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Light Based Mass Trapping of Insects in Okomu Oil Palm Estate, Benin, Edo state, Nigeria.

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ABSTRACT

Nineteen species of insects belonging to five different orders were identified from light traps monitored at three trapping heights from January to December 1999, at Okomu Oil Palm Estate. The order Coleoptera (73.6 % occurrence) was the most abundant in the three trapping levels. The mean number of insects recovered were 13.05 at (undergrowth), 7.99 (middle) and 12.44 (crown) level of palms. The level of trap placement did not significantly influence the numbers of insects trapped. It was however, affected by the duration. The numbers of insects trapped was significantly different at different ($P \leq 0.05$) times of the year. Results obtained in this study will help in early warning monitoring of pest population build up and in planning timely, environment - friendly pest management strategies in Oil Palm Plantations in Nigeria.

INTRODUCTION

Various types of light traps are used to survey or make phenological observations on insect species (Bogush, 1958, Geir, 1960). They may be used for general or long-term studies (over seasons) on the diversity of a fauna of a particular group (Southwood, 1960, 1968).

The height above the vegetation at which the trap is exposed will influence the catch. The aerial density of most insects decreases with height, in general, (i.e. the higher the trap the smaller the catch) (Frost, 1958).

Bowden (1982) in analysing factors affecting catches of insects in light trap with a variety of light sources and of different designs showed that all conformed to model describing the functioning of light - trap:

Catch = Constant X square root of W/I , where W = trap illumination, I background illumination. Light - trap catches in different cloud conditions and in open and woodland situations also varied as predicted by the model.

Mizutani (1984) investigated the influences of weather and moonlight on the light trap catches of moths. Regression analysis showed that most of the variation in the number of species collected could be described by an equation involving wind velocity, fog density, change in temperature from the previous night and lightness of the sky during the night. He found that air temperature did not significantly affect either the number of species or individuals.

This investigation aims at describing the insect fauna of the Oil Palm ecosystem, the diversity, association or affinity between species and their composition.

MATERIALS AND METHODS

Study area

All the trapping sites were situated within Okomu Oil Palm Plantation Establishment of the plantation started in 1977. Before 1977, this used to be Okomu Forest Reserve, within the virgin rain forest belt of southern Nigeria, characterised by undisturbed, species - rich, rain forest vegetation.

Description of the traps:

Six traps consisting of four rechargeable white fluorescent lamps (Sunca model), 60 cm long, and two white gas lamps were set up. These were each suspended 15 cm above six plastic basins holding 50 ml. of Decis in 20 litres of water to kill and help retain insects attracted to these sources of light. These traps were set up on six tower ladders of different heights representing the Oil Palm crown level, Mid crown level and undergrowth. (Figs. 1-3 indicate mounted traps at various heights in the plots). These traps were set up at 20 palms distance apart (166 metres apart) and monitored by a team of four workers, from 8 p.m. to 4 a.m. daily. Insects that fell into the basins were collected (scooped with a net), sorted, pinned up using entomological pins, nail varnish, and sun dried. Insects were identified by comparison with previous records (Commonwealth Institute of Entomology, London, now CABI) identified specimens and in Entomology Division, NIFOR, Benin City.

OKOMU OIL PALM COMPANY PLC

ESTATE MAP

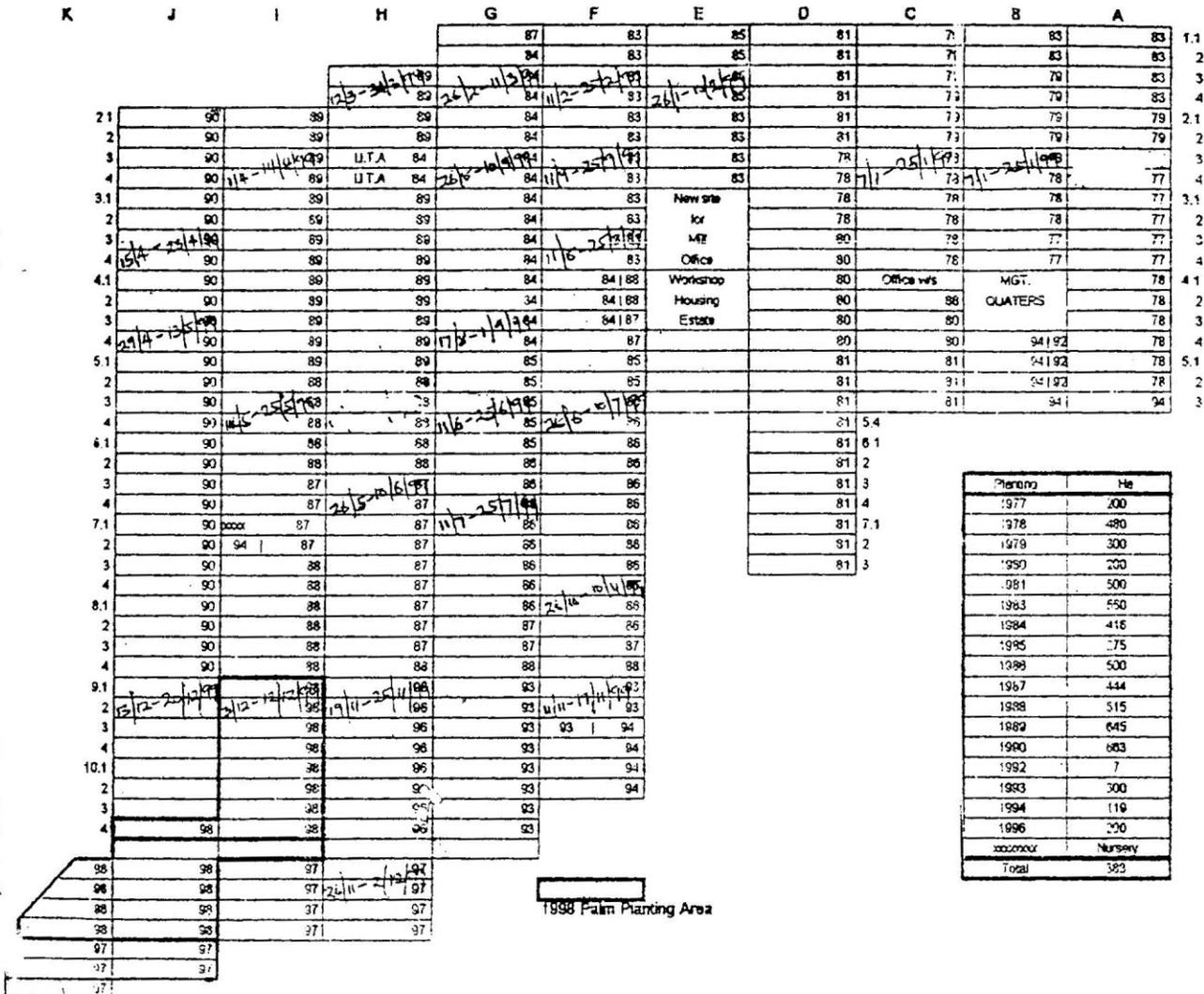


Fig. 4. Estate Map of Okomu indicating I dec' 1999. (Source: Okomu Oil Palm Company PLC)

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These trials were relocated 1 kilometre apart from one another within the plantation, every fortnight. Figure 4 indicates the Estate map of Okomu Oil Palm Company and the Light trapping ladders' movement from January to December, 1999. The duration of the trapping period was from January to December 1999.

Statistical Analysis:

The numbers of insects collected at the different level of trap placements and at the different duration of trapping was collated and subjected to Analysis of variance, using the Mstatc statistical package. Data were analysed as Completely Randomised design with Height, Duration and Interactions of Height and Duration treated as factors.

RESULTS AND DISCUSSION

Mean Distribution of Insects in Light Traps at various levels in Okomu Oil Palm Plantation from January to December 1999.

Traps at Undergrowth level: A total of 11158 individuals were recorded in traps placed at the undergrowth level. This consisted of 6755 individuals recorded in trap 1 and 4403 in trap 4.

Nineteen species of insects and an unidentified species were recorded and identified in these two traps positioned at the undergrowth level from January to December 1999.

The order Coleoptera was the most abundant, and was therefore regarded as the most predominant order.

The list of light trap insect catches are presented in table 1. They were previously coded before identification. Insects recovered were of the orders Coleoptera, Mecoptera, Lepidoptera, Dictyoptera and Diptera.

Table 1. List of insects recovered from the light traps.

-
1. A = *Apate monachus* F. (Coleoptera:Buprestidae)
 2. A1 = *Prionoryctes caniculus* (Coleoptera:Scarabaeidae)
 3. B = *Castnia licus* Drury (Lepidoptera:Castinidae)
 4. B1 = *Mecoptera* (Scorpion flies) *Bittacus* sp.
 5. C = *Mycteromimus insularis* Champ (Coleoptera:Melandryidae)
 6. C1 = *Polyspilota aeruginosa* (Dictyoptera: Mantidae)
 7. D = *Oryctes* sp. (Coleoptera:Scarabaeidae) large specimen with white stripes in thorax's dorsal elytra.
 8. D1 = *Anathesis laconooides* Cand. (Coleoptera:Elateridae)
 9. E = *Simurus opacus* Chaud (Coleoptera:Carabaeidae)
 - 10.E1 = *Rhynchophorus phoenicis* Fabricius (Coleoptera: Curculionidae)
 - 11.F = *Rhinostomus afzeli* Fahraeus (Coleoptera:Curculionidae)
 - 12.F1 = *Chrysops dimidiata* (Diptera:Tabanidae)
 - 13.G = *Aegus chelififer* Macl (Coleoptera: Lucanidae)
 - 14.G1 = Sp. et genus indet.
 - 15.H = *Odontolabis dalmani* Hope (Coleoptera:Lucanidae)
 - 16.H1 = *Camarothelops brauteri* Kolbe (Coleoptera:Tenebrionidae)
 - 17.I = *Chiroscelis digitata* (F.) Diptera:Culicidae) det. E.A. Duffy 1975
 - 18.I1 = *Tribolium castaneum* Herst (Coleoptera:Tenebroinidae)
 - 19.J = *Oryctes monoceros* (Coleoptera:Scarabaeidae)
 - 20.J1 = *Mylabris* sp. (Coleoptera: Meloiidae)
-

Table 2 indicates the species composition in each order recovered from the light traps during the trapping period. The order Coleoptera (14/19 x 100) was the most common (73.6 %), followed by Diptera (10.5 %), while Lepidoptera, Mecoptera and Dictyoptera each had (5.2 %) abundance.

Table 2. Species composition in each order recovered from the light traps

| Orders of insects | Number.of species | % Composition |
|-------------------|-------------------|----------------------------|
| Coleoptera | 14 | 73.6 |
| Lepidoptera | 1 | 5.2 |
| Mecoptera | 1 | 5.2 |
| Dictyoptera | 1 | 5.2 |
| Diptera | 2 | 10.5 |
| Total | 19 | 99.7 approximated to 100 % |

Table 3 indicates the mean numbers (frequency) of each species in traps placed at the undergrowth level during the period.

Rhinostomus afzeli (Coleoptera:Curculionidae) had the highest frequency of occurrence (7.5%) within the order Coleoptera. An *Oryctes* sp. (Coleoptera:Scarabaeidae), a large specimen with white stripes in the thorax's dorsal elytra had the least frequency of occurrence (0.55%).

Chiroscelis digitata (Diptera: Culicidae) had the highest frequency (7.23%) of occurrence amongst the other orders in the 2 traps positioned at the undergrowth level, followed by *Castnia licus* (Lepidoptera: Castniidae) (6.74%). *Bittacus* sp (Mecoptera:Bittacidae) had the least frequency of occurrence (3.48%) among all the other orders.

Traps at the Midway Level

A total of 6579 individuals made up of 2795 in trap 2 and 3784 in trap 5 were recovered from traps positioned at the midway level.

Rhinostomus afzeli (Coleoptera:Curculionidae) was similarly found to be most predominant in the traps placed at the midway level. It had a percentage occurrence of 2.81.

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Table 3. Mean* No. of Insects recovered at various Light trap levels from January to December 1999 (arranged in a decreasing order)

| Code | Undergrowth | Code | Mid Level | Code | Crown level |
|------|-------------|------|-----------|------|-------------|
| F | 19.75 | F | 10.75 | F | 19.60 |
| H | 19.15 | J | 9.65 | C | 16.50 |
| A | 18.97 | G | 9.25 | J | 16.00 |
| C | 18.50 | E1 | 8.85 | A | 15.77 |
| G | 17.55 | A | 8.68 | F | 15.03 |
| E | 17.45 | H | 8.40 | H | 15.03 |
| J | 16.50 | J1 | 8.24 | G | 14.62 |
| J1 | 11.60 | C | 8.10 | E1 | 11.00 |
| H1 | 11.50 | H1 | 7.75 | A1 | 10.60 |
| I1 | 10.55 | E | 7.36 | I1 | 10.20 |
| A1 | 10.20 | D1 | 7.35 | H1 | 10.05 |
| E1 | 9.80 | A1 | 6.90 | J1 | 8.94 |
| D1 | 6.65 | I1 | 6.88 | D1 | 8.75 |
| D | 1.65 | D | 1.80 | D | 2.00 |
| I | 18.50 | C1 | 9.35 | B | 18.50 |
| B | 18.00 | I | 9.05 | I | 16.30 |
| F1 | 11.00 | B | 8.30 | B1 | 10.50 |
| C1 | 9.50 | F1 | 8.15 | G1 | 10.40 |
| G1 | 9.20 | G1 | 7.95 | F1 | 10.05 |
| B1 | 5.35 | B1 | 7.30 | C1 | 8.90 |
| MEAN | 13.05 | | 7.99 | | 12.44 |

*Mean of 2Traps

The order Coleoptera was also the most abundant of the five orders recorded in this level. The same *Oryctes* sp as recorded in the undergrowth level also had the least frequency of occurrence (1.13%).

Polyspilota aeruginosa (Dictyoptera:Mantidae), which has been noted to be a predator of some insects, had the highest frequency (9.33 %) of occurrence amongst all the other orders recorded in the midway level while *Bittacus* sp. (Mecoptera: Bittacidae) (8.48 %) had the least frequency of occurrence.

Traps at the Crown level

A total of 7255 and 2979 insects were recorded in the two traps set up at the crown level. *Rhinostomus afzeli* (Coleoptera:Curculionidae) was also found to be the most predominant in the traps placed at the crown level. It had a percentage occurrence of 7.3.

The order Coleoptera was similarly the most predominant in this level. *Oryctes* sp. was the least frequent within the order Coleoptera (0.85 %) *Castnia licus* (Lepidoptera:Castniidae) had the highest frequency of occurrence (7.51%) among the other orders recovered at the crown level, while *Polyspilota aeruginosa* (Dictyoptera: Mantidae) had the least frequency of occurrence (3.6 %).

These recoveries of 1158, 6579 and 10134 insects at the undergrowth, midway and crown level of the palms may indicate the availability of vegetation at the undergrowth and crown (green fronds) while there is an absence of leaves at the midway level for insects to hide or seek shelter. This observation follows Bowden's 1982 observation that light trap catches in differing cloud conditions, shelter and in open and woodland situations varies.

Locational variation (the relocation of traps one kilometre apart from each other every two weeks within the oil palm estate), did not have any effect on the species composition. Berg *et al* 1994, similarly found that within forests, habitat preferences seem to be similar for different taxa such as vertebrates, cryptograms, invertebrates and vascular plants.

The level of trap placement during this study did not significantly influence the numbers of insects trapped. It was however affected by the duration. The numbers of insects trapped were significantly different at different times of the year (Table 4).

Table 4. Analysis of variance for effects of height and duration on mean numbers of insects recovered.

| K value | Source | Degrees of freedom | Sum of squares | Mean square | F value | Prob. |
|---------|----------|--------------------|----------------|-------------|---------|-----------|
| 2 | Factor A | 2 | 297.578 | 198.794 | 0.9591 | NS |
| -3 | Error | 3 | 465.495 | 155.135 | | 0.0003*** |
| 4 | Factor B | 20 | 6060.825 | 303.041 | 3.1166 | NS |
| 6 | AB | 40 | 5834.095 | 70.394 | 0.7240 | |
| -7 | Error | 60 | | | | |
| | Total | 125 | 15473.659 | 97.235 | | |

Coefficient of variation = 110.83 %

S.E for means

group 2 (Height) 1.9219 n = 42

S.E for means

group 4 (Duration) 4.0256 n = 6

S.E. for means

group 6

Height x Duration 6.9726 n = 2

The maintenance of biodiversity has become one of the most important goals for conservation, due to an increasing awareness that Integrated Pest Management with emphasis on Biological control is a more sustainable and environmentally friendly method of Pest control.

Information presented here of the abundant and rare species helps in early warning monitoring of pest outbreaks in the oil palm plantation. It may also help in planning timely application of insecticides when necessary and in minimizing the quantity of insecticide usage.

Insects have been noted to respond to various levels of ultra violet light, hence not all species of insects were recovered from this light trapping studies. Though some insects like *Oryctes monoceros* have low % incidence of occurrence, they are noted to inflict severe destruction on palms at even low population levels. Thus a prior knowledge of the destructive habit of the insects, backed up with the information gathered about their population build up (from light trap recoveries) would help in planning better Pest Management strategies.

From information gathered from previous research investigations, Lepesme (1947), Lever (1969), Wood (1968), Richards and Davies (1977), and Agwu (1981), the following summaries (Table 5) of the economic importance of these insects from light traps in this study can be made. This emphasises the necessity for the continuous investigation of the spatial and temporal distribution of these insects in Oil Palm estates in Nigeria.

Table 5. Importance of insects recovered from the Light traps

| <i>Insect</i> | <i>Known Importance</i> |
|--------------------------------|--|
| <i>Rhinostomus afzeli</i> | = Adults are generally crown and trunk feeders. They often gain entrance to palms through wounds made by <i>Oryctes monoceros</i> or by pruning |
| <i>Odontolabis dalami</i> | = Adults are fruit, flower or leaf feeders. |
| <i>Apate monachus</i> | = Adults feed on trunks and branches. |
| <i>Simurus opacus</i> | = Larvae and adults are predaceous and occasionally attack <i>Oryctes</i> grubs. <i>Mycteromimus insularis</i> = Trunk feeders. |
| <i>Oryctes monoceros</i> | = Adults bore into young unopened foliage of the central spear. May also gain entrance through the petioles. Spears may become severed at the base leading to "spearrot." |
| <i>Prionoryctes caniculus</i> | = Roots and trunk feeders. |
| <i>Camarthelops branteri</i> | = Often associated with dead and fallen trunks. |
| <i>Mylabris</i> sp. | = Adult beetles feed on the anthers destroying flowers. Larvae reported to feed on grasshopper eggs and could thus be beneficial. |
| <i>Rhynchophorus phoenicis</i> | = Crown and trunk feeder. Grubs gain entrance to the heartwood of the palm through wounds made by <i>Oryctes</i> or pruning. Associated with the incidence of red ring disease (a lethal declining disease of palms) |
| <i>Tribolium casternium</i> | = Mostly pest of stored products. |
| <i>Anathesis laconoides</i> | = Occur in rotting logs. Predaceous on grubs of <i>Oryctes</i> and other species of grubs inhabiting rotting logs. |
| <i>Bittacus</i> sp. | = Known to prey upon small Dipterans. |
| <i>Chiroscelis digitata</i> | = Culucidae are mostly known as the intermediary hosts of malaria, yellow fever, filariasis, dengue and numerous viruses. |
| <i>Castnia licus</i> | = Large caterpillars which burrow between the leaf bases and the trunk of the palm, causing older leaves to hang down the trunk and the nuts to fall through lack of adequate support. |
| <i>Polyspilota aeruginosa</i> | = They feed voraciously on flies, grasshoppers, caterpillars etc. |
| <i>Chrysops dimidiata</i> | = A known vector of <i>Loa loa</i> , which is responsible for the affliction known as Calabar swellings among the inhabitants of West Africa. |

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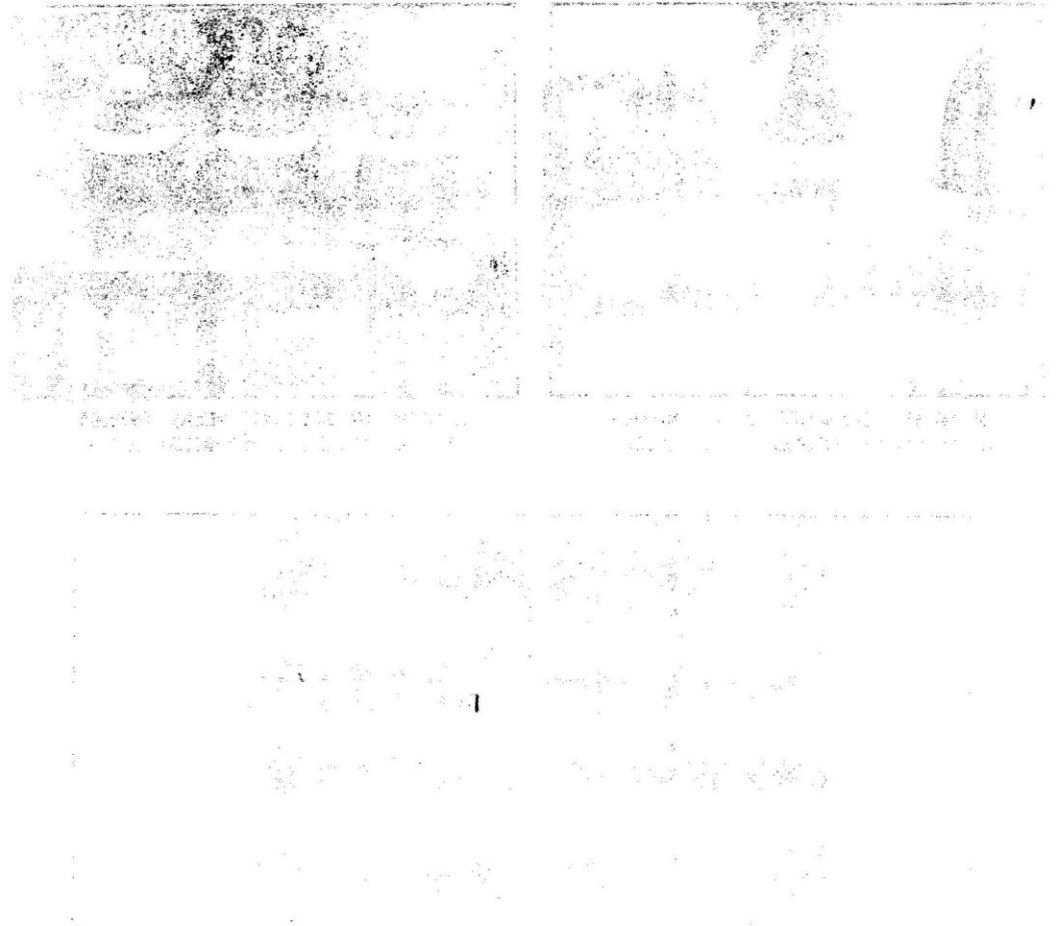
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