DISEASE IMPACT IN RUBBER PLANTATION: A CASE OF RUBBER RESEARCH INSTITUTE RUBBER ESTATE, IYANOMO, EDO STATE, NIGERIA

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ABSTRACT

This study evaluated the prevalence of some diseases in rubber plantations using the 40-hectare Rubber Estate of the Rubber Research Institute of Nigeria (RRIN) in Iyanomo, Edo State, Nigeria. Nine rubber clones (PR 107, NIG 800, NIG 801, RRIM 707, NIG 804, NIG 803, NIG 802, GT 1, and NIG 805) were planted per clone and used for the study. The clones were surveyed for disease incidence during the wet season of 2019 (April to July). Consequently, a total of 4,347 rubber trees were assessed. Data obtained shows that a total of 3, 278 (75.4%) trees were found in the field, 237 (5.48%) trees were diseased (dead), and 832 (19.11%) trees were missing. The following pathogens were prominent: white root rot disease, parasitic mistletoe disease, panel disease, and Corynespora leaf-fall disease. The plantation was highly infected with white root rot disease (41.0%), followed by Corynespora leaf fall disease (39.0%) with a moderate infection rate, parasitic mistletoe disease (17.0%), and panel disease (4.0%) with a mild rate of infection. The incidence and severity of these pathogens are huge and should attract the attention of relevant stakeholders while integrated, combined, and improved agro-practices are advocated.

Key words: Rubber. Plantation, pathogen, disease, incidence, Edo state

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INTRODUCTION

Rubber (*Hevea brasiliensis* Muell Arg.) belongs to the genus *Hevea* of the family Euphorbiaceae. It emanated from the Amazon rainforest basin. However, due to rising demand for the supply, efforts were made to cultivate the tree outside the Amazon (Brazil), which is her traditional home (Mooibroek and Cornish, 2000; Arias and Dijk, 2019). Several trials were made in Europe, Asia, and Southern America with seedlings from the Kew Garden, London. Following the Malaysian exploitation, rubber is successfully cultivated in over thirty-eight countries globally (www.rubbernews.com). The healthy state of rubber trees is very crucial considering the high economic value placed on it as a commercial crop owing to its exudates (latex) derived from tapping the tree (Panikkar, 2000; George and Priyadarshan, 2017). This substance (latex), having undergone several processes, is used in the production of several goods that cut across all spheres of human endeavour ranging from the manufacturing of automobile vehicle tyres and tubes to general playing ground equipment, health care services, railway line accessories, and transmission and elevator belts, among others (Dong *et al*., 2020; William, 2018; Distler *et al*., 2017). After 25–30 years of economic activities through tapping, the trees were felled for other uses (fuel, charcoal, and substrate for mushroom cultivation, among others), while replanting of new ones is recommended (Munasinghe and Rodrigo, 2018). To ensure a healthy plantation, emphasis is placed on planting materials, plantation maintenance, the training of farmers, and appropriate preventive measures against a possible disease threat (Herbert, 2018). The pathogens, whose spread is enhanced by global warming and travel (Waleed, 2017), if not detected at the onset, may progress rapidly with visible symptoms (Alexopoulos *et al*., 2002).

Its prevalence could be beyond treatment and recovery, thus making the death of the tree imminent (Mazian *et al*., 2019; Rao, 1975). This study aims to evaluate the presence and level of various pathogen infestations in the plantation under review to develop effective management strategies for combating their spread.

MATERIALS AND METHODS

Study site

The field study was conducted at the polyclonal rubber plantation of the Rubber Research Institute of Nigeria (RRIN) in Iyanomo, Edo State, Nigeria, situated on latitudes 6° 00' to 6° 15' N and longitudes 5° 30 to 5° 45' E. Iyanomo lies on the wet lowland rainforest of Edo State, with an annual rainfall ranging from 1230mm to 2580mm and monthly temperatures falling between 28 and 30°C.

Disease Assessment

Nine rubber clones (PR 107, NIG 800, NIG 801, RRIM 707, NIG 804, NIG 803, NIG 802, GT 1, and NIG 805) were used for the study. Each clone occupies a plot (space) of 4 hectares within the plantation, with 483 rubber trees planted in each plot laid out in rows and columns of 21 x 23 m. The clones were assessed one after the other for the disease incidence between the months of April and July, 2019. A total of 4,347 rubber trees were assessed during the study, and depending on the level of preponderance of the lesions recognized for each pathogen, disease incidence was rated using the method of Khanna et al. (1977) as follows:

$$\text{Disease Index (DI)} = \frac{h}{n} \times 100$$

Where h = number of diseased plants sampled
n = total numbered of plants assessed.

The disease severity of each pathogen was established using a grading scale of 0–4 as proposed by Parrry (1990). i.e., 0 = no infection, 1 = mild (1–20% infection), 2 = moderate (21-40% infection), 3 = high (41-60% infection), and 4 = severe (61–100% infection). The calculated disease index was expressed in percentages to reflect the level of disease severity.

Statistical Analysis

Data were analyzed using descriptive statistics of SPSS software version 25.0.

RESULTS AND DISCUSSION

The results from the survey are shown in Table 1 below. Diseases of rubber (*H. brasiliensis*) are classified based on the parts affected, namely the leaves, stem, panel, and root (Mazian et al., 2019). Early-stage detection of these diseases is crucial, as it will provide an opportunity for rescue (Orumwense, 2011). Most trees with visible disease symptoms are often beyond treatment or recovery as the rapid spread makes their deaths inevitable (Rao, 1975).

From the study conducted, a total of 4,347 rubber trees were assessed, showing that 3,278 (75.41%) were healthy rubber trees, 238 (5.48%) were dead rubber trees, and 831 (19.11%) were missing rubber trees. The cause of these missing stumps could not be ascertained.

Table 1: Synonyms of surveyed rubber plantation in Iyanomo, Edo State

Plot No.	Clone(s)	Field Size (ha)	TTP (No.)	TLT (No.)	TDT (No.)	TMT (No.)	Agronym
1.	PR 107	4	483	312	43	128	Pre-Besang
2.	NIG 800	4	483	410	11	63	Nigeria
3.	NIG 801	4	483	368	29	86	Nigeria
4.	RRIM 707	4	483	374	10	99	Malaysia
5.	NIG 804	4	483	393	7	83	Nigeria
6.	NIG 803	4	483	365	31	86	Nigeria
7.	NIG 802	4	483	391	23	69	Nigeria
8.	GT 1	4	483	337	46	100	Goteny tapeng
9.	NIG 805	4	483	328	37	118	Nigeria
10.	TOTAL	36	4,347	3,278	237	832	

Note: TTP = Total trees planted, TLT = Total living trees, TDT = Total diseased trees, TMT = Total missing trees

The clonal susceptibility of pathogens in surveyed rubber plantations is as shown in Table 2 below. It revealed that the polyclonal plantation was infected with some pathogens and that the indigenous clones (NIG 800, 801, 802, 803, and 804) were highly susceptible to infections from these pathogens in comparison to the exotic clones (GT 1, PR 107, and RRIN 707).

Table 3 shows the disease severity scale of the surveyed plantations. White root rot disease was 40%, corynespora leaf fall disease (39.0%), parasitic mistletoe disease (17.0%), and panel disease (4.0%). The disease severity scale of the surveyed plantations, displayed in Table 3, showed that the plantation trees were highly infected with white root rot disease, followed by *corynespora* leaf fall disease, parasitic mistletoe disease, and panel disease, respectively. This result is in agreement with the findings by the International Rubber Study Group (IRSG, 2014), where they reported that white root rot disease was severe in Cote d'Ivoire, Nigeria, and Sri Lanka, with a rising portion in Gabon, Liberia, Indonesia, and Malaysia. Ogbebor *et al*. (2014) reported that the disease's prevalence was attaining an alarming proportion, with sizeable hectares of Nigerian plantations infected. Omorusi *et al*. (2012) emphasized that the devastating effects of the incidences of *Corynespora* leaf fall disease were of concern, stating that the disease is present both in the nursery and in mature plantations. This view was supported by the findings of Orumwense *et al*. (2013) and Umoh and Fashoranti (2018). The presence of parasitic mistletoe disease in the surveyed plantations was supported by the findings of Terna *et al*. (2017) and Orumwense *et al*. (2017), who reported the superior strength of the disease. Ugwa and Omorusi (2005) and PRRI (2019) highlighted in their reports the presence of panel diseases in rubber plantations and the need to curb their spread.

Table 2: Clonal susceptibility of disease incidence (%) in surveyed rubber plantation in Iyanomo, Edo State

		Disease Incidence (%)			
Plot No.	**Clone(s)**	**WRRD***	**PMD****	**PD*****	**CLFD******
1.	PR 107	29.5	18.5	6.0	46.0
2.	NIG 800	52.0	20.0	4.0	24.0
3.	NIG 801	49.6	15.0	5.4	30.0
4.	RRIM 707	28.0	17.5	4.5	50.0
5.	NIG 804	51.0	18.5	3.5	27.0
6.	NIG 803	47.7	14.0	2.8	36.5
7.	NIG 802	49.6	16.5	1.5	32.4
8.	GT 1	18.6	11.0	3.0	67.4
9.	NIG 805	43.3	21.5	1.7	33.5

Note: WRRD = White root rot disease, PMD = Parasitic mistletoe disease, PD = Panel disease, CLFD = Corynespora leaf fall disease

Table 3: Disease severity scale of the surveyed rubber plantations in Iyanomo, Edo State

S/No.	Rubber Disease	**MPDI**	**SL**	**Severity**
1.	White root rot disease	41.0	3	High
2.	Parasitic mistletoe disease	17.0	1	Mild
3.	Panel disease	4.0	1	Mild
4.	Corynespora leaf fall disease	39.0	2	Moderate

MPDI = Mean percentage disease index, SL = Scale level.

CONCLUSIONS AND RECOMMENDATIONS

- The predominant pathogens identified in the rubber plantation studied were white root rot disease, parasitic mistletoe disease, panel disease, and Corynespora leaf fall disease.
- The incidence and severity of these pathogens are high and should attract the attention of relevant stakeholders, while integrated, combined, and improved agro-practices are recommended.
- To ensure that the rubber plantation continues to flourish, the estate managers or farmers owe it a duty to report on time any symptoms or signs on the field that will help detect any threat from a pathogen. The danger posed by these pathogens and the need for combined agro-management practices to stem their tide must be addressed to keep the smallholder farmer's income secure.

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