

Incidence of Insect Pest in Teak Plants (*Tectona grandis*, Verbenaceae) at Costal Odisha

M. Rout, M. K. Tripathy, H. K. Das, N. Bhol

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Abstract In a study conducted on infestation of major insect pests of full grown teak plants at Bhubaneswar revealed that three categories of insect are prevalent in this age group of plants which includes three species of foliage feeders viz. *Hyblea punea* skeletonizer *Eutectona mecharalis*, bag worm, *Pleroma plagiophelps* species of feeder viz. Aphids, *Aphis gossypi* and pentatomids i.e. *Podisus brevispinus*, *Halyomorpha halys* and mealy bugs *Pseudococcus fillamentosus*, *Pseudococcus citri*, *Ferrisia virgata* and two species of bark feeders viz. bark borer. *Inderbela quadrinotata* and termites *Odontotermus obesus* and *Neotermus* sp. were important. The extent of bark damage due to termites and bark borers were ranged from 2.56% to 12.28% and 3.8% to 9.17% in different months of observation respectively. The study further revealed that bark borer has got 16 alternate host plants in this region with teak act as a morderately attacked host.

Keywords Teak defoliator, Teak skeletonizer, Foliage feeders of teak, Seasonal coincidence.

Introduction

Teak *Tectona grandis* (Linnaeus), is one of the most preferred timber species of Odisha as well as India. In India, it grows naturally in 9 million hectares of area and considered as one of the top five tropical plantation species of the world. About 187 insects species have been found feeding on living teak tree in India which includes 78 species from order Lepidoptera, 40 species from order Coleoptera and 18 species from order Orthoptera (Hutacharerin and Tubtim 1995). In fact, the total number of insect pests infesting this plant might be more because of report of additional species by several workers around the country after the base line report. Instead of larger damage, no such established management practice is available in this country because of lack of systematic study in many aspects of the pests including biology, ecological studies like population density fluctuation, factors governing host preference of individual pests. Moreover, for economic, technical and social reasons chemical control strategies in spite of their availabilities are not preferred by the growers. In some advance states like Kerala some private growers are coming forward for taking control operations against the major pests. Outbreak of these pests occurs almost every year in Odisha as well as in other teak growing regions of India. During these outbreaks in the early flushing period of teak, trees usually suffer a total defoliation, sometimes there is partial defoliation later in the growth season (Nair 1988). Studies in young teak plantation at Nilambur in South India showed that defoliation by *H. puera* caused loss of 44.1% of the potential wood volume increment (Nair 1998).

M. Rout, M. K. Tripathy*, H. K. Das, N. Bhol
 College of Forestry, O.U.A.T., Bhubaneswar, Odisha, India
 e-mail: manojtripathy10k@gmail.com
 *Corresponding author

Table 1. Incidence of different insect pests in teak trees with more than 3 years age during the observation period (2016-2017). Each figure represents the mean value \pm SD. Figures in parentheses are the range values.

Observation week no.	Crop stage	<i>Hyblaea purea</i> larvae per twig	<i>Eutectona mechaeralis</i> larvae per twig	Pentatomid (nymphs & adults) per twig	Mealy bug nymphs & adults per twig	Bag worm (larvae & pupa) per twig	No. of aphids per twig
Jun I	Complete new leaves	0.25 \pm 0.32 (0.00-1.00)	0.58 \pm 0.54 (0.00-1.00)	0.00	5.35 \pm 1.88 (0.00-22.00)	0.00	0.00
Jun II	Complete new leaves	0.43 \pm 0.54 (0.00-1.00)	0.67 \pm 0.68 (0.00-2.00)	0.00	6.55 \pm 2.13 (0.00-24.00)	0.00	0.00
Jul I	Initiation of maturation of new leaves	2.15 \pm 1.06 (0.00-3.00)	0.58 \pm 0.61 (0.00-2.00)	0.24 \pm 0.34 (0.00-2.00)	0.00	0.00	0.00
Jul II	Initiation of maturation of new leaves	5.75 \pm 2.86 (2.00-7.00)	0.64 \pm 0.46 (0.00-2.00)	0.34 \pm 0.36 (0.00-2.00)	0.00	0.00	0.00
Aug I	Full foliage	4.12 \pm 1.24 (1.00-6.00)	1.42 \pm 1.56 (0.00-3.00)	0.12 \pm 0.18 (0.00-1.00)	0.00	5.12 \pm 2.16 (0.00-8.00)	0.00
Aug II	Full foliage	1.71 \pm 1.27 (0.00-4.00)	3.85 \pm 1.84 (1.00-5.00)	0.24 \pm 0.38 (0.00-2.00)	0.00	5.40 \pm 2.05 (0.00-8.00)	10.35 (0.00-35.00)
Sep I	Full foliage	1.43 \pm 1.46 (0.00-3.00)	5.34 \pm 2.86 (2.00-6.00)	0.42 \pm 0.35 (0.00-2.00)	0.00	3.48 \pm 3.43 (0.00-6.00)	17.81 (0.00-80.00)
Sep II	Full foliage	1.12 \pm 0.86 (0.00-2.00)	4.05 \pm 3.12 (1.00-5.00)	3.42 \pm 1.28 (0.00-7.00)	0.00	3.26 \pm 3.32 (0.00-7.00)	20.35 \pm 3.54 (0.00-60.00)
Oct I	Full foliage	0.45 \pm 0.48 (0.00-2.00)	2.03 \pm 2.04 (0.00-4.00)	2.86 \pm 1.06 (0.00-4.00)	0.00	2.16 \pm 2.24 (0.00-5.00)	45.25 \pm 4.86 (0.00-82.00)
Oct II	Full foliage	0.82 \pm 0.28 (0.00-1.00)	1.83 \pm 0.86 (1.00-3.00)	5.02 \pm 2.14 (0.00-8.00)	0.00	2.04 \pm 1.88 (0.00-4.00)	52.15 \pm 4.76 (0.00-104.00)
Nov I	Full foliage	0.31 \pm 0.29 (0.00-1.00)	0.32 \pm 0.29 (0.00-2.00)	2.14 \pm 1.86 (0.00-5.00)	2.12 \pm 1.78 (0.00-10.00)	2.32 \pm 1.68 (0.00-4.00)	25.45 \pm 3.67 (0.00-60.00)
Nov II	Full foliage	0.25 \pm 0.22 (0.00-1.00)	0.42 \pm 0.46 (0.00-2.00)	2.54 \pm 2.37 (0.00-5.00)	2.42 \pm 1.35 (0.00-10.00)	1.63 \pm 1.65 (0.00-3.00)	15.25 \pm 2.85 (0.00-45.00)
Dec I	Partial maturation of leaves	0.12 \pm 0.14 (0.00-1.00)	0.21 \pm 0.26 (0.00-1.00)	1.85 \pm 1.87 (0.00-4.00)	1.45 \pm 0.89 (0.00-8.00)	2.21 \pm 1.69 (0.00-5.00)	10.12 \pm 2.54 (0.00-32.00)
Dec II	Partial maturation of leaves	0.00	0.26 \pm 0.28 (0.00-1.00)	1.05 \pm 0.88 (0.00-3.00)	1.98 \pm 1.46 (0.00-8.00)	2.05 \pm 2.15 (0.00-5.00)	8.05 \pm 2.64 (0.00-28.00)
Jan I	Complete maturation of leaves	0.00	0.22 \pm 0.18 (0.00-1.00)	0.00	7.35 \pm 2.58 (0.00-12.00)	0.00	0.00
Jan II	Complete maturation of leaves	0.00	0.12 \pm 0.16 (0.00-1.00)	0.00	6.75 \pm 2.04 (0.00-12.00)	0.00	0.00
Feb I	Initiation of leaf shedding	0.00	0.14 \pm 0.18 (0.00-1.00)	0.00	5.55 \pm 1.78 (0.00-10.00)	0.00	0.00
Feb II	Initiation of leaf shedding	0.00	0.12 \pm 0.16 (0.00-1.00)	0.00	6.35 \pm 2.35 (0.00-12.00)	0.00	0.00
Mar I	Partial defoliation	0.00	0.23 \pm 0.26 (0.00-1.00)	0.00	7.45 \pm 1.88 (0.00-12.00)	0.00	0.00
Mar II	Partial defoliation	0.00	0.34 \pm 0.36 (0.00-1.00)	0.00	6.25 \pm 1.68 (0.00-14.00)	0.00	0.00
Apr I	Complete defoliation and emergence of new leaves	0.00	0.16 \pm 0.18 (0.00-1.00)	0.00	18.55 \pm 2.08 (0.00-24.00)	0.00	0.00

Table 1. Continued.

Observation week no.	Crop stage	<i>Hyblaea purea</i> larvae per twig	<i>Eutectona mechaeralis</i> larvae per twig	Pentatomid (nymphs & adults) per twig	Mealy bug nymphs & adults per twig	Bag worm (larvae & pupa) per twig	No. of aphids per twig
Apr II	Complete defoliation and emergence of new leaves	0.00	0.36±0.54 (0.00-2.00)	0.00	20.35±3.67 (0.00-29.00)	0.00	0.00
May I	Unfolding of new leaves	0.00	0.48±0.54 (0.00-2.00)	0.00	20.65±4.13 (0.00-28.00)	0.00	0.00
May II	Unfolding of new leaves	0.00	0.56±0.58 (0.00-2.00)	0.00	16.75±3.06 (0.00-25.00)	0.00	0.00
Jun I	Complete new leaves	0.28±0.32 (0.00-1.00)	0.48±0.44 (0.00-1.00)	0.00	7.35±1.78 (0.00-24.00)	0.00	0.00
Jun II	Complete new leaves	0.43±0.54 (0.00-1.00)	0.68±0.62 (0.00-2.00)	0.00	6.65±2.13 (0.00-22.00)	0.00	0.00
Jul I	Initiation of maturation of new leaves	2.15±1.06 (0.00-3.00)	1.68±0.86 (0.00-3.00)	0.24±0.34 (0.00-2.00)	0.00	0.00	0.00
Jul II	Initiation of maturation of new leaves	5.75±2.86 (2.00-7.00)	3.05±1.34 (1.00-5.00)	0.34±0.36 (0.00-2.00)	0.00	0.00	0.00

Hence, in the present investigation an attempt is being made for bringing out a systematic documentation regarding the damage caused by different insect pests attacking full grown teak plants in the coastal agroclimatic region of the state as well as to find out the range of alternate hosts of different important ones in this region.

Materials and Methods

Abundance of defoliating pests of teak was recorded at different locations viz., Silviculture Research Station, Bhubaneswar, College of Forestry, OUAT campus, Poplar field of College of Forestry, Live stocks Farm of OUAT and Taratua Hi-tech forest Nursery located in Khurda. At each location, plants were divided into 3 categories such as (i) Seedlings- 0-1 year old (ii) Plants- 1-3 year old (iii) Plants- more than 3 years old. For plants belonging to third category, five terminal twigs were randomly selected from the lower and middle canopy of each plant and 10 plants were taken, from which leaves from each twig were sampled for observing number of healthy and damaged leaves, thus percent infestation due to defoliation was worked out by using standard formula :

$$\% \text{ defoliation} = \frac{\text{Number of healthy leaves} - \text{Number of infested leaves}}{\text{Number of uninfested leaves}} \times 100$$

The population of foliage feeders viz., skeletonizer (*Eutectons mechaeralis*) defoliator (*Hyblea purea*) and bagworm moth (*Pteroma plagiophelps*) were expressed as no. of larvae/twig. Population of sucking insects like Aphids, Pentatomids, Mealybugs were expressed as no. of nymphs and adults per leaf. Leaves were sampled from top, middle and bottom of the twig. For termite and bark feeder infestation assessment, pole size plants of 6 to 10 years age group were selected randomly and counted as per presence of frass material for bark feeder and mud cover over trunk in case of termite attack out of which percentage infestation in each date of sampling was calculated. Observations were recorded at fortnightly interval and standard deviation as well as mean of the population was calculated (Gomez and Gomez 1984).

Results and Discussion

Data presented in Table 1 revealed that a total of six species of insects including two major ones viz., defoliator and skeletonizer were the main species among others in making the appearance and causing prominent damage in full grown plants of teak. Highest teak defoliator population was recorded during 1st fortnight of July (5.5/twigs) and least was recorded during 1st fortnight of December (0.34/twigs). Skeletonizer population was available throughout the experimental period. Highest no. of larvae (5.34/twig)

Table 2. Incidence of termites and bark borers in teak saplings during the observation period at Bhubaneswar (2016-2017). *Figures in parentheses are range values. Each figure is the mean of minimum 50 samples \pm SD.

Observation weeks	Termite incidence (mean percentage plant damage)	Bark borer incidence (mean percentage plant damage)
Jun I	2.15 \pm 2.13 (1.00-3.50)	0.00
Jun II	0.00	0.00
Jul I	0.00	0.00
Jul II	0.00	0.00
Aug I	0.00	0.00
Aug II	0.00	0.00
Sep I	0.00	0.00
Sep II	0.00	0.00
Oct I	0.00	0.00
Oct II	0.00	0.00
Nov I	4.38 \pm 2.14 (0.00-6.64)	0.00
Nov II	5.21 \pm 2.12 (0.00-7.34)	0.00
Dec I	10.45 \pm 1.48 (1.30-13.48)	4.16 \pm 2.87 (0.00-6.36)
Dec II	12.28 \pm 2.63 (1.50-15.65)	4.64 \pm 2.54 (0.00-8.56)
Jan I	5.20 \pm 1.23 (0.00-7.46)	5.75 \pm 2.87 (0.00-9.50)
Jan II	4.12 \pm 2.12 (0.00-6.86)	4.86 \pm 1.87 (0.00-7.65)
Feb I	4.65 \pm 1.49 (0.00-7.56)	7.36 \pm 2.32 (0.00-12.84)
Feb II	4.42 \pm 1.87 (0.00-7.45)	9.17 \pm 2.84 (0.00-15.88)
Mar I	5.37 \pm 2.24 (0.00-9.36)	4.84 \pm 2.57 (0.00-8.32)
Mar II	6.84 \pm 2.43 (0.00-9.86)	3.87 \pm 2.06 (0.00-7.67)
Apr I	4.52 \pm 2.25 (0.00-7.62)	0.00
Apr II	4.65 \pm 1.85 (0.00-6.89)	0.00
May I	4.24 \pm 2.43 (0.00-7.41)	0.00
May II	4.50 \pm 1.57 (0.00-8.45)	0.00
Jun I	2.56 \pm 1.07 (0.00-5.34)	0.00
Jun II	2.45 \pm 1.68 (0.00-6.12)	0.00
Jul I	0.00	0.00
Jul II	0.00	0.00

was observed during 2nd fortnight of September, 2016 and lowest no. of larvae were recorded from December to February. Pentatomids were appeared during *kharif* and highest value of 5.02 no. s/twig was observed during 2nd fortnight of October. Bag worms, another important foliage feeder species appeared during 1st fortnight of November and continued up to June 1st fortnight. Aphids were detected from August 2nd fortnight and continued up to 2nd fortnight of December. The highest and lowest values were 52.15 no. s/twig (October 2nd) and 8.05 no.s/twig (December 2nd) respectively.

From a study in Western Maharashtra it was also reported that, 3 species of Homopterans infesting teak out of a total report of 30 species (Patil and Thontadarya 1983) where as from Bengaluru, a total 19 species belonging to Hemiptera and Thysanoptera

was reported out of a total report of 45 species (Katagall 1991). Population densities of 5 insect pest species including defoliator, skeletonizer, pentatomids, mealy bugs, bag worms and aphids were documented in the present study. Population of other minor insect pests like membracids, cercopids and fulgorids were not taken into account. Teak defoliator appeared from June 1st fortnight and continued up to 1st fortnight of December with two peaks of population densities recorded during July 2nd fortnight and a smaller peak at 2nd fortnight of October. Skeletonizer made its appearance throughout the year. Pentatomids started their appearance from July 1st fortnight and continued till last of December, the peak (5.02/twig) was being recorded during October, 2nd fortnight, 2016. Bag worms were appeared starting from August 1st fortnight and continued upto December 2nd fortnight.

Data in Table 2 revealed the incidences of termites and bark borers at the experimental sites. Termite incidence was confined to 1st fortnight of November to 2nd week of June whereas bark borer incidence was noticed from December, 2016 to March, 2017. A study of host range and damage intensity due to bark borer has been mentioned in Table 3, a total of 16 alternate host plants were recorded at Bhubaneswar condition. Six plant species viz., Aonla, Jungle badam, Seemul, Casuarina and Copper pod were recorded highest intensity of damage (denoted by +++ sign). Two species of bark feeding insects viz., termites (*Neotermus* sp.) and bark borer (*Inderbela quadrinotata*) are reported from teak. Termites although don't cause mortality in large plants but can make them vulnerable to biotic stresses and in young transplants facing moisture stress condition can cause heavy mortality. Both the species are highly polyphagus. The pest *Inderbela quadrinotata* has been reported to infest to 70 plant species across the forests and avenue plantations at Punjab (Verma and Khurana 1978). The coloration of frass materials also varies mostly as per chemical constituent of wood. Termites and bark borer damage was confined to sapwood only, but consecutive attack on subsequent years makes the plants weak to natural hazards and termite attack leading to loss of plantation has been reported earlier by Sen-Sharma (1974).

Table 3. Host range and damage intensity of bark borer *Inderbela quadrinotata* at Bhubaneswar (2016-2017). + Less damage, ++ moderate damage, +++ saviour damage.

Sl. No.	Name of the host	Family	Damage intensity	Coloration of frass	
1.	Cashew	<i>Anacardium occidentale</i>	Anacardiaceae	+	Dirty grey
2.	Casuarina	<i>Casuarina equisetifolia</i>	Casuarinaceae	+++	Dark grey
3.	Semul	<i>Bombax ceiba</i>	Malvaceae	+++	Pale grey
4.	Copper pod tree	<i>Peltophorum ferrugineum</i>	Fabaceae	+++	Dark brown
5.	<i>Eucalyptus</i> sp.	<i>Eucalyptus</i> sp.	Myrtaceae	+	Dark red
6.	Jamun	<i>Syzygium cumini</i>	Myrtaceae	++	Light red
7.	Golmohar	<i>Delonix regia</i>	Cesalpiniaceae	++	Dirty grey
8.	Patali	<i>Latgestomia parviflora</i>	Lythraceae	++	Pale grey
9.	Karanja	<i>Pongamia pinnata</i>	Fabaceae	+	Dark grey
10.	<i>Albizia</i> sp.	<i>Albizia lebbek</i>	Mimosaceae	++	Light grey
11.	<i>Acacia</i> sp.	<i>Acacia</i> sp.	Mimosaceae	++	Light grey
12.	Kadamba	<i>Neolamarckia cadamba</i>	Rubiaceae	+	Dark grey
13.	Aonla	<i>Emblica officinalis</i>	Phyllanthaceae	+++	Light brown
14.	Jungle badam	<i>Terminalia catapa</i>	Combretaceae	+++	Dark brown
15.	Kanchan	<i>Bauhinia variegata</i>	Fabaceae	++	Light grey
16.	Mahua	<i>Madhuca latifolia</i>	Sapotaceae	++	Light brown

Hence it can be concluded from the present finding that among the foliage feeders, defoliator and skeletonizer are more destructive during the rainy season and among the bark feeders, termites as well as *Inderbela* sp. are important during post rainy and winter season at Bhubaneswar condition in teak plants which needs to formulate and implement specific IPM schedule for an effective control in this plant species.

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