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FAST METHOD FOR THE DETECTION OF *RIGIDOPORUS LIGNOSUS* (KLOTZSCH) IMAZ IN *HEVEA* PLANTATIONS

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ABSTRACT
This study was conducted in a rubber plantation with recorded incidence of *Rigidoporus lignosus* at the Rubber Research Institute of Nigeria, Iyanomo, Nigeria to determine suitable substrate sensitive to the presence of *R. lignosus*. Materials used were Fresh and Dry Rubber Branch, Rubber Stem, Rubber Root; Dry Rubber Sawdust, Rubber Leaves and Rubber Seed Coat. The experiments were laid out in a complete randomized block design with four replications. Rates of colonization of the materials by rhizomorph of *Rigidoporus lignosus* were observed on the fifth day in the plantation. The highest percentage of colonization was observed in Dry rubber seed coat with in water and mulch, (at 83.75%) followed by Dry rubber stem and Dry rubber leaves at 10.25% and 5.50% respectively. The study showed that colonization of plant materials by rhizomorph of the pathogen was observed within five days experimental period. This study demonstrates the efficacy of Dry Rubber Seed Coat with mulching as a cost effective, early disease detection method in five days of field incubation

KEYWORDS: Detection, *Rigidoporus lignosus*, *Hevea*.

INTRODUCTION

Rigidoporus lignosus (Klotzsch) Imaz (Basidiomycete, Polyporaceae), the causative agent of white root disease of rubber tree is a devastating pathogen in the rubber-growing regions of the world except in India (Rao, 1975; Nandris *et al.* 1983; Jayasinghe, 2010). In West Africa, the white root disease is responsible for yield losses of up to 50% in old rubber plantations (Otoide, 1978; Nandris *et al.*1983; Jayasuriya *et al.* 1996). International Rubber Research and Development Board (IRRDB) survey indicated that white root disease is severe in Cote D'Ivoire, Nigeria and Sri-Lanka, and as a significant endemic problem in Gabon, Indonesia Malaysia and Thailand. Early detection of root diseases is a problem in perennial crops, especially in rubber tree (Jean & Albert, 2002)**.** Early stages of infection of root pathogens are often difficult to detect because the rhizomorph and infection sites are below ground level, while a decaying tree often remains for a long time without visible aerial symptoms. Trees bearing visible disease symptoms are mostly beyond treatment and recovery, as rapid progress of infection makes death imminent (Ismail & Azaldine, 1985; Nadris *et al.* 1988; Mohd *et al.* 2009). Mortality caused by white root rot disease could lead to economic losses to the rubber industry in many countries (Nandris *et al.*1987; Liyanage, 1997; Semangun, 2000; Guyot, & Flari, 2002). In the field, white root disease is usually identified by digging to expose the roots to observe presence of rough white rhizomorphs on the tree root phylloplane. This method is labor-intensive on a large scale. According to Jean & Albert (2002) mulching for one month followed by root exposure is the best technique to reveal the presence of the fungus. A trial was therefore set up to compare different mulched and un-mulched materials from the rubber tree that could serve as bait and spur the growth of *Rigidoporus lignosus* rhizomorph out of the soil without root exposure and inspection for the presence of the pathogen. Simple and early detection techniques will be of great significance to the management of the disease. The aim of this study is to develop a cost effective disease detection method for the successful management of *Rigidoporus lignosus.*

MATERIAL AND METHODS

The experiment was conducted in a rubber plantation with previous records of incidence of *Rigidoporus lignosus* at the Rubber Research Institute of Nigeria, Iyanomo, Nigeria (6^{O} 9^{1} 23^{11} N, 5^{O} 35^{1} 27^{11} E). Materials used were Fresh Rubber Branch (FRB), Fresh rubber Stem (FRS), Fresh Rubber Root (FRR), Dry Rubber Leaves (DRL), Dry Rubber Branch (DRB), Dry Rubber Stem (DRS), Dry Rubber Root (DRR), Dry Rubber Sawdust (DRSD) and Dry Rubber Seed Coat (DRSC). The different materials were cut into pieces of about 1-1.5 cm thick and 15cm long with the exceptions of the DRSD, DRL and DRSC. These cut materials were bounded together in bunched with rubber band. The fresh materials were collected shortly before use while the dried materials were collected, cut to pieces and dried for two weeks on laboratory bench. Half of these materials (both the fresh and dry samples) were soaked in tap water while the other half were soaked in sugar solution (100 g of D-(+) - Glucose in I ml of water) for 24 h before used. The treatments were divided into four; samples soaked in water without mulch (rubber leave litters on the flow of the plantations were used as Mulch material. samples soaked in water and mulch

(WM), samples soaked in sugar solution without mulch (SS), samples soaked in sugar solution and mulch (SSM). The samples soaked in water without mulch served as the control. All the samples were placed on the floor of rubber plantation with direct contact with the soil. Rates of colonization of the materials by rhizomorph of *Rigidoporus lignosus* were observed on the fifth day in the plantation. The experiment was conducted in the months of June to August 2011. The experiment was randomized complete block design with four replicates and there were two trials The data generated during the course of the field study were subjected to, ANOVA and means were separated using least significant difference (LSD).

RESULTS

The Growth percentage of rhizomorph of *Rigidoporus lignosus* on different Rubber tree parts at day 5 are summarized in Table 1. There were no colonization by rhizomorph of *Rigidoporus lignosus* on the fifth day of observation in all the treatments observed with Dry Rubber Sawdust (DRSD), Fresh Rubber Root (FRR) and Fresh Rubber Stem (FRS) pieces. Dry Rubber Seed Coat (DRSC) in all the treatments produced rhizomorph of the pathogen. The highest percentage of colonization was observed with DRSC soaked in water and mulch at (83.75%) (Figure 1 a) and this was followed by DRSC at (27.50%) (Figure 1 b). Dry Rubber Stem (DRS) was the second in the mulched experiment at 10.75%.

TABLE 1. Growth percentage of rhizomorph of *Rigidoporus lignosus* on different Rubber tree parts at day 5.

Materials	Control	SS	WM	SSM
Dry Rubber Branch	1.58 ±1.50	0.00 ± 0.00	4.25 ± 3.77	3.75 ± 4.14
Dry Rubber Root	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.50 ± 0.00
Dry Rubber Stem	0.00 ± 0.00	0.75 ± 0.83	10.75 ± 5.63	1.00 ± 1.00
Dry Rubber Seed Coat	21.25 ±7.40	18.75 ± 6.50	83.75 ± 4.15	27.50 ±16.77
Dry Rubber Leaves	0.00 ± 0.00	2.50 ±1.80	5.50 ± 1.12	2.75 ± 2.28
Dry Rubber Sawdust	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Fresh Rubber Branch	0.00 ± 0.00	0.00 ± 0.00	1.25 ± 0.83	0.00 ± 0.00
Fresh Rubber Root	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Fresh Rubber Stem	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
l.s.d. = 2.957at α = 0.05				

SS- Samples soaked in sugar solution without mulch; WM-samples soaked in water and mulch; SSM-samples soaked in sugar solution and mulch

Percentage colonization by rhizomorph of *Rigidoporus lignosus* in DRSC soaked in water and mulch, and DRSC soaked in sugar solution and mulch (P > 0.05) were significantly different from control (Table 1).

FIGURE 1. Colonization of rubber seed coat by rhizomorph of *Rigidoporus lignosus*. (a) Dry Rubber Seed Coat soaked in water with mulching. (b) Dry Rubber Seed Coat soaked in sugar and mulched

FIGURE 2. Colonization of dry rubber stems by rhizomorph of *Rigidoporus lignosus*. (a) Dry Rubber Stem in the control experiment. (b) Dry Rubber Stem soaked in water with mulching

DISCUSSION

Early stages of infection by these pathogens are often difficult to detect because of the insidious nature of the white root rot infection, trees bearing visible disease symptoms are mostly beyond treatment and recovery (Ismail & Azaldine, 1985; Nadris *et al.* 1988; Mohd *et al.* 2009). According to Jean & Albert (2002) the best technique to reveal the presence of rhizomorph of white root rot is mulching of the rubber tree base for one month followed by root exposure. In this study colonization of plant materials by rhizomorph of white root rot was achieved within the experimental period of five days. One of the future concerns of plant pathologists in the International workshop on white root disease of *Hevea* rubber held in Colombo, Sri-Lanka 2010 was the development of an early disease detection system (Jayasinghe, 2010). This study therefore is in line with such concern. The use of DRSC as early warning sign may enhance the economic importance of dry rubber seed coat, which is currently a waste product of rubber seed processing.

In conclusion, this study demonstrates the efficacy of DRSC as an effective early detection method of *R. lignosus* in the field. Future area of interest include determining colonization of the rubber seed coat so as to rate the level of disease incidence in the soil in the plantation, and also to determine if colonization of rubber seed coat use as bait to attract the rhizomorph could help in reducing the level of white root rot in the soil around the rubber stand.

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