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# A Survey of Insects Associated with Coconut Palms in NIFOR Benin with Emphasis on Possible Vectors of Bronze Leaf Wilt ("Awka wilt") Disease

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ABSTRACT

One hundred coconut palms planted in 1987 in NIFOR were systematically surveyed once every month from July 1990 to July 1991. Seventeen species of insects were recorded. Of these *Oryctes monoceros* Olivier (Coleoptera: Chrysomelidae) was the most destructive. *Malenia cocos* Van Stalle (Homoptera: Auchenorrhyncha: Derbidae) and *Meenoplus proximus* Synave (Homoptera: Auchenorrhyncha: Meenoplidae) were regularly encountered. Though these auchenorrhynchous plant hoppers have not been implicated as vectors of lethal yellowing (LY) they belong to the same suborder as LY vector. Further survey of the series Auchenorrhyncha will continue.

Bronze leaf wilt ("Awka wilt") a lethal yellowing (LY) like disease of the coconut palm was first observed in Nigeria by Johnson (1918, 1919) in the Awka area (Anambra State) following a severe epidemic in 1917. This disease was termed "bud rot" and, by an Agricultural Ordinance of 1916, farmers had to fell more than 5,000 palms as a control measure. Another outbreak occurred in the latter half of 1951, principally in the Awka-Onitsha area of the then Onitsha Province, but was this time called "bronze leaf wilt"(Bull 1955).

A survey of the distribution of the disease was carried out in the former East Central State (Imo and Anambra states), but no insect was found associated with it (Agwu and Okoye 1978).

Howard (1986) published evidence of transmission of palm lethal yellowing agent by a plant hopper, *Myndus crudus* (Homoptera: Cixiidae). On the basis of the pattern of spread of coconut disease in Cuba, Johnston (1912) hypothesized that LY was spread by flying insects. Additional observations (Bruner and Boucle 1943, Carter and Suah 1964, Johnson and Eden-Green 1978, McCoy 1976, Nutman and Roberts 1955) and evidence from field experiments (Heinz et al. 1972, Howard and McCoy 1980) supported this hypothesis. By the 1940's it was suspected that LY was caused by a virus and probably transmitted by members of the Homoptera (Bruner and Boucle 1943). *M. crudus* was suspected as a possible vector as early as 1958 (Farr 1985), but other Homopterans as well as species outside of this order were investigated as possible vectors during the 1960's and 1970's. The discovery of the association of mycoplasma-like organisms (MLO's) with LY in 1972 concentrated the search on species of the suborder Auchenorrhyncha of the order Homoptera, since most known vectors of MLO-associated plant diseases belong to this taxonomic group (D'Arch and Nault 1982). Based on surveys of auchenorrhynchous insects associated with coconut palms in Jamaica (Schuiling 1976) and Florida (Woodiel 1976), *M. crudus* was the only insect of this suborder found consistently on coconut palms in both areas (Woodiel et al. 1975).

Evidence from electron microscopy (Plasvic-Bajac et al. 1972) and chemotherapy (McCoy 1972) strongly suggests that a mycoplasma-like organism (MLO) is the etiological agent of LY of coconut and other palms (Tsai 1980) and, like most plant diseases of mycoplasmal etiology, it is thought to be transmitted by an auchenorrhynchous insect (Tsai 1979). It was for this reason that Tsai and Mead (1982) investigated the insect fauna associated with palms in southern Florida in hopes of determining the likely LY vector.

The present study to survey insect fauna of the coconut palms in NIFOR, with particular reference to auchenorrhynchous plant hoppers, was undertaken for similar reasons.

## Materials and Methods

*Sampling Site.* The sampling site was the Nigerian Institute for Oil Palm Research coconut

*Table 1. Numbers* of insects encountered per 100 palms from July 1990–July 1991.*

| Species of Insects | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|
| *Alogista* sp. (Coleoptera: Alleculidae) | 1.22 | 1.22 | 0.70 | 1.22 | 0.70 | 0.70 |
| *Aspidomorpha cincta* (Coleoptera; Chrysomelidae Cassidinae) | 0.70 | 0.70 | 1.22 | 0.70 | 0.70 | 0.70 |
| *Cassida* sp. (Coleoptera: Chrysomelidae: Cassidinae) | 0.70 | 0.70 | 1.22 | 1.22 | 19.27 | 27.72 |
| *Catantops spissus spissus* (Orthoptera: Acrididae) | 0.70 | 2.12 | 0.70 | 2.12 | 2.74 | 1.58 |
| *Ceroplastes* sp. (Homoptera: Coccidae) | 0.70 | 1.58 | 1.22 | 2.35 | 3.81 | 4.18 |
| *Cedusa* sp. (Homoptera: Derbidae) (*Malenia Cocos*) | 1.22 | 1.58 | 0.70 | 2.74 | 6.52 | 4.53 |
| *Coelaenomenodera elasidis* (Coleoptera: Chrysomelidae) | 0.70 | 1.37 | 0.70 | 0.70 | 0.70 | 1.22 |
| *Cyrtacantnacris aeriginosa* (Orthoptera: Acrididae) | 1.22 | 3.39 | 6.60 | 11.68 | 7.58 | 1.58 |
| *Diostrombus luteus* (Homoptera: Derbidae) | 0.70 | 3.24 | 2.74 | 1.58 | 3.81 | 5.52 |
| *Exochomus* sp. (Coleoptera: Coccinelidae) | 0.70 | 0.70 | 0.70 | 0.70 | 3.94 | 5.05 |
| *Homocerus* sp. (Heteroptera: Coreidae) | 0.70 | 1.22 | 0.70 | 0.70 | 0.70 | 0.70 |
| *Leptoglossus australis* (Heteroptera: Lygaeidae) | 0.70 | 0.70 | 1.58 | 1.58 | 1.22 | 1.22 |
| *Meenoplus proximus* (Homoptera: Meencplidae) | 0.70 | 1.22 | 1.37 | 1.87 | 5.70 | 3.30 |
| *Cryctes monoceros* (Coleoptera: Scarabaeidae) | 1.87 | 2.12 | 1.22 | 0.70 | 0.70 | 1.22 |
| *Proutista fritilaris* (Homoptera: Derbidae) | 0.70 | 2.92 | 1.58 | 1.58 | 2.12 | 2.74 |
| *Zonocerus variegatus* (Orthoptera: Acrididae) | 9.67 | 25.25 | 10.42 | 4.42 | 1.58 | 0.70 |
| Unidentified coccinellid (Coleoptera: Coccinellidae) | 0.70 | 0.70 | 1.37 | 0.70 | 0.70 | 1.22 |
| Unidentified light brownish moth | 0.70 | 1.87 | 1.22 | 1.22 | 1.58 | 0.70 |
| Number** of palms attacked by *Oryctes monoceros* | 11.25 | 33 | 43 | 61 | 25 | 11 |
| Number** of palms attacked by scale insects | 2 | 8 | 7 | 18 | 22 | 144 |
| Number** of palms attacked by *Macrotermes bellicosus* | 0 | 0 | 0 | 0 | 0 | 0 |

* Numbers transformed using $\sqrt{X + 0.5}$.
** Not transformed.

hybrid seed garden planted in 1987, consisting of 53 rows of 36 coconut palms (*Cocos nucifera* L.) each (1,908 palms). The palms were planted at a distance of 7.6 m triangular and alternated by planting one row of local tall palms and two rows of Malaysian dwarf palms. Border palms were of the local tall variety.

*Sampling Method.* 100 coconut palms at heights of 60 cm–1.5 m were systematically surveyed by examining one row in every 5 rows of plantings once every month. All parts of the palms were examined visually and insects encountered recorded. Collections of unfamiliar insects were made, preserved dry or in 70% alcohol and sent to CIE London for identification. Live adults of *Oryctes* sp. found tunnelling into the base of the central spears were handpicked for preservation of destruction. Auchenorrhynchous plant hoppers were collected by inverting either 5 cm × 1.3 cm empty specimen vials or 7.5 cm × 2.5 cm empty specimen tubes over them and then carefully covering them back with their stocks.

The numbers of the surveyed insects were then transformed using $\sqrt{x + 0.5}$ in order to normalize the data. The numbers of palms attacked by *Oryctes monoceros*, *Aspidiotus destructor* and *Macrotermes bellicosus* per month of survey were not transformed.

## Results and Discussion

The list and numbers of insects encountered per 100 coconut palms surveyed from July 1990 to July 1991 are presented in Table 1. Of these insects, *Aspidiotus destructor*, *Zonocerus variegatus* L., *Malenia cocos* Van Stalle (formerly *Cedusa* sp.), and *Meenoplus proximus* Synave were the most abundant. The most destructive of these pests encountered was *Oryctes monoceros* Olivier.

Figure 1 illustrates the monthly occurrence of these pests per 100 palms surveyed. Though *Oryctes monoceros* was one of the least abundant, in terms of numbers per 100 palms surveyed, one *Oryctes* could do extensive and visible tunelling into the cabbage of each palm attacked. Its incidence peaked in August 1990 and July 1991, while the number of palms encountered with the visual signs of *Oryctes* damage was highest in October.

*Myndus crudus* Van Duzee (Homoptera: Cixiidae), which has been implicated in Florida as a vector of LY (Howard, 1986), was not encountered in these surveys. Two auchenorrhynchous plant hoppers which were encountered regularly in the field were observed to have some similar features as *Myndus crudus* following the descrip-

*Table 1. Extended.*

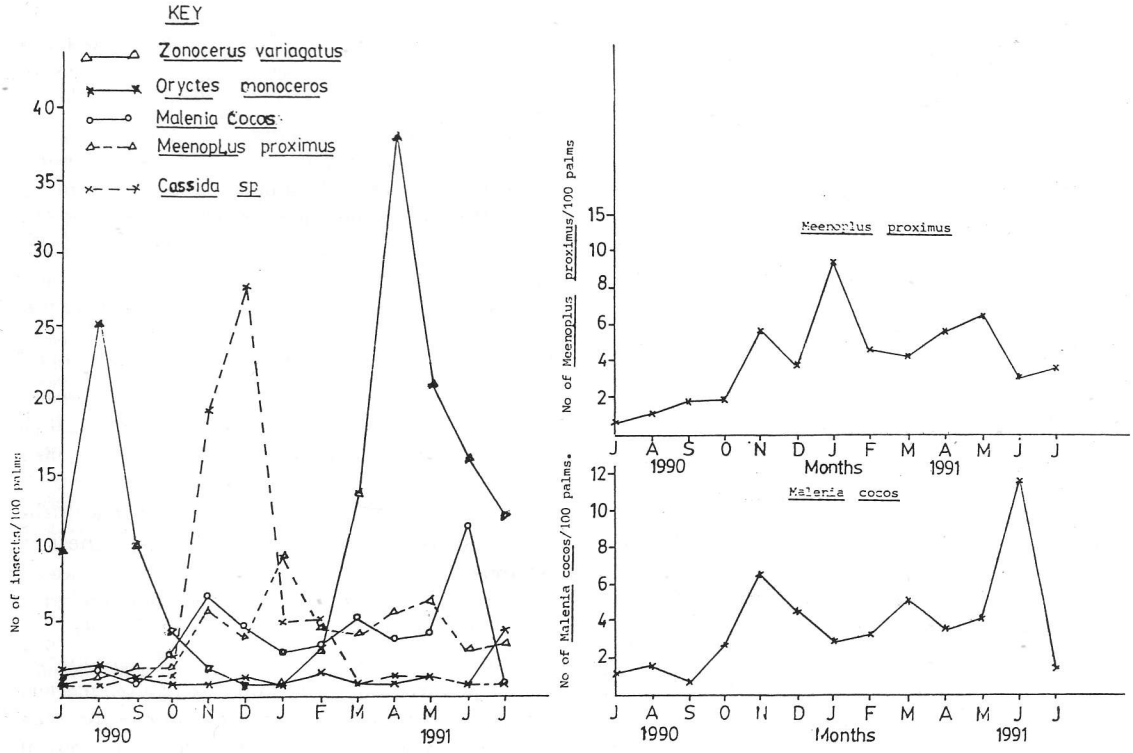
| Jan. | Feb. | Mar. | Apr. | May | June | July |
|---|---|---|---|---|---|---|
| 1.22 | 2.91 | 3.08 | 1.58 | 2.12 | 1.22 | 1.22 |
| 1.22 | 1.22 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| 4.95 | 5.14 | 0.70 | 1.22 | 1.22 | 0.70 | 0.70 |
| 3.08 | 2.12 | 0.70 | 0.70 | 0.70 | 3.24 | 3.80 |
| 4.17 | 3.80 | 5.95 | 2.91 | 5.33 | 6.04 | 5.14 |
| 2.92 | 3.24 | 5.14 | 3.67 | 4.06 | 11.64 | 0.70 |
| 0.70 | 0.70 | 1.22 | 0.70 | 1.22 | 0.70 | 0.70 |
| 2.35 | 2.12 | 4.18 | 4.63 | 4.84 | 3.53 | 5.61 |
| 2.92 | 2.34 | 3.99 | 2.73 | 8.03 | 11.2 | 7.31 |
| 2.92 | 2.12 | 1.53 | 4.52 | 1.22 | 1.22 | 0.70 |
| 2.35 | 1.22 | 1.87 | 0.70 | 1.22 | 0.70 | 0.70 |
| 0.70 | 0.70 | 1.22 | 1.22 | 1.22 | 0.70 | 0.70 |
| 9.41 | 4.52 | 1.18 | 5.52 | 6.44 | 3.08 | 3.53 |
| 0.70 | 1.58 | 0.70 | 0.70 | 1.22 | 0.70 | 4.30 |
| 3.24 | 2.50 | 5.14 | 3.93 | 4.30 | 4.74 | 3.67 |
| 0.70 | 3.08 | 13.8 | 37.9 | 20.74 | 15.93 | 12.30 |
| 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| 1.58 | 0.70 | 0.70 | 0.70 | 0.70 | 1.22 | 0.70 |
| 40 | 40 | 36 | 33 | 25 | 16 | 18 |
| 12 | 22 | 41 | 11 | 17 | 7 | 10 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

tion given by Kramer (1979). However, for positive identification these were dispatched to CIE London (CAB (11E) London). By initial comparison with previously identified specimens from CIE London, which are available in the Museum in Entomology division, NIFOR, these insects were placed as *Cedusa* sp. and *Meenoplus* sp., respectively. Confirmed identification however later placed them as

HOMOPTERA, AUCHENORRHYNCHA: DERBIDAE (M. R. WILSON (11E) det.)
*Malenia cocos* Van Stalle

HOMOPTERA, AUCHENORRHYNCHA: MEENOPLIDAE (M. R. WILSON (11E) det.)
*Meenoplus proximus* Synave

Ekpo and Ojomo (1990) documented the Ishan Area of Bendel State (Edo State) as a known focus of infection of bronze leaf wilt (=Lethal yellowing like disease). However, height disadvantage and the distance from NIFOR Benin made it inconvenient for regular monthly insect surveys to be




1. Number of major insects/100 palms recorded from July 1990 to July 1991.

carried out in that area. These preliminary surveys were therefore restricted to 60 cm–1.5 m tall uninfected palms in the NIFOR main station, Benin.

It is proposed to reach foliage of infected taller palms up to 12 m tall by employing skilled climbers or by using aluminium ladders in further surveys. These surveys will continue to pay more premium on auchenorrhynchous plant hoppers, the suborder in which the known vector of LY has been recorded by previous workers (Howard 1986, Cherry and Howard 1984).

Howard et al. (1985) in transmission tests found that lethal yellowing developed in young palms of coconut, *Pritchardia pacifica* and *Trachycarpus forntunei*, in cages in which *Myndus crudus* was present. Based on the above findings, the monthly surveys of the coconut palms planted in NIFOR in 1987 (now aged 4 years) were considered relevant.

Earlier findings by Howard and Thomas (1980) and by Tsai and Thomas (1981) revealed that large numbers of *M. crudus* (over 20,000 per cage) are required to transmit the LY agent. This planthopper appears to be an inefficient vector of the LY agent (Tsai and Mead 1982). Other homopterans are often encountered on coconut palms in NIFOR and other parts of Nigeria (including the Ishan area). There may be other insect vectors. This emphasizes the need for transmission tests to be carried out, with other auchenorrhynchous insects, in Nigeria. Transmission tests with *Oryctes monoceros* may also be an important area of study.

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# PALM BRIEF

## Columbus and Raphia taedigera

The year 1992 saw, not surprisingly, a flurry of activity associated with the celebration of the 500th anniversary of the well known departure for the "Indies." There can be no doubt of the historical significance of the voyages of Columbus and the subsequent Hispanic invasions of the Americas that followed hot-foot upon his discoveries.

Whether the event merits coloration or commiseration depends principally on one's point of view and point of origin. Whatever, the publicity involved has also rekindled interest in the claims for transatlantic contact prior the year 1492. Much of the argument in support of earlier crossings is based on the Arabic and Iberian writings of the period and also the early sixteenth century records of the appearance in the Old World of crops indigenous to the New World. This movement took place with remarkable, and some would assert impossible, rapidity, if indeed it was post-Columbian (Tuley 1992).

For those not familiar with *Raphia* palms, the numerous species included in the genus are entirely confined to the African Continent with the one exception of *Raphia taedigera*. There are conflicting arguments as to the status of this species and, particularly, as to whether it is indigenous or introduced to the New World (Otedoh 1977). In the Americas, the plant occurs in two, relatively confined, geographically distinct populations, one in coastal Brazil and the other in the Panama/Nicaragua Isthmus. In Africa, there is a scattering of records for the West Coast between the Niger and Congo deltas. This palm is very similar indeed to the ubiquitous *R. vinifera* P. Beauv. of West Africa and might well be considered to fall within the normal range of variation found in that species or perhaps as a recognizable variety of it. However, as Otedoh points out, the mesocarp of both tends to be low in saponins (highly effective fish poisons found in some other members of the genus) and it is commonly eaten and used for oil in West Africa. He proposes that the fruit was probably employed in the provisioning of post-Columbian slave vessels and viable seed thus carried to the New World. This could well be the case, but if it were a regular feature, perhaps a more diffuse establishment pattern and a wider scatter of recorded sites would be anticipated. Also one would question the probity of the slave masters and their ruffian crews in making anything other than minimal arrangements for the provisioning of their cargo, as they would have looked upon it.

If, however, we consider the evidence for pre-Columbian Moorish expeditions across the Atlantic, the roles would be reversed. European Christian slaves ignorant of local foodstuffs would be manning the sweeps with Berber and Negro troops, familiar with such, forming part of the crew. In such circumstances, the likelihood of a whole range of African foodstuffs being selected to provision the journey is far more likely. Also, if these two-way crossings were to become a regular feature, then the prospect of deliberate planting of favored plants from either shore becomes a real possibility. Such a scenario would certainly extend the historical time frame for such movements and give greater credence to the "Introduction" school of thought.

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