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Parasite diagnostics: the methods and what they will and will not tell you

M. Fisher, diplomate European Veterinary Parasitology College, ESCCAP (European Scientific Counsel: Companion Animal Parasites), Shernacre Enterprise, Shernacre Cottage, Lower Howsell Road, Malvern, Worcs., WR14 1UX, UK, mfisher@globalnet.co.uk

Introduction:
Parasite diagnostics are used as screening and diagnostic tools, and there are a variety of methods for detection of each parasite. This presentation will review in-house and specialist tests and examine their value as screening or diagnostic tools.

Screening or diagnostic?
Parasite diagnostics are sometimes carried out as screening tools, for example evaluating the heartworm status of a dog or cat from an endemic area prior to initiating heartworm prevention or where diagnosis of a patent infection is necessary before anthelmintic treatment can be administered. Diagnostics are also conducted where an animal is showing clinical signs and one or more of the differential diagnoses is parasitic.

Gastrointestinal helminth infections
Patent gastrointestinal nematode infections can be identified by faecal egg-counts using modified McMaster techniques: these reach a sensitivity of 50 eggs per gram, or centrifugal flotation techniques that can reach a sensitivity of 1 egg per gram of faeces. These tests will not work where there is an all-male or immature infection. This is particularly important where immature stages can cause severe disease as in the case of Ancylostoma caninum infection in pups. These methods are less reliable for cestode infections where eggs may be passed irregularly. Moreover, the taeniid eggs produced by E.granulosus, E.multilocularis and Taenia spp. cannot be morphologically distinguished. Other tests with high specificity include PCR tests on eggs and coproantigen. The latter is particularly useful where worm numbers are
high, with PCR tests of eggs a useful alternative where worm numbers are lower.

**Lung and heartworms**
Lungworm larvae from patent lungworm infections, together with larvae of the heartworm Angiostrongylus vasorum can be identified by bronchoalveolar lavage or by Baermann examination of faecal samples. The latter is less sensitive for larvae that are sluggish, such as Oslerus osleri larvae. Whilst these tests are imperfect, there are currently no diagnostic alternatives, although alternatives for diagnosing A. vasorum is an area of active research.

Patent infection with the heartworm Dirofilaria immitis can be detected using the Knott test to detect microfilariae in a concentrated blood sample: this test is unlikely to be useful in cats as infections are rarely patent. The microfilariae must be confirmed as D. immitis microfilariae morphologically. Around 30% of dogs with infections will not produce microfilariae so whilst the test is specific, there will be false negatives. Antigen detection tests are also highly specific in dogs but there may be false negatives for example where there are all male infections. Radiographic and ultrasonic evidence are useful additions to confirm the diagnosis. In cats diagnosis is more difficult, with antibody tests in conjunction with radiographic and other evidence being the diagnostic method of choice.

**Arthropod infestations**
Diagnosis of flea and tick infestations are relatively easy due to the large size of the parasite. Speciation is a more specialised technique: this may be important where non-endemic tick species are suspected, for example. Flea infestations can also be detected by the presence of eggs or flea faeces. Flea allergy can be diagnosed by intradermal or blood tests or by response to flea elimination.

Mite infestations are normally diagnosed by demonstration of mites in hair brushings, skin scrapes or hair plucks. One study examining the usefulness of skin scrapes compared to hair plucks and biopsies for the diagnosis of Demodex infection found skin scrapes to be the most sensitive technique. Demodex, Cheyletiella and Sarcoptes scabiei infections may also be diagnosed by the presence of eggs. Two in vitro ELISA tests for the diagnosis of canine scabies have been described. The Swedish test had a sensitivity of 83% and a specificity of 92% and a positive predictive value of 100% and a negative predictive value of 92%. The Swiss test showed 84.2% sensitivity and 89.5% specificity.

**Vector-borne disease diagnosis**
Parasitic vector-borne diseases such as leishmaniosis, babesiosis and hepatozoonosis can be diagnosed by visualisation of the parasites in smears or by in-vitro tests such as PCR. Demonstration of the organism is obviously highly specific, however there can be false negatives for example early or late in Babesia spp. infections.