EQUINE HELMINTH PARASITISM

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Though the spectrum is not always quite the same, the most important helminth pathogens affecting equines (*Parascaris equorum, the Strongylus* spp. and the cyathostomes) have a world-wide distribution. Parasitism normally shows a marked age prevalence and disease when it occurs, is most common in the young. With exposure, some degree of acquired resistance develops and an equilibrium is established in which most species continue to be represented but usually in relatively small numbers. Such host resistance does not prevent the normal seasonal events in the parasite calendar and nor is the equilibrium static. It may fluctuate and do so in favour of the host or of the parasite. A fit, well fed, adult horse maintains resistance. However, clinical parasitism may affect it if and when the equilibrium is upset in favour of the parasite, either by an inordinately heavy challenge or with old age or infirmity through disease or malnutrition.

Working equines in the semi-arid areas of the developing world, show an extreme cyclical pattern, in which their condition improves steadily to a peak towards the end of the wet season, only to decline again during the following dry period. The cycle is probably driven primarily by nutrition but parasites are very likely to have an important secondary role.

The relation between nutrition and GI parasitism is a complex one. Most studies have been in sheep but it is probable that the same principles apply to other grazing species. Depending on the site of parasitism, there may be little or no effect on digestion or absorption. However, the nitrogen economy of the host is upset, often with significant loss of endogenous nitrogen from the GI tract and with an accompanying decline in the efficiency of energy utilisation. In their review of this relationship, Coop and Kyriazakis (1999) discuss how the parasitised animal under challenge in this way allocates its nutritional resources by prioritising its bodily functions. Priority is given to maintenance and the repair of parasite damage in the GI tract, protected at the expense of muscle protein for example. The acquisition of immunity by the young, having relatively low cost, also receives priority. However, the expression of immunity does not and the expulsion of worms for instance, may be suppressed. All these effects are exacerbated by a diet poor in quality (especially low protein) or quantity. The depression of appetite which often accompanies parasitism, is a further factor.

Malnutrition, by reducing the expression of immunity can therefore tip the equilibrium in favour of the parasites. Although there may be no larvae in the environment during the dry season, the number of developing worms present may still increase as the quiescent larvae within the host, the so called hypobiotic larvae, resume development. In working equines during the dry season all these factors are likely to apply with increasing intensity and as a result the animals come to the vital seed sowing time in poor condition and unable to work to their full potential.

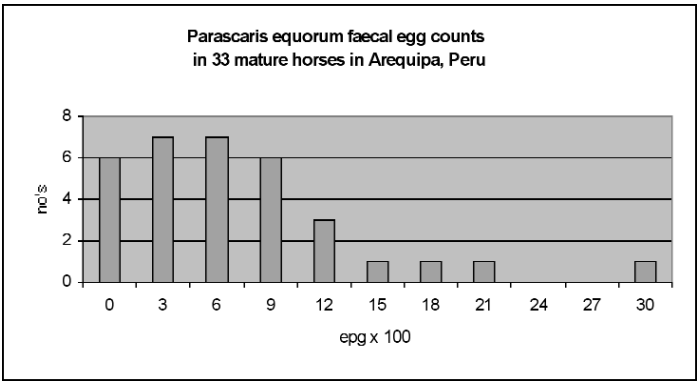
Epidemiology

Equine parasitism is best known in the temperate developed world, where the parasite calendar is determined by the cold of winter. The free-living stages develop successfully in the summer but they have very limited success in the winter and very few of them can

survive through to the spring. Eggs shed in the winter therefore have a poor expectation. For the Strongylus spp. this does not present a problem, for the length of their prepatent period ensures that larvae acquired in one grazing season, only reach maturity during the next. Egg laying occurs when the subsequent development can be successful. Having a much shorter prepatent period, the cyathostomes respond differently by undergoing hypobiosis, a period of larval dormancy within the host (Eysker, *et al*, 1984). Hypobiotic larvae remain dormant through the winter and most complete development in the following spring and summer though some may persist much longer (Gibson, 1953). Besides the epidemiological significance of this, there is potential significance for control because these larvae are relatively insusceptible to anthelmintics.

In the semi-arid areas of the world it is the dry season which is inimical for transmission and which drives the calendar. However, the part played by hypobiosis in the epidemiology of the cyathostomes requires confirmation. As was pointed out above, this is a lean period for working equines when a declining plane of nutrition may so reduce the host-parasite response as to prevent worm expulsion. If as a result adult strongylates persist throughout the dry season, the necessity for and the significance of hypobiosis would be reduced, with consequences for any control programme. In this respect it is interesting that *Parascaris equorum*, in temperate zones thought of as a parasite of the young (Russell, 1948) in the tropics may be found in equines of all ages (Figure 1). Furthermore, Eysker and Pandey (1989) found no significant hypobiotic cyathostomes in donkeys in Zimbabwe.

Figure 1



Control

With the advent of thiabendazole and the era of broad spectrum anthelmintics, control in the developed world came to rely upon their regular use throughout the grazing season, to suppress egg laying by the parasites (Duncan 1974, Uhlinger 1990). A suitable treatment interval for the benzimidazoles (BZs) and pyrantel is 6 weeks because their efficacy is confined to the adult worms and the late development stages in the gut lumen. For ivermectin the interval is extended to 8 weeks by its additional efficacy against late fourth larvae in the lumen, while that for moxidectin which has additional activity against late third larvae and fourth larvae in the mucosa (Eysker et al, 1997) the interval is 12 weeks.

Control by this means was initially successful but the intense selection pressure which it represents has given rise to widespread anthelmintic resistance. Today the inevitability of resistance is recognised and efforts are concentrated on slowing its development (Herd and Coles, 1995). Two key factors in this are first to try to reduce dependance on the anthelmintics and second, to rotate the drug annually between the three families, the BZs, pyrantel and the macrocyclic lactones (ivermectin and moxidectin).

The number of treatments given can be reduced by targeting the animals with consistently high faecal eggs counts. A high degree of control is still achieved but by reducing the number treated the selection pressure is reduced. At the same time, contamination by untreated animals allows the progency of unselected parasites to "dilute" those of the selected.

Alternatively, pasture hygiene can be used to reduce the dependance on drugs. Regular collection of faeces not only gives more efficient control than chemotherapy, which is in any case ineffective for young animals (Herd, 1986; Herd and Gabel, 1990) but it also preserves the quality of the pasture by preventing "roughs". A further alternative is to use mixed grazing or to alternate grazing with cattle or sheep.

Control in semi-arid climates

Working equines have not usually been much subjected to anthelmintic treatment and significant resistance is therefore unlikely to be present yet. They do however, experience extremes of nutrition and the pattern of parasitism is likely to be influenced by that. In contrast, the management of sports and leisure horses in the same countries is often comparable to that in the developed world. Furthermore since at this level, horses are often "international", the parasites and their resistance status are likely to be similar too. It is important therefore that both situations be looked at and that a research effort comparable to that described in this volume (p.41) by Sims *et al* in Bolivia is also carried out in other countries. Without that, the recommendations which follow must be somewhat speculative.

Because of the expense in working equines, it is necessary to keep the use of anthelmintic to a minimum commensurate with efficiency and fortunately, this is also the first principle for slowing the onset of resistance. Hygiene should be the foundation for control if possible. Whereas any form of control is more difficult if there is dependence on common or open grazing, chemotherapeutic control cannot work if untreated horses are allowed to graze on the same pastures. Hygienic control on the other hand, can do so provided most owners are prepared to collaborate.

Development and transmission are best in the wet season and this is the time to concentrate the control effort. Farmers may feel it tedious but they should be encouraged to remove faeces from the grazing twice weekly throughout the wet season. Just before the rains begin, initially an effective broad spectrum anthelmintic should be given to all equines. Most hypobiotic larvae if present, will be resuming development then and the worm population as a whole will be dominated by adults and late developmental stages and approaching its most susceptible. In the absence of drug resistance, selection can be made from a BZ, pyrantel or a

macrocyclic lactone. Faecal egg counts (FEC) on a sample of animals on the day of treatment should be compared with further FEC on the same individuals two weeks later to check the efficacy of treatment. Thereafter FEC should be four weekly on all animals but if hygiene is practiced diligently, further treatment should be unnecessary. If hygiene is not practiced, reinfection will occur but further treatment should be restricted to those individuals in which the FEC rises above a low figure of 200 epg for example. All treatments during the season must be with the same drug or at least a member of the same family. In successive years it should come from one of the other families in a three year rotation.

During the dry season transmission should cease. Less frequent faeces removal is acceptable then but they must still be removed. This is because larvae will continue to develop and persist within them until killed by thorough dryness. Faeces left on the pasture at the end of the dry period are therefore a potential reservoir from which the first rains could release immediate heavy contamination onto the pasture.

If hygiene control through the wet season was successful, infections during the dry will be light and no general treatment will be necessary. If not, infections may be heavy and hypobiotic larvae may be present. Only two drugs have efficacy against the latter. Fenbendazole in five daily doses is effective against the larvae of BZ susceptible parasites (Duncan *et al*, 1998) but is probably too costly. The evidence for moxidectin is somewhat equivocal (Eysker *et al*, 1997) but it may also have good efficacy against these larvae (Bairden *et al*, 2001) and be the drug of choice. However, if it were accepted that exclusively moxidectin was required at this point, it would restrict the freedom to alternate the anthelmintic annually, one of those key requirements for delaying the onset of resistance. It is therefore important to know the status of these larvae and much better to prevent the problem by hygiene control if possible.

The biology of *Parascaris equorum* is somewhat different from that of the strongylates but its transmission is governed by similar constraints. It too can be controlled by chemotherapy and hygiene but since it is in particular a parasite of the young, care must be taken to target them specifically by treating foals at 2 and 4 months of age. Since all the drugs of the three families are fully effective, the one current for the year should be used.

Summary

The importance of helminth parasitism to the working equines of the underdeveloped semi-arid areas of the world is discussed and its likely inter-relationship with the annual cycle of nutrition and malnutrition. While a knowledge of the situation in the temperate developed world can be used to formulate control guidelines, there are lessons to be learned if the latter are to be sustainable. Furthermore, there is a need for local study if they are to be soundly based.

One of the rewards for parasite control should be the reduction of the effect of the nutrition gap which the dry season represents. If horses can be brought to the critical cultivation period in better condition, it will greatly improve their welfare and indirectly, that of their owners and of their families.

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