



# Biosecurity @ BHI

Box Hill Institute

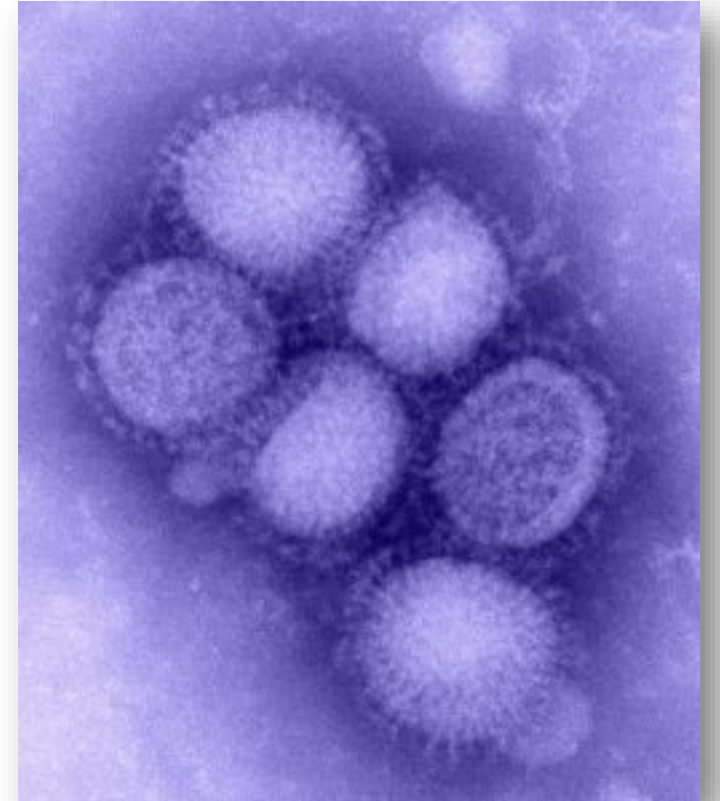


## What is Biosecurity?

- ✓ Animal Pathogens
- ✓ Plant Pathogens
- ✓ Zoonotic diseases
- ✓ Invasive Species

# Pests and Diseases

- Microbiology
  - Animal pathogens (including aquatic and avian diseases) e.g. *Foot and Mouth Disease, Avian Influenza*
  - Plant Pathogens e.g. *Xylella, Phytophthora*
  - Zoonotic diseases e.g. *SARS CoV-2 (COVID)*
- Plant Pests
  - Invasive plants and weeds e.g. *Water hyacinth*
  - Plant pests e.g. *Varroa mite (which kills bees), Giant African Snail*
- Animal Pests
  - Invasive animals e.g. *Feral cats, Cane toads, carp*



1918 Spanish Influenza

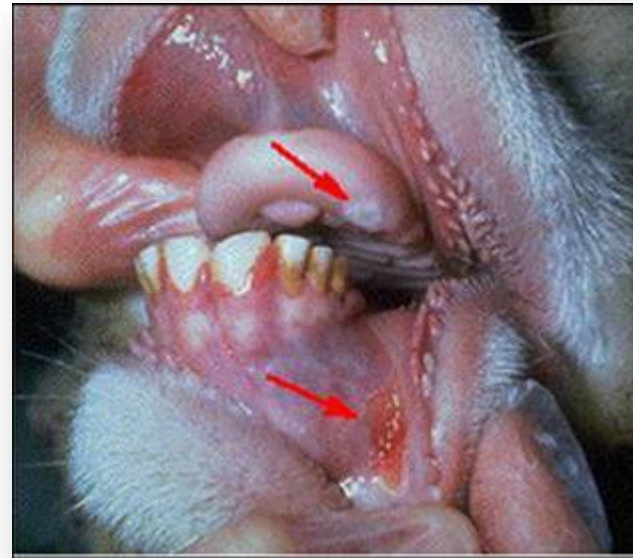
# Animal Diseases

## Foot and Mouth Disease

Foot and Mouth is one of Australia's greatest biosecurity threats.

Foot and mouth disease is a highly contagious viral disease that affects cloven-hoofed animals including **buffalo, pigs, cattle, sheep and goats**.

*Cattle slaughtered as a result of the 2001 Foot and Mouth outbreak in the UK*



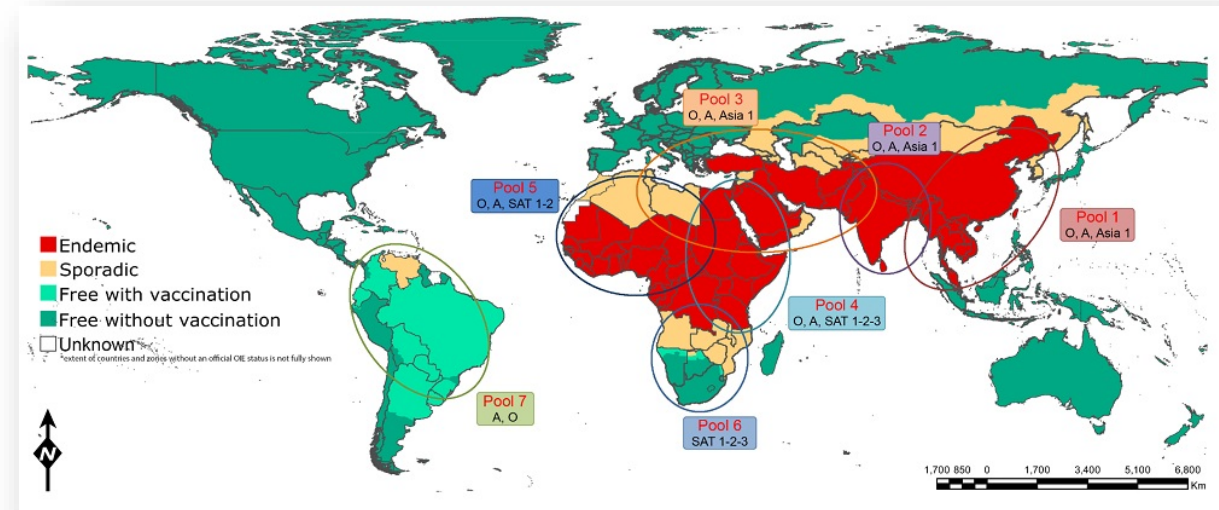
# Animal Diseases

## Foot and Mouth Disease

### Distribution

- Outbreaks are common in parts of Africa, the Middle East, Asia and South America.
- The outbreak in the UK and parts of Europe in 2001 has been disastrous, with millions of animals destroyed and billions of dollars of revenue lost.
- Australia is free from foot and mouth disease, and strict quarantine controls are in place to keep it out.
  - If an outbreak did occur, its spread could be so rapid that controls would not prevent the loss of our export livestock, meat and dairy produce markets.

*Global distribution of Foot and Mouth Disease*



*Dr. Antonello Di Nardo, Vesicular Disease  
Reference Laboratory, The Pirbright Institute*

# Animal Diseases

## Foot and Mouth Disease

- Where vaccination is not permitted, all affected and in-contact animals are usually slaughtered to eradicate the disease.

### The virus is carried by:

- Live animals
- Meat and meat products
- Soil
- Bones
- Untreated hides
- Vehicles and equipment used with animals.

*Meat products like these seized by customs in luggage at an Australian airport are high risk for FMD.*



# Animal Diseases

## Foot and Mouth Disease

### Identification

- Early signs include:
  - Fever, drooling and a reluctance to move.
  - Blisters appear on the mouth or snout, on the tongue, lips, between the hooves and on the feet.
  - The blisters rupture to expose raw, painful tissue.



Foot and mouth disease affects cloven-hoofed animals. The disease causes blisters on the mouth and snout and can affect whole herds within 48 hours.

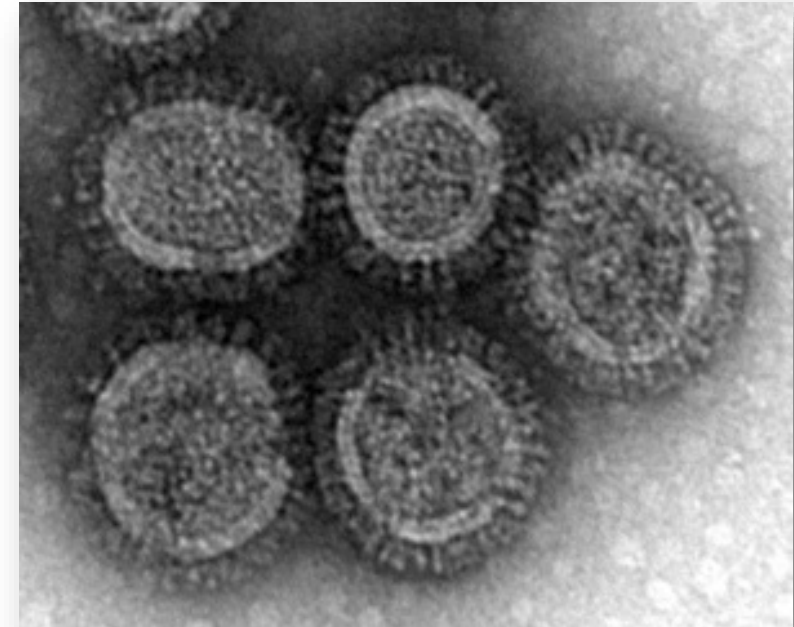
Image Source: North Dakota Dept Of Agriculture, <http://www.agdepartment.com> and Intervet/Schering-Plough Animal Health, [www.foot-and-mouth-disease.com](http://www.foot-and-mouth-disease.com)

# Animal Diseases

## Avian Influenza

- Viral disease that affects bird's respiratory, digestive and nervous systems.
- Affects many domestic and wild species including chicken, turkeys, quail, pigeons, ducks, geese, ostriches, etc.
- Wild birds can carry and spread the virus without showing signs of disease.

*Migratory wild birds are responsible spread of avian influenza across international borders. Interactions between wild and domestic can lead to disease outbreaks*



*Avian Influenza*

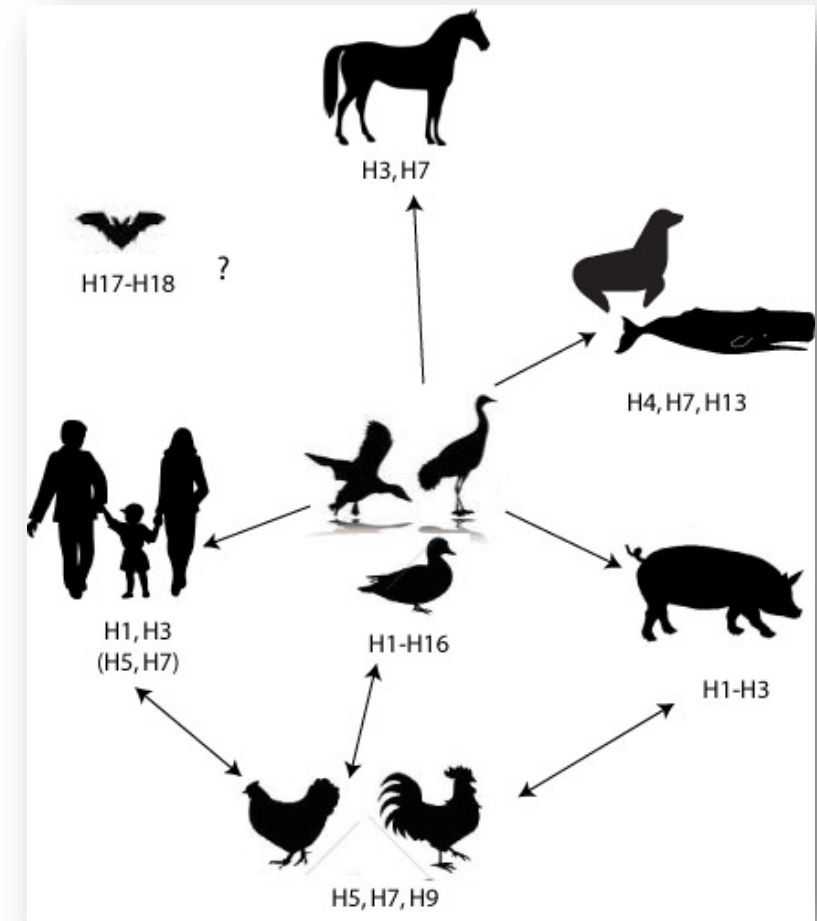


# Animal Diseases

## Avian Influenza

- The virus is transmitted through contact with faeces or discharges from the eyes and nostrils of an infected bird.
- It can be spread by contaminated footwear, clothing, equipment, feed, cages, machinery and the movement of infected birds.
- If a major outbreak happened, it would be very costly to the poultry industry, consumers, and taxpayers.
- In August 2020, three different strains of avian influenza were detected across six commercial production farms in Victoria. They have now been eradicated.
- In February 2021, Australia officially regained freedom from highly pathogenic avian influenza

*Avian influenza can be spread from wild birds to humans either directly or via intermediators*



# Plant diseases

## National Priority Plant Diseases



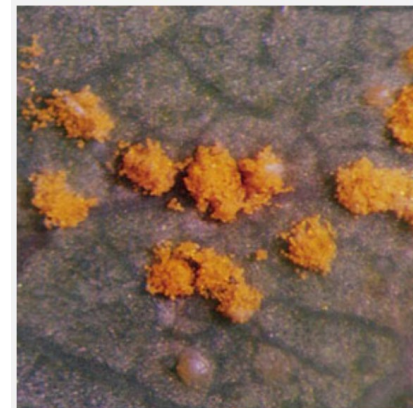
Potato late blight



Karnal bunt



Grapevine leaf rust



Guava (Eucalyptus) rust



Airborne phytophthoras



Ug99 (Wheat stem rust)



Barley stripe rust



Dutch elm disease



Panama disease



Texas root rot

# Invasive Plants

**Invasive species can be:**

– **Introduced weeds, but some are indigenous weeds**

For example:

## ***Acacia baileyana* or Cootmundra wattle**

- have been cultivated outside their limited native range
- adapted to the conditions
- escaped cultivation and become naturalised



[https://keyserver.lucidcentral.org/weeds/data/media/Html/acacia\\_baileyana.htm](https://keyserver.lucidcentral.org/weeds/data/media/Html/acacia_baileyana.htm)

[http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/0d08cd6930912d1e4a2567d2002579cb/weeds\\_trees\\_cootamundra](http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/0d08cd6930912d1e4a2567d2002579cb/weeds_trees_cootamundra)

# What is a weed?

## Weeds can be:

- A “plant growing out of place,” plants growing where they are not wanted, at least by some people, is a common, accepted explanation for what weeds are.

## *Examples:*

- Rogue potatoes spring up in your garden
- Strawberries running among vegies
- Vegetables growing in flower-beds
- But, when we refer to weeds, we really think of plants like couch, chickweed, knotweed and dandelion

*Couch grass*



*Chickweed*



*Knotweed*



*Dandelion*



# Weed Plants

- Several weed plants may cause substantial damage and losses if introduced to Australia:
  - Spiked Pepper
  - Erect Tar Vine
  - Witchweed (parasitic plant)
  - Hawkweed

*Spiked Pepper*



*Erect Tar Vine*



*Witchweed*



*Hawkweed*



*Hawkweed*



# Plant Pests

## Giant African Snail

- The world's most destructive pest of fruit and vegetables
- Can grow up to 30cm long and weighing up to a Kilogram
- Can tolerate cold or adverse conditions by retreating to its shell and remaining dormant for several months
- Can carry the lungworm parasite which infects humans (eating raw or improperly cooked snails) and causes meningitis
- It has been recorded attacking eucalypt trees
- Risk of introduction through soil (eggs), plant material, shipping containers, machinery and motor vehicles, illegal importation as pets
- At risk over 500 affected plant species

*The giant African snail (*Lissachatina fulica*) is the worlds most destructive pest of fruit and vegetables*

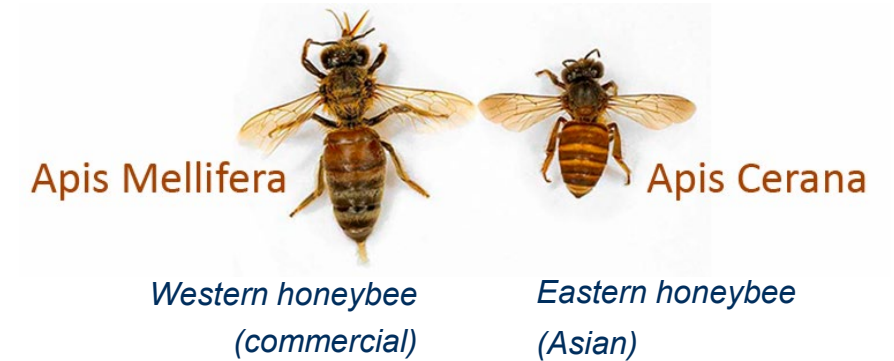


# Plant Pests

## Varroa mite

Varroa originated in Asia as a natural parasite of the Eastern honeybee (*Apis cerana*)

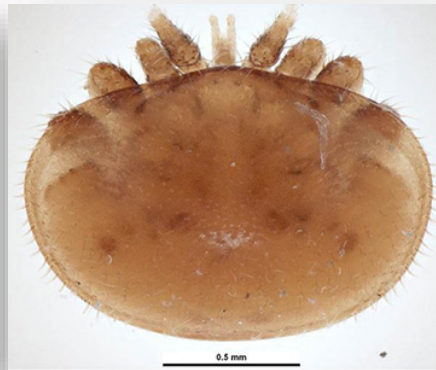
- Original species *Varroa jacobsoni* had multiple genetic variants and was first discovered on the island of Java
- In 2000 *Varroa destructor* was used to describe a genetic subset that were larger in size.
- *V. destructor* jumped to the Western honeybee (*Apis mellifera*) and spread worldwide



Varroa on mature bee



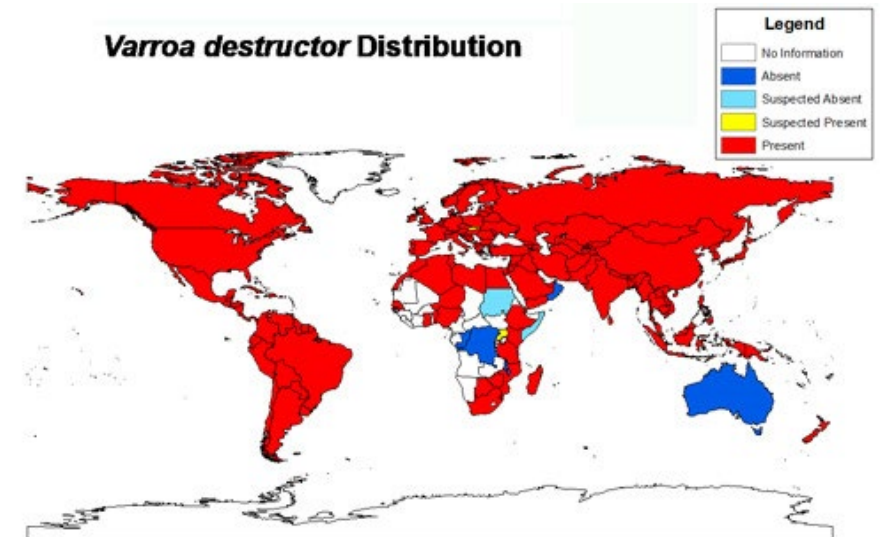
Varroa destructor



Varroa on larvae



**Varroa destructor Distribution**



# Plant Pests

## Varroa mite

Varroa is an external parasite of bees

- Spreads naturally between bee colonies by travelling on the bees
- Weakens the bees, shorten their lives, or causes death from virus infections
- Unless urgent actions is taken, the vitality of bees in the colony declines until all are dead
- Many crops rely on bees for pollination including almonds, avocados, cotton, stone fruits, pome fruit, melons and pumpkins

Not present in Australia

- Strict quarantine measures are applied on live bees import and bee and honey products

*Varroa eggs are laid in the cell of a bee larva. The young mites feed upon the growing pupa then emerge on the adult bee where they feed on the bee's body fat*





# Plant Pests

## Varroa mite

*Exotic bee populations such as this swarm on imported machinery present a high risk of a Varroa mite incursion*

### National Sentinel Hive Program

- Substantial economic cost of a Varroa mite incursion
- Requires appropriate monitoring and surveillance arrangements to be in place to support early detection.
  - Use a mix of approaches at or around possible entry points (ports and airports)
  - Include sentinel hives and bait hives (traps) that contain pheromones to attract bees.
- The mix of hives and traps need to be in sufficient numbers with regular inspection to increase the likelihood of early detection.



# Plant Pests

## Varroa mite

At high risk ports other surveillance techniques are included:

- Remote surveillance of hives

Greater number of catch boxes and floral sweep netting

- Increases the likelihood of quickly detecting the arrival of any pest bees including:
- exotic strains of Asian honey bee (*Apis cerana*), Red dwarf honey bee (*Apis florea*), and Giant honey bee (*Apis dorsata*)

*Solar powered 'Purple Hives' with artificial intelligence and 360-degree camera technology are being trialled at the Port of Melbourne in a collaboration between industry and the Victorian government*

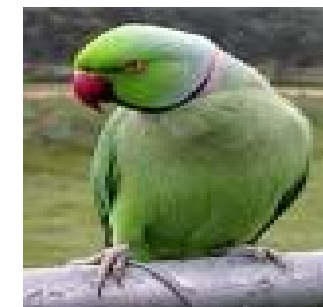


# Animal Pests

Animal pests can be described many different ways:

For example:

- Feral
- Exotic, introduced, alien, non-indigenous
- Invasive
- Pest



# Animal Pests

## Cane Toad

- The Cane Toad is a 'key threatening process' after the Australian government added it to the Environmental Protection and Biodiversity Conservation Act 1999.
- Introduced to Australia in 1935 from South America via Hawaii.
- It was an attempt to control the native-to-Australia cane beetle that was killing the sugar cane crops

<https://theculturetrip.com/>

*Poisonous Cane Toads have spread across much of northern Australia threatening many native species*



# Animal Pests

## European Rabbit

- The European Rabbit was introduced in 1857 for recreational hunting and food
- It is a prolific breeder, and causes damage to crops, killing young trees in orchards and forests, and being responsible for erosion problems.
- Rabbits have become one of the most significant factors in the loss of native plant species in Australia.

*Poisonous Cane Toads have spread across much of northern Australia threatening many native species*



# Animal Pests

## Feral Cat

- Europeans probably introduced cats into Australia in 1849 as pets.
- Whilst being the same species as domesticated cats, feral cats who escaped learned to live and reproduce in the wild, surviving on their skills to hunt and scavenge across the land.
- Responsible for carrying infectious diseases feral cats have been known to harm domestic livestock and humans, feral cats may also endanger threatened animals such as the bilby, bandicoot, numbat, and bettong.

*Feral cats are highly efficient killers of native animals and endanger several threatened species of Australian marsupial*



# Animal Pests

## Red Imported Fire Ants

- The Red Imported Fire Ant (fire ants) is a small colonial ant that is a native to Paraguay
- Fire ants sting in synchrony initiated by an alarm pheromone and the stings result in painful pustules, which may take weeks to heal.
- Its stinging ability allows it to repel larger vertebrate competitors from resources.
- People, stock, wildlife and domestic pets are readily stung if they disturb a nest and this can induce anaphylactic shock in sensitive individuals.

*Fire ants are opportunistic feeders, omnivorous and predate on invertebrates, vertebrates, and plants, destroy seeds, harvest honeydew from specialised invertebrates and also scavenge*



# Animal Pests

## Red Imported Fire Ants

- Fire ants were first detected in Queensland in 2001. Since then incursions were detected in QLD, NSW and the latest in WA (under a cost-shared eradication response).
- Fire ants have the potential to invade much of Australia.
  - Predictive studies showed that fire ants have the potential to occupy most arable land areas on mainland Australia within the next 30 years.
- The current threat is to the native flora and fauna. However, the fire ant could cause significant damage to the biodiversity throughout Australia if it spreads either naturally by winged ant dispersion or by human assisted means.



### Description

Small 2-6 mm

Variety of sizes within each nest

Head & body are coppery-brown,  
abdomen is darker

Aggressive, particularly near the nest

Inflicts a painful sting

Image Source: <http://www.dpi.qld.gov.au/>