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Distribution of Latoia Viridissima and Oryctes Monoceros in Cross River Oil Palm Estates, Nigeria

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Abstract: A survey was undertaken to study the distribution and nature of infestation of *L. viridissima* and *O. monoceros* in 4 oil palm plantations in Cross River State, Nigeria. The results showed that while *O. monoceros* was fairly prevalent across the 3 Agro-ecological zones of the state, *L. viridissima* was low in numbers except at Ibiae and Boki plantations where outbreaks was recorded. The mean number of *O. monoceros* was 13.8 per block in Ibiae, 16.4 in Boki, 13.4 in Calaro and 15.8 in Nsadop oil palm plantations respectively showing no significant differences ($p>0.05$) among the plantations. However, there were significant differences ($p<0.05$) in the mean number of *L. viridissima* with 18 per block in Ibiae, 10.8 in Boki, 6 in Calaro and 5.2 in Nsadop. Studies on the growth stages of *L. viridissima* under laboratory conditions showed that, the entire developmental period from egg to adult was between 86-123 days (mean 98 days).

Key words: *Oryctes monoceros*, *Latoia viridissima*, distribution, oil palm, growth stages

INTRODUCTION

The oil palm (*Elaeis guineensis* Jacq.) is a monoecious monocotyledonous plant which originated from the tropical forest region of West Africa. The most common products of this popular economic tree, palm oil and kernel are used for the manufacture of margarine, polishes, ink, soap and candles (Opeke, 1982; Jacquemard, 1998). Cross River State of Nigeria covers a land area of 20,156 km^2 and located at 5°5^{1}N, 8°3^{1}E with 3 main vegetation zones namely; mangrove, rainforest and derived savannah zones. The mangrove zone consists of creeks and swamps with an annual rainfall of about 2000 mm. The rainforest zone has a mixture of tall and small trees with a moderate rainfall of 1500-2000 mm annually, while the derived savannah zone has thorny bushes, scattered trees and low grasses with light rainfall of 500-1000 mm per annum. Oil palm is the major source of income of Cross River Stateand a good number of oil palm plantations have been established across the three vegetation zones of the state. Fresh fruit bunch yields of 4-7 tonnes per hectare (ha)and palm with oil yields of 400-900 kg^{-1}a annually have been reported from the estates. The environments of oil palm plantations consisting of large artificially reproduced monospecies stands are especially conducive to the survival, multiplication and dissemination of various insect pests. Damages caused by these pests include deformation, defoliation and destruction of parenchymatous tissues of leaves, inflorescence and stems by caterpillars and adults. Some insects especially members of the order Coleoptera could burrow into stems and rachis thereby creating entry points for plant pathogens that cause oil palm diseases (Ukeh, 2002). Among the major oil palm pests in Nigeria, the nettle caterpillar, *Latoia viridissima* Holland (Lepidoptera: Limacodidae) and rhinoceros beetle, *Oryctes monoceros* Oliv. (Coleoptera: Scarabaeidae, Dynastinae) are the most serious pests in plantations. The objectives of this study were to investigate the distribution of *L. viridissima* and *O. monoceros* in four major oil palm plantations in Cross River State, establish their nature of infestation and report the growth stages of *L. viridissima*.

MATERIALS AND METHODS

Survey of oil palm estates: A survey of the distribution of *L. viridissima* and *O. monoceros* was carried out in four major oil palm plantations in Cross River State, Nigeria between August 2001 and September 2002. The plantations were Calaro, Ibiae, Nsadop and Boki that cut across the three vegetation zones of the state. The palm trees were planted in an equilateral triangular pattern, 9 m per side, with an interline distance of 7-8 m. The experimental design was randomize complete block in which the four plantations were regarded as treatments. In each treatment, five blocks (replicates) of 1ha dimension were marked out with a plant population of 105 palms each. Trees of about 3 years old, 4-5 m high and which do not have yet a large leaf volume were selected for sampling. Total five trees were sampled per block on a

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monthly basis and the entire older leaves were cut off from the stem of each tree leaving only the unopened spear leaves. Each palm frond was observed for leaf-eating *L. viridissima* larvae in various developmental stages, while the leaf stalks and inflorescence were observed for *O. monoceros* larvae and adults. During each sampling period, different trees were selected alternating between the northern and southern halves of each block. The number of insect species obtained from each block were identified, recorded and preserved separately in pampel fluid. Pampel fluid was prepared by mixing the following chemicals together in this order: 30 parts of distilled water; 15 parts of 95% ethyl ethanol; 6 parts 40% ($w^{-1}v$) formaldehyde; and 4 parts glacial acetic acid. The data collected were subjected to the Analysis of Variance (ANOVA) and Tukey's pair wise comparison used to determine the difference between significant treatment effects using the on-line statistical software MINITAB version 14.

Growth stages of *L. viridissima*: The pupae of *L. viridissima* collected from Ibiae oil palm estate in 2003 were reared in the University of Calabar laboratory at 18-32°C and 60-80% rh. On adult emergence, males and females were paired and placed in netted wooden cages of 30×45×30 cm. Six pairs of the insects were placed in 4 rearing cages. Dry sticks and fresh palm leaflets were placed in each of the 4 rearing cages with cotton wool soaked in honey for possible consumption (Igbinosa, 1985). The cages were checked daily for mating and oviposition. Palm leaflets found with egg masses were cut into sizes and placed on dry 125 mm Whatman No. 1 filter paper (Springfield Mill, Maidstone, Kent, England) placed in Petri dishes. Wetted cotton wool was placed beside the eggs for maintenance of high humidity (Bolton, 1979). Two days after hatching the larvae were placed in each of the 4 rearing cagesand fed with fresh and mature oil palm leaflets every 2 days. Frass, dead larvae and pupae, which could not emerge were removed from the cages regularly.

RESULTS

The distribution of *L. viridissima* and *O. monoceros* across the ecological zones of Cross River State as represented by four oil palm plantations is shown in Table 1. There were significant differences ($p < 0.022$) in the mean number of *L. viridissima* across the plantations, as 18 of the insect per block were recorded at Ibiae, 10.8 in Boki, 6 in Calaro and 5.2 in Nsadop. However, *O. monoceros* was fairly distributed as there was no significant differences ($p>0.409$) in the mean number of the pest among the 4 plantations. The mean number of *O. monoceros* at Ibiae palm plantation was 13.8 per block, Boki 16.4, Calaro 13.4 and 15.8 in Nsadop, respectively. The result of the growth stages of *L. viridissima* under laboratory conditions are presented in Table 2. The mean developmental stages of the insect were: Egg 7 days; larva 52 days; pupa 33 daysand adult 6 days.

Table 1: Mean distribution of *Latoia viridissima* and *Oryctes onoceros* in Cross River oil palm estates

Palm estate	*L. viridissima*	*O. monoceros*
Ibiae	18.0±1.48[a]	13.8±1.67[a]
Boki	10.8±0.95[b]	16.4±1.81[a]
Calaro	6.0±0.87[c]	13.4±1.64[a]
Nsadop	5.2±0.71[c]	15.8±1.78[a]

Values followed by the same letter superscript are not significantly different ($p<0.05$)

Table 2: Mean growth stages of *L. viridissima* under laboratory onditions

	Egg (days)	Larva (days)	Pupa (days)	Adult (days)
Max. No. of days	8	65	41	9
Min. No. of days	6	49	28	3
Mean No. of days	7	52	33	6

DISCUSSION

Distribution of *L. viridissima* and *O. monoceros*: Generally, *L. viridissima* infestation was common on adult palms with the larvae spreading from one palm leaf to anotherand damages done was negligible at low population levels. However, *L. viridissima* larvae were predominant in Ibiae and Boki oil palm estates where outbreaks were reported. These numerous populations of larvae observed in Ibiae and Boki oil palm estates, could be attributed to the high fecundity of the females noted for laying hundreds of eggs over their life time (Godfray *et al*., 1987; Igbinosa, 1992). The collective feeding activities of larvae reported in these plantations resulted to devastating defoliation of the older leaflets leaving only the midrib and rachis, with the affected palm fronds taking a "fish bone" appearance (Ukeh, 2002). In addition to *L. viridissima*, *L. pallida* Moschl and *Casphalia extranea* Walker (Lepidoptera: Limacodidae) have been reported as defoliators of Palmaceae in Cote d'Ivoire (Fediere *et al*., 1990).

The results of this study also confirmed similar reports by Mariau *et al*. (1981) that *O. monoceros* is one of the main pests in the oil and coconut palm plantations of tropical Africa, particularly in Nigeria (Ukeh *et al*., 2003). The Asian sibling species, *O. rhinoceros* L., which could be found throughout the Asia-Pacific area, has a similar ecology and equally attack cultivated palms (Waterhouse and Norris, 1987). The adult beetles of *O. monoceros* burrowed into the cluster of developing spears in the crown and bored through the petioles into softer tissues of the young unopened leaves. When these leaves developed and opened, the effect can be seen as

typical V-shaped cuts so characteristic with the coconut palm. In the oil palm, the effect was rather dilapidated appearance on the young treesand considerable damage could occur in areas where breeding sites abound, in particular the rotten tissues of former stands. Where the rachis has been penetrated, leaves may snap offand previous attacks may be detected by the presence of holes in the petioles of older leaves. Hartley (1988) reported that *O. monoceros* infestation was most dangerous in young palms since the growing point may occasionally be reached or a bud rot may develop and this could kill the palm. Recently, Allou *et al.* (2006) also reported that damage in Africa could be worse through attacks by *Rhynchophorus phoenicis* (Fabr.), which lays eggs in the galleries made by *O. monoceros* and often kills palms. The fairly even distribution of *O. monoceros* across the agro-ecological zones of Cross River State could either be attributed to poor cultural practices in the plantations or the insect's better tolerance to environmental factors with particular reference to the size or degree of sclerotization of the elytra and cuticle as well as on adaptations linked to their normal habitat. Another factor for the prevalence of *O. monoceros* could be the production of aggregation pheromones by the males which are employed in chemical communication to attract both sexes for mating and aggregation at a food source. Males are reported to emit a blend of ethyl 4-methyloctanoate, a major component (Gries *et al.*, 1994) and 4-methyloctanoic (Alfiler, 1999) occasionally mixed with minor components: 4-methylo-ctanyl acetate (Chung, 1997), methyl 4-methyloctanoate (Endrodi, 1985), 4-methyloctanol and nonanyl acetate (Gharib, 1970). Electroantennography and field trapping experiments demonstrated that ethyl 4-methyloctanoate was an essential component of the male aggregation pheromone of *Oryctes* speciesand has been employed alone and synergistically with fresh palm odours to capture the beetle in pheromone-baited traps (Rochat *et al.*, 2004; Allou *et al.*, 2006).

Growth stages of *L. viridissima*: In the laboratory the newly emerged females commenced egg-laying after 2-3 days in masses. The newly egg was slightly ovoid, about 1-2.5 mm in length along its longest axis. The eggshell was transparent and the developing larva could be seen through a binocular microscope (Nikon House, Surrey, England) inside the chorion prior to eclosion. The egg stage lasted between 6-8 days, while adults lived up to 9 days.

Larval growth: After hatching, the first instar larva remained on the location of the egg and started feeding. It was a pale tiny caterpillar of about 3.5 mm in length, but the matured larva measured about 32-36 mm. There were 6 instars in all; the first two were brownish and the rest green in colour. All larval instars habitually remained on the undersurfaces of leaves, fed on the lower epidermal and mesophyll layers and creating holes in the leaf blades and leaf margins. Like all Limacodids, the larvae of *L. viridissima* have lost their prolegs and in their place was a ventral adhesive surface. A skirt-like ridge, the subspiracular flange that assists adhesion by allowing the caterpillar to form an airless seal to the substrate, surrounded the adhesive surface. The thoracic legs were still visible though much reduced and probably functionless. The head and first thoracic segment were retracted beneath the rest of the thorax except during feeding. The spines were arranged on protuberances termed scoli, while the scoli were arranged in paired rows with one in each row on every segment (Godfray *et al.*, 1987; Ukeh, 2002). The larval period from eclosion to cocoon formation lasted between 49-65 days.

Pupation: Pupation took place in silken spherical cocoon adorned with brownish stinging spines, presumably to deter predators. Cocoons containing male moths were smaller in size than those containing the female insects. The pupa inside the cocoon was short and stout with the wings, legs and antennae free from the body. The entire pupal stage lasted between 28-41 days under laboratory conditions.

Adult stage: The adult emerges through a neat circular hole cut at one end of the cocoon. The moths were greenish and medium in size, stout-bodied with relatively coarse and dense scaling. The wings were triangularand the proboscis rudimentary with large palps. The head was broad with large globular eyes and the head, thorax and abdomen adorned with tufts of hair. The females were larger than the males, but the antennae of the male were more feathery then those of the female.

CONCLUSION

A survey was undertaken to study the distribution and nature of infestation of *L. viridissima* and *O. monoceros* in four oil palm plantations in Cross River State, Nigeria. The results showed that while *O. monoceros* was fairly prevalent across the three agro-ecological zones of the state, *L. viridissima* was low in numbers except at Ibiae and Boki plantations where outbreaks was recorded. The growth stages of *L. viridissima* under laboratory conditions showed that, the entire developmental period from egg to adult was between 86-123 days (mean 98 days).

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