EFFECT OF IVERMECTIN, PYRANTEL AND MORANTEL ON THE EUROPEAN EEL AND ITS MONOGENEAN PARASITES

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Introduction

Until now only few anthelmintics have been found to eradicate the gill parasitic monogeneans *Pseudodactylogyrus* spp. from the European eel (*Anguilla anguilla*) without harming the host in short term studies. These are mebendazole (Székely and Molnar, 1987; Buchmann and Bjerregaard, 1990 a,b), luxabendazole, albendazole and flubendazole (Buchmann and Bjerregaard, 1990a) and praziquantel (Schliffka, 1986; Buchmann et al., 1990b). Schmahl et al. (1988) found an effect of toltrazuril against these monogeneans, although not confirmed by Buchmann et al. (1990 a).

In veterinary parasitology ivermectin, a drug primarily interfering with the GABA-system (Campbell, 1989) and the neuromuscular blocking anthelmintics pyrantel and morantel (Van den Bossche, 1985; Roberson, 1988) have proved to be efficacious antiparasitic compounds. In our screening of anthelmintics for their effects on the gill parasites *Pseudodactylogyrus* spp. these three compounds were also tested. In addition, the toxicity of ivermectin to the host *Anguilla anguilla* was studied in further detail, as this drug has been used against fish parasites with varying success (Heckman, 1985; Hyland and Adams, 1987; Palmer et al., 1987; Taraschewski et al., 1988).

Materials and methods

Parasiticidal effect: Small pigmented eels infected by a mixed population of *Pseudodactylogyrus bini* and *P. anguillae*, app. 3 weeks post-infection, were exposed to different concentrations of ivermectin (Ivomec, injectable), pyrantel citrate (BanminthR vet.) and morantel tartrate (Table 1). Exposure was conducted as waterbath treatments for 24 h at 25°C in 17 l aerated drug solution in 17 l aquaria. After treatment, surviving eels were transferred to clean water and examined for gill parasites after 4 days. Data for eels and infection levels are shown in Table 1.

Toxicity of ivermectin: Groups of eels (each comprising 13 to 16 specimens) were exposed to eight concentrations of ivermectin (Ivomec 10 mg/ml, injectable) and the percentage of eels showing no signs of paralysis was recorded during 24 h (Fig. 1). Paralysis of eels was studied in further detail, as this drug has been used against fish parasites with varying success (Heckman, 1985; Hyland and Adams, 1987; Palmer et al., 1987; Taraschewski et al., 1988).

Table 1. *Pseudodactylogyrus* spp. Infection level after treatment with various anthelmintics. Only surviving eels were examined.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Concentration</th>
<th>No. of eels in experiment</th>
<th>No. of surviving eels</th>
<th>Body length (cm)</th>
<th>Body weight (g)</th>
<th>Prevalence %</th>
<th><em>Abundance</em>: Mean number of parasites per host (infected and uninfected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ivermectin</td>
<td>100 ppb</td>
<td>10</td>
<td>0</td>
<td>12.2±1.4</td>
<td>2.2±1.0</td>
<td>100</td>
<td>127.0 ± 71.1</td>
</tr>
<tr>
<td></td>
<td>50 ppm</td>
<td>10</td>
<td>5</td>
<td>10.3±2.3</td>
<td>1.1±0.8</td>
<td>100</td>
<td>56.0 ± 64.4</td>
</tr>
<tr>
<td></td>
<td>5 ppm</td>
<td>10</td>
<td>9</td>
<td>9.7±1.5</td>
<td>1.0±0.5</td>
<td>100</td>
<td>49.1 ± 27.7</td>
</tr>
<tr>
<td>Pyrantel</td>
<td>10 ppm</td>
<td>10</td>
<td>8</td>
<td>11.2±1.6</td>
<td>1.3±0.6</td>
<td>100</td>
<td>49.1 ± 27.7</td>
</tr>
<tr>
<td></td>
<td>100 ppm</td>
<td>10</td>
<td>7</td>
<td>11.6±3.2</td>
<td>1.9±1.9</td>
<td>100</td>
<td>38.6 ± 25.8</td>
</tr>
<tr>
<td>Morantel</td>
<td>10 ppm</td>
<td>10</td>
<td>10</td>
<td>12.2±1.9</td>
<td>2.1±1.1</td>
<td>100</td>
<td>32.5 ± 37.1</td>
</tr>
<tr>
<td></td>
<td>100 ppm</td>
<td>10</td>
<td>9</td>
<td>10.3±1.6</td>
<td>1.3±0.7</td>
<td>100</td>
<td>63.8 ± 27.2</td>
</tr>
</tbody>
</table>
Figure 1. Toxicity of ivermectin to European eel. Exposure of small pigmented eels to various concentrations of ivermectin (waterbath) during 24 hours (H). The percentage of eels which was not paralysed was recorded (%).

fined as an outstretching and inactivation of the eels in an upside down or side-long position. Mean body length of experimental eels was 10.0 cm (SD: 1.9) and the mean body weight was 1.2 g (SD: 1.0).

Discussion
As it was found that morantel and pyrantel even in the rather high concentrations of 100 ppm caused no satisfactory parasite elimination, it is suggested that these anthelmintics are of minor interest for treatment of gill parasite infections in commercial eel farms.

Ivermectin primarily acts on the GA-BA-system in nematodes (Turner and Schaeffer, 1989). As this compound did not affect Pseudodactylogyrus spp. (Table 1). Bath treatments with pyrantel (100 ppm) and morantel (10 and 100 ppm) caused only a moderate reduction of the parasite number in these high concentrations, which were associated with some host mortality (Table 1).

When the toxicity of ivermectin was studied in detail, it was found that 50 per cent of the eels were paralysed within 2 h in 1000 ppb, within 3-4 h in 500 ppb, within 12 h in 100 ppb and within 24 h in 50 ppb. Ivermectin concentrations of 25 and 10 ppb with an exposure time of 24 h caused paralysis in 20 and 10 percent of the eels respectively. No paralysis was recorded in eels exposed to 1 ppb ivermectin and clean water.

Results
Ivermectin treatment, with a concentration which paralysed and killed 50 per cent of the eels (50 ppb), did not affect the infection level of Pseudodactylogyrus spp. (Table 1). Bath treatments with pyrantel (100 ppm) and morantel (10 and 100 ppm) caused only a moderate reduction of the parasite number in these high concentrations, which were associated with some host mortality (Table 1).

In contrast, European eel seems to possesses target mechanisms for ivermectin, as this fish species was found to be extremely susceptible to the drug. Also other fish species, e.g. rainbow trout and bluegill sunfish have been found vulnerable to ivermectin in very low concentrations (Halley et al., 1989).
Our results suggest that any use of ivermectin in eel farms should be avoided. In addition the toxicity of this anthelminthic to fish raises some environmental questions to the use of this compound in livestock grazing near water bodies containing fish populations. Although ivermectin is administered as subcutaneous injections or as pour-on preparations, a considerable amount of the drug will be found in the faeces of livestock, and a leakage of the drug to the water might at least theoretically be expected.

Summary
Water bath treatments (24 hours, 25°C) with ivermectin (5 and 50 ppb) did not affect the gill parasitic monogeneans *Pseudodactylogyra* spp. from the European eel (*Anguilla anguilla*). Morantel (10 and 100 ppm) and pyrantel (100 ppm) caused only a moderate reduction of the parasite number. In addition ivermectin was found to be extremely toxic to eels. Fifty per cent of the eels were paralysed within 2 hours in 1000 ppb, within 3-4 hours in 500 ppb, within 12 hours in 100 ppb and within 24 hours in 50 ppb. No paralysis was found in eels exposed to 1 ppb for 24 hours.

References


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