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Life history and behaviour of *Rastrococcus invadens* Williams on *Ficus thonningii* in Nigeria

*** [1]A. J. Akintola, and [2]A.T. Ande**

[1]*Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria*

[2] *Department of Zoology, University of Ilorin, Ilorin kwara state, Nigeria*

**corresponding author: johnakintola2004 @ yahoo.com*

Abstract

Investigations were conducted on life history of *Rastrococcus invadens* William (Hemi: *Pseudococcidae*) reared on *Ficus thonningii* plant in the southern guinea savanna of Nigeria. Microscopic slides were prepared for the existing life forms according to the conventional method in entomology. Observations were made on the body structure and dimensions. Attention was paid to body outgrowth and appendages as possible future tools in taxonomic key's construction. Result showed that there were three instars and the adult stage. The entire life history lasted 50 days, adult body length ranged between 10.05mm and 11.34mm (x = 10.80 ± 0.9mm) n = 20 while the body width ranged between 7.34mm and 8.67mm (x= 8.00 ± 0.94mm) n = 20. Behaviours of the neonates and adult regarding movement, feeding and growth were monitored and reported which were found to be greatly different from what was observed in Togo and Benin, (close neighbouring countries of Nigeria) with different abiotic factors such as rainfall, humidity and wind. The possible ecological factors responsible for these differences are discussed.

Key words: Mealybug, *Ficus thonningii*, antenna, stylet

Introduction

Mealybugs, *R. invadens* Williams (Homoptera :Pseudococcidae) which are widely distributed in other parts of the world, have also been recorded as pests or disease vector in Nigeria (Ibekwe and Lawani ,1977). Neuenschwander (1989) and lvibjaro *et al*.(1992) observed that different species of mealybugs have spread beyond the southern part of Nigeria to the Northern Guinea savanna. *R. invadens* is a polyphagous feeder which attack several plants including ornamentals, shade trees, flowers and certain wild species in Makurdi state, Nigeria; each of which has been classified as preferred, occasional and fortuitous host (Ukwela and Liman 2002).

Although, life histories of the various species recorded are thought to vary with environmental conditions in different locality, yet in most other parts of Nigeria, where greater proliferation of species occurs, mealybugs are still very many and are yet to be described (Akintola and Ande 2006).An extensive survey of the occurrence of mealybug was carried out in this zone and preliminary observation revealed some striking differences from what was observed elsewhere by other workers. In the Guinea savanna zone, two hosts, *Ficus thonningii* Blume (Moraceae) and *Mangifera idica* L. (Anarcadiaceae) were found for this insect but in another study in Togo and Benin

by Agounke *et al*. (1988), *M. indica* was also determined as a host and growth and development of the same insect was reported. This then prompted us to investigate the development of this insect on another host in a different ecological zone (Guinea savanna ecological zone). Growth, behaviour, spread and pattern of spread on host, of the insect were determined.

Materials and methods

Five replicates of seedlings of *Ficus thonningii* plant identified on the field were collected from the nursery of the Parks and Gardens department of Ladoke Akintola University of Technology Ogbomoso and nurtured until they became leafy. These seedlings were maintained in cages of 120 x 90 cm and were used to raise mealybugs.

Inoculation

Inoculation was achieved by transference of matured gravid female mealybugs onto the host plant leaf. Adults were retrieved 24 hours after neonates were noticed. A constant surveillance of these set up was maintained and records of events and their respective dates were kept.

Slide preparation

Each developmental stage was treated and prepared on slides as earlier described by Mackenzie (1967); Akintola and Ande (2006; 2008). Body length and width, Lengths of Prothoracic, mesothoracic and metathoracic legs, antenna and stylet were taken in millimeter with the aid of a microscope (Periplan G.F 50/60HZ model 12.5X/16MF) fitted with a micrometer eye piece.

Life cycle

The developmental period was determined as the mean time taken (days) to reach the adults stage with reference to the inoculation date. Various instar durations (stadia) were also determined as time spent (days) while the instar lasted. The behaviour of the neonates, movement on host, feeding and growth were monitored and reported for all the instars and adult respectively. The preferred feeding site, point of stylet insertion, growth, movement, defense behaviours of each of the various life stages encountered were documented for each developmental stages according to the method of Spangler and Agnello (1991). Data obtained were subjected to T-test analysis while mean and standard error were calculated.

Results and discussion

Morphometric description

The adults recovered (>50) were females. They were broad and oval in shape, pale green in appearance but covered with white wax except for bare dorsal midline region which appeared as dull white. Measurements of various body appendages and dimensions are as contained in Table 1.Eyes were present and the mouth is modified into a stylet. The antenna was thin, filiform and 9 segmented. The widest part of the organism body was the third abdominal segment and the entire abdominal segments were ten in number. The bug was found mostly on the adaxial surface of the host plant and spread to the petioles of the leaves when there was heavy infestation. Eggs were not observable, as the insect is known to be pathenogenetic.

The 2nd instar was broadly oval in shape as well and whitish in appearance while the 3rd instar was broadly oval in appearance and had pronounced segmentation on the dorsal part.

Life cycle

The developmental time of this mealybug was 50 days .The mean duration of 1st instar was 15 days, the possible insertion point was not known and the preferred location could not be determined because of high motility. The 2nd instar lasted 10 days. The mealybug, though active, was less motile but there was appearance of wax powder covering the body surface. 3rd instar stage lasted 15days; at this stage of development the organism attached itself to the mid-rib and leaf veins for feeding on both surfaces. The adult stage lasted 10 days. 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. Agounke *et al* (1988) obtained a range of 3.4 -4.0mm for the body length of *R. invadens* reared on *Mangifera indica* (mango) but in this study, the body length ranged between10.05mm and 11.04mm (Table 1) which means that *F. thonningii* is more suitable a

Table 1. Morphometric Measurements of Body and Appendages of *Rastrococcus invadens* (n= 20)

Dev. Stage	**Dimension X ± S.D mm (Range)**						
	Body Length	Body Width	Length of Antenna	Length of Stylet	Prothoracic Leg	Mesothoracic Leg	Metathoracic Leg
1st Instar	2.20 ± 0.47 (2.00 – 2.67)	1.23 ± 0.24 (1.00 – 1.34)	0.02 ± 0.01 (0.02 – 0.05)	0.13 ± 0.03 (0.12 – 0.14)	0.91 ± 0.31 (0.60 – 1.22)	0.91 ± 0.31 (0.60 – 1.22)	0.91 ± 0.31 (0.60 – 1.22)
2nd Instar	2.20 ± 0.47 (2.00 – 2.67)	2.67 ± 0.71 (2.00 – 3.00)	4.13 ± 0.56 (3.34 – 4.13)	0.13 ± 0.03 (0.12 – 0.14)	0.91 ± 0.31 (0.60 – 1.22)	0.91 ± 0.31 (0.60 – 1.22)	0.91 ± 0.31 (0.60 – 1.22)
3rd Instar	8.00 ± 1.89 (6.67 – 9.34)	6.10 ± 2.12 (4.67 – 7.67)	0.60 ± 0.05 (0.50 – 0.70)	0.13 ± 0.03 (0.12 – 0.14)	0.91 ± 0.31 (0.60 – 1.22)	0.91 ± 0.31 (0.60 – 1.22)	0.91 ± 0.31 (0.60 – 1.22)
Adult	10.80 ± 0.91 (10.05 – 11.34)	8.00 ± 0.94 (7.34 – 8.67)	0.60 ± 0.05 (0.50 – 0.70)	0.13 ± 0.03 (0.12 – 0.14)	0.91 ± 0.31 (0.60 – 1.22)	0.91 ± 0.31 (0.60 – 1.22)	0.91 ± 0.31 (0.60 – 1.22)

host than *M.indica.* Heavy and incessant rainfall in the coastal region in Benin and Togo was suspected to be responsible for the reduced body development as compared to what was obtained in this study. Also, when population dynamics of *R. invadens* was studied in The Congo on Mango and Frangipani, the population dynamics on the two hosts was linked more to the physiological and phenological characteristics of the host than to climatic factors (Matokot *et al.*1992) while Willink and Moore (1988); More (2004) believed that development of *R. invadens* was influenced by host plant and environment.

It is a well known observation that 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 in the efficiency of feeding and its conversion .According to 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 very 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.

Furthermore, *F. thonningii* is also a fortuitous plant because all the developmental stages of the insect were found on it. Another major observation in this study was the pattern of distribution on the host which differed from what was observed in *M .indica* in Benin and Togo. Agounke *et al.* (1988) documented that infestation began at the base of the leaf and progressively covered the entire leaf surface but on *F. thonningii*, the insect preferred the adaxial of the leaf but during heavy infestation (i.e.>25 insects) they spread initially to the midrib and later covered the entir*e* surface including the petiole .Unidentified intrinsic factors might be responsible for this distribution. Apart from life histories which varied in different localities, pattern of biological activities also are not the same on *F. thonningii (in Nigeria)* and *M.indica (in Togo)* a justification that environment confers a lot influence on life history and behavior of this insect.

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