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Faculty of Agriculture - Poljoprivredni fakultet

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INFESTATION WITH SMALL (*DICROCOELIUM DENDRITICUM*) AND LARGE FLUKE *(FASCIOLA HEPATICA)* IN TWO DEER HUNTING GROUNDS IN THE NORTH-WEST OF AP VOJVODINA (SERBIA)*

ZORAN A. RISTIĆ, JELENA APIĆ, DRAGAN BOŽIĆ, MARKO CINCOVIĆ[1]

SUMMARY: Fluke (fascioloides) is a parasitic liver disease that infests deer in the flatland forest and wetland plains hunting areas, rarely in the mountains. The causes of this disease are two types of liver fluke which belong to a group of flatworms: the large fluke (Fasciola hepatica seu Distomum hepaticum) and a small fluke (Dicrocoelium dendriticum). The aim of this study was to determine: (a) the impact of disease progression on the deer population, (b) optimal methods of drug treatment, (c) the number of infested deer in population after continuous drug treatment over several years and (d) the impact of this deer disease on the quality of tourism offer in the area of the Special Nature Reserve "Gornje Podunavlje". The hunting experts estimate, based on established health condition of the hunted deer, that fluke infestation has steadily increased from initial 20% up to 90%. Fluke has, undoubtedly, contributed to the overall health status deterioration of deer population, with very high mortality rate. The situation has significantly changed in 2006, when the deer were treated with an anti-parasitic preparation (Albendazole), mixed in concentrated food and salt. This treatment proved to be a very successful therapy for Fluke disease.

Key words: *large fluke, small fluke, American fluke, hunting ground, deer.*

Original scientific paper / *Orignalni naučni rad*

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INTRODUCTION

Fluke (*fascioliasis*) is a parasite which influences liver disease, which occurs in deer in flatland forest and wetland plain hunting areas, rarely in the mountains. The causes of this disease are two types of liver fluke which belong to a group of flatworms: the large fluke (*Fasciola hepatica seu Distomum hepaticum*) and a small (or lancet) fluke (*Dicrocoelium dendriticum*).

In situation of a liver fluke invasion in a small number, especially in case of good shape adult deer, clinical signs of disease were not observed. In the cases of a strong invasion on adult deer, the disease has a chronic course. Clinical signs of illness cannot be noticed at the time of lush vegetation, but the signs become visible in the months when there is a shortage of food. In these cases, the infested animals were thin, manifested by general weakness (due to anemia), changing hair more slowly, followed by the lower development and also signs of deformation of antlers. Later, with improved nutrition and better pasture, the condition improved. In case of a strong invasion at young deer, the disease has an acute course and often leads to death (Florijančić et al., 2011). Preventive measures for this disease are difficult to implement in practice (field reclamation, drainage, bar reclamation, dispensing chemicals for the destruction of pastures snails, etc.). Therefore, a method of prevention and disease control in areas contaminated with fluke is shooting weak animals and animals suspected to be diseased. By this method, the animals that are a potential source of fluke infestations are eliminated from the hunting area, and deer individuals of good body shape and good health are kept. Antihelmintic preparations are usually performed for fluke therapy in deer populations, by individual or group animal treatment (Foreyt and Todd, 1976; Qureshi et al., 1994; Janicki et al., 2005).

The aim of this study was to determine: (a) the impact of disease progression in the deer population, (b) results of group method treatment with Albendazole preparation, during several years and (c) the impact of this deer disease on the quality of tourism offer in the area of the Special Nature Reserve "Gornje Podunavlje" (North-West AP Vojvodina, Serbia).

MATERIAL AND METHOD

The Special Nature Reserve (SNR) "Gornje Podunavlje" includes two hunting grounds: "Apatinski rit", Apatin and "Kozara", Backi Monostor, located in the North-West area of AP Vojvodina (Serbia). Hunting areas are situated in the municipalities of Apatin and Sombor (Tomic et al., 2004; Stojanovic, 2005; Stojanovic, 2002). The hunting ground "Apatinski rit" occupies the area of 6579ha in a typical wetland environment by the river Danube and is completely enclosed. The main big game species are deer and wild boar, and a roe deer as an accompanying species. This hunting area is a lowland type, with the altitude from 82 to 89 m (Ristic, 2006; Ristic, 2006).

The hunting ground "Kozara" occupies the area of 11,764 ha and is completely enclosed. The main types of big game in this hunting ground are deer and a wild boar, accompanied by a roe deer (Novakovic, 1999).

Determination of fluke presence and its causes in the mentioned hunting areas took place from 1996- 2009. In order to determine the presence of the liver fluke, examination of the liver and bile ducts was carried out on all hunted deer (Cervus elaphus

L.). Detection of liver fluke eggs in feces is a good diagnostic method, but is not reliable in terms of rating the degree of therapeutic effect of applied drugs (Foreyt and Todd, 1976).

Fluke therapy began in 1997, followed by comparative analysis of the number of infected animals, cured animals and animals without infestations. The therapy was performed by antihelmintic preparations, based on Albendazole. The treatment was performed with doses of 5 mg Albendazole per 1kg of body weight/daily, by mixing adequate amount of preparation in deer concentrated feed and salt.

In order to determine the presence of various developed young (cocoon) and grown up (adult) forms of liver fluke, pathomorphological examination of the studied deer liver was conducted. Finding thickened bile ducts, presence of scar tissue, cysts or other pathomorphological changes in the liver, yet not finding any parasites, was considered as the healing of fluke. Pathomorphological changes (edema, ascites, etc.) on mucous membranes and abdominal handkerchief (omentum) were recorded, too. These pathomorphological findings are not presented in this paper.

RESULTS AND DISCUSSION

The large American liver fluke (*Fascioloides magna*) from the group of large liver flukes is present in the hunting ground within the area of SNR "Gornje Podunavlje". Pathomorfological liver examination of the hunted deer shows that deer populations from the region of SNR "Gornje Podunavlje" intensively suffer from parasitosis caused by the infection of the large liver fluke. Fluke occupancy was first recorded in serious deer numbers during 1996/97 hunting season. Treatment started immediately. From 1997 to 2006 various antiparasitics (Vermitan, Clozan) were used, mixed with concentrated nutrients but with very little or no results.

According to hunting experts' estimation, based on established health condition of hunted deer, fluke occupancy has steadily increased over time, from initial 20% to 90%. Fluke had, undoubtedly, a significant impact on the deterioration of the overall health status of deer population, with very high mortality. The situation significantly changed in 2006 because antiparasitics treatment of the entire population started with implementation of antihelmintic preparation Albendazole, which was mixed in the concentrated feed and salt. This method, undoubtedly, gave very good results after deer treatment in the hunting grounds "Kozara" and "Apatinski rit" (Table 1 and 2)

Table 1. Results of deer treatment with Albendazole in the hunting ground "Kozara"
Tabela 1. Rezultati tretmana jelena sa Albendazolom u lovištu "Kozara"

Year *Godina*	Shot *Ulovljeno* (n)	Infested *Infestirano* (%)	Cured *Izlečeno* (%)	Without fluke *Bez metilja* (%)
2004/05	505	-	-	-
2005/06	513	-	-	-
2006/07	345	75	5	20
2007/08	203	35	30	35
2008/09	244	30	30	40
2009/10	314	15	25	60

Table 2. Results of deer treatment with Albendazole in hunting ground "Apatinski rit"
Tabela 2. Rezultati tretmana jelena sa Albendazolom u lovištu "Apatinski rit"

Year *Godina*	Shot *Ulovljeno* (n)	Infested *Infestirano* (%)	Cured *Izlečeno* (%)	Without fluke *Bez metilja* (%)
2004/05	137	36	28	36
2005/06	148	99	1	0
2006/07	115	-	-	-
2007/08	23	17	83	0
2008/09	90	0	13	87

After the usage of Albendazole, the number of infested individuals decreased from 99% to 0% in the hunting ground "Apatinski rit", and from 75% to 15% in the hunting ground "Kozara". The effectiveness of the fluke therapy in white-tailed deer, with preparations based on Albendazole, was scientifically researched in the USA by Quershi et al. (1990). These authors found that Albendazole treatment effectively inhibits the development of liver fluke eggs in the digestive tract and reduces their number in feces, also causing significant mortality of adult form of parasites in the deer body. Treatment success was around 85% of the total number of treated animals.

Treatment of animals infested by various types of liver fluke is being successfully carried out by individual or group animal antihelmintic treatment (Janicki et al., 2005). Some products that are used in the treatment of liver fluke are shown in Table 3.

Table 3. A review of some antihelmintic preparations used in fluke treatment
Tabela 3. Pregled nekih preparata antihelmintika, koji se koriste u tretmanu metilja

Active ingredient *Aktivna supstanca*	Trade name *Trgovački naziv*	Dose / *Doza* (mg/kg-1)	Remark / *Napomena*
Bis-hydroxy-3,5-dichlorfenyl-sulfoxid	BHS	50	No impact on the juvenile stages *Nema efekta na razvojne forme*
Albendazole	Valbazen, Vermitan	8.5-16.5	Has an impact only on the adult stages (82-84%) *Ima efekta samo na adultnu formu*
Diamphenethid	Coriban	140	Has an impact only on the juvenile stages *Ima uticaja samo na razvojne forme*
Rafoxanid	Ranide	10-15	Dubious results / *Neizvesni rezultati*
Triklabendazol	Fasinex	10	Has an impact only on the juvenile stages *Ima uticaja samo na razvojne forme*
		50-60	Has an impact only on the juvenile stages *Ima uticaja samo na razvojne forme*

Source / *Izvor:* Florijančić et al. (2011).

Individual treatment is the most effective method of fascioliasis treatment (therapy). Anti-trematode preparations are applied in the rumen (intrarumenally) by using probe to a previously calmed animal (application of sedative). Thereafter, the treated animals should be kept in quarantine for 30 days until liver fluke eggs are fully extracted through feces (Florijančić et al., 2011). However, this method is quite difficult to perform in practical terms, especially when performed on adult deer. Namely, capture, sedation and placement of the probe intrarumenally are very risky procedures for the animal as well as for people who perform this procedure.

Group therapy of the entire population of deer is performed by mixing anti-trematode drugs in concentrated nutrients. However, success of this method greatly depends on whether the deer consume sufficient amounts of offered concentrated feed (Qureshi et al., 1994). Namely, in the absence of food in an open hunting ground, deer visiting feeding places with concentrated feed more frequently so they consume the required dose of medicine, and vice versa (Florijančić et al., 2011).

The success of an individual, and particularly group treatment, with antiparasitics application in nutrients depends on whether the deer will take this food, because taste and smell can be changed due to these medicaments. Therefore, chemical substances are added in, which, more or less successfully, neutralize a distinct taste and fragrance of medicaments. In any case, the effectiveness of group therapy treatment is, however, significantly lower than that achieved by the method of individual therapy. One of the measures to prevent the fluke infestation is extinction of water (pond) snails, which are transient host of liver fluke in its development cycle. For this purpose wetlands are treated with various molucid preparations. However, this method of prevention is not recommended because of the potential negative effects on the environment. Moreover, avoiding feeding grounds with proven presence or reasonable suspicion of the liver fluke presence can also be used as a measure of the prevention. Also, hay or other nutrients from such places should not be used to feed the wild and domestic animals. To prevent and fight liver fluke, it is necessary to have continuous veterinary control of all hunted deer (Corn and Nettles, 2001; Konjevic et al., 2002).

In European hunting grounds, infestation of deer by a large American liver fluke (*Fascioloides magna*) is more and more frequently recorded. Thus, the infestation of deer by a large American liver fluke was found in Croatia (Baranja) in 2000. It is assumed that the parasites enter into this area through the natural migration of deer from neighboring Hungary (Marinculic, et al., 2002). The occurrence and treatment of this disease, in the same region of Croatia, was more studied later by Janicki et al. (2005). They have achieved good results of treatment, using antihelmintic treating of individual animals as well as group treatment in open hunting grounds. The presence of this type of liver fluke is noticed also in deer in hunting areas around the river Danube in Austria. Antihelmintic treatment was successful, but failed to complete eradication of this disease (Usprung et al., 2006). Pathogenesis of large American liver fluke, and the pathological changes caused in the liver, lungs, diaphragm and organs of the digestive tract, are described in detail in Presidente et al. (1980).

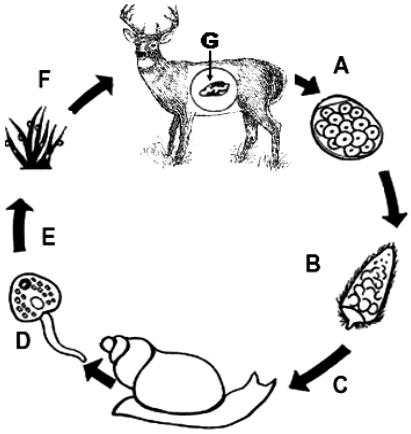
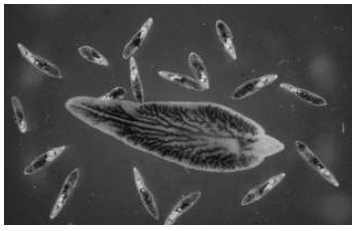


Photo 1. Life cycle of a large fluke *(Fasciola hepatica)*
Slika 1. Životni ciklus velikog metilja (Fasciola hepatica)

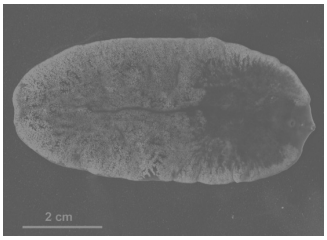
A - Eggs passed in faeces / *Jaja se izbacuju fecesom*; B – Miracidium released / *Oslobađa se Miracidium*; C – Miracidium invades snail (intermediate host) / *Miracidium invadira puža (prelazni domaćin)*; D – Cercariae leave snail / *Cerkarija napušta puža*; E – Cercariae swim until encyst on vegetation, forming metacercariae / *Cerkarija pliva, dok se ne prihvati za vodeno bilje, gde formiracistu, matacerkariju*; F – Metacercariae ingested by Deers, or other wild or domestic animals / *Metecerkariju pojede jelen ili neka druga divlja ili domaća životinja*; G-Adult fluke in liver / *Adultni oblik metilja u jetri*.

A

B



B1



C

Photo 2. A - Fasciola hepatica; B - Dicrocoelium dendriticum; B1 – Large and small fluke (size comparation);
C – Fascioloides magna (American large liver fluke)

Slika 2. A - Fasciola hepatica; B - Dicrocoelium dendriticum;B1 – Veliki i mali metilj (kompa-racija veličine);

C - Fascioloides magna (Američki veliki jetrin metilj)

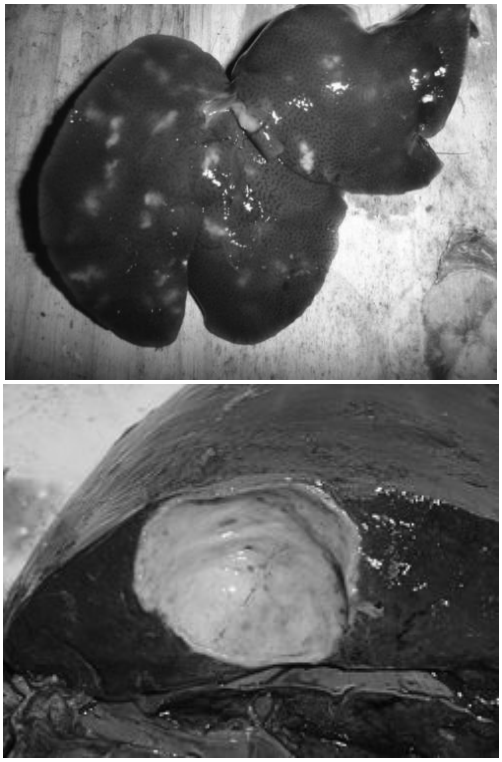


Photo 3. The fibrous capsule in the liver parenchyma of red deer

Slika 3. Fibrozna kapsula u parenhimu jetre crvenog jelena

CONCLUSION

The last few years, it was noticed that in the hunting grounds of the Special Nature Reserve “Gornje Podunavlje”, “Apatinski rit”, Apatin and Kozara “Backi Monostor”

there was a steady increase in deer infested with large liver fluke (*Fasciola hepatica still Distomum hepaticum*) and small liver fluke (*Dicrocoelium dendriticum*).

This has resulted in significant damage in natural and economic terms, due to reduced quality of deer offer in hunting tourism.

By applying the continuous group therapy treatment in deer population in these hunting grounds, by applying antiparasitics Albendazole concentrated in nutrients and salt, very high rate of heeling after treatment has been achieved.

In order to fight this disease, therapeutic and preventive measures are required in all affected areas, especially in deer hunting grounds. In this regard, it is necessary to continuously monitor epizootiological situation in hunting grounds, veterinary examination of the liver and other internal organs of each hunted deer.

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INFESTACIJA JELENA MALIM (*DICROCOELIUM DENDRITICUM*) I VELIKIM METILJEM *(FASCIOLA HEPATICA)* U LOVIŠTIMA SEVERO-ZAPADNE AP VOJVODINE (SRBIJA)

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Izvod

Metilji (*fascioloides*) su paraziti, koji prouzrokuju bolest jetre jelena, u lovištima niskih šuma i močvarnog zemljišta, a ređe u planinskim lovištima. Obolenje prouzrokuju dva tipa metilja, koji spadaju u plosnate crve: veliki metilj (*Fasciola hepatica* seu *Distomum hepaticum*) i mali metilj *(Dicrocoelium dendriticum*). Cilj ovog rada je da se ustanovi: (a) uticaj ovog obolenja na populaciju jelena, (b) optimalne metode tretmana lekovima, (c) broj infestiranih jelena posle continuiranog tremana lekovima, tokom nekoliko godina i (d) uticaj ovog obolenja na kvalitet turističke ponude u specijalnom rezervatu prirode »Gornje podunavlje«. Na osnovu ustanovljenog zdravstvenog stanja ulovljenih jelena, eksperti su ustanovili da se infestacija stalno povećava, sa početnih 20« do 90%. Metiljavost, nedvosmisleno, utiče na pogoršanje opšteg zdravstvenog stanja, sa visokom stopom smrtnosti. Situacija se značajno poboljšala od 2006. godine, kod jelena koji su bili lečeni dodavanjem antiparazitskog preparata (Albendazole) u hranu i so. Ovaj tretman se pokazao vrlo uspešnim.

Ključne reči: veliki metilj, mali metilj, američki metilj, lovište, jelen.

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