*Nematodirus*

Nematoctirus is of special importance as a parasite of lambs in temperate regions.

Hosts: Ruminants.

Site:

Small intestine.

Species:

Nematodirus battus sheep, occasionally calves

N. filicollis sheep and goats

N. spathiger sheep and goats, occasionally cattle

N. helvetianus cattle.

*N abnormalis* and *N. oiratianus* have also been recorded from sheep and goats in southern Europe. Asia. America and Australia.

Distribution:

Worldwide

IDENTIFICATION

Gross:

The adults are slender worms about 2.0 cm long. The intertwining of the thin, twisted worms produces an appearance similar to that of cotton wool.

Microscopic:

A small but distinct cephalic vesicle is present (Fig. 18). The spicules are long and slender with fused tips. In all except N. battus the male has two sets of parallel rays in each of the main bursal lobes; the female has a truncate tail with a small spine, and the egg is large, ovoid and colourless (Fig. 18) and twice the size of the typical trichostrongyle egg.

N. battus is characterized by having only one set of parallel rays in each bursal lobe while the female worm has a long pointed tail and the large egg is brownish with parallel sides (Fig. 18).

LIFE CYCLE

The preparasitic phase is almost unique in the trichostrongylids in that development to the L3 takes place within the eggshell. Hatching of most eggs requires a prolonged period of chill followed by a mean day/night temperature of more than 10°C, conditions which occur in late spring. Hence most of the eggs from one season’s grazing remain unhatched on the ground during the winter and only one generation is possible each year for the bulk of this species. However, some N. battus eggs deposited in the spring are capable of hatching in the autumn of the same year resulting in significant numbers of L3 on the pasture at this time. The ingested L3 penetrate the mucosa of the small intestine and moult to the L4 stage around the fourth day. After moulting to the L5 the parasites inhabit the lumen, sometimes superficially coiled around villi. The prepatent period is 14–16 days

``Other Nematodirus species

The other species do not have the same critical hatching requirements as N. battus and so the L3, appear on the pasture within 2-3 months of the eggs being excreted in the faeces. More than one annual generation is therefore possible

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**PATHOGENESIS**

Nematodirosis, due to N. battus infection, is an example of a parasitic disease where the principal pathogenic effect is attributable to the larval stages. Following ingestion of large numbers of L3 there is disruption of the intestinal mucosa, particularly in the ileum, although the majority of developing stages are found on the mucosal surface.

Development through L4 to L5 is complete by 10–12 days from infection and this coincides with severe damage to the villi and erosion of the mucosa leading to villous atrophy. The ability of the intestine to exchange fluids and nutrients is grossly impaired, and with the onset of diarrhea the lamb rapidly becomes dehydrated.

While the pathogenesis of infections with the other Nematodirus spp. Is probably similar there is some controversy on the extent of their pathogenic effect. For example, though N. helvetianus has been incriminated in outbreaks of bovine parasitic gastroenteritis, experimental attempts to reproduce the disease have been unsuccessful.

**CLINICAL SIGNS**

In severe infections, diarrhoea is the most prominent clinical sign. As dehydration proceeds the affected animals become thirsty and in infected flocks the ewes continue to graze, apparently unaffected by the larval challenge, while their inappetent and diarrhoeic lambs congregate round drinking places

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EPIDEMIOLOGY

Epidemiology: The three most important features of the epidemiology of

N. battus infections are:

1. The capacity of the free-living stages, particularly the egg containing the L3, to survive on pasture; some for up to 2 years.

2. The critical hatching requirements of most eggs, which ensure the appearance of large numbers of L3 on the pasture simultaneously, usually in May and June. Though the flush of larvae on the pasture may be an annual event, the appearance of clinical nematodirosis is not; thus if the flush of L3 is early the suckling lambs may not be consuming sufficient grass to acquire large numbers of L3, and if it is late the lambs may be old enough to resist the larval challenge.

There is some evidence that there is an age resistance to N. battus, which commences when lambs are about 3 months old. However, susceptible lambs of 6–7 months can have considerable N. battus burdens and it is therefore doubtful if this age immunity is absolute.

3. The negligible role played by the ewe in the annual cycling of N. battus which can thus be considered as a lamb-to-lamb disease with usually only one generation of parasites each year in the spring, although in some years an autumn generation of parasites may be seen. Adult sheep often have a few N. battus eggs in their faeces, but these are insufficient to precipitate a larval flush, although they are enough to ensure the persistence of infection on the pastures. In management systems that involve both sheep and cattle, young calves can become infected when they graze pasture that carried lambs the previous spring.

DIAGNOSIS

Because the clinical signs appear during the prepatent period faecal egg counts are of little value in diagnosis which is best made on grazing history, clinical signs, and if possible, a post-mortem examination.

TREATMENT

Several drugs are highly effective against Necnatodirtcs infections especially levarnisole, an avermectin/ milbemycin or one of the modern benzimidazoles,

fenbendazole, oxfendazole or albendazole. The response to treatment is usually rapid and if diarrhoea persists coccidiosis should be considered as a complicating factor.

CONTROL

With the exception of N. battus, which requires special consideration, disease due to monospecific Nematodirus infections is rarely seen. Instead, they are usually part of the worm burden of trichostrongyloid species which are responsible for the syndrome of parasitic gastroenteritis in sheep and as such may be controlled by the measures outlined below.

Since N. battus infection of lambs has a unique epidemiology, its control is best considered separately. Due to the annual hatching of N. battus eggs in spring, the disease can be controlled by avoiding the grazing of successive lamb crops on the same pasture. Where such alternative grazing is not available each year, control can be achieved by anthelmintic prophylaxis, the timing of treatments being based on the knowledge that the peak time for the appearance of N. battus L3, is May to early June. Ideally, dosing should be at three week intervals over May and June and it is unwise to await the appearance of clinical signs of diarrhoea before administering the drugs.

The Ministry of Agriculture in Britain has developed a forecasting system based primarily on soil temperature in the early spring which can predict the likely severity of nematodirosis. In years when the forecast predicts severe disease, three treatments are recommended during May and June: in other years two treatments in May should suffice. Several drugs are recommended, including levamisole, or any of the modern benzimidazoles or ivermectin.



Fig. 3.12 Comparison of spicules of (a) Nematodirus filicollis, (b) N.

spathiger and (c) N. battus.



Fig. 3.11 Anterior of Nematodirus battus illustrating the small cephalic

vesicle.