NSW GOVERNMENT Department of Primary Industries

primefact

Tick fever – Technical information for veterinarians

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Animal Biosecurity and Welfare, NSW DPI

What is tick fever

Tick fever or "redwater" is an economically important tick-borne disease of cattle, particularly in Northern Australia. It causes significant economic losses through mortalities, abortions, ill thrift and lost milk production.

Tick fever refers to both Babesiosis and Anaplasmosis and results from infection by the red blood cell paraites *Babesia bovis, Babesia bigemina* and *Anaplasma marginale*. These organisms are spread by cattle tick (*Rhipicephalus (Boophilus) microplus or australis)*, the most serious external parasite of cattle in Australia. Outbreaks of tick fever parallel the distribution of cattle tick which is endemic in higher rainfall areas of Northern Australia. If unrestricted by regulation, cattle tick would be endemic in much of coastal NSW north of Sydney. In the tableland and slopes of NSW winter temperatures would probably prevent cattle tick becoming endemic but it could still cause serious problems in the warmer months.

Cattle ticks and tick fever are both notifiable in NSW under the *NSW Biosecurity Regulation 2017* and surveillance along the NSW and Queensland border is aimed at preventing entry of cattle tick into NSW from the tick infested area of SE Queensland.

Strategies such as chemical tick control, resistant cattle genotypes, regional eradication programs for ticks and tick fever, and grazing management are all employed to control cattle tick and tick fever.

Occurrence in Australia

The three principal tick fever organisms have world wide distribution in tropical and subtropical areas. Tick fever was first introduced into Australia in the nineteenth century, when cattle ticks were introduced with animals from Indonesia, and occurs wherever cattle ticks are endemic, predominantly in the warm, humid regions of Northern Australia.

Outbreaks of tick fever in NSW were common up until the 1970s averaging 10 outbreaks per year. Since then outbreaks have become less frequent averaging an outbreak every 1 to 2

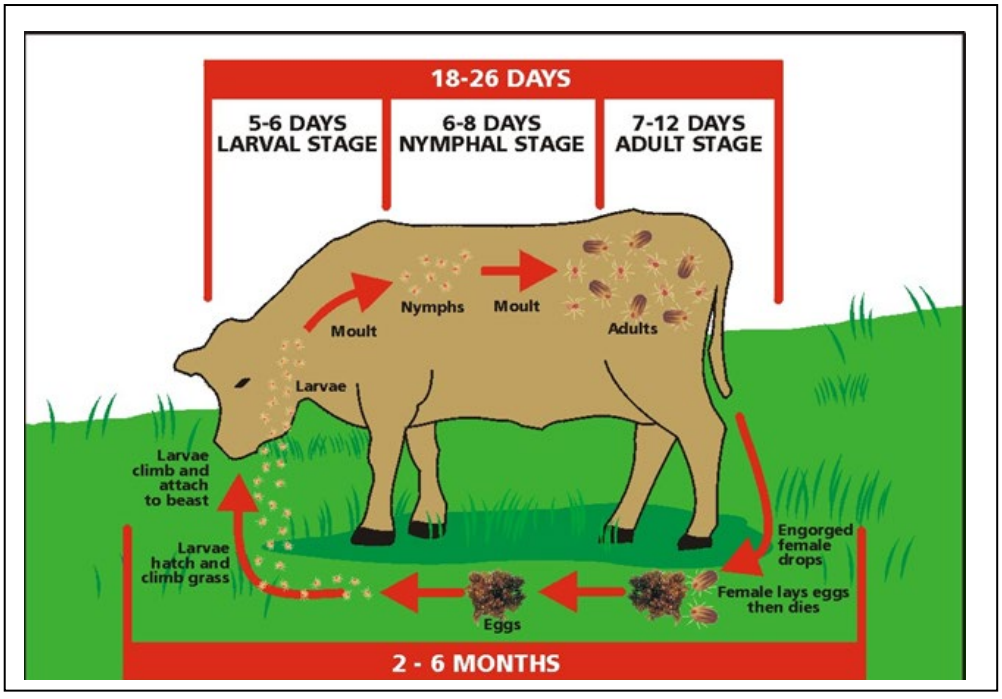
per year and in most affected herds only a small number getting infected.. Outbreaks of tick fever mimic infestations of cattle tick with more tick fever outbreaks when cattle tick infestations are high.

In Australia *B. bovis* causes around 80% of tick fever outbreaks each year, and is the most pathogenic of the tick fever organisms. *B. bigemina* accounts for around 7% of cases and Anaplasma is responsible for around 13% of tick fever cases.

Anaplasmosis has only been rarely recorded in NSW and, as in Qld, most NSW outbreaks of tick fever have been due to *B. bovis* infection. In one beef herd in northern NSW which had tick fever due to *B. bovis* causing mortalities, anaplasmosis was also diagnosed about 4 weeks later when the herd experienced an abortion storm. The herd had been on a ML pour on program but male ticks would still have been viable as ML pour affect reproductive viability of female ticks and are not contact killers like amitraz.

Rhipicephalus (Boophilus) microplus requires high humidity and ambient temperatures for optimal egg hatching. The low winter temperatures in much of inland and southern NSW would limit the ability of cattle tick to become established permanently in many areas. The environmental or non-parasitic stage can last 6-9 months depending on the climatic conditions while the animal or parasitic stage lasts around 21 days (range 18-35) It is a one host tick with all development (larvae→nymph→adult) occurring on the one host at approximately 7 day intervals.

Life cycle of cattle ticks



Images courtesy of Qld Department of Agriculture and Fisheries

Epidemiology of tick fever

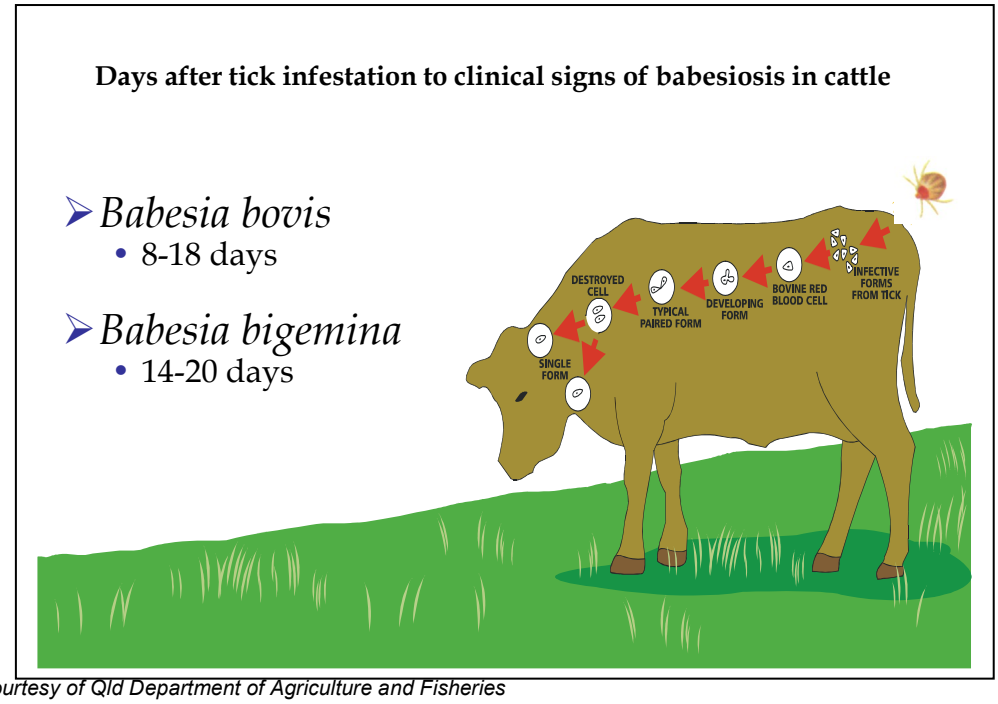
Infection with Babesia organisms occurs via tick saliva while ticks are feeding on cattle. These organisms enter the host's red blood cells and multiply causing their destruction. The life

cycle in the ticks is continued when uninfected ticks ingest Babesia organisms while feeding on host blood. Infection of the eggs occurs resulting in a new generation of infected tick larvae.

In *B. bovis* infection it only takes 2-3 days for the *Babesia* organisms to develop to an infective stage in ticks, so larval ticks are the stage which transmits the *B. bovis* organisms to cattle. For *B. bigemina* it takes about 9 days so nymph and adult stages both transmit infection.

Although only one tick is necessary to spread tick fever, only a very small proportion of cattle ticks carry the tick fever organisms. It is estimated that only 1 in 5000 cattle ticks will be infected with *B. bovis* while for *B. bigemina* it is 1 in 500.

Additional cases of tick fever can still occur in herds under cattle tick treatment particularly if there are high populations of cattle tick present in the environment. Contact killers like amitraz are not persistent and the Macrocylic Lactones (MLs) rely on ticks taking a blood feed to be effective so particularly in the case of *B. bovis* infection which is the commonest form of tick fever and spread by larval ticks transmission of infection can occur before the chemical can affect the tick. However as mentioned above tick infection rates with tick fever organisms are low so as soon as tick numbers drop the risk is much lower and further cases of tick fever will be unlikely.

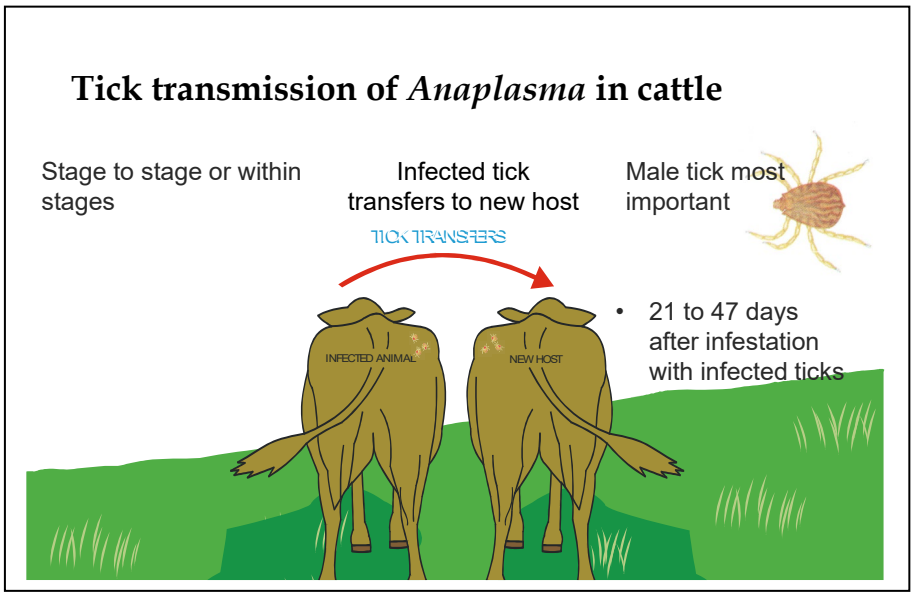


Images courtesy of Qld Department of Agriculture and Fisheries

Anaplasmosis due to *A. marginale* infection is also transmitted by cattle ticks but as well can be spread mechanically by blood contaminated equipment such as syringes, needles and gloves and by intra- uterine infection.

Male cattle ticks are the main vectors of transmission. They live longer (over 2 months) than the females and can move directly from one animal to another if they are in close contact.

Spread occurs when an infected male tick moves from an infected host to an uninfected host and transmits the organism to the susceptible host during feeding. Female ticks can also spread anaplasmosis but unlike Babesia infection, in ticks there is no transovarial passage.



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Clinical signs of tick fever in cattle

Babesiosis: as a result of infection with *B. bovis* or *B. bigemina*

- *Babesia bovis* causes severe disease with large numbers of sick and dying cattle with:
  - a fever higher than 40°C for several days
  - anorexia, depression and weakness with reluctance to move
  - increased respiratory rate particularly on exertion
  - high susceptibility to stress, particularly when driven, leading to collapse and death
  - muscle tremors
  - nervous signs such as circling, head pressing, mania and convulsions (cerebral babesiosis)
  - red urine (haemoglobinuria) and in later stages, anaemia and jaundice
  - diarrhoea
  - abortion
  - temporary fertility loss in bulls from the fever
  - death within days of the onset of fever.
- Babesia bigemina causes clinical signs to develop later in the infection and animals do not appear as sick as with *B. bovis*:
  - rapid onset, severe anaemia and jaundice – death can occur with little warning
  - haemoglobinuria, earlier and more consistently than with *B. bovis*.
  - nervous signs are not seen.

Generally symptoms are most severe in adult cattle and losses may be high. Animals showing nervous signs usually die. Young animals are usually asymptomatic. Recovery in older animals may take several weeks and bulls may have reduced fertility for six to eight weeks after infection.

Bos indicus type cattle are more resistant to infection than *Bos taurus* breeds and illness if present is more likely to be subacute.

Anaplasmosis: as a result of infection with *A. marginale*

Anaplasma has a longer incubation period than Babesia with clinical signs appearing around 3 -6 weeks after infection. Anaemia is a feature of anaplasmosis and many of the clinical signs reflect the anoxia associated with anaemia:

- weakness and respiratory distress, particularly after exercise
- pale mucous membranes
- Jaundice is common usually as animals are recovering
- Fever is mild peaking at around 40°C but usually transient and not a dominant feature of anaplasmosis.
- haemoglobinuria is not a feature but urine may be dark due to bile pigments urine will be stained due to bile pigments
- Subacute illness is more common particularly in younger animal but adult animal may show acute infection and die.

Like babesiosis, the severity of disease increases with age. Severe outbreaks are accompanied by abortions. Unlike the situation with Babesia infection, *Bos indicus* cattle are as susceptible as *Bos taurus* cattle to Anaplasmosis.

Notification

Tick fever is a notifiable disease under the *NSW Biosecurity Regulation 2017*. Members of the public, including veterinary practitioners and other persons consulted about stock, are required to notify an authorised officer in LLS or NSW DPI about any known or suspected cases of tick fever or cattle tick.

This can be by contacting the local LLS or NSW DPI office or NSW laboratory service at EMAI.

Gross pathology

In Babesia infection the spleen is enlarged and may have a jam-like consistency. The kidneys are usually dark and congested and the liver and gall bladder are swollen and congested. Haemoglobinuria (redwater) is often present except in peracute cases. Watery blood and jaundice may be more pronounced in chronic cases. With Anaplasmosis, anaemia and jaundice are more pronounced and the liver is usually orange.

It is difficult to distinguish between *B. bovis*, *B. bigemina* and *A. marginale* infection based on clinical signs or gross pathology alone and therefore samples should always be taken for laboratory examination.

There are some similarities in gross pathology between tick fever and anthrax and appropriate care should always be taken with regard to sample collection and submission to a laboratory. Anthrax exclusion testing should be requested if anthrax infection is a possibility.

Sampling for laboratory testing

The NSW Laboratory Services Tick fever webpage provides information about the collection and testing of samples for tick fever. Samples should include:

Live animals:

- Thin blood films prepared from jugular or tail vein blood **and** from tail tip capillary blood. Blood films should be air dried avoiding exposure to heat, formalin or direct sunlight.
- Thick, unstained blood smears from the sites above.
- EDTA blood sample and full clotted blood or at least 2 mLs of serum (chilled).
- Urine (chilled).

Dead Animals:

- Blood films air dried (expressed blood from an ear vein)
- Impression smears from kidney, heart, liver and brain
- Brain squash preparation from the grey matter in the cerebral cortex
- Sections of kidney, heart, liver, brain and spleen (chilled and in buffered formalin).

In cases where animals are suspected to have tick fever, both thick and thin smears should be prepared.

B. bovis can often be more readily detected in capillary blood while *B. bigemina or Anaplasma* are frequently found in normal blood smears collected by venipuncture. Brain smears are particularly useful for the diagnosis of *B bovis* infection in animasl who have displayed neurological signs.

The diagnosis of tick fever may be impaired by badly prepared or unsuitable specimens.

Technical advice on sampling for tick fever diagnosis can be found in the NSW laboratory Services Tick Fever webpage and in the Qld government publication "*Making smears for tick fever diagnosis*" at

https://publications.qld.gov.au/storage/f/2013-12-17T06%3A26%3A14.187Z/tick-fever-blood-organ-smears-for-diagnosis.pdf

A thorough examination of all animals in close contact with infected animals should be carried out to identify the presence of cattle ticks. Ticks are commonly located on the escutcheon, tail butt, belly, shoulder, dewlap and ears. Inspectors from the cattle tick program would normally assist with manual examination of stock for cattle ticks. The primefacts "Visual Inspection of cattle tick carriers" and "Ticks of concern to NSW stockowners"

on the Departmental website give guidance on detecting and identifying cattle tick on livestock.

Risk assessment

Following the detection of tick fever, a risk assessment should be carried out to determine the likelihood that susceptible species have been exposed to cattle tick carrying tick fever organisms.

The risk assessment should take into account the following factors:

- Tick fever is not considered highly contagious. It is usually transmitted only by infected viable cattle tick on grazing stock, rather than by animal to animal transmission (except for Anaplasmosis). The infection rate of cattle ticks with tick fever organisms is low so high tick burdens are need for widespread transmission in a population.
- Onset, severity and duration of clinical signs can be indicative of the causative agent.
- Scavengers, effluent and meat and bone meal prepared from carcasses have no role in the transmission and spread of disease.
- Cattle tick can survive up to 9 months under favourable environmental conditons but under unfavourable conditions such as grass free areas of feedlots it lasts less than 35 days.
- Stocking rate will determine the rate of tick pick-up: higher stocking rates increase the risk of tick pick-up and potential exposure to tick fever organisms.
- Stock condition will determine the timing and duration of a tick eradication program e.g. commencement of treatments may be delayed if cattle are in poor condition.
- Tick fever vaccination history: vaccination reactions can result in clinical signs of mild tick fever.

Cattle tick eradication

If cattle tick are found an eradication program will by supervised by NSW DPI and can take 12-15 months to complete. During that time the property will be restricted under the NSW Biosecurity Act and cattle tick hosts will only move off the property after satisfying movement requirements. For information on these requirements see Primefact 1548 Cattle Tick: moving animals off restricted holdings at https://www.dpi.nsw.gov.au/animals-and-livestock/beef-cattle/health-and-disease/parasitic-and-protozoal-diseases/ticks

If no cattle tick are found after repeated examinations the herd may just be monitored or one or more strategic treatments given rather than a full eradication program.

Treatment of stock

Imidocarb dipropionate (Imizol® or Imidox®) is an antiprotozoal drug effective against both Babesia species. It can be administered at two dose rates depending on whether treatment or temporary protection against infection is required. Oxytetracycline and imidocarb (at the high dose rate), are both effective treatments for *A. marginale* infection.

Concurrent tickicide application to remove ticks from the animals is an essential component in controlling tick fever outbreaks. As *B. bovis* is spread by larval ticks, cattle tick eradication programs where tick fever has occurred may involve more frequent treatment or additional treatments in the early stages of the program. Macrocyclic Lactones (MLs) when used for cattle tick eradication rely on a blood feed for action. Transmission of *Babesia bovis* which is spread by larval ticks can still occur while on ML programs. The use of a contact killer like amitraz is recommended to stop transmission.

NOTE: *Due to residue concerns imidocarb can only be used in dairy cattle under a minor use permit (PER11840) and only for the treatment of clinical cases, since milk must be discarded for 14 days after treatment. It cannot be used prophylactically in milking dairy cows.*

Vaccination

Tick fever vaccination is widely used in areas where cattle tick challenge is continuous (e.g. Qld infected zones) and is effective in preventing disease. In NSW where all cattle tick infestations are subject to compulsory supervised eradication programs, vaccination during tick fever outbreaks would not be of much use as immunity would be unlikely to develop in time to protect stock as it takes up to 6 weeks to develop.

Some producers however may judge that they are likely to be exposed to cattle tick challenge more frequently. This may be due to proximity to infested areas or being located near high risk enterprises where high risk stock are moved such as next to a livestock trader.

In these situations Tick Fever vaccination may be appropriate to manage the risk. Advice on the use of tick fever vaccine and its availability can be found from the Tick Fever centre who manufacture the vaccine. The vaccine is a live vaccine and has a short shelf life. It should not be used with other vaccines or with disinfectants. A single vaccination normally provides lifelong immunity but in low challenge situations in NSW, boosters may be needed and have no adverse consequences.

Adverse reactions to the vaccine are infrequent but can occur and mimic tick fever symptoms. They are treated using imidocarb and usually seen at 7-21 days following vaccination. Older animal generally show more severe reactions.

The best time to vaccinate animal against tick fever is around 6-9 months of age.

More information

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For general inquiries regarding biosecurity, phone 1800 680 244 or email animal.biosecurity@dpi.nsw.gov.au

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