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Article

Bioecological Features of Trematode Pathogens

Urokov K. H.[1], Daminov A. S.[2], Yunusov H. B.[3], Nurullayev A. A.[4], Taylakova M. Sh.[5]

1. Assistant, Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology, Uzbekistan
* Correspondence: urakovkamoliddin@gmail.com
2. Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology, Uzbekistan
* Correspondence: a.daminov1960@mail.ru
3. Professor, Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology, Uzbekistan
4. Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology, Uzbekistan
5. Doctoral Student, Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology, Uzbekistan
* Correspondence: taylakovamaxfuza@gmail.com

Abstract: Prevention of the spread of fasciolosis, dicroceliosis, paramphistomatosis and oryentobilgarciosis among large and small horned animals in Uzbekistan based on bioecological features of pathogens and their transmission conditions, depending on the season. Emphasis is made on the epidemiological significance of fascioliasis and dicroceliosis, which can be transmitted to humans.

Keywords: fasciolosis, dicroceliosis, paramphistomatosis, orientobilgarciosis, *L.truncatula*, *L.thiesseae*, *L.auricularia*, *L.bactriana*, *L.subdisjuncts*, *L.impura*

1. Introduction

According to literature data it is known that fasciolosis, dicroceliosis, oryentobilgarciosis and paramphistomatosis are the most dangerous and widespread helminthic diseases of herbivores. These helminths are widespread in irrigated and foothill areas of Uzbekistan. Orientobilgarciosis is currently considered to be a helminthiasis of local foci. However, in recent years, gastrointestinal trematodes and paramphistomatoses (calicophorosis, liorchosis, gastrotilaxosis) have spread widely along the Zeravshan River among cattle in Samarkand province. Currently, these diseases are spreading in Urgut, Taylok, Bulungur, Akdarya, Payarik, Ishtikhan and Kattakurgan districts. The occurrence of the causative agent of oryentobilgariosis, which parasitises blood vessels of the intestinal mesentery, liver and other internal organs, has been recorded in the north-western region of the republic and some districts of Tashkent oblast [1, 2].

From epizootic point of view, the most important is the fact that in Samarkand oblast liver trematodes - fasciolosis and dicroceliosis - are found throughout the year, and in cattle, paramphistomatosis is more often observed. Such epizootic process leads to severe diseases, death and forced slaughter of animals. Mixed trematodoses cause significant economic damage, especially to livestock [3, 4].

Factors contributing to the spread of mixed trematodes in geographically diverse irrigated and mountainous areas are the fact that the causative agents of fasciolosis - *Fasciola gigantica*, *F. hepatica*, pathogens of gastrointestinal paramphistomatoses - *Calicophoron calicophorum*, *Liorchis scotiae*, *Gactrotylax crumenifer* have two hosts in the parasite-host system,

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their embryonic development occurs in water, the stages of larval reproduction in intermediate hosts - pulmonary gastropod molluscs, the period of development of cystogonia, i.e. the period of formation of invasive larvae. i.e. the period of formation of invasive larvae (adolescariae) for their main hosts - farm animals, occurs in water [5, 6, 7]. Water plants, irrigated grasses and mixed grasses may contain (foci) of pathogens in pastures and in hay, rice stalks and straw made from them are a source of invasion for the occurrence of fascioliasis and paramphistomatosis. According to our observations, hay from different plants (wheat, barley, sorghum) has no epizootic significance in these diseases, as it is harvested in hot summer and used as fodder after several months [8, 9].

2. Materials and Methods

Biology, ecology, epidemiology, and pathology are all integrated into the interdisciplinary study of the bioecological characteristics of trematode infections. Trematodes, a term for parasitic flatworms that infect a variety of creatures, including people, animals, and plants, are also called flukes. It is essential to comprehend their bioecology in order to create control and management plans that work. The following is a methodological framework that covers literature review, environmental factors, data sharing, and communication in the research of the bioecological characteristics of trematode diseases.

3. Results and Discussion

The intermediate hosts of fascioliasis caused by *Fasciola gigantica* - several large molluscs belonging to the family *Lymnaedae - Lymnaea auricularia, L.bactriana, L.subdisjuncta, L.impura* - are abundant in springs (reservoirs), on the banks of groundwater (Figure 1).

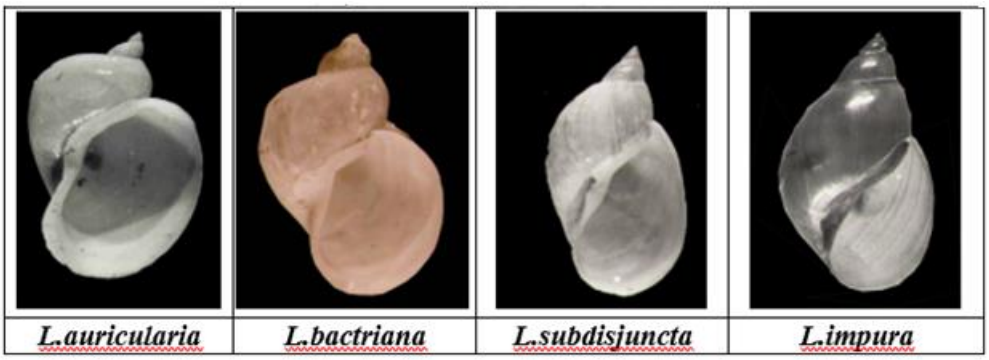

Figure 1. Intermediate hosts of *Fasciola gigantica*

The intermediate host of *F.hepatica, L.truncatula*, inhabits wetlands, small ditches and springs [14, 15, 16, 17]. In our studies, the participation in the development of *F.hepatica* of the mollusk *L.truncatula* was biologically confirmed hepatica mollusk *L.thiesseae*, morphologically close to *L.truncatula* and often found together with it (Figure 2).

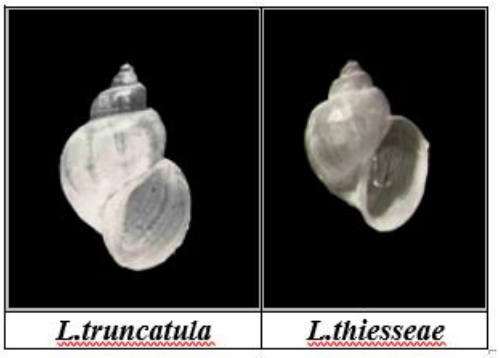

Figure 2. Intermediate hosts of *F. hepatica*

The intermediate host of paramphistomatosis - molluscs with spiral shells can be found in various water bodies in pastures, where *F. gigantica* and *F. hepatica* are common [10, 11, 12, 13].

It should be emphasised that invasive larvae of the causative agents of fascioliasis and paramphistomatosis are spread from one region to another with water, fodder harvested in the foci of the causative agents and vehicles, as well as during the movement of infected and diseased animals.

Orientobilharzia turkestanica, the causative agent of Orientobilharziasis, has no cystostome stage. Accordingly, cercariae with separate tails, detached from their intermediate host, the mollusc *L.auricularia*, cannot form cysts, and such larvae, to continue ontogenesis, penetrate through the skin into the body of animals and infect them. Thus, the occurrence of Orientobilgarciosis coincides with the period of activity of molluscs in the period of high humidity, when the main hosts of the parasite are grazing. According to biological and ecological peculiarities of fascioles and paramphistomatids - infection of animals by them can be observed all year round, while the duration of infection is much shorter in Orientobilgarcia, with the onset of cold autumn days the active life activity stops and is not observed in winter, and with the onset of spring, warm days and throughout the summer, infection of animals by Orientobilgarcia is observed.

The causative agent of dicroceliosis, *Dicrocoelium dentriticum*, is biologically and ecologically very different from the above-mentioned trematodes. The larval development of this parasite occurs in two intermediate host organisms. The first is gastropod molluscs with shells and lungs belonging to the genus Xeropicta, which inhabit terrestrial but low-moisture habitats (Figure 3), and the second intermediate host is ants belonging to the genera Formica and Proformica. They are abundant in areas adjacent to habitats inhabited by intermediate hosts of fascioles and paramphistomatids.

Figure 3. The intermediate host of *D.dendriticum* is the mollusc *Xeropicta candaxarica* (J. A. Kudratov, 2021)

Molluscs and ants infested with *D. dentriticum* larvae emerge from anabiotic state almost simultaneously in late winter and early spring. From this time onwards, animals eating such ants together with grass start to get dicroceliosis. At the same time, it is observed that the cercariae (larvae) released during the period of mollusc activity infect the ants, and the larval eggs of *D. Dentriticum* contained in the faeces of animals infect molluscs. When the molluscs go into an anabiotic state during the long summer period, the chain of infection through ants and molluscs ceases. However, active ants continue to transmit dicroceliosis larvae to animals. In autumn, with the onset of the rainy season and, in the morning, with the formation of thick dew, molluscs become active, on the one hand, they release cercariae of the parasite, and such larvae are eaten by ants, thus restoring the life cycle of parasites and ways of infection of animals. The re-infestation of molluscs with *D. dentriticum* eggs is also observed. The larvae of the parasite successfully overwinter in the organism of molluscs and ants that have gone into hibernation.

Bioecologically, *D. dentriticum*, like fasciola, parasitises in the bile ducts of animals, but differs from them in that it has no exogenous period of development. Accordingly, its embryonic development takes place in the uterus of the parasite, the parthenogony period in the mollusk and the cystogony period in the abdomen of the ant. Animals become infected with dicroceliosis during the entire period of ant activity. Our studies show that larvae of all hepatic and gastrointestinal trematodes overwinter in the organism of intermediate hosts, so their infection of farm animals begins with the spring season. Intensive infestation with dicrocelia is observed in spring and autumn, with fasciolas and paramphistomatids in summer and autumn, while dicroceliosis, as well as oryentobilgarciosis, stops completely in winter, and infestation with fasciolas and paramphistomatids continues in this season.

According to our studies, fascioles, having got into the host organism, parasitise in liver tissues of animals from 2 months (*F.hepatica*) to 4 months (*F.gigantica*), increase in size and cause acute (tissue) form of fasciolosis, from which a large number of sheep and cattle die at high intensity of invasion. Fascioles - the period of sexual maturation and sexual reproduction spend in the bile ducts of the liver. During this time fasciolosis is observed in chronic course. The acute course of fasciolosis begins in the second half of summer (*F.hepatica*) and intensifies in autumn (*F.gigantica*). In late autumn and the first half of winter, a mixed course of fascioliasis is observed. Juvenile fascioles parasitise in parenchymatous tissues of the liver, and adult fascioles parasitise in bile ducts of the liver. Accordingly, a mixed course of fascioliasis is also dangerous. Dicroceliosis has a chronic course, because its pathogen spends its whole life in hepatic bile ducts and partially in the gallbladder, without moving to the liver parenchyma. The causative agent of dicroceliosis is resistant to anthelmintics, as are young fasciolas parasitising in liver tissue, so the number is higher in older animals than in young animals.

Paramphistomatosis, like fasciolosis, runs in two forms. Their acute course corresponds to the period of vital activity of young parasites in the walls of the ileum and duodenum, and the chronic form - in the large and partially reticulated stomach of adults. Paramphistomes are among the trematodes that are fairly resistant to anthelmintic agents.

Of the trematodes occurring in Uzbekistan, fasciolosis and dicroceliosis are of certain epidemiological importance. As a result of our long-term observations, it has been established that cercariae of fascioles in some solids in water undergo a period of cystogeny and in very rare cases can form cysts on the water surface. Accordingly, we believe that fasciolosis pathogens infect humans mainly by eating greens grown in the waters of streams and springs flowing through the foci of the disease. In our studies it was found that fasciola larvae die in a few seconds at temperatures of 70-80^{o}C. According to ecological characteristics, we believe that such greens grown in rural conditions should be washed in water at a temperature of at least 70^{o}C for several minutes and then thoroughly rinsed with cold water. We know from internet sources that transmission of fasciola to humans often occurs through drinking water. We strongly recommend that running water should be boiled before consumption. The population should emphasise the proper use of various greens in food. According to our observations, the possibility of human infection with fascioliasis also arises from manual harvesting of cane, lux and rice stalks in fascioliasis hotspots. Workers must wear gloves and strictly follow sanitary rules when performing such works.

In dicroceliogenic foci, red ants can be found gnawing on green grass and dormant from early spring in meadows around the village, along the edges of fields. They are infected with invasive larvae of the causative agent of dicroceliosis. In the abdominal cavity of each ant there are several dozen or even more than a hundred larvae. Such ants, which have passed into a temporary anabiotic state, attract teenagers interested in nature. Children, playing, collect, beautiful ants and when collecting them, the abdomen of the insect can, crack between the fingers. At this time, the larvae of oval shape, barely visible in the abdomen of the ant, sucked to the surfaces of the fingers, between the nails and in case of

non-compliance with sanitary rules get into the mouth of a person through contaminated hands, resulting in infection with the causative agent of dicroceliosis. Ants infected with the larvae of the parasite can be found in meadows in terrestrial mollusk habitats during long periods of cloudy, rainy days in the spring months, while dormant on various grasses. They are only activated by exposure to sunlight. Therefore, ants infected with cysts (metacercariae) of the causative agent of dicroceliosis can be found on sunny days. Small children should be prevented from coming into contact with ants in pastures where sheep, goats and cattle are raised.

4. Conclusion

In the conditions of Samarkand region in scientific studies conducted in recent years, a spectrum of gastrointestinal trematodoses, such as fasciolosis and liver dicroceliosis of large and small animals, as well as paramphysomatoses and often their mixed course is observed. These diseases cause great economic damage to the livestock industry, especially to private farms. Specialists in this field are obliged to develop effective complex measures for the prevention of these diseases. In unfavourable areas for this infestation it is also advisable to promote prevention methods aimed at preventing mass infection with these diseases.

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