

Monitoring methods and systems

Georg von Samson-Himmelstjerna, Jürgen Krücken

Institute for Parasitology and Tropical Veterinary Medicine

Freie Universität Berlin

What suitable and validated tools/tests are currently available for monitoring resistance for all relevant species?

Where are the problem areas?

Which monitoring systems for anthelmintic resistance are available or needed in Europe?

What suitable and validated tools/tests are currently available for monitoring resistance for all relevant species?

Non (maybe one)

Where are the problem areas?

Everywhere (in principle)

Which monitoring systems for anthelmintic resistance are available or needed in Europe?

Non (available)/basic routine efficacy screens (needed)

Detection of AR

in vivo assay:

- Worm count based efficacy tests (controlled test)
Compare worm counts in **treated versus un-treated** animals post **necropsy**
- Faecal-Egg-Count-Reduction test (FECRT)
Compare faecal egg count **before** and **after** treatment.

in vitro assays:

- Egg-hatch inhibition test
Compare number of hatched larvae in **presence** and **absence** of different anthelmintic concentrations
- Larval-development inhibition test
Compare number of larvae which underwent development to third stage in **presence** and **absence** of anthelmintic
- Larval-migration inhibition assay
Compare number of larvae which migrated through a sieve following incubation in **presence** and **absence** of anthelmintic
- Allele specific molecular tools (PCR, Pyrosequencing)
Qualitative and quantitative assays for the detection benzimidazole resistance

What suitable and validated tools/tests are currently available for monitoring resistance for all relevant species?

in vivo assay:

- Worm count based efficacy tests (controlled test)
Compare worm counts in **treated versus un-treated** animals post **necropsy**

Technically suitable for ALL gastro-intestinal nematode and tapeworms species, lungworms, fluke and ALL drug classes

NOT available for monitoring due to requirement for necropsy of hosts

What suitable and validated tools/tests are currently available for monitoring resistance for all relevant species?

in vivo assay:

- Faecal-Egg-Count-Reduction test (FECRT)
Compare faecal egg count **before** and **after** treatment.

Technically suitable for MOST gastro-intestinal nematode and tapeworms species, fluke (not for lungworms) and ALL drug classes

Not available for monitoring simply due to high costs

What suitable and validated tools/tests are currently available for monitoring resistance for all relevant species?

in vitro assays:

- Egg-hatch inhibition test

Compare number of hatched larvae in **presence** and **absence** of different anthelmintic concentrations

Technically suitable for ruminant and equine gastro-intestinal strongylid nematode species and benzimidazoles

Available for monitoring

What suitable and validated tools/tests are currently available for monitoring resistance for all relevant species?

in vitro assays:

- Larval-development inhibition test

Compare number of larvae which underwent development to third stage in **presence** and **absence** of anthelmintic

Suitable and validated for ruminant gastro-intestinal strongylid nematode species and benzimidazoles, imidazothiazoles/tetrahydropyrimidines, macrocyclic lactones

Available for monitoring

What suitable and validated tools/tests are currently available for monitoring resistance for all relevant species?

in vitro assays:

- Larval-migration inhibition assay

Compare number of larvae which migrated through a sieve following incubation in **presence** and **absence** of anthelmintic

Technically suitable (not fully validated) for ruminant gastro-intestinal strongylid nematode species and imidazothiazoles/tetrahydropyrimidines, macrocyclic lactones

Not (yet) available for monitoring

What suitable and validated tools/tests are currently available for monitoring resistance for all relevant species?

in vitro assays:

- Allele specific molecular tools (PCR, Pyrosequencing)

Qualitative and quantitative assays for the detection benzimidazole resistance

Technically suitable for some ruminant gastro-intestinal strongylid nematode species and benzimidazoles

Available for monitoring

Where are the problem areas?

Sheep parasites:

- BZ resistance widespread in trichostrongyles, however, only few studies and no spatial prevalence information in most countries
- Resistance against flukicides widespread in UK/Ireland but not sufficient prevalence data available there and almost no efficacy data in other countries

Cattle parasites:

- ML resistance apparently emerging in trichostrongyles and basically no prevalence data available

Horse parasites:

- BZ and PYR resistance in Cyathostomins widespread but no current prevalence data in most countries
- ML resistance in *Parascaris* spp. occurring on stud farms but no prevalence data available

Which monitoring systems for anthelmintic resistance are available or needed in Europe?

Sheep/goat parasites:

- GIN: BZ resistance monitoring (possibly pooled flock samples) and using molecular tools (e.g. beta-tubulin codon 167/198/200 pyrosequencing) or
- GIN: EHT based BZ resistance monitoring (possibly pooled flock samples)
- GIN: FECRT based ML resistance surveillance in ‘hot spot’ regions/countries, elsewhere efficacy screening using post treatment testing
- FECRT based flukicide resistance surveillance in ‘hot spot’ regions/countries, elsewhere efficacy screening using p.t. testing

Which monitoring systems for anthelmintic resistance are available or needed in Europe?

Cattle parasites:

- GIN: FECRT based ML resistance surveillance in ‘hot spot’ regions/countries, elsewhere efficacy screening using post treatment testing

Which monitoring systems for anthelmintic resistance are available or needed in Europe?

Horse parasites:

- Cyathostomins: FECRT based BZ and PYR resistance prevalence monitoring each 3rd to 5th year
- *Parascaris*: FECRT based ML resistance prevalence monitoring on stud farms each 3rd to 5th year

Which monitoring systems for anthelmintic resistance are available or needed in Europe?

Generally needed: EU reference laboratory/laboratories

- Establishment and maintenance of reference strain library
- Evaluation/validation of monitoring tools
- Training in AR detection/monitoring