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SURVEY ON SYLVATIC PARASITOSIS IN PODUNAVLJE REGION OF CROATIA

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Summary: Parasitic diseases are permanently present in wild animals living in natural habitats along the Croatian and Serbian part of the Danube course. Results of the investigations and status of parasitosis in game species over the last twenty years are given. Direct risks for the human health are trichinellosis and allariosis. Both sylvatic and domestic infection cycle is confirmed, with new findings of *Trichinella* larvae in European badger, red fox and golden jackal. Increasing frequency of trematode *Allaria alata* and its developmental stages is observed in various animals. The health status of red deer is endangered by infection with large American liver fluke (*Fascioloides magna*), and first evidence of fascioloidosis in Croatia dated in 1999. The more effective treatment and eradication of parasitic disease in game can be achieved by cooperation between scientists in two countries.

Key words: trichinellosis, alariosis, fascioloidosis, Podunavlje, Croatia

Introduction

The Danube River between 1433 and 1295.5 river km stretches as a bordering river between Republic of Croatia and Republic of Serbia. The habitats for wildlife are situated along the left and right riverbank, and they are quite similar by the ecological characteristics. Thus, the similarity of habitats distributed in Croatian and Serbian part of the Danube course (Podunavlje) provide living place for the similar wild fauna, and often to identical population of some game, e.g. red deer. An unavoidable fact is that same pathology in game animals is present, as well as disease spreading potential. The examination and control of diseases is more comprehensive and effective if it comprise one natural, ecological and habitat entirety. The aim of this paper is to give an overview of previous results on parasitic diseases that occur in the area of Eastern Croatia, and to study possibilities for their effective suppression.

Material and Method

A review of the researches on parasitizes with significant epizootiologic importance for the game living in the Podunavlje region of Eastern Croatia is given for the period of last twenty years. These are caused by the following parasites: nematode*, Trichinella* sp.; large American liver fluke, *Fascioloides magna*; and trematode *Alaria alata.*

Results and Discussion

Trichinellosis

Both sylvatic and domestic infection cycles of trichinellosis have been recorded in the Eastern Croatia. Domestic trichinellosis, caused by *Trichinella spiralis*, was highly frequent during the 1990-ies in rural households with traditional swine-rearing practices, where the pigs came in contact with rat as a carrier. An outbreak resulted with increased number of people being infected. Eradication of domestic trichinellosis is prescribed by the legislation and implementation of continuous monitoring. In the recent time, non-encapsulated species *Trichinella pseudospiralis* was genetically identified in domesticated pigs in the Eastern Croatia [1]. Due that reason, the previously widely used trichinelloscopy as a detection method for *Trichinella* larvae in muscle tissue is now completly replaced with more accurrate method of artificial digestion. Latent sylvatic trichinellosis exists in the Eastern Croatia, with *Trichinella spiralis* and *Trichinella britovi* as main etiological agents. However, it has not be exemined in details so far. The incidence is cofirmed in wild boar and badger. Wild boar (*Sus scrofa*) meat is consumed by the people more frequently than of badger, which makes potential danger for the human health. The exemination indicated that trichinellosis is permanently present in wild carnivore or omnivore animals. The infection has been recorded in red fox and golden jackal - wild animals of special importance for sylvatic trichinellosis being retain and spread in the natural ecosystems [2]. Establishment of a long-term monitoring of shot, culled or dead wild animals is of great necessity for detection of areas with incidence of the sylvatic trichinellosis in the Eastern Croatia.

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Thus, it can be possible to disrupt infection cycle between wild and domestic animals, and to achieve eradication of trichinellosis. *Trichinella spiralis* is the most common causal agent of trichinellosis in domesticated pig and wild boar; although infection of wild boar with *Trichinella britovi* and mixed infection has been reported [3].
The human is being infected by consuming undercooked, infected meat that has thousands of cysts lying dormant within its muscles. Local people in many villages in the Eastern Croatia still processing meat in traditional way, producing indigenous meat products such as sausage, smoked ham and dry fermented salami called "kulen". Main ingredient of these meat products is pork meat, but in some receipts, it is mixed with game meat, mostly of wild boar. Taking this into account, a risk for the outbreak of trichinellosis is not negligible.
Due to considerable increasing of trichinellosis frequency in domesticated pigs and human, the Eastern Croatia was proclaimed as endemic for trichinellosis in man and animals during 1990-ies. This newly created epizootiological and epidemiologic conditions required taking all appropriate measures, including legislative, for suppression and eradication of trichinellosis. Firstly, an administrative command has been issued on mandatory inspection of meat from domesticated pigs and game that is intended for human nutrition. Prevalence of trichinellosis in the Eastern Croatia was 5.8% in 1995, and 5.7% in 1996 [4]. In the joint open hunting estates within Osijek-Baranja County, prevalence in wild boar was 0.34% [5], and 0.35% in the state hunting estate "Podunavlje-Podravlje" in Baranja [6]. The data given confirms permanent presence of *Trichinella* sp., and that wild boar is latent reservoir of this parasitic nematode in Croatia, particularly in the Eastern Croatia. Thus, precaution is needed when consuming meat of wild boar, and for the possible contact between domesticated pigs and wild animals in traditional (ecological) farming in open land.
Consumption of European badger (*Meles meles* L.) meat is still widespread in some parts of Croatia (mostly northwestern and eastern part). As the badger is omnivore, it is suspected as potential source of trichinellosis. However, incidence in humans has not been recorded up today, because thermal processing of badger meat is done properly. Frequency of trichinellosis in badger is 0.9% [7]. There is no other data on trichinellosis in badger in Croatia. Taking our own research, we recorded infection in the Eastern Croatia, near cities: Đakovo, Belišće and Vinkovci.
The red fox (*Vulpes vulpes* L.) consumes animal food (feathered game, poultry, eggs, small mammals, insects), but in the shortage it can eat some fruits or vegetables. Human does not consume meat of red fox, so it is riskless for human health. Due to its feeding habits, red fox is important in ways of trichinellosis spreading. It can be infected by eating animal carcasses containing *Trichinella* larvae. Likewise, carcasses of red fox can be source of infection for other wild, and sporadically, domesticated animals. Frequency of trichinellosis in red fox was investigated within three counties (Vukovarsko-srijemska, Osječko-baranjska, Brodsko-posavska) in the endemic area for trichinellosis in the Eastern Croatia [8]. Among 1,652 analyzed sample of muscle tissue, 82 (4.9%) was positive, with highest percentage (11.1%) for Vukovarsko-srijemska County. This data confirms role of red fox in the sylvatic infection cycle of trichinellosis.
The golden jackal (*Canis aureus* L.) enlarged its areal in east-west direction throughout Pannonian part of Croatia, during the last decade. Up today there is no published data on possible infection with *Trichinella* sp. Taking our own research, we recorded trichinellosis in golden jackal, and confirmed its role in the sylvatic infection cycle.

Alariosis

Alariosis is an emerging parasitic disease caused by a trematode *Alaria alata.* In its life cycle, a trematode multiplies in the intestines of the final host, which are animals that eat game meat, such as red fox, golden jackal or dog. Through faeces, the eggs are excreted into the environment. The further development of the parasites then occurs through two intermediate hosts, snails and frogs. In the body of aquatic snail, for 1-2 month, cercariae are being developed, and after that they changing the host. Within the frog tissue, the cercaria transforms into a mesocercaria (juvenile trematode). If so-called paratenic hosts, such as wild boar take up infected frogs, the development stages of this parasite (mesocercariae) infest the muscles or neighbouring organs and tissues. In this way humans can be infected, too and contract an alariosis.
If red fox or a dog ate the frog, immature *Alaria* migrate through the lungs prior to being swallowed and developing into adult flukes in the small intestine. When infection levels are high, pulmonary damage and hemorrhage may lead to clinical disease. The knowledge of ecology and epizootiology of alariosis in Croatia is rather poor. In 1970-ies, during the routine trichinelloscopy, live mesocercariae have been identified in muscle tissue of wild boar originated from Baranja in Podunavlje region [9]. Today, veterinarians occasionally reports on mesocercariae presence in wild boar meat [10], [11], [12] and in digestive system of red fox [13]. Although it can be a risk for human health, there is no legislative act for eradication. Individual protection is based on good thermal processing of pork and wild boar meat.

Fascioloidosis

Large American liver fluke (*Fascioloides magna*) is a treated that lives in the liver parenchyma of various wild and domestic ruminants, causing a disease - fascioloidosis. First evidence of fascioloidosis in Croatia arose in winter

1999, when an unusual weaker constitution was observed in individuals of the red deer (*Cervus elaphus* L.) free ranging population in Baranja region [14].

Liver from individuals shot in January 2000 was examined at Faculty of Veterinary Medicine in Zagreb, and 22 adult parasite *Fascioloides magna* were found. Developmental stages of *Fascioloides magna* were introduced in Croatia by migration of red deer, and by intermediate host – freshwater snails deposited with floods during the high water-level episodes. Results of parasitological monitoring in the last ten years indicated high prevalence of fascioloidosis in red deer population in hunting estates situated along the Danube course in the eastern Baranja. Low prevalence was recorded in hunting estates along the Drava River, and in the middle part of Baranja which is outside of the reach of floods and not hydrologically connected to the Danube floodplain [15]. This proves that in Baranja well-established migration routes of red deer lead from the Danube floodplains to the Drava River inundation and across the Drava to Slavonia (Figure 1). Recently, fascioloidosis was confirmed in the Lonjsko Polje, situated in the floodplain of the Sava River. Based on the migration routes of red deer, it is anticipated that fascioloidosis will occur across the Danube River, in the natural habitats in Podunavlje region of Serbia.

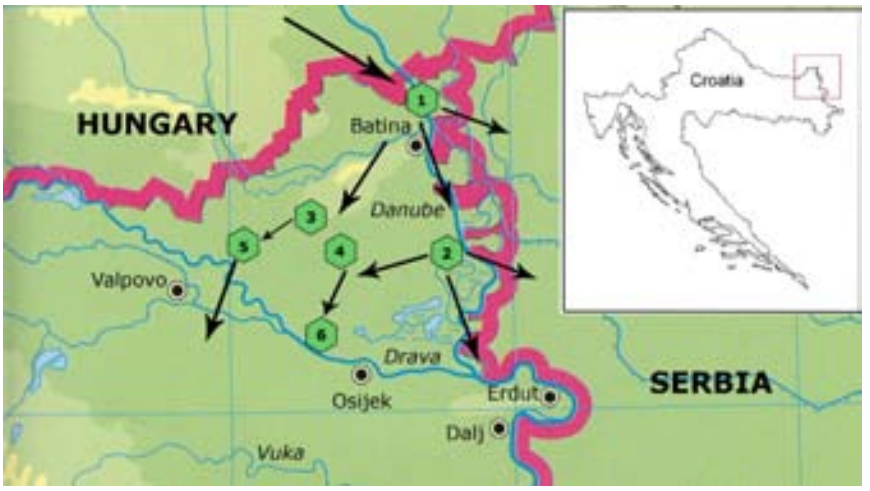

Figure 1 Routes of *Fascioloides magna* spreading in Podunavlje region of Croatia (indicated with arrows). Numbers indicates hunting estates: 1-"Šarkanj-Vrblje"; 2-"Podunavlje-Podravlje"; 3-"Haljevo"; 4-"Koha-Kozarac"; 5-"Podravlje"; 6-"Munjoroš" [15]

Conclusion

Outbreak of specific parasitic diseases in domesticated and wild animals become more frequent in the Croatian Podunavlje region during the last two decades. Some of diseases are recorded for the first time. Direct risks for the human health are trichinellosis and infection with developmental stages of trematode *Alaria alata*. The health status of red deer is endangered by infection with large American liver fluke (*Fascioloides magna*), which cause significant loss of revenues in hunting management. Currently, in Croatia in Serbia there are different approaches for investigation and treatment of parasitic diseases in game animals. Strengthening of the interdisciplinary scientific cooperation enables effective implementation of measures for suppression and eradication of diseases. Result of joint activities is keeping the good health conditions of game animals and ecological stability of natural habitats along both side of the Danube River.

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References

[1] Beck, R., Beck, A., Lučinger, S., Florijančić, T., Bošković, I., Marinculić, A. Veterinary Parasitology 159, 3-4: 304-307, 2009. [2] Florijančić, T., Marinculić, A., Antunović, B., Bošković, I. Veterinarski arhiv 76, Suppl.: S1-S8, 2006 [3] Marinculić, A., Gašpar, A., Duraković, E., Pozio, E., La Rosa, G. Journal de la Société Française de Parasitologie 8, 2 Suppl.: 92-94, 2001. [4] Vučemilo, M., Hadžiosmanović, M., Tofant, A. Zeitschrift für Jagdwissenschaft, 44: 98-101, 1998. [5] Tucak, Z., Florijančić, T., Dragičević, P., Tušek, T. Agriculture 6: 152-153, 2000. [6] Vučemilo, M., Bodakoš, D., Vinković, B., Tofant, A., Desnica. B. Zeitschrift für Jagdwissenschaft, 47: 259-267, 2001. [7] Batis, J., Brglez, J., Železnik, Z. Veterinarski glasnik 31: 819-831, 1977.

[8] Kovač, Z., Periškić, M., Krznarić, M., Balić, D., Marinculić, A. 2. Croatian Symposium of Trichinellosis, Vinkovci, Croatia, 26-28.04.2001. Book of abstracts 45-46, 2001. [9] Wikerhauser, T., Brglez, J. Atlas parazita – uzročnika zoonoza u Hrvatskoj i Sloveniji, Školska knjiga, Zagreb, Croatia, 1-127. [10] Jakšić, S., Uhitil, S., Vučemilo, M. Zeitschrift für Jagdwissenschaft 48, 203-207, 2002.
[11] Tončić J., Šoštarić, B., Vicković, I., Tarnaj I. Radovi Šumarskog instituta. Izvanredno izdanje 9: 223–236, 2006. [12] Milešević, M. 12. International Conference on Trichinelolosis, National Park Plitvice Lakes, Croatia, 25.-30.09.2007. Book of Abstracts: 158, 2007.[13] Rajković-Janje, R., Marinculić, A., Bosnić, S., Benić, M., Vinković, B., Mihaljević, Ž. Prevalence and seasonal distribution of helminth parasites in red foxes (*Vulpes vulpes*) from the Zagreb County (Croatia). Zeitschrift für Jagdwissenschaft 48: 151-160 2002. [14] Marinculić, A., Džakula, N., Janicki, Z., Hardy, Z., Lučinger, S., Živičnjak, T. Veterinarski arhiv, 72, 6: 319-325, 2002. [15] Florijančić, T., Opačak, A., Bošković, I., Ozimec, S., Jelkić, D., Marinculić, A., Janicki, Z. The 38th IAD Conference, Dresden, Germany,22.-25.06.2010. Conference Proceedings, 2010.