukono districts, 2015.

Source	Frequency (%)
Own field	51.9
fellow farmers and market i.e. Given agricultural officers	45.0
Total	100

Table 6. Year of outbreak of pineapple heart rot disease in Masaka, Luwero, Kayunga and Mukono districts, 2015.

Year	Frequency (%)
2016	2.5
2015	7.4
2014	13.1
2013	16.5
2012	20.5
2008-2011	3.3
Not sure	36.3
Total	100

DISCUSSION

Pineapple heart rot disease was observed in the majority

of the pineapple field visited though occurrence, incidence and as well as severity varied within the districts. The disease was more prevalent in Kayunga as compared to the other districts. Although pineapple heart rot disease was observed in all the fields surveyed, no field had 100% incidence indicating probably that pineapple heart rot disease is localized and not a fast-spreading disease. This is expected because *Phytophthora* species are soil borne pathogens which require to be disseminated to other parts of the field. According to Joy and Sindhu (2012), pineapple heart rot disease is spread through the use of infected suckers, contaminated tools, infested soil and irrigation water. However, the widespread prevalence of pineapple heart rot disease in Kayunga district could probably be attributed to factors such as the long history of pineapple growing in the district, or growing of pineapple in the virgin areas previously occupied by the forest or poorly drained soils among others.

According to Manohara *et al.* (2004), *Phytophthora* diseases epidemics are common in wet soil conditions characterized by poor drainage (Rodríguez *et al.*, 2015). Similarly, Shreenivasa *et al.* (2015) observed that the incidence and damage by PHRD caused by *Phytophthora nicotianae* were high during the wet season. However, earlier Onesirosan (1971), demonstrated that the situation can be worsened by the presence of infected plant materials (debris) which raises the inoculum levels. Besides, the unknown status of the suckers used by the respondents could have contributed to the problem due to latent infection (Agrios, 2005). Although the use of host plant resistance is considered the most economical and sustainable disease management strategy, no pineapple variety was found to be resistant to pineapple heart rot disease. This finding therefore is in conformity with Rodríguez *et al.* (2015); Rodríguez *et al.* (2002); Kwikiriza

et al. (2016) who reported that most of the pineapple varieties grown worldwide are susceptible to pineapple heart rot disease in situation where the disease pressure and environmental conditions are conducive.

In fact, unless managed, pineapple heart rot disease has a potential of making pineapple production impossible (Hegde, 2014). This is because of the diversity, aggressiveness and multicyclic nature of *Phytophthora* causing pineapple heart rot disease (Milenkovic *et al.*, 2014). Earlier, Thresh (2003) demonstrated that the use of phytosanitary practices and resistant varieties as only effective for diseases which do not spread very fast, no resistant variety was encountered during this survey. Therefore, to effectively managed pineapple heart rot disease, there is a need for an integrated management approach incorporating a selection of healthy planting materials and the use of 0.2% Metalaxyl and 0.1% Fosetylal was demonstrated in India (Shreenivasa *et al.*, 2015).

CONCLUSION AND RECOMMENDATIONS

The study has shown that pineapple heart rot disease is widespread and devastating in the Lake Victoria crescent of Uganda. The study has further established that no variety of pineapple is resistant to pineapple heart rot disease. This, therefore, calls for more urgent and concerted efforts to save pineapple industry from this devastating epidemic through developing an integrated management approach.

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