



## New Records of Insect-Pests and Natural Enemies on Economically Important Forest Trees in Dang District of Gujarat

Sushil Kumar<sup>1</sup>, Sachin Chavan and V.M. Prajapati<sup>2</sup>

<sup>1</sup>ASPEE College of Horticulture, Navsari Agricultural University, Navsari - 3969450 (Gujarat)

<sup>2</sup>Krishi Vigyan Kendra, NAU; Vyara

Email: [saxenasushil2003@rediffmail.com](mailto:saxenasushil2003@rediffmail.com), [saxenasushil2003@gmail.com](mailto:saxenasushil2003@gmail.com)

DOI: 10.5958/2455-7129.2017.00002.4

### ABSTRACT

Gujarat offers a variety of agro-ecological regions ranging from arid Kutch to tropical south Gujarat. In south Gujarat, Dang district considered as tropical moist deciduous forest, is typified by teak (*Tectona grandis*), sisham (*Dalbergia sissoo*), hed (*Haldina cordifolia*), sadad (*Terminalia tomentosa*), khair (*Vachellia catechu*) and khakra or Palas (*Butea monosperma*). On the basis of roving survey carried out in North (*Subir, Sarvar and Ahwa*) and South (*Chichinagavtha, Shamgahan and Galcund*) Dang at fortnightly interval during 2011-13, new insect-pests viz; spittle bug (*Clovia sp.*), leaf hopper (*Belenus sp.*) and mealy bugs (*Phenacoccus solenopsis* and *Icerya sp.*) on teak, skeletonizer (*Dichomeris sp.*) and white fly (*unidentified*) on sisham, defoliator (*Glyphodes negatalis*) on Karanj (*Milletia pinnata*), mealy bug (*Perissopneumon tectonae*) and skeletonizer (*Cydalima laticostalis*) on Indrajav (*Holarrhena antidysenterica*), leaf mining beetle (*Trachys sp.*), aphid (*unidentified*) and defoliator (*unidentified*) on Palas (*Butea monosperma*) and grasshopper (*unidentified*), mealy bug (*unidentified*), defoliator (*unidentified*) and skeletonizer (*unidentified*) on Khair were recorded. Besides insect-pests, natural enemies viz; *Apanteles* as larval cum pupal parasitoid on foliage pests (defoliator and skeletonizer) of teak, sisham skeletonizer, palas defoliator and Hed defoliator, *Brachymeria sp.* and *Xanthopimpla sp.* as pupal parasitoids on Karanj defoliator, *Scymnus coccivora* as predator of palas aphid, dragon fly as general predator of Hemipteran, Lepidopteran and Coleopteran insect pests of forest trees and yellow banded wasp (*Vespa sp.*) as general predator of insect-pests of teak, sisham, palas and hed were also recorded.

### Key words:

Teak, sisham, *Haldina cordifolia*, *Terminalia tomentosa*, *Vachellia catechu*, *Butea monosperma*, foliage pests, Tetrazolium chloride (TTZ).

### INTRODUCTION

India's forest cover is estimated to be about 95,572 km<sup>2</sup> million hectares (Anonymou 2015). India has 3.226 million ha of forest plantations, representing 4.8 per cent of total forest area.

Principal plantation species include *Acacia spp.*, *Eucalyptus spp.*, and *Tectona grandis* having greater area in planted forests than other species (FAO 2005a).

A large number of insects are known to damage both naturally regenerating forests and plantations in India although little statistics are available on the area affected by these insects (FAO 2005). One report estimated that 10, 00,000 ha of forest was damaged by insect pests (FAO 2005). The forest tree species at one time or another are hosts of variety of insect-pests. The insect-pests viz; defoliator, leaf skeletonizer, stem borers in Teak (*Tectona grandis*), Sisham (*Dalbergia sissoo*) and Hed (*Haldina (Adina) cordifolia*) cause huge economic losses. It is estimated that they cause annual losses of about Rs 100 per square mile of workable forests in India (Rs 12.5 million) (Mathur 1977). Similarly, Chey Vun Khen (2000) assessed the losses to the tune of 44 per cent in terms of wood volume growth. Meshram et al. (1990) studied the seasonal incidence of 10 insect-pests of forest trees viz; defoliator (*Hyblaea puera*), skeletonizer (*Eutectona machaeralis*), white root grub (*Holotrichia serrata*) on teak, web worm (*Atteva fabriella*) on *Ailanthus excelsa* and polyphagous pests like *Helicoverpa armigera* and *Agrotis ipsilon* using Pennsylvanian light trap equipped with a 160 W mercury vapour lamp.

Gujarat offers a variety of agro-ecological regions ranging from arid areas of Kutch to the tropical moist deciduous Forest regions in south Gujarat. The recorded forest area is 4814.76 km<sup>2</sup>, which constitutes 2.45 per cent of the geographical area of the state (Anonymous 2017). By legal status, reserved forests constitute 74.19 per cent, Protected Forest 3.67 per cent and unclassified Forest 22.14 per cent (Anonymous 2017). There are four major forest types found in the state viz; tropical moist deciduous, tropical dry deciduous, tropical thorn and littoral and swamp forests. The forests are mostly distributed in southern part of the State, whereas the central and eastern parts bear bamboo forests of inferior quality. Dang, Surat, Valsad, Narmada and Bharuch are the southern districts of the state having an area of 4814.76 sq. kms under forest. The south Gujarat region of the state supports the growth of a tropical moist deciduous forest typified by teak, Sisham (Rosewood), (*Dalbergia latifolia*), sisham (*D.*

*sissoo*), Hed, Sadad (*Terminalia tomentosa*), Khair (*Vachellia catechu*), Khakra or Kesuda or Palas (*Butea monosperma*) and Mahuva (*Madhuca indica*) etc. for which the district of Dang is well known. Presently, very little information is available on insect-pests and their natural enemies in Dang forest areas of south Gujarat. In view of this, the present study was carried out to know the biodiversity of insect pests and natural enemies.

#### **MATERIAL AND METHODS**

The regular roving survey was carried out at fortnightly interval in tropical forest of North (Subir, Sarvar and Ahwa) and South (Chichinagavtha, Shamgahan and Galcund) divisions of Dang during 2009-12. During the survey, each tree species was critically examined at each location for the presence of insects and their damage. Immature stages or adults causing damage to above tree species were collected and brought to the laboratory of Department of Entomology, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari for rearing. Rearing was carried out at optimum temperature (24.2 - 30.5 °C) and relative humidity (70.5- 80.5 %).

Field collected eggs were collected along with their host plant parts and kept in small vials and glass jars provided with some water at the bottom to maintain the turgidity of the substrate on which the insect laid eggs. After hatching of eggs, further rearing of immature stages (larva or nymph) were carried out by providing fresh food. Field collected immature stages were brought to the laboratory and kept in separate container or rearing cage. Fresh food was provided daily or as per the requirement and their nature of damage was observed. In case of leaf as a fresh food, the peduncle was wrapped with cotton wool dipped in water to keep the leaves turgid and such leaves were placed in glass Petri dish of different sizes. As soon as the larva entered into pupal stages, they were kept in separate containers and examined daily for adult emergence. After the emergence of adult, they were released in killing jar and pinning

was carried out scientifically. The adults with proper pinning were precisely packed in a container and sent for identification purpose. While rearing of immature stages or adults, observations on colour, shape, size and feeding behaviour were also critically observed.

At the time of rearing of field collected eggs, larvae or pupae, chances of parasitization by natural enemies viz., egg, larval, larval-pupal, and pupal parasitoid were also observed. As soon as the natural enemies emerged, they were transferred in separate vials and immediately preserved in 70 per cent alcohol. During laboratory rearing, photographs of different life stages of pests and their natural enemies were also taken for documentation. In case of small bodied insect viz., leaf hopper, mealy bug, hymenopteran natural enemies, pinning was not possible so they were directly preserved in 70 per cent alcohol and sent for identification.

## RESULTS AND DISCUSSIONS

During the survey, the newly reported insect pests of forest tree species of Dang district and their natural enemies are discussed hereunder:

### Record of insect pests

#### **Karanj defoliator, *Glyphodes negatalis* Walker (Lepidoptera : Pyralidae)**

During the survey, a lepidopteran insect - pest was observed feeding on Karanj (*Millettia (Pongamia) pinnata*) leaves in nursery. The newly hatched larva scraped and fed on chlorophyll. The older larvae lived between two or more adjacent leaves spun together and fed on green softer tissues of the leaves. In later stages, they folded and webbed several leaves together, forming a mass of partially eaten leaves. The colour of early instar larva was light yellowish green with light brown coloured head. Full grown larvae were 18 to 22 mm long, light to dark green on top and yellowish-green underneath; a single, thin, greenish stripe runs lengthwise down the middle of the back. The head was light brown. Pupa was formed in rolled leaf. The newly formed pupa was pale greenish brown in colour but the colour soon changed to reddish

brown and finally to dark brown before adult emergence. The pupa was obtect type. Male adult moth had a wingspan (breadth) of 18 to 22 mm, whereas in case female, it was 20 to 25 mm. Larva was the phytophagous stage. The insect was subsequently identified as *Glyphodes negatalis*, Walker (Lepidoptera: Pyralidae) by Dr. N. Roychoudhury, Scientist-F & Head, Forest Entomology Division, Tropical Forest Research Institute, Jabalpur. There are about 30 species of insect pests reported to cause damage to Pongamia raised usually as avenue planting and strip plantations on marginal lands (Orwa et al., 2009). The caterpillar of *G. negatalis*, has been found in Kolkata feeding on the leaves of the Pipal tree, *Ficus religiosa*, Linn. It also feeds on the fruit of *Dillenia indica*, Linnaeus (Alcock, 1903). Perhaps, this is the first report from Gujarat.

#### **Indrajav (*Holarrhena antidysenterica*) mealy bug, *Perissopneumon tectonae*, Morrison (Hemiptera: Monophlebidae)**

*Holarrhena antidysenterica* locally known as *Indrajav* is a shrub mainly found in deciduous forests. It belongs to the family Apocynaceae. During the survey of forest insect pests, the nymph and adults of mealy bug were observed feeding on lateral branches during May - June. The insect was subsequently identified as *Perissopneumon tectonae* (Morrison) of the family Monophlebidae of insect order Hemiptera by the Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi. Both nymph and adult suck plant sap from lateral branches. Adult is pale whitish in colour and about 4 to 5 mm long. Earlier, Arora and Nath (1960) reported that all the stages of *P. tectonae* (Morrison) were found in Hoshiarpur on the trunks and branches of guava, *Zizyphus nummularia*, *Z. jujuba*, *Grewia asiatica*, *Lawsonia alba* and *Cordia myxa*. They further revealed that the Coccid had one generation in a year. The eggs are laid in a silk covering 3-6 cm deep in the soil during August and September and hatch in May. The nymphs infest the plants in May-June. Adult females are found in July-September,

but the males die soon after pairing and are observed mainly in July. This is the first report of mealy bug on *H. antidysenterica* in Gujarat state and perhaps in India.

**Indrajav skeletonizer, *Cydalima laticostalis* (Guenee) (Crambidae: Lepidoptera)**

Another lepidopteran insect pest observed feeding on Indrajav in forest areas of Dang district was Indrajav skeletonizer. Larva is the damaging stage which feeds gregariously on chlorophyll of the leaf. As many as 30-35 larvae feed gregariously on single leaf. All the larval instars feed on the superficial epidermal cells of the leaf lamina in folded condition and ultimately the leaves looked like sieve and finally defoliated. Full grown larva was dark black in colour with a yellowish white band seen on dorsal side run longitudinally. Size of the full grown larva was 23-26 mm long with 2.5 to 2.7 mm breadth. Adult was whitish in colour with a brownish band on the antecostal region of forewing. Adult had a wing span (breadth) of 25-30 mm long. The insect was identified by Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi as *Cydalima laticostalis* (Guenee) (Crambidae : Lepidoptera). According to Hampson (1896), *Cydalima* sp. commonly known as box tree moth and its natural range is found in the humid subtropical regions of East Asia.

**Shisham skeletonizer, *Dichomeris* sp. (Gelechiidae:Lepidoptera)**

During the forest insect pest survey in nurseries, a new insect pest was recorded on Shisham leaves which was further identified by Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India as *Dichomeris* sp. (Gelechiidae: Lepidoptera). Larva was observed as damaging stage. Early instar larva (I and II) skeletonised the leaves in folded condition while the late instar larva fed on the leaves and defoliated the seedlings. The ultimate instar larva started feeding from leaf margin in folded condition. Sometimes, irregular holes were also seen on the leaf due to larval feeding. Brownish colour pupa

formed in folded leaf measured about 12-14 mm in length and 3.4-3.7 mm breadth. The full grown larva with reddish brown colour head measured 10-12 mm in length and 2.1-2.3 mm in breadth, dark black in colour with irregular whitish colour spots seen on the dorsal and lateral side. Adult wing span was measured 17-20 mm long with yellowish forewing. The dark coloured greyish band was also seen on apical margin of each forewing. Hind wings were dark greyish in colour. Thakur (2000) reported that *Dichomeris eridantis* Meyr contributed to some extent in causing damage to Shisham in many areas of the country.

**Shisham whitefly (unidentified)**

Whitefly belongs to family Aleurodidae were recorded feeding on shisham in Dang forest. Both nymph and adult were the damaging stages found feeding on the lower surface of the leaves with their piercing and sucking mouth parts. Ultimately leaves turned yellow and finally dropped down. All the stages of insect viz., eggs, nymph, pseudo-pupa and adult were recorded on the leaves. Female adult lays brownish coloured eggs singly in semicircle rows on lower surface of leaves. The typical 'T' shape marking seen on pseudo-pupae from which adults emerged out. 164 whitefly species were identified found breeding on different tree species in Western Ghats of south India. The whitefly species, *Aleuromarginatus kallarensis* recorded to feed on *Dalbergia latifolia* ([iwst.icre.org / divisions / wbd/ diversity of white flies.html](http://iwst.icre.org/divisions/wbd/diversity_of_whiteflies.html)).

**Teak spittle bug, *Clovia* sp. (Hemiptera: Aphrophoridae)**

Nymph and adult of spittle bug were also recorded on teak leaves in forest areas of Dang district. The insect was subsequently identified as *Clovia* sp. belonging to the family Aphrophoridae of insect order Hemiptera, by Dr. C.A. Viraktamath (Project In charge), Network Project of Insect Biosystematics, Department of Entomology, G.K.V.K., Bangalore (Karnataka), India. Nymph and adult were observed feeding on actively growing parts and that too on new flushes and tender stems. Nymph aggregate on the ventral side

of the tender leaves and tender growing portion and manifested damage through their piercing and sucking mouth parts. The characteristics whitish spittle like secretions was also seen on the lower surface of the leaves which was secreted by the malpighian tubules of the insect in nymphal stages. These secretions act as a protective covering of nymph. Inside the secretion more number of nymphs fed gregariously. Maddison (1993) reported that *Clovia conifera* (Walker) commonly known as spittle bug feeds on leaves and stem of sugarcane. Similarly, Lalitha et al. (2011) reported for the first time occurrence of spittle bug *Clovia* sp. nr *hirsuta* (Kirby) in the mulberry fields of Central Sericulture Research and Training Institute, Berhampore, West Bengal.

**Teak leaf hopper, *Belenus* sp. (Hemiptera: Tingidae)**

During rainy season, adult leaf hopper were observed feeding on tender leaves of teak in the Dang district. Both nymph and adult were the damaging stages and found feeding on lower and upper surface of the leaves by their piercing and sucking mouth parts. Further, it was confirmed by providing fresh leaves in laboratory condition. Adult was greenish in colour with wedge shaped body measuring about 4-5 mm long. The insect was identified as *Belenus* sp. (Hemiptera: Tingidae) by Dr. C.A. Viraktamath (Project In charge), Network Project of Insect Biosystematics, Department of Entomology, G.K.V.K., Bangalore (Karnataka), India. Tangmitcharoen et al. (2006) reported that leaf hopper, *Belenus ravana* occurs as non-pollinator insect on wild teak canopies.

**Mealybug on teak, *Phenacoccus solenopsis* Tinsley (Pseudococcidae: Homoptera)**

In teak nurseries of forest areas of Dang district, mealy bug was recorded on teak seedlings. Both nymph and adult were the damaging stages observed feeding on leaf petiole, tender portion of stem of the seedlings and also on the lower surface of the leaves using their piercing and sucking type of mouth parts. Female adult was wingless whereas, male adult was winged. Honey dew secretions were the characteristics of this insect

found on or near the feeding areas. The growth of the seedling was arrested due to feeding by this insect. The minute infestation in nursery areas was noticed as mealybug. The black ants which have mutualistic association with mealybug were also found feeding on honey dew secretions. The insect specimen was identified as *Phenacoccus solenopsis* Tinsley (Pseudococcidae: Homoptera) by Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India. Arif et al. (2009) revealed that a new mealy bug (*Phenacoccus solenopsis* Tinsley) appeared recently and has attained the status of a serious pest on a wide range of host plants. It was recorded from 154 plant species including field crops, vegetables, ornamentals, weeds, bushes and trees. Natural and induced parasitism of *Anagyrus kamali* was also studied by Félix et al. (2009) against pink hibiscus mealybug on teak shoots.

**Mealybug on teak *Icerya* sp. (Coccidae: Homoptera)**

The another mealy bug species identified as *Icerya* sp. by Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India was found feeding on teak plants in Dang district. Both nymph and adult were the damaging stages found feeding on the leaves and petioles using their piercing and sucking mouth parts. Ultimately the leaves withered and dried. The infestation was in sporadic form but not severe. The activity of insect was noticed in rainy season when the plant had vigorous growth. *Icerya purchasi*, the cottony cushion scale, was accidentally introduced into India in 1921 (FAO 2005b). It damages *Acacia decurrens* and *A. dealbata* in addition to numerous other forestry and agricultural plant species. The scale has done serious damage to plants in the Nilgiri hills in South India, and in the Anamallai hills in Tamilnadu, and has since become well established throughout the country (FAO 2005b).

**Palas leaf mining beetle, *Trachys* sp. (Buprestidae: Coleoptera)**

During the survey of forest insect pests, the adults of leaf mining beetle were also observed on leaves of Palas in the Dang district. Adult beetle is elongate hard bodied insect with three curved transverse stripes seen on the elytra. Body region showed metallic luster on dorsal surface, while ventral surface was dark black in colour. Antenna was of serrate type. Adults measured 4.5-4.8 mm in length and 2.7-2.9 mm in breadth. The larva and adult mined through the leaves and formed irregular patches or irregular zig-zag passage which was further confirmed by providing fresh leaves in the laboratory. The pest was more active during July - November. During winter, adults were observed feeding on older leaves. The insect was identified as *Trachys* sp. (Buprestidae: Coleoptera) by the Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi (India).

Earlier, Ananthakrishnan (2004) recorded the leaf mining beetle, *Trachys dasi* Théry and *T. pacifica* on jute, *T. bicolor* on *Butea frondosa* Linn., *T. virescens* on cotton and lady's finger, *T. ipomoeae* on sweet potato, *T. mansueta* on *Sida* sp. and *Trachys* sp. on *Zyziphus jujube* Mill and *Barleria cristata* L. in different parts of India. According to Rawat and Jakhmola (1969), *Trachys* sp. also mined the leaves of okra. Nair (2007) observed leaf miner, *Trachys bicolor* Kerremans on *Lagerstroemia speciosa* Pers. (Pride of India). Campobasso et al. (1999) mentioned that three different species, *T. puncticollis obscurella* Obenberger from France and Italy, *Trachys* sp. from Iran and *T. troglodytes Gyllenhal* from Greece observed feeding on the weed plant, *Convolvulus arvensis* L. (Convolvulaceae).

**Palas aphid, *Aphis gossypii* Glover (Aphididae: Homoptera)**

The aphid was recorded feeding on *Palas* plant in College farm area of Navsari Agricultural University, Navsari and in forest areas of Dang South region. Both nymph and adult were found in

colonies on tender leaves of *Palas* which sucked cell sap by their piercing and sucking mouthparts. Ultimately, tender leaves showed discoloration symptoms. Subsequently the insect was identified as *Aphis gossypii* Glover (Aphididae: Homoptera) by Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi (India). Kaygin et al. (2009) reported that being a polyphagous insect pest, *A. gossypii* feeds on various forest herbaceous and shrubs plant species. Bhagat (2011) updated information pertaining to systematic checklist, host range and species richness of 51 aphid sp. under 26 genera belonging to 10 different sub-families of family Aphididae, damaging 34 forest tree species.

**Grasshopper (unidentified)**

The insect was recorded on teak, khair and sadad leaves both in nurseries and plantation areas, wherein the adult as well as nymph were observed damaging the leaves by cutting the leaf margins and making tiny holes on leaf lamina. Although the insect was not observed in serious stage yet it may be considered as a potential foliage insect of teak in future. The major activity of the acridid was noticed after the withdrawal of monsoon i.e. second fortnight of October which reached to its peak during November – December.

**Palas (Kesuda) (*Butea monosperma*) defoliator (unidentified)**

It was recorded in damaging stage as lepidopteran larvae feeding on mature leaves of *Palas*. The larvae fed voraciously on leaf lamina eating up the entire portion in between the side veins as well as leaf midrib. The last stage of the damage indicated total defoliation. The mature larvae were greenish yellow in colour with faecal pellets near the solitary larva. The mature larvae pupated on the damaged leaf lamina which appeared brownish in appearance. Major activity period of the pest was during first fortnight of July - first fortnight of December.

**Mealybug on Khair seedlings (unidentified)**

An unidentified mealy bug was noticed on

twigs of khair (*Acacia catechu*) seedlings singly or in a small colony. Both nymph and adult were the damaging stages. The pest was not observed as a serious pest yet it may be a potential pest in future.

#### Foliage pests of Sadad (unidentified)

Two different lepidopterans were observed in damaging stage on new as well as mature leaves of sadad. On new flush, the caterpillar pest had hairy growth all along the body which was observed defoliating new leaves by making biting

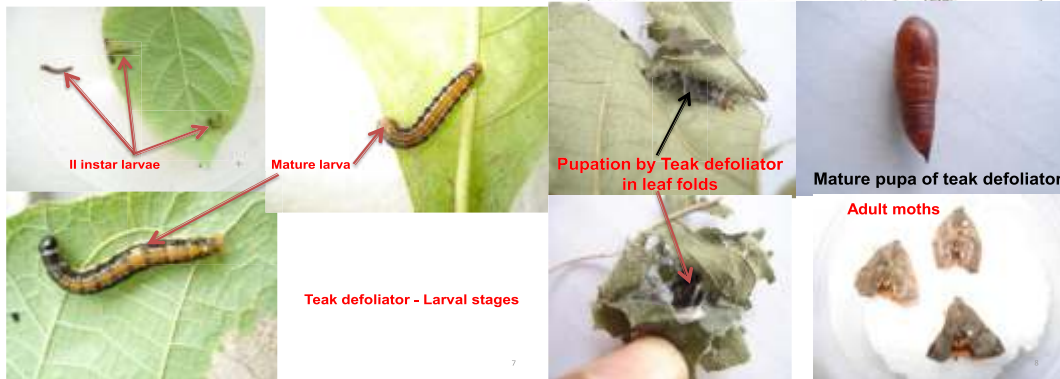
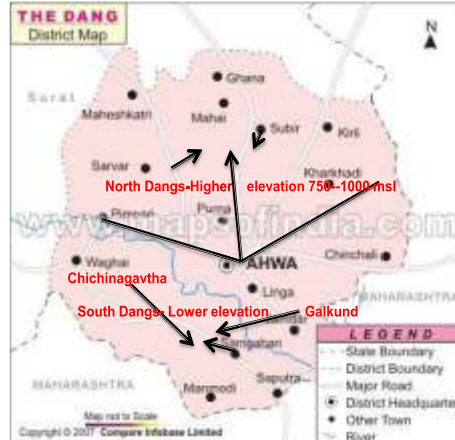
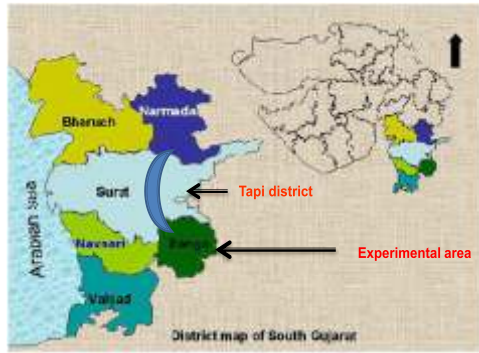
holes and cutting the leaf margins. The pest was a defoliator by virtue of its damaging characteristics, whereas another lepidopteran pest was noticed scrapping the leaf epidermis. In later stage, the damaged showed folded skeletonized leaves hanging from the attacked twig. Ultimately, the leaves fell down and defoliation was nearly complete. This pest was considered as leaf skeletonizer but was different from its larval appearance from teak skeletonizer. Major activity of these pests was noticed from June to November.

**Table 1:** List of arthropods observed/newly recorded on forest trees in Dang district of Gujarat

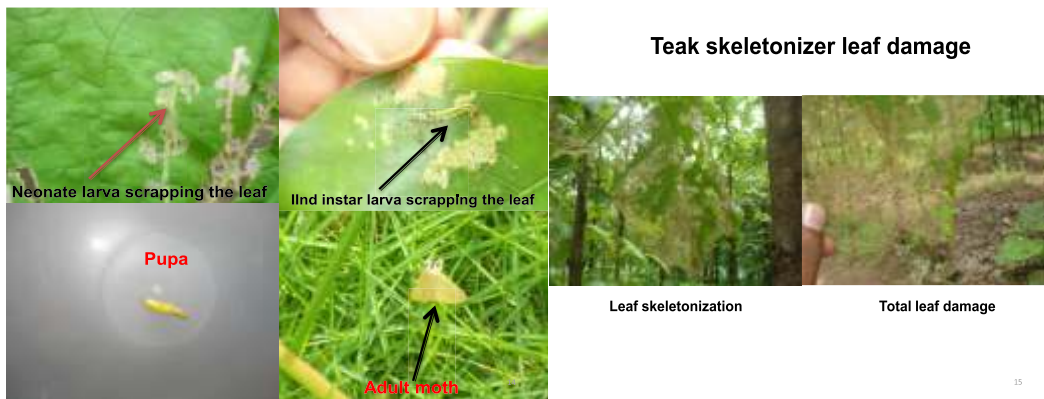
Tree sp.	Common name of the arthropod	Scientific name	Insect Family	Insect order
Karanj ( <i>Millettia pinnata</i> )	Defoliator	Glyphodes negatalis Walker	Pyralidae	Lepidoptera
Indrajav ( <i>Holarrhena antidysenterica</i> )	Skeletonizer	Cydalima laticostalis (Guence)	Crambidae	Lepidoptera
	Mealybug	Perissopneumon tectonae, Morrison	Monophlebidae	Hemiptera
Shisham ( <i>Dalbergia sissoo</i> )	Skeletonizer	Dichomeris sp.	Gelechiidae	Lepidoptera
	Whitefly	Unidentified	--	Hemiptera
Teak ( <i>Tectona grandis</i> )	Spittle Bug	Clovia sp.	Aphrophoridae	Hemiptera
	Leaf Hopper	Belenus sp.	Tingidae	Hemiptera
	Mealybug	Phenacoccus solenopsis Tinsley	Pseudococcidae	Homoptera
	Mealybug	Icerya sp.	Coccidae	Homoptera
Palas ( <i>Butea monosperma</i> )	Leaf Mining Beetle	Trachys sp.	Buprestidae	Coleoptera
	Aphid	Aphis gossypii Glover	Aphididae	Homoptera
	Defoliator	Unidentified	--	Lepidoptera
Teak ( <i>Tectona grandis</i> ), Khair ( <i>Vachellia catechu</i> ) and Sadad ( <i>Terminalia</i> )	Grasshopper	Unidentified	--	Orthoptera
Khair ( <i>Vachellia catechu</i> )	Mealybug	Unidentified	--	Homoptera
Natural enemies				
	LP	Apanteles	Braconidae	Hymenoptera
	P & LP	Brachymeria	Ichneumonidae	Hymenoptera
	P & LP	Xanthopimpla	Ichneumonidae	Hymenoptera
	P & LP	Trathala sp.	Ichneumonidae	Hymenoptera
	Ladybird beetle	Scymnus coccivora	Coccinellidae	Coleoptera
	Dragonfly	Unidentified	-	Odonata
	Yellow banded wasp	Vespa orientalis	Vespidae	Hymenoptera
	Red ant	Oecophylla sp.	--	Hymenoptera
	Praying mantid	Unidentified	--	Dictyoptera
	Ladybird beetle Giant wood spider spider Spider	Cheilomenes sp. Nephila sp. Araneae sp.	Coccinellidae	Coleoptera

L: Larval parasitoid LP: Larval-pupal parasitoid P: Pupal parasitoid

FIG. 1. FOREST COVER OF SOUTH GUJARAT



Teak defoliator, *Hyblaea puera*



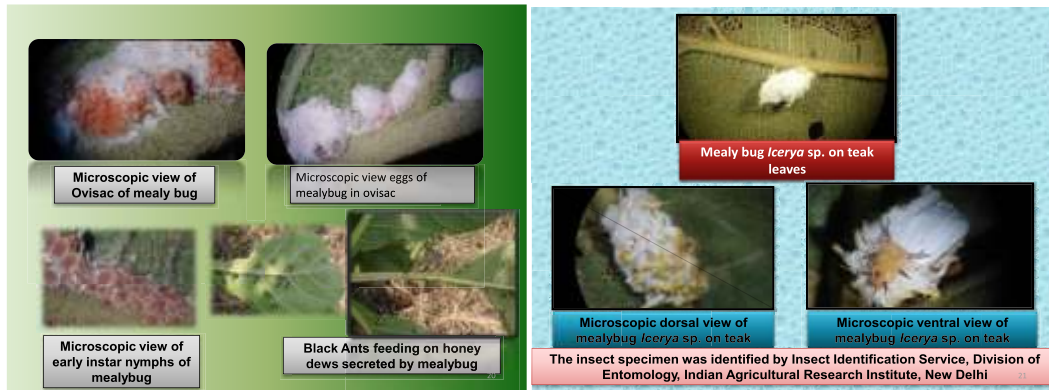
Teak skeletonizer, *Eutectona machaeralis*



Spittle bug *Clovia* sp. on teak - New Record Mealy bug on Teak – New Record

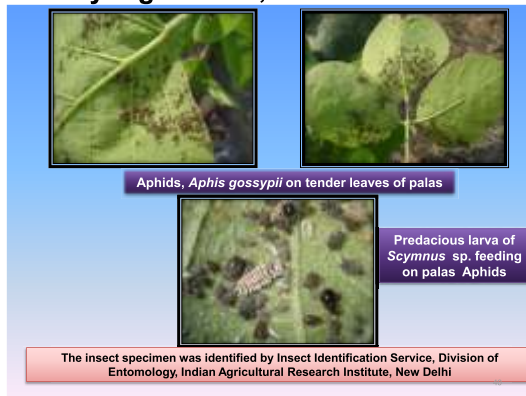
Fig. 1: New Record of Insect pests on teak





**Mealybug on teak, *Phenacoccus solenopsis***

**Mealybug on teak *Icerya* sp.**



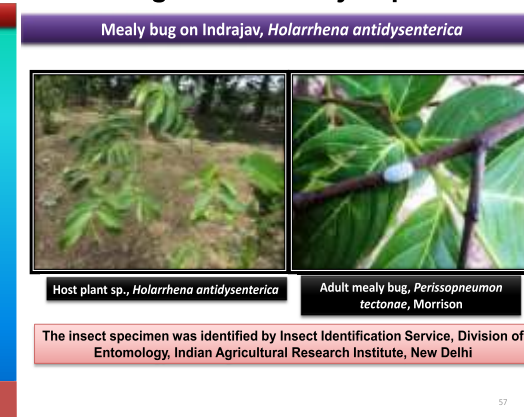
***Aphis gossypii* on Palas**



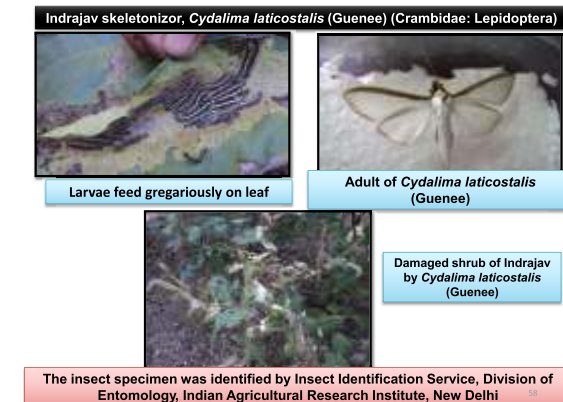
**Leaf mining beetle *Trachys* sp. on Palas**



***Dichomeris* sp. on *Dalbergia sissoo***



**Mealy bug, *Perissopneumon tectonae* on *Holarrhena antidysenterica* A New Record**



**Skeletonizer, *Cydalima laticostalis* on *Holarrhena antidysenterica***

**A New Record**

**Fig. 2: New Record of insect pests on teak, Palas Sissoo and *Holarrhena antidysenterica***

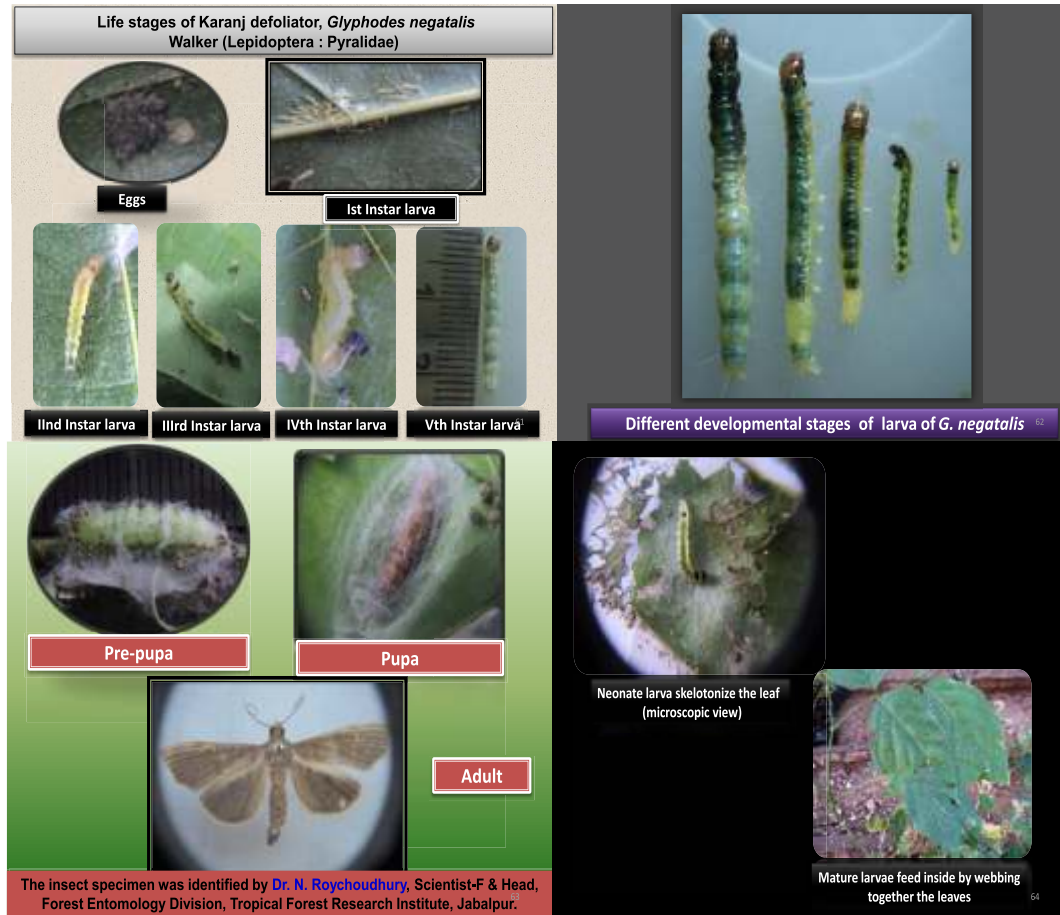


Fig. 3: Life cycle of Karanj (*Milletia (Pongamia) pinnata*) defoliator, *Glyphodes negatalis* - New Record

### Record of Natural enemies

#### Apanteles (Braconidae: Hymenoptera)

The Hymenopteran larval parasitoid, *Apanteles* sp. belonging to family Braconidae was recorded on teak, shisham, palas and hed wherein incidence of foliage pests of teak (defoliator and skeletonizer), shisham defoliator, palas defoliator and hed defoliator were also observed. These parasitoids were recorded in cocoon and adult stages. *Apanteles* was observed emerging from pupa of teak and palas defoliators, yet its parasitization under laboratory as well as field conditions is yet to be confirmed. Its parasitic action on pupae of newly reported insect pest, Karanj defoliator (*Glyphodes negatalis*) was also noticed.

According to Javaregowda and Naik (2008), incidence of parasites viz., *Apanteles* sp. (Braconidae: Hymenoptera), *Goniozus ruidus*

(Bethyidae; Hymenoptera), *Eriborus* sp., *Mesochorus* sp., *Trathala hapaliae*, *Comptotypus arinus arinus*, *Xanthopimpla* sp., *Therina maskeliyae* (Ichneumonidae; Hymenoptera), *Palexorista solennis*, *Exorista xanthaspis*, *Turagonia* sp., *Thelairodrino* sp., *Winthemia* sp., (Tachinidae; Diptera), *Brachymeria* sp. (Chalcididae: Hymenoptera) and pathogens (white muscadine fungus, *Beauveria bassiana* and *Buculovirus* HaNPV) were the predominant mortality factors regulating population of teak defoliator.

#### Brachymeria and Xanthopimpla (Ichneumonidae: Hymenoptera)

The two parasitoids were observed as pupal parasitoid on foliage pests, though they are yet to be confirmed for their pupal mortality. These two pupal parasitoids were also recorded on newly reported insect pest of Karanj, *Glyphodes*

*negatalis* in south Gujarat which were identified by Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi (India). Sudheendrakumar (1986) reported that the Brachymeria and Ichneumonid wasp were found to be the potential parasitoids of *E. machaeralis* and *H. purea* on teak.

**Ichneumonid wasp, Trathala sp. (Ichneumonidae: Hymenoptera)**

The adults of larval-pupal parasitoid, *Trathala* sp. emerged from the pupae of teak skeletoniser, *E. machaeralis*.

**Lady bird beetle, Scymnus (Pullus) coccivora (Coleoptera)**

The grub and adult of *Scymnus coccivora* were recorded feeding on palas aphid feeding on tender leaves of palas. Both nymph and adult aphid were eaten by the grubs and adults of *Scymnus* sp.

**Lady bird beetle, Cheilomenes sp. (Coleoptera)**

Adult *Cheilomenes* sp. were also recorded on teak, hed, sadad in nurseries. They seemed to act as potential predator of soft bodied insects.

**Dragonfly (unidentified) (Odonata)**

Different species of dragonfly belonging to insect order Odonata were recorded in forest areas of Dang district which seemed to act as general predator of all the stages viz., eggs, nymph or larva, pupa and adult of many hemipteran, lepidopteran and coleopteran insect pests of forest trees.

**Yellow banded wasp, Vespa orientalis (Hymenoptera)**

The hymenopteran general predator, *Vespa orientalis* a general predator on teak, sisham, palas and hed foliage pests (defoliator and skeletonizer) sisham defoliator, palas defoliator and hed defoliator were observed. Yellow colour band on its abdomen in adult stage was the typical mark of identification of this predator. Tangmitcharoen et al. (2006) studied behavior of major insect pollinators of teak and revealed that the wasp, *Vespa affinis* occurs as a pollinating insect on wild teak canopy.

**Giant wood spider, Nephila sp.**

The giant wood spider found in Dang forest area and exhibiting predatory action against teak skeletonizer and defoliator. Their abundant population was observed in heavily invested forest areas with skeletonizer. The web was extremely strong. Their webs can be found hanging off sign posts, in or between trees.

**Red ant, Oecophylla sp. (Hymenoptera)**

The red ant, *Oecophylla* sp. was also observed in colonies on forest tree species.

**Acknowledgment**

Authors are thankful to Director of Research, Navsari Agricultural University, Navsari for providing necessary facilities for conducting the present research work and Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi, Dr. N. Roychoudhury, Forest Entomology Division, Tropical Forest Research Institute, Jabalpur and Dr. C.A. Viraktamath (Project In charge), Network Project of Insect Biosystematics, Department of Entomology, G.K.V.K., Bangalore (Karnataka) for identification of insect specimens.

**REFERENCES**

- Alcock A. 1903. Indian Museum Publications relating to Economic Entomology Issued by the Government of India in the Department of Revenue and Agriculture, *Indian Museum Notes, Volume V*, 1900 - 1903.
- Ananthakrishnan TN. 2004. *General and Applied Entomology*, Tata McGraw-Hill Education, pp 1184.
- Anonymous 2015. India State of Forest Report, 2015, pp.72.
- Anonymous 2017. Report of Principal Chief Conservator of Forest and Head of the Forest Force (HoFF), Govt of Gujarat (<https://forests.gujarat.gov.in/forest-area-information.htm>).
- Arif MI, Rafiq M. and Ghaffar A. 2009. Host Plants of Cotton Mealybug (*Phenacoccus*

- solenopsis): A New Menace to Cotton Agroecosystem of Punjab, Pakistan. *Int. J. Agric. Biol.*, 11(2): 163-67.
- Arora GL. and Nath S. 1960. Biology and life-history of *Perissopneumon tectonae* (Morrison) (Coccoidea: Homoptera). *Res. Bull. Panjab Univ. Sci.*, 11 (1-2): 127-139.
- Bhagat RC. 2011. Aphid Pests (Insecta) damaging forest trees in Jammu, Kashmir and Ladakh Himalayas: An updated Annotated checklist and biodiversity. *The Indian Forester*, 137(12): 1439-1444.
- Campobasso GE, Colonnelli L. Knutson G. Terragitti and M. Cristofaro EDS. 1999. Wild Plants and Their Associated Insects in the Palearctic Region, Primarily Europe and the Middle East. U.S. Department of Agriculture, Agricultural Research Service, ARS-147, 249 pp.
- Chey Ven Khen 2000. Insect pests of teak. In: *JIRCAS Working Report* (Ed. Chang Hing Hon and K. Matsumoto) 16: 59-66.
- FAO. 2005a. Global Forest Resources Assessment 2005 – India – Country Report. Forestry Department, Forest Resources Assessment 2005, Country Report 001, 128 pp.
- FAO. 2005b. The unwelcome guests. Proceedings of the Asia-Pacific forest invasive species conference. McKenzie, P., Brown, C., Jianghua, S., & Jian, W., eds. RAP Publication 2005/18. Bangkok, Thailand, FAO Regional Office for Asia and the Pacific, pp. 172. Available at: <http://www.fao.org/docrep/008/ae944e/ae944e00.htm>.
- FAO. 2006. Global Forest Resources Assessment 2005 – progress towards sustainable forest management. Forestry Paper No. 147. FAO, Rome. Available at: <http://www.fao.org/docrep/008/a0400e/a0400e00.htm>.
- Félix GV, Laura D OA, Hector GH, Juan A. VJ, José LC, Alejandro GH and Hugo, CAB. 2009. Natural and induced parasitism of *Anagyrus kamali* against pink hibiscus mealybug on teak shoots in Bahia De Banderas, Nayarit, Nayarit. *Agrociencia*, 43(7), p.729-738.
- Hampson G.F. 1896. Moths 4. The Fauna of British India, including Ceylon and Burma. Taylor & Francis, London, 23, 594 pp.
- Javaregowda and Naik LK. 2008. Key Mortality Factors of Teak Defoliator, *Hyblaea puera* Cramer (Hyblaeidae: Lepidoptera). *Karnataka J. Agric. Sci.*, 21(4):519-523.
- Kaygin AT, Gorur G and Sade FC. 2009. Aphid (Hemiptera: Aphididae) species determined on herbaceous and shrub plants in Bartin Province in Western Black sea Region of Turkey. *African Journal of Biotechnology*, 8(12), pp. 2893-2897.
- Lalitha N, Banerjee R, Saha AK and Santha Kumar MV. 2011. Report of an emerging pest *Clovis* sp. nr *hirsute* (Kirby) (Aphrophoridae : Homoptera) in Mulberry. *Insect Environment*, 16(4): 153-155.
- Maddison PA. 1993. UNDP/FAO-SPEC Survey of Agricultural Pests and Diseases in the South Pacific, Technical report. Vol.3. Pests and other fauna associated with plants, with botanical accounts of plants. Auckland: Manaaki Whenua B Land care Research. [File downloaded from <http://nzac.landcareresearch.co.nz/>].
- Mathur RN. 1977. Integrated pest control in forestry. *Indian Forester*, 103 (9):585-591.
- Meshram PB, Pathak SC. and Jamaluddin 1990. Population dynamics and seasonal incidence of some forest insect pests (nursery stage) through light trap. *Indian Forester*, 116(6):494-503.
- Nair KSS. 2007. Tropical Forest Insect Pests - Ecology, Impact, and Management. pp 40-41. United States of America by Cambridge University Press, New York.

- Orwa C, Mutua A, Kindt R, Jamnadass R. and Simons A. 2009. Agroforestry Database :a tree reference and selection guide version 4.0.
- Sudheendra kumar VV. 1986. Studies on the natural enemies of the teak pests, *Hyblaea puera* and *Eutectona machaeralis*. In: KFRI Research Report 38: 28p, Kerala Forest Research Institute, Peechi.
- Tangmitcharoen S, Takaso T, Siripatanadilox S, Tasen W. and Owens JN. 2006. Insect biodiversity in flowering teak (*Tectona grandis* L.f.) canopies: Comparison of wild and plantation stands. *Forest Ecology and Management*, 222(1-3):99-107.
- Thakur ML. 2000. Forest Entomology (Ecology and Management). Published by Sai Publishers, Dehra Dun. [iwst.iclre.org/divisions/wbd/diversityofwhiteflies.html](http://iwst.iclre.org/divisions/wbd/diversityofwhiteflies.html)