Veterinary Parasitology 188 (2012) 294–300

Contents lists available at SciVerse ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

Efficacy of major anthelmintics against horse cyathostomins in France

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ARTICLE INFO

Article history:
Received 15 November 2011
Received in revised form 21 March 2012
Accepted 24 March 2012

Keywords:
Cyathostomins
Fenbendazole
Pyrantel embonate
Ivermectin
Moxidectin
Faecal egg count reduction test
Anthelmintic resistance

ABSTRACT

This paper reports a survey conducted in France during 2011 to evaluate the efficacy of commonly used anthelmintics against horse cyathostomins. A total of 40 farms and 1089 horses were screened for the presence of cyathostomins. All farms but one were positive, with an overall animal infection rate of 53.7%, ranging from 9% to 83% on individual farms. On 445 horses from 30 of these farms, a faecal egg count reduction test (FECRT) was performed to evaluate the efficacy of oral formulations of fenbendazole (FBZ), pyrantel embonate (PYR), ivermectin (IVM) and moxidectin (MOX). Calculation of the mean FECR and 95% confidence intervals (95% CI) around the mean was performed using bootstrap analysis. Resistance to FBZ was found on 17 of 18 farms investigated, with a mean reduction of 57% (95% CI: 38.5–71.2%). Suspected resistance for PYR was found on 6 of 30 farms, and confirmed on another 3 of 30 farms, with a mean reduction for PYR of 94.7% (95% CI: 88.9–98.5%). Reduced efficacy simultaneously of FBZ and PYR was found in 7 farms. Reduced efficacy of IVM was found in one animal on one farm and of MOX in one animal on another farm, and was combined with resistance against FBZ and/or PYR. These results indicate that single and multiple drug resistance and reduced efficacy in equine cyathostomins is present in France. Macrocylic lactones proved to be highly effective compounds against cyathostomins, with reduced efficacy for IVM and MOX in two farms only. These results extend present knowledge on the occurrence of drug resistant cyathostomins in Europe, and illustrate the necessity to use anthelmintics in appropriate worm control programmes.

1. Introduction

Protracted blanket anthelmintic treatment of horses is considered to have contributed to the selection of drug-resistant nematodes in the subfamily Cyathostominae, i.e. cyathostomins or small strongyles (Kaplan and Nielsen, 2010). Cyathostomins surviving treatment with anthelmintics may pose a serious problem to horses because these parasites cause various types of colics (Murphy and Love, 1997; Mair et al., 2000), decreased performance, rough hair coat and debilitation (Uhlinger, 1991). When larval stages encysted in the large gut wall simultaneously emerge, they may cause a potentially life-threatening syndrome called "larval cyathostominosis", i.e. colitis characterised by loss of protein and weight, intense diarrhoeic episodes, and oedema, with frequent fatalities reported (Giles et al., 1985; Eysker et al., 1989, 1990; Love and McKeand, 1997).

In many geographic regions of industrialized countries resistance to benzimidazoles (BZs) is now ubiquitous

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http://dx.doi.org/10.1016/j.vetpar.2012.03.048

(Traversa et al., 2009a; Nielsen et al., 2010). Reduced efficacy of tetrahydropyrimidines, such as pyrantel (PYR), is less commonly reported but is present in different countries in Europe and America (Kaplan and Nielsen, 2010; Nielsen et al., 2010). Macrocyclic lactones (MLs) such as ivermectin (IVM) and moxidectin (MOX) are the most effective anthelmintics but reduced efficacy of IVM has been reported in the UK, Germany and the USA, and failure to provide control of cyathostomins by MLs in the Americas is of concern (von Samson-Himmelstjerna et al., 2007; Molento et al., 2008; Lyons et al., 2011a,b). Recently, a large survey conducted in Europe showed the occurrence of drug resistance in horse cyathostomins from UK, Germany and Italy (Traversa et al., 2009a). This study indicated that single or multiple drug resistance in equine cyathostomins is present in the three countries: resistance to fenbendazole (FBZ) and PYR was present in the geographic areas examined; reduced efficacy of IVM was found on some farms and efficacy of MOX was unaffected. Also, simultaneous resistance to FBZ, PYR and IVM was reported for the first time on one UK property although MOX was 100% effective at this site (Traversa et al., 2009a).

A better understanding of cyathostomin resistance against anthelmintics is required in other European countries where small strongyles are spread. In France, a nationwide survey demonstrated 100% prevalence of small strongyle infection on 48 horse farms, with 81% of the horses investigated shedding strongylid eggs. Coproculture of faecal samples demonstrated that almost all infected horses were infected with cyathostomins (Anonymous, 1999). Other studies have indicated a prevalence of cyathostominosis up to 25%, with peaks of 40% in young horses (Fayet, 2001; Collobert-Laugier et al., 2002). In France, cyathostomins are regarded as a cause of mortality in about 10% of infected animals and larval cyathostominosis is associated with 12 and 35% of acute and chronic diarrhoea cases, respectively (Fayet, 2001). Cyathostomin resistance to BZs in France has been reported since the early 1990s (Lerasle, 1992; Collobert et al., 1996; Collobert-Laugier et al., 2002), but more recent data on the occurrence of anthelminthic resistance are lacking. The objective of this study was to evaluate the efficacy of major anthelmintics currently used in France and to estimate the prevalence of anthelmintic resistant cyathostomin populations in the country.

2. Materials and methods

2.1. Screening and selection of farms for the faecal egg count reduction test

Horse farms in France were selected in the spring of 2011 by several veterinary practitioners and invited to participate in the study. All farms whose owners agreed to participate were included in the trial. Inclusion criteria were: presence of at least 20 animals aged >6 months, no pregnant mares and the condition that anthelmintic drugs had not been administered for at least 13 weeks prior to testing. A total of 1089 horses at 40 horse farms were selected and examined for the presence of cyathostomin infection by faecal egg count (FEC). A modified McMaster technique with a sensitivity of 50 strongylid eggs per gram (EPG) was used (Sloss et al., 1994) to determine the FECs of each horse at day −7 prior to the faecal egg count reduction test (FECRT).

Fig. 1. Geographic location of the 30 French farms involved in the Anthelmintic Resistance study. They were located in the following departments: Bouches-du-Rhône (2), Corrèze (1), Dordogne (1), Haute-Vienne (2), Tarn et Garonne (4), Orne (3), Ain (2), Rhône (2), Maine et Loire (4), Calvados (3), Sarthe (3), Vosges (3).

Farms which had a minimum number of 12 horses with a FEC above or equal to 50 EPG of faeces were further enrolled in the study. On each selected farm, the 12–20 horses with the highest FECs were kept for inclusion in the FECRT. Either 4 or 5 animals were included in each treatment group, and either 3 or 4 treatment groups were included on each farm. On farms with no more than 12 eligible horses, there were only 3 treatment groups (no FBZ-group).

After the initial screening, 30 farms (445 horses), located in different regions of France (Fig. 1), were withheld for the FECRT.

2.2. Faecal egg count reduction test

All 445 horses were tested using a FECRT (Coles et al., 1992) to evaluate the efficacy of FBZ, PYR, IVM and MOX. To enable testing of at least three different drugs on as many farms as possible, a critical instead of a controlled study approach was chosen as performed in several previous surveys (Wirtherle et al., 2004; von Samson-Himmelstjerna et al., 2007; Ceňanská et al., 2009; Traversa et al., 2009a). On each of the 30 farms, horses were randomly allocated to equally sized treatment groups comprising 4 or 5 horses each, depending on the number of horses with positive FECs. On day 0, animals enrolled in each group were treated by the local veterinary practitioner with FBZ (fenbendazole 7.5 mg/kg *per os*, Panacur® oral paste, Intervet Shering-Plough), PYR (pyrantel embonate 6.6 mg/kg