

Incidence of *Rigidoporus lignosus* (Klotzsch) Imaz of Para rubber in Nigeria

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Abstract: *Rigidoporus lignosus* (Klotzsch) Imaz commonly called white root rot is the pathogen most feared by planters throughout the rubber-growing regions of the world. In West Africa, the white root rot is responsible for yield losses of up to 50% in old rubber plantations. The incidence and severity of the root rot as it affects rubber were determined from three different locations in Nigeria based on the management of diseases in the rubber estates. Plantation 2, Araromi, in Ogun State recorded the highest number of uninfected trees while the lowest numbers of uninfected trees were recorded at Plantation 3, Benin City, Edo State. The Percentage infectivity, Disease index and level of infectivity in the three plantations were significantly different from each other ($p > 0.05$). The highest gross economic loss (GEL) was recorded in Plantation 3, Benin City, Edo State (₦5,589,967:00k) while Plantation 2, Araromi, in Ogun State had the lowest GEL (₦43,067).

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1. Introduction

Rigidoporus lignosus (Klotzsch) Imaz commonly called White root rot is the pathogen most feared by planters throughout the rubber-growing regions of the world (Rao, 1975; Nandris *et al.*, 1983) except in India (Jayasinghe, 2010). It is a well-known destructive agent of trees and agricultural crops. Presently it is spreading at a disturbing rate resulting in bare patches in rubber lands. The area affected increases day by day and the bare patches remain as a source of infection.

In West Africa, the white root rot is responsible for yield losses of up to 50% in old rubber plantations (Nandris *et al.*, 1983; Jayasuriya *et al.*, 1996). International Rubber Research and development Board (2000) survey indicates that white root rot is described as severe in Cote d'Ivoire, Nigeria and Sri-Lanka, and as a significant, endemic problem in Gabon, Indonesia, Malaysia and Thailand. In 1970s, heavy casualties due to white root rot in rubber plantations were recorded in Sri-Lanka (Liyanage *et al.*, 1977; Jayasuriya *et al.*, 1996). In Indonesia alone affected area is more than 80,000 ha (Jayasinghe, 2010). In Nigeria, over half of the plantation is destroyed within five years by the time the external symptoms are expressed by the tree, extensive infection and damage on the tree may have occurred (Otoide, 1978). Several research works have been done on the diseases of rubber in Nigeria (Awoderu, 1967; Begho, 1990; Otoide, 1978; Igeleke, 1988; Ogbebor *et al.*, 2005; Adekunle & Ogbebor, 2005; Ogbebor *et al.*, 2010) with only a limited work

done on white root rot of Rubber (Awoderu, 1967; Otoide, 1978; Adekunle & Ogbebor, 2009).

In the management of *R. lignosus* the initial approach is disease avoidance under the concept of Enviromax planting recommendation. In situations where disease avoidance fails, farmers resort to chemical control. This research work is aimed at evaluating the status, incidence and severity of *R. lignosus* on rubber in Nigeria.

2. Materials and Methods

2.1 Field survey for white root rot incidence in *Hevea* plantation

The study areas were in three geographical locations in Nigeria viz: - Plantation 1, Imo State (40 54'58''N; 70 12' 37''E), South East; Plantation 2, Araromi, in Ogun State (60 35'32''N; 30 48' 15''E), South West; Plantation 3, Benin City, Edo State (60 09'23''N; 5035'28''E), SouthSouth. The incidence and severity of the root rot as it affects rubber were determined for four hectares (one hectare each in four different locations) in the selected sites above. These plantations were chosen based on the management of diseases in the rubber estates and were rated as low, moderate and high (Plantation 2, Plantation 1 and Plantation 3 respectively). Rubber plots of ages of 20 ± 3 years were evaluated for disease incidence and severity. This experiment was carried out in a Randomized Complete Block Design (RCBD).

A total of 462 trees each from 1ha plot were evaluated for the incidence and severity of root rot diseases.

2.2 Incidence and severity of white root rot rating

The recommended method of checking and rating the lateral roots of rubber for the presence of rhizomorph growth (Rao, 1975; IRRDB, 2000) was employed. The rating was used in determining the incidence and severity of the rubber trees. The following information's were recorded for each planting point originally planted to rubber in the chosen plots. It was determined whether or not the planting point is now occupied by uninfected stumps or Infected stumps. Aggregate failure, Percentage infection (PI) and Disease index were calculated. The following parameters were evaluated, viz:-

- i. Level of infectivity: measures the rate at which the root rot spreads from a diseased and dead rubber stump heavily loaded with fruiting bodies of *R. lignosus* numbering ≥ 11 to neighboring healthy rubber trees. This was done by selecting eight (8) immediate neighboring stands to the diseased and dead rubber stump.
- ii. Inoculum potential: The Inoculum potential gives an indication of level of the disease development for each stand of dead or living rubber trees that is infected. The ratings for each rubber tree were therefore used for calculating the level of the disease situation for each plot of rubber. After rating each stand of Rubber tree in accordance with IRRDB, 2000; the formula for calculating Disease index according to (Parry, 1990) was adopted for calculating Inoculum Potential for each rubber plot.
- iii. Gross economic loss: To determine the impact of the aggregate failure on the income from the plantations, the gross economic loss was calculated using the formula below (Source: Unpublished);

$$GEL = 365 - (Wp + Ad) \times Cp \times Af \quad 2$$

Where;

Wp = Wintering period (21 days) during which

rubber trees are not tapped.

Ad = Approximate number of days (21 days) in which it was not possible to tap due to rain fall.

Cp = Current price of 1kg DRC (1kg DRC = N 200)

Af = Aggregate failure which is the number of Dead trees + number of infected stumps per hectare.

3. Result Analysis

3.1. Field Survey for white root rot

The three Rubber plantations viz: Plantation 1, Imo State; Plantation 2, Araromi, in Ogun State and Plantation 3, Benin City, Edo State were surveyed. Plate 1a, 1b and 1c shows rubber plantations in Plantation 1, 2 and 3 respectively. The results of the field survey on the disease assessment of white root rot of Rubber are summarized in Table 1. Plantation 2, Araromi, in Ogun State recorded the highest number of uninfected trees and the lowest number of infected rubber trees (460.5 and 1.33 respectively) while the lowest number of uninfected trees and the highest numbers of infected trees were recorded at Plantation 3, Benin City, Edo State (274 and 171) respectively ($p > 0.05$) (Table 1).

Percentage infectivity, Disease index, level of infectivity and Inoculum Potential were similarly highest in Plantation 3, Benin City, Edo State (37.01, 38.59, 80.10, 49.81) this was followed by Plantation 1, Imo State (18.91, 16.74, 69, 17.03) and were lowest in Plantation 2, Araromi, in Ogun State (0.29, 0.19, 1.22, 0.11). The Percentage infectivity, Disease index and level of infectivity in the three plantations were significantly different from each other ($p > 0.05$). The highest gross economic loss (GEL) of ₦ 5,589,967 was recorded in Plantation 3, Benin City, Edo State; ₦ 2,820,867 from Plantation 1, Imo State, while the lowest GEL was recorded in Plantation 2, Araromi, in Ogun State (₦ 43,067).

Table 1. Field survey for white root rot disease from three rubber plantations

Parameters	Location			
	Plantation 1	Plantation 2	Plantation 3	Lsd
Uninfected stumps	366.70	460.50	274.00	10.27
Infected stumps	87.33	1.33	171.00	6.95
Wind damaged trees	8.00	0.67	17.00	3.12
Percentage infectivity	18.91	0.29	37.01	2.04
Disease index	16.74	0.19	38.59	8.39
Level of Infectivity	69.00	1.22	80.10	2.47
Inoculum Potential	17.03	0.11	49.81	0.73
Gross economic loss	₦ 2,820,867:00k	₦ 43,067:00k	₦ 5,589,967:00k	305108.5

Plantation 1 = Plantation 2, Imo State

Plantation 2 = Plantation 3, Araromi, in Ogun State

Plantation 3 = Plantation 1, Benin City, Edo State; $\alpha = 0.05$



Plate 1. Plantations from the three different location: a) Small open gaps in rubber plantation showing missing stand caused by white root rot incidence and infected rubber stumps showing fruiting bodies of *R. lignosus* in Plantation 1, Imo State, **b)** Rubber Plantation with no missing stands in Plantation 2, Araromi, in Ogun State, **c)** Wide open gaps in rubber plantation showing missing stand caused by white root incidence and infected rubber stumps showing fruiting bodies of *R. lignosus* in Plantation 1, Benin City, Edo State

4. Discursion and Conclusion

The incidence and severity of white root rot was lowest in Plantation 2, Araromi, in Ogun State and highest in Plantation 3, Benin City, Edo State. This was evident in the reduced number of infected stumps and as a result the percentage infectivity and disease index was lowest in Plantation 2, Araromi, in Ogun State. The reduced incidence of white root rot in Plantation 2, Araromi, in Ogun State is attributed to the high standard of disease management carried out in the plantations. According to Rao (1975), regular attention to estate sanitation brings about measures in keeping down root diseases. Similarly the gross economic loss was highest in plantations 3, Benin City.

Conclusively regular attention to estate sanitation brings about measures in keeping down root diseases. This study demonstrated that white root disease incidence is reduced in plantations where good cultural

practices are observed as evident in Plantation 2, Araromi, in Ogun State.

However, regular attention to estate sanitation should be practiced as this control measures help in keeping down root diseases.

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