Forest insect pests-an introduction

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Dr. N. Roychoudhury, Scientist 'G'

Forest Entomology Division
Tropical Forest Research Institute
Jabalpur-482021 (M.P.)

FOREST INSECT PESTS - AN INTRODUCTION

- This article presents an overview of forest insect pests in India and their economic impact in forestry. It has covered insect pests of promising tree species, viz. teak, sal, poplar, khamer, mahogany and pine, etc. It has also included introduced insect pests of exotic tree species. The major forest insect pests and their damage impact are succinctly described.

Introduction

- India's forest cover is estimated to be about 67.701 million hectares, or 22.8 percent of the country's land area. Other wooded lands comprise 4.110 million ha.
- The dense forest in almost all the major states has been reduced, however and forest degradation is a matter of serious concern.
- India has 3.226 million ha of forest plantations, representing 4.8 percent of total forest area.

- Principal plantation species include *Acacia* spp., *Eucalyptus* spp., and *Tectona grandis* are the main species planted having greater area in planted forests than other species.
- *Eucalyptus globulus*, *E. grandis* and *E. tereticornis* are most common, while among the acacias, *Acacia auriculiformis*, *A. catechu*, *A. mearnsii*, *A. nilotica* and *A. tortalis* are common.
- Other commonly planted broadleaf species are *Albizia* spp., *Azadirachta indica*, *Casuarina equisetifolia*, *Dalbergia sissoo*, *Gmelina arborea*, *Populus* spp. *Prosopis* spp., *Shorea robusta* and *Terminalia* spp.
- Among conifers, *Cedrus deodara* and *Pinus roxburghii* occupy a major area; *Pinus patula* and *P. caribaea* have been planted to a limited extent.

Contd.

- A large number of insects are known to damage in nurseries, naturally regenerating forests and plantations in India although little statistics are available on the area affected by these insects.
- The figures are available mostly at local level or in some national reports or papers presented at conferences.
- One report estimated that 1 000 000 ha of forest was damaged by insect pests.
- Some reviews of forest insects and their damage are available.

Overview of forest insect pests in India

Insect pests in nurseries, plantations and naturally regenerating forests

Teak-*Tectona grandis* L.f. (family Verbanaceae)

***Holotrichia* spp. Hope (Coleoptera : Scarabaeidae)**

Common name: White grubs, chafers

Hosts: *Tectona grandis*, *Dedrocalamus strictus*,

- *Holotrichia* is a genus of beetles, commonly well known as white-grubs for their white larvae (grubs) that are found under the soil where they feed on the roots and rootlets of teak seedlings in different parts of India.
- Sometimes, in nurseries, white grubs become a serious problem. The incidence of white grubs gradually increases with the age of the nursery and after 4-5 years of establishment.
- Principal species of white grubs causing severe damage of teak production nurseries in various parts of the country are *H. consanguinea*, *H. insularis*, *H. serrata* and *H. problematica*.
- It has been recorded that 80% damage of nursery stock due to white grubs in permanent teak nurseries of Madhya Pradesh and Maharashtra.
- In Kerala, it has been noticed that *H. fissa* causes 20-30% mortality of seedlings in various teak nurseries.

- **Attack of white grubs causes immediate mortality of teak seedlings in nurseries.**
- **In infested nurseries, the seedlings are attacked in patches. Infested seedlings exhibit symptom of wilting which is usually noticed only when the roots have been already eaten-up by the white grubs.**

Hyblaea puera Cramer (Lepidoptera : Hyblaeidae)

Common name: Teak defoliator

Hosts: *Alstonia scholaris*; *Avicennia* spp.; *Callicarpa* spp.; *Pterocarpus macrocarpus*; *Rhizophora* spp.; *Tectona grandis*; *Vitex*

- **The larvae of this moth species feed on the leaves of a wide range of plants including *Avicennia* spp., *Callicarpa* spp., *Rhizophora* spp., *Vitex* spp. and *Tectona grandis*.**
- **It is considered to be a major pest of teak plantations in areas of Asia.**
- **In India, *H. puera* causes one or more near-total and additional partial defoliations of teak over extensive areas annually.**
- **At Nilambur in southern India, this has resulted in a loss of 44 percent of the potential volume increment in young planted forests.**
- **In Kerala, defoliation of teak was often over 50 percent.**

Contd.

- The larvae create shelters for themselves by cutting pieces of leaves and rolling them together.
- They come out of the shelters to feed. *Hyblaea puera* is widespread throughout the tropics occurring in Asia, Australia, the Pacific Islands, Africa, Central America and South America.

Eutectona machaeralis (Walker) (Lepidoptera: Pyralidae)

Common names: Teak skeletonizer; teak leaf skeletonizer
Hosts: *Tectona grandis*, *Lantana camera*

Eutectona machaeralis **is a major pest of teak, occurring throughout South Asia and some parts of Southeast Asia.**

Complete defoliation by the pests results in more or less leaflessness during most of the late growing period.

Damage varies from almost negligible to as much as half of the total annual increment.

Past studies estimate the losses due to this insect at approximately 0.051 million ha annually.

Outbreaks of this species occur in most years with exceptionally heavy build-up in some years.

Although the insect is present throughout the year, outbreaks develop towards the end of the growing season before normal leaf shedding.

Asphondylia tectonae Mani (Diptera : Cecidomyiidae)

Common names: Twig gall midge
Host: *Tectona grandis*

- ***Asphondylia tectonae* is a gall insect that is one of few insects recorded as pests of teak in naturally regenerating forests.**
- **It has been recorded in the natural forest in Kerala and Karnataka in southern India and in poor class teak forests in central India.**
- **It attacks new shoots of teak and causes formation of galls that coalesce, harden and surround the stem of twigs.**

Sal-*Shorea robusta* Gaertn. f. (family Dipterocarpacae)

Hoplocerambyx spinicornis **Newman (Coleoptera: Cerambycidae)**

Common names: Sal heartwood borer; sal borer
Hosts: *Shorea robusta*; *S. siamensis*; *S. assamica*; *S. obtusa*; *Parashorea robusta*; *P. malaanonan*; *P. stellata*; *Anisoptera glabra*; *Hopea odorata*

- ***Hoplocerambyx spinicornis*** **is widely distributed in Asia – Burma, Bhutan, India, Indo-China, Indonesia, Malaysia, Nepal, Papua New Guinea, Pakistan, Philippines, Singapore, Thailand.**
- **It is a pest of *Parashorea robusta*, *P. malaanonan*, *P. stellata*, *Shorea siamensis*, *S. assamica*, *S. obtusa*, *S. robusta*, *Anisoptera glabra* and *Hopea odorata*.**

Contd.

- *Hoplocerambyx spinicornis* Newman (Coleoptera : Cerambycidae), commonly known as sal borer is the only known Indian representative of its genus and one of the most pernicious pest of sal that commits very serious depredations in the forest.
- This insect was first discovered as a destructive pest of sal in 1897 from Singhbhoom division in Chota Nagpur, Bihar.
- Sal borer is an oligophagous insect that feeds primarily on *S. robusta*.
- Sal heartwood borer and its tree host has received extensive emphasis than any other tree-insect system in India.

- *H. spinicornis* causes extensive damage to sal trees both in standing as well as freshly felled timbers due to the kairomonal activity of the sal sap.
- The less vigorous, weak, unhealthy trees or those with reduced vitality are easily attacked or killed due to borer.
- Its larvae girdle and kill trees and riddle the heartwood with large tunnels or galleries making it unfit for marketing as timber.
- Different abiotic and biotic factors have been the major cause for the reoccurring epidemics.
- The borer kills trees of all age groups above the girth of 20 cm, the trees between the girth class 91-150 cm are the most preferred with maximum mortality recorded in the girth class of 121-150 cm.

Contd.

- This borer has the habit of destroying the trees in patches.
- It produces characteristic symptoms: dying-off from the crown downwards by sudden withering of the foliage in autumn or spring; and profuse exudation of resin at points where the first stage larvae bore through the bark.
- The emergence of the adult beetle is closely synchronized with rainfall (June/July).
- The beetles lay eggs in the bark and sapwood and a heavily infested tree may contain as many as 900 living larvae.

- The attack of *sal* borer is considered epidemic when the trees affected by the insects are above economic threshold level (ETL), more than 1% of the total number of trees.
- Outbreaks of this insect have been recorded periodically since 1897 in Chota Nagpur, India.
- Till date, over 21 epidemics of this borer have been recorded in sal forests of different states of the country.
- Reported outbreaks include Singhbhoom, Bihar in 1899, Assam (1906, 1961), Himachal Pradesh (1948-1952), Madhya Pradesh (1905, 1927-28, 1948-52, 1959-63, 1998), Uttranchal (1916-24, 1934-37, 1958-60, 1961, 1965), and West Bengal (1931-34).

Contd.

- Recently, sal borer epidemic has occurred in Madhya Pradesh and Chhattisgarh during the year 1997-2000.
- Out of 16.84 lakh ha of sal forests, about 3 lakh ha got affected by the borer in the recent epidemic and the worst affected district was Mandla where about 8 lakh trees were damaged.
- During such epidemics, millions of trees may be killed with losses totaling millions of rupees annually.
- Recently, occurrence of sal heartwood borer and its considerable damage has been reported in Bastar Forest Division, Chhattisgarh.
- Very recently, sal borer incidences has also been reported in Dindori and East Mandla Forest Divisions, Kanha and Satpura Tiger Reserves of Madhya Pradesh and Banhupratapur, Jagdalpur and Kabirdham Forest Divisions of Chhattisgarh.

Lymantria mathura Moore (Lepidoptera: Lymantriidae)

Common name : Sal defoliator

Hosts: *Antocephalus cadamba*; *Mangifera indica*; *Quercus incana*; *Q. serrata*; *Shorea robusta*; *Syzygium cuminii*; *Terminalia arunja*; *T. myriocarpa*

- ***Lymantria mathura* is a serious defoliator found in China, Korea, India, Nepal and Japan.**
- **It is polyphagous and feeds on a variety of deciduous trees including Fagaceae (oaks and beeches), Salicaceae (willows), Rosaceae (fruit trees) Betulaceae (birches), Juglandaceae (hickories and walnuts), Oleaceae (ashes) and a number of tropical families of trees.**
- **Recorded hosts in India include *Antocephalus cadamba*, *Mangifera indica*, *Quercus incana*, *Quercus serrata*, *Shorea robusta*, *Syzygium cuminii*, *Terminalia arunja* and *Terminalia myriocarpa*.**

Contd.

- In India outbreaks are infrequent but extensive when they do occur.
- No significant tree mortality occurs after defoliation of the sal tree, *Shorea robusta*, but tree vigor may be reduced and susceptibility to attack from other insect species may increase.
- However, successive defoliations on *Shorea robusta* in Assam and north India have been known to kill trees.

Poplar-*Populus* spp. (family Salicaceae)

Apriona cinerea **Chevrolat (Coleoptera : Cerambycidae)**

Common name : Poplar stem borer

Hosts: *Populus* spp.

- **The poplar stem borer, *Apriona cinerea* is another pest of poplars. Young plants, 1-3 years old, are most prone to attack.**
- **This insect is common in the northwest Himalayas and the adjoining plains region.**

Chrysomela populi Linnaeus (Coleoptera : Chrysomelidae)

Common names: Poplar defoliator; willow leaf beetle

Hosts: *Populus* spp.; *Salix* spp.

- ***Chrysomela populi* is a pest of both poplars and willows in the temperate Himalayas from Jammu and Kashmir to Arunachal Pradesh.**

Clostera cupreata Butler (Lepidoptera : Notodontidae)

Common name: Poplar defoliator

Hosts: *Populus* spp.

- ***Clostera cupreata* has been an important pest of poplar plantations in the Tarai Region of Uttar Pradesh since 1966 and in Punjab State since 1986.**

- **Epidemics typically develop three years after plantation establishment.**

Clostera fulgurita (Walker) (Lepidoptera : Notodontidae)

Common names: Poplar defoliator

Hosts: *Populus* spp.

- ***Clostera fulgurita* has been an important pest of poplar plantations in the Tarai Region of Uttar Pradesh since 1966 and in the Punjab since 1986.**

- **Epidemics typically develop three years after plantation establishment.**

Khamer-*Gmelina arborea* Roxb. (familyLamiaceae)

Calopepla leayana **(Latreille) (Coleoptera : Chrysomelidae)**
Common name : Khamer defoliator
Hosts: *Gmelina arborea*

- **The defoliator *Calopepla leayana* appears to be most important insect pest of *Gmelina arborea* in plantations within the natural range of the tree.**
- **It is perhaps the most widely reported and studied defoliator of *G. arborea* in Asia.**
- **Young larvae feed mainly on the undersurface of gamar (*Gmelina arborea*) leaves, leaving only the mid-ribs and main veins intact.**
- **The adult beetle feeds on the leaf, cutting large circular holes, and also eats young buds and shoots.**

- **Heavy infestation leads to drying up of shoots of young trees and the trees remain leafless for about 4 months of the growing season leading to ultimate death.**

- ***C. leayana* was reported for the first time on *Gmelina* in Meghalya, India in 1995, indicating an apparent expansion of its range to the northeast of India. It is considered a serious pest of gamhar plantations in Assam.**

Mahogany-*Swietenia* spp. (family Meliaceae)

Hypsipyla robusta **Moore (Lepidoptera: Pyralidae)**

Common name : Mahogany shoot borer

Hosts : *Khaya* spp.; *Cedrella* spp.; *Toona ciliata*; *Tectona grandis*; *Swietenia macrophylla* .

- ***Hypsipyla robusta*** **caterpillars bore into the tips and shoots of several species of high quality timber species.**
- **They feed on a range of plants in Meliaceae and Verbenaceae including *Swietenia macrophylla*, *Toona cilata*, *Cedrella* spp. and *Tectona* spp.**
- **In India, it is a particular pest of of toon, *Cedrela toona*, and mahogany and is capable of causing 100 percent mortality of seedlings and young plantations.**
- **The caterpillars destroy the apical shoot causing the tree to form many side branches and frequently a deformed trunk leading to a decreased value of the timber.**
- **This insect can destroy plantations.**

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- The mahogany shoot borer mainly attacks trees in high light areas, hence the biggest effects are observed in young planted forests, particularly those planted with a single species.
- Young under storey trees in naturally regenerating forests suffer far less damage.
- Plantings of mahogany have been almost completely abandoned in some areas because of the damage caused by this insect.
- This species has also been reported to cause damage in Australia, Bangladesh, Nigeria, Pakistan, Sri Lanka and West Indies.

Willows- *Salix* spp. (familySalicaceae)

Lymantria obfuscata **Walker (Lepidoptera: Lymantriidae)**

Common name: Indian gypsy moth

Hosts : *Salix* spp.

- ***Lymantria obfuscata*** **is a damaging defoliator of willows and defoliation causes loss of increment.**
- **Trees may be killed if they are severely defoliated for more than one year.**

Chir pine-*Pinus roxburghii* Sarg. (family Pinaceae)

Cryptothelia crameri **Westwood (Lepidoptera : Psychidae)**

Common names: Chir pine defoliator

Host: *Pinus roxburghii*

- **From 1989-1990, an outbreak of *Cryptothelia crameri* a defoliator of *Pinus roxburghii* was reported in the state of Jammu and Kashmir.**
- **The outbreak caused 5 percent tree mortality over 2 000 ha with 0.3 million trees lost resulting in a net loss of 22.5 million rupees.**
- **The epidemic of this species was reported in 1885 from Tons Valley, Uttarakhand State.**
- **It was subsequently recorded from Himachal Pradesh State in 1928 and also in Kahhula, Pakistan in 1934.**

Deodar- *Cedrus deodara* (Roxb.) (family Pinaceae)

Ectropis deodarae **Prout (Lepidoptera : Geometridae)**

Common name : Deodar defoliator

Host : *Cedrus deodara*

- **Large areas of deodar forests, *Cedrus deodara*, in the northwestern and western Himalaya regions are often defoliated completely by *Ectropis deodarae*, causing heavy mortality.**
- **An outbreak was noticed in June 1994 in the Neldehra forest in Mashobra range and Badmain forest in Bhajji range near Shimla in Himachal Pradesh.**
- **The caterpillars feed on the needles from the tip to the base scraping the basal portion of the needles.**
- **As a result, the needles turn brown, dry up and fall to the ground prematurely.**

Contd.

- In the later stages of attack, the trees, branches and the undergrowth were covered with the webs and veils of silk, and the plantation had a brown, scorched appearance. The attack was so heavy that complete defoliation of 8-10 ha of a 60-70 year old stand occurred.
- Recently, an epidemic of this defoliator was reported from the Lolab Valley, Jammu and Kashmir.
- Tree mortality was as high as 30 percent.
- Epidemics occur at about 10 year intervals and may last for 2 or 3 years.

Spruce-*Picea* spp. (family Pinaceae)

Eucosma hypsidryas **(Lepidoptera : Tortricidae)**

Common name : Spruce bud worm

Hosts: *Picea* spp.

- **A budworm, *Eucosma hypsidryas*, is major cause of mortality of spruce trees in the Himalayas.**
- **Trees of all ages are attacked.**
- **Heavy and repeated infestation results in weakening of the host.**

Introduced insect pests

Heteropsylla cubana Crawford (Homoptera : Psyllidae)

Common names: Jumping louse

Host: *Leucaena leucocephala*

- ***Leucaena leucocephala* is a tree grown extensively in community forestry and agroforestry ecosystems for fodder and fuel throughout the tropics including India.**
- **The tree was almost pest free in India until 1988, when the leucaena psyllid, *Heteropsylla cubana*, appeared in Chengalpetu (Tamilnadu), South India and caused severe defoliation and extensive death of young trees.**
- **By 1990, it had attacked all the *Leucaena* plantations in the country.**

Icerya purchasi Maskell (Homoptera: Coccidae)

Common name: Australian bug

Hosts: *Acacia* spp., *Casuarnia equisetefolia*

- ***Icerya purchasi*, the cottony cushion scale, was accidentally introduced into India in 1921.**
- **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.**
- ***Rodolia cardinatis* (Coleoptera: Coccinellidae) was introduced for the control of this scale, and it has proven to be a very effective predator.**

Leptocybe invasa Fisher & LaSalle (Hymenoptera : Eulophidae)

Common names : Blue gum chalcid

Hosts : *Eucalyptus* spp.

- **The blue gum chalcid is a gall-inducing wasp native to Australia.**
- **It has become a pest of planted eucalypt forests in various parts of the world including Kenya, Morocco, New Zealand, Tanzania and Uganda. Recently it has been reported from India in planted forests and nurseries of *Eucalyptus camaldulensis* and *E. tereticornis*.**
- **This gall wasp is also known to attack other eucalyptus species including *E. botryoides*, *E. bridgesiana*, *E. deanei*, *E. globulus*, *E. gunii*, *E. grandis*, *E. nitens*, *E. robusta*, *E. saligna* and *E. viminalis*.**

Contd.

- *L. invasa* lays eggs in the bark of shoots or the midribs of leaves.
- The eggs develop into minute, white, legless larvae within the host plant.
- Damage is caused when the developing larvae produces galls on the leaf midribs, petioles and twigs.
- The galls can cause the twigs to split, destroying the cambium.
- Small circular holes indicating exit points of adults from pupae are common on the galls.
- Repeated attacks lead to loss of growth and vigour in susceptible trees.
- Severely attacked trees show gnarled appearance, stunted growth, lodging, dieback and eventually tree death.
- The blue gum chalcid is a stenophagous insect and it has a relatively narrow host range.

Pineus pini (Macquart) (Hemiptera : Adelgidae)

Common names: Pine woolly aphid

Hosts: *Pinus* spp.

- **The pine woolly aphid feeds on the shoots of *Pinus* spp., at times causing tip dieback.**
- **It occurs in Africa, Australia, Europe, New Zealand and North and South America.**
- **First introduced to India in the 1970s, *Pineus pini* has caused severe damage to *Pinus patula* plantations in the Nilgiri hills of South India.**
- **Since only trial plantations had been established, the damage has been restricted to *Pinus patula* and its further spread has been contained by discontinuing the planting of *P. patula*.**
- **This aphid has moved into new areas mostly by movement of infested planting stock.**

Quadraspidiotus perniciosus (Comstock) (Homoptera : Coccidae)

Common name : San José scale; California scale

Hosts: *Populus* spp.; *Salix* spp.; *Aesculus* spp.; *Alnus* spp.; *Betula* spp.; *Celtis* spp.; *Morus* spp.

- **A native of China, *Quadraspidiotus perniciosus* or the San Jose scale reached India in 1911, and by 1933 had attained pest status in fruit orchards and plantations of poplars and willows.**
- **The San Jose scale also damages species of *Aesculus*, *Alnus*, *Betula*, *Celtis*, *Fagus*, *Fraxinus* and *Morus*.**
- **All surface parts of young hosts are infested.**
- **Attacks are generally on wood but, in severe infestations, leaves and fruits may also be penetrated.**
- **Bark often cracks and exudes gum, resulting in a surrounding dark-brown gelatinous area.**
- **Heavy infestation causes cessation of growth and loss of yield.**

Contd.

- Published information on regular systematic annual surveys of forest insects in India is highly limited.
- Most information on pest occurrence is obtained via informal observations by scientists, foresters and forest workers.
- However, a few special surveys of insect occurrence and related damage have been conducted.
- More than 21 major insect pests affect India's forest resources but few statistics are available on their impacts.
- Some data are available at the local level or in reports or papers presented at conferences.

- Thank you