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Intercepting Parasite Resistance

Ascarids--the roundworms that infect foals--primarily show resistance to macrocyclic lactones, but there are also reports of some pyrimidine resistance.

Photo: Courtesy Dr. Martin Nielsen

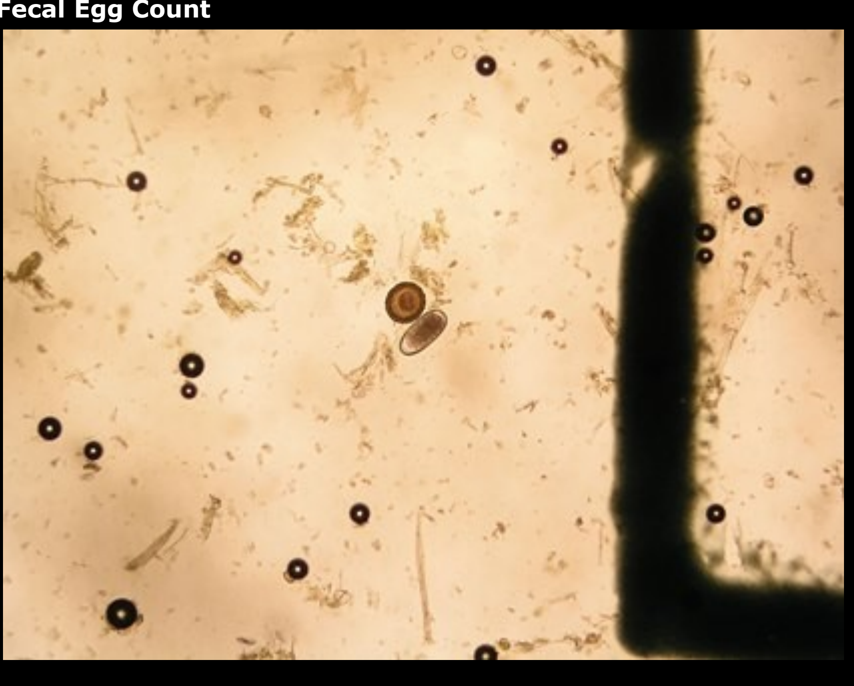
The evidence is there: The internal parasites present in all horses are evolving to be resistant to the very drugs designed to combat them. And the number of new drugs being developing to overcome this issue is a whopping zero. So over the past decade, veterinarians have begun encouraging horse owners to pay closer attention to their parasite control approaches and practice selective deworming.

Selective deworming entails administering anthelmintics (anti-parasite drugs) only as often as necessary to reduce fecal egg counts (FEC), a practice that flies in the face of the long-standing approach of deworming horses every two months regardless of their need. For selective deworming to be effective, owners must rely heavily on FECs, which calculate the number of parasite eggs in an individual horse's feces.

As we've established in related articles, "The majority of the parasites in any group of animals are concentrated in a minority of the animals," says Craig Reinemeyer, DVM, of East Tennessee Clinical Research and co-author of *The Handbook of Equine Parasite Control*. Fecal egg counts help practitioners identify this minority by revealing differences in each horse's immune response to worms and their likelihood of shedding eggs into the environment (whether the horse is a low, moderate, or high shedder), along with showing which deworming products might no longer be effective on certain farms.

While practitioners can make generalizations about how frequently parasite populations develop resistance to specific dewormer classes, such as the benzimidazoles (fenbendazole), pyrimidines (pyrantel), and macrocyclic lactones (including ivermectin and moxidectin), the American Association of Equine Practitioners (AAEP) emphasizes in its *Guidelines for Parasite Control* that "the occurrence of resistance is very variable and large differences can be found between individual farms, and resistance cannot be concluded on any given farm without proper testing." Ensuring that all anthelmintics used are still effective has become more important than following any traditional rotational patterns the industry once kept.

Fecal Egg Count



Fecal egg counts (completed under a microscope) performed before and after deworming help owners determine whether a drug is effective and which horses are low, moderate, or high shedders.

Resistance is a genetic adaptation that worms pass to succeeding generations; once they develop resistance to a particular drug, those worm populations are not likely to revert back to susceptibility.

Practitioners are relying on something called "refugia" to slow parasite resistance, says Martin Nielsen, DVM, PhD, Dipl. EVPC, ACVM, co-author of *The Handbook of Equine Parasite Control,* chair of the AAEP Parasite Control Subcommittee that developed the *Guidelines*, and an equine parasitologist at the University of Kentucky's Gluck Equine Research Center, in Lexington.

"Parasites in refugia are those that are not exposed to an anthelmintic at the time of treatment," he explains. "This includes all stages on pasture (eggs and larvae) as well as parasites residing in animals left untreated. If lots of parasites are in refugia, the selection pressure for development of resistance will be milder compared to when (numbers of parasites in) refugia are small—the role of refugia is to dilute the resistant stages by having susceptible worms make up the bulk of the parasite population. This then delays development of resistance."

"If horse owners would stop using macrocyclic lactones exclusively and far too frequently, we might be able to freeze the progress of resistance in its current tracks."

Dr. Craig Reinemeyer

Current Findings
Nielsen reports that recent European and American studies document widespread parasite resistance to dewormers. These findings are important when considering which anthelmintics are still effective. Here's what the current situation looks like:

- Overall, strongyles (cyathostomins, or small strongyles) are widely resistant to benzimidazoles, somewhat resistant to pyrimidines, and show evidence of emerging resistance to macrocyclic lactones (M/L).
- Researchers have documented double resistance (to both benzimidazole and pyrimidine classes) on several farms in both the United States and Europe.
- On some farms, benzimidazole efficacy might still be high against strongyles, but it is important to confirm this using FEC reduction tests because usually that is not the case. The drug does, however, remain an excellent anthelmintic for killing ascarids (*Parascaris equorum*, or roundworms).
- Ascarids display almost the opposite pattern to strongyles—high levels of M/L resistance and a few reports of pyrimidine resistance. At this point, resistance to pyrimidines is most commonly seen in the small strongyles.

"We're seeing outright M/L resistance through treatment failures in ascarids," reports Reinemeyer. "And, in small strongyles, the evidence has mostly been abbreviated egg reappearance periods after M/L treatment, which is considered by some to be the first manifestation of resistance—we've been at this point for some time."

Reinemeyer expresses concern about overuse of the macrocyclic lactones, saying, "If horse owners would stop using M/Ls exclusively and far too frequently, we might be able to freeze the progress of resistance in its current tracks."

One concern veterinarians have about selective deworming is the resurgence of *Strongylus vulgaris*, or the large strongyle or bloodworm, due to less frequent deworming. "One study suggests a relationship between selective therapy and recurrence of bloodworms," Nielsen notes. "This parasite is definitely still around and, subsequently, it is important to implement surveillance and control measures. We have recently developed a blood test for detection of bloodworms while still in the blood (where they are most dangerous; once they migrate to the intestines the damage is done). Currently, there are no signs of drug resistance by bloodworms so any anti-parasite drug should work. However, only some of the currently available anthelmintics are capable of treating migrating stages of bloodworms."

Overall, Nielsen suggests following the selective deworming approach in adult horses but not in foals and young horses. "Because egg counts are not reliable as monitoring tools in foals, there is concern that ascarid worm burdens may accumulate, thereby putting foals at risk for life-threatening small intestinal impactions," he explains. (Learn more about foal treatments in "Creating a Parasite Control Program.")

Seasonal Strategies
There are differences in the selective deworming approaches a horse owner takes relative to geographic location, and adhering to these can help prevent resistance. "In Northern temperate climates (roughly north of the Ohio River), strongyle eggs hatch and develop into infective larvae in spring, summer, and into late autumn," Reinemeyer explains. "However, infective larvae survive just fine through the winter months on pasture. The objective of parasite control is to limit environmental contamination (with eggs) and subsequent infectivity (from hatched larvae)—this is best done by stopping egg production during those seasons when the eggs can turn into future parasites. In Northern temperate zones, the annual strongyle transmission is April through October. That's when chemical interventions should take place.

New-Age Parasite Control
Forget everything you think you know about parasite control, says Craig Reinemeyer, DVM. Future ap
thinking, "unencumbered by tradition, accepted dogma, and black magic," he says. "For instance, som
dewormed. Period! Does this sound like heresy? You bet."

"In Southern temperate regions, the opposite is true," he continues. "Strongyle transmission occurs mostly September into May. Summers are typically too hot and too dry to support much transmission so there is no need to deworm during the off season."

Reinemeyer stresses that a positive fecal exam doesn't necessarily mean negative consequences. "If a strongyle egg gets dropped into a snow drift or onto a patch of dirt at 98°F, those units aren't going to be perpetuated," he says. "Let Mother Nature take care of transmission during the off season, and leave the drugs on the shelf."

Environmental Strategies
Reducing the presence of infective parasites in the environment can also aid in the effort to slow anthelmintic resistance. Nielsen remarks on the importance of removing manure from pastures once or twice a week as an effective parasite control method (see page 24): "This practice can effectively reduce the need for anthelmintic treatments, which should delay development of resistance." Composting can also help kill off the infective larvae in manure you plan to fertilize pastures with.

Another potential anti-parasite tool is nematophagous fungi. "There are excellent data illustrating the efficacy of predacious fungi against horse parasites," Nielsen says. "These are fed to the horse as fungal spores, which then pass through the gastrointestinal tract to end up in the fecal pile with the parasite eggs. The fungi then sporulate, and as parasite eggs are hatching, the fungi trap the larvae in meshes of budding hyphae that then kill parasite larvae." As yet, there is no commercial nematophagous fungi product, but he says this could serve as an effective adjunctive anti-parasite control measure in future.

Take-Home Message
"Not all parasite infections should be considered the next black plague," Reinemeyer says. "Horse owners have been hearing the concept of 'deworm or die' for five decades. While this has sold a lot of drugs, it may not in fact hold true in most cases," as most equine parasites don't cause major health issues.

"The problem is that we keep doing things the same way long after we've forgotten the reason we did them in the first place," he adds. "It's time to throw the old concepts out the window and start over."

Scientists have shown selective deworming in adult horses to be a practical approach to controlling parasite loads in individuals and farm-wide. "Selective deworming is a matter of identifying the active parasite transmission season and then focusing on anthelmintic treatments," Nielsen says. "I recommend a yearly fecal egg count reduction test, regardless of the drug used. This evaluates the efficacy of deworming products. If it demonstrates good efficacy through testing, it is fine to use it." (Learn more about "good efficacy" in the AAEP guidelines)

No new drugs are on the horizon for deworming horses, so both our sources say it is important to be circumspect and educated in using the currently available products. "Some compounds now being used in small animals and ruminants might have some efficacy against equine intestinal parasites," says Reinemeyer. "But it may be a long time before it would be cost-effective to use them, even if they are shown to work in horses."