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OVERVIEW OF FOREST PESTS

INDIA

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DISCLAIMER

The aim of this document is to give an overview of the forest pest[1] situation in India. It is not intended to be a comprehensive review.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

[1] Pest: Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products (FAO, 2004).

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Background

This paper is one of a series of FAO documents on forest-related health and biosecurity issues. The purpose of these papers is to provide early information on on-going activities and programmes, and to stimulate discussion.

In an attempt to quantify the impacts of the many factors that affect the health and vitality of a forest, the Global Forest Resources Assessment 2005 (FRA 2005) asked countries to report on the area of forest affected by disturbances, including forest fires, insects, diseases and other disturbances such as weather-related damage. However, most countries were not able to provide reliable information because they do not systematically monitor these variables.

In order to obtain a more complete picture of forest health, FAO continues to work on several follow-up studies. A review of forest pests in both naturally regenerating forests and planted forests was carried out in 25 countries representing all regions of the world. This *Overview of forest pests* represents one paper resulting from this review. Countries in this present series include Argentina, Belize, Brazil, Chile, China, Cyprus, Colombia, Ghana, Honduras, India, Indonesia, Kenya, Kyrgyz Republic, Malawi, Mauritius, Mexico, Moldova, Mongolia, Morocco, South Africa, Sudan, Thailand, Romania, Russian Federation, Uruguay; this list will be continuously updated.

Comments and feedback are welcome. For further information or if you are interested in participating in this process and providing information on insect pests, diseases and mammals affecting forests and the forest sector in your country, please contact:

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INDIA

Introduction

India's forest cover is estimated to be about 67.701 million hectares, or 22.8 percent of the country's land area (FAO, 2006). 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.

A large number of insects and diseases 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, 2005a). 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 and 8 400 000 ha by diseases (FAO, 2005a). Some reviews of forest insects and their damage are provided by FAO (2003) and Singh (1990).

Forest pests

Naturally regenerating forests

Insects

Indigenous insects

***Asphondylia tectonae* Mani, 1974**

Other scientific names:
Diptera: Cecidomyiidae
Common names: twig gall midge
Host type: broadleaf
Hosts: *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 (Nair, 2001). It attacks new shoots of teak and causes formation of galls that coalesce, harden and surround the stem f twigs.

***Cryptothelia crameri* Westwood**

Other scientific names:
Lepidoptera: Psychidae
Common names: chir pine defoliator
Host type: conifer
Hosts: *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 (FAO, 2003). The first epidemic of this species was reported in 1885 from Tons Valley, Uttaranchal State (FAO, 2003). It was subsequently recorded from Himachal Pradesh State in 1928 and also in Kahhula, Pakistan in 1934 (FAO, 2003).
http://www.fao.org/docrep/007/ae354e/AE354E27.htm

***Ectropis deodarae* Prout**

Other scientific names:
Lepidoptera: Geometridae
Common names: deodar defoliator
Host type: conifer
Hosts: *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 (Verma, 1995). 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. 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 (Verma, 1995).

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 (FAO, 2003).
http://www.fao.org/docrep/007/ae354e/AE354E27.htm
http://www.metla.fi/iufro/iufro95abs/d2pap130.htm

Eucosma hypsidryas

Other scientific names:
Lepidoptera: Tortricidae
Common names: spruce bud worm
Host type: conifer
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.

Eutectona machaeralis Walker, 1859

Other scientific names:
Lepidoptera: Pyralidae
Common names: teak skeletonizer; teak leaf skeletonizer
Host type: broadleaf
Hosts: *Tectona grandis*

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 growing period. Damage varies from almost negligible to as much as half of the total annual increment (FAO, 2003). Past studies estimate the losses due to this insect at approximately 0.051 million ha annually (FAO, 2003).

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 (Nair, 2001).

Hoplocerambyx spinicornis (Newman, 1842)

Other scientific names:
Coleoptera: Cerambycidae
Common names: sal heartwood borer; sal borer
Host type: broadleaf
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 (Appanah and Turnbull, 1998). It is a pest of *Parashorea robusta, P. malaanonan, P. stellata, Shorea siamensis, S. assamica, S. obtusa, S. robusta, Anisoptera glabra* and *Hopea odorata* (Appanah and Turnbull, 1998).

H. spinicornis causes severe damage in central and northern India on *Shorea robusta.* Outbreaks of this insect have been recorded periodically since 1897 in Chota Nagpur, India (Appanah and Turnbull, 1998). In 1998, this insect damaged and killed about 1 million trees (FAO, 2003). The area of forest affected by this insect has not been clearly reported however, a conservative estimate was that at least 1 000 ha of forests were affected in 2000 (FAO, 2005a). Other 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) (Appanah and Turnbull, 1998). Its larvae girdle and kill trees and riddle the heartwood with large tunnels or galleries making it unfit for marketing as timber (Appanah and Turnbull, 1998; FAO, 2002). It is normally a pest of felled and dying sal but during epidemics, it attacks healthy trees of all ages and girth (Appanah and Turnbull, 1998; FAO, 2002). The borers prefer large, mature trees, where there is more

chance of completing the life cycle. But during epidemics this borer is capable of infesting every tree above 0.3 m girth and is not confined to mature or over-mature trees. During such epidemics, millions of trees may be killed with losses totaling millions of rupees annually.

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 (Appanah and Turnbull, 1998). 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.
http://www.fao.org/DOCREP/005/AC781E/AC781E07.htm
http://www.iifm.ac.in/databank/problems/salinfo.html
http://www.panda.org/news_facts/newsroom/features/index.cfm?uNewsID=1829
http://www.worldagroforestry.org/sea/products/AFDbases/AF/asp/SpeciesInfo.asp?SpID=1525#Pests
http://www.salagubang.net/pages/species/species_cer_s0631.htm

Introduced insects

No information was available on introduced insects affecting India's naturally regenerating forests.

Diseases

Indigenous diseases

No information was available on indigenous pathogens affecting India's naturally regenerating forests.

Introduced diseases

No information was available on introduced pathogens affecting India's naturally regenerating forests.

Other pests

Indigenous other pests

No information was available on indigenous other pests (e.g. mites, nematodes, mammals, etc.) affecting India's naturally regenerating forests.

Introduced other pests

No information was available on introduced other pests (e.g. mites, nematodes, mammals, etc.) affecting India's naturally regenerating forests.

Diebacks and other conditions

No information was available on diebacks and other conditions in India's naturally regenerating forests.

Planted forests

Insects

Indigenous insects

More than 143 species of insects infest both indigenous as well as exotic species of poplars, *Populus* spp. in northwestern India, with about 65 species infesting *Populus deltoides* alone (Singh, Bhandari and Verma, 2005). Random sampling surveys of poplar plantations (1984-2002) was undertaken in the lower hills and plains of six states (Uttar Pradesh, Uttaranchal, Haryana, Punjab, Himachal Pradesh, and Jammu and Kashmir) between 1984 and 2002. The survey included 36 nurseries, 84 large (≥ 3 ha) and 255 small (< 3 ha) plantations. Seven insect species were detected at outbreak levels. Among these, three species: *Clostera cupreata, C. fulgurita* and *Apriona cinerea* were ranked as major pests as they had relatively higher incidence (> 50 percent attack) and caused extensive economic loss during outbreaks, coupled with tree mortality which persisted for several years in succession over large areas (Singh, Bhandari and Verma, 2005).

Apriona cinerea Chevrolat, 1852

Other scientific names:
Coleoptera: Cerambycidae
Common names: poplar stem borer
Host type: broadleaf
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 (FAO, 2003).

Calopepla leayana (Latreille, 1807)

Other scientific names: *Craspedonta leayana*; *Imatidium leayanum* Latreille; *Cassida leayana* Olivier; *Calopepla leayana ab. nigriventris* Weise
Coleoptera: Chrysomelidae
Common names: gamar defoliator; gamhar defoliator; yemane defoliator; yemane tortoise beetle
Host type: broadleaf
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 (Wingfield and Robison, 2004). 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 (Wingfield and Robison, 2004). It is considered a serious pest of gamhar plantations in Assam, Trefru (FAO, 2003).
http://www.cabicompendium.org/NamesLists/FC/Full/CLPPLE.htm
http://www.springerlink.com/content/j41r34826g7h0620/fulltext.pdf

Chrysomela populi **Linnaeus 1758**

Other scientific names: *Melosoma populi*
Coleoptera: Chrysomelidae
Common names: poplar defoliator; poplar leaf beetle; willow leaf beetle
Host type: broadleaf
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.
http://www.forestryimages.org/browse/subimages.cfm?SUB=10274

Clostera cupreata **Butler**

Other scientific names:
Lepidoptera: Notodontidae
Common names: poplar defoliator
Host type: broadleaf
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)**

Other scientific names:
Lepidoptera: Notodontidae
Common names: poplar defoliator
Host type: broadleaf
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.

Eutectona machaeralis **Walker, 1859**

Other scientific names:
Lepidoptera: Pyralidae
Common names: teak skeletonizer; teak leaf skeletonizer
Host type: broadleaf
Hosts: *Tectona grandis*

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 growing period. Damage varies from almost negligible to as much as half of the total annual increment (FAO, 2003). Past studies estimate the losses due to this insect at approximately 0.051 million ha annually (FAO, 2003).

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 (Nair, 2001).

***Hyblaea puera* (Cramer, 1777)**

Other scientific names: *Phalaena puera*; *Noctua saga*; *Noctua unxia*; *Heliothis apricans*
Lepidoptera: Hyblaeidae
Common names: teak defoliator
Host type: broadleaf
Hosts: *Alstonia scholaris*; *Avicennia* spp.; *Callicarpa* spp.; *Pterocarpus macrocarpus*; *Rhizophora* spp.; *Tectona grandis*; *Vitex* spp.

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 (Nair, 2001). In Kerala, defoliation of teak was often over 50 percent (Nair, 2001).

The larvae create shelters for themselves by cutting pieces of leaves and rolling them together. They come out of the shelters to feed by night. *Hyblaea puera* is widespread throughout the tropics occurring in Asia, Australia, the Pacific Islands, Africa, Central America and South America.
http://www.cabicompendium.org/NamesLists/FC/Full/HYBLPU.htm
http://www.usyd.edu.au/macleay/larvae/hybl/puera.html
http://www.forest.go.th/fig/nbcrc/nbcrc_e.html
http://www.cifor.cgiar.org/publications/pdf_files/Books/Nair.pdf
http://www.cifor.cgiar.org/publications/pdf_files/Insect-pests.pdf

***Hypsipyla robusta* Moore, 1886**

Other scientific names: *Epicrocis terebrans* Oliff, 1890; *Magiria robusta* Moore, 1886; *Hypsipyla scabrusculella* Ragonot, 1893; *Hypsipyla pagodella* Ragonot, 1888
Lepidoptera: Pyralidae
Common names: mahogany shoot borer; cedar tip moth; toon shoot fruit borer
Host type: broadleaf
Hosts: *Khaya* spp.; *Cedrella* spp.; *Cedrela toona*; *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 (FAO, 2003). 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 (FAO, 2003).

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 understorey 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.
http://linus.socs.uts.edu.au/~don/larvae/pyra/robust.html
http://www.aciar.gov.au/web.nsf/att/JFRN-6BN983/$file/pr97chapter2.pdf
http://www.usyd.edu.au/su/macleay/larvae/pyra/robust.html
http://www.fzi.uni-freiburg.de/InsectPestKey-long%20version/hypsipyl.htm
http://www.ansinet.org/fulltext/pjbs/pjbs75848-851.pdf
http://www.cifor.cgiar.org/publications/pdf_files/Insect-pests.pdf

Lymantria mathura Moore, 1865

Other scientific names: *Porthetria mathura* (Moore), *Ocneria mathura* (Moore), *Lymantria aurora* Butler, *Lymantria fusca* Leech, *Lymantria mathura aurora* Butler
Lepidoptera: Lymantriidae
Common names: pink gypsy moth; rosy gypsy moth; Russian gypsy moth; sal defoliator
Host type: broadleaf
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, the Democratic People's Republic of Korea, India, Nepal, Japan, Republic of Korea, and the Russian Federation. 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*.

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 (Appanah and Turnbull, 1998).
http://www.inspection.gc.ca/english/sci/surv/data/lymmate.shtml
http://www.forestryimages.org/browse/subimages.cfm?sub=4601
http://www.eppo.org/QUARANTINE/insects/Lymantria_mathura/LYMAMA_ds.pdf
http://www.spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=113&langdisplay=english
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=347

***Lymantria obfuscata* Walker**

Other scientific names:
Lepidoptera: Lymantriidae
Common names: Indian gypsy moth; apple hairy caterpillar; leaf eating caterpillar; Kashmir willow defoliator
Host type: broadleaf
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 (FAO, 2003).
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=342

Introduced insects

***Heteropsylla cubana* Crawford,1914**

Other scientific names: *Heteropsylla incisa* (Sulc.)
Homoptera: Psyllidae
Common names: leucaena psyllid
Host type: broadleaf
Hosts: *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 (FAO, 2005b).
http://www.cifor.cgiar.org/publications/pdf_files/Insect-pests.pdf
http://www.afae.org/html/98-201.html
http://www.deh.gov.au/cgi-bin/abrs/fauna/details.pl?pstrVol=PSYLLOIDEA;pstrTaxa=105;pstrChecklistMode=2
http://www.ento.csiro.au/aicn/name_s/b_1961.htm
http://www.forestpests.org/subject.html?SUB=307

***Icerya purchasi* Maskell**

Other scientific names: *Pericerya purchasi* (Maskell)
Homoptera: Coccidae
Common names: cottony cushion scale; fluted scale; Australian bug; mealy scale; white scale
Host type: broadleaf
Hosts: *Acacia decurrens*; *A. dealbata*

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). *Rodolia cardinatis* (Coleoptera: Coccinellidae) was introduced for the control of this scale, and it has proven to be a very effective predator (FAO, 2005b).
http://www.invasive.org/browse/subimages.cfm?sub=8365
http://www.ento.csiro.au/aicn/name_s/b_2079.htm
http://creatures.ifas.ufl.edu/fruit/cottony_cushion_scale.htm
http://www.hear.org/starr/hiinsects/images/thumbnails/html/icerya_purchasi.htm
http://www.inra.fr/hyppz/RAVAGEUR/6icepur.htm
http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7410.html
http://anrcatalog.ucdavis.edu/pdf/8051.pdf

***Leptocybe invasa* Fisher & LaSalle, 2004**

Other scientific names:
Hymenoptera: Eulophidae
Common names: blue gum chalcid
Host type: broadleaf
Hosts: *Eucalyptus camaldulensis*; *E. tereticornis*; *E. grandis*; *E. deanei*; *E. globulus*; *E. nitens*; *E. botryoides*; *E. saligna* ; *E. gunii*; *E. robusta*; *E. bridgesiana*; *E. viminalis*

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* (Jacob, Devaraj and Natarajan, 2007). This gall wasp is also known to attack other eucalypt species including *E. botryoides*, *E. bridgesiana*, *E. deanei*, *E. globulus*, *E. gunii*, *E. grandis*, *E. nitens*, *E. robusta*, *E. saligna* and *E. viminalis*.

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 (Mendel *et al*., 2004). The blue gum chalcid has a relatively narrow host range (Mendel *et al*., 2004). Host range studies in Kenya are underway.
http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/x5387e/x5387e07.htm
http://www.hortnet.co.nz/publications/nzpps/proceedings/00/00_339.pdf
http://fabinet.up.ac.za/tpcp/newsletters/TPCP_Newsletter_Nov_2005.pdf

Pineus pini

Other scientific names: *Pineus laevis* (Maskell, 1885) Börner, 1907; *Aphis pini* Gmelin, 1790; *Kermes pini* Macquart, 1819; *Anisophleba pini* Koch, 1857; *Kermaphis pini* var. *laevis* Maskell, 1885; *Pineus pini* (Macquart, 1819) Börner, 1907; *Pineus sylvestris* Annand, 1928; *Pineus havrylenkoi* Blanchard, 1944; *Pineus simmondsi* Yaseen & Ghani, 1971; *Pineus boerneri* Annand, 1928
Hemiptera: Adelgidae

Common names: pine woolly aphid; red pine adelgid; pine twig chermes; pine aphid
Host type: conifer
Hosts: *Pinus* spp.; *Pinus patula*

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 (FAO, 2005b). 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* (FAO, 2005b).

Control of this pest by biological control is variable - in some areas this method has been highly successful and significantly less so in others. This aphid has moved into new areas mostly by movement of infested planting stock.
http://www.cabicompendium.org/NamesLists/FC/Full/PINEPI.htm

Quadraspidiotus perniciosus (Comstock)

Other scientific names: *Aspidiotus perniciosus* Comstock; *Comstockaspis perniciosa* (Comstock); *Diaspidiotus perniciosus* (Comstock)
Homoptera: Coccidae
Common names: San José scale; California scale
Host type: broadleaf
Hosts: *Populus* spp.; *Salix* spp.; *Aesculus* spp.; *Alnus* spp.; *Betula* spp.; *Celtis* spp.; *Fagus* spp.; *Fraxinus* 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 (FAO, 2005b). The San Jose scale also damages species of *Aesculus*, *Alnus*, *Betula*, *Celtis*, *Fagus*, *Fraxinus* and *Morus* (FAO, 2005b).

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.
http://www.eppo.org/QUARANTINE/insects/Quadraspidiotus_perniciosus/QUADPE_ds.pdf#search=%22Diaspidiotus%20perniciosus%20%22
http://www.insectimages.org/browse/subthumb.cfm?sub=8356&start=1
http://www.ento.csiro.au/aicn/name_s/b_1373.htm

Diseases

Indigenous diseases

Balansia linearis (Rehm) Diehl (1950)

Other scientific names
Ascomycota: Clavicipitaceae
Common names: witches' broom disease
Host type: broadleaf

Hosts: *Ochlandra travancorica* var. *hirsuta*; *O. travancorica*; *O. scriptoria*; *O. ebracteata*

A witches' broom disease caused by the fungus *Balansia linearis* affecting reed bamboos was recorded during a disease survey in natural stands and plantations in Kerala State, India. Depending on site and host species, the pathogen infected up to 24 percent of the clumps of the commercially exploited reed bamboos, *Ochlandra travancorica* var. *hirsuta, O. travancorica, O. scriptoria*, and *O. ebracteata* and poses a threat to the reed bamboo industry (Mohanan, 2004).
http://www.indexfungorum.org/Names/NamesRecord.asp?RecordID=293594

***Fusarium solani* f. *dalbergiae* W.L. Gordon ex B.K. Bakshi & S. Singh, 1959**

Other scientific names:
Ascomycota: Nectriaceae
Common names: root rot; leaf blight
Host type: broadleaf
Hosts: *Dalbergia sissoo*

Root rot caused by *Fusarium solani* f. *dalbergiae* is a serious disease of *Dalbergia sissoo* in almost all the forest nurseries located in different parts of Haryana state, India. It causes 60-80 percent losses particularly in heavy and wet soils (Kaushik and Singh, 1996).
http://www.indexfungorum.org/Names/NamesRecord.asp?RecordID=348162

***Subramanianospora vesiculosa* (E.J. Butler) C. Narayanan, J.K. Sharma & Minter, (2003)**

Other scientific names:
Ascomycota: Incertae sedis
Common names: wilt bark disease; blister bark disease; *Casuarina* blister bark
Host type: broadleaf
Hosts: Casuarinaceae; *Casuarina equisitfolia*

Wilt or blister bark disease is the most destructive disease of *Casuarina equisitfolia* in India. It is caused by the fungus, *Subramanianospora vesiculosa* (Narayanan, Sharma and Minter, 2003), and was first reported from India in the early 1900s. Later outbreaks were reported from India, Mauritius and Sri Lanka (Narayanan *et al*., 1996). In recent years the disease has been reported to cause large-scale tree mortality in India and other countries (Narayanan, Sharma and Minter, 2003). Discolouration of the foliage is the initial symptom of blister bark disease. As the disease advances, necrotic lesions appear all over the main stem and branches. Subsequently, all the affected trees exhibit symptoms of wilting and drying and are ultimately killed. Likely pathways of introduction and spread include nursery stock and bark and wood packaging material, including dunnage.
http://www.indexfungorum.org/Names/NamesRecord.asp?RecordID=487950
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=519
http://www.daff.gov.au/content/output.cfm?ObjectID=D2C48F86-BA1A-11A1-A2200060A1B01742

Introduced diseases

No information was available on introduced pathogens affecting India's planted forests.

Other pests

Indigenous other pests

No information was available on indigenous other pests (e.g. mites, nematodes, mammals, etc.) affecting India's planted forests.

Introduced other pests

No information was available on introduced other pests (e.g. mites, nematodes, mammals, etc.) affecting India's planted forests.

Diebacks and other conditions

A dieback or decline of *Dalbergia sissoo* began in the late 1990s and is continuing. The condition is most prevalent in plantations of this species although in some areas, naturally regenerating forests are also affected. The problem is regional in nature and stands of this species have been affected in Bangladesh, India, Nepal and Pakistan. One report from India indicates that *Dalbergia sissoo* is diseased over an area of 8 400 km^2 of the Gangetic Plains in northern Bihar State (FAO, 2005a). The cause of the dieback is not yet known and various factors including soil nutrients, climatic factors, waterlogging of soils and root fungi have been implicated (Sah, Jha and Lamersdorf, 2002; FAO, 2005a).

Capacity for forest health protection

Government level

The Ministry of Environment and Forests (MoEF) is the body responsible for the enforcement of the central forest laws, such as the Forest Conservation Act and the Wildlife Protection Act. Central government institutions also include other ministries and departments with an influence on forests. The Indian Forest Service administers the reserved forests. State Forest Departments have delegated responsibility for sustainable timber production through state-owned Forest Development Corporations, which were originally created in 1976 to attract investments from more autonomous commercial entities. For the most part, these corporations harvest timber from both planted and naturally regenerating forests. Most of the work on forest insects and diseases is conducted by various forest research institutes in India such as the Kerala Forest Research Institute and the Forest Research Institute and College, Dehradun.

Monitoring and detection

Regular systematic annual surveys of forest insect and disease damage are not carried out in India. Most information on pest occurrence is obtained via informal observations by foresters and forest workers. However, a few special surveys of insect and disease occurrence and related damage have been conducted (Mohandas *et al*., 1990; Singh, Bhandari and Verma, 2005).

Data management

More than 21 major insect pests affect India's forest resources but few statistics are available on area affected or their impacts. Some data are available at the local level or in reports or papers presented at conferences (Mohandas *et al*., 1990; FAO, 2003; FAO, 2005a; Singh, Bhandari and Verma, 2005).

Pest management

Most pest management tactics, including chemical, biological and silvicultural, are aimed at protecting planted forests. For example, a combination of silvicultural and biological control tactics has been developed for management of defoliators of *Tectona grandis* (Mathur, 1960).

Private landowners

No information is available on private landowners in India.

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OSN = Other Scientific Name (other names, synonyms, other combinations, etc. that have been used for this species)