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Morphometry and Preffered Feeding Site of Egyptian Mealybug (Icerya Aegyptiaca *Douglas) on Croton Codiaeum Variegatum Plant*

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Abstract

Morphometrical analysis of the mealybug, Icerya aegyptiaca *(Douglas) was studied on Codiaeum variegatum under laboratory conditions between August and December, 2010. Microscopic slides were prepared for the existing life forms according to the conventional entomological method. Observations were made on the body structure, appendages and dimensions as possible future tools in taxonomic key's construction. Result showed that there were three instars and adult stage. There was a significant variation in the body structure, length and dimensions of body appendages of the various larval forms of the insect. The mean body length (cm) of the various instars was significantly different and was as follows: first instars having 1.62±0.03, second instars 1.86±0.03 third instars 2.97±0.07 and the adults to be 3.97±0.03 respectively. Body width dimension was not significantly different and first instars: 0.83±0.02; second instars: 1.04±0.01; third instars: 1.79±0.06 and the adults: 1.85±0.01 respectively. Mean antennal length was recorded to be: 1st instars: 0.53±0.02; 2nd instars: 0.64±0.01; 3rd instar: 0.84±0.02 and the adults: 0.89±0.01 respectively. The progressive development in the length of the stylet with respect to the age of the insects was thought to be affected by feeding requirement and environmental conditions and there was a progressive increase in the dimensions of nearly all the parameters examined after each moult.*

Keywords: Body appendages, *Codiaeum variegatum*, *Icerya aegyptiaca*, instars, morphometry.

Introduction

Mealybug, I. aegyptiaca (Douglas) is highly polyphagous insect pests known to feed on about 123 species of plants belonging to 49 plant families (Ben-Dov *et al.,* 2009). They have spread beyond the southern part of Nigeria to the Northern Guinea savanna where it is regarded as pests or disease vector in Nigeria (Ben-Dov ,2005;Akintola and Ande, 2009).Akintola *et al.* (2009) have also reported that life histories of the various species of mealybug recorded are thought to vary with environmental conditions in different localities, but in most other parts of Nigeria, where greater proliferation of species occurs, there are still very many that are yet to be described (Akintola and Ande 2006).

According to Huxley (1992), Croton (*Codiaeum variegatum)* was described as an evergreen shrub growing to 3 m tall and has large, thick, leathery, shiny evergreen leaves, alternately arranged, 5–30 cm long and 0.5–8 cm broad. The inflorescences are long racemes 8–30 cm long, with male and female flowers on separate inflorescences, the fruit is a capsule 9 mm diameter, containing three 6 mm seeds. Crotons only survive outdoors where temperatures do not normally drop below 10° to 13°C in winter; colder temperatures can cause leaf loss, the plant is used for ornamental and medicinal purposes.

According to Habib and Taghavi (2007), *I. aegyptiaca* (Douglas) has the tendency to cause outbreaks in areas with little wind flow, such as the inner areas of bushes and can also cause cosmetic damage when its abundant white wax cover leaf surfaces. When its population densities are high, they may induce leaf drop symptoms (i.e. leaf yellowing, defoliation, reduced plant growth) and in some cases, dieback of the branches or of the entire plant due to feeding stress. Habib *et al.* (2007) added that, they could often introduce plant pathogens such as viruses and fungi into a host. Akintola and Ande (2008) documented that unless there is a widespread attack in an area; the damage is usually overlooked or ascribed to other causes.

It has been stated that morphological identification of mealybug is notoriously difficult, time-consuming and requires a high level of taxonomic expertise (Gullan & Kosztarab, 1997; Millar, 2002; Watson and Kubiriba, 2005; Akintola and Ande,2007). Also the study of the life history and pattern of biological activities are difficult under field conditions because of the interference of biotic and abiotic factors, but despite this, laboratory studies have become essential at least for the purpose of reproduction and developmental stages description. This work, therefore, was done in order to describe the morphometric and pattern of dispersal of the insect on croton *C.variegatum* plant under a field condition.

Materials and methods

A study on biology, morphology and morphometry of *I. aegyptiaca* (Douglas) was carried out in the laboratory of the Department of Pure and Applied Biology, Ladoke Akintola University of Technology Ogbomoso, Nigeria using the population collected from naturally infested fields of *Codiaeum variegatum*. At the experimental site, twigs of croton (*Codiaeum variegatum)* was collected and brought to the laboratory and maintained in pots containing soil. Ten individual insects were separated carefully after each moult from the infested host plant with a forceps and with the aid of entomological pin into Petri dishes. Each stage of mealybug on the plant was then used for slide preparation to observe its externals.

Photographs were taken using an electronic ocular microscope manufactured in UK (model number:ANL5110000MSP0904 BRESSER) and the measurements were made using a dissecting microscope which has a graduated eyepiece inserted into it. Observations were made on the physical characters and morphometry such as colour, shape, body length and width and other appendages such as antenna and leg of the various stages of development according to the method of Spangler and Angelo (1991). Data obtained were subjected to analysis using DMRT, while mean and standard errors were calculated.

Results and discussion

Noticeable shapes were broad and oval while some were elongated, and orange in appearance, all covered with white wax. They were found mostly on adaxial surface of *C.variegatum* (Table 1) aggregating on the mid rib and covered with waxy secretion on the host plant and spread to the petioles of the leaves when there was heavy infestation. The preference for the adaxial surface is suspected to be for the purpose of feeding and protection against desiccation and predators. During heavy infestation, the colonies were widely spread to cover the entire leaf of the host. The appearances and pattern of mealy wax enabled the organism to appear star – like. The 1st and 2nd instars were elongated in shape as well and light orange in appearance while the 3rd instars and adults stages was broadly oval in shape (Table 1).

Rainfall and strong wind use to dislodge insect from the point of attachment thereby preventing feeding from taking place. Therefore, disruption of feeding and feeding regime by physical, chemical and biological factors play major roles in the efficiency of feeding and its conversion. In line with the findings of Jurie *et al.* (2001), high rainfall was found to have decreased the survivorship of Geometroid moth larvae that they studied. They posited further that during heavy raining periods, the larvae were more likely to be washed off their host plants. Wolda (1978) also observed the same thing on his work on seasonal fluctuations in rainfall, food and abundance of tropical insects.

The antenna was thin, moniliform (bead –like) and has between 6- 8 segments in the various forms (Plate 1). The antennae function almost exclusively in sensory perception. There was also variation in the length of the antenna of the various forms. The eyes were present and the mouth was modified into stylet (Plate 2a; 2b; 2c and 2d). The shape and structure of the Stylets of the different forms were similar to one another. The stylet of the first instars was some- what long and with a bulbous expanded tip, double walled, muscular with less or more suction ability. There was a little change in the architecture of the stylet of the 2nd instar as it was fairly longer .Also the 3rd and adult stylets were observed to follow same pattern.

There was a significant variation in of lengths of the body appendages found on the various instars of *I. aegyptiaca* (Table 2). In terms of body length, the various larval stages differed significantly from each other with a mean of 1.62±0.03 for first instars; 2nd and 3rd instars had 1.86±0.03 and 2.97±0.07 respectively and the adults had 3.97±0.03. Body width has the following; first instars 0.83 ± 0.02^{d}, second instars 1.04 ± 0.01^{c}.

In conclusion, there was no much difference in the body width of the third instars and the adults (i.e.1.79±0.06 and 1.85±0.01) respectively. Generally, there was a progressive increase in the dimensions of nearly all the parameters examined after each moult. The progressive development in the length of the stylet with respect to the age of the insects was thought to be affected by feeding requirement and environmental conditions.

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Table 1. Physical characteristic and various developmental stages of *Icerya aegyptiaca* and their preferred feeding site on *Codiaeum variegatum*

Developmental stage	Colour	Shape	Preferred Surface	developmental period (days)
1st	Light orange	oval	adaxial	0 6
2nd	orange	oval	adaxial	18
3rd	orange	oval	adaxial	12
adult	orange	oval	adaxial	09

Table 2: Morphometric Measurements of Body and Appendages of *Icerya aegyptiaca raised on Codiaem variegatum*.

Developmental Stages	Dimension X ± S.E mm (Range)					
	BL	BW	LA	Length of PTL	Length of MSL	Length of MTL
1st Instar	1.62±0.03^{d} (1.51-1.74)	0.83±0.02^{d} (0.77-0.89)	0.53±0.02^{d} (0.49-0.61)	1.13±0.01^{d} (1.08-1.18)	1.27±0.01^{d} (1.20-1.31)	1.43±0.01^{d} (1.41-1.46)
2nd Instar	1.86±0.03^{c} (1.76-1.99)	1.04±0.01^{c} (0.99-1.08)	0.64±0.01^{c} (0.61-0.67)	1.19±0.01^{c} (1.15-1.25)	1.39±0.01^{c} (1.36-1.43)	1.65±0.01^{c} (1.56-1.69)
3rd Instar	2.97±0.07^{b} (2.77-3.23)	1.79±0.06^{ab} (1.28-1.89)	0.84±0.02^{b} (0.79-0.89)	1.55±0.01^{b} (1.49-1.59)	1.64±0.01^{b} (1.61-1.66)	1.91±0.01^{b} (1.84-1.95)
Adult	3.97±0.03^{a} (3.81-4.05)	1.85±0.01^{a} (1.79-1.89)	0.89±0.01^{a} (0.85-0.92)	1.73±0.01^{a} (1.69-1.77)	1.96±0.01^{a} (1.92-1.99)	2.13±0.01^{a} (2.09-2.18)

Values with Different Letters means are significantly different at P=0.05 using DMRT
N.B (Values in Parenthesis shows the Range)

KEYS: BL- BODY LENGTH, BW- BODY WIDTH, LA- LENGTH OF ANTENNA, PTL- LENGTH OF PROTHORACIC LEG MSL- LENGTH OF MESOTHORACIC LEG LMTL- LENGTH OF METATHORACIC LEG

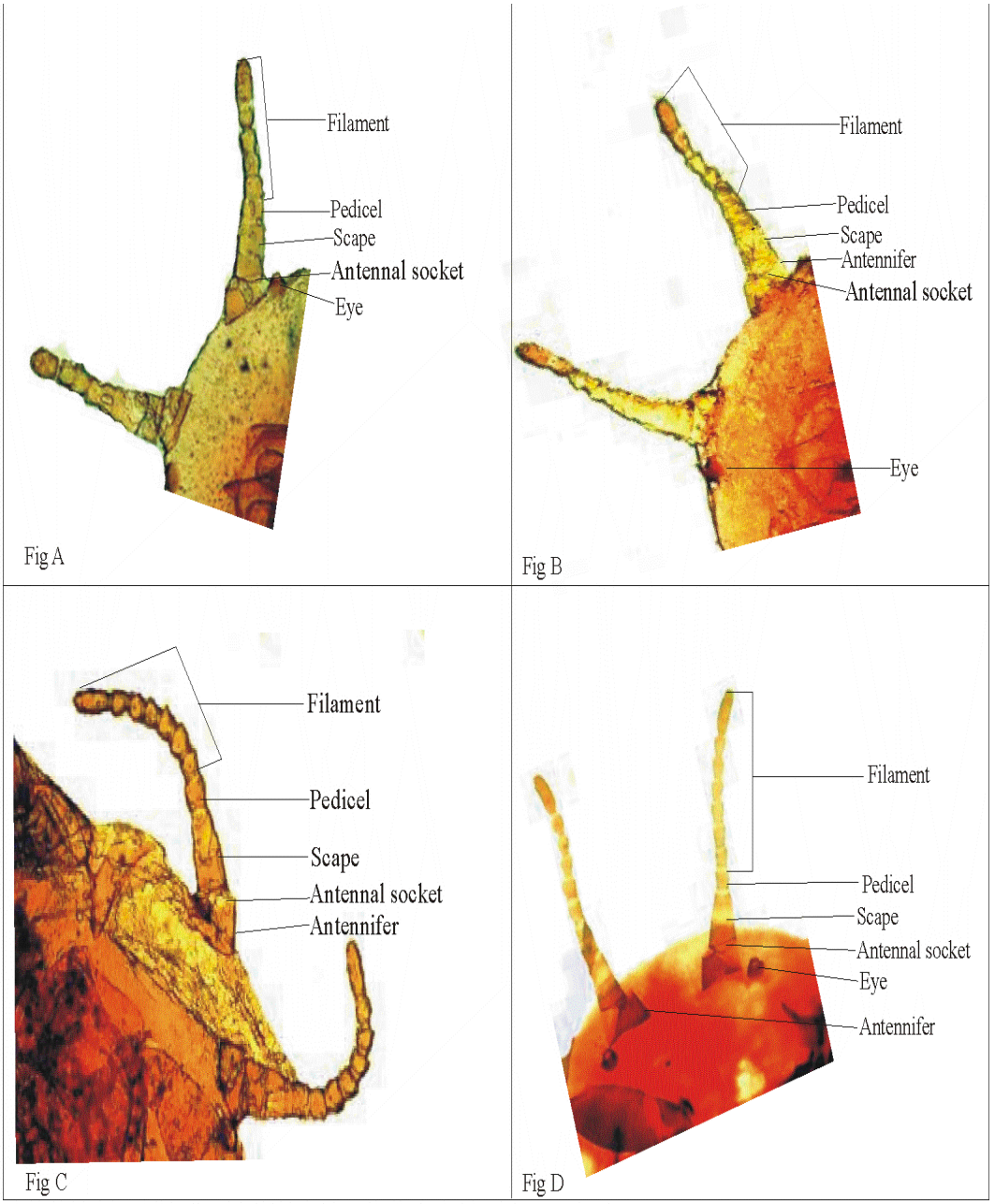

Plate 1: Antennae of different developmental stages of *Icerya aegyptia*

Fig A: antenna of 1st instar; fig B: antenna of 2nd instar

Fig C: antenna of 3rd Instar; Fig D: antenna of adult

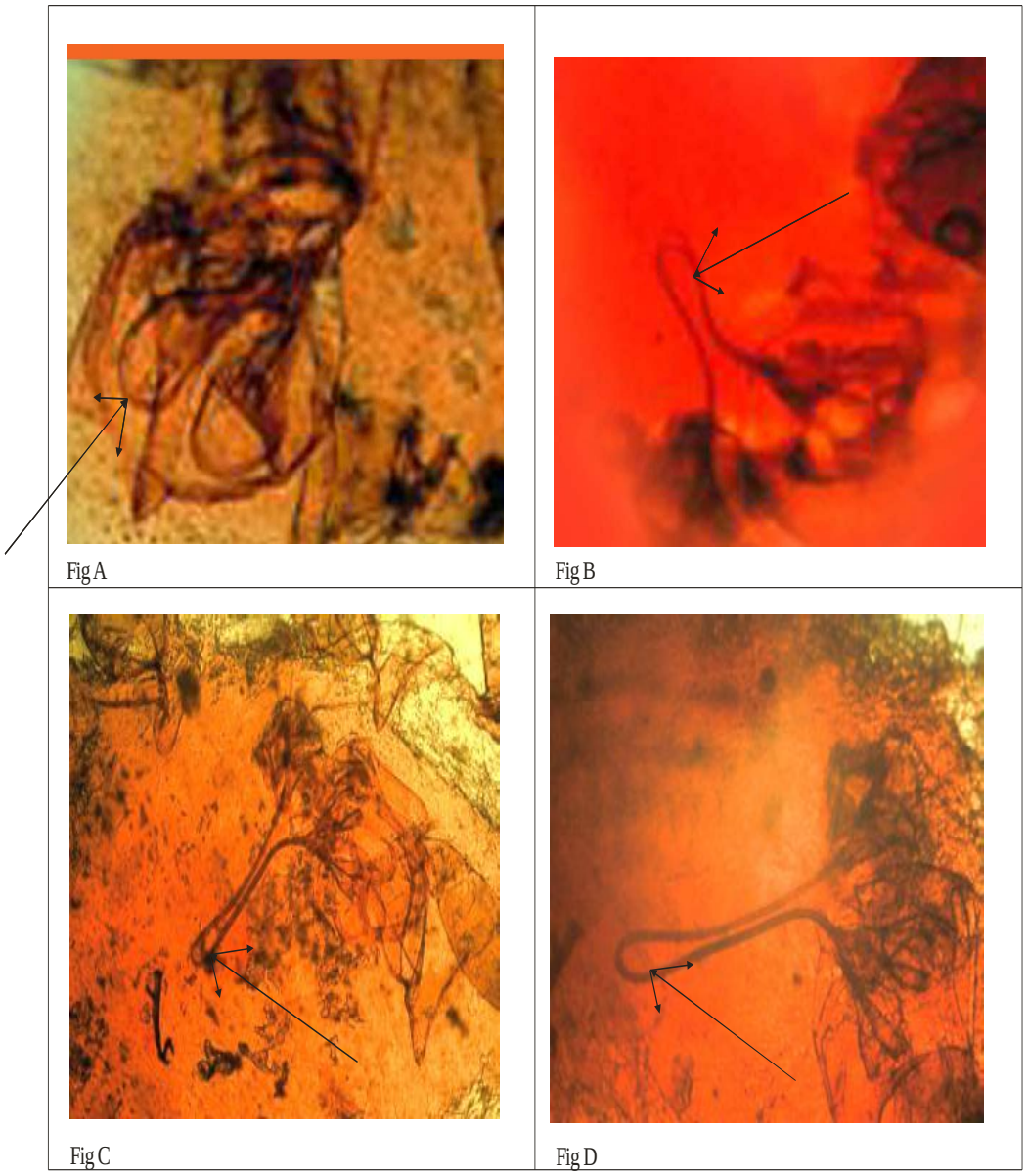

Plate 2 **Fig A stylet of 1st Instar; Fig B stylet of 2nd Instar. Fig C stylet of 3rd Instar; Fig D stylet of Adult.**