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CLINICAL COMMENTARY

Gasterophilus sp. management within an era of anthelmintic resistance

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The case report of Carbonell et al. (2023) reported cutaneous gasterophilosis in two older horses that had been following a selective parasite control programme for over a decade. *Gasterophilus* sp., or bot flies, are found in temperate regions around the world. The most common *Gasterophilus* species to infect equids is *G. intestinalis*. This fly lays its eggs on the horse's limbs and abdomen during the summer months and the larvae gestate in the non-glandular region of the horse's stomach. *G. nasalis* also commonly infects horses worldwide. This species lays its eggs on the face and larvae gestate in the lower stomach in the pyloric region. Other species of bot fly which are less common, namely *G. nigricornis*, *G. inermis* and *G. haemorrhoidalis* are observed around the world. These species lay their eggs on the horse's head near the mouth. The only species that lays eggs in grass/forage is *G. pecorum*; instars of *G. pecorum* gestate in the soft palate (Figure 1), and this species is observed, but appears more rarely in Europe (Smith et al., 2005).

The route of entry for *G. intestinalis* and *G. pecorum* is oral ingestion. *Gasterophilus pecorum* eggs are ingested with forage and *G. intestinalis* are ingested when the horse self-grooms, and this physical contact with the eggs triggers hatching. *G. nasalis* eggs that are laid on the head hatch spontaneously, and the first stage instars penetrate the epidermis to start their migration to the periodontal pockets for 3–4 weeks before progressing to the glandular portion of the stomach. Site of gestation of instars following the periodontal pockets is species dependant. They continue to moult to third stage instars and gestate over their 8–10 month gestation period before the larvae are excreted in the faeces and pupate either in the soil or faeces. For all species, the flies are free living and survive for 3 weeks, long enough to lay eggs on a host before the cycle starts again.

Gasterophilus sp. are not deemed parasites of clinical importance, and unlike cyathostomins, large strongyles, tapeworms or ascarids, intestinal disease is not associated with *Gasterophilus* sp. The migratory stage in the lifecycle, for example in the mouth (Figure 2), and the gestation of the third stage instars in the gastrointestinal tract (Figure 3) causes some tissue damage but this does not appear to have a significant effect on the host.

The case report from Carbonell et al. (2023) highlights an important point. These cases of cutaneous gasterophilosis followed a decade of selective parasite control. Parasitology is an area of veterinary medicine where academically for over two decades the focus has been on anthelmintic resistance and the required changes in the approach to parasite control. However, implementing these changes into the practice of parasite control has been slow to establish. In 2010, Kaplan and Nielsen described equine parasitology as one of the only areas of veterinary medicine to be practiced the same way as it was 40+ years ago. Change is now occurring. In the UK, both BEVA and the VMD are leading approaches to further promote targeted selective parasite control practices, and similar approaches are being taken by groups around the world. Some of the literature suggests that horse managers are changing their parasite control practices. Tzelos et al. (2019) reported that 60.9% of 652 respondents to their survey used targeted selective parasite control. This figure sounds promising for a move to selective control practices, but this study may also represent those interested in parasite control and therefore skewed to a population more likely to complete the survey. For those that have not yet implemented strategic targeted parasite control, a plethora of reasons have been proposed for this lack of uptake. McTigue et al. (2022) reported that owners are concerned about the cost and inconvenience of diagnostic testing; owners also stated it was easier to just deliver anthelmintics than use a diagnostic led approach. So, while progress has been made in moving horse managers to targeted control programmes based on diagnostic testing, there is still a long way to go. Given the recent findings of Bull et al. (2023) highlighting multi-drug-resistant cyathostomins in UK Thoroughbred studs, every anthelmintic that is prescribed needs

FIGURE 1 *Gasterophilus pecorum* larvae on the soft palate of two cadavers obtained from a UK abattoir.

FIGURE 2 *Gasterophilus* sp. first stage instars in periodontal pockets in equid cadavers from a UK abattoir.

to be carefully considered given the continued spread and development of anthelmintic resistance.

For the past 60 years, prophylactic anthelmintic use made parasite control an easy fix, the answer to a parasite problem was 'there is a drug for that' (Sangster, 2003). Moving to a targeted selective parasite control programme requires more thought and planning than a calendar-based approach. Anthelmintics licensed for use in equids are broad spectrum, over exposure is one of the key issues with resistance. So when a broad spectrum anthelmintic is used with a target parasite species in mind, there is often a lack of consideration for the exposure of that drug to other intestinal parasites that may be present. This approach is likely to have played a role in the development of resistance in cyathostomins.

Historically, equids have been given precautionary anthelmintic treatment for *Gasterophilus* sp. in a calendar-based system. Treatment typically with macrocyclic lactones was delivered after the first frost of the autumn. The rationale being that the frost would kill off the bot flies and no further eggs would be laid, so treating would then kill any larvae present and reduce the fly population the following year.

FIGURE 3 *Gasterophilus intestinalis* third stage instars in a cadaver stomach; the larval attachment site is evident where some larvae have been removed.

When considering treatment specifically for *Gasterophilus* sp., the low risk of clinical disease should be a consideration. Similar to *Oxyuris equi* (pinworms), there is very little evidence of clinical disease associated with burden and therefore anthelmintic treatment directed solely at these parasites without clinical signs of infection needs careful consideration and justification. Most horses will likely receive at least one anthelmintic treatment per year as part of targeted selective parasite control. This targeted treatment at parasites of clinical importance will also treat any *Gasterophilus* sp. that are gestating at this time. Hill and Daniels (2021) observed in stomach cadavers from managed horses fewer *Gasterophilus* sp. when compared to semi feral cadavers which suggests that the level of parasite control in the managed horses was enough to keep infection levels low. As these cadavers were collected from an abattoir, the exact parasite control practices of these animals were unknown, but the *Gasterophilus* sp. burden was significantly lower than in semi-feral animals suggesting any treatment and management they received was effective.

The case report of Carbonell et al. (2023) demonstrated clinical signs of *Gasterophilus* sp. infection, which was easily resolved with ivermectin administration. Horse managers may not realise that for *Gasterophilus* sp. there is a lack of diagnostic tools to identify the burden. Oral assessment and gastroscopy are diagnostics that can be used, but neither are particularly practical; however, owners can identify eggs laid on the coat. As with most other intestinal parasites, one way to break the *Gasterophilus* sp. lifecycle is through good husbandry. Encouraging owners to remove *Gasterophilus* sp. eggs from the coat rather than delivering a precautionary anthelmintic fits with a targeted approach to parasite control. As first stage instars can be observed orally, these may be detected during routine dental examinations and this would give rationale to consider treatment. Similarly,

if owners have observed large numbers of *Gasterophilus* sp. eggs over a season, then they should be working with their veterinarian or suitably qualified person (SQP) to consider treatment on the basis of risk of infection as part of their wider parasite control strategy.

With a change in our approach to parasite control, it is not surprising that Carbonell et al. (2023) report parasitic disease that has not been seen for some time. As preceded in Denmark and Sweden with a re-emergence of *Strongylus vulgaris* after two decades of selective parasite control. Denmark was the first country in 1999 to restrict anthelmintic access to horse managers. It appears that rather than working with practitioners on a diagnostic led programme, some horse managers stopped treating all together due to the barriers to anthelmintic access in place. It is likely that this behaviour accounts for some of the S. *vulgaris* re-emergence seen. As important as reducing anthelmintic use, it is the human behaviour change that is required to fully implement targeted parasite control in equids that requires further work. Education is also required to support horse managers in fully implementing a targeted and selective parasite control programme. Rather than thinking about anthelmintics as a parasite magic bullet, we need to work with owners and educate them on the husbandry practices they can implement to reduce parasitic infection. We also need to emphasise that low levels of parasitic infection are not a bad thing; the aim is to prevent high levels of infection where there is greater risk of clinical disease.

As the focus of parasite control becomes more selective and diagnostic focussed in the face of anthelmintic resistance, it is likely that we may see challenges in re-emergence of some conditions deemed of the parasitology past. Working together with owners making the most of diagnostics and diagnostic led treatments ensures some future for effectively treating those parasites of clinical importance with anthelmintics, which is key in the face of growing levels of anthelmintic resistance.

AUTHOR CONTRIBUTIONS

S. Daniels was the sole contributor to this commentary.

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No conflict of interest was declared.

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REFERENCES

Bull, K.E., Allen, K.J., Hodgkinson, J.E. & Peachey, L.E. (2023) The first report of macrocyclic lactone resistant cyathostomins in the UK. *International Journal for Parasitology: Drugs and Drug Resistance*, 21, 125–130. Available from: https://doi.org/10.1016/j.ijpddr.2023.03.001

Carbonell, J.D., Bartolome, I.M. & Meana, A. (2023) Equine cutaneous gasterophilosis in an era of selective parasite control. *Equine Veterinary Education*, *35*, 465, e608–e613.

Hill, T. & Daniels, S. (2021) The prevalence of *Gasterophilus* Sp. in the gastrointestinal tracts of managed and semi-feral horses. *Equine Veterinary Education*, 33(S12), 32.

Kaplan, R.M. & Nielsen, M.K. (2010) An evidence-based approach to equine parasite control: it ain't the 60s anymore. *Equine Veterinary Education*, 22(6), 306–316.

McTigue, F.E., Mansbridge, S.C. & Pyatt, A.Z. (2022) Equine anthelmintic resistance: horse owner and yard manager perception of the barriers affecting strategic control measures in England. *Veterinary Sciences*, 9(10), 560. Available from: https://doi.org/10.3390/vetsci9100560

Sangster, N.C. (2003) A practical approach to anthelmintic resistance. *Equine Veterinary Journal*, 35(3), 218–219.

Smith, M.A., McGarry, J.W., Kelly, D.F. & Proudman, C.J. (2005) *Gasterophilus pecorum* in the soft palate of a British pony. *Veterinary Record*, 156, 283–284.

Tzelos, T., Morgan, E.R., Easton, S., Hodgkinson, J.E. & Matthews, J.B. (2019) A survey of the level of horse owner uptake of evidence-based anthelmintic treatment protocols for equine helminth control in the UK. *Veterinary Parasitology*, 274, 108926. Available from: https://doi.org/10.1016/j.vetpar.2019.108926

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