Environtropica, March 2019, Vol. 15, 55-59 ISSN 1597-815X

Observations on the metamorphosis of captive-reared caterpillars of *Parasa euchlora* Karsch, 1895 (Lepidoptera: Limacodidae)

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Accepted on May 06, 2018

Abstract

Metamorphic development of captive larvae of *Parasa euchlora* reared in a small enclosure was observed and recorded. Ten (10) of over 100 caterpillars of this moth species found feeding on the leaves of *Khaya ivorensis* were collected and reared in a locally built wooden box to enable monitoring of their development. All the larvae pupated within 28 to 32 days after collection. Both the larvae and pupae cocoons of the species caused painful skin irritation to humans, indicating the species' possession of a potentially anti-predatory chemical defence secretion. Adults started emerging from cocoons 52 days after commencement of pupation, and achieved flight after about 4 hours of emergence. The ecological and agricultural significance of documenting the life history of Lepidoptera species is highlighted.

Keywords: *Metamorphosis, Lepidoptera, Caterpillar, Cocoon, Pupa.*

Introduction

Breeding and development process of Lepidoptera species are principally one of their distinguishing characteristics (Doncaster and Raynor, 1906; Smithers, 1977; James, 1981). This group of insects passes through various biologically remarkable stages as they develop into their adult stages. The metamorphoses are of biological importance because they have agricultural and other environmental implications. The economic losses due to the voraciousness of some caterpillars (the larvae of Lepidoptera) on the leaves of their host/food plants are often a concern in modern day agriculture (Avhad and Hiware, 2013). Oftentimes, under the pretext of agricultural pest control, actions with negative environmental side effects are usually launched without due consideration to the potential deleterious consequences on adult populations of the affected species, and other biodiversity. Such actions may be contributing to what many scientists and non-scientists now refer to as the "sixth mass extinction of life on earth" (Sutter, 2016). Thus, it is important that humans possess a good knowledge of the ecology of as much of our biosphere as possible, so as to be able to slow down or stem earth's on-going debacles.

The moths of the family Limacodidae are made up of over 4000 species in 400 genera (Hill, 2008), with a distribution that cuts across most tropical regions of the world. Larvae of members of this family are often referred to as slug caterpillars. They possess stinging spines which serve to protect them from predators (Lill *et al*., 2006; Murphy *et al*., 2010). Slug caterpillars are often pests of urban and fruit trees (Chenon, 1982; Nagamine & Epstein, 2007; Yamazaki *et al*., 2007). This study is a record of some observations made on the development of a moth species of this interrelated taxon.

Materials and Methods

The study emanated from observations in a newly established small arboretum in Michael Okpara University of Agriculture (MOUA), Umudike (05° 28.59′N; 007° 32.28′E), in the humid tropical forest zone of eastern Nigeria. The arboretum was a community of scantily wooded lot comprising mainly young fruit trees and other woody vegetation, such as *Citrus limon*, *Irvingia* sp., *Khaya ivorensis*, *Ceiba pentandra*, *Tetrapleura tetraptera*, *Vitex doniana*, *Dacryodes edulis*, *Garcinia kola*, and *Chlorophora excelsa*, many more which were of heights of 3 m – 7 m.

Collection of the caterpillars and observations on their metamorphic stages

On 5th June, 2016, over a hundred larvae of the then unknown Lepidoptera species were found feeding on the leaves of a Forest Mahogany *Khaya ivorensis* tree. They were light-blue in colour and measured 3 cm – 4 cm in length (Fig. 1). They possessed stinging spines which caused severe irritation to human skin.

Fig. 1. A larva of *P. euchlora* on the trunk of *Khaya ivorensis* which was the larval food plant. The larva was descending to the soil from the host plant, probably preparatory to pupation.

Ten of the larvae were collected and reared in a rectangular box of 21 cm by 29.7 cm. The box was stocked with leafy twigs of the Forest Mahogany (the caterpillars' food plant) and kept in a laboratory to enable close monitoring. Fresh leafy twigs of the food plant were brought in daily to replace unconsumed food of the previous day, which were carefully removed and discarded. The larvae were observed daily and any changes that occurred were noted, until emergence of adults from the cocoons they had metamorphosed into. During the monitoring of the developing cocoons (at about 60 days after the collection and isolation of the larvae), one of the cocoons was cut open with a dissecting pair of scissors, and the developing pupa photographed.

Results and Discussion

All the larvae formed cocoons within 28 – 32 days of being collected and enclosed. The cocoons were strongly glued to the walls of the enclosure and on leaves of the food plant. Baylis and Pierce (1991) and Onyenweaku *et al*. (2017) had observed the use of host plant parts as substratum for anchorage of pupae by some Lepidoptera species. Like the caterpillars, the cocoons which housed the pupae caused severe irritation on contact with human skin. This suggests that the species might have continued to produce chemical irritants to protect the pupae from being predated upon. Pasteels *et al*. (1983) and Chow and Tsai (1989) noted that chemical attack and repellence are usually the main defence mechanism of some arthropods against their predators.

Fig. 2. A developing pupa of *P. euchlora* extracted from a cocoon.

The developing pupa which was removed from a cocoon measured 2.5 cm in length (Fig. 2). Adult features, including fused head and thorax and small wings were obvious. The abdominal segments had been fully developed. Adults began to emerge from the cocoons 84 days after the collection and isolation of the larvae. They emerged by opening the anterior end of the oval-shaped cocoon (Fig. 3). Newly emerged adults measured 3.0 cm - 3.5 cm in length (Fig. 4) and had two pairs of fluffy wings. They were able to fly within 4 hours of emergence. The species was also observed to have attacked a cashew (*Anacardium occidentale*) tree at a different location. The larvae which were in mass of hundreds, defoliated almost entirely, the leaves of the cashew and then burrowed to the soil where they formed cocoons afterwards.

Fig. 3. A cocoon of *P. euchlora* from which an adult had emerged. Notice the round anterior opening of the cocoon from where the newly formed adult emerged.

Knowledge of the reproductive ecology of arthropods is very important, especially with regard to exposing vulnerable stages in species' life histories, which can be crucial in fashioning strategies for control, especially noxious species. For the Lepidoptera taxon, caterpillar rearing is an accepted method of identifying breeding species (Staude *et al*., 2016). Knowledge of a species' life history may also help gain a better understanding of threats to the species' survival (Edge, 2011). Reports from various research groups indicate that a large number of Lepidoptera taxa distributed across Africa and elsewhere are threatened (Edge, 2011). This may be traceable to poor documentation of the ecology of most African Lepidoptera.

Fig. 4. A newly emerged adult *P. euchlora*. The colouration of white stripes on light green wings is the key identification characteristic of the species.

It is hoped that observational studies of this kind will contribute to the much needed database on African Lepidoptera, and thus contribute to their conservation. Edge (2011) reasoned that butterfly and moth species that have been reported as severely threatened are predominantly those which have experienced habitat loss and fragmentation, resulting from synergistic combos of deleterious anthropogenic activities. Furthermore, Edge and Mecenero (2015) applauded the new approaches of conserving habitats and landscapes as more productive. The developing small arboretum and the partially protected relict forest at MOUA, Umudike, are steps in that direction.

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