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# INTESTINAL CESTODE INFESTATION IN SHEEP IN UZBEKISTAN: EPIZOOTIOLOGICAL STUDIES, ECOLOGICAL FACTORS, AND SEASONAL DYNAMICS

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**Abstract:** This article examines the degree of intestinal cestode infestation in sheep in Uzbekistan, their distribution, the impact of ecological factors, and seasonal changes. The research results indicate that parasitic diseases such as monieziosis and thysanieziosis vary in distribution depending on age and geographical zones. The infestation rate peaks in spring and autumn and declines during winter. Additionally, ecological factors, particularly precipitation, temperature, and humidity, significantly influence the infestation process by Moniezia species. The article also provides scientific and practical recommendations for improving diagnostics, prevention, and veterinary control measures.

**Keywords:** Sheep, intestinal cestodes, monieziosis, thysanieziosis, epizootiology, infestation prevalence, infestation intensity, ecological factors, seasonal dynamics, diagnostics, prevention.

I.X. Ergashev and T. Abdurakhmanov (1992) reported that *M. benedeni* was found year-round among young sheep in all zones of Uzbekistan, whereas *M. expansa* was detected in irrigated, foothill, and mountain zones in winter (8.0%) and autumn (7.0%), with no cases recorded in summer. They noted that monieziosis prevalence decreases with age and that sheep are initially infected with *M. expansa* and later with *M. benedeni.*

Sh.A. Azimov (1974) found that in Uzbekistan's foothill-mountain and desert-pasture zones, *M. expansa* infestation was 11.2% on average, while *M. benedeni* infestation was 29.3%. The number of *M. expansa* cestodes per animal ranged from 1 to 15, while *M. benedeni* ranged from 1 to 23. In foothill-mountain areas, lamb infestation rates with Moniezia were 7.6% in April, 47.0% in May, 11.0% in summer, and peaked in autumn before reaching a minimum in winter. Among sheep under two years old, infestation rates ranged from 5.2% to 30.0%, while in older sheep, rates were 2.0–15.0%. In desert-pasture zones, lamb infestation rates ranged from 4.1% to 33.6%, sheep under two years old from 4.2% to 26.5%, and older sheep from 3.2% to 20.0%.

Po‘latov G.S. and O‘tepov A.D. (1976) found that sheep in Karakalpakstan were less infested with Moniezia species compared to goats. They identified *M. benedeni* as the primary causative agent, while *M. expansa* was rarely observed and completely absent from September to February.

In the Kyzylkum region (Bukhara and Navoi provinces), monieziosis was observed year-round in lambs and adult sheep, with infestation rates of 23.4% in lambs and 16.6% in sheep. The average infestation intensity of *M. expansa* and *M. benedeni* was 3.6–3.8 cestodes per animal. The highest infestation rates were recorded in spring (50.0% in lambs and 27.5% in sheep), followed by a decline in summer, reaching a minimum in winter (9.6–6.7%) (T.K. Nematov, 1977).

Further studies conducted in the desert biosenosis of Bukhara and Navoi provinces from 1979 to 1985 (N.M. Matchonov et al., 1989) reported a significant decline in monieziosis prevalence. Infestation rates for *M. expansa* were only 3.0% and for *M. benedeni*, 2.7%, with an infestation intensity ranging from 1 to 8 cestodes per animal (average of 2.2). Additionally, in this zone, goats were exclusively infected with *M. expansa*, but with a lower infestation intensity (1–5 cestodes per animal). Considering the ecological, physiological, biological, and dietary characteristics of small ruminants, these epizootiological findings are particularly intriguing. Similar observations were reported in the studies of G.S. Po‘latov and A.D. O‘tepov.

The studies were conducted on the small intestines of sheep that had died from disease, were culled, or were slaughtered for meat production, either on-site or in the scientific research laboratory of the "Veterinary Medicine and Pharmacology" department. The intestines were examined using the complete helminthological dissection method of academician K.I. Skryabin. All cestodes found in the intestines were washed in clean water and placed in special glass containers. Each cestode’s scolex, neck, and strobila segments were examined separately using macroscopic and microscopic methods to determine their shape, size, and the presence of eggs or capsules in mature segments. Once identified, they were preserved in either 70% alcohol or 3.0% Barbagallo’s solution.

The strobila of *M. autumnalia* is thicker, more robust, and transparent compared to *M. benedeni* and has a whitish hue. Its segments do not exceed 6-8 mm in width. In *M. benedeni*, the segment width is 4-5 times smaller than its length, whereas in *M. autumnalia*, the hermaphroditic segments are only 1.5 times longer than they are wide, and in mature segments, the length often exceeds the width (M.I. Kuznetsov, 1967).

According to E.M. Matevosyan and S.O. Movsesyan (1927), the mature strobila of *M. autumnalia* ranges from 160 to 284 cm in length, with a net-like uterus and eggs that are 10-12-angled. This type of cestode was not encountered in our study. It was previously identified in the mountainous ecosystems of Uzbekistan in sheep by R.R. Mufazalov (1995).

*M. alba* (Peroncito, 1879) has a strobila length of 60 to 250 cm. Its scolex is large, spherical, and rectangular (1.15-1.40 mm in width). The neck measures between 1.5 and 5.3 mm in length and 0.6-0.9 mm in width. The segments are thick and not very transparent. Mature segments range from 8 to 14 mm in width and 2.0 to 6.5 mm in length, with a thickness of 1.5 mm. There are no intersegmental glands, and the segment edges have small serrations (K.I. Skryabin, R.S. Shults, 1937; V.I. Bondoreva, 1960). This cestode species has been found in large ruminants and sheep.

*M. rangiferina* has a strobila length of 5-10 m and a width of 12-18 mm, with segments that are wider than they are long. The scolex has four suckers, and the intersegmental glands are arranged irregularly in a ring shape, with 12-28 glands at the segment edges, sometimes clustered together. The reproductive organs are paired. The uterus is round, and the eggs have a pear-shaped apparatus (D.V. Kolmakov, 1938).

*M. taimerica* has a strobila length of up to 370 cm. Oval-shaped intersegmental glands are located at the upper and lower edges of the posterior segments. These glands are closely arranged and, in some cases, merge, occupying the middle of the segment edges. The reproductive organs are paired, and the uterus is net-like (N.S. Semenova, 1965).

*M. baeri* has a strobila length of 160 cm and a width of 6.5 mm. It lacks intersegmental glands. The uterus is net-like, and the oncospheral eggs possess a pear-shaped apparatus (K.I. Skryabin, 1931).

No additional information on the morphology of other species was found in the literature.

The above findings indicate that, apart from *M. expanza* and *M. benedeni*, other intestinal parasites from the *Moniezia* genus may also occur in sheep.

It is known that *M. expanza* and *M. benedeni* differ significantly from other intestinal cestodes such as *Thysaniezia giardi* (Moniez, 1879) and *Avitellina centripunctata* (Rivolta, 1874) in terms of their short necks, rapid segment formation, and broad segments. Additionally, their uteri contain oncospheral eggs with a pear-shaped apparatus.

According to our research, in *T. giardi*, the segments are initially indistinct after the neck but later expand in width. Mature segments do not exceed 8-9 mm in width, sometimes reaching 10 mm, and the final segments contain paruterine organs (capsules), inside which several small, non-pear-shaped oncospheral eggs develop.

Similarly, in *A. centripunctata*, the segments are initially indistinct but later expand in width. Just before maturity, they shorten in both width and length. The final segments, which make up the terminal part of the strobila, take on a nearly square shape, resembling a chain. These segments contain paruterine organs similar to those in *Thysaniezia*, with eggs that lack a pear-shaped apparatus.

Based on the biology of *Moniezia* and the ecology of its intermediate hosts, during our master's studies, under the guidance of our scientific advisor, Prof. B.S. Salimov, we conducted daily meteorological and phenological observations in the conditions of Samarkand region and its neighboring areas. The results are as follows:

In the first half of autumn 2024, no precipitation was observed. Such ecological conditions limited the infection of *Moniezia* in all even-toed ungulate ruminants, especially in desert areas.

From mid-October 2024, rainfall began, intensifying particularly in the mountainous and foothill regions of Kitob district, Kashkadarya region. The precipitation at the end of November and in mid-December, along with relatively optimal temperatures (17-20°C during the day and +1 to +5°C at night in the first ten days of December), allowed green grass to grow on pastures, providing feed for sheep and goats. Due to the moist pastures and the weakly developed roots of the grass, some soil, along with ticks,

could mix into the animals' mouths while grazing. Such ecological conditions created opportunities for sheep to become infected with *Moniezia*. As a result, in January 2024, mortality among sheep due to *Moniezia* infections was recorded in sheep farms of Kashkadarya and Samarkand regions.

In mid-December 2024, snowfall and a sharp drop in temperature were observed. In Samarkand region, nighttime temperatures dropped to -15 to -17°C, while daytime temperatures ranged from -2 to -6°C. In the northern regions of Uzbekistan, nighttime temperatures plummeted to -25 to -28°C. Such harsh ecological conditions effectively halted the infection of animals with *Moniezia*. Cold temperatures persisted throughout the first half of January 2024. However, at the beginning of the first ten days of January, the temperature started to rise, reaching +10 to +12°C. These favorable ecological conditions contributed to the resurgence of *Moniezia* infections in animals.

At the beginning of the second ten-day period of January, strong thunderstorms, heavy rains, hail, and a drop in temperature were recorded, followed by snowfall. On a single day, spring-like weather was observed in the morning, autumn-like conditions in the afternoon, and winter weather in the evening. The next day, temperatures began to rise again, but soon dropped once more. In the third ten-day period of January, rain alternated with snow, and pastures were eventually cleared of snow.

Subsequent winter and spring months had sufficient temperature and humidity, creating favorable abiotic conditions for the continuous infection of sheep and goats with *Moniezia*. However, certain days in March, such as March 7, saw snowfall in Samarkand region, temporarily limiting *Moniezia* infections in animals until March 11-12. From March 13 onwards, temperatures rose, humidity remained sufficient, and ticks became active again, leading to the continued spread of *Moniezia* infections.

April and May also maintained similarly favorable conditions for infection.

**Results:** Studies on the infestation of sheep with intestinal cestodes in Uzbekistan have yielded the following results:

Monieziosis and thysanieziosis are widespread, and their invasion extensiveness and intensity depend on seasonal factors.

The highest levels of infestation were observed in spring and autumn, while in winter, the invasion rate significantly decreased.

The distribution of *M. expansa* and *M. benedeni* varied: *M. expansa* was more prevalent in spring and summer, whereas *M. benedeni* was more common in autumn and winter.

The activity of oribatid mites had a significant impact on the spread of monieziosis. Since they are most active in spring and autumn, the disease was more prevalent during these seasons.

Environmental factors (temperature, humidity, and precipitation) directly influenced the distribution of intestinal parasites. The invasion rate increased during rainy and humid seasons but decreased in hot and dry conditions.

The distribution characteristics of thysanieziosis and avitellinosis changed, with the relative proportion of avitellinosis increasing.

**Discussion and Analysis:** When comparing these findings with previous scientific sources, certain differences in the distribution of intestinal cestodes were observed. *M. expansa* has become epidemiologically dominant, while *T. giardi* has declined, indicating changes in the ecological and epidemiological characteristics of intestinal parasites.

Seasonal changes significantly affected the spread of parasites. The increased activity of oribatid mites in spring and autumn led to a higher probability of lambs becoming infected. In contrast, the invasion rate decreased during the summer months.

When comparing the diagnostic effectiveness of the Fülliborn method and the sequential washing method, the Fülliborn method provided more accurate and rapid results. However, the sequential washing method proved to be cost-effective and useful for detecting trematodoses.

The study showed that lambs are the most vulnerable group to monieziosis. They become infected from the age of 1-2 months, with the disease reaching its peak intensity in spring and autumn. The extent and intensity of monieziosis decrease with age, though parasites are still occasionally found in adult sheep.

The activity of oribatid mites, which depends on environmental factors, played a decisive role in the spread of these parasites. Since mite activity increases during periods of high soil and air humidity, monieziosis reached its highest prevalence in spring and autumn. Conversely, in summer, high temperatures and drought forced mites to retreat into deeper soil layers, reducing their activity.

**Conclusion:** The results of this study indicate that intestinal cestodes, particularly monieziosis and thysanieziosis, are widespread among sheep in Uzbekistan. In recent years, *M. expansa* has become the dominant species epidemiologically, while *T. giardi*, previously widespread, has dropped to third place.

The seasonal dynamics of the disease are characterized by a peak in spring and autumn, while the invasion rate decreases in summer. The Fülliborn method has been confirmed as an effective diagnostic tool, but the sequential washing method remains cost-effective and useful for detecting trematodoses.

These findings provide an important scientific basis for developing strategies to combat intestinal cestodes in veterinary practice and for implementing effective preventive measures.

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