

Electronic Journal of Polish Agricultural Universities is the very first Polish scientific journal published exclusively on the Internet, founded on January 1, 1998 by the following agricultural universities and higher schools of agriculture: University of Technology and Agriculture of Bydgoszcz, Agricultural University of Cracow, Agricultural University of Lublin, Agricultural University of Poznan, Higher School of Agriculture and Teacher Training Siedlce, Agricultural University of Szczecin, and Agricultural University of Wroclaw.



**ELECTRONIC
JOURNAL
OF POLISH
AGRICULTURAL
UNIVERSITIES**

**2003
Volume 6
Issue 1
Series
VETERINARY
MEDICINE**

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CISEK A., BALICKA-RAMISZ A., RAMISZ A., PILARCZYK B. 2003. COURSE AND TREATMENT OF LUNGWORM INFECTION GAME ANIMALS (RED DEER, ROE DEER, AND FALLOW DEER) IN NORTH-WEST POLAND **Electronic Journal of Polish Agricultural Universities**, Veterinary Medicine, Volume 6, Issue 1.

Available Online <http://www.ejpau.media.pl>

COURSE AND TREATMENT OF LUNGWORM INFECTION GAME ANIMALS (RED DEER, ROE DEER, AND FALLOW DEER) IN NORTH-WEST POLAND

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ABSTRACT

The aim of this study was to determine the prevalence of lungworm infection in the deer ([Phot. 1](#)) that inhabit North-West Poland, and to find a method to fight this parasitosis. The studies were carried out on 156 faecal samples of wild-living deer (43 of red deer, 34 of fallow deer, and 79 of roe deer), using the Baermann method to detect the first stage of pulmonary nematodes in the examined faeces. The samples were collected in nine forest areas of North-West Poland from January 1999 to March, 2000. Additionally, anthelmintic treatments were carried out in the Breeding Station Krajenka, situated near Złotów, Poland. The animals were fed with special granulated feed containing Panacur (7.8 mg/kg body weight). The following nematode species were found: *Elaphostrongylus cervi*, *Varestrongylus sagittatus*, and *Varestrongylus capreoli*. The prevalence of *Elaphostrongylus cervi* was 88.37% in red deer and 58.82% in fallow deer. *Varestrongylus sagittatus* were found in 67.44% of red deer and 47.06% of fallow deer. In the faeces of roe deer, *Varestrongylus capreoli* was found only, with the prevalence of 40.51%. The efficacy of Panacur ranged between 80.84% and 82.13%.

Key words: lungworm infection, roe deer, red deer, fallow deer

Phot.1



INTRODUCTION

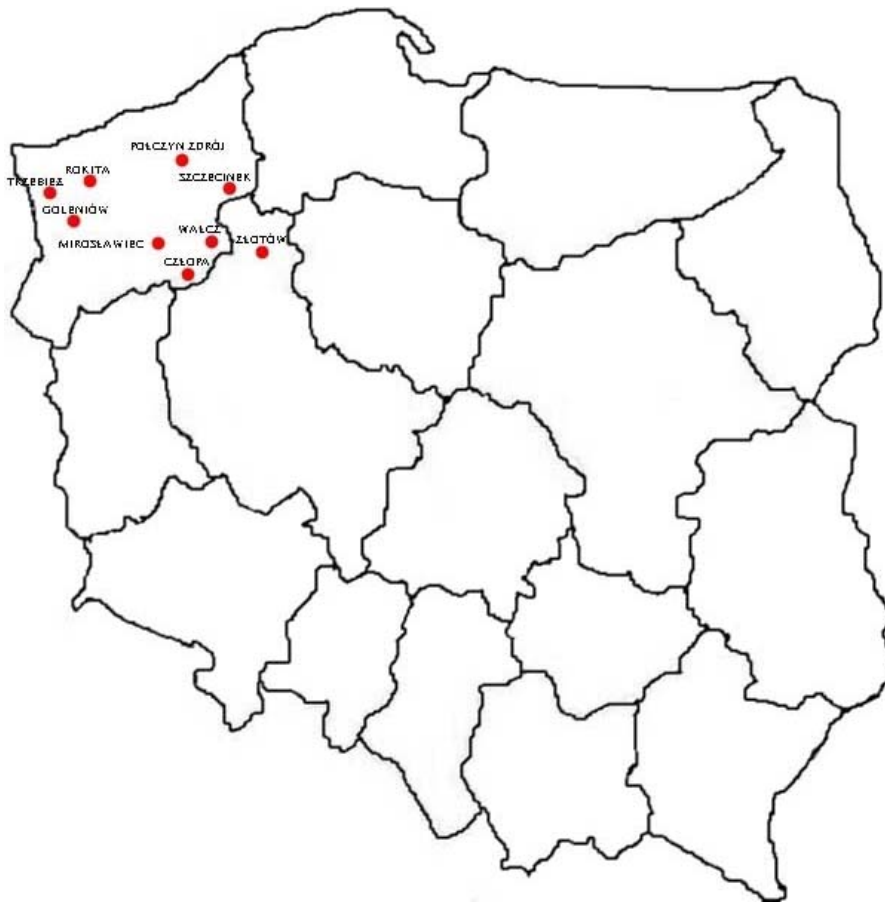
Game population management, under unceasing deterioration of natural conditions of field and forest hunting grounds, is now becoming a task more and more complex and difficult to deal with. As a result of human pressure, complex structure of arable fields has been reduced and species composition of forests has become unified. In a range of cases, such a situation has led to disturbed balance in natural ecosystems, and consequently adverse changes have appeared in habitat conditions of wild animals. In the changed conditions, the pressure of parasitic infestations on game ruminants has grown high. Large scale research carried out in some parts of Poland [6,9,10,11,13,14,15,16,17,19] has demonstrated that 100% of deer population are infected by nematodes. Among the parasitic roundworms of game ruminants, pulmonary nematodes are of particular importance, as their overall infestation prevalence in the so-far studied regions of our country ranged between 3-100% [2,17]. Two families have been observed in this group of parasites, namely *Dictyocaulidae* and *Protostrongylidae*. The previous is represented by the nematode *Dictyocaulus noerneri*, a parasite of a simple development stage, without an intermediate host, whose adult individuals are localised in the bronchia and tracheas of red, fallow, and roe deer. The family *Protostrongylidae* in red deer and fallow deer is represented by *Elaphostrongylus cervi* and *Varestrongylus sagittatus*, whereas in roe deer – by *Varestrongylus capreoli* [24]. The nematodes of the genus *Varestrongylus* represent typical parasites of lungs, which settle in bronchioles and lung interstitium. In contrast, the *Elaphostrongylus* genus nematodes invade central neural system or intermuscular connective tissue, and only their larvae pass through lung interstitium, creating mechanical damages which result in inflammatory states. *Elaphostrongylus cervi* is a very common parasite of Eurasian cervids, which causes elaphostrongylosis. It is one of the very few nematodes that live in central neural system. This locality may be associated with a high pathogenicity [1].

It should also be stressed that lungworm infestations are not evenly distributed over the area of Poland; it was observed that incidences of particular species concentrate in various areas of the country. For example, *E. cervi* occurred in 91% and 100% of red deer in the Białowieśka Forest [2,6] and in 40% of these animals living in Kosewie [4]. *D. noerneri* was found in 10% of fallow deer inhabiting the forests of Silesia [25], and in 40% fallow deer of Kosewie [5]. The aim of this study was to determine the prevalence of lungworm infection in the deer that inhabit North-West Poland, and to find a method to fight this parasitosis.

MATERIAL AND METHODS

The material for the study comprised faecal samples of the animals, collected in the area of the following nine forest inspectorates in North-West Poland: Złotów, Walcz, Człopa, Mirosławiec, Szczecinek, Polczyn Zdrój, Trzebież, Goleniów, and Rokita (Figure 1). From January 1999 to March 2000, a total of 156 samples were examined, including 43 red deer, 79 roe deer, and 34 fallow deer faeces. Baermann's method was applied in order to detect the first stage of lungworm larvae. The nematode larvae collected this way were inspected under a microscope and identified as recommended by Demiaszkiewicz [1,3].

Fig. 1. The examined Forest regions



The next stage of the study consisted in anthelmintic treatment. Supplemental winter feeding provided a convenient moment for the administration of an anthelmintic to the animals. The treatment was carried out in the area of the Breeding Station in Krajenka near Złotów, in March 2000. The Station occupies about 800 ha, where roe, red, and fallow deer are kept. Panacur anthelmintic was administered twice, in ten-day interval, in the dose of 7.8 mg per 1 kg of animal's body weight, converted to the active substance, i.e. fenbendazole. In each time, the specific was given for 3 days. Panacur was included into feed mix for forest animals, which had been previously prepared by Krajenka Cereal Company.

The efficacy of the treatment was calculated in the following way:

$$E = \frac{N - N_1}{N} \cdot 100$$

where: E – efficacy of treatment (%), N – mean number of larvae before the treatment, N_1 – mean number of larvae after the treatment.

The results of the worming treatments were statistically processed, using STATISTICA software package, and the significance of differences was estimated with a t-Student test.

RESULTS AND DISCUSSION

The results concerning the extensiveness of lungworm infestation in deer are presented in [Table 1](#). Two species of pulmonary nematodes of the family *Protostrongylidae* were found in the faeces: *Elaphostrongylus cervi* and *Varestrongylus sagittatus*. Mixed infestations constituted the majority of cases. The prevalence of red deer infection with *E. cervi* was high, 88.37%. To date, the only higher values, i.e. 91% and 100%, have been reported by Demiaszkiewicz et al. [2,6] in the Białowieża Forest. In other parts of Poland, the prevalence of red deer infestation with this nematode was lower: 68% in Słowiński National Park [12,13], 79.4% in the forests of

Olsztyn [25], 40% in Kosewo [4], 80% in the Borecka Forest, 63.6% in the Świętokrzyskie Mountains, 72.7% in the Bieszczady Mountains [2], 86.4% in the forests of Silesia, and 80.6% in Szklarska Poręba [25]. The data on red deer infestation by *V. sagittatus* in own studies were slightly different, as the prevalence of the infection reached 67.44% and was highest in comparison with the data by other authors, who reported the following values for other parts of Poland: 17.4% in Upper Kosewo [4]; 20.6% in the forests of Olsztyn [25]; 34.5% and 50% in the Białowieska Forest [2,6]; 27.3% in the Bieszczady Mountains [2]; 18.2% in the Silesian forests, and 17.4% in the area of Szklarska Poręba [24,25]. No incidence of *V. sagittatus* was observed in the Świętokrzyskie Mountains or the Borecka Forest. *D.noernerii* was observed in red deer at: Olsztyn and Silesian Forest – in 27.3% and 26.8% red deer [25]; Białowieska Forest (21%) [6]; Szklarska Poręba (3.2%) [24].

Table 1. The prevalence of lungworm infection in deer in North-West Poland

| Pulmonary nematode species | Red deer | | Roe deer | | Fallow deer | |
|----------------------------------|----------|---------|----------|---------|-------------|---------|
| | Ni | E.I (%) | Ni | E.I (%) | Ni | E.I (%) |
| <i>Elaphostrongylus cervi</i> | 38 | 88.37 | - | - | 20 | 58.82 |
| <i>Varestrongylus sagittatus</i> | 29 | 67.44 | - | - | 16 | 47.06 |
| <i>Varestrongylus capreoli</i> | - | - | 32 | 40.51 | - | - |

Altogether 43 red deer, 79 roe deer, and 34 fallow deer faeces samples were collected; Ni – number of lungworm-infected faeces samples, E.I (%) extensiveness of infestation

As far as fallow deer are concerned, the prevalence of *E. cervi* and *V. sagittatus*, respectively 58.82% and 47.06%, was slightly lower than in red deer. In previous, domestic research, three nematode species were found in fallow deer: *Elaphostrongylus cervi*, *Varestrongylus sagittatus*, and *Dictyocaulus noerrii*. According to Drózdź et al. [17], *Elaphostrongylus cervi* occurred in 5%, *Varestrongylus sagittatus* in 3%, and *Dictyocaulus noerrii* in 8% of fallow deer in Upper Kosewo. Later in the same region, Demiaszkiewicz et al. [5] demonstrated 40% incidence of *Dictyocaulus noerrii* in fallow deer. According to Misiewicz and Demiaszkiewicz [25], who studied the parasites in the Olsztyn and Silesian forests, fallow deer infestation by *Elaphostrongylus cervi* was at the level of 62.2% and 38.8%, respectively; *Dictyocaulus noerrii* was found in 7.6% of the fallow deer in the Olsztyn area and in 10% of the animals in Silesia. Later studies carried out in the same areas by Misiewicz [24] showed the prevalence of *Elaphostrongylus cervi* in 43.9% (the Olsztyn forests) and in 69.1% (Silesian forests) of fallow deer.

Roe deer faeces examination revealed the incidence of a single pulmonary nematode species – *Varestrongylus capreoli*. The lungworm was found in 40.51% roe deer. This result is comparable to these obtained by Demiaszkiewicz [2] in the area of the Kampinos Forest (44.4%) and the Białowieża Forest (43.5%). Higher infection extensiveness, 53.3% and 83.3%, was noted respectively in Great Poland [20] and the Świętokrzyskie Mountains [25]. In further studies carried out in the area of Szklarska Poręba, Misiewicz [24] observed 36.4% roe deer infected with *V. capreoli*. For the Borecka Forest, Drózdź et al. [11] confirmed *V. capreoli* in 25% of roe deer. The lowest prevalence of *V. capreoli* in roe deer, 12.7%, was found by Demiaszkiewicz [2] in the area of Poznań. *Dictyocaulus noerrii*, a lungworm found in roe deer in other parts of Poland, was not observed in these studies. The species was reported by Drózdź et al. [11] only in the area of north-east Poland, where its prevalence was 10% and 5% in roe deer of, respectively, the forests of Olsztyn and the Borecka Forest.

Table 2. Results of anthelmintic treatment of deer in the Breeding Farm in Krajenka – pulmonary nematodes

| Species | Before treatment | | | | 7 days after treatment | | | | | 14 days after treatment | | | | |
|--------------------|------------------|----|-------|-----|------------------------|----|-------|-----|--------------|-------------------------|---|-------|----|--------------|
| | O | I | E.I % | L | O | I | E.I % | L | E % | O | I | E.I % | L | E % |
| Red deer | 15 | 14 | 93.33 | 450 | 18 | 10 | 55.5 | 100 | 77.7 | 15 | 2 | 13.5 | 86 | 80.84 |
| Roe deer | 40 | 17 | 42.50 | 403 | 42 | 12 | 28.57 | 95 | 76.43 | 42 | 1 | 2.30 | 72 | 82.13 |
| Fallow deer | 28 | 16 | 57.14 | 338 | 25 | 6 | 24.0 | 87 | 74.26 | 20 | 1 | 5.00 | 64 | 81.10 |

O – Overall number of examined faeces samples
 I – number of faecal samples with lungworm larvae
 E.I – extensiveness of lungworm infestation
 L – mean number of lungworm larvae
 E – treatment efficacy

Table 3. Results of statistical analysis of treatment efficacy for lungworms

| Species | A - B | B - C | A - C |
|--------------------|----------|----------|----------|
| Red deer | P ≤ 0.05 | P ≤ 0.01 | P ≤ 0.01 |
| Roe deer | P ≤ 0.05 | P ≤ 0.01 | P ≤ 0.01 |
| Fallow deer | P ≤ 0.01 | P ≤ 0.05 | P ≤ 0.01 |

A – infection before anthelmintic treatment
 B – infection 7 days after treatment
 C – infection 14 days after treatment
 P – significance level

The efficacy of the anthelmintic was evaluated in respect to lungworms (Table 2) of roe deer, fallow deer, and red deer. The anthelmintic proved effective. After 7 days, its efficacy was highest in red deer (77.7%), next in roe deer (76.43%), and then in fallow deer (74.26%). After 14 days, the efficacy of the treatment was higher, 82.13% in roe deer, 80.84% in red deer, and 84% in fallow deer. The obtained results were subjected to statistical analysis; statistically significant differences were found between the prevalence of infestation before the anthelmintic treatment, 7 days after the treatment, and 14 days after the treatment (Table 3).

CONCLUSIONS

A number of anthelmintics have been used both in Poland and in other countries, mainly those administered to feeds. Demiaszkiewicz et al. [4] applied Eprinex pour-on endectocide and indicated its high, 100% efficacy in pulmonary nematode elimination. The pour-on method of administration requires that the animal be caught, which means both much stress for the animal and higher costs of the treatment. Among other novel pharmaceuticals, Ivomec premix [23] and Ceremix [21] have been used in our country. An application of Ivomec premix on a farm in Kosewo was efficacious in relation to lungworm in 90.3% to 99.6%. The efficacy of this in-feed medicine was also tested when repeatedly applied [5], which resulted in 98.4% to 100% efficacy. Cermix was tested on the Rypin hunting ground, however its efficacy was much lower. In the Cermix-treated roe deer, no significant differences were observed in the extensiveness of lungworm infestation, whilst its intensiveness decreased by 20% [21]. In the region of Great Poland, preparations of benzimidazole group were applied to destroy *Capreocaulus capreoli*, and 52.8-78% efficacy was achieved [20]. *Elaphostrongylus cervi* is a pulmonary nematode that is particularly resistant to anthelmintic treatments. Some authors suggest that anthelmintics do not remove the parasite, but only hinder the excretion of its larvae [8,22]. Recently, Demiaszkiewicz [8] achieved very good results in the control of elaphostrongylosis in domestic ruminants using Eprinex pour-on. Also Swiss authors effectively cured goats of elaphostrongylosis by application of ivermectin, fenbendazole, and flunixin after [8].

To sum up, one must stress that the extensiveness of pulmonary nematodes infection of deer in North-West Poland is high. In the case of *V. sagittatus*, one may also state that the nematode shows focused incidence. None of the examined cervids revealed an infection by *D. noerneri*. Panacur proved to be an efficacious anthelmintic, thus it can be recommended for seasonal treatments of game animals. It should also be stressed that the efficacy of this anthelmintic was high, as compared with the other benzimidazole group of preparations. Moreover, the anthelmintic added to feed mixture is readily eaten by the animals, and is safe with its low toxicity.

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