



Forests and Timber:

A Field Guide to Exotic Pests and Diseases

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This publication has been produced by the Australian Quarantine and Inspection Service and the National Office of Animal and Plant Health, both agencies within the Commonwealth Department of Agriculture, Fisheries and Forestry – Australia, and the Ministerial Council on Forestry, Fisheries and Aquaculture – Standing Committee on Forestry.

Disclaimer

The material in this field guide was prepared from the most accurate and up to date information available at the time of publication.

It is intended as a guide only and the publisher accepts no responsibility for errors.

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This publication is also available on the AQIS web site at www.aqis.gov.au and the National Office of Animal and Plant Health web site at www.affa.gov.au/nat-offices.

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About this guide

This field guide has been produced by AQIS, the National Office of Animal and Plant Health (NOAPH) and the Standing Committee on Forestry (SCF) for wharf workers, container depot staff, timber handlers, timber yard workers, forest workers and forest technical staff.

The guide aims to provide basic information on some high-risk exotic pests and diseases of forest and amenity trees and imported timber.

The pests and diseases featured in this guide are only a few – though very important – examples of exotic forest pests and diseases

that could cause damage in the Australian environment. The guide also lists who to contact if you spot an exotic insect, or signs or symptoms of an exotic disease that might be of quarantine or forest health concern.

How do AQIS, NOAPH and SCF fit into the picture?

AQIS and NOAPH are both part of the Department of Agriculture, Fisheries and Forestry – Australia and work closely to prevent and manage incursions of exotic pests, weeds and diseases.

AQIS is responsible for minimising the risk of entry into Australia of diseases and pests affecting humans, animals and plants.

NOAPH provides national and international leadership and co-ordination in managing animal and plant health emergencies, and minimising the effects of incursions of pests and diseases on Australia's agricultural producers and the community.

The Standing Committee on Forestry (SCF) is comprised of the heads of the Commonwealth, State, Territory and New Zealand forestry agencies. SCF is supported by a network of sub-committees and working groups including the Forest Health Committee

and the research working group on Forest Health, both of which deal with pest and disease issues.

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Formosan subterranean termite

Coptotermes formosanus Shiraki

Identification: live in colonies, soldiers 12-15mm long, pale yellow, exude drops of milky fluid from the head when disturbed. Yellowish-brown winged forms produced early spring to midsummer, swarm in large numbers at dusk.

Hosts: more than 50 species of timber including oak, citrus and cypress; timber in contact with ground, timber in-service.

Distribution: China, Taiwan, Japan, Sri Lanka, South Africa and the USA, including Hawaii.



Formosan subterranean termites

Source: USDA-ARS Photo Unit

Detection:

Nests: built from a substance resembling paper; made in soil, wood, hollows or spaces between walls and floors – can be in places not in contact with ground.

Most likely to enter Australia in nests in shipping containers or in timber.

Potential impact: one of the most destructive termites in the world; can severely damage buildings and timber in-service.



Formosan subterranean termite damage to century old structural timbers

Source: USDA-ARS Photo Unit

Western drywood termite

Incisitermes minor (Hagen)

Identification: live in colonies, soldiers 11-12.5mm long, pale yellow body with an orange-brown head. Yellowish-brown winged forms produced from early spring to mid-summer, swarm in large numbers at dusk.

Hosts: dry wood (moisture content >12%); wood in contact with ground and timber in-service.

Distribution: USA, Mexico and Canada.



Close-up of soldier termite head

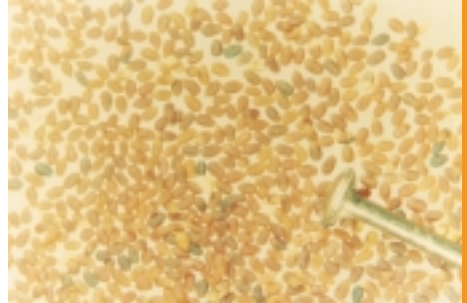
Source: Rudolf Scheffrahn,
University of Florida

Detection:

Nests: built from a substance resembling paper. Nests are not made in the soil but are located inside the wood, which is the food source. Frass sometimes visible outside nests; usually hard, hexagonal pellets less than 1mm diameter.

Most likely to enter Australia aboard ships in containers or hidden in timber and on yachts.

Potential impact: a serious timber pest that can severely damage timber in-service.



Hexagonal termite frass

Asian longhorn beetle

Anoplophora glabripennis (Motschulsky)

Identification: larvae elongate and cylindrical with reduced head and legs, 50mm long at maturity. Adult beetles 50-70mm long, shiny black with about 20 white dots on wing-covers. Antennae black with white rings, much longer than the body. Plate-shaped feet black with whitish-blue upper surface.

Hosts: standing trees and timber of many species including elm, willow, poplar, apple, plum and maple.

Distribution: Southern China, Korea, Japan, introduced to USA (some parts).



Asian longhorn beetle exit holes and frass

Detection:

Eggs: laid under tree bark in oval to round darkened wounds.

Larvae: tunnel into the heartwood of the tree; feeding can cause branch breakage, branch and tree death.

Adults: emerge in summer from trees or timber from circular holes 9-11mm in diameter, often leave piles of sawdust at base of trees or in branch crevices, live for 3-66 days, strong fliers.

Probable means of entry into Australia is in imported timber and wood used for packing materials from Asia.

Potential impact: very destructive, and could potentially devastate Australia's hardwood forests, apple and pear plantations and parkland trees.



Adult Asian longhorn beetle

Source: *USDA Forest Service*

Burnt pine longicorn

Arhopalus ferus (Fabricius)

Identification: larvae elongate and cylindrical with reduced head and legs, 25mm long at maturity. Adult beetles 12-30mm long; male light brown, female dark brown to black. Antennae half as long as the body.

Hosts: burned or windthrown pine and spruce.

Distribution: United Kingdom, Europe, Russia, introduced to New Zealand.



Burnt pine longicorn beetle adult

Source: Forest Research, New Zealand

Detection:

Eggs: laid in groups of 5-50 in bark crevices on freshly burned or felled timber.

Larvae: feed in cambium; tunnels oval in cross-section, up to 12mm wide, loosely packed with frass and coarse wood particles.

Adults: emergence holes are oval and average 6mm diameter; adults live for several weeks, can appear in large numbers, active dusk to dawn, attracted to light, shelter in crevices during the day.

Probable means of entry is on imported timber and cargo loaded during the adult beetle's flight period (usually summer).

Potential impact: could cause severe economic loss of windthrown or fire damaged trees.



Damage caused by burnt pine longicorn beetle

Source: Forest Research, New Zealand

Coleoptera (beetles), Cerambycidae

Drywood longicorn beetle

Stromatium barbatum Fabricius

Identification: larvae elongate and cylindrical with reduced head and legs, to 38mm long and 9.5mm wide. Adult beetles 12-28mm long, reddish-brown to almost black, covered with fine, short buff hairs, antennae up to 1.5 times body length.

Hosts: 350 species of seasoned hardwood and softwood timber and plywood including eucalyptus, pine, elm and oak. Unlike Australian longicorns, drywood longicorn only attacks seasoned timber.

Distribution: India, Sri Lanka, Burma, Mauritius, Madagascar, Pakistan, Nepal and Tanzania.



Drywood longicorn beetle adult

Detection:

Larvae: form irregular tunnels tightly packed with very fine powdery frass; in heavy infestations tunnels can interlace so interior of wood is reduced to powder and exterior surfaces are left intact; can take up to 10 years to emerge. Most often detected in packing material, dunnage, furniture and sporting goods such as cricket bats and stumps.

Adults: emerge during summer, active at night.

Potential impact: potentially of great economic importance in Australia because of its large host range and preference for seasoned timber.



Damage made by beetle

European house borer

Hylotrupes bajulus (Linnaeus)

Identification: larvae elongate and cylindrical with reduced head and legs, 19-41mm long and to 7.5mm wide at maturity. Adult beetles 18-25mm long, brownish-black to black, slightly flattened in appearance. Antennae half as long as body, wing-covers usually completely black but may have distinctive white bands. This borer prefers temperatures of 28-31 Celsius.

Hosts: attacks seasoned softwood timber including pine, fir and spruce. Roof timbers most often infested.



European house borer adult

Distribution: Europe, Middle East (Turkey), North Africa, South Africa, South America, USA, China and Asia Minor.

Detection:

Larvae: form galleries parallel to grain, tightly packed with fine powdery frass and tiny pellets, tunnels 9-12mm wide and 6mm high.

Adults: emerge after 2-17 years from an oval-shaped hole 5 x 9mm in size (emergence holes usually first sign of infestation); strong fliers, attracted to night lighting.

Most likely to enter Australia on imports of seasoned timber or timber articles such as furniture.

Potential impact: one of the world's most destructive pests of seasoned softwood timber.



Damage caused by European house borer larva

Hoop pine weevil

Vanapa oberthuri Pouillaude

Identification: larvae pale yellow with brown head, C-shaped, up to 90mm long. Adult black, up to 70mm long, with longitudinally ridged wing covers and long curved rostrum with elbowed antennae at end.

Hosts: trees and timber of Araucaria species (such as hoop pine and klinki pine).

Distribution: Papua New Guinea and Indonesia (West Irian).



Hoop pine weevil adult on stem of hoop pine

Source: B. Gray, Bulolo, Papua New Guinea

Detection:

Larvae: make J-shaped tunnels in wood, 10-15mm in diameter, about 40mm depth, may make audible crushing noise, often leave clean wood debris on bark. Pupal chamber plugged with wood slivers. Damage usually occurs clumped in-groups of up to 10 trees, cause dead branches, and can kill tree within five months.

Adults: emergence hole round, 8-13mm in diameter. Life span 6-8 weeks, feed on green bark of pine twigs, lay eggs in fresh resin on bark. Species most likely to enter Australia from PNG via items carried by people for traditional trade, or in timber from *Araucaria* species or souvenirs.

Potential impact: could have severe impact upon Australia's native *Araucaria* forests.

European spruce bark beetle

Ips typographus Linnaeus

Identification: mature larvae about 5mm long, white, legless, with light brown head. Adults 4-5.5mm long; cylindrical and dark brown to black, with long yellowish hairs on head and sides of body; head is visible from dorsal surface. Rear end of body concave, framed on sides by a raised margin bearing four distinct spikes.

Hosts: bark of damaged and healthy softwood trees and timber.

Distribution: Europe, China, Japan, Korea and Far Eastern Russia.



Adult beetle on Norway spruce

Source: Forestry Commission
Research Agency, UK

Detection:

galleries extend about 12.5cm on the long axis of the trunk, visible when bark is removed, cause red-brown dust in bark crevices, emerge en masse. Emergence holes visible as circular holes 2-3mm in diameter or small tubes of resin protruding from the bark.

Species most likely to enter Australia on imported timber packaging or dunnage contaminated with bark.

Potential impact: one of the most destructive pests of spruce in Europe, normally breeds in freshly fallen or weak standing trees but high populations will attack and kill healthy trees.



Larval gallery system on imported dunnage

*Source: Forestry Commission
Research Agency, UK*

Scolytinae (bark beetles)

Mountain pine beetle

Dendroctonus ponderosae Hopkins

Identification: mature larvae about 5mm long, white, legless, with light brown head. Adults 3.7-7.5mm long; stout and cylindrical; rusty-brown to black; head is visible when viewed dorsally.

Hosts: Polyphagus in *Pinus* genus, can attack species such as spruce (*Picea*) if in large numbers.

Distribution: Canada and the USA.

Detection:

Larvae: chew feeding galleries at right angles to parent gallery; often cause red-brown dust in bark crevices; emerge en masse from circular holes 2-3mm diameter or small tubes of resin protruding from bark.



Adult beetle

Source: *Forest Research, New Zealand*

Most likely to enter Australia on imported timber, packaging or dunnage contaminated with bark; associated with a blue stain fungus visible in wood.

Adults: construct egg galleries up to 90cm long beneath bark and parallel to the grain of the timber.

Potential impact: population build up in freshly fallen or weakened trees but will vigorously attack and kill growing trees when populations are in large numbers. Blue stain fungi and risk of increased timber decay associated with beetle introduction.



Colony with mountain pine beetle adult, larvae and damage

*Source: Forest Research,
New Zealand*

Scolytinae (bark beetles)

Powder post beetle

Heterobostrychus aequalis (Waterhouse)

Identification: larvae to 15mm long, C-shaped, white with brown heads. Adults 6-13mm long, cylindrical, dark brown-to-black; head not visible from above; segment behind head is distinctly excavated in front.

Hosts: hardwood, freshly felled trees and green or seasoned timber.

Distribution: Europe, India, Asia, Middle East and South Africa.



Adult powder post beetle

Source: *Department of Primary Industries, Qld*

Detection:

Larvae: feed along grain, making circular tunnels up to 38cm long and 6mm in diameter, tightly packed with a fine floury frass often visible when adults emerge.

Most likely to enter Australia on imported timber packaging, dunnage, furniture, souvenirs etc.

Adults: bore circular holes into sapwood and continue feeding until sapwood is gone; can reduce interior of timber to powder.

Potential impact: damage to exposed wood in houses, furniture and panelling.



Damage made by powder post beetle

Source: *Department of Primary Industries, Qld*

Asian gypsy moth

Lymantria dispar (Linnaeus)

Identification: egg masses – contain between 100 – 1000 eggs; covered with buff/yellowish scales, average 38mm long, 20mm wide. Larvae highly variable in colour with long hairs covering the body, two distinctive rows of large spots along the back, usually in five pairs of blue and six pairs of red from head to rear. Adult females, white with black markings and wingspan 50mm or more; adult males, greyish brown and wingspan about 38mm.

Hosts: larvae feed on the foliage of 600 plant species including oak, birch, willow, elm, eucalyptus, pine, fruit trees and urban ornamental plants.



Asian gypsy moth egg masses inside the rear wheel of a vehicle

Source: Gary Higgins, Ministry of Agriculture and Forestry, New Zealand

Distribution: China, Far Eastern Russia, Korea, Japan and the USA.

Detection:

Eggs and larvae: most often found on forest products, shipping containers, cargo and ships' structures. Larvae can survive a week without feeding, spin silken threads and spread long distances in the wind.

Adults: females can fly up to 40km and die after laying eggs, males die shortly after mating; both are attracted to light.

Potential impact: causes significant damage to forest, horticultural and urban trees. Of the several biotypes known, the Asian biotype is the most damaging, but all are a risk to Australia.



Adult female (lighter) and Male (darker) Asian gypsy moth

Nun moth

Lymantria monacha (Linnaeus)

Identification: eggs orange-brown, spherical, and laid in clumps without covering of scales. Larvae 30-40mm long; have dark grey, tan or green coloured bodies, orange heads with black freckles. Adults have white forewings with dark lines and patches; occasionally dark brown to black colour form occurs. Females have a pointed reddish abdomen with black spots and a 45-55mm wingspan; males 35-45mm wingspan.

Hosts: larvae feed on the foliage of ornamental and forest conifers, elm, oak, larch, maple and fig.



Nun moth caterpillar

Source: USDA

Distribution: Europe and Far Eastern Russia.

Detection:

Eggs and larvae: most often found on forest products, shipping containers, cargo and ships' structures. Eggs are laid randomly; larvae can survive a week without feeding, spin silken threads and spread long distances in the wind.

Adults: strong fliers, attracted to light.

Potential impact: defoliation by larvae can kill trees, causes enormous economic loss.



Nun moth male, dark form

Source: USDA

White spotted tussock moth

Orgyia thyellina Butler

Identification: eggs white-to-buff, laid in clusters (not covered by scales) about the size of a 10 cent coin. Young larvae black and very hairy; mature larvae about 30mm long with four distinctive white tufts of hair, orange stripe down each side, two spots on tail. Adult females have creamy white wings with dark spot, males smaller, grey-black with a similar spot.

Hosts: larvae feed on the foliage of urban trees and plants, horticultural plants, exotic and indigenous forest trees.

Distribution: China, Korea, Japan, Far Eastern Russia and Taiwan.



Adult female moth and egg mass

Source: Forest Research, New Zealand

Detection:

Eggs and larvae: eggs laid randomly on or near food plants, forest products, shipping containers, cargo and ships' structures; or on brown, felt-like cocoons from which female moths have emerged.

Adults: strong fliers, attracted to light.

Potential impact: absence of natural enemies could allow this species to become a serious pest of timber species and ornamentals.



White spotted tussock moth larva

Source: Forest Research, New Zealand

Black carpenter ant

Camponotus pennsylvanicus (De Geer)

Identification: live in colonies, most prevalent are the workers which are black, reddish-black, 11-18mm long. Winged males and females produced early spring-midsummer, swarm in large numbers.

Hosts: nest in living and dead trees, rotting logs and stumps, buildings, wooden structures. Hard and softwoods may be attacked: infestations recorded from white and pitch pine, balsam, elm, hickory, juniper, aspen, oak, Douglas fir and western red cedar.

Distribution: USA and Canada (eastern and central states).



Black carpenter ant worker

Detection:

Nests: in imported containers, in untreated imported timber and timber packaging and dunnage. Nests established in cavities in wood that has deteriorated or been exposed to moisture. Small piles of sawdust outside the colony entrance can indicate infestation. Galleries kept smooth and clean, not lined with moist soil (*cf* termite galleries).

Potential impact: can cause serious damage to timber in-service; undetected infestations can lead to failure in structures and other timbers.



Black carpenter ant damage caused by ants constructing galleries

Wood wasp

Urocerus gigas (Linnaeus)

Identification: larvae 30mm long, creamy white, with a dark brown spine at the posterior end. Adults to 35mm long, with two pairs of transparent amber wings and a black abdomen with yellow-brown stripes. Females have an ovipositor up to 20mm long. Adults can be confused with other large native Australian wasps and *Sirex noctilio*.

Hosts: wood of pines and conifers, recently cut, fallen or severely weakened trees and green timber.

Distribution: Asia, Europe, Chile, USA, Canada and Russia.



Wood wasp adult

Source: Forest Research, New Zealand

Detection:

Larvae: feed on fungus growing on wood within timber, make longitudinal tunnels 15-75cm long (usually tightly packed with frass) from sapwood to heartwood and back. Wood decay (white rot) may be also visible.

Adults: emerge in summer from circular exit holes up to 8mm diameter (this size may vary), pale halos often visible around holes; fly for considerable distances. Females usually lay eggs in weakened trees, often on freshly burned or cut logs. Adults occasionally emerge from timber used in houses or furniture; most likely to enter Australia in pine logs, packing material and unseasoned dunnage.

Potential impact: can kill weakened trees and degrade wood leading to structural damage.



Typical wood wasp circular exit holes

*Source: Forest Research,
New Zealand*

Pine wood nematode

Bursaphelenchus xylophilus

(Steiner & Buhrer) Nickle

Distribution: USA, Canada, Japan, China, Korea and Taiwan.

Hosts: pines, Douglas fir, spruce, larch and fir.

Signs: first visible sign may be arrested growth and foliage of a fading green or slight yellowing colour; foliage of infected trees turns reddish brown; trees can die so quickly that brown needles cling to twigs.

Yellowing or wilting and browning begin soon after colour begins to fade. Resin production falls; branch cut from diseased tree may not produce any resin;



Yellowing symptoms on pine forest in Japan

branch twigs become brittle and dry and break easily.

Various wood-inhabiting beetles can vector the nematode.

Likely pathway: nursery stock, bark, lumber and wood packaging material including dunnage and insects.

Potential impact: has caused very severe losses in pine forests of Japan and China with > 2 million cubic metres of wood lost per year in USA.



Invaded bark tissues turn brown

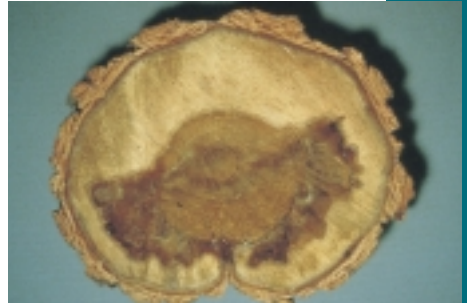
Annosus root and butt rot

Heterobasidion annosum (Fr.:Fr.) Bref.

Distribution: USA, Canada, India, China and throughout Europe.

Hosts: wide host range, including gymnosperms and angiosperms.

Signs: leaves of young trees (especially pines) can turn brown and drop quickly with no prior indication of stress. Pines and other resinous trees can exude resin at butt. Resinous lesions develop on roots at points of attack and spread as pathogen grows toward butt. Trees with diseased roots may not show obvious signs above ground.



Annosus root and butt rot in white fir

Source: *USDA Forest Service*

Fruiting bodies annual or perennial, woody to leathery: upper surface is dark brown to black with acute margin; lower surface white to cream. Fruiting bodies most often found on undersides of decayed roots of living and standing dead trees: readily produces conidia that are airborne; incipient stage of decay yellow-brown to red-brown; in advanced stage wood is reduced to a white stringy or spongy mass with many small black flecks parallel to grain.

Likely pathway: bark, lumber and wood packaging material including dunnage.

Potential impact: trees with major portion of root system killed show reduced leader and branch growth and foliage yellowing. Trees with extensive decay in structural roots subject to windthrow.



Infected ponderosa pine stump and killed cedar saplings

Source: USDA Forest Service

Black stain root disease

Ophiostoma wageneri

(Goheen & Cobb) Harrington

Distribution: southwestern/western USA and western Canada.

Hosts: Douglas fir, hemlock, pine, spruce and fir.

Signs: reduced leader and branch tip growth followed by leaf discoloration and crown thinning: these symptoms usually accompanied by characteristic purple-brown to black stain in main lateral roots, root collar and lower bole (where it is usually limited to long, tapered streaks).



Cross section of black stain that develops follows annual rings

Source: D. Morrison,
Canadian Forest Service

Cross-sections of infected boles show narrow bands of stain following annual rings (in contrast, most sap stains are wedge-shaped, blue). There are three varieties distinguished by both host preference and morphological characteristics.

Likely pathway: bark, lumber, wood packaging material including dunnage and insects.

Potential impact: hinders water conduction, causes vascular wilt and mortality in Douglas fir and pines.



In contrast, most sap stains are wedge-like and blue

*Source: Eric Allen,
Canadian Forest Service*

Blue gum mycosphaerella

Mycosphaerella juvenis Crous & M. J. Wingfield

Distribution: Kenya, South Africa, Tanzania and Gambia.

Hosts: *Eucalyptus globulus*, *E. grandis*, *E. nitens*.

Signs: leaf spots on both sides, round to irregular, separate, then becoming joined, 2-12mm diameter, evenly light brown on surface nearest to the leaf axis, whitish brown on surface furthest from the axis, surrounded by raised borders. Spore containing structure (pseudothecia) under the leaf – single, evenly distributed, black, and globe-like.



Leaf spots on blue gum

Source: Mike Wingfield, University of Pretoria, Republic of South Africa

A number of other species of *Mycosphaerella* may be associated with leaf blotch diseases of eucalypts. The picture above shows typical signs of *Mycosphaerella* leaf blotch.

Likely pathway: seeds, foliage, nursery stock, bark crevices.

Potential impact: infected leaves develop spots, blotches; affected trees suffer premature defoliation; severe infection can cause tree death.

Casuarina blister bark

Trichosporium vesiculosum Butler

Distribution: India, Sri Lanka, Mauritius, Indonesia, Vietnam, Thailand and Kenya.

Hosts: species of Casuarinaceae.

Signs: trees 2-4 years most often affected show foliage yellowing, rapid wilting and desiccation. Disease can be recognised by firm raised blistering of bark, varying in size and shape, join together lengthwise along trunk or branches on some dead trees. Black, sooty spore masses often evident on bark rupturing, peeling or flaking.



Sooty spore mass in bark layers on host

Source: CSIRO Forestry and Forest Products

Likely pathway: nursery stock, bark and wood packaging material including dunnage.

Potential impact: can cause heavy loss in plantations, with mortality rates to 90 per cent.



Bark blisters and exposed sooty spore mass

Source: CSIRO Forestry and Forest Products

Chestnut blight

Cryphonectria parasitica (Murr.) Barr.

Distribution: Japan, China, Korea, USA, Canada, Italy and throughout Europe.

Hosts: chestnut, oak, red maple, shagbark hickory and eucalyptus.

Signs: characterised by cankers that kill bark and usually cambium and sapwood of twigs, branches, and trunks. Leaves and shoots wilt and die. From a distance, the prominent signs are yellow and brown leaves on one or more branches and eventually dead leafless branches.



Typical young cankers on American chestnut

Typical canker on young, smooth-barked stems are recognised by the yellow-brown to orange surface colour representing the small fruiting structures of the pathogen. Cankers on thick barked trees are inconspicuous until splits and cracks expose the buff-coloured inner bark. Adventitious sprouts may develop from below a canker indicating its position on the host. Entire trees may die if the trunk is girdled.

Likely pathway: nuts/seeds, nursery stock, bark, lumber and wood packaging material including dunnage.

Potential impact: one of the most serious plant diseases in North America. Within 50 years the disease spread to the extremes of the natural range of the American chestnut, destroying the economic and aesthetic value of one of America's most versatile trees.



Orange-red fruiting bodies on American chestnut

Dutch elm disease

Ophiostoma ulmi (Buism.) Nannf.,
Ophiostoma novo-ulmi

Distribution: Europe, North America, India, Iran, Turkey, Russia and New Zealand.

Hosts: species of *Ulmus*.

Signs: primary signs of infection – loss of water conducting ability and browning of infected sapwood in narrow streaks that follow grain. Cross-sections of infected branches show dark spots in outer annual ring, often forming a definite ring. Secondary signs of infection include shoot wilting followed by yellowing and browning of leaves. Branches die back from tip and severe attack can kill entire tree.

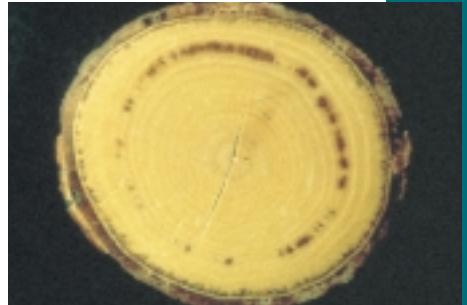


Wilting, yellowing, browning and dieback

Bark beetles belonging to the genus *Scolytus* or *Hylurgopinus* are vectors of the disease.

Likely pathway: seeds, nursery stock, bark, lumber, wood packaging material including dunnage and insects.

Potential impact: estimated to have killed >17 million of 23 million elms in southern England; lost 119,000 of 300,000 American elms over three years.



Cross-section of diseased branch showing discoloured streaks as brown dots in xylem

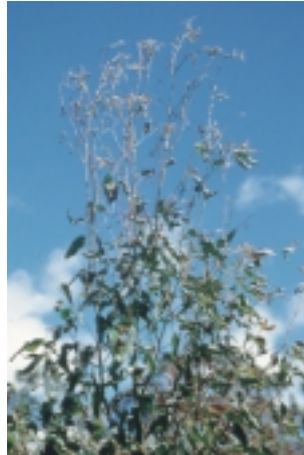
Eucalyptus rust (guava rust)

Puccinia psidii Winter

Distribution: Central/South America, Caribbean, South Florida and Taiwan.

Hosts: species of *Eucalyptus* and other Myrtaceae.

Signs: attacks leaves, flowers, young twigs, shoots, and fruits. First signs of infection are tiny raised spots or pustules on infected tissue; after a few days pustules turn a distinctive egg-yolk yellow. Plants shrivel, leaves are deformed; infection can cause heavy defoliation, stunted growth and death.



Browning, wilting, defoliation and dieback

Source: Ken Old, CSIRO Forestry and Forest Products

Likely pathway: seeds, nursery stock, bark crevices, lumber and wood packaging material including dunnage with attached bark.

Potential impact: one of the most serious threats to eucalypt plantations in moist tropical and subtropical regions. Severe damage has occurred to several Eucalyptus species and other members of Myrtaceae family.



Rust postules on young leaves of Eucalyptus

Source: Ken Old, CSIRO Forestry and Forest Products

Pine pitch canker

Fusarium circinatum Nirenberg & O'Donnell

Distribution: USA, Mexico, South Africa, Haiti, Japan and Spain.

Hosts: species of *Pinus* and *Pseudotsuga*.

Signs: wilting, fading of needles on branch tips, copious amounts of resin at or near infection site. Needles become yellow, then red, fall from branch; infected wood is slightly sunken, honey coloured, with resin. Trees can suffer crown dieback or may die. Also causes a damping off of seedlings in nurseries. Bark, twig and cone beetles are vectors of the disease.



Flagging signs in radiata pine

Source: CSIRO Forestry and Forest Products

Likely pathway: seeds, nursery stock, bark, lumber, wood packaging material including dunnage and insects.

Potential impact: has caused severe damage in native stands and plantations of *Pinus radiata* in California and could pose a significant economic threat to the *Pinus* and *Pseudotsuga* plantations in Australia.



Copious sticky resin flow associated with pitch canker

Source: CSIRO Forestry and Forest Products

Fungal pathogens

Western gall rust

Endocronartium harknessii (J. P. Moore)

Y. Hiratsuka

Distribution: Canada, USA and Northern Mexico.

Hosts: restricted to pines.

Signs: include formation of spherical, sometimes irregularly shaped and deeply fissured galls usually between 5 -10cm diameter on branches and stems of trees. Masses of orange-yellow spores produced from galls on diseased trees; irregular, rounded to pear-shaped swellings appears on host trees 1-2 years after infection.



Branch and stem galls on lodgepole pine

Source: Eric Allen, Canadian Forest Service

Likely pathway: seeds, nursery stock, lumber and wood packaging material including dunnage.

Potential impact: severe infection causes death of seedlings and saplings, shoot death and stem malformation in older trees that can cause stem breakage.



Western gall rust with orange spores beneath bark

Source: Eric Allen, Canadian Forest Service

Who to contact if you find a suspected exotic pest or disease

Contact your nearest AQIS office or State Forestry Agency as soon as possible to report a suspected exotic pest or signs and/or symptoms of a forest disease and to seek further information on what to do.

AQIS

National Office
Australian Quarantine and
Inspection Service (AQIS)
GPO Box 858
CANBERRA ACT 2601
Ph: (02) 6272 3933
Fax: (02) 6272 5697
Email: importclear@qis.gov.au
Website: www.aqis.gov.au

NATIONAL OFFICE OF ANIMAL AND PLANT HEALTH (NOAPH)

Chief Plant Protection Officer
Plant Protection Branch
AFFA
GPO Box 858
CANBERRA ACT 2601
Ph: (02) 6271 6534
Fax: (02) 6272 5835
Email: plant.protection@affa.gov.au
Website: www.affa.gov.au/nat-offices

AQIS

ACT

AQIS ACT

PO Box 7193

Canberra Mail Centre

ACT 2610

Ph: (02) 6272 5131

Fax: (02) 6239 7351

STATE FORESTRY AGENCIES

ACT Forests

ACT Forests HQ

113 Cotter Rd

WESTON ACT 2611

Ph: (02) 6207 2486

Fax: (02) 6207 2544

NSW

AQIS NSW

PO Box 657

MASCOT NSW 1460

Ph: (02) 9364 7222

Fax: (02) 9364 7340

Forest Health Section

Forest Research and Development Section

State Forests of NSW

PO Box 100

BEECROFT NSW 2119

Ph: (02) 9872 0111

Fax: (02) 9871 6941

AQIS

Northern Territory
 AQIS Darwin
 NT Quarantine and Inspection Branch
 GPO Box 2268
 DARWIN NT 0801
 Ph: (08) 8999 2075
 Fax: (08) 8999 2108

Queensland
 AQIS Brisbane
 GPO Box 778
 BRISBANE QLD 4001
 Ph: (07) 3246 8755
 Fax: (07) 3839 9313

South Australia
 AQIS SA
 PO Box 63
 PORT ADELAIDE SA 5015
 Ph: (08) 8305 9700
 Fax: (08) 8305 9825

STATE FORESTRY AGENCIES

DPIF Forestry
 GPO Box 990
 DARWIN NT 0801
 Ph: (08) 8999 2316
 Fax: (08) 8999 2043

Queensland Forest Protection Group
 Forestry Research Institute
 PO Box 631
 INDOOROOPILLY QLD 4068
 Ph: (07) 3896 9713
 Fax: (07) 3896 9628

ForestrySA
 PO Box 162
 MT GAMBIER SA 5290
 Ph: (08) 8724 2888
 Fax: (08) 8724 2870

Tasmania
AQIS Tasmania
PO Box 347
NORTH HOBART TAS 7002
Ph: (03) 6233 3626
Fax: (03) 6234 6785

Forestry Tasmania
GPO Box 207 B
HOBART TAS 7001
Ph: (03) 6233 8219
Fax: (03) 6233 8292

Victoria
AQIS Melbourne
PO Box 60
World Trade Centre
MELBOURNE VIC 3005
Ph: (03) 9246 6777
Fax: (03) 9246 6800

Natural Resources and Environment
Centre for Forest Tree Technology
PO BOX 137
HEIDELBERG VIC 3084
Ph: (03) 9450 8666
Fax: (03) 9450 8644

Western Australia
AQIS Perth
PO Box 1410
CANNING VALE WA 6970
Ph: (08) 9311 5333
Fax: (08) 9455 3052

Department of Conservation and Land
Management
Locked Bag 104
Bentley Delivery Centre WA 6983
Ph: (08) 9334 0333 (Operational Headquarters)
Ph: (08) 9334 0299 (Science Division)

Glossary

Angiosperms – (flowering plants) a class of vascular plants, all characteristically bearing seeds within enclosing carpellary systems (eg. oaks and eucalypts).

Anterior – at or towards the front of an insect.

Bole – the trunk of a tree up to the first main branches.

Cambium – the meristematic tissue that gives rise to secondary wood (xylem) and secondary inner bark (phloem).

Canker – a disease of woody plants characterised by sharply delimited necrosis of the cortical tissues and malformation of the bark caused by recurring localised killing of the cambium layer.

Castes – any set of individuals in a given colony that are both morphologically distinct and specialised in behaviour (eg. workers, soldiers, queens etc.).

Crown – leafy upper part of a tree.

Defoliation – the shedding of leaves, either as a seasonal normality or as a consequence of disease.

Dorsal – on the upper surface of an insect.

Dunnage – off-cuts of timber used for packaging and stabilising cargo to protect it from damage during shipping and transport. Often very poor quality timber is used for dunnage.

Foliage – leaves.

Frass – solid insect excrement.

Galleries – tunnels and chambers formed by insects eating wood or composed of silk and debris, usually faecal.

Green timber – timber which is newly cut and still has high moisture content.

Technically referred to as unseasoned timber.

Gymnosperms – Gymnosperms differ from the angiosperms in having naked seeds with no enclosing carpellary structures (eg. pines and cypress).

Host – a plant or other organism that furnishes subsistence to, or harbours a parasite.

Incipient decay – the early stage of wood decay in which the wood is invaded and may show discolouration but is not otherwise structurally altered.

Larva – the second stage in the life cycle of an insect between egg and pupa. Also known as a grub or caterpillar.

Ovipositor – specialised structure at the rear end of female insects which is used for depositing eggs.

Perennial – a plant that lives for several years.

Posterior – at or towards the rear of an insect.

Pronotum – is the upper and dorsal part of the prothorax of an insect - insects generally have three segments: head, pronotum and abdomen.

Pupa – the third stage of the insect life cycle, in which the larva undergoes transformation into the adult.

Resin – a substance exuded by certain plants when wounded. On exposure to air, components evaporate leaving a solid or semi-solid residue protecting the damaged area.

Rostrum – the elongated snout that extends the mouthparts of some insects.

Seasoned timber – timber dried to a moisture content that is stable.

Spore – reproductive structure from which a new organism arises, produced by some plants, fungi, bacteria, and protozoa.

Timber in-service – timber that is used in buildings and field structures, including constructional timbers such as building structures, utility poles, railway sleepers, bridge timbers and other outdoor service timber.

Vector – an agent that carries a disease to a host (eg. insects, animals, wind, rainsplash and infected tools).

Ventral – towards or at the lower surface of an insect.



**Standing Committee
on Forestry**



Quarantine Matters!