NATIONAL FERAL PIG ACTION PLAN

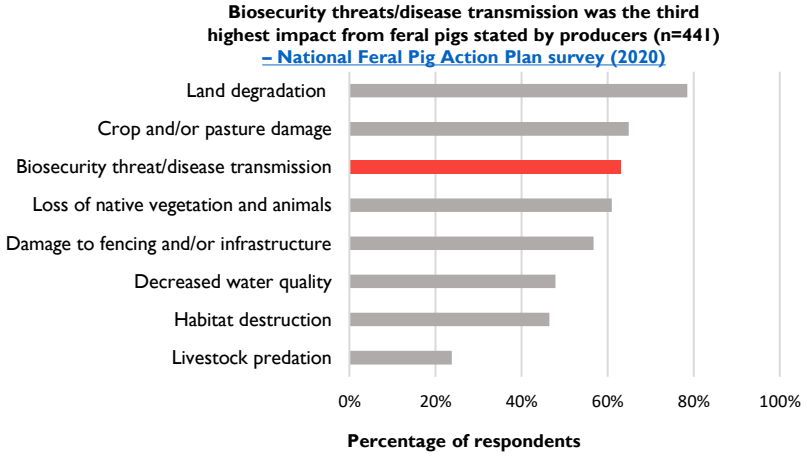
Parasites of feral pigs – what's hidden within

Feral pigs can harbour and transmit many different types of parasites of concern to humans, livestock, and companion animals.

This booklet summarises some of the most important and common parasites of feral pigs. Not much is known about the presence and impacts of these parasites in feral pigs in Australia and the hidden costs they may incur.

Risks and consequences:

- Productivity losses due to reduced lambing rates, abortions of stock etc.
- Financial impacts
- Human, livestock, wildlife, and companion animal health risks
- Condemnation of carcases and non-carcase parts by meat inspectors
- Costs of parasite prevention and treatment to producers
- Ongoing disease transmission
- Secondary disease transmission risks



With the widespread distribution of feral pigs in the landscape, there are risks of co-mingling (and subsequent parasite transmission) with commercial livestock, domestic pets and people.

How to avoid infection and transmission of feral pig parasites:

- Break the life cycle of parasites by reducing feral pig populations in the environment
- Ensure regular and timely livestock and pet parasitic control regimens
- Establishment, and regular maintenance of, predator exclusion fencing around properties to ensure minimal contact between feral pigs and livestock
- Don't feed offal from feral pigs to other animals or allow access to refuse sites
- When handling pigs (live or carcases):
    - Regularly wash hands
    - Protective clothing, footwear and gloves should be worn
- Ensure feral pig meat is:
    - Frozen for at least 5 days
    - Cooked thoroughly
- Wash fruits and vegetables from the garden thoroughly
- Ensure hygienic practices are being applied

About parasites and their lifecycles:

Parasites are organisms that live and feed off another host during at least one part of their life cycle, if not their entire life. These organisms are usually detrimental to the health of the host and can cause clinical and sub-clinical disease, and sometimes death.

Definitions:

- **Definitive host -** the animal in which the adult stage of a parasite lives, the main host.
- **Intermediate host -** a required host that carries the larval stage of a parasite
- **Paratenic host -** a host that is not required but can act to transport a parasite between one host and another.
- **Zoonotic –** a parasite that can spread from animals to humans

Endoparasites

Endoparasites harboured by feral pigs can be found in their muscles, gastrointestinal tract, and in their organs including the liver, lungs and brain.

Toxoplasma gondii

Toxoplasma gondii is a significant zoonotic organism and can be transmitted by the consumption of infected muscle, water and faecal matter. Infection can result in early embryonic death, abortion, stillbirth and neonatal death.

Zoonotic: Yes
Present in Australia: Yes
Definitive hosts: domestic and feral cats
Intermediate hosts: rodents, birds
Paratenic hosts: mammals including pigs, sheep, cattle and kangaroos

How do humans and animals get infected:

- Eating undercooked/raw meat with tissue cysts is the main source of infection for humans
- Ingesting oocysts present in contaminated water
- Congenital transmission
- Not washing vegetables thoroughly
- Poor hygiene after handling cat litter

Clinical signs and impacts:

- Asymptomatic in 80% of human cases
- Flu-like symptoms including swollen lymph nodes
- Muscle aches and pains
- Damage to the brain, eyes, or other organs

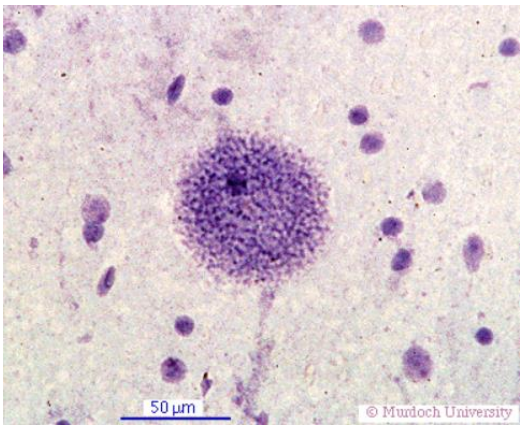


Photo: *Toxoplasma gondii* tissue cyst in a mouse brain
Supplied by Murdoch University, WA

For more information, see:

- Dubey, J.P. (2012) High prevalence and genotypes of *Toxoplasma gondii* isolated from organic pigs in northern USA, *Veterinary Parasitology*, 188: 14-18.
- Borkens, Y. (2021) *Toxoplasma gondii* in Australian macropods (Macropodidae) and its implication to meat consumption, *International Journal of Parasitology: Parasites and Wildlife*, 16: 153-162.
- Toxoplasmosis of Australian mammals - Wildlife Health Australia website

Cryptosporidium, Giardia, Balantidium and *Entamoeba*

Water-borne pathogens

All of these are important waterborne zoonotic pathogens that pose major threats to drinking water quality to humans, livestock and wildlife.

Zoonotic: Potentially, depends on which species they are infected with
Present in Australia: Yes
Definitive hosts: most mammals

How do humans and animals get infected:

- Swimming in, or ingesting, contaminated water

Clinical signs and impacts:

- Diarrhoea
- Abdominal pain
- Lethargy

Managing infection risks:

- Protect drinking water catchments from feral pigs
- Foraging and wallowing behaviour of feral pigs can contaminate water supplies and increase its turbidity

Photos: Wallows from feral pigs

For more information, see:

- Hampton et al (2006). Prevalence of zoonotic pathogens from feral pigs in major public drinking water catchments in Western Australia, *EcoHealth*, 3: 103-108

Endoparasites

Echinococcus granulosus

Hydatid

This parasite can cause life-threatening hydatid cysts in vital organs of livestock, wildlife and humans.

Zoonotic: Yes
Present in Australia: Yes
Definitive hosts: domestic and wild dogs, dingoes
Intermediate hosts: mammals (usually non-carnivorous)
How do humans and animals get infected:

- *Dogs*: eating infected animals or offal
- *Humans and other intermediate hosts*: ingesting eggs from canid faeces

Clinical signs and impacts:

- Acute liver disease, anaemia and progressive weakness.

Notes:

- In intermediate hosts, hydatid cysts form in the liver, lung, brain etc.
- Production losses by way of less milk and meat productivity and decreased fecundity
- Carcase condemnation of infected livestock - unfit for consumption
- Pigs can act as a reservoir in the environment and canids get infected by ingesting raw, infected meat
- Role of feral pigs in disease transmission has not been quantified
- Humans cannot get infected by ingesting infected meat

Photo: Hydatid cysts in liver,
Specimen supplied by Murdoch University

For more information, see:

- Hydatid disease - Business Queensland website
- Jenkins DJ. Echinococcus granulosus in Australia, widespread and doing well! Parasitology International 2006;55 Suppl:S203-6. doi: 10.1016/j.parint.2005.11.031. Epub 2005 Dec 13. PMID: 16352462.

Taenia solium

Pork tapeworm, pig measles

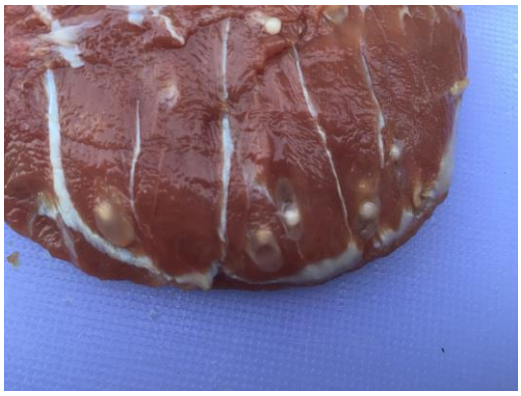
This parasite affects the musculature of pigs

Zoonotic: Yes
Present in Australia: Not as a transmittable risk
Definitive host: humans
Intermediate hosts: pigs and humans
How do humans and animals get infected:

- Eating undercooked/ raw contaminated meat
- Poor personal hygiene
- Drinking water contaminated with faeces and tapeworm eggs from a human infected by the adult worms

Clinical signs and impacts in humans:

- Flu-like symptoms including swollen lymph nodes
- Muscle aches and pains
- Malnutrition
- Neurological and epileptic signs



Photos: *Taenia solium* cysts in masseter muscle
Supplied by Marshall Lightowlers, U. Melbourne

Notes:

- The cysticerci can be rendered harmless by either freezing or cooking sufficiently. Cysticerci will be rendered non-viable if cooked at 50 °C for >40 minutes or dead if cooked at 10 minutes to a core temperature of 80 °C.
- Condemnation of infected livestock – unfit for human consumption
- Transmission of this parasite requires human faecal contamination
- High levels of sanitation in Australia should prevent the establishment of this parasite
- There are other species of *Taenia* that can affect feral pigs, but this species is considered to have the highest potential impact.

For more information, see:

- Taeniasis - Victorian Department of Health
- Pork tapeworm: 1st locally acquired neurocysticercosis case reported in Melbourne, Australia - Outbreak News Today, 3 October 2020

Endoparasites

Spirometra spp

Zipper worm, sparganosis

This parasite affects the musculature of pigs and other mammals.

Zoonotic: Yes
Present in Australia: Yes
Definitive hosts: dogs, cats, foxes and dingoes
Intermediate and paratenic hosts:

- Fresh water invertebrate
- Reptiles, amphibians, birds, and small mammals including pigs

How do humans and animals get infected:

- Eating inappropriately cooked meat of paratenic or intermediate hosts
- Drinking from/ swimming in untreated water sources i.e. lakes/dams/streams

Clinical signs and impacts:

- Neurological issues with symptoms including:
  - weakness
  - headache
  - seizures

Photo: *Spirometra* sp. plerocercoid
© Lance Wheeler, 2018, Courtesy of photographer: Kaitlan Hovis, www.veterinaryparasitology.com

For more information, see:

- Tran, R. et al (2019) Sparganosis: an under-recognised zoonosis in Australia?, *BMJ Case Reports*, 12; e228396
- Sparganosis - DermNet NZ

Fasciola hepatica

Liver fluke

Fasciola hepatica is a threat to domestic livestock where there is habitat overlap with feral pigs
Zoonotic: Yes
Present in Australia: Yes
Definitive hosts: Any mammals including cattle, sheep, horses, kangaroos, pigs and humans
Intermediate hosts: fresh water snail
How do humans and animals get infected:

- Ingesting the larval stage (cercariae) in contaminated water sources or
- Ingesting larvae from the grass on the waters edge.

Clinical signs and impacts:

- Acute liver disease, anaemia and progressive weakness.

Notes:

- Drug resistance to common antiparasitic drug
- Present in Eastern Australia but not in Western Australia. Efforts are in place to prevent entry into WA.
- In endemic regions, 100% of the animals can be infected. It is particularly harmful, even fatal for sheep
- The establishment of this parasite in Western Australia, would be financially devastating to the livestock industries, as eradication would be almost impossible

Photo: Adult *Fasciola hepatica*
Specimen supplied by Murdoch University

For more information, see:

- Liver Fluke in Western Australia - DPIRD WA
- Liver Fluke - a review - DPI NSW

Strongyloides ransomi

Threadworm

This parasite affects the gastrointestinal tract of pigs.

Zoonotic: No
Present in Australia: Yes
Definitive hosts: pigs
How do pigs get infected:

- Ingestion of larvae in dirt
- Skin penetration
- Suckling pigs can be infected by drinking infected colostrum

Clinical signs and impacts:

- Enteritis
- Severe diarrhoea (often bloodstained)
- Anaemia
- Poor growth
- Death

Notes:

- Piglets up to 8 weeks of age are most susceptible
- In domestic pigs, death rates up to 75% have been reported

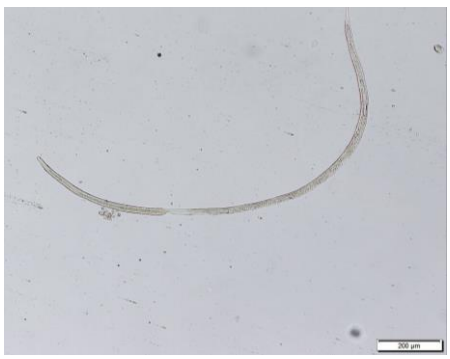


Photo: *Strongyloides* spp
Supplied by Aileen Elliott, Murdoch University, WA

For more information, see:

- Thamsborg, S. et al (2016). *Strongyloides* spp. infections of veterinary importance. *Parasitology*, 144; 274-284

Endoparasites

Ascaris suum

Large roundworm

Large roundworm is the most important gastrointestinal worm of pigs.

Zoonotic: Yes
Present in Australia: Yes
Definitive hosts: pigs
How do humans and animals get infected:

- Picking up eggs from the environment
- *Humans*: Poor personal hygiene (e.g. not washing hands)

Clinical signs and impacts in pigs:

- Loss of appetite
- Vomiting
- Poor feed efficiency and slow growth
- Liver damage from parasite migration
- Death

Clinical signs and impacts in other animals:

- Pneumonia
- Liver damage
- Diarrhoea
- Malnutrition

Notes:

- Eggs can survive in the environment for a number of years so prophylactic treatment within the host is important
- If present in feral pigs, population control strategies should be applied

Identifying features in a pig

- Presence of 'milk/white spots' on the liver

Photo: *Ascaris suum* in pig intestine
Specimen supplied by Murdoch University

Photo: Typical "white spot" lesions in the liver caused my migration of immature *A. suum*
Provided by Patricia Holyoake

For more information, see:

- Ascaris suum- Atlas of Living Australia
- Ascariasis from pigs FAQS- CDC
- Got Pigs? Got worms? - CDC

Trichuris suis

Whipworm

This parasite affects the large intestine of pigs.

Zoonotic: Potentially
Present in Australia: Yes
Definitive hosts: Pigs
Transmission risk: Humans
How do humans and animals get infected:

- Ingesting eggs from contaminated soil
- Using contaminated soil/manure on vegetable gardens

Clinical signs and impacts in pigs:

- Similar to swine dysentery
- Bloody diarrhoea and shedding of mucus
- Weight loss

Notes:

- There is some controversy as to whether the species that infects humans is the same as for pigs.

Photo: *Trichuris suis*
Supplied by Aileen Elliott, Murdoch University, WA

For more information, see:

- Pittman, J. S. et al (2010). *Trichuris suis* in finishing pigs: Case report and review. *Journal of Swine Health and Production*, 18; 306-313

Endoparasites

Stephanurus dentatus

Kidney worm

Zoonotic: No
Present in Australia: Yes
Definitive hosts: Domestic and feral pigs
How do pigs get infected:
- From non regular rotation of pig in paddocks or contaminated dirt

Clinical signs and impacts in pigs:
- Clinical signs rare
- In heavy infections poor appetite, weight loss and weakness

For more information, see:
- *Stephanurus dentatus* in swine - Parasitipedia
- Swine Kidney Worm infection - MSD Manual

Photo: *Stephanurus dentatus* worm in kidney fat
Supplied by Aileen Elliott, Murdoch University, WA

Metastrongylus spp.

Lung roundworm

Zoonotic: No
Present in Australia: Yes
Definitive hosts: Pigs
Intermediate hosts: Earthworm
How do pigs get infected:
- Ingesting infected earthworms

Clinical signs and impacts:
- Only mildly pathogenic.
- High lungworm infections can also lead to bacterial infections that reduce the lung capacity of the host and can cause the mortality of young pigs

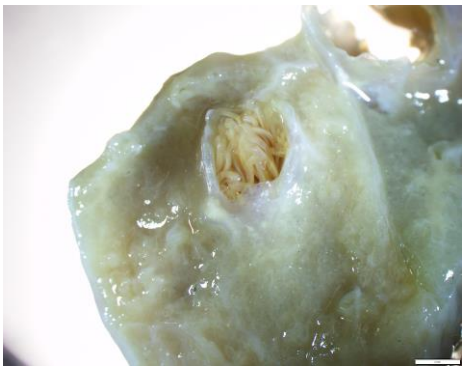


Photo: *Metastrongylus* sp. in lung tissue
Supplied by Aileen Elliott, Murdoch University, WA

For more information, see:
- Wallgren, P. and Pettersson, E. (2022). Lungworms (Metastrongylus spp.) demonstrated in domestic pigs with respiratory disease: was there a clinical relevance? Porcine Health Management. 8

Trichinella spiralis

Trichinellosis

Trichinella spiralis infection is a notifiable disease in Australia.
Zoonotic: Yes
Present in Australia: No
Definitive hosts: Mammals
Transmission risk: Domestic and wild animals, and humans
How do humans and other animals get infected:
- Eating uncooked meat

Clinical signs and impacts:
- Pain
- Muscle weakness
- Death

Notes:
- Infection is most common in rodents and carnivores
- It is likely that all mammalian species can serve as suitable hosts

Photo: *Trichinella spiralis* in muscle
Supplied by Aileen Elliott, Murdoch University

For more information, see:
- Trichinellosis and Australian Wildlife - Wildlife Health Australia
- Trichinella - ScienceDirect

Ectoparasites

Ectoparasites are usually invertebrates that are found on the outside of a feral pig e.g. mites, ticks and lice.

- If a feral pig is infested with ectoparasites, you will notice mud wallows and rub marks on trees.
- Feral pigs wallow in mud to not only aid in thermoregulation but to kill ectoparasites. They then scratch themselves on trees, posts or fences to mechanically remove the mud and ectoparasites.
- These rubbing behaviours expend considerable amounts of energy.

Photo: Rubbings on a tree from a feral pig

Haematopinus suis

Swine louse

Clinical signs and impacts:

- Mild irritation
- Scratching
- Heavy infestations may affect weight gain and feed efficiency of domestic livestock

Notes:

- Only found on pigs
- Are known to carry and transmit classical swine fever (CSF)

For more information, see:

➢ Lice in pigs - MSD Manual

Photo: *Haematopinus suis*
Supplied by Aileen Elliott, Murdoch University

Sarcoptes scabiei

Mite, mange

Transmission risk: humans, pets, livestock and wildlife.

Clinical signs and impacts:

- Frequent scratching
- Hair loss
- Skin damage with secondary infection
- General loss of condition

Notes:

- Most significant mite that feral pigs carry
- Many infestations go unnoticed
- Economically significant as it causes:
  - Morbidity
  - Mortality
  - Decreased fertility
  - Reduced feed conversion ratio in livestock
- Potential to spread to native wildlife, including wombats and southern brown bandicoot

For more information, see:

➢ Mange in pigs - MSD Manual

Photo: *Sarcoptes scabiei*

Ectoparasites

Amblyomma spp.

Tick

Transmission risk: humans, companion animals, livestock and wildlife.

Clinical signs and impacts:

- Frequent scratching
- Hair loss
- Skin damage with secondary infection
- Loss of body condition

Notes:

- Multiple species of *Amblyomma* have been found on feral pigs including
  - *Amblyomma triguttatum triguttatum*
  - *Amblyomma breviscutum* (initially reported as *A. cyprium*) in Cape York, assumed introduced with pigs from Papua New Guinea
- *A. triguttatum triguttatum* can carry Rickettsia spotted fever and Q fever

Photo credit: Caroline Harding, Museum Victoria

For more information, see:

- Li, A. et al 2010 High prevalence of *Rickettsia gravesii* sp. nov. in *Amblyomma triguttatum* collected from feral pigs. *Veterinary Microbiology*. 146; 59-62

Ixodes australiensis

Tick

Transmission risk: humans, pets, livestock and wildlife.

Clinical signs and impacts:

- Frequent scratching
- Hair loss
- Skin damage with secondary infection
- Loss of body condition

Notes:

- Can carry Rickettsia spotted fever

Photo: *Ixodes australiensis* dorsal and ventral view
Supplied by Aileen Elliott, Murdoch University, WA

For more information, see:

- Li, A. et al 2010 High prevalence of *Rickettsia gravesii* sp. nov. in *Amblyomma triguttatum* collected from feral pigs. *Veterinary Microbiology*. 146; 59-62

Ornithodoros gurneyi

Soft tick

Clinical signs and impacts:

- Scratching
- Hair loss
- Skin damage with secondary infection

Photo: *Ornithodoros gurneyi*
Image by S. Ong

Notes:

- Ticks from the genus *Ornithodoros* act as vectors of African swine fever (ASF) between pigs. The role of *O. gurneyi* in the transmission of ASF in Australia has not been confirmed.
- *Ornithodoros* are vectors of *Coxiella* bacteria (Q fever)
- These ticks are often found in burrows or in the environment and only stay on a host for a meal
- Not host specific

For more information, see:

- Quinat, C. et al 2016 Transmission routes of African swine fever virus to domestic pigs: current knowledge and future research directions. *Veterinary Record*. 178; 262-267

Further resources:

- Managing Vertebrate Pests: Feral Pigs - PestSmart
- Controlling worms - Department of Agriculture and Fisheries, Queensland
- Thompson, RCA. et al 2003, Parasites and biosecurity – the example of Australia. *Trends in Parasitology*. 19; 410-416
- Internal Parasites of pigs - NSW DPI
- External parasites of pigs - DPI NSW
- Pathogens in vertebrate pests in Australia - PestSmart