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HELMINTHS OF THE MALLARD, *ANAS PLATYRHYNCHOS* (AVES, ANATIDAE), IN UKRAINE: ANALYSIS OF THE DIVERSITY IN MIXED FOREST ZONE AND THE BLACK SEA REGION

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Helminths of the Mallard, *Anas platyrhynchos* (Aves Anatidae), in Ukraine: Analysis of the Diversity in Mixed Forest Zone and the Black Sea Region. Syrota, Ya. Yu., Greben, O. B., Poluda, A. M., Maleha, O. M., Lisitsyna, O. I., Kornyushin, V. V. — Thirty-eight Mallards were collected on the territory of Ukrainian Polissia to study the fauna of their gastro-intestinal helminths. Materials were collected in 1998–2000, 2014 and 2016 on the territory of Volyn and Chernihiv Regions. In total, 33 species of helminths were found. The prevalence of cestode infection was 78.9 %. We found 18 cestode species: *Aploparaksis furcigera*, *Cloacotaenia megalops*, *Dicranotaenia coronula*, *Diorchis acuminatus*, *D. stefanskii*, *Fimbriaria fasciolaris*, *F. teresae*, *Microsomacanthus compressa*, *M. spiralibursata*, *M. paracompressa*, *M. paramicrosoma*, *M. parvula*, *M. hopkinsi*, *Platyscolex ciliata*, *Retinometra venusta*, *Sobolevicanthus aculeostyleticus*, *S. gracilis*, *S. stolli*. The prevalence of trematode infection was 73.7 %. There were 10 trematode species: *Bilharziella polonica*, *Apatemon gracilis*, *Echinoparyphium aconitum*, *E. cinctum*, *Echinostoma revolutum* group, *Hypoderaeum conoideum*, *Notocotylus attenuatus*, *Parastrigea robusta*, *Prosthogonimus ovatus*, *P. cuneatus*.The prevalence of nematode infection was 7.9 %. There were four nematode species: *Capillaria anatis*, Capillariidae gen. sp., *Eucoleus contorta*, *Tetrameres fissispina*. The prevalence of an acanthocephalan *Filicollis anatis* was 18.4 %. The most common species of helminths were *A. furcigera*, *B. polonica*, *A. gracilis*, *Echinostoma revolutum* group, *F. fasciolaris*, *H. conoideum*. The helminth faunas of Mallards from the territory of Ukrainian Polissia and from the Black Sea Region of Ukraine were compared. The results of comparison demonstrated a high level of their qualitative similarity.

Key words: helminths, birds, Cestoda, Trematoda, Nematoda, Ukraine.

Introduction

The Mallard (*Anas platyrhynchos* Linnaeus) is one of usual wild game-birds in Ukraine. The most complete data on helminth fauna of this bird in the country are generalized in a monograph by Smogorzhevskaya (1976). This book provides consolidated information on helminth of all species of birds from different regions of Ukraine studied at that time. However, works on helminths of birds in Polissia are relatively rare. The fragmentary data on helminth fauna of Mallard from Polissia were published by Vasylevska (1956). More detailed information is available in the work by Srebrodolskaya(1964) on the study of waterfowls of North-Western Polissia, where helminths were examined on the side. Another large-scale survey (Greben, 2008) deals exclusively with cestode sof birds in Polissia. On the other hand, detailed analysis of Mallard helminths composition was made for the southern part of Ukraine based on the material collected in the Black Sea region (Kornyushin et al., 1983, 2003, 2004; Korol, Kavetska, 2004).Totally, 90 gastro-intestinal helminth species were reported in Mallard from Ukraine in the previous studies.

The aim of this work is to identify the qualitative composition of the helminth fauna of Mallard in Ukrainian Polissia and to compare it with that from the south of Ukraine.

Material and methods

Sampling. Material was collected in August–October 2014 and 2016 in Volyn Region (Manevychi District (51°20′09″ N; 25°48′48″ E), Lutsk District (50°44′04″ N; 25°09′44″ E), Turiisk District (51°05′07″ N; 24°27′10″ E), Stara Vyzhivka District (51°28′57″ N; 24°26′32″ E)) and Chernihiv Region (Horodnia District (51°53′19″ N; 31°32′11″ E), Ripky District (51°50′34″ N; 31°08′05″ E)). Totally, 16 birds were examined.

Helminths (trematodes and acanthocephalans) stored in the collection of the I. I. Schmalhausen Institute of Zoology NAS of Ukraine, Kyiv (SIZK) were identified in addition to the material collected. Those helminths were collected in 1998–2000 in Chernihiv Region (Nizhyn District (51°00′06″ N; 31°54′16″ E), Ripky District (51°50′34″ N; 31°08′05″ E), Borzna (51°15′19″ N; 32°28′43″ E) and Sosnytsia Districts (51°38′09″ N; 32°31′14″ E)). Totally, helminths from 22 Mallards were examined. Also, cestodes identified and described from the same hosts previously (Greben, 2008) were taken into account.

The data obtained were compared with the information on helminths collected in the 1960s in the steppe zone of Ukraine (Black Sea Region), in Kherson Region (46°46′ N; 32°36′ E). The data on these worms were taken from the catalogue of the SIZK Collection and from the following publications: Kornyushin et al. (1983, 2003, 2004), Korol, Kavetska (2004). To reduce the influence of seasonal dynamics on the qualitative composition of helminth fauna and make samples more comparable, helminths collected from birds in August–October only were used for comparative analysis. Totally, material from 12 specimens of Mallards was selected for the comparison.

Helminths identification. Birds were obtained from hunters during the hunting season. If necessary, internal organs of birds were fixed in 40° ethanol. Bird gastrointestinal tracts only were examined for the presence of helminths. Some tracts were without the liver. Helminths were fixed in 70° ethanol. For permanent mounts, cestodes were stained with acetocarmine, trematodes — in Mayer′s haematoxylin. Stained helminths were dehydrated, cleared and mounted in Canadian balsam. For temporary mounts, nematodes were cleared in lactophenol, trematodes and cestodes — in glycerine. Some cestodes were mounted in Berlese′s medium. Helminths morphology was studied under Zeiss Axio Imager M1 light microscope with digital camera and AmScope T690B microscope. The species were identified according to Birova, Macko (1991), Czaplinski (1956), Spasskaya (1966), Tolkacheva (1991) (cestodes); Filimonova (1985), Iskova (1985), Spasskaya, Spasskii (1971), Sudarikov (1984) (trematodes); McDonald (1974) (nematodes); Petrochenko, (1958), Khohlova, (1986) (acanthocephalans).

Data analysis. To identify the main characteristics of helminth fauna, comparison of samples from the mixed forest zone with samples collected in the steppe zone was made. For this purpose, only helminths identified to species were used. Helminths from the liver were excluded from the analysis. The terminology for the description of the fauna was used according to Bush et al (1997).

For qualitative comparisons between the analysed samples Sørensen similarity index (S) was used: $S = 2a/(2a + b + c)$, where a is the number of species common to both samples, b is the number of species unique to the first sample, and c is the number of species unique to the second sample (Magurran, 2004).

Average intensity and average prevalence were calculated for each helminth species. Confidence intervals (at significant level of 95 %) were calculated for the average prevalence. The prevalence calculated by Fisher′s exact test for both samples was compared. The test was made for every taxonomic group of helminths, as well as for every species of helminths found in both territories. All above calculations were made in QP3 program (Rózsa et al., 2000).

All results of the Fisher′s exact test were corrected for multiple comparisons by the Holm method. Standard function of the software environment R v. 3.4.0. (RcoreTeam, 2017) was used for calculations.

To extrapolate species diversity in samples, the following estimators were used: Chao2, Bootstrap, Jack 1, and Chao1 (Colwell, 2013). Program EstimateS 9 was used for these estimators. The following options were used for calculations: classical formulas and 100 randomizations.

The peculiarities of space-time distribution of Mallards on the territory of Ukraine were established based on the information on findings of ringed birds (returns) provided by the Ukrainian Bird Ringing Centre. There are 223 Mallard returns in the Ukrainian Bird Ringing Centre database, of them, 110 were obtained from birds ringed outside Ukraine and found on its territory, 113 were ringed within the country. All these birds were ringed in 1929–2003. Analysis of these returns was realized by GIS package ArcView 3.1 with visualization of ringing data on geographic maps. Distance between the ringing and finding points, the azimuth of the bird´s movement was calculated for each return.

Visualization of the qualitative differences between individual Mallards was made by non-metric multidimensional scaling (nMDS) together with hierarchical cluster analysis. Uninfected individuals were excluded from the analysis. The Sørensen index was calculated for each pair of Mallards. The obtained matrix of similarities was visualized by nMDS method in two-dimensional space. Since the stress level exceeded 0.1, cluster analysis of the matrix and the overlay of its results on nMDS chart were performed for higher reliability. The calculations were made in Primer 6 (Clarke, Gorley, 2006).

Results and discussion

We found 33 species of helminths in the studied Mallards from the mixed forest zone (Polissia). For each species found, information about the site of infection, prevalence, intensity (mean value with range shown in parentheses), and localities are presented below.

Phylum Platyhelminthes
Class Trematoda
Family Echinostomatidae Dietz, 1909

Echinostoma revolutum group — intestine, cecum. 42.1 %, 8(1–53). Volyn Region (Lutsk area), Chernihiv Region (Nizhyn, Ripky and Sosnytsia Districts).

All identified helminths belonging to the genus *Echinostoma* possessed 37 collar spines. They were assigned to the *E. revolutum* group because of the absence of clear morphological criteria allowing exact identification of adult trematodes of this group (Kanev, 1994).

Hypoderaeum conoideum (Bloch, 1782) — intestine, cecum. 47.4 %, 11(1–43). Volyn Region (Stara Vyzhivka District), Chernihiv Region (Borzna, Nizhyn, Ripky and Sosnytsia District).

Echinoparyphium aconiatum Dietz, 1909 — intestine. 2.6 %, 2(2). Volyn Region (Turiisk District).

Family Notocotlidae Lühe, 1909

Notocotylus attenuatus (Rudolphi, 1809) — cecum. 15.8 %, 7(1–19). Volyn Region (Stara Vyzhivka District), Chernihiv Region (Nizhyn and Ripky Districts).

Notocotylus sp. — cecum. 7.9 %, 7(2–13). Volyn Region (Turiisk District) and Chernihiv Region (Ripky District).The specimens were not identified to the species level because of their poor condition.

Family Prosthogonimidae Lühe, 1909

Prosthogonimus cuneatus (Rudolphi, 1809) — bursa of Fabricius. 5.3 %, 1(1). Chernihiv Region (Nizhyn District).

Prosthogonimus ovatus (Rudolphi, 1803) — bursa of Fabricius. 5.3%, 3(2–4). Chernihiv Region (Nizhyn District).

Family Schistostosomatidae Poche, 1907

Bilharziella polonica (Kowalewski, 1895) — intestinal veins. 28.9 %, 4(3–16). Volyn Region (Manevychi, Lutsk and Turiisk Districts), Chernihiv Region (Nizhyn, Ripky and Sosnytsia Districts).

Family Strigeidae Railliet, 1919

Apatemon gracilis (Rudolphi, 1808) — intestine. 23.7 %, 9(1–23). Volyn Region (Lutsk area), Chernihiv Region (Nizhyn and Sosnytsia Districts).

Apatemon sp. — intestine. 5.2 %, 2.5(2–3). Volyn Region (Turiisk and Manevychi Districts).

The specimens were not identified to the species level because of their poor condition.

Parastrigea robusta Szidat, 1928 — intestine. 5.3 %, 1(1). Volyn Region (Lutsk District), Chernihiv Region (Nizhyn District).

Class Cestoda
Family Hymenolepididae (Ariola, 1899)

Aploparaksis furcigera (Rudolphi, 1819) — intestine, cecum. 43.7 %, 26(1–78). Volyn Region (Lutsk and Turiisk Districts), Chernihiv Region (Ripky District).

Cloacotaenia megalops (Nitzsch in Creplin, 1829) — cloaca. 12.5 %, 1(1). Volyn Region (Stara Vyzhivka District) and Chernihiv Region (Ripky District).

Dicranotaenia coronula (Dujardin, 1845) — intestine. 6.2 %, 1(1). Chernihiv Region (Ripky District).

Dicranotaenia sp. — intestine. 6.25 %, 1(1). Volyn Region (Lutsk District).

The specimen was not identified to the species level because it was immature.

Diorchis stefanskii Czaplinski, 1956 — intestine. 6.2 %, 3(3). Volyn Region (Turiisk District).

Fimbriaria fasciolaris (Pallas, 1781) — intestine. 6.2 %, 1(1). Chernihiv Region (Ripky District).

Fimbriaria teresae Grytner-Ziecina & Cielecka, 1995 — intestine. 13.2 %, 2(1–3). Volyn Region (Lutsk District) and Chernihiv Region (Nizhyn District).

Description (based on three specimens without scolices).

Length of strobila without scolex 310 mm, maximum width 3.5 mm. Pseudoscolex well developed, 1.46–1.86 mm long and 0.6–0.8 mm wide. Genital pores unilateral, genital atrium simple. Total length of evaginated cirrus 30–40 (35, n = 6) (fig. 1, A). Cirrus compound, in two parts. Basal part conical, 20–26 (23.6, n = 8) long and about 25–35 (29.3, n = 28) in diameter, armed with well visible spines (fig. 1, B). The largest hookspines 9–10 (10, n = 23) in number, surrounding base of cirrus. Distal cylindrical part armed with small spines, 10–18 (14.8, n = 5) long and 8–12 (9.8, n = 5) in diameter, slightly narrower

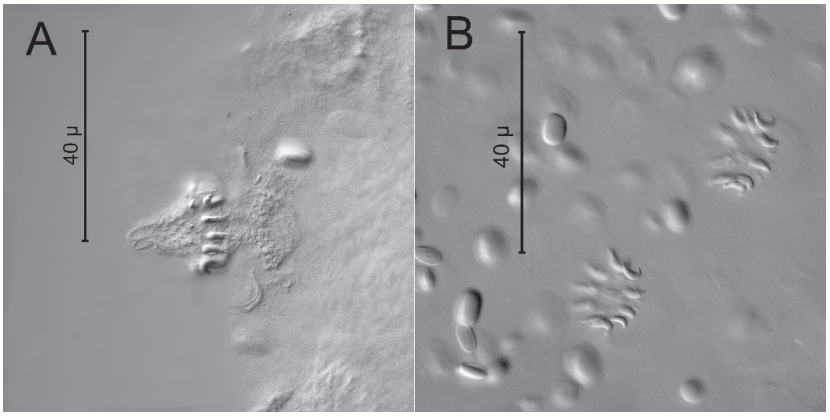

Fig. 1. *Fimbriaria teresae*: A — cirrus; B — cirrus hooks.

(6–10) terminally. Spines absent on terminal part 5–10 (n = 3) in length. Copulatory part of vagina funnel-shaped, with characteristic short internal spine-like structures, 12–20 × 25–35 (15.6 × 26.8 n = 25). Conductive part of vagina tubular, with thick walls.

Remark. It is the second registration of this species in Ukraine. Only scolex of *F. teresae* was found in previously studied material (Greben, 2008). This species was described from *Anas clypeata* L. (Grytner-Zięcina et Cielecka, 1995) and found in *A. platyrhynchos* (Grytner-Zięcina et al., 2005) in Poland.

Fimbriaria sp. — intestine. 37.5 %, 5(1–9). Volyn Region (Manevychi, Lutsk and Turiisk Districts), Chernihiv Region (Ripky District).

The specimens were not identified to the species level because they were immature.

Microsomacanthus compressa (Linton, 1892) — intestine. 18.7 %, 2(1–4). Volyn Region (Turiisk District) and Chernihiv Region (Ripky District).

Microsomacanthus spiralibursata (Czaplinski, 1956) — intestine. 6.2 %, 250(250). Volyn Region (Lutsk District).

Microsomacanthus paracompressa (Czaplinski, 1956) — intestine. 18.7 %, 67(2–190). Volyn Region (Lutsk and Turiisk Districts) and Chernihiv Region (Ripky District).

Microsomacanthus sp. — intestine. 6.2 %, 2(2). Volyn Region (Turiisk District).

The specimens were not identified to the species level because they were immature.

Retinometra venusta (Rosseter, 1897) — intestine. 6.25 %, 5(5). Volyn Region (Turiisk District).

Retinometra sp. — intestine. 6.2 %, 1(1). Volyn Region (Turiisk District).

The specimen was not identified to the species level because it was immature.

Sobolevicanthus aculeostileticus Birova and Macko, 1991 — intestine. 12.5 %, 1(1). Volyn Region (Turiisk District), Chernihiv Region (Ripky District).

Sobolevicanthus gracilis (Zeder, 1803) — intestine. 18.7 %, 9(4–12). Volyn Region (Turiisk District), Chernihiv Region (Ripky District).

Sobolevicanthus sp. — intestine. 6.2 %, 18(18). Volyn Region (Turiisk District).

The specimens were not identified to the species level because they were immature.

Family Dilepididae Railliet & Henry, 1909

Platyscolex ciliata (Fuhrmann, 1913) — intestine. 6.2%, 604(604). Volyn Region (Lutsk District).

Phylum Acanthocephala
Class Palaeacanthocephala
Family Polymorphidae Meyer, 1931

Filicollis anatis (Schrank, 1788) — intestine. 18.4 %, 8(1–35). Volyn Region (Stara Vyzhivka and Turiisk Districts), Chernihiv Region (Nizhyn District).

Phylum Nematoda
Class Enoplea
Family Capillariidae Neveu-Lemaire, 1936

Capillaria anatis (Schrank, 1790) — cecum. 2.6 %, 7(7). Volyn Region (Lutsk District).

Eucoleus contortus (Creplin, 1839) — esophagus. 2.6 %, 2(2). Volyn Region (Lutsk District).

Capillariidae gen. sp. — intestine. 2.6 %, 2(2). Volyn Region (Lutsk District). Fragments of two females with eggs were found. The morphology of eggs and the site of infection differed them from both *C. anatis* and *E. contortus*.

Class Chromadorea
Family Tetrameridae Travassos, 1914

Tetrameres fissispina (Diesing,1861) — proventriculus, esophagus. 5.2 %, 5(2–8). Volyn Region (Lutsk and Stara Vyzhivka Districts).

Tetrameres sp. — proventriculus. 6.2 %, 1(1). Chernihiv Region (Ripky District). This specimen was not identified to the species level because it was a female.

Of 33 species of helminths found in the sample from the mixed forest zone, there were 10 species of trematodes, 18 species of cestodes, four species of nematodes and one species of acanthocephalans. At the same time, in the samples from the steppe zone only 24 species of helminths were found: 13 species of trematodes, seven species of cestodes, three species of nematodes, and one species of acanthocephalans. Twelve species were common to both samples. Sørensen index is 0.421 for these samples. The prevalence of infection with 95 % confidence interval and the average intensity with range are given for each species found on separate territory (figs. 2, 3). The following species of helminths recorded in the steppe zone were not found in the mixed forest zone in this study: *Amidostomoides acutum* (Lundahl, 1848), *Cotylurus cornutus* (Rudolphi, 1808), *Cryptocotyle concava* (Creplin, 1825), *Echinoparyphium recurvatum* (Linstow,

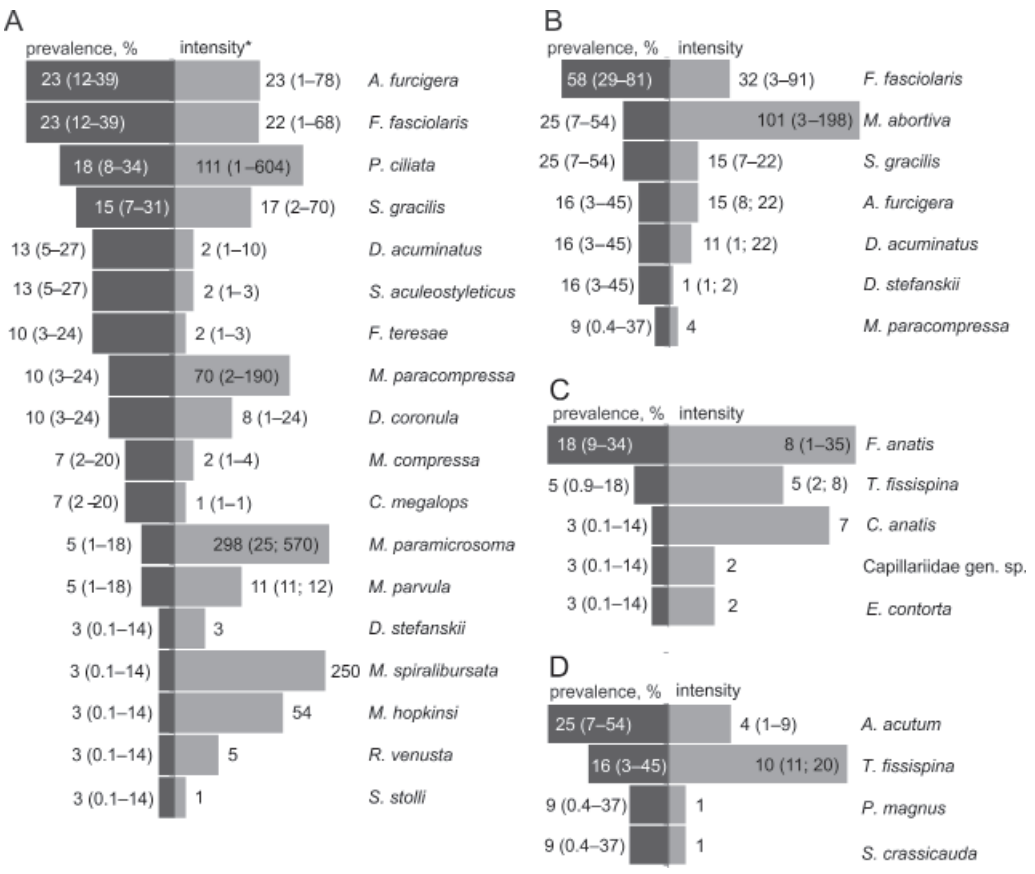

Fig. 2. Prevalence (with lower and upper confidence intervals at significant level 95 %) and average intensity (with range; in case when one or two birds were infected by a certain type of helminth, then the actual intensity values are given) of Mallard´s infection with: A — cestodes from the mixed forest zone; B — cestodes from the steppe zone; C — nematodes and acanthocephalans from the mixed forest zone; D — nematodes and acanthocephalans from the steppe zone.* Logarithmic scale was used.

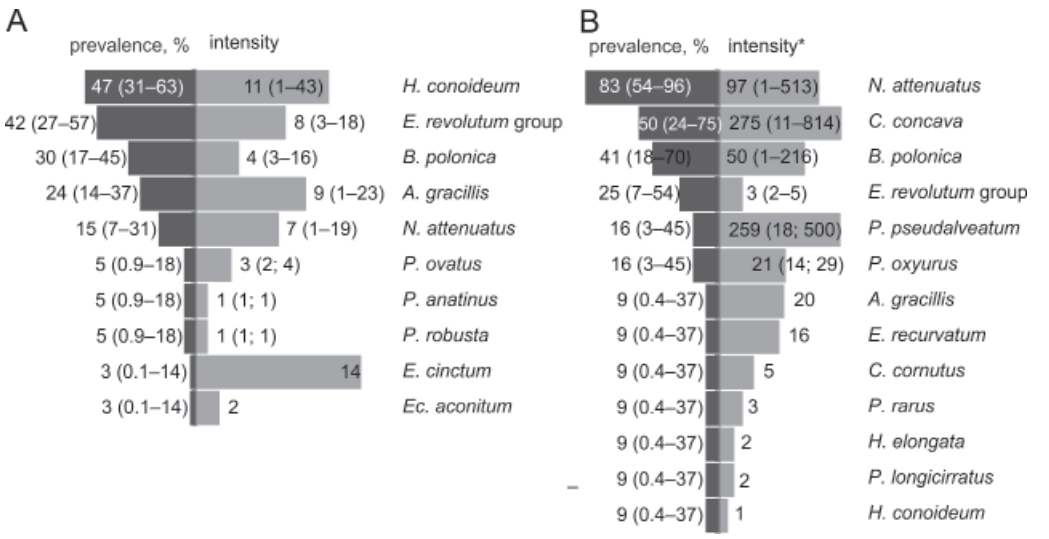

Fig. 3. Prevalence (with lower and upper confidence intervals at significant level 95 %) and mean intensity (with range; in case when only one or two birds were infected by a certain type of helminth, then the actual intensity values are given) of Mallard´s infection with: A — trematodes from the mixed forest zone; B — trematodes from the steppe zone. * Logarithmic scale was used

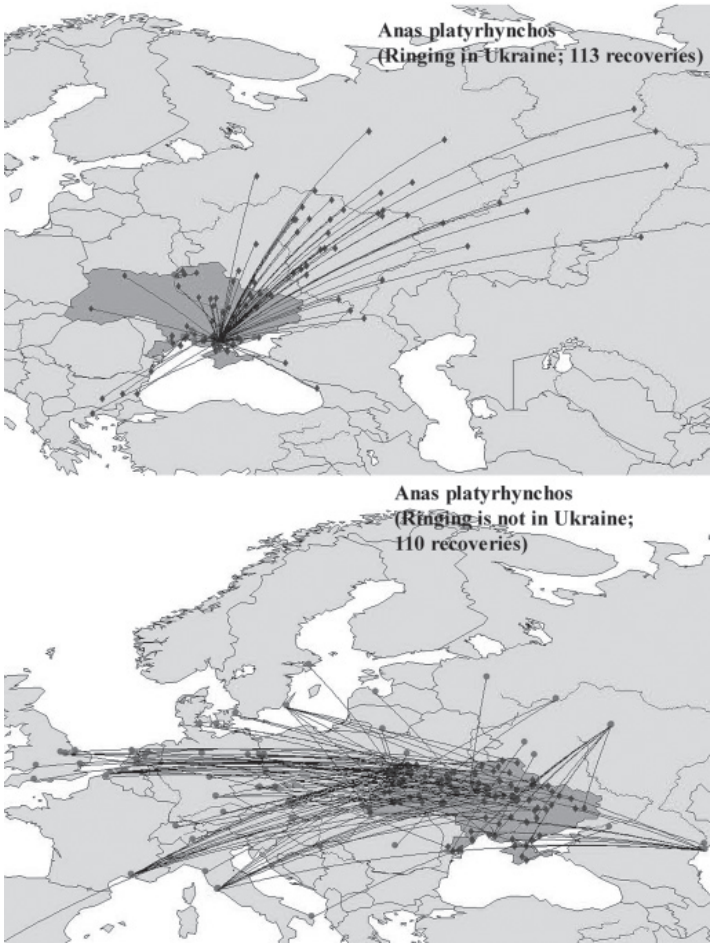

Fig. 4. Data on Mallards ringing.

1873), *Himasthla elongata* (Mehlis, 1831), *Paramonostomum pseudalveatum* Price, 1931, *Polymorphus magnus* Skrjabin, 1913. *Psilochasmus longicirratus* Skrjabin, 1913, *Psilochasmus oxyurus* (Creplin, 1825), *Prosthogonimus rarus* (Braun, 1901), *Streptocara crassicauda* (Creplin, 1829).

Analysis of space-time distribution of Mallards (fig. 4) on the territory of Ukraine in different periods of year shows rather weak relationships between birds from northern and southern regions. There are only few registered cases of direct movements of ringed Mallards between these parts of the country. The ducks of Polissia are known to spend winter in Western Europe, while the South-Ukrainian ducks stay in winter either in the same region or leave for Southern Europe. There could be together both "southern" and "northern" Mallards, but the number of these birds is small. Similar situation could be observed in places of massive ducks´ moulting (Northern Caspian, Kuban) (Kotyukov, Rusanov, 1997). This makes it possible to consider the helminth faunas from the two regions as different that, and in turn, allows us to analyse them as independent samples.

The overall prevalence of infection in the sample from the mixed forest zone was 92 %, and in the sample from the steppe zone it was 100 %. Comparison of the prevalence by taxonomic groups of helminths revealed statistically significant difference only for nematodes (table 1). The infection with this group of helminths was significantly higher in the South of Ukraine. Comparison of the prevalence of helminth species common to both samples (table 2) did not show statistically significant differences for all species except for *N. attenuatus*.

Table 1. Comparison of the prevalence of taxonomic helminths groups using Fisher´s exact test

Taxa	Mixed forest zone, %	Steppe zone, %	p-value	p-value (with Holm correction)
Cestoda	78.9	100.0	0.256	0.512
Trematoda	73.7	58.3	0.257	0.512
Nematoda	7.9	91.7	0.003	0.009
Acanthocephala*	18.4	8.3	–	–

*Comparison for acanthocephalan was not performed since one species was found in each region.

Table 2. Meaning of Fisher´s exact test for the species found in both samples

Species	*Aploparaksis furcigera*	*Apatemon gracilis*	*Bilharziella polonica*	*Diorchis acuminatus*	*Diorchis stefanskii*	*Echinostoma revolutum* group	*Fimbriaria fasciolaris*	*Hypoderaeum conoideum*	*Microsomacanthus paracompressa*	*Notocotylus attenuatus*	*Soboleviccanthus gracilis*	*Tetrameres fissispina*
p-value	1.000	0.416	0.486	1.000	0.139	0.332	0.036	0.018	1.000	0.000	0.668	0.240
p-value (with Holm correction)	1.000	1.000	1.000	1.000	1.000	1.000	0.360	0.198	1.000	0.000	1.000	1.000

Table 3. Estimated species diversity

Species richness	Mixed forest zone	Steppe zone
Observed	33	24
Chao 1	33	26
Chao 2	41	33
Jacknife 1	42	33
Bootstrap	37	28

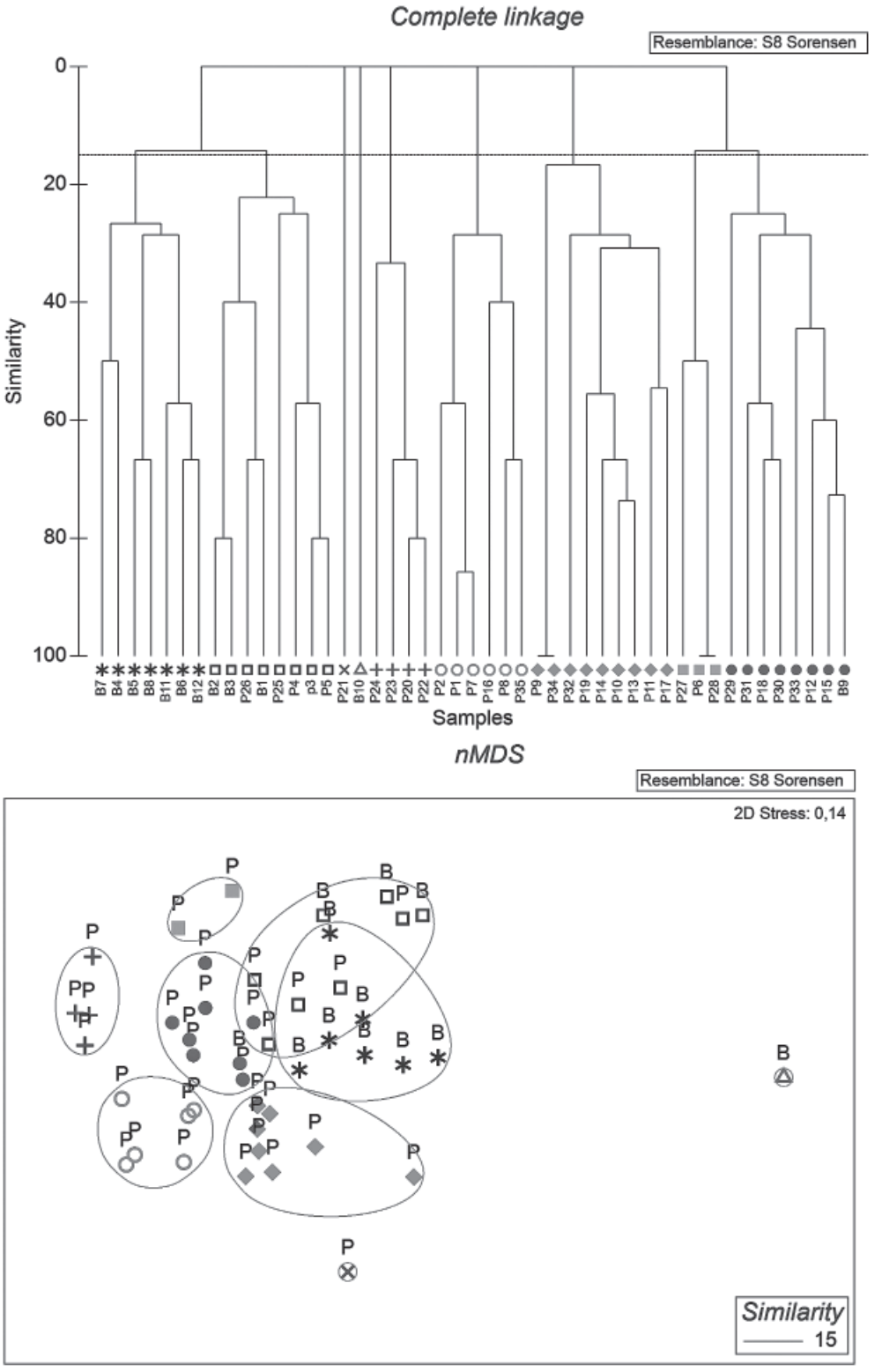

Fig. 5. Configuration of 2-dimensional MDS for specimens of Mallard from the mixed forest zone (P) and from the steppe zone (B) with overlapping clusters at similarity level of 15 %.

Chao 1 estimator for the sample from the mixed forest zone was equal to observed species richness, whereas for samples from the steppe zone it added 2 more species. Other estimators provide from 4 to 9 unfound species for both territories (table 3). Considering features of the estimators, such result indicates that the size of the samples was enough for detecting the most widespread species of helminths, but it did not allow to detect all rare species.

Result of nMDS (fig. 5) showed a high degree of similarity between Mallards from both samples. Tendency for aggregation of the samples from the steppe zone in the upper right part of the graph is noticeable. Mallards from each sample were present in every cluster except for two clusters which contained only one bird each. So, it can be concluded that the species composition of Mallards on the territory of the mixed forest zone differs from the species composition of Mallards on the territory of the steppe zone less than it would have been expected based on a simple comparison of the actual list of identified species.

Analysis of literature data shows that most species previously found in Mallard from the mixed forest zone of Ukraine were also registered in our study. Undetected species can be included in the number of species foreseen by estimators of species diversity. It is evident that in the mixed forest zone there are no species requiring salt-water intermediate hosts: *C. concava*, *H. elongata*, and *P. pseudalveatum*.

Looking at the differences between groups of helminths we can see that Mallards from the mixed forest zone are less infected with nematodes, especially with *A. acutum*. This species was not found in the sample from the mixed forest zone while in the sample from the steppe zone it is a rather common species. This nematode has a direct life cycle and is a common parasite of Anatidae (Anderson, 2000). Its absence could be the evidence of the low concentration of Mallards, although such assumption does not exclude the existence of local centres, undetected in the present study, with high level of prevalence.

The most common helminth species (the lower limit of confidence interval for prevalence is greater than 10 %) of Mallards in the mixed forest zone are *A. furcigera*, *B. polonica*, *A. gracilis*, *E. revolutum* group, *F. fasciolaris*, *H. conoideum*. And the most common helminths species of Mallards in the steppe zone are *N. attenuatus*, *F. fasciolaris*, *C. concava*, *B. polonica*. Thus, *B. polonica* and *F. fasciolaris* are the most common species in both samples. *C. concava* is absent in the mixed forest zone because its circulation is connected with saltwater. *N. attenuatus* is not included in the list of the most common species in the mixed forest zone while the prevalence of this species in another sample is very high. Taking into account that the final host acquire *N. attenuatus* by swallowing the adolescariae (Filimonova, 1985), the high prevalence of infection can be another evidence, along with absence of *A. acutum*, of a relatively lower concentration of Mallards in the mixed forest zone.

Another four species considered as very common in the mixed forest zone sample, are also present in the sample from the steppe zone; however, they are not among the most common species. Because we did not find statistically significant differences in prevalence of these species between samples examined and the small size of analysed sample from the steppe zone, we can assume that these species could be among the most common species provided the larger sample from the steppe zone.

Since our samples contain birds gathered in different years, we see long-term tendencies based on the identified helminths. We can state that two samples collected in very different time and different places tend to be more similar. This is shown in the similar qualitative composition and the prevalence of infection with common helminth species. Given the tendency to isolation of those two territorial groups of Mallards, there is evidently no isolation of their helminth faunas over a long period of time. That is why, the helminth fauna of these two groups of Mallards appears to be the united faunal complex.

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