



# Forestry Department

Food and Agriculture Organization of the United Nations

## Forest Health & Biosecurity Working Papers

### OVERVIEW OF FOREST PESTS

### PEOPLE'S REPUBLIC OF CHINA

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**Forest Resources Development Service  
Forest Management Division  
Forestry Department**

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### **DISCLAIMER**

The aim of this document is to give an overview of the forest pest<sup>1</sup> situation in the People's Republic of China. 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.

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<sup>1</sup> 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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## PEOPLE'S REPUBLIC OF CHINA

### **Introduction**

In 2005, the People's Republic of China's forest cover was estimated at 197 million hectares or 21 percent of the total land cover (FAO, 2006). Other wooded lands comprised about 87 million hectares or 9 percent the total land cover (FAO, 2006). Principal tree species in the country include pines (*Pinus massoniana*, *P. koraiensis*, *P. tabulaeformis*, *P. silvestris* var. *mongolica*), oak (*Quercus acutissima*, *Q. aliena*, *Q. liaotungensis*, *Q. mongolica*, *Q. stewardii*, *Q. variabilis*), fir (*Abies delavayi*, *A. fargesii*, *A. georgei*, *A. kawakamii*, *A. koreana*, *A. nephrolepis*, *A. nukiangensis*, *A. squamata*), spruce (*Picea brachytyla*, *P. jezoensis*, *P. morrisonicola*, *P. spinulosa*), larch (*Larix* spp.), birch (*Betula* spp.) and poplar (*Populus* spp.).

The Greater Hing'an, Lesser Hing'an and Changbai mountain ranges in the northeast have the country's largest areas of naturally regenerating forests. The major tree species found here are conifers – *Pinus* spp. and *Larix* spp. – as well as a variety of deciduous broadleaf species. The major tree species that occur in the southwest of the country include *Abies* spp., *Picea* spp. and *Pinus* spp., as well as a number of broadleaf species. China's naturally regenerating forests have a high degree of diversity, especially the Xishuangbanna Forest which is located in the south of Yunnan Province. This is a tropical broadleaf forest that has more than 5000 plant species.

The People's Republic of China has a vast area of planted forests – over 31 000 000 ha representing 15.9 percent of the country's total forest area (FAO, 2006). Important plantation species include *Populus* spp., *Salix* spp., *Pinus* spp. and *Ulmus* spp.

A large number of indigenous insects and diseases cause damage in both China's natural and planted forests. Several damaging pests have also been accidentally introduced and are causing significant losses to the country's forests (FAO, 2005a). In 2000, it was estimated that the average area affected annually by insects was almost 6.2 million hectares, 883 000 ha were affected by disease, and 820 000 ha by other disturbances (mice) (FAO, 2005b).

### **Forest pests**

#### **Naturally regenerating forests**

##### **Insects**

##### **Indigenous insects**

##### ***Dendrolimus sibiricus* Tschetwerikov**

Other scientific names: *Dendrolimus laricis*; *Dendrolimus superans*

Lepidoptera: Lasiocampidae

Common names: Siberian caterpillar; Siberian silk moth; larch caterpillar

Host type: conifer

Hosts: *Larix* spp.; *Pinus* spp.; *Abies* spp.; *Picea* spp.; *Tsuga* spp.

*Dendrolimus sibiricus* is species of moth that has caterpillars that cause significant defoliation of both natural and planted forests. This moth, unlike a number of other tree pests, is able to attack and kill healthy plants and it has been known to kill trees across very wide areas. Other impacts are the loss of vigour, reduction in growth, reduced seed crops, and tree mortality by secondary species. In northern China, this species has a significant impact on larch forests (*Larix* spp.). It feeds on plant species in several genera of Pinaceae including *Pinus*, *Larix*, *Abies* and *Picea*.

The life cycle of this species lasts over two calendar years. Outbreaks of this moth are cyclic, occurring 10-11 years following a few years of water shortage. The period between outbreaks is becoming shorter partly due to changing climate. The adults are strong fliers and can spread fairly rapidly. Pathways of introduction include natural movement of adults and the movement of eggs on nursery stock or forest products.

The taxonomy of this species is not clear. There is considerable confusion as to whether this species is part of a species complex or a single species (see Davis, French and Venette, 2005).

<http://www.aphis.usda.gov/ppq/ep/pestdetection/pradsuperanspra.pdf>

[http://www.exoticforestpests.org/english/Detail.CFM?tblEntry\\_PestID=45](http://www.exoticforestpests.org/english/Detail.CFM?tblEntry_PestID=45)

[http://www.eppo.org/QUARANTINE/insects/Dendrolimus\\_sibiricus/DSDENDSI.pdf](http://www.eppo.org/QUARANTINE/insects/Dendrolimus_sibiricus/DSDENDSI.pdf)

#### ***Dendrolimus tabulaeformis* Tsai & Liu**

Other scientific names: *Dendrolimus punctatus tabulaeformis* Tsai & Liu (1999)

Lepidoptera: Lasiocampidae

Common names: Chinese pine caterpillar; Chinese pine moth

Host type: conifer

Hosts: *Pinus* spp.

The caterpillars of *Dendrolimus tabulaeformis* cause significant defoliation of pines in both natural and planted forests. This species of moth causes loss of vigour, reduction in growth, reduced seed crops and susceptibility to secondary species which can lead to the death of trees. The adults are strong fliers and can spread fairly rapidly. Pathways of introduction include natural adult spread and the movement of eggs on nursery stock or forest products.

<http://www.cabicompendium.org/NamesLists/FC/Full/DENDTA.htm>

#### ***Lymantria dispar* Linnaeus, 1758**

Other scientific names: *Bombyx dispar*; *Hypogymna dispar*; *Liparis dispar*; *Ocneria dispar*; *Phalaena dispar*; *Porthesia dispar*; *Porthetria dispar*; *Porthetria hadina* Butler, 1881; *Porthetria umbrosa* Butler, 1881

Lepidoptera: Lymantriidae

Common names: Asian gypsy moth; gypsy moth

Host type: broadleaf and conifer

Hosts: *Populus* spp.; *Salix* spp.; *Quercus* spp.; *Ulmus* spp.; *Betula* spp.; *Larix* spp.; *Pinus* spp.

The Asian gypsy moth is a destructive defoliator of a wide range of broadleaf trees including fruit and forest trees although outbreaks generally occur on primary hosts such

as poplars (*Populus* spp.) and oak (*Quercus* spp.). Outbreaks typically last for about three years and collapse when host trees are weakened to the point that they produce little or no foliage the following spring for the next generation of larvae. In some cases, high levels of parasitism and viral infestation can cause outbreaks to collapse. It can occur at low levels for many years without causing significant damage. However, at times there are significant outbreaks causing severe defoliation of trees and sometimes death. Frequently outbreaks coincide with periods when the trees are under stress.

In China, the larvae feed on 50 species of plants. Favourite hosts are species of *Populus*, *Salix*, *Betula*, *Quercus*, *Ulmus* and fruit trees. Outbreaks occur frequently and, in some cases, occur at periodic intervals. This insect prefers mature naturally regenerating forests and plantations (Schmutzenhofer *et al.*, 1996). Damage includes growth loss, dieback and, in the event of severe outbreaks, tree mortality.

The females of this species lay large numbers of eggs indiscriminately on almost any surface including man-made materials. The larvae hatch enmass and feed on suitable host plant material. Hence this species can cause significant damage in a relatively short time.

Pathways of entry of gypsy moth include vehicles, camping equipment, nursery stock, equipment that has been exposed for a period to the outdoors, ships, and vehicles. Like other moths, the females are attracted to strong lights and thus will fly to the strong lights on board ships and lay eggs on the superstructure. Adults of Asian strains are capable of flight, hence dispersal by the adults is possible and the risk of introduction to new areas is increased. Females of European strains cannot fly. Young larvae can move some distance by ballooning from tops of trees.

<http://www.forestpests.org/subject.html?SUB=165>

<http://www.issg.org/database/species/ecology.asp?si=96&fr=1&sts=sss>

<http://www.inspection.gc.ca/english/sci/surv/data/lymdise.shtml>

<http://www.padil.gov.au/simplePestSearchResults.aspx?fldKeywords=lymantriidae>

[http://www.forestry.ubc.ca/fetch21/FRST308/lab5/lymantria\\_dispar/gypsy.html](http://www.forestry.ubc.ca/fetch21/FRST308/lab5/lymantria_dispar/gypsy.html)

## **Introduced insects**

### ***Hyphantria cunea* Drury**

Other scientific names: *Hyphantria textor* (Harris)

Lepidoptera: Arctiidae

Common names: fall webworm; American white moth; mulberry moth; blackheaded webworm; redheaded webworm

Host type: broadleaf

Hosts: *Populus* spp.; *Salix* spp.; *Fraxinus* spp.; *Betula* spp.; *Alnus* spp.; *Carya* spp.; *Juglans* spp.; *Ulmus* spp.; *Acer* spp.; *Diospyros* spp.; *Liquidambar* spp.

*Hyphantria cunea* has a very wide host range across several plant families. It is known to feed on over 600 species of plants and trees including alder (*Alnus* spp.), willow (*Salix* spp.), birch (*Betula* spp.), cottonwood (*Populus* spp.), pecan and hickory (*Carya* spp.), walnut (*Juglans* spp.), elm (*Ulmus* spp.), maples (*Acer* spp.), persimmon (*Diospyros* spp.), sweetgum (*Liquidambar* spp.), and fruit trees. They are significant defoliators and can cause considerable damage including defoliation and tree stress. The fall webworm is native to North America where it occasionally causes considerable damage, particularly

in shade trees and ornamentals. The fall webworm was reported in China in 1979 and is now established in the country.

The females lay many egg masses which consist of large numbers of eggs, usually 500-600. The eggs hatch enmass and the larvae are gregarious throughout most of their life stages. The larvae have six instars and the first four instars feed in colonies on the foliage of a number of broadleaf species and construct large webs or tents (Schmutzenhofer *et al.*, 1996). Only the last two larval instars feed as isolated individuals. They pupate in concealed places such as bark, wall crevices and tree litter. Depending on the climate there are between two and four generations per year. This insect can be a pest in both natural and planted forests.

<http://www.forestpests.org/southern/foresttentcat.html>

<http://www.bugwood.org/factsheets/webworm.html>

[http://www.forestry.ubc.ca/fetch21/FRST308/lab5/hyphantria\\_cunea/webworm.html](http://www.forestry.ubc.ca/fetch21/FRST308/lab5/hyphantria_cunea/webworm.html)

<http://warehouse.pfc.forestry.ca/pfc/2201.pdf>

[http://www.cfl.scf.rncan.gc.ca/IMFEC-IDECECF/ficheinsecte\\_e.asp?id=8125](http://www.cfl.scf.rncan.gc.ca/IMFEC-IDECECF/ficheinsecte_e.asp?id=8125)

<http://www.forestryimages.org/browse/subthumb.cfm?sub=158>

<http://www.cabicompendium.org/NamesLists/FC/Full/HYPHCU.htm>

## Diseases

### **Indigenous diseases**

No data was available on indigenous diseases affecting naturally regenerating forests in China.

### **Introduced diseases**

No data was available on introduced diseases affecting naturally regenerating forests in China.

## Other pests

### **Indigenous other pests**

No data was available on indigenous other pests (e.g. mites, nematodes, mammals, etc.) affecting naturally regenerating forests in China.

### **Introduced other pests**

#### ***Bursaphelenchus xylophilus***

Other scientific names:

Tylenchida: Aphelenchoididae

Common names: pine wood nematode; pine wilt nematode; pine wilt disease

Host type: conifer

Hosts: *Pinus* spp.; *P. massoniana*; *P. thunbergi*

The pine wilt nematode causes pine wilt disease. It kills pines in several Asian countries where it has been introduced. The nematode is native to North America and was



discovered in Nanjing, Jiangsu Province in 1982. Between 1982 and 1995, over 231 000 pines were killed in Jiangsu Province by this nematode (Wenli, Kequin and Yuansheng, 1995). The death of over one million pine trees in Zhejiang Province is attributed to this nematode between 1991 (when it was first detected) and 1995 (Jiel and Yianxue, 1995). In 1995, this nematode was known to occur in five provinces (Baojun, 1995). Two species of pine, *Pinus massoniana* and *P. thunbergi* are the primary hosts. Both naturally regenerating forests and planted forests are affected. The nematode can cause very rapid decline and death of trees.

The spread of this nematode is via longhorned beetles in the genus *Monochamus*. The beetles act as vectors of the nematode by carrying the nematode between trees. The nematode enters the trees via wounds created by the beetles which feed on fresh shoots and breed in apparently healthy trees. The beetles often attack stressed or weakened trees. The adult beetles can act as vectors for thousands of nematodes. In China, the primary vector of the pinewood nematode is *Monochamus alternatus*.  
<http://ucdnema.ucdavis.edu/imagemap/nemmap/ent156html/nemas/bursaphelenchusxylophilus>

## Diebacks and other conditions

No records were available for diebacks and other conditions affecting China's naturally regenerating forests.

## Planted forests

### Insects

#### Indigenous insects

##### *Anoplophora glabripennis* (Motschulsky, 1853)

Other scientific names: *Cerosterna glabripennis*; *Cerosterna laevigator*; *Melanauster nobilis*; *Melanauster luteonotatus*; *Melanauster angustatus*; *Melanauster nanakineus*  
Coleoptera: Cerambycidae

Common names: Asian longhorned beetle; starry sky beetle

Host type: broadleaf

Hosts: *Acer* spp.; *Populus* spp.; *Salix* spp.; *Melia* spp.; *Morus* spp.; *Prunus* spp.; *Pyrus* spp.; *Robinia* spp.; *Ulmus* spp.; *Fraxinus* spp.; *Betula* spp.; *Hibiscus* spp.

The Asian longhorned beetle is a major pest of broadleaf plantations. The larvae tunnel under the bark and bore into the wood. The main genera of trees that it feeds on are *Acer*, *Populus* and *Salix* species; other hosts include *Melia*, *Morus*, *Prunus*, *Pyrus*, *Robinia*, *Ulmus*, *Fraxinus*, *Betula* and *Hibiscus* species (Lingafelter and Hoebeke 2002).

This is a large species of beetle and there are many old records of this beetle in China including some that date back to at least the Qing Dynasty. It is a native species to China and Korea but now has been found in North America and Europe. It is only in more recent times that it has been reported as a pest in China. Significant losses attributed to the insect were not recorded until the 1980s when vast tracks of poplars, grown as shelterbelt trees, were affected. In the 1980s there was a population explosion and rapid

increase in the pest status of this beetle occurred. Records of damage by this species in China increased from about 70 000 ha to more than 150 000 ha during the 1980s when many trees died and the forest shelterbelts were destroyed. In some areas infestation levels reached as high as 100 percent of trees and insect levels reached several hundred per tree. The damage caused by the tunnelling of the larvae of this beetle means that timber is often unsalvageable from infested trees. As well, because these beetles are internal feeders in tree trunks and branches, treatment is difficult to apply in a widespread manner. The Asian longhorned beetle is able to attack healthy trees as well as stressed trees. Several generations can develop in one tree, causing severe damage to timber.

This beetle is able to survive and finish development in cut logs. The presence of pre-adult stages is usually not easily detectable hence they are readily dispersed in infested timber such as solid timber packaging and dunnage. Adults are capable of flight.

<http://www.fao.org/forestry/site/20528/en/chn>

<http://www.fao.org/forestry/foris/webview/common/media.jsp?mediaId=6689&langId=1&geoId=102>

<http://www.fao.org/forestry/foris/webview/common/media.jsp?mediaId=7175&langId=1&geoId=102>

<http://www.issg.org/database/species/ecology.asp?si=111&fr=1&sts=sss>

<http://www.inspection.gc.ca/english/sci/surv/data/anoglae.shtml>

<http://www.padil.gov.au/viewPest.aspx?id=266>

### ***Conogethes punctiferalis* Gueneé**

Other scientific names: *Astura guttatalis*; *Cognogethes punctiferalis*; *Dichorocis punctiferalis*

Lepidoptera: Pyralidae

Common names: yellow peach moth; durian fruit borer; cone moth

Host type: broadleaf

Hosts: *Pinus* spp.; *Castanea* spp.; *Macadamia* spp.; *Prunus* spp.; *Durio* spp.

This moth bores into the fruit and shoots of a wide range of plants including chestnuts (*Castanea* spp.), macadamias (*Macadamia* spp.), peaches (*Prunus* spp.), durians (*Durio* spp.) and pines (*Pinus* spp.). It causes significant damage to stems, fruits and seeds of host plants. In China, where chestnuts are a significant non-wood forest product, this moth contributes to the loss of up to 25 percent of crops.

This species has a relatively short life cycle and can have 2 to 3 generations a year in suitable conditions. The female lays eggs singly on or near host fruit or seed. The larvae then bore into the fruit or shoots where they remain until they pupate. Pathways of introduction of this pest include the transport of infested plants, seeds or fruit. Adults are capable of short distance dispersal.

<http://www.inspection.gc.ca/english/sci/surv/data/compune.shtml>

[http://www.ipmthailand.org/en/Pests/Durian\\_fruit\\_borer.htm](http://www.ipmthailand.org/en/Pests/Durian_fruit_borer.htm)

### ***Curculio davidi* Fairmaire**

Other scientific names:

Coleoptera: Curculionidae

Common names: chestnut weevil

Host type: broadleaf

Hosts: *Castanea mollissima*

*Curculio davidi* is a weevil that feeds on chestnuts (*Castanea mollissima*); an important non-wood forest product in many parts of China. The larvae feed on the chestnuts and degrade or destroy them. Insects can account for up to 25 percent loss of chestnut crops in some parts of China. A study conducted in Xinxian County, Henan Province showed that less than 50 percent of the chestnut burrs present on trees in early July survived to harvest. Insects accounted for between 12.75 and 28.58 percent of the loss. Other factors included missing or aborted burrs, empty burrs and disease (Gaoping *et al.*, 2001).

<http://www.fao.org/forestry/foris/webview/pageview.jsp?pageId=23328&geoId=-1&langId=1&78023720>

### ***Cydia splendana* Hubner**

Other scientific names: *Carpocapsa splendana*; *Enarmonia splendana*; *Laspeyresia splendana*

Lepidoptera: Tortricidae

Common names: chestnut tortrix; nut fruit tortrix

Host type: broadleaf

Hosts: *Castanea* spp.; *Quercus* spp.; *Corylus* spp.; *Macadamia*

The larvae of *Cydia splendana* feed on the fruit and nuts of several groups of trees including chestnuts, oaks and hazelnuts. They cause significant damage to the seeds of host plants. In China, where chestnuts are a significant non-wood forest product, this moth contributes to the loss of up to 25 percent of crops. This species of moth also causes damage to the introduced nut trees in the genus *Macadamia*.

This species usually has only one generation per year. The female lays eggs on the leaves of the host plant. The larvae then bore into buds and then the seeds where they remain feeding and developing until they emerge to pupate. Some of the means of introduction of this pest include movement of infested plants or seeds.

<http://www.inra.fr/Internet/Produits/HYPPZ/RAVAGEUR/6cydspl.htm>

### ***Dendrolimus punctatus***

Other scientific names: *Metanastria punctata*

Lepidoptera: Lasiocampidae

Common names: Masson pine moth; pine caterpillar

Host type: conifer

Hosts: *Pinus* spp.; *P. massoniana*; *P. radiata*; *P. taeda*

*Dendrolimus punctatus* is a major pest of pine plantations in central and southern China. It is a leaf-feeding caterpillar that eats *Pinus* spp., in particular it feeds on the foliage of the indigenous *Pinus massoniana*. It is also known to feed on *Pinus radiata* and *Pinus taeda*. Young pine plantations and pure natural stands ranging in age from 8 to 15 years are susceptible to outbreaks of this caterpillar. The larvae tend to feed on older needles. There are between 2 and 4 generations per year depending on climatic conditions. Usually trees are not killed by this caterpillar; the main affect is retardation in growth of

trees. However in one growing season, defoliation can occur several times on one set of trees; this weakens trees making them more susceptible to attack by bark beetles. The subsequent feeding by the beetles may then cause tree mortality (Browne, 1968).

The adults are capable of dispersal over several kilometres and newly emerged larvae are dispersed on air currents. Over longer distances, this species is spread by transport of material infested with egg masses.

Another significant affect of large infestations is that the larvae of *Dendrolimus punctatus* have urticating hairs. These hairs can cause skin rash and eye irritation upon contact hence causing severe discomfort for humans that come in contact with the larvae.

<http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=84&langdisplay=english>  
<http://www.invasive.org/browse/subject.cfm?sub=4533>

### ***Niphades castanea* Chao**

Other scientific names:

Coleoptera: Curculionidae

Common names: chestnut flake weevil

Host type: broadleaf

Hosts: *Castanea mollissima*

*Niphades castanea* is a weevil that feeds on chestnuts (*Castanea mollissima*); an important non-wood forest product in many parts of China. The larvae feed on the chestnuts and degrade or destroy them. It causes up to 25 percent loss of chestnut crops in some parts of China. A study conducted in Xinxian County, Henan Province showed that less than 50 percent of the chestnut burrs present on trees in early July survived to harvest. Insects accounted for between 12.75 and 28.58 percent of the loss. Other factors included missing or aborted burrs, empty burrs and disease (Gaoping *et al.*, 2001).

### ***Introduced insects***

#### ***Brontispa longissima* (Gestro, 1885)**

Other scientific names:

Coleoptera: Chrysomelidae

Common names: coconut leaf beetle; coconut hispid beetle; coconut chrysomelid hispine beetle; coconut hispine beetle

Host type: broadleaf

Hosts: *Cocos nucifera*

*Brontispa longissima* is potentially the most serious pests of coconut palms. Both larvae and adults of the beetle inhabit the developing, unopened leaves of the coconut palm where they feed on leaf tissues. Where an attack is severe, complete defoliation of the palms may result. Prolonged attack, particularly to young or unhealthy palms, may result in tree death.

In 2002, this pest was found in Hainan Island, China and chemicals were used to control the beetle for the first two years with a certain level of success (APFISN, 2006; Nakamura, Konishi and Takasu, 2006). Two biological control agents – *Asecodes hispinarum* and *Metarhizium anisopliae* – have been tested to manage this pest. A.

*hispinarum* was introduced to Hainan Province from Viet Nam in 2002 and released (Nakamura, Konishi and Takasu, 2006).

[http://www.ento.csiro.au/aicn/name\\_s/b\\_726.htm](http://www.ento.csiro.au/aicn/name_s/b_726.htm)

<http://www.fao.org/docrep/007/ad522e/ad522e00.htm>

### ***Dendroctonus valens* LeConte**

Other scientific names: *Dendroctonus rhizophagus*

Coleoptera: Scolytidae

Common names: red turpentine beetle; bark beetle

Host type: conifer

Hosts: *Pinus* spp.; *P. tabulaeformis*; *P. armandi*; *Picea* spp.; *Abies* spp.

In China, *Dendroctonus valens* feeds primarily on *Pinus tabulaeformis* and occasionally on *Picea* and *Abies* spp. It usually attacks stressed trees which appear healthy. This beetle attacks the base of trees where it lays eggs and larvae develop. In China, this insect causes considerable damage to *Pinus tabulaeformis* which is a principal tree used for reforestation in northern China. Therefore it is extremely valuable from forestry, ecological and social standpoints in arid zones with poor soils and where watershed and soil conservation is critical (LUBIES, n.d.). The red turpentine beetle is native to North America and is thought to have been introduced into China in the mid 1980s.

<http://www.barkbeetles.org/rtb/rtbFIDL55.htm>

<http://www.odf.state.or.us/pcf/Pub/fhn/redturp.pdf>

### ***Hemiberlesia pitysofila* Takagi, 1969**

Other scientific names:

Hemiptera: Diaspididae

Common names: pine needle hemiberlesian scale

Host type: conifer

Hosts: *Pinus* spp.; *P. massoniana*

This is a sap-sucking insect that damages a range of *Pinus* species including slash pine, Caribbean pine, loblolly pine and Japanese black pine. In China, it is particularly damaging to the Chinese red pine, *Pinus massoniana*. It feeds on the needles of the trees causing loss of growth and can lead to death of trees particularly when severe, consecutive infestations occur over several years. Susceptibility varies significantly between pine species.

Infestation level is dependant of the climatic conditions to a greater extent. The most favourable conditions for this insect are temperatures between 18 and 23°C. The main mechanisms for dispersal are either the movement of infested plant material or the movement of first instar larvae on air currents (as aerial plankton).

<http://ip30.eti.uva.nl/bis/diaspididae.php?menuentry=soorten&id=126>

### ***Oracella acuta* Lobdell**

Other scientific names:

Hemiptera: Pseudococcidae

Common names: pine mealy bug; loblolly pine scale

Host type: conifer

Hosts: *Pinus* spp.; *P. elliotii*; *P. massoniana*

*Oracella acuta* is native to the United States and was introduced into Guangdong Province in 1988 on pine scion material collected in the US to improve the quality of planting stock. The insect was discovered in 1990 when damage was detected in the Hongling Pine Seed Orchard near Taishan, where the scion material was grafted onto rootstocks. At the time of the discovery of this insect, approximately 55 hectares were infested.

In the US, this species is usually kept below economic thresholds by natural enemies. In the absence of its natural enemies, it spread rapidly in China and by the end of 1993 it had infested a gross area of approximately 136 000 hectares, primarily in plantations of *Pinus elliotii*. During the mid 1990s, infestations were spreading at the rate of 17-22 km/yr. *O. acuta* feeds in colonies on the buds and expanding shoots of pines resulting in yellowing of the foliage, growth loss and a resin exudation, which adults and nymphs use as protective cover. There are efforts underway to find biological control agents for this mealy bug.

[http://www.fao.org/documents/show\\_cdr.asp?url\\_file=/docrep/008/v5020e/V5020E03.htm](http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/008/v5020e/V5020E03.htm)

### ***Tomicus* n.sp.**

Other scientific names:

Coleoptera: Scolytidae

Common names: pine shoot beetle

Host type: conifer

Hosts: *Pinus yunnanensis*

A new species of pine shoot beetle, *Tomicus* n.sp., has caused extensive mortality of Yunnan pines (*Pinus yunnanensis*) in the Yunnan Province of China, affecting over 200 000 ha of pine plantations (Sun *et al.*, 2005).

The identification of the new species of *Tomicus* is difficult as both *Tomicus piniperda* and *T. minor* have been reported from the Yunnan Province and it is unclear how much of the damage and mortality attributed to these species was actually caused by *Tomicus* n. sp. (Sun *et al.*, 2005). In addition, *Tomicus* n.sp. and *T. piniperda* are morphologically undistinguishable.

The beetles in the Yunnan Province aggregate during maturation feeding (Sun *et al.*, 2005). Emerging adults fly to the shoots starting in March, with peak flight in mid-June. A long period of maturation feeding *Tomicus* species present in the Yunnan Province ensues, lasting six to eight months. Trunk attacks occur from December through May, peaking from January-March. Trunk attacks begin in the crown and spread down the bole, often on the same trees affected by severe shoot-feeding. Recent studies have shown that shoot feeding can weaken the host trees, leading to tree mortality if followed by trunk attacks.

## **Diseases**

### ***Indigenous diseases***

***Agrobacterium tumefaciens* (Smith & Townsend, 1907) Conn, 1942**

Other scientific names: *Achromobacter radiobacter*; *Agrobacterium radiobacter*; *Alcaligenes radiobacter*; *Bacillus radiobacter*; *Bacterium radiobacter*; *Bacterium tumefaciens*; *Phytomonas radiobacter*; *Pseudomonas tumefaciens*

Rhizobiales: Rhizobiaceae

Common names: crown gall

Host type: broadleaf

Hosts: *Populus* spp.

Crown gall is a common disease that is widely distributed and affects a broad range of trees and plants. Infected plants grow galls on their stems, branches, trunks and roots. The bacteria are introduced into plants via wounds, such as feeding, egg deposition by insects, or pruning of plants. The galls affect the vigour of plants thus making them more susceptible to other pests and diseases. It is almost impossible to eliminate this bacterium from a particular plant once it has been infected. This bacterium can persist in the soil for several years after an infected plant has been removed. This disease is one of several diseases that cause significant damage to poplars in China.

<http://www.fao.org/DOCREP/006/AD114E/AD114E02.htm>

<http://www.ipm.iastate.edu/ipm/hortnews/1995/5-19-1995/cgall.html>

***Chondroplea populea* Sacc. & Briard Kleb.**

Other scientific names: *Dothichiza populea*

Ascomycota: Valsaceae

Common names: bark canker

Host type: broadleaf

Hosts: *Populus* spp.

*Chondroplea populea* is primarily a disease of poplars in intensive cultivation. The disease usually attacks weak or stressed trees, particularly water stressed trees. It causes dark lesions on the bark and kills areas around the infection site. The disease can progress to the extent where it kills an area around the entire tree which then leads to death of the tree. This disease is found in most parts of the world.

<http://www.fao.org/DOCREP/006/AD114E/AD114E02.htm>

<http://www.efor.ucl.ac.be/ipc/pub/celle01/cellf0103.htm>

***Coryneum populinum* Bres.**

Other scientific names:

Ascomycota: Melanconidaceae

Common names: poplar grey spot

Host type: broadleaf

Hosts: *Populus* spp.

Poplar grey spot appears as blotches on leaves and causes leaves to drop early. Severe infections will cause loss of vigour and vitality and if the condition persists for several seasons can eventually lead to death of the tree. The other significant affect is that it can weaken trees such that it predisposes them to attack by secondary invasive species.

<http://www.efor.ucl.ac.be/ipc/pub/celle01/cellf0103.htm>

[http://www.fao.org/documents/show\\_cdr.asp?url\\_file=/DOCREP/006/AD114E/AD114E02.htm](http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/006/AD114E/AD114E02.htm)

***Dothiorella gregaria* Sacc.**

Other scientific names:

Ascomycota: Botryosphaeriaceae

Common names: blister canker; ulcer disease

Host type: broadleaf and conifer

Hosts: *Populus* spp.

This species of fungus is highly polyphagous and occurs on over 100 genera of plants both conifer and broadleaf. Generally, it attacks plants that are stressed or weakened by some other factor. In north-central China, *Dothiorella gregaria* causes disease on poplars resulting in significant production losses. The disease is expressed in the form of dead patches of bark on trunks or branches.

<http://www.fao.org/DOCREP/006/AD114E/AD114E02.htm>

<http://www.efor.ucl.ac.be/ipc/pub/celle01/cellf0103.htm>

<http://www.forestryimages.org/browse/subimages.cfm?sub=13846>

***Drepanopeziza punctiformis* Gremmen**

Other scientific names: *Gleoposporium brunneum*; *Marssonina brunnea*; *Marssonina populina*; *Marssonina brunnea*; *Marssonina populina*; *Marssonina tremulae*; *Marssonina tremuloides*

Ascomycota: Leotiales

Common names: Marssonina leaf spot

Host type: broadleaf

Hosts: *Populus* spp.

*Marssonina brunnea* is able to attack healthy plants and is found on *Populus* spp. It is mainly a disease of planted forests and usually attacks young leaves and shoots. The disease expresses itself as brownish spots on both sides of the leaf. The fungus infection usually leads to early leaf drop and loss of productivity. This is one of several diseases that cause significant damage to poplars in China.

<http://www.fao.org/DOCREP/006/AD114E/AD114E02.htm>

<http://www.forestryimages.org/browse/detail.cfm?imgnum=1399110>

<http://www.efor.ucl.ac.be/ipc/pub/celle01/cellf0103.htm>

***Melampsora laricis-populina* Klebahn**

Other scientific names:

Basidiomycota: Melampsoraceae

Common names: poplar leaf rust

Host type: broadleaf

Hosts: *Populus* spp.

Poplar leaf rust is a common, widespread and serious pathogen of poplar plantings. This fungus causes rust spots to occur on leaves and results in leaf drop. This disease can



cause epidemics leading to widespread losses. There is variability in pathogenicity of this pathogen.

<http://www.fao.org/DOCREP/006/AD114E/AD114E02.htm>

<http://www.rsnz.org/publish/nzjb/1988/8.pdf>

***Mycosphaerella populi* (Auersw.) J.Schöter**

Other scientific names: *Septoria populi*; *Sphaerella populi*

Ascomycota: Mycosphaerellaceae

Common names: Mycosphaerella leaf spot; Septoria leaf spot

Host type: broadleaf

Hosts: *Populus* spp.

*Mycosphaerella populi* causes leaf spots on poplars. Severe attacks by this species cause yellowing of the crown and premature leaf drop. It usually requires higher temperatures and humidity for significant outbreaks.

<http://www.fao.org/DOCREP/006/AD114E/AD114E02.htm>

<http://www.cabicompendium.org/cpc/home.asp>

<http://www.efor.ucl.ac.be/ipc/pub/celle01/cellf0104.htm>

**Paulownia witches' broom**

Other scientific names:

Phytoplasma

Common names: Paulownia witches' broom

Host type: broadleaf

Hosts: *Paulownia* spp.

*Paulownia* witches broom is a phytoplasma that causes reduced vigour and severe decline in *Paulownia* spp. Usually infection eventually leads to death, however prior to death it causes severe degradation in the quality of timber produced by a plant hence infected plants are often unable to be salvaged. It causes the plants to produce many slender shoots with minimal leaves or leaves reduced in size, hence the name witches broom. It is highly infectious and is vectored by some sap-sucking species such as *Empoasca* spp. It can also be transmitted mechanically such as by grafts.

<http://www.idrinfo.idrc.ca/Archive/Corpdocs/071235/071235j.htm>

***Valsa sordida* Nitschke**

Other scientific names: *Cytospora chrysosperma* (Pers.) Fr.; *Naemaspora chrysosperma* Pers.

Ascomycota: Valsaceae

Common names: Cytospora canker

Host type: broadleaf

Hosts: Salicaceae; *Populus* spp.

*Cytospora chrysosperma* is a fungus that causes Cytospora canker and blackstem disease in Salicaceae. Cytospora canker has been associated with the decline and death of trees. Generally this fungus attacks stressed or damaged trees which then exacerbates the health of the trees leading to death. Species of *Cytospora* are difficult to identify, hence the full

host range is difficult to determine. However, it is known that *Cytospora chrysosperma* and its perfect state (*Valsa sordida*) exist as saprophytes on healthy trees. This fungus is of little consequence in natural stands however it can cause significant problems in managed plantings. It attacks stressed or injured trees, entering the plant tissue via wounds. This disease is one of several diseases that cause significant damage to poplars in China.

<http://www.fao.org/DOCREP/006/AD114E/AD114E02.htm>

[http://www.treelink.org/joa/2000/nov/05\\_PATHOGENICITY\\_OF\\_CYTOSPORA\\_ON\\_HARDWOOD\\_kepley.pdf](http://www.treelink.org/joa/2000/nov/05_PATHOGENICITY_OF_CYTOSPORA_ON_HARDWOOD_kepley.pdf)

<http://www.ipm.uiuc.edu/diseases>

### ***Venturia populina* (Vuill.) Fabric.**

Other scientific names: *Didymosphaeria populina*; *Endostigme populina*; *Fusicladium radiosa* var. *balsamiferae*; *Pollaccia balsamiferae*; *Pollaccia elegans*

Ascomycota: Venturiaceae

Common names: shepherd's crook; leaf blight

Host type: broadleaf

Hosts: *Populus* spp.

This fungus deforms and kills growing shoots of the trees it infects. The dead shoots have the tendency to droop hence the common name for the disease. In moist conditions during the growing season it can kill nearly all of the new shoots resulting in a significant reduction in tree growth.

<http://www.fao.org/DOCREP/006/AD114E/AD114E02.htm>

[http://www.pfc.forestry.ca/diseases/CTD/Group/Broad/broad4\\_e.html](http://www.pfc.forestry.ca/diseases/CTD/Group/Broad/broad4_e.html)

<http://www.forestpests.org/subject.html?SUB=720>; <http://www.indexfungorum.org>

### ***Introduced diseases***

No data was available on introduced diseases affecting planted forests in the People's Republic of China.

### **Other pests**

#### ***Indigenous other pests***

##### **Mouse**

Other scientific names:

Rodentia: Muridae

Common names: mouse

Host type: broadleaf and conifer

Hosts:

Mice cause significant disturbance in forests in China. An average of over 800 000 hectares of forests are disturbed by mice annually (FAO, 2005b). One of the major impacts is the destruction of seeds which thereby hinders regeneration.

#### ***Introduced other pests***

### ***Bursaphelenchus xylophilus***

Other scientific names:

Tylenchida: Aphelenchoididae

Common names: pine wood nematode; pine wilt nematode; pine wilt disease

Host type: conifer

Hosts: *Pinus* spp.; *P. massoniana*; *P. thunbergi*

The pine wilt nematode causes pine wilt disease. It kills pines in several Asian countries where it has been introduced. The nematode is native to North America and was discovered in Nanjing, Jiangsu Province in 1982. Between 1982 and 1995, over 231 000 pines were killed in Jiangsu Province by this nematode (Wenli, Kequin and Yuansheng, 1995). The death of over one million pine trees in Zhejiang Province is attributed to this nematode between 1991 (when it was first detected) and 1995 (Jiel and Yianxue, 1995). In 1995, this nematode was known to occur in five provinces (Baojun, 1995). Two species of pine, *Pinus massoniana* and *P. thunbergi* are the primary hosts. Both naturally regenerating forests and planted forests are affected. The nematode can cause very rapid decline and death of trees.

The spread of this nematode is via longhorned beetles in the genus *Monochamus*. The beetles act as vectors of the nematode by carrying the nematode between trees.

The nematode enters the trees via wounds created by the beetles which feed on fresh shoots and breed in apparently healthy trees. The beetles often attack stressed or weakened trees. The adult beetles can act as vectors for thousands of nematodes. In China, the primary vector of the pinewood nematode is *Monochamus alternatus*.

<http://ucdnema.ucdavis.edu/imagemap/nemmap/ent156html/nemas/bursaphelenchusxylophilus>

### **Diebacks and other conditions**

No records were available for diebacks and other conditions affecting China's planted forests.

## ***Capacity for forest health protection***

### **Government level**

In the People's Republic of China, all lands are owned by the state. However, in some cases, trees planted on state lands are privately owned. The State Forestry Administration (SFA) is the primary national level government agency in charge of forestry administration, policy development and planning, research policy, and forest law enforcement. The Administration is also in charge of the management and implementation of national forestry programmes. Government agencies with a responsibility for forest management and protection also exist at the provincial and county levels.

The Chinese Academy of Forestry is China's national research centre. Research laboratories also exist in various provinces including several that concentrate on forest insect and disease research and development (e.g. the Anhui Province Forest Biological Control Center in Hefei). The General Station of Forest Pest Control (SFPC) is an

institution under the jurisdiction of the State Administration of Forestry, which is in charge of forest pest control in China. Work is done in collaboration with scientific research units and the Chinese Academy of Science and internationally with the ongoing Sino-German Project “Construction and management of the network system on forest pest monitoring and forecasting”.

There are 18 964 personnel throughout the country and 2 958 forest pest control stations including 35 provincial stations, 354 district stations and 2 569 county stations. There are 1 000 state forecasting stations, 35 provincial monitoring and forecasting centres, 500 provincial forecasting stations and 344 district forecasting stations throughout the country. There is one identifying and risk assessment centre, 35 provincial quarantine laboratories, 40 provincial quarantine nurseries, 344 quarantine treatments stations and 1 000 quarantine stations.

### **Monitoring and detection**

A wide variety of monitoring and detection methods are used ranging from informal surveillance by forestry officials to detect abnormally high levels of insects and diseases to the use of traps baited with attractants to monitor certain species. A risk rating system, based on forest characteristics has been developed for the pine caterpillar in east central China. Monitoring of the introduced bark beetle, *Dendroctonus valens*, is done with traps (LUBIES, n.d.).

### **Data management**

While much of the data on forest insect and disease occurrence in China is qualitative in nature, some statistical information is available on the area affected by major pest species.

An expert system has been developed to support decisions for or against control of the defoliating caterpillar, *Dendrolimus punctatus*. This system considers factors such as population density, incidence phase (increasing, outbreak, declining or stable), region of occurrence and forest management objectives (Shufen *et al.*, 1991).

### **Pest management**

In the Three North Region of China, the Regional Government has removed more than 0.2 billion infested trees, equivalent to approximately 120 000 hectares, including poplars, willows and elms for control of Asian longhorned beetle (Yang, 2005). Pest management tactics for defoliating insects consist of aerial and ground application of chemical and biological insecticides and mass rearing and release of fungi and parasitoids.

Outbreaks of the pine caterpillar, *Dendrolimus punctatus*, have been successfully treated with inundative releases of egg parasites and a fungus, *Beauveria bassiana*. Use of a cytoplasmic virus for control of this insect is being investigated (Murphy, 1998). Work is underway on the introduction and establishment of the bark beetle predator *Rhizophagus grandis* (a predator of a related species, *Dendroctonus micans*) for biological control of *Dendroctonus valens* (LUBIES, n.d.). Guidelines are available for the management of

insects and diseases affecting plantations of poplar and other species in the Three North Region of northeastern China (Schmutzenhofer *et al.*, 1996).

### Private landowners

In the People's Republic of China, all lands are owned by the state. However, in some cases, trees planted on state lands are privately owned.

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

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