

Government of the Union of Myanmar
Ministry of Natural Resources and Environmental Conservation
Forest Department
Forest Research Institute



**Diversity of Insect Pests and Their Natural Enemies Infesting
Teak (*Tectona grandis* L. f, Lamiaceae) in Bago Region, Myanmar**

**Dr. Thant Shin, Htoo Htoo Lwin, Myo Htet Aung, Ye Lwin Aung,
Zaw Min Aye, Dr. Mu Mu Kyaw, Moe Zaw**

February, 2023

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**Diversity of Insect Pests and Their Natural Enemies Infesting Teak
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Dr. Thant Shin¹, Htoo Htoo Lwin^{2*}, Myo Htet Aung^{3*}, Ye Lwin Aung⁴, Zaw Min Aye⁴, Dr.

Mu Mu Kyaw⁵, ⁶ Moe Zaw

¹Deputy Director, Forest Research Institute, ²Project Assistant, ^{3*}Project Secretary,

⁴Staff Officer Forest Research Institute, ⁵ Pest Technician, ⁶ Director, Forest Research
Institute, *FD-AFoCO IPDM Project

Abstract

This survey was carried out to record the pests and their natural enemies associated with teak plantation in five townships namely, Paukkhaung, Padaung, Tharrawaddy, Minhla and Gyobingauk Township at Pyay and Tharyarwaddy Districts, Bago Region from August to December, 2022. In this experiment 23 pest species and 13 species of natural enemies were recorded by visual observation. 26 pest species and 11 species of natural enemies were recorded by using light trap. 30 pest species and 14 species of natural enemies were recorded by using yellow sticky trap. 27 pest species and 8 species of natural enemies were recorded by using insect net. The results revealed that teak is attacked by totally 46 species of pest. Out of them, 12 species were from Lepidoptera (26.1%), 12 species from Coleoptera (26.1%), 10 species from Hemiptera (21.7%), 7 species from Orthoptera (15.2%), 3 species from Homoptera (6.5%) and 2 species from Isoptera (4.4%). Out of the total reported species, leaf feeders are dominant (45.7%), sap feeders (26.1%) are moderate followed by stem borer (10.9%), root feeder (8.7%), flower and seed feeders (4.3 %) and bark feeders (4.3%) respectively. The results also revealed that totally 19 species of natural enemies were associated with pests. Out of 19 species of natural enemies, 5 species from Hymenoptera (26.3%), 5 species from Araneae (26.3%), 4 species from Coleoptera (21 %), 2 species from Odonata (10.5%), 1 species from Orthoptera (5.3%), 1 species from Hemiptera (5.3%) and 1 species from Neuroptera (5.3%) were recorded.

Keywords: Teak, *Tectona grandis*, diversity, pest, natural enemies, Bago region, Myanmar

**ပဲခူးတိုင်းဒေသကြီးအတွင်း တည်ထောင်ကျွန်းစိုက်ခင်းများတွင် ကျရောက်တတ်သည့်
အင်းဆက်ဖျက်ပိုးများနှင့် ၎င်းတို့၏သဘာဝရန်သူ အင်းဆက်များ**

ဒေါက်တာသန့်ရှင်း^၁၊ ထူးထူးလွင်^၂၊ မျိုးထက်အောင်^၃၊ ရဲလွင်အောင်^၄၊ ဇော်မင်းအေး^၅၊
ဒေါက်တာမူမူကျော်^၆၊ မိုးဇော်^၆

^၁ဒုတိယညွှန်ကြားရေးမှူး (သစ်တောသုတေသနဌာန)၊ ^၂စီမံကိန်းလက်ထောက်၊
^၃စီမံကိန်းအတွင်းရေးမှူး၊ ^၄ဦးစီးအရာရှိ(သစ်တောသုတေသနဌာန)၊ ^၅ဖျက်ပိုးပညာရှင်၊
^၆ညွှန်ကြားရေးမှူး(သစ်တောသုတေသနဌာန)၊ *FD-AFoCO IPDM Project

စာတမ်းအကျဉ်း

သာယာဝတီခရိုင်၊ သာယာဝတီ၊ မင်းလှ၊ ကြို့ပင်ကောက်မြို့နယ်များနှင့် ပြည်ခရိုင် ပေါက်ခေါင်းမြို့နယ်၊ ပန်းတောင်းမြို့နယ်များရှိ ကျွန်းစိုက်ခင်းများတွင် ကျရောက်တတ်သည့် အင်းဆက်ဖျက်ပိုးများနှင့် ၎င်းတို့၏ သဘာဝရန်သူအင်းဆက်များအား လေ့လာမှတ်တမ်းတင်နိုင်ရန် ဤသုတေသနလုပ်ငန်းအား ဆောင်ရွက်ခဲ့ခြင်းဖြစ်ပါသည်။ ၂၀၂၂ ခုနှစ် ဩဂုတ်မှ ဒီဇင်ဘာလအတွင်း ကွင်းဆင်းဆောင်ရွက်ခဲ့ခြင်းဖြစ်ပါသည်။ ဖျက်ပိုး (၂၃) မျိုးနှင့် ၎င်းတို့၏သဘာဝရန်သူ (၁၃) မျိုးအား မျက်မြင်လေ့လာခြင်းဖြင့်လည်းကောင်း၊ ဖျက်ပိုး (၂၆) မျိုးနှင့် ၎င်းတို့၏ သဘာဝရန်သူ (၁၁) မျိုးအား မီးအိမ်ထောင်ခြောက်ဖြင့်လည်းကောင်း၊ ဖျက်ပိုး (၃၀) မျိုးနှင့် ၎င်းတို့၏သဘာဝရန်သူ (၁၄) မျိုးတို့ အား အဝါရောင်ကော်ပြားဖြင့်လည်းကောင်း၊ မီးအိမ်ထောင်ခြောက်ဖြင့်လည်းကောင်း၊ ဖျက်ပိုး (၂၇) မျိုးနှင့် ၎င်းတို့၏သဘာဝရန်သူ (၈) မျိုးတို့အား အင်းဆက်ဖမ်းပိုက်ဖြင့်လည်းကောင်း ဖမ်းဆီး၍ မှတ်တမ်းတင်နိုင်ခဲ့ပါသည်။ ကျွန်းစိုက်ခင်းများတွင် ကျရောက်တတ်သည့် ဖျက်ပိုး စုစုပေါင်း (၄၆) မျိုးအား မှတ်တမ်းတင်နိုင်ခဲ့ပါသည်။ လေ့လာခဲ့သည့် ဖျက်ပိုးများအနက် Lepidoptera (၁)၂ မျိုး၊ Coleoptera (၁၂) မျိုး၊ Hemiptera (၁၀) မျိုး၊ Orthoptera (၇) မျိုး၊ Homoptera (၃) မျိုး၊ Isoptera (၂) မျိုးတို့အား မှတ်တမ်းတင်နိုင်ခဲ့ပါသည်။ ၎င်းတို့အနက် ရွက်စားပိုး ၄၅.၇ %၊ စုတ်စားပိုး ၂၆.၁ % ၊ ပင်စည်ထိုးပိုး ၁၀.၉ %၊ အမြစ်ထိုးပိုး ၈.၇ %၊ အပွင့်နှင့် သစ်စေ့ဖျက်ပိုး ၄.၃ % နှင့် အခေါက်ထိုးပိုး ၄.၃% ဖြစ်ကြောင်း လေ့လာသိရှိခဲ့ရပါသည်။ အဆိုပါ ဖျက်ပိုးများ၏ သဘာဝရန်သူ (၁၉) မျိုးအား လေ့လာမှတ်တမ်းတင်နိုင်ခဲ့ပါသည်။ သဘာဝရန်သူ များအနက် Hymenoptera (၅) မျိုး၊ Araneae (၅) မျိုး၊ Coleoptera (၄) မျိုး၊ Odonata (၂) မျိုး၊ Orthoptera (၁) မျိုး၊ Hemiptera (၁) မျိုး၊ Neuoptera (၁) မျိုးတို့အား မှတ်တမ်းတင်နိုင်ခဲ့ပါသည်။

Diversity of Insect Pests and Their Natural Enemies Infesting Teak (*Tectona grandis* L. f, Lamiaceae) in Bago Region, Myanmar

1. Introduction

Teak (*Tectona grandis* L.f.) (Family Lamiaceae) is highly prized constructional and multipurpose timber species, found in the tropical and sub - tropical forests. Its natural distribution in India, Myanmar and Thailand ranges from sea level to 800m, even up to 1300m above sea level. The species has been planted in other tropical regions since the beginning of the 19th century, especially in Asia, Africa and Central America (Keogh, 1979; Dupuy, 1990). Teak, *Tectona grandis*, is a hardwood tree native to much of South and Southeast Asia, including Myanmar. Due to its natural water resistance, teak is sought out for a variety of uses including furniture-making and shipbuilding (Bryant, 1997).

Teak has been important to the economy of Myanmar since British Colonization. In Myanmar, large area of teak plantations have been establishing since 1980 and a total of 255,711 acres have been raised up to 1996 (Myint, 1997). In Myanmar, it is naturally found in areas between the 25°30'N and 10°N lines of latitude. Teak mostly grows in hilly areas below 900 metres (3,000 ft) in elevation. Within the country, teak is most common in mixed deciduous forests as well as evergreen and semi evergreen forests (Gyi and Tint, 1995). In the south of Myanmar, major teak forests existed in the Bago and Tanintharyi Hills. Other notable areas of teak growth include the Arakan (Rakhine) Mountains in the west of the country and the Shan Hills in the East (Gyi and Tint, 1995).

Nearly 294 insects have been identified on teak, which includes 147 species from order Coleoptera, 94 species from Lepidoptera, 23 species from Orthoptera, 21 species from Hemiptera, 7 species from Isoptera, 1 species from Diptera and 1 species from Hymenoptera (Beeson, 1941; Mani 1959; Mathur, 1960; Mathur and Singh, 1960; Muttiah, 1967; Browne, 1968; Vastrad *et al.*, 1989; Varma, 1991; Tewari, 1992; Chey, 1996; Roychoudhury *et al.*, 2001). These insects attack all the stages of teak growth, from seed to mature trees. About 196 species of insects are associated with living teak, comprising mainly defoliators (141), sap suckers (17), stemborers (16), root feeders (12) and seed feeders (9) and gall former (1) (Shukla *et al.*, 2001). Many of these insects are minor or occasional pests and very few are considered as insect pests of economic importance (Roychoudhury, 1998).

Teak plantations often suffer severe damage from insect attack and outbreak of infestation has been occasionally reported in Myanmar. Myint and Win (2016) earlier reported that shoot borer (*Zeuzea coffeae* Nietner), leaf feeder (*Eutectona machaeralis* Walker), sap sucking bug (*Tingis* sp.), stem borer (*Acalolepta cervinus* Hope), saplingborer (*Sahyadrassus malabaricus* Moore) and termite (*Copotermes curvignathus*) infested young teak plant from an experiment conducted in Nyaung Chae Thawk Reserve Forest, Oktwin Township, Bago Region and in Pa Lway Reserve Forest, Leway Township, Nay Pyi Taw, Myanmar.

In fact, the total number of insect pests infesting teak was not reported in forest trees protection in Myanmar. Hence, in the present investigation an attempt is being made for bringing out a systematic documentation of all the insect pests attacking teak in Bago Region as well as the occurrence of natural enemies of the major pests in this region with following objectives.

2. Literature review

2.1. Major insect pests

Teak is attacked by 30 species of insect pests belonging to genera *Mylocerus*, *Astycus*, *Trachypholis*, *Xyloboris*, *Cryphalus*, *Silvanus*, *Eugonius*, *Figureros*, *Psiloptera*, *Adelocera*, *Mesomorpha*, *Aspidomorpha*, *Aegosoma*, *Gelonaetha* etc. of order Coleoptera, *Hyblaea*, *Pyrausta*, *Eutectona* of order Lepidoptera and *Monophlebus* and *Aleurodicus* of order Hemiptera (Patil, S.S. Sutar M.V. and T.V. Sathe, 2016). Tripathy and Rout (2018) also reported that teak is attacked by 42 species of insect pests out of which *Hyblaea puera*, *Eutectona machaeralis*, *Pteroma plagiophelps*, *Orgia albipunctata*, *Oxya velox*, *Atractomorpha crenulata*, *Mylocerus* sp., *Odontotermes obesus*, *Sahyadrasus malabaricus*, *Inderbala quadrinotata*, *Ferissia virgate*, *Celosterna scabrator*, *Aphis gossypii*, *Tricentrus bicolour*, *podisus brevispinus* were found as major pests.

2.2. Nursery pests

Teak is heavily attacked in the nurseries by insects. Root feeders and sap suckers are major in nursery. Severe damage is caused by white grubs, which feed on the roots. Among the white grubs, *Holotrichia* sp. (Coleoptera: Scarabaeidae) is found to be most injurious and causes high mortality among teak seedling (Muttiah, 1967; Oka and Vaishampayan, 1979; Sen-Sarma and Thapa, 1981; Vashampayan and Bhandari, 1981).

2.3. Defoliators (Leaf feeders)

Defoliators are the major pest of teak. Among all, *Hyblaea puera* Cramer (Lepidoptera: Hyblaeidae), popularly known as the teak defoliator, and *Eutectona machaeralis* Walker, popularly known as the teak skeletonizer, are recognized as major insect pests of economic importance (Roychoudhury, 2002). Roychoudhury and K.C.Joshi (2002) also mentioned that *Spodoptera litura*, *Mylocerus viridanus*, *Colasposoma* sp, *Aulacophora nigripennis*, *Aulacophora foveicollis*, *Colasposoma* sp, *Spilosoma obliqua*, *Tarbinskiellus portentosus*, *Hyblaea puera*, *Aspidimorpha sanctaecrucis*, *Phyllocnistis tectonivora*, *Conocephalus maculatus*, *Pterophylla camellifolia*, *Mecopoda elongate*, *Acrida turrita*, *Eutectona machaeralis* and *Acraea violae* were leaf feeders of teak.

Recently, *Paliga demastesalis* Walker (Lepidoptera: Pyralidae) has been reported as an important teak skeletonizer in Malaysia (Chey, 1996; Intachat, 1998, 1999). Myint (1997) reported an average of 36% of the teak trees were severely defoliated by *H. puera*. Moreover, due to severe defoliation, consequent reduction in teak fruit production was found in those trees during August 1996 in the seed production area within the Compartment number 59, Taung Nyo Reserve Forest, Myanmar.

2.4. Sap feeders

Roychoudhury and K.C.Joshi (2002) mentioned that *Aphis gossypii*, *Bothrogonia ferruginea*, *Tingis* sp., *Icerya* sp., *Pseudococcus* sp., *Leptocentrus taurus* were sap feeders of teak.

2.5. Stem and bark feeders

Stem borer, such as *Alceterogystia cadambae* (Moore) (Lepidoptera: Coccidae), *Sahyadrassus malabaricus* (Moore) (Lepidoptera: Hepialidae), cause heavy localized infestations (Mathew, 1990). However, the timber of teak is resistant to the borer attack due to the presence of certain phenolic compounds, such as tectoquinone and lapachol (Sandermann and Simatupang, 1966). Attack of several species of stem borers to teak has been reported from the country and abroad by various workers like Baksha (1990) among

which sapling borer was the important one. Babul root and shoot borer being a polyphagous one also attack teak and reported earlier by Sen Sharma (1983). Indarbela sp. was also reported as feeder on the bark in http://www.dnp.go.th/FIG/pests/others/indarbela_t.htm.

2.6. Root feeders

Jha and Sen Sharma (2008) reported white grubs along with termites as the main root feeding species in teak nurseries of M. P. Chatisgarh and Odisha.

2.7. Flower and Seed feeders

Insects feeding on the reproductive parts of teak are responsible for poor seed setting particularly in seed orchards and seed production areas. In these areas, seed borer such as *Dichocrosis punctiferalis* Guenee (*Conogethes punctiferalis*) (Lepidoptera: Pyralidae) is very serious pest and causes heavy damage to seeds. It feeds on the flowers and seeds of the tree (Hedegart, 1973, Roychoudhury and K. C. Joshi, 2002). Nair, 2001 reported that *Mylabris phalerata* and *Leptocentrus* sp. cause significant damage to the flowering shoots and young fruits of teak in Thailand (http://www.forest.go.th/FIG/pests/others/mylabris_t.htm).

2.8. Timber pests

Considerable degradation of teak wood takes place due to insect borers in freshly felled or stored logs. According to Sadermann and Simatupang (1966), teak timber is resistant to the borer attack due to the presence of certain phenolic compounds, such as tectoquinone and lapachal. However, in freshly felled tree and sap wood of dry timber, damage by borer is known (Mathur, 1960). Though some borers also attack dead wood but the intensity of attack is less. The freshly felled timber is attacked by the pin whole borer, *Platypus* sp. And *Crossotarus* sp. (Coleoptera: Platypodidae). Other borers of freshly felled timber include about 22 species of the genus *Xylebours* (Coleoptera: Scolytidae) (Tewari, 1992).

The borers of sap wood and dead wood are of less importance and do not cause much damage except sap wood borer which sometimes causes heavy damage to even converted timber having sapwood. Most injurious insect damaging sap wood of converted timber of teak wood is *Lyctus africanus* Lesne (Coleoptera: Lyctidae), generally known as powder post beetle. The ghun or shot hole borer, *Dinoderus* sp. (Coleoptera: Bostrychidae) has been recorded to damage stored timber of teak (Joshi and Namdeo, 1990).

2.9. Natural enemies

A total of 45 species of parasitoids, 108 species of predators (insects and birds) of *H. puera* and 75 species of parasitoids, 31 species of predatory insects, 38 species of predatory spiders, many species of predatory birds of *E. machaeralis* was reported by Nair (1988). Mantids and wasps are reported to be the major predators of teak defoliator by Patil and Mohan Naik (1998).

3. Objectives

The main objective of this research is to study the diversity of insect pests infesting teak plantations and their natural enemies. The main objectives are as follow;

- To list the major insect pests found in young and old Teak plantations in Myanmar,
- To observe the natural incidence as well as to formulate effective control measures
- To list natural enemies of major insect pests infesting Teak

4. Materials and Methods

A survey was carried out to record the pests associated with teak plantation in Pyay and Tharyarwaddy Districts, Bago Region from August to December, 2022. Tharyarwaddy District is located in Bago Region of West Bago Yoma (between the latitude 17° 28' to 18° 48' N and longitude 95° 09' to 96° 05' E), Myanmar. It is 1,794,151ac (726,067 ha) in size and is composed of 8 Townships, namely; Tharyarwaddy, Letpadan, Minhla, Monyo, Okhpo, Gyobingauk, Zigon and Nattalin Townships. Pyay District is also located in Bago Region of West Bago Yoma (between the latitude 18° 20' to 19° 22' N and longitude 95° 06' to 97° 66' E), Myanmar. It is composed of 6 Townships, namely; Pyay, Paukkhaung, Padaung, Paungde, Thegon and Shwedaung Townships covering an area of 1,898,456 ac (768,278 ha). Among them survey areas were selected in Paukkhaung, Padaung, Tharrawaddy, Minhla and Gyobingauk Township. A total of 5 sample plots (100 acres) were selected from each township. One sample plot has an area of 20 acres. 5 subsample plots were laid out again within each sample plots in accordance sampling design.

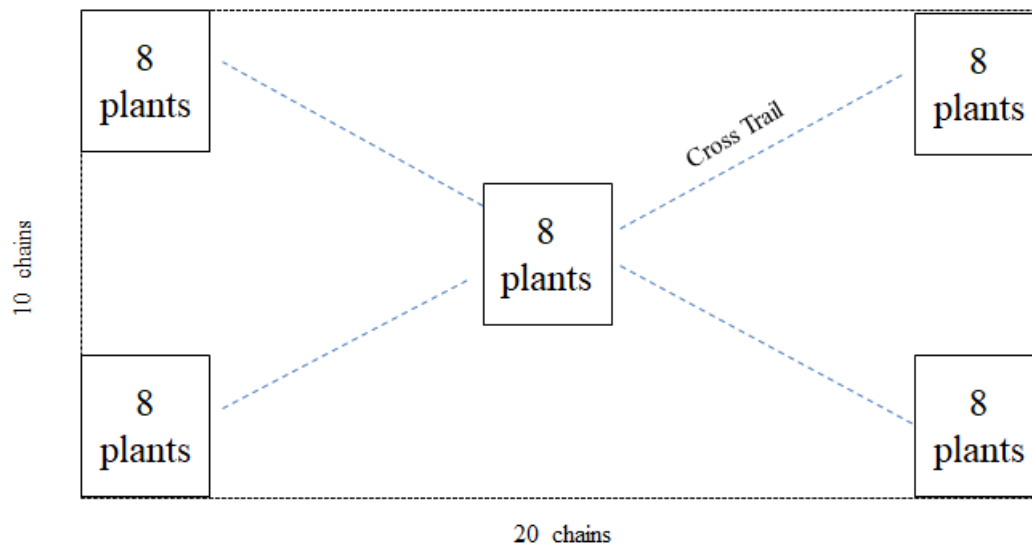


Figure 1: Layout design of sample plot

Table 1: List of representative teak plantations for pest survey

Sr.no.	Plantation No.	Year of Establishment	Location
1	2/1979	1979	Nawin (S) Reserve, Paukkhaung Township
2	2/1998	1998	Nawin (S) Reserve, Paukkhaung Township
3	2/2007	2007	Nawin (M) Reserve, Paukkhaung Township
4	3/2013	2013	Nawin (S) Reserve, Paukkhaung Township
5	2/2021	2021	Nawin (M) Reserve, Paukkhaung Township
6	1/2008	2008	Thayetan Reserve, Padaung Township
7	2/2010	2010	Thayetan Reserve, Padaung Township
8	2/2012	2012	Thanlaegyí Reserve, Padaung Township

Sr.no.	Plantation No.	Year of Establishment	Location
9	1/2020	2020	Thani Reserve, Padaung Township
10	1/2021	2021	Thayetan Reserve, Padaung Township
11	1/2008	2008	Thonese Reserve, Thayarwaddy Township
12	1/2011	2011	Thonese Reserve, Thayarwaddy Township
13	1/2016	2016	Kanni Reserve, Thayarwaddy Township
14	1/2019	2019	Thonese Reserve, Thayarwaddy Township
15	1/2021	2021	Thonese Reserve, Thayarwaddy Township
16	1/2004	2004	Minhla Reserve, Minhla Township
17	2/2009	2009	Minhla Reserve, Minhla Township
18	1/2016	2016	Mokkha Reserve, Minhla Township
19	1/2017	2017	Mokkha Reserve, Minhla Township
20	1/2019	2019	Mokkha Reserve, Minhla Township
21	1/2008	2008	Bawbin Reserve, Gyobingauk Township
22	4/2010	2010	Bawbin Reserve, Gyobingauk Township
23	5/2010	2010	Bawbin Reserve, Gyobingauk Township
24	2/2011	2011	Bawbin Reserve, Gyobingauk Township
25	1/2021	2021	Bawbin Reserve, Gyobingauk Township

4.1. Methods of observations

The following methods were adapted to record observations;

- 4.1.1 Visual observation
- 4.1.2 Using light trap
- 4.1.3 Using yellow sticky trap
- 4.1.4 Using insect net

4.1.1. Visual observation

In each Township, 200 trees from 100 acres (over 45 ha) teak plantation were enumerated regarding the sample plot. A sub-sample-plot was collected in the four corners and in the middle of the teak plantation area in each 100 acres sample plot. Therefore, there will be 5 sub plots in each township to collect pest information. 40 trees were randomly marked permanently to record infestation of pests in one sub-sample plot at monthly interval (Figure 1.). The total number of larva, nymphs, adults of insects and natural enemies were counted at each observation on teak trees and classified. Not only Insect pests were counted but also damaged leaves were observed by visual observation (Figure 2 & 3).



Figure 2: Making marker number on teak tree



Figure 3: Visual counting in young teak plantations and old teak plantations

4.1.2. Using light trap

One light trap was set up in each sub-sample plot one night before recording. Light trap was lighting on from 6 pm to 6 am (Figure 4). Total number of individual pests and natural enemies trapped in light trap were counted and identified.



Figure 4: Setting light trap (up sight and lateral sight)

4.1.3. Using yellow sticky trap

Five yellow sticky traps were set up in each sub-sample plot at days 7 of individual pests and natural enemies stuck on yellow sticky traps were counted and identified.



Figure 5: Yellow sticky trap in young and old teak plantations

4.1.4. Using insect net

In each sub-sample plot, sweep net collection was done by walking in crossing before nine o' clock in the morning (Figure 7). Total number of individual pests and natural enemies collected in insect net were counted and identified.



Figure 6: Sweeping net collecting in teak plantation

5. Results and Discussion

5.1. Visual observation

Number of different species of pests and natural enemies recorded by visual observation in teak plantations are presented in Table 1 and 2. 23 pest species and 13 species of natural enemies are recorded in 5 townships (Table 1 and 2).

Table 2: Different species of pest recorded by visual observation in teak plantations of Pyay and Tharrawaddy Districts, Bago Region (August - December, 2022)

No	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
1.	Aphid	<i>Aphis gossypii</i>	x	-	-	x	x
2.	Ash weevil	<i>Mylocerus viridanus</i>	x	-	x	-	-

No	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
3.	Cricket	<i>Tarbinskiellus portentosus</i>	x	-	x	x	x
4.	Chafer beetle	<i>Amphimallon majale</i>	-	-	x	-	-
5.	Teak Defoliator	<i>Hyblaea puera</i>	-	x	-	x	x
6.	Golden tortoise beetle	<i>Aspidimorpha sanctaecrucis</i>	-	-	x	-	-
7.	Green leaf hopper	<i>Bothrogonia ferruginea</i>	x	x	-	-	x
8.	Gundhi bug	<i>Leptocoris oratoria</i>	x		x	-	x
9.	Horned shield bug	<i>Placosternum</i> sp.	-	-	-	x	-
10.	Lace bug	<i>Tingis</i> sp.	-	-	-	x	-
11.	Long horned grasshopper	<i>Conocephalus maculatus</i>	x	-	-	x	x
12.	Mealy bug	<i>Icerya</i> sp	x	-	-	x	-
13.	Mealy bug	<i>Pseudococcus</i> sp.	x	-	-	x	-
14.	Red borer	<i>Zeuzera coffeae</i>	-	-	-	x	-
15.	Scutellarid bug (Jewel bug)	<i>Chrysocoris purpureus</i>	-	-	-	x	-
16.	Short horned grasshopper	<i>Acrida turrita</i>	x	x	x	x	x
17.	Skeletoniser	<i>Eutectona machaeralis</i>	x	x		x	x
18.	Tawny coster	<i>Acraea violae</i>	-	-	x	x	x
19.	Teak canker grub	<i>Acalolepta cervinus</i>	-	-	-	x	-
20.	Fungus-growing Termite	<i>Odontotermes</i> sp.	x	x	x	x	x
21.	Rubber Termite	<i>Coptotermes curvignathus</i>	x	x	x	x	x
22.	Whitefly	<i>Bemisia tabaci</i>	-	-	-	x	-
23.	Yellow peach moth	<i>Conogethes punctiferalis</i>	-	-	-	x	-

Remark: Present x
Absent -

Table 3: Different species of natural enemies recorded by visual observation in teak plantations, Pyay and Tharrawaddy Districts, Bago Region (August - December, 2022)

No.	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
1.	Black ant	<i>Camponotus</i> sp.	x	x	x	x	x
2.	Red dragonfly	<i>Sympetrum fonscolombii</i>	-	x	-	-	x
3.	Green lace wing	<i>Chrysoperla</i> sp.	-	-	-	x	-
4.	Lady beetle	<i>Coccinella transversalis</i>	-	x		x	x
5.	Praying mantis	<i>Mantisa religiosa</i>	x	x	x	x	x
6.	Red ant	<i>Solenopsis</i> sp.	-	-	-	x	-

7.	Spider	<i>Lycosa pseudoanulata</i>	x	x	-	x	x
8.	Green lynx spider	<i>Peucetia viridans</i>	x	x	-	x	x
9.	Spider	<i>Oxyopes javanus</i>	x	x	-	x	x
10.	Spider	<i>Argiope</i> sp.	x	x	-	x	x
11.	Huntsman Spider	<i>Olios</i> sp.	x	x	-	x	x
12.	Wasp	<i>Bracon</i> sp.	-	x	-	x	-
13.	European paper wasp	<i>Polistes dominula</i>	-	-	x	x	x

Remark: Present x
Absent -

5.2. Using light trap

Number of different species of pests and natural enemies recorded by using light trap in teak plantations are presented in Table 3 and 4. 26 pest species and 11 species of natural enemies are recorded in 5 townships (Table 3 and 4).

Table 4: Different pest species recorded by light trap in teak plantations of Pyay and Tharyarwaddy Districts, Bago Region (August - December, 2022)

No.	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
1.	Aphid	<i>Aphis gossypii</i>	-	-	-	x	-
2.	Ash weevil	<i>Myloccerus viridanus</i>	x	-	x	-	-
3.	Black bug	unidentified	-	x	-	-	-
4.	Blister beetle	<i>Mylabris phalerata</i>	-	-	-	x	x
5.	Chafer beetle	<i>Amphimallon majale</i>	x	x	x	x	-
6.	Cricket	<i>Tarbinskiellus portentosus</i>	x	x	x	x	x
7.	Teak Defoliator	<i>Hyblaea puera</i>	x	-	-	x	x
8.	Dung beetle	<i>Heliocopris bucephalus</i>	x	-	-	-	-
9.	Green leaf hopper	<i>Bothrogonia ferruginea</i>	-	x	x	x	x
10.	Gundi bug	<i>Leptocoris oratoria</i>	-	-	x	x	x
11.	Horned shield bug	<i>Placosternum</i> sp.	-	-	-	x	-
12.	Lace bug	<i>Tingis</i> sp.	x	-	-	x	-
13.	Leaf hopper	<i>Ptyclis praefractus</i>	x	-	-	x	x
14.	Long horned Grass Hopper	<i>Conocephalus maculatus</i>	x	x	-	-	-
15.	Bush cricket	<i>Mecopoda elongate</i>	-	-	-	-	-
16.	Red borer	<i>Zeuzera coffeae</i>	x	-	-	x	-
17.	Root borer	<i>Phassus signifer</i>		x		x	-
18.	S Grass Hopper	<i>Acrida turrita</i>	x	x	x	x	x
19.	Sapling borer	<i>Sahyadrassus malabaricus</i>	-	-	-	x	-
20.	Scutellaria bug (Jewel bug)	<i>Chrysocoris purpureus</i>	-	-	-	x	-

No.	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
21.	Skeletoniser	<i>Eutectona machaeralis</i>	-	-	-	x	x
22.	Tawny coster	<i>Acraea violae</i>	-	-	-	x	-
23.	Teak canker grub	<i>Acalolepta cervinus</i>	-	-	-	x	-
24.	White fly	<i>Bemisia tabaci</i>	-	-	-	x	-
25.	White grub	<i>Holotrichia consanguinea</i>	-	-	-	x	-
26.	Yellow peach moth	<i>Conogethes punctiferalis</i>	-	-	-	x	-

Remark: Present x

Absent -

Table 5: Different species of natural enemies recorded by using light trap in teak plantations of Pyay and Tharrawaddy Districts, Bago Region (August - December, 2022)

No.	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
1.	Black ant	<i>Camponotus</i> sp.	x	-	x	-	x
2.	Red dragonfly	<i>Sympetrum fonscolombii</i>	-	-	-	x	-
3.	Ground beetle	<i>Nebria brevicollis</i>	x	x	-	x	-
4.	Lace wing	<i>Chrysoperla</i> sp.	-	x	-	x	-
5.	Lady beetle	<i>Coccinella transversalis</i>	-	x	-	x	-
6.	Praying mantis	<i>Mantisa religiosa</i>	x	-	x	-	x
7.	Red ant	<i>Solenopsis</i> sp.	-	-	-	x	-
8.	Spider	<i>Lycosa pseudoanulata</i>	x	-	x	x	x
9.	Wasp	<i>Bracon</i> sp.	-	x	-	-	-
10.	Wasp	<i>Polistes dominula</i>	-	-	-	x	x
11.	Wasp	<i>Apanteles</i> sp.	x	-	x	x	x

Remark: Present x

Absent -

5.3. Using yellow sticky trap

Number of different species of pests and natural enemies recorded by using yellow sticky trap in teak plantations are presented in Table 5 and 6. 30 pest species and 14 species of natural enemies are recorded in 5 townships (Table 5 and 6).

Table 6: Different pest species recorded by using yellow sticky trap in teak plantations of Pyay and Tharyarwaddy Districts, Bago Region (August – December, 2022)

No.	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
1.	Aphid	<i>Aphis gossypii</i>	-	-	-	x	-
2.	Army worm	<i>Spodoptera litura</i>	-	-	-	x	-
3.	Black bug	unidentified	-	x	-	-	-
4.	Black pumpkin beetle	<i>Aulacophora nigripennis</i>	x	-	-	-	-
5.	Blister beetle	<i>Mylabris phalerata</i>	-	-	-	x	-
6.	Chafer beetle	<i>Amphimallon majale</i>	x	-	x	x	-
7.	Cicada	<i>Burmecicada protera</i>	-	-	-	x	-
8.	Common hairy caterpillar	<i>Spilosoma obliqua</i>	-	x	-	x	-
9.	Cotton stainer bug	<i>Dysdercus cingulatus</i>	-		-	x	-
10.	Cricket	<i>Tarbinskiellus portentosus</i>	x	x	x	x	x
11.	Teak Defoliator	<i>Hyblaea puera</i>	x	x	-	x	
12.	Green leaf hopper	<i>Bothrogonia ferruginea</i>	-	x	x	x	x
13.	Gundhi bug	<i>Leptocorisa oratoria</i>	x	-	x	x	-
14.	Horned shield bug	<i>Placosternum</i> sp.	-	x	-	x	-
15.	Lace bug	<i>Tingis</i> sp.	-	-	-	x	
16.	Leaf hopper	<i>Ptyclis prae fractus</i>	x	-	-	x	x
17.	L grass hopper	<i>Conocephalus maculatus</i>	x	x	-	x	-
18.	Red borer	<i>Zeuzera coffeae</i>	x	x	-	x	-
19.	Red Pumpkin beetle	<i>Aulacophora foveicollis</i>	x	-	-	-	-
20.	Root borer	<i>Phassus signifer</i>	-	-	-	x	-
21.	Short horned Grasshopper	<i>Acrida turrita</i>	x	x	x	x	x
22.	Sapling borer	<i>Sahyadrassus malabaricus</i>		-	-	x	-
23.	Skeletoniser	<i>Eutectona machaeralis</i>	x	-	-	x	-
24.	Spider		x	x	x	x	x
25.	Sucking bug		-	x	-	-	-
26.	Teak canker grub	<i>Acalolepta cervinus</i>	-	-	-	x	-
27.	Trunk borer	<i>Alceterogystia cadambae</i>	-	-	-	x	-
28.	Tree hopper	<i>Leptocentrus Taurus</i>	x	-	-		-
29.	White fly	<i>Bemisia tabaci</i>	x	-	-	x	-
30.	Yellow peach moth	<i>Conogethes punctiferalis</i>	-	-	-	x	-

Remark: Present x
 Absent -

Table 7: Different species of natural enemies recorded by using yellow sticky trap in teak plantations of Pyay and Tharyarwaddy Districts, Bago Region (August - December, 2022)

No.	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
1.	Assassin bug	<i>Zelus renardii</i>	x	-	-	-	-
2.	Black ant	<i>Camponotus</i> sp.	x	x	x	x	x
3.	Red dragonfly	<i>Sympetrum fonscolombii</i>	x	x	-	x	x
4.	Damsel fly	Unidentified	x	x	x	x	x
5.	Ground beetle	<i>Nebria brevicollis</i>	x	x	-	x	
6.	Lace wing	<i>Chrysoperla</i> sp.	x	-	-	x	-
7.	Lady beetle orange	<i>Coccinella transversalis</i>	x	x	-	x	x
8.	Lady beetle	<i>Cycloneda munda</i>	x	-	-	-	-
9.	Lady beetle red	<i>Coccinella undecimpunctata</i>	x	-	-	-	-
10.	Mantis	<i>Mantisa religiosa</i>	-	x	x	x	-
11.	Spider	<i>Lycosa pseudoanulata</i>	x	x	x	x	x
12.	Wasp	<i>Bracon</i> sp.	x	x	x	x	
13.	Wasp	<i>Apanteles</i> sp.	x	x	x	x	x
14.	European Paper wasp	<i>Polistes dominula</i>	-	-	x	x	-

Remark: Present x
 Absent -

5.4. Using insect net

Number of different species of pests and natural enemies recorded by using insect net in teak plantations are presented in Table 7 and 8. 27 pest species and 8 species of natural enemies are recorded in 5 townships (Table 7 and 8).

Total number of different species of pests and natural enemies recorded in teak plantations in five townships are presented in Table 9 and 10. 46 pest species and 19 species of natural enemies are recorded in 5 townships (Table 9 and 10).

Table 8: Different species of pest recorded by using insect net in teak plantations of Pyay and Tharyarwaddy Districts, Bago Region (August – December, 2022)

No.	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
1.	Ash weevil	<i>Myliocerus viridanus</i>	x	-	x	-	-
2.	Black bug	unidentified	x	-	-	-	-
3.	Blue beetle	<i>Colasposoma</i> sp	-	-	-	x	-

No.	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
4.	Black beetle	<i>Colasposoma</i> sp	-	-	-	x	-
5.	Butterfly	<i>Catopsilia pomona</i>	-	-	-	x	-
6.	Chafer beetle	<i>Amphimallon majale</i>	x	-	x	-	-
7.	Cricket	<i>Tarbinskiellus portentosus</i>	x	-	x	-	x
8.	Defoliator	<i>Hyblaea puera</i>	-	-	-	x	
9.	Green leaf hopper	<i>Bothrogonia ferruginea</i>	-	x	x	x	x
10.	Gundi bug	<i>Leptocoris oratoria</i>	x	-	x	x	
11.	Horned shield bug	<i>Placosternum</i> sp.	x	-	-	-	-
12.	Jewel beetle		-	-	-	-	x
13.	Lace bug/ Sucking bug	<i>Tingis</i> sp.	-	-	-	x	-
14.	L Grass hopper	<i>Conocephalus maculatus</i>	x	x	-	x	x
15.	L Grass hopper	<i>Mecopoda elongate</i>	x	x	-	x	x
16.	L Grass hopper	<i>Pterophylla camellifolia</i>	x	x	-	x	x
17.	Red borer	<i>Zeuzera coffeae</i>	-	-	-	x	-
18.	Root borer	<i>Phassus signifer</i>	-	-	-	x	-
19.	S. Grass Hopper	<i>Acrida turrita</i>	x	x	x	x	x
20.	S. Grass Hopper	<i>Oxya chinensis</i>	x	x	x	x	x
21.	S. Grass Hopper	<i>Oxya yezoensis</i>	x	x	x	x	x
22.	Skeletoniser	<i>Eutectona machaeralis</i>	x	-	-	x	-
23.	Tawny coster	<i>Acraea violae</i>	-	x	-	-	-
24.	Teak canker grub	<i>Acalolepta cervinus</i>	-	-	-	x	-
25.	Trunk borer	<i>Alceterogystia cadambae</i>	-	-	-	x	-
26.	Tree hopper	<i>Leptocentrus Taurus</i>	x	-	-	-	-
27.	White fly	<i>Bemisia tabaci</i>	x	-	-	x	-

Remark: Present x
Absent -

Table 9: Different species of natural enemies recorded by using insect net in teak plantations of Pyay and Tharrawaddy Districts, Bago Region (August - December, 2022)

No.	Common Name	Scientific	Tharyar	Minhla	Gyobin	Pauk	Pa
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		Name	waddy		gauk	khaung	daung
1.	Black ant	<i>Camponotus</i> sp.	x	-	x	x	x
2.	Red dragonfly	<i>Sympetrum fonscolombii</i>	x	x	x	x	x
3.	Lady beetle orange	<i>Coccinella transversalis</i>	x	x	-	x	x
4.	Praying mantis	<i>Mantisa religiosa</i>	x		x	x	x
5.	Spider	<i>Lycosa pseudoanulata</i>	x	x	x	x	x
6.	Wasp	<i>Bracon</i> sp.	-	x	x	-	-
7.	Wasp	<i>Apanteles</i> sp.	x	x	x	x	x
8.	European paper wasp	<i>Polistes dominula</i>	-	-	-	x	x

Remark: Present x
Absent -

Table 10: Total number of different pest species recorded in teak plantations in five townships, Pyay and Tharrawaddy Districts, Bago Region (August - December, 2022)

No.	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
1.	Aphid	<i>Aphis gossypii</i>	x	-	-	x	x
2.	Army worm	<i>Spodoptera litura</i>	-	-	-	x	-
3.	Ash weevil	<i>Myliocerus viridanus</i>	x	-	x	-	-
4.	Black beetle	<i>Colasposoma</i> sp	-	-		x	-
5.	Black Pumpkin beetle	<i>Aulacophora nigripennis</i>	x	-	-	-	-
6.	Blue beetle	<i>Colasposoma</i> sp	-		-	x	-
7.	Black bug	unidentified	x	x	-	-	-
8.	Blister beetle	<i>Mylabris phalerata</i>	-	-	-	x	x
9.	Butterfly	<i>Catopsilia pomona</i>	x	-	-	-	-
10.	Chafer beetle	<i>Amphimallon majale</i>	x	x	x	x	-
11.	Cicada	<i>Burmacicada protera</i>	-	-	-	x	-
12.	Common hairy caterpillar	<i>Spilosoma obliqua</i>	-	x	-	x	-
13.	Cotton stainer bug	<i>Dysdercus cingulatus</i>	-	-	-	x	-
14.	Cricket	<i>Tarbinskiellus portentosus</i>	x	x	x	x	x
15.	Defoliator	<i>Hyblaea puera</i>	x	x	-	x	x
16.	Dung beetle	<i>Helicopriss bucephalus</i>	x	-	-	-	-
17.	Golden tortoise beetle	<i>Aspidimorpha sanctaecrucis</i>	-	-	x	-	-
18.	Green leaf hopper	<i>Bothrogonia</i>	x	x	x	x	x

No.	Common Name	Scientific Name	Tharyar waddy	Min hla	Gyobin gauk	Pauk khaung	Pa daung
		<i>ferruginea</i>					
19.	Gundi bug	<i>Leptocoris oratoria</i>	x		x	x	x
20.	Horned shield bug	<i>Placosternum</i> sp.	x	x	-	x	-
21.	Jewel beetle	<i>Chrysochroa fulgidissima</i>	-	-	-	-	x
22.	Lace/ sucking bug	<i>Tingis</i> sp.	x	x	-	x	-
23.	Leaf miner	<i>Phyllocnistis tectonivora</i>	x	x	x	x	x
24.	L. Grass Hopper	<i>Conocephalus maculatus</i>	x	x	-	x	x
25.	L. Grass Hopper	<i>Pterophylla camellifolia</i>	x	x	-	x	x
26.	L. Grass Hopper	<i>Mecopoda elongate</i>	x	x	-	x	x
27.	Mealy bug	<i>Icerya</i> sp	-	-	-	x	-
28.	Mealy bug	<i>Pseudococcus</i> sp.	-	-	-	x	-
29.	Red borer	<i>Zeuzera coffeae</i>	x	x	-	x	-
30.	Red Pumpkin beetle	<i>Aulacophora foveicollis</i>	x	-	-	-	-
31.	Root borer	<i>Phassus signifer</i>	-	x	-	x	-
32.	S. Grass Hopper	<i>Acrida turrita</i>	x	x	x	x	x
33.	S. Grass Hopper	<i>Oxya chinensis</i>	x	x	x	x	x
34.	S. Grass Hopper	<i>Oxya yezoensis</i>	x	x	x	x	x
35.	Sapling borer	<i>Sahyadrassus malabaricus</i>	-	-	-	x	-
36.	Skeletoniser	<i>Eutectona machaeralis</i>	x	x	-	x	x
37.	Scutellaria bug	<i>Chrysocoris purpureus</i>	-	-	-	x	-
38.	Tawny coster	<i>Acraea violae</i>	-	x	-	x	x
39.	Teak canker grub	<i>Acalolepta cervinus</i>	-	-	-	x	-
40.	Termite	<i>Odontotermes</i> sp.	x	x	x	x	x
41.	Termite	<i>Coptotermes curvignathus</i>	x	x	x	x	x
42.	Trunk borer	<i>Alceterogystia cadambae</i>	-	-	-	x	-
43.	Tree hopper	<i>Leptocentrus Taurus</i>	x	-	-	-	-
44.	White grub	<i>Holotrichia consanguinea</i>	-	-	-	x	-
45.	white fly	<i>Bemisia tabaci</i>	x	-	-	x	-
46.	Yellow peach moth	<i>Conogethes punctiferalis</i>	-	-	-	x	-

Remark: Present x

Absent -

Table 11: Total number of natural enemies species recorded in teak plantations in five townships, Pyay and Tharyarwaddy Districts, Bago Region (August – December, 2022)

No.	Common Name	Scientific Name	Tharyarwaddy	Minhla	Gyobingauk	Paukkaung	Paung
1.	Assassin bug	Unidentified	x	-	-	-	-
2.	Black ant	<i>Camponotus</i> sp.	x	x	x	x	x
3.	Ground beetle	<i>Nebria brevicollis</i>	x	x	-	x	
4.	Red Dragonfly	<i>Sympetrum fonscolombii</i>	x	x	x	x	x
5.	Damsel fly	Unidentified	x	x	x	x	x
6.	Lace wing	<i>Chrysoperla</i> sp.	x	x	-	x	-
7.	Lady beetle orange	<i>Coccinella transversalis</i>	x	x	-	x	x
8.	Lady beetle	<i>Cycloneda munda</i>	x	-	-	-	-
9.	Lady beetle red	<i>Coccinella undecimpunctata</i>	x	-	-	-	-
10.	Mantis	<i>Mantisa religiosa</i>	x	x	x	x	x
11.	Red ant	<i>Solenopsis</i> sp.	-	-	-	x	-
12.	Spider	<i>Lycosa pseudoanulata</i>	x	x	x	x	x
13.	Spider	<i>Oxyopes javanus</i>	x	-	x	-	-
14.	Spider	<i>Argiope</i> sp.	x	-	-	-	-
15.	Huntsman spider	<i>Olios</i> sp.	x	-	-	-	-
16.	Green lynx spider	<i>Peucetia viridans</i>	x	-	-	-	-
17.	Wasp	<i>Bracon</i> sp.	x	x	x	x	
18.	Wasp	<i>Apanteles</i> sp.	x	x	x	x	x
19.	Wasp	<i>Polistes dominula</i>			x	x	x

Remark: Present x
Absent -

Out of 46 species of insect pest, 12 species from Lepidoptera (26.1%), 12 species from Coleoptera (26.1%), 10 species from Hemiptera (21.7%), 7 species from Orthoptera (15.2%), 3 species from Homoptera (6.5%) and 2 species from Isoptera (4.4%) are shown in Table 11 and Fig. 6. Fig. 7 also indicate that leaf feeders are dominant (45.7%), sap feeders (26.1%) are moderate followed by stem borer (10.9%), root feeder (8.7%), flower and seed feeders (4.3 %) and bark feeders (4.3%) respectively.

Out of 19 species of natural enemies, 5 species from Hymenoptera (26.3%), 5 species from Araneae (26.3%), 4 species from Coleoptera (21 %), 2 species from Odonata (10.5%), 1 species from Orthoptera (5.3%), 1 species from Hemiptera (5.3%) and 1 species from Neuroptera (5.3%) are indicated in Table 12 and Fig. 8. Order Hymenoptera and Araneae are dominant order among the detected species of natural enemies. Order Coleoptera which includes lady beetles is moderately dominant followed by order Odonata (Red dragonfly and damsel fly), Orthoptera (prying mantid), Neuroptera (green lace wing) and Hemiptera (Assassin bug) respectively. Insect pests and natural enemies recorded are shown in Appendix. Shoot borer, *Hypsipyla robusta* and bark borer, *Indarbela tetraonis* were not found in this survey period.

Table 12: Categories of different pests of *Tectona grandis* based on the nature of damage in Pyay and Tharyarwaddy Districts, Bago Region (August – December, 2022)

No.	Common Name	Scientific Name	Order	Family	Pest Category
1.	Army worm	<i>Spodoptera litura</i> Fabricius	Lepidoptera	Noctuidae	Defoliator
2.	Ash weevil	<i>Mylloceris viridanus</i>	Coleoptera	Curculionidae	Foliage Feeder
3.	Black beetle	<i>Colasposoma viridicoeruleum</i>	Coleoptera	Chrysomelidae	Foliage Feeder
4.	Black Pumpkin beetle	<i>Aulacophora nigripennis</i>	Coleoptera	Chrysomelidae	Foliage Feeder
5.	Blue beetle	<i>Colasposoma</i> sp.	Coleoptera	Chrysomelidae	Foliage Feeder
6.	Black bug	unidentified	Hemiptera		Foliage Feeder
7.	Butterfly	<i>Catopsilia pomona</i>	Lepidoptera	Pieridae	Foliage Feeder
8.	Common hairy caterpillar	<i>Spilosoma obliqua</i>	Lepidoptera	Erebidae	Foliage Feeder
9.	Cricket	<i>Tarbinskiellus portentosus</i>	Orthoptera	Gryllidae	Foliage Feeder
10.	Teak Defoliator	<i>Hyblaea puera</i>	Lepidoptera	Hyblaeidae	Defoliator
11.	Golden tortoise beetle	<i>Aspidimorpha sanctaecrucis</i>	Coleoptera	Chrysomelidae	Foliage Feeder
12.	Leaf miner	<i>Phyllocnistis tectonivora</i> Meyrick	Lepidoptera	Gracillariidae	Foliage Feeder
13.	Long horned Grass Hopper	<i>Conocephalus maculatus</i>	Orthoptera	Tettigoniidae	Foliage Feeder
14.	Rough-winged katydid	<i>Pterophylla camellifolia</i>	Orthoptera	Tettigoniidae	Foliage Feeder
15.	Bush cricket	<i>Mecopoda elongate</i>	Orthoptera	Tettigoniidae	Foliage Feeder
16.	Red Pumpkin beetle	<i>Aulacophora foveicollis</i>	Coleoptera	Chrysomelidae	Foliage Feeder
17.	Short horned grasshopper	<i>Acrida turrita</i>	Orthoptera	Acrididae	Foliage Feeder
18.	Short horned grasshopper	<i>Oxya chinensis</i>	Orthoptera	Acrididae	Foliage Feeder
19.	Rice field grasshopper	<i>Oxya yezoensis</i>	Orthoptera	Acrididae	Foliage Feeder
20.	Skeletoniser	<i>Eutectona machaeralis</i> Walker	Lepidoptera	Pyalidae	Defoliator
21.	Tawny coster	<i>Acraea violae</i>	Lepidoptera	Nymphalidae	Foliage feeder
22.	Aphid	<i>Aphis gossypii</i> Glover	Hemiptera	Aphididae	Sap Feeder
23.	Cicada	<i>Burmacicada protera</i>	Homoptera	Cicadidae	Sap feeder
24.	Cotton stainer bug	<i>Dysdercus cingulatus</i>	Hemiptera	Pyrrhocoridae	Sap Feeder
25.	Green leaf hopper	<i>Bothrogonia ferruginea</i>	Homoptera	Cicadallidae	Sap Feeder
26.	Gundhi Bug	<i>Leptocoris oratoria</i>	Hemiptera	Alydidae	Sap Feeder
27.	Horned shield bug	<i>Placosternum</i> sp.	Hemiptera	Pentatonidae	Sap Feeder
28.	Lace bug	<i>Tingis</i> sp.	Hemiptera	Tingidae	Sap Feeder
29.	Mealy bug	<i>Icerya</i> sp.	Hemiptera	Coccidae	Sap Feeder
30.	Mealy bug	<i>Pseudococcus</i> sp.	Hemiptera	Pseudococcidae	Sap Feeder

No.	Common Name	Scientific Name	Order	Family	Pest Category
31.	Scutellerid bug (Jewel bug)	<i>Chrysocoris purpureus</i>	Hemiptera	Scutelleridae	Sap Feeder
32.	Eggplant horned planthopper	<i>Leptocentrus Taurus</i> Fabricius	Hemiptera	Membracidae	Sap Feeder
33.	White fly	<i>Bemisia tabaci</i>	Hemiptera	Aleyrodidae	Sap Feeder
34.	Jewel beetle	<i>Chrysochroa fulgidissima</i>	Coleoptera	Buprestidae	Stem borer
35.	Sapling borer	<i>Sahyadrassus malabaricus</i> Moore	Lepidoptera	Hepialidae	Stem borer
36.	Redborer	<i>Zeuzera coffeae</i> Nietner	Lepidoptera	Cossidae	Stem borer
37.	Teak canker grub	<i>Acalolepta cervinus</i>	Coleoptera	Cerambycidae	Stem borer
38.	Rubber Termites	<i>Coptotermes curvignathus</i> Holmgren	Isoptera	Rhinotermitidae	Bark Feeder
39.	Fungus-growing Termites	<i>Odontotermes</i> sp.	Isoptera	Termitidae	Bark Feeder
40.	Trunk borer, Carpenterworm	<i>Alcterogystia cadambae</i> Moore	Lepidoptera	Cossidae	Stem borer
41.	Blister beetle	<i>Mylabris phalerata</i>	Coleoptera	Meloidae	Flower and seed Feeder
42.	Yellow peach moth	<i>Conogethes punctiferalis</i>	Lepidoptera	Pyrilidae	Flower and seed Feeder
43.	Chafer beetle	<i>Amphimallon majale</i>	Coleoptera	Scarabaeidae	Root Feeder
44.	White grub (Sugarcane Beetle)	<i>Holotrichia consanguinea</i>	Coleoptera	Scarabaeidae	Root Feeder
45.	Dung beetle	<i>Heliocopris bucephalus</i>	Coleoptera	Scarabaeidae	Root Feeder
46.	Root borer	<i>Phassus signifer</i> Walk.	Lepidoptera	Hepialidae	Root and stem borer

Table 13: Natural enemies of major pests of Teak Pyay and Tharrawaddy District, Bago Region (August - December, 2022)

No.	Common Name	Species	Order	Family	Type of nature
1.	Wasp	<i>Apanteles</i> sp.	Hymenoptera	Braconidae	Parasite
2.	Wasp	<i>Bracon</i> sp.	Hymenoptera	Braconidae	Parasite
3.	European paper wasp	<i>Polistes dominula</i>	Hymenoptera	Polistinae	Parasite
4.	Black ant	<i>Camponotus</i> sp.	Hymenoptera	Formicidae	Predator
5.	Red ant	<i>Solenopsis</i> sp.	Hymenoptera	Formicidae	Predator
6.	Lady beetle	<i>Coccinella undecimpunctata</i>	Coleoptera	Coccinellidae	Predator
7.	Lady beetle	<i>Coccinella transversalis</i>	Coleoptera	Coccinellidae	Predator
8.	Lady beetle	<i>Cycloneda munda</i>	Coleoptera	Coccinellidae	Predator
9.	Spider	<i>Lycosa pseudoanulata</i>	Araneae	Lycosidae	Predator
10.	Green lynx spider	<i>Peucetia viridans</i>	Araneae	Oxyopidae	Predator
11.	Spider	<i>Oxyopes javanus</i>	Araneae	Oxyopidae	Predator
12.	Spider	<i>Argiope</i> sp.	Araneae	Papaveraceae	Predator
13.	Huntsman spider	<i>Olios</i> sp.	Araneae	Sparassidae	Predator
14.	Praying mantis	<i>Mantisa religiosa</i>	Orthoptera	Mantidae	Predator
15.	Green lace wing	<i>Chrysoperla</i> sp.	Neuroptera	Chrysopidae	Predator
16.	Red dragonfly	<i>Sympetrum fonscolombii</i>	Odonata	Libellulidae	Predator
17.	Damsel fly	Unidentified	Odonata		Predator
18.	Ground beetle	<i>Nebria brevicollis</i>	Coleoptera	Carabidae	Predator
19.	Assassin bug	<i>Zelus renardii</i>	Hemiptera	Reduviidae	Predator

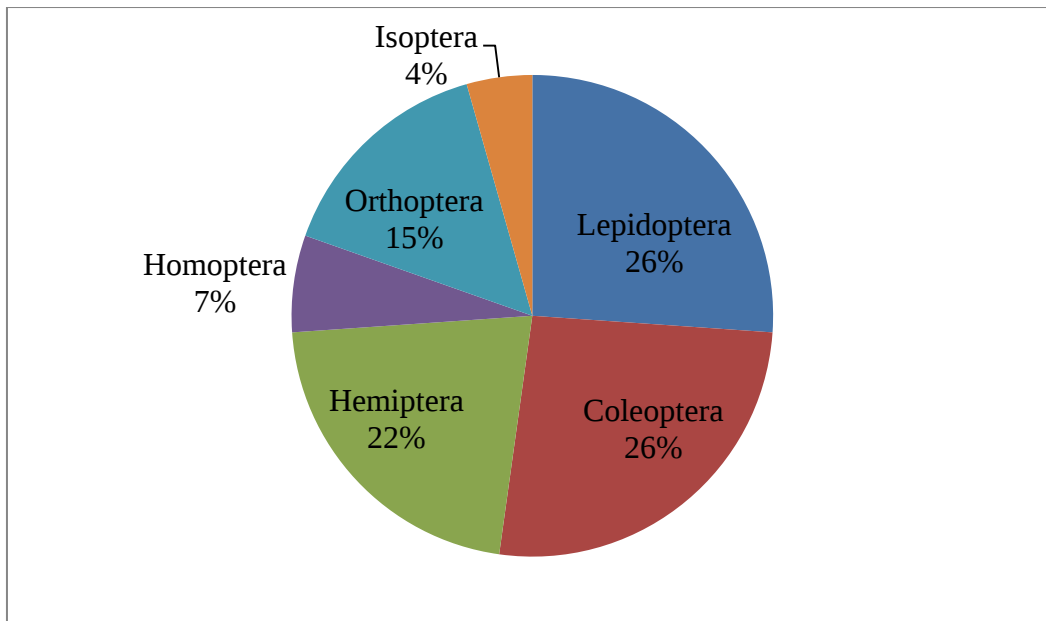


Figure 7: Percentage of different order of insect pests infesting Teak in Pyay and Tharyarwaddy Districts, Bago Region, August-December, 2022

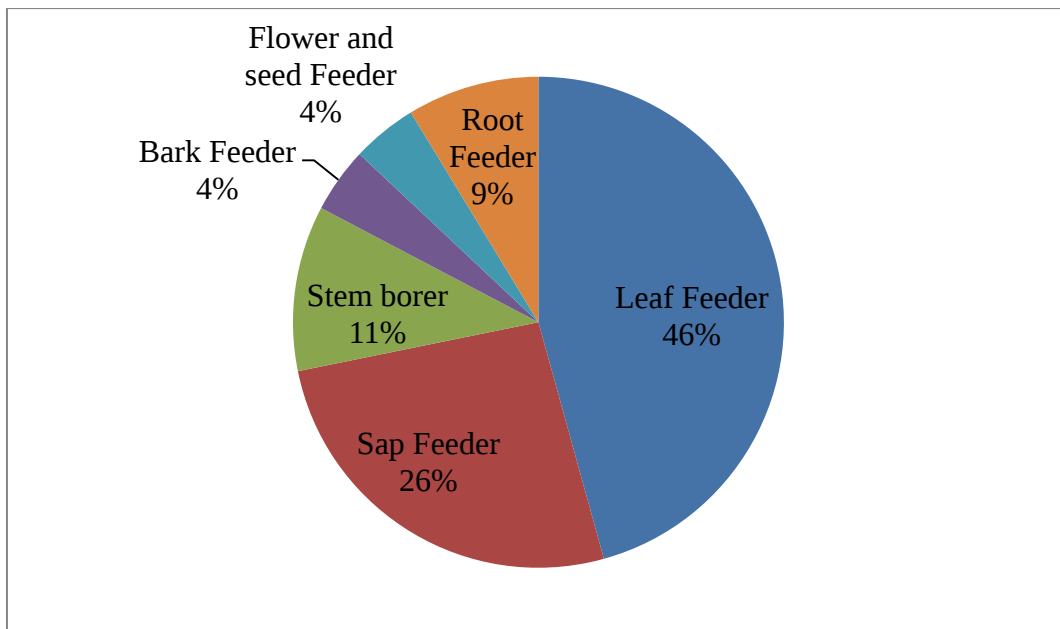


Figure 8: Percentage of different categories of insect pests infesting Teak in Pyay and Tharyarwaddy Districts, Bago Region, August-December, 2022

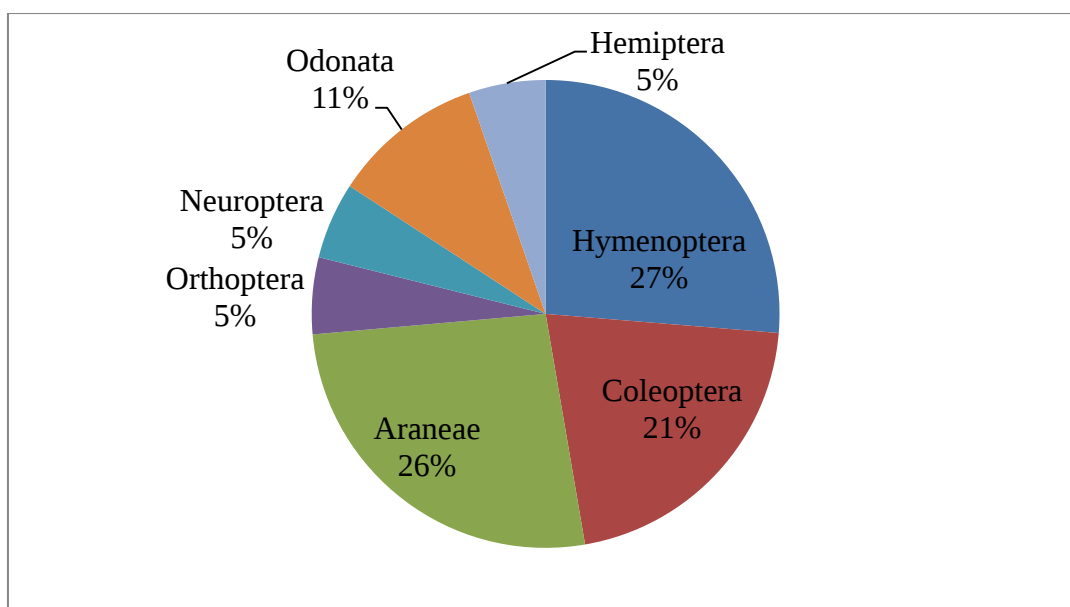


Figure 9: Percentage of different natural enemies attacked pest of Teak in Pyay and Tharyarwaddy Districts, Bago Region, August-December, 2022

6. Conclusions

On the whole results of the present study is hoped to be benefit to cultivators, by getting the awareness on what sort of insects pests infest the teak (*Tectona grandis*) and their prevalence on the specific parts of the tree. Therefore, necessary control measures would be taken to maintain the teak production in future. But the findings presented in this paper are only recorded from August to December, 2022 (5 months). It is monsoon season. So that it is not completed. Year round incidence of pest on teak is needed to know. Therefore this survey is being continued to Post-monsoon (winter) and Pre-monsoon (summer) season from January to November.

7. Acknowledgements

Authors would like to express our heartfelt thanks to Ministry of Natural Resources and Environmental Conservation, for kind permission and administrative support to conduct this survey research in Bago Region. We are thankful to Asian Forest Cooperation Organization (AFoCO), for financial assistance of research project entitled “Integrated Pest and Disease Management in Teak Plantations in Bago Region, Myanmar”(AFoCO/014/2020)”. Our thanks also go to U Tin Maung Win and U Mya Win Kaung, Assistant Directors of Forest Department from Pyay and Tharyarwaddy Districts for the cooperation during our visit to the field. Finally, thanks very much to forestry staffs that helped us for success of survey research in all aspects from Forest Department in Tharyarwaddy, Minhla, Gyobingauk, Paukkhaung and Padaung townships.

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http://www.forest.go.th/FIG/pests/others/mylabris_t.htm

http://www.dnp.go.th/FIG/pests/others/indarbela_t.htm

Appendix

Insect pests infecting teak



Hyblaea puera (Cramer)



Eutectona machaeralis



Spilosoma obliqua



Spodoptera litura Fabricius



Myloccerus viridanus



Phyllocnistis tectonivora
(leaf miner)



Acrida turrita



Oxya chinensis



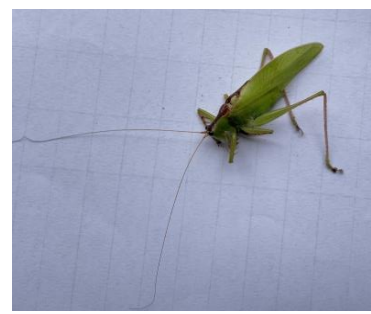
Oxya yezoensis



Tarbinskiellus portentosus



Mecopoda elongate



Pterophylla camellifolia

Insect pests infecting teak



Conocephalus maculatus



Burmacicada protera



Bemisia tabaci



***Aphis gossypii* Glover**



***Pseudococcus* sp**



***Tingis* sp.**



Leptocorisa oratoria



Leptocentrus Taurus



***Placosternum* sp.**



Dysdercus cingulatus



Chrysochroa fulgidissima



Zeugera coffeae



Alcterogystia cadambae



Sahyadrassus malabaricus



Phassus signifier

Insect pests infecting teak



Amphimallon majale



Heliocopris bucephalus

Natural Enemies of Insect pests infecting teak



Mantisa religiosa



Chrysoperla sp.



Zelus renardii



Coccinella undecimpunctata



Cycloneda munda



Peuceetia viridans



Sympetrum fonscolombii



Camponotus sp.



Solenopsis sp.



Nebria brevicollis



Polistes dominula



Apanteles sp.

Authors' contributions

^{1,2,3,4,6} Formulation of research design, regular survey, finalization of manuscript

⁵ Formulation of research design, regular survey, identification of pests, data entry and analysis, preparation of first draft manuscript