Research Article

# Helminth Infections of the Common Shrew (Mammalia, Soricidomorpha) on Reclaimed Areas

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**Abstract** | The common shrew (*Sorex araneus* Linnaeus, 1758) inhabits of drainage channels banks on reclaimed areas, where a specific complex of helminths is formed. The aim of the study is to conduct a helminthological investigation of common shrews inhabiting on drainage channel banks on model reclamation systems in Brest Polesie (South-West Belarus), to establish the species composition of helminths and their infection of these animals under conditions of increased anthropogenic pressure on the channels associated with periodic mowing of their banks and slopes. Common shrews were caught with mousetraps lined up along drainage channel bank in mixed forests, on arable lands, pastures, and along roads in Brest, Zhabinka and Malorita districts of Brest region during 2015–2019. 4,000 trap-days were worked out. 127 common shrews were caught. Animals were examined by the method of complete helminthological dissections. The number of common shrews on drainage channel banks was 3.18 individuals per 100 trap-days. Infection with helminths was 98.4 %. 28 species of helminths were found (8 Trematoda, 10 Cestoda and 10 Nematoda). Cestodes *Monocercus arionis* (Siebold, 1850) and *Neoskrjabinolepis singularis* (Cholodkowsky, 1912) dominated the infection. The trematode *Prosolecithus danubica* Tkach et Bray, 1995 found in the common shrew is a new species of helminths in Belarus. The results of 2015–2019 study period also compared with data obtained in 1996–1999 (first study period) and 2005–2010 (second study period). A total 36 helminth species parasitize common shrews during three research periods.

**Keywords** | Helminths, Common shrew, *Sorex araneus*, Drainage channel bank, Belarus

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## INTRODUCTION

The common shrew (*Sorex araneus* Linnaeus, 1758) is one of the representatives of the mammals of the family Soricidae (order Soricidomorpha) that lives in various terrestrial biocenoses. It inhabits drainage channel banks on reclaimed areas.

There are many reclamation systems with drainage channels in the world, and I am the only one who conducts helminthological investigations of common shrews inhabiting the banks of such channels. Two periods of helminthological investigations of common shrews living on drainage channel banks in reclamation systems of Brest Polesie (Brest, Zhabinka and Malorita districts of Brest region; South-West Belarus; western part of Belorussian Polesie) were carried out in 1996–1999 and 2005–2010. 10,500 trap-days were worked out on drainage channel banks passing in mixed forests, on arable lands, pastures and along roads, 233 common shrews were caught (the number was 2.22 individuals per 100 trap-days), in which 32 species of helminths were found, and their infection was 95.3 % for the first period (Shimalov, 2001; Shimalov, 2007). After this study, I proposed ecological and helminthological (ecological and parasitological) monitoring of the helminth fauna of shrew mammals inhabiting of drainage channel banks. Monitoring conducted in 2005–2010 (the second period of research), when 5000 trap-days were worked out, showed that the number of the common shrew was 3.02 individuals per 100 trap-days (151 specimens were caught), 27 species of helminths were identified, and the infection was 97.4 % (Shimalov, 2012).

The nematode *Eucoleus oesophagicola* (Sołtys, 1952) (syn.: *Thominx oesophagicola*) prevailed in the infection of this animal in the first period (62.2 % were infected) (Shimalov, 2001; Shimalov, 2007), the cestodes *Monocercus arionis* (Siebold, 1850) ((syn.: *Molluscotaenia crassiscolex* (Linstow, 1890)) and *Neoskrjabinolepis singularis* (Cholodkowsky, 1912) in the second period (infected 57.6 % and 50.3 %, respectively) (Shimalov, 2012).

I drew attention to the increased anthropogenic pressure on drainage channels mainly due to periodic mowing of their banks and slopes by humans during the second period of research, and also suggested that this may affect the species composition and abundance of shrews and their helminths (Shimalov, 2012).

The aim of the study is to conduct a helminthological investigation of common shrews inhabiting on drainage channels banks on model reclamation systems in Brest Polesie, to establish the species composition of helminths and their infection of these animals under conditions of increased anthropogenic pressure on the channels associated with periodic mowing of their banks and slopes.

## MATERIALS AND METHODS

The material for this report was collected during 2015–2019 in the western part of Belorussian Polesie. The common shrews were caught by mousetraps placed in line (25 traps over 4 days = 100 trap-days) along the banks of drainage channels in mixed forests, on arable lands, pastures and along the roads in Brest, Zhabinka and Malorita districts of Brest region (Brest Polesie). The total number of trap-days was 4,000 (1,000 at each place of passage of the drainage channel). If the banks and slopes of channels passing through arable lands, pastures and roads were periodically mowed down by humans, then the banks and slopes of channels in mixed forests were not. A total of 127 common shrews (62 males and 65 females; 21 adults and 106 immatures) were investigated.

The animals were examined by complete helminthological autopsy according to Skrjabin (1928). Identification and synonymy of helminths was carried out with the aid of keys to the trematodes and cestodes (Keys to the cestode parasites of vertebrates, 1994; Keys to the Trematoda, 2008), monographs (Arzamasov et al., 1969; Genov, 1984; Sharpilo and Iskova, 1989; Anderson, 2000) and articles (Gulyaev and Kornienko, 1998; Tkach, 1998; Karpenko, 1999; Kornienko et al., 2006; Kirillova and Kirillov, 2007; Kornienko and Binkiene, 2008; Binkiene et al., 2011; Nikonorova et al., 2018).

The percentage of animal infection by helminths, the prevalence of infection by each species of helminth, the minimum, maximum and total number of helminths found and overall mean of helminth specimens were calculated during statistical processing of the material.

The number of investigated and infected by helminths common shrews examined on drainage channel banks in Brest Polesie is illustrated in Table 1.

## RESULT AND DISCUSSION

The number of common shrews on drainage channel banks was 3.18 individuals per 100 trap-days. It ranged from 2.4 individuals (channel banks in mixed forests) to 3.7 (channel banks along roads) and 3.8 individuals per 100 trap-days (channel banks on pastures) (see Table 1). The number of common shrews living on drainage channel banks of passing on pastures and in mixed forests is approximately the same as in 1996–1999 (3.49 and 2.05 individuals per 100 trap-days, respectively) (Shimalov, 2007). But the number of these animals on drainage channel banks of on arable lands and along roads was significantly lower in 1996–1999 than in 2015–2019 (1.50 and 1.41 individuals per 100 trap-days, respectively) (Shimalov, 2007). It should be noted that the number of common shrews was higher even with periodic mowing of vegetation on the banks and slopes of drainage channels in 2015–2019. It should also be taken into account that the populations of the common shrew in the first 2 periods of research were subjected to a certain anthropogenic stress associated with the removal of some number of animals (384 specimens) for scientific research. However, this did not prevent the animals from restoring their numbers to about 3 individuals per 100 trap-days.

The total rate of helminth infection of common shrews was 98.4 % in 2015–2019. This is slightly higher than in the first and second periods of my helminthological research. The percentage of infection of common shrews with helminths is quite high on drainage channel banks passing in different places (Table 2). It can reach up to 100 on drainage channel banks on arable lands and along roads, where the average intensity of infection is 21.7 and 24.8 individuals, respectively. Although the highest average intensity of infection of common shrews was recorded on drainage

**Table 1:** The number of investigated and infected by helminths common shrews examined on drainage channel banks in Brest Polesie (2015–2019).

| Place of passage of the drainage channel | Number | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | investigated | | | | per 100 trap-days | infected | | | | | | |
| | males | fe-males | adults | imma-tures | | males | fe-males | adults | imma-tures | trematodes | cestodes | nematodes |
| Mixed forest | 11 | 13 | 7 | 17 | 2.4 | 10 | 13 | 7 | 16 | 14 | 23 | 19 |
| Arable lands | 11 | 17 | 7 | 21 | 2.8 | 11 | 17 | 7 | 21 | 16 | 24 | 25 |
| Pastures | 19 | 19 | 6 | 32 | 3.8 | 19 | 18 | 6 | 31 | 19 | 35 | 27 |
| Along roads | 21 | 16 | 1 | 36 | 3.7 | 21 | 16 | 1 | 36 | 28 | 37 | 22 |
| Total: | 62 | 65 | 21 | 106 | 3.18 | 61 | 64 | 21 | 104 | 77 | 119 | 93 |

**Table 2:** Helminth infection of common shrews living of drainage channel banks in Brest Polesie (2015–2019).

| Helminth species | Place of passage of the drainage channel | | | | | | | | Total, n=127 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | mixed forest, n=24 | | arable lands, n=28 | | pastures, n=38 | | along roads, n=37 | | | |
| | preva-lence, % | no. hel-minths (min-max; total; mean) | preva-lence, % | no. hel-minths (min-max; total; mean) | preva-lence, % | no. hel-minths (min-max; total; mean) | preva-lence, % | no. hel-minths (min-max; total; mean) | preva-lence, % | no. hel-minths (min-max; total; mean) |
| Trematoda | | | | | | | | | | |
| Brachylaimidae | | | | | | | | | | |
| *Brachylaima fulvum* Dujardin, 1843 | 16.7 | 1-3; 9; 2.25 | 25.0 | 1-4; 17; 2.4 | 18.4 | 1-8; 20; 2.9 | 43.2 | 1-9; 47; 2.9 | 26.8 | 1-9; 93; 2.7 |
| Panopistidae | | | | | | | | | | |
| *Pseudoleucochloridium soricis* (Sołtys, 1952) | 16.7 | 4-52; 75; 18.75 | 7.1 | 1-5; 6; 3.0 | – | – | 16.2 | 1-7; 20; 3.3 | 9.5 | 1-52; 101; 8.4 |
| Strigeidae | | | | | | | | | | |
| *Strigea sphaerula* (Rudolphi, 1803), larvae | – | – | 7.1 | 3-16; 19; 9.5 | 7.9 | 1-18; 35; 11.7 | 2.7 | 2; 2; 2.0 | 4.7 | 1-18; 56; 9.3 |
| | | | | | | | | | | |
| Diplostomidae | | | | | | | | | | |
| *Alaria alata* (Goeze, 1782), larvae | 8.3 | 1-1; 2; 1.0 | 3.6 | 2; 2; 2.0 | – | – | 2.7 | 1; 1; 1.0 | 3.2 | 1-2; 5; 1.25 |
| Dicrocoeliidae | | | | | | | | | | |
| *Prosolecithus danubica* Tkach et Bray, 1995 | 4.2 | 32; 32; 32.0 | – | – | 5.9 | 2-13; 15; 7.5 | 5.4 | 1-3; 4; 2.0 | 3.9 | 1-32; 51; 10.2 |
| Omphalometridae | | | | | | | | | | |
| *Neoglyphe sobolevi* (Schaldybin, 1953) | 16.7 | 3-12; 27; 6.75 | 10.7 | 1-3; 6; 2.0 | 15.8 | 1-38; 62; 10.3 | 29.7 | 1-88; 184; 16.7 | 18.9 | 1-88; 279; 11.6 |
| *Rubenstrema exasperatum* (Rudolphi, 1819) | 20.8 | 1-6; 15; 3.0 | 32.1 | 1-4; 16; 1.8 | 36.8 | 1-10; 43; 3.1 | 48.7 | 1-14; 42; 2.3 | 36.2 | 1-14; 116; 2.5 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *R. opisthovitellina* (Sołtys, 1954) | – | – | 10.7 | 1-2; 4; 1.3 | 7.9 | 2-3; 7; 2.3 | 13.5 | 1-5; 10; 2.0 | 8.7 | 1-5; 21; 1.9 |
| Cestoda | | | | | | | | | | |
| Hymenolepididae | | | | | | | | | | |
| *Ditestolepis diaphana* (Cholodkowsky, 1906) | 62.5 | 2-240; 692; 46.1 | 14.3 | 1-12; 16; 4.0 | 13.2 | 1-22; 53; 10.6 | 2.7 | 6; 6; 6.0 | 19.7 | 1-240; 767; 30.7 |
| *Lineolepis skutigera* (Dujardin, 1845) | 20.8 | 1-8; 17; 3.4 | 26.0 | 3-12; 34; 4.9 | 13.2 | 1-5; 14; 2.8 | 24.3 | 3-24; 66; 7.3 | 20.5 | 1-24; 131; 5.0 |
| *Neoskrjabinolepis singularis* (Cholodkowsky, 1912) | 50.0 | 1-28; 89; 7.4 | 50.0 | 1-82; 257; 18.4 | 65.8 | 1-48; 204; 8.2 | 64.9 | 1-58; 307; 12.8 | 59.1 | 1-82; 857; 11.4 |
| *Soricinia infirma* (Žarnowsky, 1955) | 8.3 | 1-4; 5; 2.5 | – | – | – | – | 2.7 | 6; 6; 6.0 | 2.4 | 1-6; 11; 3.7 |
| *Staphylocystis furcata* (Stieda, 1862) | 16.7 | 1-8; 11; 2.75 | 21.4 | 1-3; 10; 1.7 | 21.1 | 1-8; 27; 3.4 | 29.7 | 1-16; 45; 4.1 | 22.8 | 1-16; 93; 3.2 |
| *Urocystis prolifer* Villot, 1880 | 8.3 | 3-8; 11; 5.5 | 7.1 | 1-8; 9; 4.5 | 5.3 | 3-8; 11; 5.5 | – | – | 4.7 | 1-8; 31; 5.2 |
| *Vigisolepis spinulosa* (Cholodkowsky, 1912) | 8.3 | 2-2; 4; 2.0 | – | – | – | – | – | – | 1.6 | 2-2; 4; 2.0 |
| Paruterinidae | | | | | | | | | | |
| *Cladotaenia globifera* (Batsch, 1786), larvae | – | – | – | – | 7.5 | 2-12; 24; 8.0 | – | – | 2.4 | 2-12; 24; 8.0 |
| Dilepididae | | | | | | | | | | |
| *Dilepis undula* (Schrank, 1788) | 4.2 | 1; 1; 1.0 | 3.6 | 1; 1; 1.0 | – | – | – | – | 1.6 | 1-1; 2; 1.0 |
| *Monocercus arionis* (Siebold, 1850) | 37.5 | 1-34; 79; 8.8 | 53.6 | 1-8; 59; 3.9 | 47.4 | 1-10; 71; 3.9 | 59.5 | 1-12; 88; 4.0 | 50.4 | 1-34; 297; 4.6 |
| Nematoda | | | | | | | | | | |
| Capillariidae | | | | | | | | | | |
| *Aonchotheca kutori* (Ruchljadeva, 1946) | 4.2 | 6; 6; 6.0 | 17.9 | 1-2; 7; 1.4 | 2.6 | 4; 4; 4.0 | 2.7 | 2; 2; 2.0 | 6.3 | 1-6; 19; 2.4 |
| *Calodium soricicola* (Yokogawa et Nischigori, 1924) | – | – | – | – | 7.9 | 2-4; 8; 2.7 | 2.7 | 2; 2; 2.0 | 3.2 | 2-4; 10; 2.5 |
| *Eucoleus oesophagicola* (Sołtys, 1952) | 37.5 | 1-3; 12; 1.3 | 35.7 | 1-5; 26; 2.6 | 31.6 | 1-10; 38; 3.2 | 29.7 | 1-5; 22; 2.0 | 33.1 | 1-10; 98; 2.3 |
| *Liniscus incrassatus* Diesing, 1851 | 20.8 | 1-16; 24; 4.8 | 14.3 | 1-5; 12; 3.0 | 31.6 | 1-18; 59; 4.9 | 18.9 | 1-7; 19; 2.7 | 22.1 | 1-18; 114; 4.1 |
| Strongyloididae | | | | | | | | | | |
| *Parastrongyloides winchesi* Morgan, 1928 | – | – | – | – | 2.6 | 3; 3; 3.0 | – | – | 0.8 | 3; 3; 3.0 |
| Heligmosomidae | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Longistriata depressa* (Dujardin, 1845) | 62.5 | 1-22; 72; 4.8 | 67.9 | 1-18; 100; 5.3 | 29.0 | 1-28; 71; 6.5 | 29.7 | 1-10; 43; 3.9 | 44.1 | 1-28; 286; 5.1 |
| Ascarididae | | | | | | | | | | |
| *Porrocaecum depressum* (Zeder, 1800), larvae | 8.3 | 1-1; 2; 1.0 | 3.6 | 1; 1; 1.0 | 10.5 | 1-2; 5; 1.25 | – | – | 5.5 | 1-2; 8; 1.1 |
| *Porrocaecum* sp., larvae | 16.7 | 1-1; 4; 1.0 | – | – | – | – | 5.4 | 1-2; 3; 1.5 | 4.7 | 1-2; 7; 1.2 |
| Spirocercidae | | | | | | | | | | |
| *Ascarops strongylina* (Rudolphi, 1819), larvae | 4.2 | 1; 1; 1.0 | 10.7 | 1-3; 5; 1.7 | 2.6 | 1; 1; 1.0 | – | – | 3.9 | 1-3; 7; 1.4 |
| Acuariidae | | | | | | | | | | |
| *Skrjabinoclava soricis* (Tiner, 1951) | – | – | 3.6 | 1; 1; 1.0 | 2.6 | 1; 1; 1.0 | – | – | 1.6 | 1-1; 2; 1.0 |
| Total: | 95.8 | 1-240; 1190; 51.7 | 100 | 1-82; 608; 21.7 | 97.4 | 1-48; 776; 21.0 | 100 | 1-88; 919; 24.8 | 98.4 | 1-240; 3493; 27.9 |

channel banks in mixed forests (51.7 individuals with 95.8 % of infected animals). Attention is drawn to the fact that 4.3 times (from 23.3 % in 1996–1999 (Shimalov, 2007) to 100 % in 2015–2019) increased the infection of common shrews living on drainage channel banks of running along roads. Although in other places where the channels run, it already exceeded 95 % in 1996–1999 (Shimalov, 2007).

The following trend persists from period to period of research: males are more intensely infected than females, and adults than immature ones (Shimalov, 2001; Shimalov, 2012; data from 2015–2019 research years).

But in the percentage of infection of common shrews with trematodes, cestodes and nematodes, there are differences in the periods of research. Nematodes and cestodes dominated in infection (78.1 % and 71.2 %, respectively), while trematodes were found only in 34.3 % of common shrews examined in the first period (Shimalov, 2001). Cestodes were more common than nematodes and trematodes in subsequent study periods. The prevalence of cestodes, nematodes and trematodes in common shrews was 92.1 % and 93.7 %, 75.5 % and 73.2 %, 47.0 % and 60.6 %, respectively in the second study period (Shimalov, 2012) and in 2015–2019. If in the second and third (2015–2019) periods of research, the percentage of infection of common shrews with nematodes and cestodes was approximately the same, then the percentage of infection with trematodes increased by almost 1.3 times.

Infections by 2–14 of helminths were found in 92.9 % of common shrews examined in 2015–2019. These indicators have increased in comparison with the first period of research, when 2–8 species of helminths were localized in 78.1 % of animals (Shimalov, 2001).

The animals are host for 28 species of helminths: 8 trematode species, 10 cestode species and 10 nematode species (Table 2). A total of 3,493 parasites were found with the average intensity of infection being 27.9 specimens. The range of trematode intensity was 1–88 specimens and overall mean was 9.4 specimens, cestode was 1–240 specimens and overall mean was 18.6 specimens, nematode was 1–28 specimens and overall mean was 6.0 specimens.

The largest number of helminth species in one individual was found in common shrews caught on drainage channel banks passing on arable lands and pastures: 12 species (adult male; channel bank on pasture) and 14 species (immature female; channel bank on arable land).

The nematode *E. oesophagicola* gradually lost its dominant position in the infection of the common shrew in 2005–2010 (Shimalov, 2012) and 2015–2019, which dominated in the infection of this animal in 1996–1999 (Shimalov, 2001; Shimalov, 2007). The prevalence of this helminth was the highest and amounted to 37.5 % only on drainage channel banks in mixed forests. This indicator in other places where the channels passed was in the range of 29.7–35.7 % (Table 2).

The cestodes *N. singularis* and *M. arionis* dominated in the infection of the common shrew, as in the second study period (59.1 % and 50.4 %, respectively). The nematode *Longistriata depressa* (Dujardin, 1845) was their subdominant (infected 44.1 % of common shrews examined).

In general, the cestodes *M. arionis* and *N. singularis* dominated the infection of the common shrew on drainage channel banks in Brest Polesie, as in 2005–2010 (Shimalov, 2012). They were dominant or subdominant in the infection on drainage canal banks running in different places. The nematode *L. depressa* dominated in the infection of the common shrew which lives only on drainage channel banks in mixed forests (62.5 %) and on arable lands (67.9 %). This nematode belongs to the subdominant of the above cestodes. 42.4 % of common shrews were infected with it in 2005–2010 (Shimalov, 2012), and 44.1 % in 2015–2019 (Table 2). The cestode *Ditestolepis diaphana* (Cholodkowsky, 1906) dominated in the infection of the common shrew only on drainage channel banks in mixed forests (92.5 %). The cestodes *M. arionis* and *N. singularis* were its subdominants there.

*Rubenstrema exasperatum* (Rudolphi, 1819) and *Brachylaima fulvum* Dujardin, 1843 are background species among trematodes in infections of common shrews. The prevalence of the first trematode species ranged from 10.7 % (first period of research) (Shimalov, 2001) to 36.2 % (data of 2015–2019), and the second trematode species from 12.9 % (first research period) (Shimalov, 2001) to 26.8 % (data of 2015–2019).

The trematode *Prosolecithus danubica* Tkach et Bray, 1995 is a new helminth species for the fauna of Belarus. True, I found it back in 1998 and mistakenly identified it as *Skrjabinoplagiorchis polonicus* (Sołtys, 1957) (Shimalov, 2001; Shimalov, 2007). The discovered trematode fully corresponded to the description of *P. danubica*, which is noted in the article (Shimalov, 2022).

The nematode *Skrjabinoclava soricis* (Tiner, 1951) appeared in the helminth fauna of the common shrew, which was absent in previous research periods (Shimalov, 2007; Shimalov, 2012). One specimen of it was found in the stomach of immature female common shrew caught on July 22, 2017 on the reclamation system located in the vicinity of the village of Semisosny (Brest district; drainage channel bank on arable land) and in immature male common shrew caught on August 19, 2018 on the reclamation system located in the area of 20–21 km of the Brest–Kovel highway (Malorita district; drainage channel bank on pasture). This is a nematode species of the common shrew known for the fauna of Belarus (Arzamasov et al., 1969).

In addition, the species *Porrocaecum depressum* (Zeder, 1800) was identified from the group of nematodes of the genus *Porrocaecum*. Larvae of this nematode were found in 5.5 % of common shrews examined.

Also, a more detailed study of cestodes from the common shrew, which I identified earlier (Shimalov, 2012) as a species of *Soricinia soricis* (Baer, 1928), convinced me that this is a species *Soricinia infirma* (Žarnowsky, 1955) (syn.: *Insectivorolepis infirma*). The cestode *Staphylocystis tiara* (Dujardin, 1845) found in common shrews (Shimalov, 2007) should be assigned to the species *Staphylocystis furcata* (Stieda, 1862).

Thus, to the 28 species of helminths that I found in common shrews in 2015–2019, we should also add the trematode *Neoglyphe locellus* (Kossack, 1910), the nematode *Gongylonema soricis* Fain, 1955, larvae of the nematode *Physocephalus sexalatus* (Molin, 1860), the cestode *Sacciuterina paradoxa* (Rudolphi, 1802) (syn.: *Polycercus paradoxa*), the larvae of trematodes Echinostomatidae gen. sp., *Strigea strigis* (Schrank, 1788) (found in the first period of research) (Shimalov, 2001; Shimalov, 2007) and *Strigea falconis* Szidat, 1928, the cestode *Neomylepis magnirostellata* (Baer, 1931) (syn.: *Vampirolepis magnirostellata*) (found in the first and second periods of research) (Shimalov, 2001; Shimalov, 2007; Shimalov, 2012).

Taking into account these data and a critical assessment of the species composition of helminths, a total of 36 species of helminths (12 species of trematodes, cestodes, and nematodes each) were found in the common shrew living on drainage channel banks of over three periods of research.

It should be noted that the common shrew is involved in the life cycles of helminths whose obligate definitive hosts are birds (trematodes *S. falconis*, *S. sphaerula*, *S. strigis*, cestodes *Dilepis undula* (Schrank, 1788), *Cladotaenia globifera* (Batsch, 1786), *S. paradoxa*, nematodes *P depressum* (Zeder, 1800), *Porrocaecum* sp.), carnivores ((trematode *Alaria alata* (Goeze, 1782)) and non-ruminant artiodactyls ((nematodes *Ascarops strongylina* (Rudolphi, 1819) and *P. sexalatus*)). The trematode *A. alata* have medical and veterinary significance. At different stages of development, it can parasitize humans, domestic pigs, dogs and cats. Larvae (mesocercariae) of this helminth were found in common shrews in the second and third periods of research. They infected 0.7 % of animals in the second period of research (Shimalov, 2007) and 3.2 % of animals in the third period of research (Table 2). The number of larvae varied from 1 to 2. The nematodes *A. strongylina* and *P. sexalatus* are of veterinary importance as parasites of domestic pigs. The last species of nematodes was discovered by me in the first period of research (infected 2.6 %, the number of larvae varied from 1 to 60) (Shimalov, 2001), and the penultimate one in all periods of research (infection of 1.3 %, 0.7 % and 3.9 %, respectively was recorded for the periods; the maximum number of larvae of 20 specimens was revealed in the first period, in the second there were 8, in the third 3).

Species of helminths that I found in the common shrew are typical parasites of shrews and have been found in various European countries (Genov, 1984; Binkiene et al., 2011;

Nikonorova et al., 2018). Only the presence in the common shrew the metacercaria of a trematode not defined to the species and assigned to the family Echinostomatidae was noted in Belarus (one metacercaria was enclosed in a cyst with a diameter of 0.5 mm and localized in the intestinal wall of an adult male caught on April 12, 1998 on the drainage channel bank passing through a pasture in the floodplain of the Mukhavets River in the city of Brest; in metacercariae, a circumoral headcollar was visible, the ventral sucker was larger than the oral sucker). The species affiliation of the metacercaria of this trematode and the ability of larvae of trematodes of this family to parasitize shrews require study. The fairly diverse composition of the family Echinostomatidae includes 91 nominal genera (Kostadinova, 2005). Most of the species parasitize birds, mainly associated with the aquatic environment. The floodplain of the Mukhavets River in the place of my research abounds with waterfowl.

## CONCLUSIONS

1. The common shrew inhabits of drainage channel banks running in mixed forests, on arable lands, pastures, along roads in meliorated territories. It adapts to the conditions of existence, maintaining an average number of about 3 individuals per 100 trap-days.

2. Periodic mowing of vegetation on the banks and slopes of drainage channels does not contribute to a decrease in the number of the common shrew on the banks of drainage channels, its percentage of helminth infection and a radical change in the number and species composition of dominant helminths. Only the nematode *E. oesophagicola*, which dominated in infection in the first study period, gradually lost its dominant position in the second and third study periods. Cestodes *M. arionis* and *N. singularis*, nematode *L. depressa*, trematode *R. exasperatum* have become common in the infection of common shrews. A high percentage of helminth infection of the common shrew is noted, regardless of the location of the drainage channel and the level of anthropogenic impact associated with mowing the banks and slopes of the channels. The variety of helminths includes 36 species (12 species of trematodes, cestodes and nematodes). The 2015–2019 study showed that the prevalence of helminths is high and amounts to 98.4 % (were found 28 helminth species). It can reach up to 100 % on drainage channel banks on arable land and along roads.

3. The common shrew is involved in the life cycles of helminths who obligate definitive hosts are birds (8 helminth species), carnivores (1 trematode species) and non-ruminant artiodactyls (2 nematode species). Of these, 3 species (*A. alata*, *A. strongylina*, *P. sexalatus*) are important for medical and veterinary science.

4. A new species of helminths for Belarus (trematode *P. danubica*), nematode *S. soricis*, previously not found in the common shrew on drainage canal banks were identified, and the nematode *P. depressum* was identified from the group of nematodes of the genus *Porrocaecum* in 2015-2019.

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## CONFLICT OF INTEREST

The author states that there is no conflict of interest.

## NOVELTY STATEMENT

There are no analogues of such a study in reclaimed territories in the world. The data obtained can be used in planning and carrying out land reclamation works in regions where there are center of zoonotic diseases.

## AUTHOR CONTRIBUTION

Shimalov V.V. collected and identification the material, conducted a microscopical examination of the samples, contributed to data analysis and table orientation, wrote and corrected the manuscript.

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