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Studies on the lifecycle of Aleurodicus dispersus (Rusell) (Homoptera: Aleyrodidae) on potted cassava plant in a screen house

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ABSTRACT: The life cycle, and morphometrics studies of *A. dispersus* (Rusell), white flies were conducted in a screen house in the Department of Zoology, University of Ibadan, Ibadan. The study revealed that *A. dispersus* (Rusell) on cassava potted plants leaves, *Manihot esculenta* (Cranzt) (TMS 91934), have six stages, which include, egg first instar, secxond instar, third instar, pupa and adult. *Trichoderma lignorum* a fungal was identified as the cause of high mortality rate which occurred on the eggs and the intars of *A. dispersus*. The study was carried out under varied temperature and relative humidity of (27.20 – 30.33°C) and 68.00 – 82.33%) respectively for a period of 29 days.

Introduction

The importance of *Aleurodicus dispersus* (Rusell), whiteflies, as economic pests seems to expand continually. This anthropod belong to the family Aleyrodidae, under sub-family Alerodicinae (Bryne et al., 1990). *A. dispersus* have six life stages, which includes, the egg, the crawler (First nymphal instar), two sessile nymphal instart (second and third instar nymphs), the "pupa" (Forth instar) and the adult or imago. The terms "nymphal" and "larval" have been used interchangeably in the literature to denote the immature forms. It's been shown by Webber (1931) and Nechols and Yauber (1977), that the fourth instar is not a time pupa because feeding occurs during the first part of this stage and adult do not come from "pupal" moulting but from transformed "pupa". In this write up, the first three immatured stages will be referred to as nymph, while pupal will be used to denote the last immature stage.

Series of work has been done on the whiteflies taxonomy but very little has been done on the biology of *Aleurodicus dispersus*. Reamer first describes whiteflies in 1736. Then he place *Aleyrodis protetalla* in lepidoptera order mistakenly. This wrong impression was corrected by Latreilla in 1795 when he placed them in Homopteran order (Douglas, Rye, Malachlan and Stainton, 1877 – 78). Since 1736 when the insect was first described until 1895 about 50 noteworthy articles were published. Many of these papers were taxomic treatments with little information about whitefly biology, (Maskell, 1895). The little work done was centred on specific species. Back (1909), was concerned about the presence of *Aleurothrixus floccosus* on citrus. Lloyd (1922), published a report on the biology of *Trialeurodes vaporariorum*, but his primary aim was to describe greenhouse management strategies. Some other works were also conducted, but after the turn of the century more attention was focused on basic biology. Hargreaves (1914) and Garman and Jewill (1922) are some of the early reporters on whiteflies biology.

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These workers concentrated on polyphagous whiteflies, a character that is not common to Aleyrodidae. Therefore, drawing conclusion about the family based on what is known about a far species might not be appropriate. Consequently, this research work become very important. This was conducted to study the life cycle of spiralling whitefly. *A. dispersus* (Rusell), using TMS 91934 cassava as host plant; under screen house condition.

This homopteran insect, damage crops by extracting large quantities of phloem sap which can result in more than 50% yield reduction's (Lloyd, 1922). *A. dispersus* serve as vector of fungi (e.g. *Capodium sp.*) that discolour parts of the plant used for food and fiber. Furthermore, a few species are also vector of several economically important viral plant pathogens, (Muniyappa, 1980).

Materials and Methods

Screen House Dimension

This experiment was carried out in a scren house with a dimension of 10m length x 12m breadth x 7m height. This was situated in the department of Zoologyh, University of Ibadan, Ibadan.

Propagation of Potted Cassava Plants (Host Plant)

A suitable cassava variety TMS 91934 was used as host plant for this experiment. The cassava plants were propagated from stem cuttings collected from International Institute of Tropical Agriculture (IITA) farm in Odogbo in two gallons plastic pots with fertile soil. The germplasm were supplied regularly with 500cm^3 water every other day. This was done outside the screen house.

Plot Layout in Screen House

Potted cassava plants were introduced into the screen hour at about 3 months old. The potted cassava plants were arranged into two plots. Each plot contained fourteen potted plants in two rolls with distance of 0.76m (2ft) apart, while the two plots were 1m away from each other.

Spraying of Screen House

After the introduction of the cassava potted plants into the screen house, Dichlovros (DDVP), was used to spray the plants and the entire screen house to keep the screen house free from pest which may contaminate the experiment. The potted plants were drenched seriously with water and left for 96 hours to get stabilised before infestation with waterflies was done.

Infestation

The potted cassava plants were infested with matured male and female *Aleurodicus dispersus* (Rusell). The insect pests were collected from a research farm in University of Ibadan, Ibadan. The collection was done by plucking the infected cassava plants branches with *A. dispersus*. The plucked infected cassava plants branches were quickly transferred into a box, constructed with mosquito netting of 1m x 1m dimension. This was taken to the screen house within 20 minutes of collection. About 500 *A. dispersus* were collected at once for infestation in the screen house. Infestation wa srepeated three different times before the pests, *A. dispersus* could be established on the cassava potted plants.

Life Cycle Monitoring

Twenty-four hours after infestation of the cassava potted plants in the screen house, egg laying were observed, after this continual monitoring work commenced. Monitoring was done on a daily basis to observe and record any changes on the eggs. A mononucular microscope at magnification power of x40 and x60 were used to observed the eggs on the lower surface of the cassava potted plant leaves. Microscope was implored during observation of the first three immatured stages – the eggs, first and

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second instar stages. This was due to the microscopic nature of the stages. Furthermore, subsequent stages were observed with the aid of a hand lens.

Environmental Conditions

Daily temperature and relative humidity, were recorded three times, in the morning, afternoon and evening. The readings were done with the aid of thermometer (°C) and hydrometer (%) throughout the period of the experiment. The experiment lasted the period of 29 days.

Fungal Infestation

Fungal infestation was observed on the eggs and instar stages, due to the infestation, identification of the fungal in question was carried out in an isolation experiment using potato dextrose agar medium (PDA), (Brock and Madigan, 1991, and Michael et al., 1993), in the Department of Botany and Microbiology, University of Ibadan, Ibadan.

Results

Life cycle studies of *Aleurodicus dispersus*, (Rusell)

The life cycle of *A. dispersus* consists of six stages. The stages include, the egg, crawllers, which is made up of first, second and third crawlers, the pupa and the adult or imago.

Egg Stage

The egg is oval in shape with pedicel at the anterior end for anchorage to leaves under surface, vide Figure 1a. From this research,an ovipositor period of eleven days (11 days) was recorded. Maximum of 85 eggs were laid, with a 77.6% hatchability (Table 1). It measured 0.18mm length and 0.07mm in width (Table 3).

Larval Stages

There were three instars, see Figures 1b – 1d. The periods of development for each instar are given in Table 1. Morphometrics parameters and morphology were shown in Table 3, and Figures 1b – 1d respectively. The length and breadth ranges between 0.72 – 0.78mm and 0.48 – 0.57mm (Table 3).

Pupal Stage

The morphology and measurement of pupal were shown in Figure 1e and Table 3 respectively. Developmental period from pupal to adult is presented in Table 1.

A life Table to show the numbers of eggs laid and subsequent first larvae, second larvae, third larvae emergent and fifth immature stage, that is, pupa were shown in Table 2. However, no adult was recorded because all of the immature stages were killed by fungal attack.

The life cycle from egg to pupa was completed within a period of 29 days (Table 2). This experiment was conducted under temperature and relative humidity of 27.80°C ± 3.43°C and 70.10% ± 3.49% respectively, in a screen house.

Identification of Fungal

From theisolation experiment using potato dextrose agar medium (PDA). A pure culture was raised. After 72 hours, *Trochoderma lignorum* was identified from the grown culture. The fungal was responsible for the highj mortality rate of *A. dispersus* immature stages.

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Figure 1:

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Figure 2:

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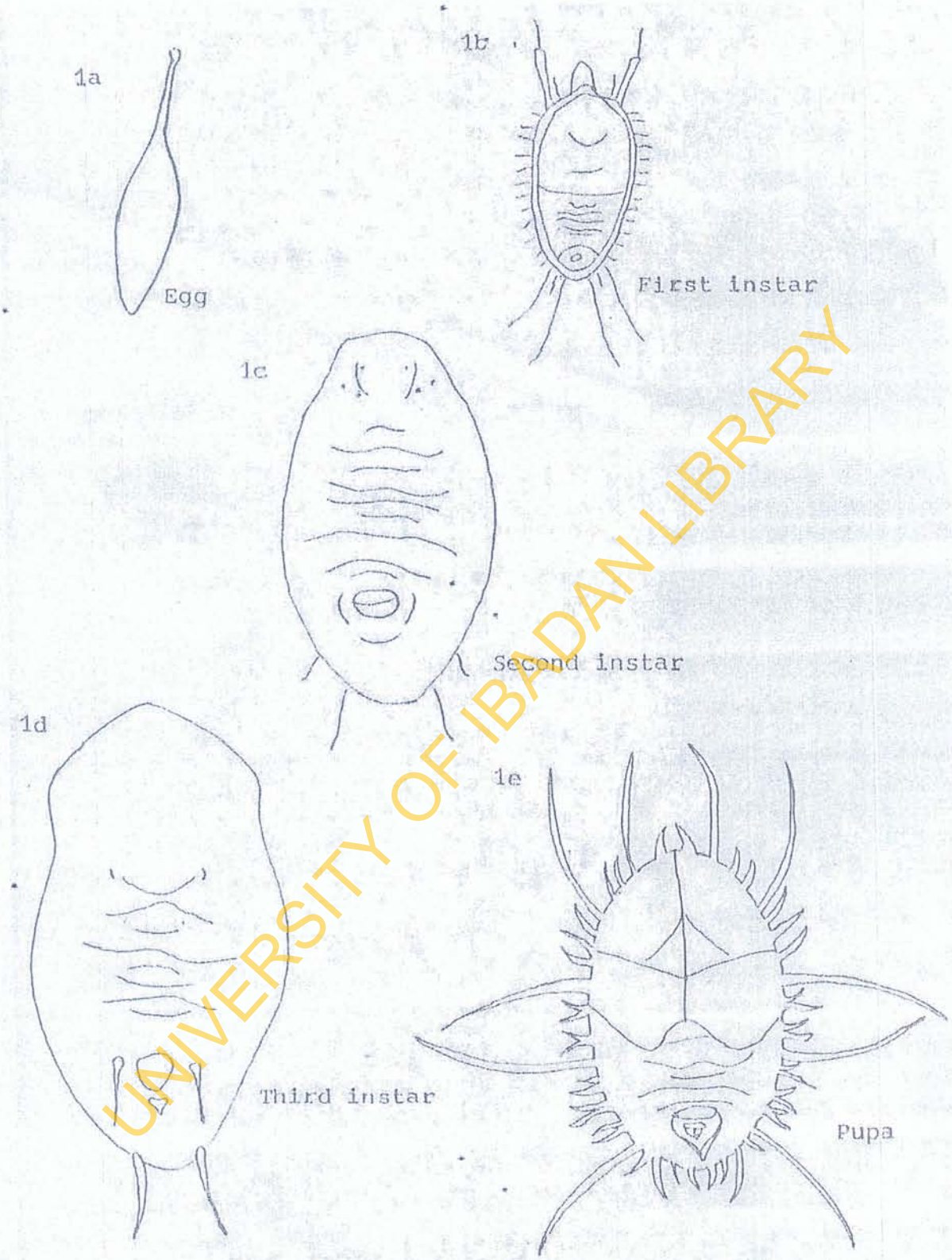

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Fig. 2: Life cycle of A.dispersus (Rusell)

1a Egg, 1b First, 1c second, 1d Third instars and 1e Fourth instar (Pupa) Ventral view.

Table 1: Incubation period of Eggs and Developmental periods of whiteflies, *A. dispersus* (Rusell) instars in Days, under screen house, condition of 27.80°C and 70.10%, temperature and relative humidity respectively.

	Eggs incubation period	Developmental periods of 1st Instar	2nd Instar	3rd Instar	Pupa
Mean of periods (Days) (x ± SD)	11.82±3.35	4.58±3.06	5.00±0.57	5.00±0.00	8.00±0.00
Range of Periods (Days)	11 - 17	2 - 6	4 - 6	5	8

Table 2: Life Table of whiteflies, *A. dispersus* (Rusell) on cassava potted plant leaves, under screen house condition of 27.80°C and 70.10%, temperature and relative humidity respectively.

Period (Days)	No. of eggs laid	Population of Whiteflies Instars 1st Instar	2nd Instar	3rd Instar	4th (Pupa)
1	22				
2	63				
3	85				
4	85				
5	85				
6	85				
7	85				
8	85				
9	85				
10	85				
11	85				
12	75	10			
13	48	10			
14	48	37	2		
15	33	37	2		
16	32	37	4		
17	28	53	8		
18	24	57	10		
19	23	61	20		
20	22	62	20		
21	21	63	20		
22	19	64	20	4	
23	19	66	20	4	4
24	19	66	20	4	4
25	19	66	20	4	4
26	19	66	20	4	4
27	19	66	20	4	4
28	19	66	20	4	4
29	19	66	20	4	4

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Table 3: Morphometrics of *A. dispersus* (Rusell) immature stages in millimetres (mm)

	Eggs		Larvae			Pupal
	Length	Width	Length	Width	Length	Width
Mean (X±SD)	0.18±0.000	0.07±0.04	0.77±0.04	0.52±0.04	1.29±0.25	0.81±0.07
Range	0.18-0.19	0.7-0.8	0.72-0.78	0.48=0.57	1.36-1.42	0.75-0.90

Discussion

Life Cycle Studies of *A. dispersus*

The results obtained from this experiment which is presented above, clearly demonstrated that *A. dispersus* (Rusell) life cycle consist of six stages. The stages include, egg, first instar, second instar, third instar, pupa and adult. However, only five of these stages were observed. The observation recorded were in line with earlier submission of Webber (1931); Nechols and Tauber (1977), on the life cycle of other members of the Aleurodidae family.

The eggs of *A. dispersus*, is elongate – oral in shape and it possess pedicel for anchorage to under surface of young leaves. Deshpande (1936), Poinar (1965); Choice (1986) and Paulson and Beardsley, (1986) also agreed to this submission. The egg took a period of 11.82±3.35 days to incubate and it measured (0.18±0.00)mm in length and (0.07±0.04)mm in breath. The oviposition period was eleven days (11d), with hatchability of 67% which may be due to the favourable condition of the screen house. Rate of development was highly affected by temperature and relative humidity. Optimum rate was achieved at temperature of 28°C. However, upper threshold of almost 35°C will favour higher developmental rate, Hulpas – Jordan and Van Leuteren (1989).

The crawlers. This is the first instar, it possesses walking legs and antennae, it is oral and elongated. This was corroborated by Gill, 1990 findings. This crawler moves a very short distance, see Gerling (1990). To further corroborate this, Hangreaves (1914), stated that the crawler of *T. vaporaviorum* (Westwood) has four or possibly five leg segments and 2 – 3 antennae segments. However, actual body segmentation usually is not clear. This fact was encountered during the period of experimentation. First instar stage took the period of (4.58±3.06) days to moult to second instar stage, while second instar spend (5.00±0.57) days to become third instar stage. This third instar stage undergo metamorphosis to become pupa after the period of (5.00±0.00)days. A total of about 14 days was used to developed from first instar to third instar. The developmental period could be affected by age of plants. It was observed that most of the larvae were found under surface of young leaves and very close to the leaf veins, where they extract large quantities of phloemsap, (Lloyd, 1922). The crawlers body is covered with wax on the dorsal surface giving the white colour. This was found at the marginal fringe, forming spines like structure.

The pupa; the body colour ranges from translucent to black opague, with elongated shape. Some species vary from nearly circular to very elongate (Gerling, 1988). It was covered with wax at the dorsal surface. The wax is very prominent and it form long spine like structure. Pupa of *A. dispersus* measured, (1.29±0.25)mm in length and (0.81±0.07)mm in width. It spend about eight days (8 days) before the four pupae left died due to fungal infection. Muniyapa(1980) stated that some whitefly species serve as vector of several economically important viral and fungal plant pathogens. High motality rate was recorded at the immatured stages. Mortality rate in egg and crawler stages was high. This was basically due to the fungal infestation. During this work, a 100% pre-adult mortality was recorded. A 90% mortality of *B. tabaci* was recorded, in the lab in an experiment (Muniyapa, 1980). Furthermore, fungal infestation of *B. tabaci* was observed on cassava in India (Nair and Nambiar, 1984).

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Consequently, the fungus responsible for this high mortality rate was identified. In identifying the fungus, potato dextrose agar (PDA) was used in isolating the fungus (Brock and Madigan, 1991). This was done by growing pure culture of the microorganisms found around the eggs and the other immature stages. The pure culture from eggs and crawlers were found to contain a fungus called *Trichoderma lighorum*. Some other fungi have been reported to be killers of *A. dispersus* immature and adult stages of this fungus include, *Verticilium lecanni*, *beavenia bassiaua* and *Paecilomyces farinosus* (Avido, 1956). The latter, causes 90% mortality of *B. tabaci* adult in the laboratory (Muniyapa, 1980).

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