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PREVALENCE OF LETHAL YELLOWING DISEASE, INSECT VECTORS AND PREMATURE NUT FALL OF THE COCONUT PALMS IN NIGERIA

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Abstract: The Prevalence of lethal yellowing disease (LYD), insect vectors and premature nut fall of the coconut palms have been studied within the locations and states visited in Nigeria. The locations were fields with mixture of dwarfs, hybrids and West African tall coconut palms including decapitated coconut stems. The prevalence of LYD was higher in the South South with 25.4% when compared with the South East with 2.5%. In the South West Lagos Badagry there was no LYD prevalence. However soil moisture, stress and water-log appears to predispose palms to the condition of root wilt and bud rots which results in crownless of the palms. This was not an indication of LYD. In the locations visited in North central zone there was no visible occurrence of LYD. The South-South recorded high level of insect vectors on coconut canopies with 11.6%, followed by South East 6.6%, South West 4.7% and North central zone 6.9 %. The prevalence of premature nut fall in the South-South was higher with 28.6%, South East 23.2%, South West 15.9% and North zone 8.3% based on sample sizes. In some of the zones visited, different species of leaf and plant hoppers likely to be insect vectors were found feeding on the canopies of LYD and premature nut fall coconut palms. The high level of insect vectors *Cicadellidae* (leafhoppers) and *Flugoroidea* (planthoppers) found in the South-South could possibly be the reason of high level of prevalence of LYD and premature nut falls recorded in the region.

Key words: Coconut; LYD; Insect vector; Nut fall; Prevalence.

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INTRODUCTION

Coconut palm (*Cocos nucifera* L.) has long been of concerned because of the economic importance of coconut in Nigeria. Lethal yellowing is a highly destructive disease of the coconut palm (McCoy *et al*., 1983). Spread of the disease into previously unaffected areas has continued. Lethal disease (LD), a destructive lethal yellowing-type disease (LYD) has become one of the major factors limiting coconut production in Nigeria. Symptoms of LD are similar to those caused by LYD in West Africa and the Caribbean (Schuiling *et al*., 1981) and like these diseases; LD is associated with phytoplasmas which was formerly known as mycoplasma-like organisms (MLOs) (Nienhans *et al*., 1982). Coconut LY and related diseases are believed to be caused by phytoplasmas as this cell wall-less prokaryote are consistently found in the phloem of diseased palms but not in healthy palms (McCoy *et al*., 1983). Detection of phytoplasmas for diagnostic purposes has been complicated by several factors including an inability to culture these pathogens in culture media because of their small size and presence in low numbers in plant tissues (Thomas and Norris, 1980). Phytoplasma cannot be cultured in vitro, a phenomenon due probably to the

lack of essential genes and functions (Razin, 2007). There an estimated total of 15,000 hectares of land under coconut cultivation in Nigeria with over 2 million coconut trees and more than 80% of it occurs as a continuous belt of I kilometer wide stripe of grooves along some 200 km of coastline in Lagos state. More than 80% of these grove populations are of the West African Tall cultivar susceptible to LYD. (Osagie *et al.,* 2008). Phytoplasma diseases are invariably transmitted by insects of the order *Homoptera*, suborder *Auchenorryncha*, particularly the families, *Cicadellidae* (leafhoppers) and *Flugoroidea* (Planthoppers) (Nelson, 1979). Aproximately 20,000 leafhopper species have been described (Dietrich 2005). Populations of this plant hopper species were as much as 40 times higher in areas of high lethal yellowing (LY) incidence than disease free areas (Howard 1980). In a related study, pepper, tomato, potato, cassava, sugar cane, *Solanum* spp. and *Euphorbia* spp. have been reported to host phytoplasmas (Nasir et al., 2007). The objective of this study was to know the high incidence of LYD and their insect vectors in coconut growing belts of Nigeria with the view to reduce the spread to new replanted coconut fields

EXPERIMENTAL

Sampling Location: Sampling of coconut palms and insects were carried out in four locations of LYD areas in Edo State (NIFOR sub station Ubiaja Edo State), South East (Igboriom Anambra State), South West (NIFOR sub station, Badagry Lagos State) and central (Aloma-Ofu, Kogi State) of Nigeria. The insects collected were preserved in sample bottles containing 80% alcohol, buffer solution and agarose gel granules for future use.

Sampling LYD Coconut Palms and Insects: We evaluate the state of LYD coconut palms and premature nut fall spread on the basis of incidence and severity of the disease. Percentage of the incidence was calculated on the basis of ratio of the number of diseased palms to the total number of palms planted. Intensity of symptoms on the palms was determined using the disease index scale from 0 to 5 to determine the progression of the intensity of disease were as follows:

0 - No disease, healthy palm
1 - Premature nut fall, blackening of inflorescence, leaves still green
2 - Yellowing of leaves, less than half of the canopy leaves still green
3 - Most of the leaves yellow with few green leaves
4 - Total yellowing / bronze colour of all the leaves
5 - Wilting / decapitation

We collected adult insects using sweep nets twelve times each from coconut canopies (spathes and inflorescences).

Data Analysis: For each location the percentage occurrence was calculated as the percentage of infected palms in the total palms population sampled.

RESULTS AND DISCUSSION

Of a total of 768 coconut palms of different varieties, West African Tall (WAT); Malayan Red Dwarf (MRD); Malayan Yellow Dwarf (MYD) and Malayan Green Dwarf (MGD) that were sampled in South East zone, 2.5% were LYD palms; 6.6% were plant and leaf hoppers of *Flugoroidea* and *Cicadellidae* species (plate1) and 23.2% of some of the palms suffer premature nut fall. Other major insect pests of the palms were also found (table 1). In the South South zone, a total of 1,344 coconut palms also of different varieties were sampled, 25.4% were infected with LYD; 11.6% of *Flugoroidea* and *Cicadellidae* species were found and 28.6% suffers premature nut fall (table 2). The situation was different in the South West, a total of 1,191 coconut palms were sampled. There was no LYD prevalence with 0.0%, *Flugoroidea* and *Cicadellidae* species recorded 4.7% and premature nut fall had 15.9% (table 3). Also in the North Central, a total of 72 coconut palms were sampled but there was no prevalence of LYD with 0.0%, *Flugoroidea* and

Cicadellidae species 6.9% and premature nut fall recorded 8.3%. The high numbers of sampled coconut palms in the South West were attributed to small and large scale farmers expanse of the coconut belt. The low number of sampled coconut palms in North Central shows that coconut palms were cultivated for beautification of houses. A dozen or less could be seen within a location. But there was no prevalence of LYD.

The prevalence of LYD was higher in the South South when compared with the South East. In the South West of Lagos-Badagry, soil moisture, stress and water-log appears to predispose palms to the condition of root wilt which resultet in crownless of the palms. This was not an indication of LYD. The high prevalence of *Flugoroidea* and *Cicadellidae* species in the South South zone must have contributed to the high prevalence of LYD. This study supports the study of Howard et al., (1982), who reported that populations of plant hopper species were as much as 40 times higher in areas of high LYD incidence than disease free areas. The gradual spread of the LYD from one zone to the other might be attributed to susceptible coconut cultivars. This was supported by Kirkpatrick (1992), who reported that plant to plant transmission were carried out by insect vectors through vegetative propagation of infected plant materials. In similar study Wilson (2005), reported that plant hopper species were of major importance because of their high fecundity thereby damaging crops and are also known vectors of bacterial or viral pathogens.

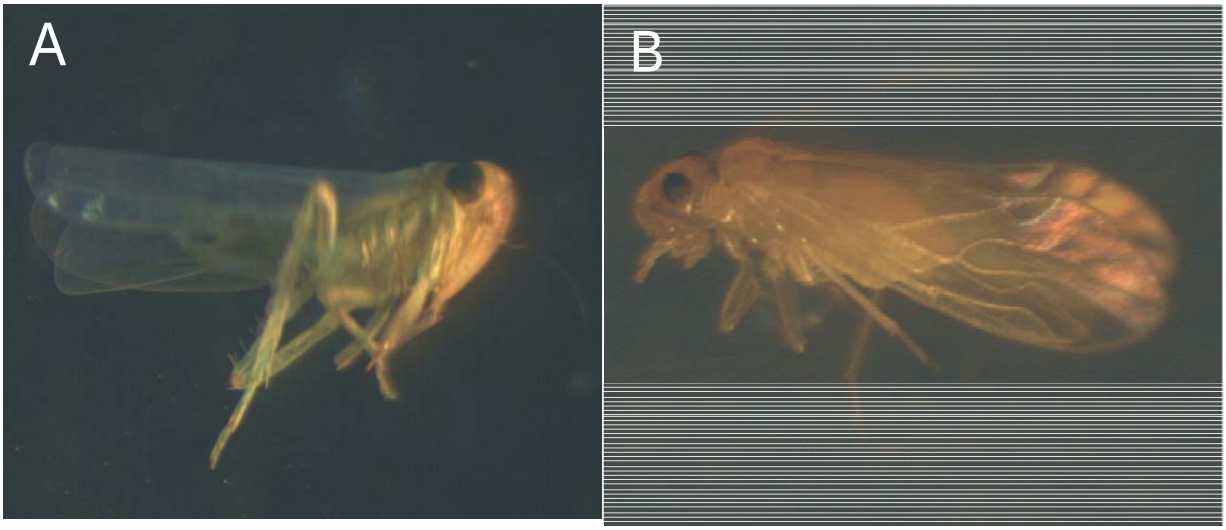

Plate 1 (A and B) Shows Insect vectors: A- *Cicadellidae* (small 2.4µ) and B- *Flugoroidea* (small 2.3µ) species

Table 1. Lethal Yellowing Disease Prevalence in South East Zone

Zone	State	Location	LYD			Vector insects			Premature nut fall		
			Sample size	Infected palms	Inf.%	Sample size	Infected palms	Inf.%	Sample size	Infected palms	Inf.%
South East	Anambra	Rogeny	194	2.0	1.0	194	0.0	0.0	194	56	28.9
		Igboriom	168	3.0	1.8	168	16	9.5	168	11	6.5
	Enugu	Enugu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Imo	Owerri/Okigwe	63	0.0	0.0	63	0.0	0.0	63	9.0	14.3
	Abia	Ubakala	124	14	11.3	124	7.0	5.6	124	4.0	3.2
	Ebonyi	Umuebe	219	0.0	0.0	219	28	12.7	219	98	44.7
Total			768	19	2.5	768	51	6.6	768	178	23.2

Table 2. Lethal Yellowing Disease Prevalence in South South Zone

Zone	State	Location	LYD			Vector insects			Premature nut fall		
			Sample size	Infected palms	Inf.%	Sample size	Infected palms	Inf.%	Sample size	Infected palms	Inf.%
South South	Edo	NIFOR main	164	8.0	4.9	164	31	18.9	164	73	44.5

		station								
		NIFOR station Ubiaja	332	297	89.5	332	97	29.2	332	136	40.9
		Agomokpai	88	27	30.7	88	16	18.2	88	13	14.8
	Delta	Odogwu villa	83	0.0	0.0	83	0.0	0.0	83	18	21.7
		Umunede/ Ogwashi	98	6.0	6.1	98	5.0	5.1	98	14	14.3
		Songhai	218	0.0	0.0	218	0.0	0.0	218	11.3	51.8
	Akwal bom	Umuahia-Uyo Rd.	211	4.0	11.3	211	7.0	3.3	211	4.0	19.0
	Rivers	Harris Town	54	0.0	0.0	54	0.0	0.0	54	0.0	0.0
		Aba/Port-Harcourt rd.	96	0.0	0.0	96	0.0	0.0	96	14	14.6
Total			1,344	342	25.4	1,344	156	11.6	1,344	385	28.6

Table 3. Lethal Yellowing Disease Prevalence in South West Zone

Zone	State	Location	LYD			Vector insects			Premature nut fall		
			Sample size	Infected palms	Inf.%	Sample size	Infected palms	Inf.%	Sample size	Infected palms	Inf.%
South West	Lagos	NIFOR station Badagry	318	0.0	0.0	318	23	7.2	318	78	24.5
		Topo village	73	0.0	0.0	73	6.0	8.2	73	8.0	10.9
		Gayingbe	85	0.0	0.0	85	9.0	10.6	85	0.0	0.0
		Gbetrome	297	0.0	0.0	297	5.0	1.9	297	16	5.4
		Atlantic coast Badagry	418	0.0	0.0	418	13	3.1	418	87	20.8
Total			1,191	0.0	0.0	1,191	56	4.7	1,191	189	15.9

Table 4. Lethal Yellowing Disease Prevalence in North Central Zone

Zone	State	Location	LYD			Vector insects			Premature nut fall		
			Sample size	Infected palms	Inf.%	Sample size	Infected palms	Inf.%	Sample size	Infected palms	Inf.%
North zone	Kogi	Aloma-ofu	12	0.0	0.0	12	2.0	16.6	12	2.0	16
		Omabi	8	0.0	0.0	8	0.0	0.0	8	1.0	12.5
		Etutu-Okpo	5	0.0	0.0	5	0.0	0.0	5	0.0	0.0
		Sheria-Dekina	7	0.0	0.0	7	0.0	0.0	7	0.0	0.0
		Ejule Ofu	9	0.0	0.0	9	1.0	11,1	9	0.0	0.0
		Elubi	11	0.0	0.0	11	0.0	9.1	11	2.0	18.2
	Kwara	Ilorin axis	9	0.0	0.0	9	0.0	11.1	9	1.0	11.1
	Niger	Bida axis	6	0.0	0.0	6	0.0	0.0	6	0.0	0.0
	Plateau	Jos axis	5	0.0	0.0	5	0.0	0.0	5	0.0	0.0
Total			72	0.0	0.0	72	4.2	6.9	72	6.0	8.3

CONCLUSION

The study conforms to the general epidemiology of disease epidemics such as climate, surrounding flora, susceptible host and vector insects. Adequate weed management technique should be practiced to eliminate avenues for mass breeding of alternate hosts of the LYD.

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CONFLICT OF INTEREST : Nothing