European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 01, 2020

Schistosomiasis Of Animals In Uzbekistan

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Abstract: The work specifies the current distribution of Schistosoma turkestanicum Skrjabin, 1913 causing schistosomiasis in the animals of Uzbekistan. Populations of mature blood flukes were recorded in 14 mammal species. Three of these species – Hare, Goitered Gazelle and Bukhara Red Deer – were for the first time identified as definitive hosts for the blood flukes in question. Persistent foci of schistosomiasis of animals were identified in the Aral Sea area. Recorded prevalence: cattle – 55.5%, sheep – 33.0%, goats – 15.5%, camels – 10.2% and horses – 21.5%.

Keywords: schistosomiasis, Schistosoma turkestanicum, molluscs, epizootology, Uzbekistan

1. INTRODUCTION

Schistosomiases of humans and animals rank among the most socially and economically important parasitic diseases.

The schistosomiasis caused by Schistosoma turkestanicum Skrjabin, 1913, was for the first time recorded as a nosologic unit in domestic animals in Iraq in 1936 (MacHattie, 1936). In the wetlands of Iraq and on rice plantations along the banks of the Tigris the prevalence of this disease reaches 80% in sheep, goats, cattle and buffalloes and 15% in horses, donkeys, mules and camels.

MacHattie's publication attracted the attention of various parasitologists to the problem, and, aside from Iraq, Sch. turkestanicum was recorded in animals in many other countries across Europe and Asia (Azimov, 1975).

In 1965, 1985 and 2005 three strong outbreaks of schistosomiasis were recorded in the Republic of Karakalpakstan and Khoresm Province in Uzbekistan, which resulted in the infection of hundreds of thousands of individuals of cattle and sheep, 50% of which died. The bad epizootic situation associated with schistosomiasis of animals forced researchers to begin studying actively the biology and ecology of the parasite and the epizootology, pathogenesis, diagnosis, and methods of treatment and prevention of schistosomiasis in the animals of Uzbekistan (Azimov, 1986).

Although science quite succeeded in dealing with schistosomiasis of animals, this disease continued to spread in Uzbekistan and many other countries. Numerous publications support the concept that Sch.turkestanicum causing schistosomiasis in animals is widely spread (Skriabin, 1951; Kumar, 1973; Massoud, 1973; Chauhan et al., 1973; Lien Chien-An et al., 1975; Tang et al., 1983; Liu et al., 1987; Wang et al., 2009; Lockyer et al., 2003; Li et al., 2008; Qiu et al., 2008; Majoros et al., 2010). According to the last two authors, Sch. turkestanicum was recorded in Red Deer in Hungary, in the centre of Europe, in 2010.

Currently, populations of Sch. turkestanicum are registered in domestic and wild mammals in many countries across Asia and Europe (Azimov et al., 2014). As for medical aspects, cercariae of this trematode cause non-specific cercarial dermatitis in humans (Sahba, Malek, 1979; Athari et al., 1990, 2006; Wang et al., 2009; Majoros et al., 2010; Azimov et al., 2014).
It is obvious that today the disease caused by Sch. Turkestanicum has grown into a grave transcontinental problem for clinical veterinary science and other branches of medicine.
The goal of this work was to study the distribution of Schistosoma turkestanicum – an agent causing schistosomiasis in animals – and to develop measures to control the disease in Uzbekistan.

2. MATERIALS AND METHODS

The material of the research consisted of mature blood flukes collected from domestic and wild animals in the north-western part of Uzbekistan. The vast study area encompassed the entire areas of the Republic of Karakalpakstan and Khoresm Province, Uzbekistan, which demonstrate good level of development in all animal breeding sectors and are a home for various wild mammals (Fig. 1, map).
Mature Schistosoma were extracted from the veins of the mesentery and liver of animals in spring, summer, autumn and winter between 2000 and 2020, following a commonly accepted method (Skriabin, 1928).

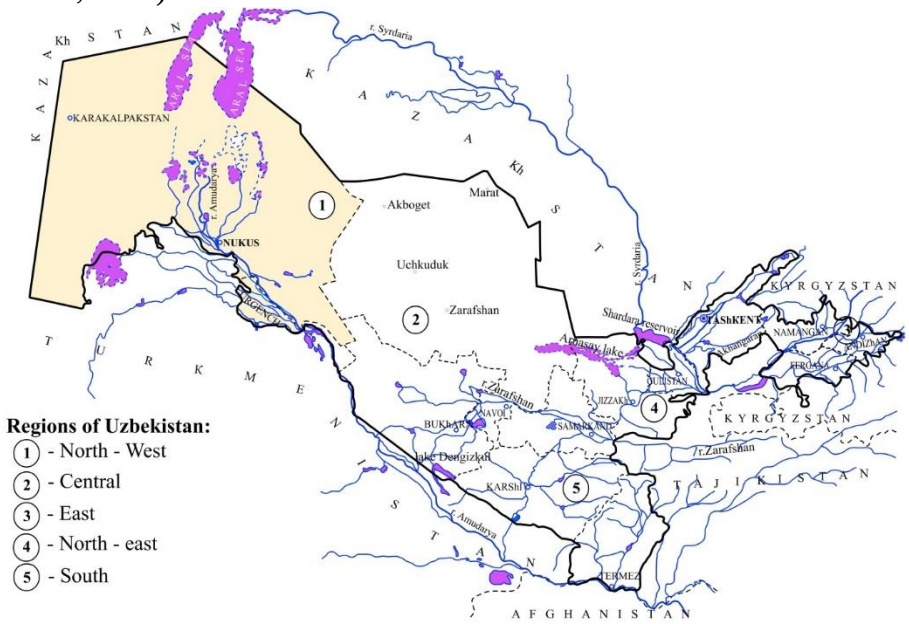

Figure 1. Location of the site in Uzbekistan where the material was collected

The following animals were examined for blood flukes: sheep – 2,175 individuals, goats – 104 individuals, cattle – 2,452 individuals, camels – 26 individuals, horses – 102 individuals. Mature blood flukes were collected from animals killed in slaughter houses in the study area. We also examined some individuals of wild mammal species killed by poachers and confiscated by inspectors from nature conservation organisations: Wild Boar (Sus scrofa) – 16 individuals, Saiga (Saiga tatarica) – 11 individuals, Goitered Gazelle (Gazella subgutturoza) – 13 individuals, Bukhara Red Deer (Cervus elaphus) – 11 individuals, Hare (Lepus capensis) – 36 individuals. Some individuals of Hare and Wild Boar were killed legally by hunters during a hunting season, who kindly agreed to provide the animals' organs for the examination.
To estimate the scale of the infection of animals with blood flukes standard parasitological indices were used, such as prevalence (%) and intensity of infection (No. of individuals).

Molluscs were being collected in spring, summer and autumn annually between 2016 and 2020, in various types of bodies of water in the lower course of the Amudarya, using generally accepted hydrobiological methods (Zhadin, 1952), and were examined using generally accepted parasitological methods (Ginetsinskaia, 1968). Stationary surveys of molluscs were carried out in the Dautkul lake system and on bodies of water in Karajar and Kyzyljar, transect surveys – on bodies of water on pastures in Bozatau, Chimbay, Kegeyli, Kungrad, Muynak and Turtkul Districts of Karakalpakstan. In total, 8,569 individuals of molluscs Lymnaea auricularia were collected and examined.

3. RESULTS AND DISCUSSION

We established that many species of both domestic and wild mammals were infected with mature blood flukes Schistosoma turkestanicum Skrjabin, 1913, which corresponds with data provided by earlier publications (Azimov, 1975, 1986). It was the first time that this species was recorded in Bukhara Red Deer, Goitered Gazelle and Hare (Table 1) in the territory of Karakalpakstan.

Table 1. Infection of various animal species with mature blood flukes in Uzbekistan

Species	No. of examined individuals	Prevalence, %	
		Limits	M±m
Ovis aries	2,175	20.0-46.0	33.0
Capra hircus	104	10.5-20.5	15.5
Bos taurus	2,452	26.2-85.3	55.2
Camelus bactrianus	26	5.2-15.2	10.2
Equus caballus	102	8.5-34.5	21.5
Lepus capensis	36	2.7-5.5*	4.1
Sus scrofa	17	5.8-11.7*	8.7
Cervus elaphus	11	9.0*	
Saiga tatarica	11	9.0*	
Gazella subgutturoza	13	7.5*	

*-developed Sch. turkestanicum eggs were recorded in faeces taken from the animals' recta

Mature blood flukes were discovered in the veins of the mesentery and liver in the autumn and winter of 2016. The following prevalence was recorded in various animals: Hare – 4.1%, Bukhara Red Deer – 9.0%, Goitered Gazelle – 7.5%. The intensity of infection was not high in these species and ranged between 37 and 126 individuals of flukes. Our records of blood flukes in Wild Boar and Saiga were made in new locations in the north-west of Uzbekistan; they corresponded with the results of earlier research (Azimov, 1975, 1986).

Sch. turkestanicum is a common parasite for the domestic animals of the north-western portion of Uzbekistan. Persistent foci of infection were recorded in the Aral Sea area. This is confirmed by recent data obtained during resumed research (2016-2020) (Table 1). Sheep and cattle infected with schistosomiasis were recorded in areas with developed animal breeding in the Republic of Karakalpakstan and Khoresm Province of Uzbekistan. The highest prevalence was shown by cattle – 55.2% on average. In some farms in Bozatau, Kegeyli, Chimbay, Kungrad, Muynak, Turtkul, Amudarya, Takhtakupyr and Kanlykul Disctricts of Karakalpakstan cattle demonstrated a prevalence of around 100% and a high intensity of infection. The blood fluke individuals found in the veins of the mesentery and liver could number hundreds of thousands in each infected animal (Fig. 2). It was also established that schistosomiasis showed some variation depending on the season.

Figure 2. Schistosoma turkestanica Skrjabin, 1913: mature forms of schistosomes (males and females) extracted from the veins of cattle, Bozatau District, Karakalpakstan (original).

The study of the seasonal dynamics of schistosomiasis in cattle shows that blood flukes are recorded in animals throughout the year, with just a slight variation in numbers. The only exception is youngsters under one year old. For the first time this group of animals becomes infected with mature schistosomes in late July. In subsequent months prevalence in this group increases. From July to December the portion of calves infected with blood flukes varied between 4.9% and 25.5% (Table 2).

Table 2. Prevalence dynamics in cattle infected with schistosomiasis (based on 410 ovo-larvoscopic studies)

Seasons	Prevalence, %		
	Young animals aged under 1 year	Animals aged between 2 and 3 years	Adult animals
Spring	0	20.5	40.6
Summer	4.9	29.8	50.9
Autumn	20.2	35.5	55.5
Winter	25.5	38.2	55.9

The prevalence of schistosomiasis in young animals aged between 2 and 3 years ranged from 20.5% to 35.2%. The highest prevalence was recorded in adult cattle (40.6-55.9%).

The study shows that the highest rate of infection with mature schistosomes in animals occurs in late autumn-early spring, with the disease peaking in winter months. This is confirmed by enzootic outbreaks of schistosomiasis recorded in cattle across the animal breeding farms of Karakalpakstan.

The analysis of the seasonal dynamics of schistosomiasis in cattle in the Aral Sea area shows that the animals become infected with schistosomes throughout summer, starting from the second half of June to late August. This period coincides with the highest rate of infection with Sch. turkestanicum parthenitae and cercariae in mollusc Lymnaea auricularia, the blood fluke's intermediate host, in various wetlands and bodies of water across the region. The prevalence of the infection in molluscs in individual biotopes in Bozatau, Kegeyli, Chimbay, Kungrad, Muynak and Turtkul Disctricts of Karakalpakstan is quite high and ranges between 10% and 45% (Table 3, Fig. 3).

Table 3. Infection of molluscs Lymnaea auricularia with the larval forms of Sch. turkestanicum in the study area

Name of water body	No. of examined individuals	No. of infected individuals	Prevalence, %	The start of the emergence of cercariae, month/year
Dautkul lake system	2,140	222	10.0	June 2016
Karajar	2,140	325	15.6	July 2017
Kyzyljar	2,120	248	11.5	July 2016
Pools around artesian wells in Bozatau District	1,100	356	35.9	June 2016
Pools at farms in Bozatau District	1,160	525	45.0	July 2018

The research shows cyclicity in the epizooty of schistosomiasis of cattle in the north-west of Uzbekistan. The epizooty was recorded in 1964-1965, 1984-1985 and 2004-2005 towards the end of the grazing season – in autumn and winter – and resulted in a large number of deaths. So, each cycle continues for about 20 years. This is a very interesting fact. The thing is that Sch. turkestanicum, like other representatives of the genus Schistosoma, stay quite long in their definitive host, almost until the latter's death. Animals become infected with schistosome cercariae every year, which leads to the accumulation of mature flukes and their numbers growing drastically year after year. Hundreds of thousands of schistosome individuals and even more concentrate in the veins of the mesentery and liver, which may be the cause of the cyclic character of schistosomiasis of animals in the Aral Sea area.

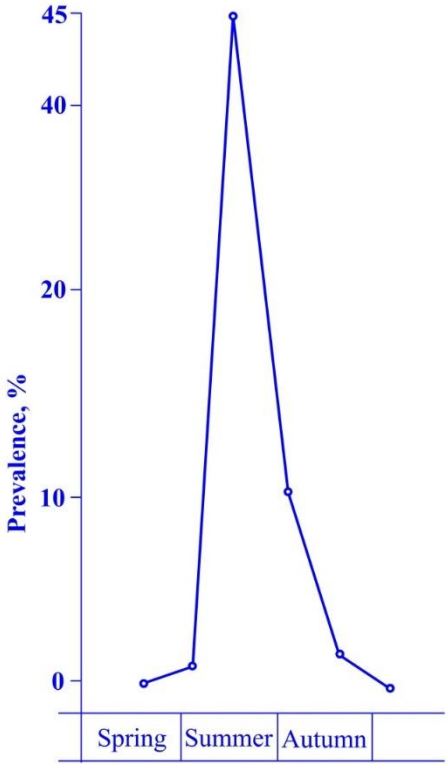

Figure 3. Sporadic infection of molluscs Lymnaea auricularia with Schistosoma turkestanicum larvae in Karakalpakstan (original).

Molluscs Lymnaea auricularia in the north-west of Uzbekistan – a region with an adverse schistosomiasis situation – form stable populations. By releasing enormous numbers of cercariae into the external environment they produce a high concentration of infectious elements at the sides of the bodies of water, which facilitates the active infection of definitive hosts with schistosomes. Moreover, travelling from one body of water to another, infected molluscs spread the disease and thus facilitate the distribution of the infection among susceptible animals.

The strategy to control the infection must include: measures to reduce the transmission of the disease by lowering the numbers of molluscs; dehelminthisation of animals – sources of infection; development of new efficient medicine; modernisation of the organisational structure of anti-epizootic services; strict conformity of farms with veterinary, sanitary and environmental standards.

Based on the results of comprehensive studies we developed and tested methods and means to control schistosomiasis:

- Substitution of infectious pastures for safe ones for the period between June and October (the most efficient measure);
- Drainage of wet areas to impede the development of molluscs and reduce their numbers; closed drainage is preferable in this situation;
- Keeping animals in stalls;
- Separation of young animals from adult ones and the former's grazing on safe pastures;
- Improvement of the sanitary conditions of water bodies and drinking places;
- Biothermal disinfection of faeces.
- Preventive dehelminthisation of animals with schistosomicide antihelminthics, such as Praziquantel and Azinox in prescribed amounts. The first course of treatment should be taken in late April, before driving the animals to pastures, the second one – in September-October.

4. CONCLUSION

According to our observations, populations of Sch. turkestanicum causing schistosomiasis in animals are widely distributed in the north-western portion of Uzbekistan. Schistosomes were recorded in a number of mammal species. Taking into account the data of earlier works, it was established that the definitive hosts of blood flukes in Uzbekistan includes 14 species of domestic and wild mammals.

This schistosome is much more common in domestic animals in comparison with wild ones, the latter showing much lower prevalence and intensity of infection.

The data obtained during the research on the infection of molluscs L. auricularia with parthenogenetic forms of Sch. turkestanicum in the Aral Sea area correspond with those in earlier publications on the role of molluscs in the formation of foci of infection and its circulation in the wild.

It is essential to permanently monitor the infection of intermediate and definitive hosts with various forms of blood flukes and take appropriate measures to control schistosomiasis of animals.

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