Control of ectoparasites of cattle

This document is part of the COWS Technical Manual which aims to provide a sound basis for advice to industry.

The manual also comprises chapters on controlling liver and rumen fluke, parasitic gastroenteritis, lungworm and integrated parasite control.

COWS is an industry initiative promoting sustainable control strategies for parasites in cattle

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Section 1: Introduction

Cattle are affected by a range of arthropod ectoparasites and nuisance pests, which can cause significant production losses and severely compromise animal welfare.

The major ectoparasites are considered group by group in the following sections.

Key UK ectoparasites

- Lice – severe infestations may indicate underlying disease
- Mites – cause mange with itching and scratching common
- Ticks – transmit infectious diseases
- Flies – spread disease and disrupt behaviour reducing productivity

Section 2: Lice

Lice are parasites that complete their entire life-cycle on the host, inhabiting the hair and skin surface. They are very common parasites of UK cattle and any disease caused is called pediculosis. They can only survive for short periods when off the host.

Nymphs, which closely resemble tiny adults, hatch from eggs which have been glued onto hairs by adult females. The nymph increases in size through a succession of moults until the adult stage is reached. The life cycle from egg to adult takes two to three weeks on average.

Lice are conveniently divided into two functional groups: chewing lice (sometimes called chewing/biting) and sucking lice. Chewing lice feed on skin and hair, while sucking lice have piercing mouthparts and feed on blood.

These two groups of lice are easily distinguished by examining the shape of the head. For chewing lice, the width of the head is about the same as the width of the abdomen. For sucking lice, the head is always much narrower.

Correct differentiation between them is important to inform the correct product choice and method of application likely to be most effective in achieving control.

Low burdens of lice are very common and should not necessarily be considered to be of any immediate pathogenic importance. Lice are almost normal inhabitants of the dermis and coat of cattle, especially in the winter.

However, louse populations can increase very rapidly. Moderate infestations are associated with mild chronic dermatitis and are usually well tolerated. In heavier infestations there is intense itching, with rubbing and licking. If sucking lice are present in large numbers, the cattle may become anaemic.

Resting a warm hand on an animal's coat for a minute or so will often encourage lice to move to the surface, where they can be easily observed, particularly on light-coloured cattle.

It is important to remember that a heavy louse infestation may itself be a sign of other underlying conditions, such as malnutrition or chronic disease, as debilitated animals may not groom themselves effectively. It has been suggested that lice should largely be considered primarily as indicators of ill thrift, rather than being of pathogenic significance themselves.

Transfer of lice between animals and herds is usually by direct physical contact. As lice do not survive for long off their host – usually about three to five days, depending on conditions such as sunlight and humidity, the potential for animals to pick up infestations from dirty housing is limited, although it should not be ignored. Louse transfer via fomites, such as a worker's clothing, is also a possibility.

Lice and eggs are easily found by parting the

animal's hair, especially along the midline. The lice are present next to the skin and the eggs are scattered like coarse powder throughout the hair.

In the UK, the heaviest infestations are seen in the winter, when the coat is at its thickest, giving a sheltered, humid habitat for optimal multiplication. The most rapid annual increase in louse populations is seen when cattle are winter-housed.

In late spring, there is usually an abrupt fall in the numbers of lice as most of the parasites and eggs are shed with the winter coat. Numbers generally remain low throughout the summer. This is partly because the thinness of the coat provides a restricted habitat, but also because high skin surface temperatures and direct sunlight limit multiplication and may even be lethal to lice.

UK lice species

Four species of lice have been recorded in British cattle: one species of chewing louse and three species of sucking lice.

Bovicola bovis is a chewing louse (Figure 1).

This is one of the commonest cattle parasites and is usually found on the head, especially in the curly hair of the poll and forehead, or on the neck, shoulders, back, rump, and occasionally the tail switch.

If infestations reach high levels, the lice may spread down the flanks and may cover the rest of the body.

This louse is a reddish-brown with dark transverse bands on the abdomen. An adult measures up to 2mm in length and 0.3–0.5mm in width. The head is relatively large, as wide as the body and is rounded anteriorly. The mouthparts are adapted for chewing. The legs are slender for moving amongst the hair, with small claws on each leg.

The louse causes considerable irritation to the host animal. The skin reaction can cause hair to loosen and the cattle to react to the irritation by scratching, which results in patches of hair being pulled or rubbed off. Scratching may produce wounds or bruises and a roughness to the skin. This may lead to secondary skin infections and skin trauma, which can appear as defects in the hide – seen as light spots, flecks and grain loss, reducing its value.

Linognathus vituli is a sucking louse, ie blood feeding (Figure 2).

This is known as the long-nosed cattle louse. It is often found around the head, neck and dewlap. It is medium sized with an elongated, pointed head and

Figure 1: A chewing louse of cattle

Alan Walker, University of Edinburgh

Figure 2: A sucking louse of cattle

Alan Walker, University of Edinburgh

body, approximately 2.5mm in length. Unfed, they appear reddish brown, but after feeding they darken to a blue-black colour. These lice form dense, isolated clusters on the host.

Haematopinus eurysternus is a sucking louse.

Known as the short-nosed louse, this sucking louse can be found on the skin of the poll, at the base of the horns, in the ears and around the eyes and nostrils. In mild infestations it can also be found in the tail switch.

In severe infestations, the entire region from the base of the horns, over the face to the base of the tail can be infested. It is one of the largest lice of domestic mammals, measuring 3.5–5mm in length. The louse is broad in shape with a short, pointed head.

Solenopotes capillatus is a sucking louse.

Commonly known as the little blue cattle louse, it tends to occur in clusters on the face, neck, head, and under the jaw, but may spread over the shoulders, back and tail in heavy infestations. At 1–1.5mm in length *Solenopotes capillatus* is the smallest of the sucking lice found on cattle.

Louse control

A range of pour-on or spot-on synthetic pyrethroids eg, deltamethrin, alpha-cypermethrin or permethrin, is available for louse control.

Pour-on and injectable macrocyclic lactones (MLs) are also commonly used, eg ivermectin, eprinomectin, moxidectin and doramectin. Injectable MLs have only limited activity against chewing lice and are more effective against sucking lice, due to their blood-feeding behaviour. It is therefore important to know which lice are present and causing the problem.

Most insecticides registered for use on cattle are not active against louse eggs. This means that after treatment eggs can still hatch. These newly hatched nymphs must be killed by the persistent effects of the treatment if the life-cycle is to be broken with a single application. If, however, the residual efficacy of the product applied is short ie, less than two weeks, the newly hatched nymphs can continue the infestation. Where this is the case, a second treatment will be required.

The timing and frequency of treatments depends on individual circumstances. In many cases treatment in late autumn or early winter will give adequate control of cattle lice. Louse control is usually undertaken when cattle are housed and may be achieved alongside treatment for other parasites.

Treatment of all stock on farm, along with subsequent quarantine and treatment of all newly introduced animals, will allow a good degree of louse control to be maintained.

There have been reports of reduced susceptibility to pyrethroids in cattle lice, and prescribers should take this into consideration when assessing treatment choice.

Section 3: Mange mites

Mange types

- Chorioptic – commonest in the UK
- Psoroptic – rare in the UK but found in Europe
- Sarcoptic – increasingly seen in UK and in UK goats and pigs
- Demodectic – very rare in the UK

Mites, like lice, are permanent residents upon the host. Infestation by mites can result in severe dermatitis, known as mange.

Their presence may provoke an inflammatory response leading to intense itchiness, further tissue damage and bacterial infections.

Cattle mites feed on lymph, blood and/or sebaceous secretions, which they scavenge from the skin surface or obtain from epidermal lesions. Eggs hatch into six-legged larva, which then moult through eight-legged protonymph, tritonymph and adult stages.

The life cycle can be completed in only 14 days. All life-cycle stages are found simultaneously on the host and they spend their entire lives in intimate contact with them.

Figure 3: Chorioptic mange on the tail head

Andy Forbes

Transmission from host-to-host is primarily by physical contact, but may also occur through contact with a contaminated environment, such as bedding, housing or trailers etc.

Chorioptic mange

The most common mange affecting UK cattle is caused by the mite *Chorioptes bovis* (Figure 3).

Other host-adapted strains of *C. bovis* infest UK livestock species, however it is thought that the risk

of cross-transmission is low. Therefore infestations of other host species are not thought to be of clinical significance for in-contact cattle.

Chorioptic mange occurs most often in housed animals, particularly dairy cattle. Similar to louse infestations, mite populations are highest in the winter and may regress over summer.

Chorioptic mange is most commonly seen on the feet, legs and base of the tail and udder. It is usually considered to be only mildly pathogenic and lesions tend to remain localised and spread slowly.

Hosts can be asymptomatic with low densities of mites present but can act as carriers which transfer the mite to other animals. However, if mite numbers reach high densities clinical pathology may be observed. Clinically affected animals may have pustular, crusted, scaly and thickened patches of skin with hair loss. This is usually confined to the tail head, legs and lower body, but in some cases, this may spread to other areas and cause disease.

The pathology is highly variable depending on the intensity and duration of infection. There is considerable individual variation in clinical response to infestation and this may be exacerbated by ill thrift and underlying disease. The itching caused by the mites results in rubbing and scratching, with damage to the hide. Heavy infestations have been associated with decreased milk production (Figure 5).

Control of chorioptic mange

A relatively small number of products are authorised for use against mange. Permethrin is the only pyrethroid with a claim in the UK against chorioptic and sarcoptic mange mites in cattle.

Other synthetic pyrethroids, as well as the Macrocyclic Lactones (MLs) such as Ivermectin, doramectin, eprinomectin and moxidectin, applied topically as a pour-on are also effective. Injectable MLs are generally less effective.

Product claims vary so check the datasheets carefully; a claim for 'aid in control' will not eliminate the parasite.

The treatment of all animals in the herd and any in-contact animals is essential to eradicate this parasite.

Immediately following treatment, cattle should be moved to new housing that has not been used to house cattle for at least three weeks. This is particularly important when using products with low levels of residual activity, due to the potential off-host survival of mites.

Figure 4: Chorioptic mange on the leg

Andy Forbes

Figure 5: Severe chorioptic mange

Andy Forbes

The precise off-host survival of *Chorioptes* mites is not definitively known, but is likely to be at least three weeks, depending on temperature and humidity. As yet, no acaricidal resistance has been recorded in *Chorioptes* mites in Europe.

Psoroptic mange

Psoroptic mange has rarely been reported in cattle in the UK, although it is common in parts of mainland Europe, particularly in breeds such as the Belgian Blue.

The disease was however, diagnosed in South West Wales in 2006 and has since been diagnosed on more than 20 premises, the majority in Wales, but also several farms in England and Scotland.

Most animals infested were beef cattle. It appears probable that the initial outbreak has now been controlled, but isolated cases continue to be diagnosed by the Animal and Plant Health Agency (APHA).

There is a continuing threat of importing the disease from abroad and the source of infestation often cannot be identified.

Psoroptes mites may cause intense itching, papules, crusts, skin damage and hair loss (Figure 6). The

pathology is generally considered to be more severe than most cases of infestation with *Chorioptes*.

The skin below the crusts may be moist and bleeding may occur. Lesions are most common along the dorsum, particularly over the shoulders and tail head.

Following treatment, it has been reported that clinical signs declined at spring turn out, only to reappear at housing in a larger number of animals over the following winter. Weight-loss, decreased milk production and increased susceptibility to other infections can occur as a result of psoroptic mange.

On gross pathology, it can be extremely difficult to distinguish psoroptic mange from a severe case of chorioptic mange and identification of mites from skin scrapings is essential – see panel below.

Figure 6: Severe psoroptic mange

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Distinguishing *Chorioptes* from *Psoroptes* mites

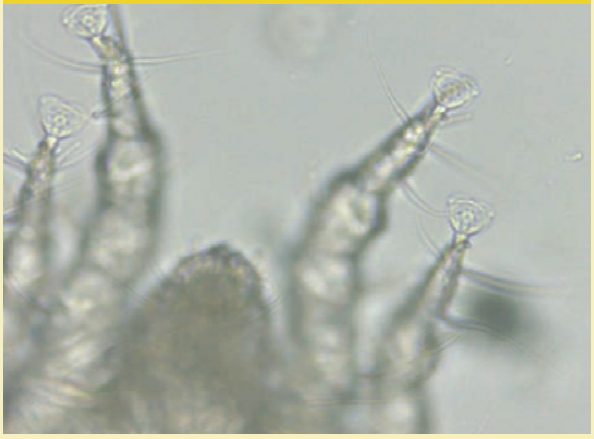
The pre-tarsus and pullvilus (sucker) of *Chorioptes* and *Psoroptes* mites assist with visual identification.

Chorioptes bovis are about 300m in length and are considerably smaller than *Psoroptes ovis* measuring 500–750m.

Chorioptes do not have jointed pretarsi; their pretarsi are shorter than *Psoroptes* and the sucker-like pullvillus is more cup-shaped.

The mouth-parts of *Chorioptes* are distinctly rounder and the abdominal tubercles of the male are noticeably more truncate than those of *Psoroptes*. In contrast, *Psoroptes* mites have a characteristic three-jointed pretarsus on the anterior legs which bears a trumpet-shaped sucker.

Psoroptes mite



John McGarry, University of Liverpool

Control of psoroptic mange

The control of psoroptic mange in cattle is challenging, as there appears to be considerable variation in response by the psoroptic mites to different acaricides.

Elements of tolerance, resistance and host-adaptation may all be involved in creating this variable response to treatment in different mite populations. However, it is also difficult to disentangle poor treatment efficacy from poor administration practice, particularly where only clinically affected animals are treated.

Outbreaks are thought to be caused by a cattle-adapted strain of *Psoroptes ovis*. Response to licensed treatments may be poor, although there are some reports of success with injectable doramectin. However, it would be prudent to follow up any treatment with skin scrapes to check for remaining mites, ensure all animals in the contact group are treated and remove them after treatment to an area that has been cattle free for at least 18 days, to prevent re-infestation from mites surviving in the environment.

Sarcoptic mange

Sarcoptic mange is caused by *Sarcoptes scabei* (Figure 7).

This is a small, round-bodied, burrowing species, quite different in appearance and behaviour to *Chorioptes* or *Psoroptes*. The dorsal surface is covered

Figure 7: *Sarcoptes scabei*

R. Wall

Figure 8: Chronic sarcoptic mange

Andy Forbes

with transverse ridges, but also bears a central patch of triangular scales. The legs are stumpy and barely extend beyond the body margins.

Sarcoptic mange can be severe, although many cases are mild. Sarcoptic mange is infrequently diagnosed by the APHA.

Mild cases are characterised by scaly skin with little hair loss, usually on the neck, face and tail head. In severe cases the skin becomes thickened and there is marked loss of hair and crusts form (Figure 8).

There is intense itching leading to loss of production and to hides being downgraded because of damage by the animal scratching and rubbing. There are a number of host-adapted varieties of *Sarcoptes scabei* that differ subtly in their morphology.

Sarcoptic mange is also common in goats and pigs, so the potential for cross-transmission cannot be ignored. Treatment of all affected and all potential in-contact animals with systemic MLs may give good results.

Section 4: Ticks

Ticks are blood-feeding ectoparasites that are only present on the host during a short blood-feeding period of several days.

When not feeding, they leave the host and remain hidden in vegetation on the ground.

Adult female ticks lay thousands of eggs in vegetation before they die. Six-legged larvae hatch and climb up plants and wait for a host to brush past (questing). They attach themselves to the host and feed for about three days before dropping to the ground and moulting to the eight-legged nymph.

The process repeats, whereby the nymph feeds and moults to the adult stage. The adult tick seeks a host to feed on and to mate, before dropping off and completing the life cycle.

In the UK, ticks usually enter a state of diapause over winter in between each life- cycle stage. Therefore, ticks generally feed once a year and take around three years to complete one life cycle.

In northern European countries such as the UK, intensities of infection in cattle are usually low, averaging between one and three ticks per infested animal. Nevertheless, they may cause tissue damage at the sites of attachment, occasionally complicated by secondary infections, which cause irritation and inflammation.

More importantly, ticks can transmit a number of infections, which in turn can lead to severe, sometimes fatal, disease.

The most important pathogens transmitted to cattle by ticks in the UK are *Babesia divergens* and *Anaplasma phagocytophilum*.

Babesia divergens is a protozoan parasite, usually transmitted by the tick *Ixodes ricinus* (Figure 9).

It is the main agent of bovine babesiosis, known as redwater fever. Primarily a concern in southwest England, cases of redwater are also reported in Scotland and Wales.

Calves up to one year old, although fully susceptible to infection, are relatively resistant to disease. This means in areas of high tick infection pressure, most animals become infected when young and acquire immunity, without showing clinical signs. In older cattle, immunity is reinforced by repeated tick challenge. So, in areas where babesiosis is endemic, clinical cases tend to be rare, although the parasite may be detectable in most animals.

Outbreaks of clinical babesiosis are most commonly observed when enzootic stability breaks down, eg when naïve cattle are introduced into an area of endemic babesiosis with high tick infestation pressure. As a result, babesiosis is often seen where one to two-year old beef animals are introduced to marginal, tick-infested grazing, until ready to be sold for finishing.

Anaplasma phagocytophilum (formerly *Ehrlichia phagocytophila*) is a gram-negative bacterium, again transmitted largely by *Ixodes ricinus* in the UK. It is the causative agent of tick-borne fever (TBF) in cattle. Tick-borne fever is primarily a concern in Scotland, south west England, Wales and Northern England.

Infection may be characterised by fever and general immune suppression, occasionally resulting in more severe secondary infections. However, in the UK, infection with *Anaplasma* in cattle is usually mild, the main losses being due to abortion when pregnant cows become infected.

Ticks may also transmit louping ill virus, which causes an acute encephalomyelitis particularly in sheep and is frequently fatal. It is particularly prevalent in Scotland and south west England. The main vector is the sheep tick, *Ixodes ricinus*. A wide variety of other animals are susceptible to the virus, including cattle and occasionally humans.

Tick control

Tick control is difficult because the ticks spend most of their life-cycle away from the host, sheltered at the base of thick damp vegetation.

Figure 9: The tick *Ixodes ricinus*

A. Jennett / R. Wall

Ticks are thought to become active and start to feed in early spring, when mean daily temperature exceeds 7°C. However, ticks have been observed questing in the UK, albeit in low densities, when air temperatures are well below this threshold. Therefore, the start and duration of the tick season is difficult to predict precisely, as it is dependent on both temperature and humidity and the microclimate afforded by the vegetation.

A reduction in the tick population may be achieved through significant pasture improvement and preventing access to scrub, although this is a long-term exercise requiring sustained effort. When alternative hosts, such as deer are present, tick population management is even more difficult.

Attempts to reduce tick populations by environmental treatment with acaricides is unacceptable because of the effects on other invertebrates. Where required, eg when beef cattle are about to be moved to a known tick area, prophylactic protection may be attempted.

A range of pour-on pyrethroids have UK license claims for treatment of ticks on sheep but no products in the UK have a label claim for cattle at present.

The use of either flumethrin or amitraz to treat ticks on cattle is licensed in the Republic of Ireland, but not in the UK. Vets should seek information from the manufacturers and relevant regulatory authorities before using.

Section 5: Flies

Blood-feeding and secretophagous flies, collectively called nuisance or worry flies, are one of the most economically important groups of arthropods affecting cattle.

In the UK there are at least 20 common species of fly that feed on cattle. These flies may feed on blood, sweat, skin secretions, tears or saliva. They do this by either puncturing the skin directly, known as biting flies, or by scavenging at the surface of the skin, wounds or body orifices, classified as non-biting or nuisance flies (Figure 10).

Many of these flies act as vectors for a range of disease pathogens and the irritation they cause may lead to disturbance and loss of productivity through reduced weight gain or milk yield.

Fly activity may directly cause dramatic escape behaviour known as gadding, in which self-injury can occur, or more commonly movement into shade, restlessness, skin rippling or simply stamping and tail switching. However, all these changes in behaviour result in reduced time spent feeding and decreased performance.

For example, a single horn fly (*Lyperosia (Haematobia) irritans*) takes 20 to 30 blood meals per day and more than 200 biting flies per cow has been shown to have a significant economic impact on performance. Studies in the USA demonstrated that calf weaning weights were on average 5–10kg higher when flies were controlled on their mother.

Flies may also be of importance due to infestation by their larvae, a condition known as myiasis. This is relatively rare in cattle and is usually only seen where there is a pre-disposing wound or skin lesion.

Cattle-visiting flies are biological and mechanical vectors of a number of bacterial and viral diseases and nematode infections.

Mechanical transmission may be exacerbated by the fact that some fly species, such as tabanids (horse flies), inflict extremely painful bites, so are frequently disturbed by the host while blood-feeding. As a result, the flies are forced to move from host to host over a short period, thereby increasing their potential for pathogen transmission. The biting activities of blood-feeding flies may also provoke hypersensitivity reactions.

Amongst the biting flies, *Stomoxys calcitrans*, *Haematobia stimulans*, *Lyperosia* (*Haematobia*) *irritans* and a range of species of horseflies (*Tabanidae*), midges (*Culicoides*) and blackflies (*Simulium*), may all be locally important.

Figure 10: Flies clustering on the leg of a cow

A. Giangaspero

In cattle, large numbers of the secretophagous (non-biting) fly *Hydrotaea irritans* often cluster on the ventral abdomen and udder and since the bacteria involved in summer mastitis, *Arcanobacterium pyogenes*, *Streptococcus dysgalactiae* and *Peptococcus indolicus*, have been isolated from these flies, there is strong presumption that they may transmit the disease. In addition, this species is believed to transmit infectious bovine keratoconjunctivitis, although more epidemiological evidence is needed to verify their importance in natural outbreaks.

Culicoides spp. are vectors of bluetongue virus and Schmallenberg virus. Clinical disease caused by both of these viruses has been recorded in the UK and their continued presence in Europe requires surveillance and vigilance.

Another non-biting fly, *Musca autumnalis* is often the most numerous fly to be worrying cattle on pasture. The eggs are usually laid in bovine faeces, and if conditions are suitable the resultant large fly populations can cause serious annoyance to the animals, contributing to reduced production rates.

Fly control

Knowing the breeding sites of flies informs the practical side of integrated control. For example, the most abundant secretophagus species *Hydrotaea*

irritans and *Musca autumnalis* breed in pasture soil and in dung on pasture, respectively. The stable fly *Stomoxys calcitrans* breeds mainly in dung inside accommodation. Biting midges can be associated with dung heaps.

It is important to appreciate that farm hygiene practices and mechanical removal of dung, where practical, can help reduce certain fly populations.

Integrated control usually involves removing the breeding sites (where practical) combined with treating animals with an insecticide.

Insecticide impregnated ear tags and tail bands mainly containing pyrethroids, together with pyrethroid pour-on, spot-on and spray preparations, are widely used to reduce fly annoyance in cattle.

Various types of screens and electrocution traps for buildings are available to reduce fly nuisance.

Aerosol space sprays, residual insecticides applied to walls and ceilings and insecticide-impregnated cards and strips may reduce fly numbers indoors, mainly *Stomoxys calcitrans*.

Insecticides may also be incorporated into solid or liquid fly baits, using attractants such as sugary syrups or hydrolysed yeast and animal proteins. Larvicides are also available for the treatment of manure.

However, given the high rates of reproduction, high rates of dispersal and multiple generations per year, area-wide control of most fly populations is generally impractical.

Consequently, it is important to commence treatment early on the season, before rapid population growth, and repeat according to the manufacturer's instructions.

Generalised environmental treatment with insecticides is not usually recommended due to the effects on non-target invertebrates.

Section 6: Combining ectoparasite control

Animals are likely to be infected with a range of both endoparasites and ectoparasites simultaneously. It is important to consider strategies that integrate treatment protocols for individual farms, to minimise costs, reduce off-target effects which promote the development of resistance/tolerance and to optimise impact.

These are detailed in the 'Integrated Parasite Control on Cattle Farms' chapter of the COWS Guide.

Ectoparasite Control Options							
	Lice biting	Lice Sucking	Chorioptes	Psoroptes	Sarcoptes	Ticks	Flies
Permethrin	✓	✓	✓	✗ [3]	✓	✗	✓
Deltamethrin	✓	✓	✗	✓	✗	✗ [2]	✓
Cypermethrin	✗	✗	✗	✗	✗	✗ [2]	✓
Alphacypermethrin	✓	✓	✗	✗	✗	✗ [2]	✓
Ivermectin injection	AID	✓	AID	✓	AID	✗	✗
Ivermection pour-on	✓	✓	AID	✗	✓	✗	✗
Eprinomectin injection	✗	✓	✗	✗	✓	✗	✗
Eprinomectin pour-on	✓	✓	✓	✗	✓	✗	✗
Moxidectin injection	AID	✓	AID	✓	✓	✗	✗
Moxidectin pour-on	✓	✓	✓	✓	✓	✗	✓[1]
Doramectin injection	AID	✓	AID	✓	✓	✗	✓
Doramectin pour-on	✓	✓	✓	✓	✓	✗	✓[1]

[1] = *Haematobia irritans* only [2] = Licensed for tick control in sheep. May be used under the veterinary cascade/risk-based decision tree [3] = Some evidence for efficacy. May be used under the veterinary cascade/risk-based decision tree AID = Aid in control claim

Information on individual products is available in the NOAH Compendium of Data Sheets for Animal Medicines at www.noahcompendium.co.uk or from the product manufacturer. Duration of activity of products can vary widely. Always check the latest product data sheet and/or product label before advising or administering products.

Further reading

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