Pest Status of *Thyridopteryx ephemeraeformis* (Lepidoptera: Psychidae) (Bagworms) on *Delonix regia* (Fabales:Fabaceae), an Ornamental Tree

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ABSTRACT

The pest activity of Thyridopteryx ephemeraeformis (bagworms on Delonix regia was surveyed in the month of November in a selected landscape field within National Root Crop Research Institute (NRCRI), Umudike in Abia State, Nigeria. Five plant trees (Delonix regia) were sampled to access bagworm populations and extent of damage. The larval bagworms were found to cause severe damage to the plant. The severity of damage by bagworms were: alpha, 4; beta, 3; charlie 6; delta, 6+; epsilon, 1. With percentage prevalence rating as: alpha, 62.91; beta, 55.43; charlie, 96.57; delta, 90.50; epsilon, 10.32, showing that infestation began from beta and spread across to other infected trees. The categories of bagworm abundance on the flamboyant trees- alpha(O), beta(F), charlie (A), delta(A), epsilon(R), shows that delta will die after three more severe bagworm infestations. Based on foliage damage level by bagworms on the tree plants, delta showed maximum damage (new[1], mature[0], eaten[5] and epsilon showed lowest foliar damage (new[5], mature[5], eaten[2]. Though the source of infestation on these tree plants could not be ascertained, the feeding activity of this pest removed the beauty this ornamental plant served the environment.

KEYWORDS: *Pest Status; Thyridopteryx ephemeraeformis; Bagworms; Delonix regia; Ornamental tree.*

Introduction

Thyridopteryx ephemeraeformis belongs to the class insecta, order Lepidoptera and family Pyschidae, in which all species larvae are enclosed in a bag (hence the name bagworms), with most species having flightless female adults (Moore and Hanks, 2004). Bagworms never leave their bag-shaped shelter of silk and leave fragments, with only their head and thorax protruding, and enlarge their bag as they grow (Moore and Hanks, 2004). Neither the male nor female adult feeds. The female lives a couple of weeks, while the male lives only one to two days (Rhainds *et* al., 2009).

It is a major pest of cedars, arborvitae, junipers and other landscape trees(Heather *et al*., 2014), and can feed on over 50 families of deciduous and evergreen trees and shrubs(Rhainds *et al*., 2009). Infestations by bagworms often go un-noticed because people mistaken the protective bags for cones or other plant structures, with severe infestations damaging the aesthetics and

health of host plants, as the older larvae strips the plant of its needles and consumes the whole leaves of susceptible deciduous plant species, leaving only the large veins (Ellis *et al*., 2005).

Initial feeding damage on evergreen trees causes branch tips to appear brown and unhealthy (Baxendale and Kalisch, 2009). As the larvae becomes larger, their feeding damage becomes more apparent, as they cause severe defoliation and even death, especially in evergreen species whose leaves are not easily replenished like the deciduous ones.

One of such victims of bagworm infestation is *Delonix regia,* with varied common English names such as flamboyant, flamboyant flame tree, flame of the forest etc. The genus *Delonix* belongs to the legume family (Fabaceae), subfamily Caesalpinioidae (ILDIS, 2008). *D.regia* is an ornamental tree that attains a maximum height of about 18meters, a girth of up to 2 meters; with a large trunk, that is buttressed and angled towards the base. It has a smooth bark that is greyish-brown, sometimes slightly cracked and with many dots (lenticels) (Orwa *et al*., 2009).The leaves are biparipinate, alternate, light green, feathery and about 20-60cm long (Orwa *et al*., 2009)

Some useful products from *D.regia* include gums, resins, fuel, timber, medicinal derivatives and timber. It is also serves as shade, serves ornamental purposes, serves as boundary or barrier and also has its flowers reported to produce bee forage (Orwa *et al*., 2009)

It also has impact on soil fertility, with a 13% increase in soil Nitrogen observed with the application of *D.regia* prunings to a calcareous soil after five years, with also higher organic contents, mineralization and turnover rates as compared to the control (Isaac *et al*., 2003)

D.regia leaves and flower extract have also been proved to be an herbicide capable of controlling *Mikania micrantha,* an invasive climber (Kuo *et al*., 2002). Its wood ash induced up to 78%, 81% and 89% reduction in the mycelia growth of *Helminthosporium sativum, Curvularia lunata,* and *fusarium graminearum,* respectively (Enikuomehin and Kehinde, 2007). It also has effects against insects (such as coleopteran storage pests), nematodes etc.

Considering the enormous benefits of *D. regia,* and the great damage inflicted upon it by *T. ephemeraeformis,* there is therefore need for a critical examination of the pest status of *T. ephemeraeformis* on it, with the aim of observation, identification and collection of bagworms from this tree. This will make known the mode and rate of attack of these bagworms on the flamboyant tree and hence reveal the prevalence and severity of the pests damage on the tree, and hence provide baseline data for further studies.

Materials and methods

Study area

The study was carried out in the landscape field of National Root Crop Research Institute (NRCRI), Umudike in Ikwuano L.G.A. of Abia state, South-eastern Nigeria. Ikwuano, is located in the tropical rain forest zone of Nigeria on Latitude 05°26'-5°29'N and Longitude 07°34'-7°36'E. It has a mean annual rainfall of 2238 mm, minimum and maximum temperatures of 23 and 32°C, respectively, with a relative humidity range of 63-80% (NRCRI, 2003).

Sampling and data collection

Five bagworm infested flamboyant trees, 10 -13cm apart in the landscape field were selected for this study. The trees sampled and used for the study were named alpha, beta, Charlie, delta and epsilon respectively.

Routine monitoring and inspection was carried out between 7-10am and 2-6pm daily when temperature is relatively low and insects less active, for a period of one month. Bagworms were handpicked for identification and culture. Identification was done using keys from textbooks and the internet (Hill and Waller, 1998). Bagworms encountered were photographed and placed in labelled Petri dishes for the purpose of inspection, analyses and references.

The damage inflicted on the flamboyant trees was critically observed and documented. More so, other information to support this study was taken by opportunistic sampling. Based on the number of branches attacked by the bagworms, the percentage abundance of bagworms from branches to leaves was determined using the prevalence formula modified from Hill and Waller, (1988). The prevalence formula is as shown below,

$$\text{PREVALENCE FORMULA} = \frac{\text{Number of branches damaged}}{\text{Total number of branches}} \times 100$$

Data sheets were used to collect permanent records of the bagworm species as they occurred at a given time and place. The data sheet used to collect information had the following features: date, time, location, species, general comments for each specimen, extent of foliage damage, bagworm population assessment and collection numbers. The data sheet was used to standardize the data, in order to compare between the flamboyant trees. The extent of crop damage, which is usually proportional to the number of insect pests, was assessed visually on a scale as follows:

6+, 6, 5 — Very Severe (VS)

4 — Severe (S)

3 — Mild (M)

2, 1 — Very Mild (VM)

Furthermore, to support assessment of damage level of the flamboyant trees, records on the quantity of leaves was recorded. This record was taken basically on leaves because bagworms feed strictly only on leaves. This was assessed visually on the scale as follows:

Types of leaves **Quantity codes**

New	0-	none	
Mature	1 -	up to 5%	- Rare
Eaten	2 -	5% to 10%	- Very few
	3 –	10% to 20%	- Occasional
	4 –	20% to 30%	- Frequent
	5 –	Over 30%	- Abundant

The U.K "Biological Sites Recording Scheme" (1991) advocated four abundance (frequency) categories for abundance/population size assessment of insect pests on crops; this assessment method was also used for categories of abundance, and is as follows:

- Abundant (A) - Very Common (VC)
- Frequent (F) - Common (C)
- Occasional (O) - Uncommon (U)
- Rare (R) - Rare (R)

General comments were taken on the specimen being observed. Brief, precise notes were taken in this column (section) of the datasheet. The datasheet is shown in below.

Flamboyant tree

Date:	**Observer:**
Species:	**Location:**

New leaves
Mature leaves
Eaten leaves

Quantity codes
0 – None
1- Up to 5% - Rare
2 – 5% to 10% - Very few
3 – 10% to 20% - Occasional
4 – 20% to 30% - Frequent
5 – above 30% - Abundant

Very Severe (VS)

Severe (S)

Mild (M)

Very Mild (VM)

COMMENTS

ON GROUND ON TREE

Larva: _____

Pupae: _____

Fig. 2.2: Data sheet used for sampling

RESULTS

Sequel to the methods employed in this research, the results were summarized thus:

Pest status of bagworms

The bagworms (larvae) showed preference to leaves of flamboyant tree in their attack, showing that they strictly feed on the leaves of this plant. The extent of damage also caused by the bagworms varied on the flamboyant trees sampled. Based on pest assessment status, bagworms were classified into the following groups:

- Very serious pest
- Serious pests
- Least serious pests

Table 1.Pest status of bagworms on the various flamboyant trees sampled

Pest Status	Flamboyant Tree Specimen
Serious pest	Alpha
Serious pest	Beta
Very serious pest	Charlie
Very serious pest	Delta
Least serious	Epsilon

Table 2. Categories of bagworm abundance on the various flamboyant trees

Using four abundance categories for insect pest population assessment, the bagworms were categorized thus:

Categories	Flamboyant Tree
Occasional (O)	Alpha
Frequent (F)	Beta
Abundant (A)	Charlie
Abundant (A)	Delta
Rare (R)	Epsilon

Key:

Abundant – Very Common (VC)

Frequent – Common (C)

Occasional – Uncommon (U)

Rare – Rare (R)

Table 3. Percentage prevalence of bagworms on the various flamboyant trees sampled.

Flamboyant Tree	Percentage Prevalence
Alpha	62.91
Beta	55.43

Charlie	96.57
Delta	90.50
Epsilon	10.32

Severity of bagworm damage

The bagworms were recorded in relatively high numbers on some trees and relatively small numbers on some other flamboyant trees in the research landscape. Hence, this made the severity of defoliation on the different infested flamboyant trees varied. Table 5 below shows the damage rating of bagworms on foliage (leaves) of the flamboyant trees.

Table 4.Damage rating on foliage by bagworms on the various flamboyant trees

Flamboyant Tree	Foliage Damage
Alpha	4
Beta	3
Charlie	6
Delta	6+
Epsilon	1

6+
6 } Very Severe (VS)
5
4 } Severe (S)
3 } Mild (M)
2 } Very Mild (VM)
1

Table 5.Assessment of foliage damage level on various flamboyant trees

Flamboyant Tree	New	Mature	Eaten
Alpha	3	5	3
Beta	4	5	4
Charlie	2	0	5
Delta	1	0	5
Epsilon	5	5	2

1 - up to 5% - Rare

2 - 5% to 10% - Very few

3 – 10% to 20% - Occasional

4 – 20% to 30% - Frequent

5 – Over 30% - Abundant

Discussion

The observed assessment of bagworms pattern of defoliation coincided with reports in literatures on defoliation of leaves in ornamental, evergreen trees. Patra and Bara (2012) noted a complete defoliation by bagworms, the larvae wholly or partly stripping the leaflets from the biparitinnate leaves, hence leaving bare branches with hanging bags. Damage inflicted by the bagworms on flamboyant trees was strictly on leaves, and this reduced the aesthetic quality of these trees, as documented also by Ellis *et al*. (2005). There was no observed attack on pods and they only used the stem for pupation which posed no obvious threat, other than the branch tips that appeared brown and unattractive due to initial feeding damage, as was also documented by Baxendale and Kalisch (2009). The fact that bagworms were incriminated on flamboyant trees perhaps indicates that bagworms can adapt to the leaves of ornamental, deciduous, evergreen trees for food in the absence of cider, juniper or arborvitae. The flamboyant trees survival of the sudden onslaught by bagworms can be attributed to the role of natural enemies like wasps, birds and several parasitic insects which helped to control their population as reported by Ellis *et al*. (2005).

From the percentage prevalence rate of bagworms (table 3), the pest status of bagworms (table 1), the categories of bagworm abundance and their damage rating on foliage (table 4), it is inferred that bagworms infestation/attack began on the second tree, 'beta' and spread to the other trees through dispersal by wind and movement, caused by the need for more food.

Due to the severity of damage on foliage from damage rating on foliage (table 4) and assessment of foliage damage (table 5), it is predicted that 'charlie' and 'delta' may die with a stable bagworm prevalence rate in two more bagworm generations, this is in consonance with report from Beach *et al.*, (1994).

Based on result from pest status (table 1), it is clear that bagworms are serious pests of flamboyant trees but possess reduced pest ability after larval stage.

Conclusion

Despite the numerous benefits derived from flamboyant tree (*Delonix regia),* its production seems to be hampered by the prevailing attack by bagworms. Bagworms attack on this plant inflicts serious damage caused by defoliation, which is usually in the beginning of the dry season – harmattan – and may cause death of the plant after about 3 bagworm generations if the severity of damage is quite high in those periods.

However, the rate of damage by the insect pest on *Delonix regia* can be considerably reduced to the barest minimum through handpicking the insects at early larval stage and the guided use of insecticides.

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