

VETERINARSKI ARHIV 85 (4), 415-423, 2015

The prevalence and control of gastrointestinal nematodes in farmed fallow deer (*Dama dama* L.)

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PILARCZYK, B., A. TOMZA-MARCINIAK, J. UDAŁA, J. KUBA: The prevalence and control of gastrointestinal nematodes in farmed fallow deer (*Dama dama* L.). Vet. arhiv 85, 415-423, 2015.

ABSTRACT

The aim of the study was to determine the prevalence and intensity of infection with gastrointestinal nematodes in farmed fallow deer, and to assess the effectiveness of ivermectin used to control them. Faeces samples were collected from fallow deer (n = 468), raised on an organic farm. The study showed an average prevalence and intensity of infection with gastrointestinal nematodes in an annual cycle at 57.33 % and 529 EPG, respectively. Nematodes of the *Trichostrongylus* (13.33 %) and *Chabertia* (10 %) species were recorded most frequently, while *Strongyloides* sp. (3.33 %) had the lowest prevalence. Deworming was performed twice, in December and in March, during which a 1 % ivermectin injection was applied. The efficacy of the first deworming with ivermectin was 94.44 % and of the second deworming 95 %. The deworming did not result in removal of gastrointestinal nematodes in all hosts, but significantly reduced the intensity of infection in these animals. Ivermectin, administered by subcutaneous injection, was highly effective against gastrointestinal nematodes in fallow deer. However, the deer were kept in a limited area, which caused the accumulation of eggs of gastrointestinal nematodes in the pasture sward, creating perfect conditions for reinvasion (ingestion of invasive forms with food).

Key words: deworming, fallow deer, farm raising, gastrointestinal nematodes

Introduction

In recent years the number of cervid farms in the world has been increasing. Farm-bred fallow deer may be an alternative to modern agriculture. Fallow deer farming, apart from deworming preparations, uses virtually no medication.

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ISSN 0372-5480
Printed in Croatia

An important element of health care in fallow deer is monitoring the occurrence of parasitic diseases. Even well-maintained cervids are exposed to invasive forms of parasites (BORKOVCOVÁ et al., 2013; BURLIŃSKI et al., 2011; MEDNE et al., 2009; REHBEIN et al., 2014). Infestations in farms have a very large impact on the health and productivity of animals. A review of the literature suggests that parasitological studies of wild cervids have been carried out quite regularly (BALICKA-RAMISZ et al., 2005; CISEK et al., 2003 and 2004; DRÓZDŹ, 1998; KOWAL et al., 2012; REHBEIN et al., 2001 and 2014; SANTIN-DURAN et al., 2004; SHIMALOV and SHIMALOV, 2002; VENGUST and BIDOVEC, 2003). The situation is different in farm reared animals (AMBROSI et al., 1993; BORKOVCOVÁ et al., 2013; SHIMALOV and SHIMALOV, 2002; DRÓZDŹ et al., 1997; BARTH and MATZKE, 1984). Therefore, it is necessary to perform parasitological studies, aimed at determining the prevalence and intensity of infestation, allowing in turn for the development of appropriate prevention programs to control parasitic infections in these animals. It is believed that the process of intensification of livestock production, and particularly the associated high density of animals, favours high prevalence and intensity of infection. To date, most prevention programs controlling parasitic infections have usually included double deworming of animals, which is applied at various time periods on farms.

The aim of the study was to determine the prevalence and intensity of infection with gastrointestinal nematodes in farmed fallow deer, and to assess the effectiveness of ivermectin used to control them.

Materials and methods

Animals. Faeces samples were collected from fallow deer (n = 468), raised on an organic farm. The farm was situated on the edge of the Notecka Primeval Forest in Lubuskie Voivodeship. The farm had 300 hectares of meadows and pastures, 150 of which were fenced and divided into grazing areas. The study was conducted in the period from October 2011 to October 2013. The herd was kept in an extensive system (it remained in the pasture throughout the year). The owner used veterinary services on an ad hoc basis, usually when medical problems emerged in animals.

A total of 468 faeces samples of fallow deer (265 females, 203 males) were tested. Due to the high aggressiveness of the animals, faeces samples for parasitological tests were collected from a pasture area immediately after an animal defecated, and not directly from the rectum of each animal. Due to the fact that animals of different ages were kept together in the pasture, it was not possible to analyse the results with respect to age groups. Approximately 20 g of faeces were collected into polyethylene bags, and when necessary, the material was stored in a refrigerator at 4-6 °C (for up to two days).

Detection of parasites in faeces. The evaluation of the prevalence and intensity of infection was based on faeces analysis, using the method of Willis-Schlaf flotation with

saturated NaCl solution, and the McMaster technique using saturated NaCl solution as the flotation fluid, with a detection level of 50 gastrointestinal nematode eggs per gram of faeces (in EPG - eggs per gram of faeces). In order to determine the species of gastrointestinal nematodes, coprocultures were prepared from the positive faecal samples and incubated at 24 °C in moist conditions, with 2.5 % aqueous solution of potassium dichromate ($K_2Cr_2O_7$, to prevent mould growth) to obtain the infective third stage larvae (L3) (ZIOMKO and CENCEK, 1999). The key of TIENPONT et al. (1986) was used to identify the gastrointestinal nematodes.

Deworming in this study was performed in December and in March, during which a 1 % ivermectin injection was applied (Vetoquinol Biowet). This drug is an antiparasitic agent with a broad spectrum of action, registered in Poland for veterinary use in cattle, sheep and pigs. Ivermectin was administered in the folds of skin behind the shoulder in all animals individually, once, by subcutaneous injection, at the recommended dose of 1 mL/50 kg bw.

The test of faecal egg count reduction (FECR) was used to assess the efficacy of treatment in the control of infection caused by gastrointestinal nematodes. This method is recommended by the World Association of Veterinary Parasitology. Antihelmintic efficacy was calculated by the FECR test (COLES et al., 1992) according to the following formula:

$$\text{FECR (\%)} = \frac{\text{Pre-treatment EPG} - \text{Post-treatment EPG} \times 100}{\text{Pre-treatment EPG}}$$

Efficacy of drugs was determined 14 days after administration.

Results

The average prevalence of infection with gastrointestinal nematodes in the tested fallow deer was 57.33 %. The dynamics of egg excretion of gastrointestinal nematodes in the annual cycle varied. The highest prevalence was demonstrated in March (100 %) and December (93.33 %), and the lowest in January (13.33 %), i.e., after deworming. The seasonal dynamics of the occurrence of gastrointestinal nematodes in test animals is shown in Fig. 1. The presence of eggs of the following gastrointestinal nematodes was detected in the faeces of fallow deer: *Haemonchus* sp., *Nematodirus* sp., *Oesophagostomum* sp., *Ostertagia* sp., *Strongyloides* sp., *Trichostrongylus* sp. and *Chabertia* sp. (Table 1).

Table 1. The average prevalence of infection with gastrointestinal nematodes in test fallow deer

Parasite	Infection rate (%)
<i>Haemonchus</i> sp.	8.33
<i>Nematodirus</i> sp.	6.67
<i>Oesophagostomum</i> sp.	6.67
<i>Ostertagia</i> sp.	8.33
<i>Strongyloides</i> sp.	3.33
<i>Trichostrongylus</i> sp.	13.33
<i>Chabertia</i> sp.	10.00

The average intensity of infection with gastrointestinal nematodes in studied fallow deer was 529 EPG (eggs per 1 g of faeces). The highest intensity of infection was demonstrated in March (900 EPG) and December (1000 EPG), while the lowest in January and April (50 EPG), after deworming. The seasonal dynamics of the intensity of infection with gastrointestinal nematodes in test fallow deer is shown in Fig. 2.

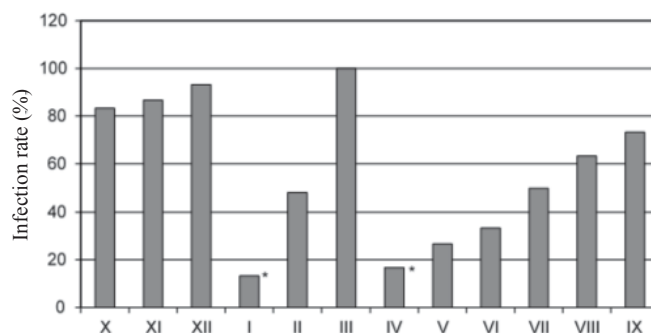


Fig. 1. Prevalence of infection with gastrointestinal nematodes in fallow deer in individual months; *examination after deworming

Deworming of fallow deer did not result in removal of gastrointestinal nematodes in all hosts, but significantly reduced the intensity of infection in these animals (Figs. 1 and 2).

The efficacy of deworming in March and December was similar, 94.44 % and 95 % respectively (Fig. 3). 45 days after the deworming in March, the efficacy decreased to 72.22 %. Two months after the treatment, the nematode egg count significantly increased and amounted to 400 eggs in 1 g of faeces. The prevalence of infection also increased at that time, and was at the level of 33.33 % (Fig. 2). Two months after the treatment with

ivermectin in December, the gastrointestinal nematode egg count significantly increased and mounted to 900 eggs in 1 g of faeces. The prevalence of infection also increased at that time, and was at the level of 100 % (Fig. 2). Parasitic reinvasion occurred in the test group of fallow deer.

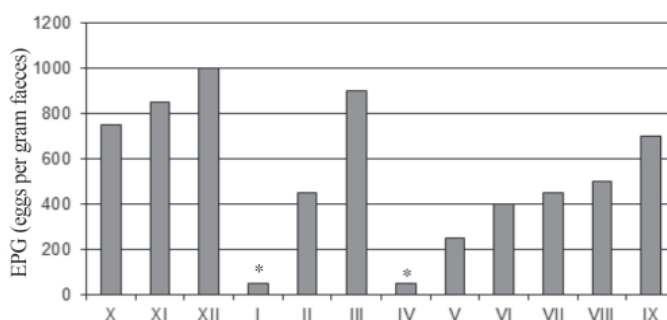


Fig. 2. The intensity of infection with gastrointestinal nematodes in fallow deer in individual months; *examination after deworming

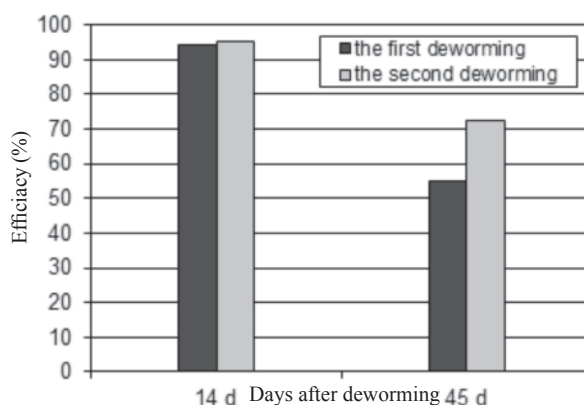


Fig. 3. The efficacy of ivermectin in 14 and 45 day after treatment

Discussion

Our study showed an average prevalence of infection in fallow deer with gastrointestinal nematodes in an annual cycle at the level of 57.33 %, which is comparable with the results obtained by other authors in farmed cervids (BORKOVCOVÁ et al., 2013). A significantly higher prevalence of infection in wild fallow deer was reported by numerous authors (BURLIŃSKI et al., 2011; CISEK et al., 2003; BALICKA-RAMISZ et al., 2005)

whereas ZALEWSKA-SCHÖNTHALER and SZPAKIEWICZ (1987) recorded the presence of these parasites in 50 % of individuals studied in north-eastern Poland. According to ROMANIUK (1999), the prevalence of infection with gastrointestinal nematodes was only 30 % in wild red deer and 40 % in farm-raised populations.

Nematodes of the species *Trichostrongylus* (13.33 %) and *Chabertia* (10 %) were recorded most frequently, while *Strongyloides* sp. (3.33 %) had the lowest prevalence. The study of DRÓZDŹ (1998) conducted on cervids most frequently observed invasions of gastrointestinal nematodes from the family *Trichostrongylidae*. In fallow deer from northern Poland BURLINSKI et al. (2011) demonstrated the highest occurrence of the nematode species *Chabertia* sp. (11.36 %), *Ostertagia* sp. (13.18 %) and *Trichostrongylus* sp. (10.68 %), while the least common were *Oesophagostomum* sp. (0.45 %) and *Bunostomum* sp. (0.91 %).

The parasitological analysis of endoparasites in fallow deer faeces showed that the treatment applied in this study was not fully effective. It should be noted that the administered drug only had a protective effect on fallow deer for a short period of time. The World Association for the Advancement of Veterinary Parasitology (WAAVP) reports that drug resistance of helminths occurs when FECRT is below 90 %. In our study, the efficacy of ivermectin was 94.44 % (first deworming) and 95 % (second deworming). Unfortunately, after two months of deworming an increase in the intensity and prevalence of infection was recorded. The study of MALCZEWSKI et al. (1998) also showed the high efficacy of Ivomec (ivermectin as the active substance) in the control of nematode infections of the family *Trichostrongylidae* in fallow deer (95.5 %). These authors, in contrast to our data, found a significant effect of deworming, which was sustained up to 120 days after treatment. Ivermectin accumulates in adipose tissue in the host organism, and is gradually released. It acts on the nervous system of ecto- and endoparasites as an antagonist of the neurotransmitter GABA (gamma aminobutyric acid) present in the peripheral nervous system of nematodes. After administration, the transmission of nerve impulses is disturbed, leading to paralysis and death of the parasites. KUTZER (1997) applied Ivermectin with good results in deer, by spraying concentrated feed with diluted Ivomec solution for injections. DRÓZDŹ et al. (1998) reported deworming of fallow deer with fenbendazole, noting the manifestation of drug resistance in certain species of nematodes.

The most common method of controlling parasites is the use of chemotherapeutic agents. The study showed that the accepted prophylactic treatment, which included double deworming of the entire herd (December, March), did not effectively protect animals against gastrointestinal nematodes. Therefore, the results of the present study and data available in the literature indicate that systematic parasitological monitoring in farm-raised fallow deer should be strictly pursued. The results of our study may help

to reduce the prevalence and intensity of gastrointestinal nematode infections in farmed fallow deer, through the development of an appropriate deworming program for these animals.

Ivermectin administered by subcutaneous injection was highly effective against gastrointestinal nematodes in fallow deer. However, the deer were kept in a limited area, which caused the accumulation of eggs of gastrointestinal nematodes in the pasture sward, creating perfect conditions for reinfection (ingestion of invasive forms with food).

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Received: 19 May 2014

Accepted: 28 April 2015

PILARCZYK, B., A. TOMZA-MARCINIAK, J. UDAŁA, J. KUBA: Prevalencija i kontrola želučano-crijevnih oblića u farmski uzgajanih jelena lopatara (*Dama dama* L.). *Vet. arhiv* 85, 415-423, 2015.

SAŽETAK

Cilj istraživanja bio je odrediti prevalenciju i jačinu invazije želučano-crijevnim oblicima u jelena lopatara i procijeniti učinkovitost liječenja ivermektinom. Pretraženo je 468 uzoraka izmeta ekološki uzgojenih jelena lopatara. Prevalencija je iznosila 57,33 % s intenzitetom od 529 jaja po gramu izmeta. Najčešće su bila dokazana jajašca oblića roda *Trichostrongylus* (13,33 %) i *Chabertia* (10 %), a najrjeđe jajašca oblića roda *Strongyloides* (3,33 %). Jeleni su bili dvokratno dehelmintizirani i to u prosincu i ožujku ubrizgavanjem

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preparacija koji je sadržavao 1 % ivermektina. Učinkovitost prve dehelmintizacije iznosila je 94,44 %, a druge 95 %. Dehelmintizacija ivermektinom nije uklonila parazite iz svih životinja, ali je značajno smanjila intenzitet invazije. Supkutana primjena ivermektina bila je vrlo učinkovita. Ipak valja napomenuti da su jeleni bili držani na ograničenom prostoru što je dovelo da nakupljanja jajašaca na pašnjaku i stvorilo uvjete za reinvaziju.

Ključne riječi: dehelmintizacija, jelen lopatar, farmski uzgoj, želučano-crijevni oblici
