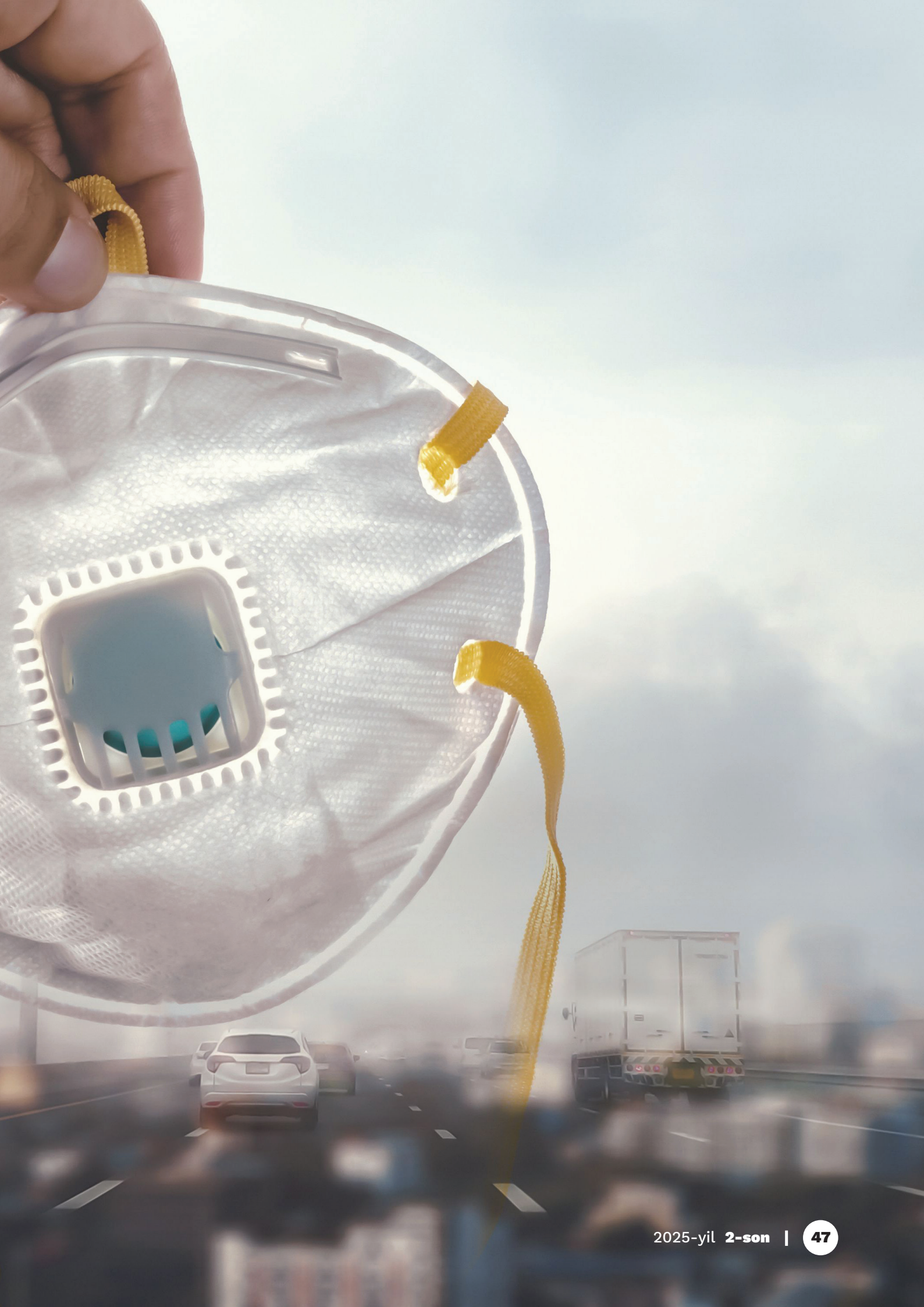
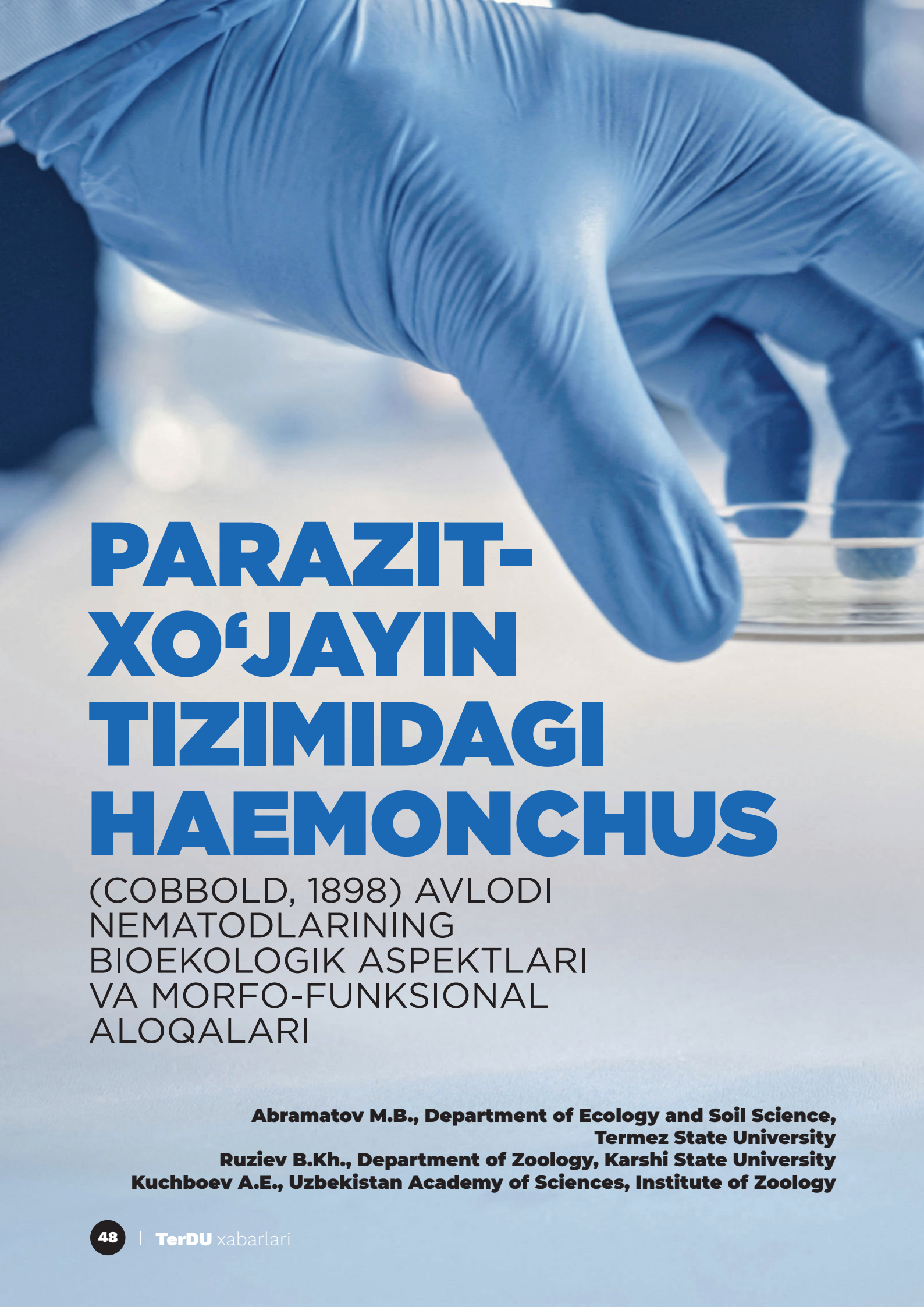






PARAZIT- XO‘JAYIN TIZIMIDAGI HAEMONCHUS

(COBBOLD, 1898) AVLODI
NEMATODLARINING
BIOEKOLOGIK ASPEKTLARI
VA MORFO-FUNKSIONAL
ALOQALARI

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Annotatsiya.

Hozirgi vaqtda tuyoqli hayvonlarning oshqozon-ichak tizimida parazitlik qiluvchi ushbu avlodning 13 turi qayd etilgan. Cervidae (1) Antilocapridae (1), Giraffidae (1), Bovidae (12) va Camels (2) oilasiga mansub tuyoqli hayvonlar ushbu parazitning aniq xo'jayini sifatida qayd etilgan. Haemonchus turlarining alohida populyatsiyalari Osiyo, Evropa, Amerika, Afrika va Avstraliyada qayd etilgan. Haemonchus contortusdagi jins nisbati 1:5. Bir urg'ochi kuniga 150 dan 10 000 tagacha tuxum qo'yadi.

Introduction.

It is well known that the need to elucidate the mechanisms of parasite adaptation to changing environmental conditions and functional relationships between partners is of great interest for optimizing methods and developing disease prevention tools. Consequently, knowledge of the mechanisms of formation of helminth faunal complexes will make it possible to determine the distribution areas of the parasite across hosts, study the population structure and determine the interaction between hosts and parasites, and predict the basis for identifying biotic and abiotic determinants of parasite-host communities.

The availability of information on the biological diversity of helminths is a critical basis for determining responses under the prevailing conditions of ecological change in the parasite-host system.

In addition, knowledge of the mechanisms of regulation of the number of parasites is possible mainly at the population level, since the latter is a form of existence of the species.

Currently, according to the literature data [1,5,7] and materials of our own research, 13 species of nematodes of the genus *Haemonchus* Cobbold, 1898, parasitizing the abomasum of ungulates, are registered in the world fauna. Ungulates of the families Bovidae (12 species), Cervidae (1 species), Giraffidae (1 species), Antilocapridae (1 species), and Camelidae (2 species) were identified as definitive hosts. Individual populations of hemonchus species have been recorded in the ecosystems of Asia, Europe, America, Africa, and Australia.

These nematodes are also widespread in the biogeocenoses of Uzbekistan and are recognized as the most pathogenic ruminant helminths. The losses caused to animal husbandry by these parasites are significant [1, 2, 4, 8].

Questions of bioecology and morpho-functional relationships of nematodes of the genus *Haemonchus* Cobbold, 1898 in the "parasite-host" system are still insufficiently studied.

Materials and methods. For bio-ecological characterization of helminthes *Haemonchus*, complete helminthological dissections of sheep were performed according to the method of K.I. Skryabin in farms and dehkan farms of Surkhandarya, Kashkadarya, and Namangan regions, as well as in slaughterhouses in the cities of Tashkent and Namangan [7]. Caprological studies were carried out according to the generally accepted methods of Berman-Orlov. The material was eggs and sexually mature individuals of *Haemonchus contortus* from spontaneously infected sheep in Uzbekistan.

Results. Morphological characteristics of nematodes of the genus *Haemonchus* Cobbold, 1898.

The size of nematode eggs, for the most part, depends on the characteristics of their development. *Haemonch* eggs do not contain a large amount of nutrient material, since they develop only until the larvae of the first stage appear. Egg sizes: length 82.3 ± 0.35 and width 41.9 ± 0.34 microns.

Invasive haemonch larvae are characterized by the following characteristics: the size of the esophagus, intestines and tail end, the number and shape of intestinal cells. Larvae are small in size: 0.7-0.8 mm long, with a thread-like tail end. The esophagus is relatively short and is 0.15–0.17 mm. Intestinal cells 14, triangular in shape. The last two intestinal cells are of unequal length and spindle-shaped. The excretory opening is located at the posterior end of the body.

Morphology of males and females of *Haemonchus contortus* Rudolphi, 1803.

Male. The body length is 20.31 ± 0.43 mm, the maximum width near the base of the bursa is 351 ± 10.52 microns. The length of the esophagus is 1.82 ± 0.04 microns.

The nerve ring is located at a distance of 261 ± 7.62 microns, and the excretory opening is 301.3 ± 7.47 microns from the anterior end of the body. The length of the left spicule is 509.9 ± 7.95 microns, and the length of the right spicule is 511.5 ± 7.91 microns. Each spicule has in the tapering part one sharp, like a harpoon, spike located at a different distance from the distal end: in the right spicule 53 ± 0.72 microns, in the left 22.2 ± 0.47 microns. The stem is brown, slightly lighter than the spicules, shuttle-shaped shuttle-shaped, and 271.7 ± 5.21 microns long (Figure 1).

The female. Female hemonchs, like other nematodes, are characterized by monotonous morphology. Body length 29.6 ± 0.51 mm, maximum width 647 ± 16.07 microns. The length of the esophagus is 2.2 ± 0.07 mm. The nerve ring is located at a distance of 285.1 ± 7.88 microns, and the excretory opening is 309.5 ± 5.93 microns from the anterior end of the body. The vulva is located at a distance of 4.05 ± 0.11 mm from the posterior end of the body, and is equipped with a powerful lingual valve. The length of the front funnel is 309.6 ± 14.31 microns, and the length of the rear funnel is 286.3 ± 15.04 microns. The length of the anterior sphincter is 205.9 ± 10.51 microns, and the length of the posterior sphincter is 206.2 ± 10.28 microns. The egg thrower is well developed, 398.1 ± 3.6 microns in length. Tail length 449.5 ± 31.12 microns. Egg length 82.3 ± 0.35 microns, width 41.9 ± 0.34 microns (Figure 3).

Morphology of males and females of *Haemonchus placei* Place, 1893.

Male. Body length 20.37 ± 0.35 mm, maximum width (near the base of the bursa) 368.25 ± 8.87 microns. The length of the esophagus is 1.89 ± 0.04 microns. The nerve ring is located at a distance of 282.7 ± 7.42 microns in the anterior part of the body. And the excretory opening is 310.7 ± 4.97 microns. The length of the knuckle is 243.24 ± 7.35 microns. The length of the left spicule is 539.7 ± 6.56 microns, and the length of the right spicule is 540.2 ± 6.42 microns. Each spicule has a spike. The length of the left spicule from the hook to its distal end is 29.67 ± 0.74 microns, and the length of the right spicule is 58.94 ± 0.91 microns (Figure 2).

The female. Body length 29.8 ± 0.53 mm, maximum width 644.5 ± 13.1 microns. The length of the esophagus is 2.24 ± 0.06 mm. The nerve ring is located at a distance of 282.25 ± 7.89 microns, and the excretory opening is 325 ± 7.78 microns from the anterior end of the body. The vulva is located at a distance of 6.5 ± 0.09 mm from the posterior end of the body. The length of the front funnel is 334.8 ± 15.71 microns, and the length of the rear funnel is 272.2 ± 10.2 microns. The length of the anterior sphincter is 219.4 ± 8.56 microns, and the length of the posterior sphincter is 220.2 ± 8.33 microns. The length of the egg thrower is 540 ± 7.63 microns. The tail length is 416 ± 4.15 microns. Egg length 82.1 ± 0.32 microns, width 41.6 ± 0.36 microns (Figure 4).

Investigating the morphological features of hemonchs, we found that in *H. placei* the spicules are curved slightly to the right, and its outer edge from the hook to the tip of the left spicule is convex, whereas in *H. contortus* the spicules

are straight, and the outer side from the hook to the tip of the left spicule is concave. As for females, *H. placei* has the majority of individuals with a hemispherical outgrowth on the side of the vulva, while *H. contortus* has females with a tongue-shaped valve. Other types of females are also

found, as in *H. placei*. In *H. placei* females, compared to *H. contortus* females длиннее, the ovipositor is 540 ± 7.63 microns longer (= ovipositor reservoir with sphincters) and the vulva and anus are located further from the caudal end of the body. Thus, we state these two types as independent.

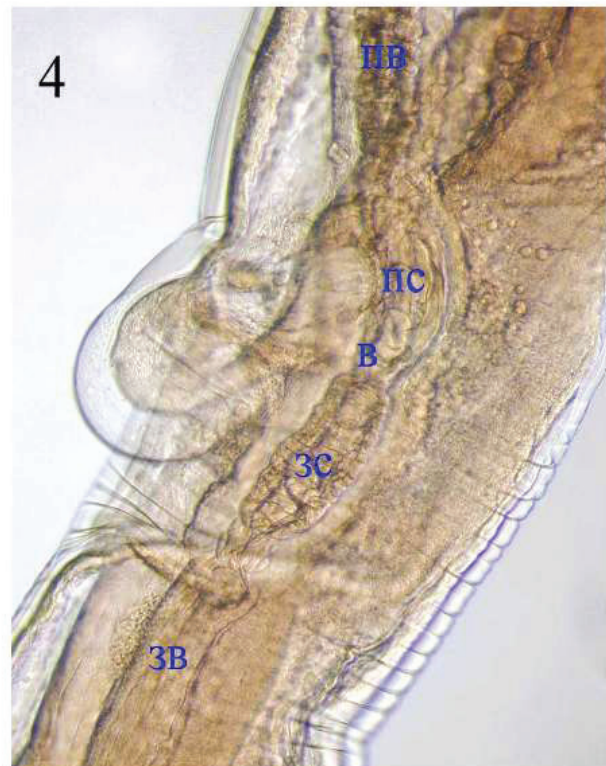
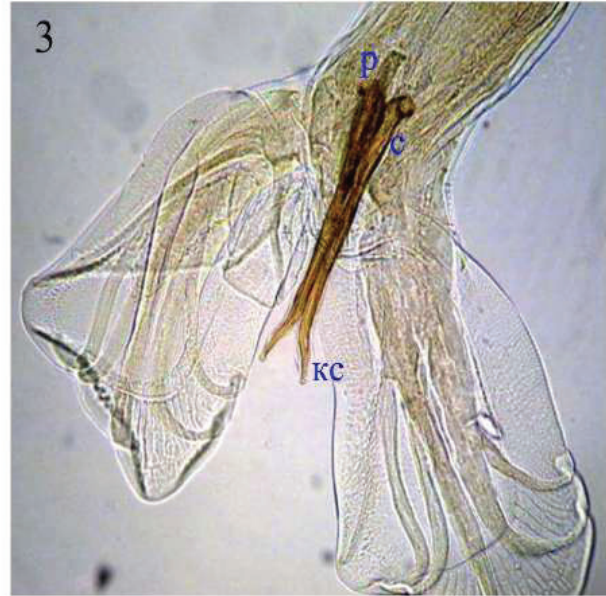
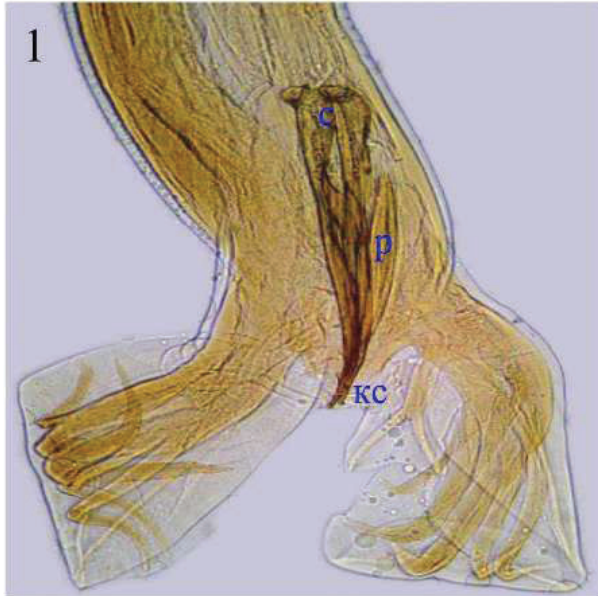


Figure 1 and 3. Tail ends of males: *H. contortus* Rudolphi, 1803 and *H. placei* Place, 1893:
k– knuckle, es - end of the spicule, s–spicules;

Figure 2. and 4. Tail ends of females (vulva area): *H. contortus* and *H. placei*:
as–anterior sphincter, af–anterior funnel, sf–posterior funnel, ps–posterior sphincter, v–vulva; (eyepiece 10, lens 40, original)

Studies have shown that hemonchs live on the entire mucosal surface of the abomasum of sheep. At the same time, the majority of *Haemonchus contortus* individuals were concentrated in the fundal and cardiac parts *Haemonchus* of the abomasum. To study the sex ratio, the sex index (SI) was determined, i.e. the ratio of the number of females to males of the studied species over a certain period of time. In common, less prolific species, IP changed more significantly by season. In April-June, August-October, and later, the IP of *H. contortus* increased to 2.0-3.0, fluctuating from 0.3 to 2.8 during the year. In *H. contortus*, the number of females during the year is 3 times greater than that of males. This ratio of females to males is 1: 5.

Thus, the sex index is high in populations with a significant number of individuals of both sexes. In *H. contortus*, it is often higher than 2.5 and is maximal in the seasons when the environment has the most favorable conditions for the development of free-living forms of hemonch, and their abundance in the hosts reaches maximum values. It should be noted that the higher the fecundity of females, the lower its sex index and vice versa.

The fecundity of hemonchs can be judged by the number of eggs laid by one female per day, or by the number of eggs that are found in 1 g of animal feces per individual or female of the species. When examining animals for the presence of intestinal strongylates, it was found that the most prolific are hemonchs. One female lays 150 to 10,000 eggs per day.

The above data indicate that the fecundity of hemonchs varies significantly. 30-45 eggs were found in 1 g of animal feces per female.

When calculating the ratio of the number of sexually mature individuals of *H. contortus* and the number of their eggs in one ball of sheep feces weighing 0.3-0.5 g, it turned out to be 1: 1.2.

According to our observations, *H. contortus* females lay 6-8 times more eggs than *Trichostrongylus* spp. or *Ostertagia* spp.

The fluctuations in the fecundity of hemonchs noted by us and many other researchers depended on a number of reasons, among which, first of all, we should highlight the factors that determine the season of the year. The leading ones, apparently, are the temperature and humidity of the environment, because in the season when these climatic factors were most favorable for the development of free-living hemonch larvae. The latter, having reached sexual maturity, laid a large number of eggs. This is confirmed to a certain extent by our studies on the seasonal dynamics of hemonchs and special experiments.

Studies have shown that the fecundity of hemonchs is correlated with the body size and age of female nematodes.

The fecundity of females undoubtedly depended on age. Females of *H. contortus* begin to lay the maximum number of eggs in 30-40 days after infection of animals. This rise depends on the type of helminth, the intensity of immunological reactions caused by it in the host, and many other reasons that are not always clear and lasts from 6-9 days to 1-2 months. After that, the number of eggs gradually decreases and, finally, their allocation completely stops.

We noted a sharp increase in the fecundity of

hemonchs in spring, after sheep eat young grasses.

Thus, it can be assumed that the daily egg production of hemonchs varies seasonally, which depends on the reproductive activity of nematodes.

Hemonchae develop without intermediate hosts, i.e. they belong to monoxene helminths. Larvae emerging from eggs develop in the external environment. They are not very resistant to drying. In the biogeocenoses of Uzbekistan, they survive for 2-3 days in summer, up to 65 days in spring, and up to 5 months in autumn and winter, when the air and soil temperature are low and humidity is high. (Figure 5)

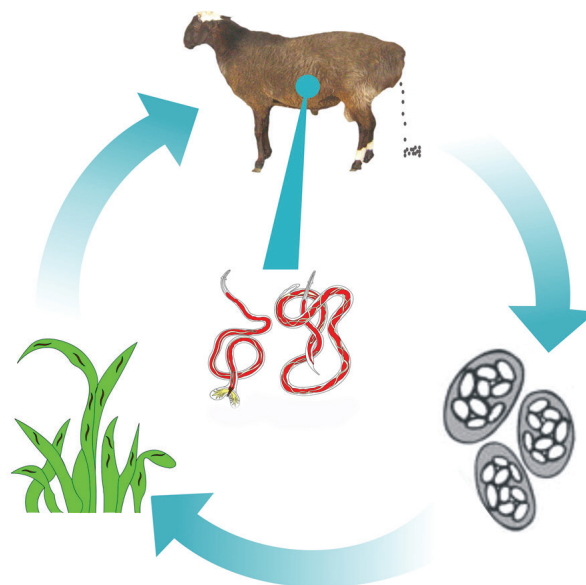


Figure 5. Development cycle of nematodes of the genus *Haemonchus* Cobbold, 1898

Discussion.

Highly productive strongylates, i.e. hemonchs, either survive relatively short in their hosts, or their embryos are weakly resistant to environmental factors and do not last long here than the same embryos of low-fruited strongylates. At the same time, gemonkhs theoretically have the same chances of getting into the host and populating them to such an extent that it does not pose a threat to the animal and, ultimately, to the gemonkhs themselves. Hemonches are self-regulating organisms in which, as already noted, even the sex ratio is directly proportional to the fecundity of their females.

The above-mentioned self-regulation of strongylates is closely related to the ecology of helminths and their hosts and, of course, is not always clearly manifested in experiments and can be disturbed in natural conditions. In the latter case, hemonchs either do not take root in their hosts, or such parasite-host relations develop, in which animals are excessively overpopulated with hemonchs and become seriously ill.

In this regard, we believe that any anti-helminthic

measures should begin with an ecological analysis of a specific parasitological situation and, first of all, with the identification and elimination of the causes that cause disruption of hemonch self-regulation in ecosystems that also include these nematodes.

Monitoring of the epizootic process in sheep hemonchosis.

One of the components of the epizootic process is the seasonal and age dynamics of sheep hemonchosis in the biogeocenoses of Uzbekistan. The first appearance of eggs and mature hemonchs in lambs under the age of one year was observed in October. At the same time, the extensiveness of the invasion was 8% at this time. By the end of autumn, the extent of the infestation increased to 20% and peaked in March (52%).

In April, hemonch eggs were found in 16% of the lambs examined, in May - in 12%. In the following months, the percentage of lambs infected with hemoncha decreased to 4%. In July, August and September, no hemonch eggs were found in lambs.

In adult sheep, an increase in hemonchosis is also observed in the spring. The maximum extent of infestation is significantly lower in them (34-36%) than in lambs (52%).

Based on the conducted studies, it was established that in the foothill zone, lambs' eggs and mature hemonchs appear for the first time in October, as well as in lambs in the desert zone. The infection rate is 6.7%.

It should also be noted that the intensity of infestation in adult sheep with hemonchs during this period is also high. As the results of the autopsy of rennet showed, it was estimated in thousands of copies. During this period, up to 1000 hemonch specimens were found in the abomasum of one sheep. Starting from the second half of April, the extensiveness and intensity of the invasion of sheep by hemonchs decreases and in the summer months it drops to zero. In the autumn and especially in the winter periods of the year the hemonch infestation increases again in young animals located in the foothill zone of Uzbekistan.

Seasonal dynamics of hemonchosis in adult sheep is also characterized by a spring rise. When the extensiveness of the invasion reaches up to 56%, and the maximum intensity is 3972 instances. In May, there is a decrease in infestations (32%) and in the summer months it reaches zero. In autumn, there is a gradual increase in infestation (6-16.7%).

As for the clinical signs of hemonchiasis, it turned out that it manifests itself in sheep of the foothill and semi-desert zones at different times. In the semidesert zone, the mass disease and death of sheep from hemonchosis is observed in March, and in the foothill zone - in April.

The dynamics of sheep hemonchosis is directly dependent on the climatic and geographical conditions of pasture areas and on those external factors (temperature, humidity, etc.) that either inhibit or contribute to the development and preservation of invasive elements in the external environment.

The high infestation of sheep with hemonch in the spring period is due to the high saturation of the external

environment (pasture) with invasive larvae, which creates favorable conditions for mass infection of animals. Mass infection of sheep during this period also contributes to the low resistance of animals to reinvasion.

The degree of invasiveness of different age groups of sheep varies widely. Apparently, this depends on the age-related and acquired immunity. The decrease in the extensiveness and intensity of invasion in the summer period is explained by the fact that animals, using rich pastures, acquire sufficient fatness and become more resistant to reinvasion. In addition, in the hot summer of Uzbekistan, hemonch larvae do not develop to the invasive stage and die under the influence of sunlight.

Comparison of the dynamics of sheep hemonchosis by year in both the desert and foothill zones of Uzbekistan indicates a constant trend of parasitization of hemonch in sheep in the autumn-winter and spring periods, with a single-peak peak in spring (March, April).

In order to prevent and eliminate sheep hemonchosis in farms, it is necessary to carry out a complex of organizational and economic, veterinary and sanitary and special medical and preventive measures, taking into account the peculiarities of epizootology in specific regions.

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