

Quarantine Matters!

Australia's most unwanted.

A guide to exotic pests and disease.



Australian Government
Australian Quarantine
and Inspection Service

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INTRODUCTION

What is AQIS?

AQIS – the Australian Quarantine and Inspection Service – is part of the Australian Government Department of Agriculture, Fisheries and Forestry.

AQIS's 2900 employees provide quarantine inspection for international passengers, cargo, mail, animals, plants and animal or plant products arriving in Australia. AQIS also provides inspection and certification for agricultural products exported from Australia.

AQIS's import and export inspection and certification are essential to maintaining Australia's highly favourable animal, plant and human health status and access to export markets.

Quarantine controls at Australia's borders also manage exotic pest and disease risks, to protect Australia's agriculture industries and environment.

Export inspection and certification contribute to Australia's meat, horticulture, grain, fish, dairy, organic and live animal export industries, worth more than \$30 billion a year.

AQIS works with industry and trading partners to gain and maintain market access for agricultural commodities and participates in international forums to develop policies and standards for trade in food products.

Border protection

Many countries have pests and diseases that could have disastrous effects on Australia's animals and plants. These pests and diseases could be carried by people, by animals, in animal products such as meat, in plants or in plant products such as timber, or in soil on machinery.

All of these must undergo quarantine inspection, and many plants and animals must be isolated at quarantine stations so any pest or disease risks can be identified and prevented from entering the community.

Why 'manage' risks?

Our 36,000 kilometre coastline and proximity to neighbouring Asian and Pacific nations make Australia particularly susceptible to pest and disease incursions.

Australia's approach to quarantine aims to reduce quarantine risks to a very low level, while recognising that there can never be complete freedom from quarantine risks.

The only way to approach a 'zero risk' to quarantine would involve stopping the movement of people and cargo into and out of Australia — and the impossible task of preventing the natural movements of marine animals, insects and migratory birds.

Australia also exports more than two-thirds of its agricultural produce. Trying to prevent commodities coming in from overseas would lead to our export markets banning Australian produce, threatening agricultural export industries worth \$30 billion a year as well as the communities that depend on those industries.

HOW DOES AQIS MANAGE RISKS?

Border control

Passenger and cargo clearance are the main aspects of quarantine control at entry points into Australia. Quarantine officers use a range of techniques including risk assessment, detector dogs, X-ray machines, surveillance and inspection at international airports, seaports, mail exchanges and container depots.

Animal quarantine

Animal quarantine applies to all kinds of animals and their products, including insects, fish, reptiles, birds and mammals. Animals coming into Australia must spend time at quarantine stations to ensure they are free of disease before being released.

Not all animals are allowed into Australia – pest or disease risks associated with some imports may be considered too great.

of humans with avian influenza virus is relatively rare and usually results in mild conjunctivitis; however, infection with some types of avian influenza can be fatal in humans. In all reported cases the affected individuals have had close contact with infected birds.

What's the risk to Australia?

A major outbreak of avian influenza in Australia would be costly to the poultry industry, consumers, and taxpayers. An outbreak in the United States in 1983-84 required an eradication program that cost close to US\$65 million, resulted in the destruction of more than 17 million birds, and caused retail egg prices to increase by more than 30 per cent.

AQIS officers at airports and international mail centres have been on high alert for bird and poultry products since the first, isolated cases of avian influenza were reported in Asia in late 2003.

Quarantine officers screen all flights, passengers, baggage, mail and cargo from high-risk countries using X-ray machines, detector dog inspection and physical inspection. They pay particular attention to eggs, egg products, poultry meat, poultry vaccines, feathers and similar items.

FOOT AND MOUTH DISEASE

What is it?

Foot and mouth disease (FMD) is a viral disease and is one of the most contagious diseases of livestock. It affects cloven-footed animals including cattle, buffalo, camels, sheep, goats, deer and pigs. The disease is generally most severe in cattle and pigs, but it is not a human health risk.

Where is it found?

FMD is widespread in parts of Asia, Africa and South America, with occasional outbreaks in normally disease-free areas such as in the United Kingdom, Ireland, France and the Netherlands in 2001. Australia has been free of FMD since 1872.

What are its effects?

Although FMD is not very lethal in adult animals, it causes serious production losses and can kill young animals.

Early signs include fever, drooling and reluctance to move. Fluid-filled blisters appear on the tongue, lips, mammary glands, between the toes and on the feet. The blisters eventually erupt to leave raw, painful ulcers that take up to 10 days to heal. Foot lesions leave animals lame and unable to walk to feed or water; mouth lesions are highly painful and cause animals to stop eating.

Infected adults usually begin eating again after a few days, but young animals may weaken and die, or be left with deformities.

FMD spreads very rapidly between animals, particularly in cool, damp conditions or when animals are penned together during cold weather. An entire herd can be infected within 48 hours.

The disease can be spread by saliva, mucus, milk or faeces as well as on wool, hair, grass or straw, by the wind, or by mud or manure sticking to footwear, clothing, livestock equipment or vehicle tyres.

There is no treatment or cure, and eradication in previously free countries is usually based on the slaughter and rapid burial or burning of all susceptible animals on premises infected with FMD.

The virus is destroyed by heat, sunlight, low humidity or some disinfectants, but under favourable conditions can remain infective in a suitable medium (such as the frozen carcass of an infected animal) or on contaminated objects for many months.

What's the risk to Australia?

The most likely path of entry into Australia is through the importation of infected animals or infected food. This is one reason imports into Australia of live animals, uncooked meat and dairy products from FMD-affected countries are subject to strict quarantine regulations.

The risk of FMD virus being transported on passengers' footwear is relatively low; however, Australian quarantine law requires passengers to declare whether they have been on a farm or in contact with livestock. Their footwear, clothing, sporting or camping equipment may be inspected and cleaned if necessary to deal with any potential FMD risk.

Quarantine officers also interview passengers from FMD-affected countries to ensure they're not carrying items such as meat or dairy products, straw packaging, or equipment used with livestock.

Australia has an internationally recognised capability to deal quickly and effectively with emergency animal disease outbreaks, but FMD would have very serious effects on Australia's livestock industries.

An uncontrolled outbreak could lead to key beef, lamb and pork export markets being closed for more than a year; control costs would be between \$8 billion and \$13 billion, and the consequences of an outbreak would be felt for up to 10 years. Even an isolated, rapidly controlled outbreak could cost \$2-3 billion to eradicate, with economic and social effects in other sectors, including tourism.

NEWCASTLE DISEASE

What is it?

A highly contagious viral disease, Newcastle disease affects almost all domestic and wild bird species. Domestic fowls, turkeys, pigeons and parrots are most susceptible, with milder disease generally seen in ducks and geese.

Where is it found?

Strains of Newcastle disease virus are present in most countries. Relatively mild strains are endemic in Australia, which is free of the most virulent forms. There have been several outbreaks of virulent Newcastle disease in Australia; the most recent was in New South Wales in 2002.

What are its effects?

Signs vary according to the strain of virus and the age, health and species of the bird. Signs of disease usually occur five or six days, but can be up to 15 days after infection.

Newcastle disease affects respiratory, nervous and digestive systems. Signs in poultry range from mild respiratory disease to severe depression, rapid breathing, diarrhoea, swollen tissue around the eyes, collapse, paralysis and death. Severe outbreaks can kill all birds in an infected flock within 72 hours.

Spread of the disease is usually by direct physical contact with infected or diseased birds. The virus can be present in manure and breathed out into the air, on contaminated equipment and on or in carcasses, water, food or clothing.

Stringent quarantine and strict controls over the movement of anything that may have been contaminated by the virus are essential to successful eradication. The most efficient means of controlling an outbreak is the immediate slaughter and incineration or burial of all birds in an affected flock.

Newcastle disease virus can remain infective for several weeks on feathers, manure and other materials, and indefinitely in frozen material; however, it is easily destroyed by heat (including direct sunlight) or acids or alkalis.

Newcastle disease poses no health risk to consumers of poultry or poultry products. Human infection is extremely rare and results in mild, short-term conjunctivitis or flu-like symptoms, generally only in people such as poultry workers who have been in close direct contact with infected birds.

Newcastle disease is not the same as avian influenza – it belongs to a completely different family of viruses.

What's the risk to Australia?

In April 1999 an outbreak of the disease in NSW resulted in the slaughter of 1.9 million meat chickens, 13,000 laying hens, 5000 ducks, 3000 meat pigeons, 60,000 pullets, 17 ostriches and more than 2000 domestic birds. The outbreak cost almost \$24 million to eradicate.

An outbreak of virulent Newcastle disease would have many social and economic costs. The Australian Bureau of Agricultural and Resource Economics has estimated the short term total loss to Australian society from a significant outbreak would amount to about \$50 million a year, made up of losses to producers and costs to consumers due to higher prices.

Australia has strict quarantine over imports of birds and bird products. Live birds and eggs can only be imported through special quarantine facilities. Quarantine officers also interview visitors to Australia to make sure they're not carrying items that could carry Newcastle disease virus.

RABIES

What is it?

Rabies is a fatal viral disease of warm-blooded animals, including humans. It is usually spread by the bite of an infected animal such as a dog, cat, bat or fox.

Where is it found?

Rabies is present in many countries in the world, except Australia, New Zealand, the United Kingdom, Japan and a number of small islands. Many of these are island nations with strict controls on the entry of animals; both factors have helped prevent entry of the disease.

What are its effects?

The rabies virus attacks the central nervous system, then spreads to the salivary glands and other organs of the body.

There are two types of rabies:

'Furious' rabies causes the animal to foam and drool at the mouth. Animals behave unpredictably and may become vicious, snap at imaginary objects and attack without warning. The animal becomes progressively unco-ordinated, paralysed and usually dies in four to five days.

'Dumb' rabies causes early paralysis, followed by drooling and death. Animals with dumb rabies remain quiet and only bite when provoked. They are unable to eat, but will frequently try to drink water.

Humans are most commonly exposed to rabies if the saliva from a rabid animal enters the body through a bite or an open wound. Other rare means of infection are through entering a cave polluted by infected bats or through receiving organ transplants from a person carrying the rabies virus.

Early symptoms include headaches, fever and lethargy. Neurological signs and symptoms include insomnia, anxiety, confusion, paralysis, hallucinations, agitation, excessive salivation, difficulty swallowing and hydrophobia (fear of water). Death usually occurs within days of the onset of symptoms.

Rabies signs and symptoms typically appear about 30-50 days after exposure but can occur between 10 days to a year or longer depending on the severity and location of the bite, the amount of virus present and the strain of the virus.

The only hope for those bitten by a rabid animal is a course of vaccination before symptoms appear. Treatment requires prompt cleaning and disinfection of the bite site and a course of six injections over a month; one injection contains antibodies to fight the virus, the others are vaccinations to ensure long-term protection against the disease.

Between 40,000 and 70,000 people die of rabies worldwide each year, with a further 10 million receiving treatment after being exposed to animals suspected of having rabies. Detecting, preventing and controlling the disease in the United States costs more than \$US300 million a year.

What's the risk to Australia?

Rabies could profoundly change our way of life and the disease would be very difficult to eradicate if it became established in dogs and cats or native wildlife. We could never feel safe when approaching a stray cat or dog. All imported animals are subject to strict quarantine requirements, including vaccination for dogs and cats from all affected countries.



KARNAL BUNT

What is it?

Karnal bunt is primarily a disease of wheat used to make bread, but also affects durum wheat. It is caused by the fungus *Tilletia indica*. Flour made from infected wheat is unfit for human consumption because it has an objectionable smell and taste.

Where is it found?

Karnal bunt was first noticed in northern India in 1930. It prefers cool, humid conditions and has since spread to other parts of India, Pakistan, Afghanistan, Nepal, Iraq, Iran, Mexico, South Africa and southern and eastern parts of the United States.

What are its effects?

Signs of karnal bunt are hard to detect in the field because only a few seeds on each head are attacked, but symptoms become more obvious in processing. All or part of the grain is replaced with a powdery mass of dark spores that emit a strong, fishy odour.

Harvesting shatters infected grains, releasing the spores and leaving behind a broken, hollow grain. Spores can spread over long distances by wind and survive in the soil or on stored seed for up to five years.

What's the risk to Australia?

Australia has suitable conditions for karnal bunt and the disease could have a major economic impact on our wheat-growing industry, severely disrupting grain exports. To manage the risk of this disease, Australia has strict quarantine regulations for imports of new wheat varieties or breeding lines for sowing.

Because karnal bunt can survive in soil and on agricultural machinery, Australia also requires that imported agricultural machinery must be cleaned. Feed meals, seeds and fertilisers that may have been handled in the same transportation system as infected wheat must also be free of wheat seed contamination.

PLUM POX

What is it?

Plum pox virus, also known as sharka, is the most devastating viral disease of stone fruit in the world. This virus affects many wild and cultivated species of Prunus plants, including plums, peaches, apricots, nectarines, cherries and almonds.

Where is it found?

Plum pox was first discovered in Bulgaria in 1917 and has since spread through most of Europe; it is estimated that more than 100 million trees are now infected. The disease is also present in Turkey, Syria, Egypt, India, the United Kingdom, Africa, the former USSR and parts of the United States, Canada and South America.

What are its effects?

Trees infected with plum pox virus can show a range of signs on leaves, flowers and fruit depending on host species, locality and season. The disease develops slowly over several years, usually affecting one or two branches before spreading through the tree.

Fruit production drops by up to a third and fruit may drop prematurely; the presence of other viruses in the tree can increase the severity of plum pox infection.

Fruit from infected trees is deformed or blemished and marked with spots or rings; it is usually unmarketable because of its unattractive appearance, low sugar content, poor flavour and short shelf life.

Plum pox virus is spread by grafting diseased stock onto other trees, by aphids that suck sap and by seed. There is no cure or treatment for the virus and all infected trees in an area must be destroyed.

What's the risk to Australia?

Plum pox virus poses a considerable risk to Australia's stone fruit industries. To keep it out, all imports of stone fruit planting material are screened in quarantine facilities. Many stone fruit food products containing seeds require heat treatment to kill the seed and prevent the spread of the virus.

PINE PITCH CANKER

What is it?

Pine pitch canker is caused by a fungus, *Fusarium circinatum*, which affects pines and Douglas fir. Spores are spread by wind or can be carried in fog or rain and can enter trees or seedlings through wounds caused by hail, wind damage or removal of branches; through damage caused by insects such as beetles or weevils; on seeds; or through the roots. The fungus can live for more than a year in wood.

Where is it found?

Fusarium circinatum probably originated in Mexico but is now found in North, Central and South America, in Europe and in parts of Asia and Africa.

What are its effects?

Pine pitch canker causes bleeding infections that can encircle branches, exposed roots and trunks. The wood beneath the infection site is saturated with resin and becomes a characteristic honey colour. While the major damage from this fungus is to branches, needles, trunk or stem and roots, pine pitch canker can also infect trees' reproductive structures, killing female flowers and mature cones and causing damping off disease in young seedlings.

What's the risk to Australia?

Pine trees are planted over large areas of Australia and are the basis of a major industry. Virtually all pines are susceptible to pine pitch canker. Many thousands of radiata pine trees have been killed by this disease in California, and all native mainland populations of radiata pine in the United States are severely threatened by pine pitch canker. If the disease became established in Australia it could cause severe damage and losses in pine plantations.

EUCALYPTUS/GUAVA RUST

What is it?

Eucalyptus rust or guava rust is a serious disease caused by the fungus *Puccinia psidii*. This pathogen is very unusual in that it has a very wide host range in the plant family Myrtaceae, which includes about 3000 tree and shrub species – many of which have great economic and conservation significance. Plants native to Australia that are known to be susceptible to this disease include eucalypts (*Eucalyptus* and *Corymbia*), bottlebrush (*Callistemon*) and paperbark (*Melaleuca*).

Where is it found?

Puccinia psidii is native to parts of South America. It now also occurs in North America (Mexico, Florida) and parts of Central America including the Caribbean.

What are its effects?

Eucalyptus/guava rust causes disease of young shoots, flower buds and young fruit depending on the host plant. Eucalyptus species are the most important hardwood forest plantation trees in the world and are grown in many countries.

Puccinia psidii is the only rust known to infect eucalypts and causes serious disease in eucalypt plantations. The disease is particularly severe on susceptible eucalypt seedlings, cuttings, young trees, coppice or damaged mature trees. Highly susceptible trees may be grossly malformed or even killed. Growth rates of infected trees are diminished and plantation productivity reduced.

What's the risk to Australia?

Eucalyptus/guava rust can be managed in plantations by producing resistant trees through selection and breeding. This is happening in countries such as Brazil, but the disease would be impossible to manage in natural environments and would have devastating effects on Australian ecosystems where susceptible species occur.

Eucalyptus/guava rust spores are easily dispersed in air currents and could enter Australia on clothes, hair or luggage.

Forestry workers or tourists who have visited plantations or forest areas in countries with eucalyptus/guava rust should make sure they thoroughly clean their clothing before returning to Australia.

PESTS OF ANIMALS

SCREW-WORM FLY

What is it?

Screw-worm fly is an insect parasite of warm-blooded animals, including humans. Related to the blowflies that cause fly-strike in Australian sheep, it prefers hot, humid climates and cannot survive in frost-prone areas.

There are two species of screw-worm fly: 'Old World' (*Chrysomya bezziana*) and 'New World' (*Cochliomyia hominivorax*).

Where is it found?

Old World screw-worm fly occurs in almost all tropical countries except Central and South America and Australia, including much of Africa, India, Southeast Asia and New Guinea. Screw-worm flies are also present in the coastal swamplands of Papua New Guinea adjacent to the Torres Strait. Because of their proximity to Australia, these pose the greatest risk of entry through either sea trade or a fly strike wound on animals or people.

The New World species is found in the western hemisphere, including Central and South America. Long-distance spread of the insect generally depends on the movement of infected animals.

What are its effects?

Screw-worm flies breed in wounds on mammals, including humans. The female screw-worm fly lays up to 250 eggs on the edge of an injury, scratch, branding mark or castration wound.

Larvae (maggots) hatch within 24 hours, enter the wound and chew their way into healthy underlying flesh to feed. The wound becomes a mass of maggots, causing extensive tissue damage and leaving the flesh susceptible to a secondary fly strike. After about a week the larvae drop from the wound to pupate in the soil. Adults emerge in another seven days to mate and repeat the cycle.

If left untreated, infested animals can die from infection and loss of tissue fluid.

Screw-worm flies look like Australian blowflies, with a shiny, blue-green body and red eyes, and can only be distinguished from native flies through microscopic examination or DNA analysis.



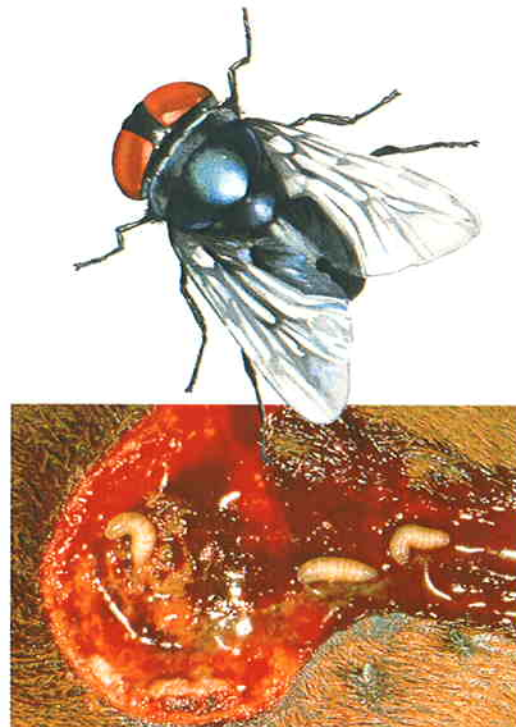
What's the risk to Australia?

Screw-worm flies could cost close to \$500 million a year in lost production and control measures if they entered Australia. They would have a devastating effect on northern livestock production, particularly cattle and sheep industries. In some herds, 10 to 15 per cent of cattle could be struck at any time; the greatest loss would be through the deaths of newborn calves as a result of navel strike.

The potential spread of this pest from Papua New Guinea is one of the major quarantine threats to northern Australia. Eradication would depend on the release of millions of sterile male screw-worm flies to reduce breeding numbers. This could take up to five years, with health implications for remote northern communities.

AQIS has a monitoring program in the Torres Strait, on Cape York Peninsula and in other strategic locations to ensure early detection of a screw-worm fly incursion.

The program includes lure traps for adult screw-worm flies around airports, seaports and other high-risk areas, and inspection of livestock for fly strike. Quarantine officers also inspect returning livestock vessels, and sentinel cattle herds are used to monitor for maggots.



PESTS OF PLANTS & PLANT PRODUCTS

ASIAN GYPSY MOTH

What is it?

Asian gypsy moth caterpillars eat the leaves of trees and shrubs over very large areas, causing major damage and dieback.

Where is it found?

Asian gypsy moth occurs in Asia, Europe and North America.

The European strain was accidentally introduced to the eastern United States in 1869 and spread to Canada in 1924. Eradication programs are conducted in neighbouring areas to prevent its spread and establishment in new regions.

The Asian strain originated in eastern Asia and is found throughout eastern Russia, China, Korea and Japan. It was accidentally introduced to North America in the early 1990s, where it is now the subject of widespread control and eradication programs.

New Zealand discovered Asian gypsy moth in 2003 and immediately began a comprehensive control and eradication program to prevent its establishment.

What are its effects?

Asian gypsy moth caterpillars feed on more than 500 species of trees and other plants, including pines, holly, eucalypts, acacias, roses, apples, pears,

cherries, oaks and urban ornamentals. Asian gypsy moth has defoliated 5.2 million hectares (12.9 million acres) of hardwood forests across the northeastern United States.

Newly hatched larvae can live for up to a week without feeding, allowing them time to move to a host plant, where they begin feeding on new foliage. They also disperse widely in the wind, floating on silke threads.

Most damage to host plants takes place during the final caterpillar stages and a severe infestation can completely defoliate host plants, killing them or reducing their capacity to tolerate other insect pests or diseases or causing them to die.

What's the risk to Australia?

A major outbreak of Asian gypsy moth in Australia has the potential to destroy forests and native bush, street trees, crops and the communities that depend on them.

There is a high risk of the moth arriving on ships carrying cargo containers. Asian gypsy moth is attracted to light, so there is the potential for eggs to be deposited on ships, aircraft and vehicles at brightly lit urban parking lots, airports and seaports.

As well as inspecting ships and their cargo, AQIS officers maintain a trapping program to provide early warning of the potential entry of this pest.

ASIAN LONGHORN BEETLE

What is it?

Asian longhorn beetle (*Anoplophora glabripennis*) is a serious pest that bores deep into hardwood trees, eventually killing them. Asian longhorn beetles attack maple, elm, willow, poplar, mulberry, apple, plum, pear and other hardwood trees.

Where is it found?

Asian longhorn beetle is native to southern China, Korea and Japan. It was found in parts of the United States in 1996, probably after arriving in solid wood packing material such as crates and pallets from Asia. In 2001 an outbreak was identified in maple and sycamore trees in Austria.

What are its effects?

Asian longhorn beetle larvae burrow deep into the heartwood of trees to feed, making this pest hard to control using insecticides. Control is only possible by cutting down and chipping or burning infested trees and then replacing them with species not attacked by the beetle.

What's the risk to Australia?

Asian longhorn beetle could devastate 150 million hectares of Australia's native forests. It also poses a threat to our apple and pear plantations and parkland trees.

The highest risk of Asian longhorn beetle getting into Australia is on imported timber and wood pallets or packing materials from overseas, or on other timber items such as furniture. For this reason timber products from Asia must be treated before being imported or on arrival in Australia.



EXOTIC FRUIT FLIES

What are they?

Fruit flies are the world's worst pests of fruit and fruiting vegetables, causing millions of dollars worth of damage a year.

Australia has a number of native fruit flies, but most of these do not attack crops of economic significance. In contrast, exotic fruit flies present in neighbouring countries can infest commercial crops, causing crop devastation and trade disruption and requiring expensive eradication campaigns.

Early detection is the best means to achieve speedy and cost-effective eradication, and Australia has an extensive fruit fly surveillance program. Fruit fly traps are set in more than 1600 locations across Australia to monitor for exotic fruit flies, including trapping in remote northern locations by AQIS's Northern Australian Quarantine Strategy (NAQS). Trapping also provides evidence to overseas trade partners of Australia's freedom from particular fruit fly species.

Economically, the impact of a widespread exotic fruit fly outbreak would be felt across many sectors. International trade bans would cost millions of dollars in exports, the movement of fruit and vegetables across State borders would be further restricted and there would be extensive costs associated with the use of pesticides and other control measures.

The most likely way for fruit flies to enter Australia is in larvae-infested fruit. All commercial imports of fresh fruit are disinfested or are certified as being grown in a fruit fly free country or region. Non-commercial imports such as fruit carried by passengers arriving in Australia or in mailed parcels are destroyed.

What are their effects?

Fruit flies lay eggs in unripe and ripening fruit, where larvae hatch and feed on the fruit pulp. Infested fruit fails to ripen and spoils quickly. Flies can lay up to 800 eggs that grow to adulthood in three to five weeks.

What are the risks to Australia?

Several exotic fruit flies are of particular concern to Australia:

Papaya fruit fly

Papaya fruit fly (*Bactrocera papayae*) affects most commercial fruit including bananas, capsicums, chillies, citrus, guavas, mangoes, papaya and tomatoes. It is widespread in southern Thailand, East Malaysia, Singapore and Indonesia, and has become established in Papua New Guinea.

It is occasionally trapped on islands in the Torres Strait. An outbreak around Cairns, North Queensland in 1995 devastated local crops but was successfully eradicated in 1999. The eradication campaign cost \$33.5 million – a small price to pay compared with predicted losses of more than \$100 million a year in trade disruption alone.

Melon fly

Melon fly (*Bactrocera cucurbitae*) mainly affects plants such as cucumbers, pumpkins, rockmelons, squash, watermelons, but also chillies, green beans, mangoes, papayas, tomatoes, citrus and stone fruits.

It has a worldwide distribution including China, India, Hawaii, Japan, Malaysia, Papua New Guinea, Taiwan and Thailand. It is occasionally detected on islands in the Torres Strait but is not established in Australia.

Mediterranean fruit fly

Mediterranean fruit fly (*Ceratitis capitata*) is probably native to Africa. It can infest more than 200 fruits including avocado, bananas, capsicums, chillies, citrus, figs, custard apples, grapes, guavas, passionfruit, persimmons and pome and stone fruit. In Australia this pest only occurs in Western Australia.



GIANT AFRICAN SNAIL

What is it?

The giant African snail (*Achatina fulica*) is one of the world's most destructive pests of fruit and vegetables. Growing up to 30 centimetres long and weighing up to a kilogram, it is known to eat around 500 species of plants including cocoa, papaya, peanut, rubber trees and most varieties of beans, peas, cucumbers and melons. This species has also been recorded as eating fallen fruit, garbage, human and animal excrement... even other giant African snails.

Giant African snails are regarded as a delicacy in many countries and deliberate introductions to new areas are probably responsible for the pest's spread to Indian and Pacific Ocean islands.

Where is it found?

Giant African snail originated in East Africa and is now present on most Pacific and Indian Ocean islands. The species was first recorded in American Samoa in the mid-1970s: a million snails were collected by hand in 1977 during a government campaign to reduce snail numbers, and more than 26 million snails were collected over the following three years.

What are its effects?

Giant African snails are hermaphrodites, with each individual having both male and female reproductive systems. An individual snail can lay up to 1200 eggs a year after a single mating and can live up to nine years.

Although the species is tropical, it can tolerate cold or adverse conditions by retreating into its shell and remaining dormant for several months. Dormant snails can lose 60 per cent of their weight and may appear to be dead.

Apart from causing serious damage to crops and the environment, giant African snails also carry the rat lungworm parasite *Angiostrongylus cantonensis*, which can infect humans and cause meningitis. People can become exposed to the parasite by eating raw or improperly cooked snails.

What's the risk to Australia?

The main risk of this pest's introduction into Australia is on plant material in or on crates, shipping containers, machinery and motor vehicles. Eggs can also be carried in soil. As well as eating a wide variety of fruit trees and vegetable crops, giant African snails have also been recorded attacking eucalypt trees and could threaten Australia's native forests.



KHAPRA BEETLE

What is it?

Khapra beetle (*Trogoderma granarium*) is one of the world's worst stored-product pests. Adult beetles are brownish and 2-3 millimetres long. Immature larvae are up to 5 mm long and are covered in dense, reddish-brown hair.

Where is it found?

Khapra beetle originated in India and has become established in a number of Mediterranean, Middle Eastern, Asian and African countries. It has been accidentally introduced and subsequently successfully eradicated in the United States at huge cost.

The beetle prefers hot, dry conditions and is often found in grain and food stores, in malhouses, seed processing plants, fodder production plants, dried milk factories, stores of packing materials (used or unused sacks, bags, crates) and kitchen pantries.

What are its effects?

Adult female khapra beetles lay from 50 to more than a hundred eggs at a time, and there can be up to nine generations a year.

The beetle is particularly hard to control because larvae can survive without food for several years and spend most of their time in crevices and other shelters, making them difficult to spot and hard to control with chemical treatments (fumigation is the only reliable treatment currently available).

The larvae are voracious feeders on grains and seeds as well as processed vegetable and animal products including spices, herbs, nuts and dried fruits.

What's the risk to Australia?

Khapra beetles are easily transported with agricultural products in shipping containers, vessels or vehicles, even in shipments of canned products, rubber and clothing. Their ability to survive without food enables them to be carried around the world. Cargo and products from countries with khapra beetle require careful inspection by Quarantine officers.

Australia provides an ideal environment for this pest, and its establishment here would make grain exports considerably more expensive because many countries require fumigation against khapra beetle. Domestic grain and high-risk products would also be more expensive because of treatment costs – and accurate identification of khapra beetle would be very difficult because there are many almost identical species that are native to Australia.



VARROA MITE

What is it?

Varroa mites (*Varroa destructor*) are external parasites of bees. The mites, which are about the size of a pinhead, use specialised mouthparts to attack developing bee larvae or adult bees, resulting in deformed bees, reduced lifespan and ultimately the destruction of the colony or hive. These mites are the most important pest of honeybees around the world.

Where is it found?

Varroa mites were originally a relatively harmless parasite of the Asian honeybee. In recent decades they have adjusted to living on domestic European honeybees and have become established in most beekeeping regions of the world.

What are its effects?

Varroa mites spread naturally between bee colonies by travelling on the bees. Modern beekeeping practices of moving hives and equipment between apiary sites have the potential to spread mites quickly over long distances.

One or sometimes more female mites enter a brood cell in the bee hive laying about five or six eggs each. Newly hatched (nymph) mites feed on the growing bee larva.

Once mites reach maturity they mate, the males die; the females attach themselves to adult bees and feed by sucking their blood. A heavily infested colony may have mites on a third or more of adult bees or brood.

Attack by varroa mite weakens bees, shortens their lives, or causes death from virus infections that would otherwise cause little harm. In severely attacked colonies bees may have stunted wings, missing legs or other deformities. Unless urgent action is taken, the vitality of bees in the colony declines until all are dead.

Varroa mites can remain undetected for up to two years, by which time it is too late to prevent spread to other hives.

What's the risk to Australia?

The most obvious threat is to Australia's bee and honey industries. Apart from reduced honey production, apiarists would need to repeatedly treat their hives to ensure their survival.

However, the major part of the cost of varroa would probably be felt by other industries with crops that rely on honeybees for pollination, including almonds, avocados, cotton, stone fruits, pome fruit, melons and pumpkins.

Varroa mites were discovered in New Zealand in 2000 and have already had an immense economic impact, with significant control costs and losses of bees, hives, honey production, crop yields and export revenue.

Live bees can't be imported into Australia without strict quarantine measures. Visitors must declare all bee and honey products for inspection, and some states also have their own quarantine restrictions on the movement of honey and bee products in Australia.



BLACK-STRIPED MUSSEL

What is it?

Black-striped mussels (*Mytilopsis sallei*) are rapidly growing marine pests that breed quickly, fouling marine structures, vessel cooling systems and hulls and overgrowing other marine species. They are perhaps the most serious threat to tropical Australian waters.

Where is it found?

Native to the tropical and subtropical waters of the eastern Pacific, the Gulf of Mexico and northern parts of South America, black-striped mussels have now spread to Fiji, India, Japan, Taiwan and Hong Kong.

They have the potential to infest Australia from Fremantle in Western Australia across the north of the continent to Sydney, as well as warmer parts of the Spencer and St Vincent Gulfs in South Australia.

What are its effects?

Black-striped mussels live up to two years and grow to about 2.5 centimetres long in around six months, but need only be half this size to begin breeding. Each mussel releases tens of thousands of eggs and can spawn every 28 days.

Mussels spread rapidly over objects in the water, covering them and building a layer up to 15 centimetres thick. They foul anchors, pylons, buoys, stormwater

pipes, vessel hulls and breakwaters and compete with native marine species for food and space, leading to a substantial reduction in biodiversity.

What's the risk to Australia?

Black-striped mussels invaded Darwin Harbour in 1998-99. Fortunately, the incursion was limited to an enclosed marina but eradication required pumping copper sulphate and chlorine into the infested site.

The emergency response required national and local action at great economic and social costs, though these were minor when compared with potential damage to a \$350 million a year pearling industry and a northern prawn fishery catch worth close to \$120 million.

In the Great Lakes region of North America the zebra mussel, a relative of the black-striped mussel, costs an estimated \$US600 million a year in remedial engineering and in cleaning mussel encrusted pipes and water systems.

Transportation of black-striped mussels around the world has been linked with vessel hull fouling, and larvae could also be carried in ballast water.

AQIS has strict regulations regarding the berthing of vessels in Australian waters and, with few exceptions, requires vessels to conduct a mid-ocean exchange of ballast water en route to Australia to minimise the risk of introducing pests such as black striped mussels.



Weeds already established in Australia cost billions of dollars, is the damage caused to our natural environment. In northern remote Australia, AQIS monitors for new weed threats by conducting weed surveys and promoting awareness of weed threats.

ERECT TAR VINE

What is it?

Erect tar vine (*Boerhavia erecta*), also known as erect spiderling vine, is a fast-growing weed that invades crops, degrades the environment and provides almost impenetrable refuges for feral animals.

Where is it found?

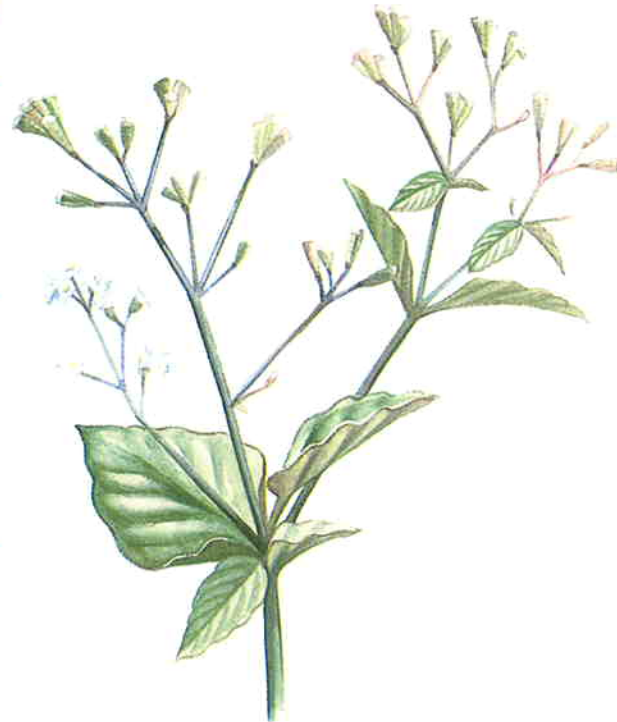
Erect tar vine originated in American tropics but is now widespread in Africa, India, Thailand, China, Indonesia, Papua New Guinea and western Polynesia. There are several native relatives of tar vine in Australia, but erect tar vine has not yet been recorded here.

What are its effects?

Erect tar vine is a spreading, herbaceous plant that grows to about a metre. It rapidly invades annual crops such as maize (corn), sorghum, peanuts, beans and also young orchards and the understoreys of native woodlands, smothering vegetation. It is highly suited to dry climates and can grow in sandy, nutrient-poor soils.

What's the risk to Australia?

Erect tar vine's sticky seeds spread long distances by attaching themselves to clothing, footwear, fur, feathers, farm implements and vehicles, which are all possible modes of entry into Australia.



HAWKWEED

What is it?

There are several hundred species of *Hieracium* hawkweed (in the plant family Asteraceae), all of them invasive. Weedy hawkweeds reach between 15 to 90 centimetres high, with horizontal stems that can develop new roots. A one square metre patch of hawkweed can produce up to 40,000 seeds.

What are its effects?

Hawkweeds develop in very dense, outward-growing patches, displacing native or cultivated vegetation.

Where is it found?

Hawkweeds are mostly native to temperate and mountainous areas of the northern hemisphere. Several European species have become major weeds of pasture lands in northeastern America, Japan, New Zealand and Patagonia.

Although not yet widely naturalised in Australia, four invasive hawkweed species have already been found (*Hieracium praealtum* in Victoria, *H. aurantiacum* in Tasmania and *H. murorum* in NSW) and are the subjects of eradication programs in these states.

What's the risk to Australia?

Hawkweeds are most likely to enter Australia in consignments of seeds from Europe, North America or New Zealand and represent a significant threat to agriculture, horticulture and native vegetation.

SPIKED PEPPER

What is it?

Spiked pepper (*Piper aduncum*) has been grown as an ornamental plant but is regarded as a weed because of its ability to rapidly invade pastures and native landscapes, including disturbed rainforests. It grows extremely quickly, forms large clumps and can almost completely exclude native species.

Where is it found?

Native to the West Indies and tropical America, spiked pepper has become established in Florida, Southeast Asia, a number of Pacific islands and in Papua New Guinea.

What are its effects?

Spiked pepper grows to seven metres high, shading out or displacing crops or native vegetation. Its berry-like fruit is attractive to birds, fruit bats and other animals, which aid in dispersing its tiny seeds.

What's the risk to Australia?

The presence of spiked pepper in neighbouring Papua New Guinea represents a significant threat to our pastures and native landscapes. AQIS inspects plant and seed imports as well as examines imports of machinery for sowing to ensure it is not imported.

WITCHWEED

What is it?

There are about 60 species of parasitic witchweeds (*Striga*). *Striga asiatica* and *S. hermonthica* are the most widespread and cause major economic losses to agriculture around the world.

Where is it found?

Witchweeds have been reported in Africa, India, other parts of Asia, North America, Indonesia and Papua New Guinea. Two native species of *Striga* are present in Australia but these species are not weedy in their own environment.

What are its effects?

Witchweeds are not root parasites that damage cereal crops such as maize (corn), sorghum, rice and sugarcane, depriving them of water and nutrients.

Millions of tiny, dust-like seeds can be produced in a square metre of soil and are easily spread by wind or on the harvested crop, machinery or clothing.

Quarantine Matters!



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