



SUSCEPTIBILITY OF SOME RUBBER (*Hevea brasiliensis*) CLONES TO MISTLETOE INFESTATION: A CASE OF RUBBER RESEARCH INSTITUTE, RUBBER ESTATE, EDO STATE, NIGERIA

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Abstract

The study was conducted to determine the susceptibility of different *hevea* clones to mistletoe infestation at the polyclonal plantation of Rubber Research Institute of Nigeria (RRIN) Rubber Estate, Iyanomo, Edo State, Nigeria which lies on longitude 50° 27"E and latitude 60° 23"N. Four clones: NIG 800 and NIG 804 (both indigenous), and PR 107 and GT 1 (both exotic/foreign), laid out in a plot (block) of 21 x 23m comprising 483 rubber trees per clone were studied. Three hundred and twenty two (322) rubber trees in each plot were randomly selected and assessed for the disease incidence using standard procedures. The result obtained showed NIG 800 had the highest percentage (77.95%) of infection (251 trees infected), NIG 804- 74.53% (240 trees infected), RRIM 707- 42.83% (138 trees infected) and GT 1- 36.34% (117 trees infected). Therefore, mistletoe infestation was severe on the indigenous clones compared with the exotic clones. Thus, more research is needed on the development of indigenous resistance clones to enhance high latex yield. Regular pruning of affected tree parts is also recommended.

Keywords: Mistletoe, rubber, clone, susceptibility, and disease

Abbreviations

RRIN-Rubber Research Institute of Nigeria

NIG-Nigeria

PR-Pre -Besang

GT-Goteny Tapeng

Introduction

The rubber tree (*Hevea brasiliensis*) is a commercial crop cultivated for the purposes of generating income because of its sap-like extract known as latex. This substance (latex) is present in almost all parts of the plant and it is the main source of natural rubber (Vijayakumar *et al.*, 2000). Through the process of vulcanization, this sap-like substance is transformed into several products of great importance with uses varying from household items to industrial products with tyres and tubes (automobile and aircrafts) being the largest consumer followed by gloves, toys, and balloons, footwear among others. Rubber (*H. brasiliensis*) emanated from the Amazon Basin in Brazil where the world supply of the commodity solely came from (Arias and Dijk, 2019). Rubber was introduced into Nigeria about a century ago with over 200,000 hectares of land under cultivation with the small holders accounting for more than 70% of the total land area (NAERLS, 2006). It is propagated either through its

seeds or vegetative under humid lowland tropical conditions, well-drained alluvial and red loam soils with an altitude of 27m above sea level, comparative little variation in temperature ranging from 28°C to 35°C and well distributed rainfall of 1230 to 2580mm (Aigbekaen *et al.*, 2000; Priyadarshan, 2017). In the past, rubber was one of the mainstay crops of the Nigerian economy as it provided employment for the people and foreign exchange as an export crop (Umar, *et al.*, 2012). Rubber (*H. brasiliensis*) is prone to attack by several pathogens and pests. The problems of different insects and rodent action have been reported (Rao, 1975). Early detection of these diseases is very important in perennial crops like rubber to enhance its latex yield (Orumwense, 2011).

Mistletoes are hemi-parasite, able to synthesize their own food and depend on their host for water and mineral nutrients. Their host includes; orange (*Citrus* sp.), cocoa (*Theobroma cacao*), cush mango (*Irvingia gabonensis*),

cola nut (*Cola nitida*), guava (*Psidium guajava* L.), coffee (*Coffea arabica* L.) and rubber (*H. brasiliensis*) among others (Norton and Carpenter, 1998; Boussim, *et al.*, 2004; Dlama, *et al.*, 2016). The mistletoe parasite exerts a heavy weight on the branches as it spreads slowly throughout its host as black streaks of coagulated latex and is noticed at the point of attachment to its host which might result in breakage of the branches during wind fall (Kelly *et al.*, 1997). Before now, little or no attention has been given to clonal infestation arising from the menace of the disease. Hence, the aim of this study is to determine the susceptibility of different rubber clones in RRIN rubber estate, Edo State.

Materials and Methods

Plant selection

The field study was conducted at the polyclonal rubber plantation of Rubber Research Institute of Nigeria (RRIN), Rubber Estate, Iyanomo, Edo State, Nigeria. Four rubber clones; NIG 800 and NIG 804 (indigenous clones), and PR 107 and GT 1 (exotic clones) were used for the study. Each clone occupies a plot (land area) of 4 hectares within the plantation under study, and laid out in rows/columns of 21 x 23m. Three hundred and twenty two (322) rubber trees were randomly assessed for the disease incidence.

Assessment of Disease Index

A total of 1288 rubber trees were assessed during the study and depending on the level of preponderance of the lesions on the affected tree disease incidence was rated using the method of Khanna *et al.* 1977 as follows:

$$\text{Disease Index (DI)} = \frac{h}{n} \times 100/1$$

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

Disease severity was rated according to the equations proposed with modification by Omorusi *et al.*, 2014, used to establish the severity in various clones using numerical scale of 0 – 4 as follows: 0 = no infection, 1 = mild (1 -20% infection), 2 = moderate (21-40% infection), 3 = high (41-60% infection) and 4 = severe (61 % infection and above). The calculated disease index was expressed in percentages to reflect the level of disease severity.

Statistical Analysis

Data were analyzed using descriptive statistics with SPSS software version 25.0

Results and Discussion

The results in Table 1 show the incidence of mistletoe in the various clones studied. It indicated that NIG 800 clone was heavily infested with the disease (77.95%), followed by NIG 804 (77.53%), PR 107 (42.85%) and GT 1 (36.34%), indicating that N800 and N804 were clones significantly infected ($p < 0.05$). Table 2 further revealed the severity of the disease in the various clones surveyed; NIG 800 and NIG 804 had severe parasitic attack (Severity score = 4), while PR 107 and GT 1 recorded a moderate and mild level of infestation (Severity score = 3 and 2, respectively). Furthermore, the mean rate of infestation for the indigenous clones was 77.74%, while that of the exotic clones was 39.60%.

Table 1: Incidence of mistletoe in *hevea* clones of RRIN Rubber Estate

S/No	Clone(s)	NIT*	NUT*	TTS*	PDI* (%)	PDUI* (%)
1.	NIG 800	251	71	322	77.95	22.05
2.	NIG 804	240	82	322	74.53	25.47
3.	PR 107	138	184	322	42.85	57.15
4.	GT 1	117	205	322	36.34	63.66

NIT* = no. of infected trees, NUT* = no. of uninfected trees, TTS* = Total no. of trees sampled, PDI* = percentage of disease infected, PDUI* = percentage of disease uninfected

Table 2: Severity of disease in surveyed *hevea* clones in RRIN Rubber Estate

S/No	Clone(s)	SL*	Severity	Incidence
1.	NIG 800	4	Severe	77.95
2.	NIG 804	4	Severe	74.53
3.	PR 107	3	Moderate	42.85
4.	GT 1	2	Mild	36.34

SI* = Scale level

In the course of the study, a total of 1288 rubber trees from four clones selected for the study were assessed for the parasitic mistletoe disease incidence. Mistletoe was identified on 746 rubber trees (57.92%) while 542 rubber trees were not infected by the disease (42.08%). Asare-Bediako, *et al.* 2013 had early reported the prevalence of the

parasite on some citrus trees in their study with a high incidence of infestation while Terna, *et al.* 2017 highlighted the incidence and severity of the disease in the survey they carried out which is in line with our findings. Table 1 shows that percentage of mistletoe infestation differed significantly among the clones assessed, while in

Table 2 incidence of mistletoe on the clones assessed varied considerably with percentage disease index (PDI). This result was further supported with the study of Lopez de Buen *et al.* (2002), where he disclosed that individual differences among host trees play an important role in explaining local abundance and distribution of the parasite on plants. Furthermore, Orumwense *et al.* 2017, in their study, reported the abundance of the parasite where they emphasized that its rate of infestation was highly visible in the plantation. Mistletoe as a parasite, attach themselves through their root on the branches and trunks of their host and being able to obtain water and nutrient from their host, they are able to synthesize their own food. Hence, the parasite grows slowly and spread very fast. These attributes enables it to exert an excessive weight on the host branches/trunks which results in breakage during wind. As a result, Kelly *et al.* 1997 in their study recommended regular pruning of affected tree parts to prevent other destructive pathogens from gaining entry into the host. Due to the havoc associated with crop loss by diseases, efforts are being made to develop resistance varieties of several crops (including rubber) as an alternative to chemical control method being employed by using new genotypes of crops which are evaluated not only for their resistance, but also their growth, increased yield and vigour (Garcia, *et al.*, 2004; Dong and Ronald, 2019).

Conclusion

The study highlights the need to evolve clones with resistant properties when selecting planting materials as a way of curbing the spread of the disease. Adequate enlightenment and sensitization should be given to small holder farmers on the need to report without delay the onset of any disease threat, while combined agro-management practice is very essential in minimizing the incidences of the disease.

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