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DOI 10.2478/s11687-013-0102-x

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HELMINTHOLOGIA, 50, 1: 15 – 19, 2013

Endoparasitoses of fallow deer (*Dama dama*) in game-park in South Moravia (Czech Republic)

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Summary

During the years 2002 – 2008 endoparasitoses of fallow deer *Dama dama* were monitored in White Carpathians (Czech Republic). Samples of excrements were tested by flotation and Baermann method and occasionally grallochs were dissected in order to detect gastrointestinal nematods (GIN) and lungworms (LW). In the same time we cooperated with gamekeepers, who carried out several differently successful measurements to lower the endoparasites' prevalence. These measurements included pasture management, shooting management, additional-feeding management and drug treatment, all during the whole period of monitoring. Prevalence of endoparasites had descending trend, while intensity of infection had ascending trend. Total maximal prevalence (GIN+LW) in herd was 60 % (2004), in 2008, it fell down to 20 %. Annual dynamic of parasites was always highest in autumn months. Spectrum of detected parasites consisted only of species of the order Strongylida. Monitoring proved, that breeding management strategy can significantly influence parasitocenoses and help animals to regain health.

Keywords: *Dama dama*; endoparasitoses; game keeping; management

Introduction

Fallow deer (*Dama dama* (Linnaeus, 1758)) appeared in Czech Republic for the first time in 15th century. In time it became fashion game kept before all in game-parks (Červený *et al*., 2001). There it was often additionally fed. Additional feeding was concentrated mainly on production of great hunting trophies, thus the animals got high quality trefoil or lucerne hay, fleshy fodder and grain fodder (Wolf, 2000). Keepers usually took broad care of animals. They even considered the parasitic aspect, because especially parasitoses can be limiting factor of game class and through that even of economical results of management (Chroust, 2001). Deer in common, and fallow deer as well, can suffer from several tens of endoparasite species (GIN and LW) (Kotrlá *et al*., 1984; Balicka-Ramisz *et al*., 2005; Vengušt & Bidovec, 2003), with different prevalence and intensity of invasion (Ambrosi *et al*., 1993; Santin-Duran *et al*., 2004; Drozdz *et al*., 1997).

Values of prevalence and intensity themselves, however, don't have to predicate the health status of animals (Horning, 1975). Furthermore, this aspect may be influenced by presence of other deer species in the area (Santin-Duran *et al*., 2004; Horning, 1975), subclinical infection of hosts (Gunn & Irvine, 2003; Langrová *et al*., 2008) and of course breeding management and eventual drug treatment (Chroust, 2001; Chroust & Vitula, 2005). Aim of this work was to detect fluctuation of prevalence and intensity of parasitocenoses in fallow deer during period of joint efforts of breeder and parasitologist in order to help the animals regain health.

Material and methods

Monitored game-park in the southern Moravia (Czech Republic) was established in 1960 in order to keep introduced fallow deer game. It is situated 240-583 meter above sea level. Total area is 1565 ha, of which 1371 ha are woods, 192 ha meadows and pastures, 1 ha water basin and 1 ha other. Game-park is enclosed by wire fence 19.9 km long and 2.8 meters high.

Game-park has very broken relief. Lower attitudes are covered with oak-hornbeam groves, higher mostly with beech forests. Woods consist of broad-leaf trees (62.6 % – mainly oak, beech, hornbeam, lime and ash) and coniferous trees (36.3 % – spruce, pine and larch). Area has high carrying capacity, however animals are additionally fed all year round on approximately 45 feeding places. Numbers of fallow deer during the monitoring period were 387 heads in average. Minimal numbers were 290 heads in

2002, maximal 490 heads in 2007, in the end of monitoring there were 430 heads. Cut down to 300 heads of fallow deer is expected in the future. Monitoring started in September 2002 and ended in February 2008. Samples were taken during all year round once per month from several places within the game enclosure and their number was 10 % of bevy-number in average. In addition occasional dissections of grallochs were made to compare results of coprology. In years 2004 and 2005 25 fallow deers were brought into the game-park (totally 50 heads) in order to set up larger antler shovel in breed. Animals came from Hungarian regions Guth and Gyulay and they were let out without helminth control.

In January 2007 new gamekeeper replaced the old one. This led to changes in keeping strategy, especially in additional feeding. While until that animals got fodder (hay, fleshy fodder and grain fodder or wide spectral drugs) on the ground in stripes from January 2007 the fodder was served in racks and animals gathered around them. In order to gain the biggest and highest quality hunting trophies carbohydrate fodder was served to animals during dry spring months in 2007 furthermore.

To detect the larvae of lungworms the Baermann method (Kassai, 1999) was used and the number of larvae (LPG) was made out.

To detect prevalence of eggs and oocysts in samples of excrements we used Breza's flotation method (Kassai, 1999), and for making out the intensity of eggs (EPG) the Várady (1993) method was used.

Results

Essential facts about intensity, prevalence and management measures are shown in Fig.1. Total prevalence (GIN + LW) fluctuated between 20 – 60 %, while maximal prevalence in herd was in autumn 2004 and minimal in winter 2007. During the first two years of monitoring prevalence oscillated around 39 – 51 %. But after the new animals were imported, in 2004 and 2005, prevalence rose up to the peak of 60 %. With the change of additional feeding strategy it dropped down significantly to the lowest values 20 % in winter 2007 and 21 % in spring 2008 respectively. Average value of total prevalence was 39.56 %.

Prevalence of GIN and LW had almost the same progression. Prevalence of GIN was 28 % in the beginning, 8% in the end of monitoring. Highest value was 32 % in the autumn 2004; lowest value was 8 % in summer 2003. Average value of GIN prevalence was 17.21 %.

Lungworms had apart few exceptions higher prevalence than GIN. Prevalence was 29 % in the beginning, in the spring 2008 it was 17 %. Highest prevalence of lungworms was recorded in autumn 2004 – 48%, lowest in winter 2005 – 12 %. Average value of prevalence during the monitoring period was 28.08 %.

From summer 2007 all values of prevalence were lower than average numbers of whole monitoring period, therefore declining trend after breeder's intervention is significant.

Intensity of GIN eggs (EPG) fluctuated during the whole monitoring, with lightly declining trend at the end of monitoring period. Values were from 15 to 75 eggs.

LPG values of lungworms, which also fluctuated during the years and during the seasons of each year, are also shown in Fig.1. Until the change in additional feeding strategy (January 2007) it was always highest during autumn months, while during the rest of the year it held on low to very low level. In the end of spring 2007 intensity rose up quickly and after slight decline in autumn and winter 2007 it rose again to highest measured level in spring 2008. Values of LPG were 12 – 56.

During the whole monitoring period helminth control was done once a year in spring, followed by decline of GIN prevalence. In spring 2007, because of long lasting drought, animals were intensively additionally fed by glycid fodder. This led into dying of animals, especially of very strong and healthy fallow deer females during lying-in.

During the whole period of monitoring no case of clinical illness caused by parasites was recorded in fallow deers.

Discussion

According to the knowledge recorded in literature, parasitoses under our conditions can have intensive impact on health status and class of ungulate game and thereby on the results of hunting management (Chroust & Vitula, 2005). Venison, as well as domesticated ruminants, has various endo- and ectoparasites. On the contrary to wild ungulate game, animals kept in game-parks are more susceptible to parasite infection as a result of huge density of animals living in restricted area and the intensive breeding practices (Barth & Matzke, 1984; Rehbein & Bionschek, 1995; Rehbein *et al*., 2001).

In former times, according to Chroust (2001), parasitoses were the main cause of losses in ungulate game. This experience was confirmed by the results of highly detailed and wide dissections and coprologic exams that were carried out in the beginning of the 80's. Based on these results, areal treatment of animals during the winter additional-feeding was implemented afterwards, all around the country.

Serving of highly effective medicaments, step-by-step elimination of natural parasitoses centres and other veterinarians' and breeders' actions resulted on many localities in decreasing of both intensity and prevalence of parasitoses and also in overall improvement of health status and condition of ungulate game (Ševčík, 2000). Results of our survey confirm this matter, and are also conformable with the statement of Chroust (2001). He claims that the curing of parasitoses has to be targeted, i.e. based on indication, which has to be a result of thorough observing and parasitologic examination, and which needs to be done in the whole population (all age-groups). It is also necessary to bear ecological and other factors (environmental disturbances, food, economical aspects of treatment) in mind. From the economical point of view the importance of parasitoses cannot be judged only by the number of dead animals or by results of flotations, because conditions with no symptoms may occur. Such situation

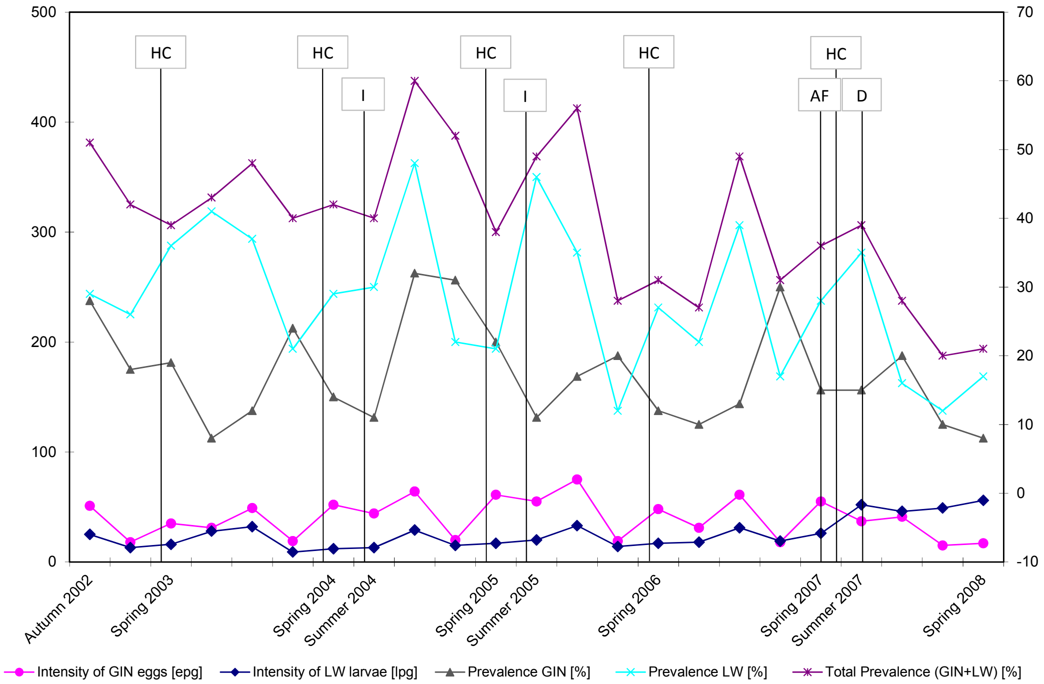

Fig. 1. Essential facts about prevalence, intensity of infection and management measures
D – death of females during giving birth; AF – additional feeding; HC – helminth control; I – introduction of new animals into game-park

can essentially worsen and accelerate the course of diseases and other etiology, weaken stamina and thereby very significantly influence the results of game keeping. It is also necessary to take the strong impact of parasitoses on the basic physiological processes in organisms into account. Considering this fact we intended to do dissections of fallow deers (shot during regular autumn shooting and perished). However, our aim was affected by the gamekeepers (as came out after the monitoring period), who wanted to get negative or low intensity results and therefore submitted grallochs of apparently healthy animals. Considering the relatively small number of dissections and their zero results these were not included into final evaluation.

Gastrointestinal nematodes (GIN)

Fallow deers have quite wide variety of parasites (Kotrlá *et al.*, 1984; Rehbein *et al.*, 2001) with different prevalence (Ambrosi *et al.*, 1993; Balicka-Ramisz *et al.*, 2005). Vengušt & Bidovec (2003) state that the prevalence is usually low, thus there are no significant changes in animals' physical appearance nor clinical symptoms appropriate for the illness. Drozdz *et al.* (1997) did 28 dissections of Cervidae during their study, of which 16 were fallow deers. Coproscopy was done in several hundreds samples, and 23 species of nematodes and one tapeworm was detected.

Helminth eggs founded during our monitoring belonged to order Strongylida, family Trichostrongylidae. Of this family the members of genera *Haemonchus*, *Ostertagia, Spiculopteragia, Skrjabinagia, Rinadia, Cooperia, Trichostrongylus, Nematodirus* are most common if fallow deer and are considered the most pathogenic (Chroust, 2001). Romaniuk (1999) monitored the prevalence in fallow deers by flotation and Vajda's method. When he compared herds in forest game-parks, outside the forest ones and freely living animals (outside game parks), the highest prevalence was in the game-parks in forest – family Trichostrongylidae 40 %. In our monitoring we observed animals on areas including forest as well as large meadows, and the highest GIN prevalence was 32 % in autumn 2004.

Lungworms (LW)

In literature the most often declared and very dangerous parasites of ungulate game are *Dictyocaulus noerneri, D. viviparie* (Chroust, 2001). While *D. viviparie* was detected with prevalence 10 – 12 % (Kotrlá *et al.*, 1984), *D. noerneri* with prevalence 25 % in dissection (Chroust & Vitula, 2005). In our survey presence of parasites of genus *Dyctiocaulus* was also confirmed, and their prevalence was always lower than of other genera of lungworms. Other species that is often found in fallow deers' lungs is *Varestrongylus (Bicaulus) sagittatus*), which occurs in the whole area of Czech Republic (Kotrlá *et al.*, 1984; Chroust, 2001). In fallow deer its prevalence can rise up to 53 % (Kotrlá *et al.*, 1984). Chroust (2001) states that it occurred mainly in more humid areas, more often in game-parks that in free areas. In our work we did not divide results of lungworm prevalence into species-categories, because species detection was not aim of this work; this will be the topic of following work.

Annual dynamic and prevalence

During the monitoring period the prevalence fluctuated in dependence on seasons, similarly as showed in results of studies by other authors (Kotrlá *et al.*, 1984; Chroust, 2001). Highest GIN intensity occurred in different months than in lungworms (Fig. 1). However, as seen in Fig. 1, the level of prevalence was influenced by other factors as well – especially naturalization of imported animals and management of additional feeding.

Our animals received additional food, which was served on the ground in stripes, for several years. Because of the hay the ground on feeding area was not trampled down into mud, and the samples were taken from dry land. After the arrival of new gamekeeper, the strategy of additional-feeding was changed. Hay was stuffed into crèches while animals gathered around them in circles. Animal gathered in higher numbers in one place, therefore the ground was trampled down and often muddy. Samples were thus taken from very different environment – more humid – increasing of lungworms intensity (Fig. 1) in winter 2007 and spring 2008 can therefore be influenced by this factor as well.

New gamekeeper and consequential changes of management - additional-feeding

Greatest change after the arrival of new gamekeeper was in the additional feeding management. Instead of former laying on the ground in stripes, hay was now stuffed into crèches. During the first year of using this new way of additional feeding, there were increase of invasion intensity and decrease of prevalence. This can be caused by the fact that the strongest animals got to the hay first, while the weaker had to wait what will be left. Therefore they are becoming weaker, while quality food can not help them to lower the invasion intensity. Moreover, there is higher probability that subclinical infection can unfold to clinical case.

Gunn & Irvine (2003) review the importance of subclinical infection with the statement, that even subclinical infection restrains the reproductive success. Animal eats less; its growth figure is smaller. Therefore the way of additional feeding should be planned in order not to support the progress of subclinical infections. According to mentioned authors, evidence is gathered, that hosts are evolving strategies to prevent getting infected, by avoiding areas with many excrements. Animals themselves are trying not to venture to areas with high faecal contamination. So if we evaluate feeding strategy, we should include also the relationship between parasites and their hosts, monitor the animals' behavior and often move the feeding place.

Other change in comparison to years before was the use of glycid fodder for additional feeding on spring 2007. There was drought, which inhibited the grass growth. Fears were, that antlers of males would not be of requested quality and size. This additional-feeding had several drawbacks. Highly nutritive fodder caused enlargement of fetus and females were dying during lying-in, because they were not able to give birth to such a great young. Also prevalence and intensity of infection rose up to the same level as at the beginning of our study. Ryboš *et al*. (1995) states glykogen is the greatest energy storage (source) for animal parasites living in anaerobic conditions (low oxygen tension). It is therefore possible, that the cause of intense development of parasites was just this intensive additional feeding. To reach the goal of planned reduction of animals to almost 3/5 of maximum numbers, massive reduction was done, by shooting in the end of monitoring period. Weaker and older animals were shot, therefore it is expected that this intervention will result in better health status of monitored animals.

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RECEIVED JANUARY 25, 2012 ACCEPTED SEPTEMBER 20, 2012